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Contents – Overview

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Competence in Test and Measurement, Radio Communications and Broadcasting

From our Principles

We are an independent manufacturer of electronic equipment and systems. Our name is synonymous with innovation, precision and quality. A leading position on the European market and worldwide presence are the solid basis to our success.

Who we are and what we do

Rohde & Schwarz is an internationally active company in the fields of radiocommunications and test and measurement. For more than 60 years the company group has been developing, producing and marketing a wide range of electronic products for the capital goods sector. The company is headquartered in Munich.

With 4400 employees worldwide and subsidiaries and representatives in over 70 countries around the world, the Rohde & Schwarz group achieves an annual turnover in excess of 1.3 billion DM. The company is highly export-oriented: more than 70% of the total turnover is achieved outside Germany. Due to the comprehensive know-how and the innovative strength of its employees, Rohde & Schwarz is among the technological leaders in all of its business fields.

Today the Rohde & Schwarz group of companies covers the following fields:

- Test and measurement
- Radiocommunications systems
- Broadcasting
- Radiomonitoring and radiolocation
- IT security
- Services

The quality management system of Rohde & Schwarz has been certified to DIN EN ISO 9001 and complies with the standards of AQAP 110 and 150. The company has approval for the development, production, installation and servicing of avionic communication equipment and is the first German transmitter manufacturer authorized to carry out BZT (Federal Approvals Office for Telecommunications) approval testing for radio transmitter systems.

Our Business Fields and Products

Test and Measurement

Rohde & Schwarz is the largest manufacturer of electronic test and measurement equipment in Europe. Our T&M instruments and systems are setting standards worldwide in research, development, production and service.

We are the key partner for the industry and network operators as far as all measurement tasks in the field of digital communications are concerned.

- Mobile radio measurements
- EMC measurements
- General-purpose and RF measurements
- Automatic test systems

Radiocommunications Systems

Rohde & Schwarz is one of the leading international suppliers of professional HF, VHF and UHF radio systems for use in stationary and mobile ground stations, on ships and in aircraft. Govern mental authorities, embassies and armed forces worldwide use our radio equipment for voice, data and image transmission. We support our customers by providing product-related consulting, logistics concepts and services.

Rohde & Schwarz ranks among the leading suppliers of mobile radio systems for the professional user. Worldwide installations at Ministries of the Interior, commuter traffic enterprises, at airports and railway stations as well as for public network operators speak for the effectiveness of our solutions.

- ATC and air defense systems
- Global communication systems
- Avionics
- Navy, army and information technology systems
- Trunked radio systems
- Antennas for receive and transmit operation

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Broadcasting

For 50 years sound and TV broadcasting has been one of the key activities of Rohde & Schwarz. We are the only supplier of a complete range of transmission, monitoring and measurement equipment in the world. We are international leaders as regards equipment and T&M systems and instruments for the new digital transmission methods DAB, DVB and MPEG2.

- Sound and TV broadcast transmitters
- Measurement and monitoring systems
- Video and broadcast measurements

Radiomonitoring and Radiolocation

Rohde & Schwarz is worldwide a leading manufacturer of equipment and systems for detection, location and analysis of radiocommunication signals in the following fields of application:

- Internal and external security
- National and international radiomonitoring by postal authorities
- Frequency management

We are leading in the design and implementation of full-coverage automatic radiomonitoring and frequency management systems. Many years of experience and ultramodern technology are the sound basis of our

- Receivers
- Direction finders
- Signal analyzers
- Antennas

IT Security

The Rohde & Schwarz subsidiary SIT Gesellschaft für Systeme der Informationstechnik mbH satisfies customers' demands for secure and reliable utilization of information and communications technology.

Key activities are the development of crypto products and systems for the protection of information in modern data processing and communication systems as well as consulting and IT security analyses for industry and government authorities.

- Hardware and software crypto products
- Development of customer-specific crypto systems
- Consulting and IT security analyses

Services

Rohde & Schwarz maintains at its Cologne Plant one of Europe's largest service centers for T&M and communications equipment.

Our training centers in Cologne and Munich offer a comprehensive choice of courses on T&M and communications topics, which on request can also be held at the customer's.

- Calibration, service and maintenance
- Planning, development, system integration
- Seminars and training courses
- Development of customer-specific systems
- Technical documentation and logistics
- Electronic information systems, multimedia applications

Headquarters Munich (1993) (photo 40802-2)

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Rohde & Schwarz is one of the leading international suppliers of professional HF, VHF and UHF radio systems for use in stationary and mobile ground stations, on ships and in airplanes. Embassies, authorities and armed forces worldwide use our radio equipment for voice, data and picture transmission. We support our customers by providing product-related consulting, logistics concepts and services.

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VLF-HF Receiver EK2000

10 kHz to 30 MHz

Handles all types of modulation used in military, government and civil radiocommunications

Brief description

With VLF-HF Receiver EK2000 Rohde & Schwarz is adding an attractive product to its XK2000 family of shortwave radio equipment.

This receiver is able to handle all modulation types relevant for professional use and includes a fast data modem (option). EK2000 moreover features a built-in power supply. The man-machine interface has been optimized for reception, but the receiver can also serve as a modulator for detached transmitters.

Features and benefits

Receiving characteristics

- Frequency range 10 kHz to 30 MHz
- 1 Hz frequency resolution
- Outstanding large-signal characteristics
- Immunity to input interference up to 200 V EMF
- 17 group-delay-compensated IF filter bandwidths from 50 Hz to 8 kHz
- Settable notch filter
- Passband tuning
- Syllabic squelch
- Noise blanker
- Fast channel/frequency scan with user-selectable step size, dwell time, hold time and RF thresholds
- Digitally tunable preselection as plug-in module or external motor-tuned preselection, maximum attenuation 40 dB at 10 % frequency offset

Signal processing

- Digital IF signal processing
- BRASS/MAHRS/data link operation in line with MIL-STD-188-203-1A
- High-speed data transmission (for text, fax, data, video pictures, etc) including operation in line with STANAG 4285, STANAG 4481 w/o FSK, STANAG 4529 and MIL-STD-188-110A
- ISB/DATA LINK modulator/demodulator (optional)

Operation, benefits for customer

- Telephone-like operation (automatic link setup and telephone patching, using normal telephones)
- Remote control via control unit, PC or Remote Control Processor GP 2000
- Optimized graphical MMI
- 19" version or rackmount
- Built-in power supply with input voltage range 97 V to 253 V
- Easy upgrade to exciter or 150 W transceiver by means of exchange of modules

Applications

EK2000 is above all ideal for all applications and platforms in communication networks, but it is also suited for radio interception and radiomonitoring. Its excellent RF characteristics, its comprehensive remote control features and its high reliability even under difficult operating conditions make this receiver the first choice for navy vessels. In addition to classic reception modes, EK2000 also enables broadcast reception (eg BRASS = broadcast and ship to shore) as well as split-site mode. Remote Control Processor GP2000 is available for controlling EK2000.

The use of sophisticated DSP technology throughout allows EK2000 to handle all types of modulation used in military, government and civil radiocommunications. For the reception of morse, speech, teletype and data signals, EK2000 can be operated in the SSB (USB/LSB), ISB, AME, CW, FSK, AFSK, F1C and FM modes, and meets MIL-STD-188-141A specifications for receivers. The following modes can optionally be implemented:

– Link 11 mode in line with MIL-STD-188-203-1A or STANAG 5511
– Link 22 mode in line with STANAG 5522

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VLF-HF Receiver EK2000

– SLEW (Single Tone Link Eleven Waveform) mode
– Link Y (with MkII modem)

The optional multistandard HF Modem GM2100 enables the reception and demodulation of data signals transmitted in single-tone mode (PSK) in line with MIL-STD-188-110A, STANAG 4481 (without FSK), STANAG 4285 and STANAG 4529.

The receiver has ready functionality for future waveforms, so any new software application has only to be loaded via the receiver's serial interface.

In the FSK and PSK modes (STANAG 4285, 4529 and MIL-STD-188-110A) Receiver EK2000 can also be used as a modulator for detached transmitters.

Design

EK 2000 is of modular design and is equipped with the modules of the XK2000 transceiver family. This ensures a uniform logistics concept and the convenient integration of the receiver into existing and new systems. EK2000 provides menu-guided operation and has versatile, flexible interfaces. The sturdy design and the water- and dust-proof front panel (protection class IP42) allow use of the receiver even under adverse environmental conditions. EK2000 complies with the environmental specifications of MIL-STD-810E.

Options for EK 2000 applications

The basic equipment sets of EK2000 are already factory-prepared and prewired to accept plug-in options. These internal options can be placed in specific slots on the mainboard (eg for VPU, HF modem, digital selection modules) and/or inserted as interface options at the rear of the units.

These interface options allow the simple connection of external system options or peripheral system equipment and accessories. They offer suitable matching and isolation as well as comprehensive EMC filtering and protection to satisfy international standards (eg ISO, CCIR, CCITT, MIL, FCC, DIN). The rear 3-slot interface cabinet makes for the connection of an external HF modem, GMDSS-DSC set, control of up to 256 external functions, matching of DATA LINK modems, PABX/PSTN telephone facilities, remote control facilities (GB2000 and/or MERLIN PC), TTY PCs/printer, etc.

The full advantages of the mentioned applications are mostly a matter of detailed system knowledge, planning and engineering, and therefore cannot be covered by this catalog.

Available options

- HF Modem GM2100
- Data Link Interface GV2120
- Modem Data Interface GV2130
- Modem Control Interface GS2120
- Digital Selection Unit FK2010
- OCXO Frequency Standard GF2010

For more information see Transceiver Family XK2000 (page 20).

To install EK2000 in a 19" console or rack the 19" Adapter Set KA2100 is required.

Specifications

Frequency

Frequency range	10 kHz to 30 MHz
Frequency steps	1 Hz
Channel memory	
Freely programmable channels	401
Half-duplex channels	100 (transmit and receive frequencies separately programmable)
Fixed-programmed channels (ITU)	1839 (channel numbers between 401 and 2240, half duplex)
Additional channels for ALE	120
Frequency and channel scanning	variable scanning time and threshold value, automatic stop when signal is received, programmable dwell time with manual override, manual operation possible
Frequency stability	
Standard TCXO	$<2 \times 10^{-8}$/°C
Aging	$<1 \times 10^{-6}$/year
Option (OCXO)	$<1 \times 10^{-9}$/°C
	$<5 \times 10^{-9}$/day
Aging	$<1 \times 10^{-7}$/year
Connection for external frequency standard	1/5/10 MHz
Frequency change	< 50 ms (without ATU and remote control, depending on baud rate)

Receiver specifications

Input impedance	50 Ω, nominal
VSWR	< 3 for set receive frequency
Input sensitivity (without preamplifier, without digital selection, f = 0.2 to 30 MHz, S/N = 10 dB)	
A1A (CW), B = 300 Hz	0.45 µV EMF (typ. 0.4 µV EMF)
J3E (SSB), J7B, B = 2.7 kHz	1.1 µV EMF, (typ. 1.0 µV EMF)
H3E (AME), 1 kHz, m = 60% B = 6 kHz	3.0 µV EMF, (typ. 2.7 µV EMF)
Input sensitivity (with preamplifier, without digital selection, f = 0.2 to 30 MHz, S/N = 10 dB)	
A1A (CW), B = 300 Hz	0.2 µV EMF (typ. 0.15 µV EMF)
J3E (SSB), J7B, B = 2.7 kHz	0.45 µV EMF (typ. 0.4 µV EMF)
H3E (AME) 1 kHz, m = 60%	1.1 µV EMF, B = 6 kHz (typ. 1.0)

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Receive bandwidths (automatic adjustment to class of emission, additionally manually selectable)	3 dB	60 dB
	±25 Hz	±125 Hz
	±75 Hz	±150 Hz
	±150 Hz	±215 Hz
	±200 Hz	±335 Hz
	±300 Hz	±430 Hz
	±400 Hz	±650 Hz
	±500 Hz	±770 Hz
	±750 Hz	±1000 Hz
	±900 Hz	±1440 Hz
	±1050 Hz	±1600 Hz
	±1200 Hz	±1760 Hz
	±1350 Hz	±1900 Hz
	±1550 Hz	±2100 Hz
	±1850 Hz	±2850 Hz
	±2250 Hz	±3220 Hz
	±3000 Hz	±4100 Hz
	±4000 Hz	±5100 Hz
Automatic amplitude control	<3dB (1 µV to 1 V EMF)	
Control rates (for 60 dB increment)		
Response time	<10 ms	
Decay time	25 ms, 150 ms, 500 ms, 1 s, 3 s adjustable (for modes B7D and B8E according to STANAG 5511)	
A1A (CW) BFO	± 5 kHz in 1 Hz increments	
AF distortion factor		
Line output 0 dBm	<1 %	
Headphones, loudspeaker	<3 % of nominal power	
Signal-to-noise ratio (H3E)	>46 dB SINAD at 1 mV EMF weighted with filter according to CCITT (O.41/P53)	
Nonlinearities (1.5 to 30 MHz, without preamplifier)		
Blocking, 3 dB signal attenuation at Δf > 30 kHz		
Wanted signal	2 mV EMF	
Interfering signal	5 V EMF	
Desensitization, > 20 dB SINAD at Δf > 30 kHz, B = 2.7 kHz		
Wanted signal	30 µV	
Interfering signal	100 mV	
Intercept point IP3	≥30 dBm , typ. 35 dBm, Δf >30 kHz	
Test signals	2 x 0 dBm	
Intercept point IP2	≥60 dBm, typ. 70 dBm	
Crossmodulation	<10 % remodulation	
Wanted signal	1 mV EMF	
Interfering signal	4 V EMF (1 kHz/30%) at Δf >30 kHz	
Inherent spurious signals	<1 µV equivalent EMF with few exceptions	
Noise rejection (Δf >30 kHz)		
Image-frequency rejection	>80 dB, typ. >90 dB	
IF rejection	>80 dB, typ. >90 dB	
Oscillator reradiation at antenna input	<10 µV into 50 Ω	
Protection of receiver input	10 V EMF operation (standard) 100 V EMF non-destructive (R_i = 50 Ω) without digital selection 200 V EMF non-destructive with digital selection (R_i = 50 Ω , f <30 MHz)	
Operating modes	A1A (CW), J3E (SSB), (USB/LSB selectable), H3E (AME), (USB), J7B (A7J), data transmission (J3E), B8E (ISB), F1B (FSK, AFSK), STANAG 4295, baud rate 50 to 600 Bd, deviation 42.5 to 425 Hz, F3E (FM), F7B (diplex telegraphy), F1C (fax), A3E (AM), B7D, MIL-STD-188-203-1A (option for con-figurable CLEW or SLEW), J2B, J2D with GM2100 (option), built-in dem-odulators (with GM2100), in line with R&S waveform, MIL-STD-188-110A, STANAG 4285 and STANAG 4529	

Maintenance	
Built-in test equipment (BITE)	selectable, display of control unit or front panel with plain-text error read-out (English), localization down to module level
Inputs/outputs, interfaces	
AF interfaces	
Inputs/outputs (2 (optionally 3))	selectable on symmetrically (floating) front panel or control unit, configura-ble according to MIL-STD-188, 0 dBm, 600 Ω, adjustable from –10 to +10 dBm
AF output for loudspeaker	3 W into 4 Ω, selectable, on/off, short-circuit-proof
AF output for headset	50 mW into 300 Ω, adjustable
Microphone inputs (2)	15 mV (1 to 30 mV), 150 Ω 150 mV (10 to 300 mV), 150 Ω
Teleprinter connection ports (2)	V28, selectable via front panel of remote control unit
Control interface	
Squelch (output)	open collector (30 V, 50 mA)
Receiver inhibiting	muting of receiver via contact to ground
Serial interfaces	
Computer control	RS-422, RS-485 (bus) or RS-232-C
Remote control	RS-232-C
RF interfaces	
RF input	N female connector, 50 Ω
Receive antenna (separate)	BNC female connector
External frequency standard	BNC female connector, 1/5/10 MHz selectable, 0 dBm/ 50 Ω ±3 dB
General data	
Power supply	97 to 246 V AC, 47 to 440 Hz and/or 19 to 31 V DC, I <2 A (without options)
Colour	
Front panels	light grey (RAL 7035)
Inscription	black grey (RAL 7021)
Dimensions (W x H x D)	483 mm x 132 mm x 340 mm (19" 3 HU)
Weight	approx. 13 kg without options
Environmental conditions	
Rated temperature range	according to MIL-STD-810E, Meth. 501.3 and 502.3
Operating temperature range	–25°C to +55°C at 1000 m
Storage temperature range	–40°C to +85°C
Altitude	max. 3000 m, max. +35 °C (operation) max. 10000 m (transport)
Humidity	according to MIL-STD-810E, Meth. 503.7, 95 % rel. humidity at +26/+41°C, 5 days, light condensa-tion
Vibration	
Sinusoidal (IEC 68)	5 Hz to 55 Hz, 0.2 mm DA (HVO 100)
Random (MIL-STD-T28800)	0.01 g^2/Hz, 10 to 300 Hz, 1.9 g rms (HVO 103)
Shock, random	MIL-STD-810E, Meth. 516.4 40 g, transition frequency 45 Hz (HVO 110)
Foreign matter, contact, water (DIN 40050)	IP 42
Electromagnetic compatibility	MIL-STD-461 class A3, A4 (CE03, RE 02, CS01, CS02, CS03) EN 50081/50082
Transient	VDE 160 (1.3 ms, 2.3 x voltage at nominal load)
Safety	VDE866, VDE804, VDE805, EN60950

Ordering information

VLF-HF Receiver	EK 2000	6093.6002.02

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Digital VLF-HF Receivers EK895, EK896 – Overview

EK895 and EK896 (Photo 41623)

10 kHz to 30 kHz

Compact DSP-based receivers for radiomonitoring and detection, radiocommunication, search operation, DF systems and as front-end for HF intelligence tasks

Brief description

The compact and modular VLF-HF receivers are ideal for use in stationary, mobile and remote receiving systems. Thanks to the modern and flexible concept, the receivers can be used as communication receivers in communication networks and for fast search, scanning, radio detection and radiomonitoring tasks. Moreover, the units are optimally suitable as high-performance front-end units (eg for special post-processing applications (COMINT) as well as for frequency-synchronous receiving or DF systems.

Digital VLF-HF Receivers EK895/896 resort to the use of digital signal processing (DSP) for the IF, demodulation and AF. The DSP, equipped with a very powerful microprocessor, offers a variety of additional features to the user such as automatic signal processing, signal optimization and high operating convenience. All this significantly improves the attainable reception quality.

The very compact ½ 19" single receivers or 19" (rackable) single or dual receivers allow any type of system combinations in the form of operator positions or handoff receivers (master-slave operation). Handoff or remote receiving operation over any distance is possible without any constraints using master (EK896)/slave (EK895) concepts (see page 15).

Moreover, Remote Control Unit GB899 or serial computer interfaces (also bus-compatible) for PC-controlled operation of single receivers or up to 99 handoff receivers (addressable) are available in the system.

Features and benefits

All the well-proven features of the EK890 family such as RF characteristics, operating and remote-control concept, applications, high immunity to spurious emission as well as high reliability (especially in the RF field and under environmental stress) can be found in these two receivers.

Well-proven system concept

- 2 different models:
  - Half-rack receiver EK895
  - Search receiver EK896 (19")
- Receiving range throughout with 1 Hz resolution
- 13 or 128 bandwidths
- Excellent large-signal behaviour
- Very short frequency change time (typ. 10 ms)
- High rejection of strong interfering signals
- BIT (built-In-test) integrated down to module level
- MIL-STD-810D and MIL-STD-461B
- Digital signal processing (DSP) for convienient and versatile operation
- Excellent radio signal analysis application with Digital Spectrum Display EP090

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Digital VLF-HF Receivers EK895, EK896 – Overview

Operational features

- Easy to operate via terminal, computer, remote control unit or front panel
  - Menu-guided settings
- Remote control of all settings – over any distance when using modems
  - Real-time remote control or master/slave mode
  - Master/slave and system operation
  - Fully BUS-controllable (RS-232-C, RS-485, 2/4-wire)
  - Available with operator front panel or remote-control-only front panel
- 1000 programmable channel memory locations
- Scan mode for programmable frequency ranges and any desired channel sequences
- Ideal handoff receivers in stationary, mobile and remote receiving systems

Customer benefits

- Extremely reliable operation under harsh environmental and EMC conditions (MTBF >14000 hours)
- High availability thanks to long MTBF and short MTTR
- Easy to adapt to special requirements by means of optional plug-in modules and standardized interfaces
- Excellent price/performance ratio
- Powerful microprocessor for bus interfacing, menus and user programs
- Free slots for retrofitting of options
- Integrated self-test down to module level with plain-text result display
- Low power consumption <25 VA (basic model EK895), therefore little self-heating
- Highly compact, width ½ 19" (EK895) or 19" (EK896)
- Dual receiver as 19" bench or rack models

Overview of EK890 models

Type	Model	Use (typ.)	Special features	Size	Bandwidths	Local & remote control	Remote control	Available internal opt.	Page
EK895	02	Slave, comm., monitoring	DSP + additional features	½ 19"	13	–	•	7	11
	07	Special communication	LINK11 reception/demodul.	½ 19"	13	–	•	7	11
	12	Gen.-purpose, comm., monitoring	DSP + additional features	½ 19"	13	•		6	11
	14	Gen.-purpose, monitoring, comm.	DSP, OCXO, opt. 128 BW	½ 19"	13	•		7	11
	17	LINK11 reception	With internal OCXO	½ 19"	13	•		7	11
	37	LINK11 reception	For use with external frequency standard	½ 19"	13	•		7	11
	63	1.44 IF	Additional IF output	½ 19"	13	•		7	11
EK896	12	Master, gen.-purpose, monitoring	DSP, fast and easy op., opt. 128 BW	19"	128	•		7	13
	14	Gen.-purpose, master, monitoring	DSP, fast and easy op., OCXO, monitoring RX	19"	128	•		8	13
	17	LINK11 reception	With internal OCXO	19"	128	•		8	13
	37	LINK11 reception	For use with external frequency standard	19"	128	•		8	13

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Digital VLF-HF Receiver EK895

Compact ½19" DSP-based high-end receiver for radiocommunication, radiomonitoring and detection, search operation, DF systems and as front-end for HF intelligence tasks

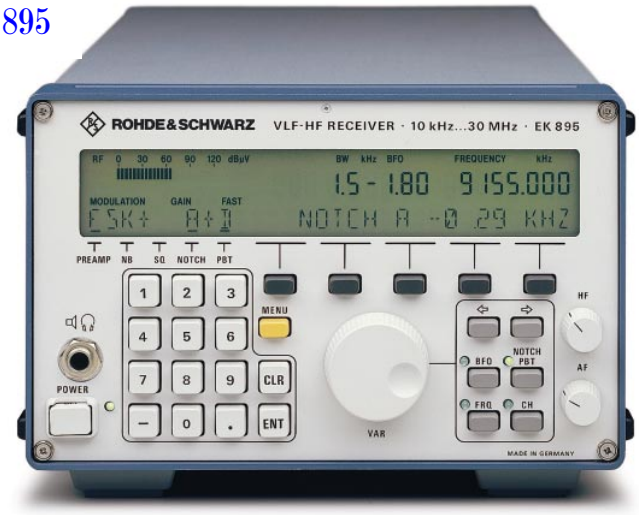

Photo 41636

Features and benefits

- Digital signal processing (DSP) for convenient and versatile operation
- Clear-cut front panel for simple, menu-guided operation
- Real-time remote control or master-slave mode
- Well-proven system concept
- Excellent price/performance ratio
- Extremely reliable operation under harsh environmental and EMC conditions
- Application-specific options and accessories available

Applications

Due to the excellent RF characteristics and the uncomplicated and full remote-control capability EK895 is suitable for all civil, administrative and military shortwave applications. Receiver EK895 is an ideal choice for receiving systems which have to fulfill extremely high reliability requirements, in particular under harsh environmental and EMC conditions.

Characteristics

With EK895, Rohde&Schwarz has a powerful VLF-HF receiver which is a top-end product benefiting from many years of experience in this field. Due to the advantages of digital signal processing, embedded in Receiver EK895 a number of additional features and operator convenience have been added. The operational features additionally incorporated into EK895, such as preamplifier (PREAMP), noise blanker (NB), squelch (SQ), notch filter (NOTCH) and passband tuning (PBT), are selected in submenus using softkeys. If one of these features is active, a bargraph appears on the display above the relevant inscription (PREAMP, NB, SQ, NOTCH, PBT).

A clearly organized, menu-guided selection and programming of the receiving settings ensure excellent processing and handling of the received signal content. Thanks to its full system compatibility, the receiver provides the basis for extremely economical customer-specific solutions.

EK895 thus fulfills the requirements for versatile use in voice receiving and any kind of data communication systems as well as for all radiomonitoring, radio detection and radio intelligence (COMINT) applications.

Operation

The built-in memory has capacity for nonvolatile storage of 1000 complete channel settings so that channel management and control by an external computer are not required but nevertheless additionally possible.

Receivers with remote-control panel

The receivers can be remote-controlled by ASCII command sequences via a multistandard interface (RS-232-C, RS-485, RS-422/423, 2/4-wire). In the simplest case, a terminal can be used as the control unit. For more convenience a computer can be used to handle complex tasks and to create special user interfaces. A demo program for generating a virtual front panel is available if desired.

A remote control unit (GB899) permits full remote control via the serial interface, and with external line modems, over any distance.

Two wired and bus-integrated slots for plug-in modules are provided in EK895 for extensions.

The comprehensive sequence control can be used for all demanding short-

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wave reception tasks. Due to flexible programming of the processor, the following operating modes are possible:

– Manual operation
– Remote control or master-slave operation
– Channel scanning, sequential and programmable
– Frequency scan
– Channel reception
– Password-protected channel reception

Special features

- Excellent large-signal behaviour, very good intercept points
- High resolution of tuning frequency down to 1 Hz
- Fast and low-noise synthesizer
- Demodulators for AM, CW, LSB, USB, ISB, FM, FSK, AFSK and FAX included in basic configuration
- 13 bandwidths from 150 Hz to 8 kHz (128 BW as option)
- LINK11 reception (models 07, 17, 37)
- RF preamplifier, switchable (noise figure 8 kT_0)
- Double notch filter
- Noise blanker
- Passband tuning
- Syllabic squelch
- Special RTTY (FSK/AFSK) mark and space filters, matched to the selected shift
- Digital data output (Data, Clock, Frame)
- Maximum input voltage protection up to 100 V EMF
- Control interface fully complying with international standards
- Low power consumption <25 VA (basic model EK895), therefore little self-heating
- Powerful microprocessor for bus interfacing, menus and user programs
- Dual receiver as 19" bench or rack models
- Free slots for retrofitting of options
- Integrated self-test down to module level with plain-text result display
- Available with operator front panel or remote-control-only front panel
- Highly compact, width ½ 19"

Specifications

Frequency range	10 kHz to 30 MHz	
Resolution	1 Hz	
Frequency drift	−10 to +45 °C	aging/year
Frequency standard (TCXO)	5×10^{-7}	1×10^{-6}
Option: OCXO	1×10^{-7}	1×10^{-7}
External frequency standard	1/5/10 MHz, 0.2 to 1 V RMS	
Antenna input	BNC connector, 50 Ω	
Max. input voltage (≤30 MHz)	100 V_{EMF}	
Demodulation modes	CW/MCW (A1A, A1B, A2A, A2B) FAX1 (F1C) AM/AME (A3E, H2A, H2B, H2E) USB/LSB (R2A, R3E, J2A, J3E) ISB (B8E) FSK/AFSK (F1A, F1B), F6 (F7B) FAX2 (F3C), FM (F3E) DATA LINK to MIL-STD-188-203-1A (on request)	
IF bandwidth (standard values)	13, selectable between 150 Hz and 8 kHz	
Quasicontinuous bandwidth selection	128 steps, between 100 Hz and 9 kHz (with option EK895S7)	
Sensitivity (for S/N=10 dB, f=0.1 to 30 MHz)		
A1A (CW)	0.4 µV EMF (−121 dBm), BW=300 Hz	
J3E (SSB), J7B	1.0 µV EMF (−113 dBm), BW=2.7 kHz	
H3E (AME), 1 kHz, m=60%	2.7 µV EMF (−104 dBm), BW=6 kHz	
with preamplifier, f=0.2 to 30 MHz		
A1A (CW)	0.2 µV EMF (−127 dBm), BW=300 Hz	
J3E (SSB), J7B	0.4 µV EMF (−121 dBm), BW=2.7 kHz	
H3E (AME), 1 kHz, m=60%	1.0 µV EMF (−113 dBm), BW=6 kHz	
Immunity to interference, non-linearities		
Intermodulation (1.5 to 30 MHz)		
IP_2	>60 dBm (typ. 70 dBm)	
IP_3	>30 dBm (typ. 35 dBm)	
`Gain control`	automatic (AGC), manual (MGC) or remote (DGC)	
AGC error	≤3 dB (1 µV to 1 V EMF)	
Time response constants		
Attack time	<10 ms	
Decay time	25/150/500 ms, 1 s, 3 s	
DGC range	0 to 120 dBµV EMF in 1 dB steps	
`AFSK/FSK demodulator`	transfer rate (50 to 600 baud) and deviation range (±42.5 to ±425 Hz) adjustable; V.28 interface and audible tone circuit	
`Diplex telegraphy demodulator (F7B)`	2 x V.28 interface	
`Channel memory`	for 1000 channels, nonvolatile, storage of complete receiver setup for each channel	
`Data interface`	RS-232-C, RS-485 (bus-compatible)	
Transfer rate	50 to 38 400 baud	

General data

Environmental conditions	to MIL-STD-810 D
Rated temperature range	−10 to +45 °C
Operating temperature range	−25 to +55 °C
Storage temperature range	−40 to +80 °C
Humidity (non-condensing)	max. 95% at +40 °C
Vibration test	10 to 55 Hz; 0.4 mm double amplitude
Shock test	30 g, 11 ms
EMC	to MIL-STD-461/462
MTBF	>14 000 h
Power supply	100/120/230/240 V −15/+10%, 47 to 420 Hz (approx. 25 to 75 VA, depending on model)

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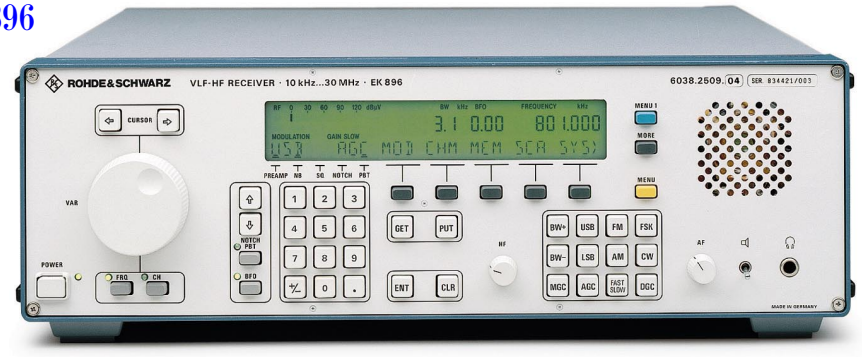
Dimensions (W x H x D), weight	211 mm x 132 mm x 460 mm, approx. 8 kg	

Ordering information EK895

VLF-HF Receiver		
with control panel for local/remote control		
Standard Receiver (with TCXO)	EK895	6057.8996.12
with oven-controlled frequency standard (OCXO)	EK895	6057.8996.14
with front panel for remote control		
Standard Receiver (with TCXO)	EK895	6057.8996.02
for LINK11 reception		
Standard Receiver (with TCXO)	EK895	6057.8996.07
for LINK11 reception, with oven-controlled frequency standard (OCXO)	EK895	6057.8996.17
for LINK11 reception, for use with external frequency standard	EK895	6057.8996.37
with 1.44 MHz additional IF output	EK895	6057.8996.63
Accessories supplied	manual	
Recommended extras		
Control Panel	GB890	6007.7709.03
Remote Control Unit	GB899	6037.3501.03
19" Adapter Kit	ZZA98	0827.4533.00
19" Adapter Kit for 2 EK895	KA890L1	6041.6699.03
Service manual	EK895	6045.6712.62
Line Current Source	GH890	6007.6054.02
Plug-in modules		
Input Filter Unit	FK890H1	6007.7750.02
BCD Interface	GC890	6007.7809.02
Broadband Output (module)	GM893	6051.8494.03
IF Converter (submodule of IF/AF processor)	UX895	6077.0261.02
Quasicontinuous IF Bandwidth Control (128 BW)	EK895S7	6077.0510.02

Digital VLF-HF Receiver EK896

19" DSP-based receiver for radiomonitoring and detection, radiocommunication, master receiver for radio workstations



Search Receiver EK896 with front panel for local/remote control (Photo 41639)

Features and benefits

- Digital signal processing (DSP) for convenient and versatile operation
- Digital RF selection (optional)
- Real-time remote control or master-slave mode
- Well-proven system concept
- Excellent price/performance ratio
- Extremely reliable operation under harsh environmental and EMC conditions
- Application-specific options/accessories available

Applications

EK896 has been designed with a particular view to complex tasks of radio detection and search reception, its operating principle and configuration matching perfectly the relevant requirements. As standard it is fitted with panel controls and LC display for local and remote-control operation since with radiomonitoring manual optimization of receive parameters is practically always necessary.

High-speed and reliable radiomonitoring is supported by temporary storage of a complete receiver setup and its transfer to or readout from the connected slave. EK896 is the optimal operator's position in modern radiomonitoring systems. In the usual master-slave mode, a master receiver can control up to 99 slave receivers via additional line drivers to handle simultaneous radiomonitoring or specific radio detection tasks. Due to its outstanding characteristics, EK896 is also ideal for use as a stand-alone receiver. All EK895 options can be fitted.

Characteristics

EK896 is based on the basic model EK895, see page 11.

Special operations
- Master-slave operation
- Complete erasure of channel memory

In addition, the following functions can be selected on the front panel:
- Display of interface configuration
- Fast channel storage
- Channel buffer storage
- Default settings on/off
- Password for channel service
- Local/remote mode
- Knob increments

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Special features

- Excellent large-signal behaviour, very good intercept points
- High resolution of tuning frequency down to 1 Hz
- Fast and low-noise synthesizer
- Demodulators for AM, CW, LSB, USB, ISB, FM, FSK, AFSK and FAX included in basic configuration
- 128 bandwidths from 100 Hz to 9 kHz
- RF preamplifier, switchable (noise figure 8 kT_0)
- Double notch filter
- Noise blanker
- Passband tuning
- Syllabic squelch
- Special RTTY (FSK/AFSK) mark and space filters, matched to the selected shift
- Direct, fast access key panels
- Digital data output
- Maximum input voltage protection up to 100 V EMF (up to 200 V EMF, see option)
- Control interface fully complying with international standards
- Digital selection (optional)
- Built-in speaker, switchable
- Large tuning knob
- Low power consumption <25 VA (basic model EK896), therefore little self-heating
- Powerful microprocessor for bus interfacing, menus and user programs
- Receiver as 19" bench or rack models
- Free slots for retrofitting of options
- Integrated self-test down to module level with plain-text result display

Specifications

Frequency range	10 kHz to 30 MHz	
Resolution	1 Hz	
Frequency drift	–10 to +45°C	aging/year
Frequency standard (TCXO)	5×10^{-7}	1×10^{-6}
Option: OCXO	1×10^{-7}	1×10^{-7}
External frequency standard	1/5/10 MHz, 0.2 to 1 V RMS	
Antenna input	BNC connector, 50 Ω	
Max. input voltage (≤30 MHz)	100 V EMF, opt. 200 V EMF	
Demodulation modes	CW/MCW (A1A, A1B, A2A, A2B) FAX1 (F1C) AM/AME (A3E, H2A, H2B, H2E) USB/LSB (R2A, R3E, J2A, J3E) ISB (B8E) FSK/AFSK (F1A, F1B), F6 (F7B) FAX2 (F3C), FM (F3E) DATA LINK to MIL-STD-188-203-1A (on request)	
IF bandwith	13, selectable between 150 Hz and 8 kHz and 128 steps, between 100 Hz and 9 kHz	
Sensitivity	(for S/N=10 dB, f=0.1 to 30 MHz)	
A1A (CW)	0.4 µV EMF (–121 dBm), BW=300 Hz	
J3E (SSB), J7B	1.0 µV EMF (–113 dBm), BW=2.7 kHz	
H3E (AME), 1 kHz, m=60%	2.7 µV EMF (–104 dBm), BW=6 kHz	
with preamplifier, f=0.2 to 30 MHz		
A1A (CW)	0.2 µV EMF (–127 dBm), BW=300 Hz	
J3E (SSB), J7B	0.4 µV EMF (–121 dBm), BW=2.7 kHz	
H3E (AME), 1 kHz, m=60%	1.0 µV EMF (–113 dBm), BW=6 kHz	
IP2 and IP3	same as EK895	
Gain control	automatic (AGC), manual (MGC) or remote (DGC)	
AGC error	≤3 dB (1 µV to 1 V EMF)	
Time response constants		
Attack time	<10 ms	
Decay time	25/150/500 ms, 1 s, 3 s	
DGC range	0 to 120 dBµV EMF in 1 dB steps	
AFSK/FSK demodulator	transfer rate (50 to 600 baud) and deviation range (±42.5 to ±425 Hz) adjustable; V.28 interface and audible tone circuit	
Diplex telegraphy demodulator	2 x V.28 interface	
Channel memory	for 1000 channels, nonvolatile, storage of complete receiver setup for each channel	
Data interface	RS-232-C, RS-485 (bus-compatible)	
Transfer rate	50 to 38 400 baud	
General data		
Environmental conditions	to MIL-STD-810 D	
Rated temperature range	–10 to +45°C	
Operating temperature range	–25 to +55°C	
Storage temperature range	–40 to +80°C	
Humidity (non-condensing)	max. 95% at +40°C	
Vibration test	10 to 55 Hz; 0.4 mm double amplitude	
Shock test	30 g, 11 ms	
EMC	to MIL-STD-461/462	
MTBF	>14 000 h	
Power supply	100/120/230/240 V –15/+10%, 47 to 420 Hz (approx. 25 to 75 VA, depending on model)	
Dimensions (W x H x D), weight	426 mm x 132 mm x 460 mm, approx. 11 kg	

Ordering information

VLF-HF Receiver		
with control panel		
Standard Receiver with TCXO	EK896	6038.2509.12
with oven-controlled frequency standard (OCXO)	EK896	6038.2509.14
for LINK11 reception (int. OCXO)	EK896	6038.2509.17
for LINK11 reception (for use with external frequency standard)	EK896	6038.2509.37
Accessories supplied	manual	
Recommended extras		
Remote Control Unit	GB899	6037.3501.03
Service manual	EK896	6045.7783.62
Line Current Source	GH890	6007.6054.02
Plug-in modules		
Input Filter Unit	FK890H1	6007.7750.02
BCD Interface	GC890	6007.7809.02
Broadband Output (module)	GM893	6051.8494.03
IF Converter		
(submodule of IF/AF processor)	UX895	6077.0261.02
Quasicontinuous		
Digital Selection	FK896	6077.2264.02
Remote Control Software	EK890S2	6077.2264.03
HF Unit with 1.44 MHz		
IF output, unregulated	(EK890)	6007.4400.03

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Control Concepts of VLF-HF Receivers EK895/896

Remote control

… via PC or ASCII terminal

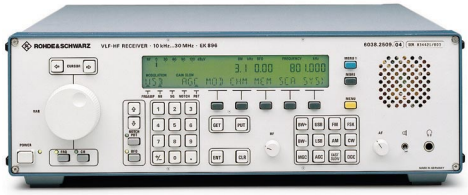
EK895 with front panel for remote control (Photo 40376)

… via Remote Control Unit GB899, model 03 (Photo 41978)

RS-485 bus

Local control

EK895 with control panel as a stand-alone unit or as a master receiver in systems (Photo 41637)



Search Receiver EK896 (Photo 40439)

Master-slave operation

Slave receivers, max. 99 addressable (Photo 41625)

Internal Options for EK895/EK896 – Overview

	Control Panel GB890, 03	IF Conv. UX895	Input Filter FK890H1	Broadband Output GM893 model 03	BCD Interf. GC890	Line Curr. Source GH890	Digital Selection FK896	IF Bandw. Contr. (128) EK895S7	Remarks
EK895 (model 02 to 14)	o	o	o	o	o	o	—	o	max. 2/ set
EK896 (model 12, 14)	—	o	o	o	o	o	o	o	max. 2/set

— not available
• standard
o optional

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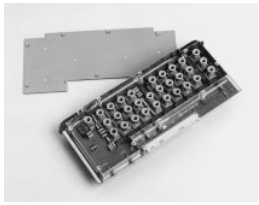
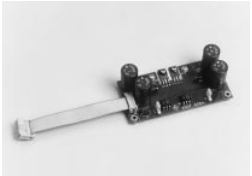
Internal Options for VLF-HF Receivers EK895/896

Designation	Description	Features and benefits Specifications	Ordering information
Control Panel GB890 	Control Panel GB890, also called operator front panel for local control, is part of Receivers EK895 and EK896, models ≥12. GB890 can be easily retrofitted – also during operation – into receivers, which makes them particularly suitable for the field of servicing. In addition to the controls and displays, GB890 also contains an AF amplifier for headphones or for an external loudspeaker.	Easily exchangeable front panel with control, setting and display elements as well as AF amplifier (max. 1 W into 8 Ω) at headphone jack plug.	**Blank Panel** GX890 6007.5506.02 **Control Panel** GB890 6057.9140.02
IF Converter UX895	IF Converter UX895 is a submodule for the IF/AF (DSP) processor. Instead of the analog IF output (0 to 40 kHz) IF Converter UX895 performs a linear conversion of the set receive parameters into the IF of 455 kHz (100 kHz output frequency on request). This option allows connection of external signal processing units/analyzers operating with an input frequency of 455 kHz.	Level0 dBm ConnectorBNC Impedance50 Ω	IF Converter UX895 6077.0261.02
Input Filter Unit FK890H1 	The input filter module comprises a lowpass filter, a bandpass filter and eight suboctave filters which are automatically selected with the receive frequency. It is also equipped with a signal input protection up to 30 V EMF (for the HF bands). The input filter unit has a very low insertion loss (<1dB) and an excellent large-signal behaviour matching with the receiver (no inherent distortion/hysteresis). The input filter unit is recommended for use to ensure unimpaired reception in an environment subject to RF interference (collocation). In this case, unwanted (interfering) frequency ranges are strongly suppressed.	Lowpass filter0 to 0.5 MHz Bandpass filter0.5 to 1.5 MHz Suboctave filters (8x)1.5 to 30 MHz Insertion loss<1 dB Input voltage protection≥30 V EMF Designplug-in module	Input Filter Unit FK890H1 6007.7750.02
BCD Interface GC890	The BCD interface provides the current receive frequency information – with a resolution of 100 Hz to a parallel BCD output. This frequency information can be used to control external frequency-dependent add-on units such as tuned Selection FK101 or tuned active Antenna System AK001. This option needs an additional output connector at the rear of the receiver (BCD interface).	Frequency information22 bit parallel, CMOS, 5 V Designplug-in board	**BCD Interface** GC890 6007.7809.02
TTY Line Current Source GH890 	This option supplies the line current (40 mA at 60 V, or ±20 mA at ±30 V) required for direct connection of teletype units provided that a FSK/AFSK demodulation (eg with GM890) – standard for EK895/896 – is given. This option is recommended for the connection of older teletype units which still need line current. It is not required for modern teletype units that are operated under V.28 or TTL control.	Line current40 mA/60 V Double current (can be selected)±20 mA/±30 V Designprinted circuit	TTY Line Current Source GH890 6007.6054.02

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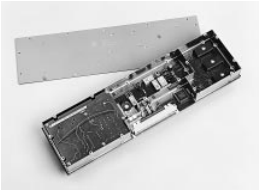
Internal Options for VLF-HF Receivers EK895/896

Designation	Description	Features and benefits Specifications	Ordering information
Digital Selection FK896 (for EK896 only) 	This option comprises Digital Selection FK2010 which, together with Control Interface GS896, is integrated into EK896. The automatically tuned, tracking selection circuit incorporates the following functions: The digital selection is recommended for use in environments with strong RF interference (ie collocation problems). It improves input selection by automatic tracking of the receive frequency and increases the input voltage protection (overload protection) of the receiver. Design: filter unit (FK2010) plus plug-in board (GS896).	• 7-circuit lowpass (0 to approx. 30 MHz) • 5-circuit lowpass (0 to approx. 1.5 MHz) for rejection of strong shortwave interfering signals • Tracking single-circuit filter 1.5 to 30 MHz with stopband attenuation of >20 dB at 10% spacing • Power on/off by remote control (can be bypassed) • Input voltage protection to 200 V EMF	DigitalSelectionFK896 6077.2264.02
DATA LINK demodulator	This software option is used for the demodulation of DATA LINK emissions according to MIL-STD-188-203-1.	Further information supplied on request.	
Quasicontinuous IF Bandwidth Control EK895S7	This software option allows the fine selection of the IF bandwidth between 100 Hz and 9 kHz in 128 steps and thus permits optimization of the required bandwidth for the different types of modulation or of the adjacent-channel suppression. This option offers a choice of operation with either 13 (standard) or 128 bandwidths. The advantage lies – especially important for radiodetection and analyzing receiving equipment – in the optimum S/N ratio setting for the signal received and demodulated. The optimum bandwidth can be stored with DEF OFF and is then automatically set again depending on the modulation type. This option has to be indicated when ordering the relevant receiver (factory installation).	BW steps128 steps between 100 Hz and 9000 Hz, displayed, variable by means of knob Shape factor (max. at 3 dB)1.2 to 1.5	**Quasicontinuous IF Bandwidth** Control EK895S7 6077.7051.02 Note: This option is standard in Receiver EK896.
Broadband Output GM893	The optional broadband output (plug-in module) supplies an approx. 1 MHz broad signal at the first IF of 41.44 MHz (at the receive frequency ±500 kHz). To avoid impairment of the receiver sensitivity of the main (information) channel, the path to the broadband channel is decoupled by ≈10 dB. For broadband spectrum analysis, Spectrum Display EPZ513 can be connected to this broadband output.	Output frequency 41.44 MHz Bandwidth>1 MHz (at 3 dB) Min. gain –10 dB, related to antenna input Impedance 50 Ω	**Broadband Output** GM893 6051.8494.03
Oven-controlled crystal oscillator (OCXO)	To obtain a higher frequency stability of the receiver an OCXO module can be incorporated into the synthesizer instead of a standard crystal oscillator (TCXO). This option has to be indicated when ordering the relevant receiver (factory installation).	Stability short-term<1 x $10^{-9}/_{day}$ long-term<1 x $10^{-7}/_{year}$ Drift versus temperature<5 x 10^{-7} (–10 to +45°C)	Oven-controlled crystal oscillator (OCXO) for EK895 6057.8996.14 for EK896 6038.2909.14

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External Options for VLF-HF Receivers EK895/896

Designation	Description	Features and benefits Specifications	Ordering information
Remote Control Unit GB899, (models 02, 03) 	Remote Control Unit GB899 can be used to remote-control one or several receivers of the EK890 family via the serial and bus-compatible interface. The receivers can be selected and operated via addresses 01 to 99. GB899 has the same appearance and dimensions as EK895.	InterfaceRS-232, RS-485 (bus) Data transfer50 to 19200 Bd For distances of more than 100 m the use of standard line modems is recommended.	Remote Control Unit GB899 6037.3501.03
Shockmount KS890 for EK895 	Two types are available, one for MIL-specified uses, one for non-specified use.	KS890M1: random vibration and shock according to MIL-STD-810D Test Procedure 514.3 or 416.3, proc. 1. KS890C1: for highly qualified applications, using silicon elastomer absorbers.	**Shockmount** KS890M1 6043.4941.xx **Shockmount** KS890C1 6043.4941.xx

Service Kit KA890C1

Service kit for EK895/896. This service kit is packed in a small hard-foam-lined case, with the following contents:

List of contents

No.	Quantity	Designation	Order No.	Used for
1	1	Adapter Card	6030.9104.02	Motherboard to: • Synthesizer • RF Unit • IF Section • IF Unit/Demodulator • IF/AF Processor For optional modules: • Preselection Unit • IF Signal Processor • IF Converter • BCD Interface • Control Unit 2
2	1	Adapter 96 pin	6007.7680.02	Control Processor
3	4	Coaxial Cable	699.4196	
4	1	BNC-SMB Adapter	FJ 080.2270	

Ordering information

Service Kit	KA890C1	6030.9004.02

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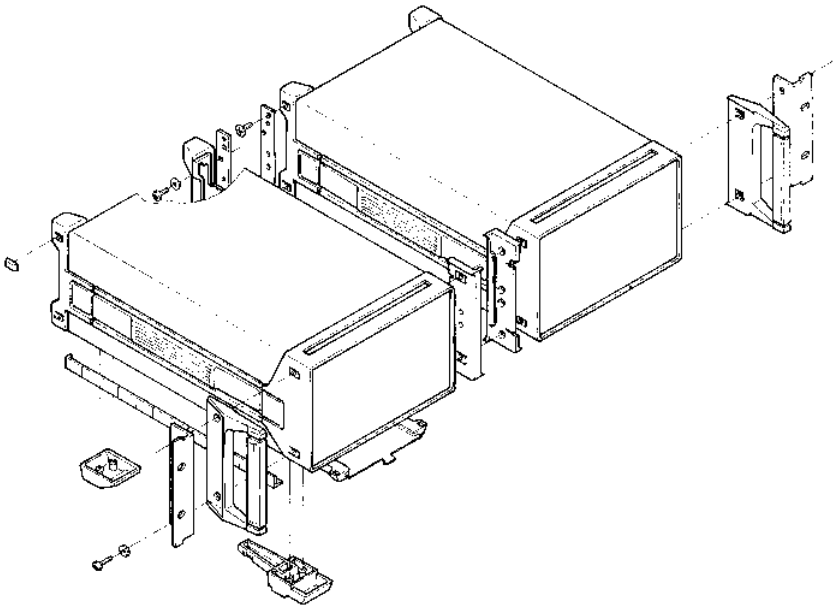
19" Rackmount Kits

Rackmount Kit KA890L1

For side-by-side mounting of 2 EK895 receivers in one 19" unit,

- as desktop model: KA890L1, model 02
- as rackmount set: KA890L1, model 03 of 6041.6699.xx

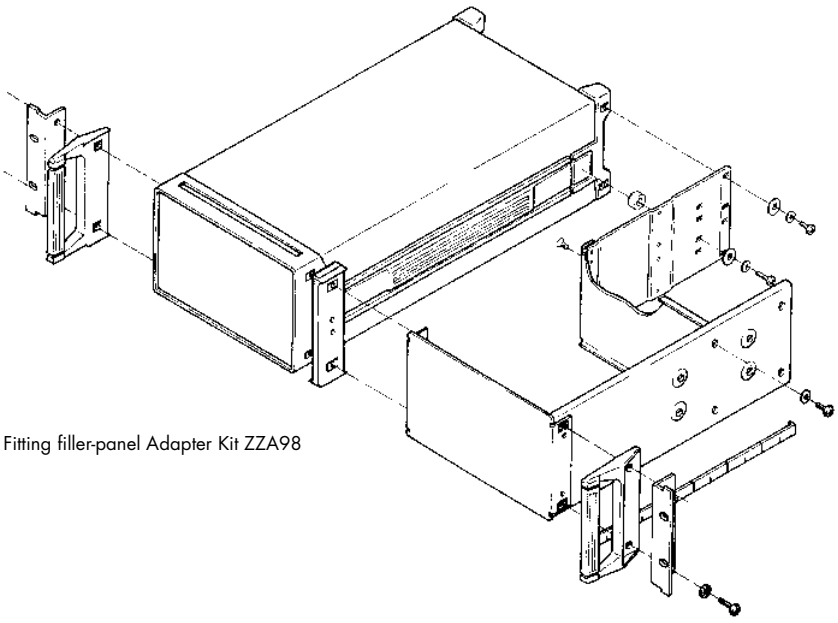


Fitting 19" rackmount kit to a combination of two 3 HU ½ W units with the same depth

Adapter Kit ZZA98

For assembling one EK895 receiver together with a blank panel in a 19" rackmount unit.
(3 HU, ½ width, depth 460 mm)

(Order No. 0827.4591)

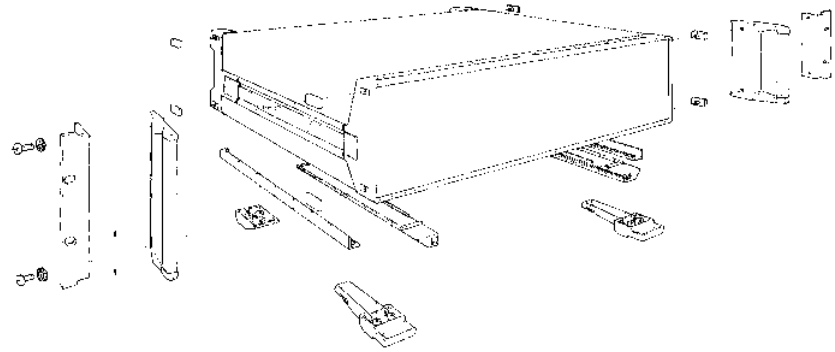


Fitting filler-panel Adapter Kit ZZA98

Adapter Kit ZZA93

For EK896 to obtain a 19" rackmount receiver (3 HU).

(Order No. 0396.4892)



19" adapter, from desktop model to rackmount

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Brief description

With HF Transceiver Family XK2000, Rohde&Schwarz is continuing its long-standing tradition in the field of shortwave communications. The XK2000 line includes transceiver systems for mobile and stationary use with powers of 150 W, 500 W and 1000 W.

XK2000 not only provides the full range of standard radiocommunication functions, it also offers a wide variety of applications:

- Shortwave telephone and fax
- Transmission of picture and computer data with up to 5400 bit/s
- GMDSS for maritime applications
- MAHRS/LINK expandability

Further advantages are:

- Optimum operating concept
- Plug-in options
- Fail-safe 24-h operation
- EMC protection to MIL and EN
- Sturdy construction

Communication processors to international standards, fast and reliable data transmission as well as message handling (eg with MERLIN) allow XK2000 to be integrated into modern multimedia systems, thus providing the basis for reliable, worldwide-communication independent of existing infrastructures.

Versatility built into the basic configuration

XK2000 in its basic configuration is capable of transmitting morse, speech and teletype data. All common classes of emission such as SSB (USB, LSB), ISB, AME, CW, FSK, AFSK, weather fax and FM are available. This equipment can thus be used both for high-quality SSB/AME/FM radiotelephony and for teletype and fast data transmissions.

Completely new areas of application are opened up by a variety of options, provided mostly as plug-in modules for the basic unit.

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Options for every application

Automatic link establishment (ALE)
ALE Processor GS2200 automatically sets up the optimum radiocommunication link using the adaptive Rohde & Schwarz ALIS 2000 procedure or FED-STD-1045A (MIL-STD-188-141A). As for ALIS, this procedure is 100% compatible with the HF850 family of radio equipment.

Data transmission
The transmission rate can be markedly increased (up to 5400 bit/s) by means of the internal HF Modem GM2100. This enables the transmission and reception of telefax messages, computer data, and colour video still pictures, for example. Connection between the data terminal (fax machine, video camera) and XK2000 is made by System Processor MERLIN from Rohde & Schwarz or an equivalent PC with the appropriate software. Alternatively, an external HF modem (eg GM857C4) can be connected via Interface GV2100.

Shortwave telephone links
Optional Automatic Phone Patch (APP) GN2100 allows a telephone to be linked up to a private automatic branch exchange (PABX). ALE Processor GS2200 establishes the radio link with the called subscriber, who can be dialled directly in half-duplex mode; transmit/receive switchover is voice-controlled by means of a VOX circuit.

GN2100 automatically adapts itself to telephone lines of varying quality. Instead of the PABX, direct connection can be made to the public switching telephone network (PSTN), provided official regulations make allowance for this. As a matter of course, XK2000 offers all the amenities of a modern telephone set: short-code dialling memory, optional pulse or dual-tone multifrequency dialling (DTMF).

High quality of speech
Using digital signal processing (DSP), Digital Voice Processing Unit GN2110 considerably improves speech intelligibility by suppressing noise and interference in the transmission or reception mode. This option also allows voice control of squelch and VOX circuits. A speech scrambler can be fitted in addition to provide security against interception.

Three power classes

The system is available in three versions with different output powers:

- XK2100 with 150 W
- XK2500 with 500 W
- XK2900 with 1000 W

Each transceiver system comprises a receiver-exciter, an amplifier, a power supply, an antenna tuning unit, and internal and external options (see diagram below). All units are available as bench models or rackmounts.

The XK2000 systems are used for reception in the range 10 kHz to 30 MHz and for transmission in the range 1.5 to 30 MHz. Broadband antennas can be connected directly to the system. Optimum antenna matching is provided for each power class by means of Antenna Tuning Units FK2100, FK855 and FK859. Antenna Tuning Unit FK2100, which is used in the 150 W system (XK2100), is connected via a single coaxial cable, which carries at the same time the RF signal, the control data and the supply voltages.

State-of-the-art technology

HF Transceiver Family XK2000 is in line with the very latest in technology both in terms of hardware and software. This includes, for example, digital signal processing (DSP) in the transmitting and receiving sections, and internal instrument control by means of a fast, serial control bus (Rohde & Schwarz SERBUS). This allows hardware extensions (options) to be integrated fast and easily, and software updates to be made conveniently via an RS-232-C interface. Plain-text display of faults down to module level by means of the built-in test system (BIT) greatly facilitates troubleshooting and servicing.

Great importance has been attached to electromagnetic compatibility (EMC). The relevant requirements of MIL-STD-461 and EN 50081/ EN 50082 are fulfilled.

The XK2000 systems are available in two versions: for local and remote control and for remote control only. Both versions can be operated from Remote Control Unit GB2000 and/or a commercial PC.

The core of the XK2000 family is formed by basic units XK2100 (150 W transceiver) and GX2900 (receiver-exciter for the 500 W and 1000 W versions). These units include, in their basic configuration, six easily exchangeable modules and a number of free slots for options (see block diagram).

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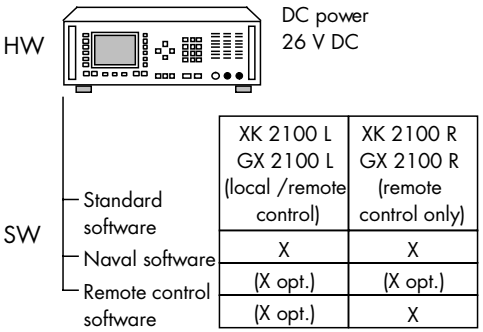
XK2000 Family

Basic Sets: XK2100 / XK2500 / XK2900 / GX2900.rx / GB2000

Transceiver XK 2100 (150 W)

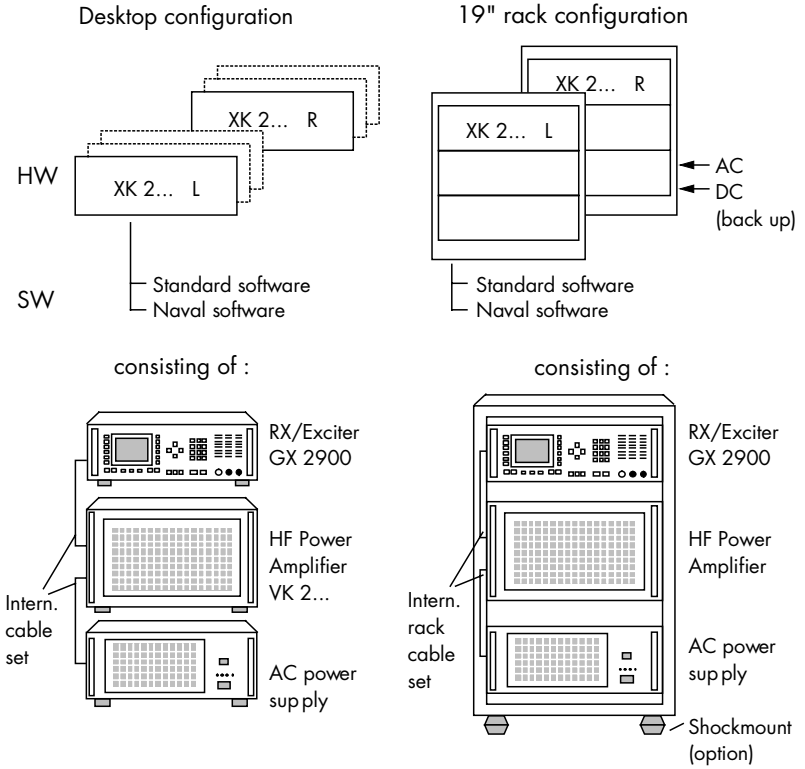


	XK 2100 L GX 2100 L (local /remote control)	XK 2100 R GX 2100 R (remote control only)
Standard software	X	X
Naval software	(X opt.)	(X opt.)
Remote control software	(X opt.)	X

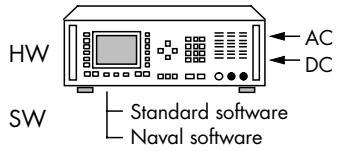
Note: prepared/prewired/BIT-covered
for up to 5 internal optional modules
for up to 4 interface modules
(details see XK 2000 options sheet)

Connectors for external options:
- Remote control (2 I/Os)
- ATUs
- R&S broadband antennas
- RF postselections (RX/TX and TX power)
- Receivers
- Automatic phone patch
- TTY set (PC + printer)
- Fast data (fax, video, files)
- System/control PCs, ATs (Merlin)

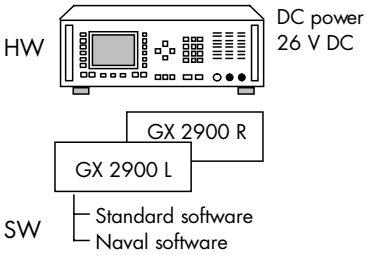
Transceiver XK 2500/XK 2900 (500 W/1000 W)



Remote Control Unit GB 2000



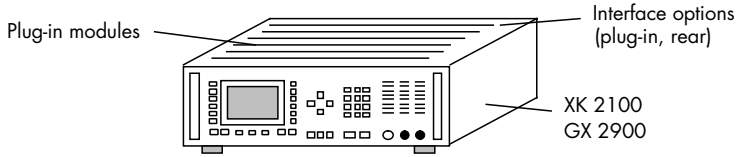
Receiver GX 2900.rx



System Receiver GX 2900.rx
for
- Duplex operation
- Split-site operation
- Large transmit/receive systems

Common features XK 2000
- Operations
- Logistics
- System solutions

XK2000 Options



Internal
Customer-installed

Plug-in modules

HW

- Link processor: ALE Proc. GS 2200
- Multimode modem: HF Modem GM 2100
- Automatic phone patch: APP Mod. GN 2100
- Voice proc. unit: VPU (NRU) GN 2110 + NRU + SCR
- Digit. Select. FK 2010

SW

- ALE Proc. GS 2200: ALIS 2000 Std; ALIS 2000 FH; ALIS 2000 ARQ; ALE 1045
- HF Modem GM 2100: R&S std.; STANAG 4285; MIL-STD-188-110
- APP Mod. GN 2100: R&S std.

Plug-in interfaces

- ALE / APP IF FK 2110: ALE config. ALE data IF; PABX PSTN
- RX/TX Interf. GS 2110: 2nd RX or 2nd TX; NMEA
- Ext. Control GV 2110: Max. 100 m; Option IF GV 2000; (TX filter); (Motor Select.); AK001
- DATA LINK GV 2120: DTS (MIL-STD-188-203)
- Mod.Data IF GV 2130: GM2000 GM2100; Ext. LINK process. +ARAMIS +RSX.25
- Modem IF GV 2100: Ext. HF modem ARQ Factor

Internal
Factory-installed

- High Freq. Stability OCXO GF 2010

External

XK 2100

HW

- ATU FK 2100 — SW: Std.SW
- ATU FK2100M — SW: Std.SW; Naval SW
- Shockmount for XK2100 KS 2110
- Shockmount for XK2100 +KS 2100
- 19" Adapter for XK2100 KA 2100
- 19" Adapter for IN 2100 KA 2120
- AC / DC PS IN 2100
- Blower Unit KL 2100

XK 2500/2900

- ATU HF850 Series
- RX Input Protect. ZW 2900
- 440 V Transf. BV 2900
- Rack 19" KG 2900 — Internal cable set
- 19" Adapter Kit KA 2900

XK 2000 System

- 1 kW TX filter (in prepar.)
- FK 2100 (M) — 150 W TX Filter FK 2101 — XK 2100
- Ext. Motor Selection FK 2850
- Remote Control GB 2000
- System Receiver GX 2900
- Split Site Controller GP 2000
- Service Kit KA 2110
- Telephone Exchange GA 2160
- Cable Set XK200XC: 01 — 12

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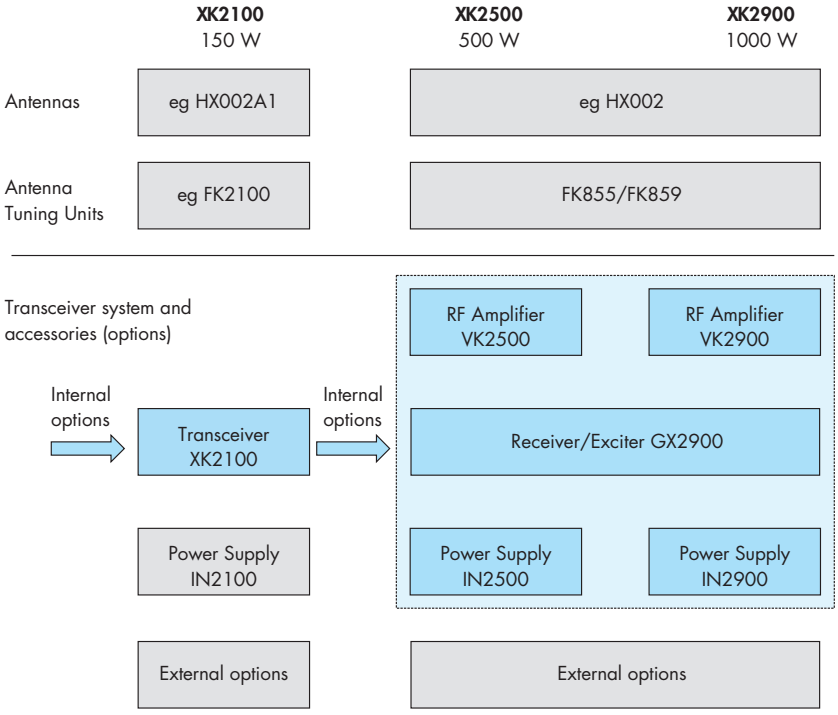
HF Transceiver Family XK2000

System interconnections

Rohde & Schwarz supplies standardized cable sets for expanding the units of the XK2000 family to systems. Depending on the system configuration, suitable interconnecting cable sets are offered for the fast data transmission mode in conjunction with the system processor (MERLIN or PC), internal or external Rohde & Schwarz data modem and error control in line with RSX.25. Ready-made cables are also available for extended radio mode, for remote control using Remote Control Unit GB2000 as well as for controlling the antennas by means of automatic tuning units (ATUs of the HF850 series). The cables are listed under the section: external options, Standard Cable Sets XK2000C.



HF Transceiver Family XK2000 is available in three power classes: 150 W, 500 W and 1000 W. The diagram shows the basic system configuration with recommended ATUs and antennas

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HF Transceiver XK2100L/R

HF Transceiver XK2100L (Photo 41254)

Brief description

The 19" desktop, 150 W HF Transceiver XK2100L for the frequency range 1.5 to 30 MHz can be operated locally as well as remotely via an integrated, multistandard serial interface. For the local mode, a user-friendly, large LCD display with backlighting is provided, ie a bright display together with function-assigned softkeys. These control elements allow the complete operation, programming of approx. 1000 channels as well as configuration of the transceiver via user-specific menus (incorporated as firmware).
XK2100R can only be operated remotely. Same as from the front panel all settings of the transceiver can be effected via the RS-232/485 interface (integrated and configurable).
The following remote control units can be used:

- Split Site Controller GP2000
- Remote Control Unit GB2000
- Terminal
- IBM-compatible PC

Note:
Two remote control units can be simultaneously connected. The associated software (XK2000S) is supplied on a 3.5" disk.

The basic unit XK2100 comes with free slots at the rear to take up user-specific interface options for matching the system or user units.

The basic unit XK2100L/R is powered from a nominal 26.5 V DC source (21 to 31 V).

AC supply operation of the transceiver is effected by an external power supply (IN2100) with autoranging to the available power line (88 to 264 V). Moreover a 24 V standby battery can be connected to IN2100 for interrupt-free operation of the transceiver in the case of power failure.

If the transceivers are operated in DATA mode, ie continuously at full transmit power, the use of the blower unit option (KL2100) mounted at the rear is recommended.
Interface options GVxx, FK21xx and GS21xx that are plugged in at the rear of the XK2100 transceivers allow easy connection or matching to external options such as a system processor (MERLIN), HF modem, telephone PABX, detached duplex or emergency receiver (GMDSS).

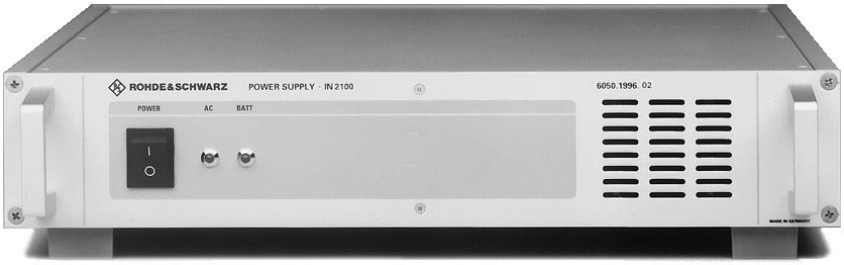
Up to four interface options can be inserted into the free slots at the rear.

Power Supply IN2100

Application

IN2100 supplies power to the 150 W Transceiver XK2100 and its options. It permits parallel power supply from 24 V DC and AC line with undelayed automatic switchover.

IN2100 has a separate DC output ("Aux Output" connectors) for the supply of additional external units.



Power Supply IN2100 (Photo 42009)

Specifications

AC input voltage	88 V to 264 V
DC output voltage (floating)	24 V to 28 V ±0.5 V internally adjustable; factory-set to 26.5 V ± 0.5 V
AC power consumption	800 VA max.
Output current	19 A max.
Auxiliary DC output	26.5 V, 1 A
DC emergency power supply	input for 24 V battery
AC/DC switchover	automatic, without delay

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Brief description

The 500 W HF Transceiver XK2500L available as a desktop version or as a sturdy rackmount for the frequency range 1.5 to 30 MHz can be operated locally as well as remotely via an integrated, multistandard serial interface. For the local mode, a user-friendly, large LCD display with backlighting is provided on the front panel of Receiver/Exciter GX2900L, ie a bright display together with function-assigned softkeys. These control elements allow the complete operation, programming of approx. 1000 channels as well as configuration of the transceiver via user-specific menus (incorporated as firmware).

All settings of the transceiver can be effected via the RS-232/485 interface (integrated and configurable). The following remote control units can be used:

- Remote Control Processor GP2000
- Remote Control Unit GB2000
- Terminal
- IBM-compatible PC

Note:
Two units can be simultaneously connected. The associated software (XK2000S) is supplied on a 3.5" disk.

The basic model of XK2500 consists of:

- Receiver/Exciter GX2900L
- Power Amplifier VK2500
- AC Power Supply IN2500

GX2900L comes with free slots at the rear to take up user-specific interface options for matching the system or user units. ATUs of the HF 850 family are connected to the rear VK... interface.

AC supply operation of the transceiver is effected by Power Supply IN2500 which can be set to different input voltages as well as to single- or three-phase networks. Moreover a 24 V standby battery can be connected to IN2500, supplying 24 V DC in the case of power failure so that an interrupt-free operation of the transceiver at reduced RF power is possible.

If the transceivers are operated in DATA mode, ie continuously at full transmit power, an integrated blower system, which is switched on automatically when required, ensures trouble-free continuous operation of the transceivers.

Interface options GVxx, FK21xx and GS21xx that are plugged in at the rear of Receiver/Exciter GX2900 allow easy connection or matching to external options such as a system processor (MERLIN), HF modem, telephone PABX, detached duplex or emergency receiver (GMDSS).

Up to four interface options can be inserted into the free slots at the rear.

Spacing/interconnections between units
The spacing between the units GX..., VK..., and IN... is fixed by the internal interconnecting cables. This is 5 m between GX2900 and VK2500/2900 and 1 m between VK... and IN2500/2900.

The distance between GX... and VK... can optionally be extended to max. 65 m (on request).

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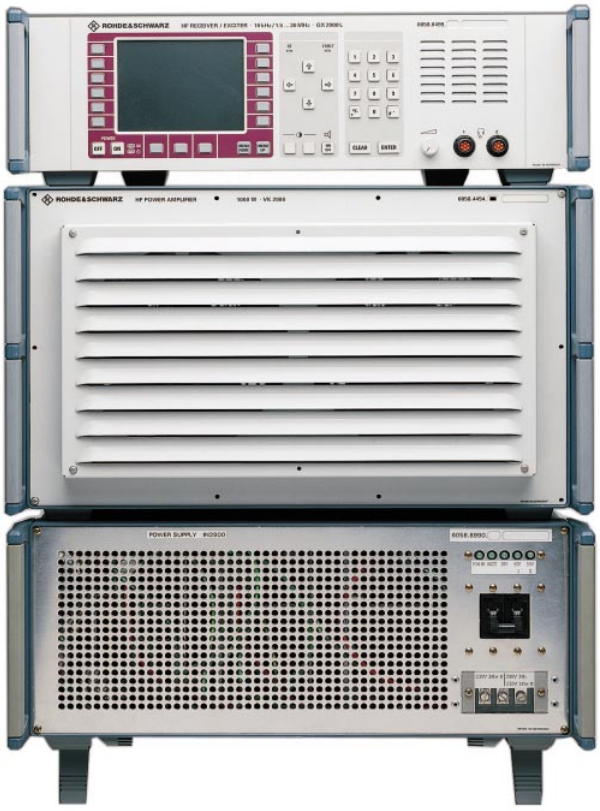
HF Transceiver XK2900L



HF Transceiver XK2900L (Photo 41572)

Brief description

The 1000 W HF Transceiver XK2900L available as a desktop version or as a sturdy rackmount for the frequency range 1.5 to 30 MHz can be operated locally as well as remotely via an integrated, multistandard serial interface. For the local mode, a user-friendly, large LCD display with backlighting is provided on the front panel of Receiver/Exciter GX2900L, ie a bright display together with function-assigned softkeys. These control elements allow the complete operation, programming of approx. 1000 channels as well as the configuration of the transceiver via user-specific menus (incorporated as firmware).

All settings of the transceiver can be effected via the RS-232/485 interface (integrated and configurable).

The following remote control units can be used:

- Remote Control Processor GP2000
- Remote Control Unit GB2000
- Terminal
- IBM-compatible PC

Note:
Two units can be simultaneously connected. The associated software (XK2000S) is supplied on a 3.5" disk.

The basic model of XK2900 consists of:

- Receiver/Exciter GX2900L
- Power Amplifier VK2900
- AC Power Supply IN2900

GX2900L comes with free slots at the rear to take up user-specific interface options for matching the system or user units.

AC supply operation of the transceiver is effected by Power Supply IN2900 which can be set to different input voltages as well as to single- or three-phase networks. Moreover a 24 V standby battery can be connected to IN2900, supplying 24 V DC in the case of power failure so that an interrupt-free operation of the transceiver at reduced RF power is possible.

If the transceivers are operated in DATA mode, ie continuously at full transmit power, an integrated blower system, which is switched on automatically when required, ensures trouble-free continuous operation of the transceivers.

Interface options GVxx, FK21xx and GS21xx that are plugged in at the rear of Receiver/Exciter GX2900 allow easy connection or matching to external options such as a system processor (MERLIN), HF modem, telephone PABX, detached duplex or emergency receiver (GMDSS).

Up to four options can be inserted into the free slots at the rear.

Spacing/interconnections between units
The spacing between the units GX..., VK..., and IN... is fixed by the internal interconnecting cables. This is 5 m between GX2900 and VK2500/2900 and 1 m between VK... and IN2500/2900.

The distance between GX... and VK... can optionally be extended to max. 65 m (on request).

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Specifications

Transmission	XK2100	XK2500	XK2900
Frequency range	1.5 to 30 MHz	1.5 to 30 MHz	1.5 to 30 MHz
Output power into 50 Ω, VSWR <1.5	150 W ±0.5 dB PEP, 100 W ±0.5 dB CW	500 W ±0.5 dB PEP or CW (400 W ±0.5 dB with ATU FK855)	1000 W ±0.5 dB PEP or CW
Power levels	10/30/100 W CW 10/30/150 W PEP	40/100/500 W	100/500/1000 W
Spurious suppression	>70 dB	>70 dB	>70 dB
Harmonics suppression	typ. 60 dB	typ. 60 dB	typ. 60 dB
Intermodulation products (ref. to PEP)	>32 dB	>36 dB	>36 dB
S/N ratio	>150 dBc	>150 dBc	>150 dBc
Carrier suppression	typ. 70 dB	typ. 70 dB	typ. 70 dB
Suppression of unwanted sideband	>60 dB	>60 dB	>60 dB
Voice compression (VC)	built in, power increase with radiotelephony		

Frequency setting		decadic in 1 Hz steps
Channel memory		
User-programmable channels		401
Half-duplex channels included		100 (transmit and receive frequencies separately programmable)
Fixed-programmed channels (ITU)		channel numbers between 401 and 2240 (half-duplex)
Additional channels for ALE		120 (half-duplex)
Frequency error	Standard (TCXO)	<2 x 10^{-8}/°C
	Optional (OCXO)	<1 x 10^{-9}/°C, <1 x 10^{-9}/day
Aging	Standard (TCXO)	<1 x 10^{-6}/year
	Optional (OCXO)	<1 x 10^{-7}/year
Classes of emission		A1A (CW), J3E (SSB), (USB/LSB selectable), H3E (AME, USB), J7B (A7J), data transmission (J3E), B8E (ISB), F1B (FSK, AFSK, baud rate 50 to 600 Bd, shift 42.5 to 425 Hz), F3E (FM), F1C, A3E (AM) (reception only), MIL-STD-188-203-1A (optional)

Reception

Frequency range	10 kHz to 30 MHz
Input impedance	50 Ω, VSWR <3
Input sensitivity (for S/N = 10 dB, f = 0.2 to 30 MHz)	
without preamplifier and presel.	
A1A (CW)	typ. 0.4 µV EMF, BW = 300 Hz
J3E (SSB), J7B	typ. 1.0 µV EMF, BW = 2.7 kHz
H3E (AME), 1 kHz, m = 60%	typ. 2.7 µV EMF, BW = 6 kHz
with preamplifier, without presel.	
A1A (CW)	typ. 0.15 µV EMF, BW = 300 Hz
J3E (SSB), J7B	typ. 0.4 µV EMF, BW = 2.7 kHz
H3E (AME), 1 kHz, m = 60%	typ. 1.0 µV EMF, BW = 6 kHz
Receiving bandwidths	
3 dB	±75 Hz, ±150 Hz, ±300 Hz, ±500 Hz, ±750 Hz, ±1050 Hz, ±1200 Hz, ±1350 Hz, ±1550 Hz, ±3000 Hz, ±4000 Hz
60 dB	±150 Hz, ±225 Hz, ±430 Hz, ±770 Hz, ±990 Hz, ±1600 Hz, ±1760 Hz, ±1900 Hz, ±2100 Hz, ±4200 Hz, ±5200 Hz
AGC	<3 dB (1 µV to 1 V EMF)
Response to 60 dB step variation	
Attack time	<10 ms
Decay time	25/150/500 ms, 1 s/3 (selectable)
Immunity to interference	
Image-frequency rejection	typ. 90 dB
IF rejection	typ. 90 dB
Oscillator reradiation	<10 µV (at antenna input)
Protection of receiver input	up to 100 V EMF (f <30 MHz)
with digital selection	up to 200 V EMF (f <30 MHz)

Options

Digital Selection FK2010	attenuation >20 dB at spacing >10% from nominal frequency
Noise figure	typ. 13 dB
IP3 (Δf >30 kHz)	>35 dBm
Insertion loss	0 dB
ALE Processor GS2200	automatic link establishment (ALE) to ALIS 2000 for speech and data transmission, or to FED-STD-1045A (Info PD 756.5562.21); always to be ordered with suitable software (GS2200S to GS2211S)
Automatic Phone Patch GN2100	call transfer to private automatic branch exchange (PABX) with automatic line matching
HF Modem GM2100	advanced multimode HF modem with selectable waveforms to either R&S standard (single tone up to 2700 b/s, short sync time, high redundancy) or R&S advanced (900 to 5400 b/s) and additionally selectable waveforms to: - STANAG 4285 (incl. STANAG 4481 without FSK) - MIL-STD-188-110A (single tone) - STANAG + MIL
Digital Voice Processing Unit GN2110	noise and interference suppression, speech squelch, VOX with digital signal processing, speech scrambler available as a suboption
Blower KL2100 (XK2100)	required for cont. data transmission
Remote Control Unit GB2000	up to 50 m; with modems for distances >50 m; class of protection IP42 to DIN 40050 (IP54 as an option)
EMC Filter ALE/APP FK2110	APP interface to PABX interface, ALE-DTE interface (FED-STD-1045A) and ALIS 2000
Modem Interface GV2100	AF, PTT, data and DTE (V.10)
External Control Interface GV2110	for control of external FK2850, FK2101X, AK001 options (via Option Interface GV2000), output: serial control bus RS485 + 4 RF I/Os
Option Interface GV2000	external interface unit: serial control bus (RS-485), output: parallel (BCD) control commands + 4 RF I/Os to eg FK2850, FK2101X or AK001
RX/TX Interface GS2110	for duplex receiver, external transceiver, GMDSS-DSC (NMEA 183) and system applications, ie serial control (RS-232-C), AF & PTT
Test Interface	for output of fault histogram (ASCII, 5 V CMOS)

Serial interfaces

RS-485/RS-422	for remote control over long distances, bus-compatible, suitable for Remote Control Unit GB2000
RS-232-C	for remote control and software updates (direct connection of PC), suitable for Remote Control Unit GB2000
Transmission rates	110/230/300/600/1200/2400/4800/9600 Bd

Antenna tuning units (ATUs) and antennas

	XK2100	XK2500	XK2900
Frequency range	1.5 to 30 MHz	1.5 to 30 MHz	1.5 to 30 MHz
Recommended ATUs	FK2100 FK2100M	FK859 FK855C1[1)] FK855C3[1)]	FK859 FK859C1 FK859M1 FK855[1)]
Recommended antennas (see Cat. PD 756.9800)	HX002A1 AK503	HX002, AK471	with Line Flattener FK859C1

1) Specs conditionally

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General data (without Power Supplies IN...)

	XK2100	XK2500	XK2900
Temperature range	to MIL-STD-810E, Methods 501.3 and 502.3		
Operation	–25 to 55°C		
Storage	–40 to 85°C		
Humidity	MIL-STD-810E, Method 507.3		
Mechanical test			
Vibration	DIN IEC 68, 5 to 55 Hz, 0.2 mm amplitude MIL-STD-T-28800, Table V, class 5, 6		
EMC	MIL-STD-461, class A3, A4 (CE03, RE02, CS02, CS06), EN 50081/50082		
MTBF	>9600 h (XK2100R)	>5500 h	>5000 h
Class of protection	IP 42/32	IP 42/20	IP 42/20
Dimensions W x H x D in mm (without options)	XK 443 x 127 x 386 IN: 400 x 82 x 350	GX 483 x 132 x 340 VK: 483 x 281 x 570 IN: 483 x 192 x 570	GX 483 x 132 x 340 VK: 483 x 281 x 570 IN: 483 x 192 x 570
Weight (without options)	XK: 15 kg IN: 9 kg	GX: 13 kg VK: 34 kg IN: 27 kg	GX: 13 kg VK: 42 kg IN: 32 kg

Power supplies	IN2100	IN2500	IN2900
Input AC supply voltage	88 to 264 V AC	230 V +10/–15% Phases: 1/3	
Battery	24 V DC emergency supply		
Power consumption AC supply/battery switchover	max. 0.8 kVA instantaneous, by means of diodes	1.5 kW	3.5 kW
Output I	24 to 28 V, 19 A, 26.5 V nominal	54 V, 35 A	54 V, 35 A
Output II	24 to 28 V, 1 A, decoupled	28 V	54 V, 35 A
Output III	—	—	28 V
Overload protection	sustained short-circuit-proof, automatic restart, current limiting to prevent overload, switch-on current limiting		
Operating temperature range	0 to 50°C	–25 to +55°C	–25 to +55°C
Storage temperature range	–40 to +85°C	–40 to +85°C	–40 to +85°C

Ordering information

HF Transceiver 150 W		
Desktop model		
Local and remote control	XK2100L	6033.0508.02
Remote control only	XK2100R	6051.1490.02
Antenna Tuning Unit	FK2100	6046.8948.02
Rackmount		
19" Adapter XK...	KA2100	6050.3499.02
IN...	KA2120	6064.0751.02
Standard Software	XK2101S	6090.2758.02
Naval Software	XK2101S	6090.2758.07
HF Transceiver 500 W		
Desktop model		
Local and remote control	XK2500L	6071.0518.02
Rackmount		
Local and remote control	XK2500L	6071.0518.12
Standard Software	GX2901S	6090.2506.02
Naval Software	GX2901S	6090.2506.07
HF Transceiver 1000 W		
Desktop model		
Local and remote control	XK2900L	6057.9992.02
Rackmount		
Local and remote control	XK2900L	6057.9992.12
Standard Software	GX2901S	6090.2506.02
Naval Software	GX2901S	6090.2506.07

Adapter kits

Use of other racks than KG2900 for installation of Transceivers XK2500 and XK2900 requires the following adapter kits:

Telescopic slides	0062.8334.00
Connection strips	0396.5449.00

Options

Data Link Processor	GS2200	6091.5009.02
FED-STD-1045/1046	GS2200S	6091.5709.02
Option: FED-STD-1049	GS2201S	6091.5809.02
R&S Standard: ALIS	GS2210S	6091.5909.02
R&S Standard: ALIS Hopping	GS2211S	6091.6005.02
Automatic Phone Patch with Telephone Adapter	GN2100	6033.9505.02
Standard Software for APP	GN2100S	6090.5805.02
Digital Voice Processing Unit (NRU)	GN2110	6033.7502.02
Digital Voice Processing Unit (NRU + SCR)	GN2110	6033.7502.03
Digital Selection	FK2010	6033.6506.02
External Control Interface	GV2110	6033.6006.02
Standard Software (for GV2110)	GV2110S	6090.8504.02
Option Interface (to GV2110)	GV2000	6090.8504.02
RX/TX Interface	GS2110	6033.5500.02
Standard Software for GS2110	GS2110S	6090.5605.02
EMC Filter ALE/APP	FK2110	6054.9491.02
Modem Interface	GV2100	6033.8509.02
Modem Data Interface	GV2130	6090.3254.02
Data Link Interface	GV2120	on request
Blower Unit (external)	KL2100	6050.2992.02
HF Modem, multistandard	GM2100	6079.4246.02
Software for GM2100:		
R&S: 5.4 kbit/s+2.7 kbit/s	GM2100S	6090.5705.02
MIL-STD-188.110 Single Tone	GM2101S	6091.5509.02
STANAG 4285/4481	GM2102S	6091.5609.02
Remote Control Unit	GB2000	6064.2002.02
RCU (GB2000) Standard Software	GB2001S	6090.3002.02
RCU (GB2000) Naval Software	GB2001S	6090.3002.07
Receiver Input Protection	ZW2900	6072.2514.02
440 V Transformer	BV2900	6072.7016.02
Power Supply	IN2100	6050.1996.02
Antenna Tuning Unit (150 W)	FK2100	6046.8948.02
Standard Software for FK2100	FK2100S	6090.5505.02
Naval Antenna Tuning Unit	FK2100M	6064.9550.02
Naval Software for FK2100M	FK2100S	6090.5505.07

Recommended extras

Shockmount for		
XK2100	KS2100	6050.3999.02
XK2500/2900	KS2900	6072.6510.02
Service Kit	KA2110	6050.4995.02
Service manual (English) for		
XK2100		6045.5868.62
FK2100		6045.5874.62
GX2900		6045.6793.62
VK2500/2900		6045.6758.62

LINK11 Kit, for external DTS (Data Terminal Set), consisting of:

Data Link Interface, required for external DTS, for example LINK Y, LINK E, LINK 11; complies to MIL-STD-188-203-1A	GV2120	6079.1013.02
High-precision Frequency Standard (OCXO) for higher frequency stability requirements, only factory-installed	GF2010	6033.5000.02
Naval Software XK2100L/R	XK2101S	6090.2758.07
Naval Software XK2500/2900 L/R (alternative for 500 W/1 kW)	GX2901S	6090.2506.07

GMDSS-KIT, extension of XK2000 to naval applications in line with GMDSS regulations, consisting of:

Receiver Interface for the control of an external receiver or as DSC-NMEA interface Controller	GS2110	6033.5500.02

Further options and accessories on request

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Remote Control Unit GB2000

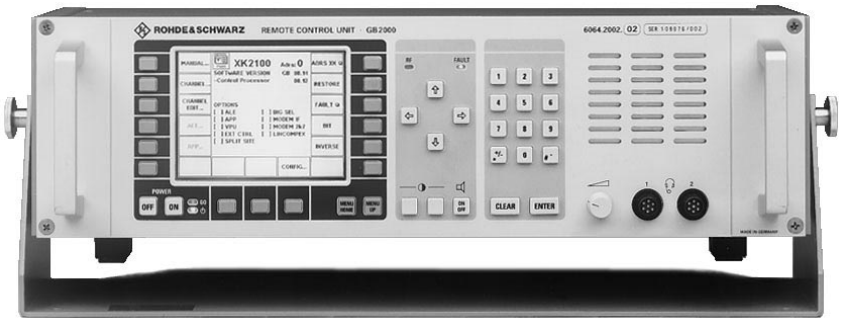

Photo 41979-2

Brief description

Remote Control Unit GB2000 enables the remote control of all transceivers of the XK2000 family. The use of GB2000 is recommended whenever detached operation – also over any distance – is required because of reasons of space or system layout (central control unit and radio equipment are at different locations). An integrated, serial and bus-compatible interface affords point-to-point and addressable operation for up to 99 radios in a system. For more than 10 radios line drivers must be provided. At distances less than 100 m (between GB… and XK…) a 3-core screened cable is sufficient.

As far as the front-panel layout and operating concept are concerned Remote Control Unit GB2000 is identical with the local operation of Transceiver XK2100 and Receiver/Exciter GX2900. An optional swivel adapter allows the operator to make adjustments for optimal viewing angle and ergonomic operation.

Features and benefits

- Layout and function of control and display elements are identical to the local front panel
- Remote control of all functions (operation, programming and configuration)
- Remote control of auxiliary equipment and antennas via External Control Interface GV2110
- Simultaneous connection of local (front panel) and remote unit (GB2000 or PC) possible
- Remote control over any distance via telephone or directional radio-channels by means of line modems or VFT modems
- Direct connection of a PC/printer for teletype (TTY) operation via Standard Cable Set XK2010C
- Very good system flexibility due to easy configuration of various AF and PTT assignments, serial control ports, hardware or software switching of PTT
- Robust and splash-proof design, dust-protected front panel (IP 54 protection); rugged case (IP 42), optional IP 54 protection available on request
- Remote ALE (to FED-STD-1045) operation

Specifications

Inputs, outputs/interfaces

AF interfaces

AF input/output to XK2000	at AF/REMOTE connector
AF input/output for local mode	at AF/LOCAL connector
AF output for headphones	50 mW, 300 Ω (adjustable)
AF output for loudspeaker	3 W, 4 Ω, adjustable, switchable
Microphone inputs	2

Serial interfaces (control)

Remote control for long distances (via modems)	RS-485/RS-422, bus-compatible
Remote control (via modems) and software updates (direct downloading from PC)	RS-232
Transmission rates	100/200/300/600/1200/2400/4800/9600 Bd

PTT control interface

AF/LOCAL connector	linked with AF/REMOTE, TTL and V.10 levels
AF/REMOTE connector	activated by ORed combination of the two PTTs of AF/LOCAL connector, V.10 level
PTT	with remote telegram or configurable line
Power supply	16 to 31 V DC, and 90 to 260 V AC, with automatic switchover from AC to DC (if AC fails)
Current drain (DC)	approx. 800 mA

Remote switch-on

XK2000 can be switched on separately or together with GB2000; programmable port output for remote switch-on with V.10 level

General data

Desktop version, 3 HU, 443 mm wide, approx. 140 mm deep (w/o connectors)

Ordering information

Remote Control Unit	GB2000	6064.2002.02
Swivel Adapter	KA2000	6064.3250.02

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Remote Control Processor GP2000

Brief description

Flexibility becomes more and more the foremost requirement for customized solutions in shortwave communications.

Remote Control Processor GP2000 considerably enhances the flexibility both of existing and newly designed HF communication systems. Technical concept, outer appearance and user interface of the remote control processor are largely identical with that of the transceiver or Remote Control Unit GB2000, which is a clear advantage for service, logistics and operation. In contrast to GB2000, Remote Control Processor GP2000 can be equipped with options and interface modules such as ALE processor or HF data modem.

Key applications

- Split-site applications with remote transmitters and/or receivers (XK2000 series, XK850 series, EK890 series)
- Local applications using non-XK2000 equipment (XK850 family, EK890 family, Transceiver XK516) for adaptation to XK2000 systems
- Upgrading of available HF systems to XK2000 standard
- Applications using ARINC-429 equipment

Split-site applications

Split-site solutions are necessary wherever collocation problems are to be expected because of high transmitter power or the use of several transmitting antennas. Transmitters and receivers then must be set up separately at a certain distance from each other. In the ideal case all the transmitters are set up at one site and all the receivers at another location far away. In many cases it is sufficient to install only the transmitters remotely and leave the receivers in the central station. All transceivers from the XK2000 or XK850 family may be used as transmitters.

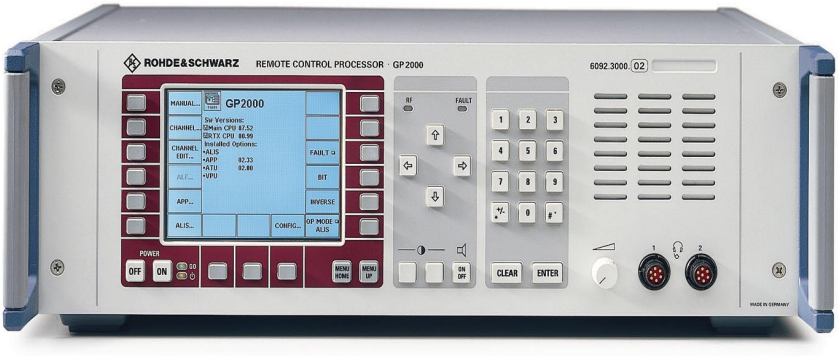
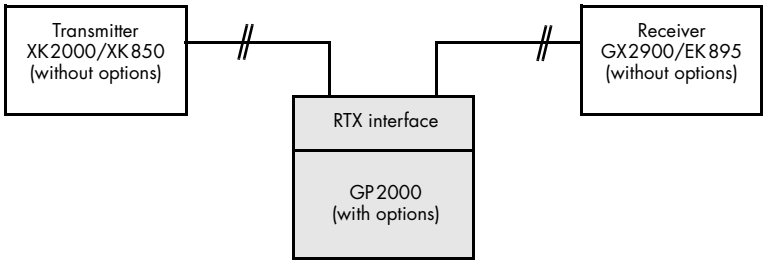


Photo 42898

Example



Split-site application with remote transmitter and remote receiver (implemented with GP2000 and RTX interface)

Flexible networking

For interconnection of the individual system components, different transmission media can be used depending on the distance to be covered:

- For distances up to approx. 100 m: transmission directly via cable
- For distances up to approx. 100 km: transmission via dedicated/PSTN lines by means of modems
- For distances up to approx. 50 km: transmission via microwave link

Like GX2900/XK2000, GP2000 can be fully remote-controlled from a system processor, eg MERLIN or GR2000, via its remote-control interface.

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Upgrading available HF systems to XK2000 standard

Applications using HF 850

GP2000 allows upgrading of available systems to XK2000 standard. This means more than mere functional compatibility between ALIS HF850 and ALIS 2000 or between GM857C4 and GM2000. Through the use of GP2000 new features such as ALE (FED-STD-1045/46/49) HF Data Modem GM2100 can be combined with the available transceivers from the HF850 family.

The following XK2000 features are available when using HF850 together with GP2000:

- User interface identical with XK2100L and GB2000
- ALIS
- ALE (FED-STD-1045/46/49)
- Fast data mode with 5400 bit/s
- Automatic Phone Patch APP
- Voice Processing Unit (VPU) GN2110 (with/without scrambling)
- Automatic mode
  The automatic modes ALIS/ARQ, ALIS/PRP, ALIS/FAST DATA, ALE/PRP, ALE/FAST DATA are supported

Applications using ARINC-429 equipment

If GP2000 with an RTX interface is equipped with the ARINC option, it can be used for controlling transceivers having an interface in line with ARINC-429, as for instance Transceiver XK516.

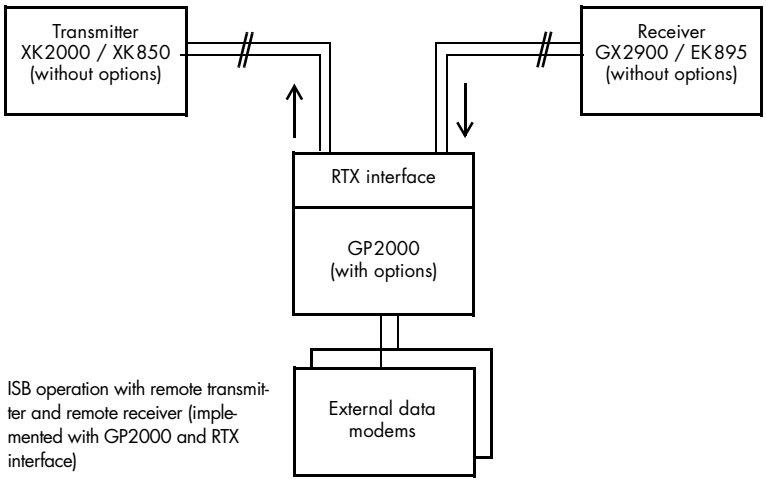
Options

GP2000 as well as GX2900 are able to accommodate several options and interface modules from the XK2000 series. The following modules may be used:

GS2200	Data Link Processor (with ALIS or ALE software)
GN2100	Automatic Phone Patch (APP)
GN2110	Digital Voice Processing Unit (VPU) (with/without scrambling)
FK2110	EMC Filter ALE/APP
GM2100	HF Modem
GV2100	Modem Interface
GV2130	Modem Data Interface

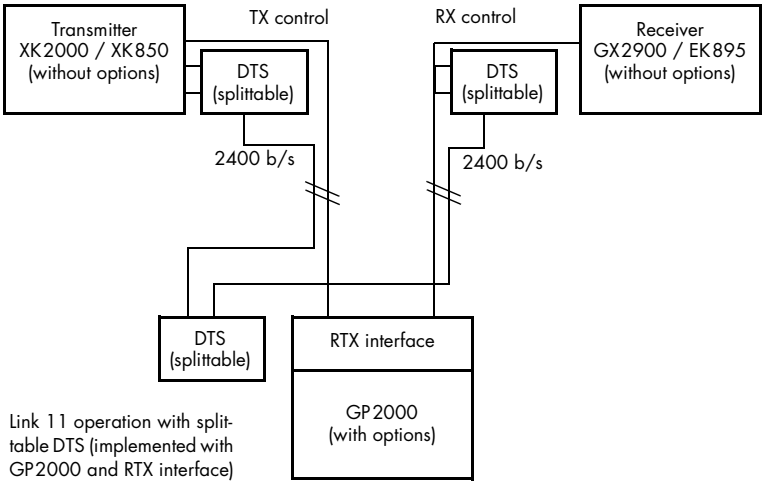
Special applications

ISB operation



ISB operation with remote transmitter and remote receiver (implemented with GP2000 and RTX interface)

Link 11 configuration



Link 11 operation with splittable DTS (implemented with GP2000 and RTX interface)

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Rear view of GP2000 (Photo 42899)

Specifications

General data

Display	high-contrast LCD graphic display with softkeys for menu-guided operation, text display for frequency, channel, modulation, BITE information, bar-graph display of receive field strength in dBµV, output power in W, frequency shift in kHz, manual gain control (MGC) in dBµV
Manual control	step keys (rollkey editor) for selection of modulation modes, bandwidths, output power stages, etc
Remote control	fully remote-controlled from PC via remote-control interface

User interfaces

AF interfaces	
2 x AF input (line)	rear panel, 0 dBm, 600 Ω, floating, –10 to +10 dBm selectable
2 x AF output (line)	rear panel, 0 dBm, 600 Ω, floating, –10 to +10 dBm selectable
2 x microphone	front panel, 1 to 30 mV, 150 Ω or 10 to 300 mV, 150 Ω
AF headphones	front panel, 50 mW into 300 Ω, controlled on front panel
AF loudspeaker	front panel and rear panel, 3 W into 4 Ω, controlled and switched off on front panel
Morse key	front panel, contact to ground
2 x teletype	rear panel, for V.28 teletype
5 x PTT	front panel, TTL, transmission = contact to ground rear panel, TTL and V.10 (separate for voice and TTY)
Serial interface (rear panel)	
2 x PC interface	RS-232 (V.24/V.10) and RS-422/ RS-485 (bus-compatible) asynchronous, 300 to 9600 baud, 7/8 bit

Radio interfaces (RTX interface)

AF interfaces	
2 x AF output for Tx	0 dBm, 600 Ω, floating, –10 to +10 dBm selectable
2 x AF input for Rx	0 dBm, 600 Ω, floating, –10 to +10 dBm selectable
3 x PTT for Tx	V.10, transmission = +5 V V.10, transmission = –5 V TTL, transmission = contact to ground
2 x Rx disable	V.10, Rx disable = HIGH TTL, Rx disable = contact to ground
FSK output for Tx	V.10, 50 to 600 baud
FSK input for Rx	V.10, 50 to 600 baud
Serial interfaces	
Tx control	V.10, asynchronous, 300 to 38400 baud, 7/8 bit + parity (odd/even/none)
Rx control	V.10, asynchronous, 300 to 38400 baud, 7/8 bit + parity (odd/even/none)
ARINC-429 interface (optional)	
Tx/Rx command	to ARINC-429
Tx/Rx answer	to ARINC-429

Power supply

Battery	19 to 31 V DC
Power consumption	<100 W

Environmental specifications

Temperature range	to MIL-STD-810E, Methods 501.3 and 502.3
Operation	–25 °C to 55 °C
Storage	–40 °C to 85 °C
Humidity	MIL-STD-810E, Method 507.3
Mechanical test	
Vibration	DIN IEC68, 5 to 55 Hz, 0.2 mm amplitude MIL-STD-T-28800, Table V class 5, 6
EMC	MIL-STD-461, class A3, A4 (CE03, RE02, CS02, CS06), EN 50081/50082
MTBF	>9600 h (XK2100L)
Class of protection	IP 42/32

Mechanical data

Dimensions (W x H x D)	
Desktop model	443 mm x 132 mm x 340 mm
19" model	483 mm x 127 mm x 340 mm
Weight	approx. 10 kg without options

Ordering information

Remote Control Processor	GP2000	6092.3000.02

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Data Link Processor GS2200

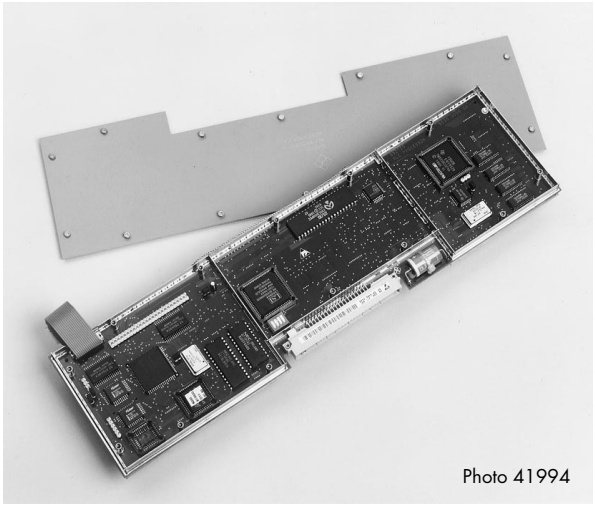
Photo 41994

Brief description

Two different procedures are available for the ALE (Automatic Link Establishment) radio processor ; these are ALIS and ALE to FED-STD-1045/46/49 (US). One of these ALE standards/protocols can be loaded into Processor GS2200 from Rohde & Schwarz. Using the Rohde & Schwarz automatic radio link setup and continuous link quality monitoring procedure of ALIS (Automatic Link Setup) along with the XK2000 transceiver family, unequalled operating features are offered:

- Simple operation by entering a 4-digit address
- Real-time channel analysis
- Best-channel calculation and setting
- Automatic link setup
- Ongoing channel monitoring
- Adaptive response in case of interference
- 100% error-free transmission

With the ALIS software selected for Data Link Processor GS2200 the following functions are handled by the processor:

- Automatic continuous passive channel analysis of all user-programmed pool frequencies during scanning mode
- Automatic channel selection by means of computation of the optimum working frequency from a pool of frequencies
- Automatic reliable and fast link setup through narrowband FSK (BW = 300 Hz, shift = ±85 Hz) at the optimum frequency from the pool
- Selective calling addr. (up to 9999)
- Automatic transmission of status
  - type of modulation
  - speed of data transmission
  - type of data protection (FEC, ARQ, PRP)
- Automatic error correction (ARQ or PRP) and adaptive response during message transmission, either at a data rate of 228 bit/s (normal FSK modulation, basic feature) or with additional HF data modem up to 5400 bit/s
- Data transmission format
  - 5 bit Baudot (telex)
  - 7 bit ASCII (text files from PCs)
  - 8 bit ASCII (text and binary files etc)
- Message length: unlimited
- SSB voice operating capability after automatic link setup procedure (no adaptive response during voice operation)

Depending on the requirements:

- Preferred or existing method
- Link setup with or without adaptive response
- Response to interference on the radio link (ARQ)
- Frequency economy, spectrum pollution and probability of intercept considerations
- Operator convenience, error correction and expandability
- Interoperability with other systems and those of other manufacturers

Rohde & Schwarz offers ALE methods meeting:

- Rohde & Schwarz standard ALIS
- Federal Standard 1045/1046/1049
- MIL-STD-188-141A

Ordering information

For the selection of the data link processor option, GS2200 and user-specific software (basic software) have to be ordered specially as follows:

Processor hardware (module without loaded software not operational)	GS2200	6091.5009.02
ALE Software to ALIS (adaptive) consisting of: ALIS HF850 compatibility ARQ (228.5 Bd) fast data (PRP) with GM857/GM2000 FEC with GM857/GM2000 APP capability	GS2210S	6091.5909.02

Further ALIS software options ALIS + Hopping (FH) –restricted–, offers on request	GS2211S	6091.6005.02
ALE Software to FED-STD-1045/1046 (MIL-STD-188-141A) consisting of: standard software to FED-STD plus UUF (user unit function): APP and fast data PRP capability	GS2200S	6091.5709.02
Option FED-STD-1049	GS2201S	6091.5809.02

Note:
Any software combinations (customer-specific) on request

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Automatic Phone Patch (APP) GN2100

Brief description

The APP option serves for the automatic (as well as manual) routing of telephone calls to and from an HF link. When the option is used together with a Rohde & Schwarz radio processor option GS2200 + ALE software, the telephone number of the called subscriber can be reliably transmitted in addition to the automatic selection of the HF channel (link setup).

The called HF point may be the desired phone itself or it may be dialled into a local (PABX) or public (PSTN) network.

Fully featured DTMF phones (short-code dialling, etc) serve as terminals in an HF radio system equipped with APP and ALE options at both ends. The speech/listen switchover in semiduplex is voice-controlled by means of a VOX circuit. The APP automatically adapts itself to the telephone line (hybrid balance) during the linkup to the end subscriber (to PABX or PTT network) to achieve optimal transmission from radio to line network and vice versa. Via voice and tone prompts the subscribers receive information on the state and progress of the automatic linkup to the called subscriber.

Same as in the configuration of APP parameters, the APP is operated from the front panel via keys, a graphic display, softkeys and a menu-guided user interface. If XK2000 is the terminal unit, the numeric keypad is used for entry, the loudspeaker for signalling and the phone receiver as speech/listening facility.

The optional voice processing unit allows the voice signals not only to be freed from transmission interference but also to be encrypted, ie protected against interception.

Note:
Any access to a public telephone network must be in compliance with the applicable local PTT regulations.

The technical interface specifications of the APP's telephone box are designed to comply with German PTT regulations FTZ 1 TR 2 and FTZ 144 TV 41 regarding equipment connected to telephone lines, but the box is not officially certified.

Specifications

Consisting of plug-in APP GN2100 as well as telephone connecting box.

Output level to phone line	nominal –7dBm (adjustable: –16 to –4 dBm in 3 dB steps)
Input level from phone line	nominal –7 dBm (adjustable: –16 to –4 dBm in 3 dB steps)
Frequency response	±2 dB, 300 to 3200 Hz
Output impedance to phone line	600 Ω
Ultimate hybrid balance (into 600 Ω)	typ. –50 dB over 300 to 3200 Hz BW, measured with single tone
Hybrid impedance matching capability	0 to ∞ Ω complex impedance
Dialling	DTMF or pulse dialling, all timing parameters are configurable
Functional control (from the phone line)	DTMF tones (from normal 12-key pad)
Phone line connections	screw terminals

Ordering information

Automatic Phone Patch	GN2100	6033.9505.02
APP Software	GN2100S	6090.5805.02

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HF Modem GM2100

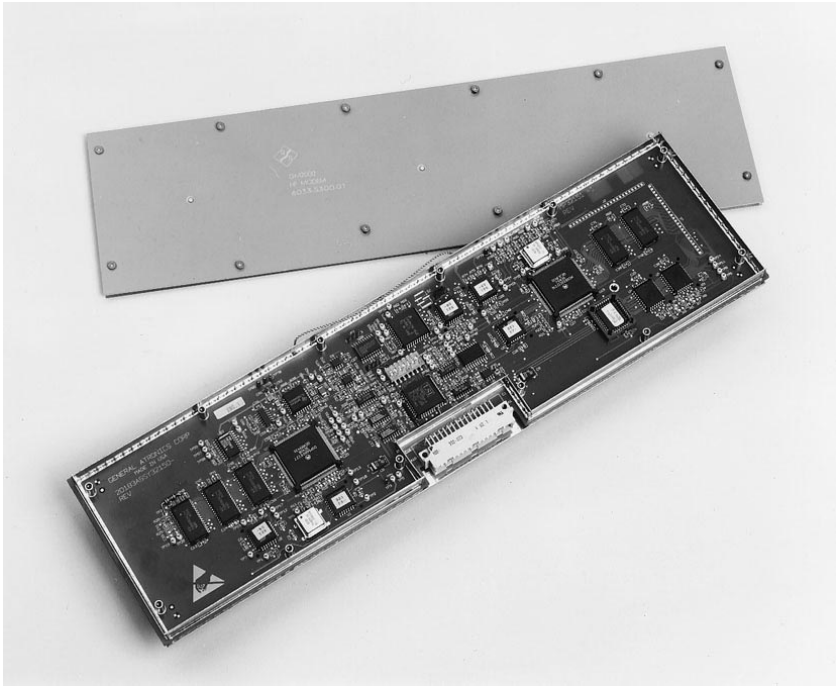

Photo 41992

Brief description

The multimode HF Modem GM2100 from Rohde & Schwarz is currently the most advanced serial HF data modem that is fully integrated in the XK2000 radio equipment family. This modem can form the backbone of a fast and reliable data transmission system. Thus large volumes of data such as for fax, color video still pictures, electronic mail from PC to PC can be sent rapidly, anywhere in the world.

With the aid of the modem it is possible to transmit data economically and reliably via shortwave at high speed (up to 5400 bit/s) in contrast to traditional data transmission techniques such as radioteletype (RTTY) with 50 or 100 bd only.

Features and benefits

- Multistandard HF modem
- Single-tone modem technology
- Short preamble
- Error correction (ARQ)
- TDMA operation
- PR system
- Remote control (ASCII code)
- CW suppression
- Compact plug-in module
- Built-in test (BIT)
- Software selectable to:
  - Standard advanced waveforms
  - STANAG 4285 (including STANAG 4481 w/o FSK)
  - MIL-STD-188-110

In conjunction with a system processor, eg MERLIN, and corresponding software and interfaces from Rohde & Schwarz, office communication terminals such as fax machines, color video cameras/monitors or PCs may be connected and the associated data in compressed form to save time are transmitted via shortwaves.

A system with HF Modem GM2100 and System Processor MERLIN coupled with ARQ-supported RSX.25 data protection yields 100% error-free data when taking all software error correction facilities and data compression techniques into account. The transfer time for an A4 size text page is only about 3 to 6 s and that for a colour picture including compression less than half a minute.

Specifications

HF Modem GM2100	multimode HF modem, plug-in type for XK2000 series of equipment

Ordering information

HF Modem (hardware module)	GM2100	6079.4264.02
Software for GM2100:		
R&S: 5.4 kbit/s+2.7 kbit/s	GM2100S	6090.5705.02
MIL-STD-188-110A Single Tone	GM2101S	6091.5509.02
STANAG 4285/4481	GM2102S	6091.5609.02

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Voice Processing Unit (VPU) GN2110

Brief description

The VPU is a multifunction speech processing module which can be extended and configured for different tasks and functions. It is provided in its basic model as a DSP-supported NRU (noise reduction unit).

The functions of the NRU enable:

- Higher speech intelligibility through effective suppression of interference and noise on the receive channel
- Speech-selective squelch function, ie speech-controlled, syllabic muting circuit
- Suppression of acoustic interference and noise during speech input (microphone) prior to transmission

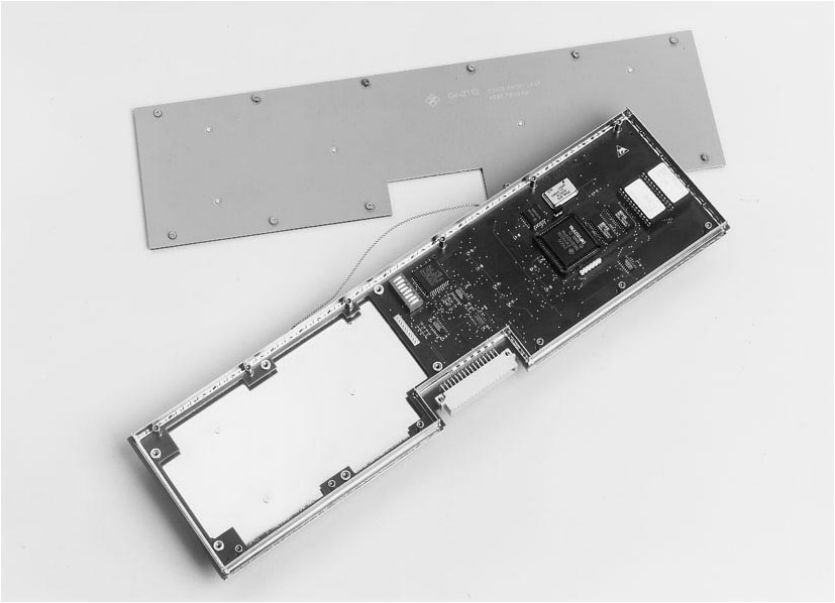
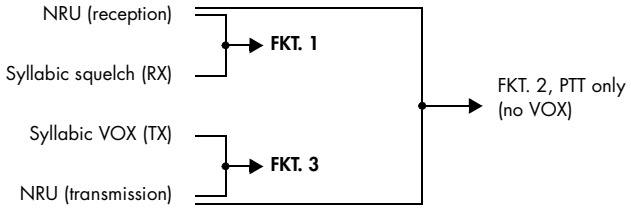


Photo 41993

Depending on its application, the NRU may be configured for one of the following function blocks per software:

In addition to the NRU tasks described above the VPU can also be supplied with a speech scrambling submodule. This scrambler ensures the privacy of a speech or telephone link via short-wave by coding the speech contents prior to transmission, thus making it unintelligible for the unauthorized listener on the radio link, and by decoding at the receiver to obtain a clear language output. A modifiable code key with 4096 codes changes the scrambling algorithm making eavesdropping more difficult.



Specifications

NRU: ON/OFF	OFF/NIR/PEAK/NIR + PEAK
PRIVACY: ON/OFF	code number configurable

Ordering information

Voice Processing Unit		
with NRU	GN2110	6033.7502.02
with NRU + SCR	GN2110	6033.7502.03

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Digital Selection FK2010

Brief description

The use of Digital Selection FK2010 is recommended in strongly disturbed RF environments, ie for collocation problems such as they occur on board of ships. With a digitally tuned filter FK2010 improves the receiver input selectivity and the phase noise at the transmitter (>170 dB/Hz) and reduces harmonics and nonharmonics. Its bidirectional function in XK2000 transceiver coupled with very short tuning times (<10 ms) allows frequency-agile operation.

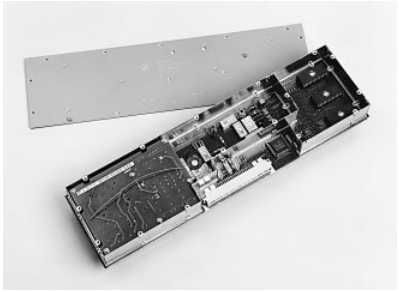

Photo 42005

The automatically tuned tracking selection incorporates the following functions:

- Seven-pole lowpass (0 to approx. 30 MHz) for suppressing interference >30 MHz
- Five-pole lowpass (0 to 1.5 MHz) for blanking out strongly interfering shortwave signals
- Single-tuned tracking filter (1.5 to 30 MHz) with a stopband attenuation of >20 dB at 10% offset
- Remote control on/off (can be bypassed)
- Input voltage protection up to 200 V EMF

Digital Selection FK2010 is a plug-in module and can also be retrofitted in XK2100 or GX2900.

Specifications

Frequency range	0 to 30 MHz at f <1.5 MHz lowpass function
Stopband attenuation	>20 dB at 10% offset from operating frequency
Gain	0 to +2 dB
Inband IP3	>34 dBm
Tuning time	<10 ms
Input voltage protection	200 V EMF max (with Z_{in} = 50 Ω)
Threshold level for protection circuit at	approx. >10 V EMF or RF current >4 A

Ordering information

Digital Selection	FK2010	6033.6506.02

Motor Selection FK2850

Brief description

Motor Selection FK2850 is an automatic tuning filter designed for use together with XK2000 transceivers, exciters and receivers, but also in combination with receivers of the EK890 series. Installation of the option is between exciter and power amplifier, between RX antenna and receiver input respectively. The filter performs high selectivity for applications where the effect of other filter devices (eg digital selection) is not sufficient. FK2850 tunes in approx. 2 s to a new frequency and provides more than 25 dB selectivity at a frequency spacing of 5 % (more than 40 dB at $\Delta f / f = 0.1$). In case of temporary need of very fast frequency changes the RF path of the motor-tuned filter can be bypassed. Control of this option is via External Control Interface GV2110 and Option Interface GV2000. GV2110 is a plug-in module for the XK2000 transceiver/exciter that has to be ordered separately, while GV2000 is already integrated in FK2850. The control signals are looped through to allow control of other options, as eg Antenna System AK001. For operation with receivers of the EK890 series, BCD Interface GC890 is used instead of GV2110.

Specifications

Frequency range	1.0 to 30.0 MHz
Intermodulation ($\Delta f \geq 30$ kHz, spurious signal –7 dBm)	+25 dBm
Insertion gain	–1 dB (f = 400 kHz to 1 MHz) 0 to +3 dB (f = 1 MHz to 30 MHz)
Power supply	115/230 V, 47 to 63 Hz, 50 VA
Dimensions (W x H x D)	437 mm x 127 mm x 230 mm
Weight	8.6 kg

Ordering information

Motor Selection	FK2850	6035.1953.04

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EMC Filter ALE/APP FK2110

Brief description

This interface plug-in module serves for matching the options

- Data Link Processor GS2200 and/or
- Automatic Phone Patch (APP) GN2100

to external system components and is to be fitted into XK2100 or GX2900 together with one or both of the above options.

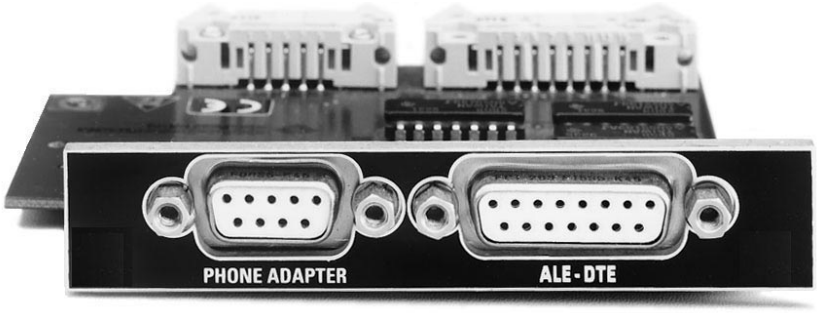

Photo 42006

Interface ALE-DTE is the external data interface to the radio processor (FED-STD-1045/46/49 or ALIS 2000) for fast data transmission with error correction (RSX.25 protocol).

With Automatic Phone Patch GN2100 (eg HF phone), the phone adapter which is a part of the APP option is connected to the APP interface of FK2110 enabling linking up with external PABX or PSTN.

Specifications

Plug-in module with 15- and 9-contact Cannon connectors, designation ALE DTE, PHONE ADAPTER

Ordering information

EMC Filter ALE/APP	FK2110	6054.9491.02

Note: This option is obligatory for ALE and/or APP operation.

Modem Interface GV2100

Brief description

This interface plug-in module is used to connect an external HF data modem to the transceivers of the XK2000 family.

It performs level matching at the AF for different types of modems, configuration of the PTT line (V.28/TTL) and incorporates a serial control interface (of Data Link Processor GS2200) to the external modem.

The modem interface allows the use of Rohde & Schwarz HF modems such as GM857C4 and GM857C5, as well as of other qualified HF modems (assuming that link setup and ARQ/data protection is performed in XK 2000) or data processors (assuming a complete external set, including HF modem, data protection, ie ARQ or PRP).

This interface is not required for operation with the internal HF Modem GM2100.

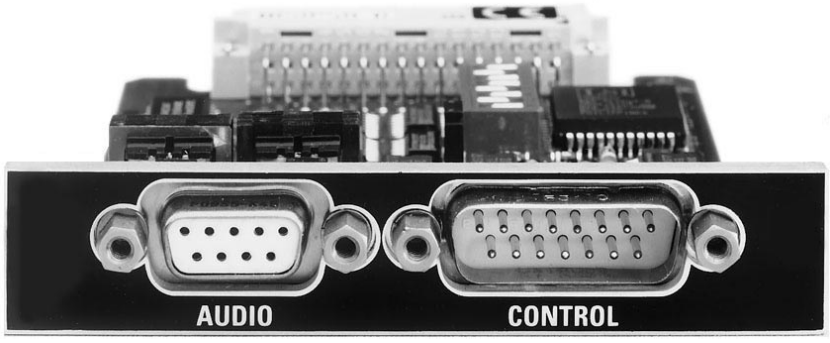

Photo 42001

Specifications

Plug-in card with 15-contact Cannon male and 9-contact Cannon female connector, designations CONTROL, AUDIO

Ordering information

Modem Interface	GV2100	6033.8509.02

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RX/TX Interface GS2110

Brief description

This option can be used in three applications:

- DSC-NMEA interface for transceiver control
- Control interface for a detached receiver (EK895)
- Control interface for a detached transceiver (XK2000)

NMEA-183
For naval applications in line with GMDSS regulations, an external DSC (digital selective call) controller drives an HF transceiver of the XK2000 family via a standardized NMEA-183 interface. It is thus possible to receive emergency calls with an external receiver, to evaluate them and to answer or send out emergency calls at HF distress frequencies according to internationally accepted GMDSS procedures.

The second application of RX/TX Interface GS2110 is for controlling a detached receiver from the transceiver or receiver/exciter of the XK2000 family. A typical example is duplex operation involving the simultaneous transmission and reception at two frequencies. The receiver (EK895) detached up to 2 km is controlled via this interface and the received AF is available in the transceiver.

The third application is for transceiver control/audio/data from a detached controller device.

Specifications

Plug-in interface with 2 Cannon connectors

NMEA-183	DSC-XK2000 control interface
REMOTE RX/TX	RS-232 serial control and receiver audio, to/from EK895, GX2900.xx or transceiver (XK2000)

Ordering information

RX/TX Interface	GS2110	6033.5500.02

Data Link Interface GV2120

Brief description

Data Link Interface GV2120 is provided for connecting an external DTS (Data Terminal Set) as required, for example for DATA LINK Y or LINK 11 transmission and reception. This interface complies to MIL-STD-188-203-1A and STANAG 5511.

In addition and irrespective of the standard and audio I/Os of the XK2000 transceivers, GV2120 supplies the levels required for data link at a separate 15-contact D-SUB connector.

Data Link Interface GV2120 is a plug-in interface card for data link control; data and audio I/Os, all AF inputs and outputs settable, 2 keyline inputs (+6 V, contact to ground), D-SUB connector, 15 contacts.

Ordering information

Data Link Interface		
for Link 11 and/or Link Y operation for single-tone (SLEW) and/or multitone (CLEW) operation in ISB and/or USB/LSB	GV2120	6079.1013.02
for Link Y operation only	GV2120	6079.1013.03

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Modem Data Interface GV2130

Brief description

This interface is used for system applications where an internal modem (GM2100) is operated with an external system processor, eg PC (MERLIN) with RSX.25 data protection.

Specifications

Plug-in interface to be connected at the rear of XK2100/GX2900

Ordering information

Modem Data Interface	GV2130	6090.3254.02

External Control Interface GV2110

Brief description

This plug-in interface to be built in at the rear of XK2100/GX2900 is for the control of external options/peripheral equipment. It requires an Option Interface GV2000 at the external option. Option Interface GV2000 is available for the following external units:

- Motor Selection FK2850
- Postselection (TX filter), 150 W, FK2101X
- HF Antenna System AK001

Permissible length between GV2110 and GV2000 approx. 100 m.

The serial control has a bus structure (RS485), hence more than one GV2000 can be connected to a GV2110 (cascaded).

The I/O connector of GV2110 has also 4 embedded coax connectors for the RF link to the external filter units (FK2850, FK2101X).

Ordering information

External Control Interface	GV2110	6033.6006.02

Option Interface GV2000

Brief description

This option interface is a programmable interface card which is usually integrated into the external option/peripheral device.

Its outputs are application-specific interfaces to control the connected option from the XK2000 set. One typical output is the current frequency information (set at the XK 2000) in parallel code as well as the RF connections to the selective devices.

Specifications

on request

Ordering information

Option Interface	GV2000	6090.7008.02

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OCXO Frequency Standard GF2010

Brief description

For the purpose of achieving higher frequency stability, an oven-controlled crystal oscillator (OCXO) rather than the standard crystal oscillator can be employed in the HF unit/synthesizer of the transceiver. The GF2010 option which can only be fitted in the factory must be specified in the customer's order.

The higher requirements for transceiver frequency stability are needed for the DATA LINK modes for example and can be met by the GF2010 option.

Specifications

Frequency	10 MHz
Short-term stability	≤1 x 10^{-9}/day (after 30 days)
Long-term stability	≤1 x 10^{-7}/year
Drift versus temperature	≤1 x 10^{-9}/°C

Ordering information

OCXO Frequency Standard (can only be factory-installed)	GF2010	6033.5000.02

Blower Unit KL2100 (for 150 W units only)

Brief description

For the use of Transceiver XK2100 in continuous transmit mode, Blower Unit KL2100 is recommended for keeping the operating temperature and the quality parameters within given tolerances even under harsh environmental conditions. This option is particularly required for continuous radio data or radiotelephony operation with voice compression or in relay mode.

Photo 42016

The blower unit is fixed mechanically and electrically to the rear of the transceiver behind the heat sink and connected to the power supply of the transceiver.

The blowers are temperature-controlled from the output stage.

Specifications

Twin blower	with housing and air filter
Supply voltage	24 V DC (from transceiver)

Ordering information

Blower Unit	KL2100	6050.2992.02

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RX Input Protection ZW2900

Brief description

An optional RF protection for the input of the 500 W and 1000 W XK2000 transceivers is available. The add-on module ZW2900 ensures destructive-free reception in the presence of RF interference at the antenna (caused by very close transmitters) of up to 100 V rms corresponding to a power of 200 W into 50 Ω.

The protection function is afforded by a power PTC resistor which is looped into Power Amplifier VK2500/2900 between the antenna and the receiver input. The PTC resistor goes high impedance when RF interference is present and thus protects the receiver input.

Photo 42020

The use of the ZW2900 option is required whenever collocation problems caused by RF irradiation impair reception or make it impossible. This type of situation arises in particular on ships and can be overcome by using the ZW2900 option.

Specifications

Receiver input protection against RF overloading	100 V rms (corresponding to 200 W RF into 50 Ω)

Ordering information

RX Input Protection	ZW2900	6072.2514.02

Transformer 440 V BV2900

Brief description

For supplying Transceivers XK2500 and XK2900, Power Supplies IN2500 and IN2900 can be configured for the following input voltages/modes/phases:

Voltage	Mode	Phase
230 V	–	1 ∅
3 x 230 V + N	star	3 ∅
3 x 208 V	triangle	3 ∅
(= 3 x 120 V)	star	3 ∅
3 x 115 V	triangle	3 ∅ – on request

For the special application: 3 x 440 V, 3-phase, triangle, Transformer 440 V BV2900 is required. This 5 kVA autotransformer is built into Adapter KG 2900.

It is thus possible to operate transceivers also in special nets (STANAG 1008) such as on ships.

Ordering information

Transformer 440 V	BV2900	6072.7016.02

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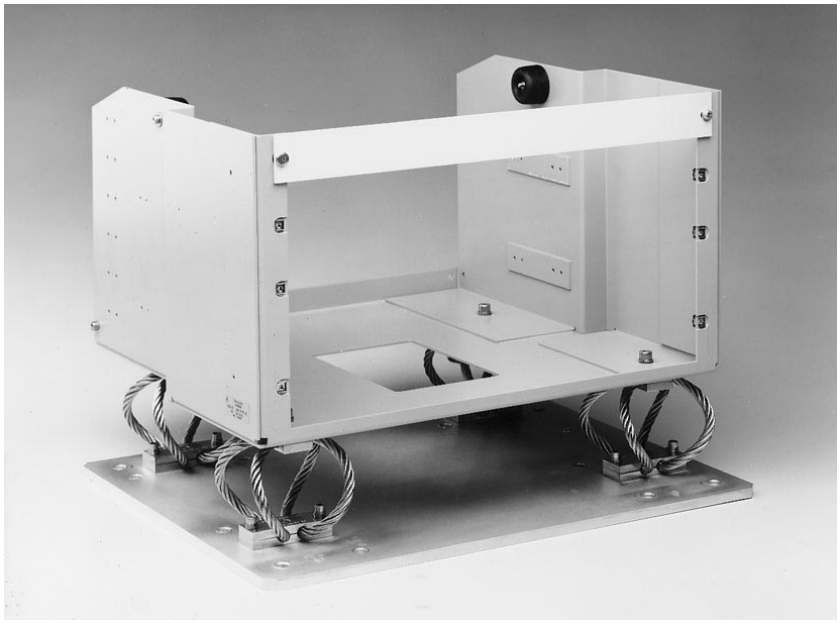
Shockmount KS2100 for XK2100

Brief description

The sturdy Shockmount KS2100 fitted with absorbers is available for the fully mobile use of 150 W Transceiver XK2100, ie in applications subject to high levels of shock and vibration. Shockmount KS2100 can accommodate a Transceiver XK2100L/R as well as an AC Power Supply IN2100 and an optional external data modem GM857C4/GM857C5. Different models of the shockmount are obtainable to suit the system configuration.

Shockmount installation of the transceiver requires also 19" Adapter KA2100, Power Supply IN2100 requires 19" Adapter KA2120.



Groundplate 6050.4108.01 not supplied with Shockmount KS2100 (Photo 42017)

Specifications

MIL-STD-810E (for KS2100)	random to method 514.4, shock to method 516.4, with 40 g when fully equipped

Ordering information

Shockmount for XK2100		
xx: 02 = XK2100L/R + IN2100 + GM857C4/C5	KS2100	6050.3999.xx 6050.3999.02
xx: 03 = XK2100L/R + IN2100		6050.3999.03
xx: 04 = XK2100L/R		6050.3999.04
19" Adapter	KA2100	6050.3499.02
19" Adapter	KA2120	6064.0751.02
Shockmount for XK2500/XK2900	KS2900	6072.6510.02
Extra		
Groundplate		6050.4108.01

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Antenna Tuning Units (ATU) FK2100 and FK2100M

Brief description

Antenna Tuning Unit FK2100 is part of the XK2000 equipment family. It serves for the automatic matching of antennas, in particular of very short antennas, to 150 W HF Transceiver XK2100. The sturdy and water-proof plastic casing of FK2100 is shock- and UV-resistant and thus ideally suited for mobile applications. FK2100M which is a sea-water- and drop-resistant version of FK2100 is especially designed for shipboard applications and can match antennas with very low ohmic resistance.

Particular attention was paid to obtain an effective lightning protection. Both ATUs are fully arc-protected against direct lightning strokes. They are tested to withstand arcs of 10 kV/10 kA. Automatic BIT (built-in test) for default detection and reporting to the XK2100 transceiver.

The microprocessor-controlled tuning allows the self-learning of a maximum of 1500 tuning settings which together with the channels stored in Transceiver XK2100 (including ALE, APP, ITU and 100 silent channels) are retained in a non-volatile memory. In FK2100M up to 1500 silent tuned channels are provided in addition to the learn channels. The stored channels can be called up with very short setting times both in FK2100 and FK2100M.

The software (FK2100S) can be easily loaded, changed, updated into the ATU´s internal FLASHPROM from the transceiver (no disassembling of ATU and no change of EPROMS necessary).

Photo 40695-1

With a single cable between the transceiver and ATU carrying RF, supply voltage and all bidirectional control data, FK2100 is highly installation-friendly and at the same time has less EMC problems.

Shockmount KS2110

(for FK2100 and FK2100M)

For extremely harsh environmental operating conditions of the ATU, a rugged shockmount is available.
Typical applications of KS2110 are installations on board of small ships or armoured vehicles.

Specifications

Common data	
Shortest matched antenna	3 m whip, with duty cycle 1:1
Long-wire antennas	up to 15 m length
Lightning protection	tested for 10 kV/10 kA direct lightning strokes
Fungus-protected	
Solar-radiation-proof	
Salt-fog-proof	
Specifications FK2100M	
Frequency range	1.5 to 30 MHz
Shortest matched antenna	5 to 7 m whip; 7 to 12 m rod
Channels	1500 channels for silent tuning, in addition to 1500 learn channels and ITU channels, ALE and APP channels
Tuning time	
Initial tuning	typ. 1000 ms
Retuning	<100 ms
SWR (tuned)	<1.5, typ. 1.2
Cable	1 coax cable for RF, control and supply voltage
VLF output	N connector
Temperature range	–30° to +55°C
Dimensions (W x H x D)	389 mm x 338 mm x 168 mm
Weight	7.5 kg

Fully sea water-proof (partly submersible)
Shock, random vibration to MIL-STD-810 C/D/E

Ordering information (for both models)

Antenna Tuning Unit	FK2100	6046.8948.02
	FK2100M	6064.9550.02
Standard Software	FK2100S	6090.5505.02
Naval Software (for FK2100M)	FK2100S	6090.5505.07
Shockmount	KS2110	6090.5905.02

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Standard Cable Sets XK2000C

Brief description

Standard cable sets are available from Rohde & Schwarz for system applications of Radio Equipment Family XK2000 with external components. These applications encompass:

A) Fast data modes
B) Extended TX/RX operation
C) ATU control cable (HF850)
D) Remote control cable

Fast data transmission (>2700 bit/s)
Standard ready-made cable sets are available for expanding radio systems of the XK2000 family to an ALE-supported system with fast data capability. The cables interconnect the radio equipment with the external system processor (eg MERLIN) or an external HF modem.

The cable sets can be used equally for the standard radio equipment of type series NK 21./25./29. -04 and -05 and as standard components in project-specific systems. The cable sets supplied differ in the following respects:
- System processor (PC or MERLIN)
- I/O device of the system processor (COM port or ICOM multi I/O board)
- With or without RSX.25 data protection protocol
- Internal or external HF modem

A) Fast data modes

Cable set	System components/application
XK2002C	For use of a PC or MERLIN with COM port and internal HF modem (GM2100), with ALE
XK2003C	For use of a PC or MERLIN with COM port and external HF modem (GM857C4/C5), with ALE
XK2004C	For use of a PC or MERLIN with COM port, external HF modem (GM857C4/C5) and RSX.25 data protection, with ALE
XK2005C	For use of MERLIN with ICOM board and internal HF modem, optional ALE with X.25 protocol, with ALE
XK2006C	For use of MERLIN with ICOM board and external HF modem (GM857C4/C5), with ALE
XK2007C	For use of MERLIN with ICOM board, external HF modem (GM857C4/C5) and RSX.25 data protection, with ALE
XK2010C	For use of a PC or MERLIN as TTY I/O device
XK2011C	For use of an external modem GM867C5 with MERLIN
XK2012C	For use of an external modem GM857C5 with PC

B) Extended TX/RX operation

Cable set	System components/application
XK2001C	Antenna (coax) cable to connect transceiver with: 1) A T U or 2) Broadband antenna, eg HX002 (A1) Note: Lightning protection should be considered
XK2008C	Antenna cable for VLF reception with the use of XK2100 and FK2100

C) ATU control cable (HF850)

Cable set	System components/application
ATU control cable	Between Transceivers XK2500/XK2900 and ATUs of the HF850 family. For information, see under HF850 accessories or in price list

D) Remote control cable

Cable set	System components/application
XK2009C	Connecting cable for remote control between GB2000 and XK2100/GX2900

Ordering information

Quantity; length	Type	Order number
1 cable; 25 m	XK2001C	6063.5508.25
2 cables; 2 m each	XK2002C	6063.6504.02
4 cables; 2 m each.	XK2003C	6063.7000.02
3 cables; 2 m each	XK2004C	6063.7252.02
2 cables; 2 m each	XK2005C	6063.7500.02
4 cables; 2 m each	XK2006C	6063.7752.02
3 cables; 2 m each	XK2007C	6063.8007.02

Quantity Length	Type	Order number
1 cable; 10 m	XK2008C	6063.8507.10
1 cable; 20 m	XK2009C	6077.2012.20
2 cables; 2 m each	XK2010C	6078.3364.02
2 cables; 2 m each	XK2011C	6090.9000.02
2 cables; 2 m each	XK2012C	6090.9252.02

Note: If cable lengths other than the standard lengths are required, the model designation xx changes where it corresponds to the length in meters of all cables within the set. Prices and terms of delivery on request.

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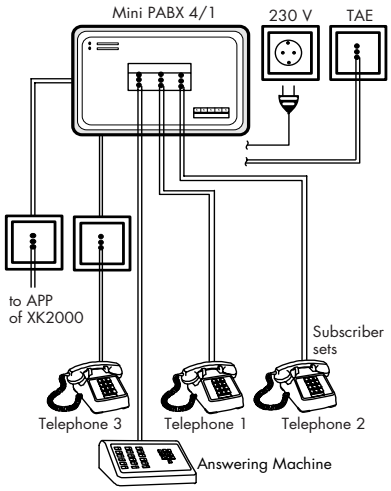
Telephone Exchange Set GA2160

Brief description

For the optional telephone-operated service within the XK2000 family, the radio must be equipped with the internal options ALE, APP and EMC filter ALE/APP.
Moreover the accessory Telephone Exchange Set GA2160 – which consists of a PABX and one standard telephone set – must be connected to the telephone connection box of the APP. This assembly allows telephone-like operation of the entire radio system, with full radio operation (link setup), ringing, signalling and (semiduplex) operation from the telephone set.
For further extensions regarding the number of subscribers or access to the telephone network, other (larger capacity) PABXs can be used, or a direct PSTN line can be connected to the APP's telephone connection box.

Note:
Any access to a public telephone network must be in compliance with the applicable local PTT regulations.
The technical interface specifications of the APP's telephone box are designed to comply with German PTT regulations FTZ 1 TR 2 and FTZ 144 TV 41 regarding equipment connected to telephone lines, but the box is not officially certified.



Specifications and standard installation

Subscriber connection	
Internal feed	24 V
DC range	2 x 20 Ω
Call signal voltage	38 V rms/50 Hz
Audio frequency	440 Hz
Audio level	–18 dB
Public line connection	
Voltage	24 to 60 V
Transmission and switching impedance to German PTT requirements, with charge pulse transmission, dialling technique	IWV (60/40 ms), MFV with flash key
Automatic dial pause	3 s
Non-interruptive AC supply failure	0.1 s
Memory retained on power failure	unlimited
Public line switchover on power failure	position 1
Operating temperature range	0 to 40°C

Adapter	
AC supply voltage	230 V ±10%, 50 to 60 Hz
Rated power (quiescent/op)	4 W/8 W
Connecting line	1.5 m with MSV4 connector
Telephone line	3 m, TAE-F connector to MSV4 conn.
Subscriber telephone set (1 x)	Euroset 820 (subscriber telephone set)

Ordering information

Telephone Exchange Set	GA2160	6064.9507.02

Service Kit KA2110

Brief description

Service Kit KA2110 together with the associated repair manual allows service and repair to be carried out on the following units of the XK2000 family: XK2100; FK2100; GX2900; VK2500; VK2900 and GB2000 Service Kit KA2110 is intended for on-site troubleshooting/repair of defective units or internal modules with the aid of a functional reference unit. Recommended test equipment listed in the repair manual should be available.

The service kit consists of a variety of adapter cards, cables, adapters and a connection box which makes the data, PTT and signal outputs for the basic functions of the DUT available for switching and measurement.
All components of the service kit are accommodated in a portable case.

Ordering information

Service Kit	KA2110	6050.4995.02

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Components for HF Broadband System XB2900: Power Management Unit (PMU) GV2900

Brief description

Power Management Unit (PMU) GV2900 assigns the exciter signals to the inputs of the power amplifiers, and assures that the number of HF transmitting lines and the RF power of each HF line is configured in accordance with the current user requirements of the HF transmission system.

The radio operator configures HF Broadband System XB2900 via the central control system, installed in the console in radio room 1, using a user-friendly man-machine interface. For emergency purposes a predefined configuration is activated immediately. In addition the system can be controlled manually by the operator, since all components of HF Broadband System XB2900 are equipped with a local control unit.

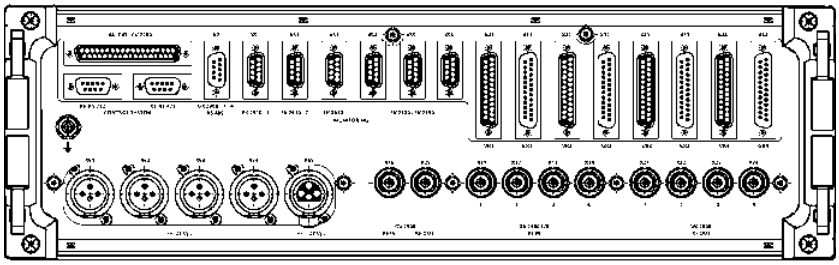
Inside the power management unit, the RF signals are distributed by high-performance switching devices, at low power levels.

Photo 42549

The system is designed so that no high-power RF switching is necessary, thus ensuring high reliability and instantaneous channel changing for frequency-adaptive and ECCM applications.

The following operating modes are possible:

Single-line mode	**Each VK2900 amplifier is allocated to a single GX2900 exciter**
2 kW mode	Two VK2900 power amplifiers are driven with the same exciter signal, ie Nos. 1 & 2 and Nos. 3 & 4
4 kW mode	All four VK2900 amplifiers are coherently driven with the same exciters signal
Mixed mode	One exciter unit controls two power amplifiers, ie coherent driving, two exciters operate on independent lines and one exciter remains free for receiver operation



Rear Panel of GV2900

Specifications

HF data

Frequency range	1.5 to 30 MHz
Intermodulation - output signals (P_{in} = 7 dBm PEP)	>50 dB referred to single tone
Decoupling, single lines	>40 dB
Harmonic suppression (P_{in} = 7 dBm CW)	>40 dB
Frequency response	<2 dB
Mode switching time	<3 s

General data

Operation temperature range	–25 to +55°C
Storage temperature range	–40 to +85°C
Humidity	MIL-STD-810 E, Method 507.3, 95% relative humidity with slight dew accumulation
Vibration	DIN/IEC 68, 5 to 55 Hz, amplitude 0.2 mm
Shock	MIL STD 810 E, method 516,4
Foreign objects	IP 20
EMC	MIL STD 461, Class A3, A4 (CE 03, RE02, CS 01)
Electrical safety	VDE 866, VDE 804, CDE 805 (EN 60950)
Dimensions (D x W x H)	565.6 mm x 482.6 mm x 132.1 mm
Weight	14.7 kg

Ordering information

Power Management Unit	GV2900	6077.3519.02

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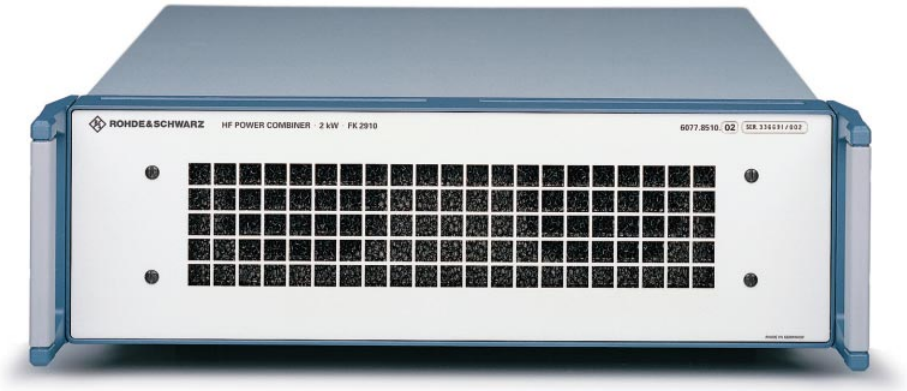
Components for HF Broadband System XB2900: Passive HF Power Combiners FK2910, FK2920

FK 2910: 2 kW

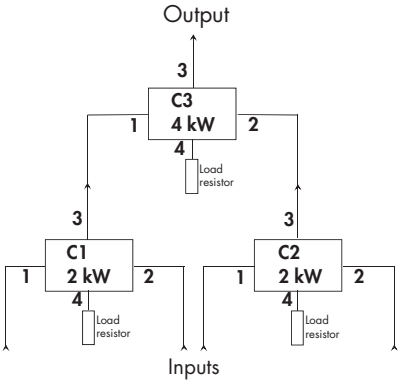
FK 2920: 4 kW



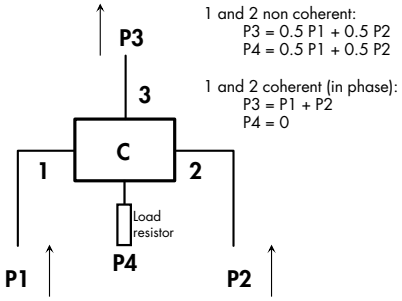
FK 2910 (Photo 42542-1)

Description

The power combiner section consists of 3 individual couplers, arranged in two levels and in such a way as to maximize the power management possibilities.



The individual couplers are zero-degree couplers. This means that perfect power combination takes place if the two inputs are in phase. The coupling device is built up as 4 port system, which provides 2 inputs, one RF signal output and one output to the dummy load. To explain the function a simple example is outlined in the following figure:



Two exciter signals P1 and P2 are applied to the inputs of the coupler, which behaves differently according to whether the two signals are

a) identical – coherent and in phase
b) not identical, not coherent.

Coherent in this sense means that the signals originate from the same source (modulator) and are thus in phase.

Case a)
At the output of the coupler the sum of the powers of both signals (P3 = P1 + P2) appears. The residual loss is typically less than 0.4 dB.

Case b)
At the output of the coupler the sum of the half powers of both signals (P3 = 0.5 x P1 + 0.5 x P2) appears. The loss of one signal is typically between 3.2 and 3.4 dB. The loss of 3 dB, which is caused by the non-coherent combination, is dissipated in a load resistor connected to a fourth port of the coupler.

This typical behaviour of a coupler allows to control the coupler loss by appropriate and intelligent selection of the input signals, which in practice will be done by the Power Management Unit, as directed by the operator from System Processor MERLIN GR2000X in the operator console.

The second remarkable property of a power coupler is its isolation. This means that a signal P1 fed into one input (eg input 1) appears at the output 3, not at the other input 2. Thus the two power sources are decoupled and intermodulation between the signals is virtually eliminated.

The insertion loss is between 0.2 and 0.4 dB nominal. The coupling loss is 0 dB in the in-phase case and 3 dB in the non-coherent case.

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Components for HF Broadband System XB2900: Passive HF Power Combiners FK2910, FK2920

The isolation of the coupler – typically 25 dB for adjacent lines, higher for non-adjacent lines – determines the backdoor intermodulation in the power amplifiers. The primary source of backdoor intermodulation therefore occurs between two adjacent power amplifiers which are combined by a coupler. The amplifier-to-amplifier paths in the combiner add a multiple of 3 dB to the isolation. Each coupler can accept a maximum of 1122 W (FK2910), or 4 kW (FK2920) input power per input port.

Due to the fact that the power combining unit consists only of passive and solid-state devices, there are no limitations for frequency-agile EPM (ECCM) operating modes and frequency separation between the various HF transmitting channels.

In addition these passive devices exhibit an outstanding MTBF figure in the order of 15000 to 18000 hours, depending on the operational configuration, power levels used, coherent or non-coherent etc.

Specifications

Electrical data

RF IN A/RF IN B (X101/X102)

Frequency range	2 to 30 MHz
Power	FK2910: max. 1122 W; FK2920: max. 4100 W decoupled, max. 2150 W, coupled
Passband attenuation	0.4 dB, typ. 0.2 dB
Input impedance	Z = 50 Ω (in passband range at termination with Z_o = 50 Ω)
Return loss	23.5 dB, load resistance at all other ports 50 Ω
Output impedance, nominal	Z_o = 50 Ω

RF ABSORB (X104)

Frequency range	2 to 30 MHz
Power, coupled operation	FK2910: max. 1075 W into 50 Ω FK2920: max. 3915 W, into 50 Ω

RF OUT (X105)

Frequency range	2 to 30 MHz
Power, coupled operation	FK2910: max. 2150 W, transmission loss <0.27 dB between RF OUT and RF IN A/B FK2920: max. 4100 W, transmission loss <0.22 dB between RF OUT and RF IN A/B
Power, decoupled operation	FK2910: max. 1075 W, transmission loss <3.27 dB between RF OUT and RF IN A/B FK2920: max. 3915 W, transmission loss <3.22 dB between RF OUT and RF IN A/B

Monitoring and Power Supply (X103)

Current supply	19 to 31 V DC
Current consumption	FK2910: max. 0.3 A FK2920: max. 0.5 A
Monitoring	
FORWV, forward voltage	0.05 to 4.5 V DC analog
REFLV, reflected voltage	0.05 to 4.5 V DC analog
SEA, sense absorber	0 V/+5 V digital
BLS, blower sense	0 V/+5 V digital

General data

Operation temperature range	–25 to +55°C
Storage temperature range	–40 to +85°C
Altitude	3 000 m above sea level, T = 35 °C
Humidity	26 °C/41 °C, 95 %, 5 days MIL-STD-810 E, method 507.3 with slight condensation
Vibration	Sinusoidal DIN/IEC 68, 5 to 55 Hz, max. 2 g, 55 to 150 Hz, 0.5 g constant (HVO 100), MIL-STD-810D, method 514,2
Random	10 to 500 Hz, 1.9 g rms/30 min per axis (HVO 103)
Shock	MIL-STD-810 E, method 516.4
Protection	DIN 40050, IP20
EMC	MIL-STD-461 B, except for transmit frequency
Noise level	<55 dBA at a spacing of 1 m

Mechanical data FK2910

RF inputs/RF outputs	coaxial socket, type N
Monitoring lines	9-way Cannon connector
Design	19" slide-in unit, 3 height units
Dimensions (D x W x H)	460 mm x 482.1 mm x 132.1 mm
Weight	10.2 kg
Colour	front panel: RAL 7035, semi-matt
MTBF	18 000 hours
MTTR	0.3 h

Mechanical data FK2920

RF inputs/RF outputs	7/16 connector system
Monitoring lines	9-way Cannon connector
Design	19" slide-in unit, 5 height units
Dimensions (D x W x H)	460 mm x 482.1 mm x 221 mm
Weight	max. 17 kg
Colour	front panel: RAL 7035, semi-matt
MTBF	18 000 hours
MTTR	0.3 h

Ordering information

Passive HF Power Combiner 2 kW	FK2910	6077.8510.02
Passive HF Power Combiner 4 kW	FK2920	6090.0003.02

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Components for HF Broadband System XB2900: Antenna Triplexer FK2950

Brief description

After combining the RF power lines with the cascaded 3 dB coupling devices, all RF transmit signals are routed to an HF broadband antenna system, which consists of an Antenna Triplexer FK2950 and a three-section broadband antenna. An antenna mismatch of VSWR up to 3:1 can be tolerated without loss of power. For land-based installations single broadband antennas (eg log periodic antennas) from 1.5 to 30 MHz can be used.

Specifications

Electrical data

Frequency range	2 to 30 MHz
Passband range	
WBL (wideband low)	2 to 7.415 MHz
WBM (wideband medium)	7.79 to 20.487 MHz (Model 02) 7.79 to 16.5 MHz (Model 03)
WBH (wideband high)	21.525 to 30 MHz (Model 02) 16.4 to 30 MHz (Model 03)
Filter types	
WBL	lowpass
WBM	bandpass
WBH	4400 W in CW mode, voltage stability at termination with VSWR 3 : 1
Passband attenuation	<0.4 dB, typ. 0.25 dB
Stopband attenuation	
WBL	1.3 x f_o : 40 dB
WBM	f_u / 1.3 : 40 dB ; f_o x 1.3 : 40 dB
WBH	f_u / 1.3 : 40 dB ; f_o x 1.3 : 40 dB
Input impedance	Z = 50 Ω, VSWR <1.28 in passband range at termination with Z_o = 50 Ω
Output impedance, nominal	Z_o = 50 Ω
Current supply	19 to 31 V DC
Current consumption	max. 0.3 A
Monitoring	output power WBL, WBM, WBH reflected power WBL, WBM, WBH

General data

Operation temperature range	–25 to +55°C
Storage temperature range	–40 to +85°C
Altitude	3 000 m above sea level, T = 35 °C
Humidity	26 °C/41 °C, 95 %, 5 days MIL-STD-810 E, method 507.3 with slight condensation
Vibration	
Sinusoidal	DIN/IEC 68, 5 to 55 Hz, max. 2 g, 55 to 150 Hz, 0.5 g constant (HVO 100), MIL-STD-810 D, method 514.2
Random	10 to 500 Hz, 1.9 g rms/ 30 min per axis (HVO 103)
Shock	MIL STD 810 E, method 516.4
Protection	DIN 40050, IP20
EMC	MIL-STD-461 B, except for transmit frequency

Mechanical data

RF input	coaxial socket, system 7/16
RF outputs	WBL: coaxial socket, system 7/16 WBM: coaxial socket, system 7/16 WBH: coaxial socket, system 7/16
Monitoring lines	3 x 9-way Cannon connector
Design	19" slide-in unit, 7 height units
Dimensions	depth 565 mm (measured from front panel, including connectors)
Weight	48 kg
Colour	front panel: RAL 7035, semi-matt case: aluminium, chrome finish
MTBF	18 000 hours
MTTR	0.3 h

Ordering information

Antenna Triplexer	FK2950	6090.3502.02

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Shortwave Radio Equipment Family HF850 – Overview

Superior RF characteristics pave the way for broad application of Radio Equipment Family HF850 in existing or newly created shortwave radio networks. Modular design throughout and special constructional features ensure high MTBF (Photo 40321)

With Radio Equipment Family HF850 Rohde & Schwarz continues its long tradition in the field of shortwave equipment using all available know-how and development potential

Shortwaves from Rohde & Schwarz

The HF850 family comprises transmitting/receiving systems for mobile/stationary use with transmitter output powers of 150 W, 400 W and 1000 W, a communication receiver for duplex systems as well as an intelligent communication and monitoring receiver with a great variety of operational features. The equipment family is not only characterized by a common design (eg control panel), but is also made up of identical modules.

Moreover, an optimum equipment configuration to meet different operational requirements is ensured by a variety of options and alternatives, such as ALIS (automatic link setup), ISB modem (also high-speed data transmission to LINK 11), ARQ (automatic repeat request), fast data transmission (2700 bit/s), FEC (forward error correction) and frequency hopping (FH).

Basic unit

All HF transceivers of the HF850 family are designed for reception in the frequency range 0.4 to 30 MHz (or receivers from 10 kHz to 30 MHz) and for transmission in the range 1.5 to 30 MHz. The frequency can be set in smallest increments of 10 Hz. Up to 100 frequencies (in half-duplex mode separate transmit and receive frequencies) can be stored in a nonvolatile channel memory.

The built-in test equipment continuously monitors all major functions of the transmitting/receiving system and indicates the current operating status on the control unit. If a fault occurs, which is indicated by a CM (continuous monitoring) message, a test routine can be triggered for localizing the defective module. Since the electrically and mechanically exactly defined modules are factory-adjusted within specified tolerances, they can be replaced without any need for readjustment. This, coupled with rapid replacement of the modules, makes for minimum repair times. Special constructional measures reduce heat generation and enable 24-hour continuous operation.

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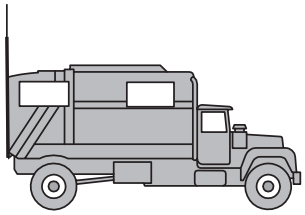
Densely integrated components and the low self-heating ensure a MTBF of more than 4000 hours for the HF transceivers. Very high MTBF and rapid localization and replacement of defective modules result in an extremely high availability for the user.

This section provides an overview of the main members of the HF850 family. The range of applications is further enhanced by a great variety of add-on units.

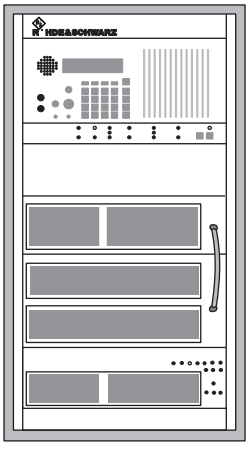
HF850 equipment characteristics and operational requirements in stationary, land-mobile and shipboard use

Land-mobile use

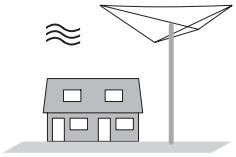


- Interference-immune transmission (frequency hopping, burst) using ALIS processor
- Transmission and reception while on the move
- Single- or three-phase connection for line power
- High efficiency
- Low weight and small dimensions
- Low noise level
- Battery-driven backup (emergency) operation

3 RF power ranges 150 W, 400 W, 1000 W



Stationary use



- Error-protected data transmission (ARQ, FEC) by means of add-on modules
- Duplex capability
- Automatic antenna switchover (add-on unit)

Shipboard use

- Excellent collocation characteristics
- LINK 11 capability ensured by ISB modem (add-on unit)
- Silent tuning
- Power supply in line with MIL-STD-761B
- Nonmagnetic design (option)

Application-specific transceiver models

Type	Power class	Model	Uses, special features
XK852...	150 W	...C1:	Standard model for land-mobile and stationary use, 19"
		...C2:	Same as C1, desktop
		...C3:	Marine model, reception from 10 kHz, silent tuning
		...H2:	Frequency hopping capability, with double synthesizer
		...L1:	LINK 11 capability, collocation-immune, selective probe (forward and reflected), no power reduction with VSWR, otherwise same as C3
XK855...	400 W	...C1:	Standard model for mobile use with DC supply or for stationary use with AC supply
XK859...	1000 W	...C1:	Standard model for stationary or shelter applications, in 19" rack
		...H2:	Frequency hopping capability, with double synthesizer
		...L1:	LINK 11 capability, separate RX (EK851L1) required

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Shortwave Radio Equipment Family HF850 – Overview

Essential characteristics in brief

Operational

- Easy and reliable to operate thanks to integrated, intelligent control unit and uniform operating concept for all transceivers of the HF850 family
- 100 preselectable channels for complete settings with separately programmable transmit and receive frequency (half-duplex operation)
- System-compatible through universal remote-control interface V.24/V.28 (RS-232-C)
- Interface for control of add-on units (antenna selector, AF matrix, etc)

Obsolescence-proof design

- In conjunction with Remote Control Processor GP2000 suitable for automatic link setup and adaptive radio transmission methods. Add-on modules make the transceiver suitable for methods with low probability of intercept (LPI) and for ECM-resistant methods such as burst transmission and frequency hopping
- With additional modem suited for high-speed data transmission
- Flexible incorporation of receiver/exciter, amplifier and antenna tuning unit
- FSK modem for direct connection of teletype (recommended add-on)
- Integrated voice compressor
- Short-circuit- and open-circuit-proof power amplifier with FETs
- 24 h duty cycle
- Filter stage: choice of three modules
- TX/RX switchover <10 ms
- Complies with all relevant military standards such as
  - **MIL-STD-461 to 463**
  - **MIL-STD-810C**
  - **MIL-STD-1399**
- Power supply: 19 to 31 V DC or 115/230 V AC 1 phase, 230 V_{AC} 1 phase or 380 V_{AC} 3 phase

Logistic advantages

- Modular design
- Practically identical modules for all transceivers of HF850 family
- Same exciter for all power classes
- Built-in test equipment (continuous monitoring/fault location down to module level, modules replaceable without readjustment)
- High availability: MTBF >4000 h (XK852)

Product overview

150 W HF Transceiver XK852

The rugged, waterproof and dustproof construction (photo) permits use on ships and even on open vehicles in addition to stationary use. This radio system complies with the major civil and military standards. The extremely fast tuning Antenna Tuners FK852 (C1=standard, C3=marine, H2 for frequency hopping capability) enable the transmitter output stage to be matched to all conventional vehicle antennas and antenna systems plus silent tuning on the 100 programmable channels without any radiation of power.

The supply voltage is 19 to 31 V DC. Using AC Power Supply IN852C1 AC operation (115/230 V, single phase, with backup-battery input) is possible.

150 W HF Transceiver XK852 (Photo 38809)

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Shortwave Radio Equipment Family HF850 – Overview

400 W HF Transceiver XK855

The photo shows Receiver/Exciter GX855 together with 400 W HF Power Amplifier VK855. The latter is a linear amplifier; all stages are designed with power FETs, ensuring high efficiency and spectral purity of the output signal.

The power supply comes in two versions:
– IN855P1 for AC supply operation (100 to 250 V AC)
– IN855P2 for battery operation (19 to 31 V DC)

Three antenna tuners are available for matching antennas to the amplifier output:
– Line Flattener FK859C1 permits operation on broadband antennas with VSWR up to 3
– Antenna Tuning Units FK855 (C1 = standard and C3 = marine) permit matching of electrically short antennas

400 W
HF Transceiver XK855
(Photo 39731)

1000 W HF Transceiver XK859

The photo shows 1000 W Transceiver XK859 in a rugged 19" rack. It consists (top to down) of Receiver/Exciter GX859, space for further options, Line Flattener FK859C1, Linear Power Amplifier VK859 and AC Power Supply IN859 which is available for single- or three-phase AC lines.

Three antenna tuners are available: Line Flattener FK859C1, ATUs FK859 (standard) and FK859M1 (marine).

1000 W
HF Transceiver XK859
(Photo 35172)

Control Unit GB853

Control Unit GB853 is identical for all transceivers of Radio Equipment Family HF850. Control is effected locally with the unit built into the exciter, in detached operation over short distances or via remote control. Whereas GB853 is supplied from the exciter in detached operation, units for remote control are provided with their own power supplies. Microphone, Morse key, headphones, loudspeaker, data units and teletype may be connected to the control unit.

The remote control interface is fully compatible to CCITT V.24/V.28 RS-232-C and BUS compatible (RS-485), allowing particularly simple and direct remote control concepts to be implemented.

Control Unit GB853 for Radio Equipment Family HF850 (Photo 41205)

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150 W HF Transceiver XK852

CW, AME, USB, LSB,

ISB, FSK, data

Photo 34598

Brief description

Uses

XK852 is a microprocessor-controlled HF transceiver for stationary, land-mobile and shipboard use. It is used for establishing simplex or half-duplex operation in the CW, AME, USB and LSB modes. With the aid of add-on modules it can be easily adapted for FSK, ISB and high-speed data signals. Transmission is possible in the frequency range from 1.5 to 30 MHz, reception in the range from 400 kHz to 30 MHz. Remote Control Processor GP2000 (alternative configuration) makes XK852 suitable for adaptive EMC-resistant radio transmission methods, thus extending its range of applications.

Intelligence

The microprocessor ensures easy operation by automatically assigning the bandwidth, control time constant and BFO setting to the selected operating mode. The transceiver is thus protected against incorrect operation and impermissible settings. Incorrect operation is indicated by ERROR on the display.

Interfaces

For remote control over short and long distances and computer control the transceiver is fitted with a standard data interface to CCITT V.24/V.28 (RS-232-C). This interface enables to control several transceivers from a central computer or central control unit as well as control of peripheral equipment.

Remote control can also be performed via telephone lines or microwave links without any problems.

Control Unit GB853 integrated into XK852 is also available as a stand-alone unit. It is fitted with a standard V.24/V.28 interface (RS-232-C) and can be used for the remote control of XK852 over any distance.

Design

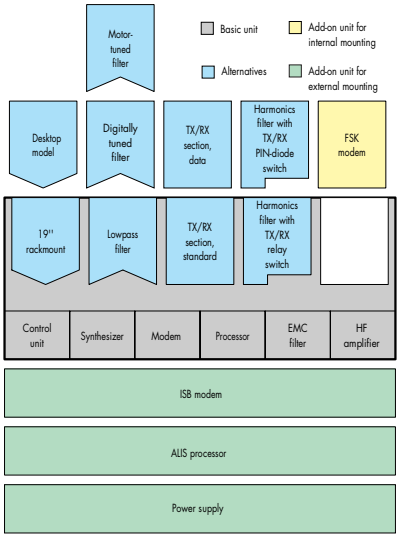
The transceiver is designed for 24-hour continuous operation. The compact design makes it suitable for use in mobile systems. Thanks to these characteristics, together with the water- and dust-protected, robust construction the receiver can also be used under adverse conditions.

Basic unit

Built-in Control Unit GB853; configured for modes of operation CW, AME, USB and LSB; 150 W (PEP); 100 programmable channels; voice compressor; BFO; squelch; V.24/V.28 interface; BCD output for control of external units; built-in test equipment (BITE).

Alternative configurations

- Desktop model
- 19" rackmount
- 30 MHz lowpass filter
- Digitally tuned TX/RX filter
- Motor-tuned TX/RX filter
- Transmitter/receiver section with standard SSB filters:
  ±150 Hz, 2.4 kHz
- Transmitter/receiver section with SSB filters for fast data transmission (2.4 kbit/s):
  ±150 Hz, 3.1 kHz
- Optional Power Supply IN852C1 for AC operation 115/230 V



Incorporation into the basic unit is only possible for two add-on units. A third one must be ordered as stand-alone unit

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Specifications XK852

Common data of transmitter and receiver

Frequency range	
for transmission	1.5 to 29.99999 MHz
for reception	0.4 to 29.99999 MHz
Frequency setting	in 10 Hz steps
Frequency error	
within one day	≤3 x 10^{-8}
within rated temperature range	≤3 x 10^{-7}
Programmable channels	100 (transmit and receive frequencies separately programmable for half-duplex operation)
Classes of emission	A1A (A1), J3E (A3J), upper/lower sideband, switch-selected, H3E(A3H), J7B (A7J), data transmission
Options	
ISB modem GM853C1	B8E (A3B)
FSK modem GM852P1	F1B (F1) with three frequency shifts

Selectivity characteristics

Digitally tuned filter (alternative configuration)	
Frequency range	1.5 to 30 MHz
Selectivity (Δf/f ≥0.25 in the range 12 to 30 MHz)	≥15 dB
Bandpass filter in the range	0.4 to 1.5 MHz
Tuning time	approx. 20 ms
Motor-tuned filter (alternative configuration)	
Frequency range	1 to 30 MHz
Selectivity (Δf/f ≥0.1)	≥40 dB, typ. 45 dB
Lowpass filter in the range	<1 MHz
Tuning time	approx. 2 s

Transmitter data

Output power into 50 Ω (with 26.5 V supply voltage)	>100 W CW, 150 W PEP –1 dB
Power reduction	according to mismatch (no cutout)

Intermodulation products (with two-tone modulation referred to PEP)

with data transmission	≥36 dB down

Receiver data

Antenna input	50 Ω
Max. input voltage 0.4 to 30 MHz	100 V EMF into 50 Ω
Sensitivity (f = 1.5 to 30 MHz) for	
A1A (A1)	≤0.4 µV (≤0.6 µV) EMF
J3E (A3J), J7B (A7J), H3E (A3J)	≤0.4 µV (≤1.5 µV)

Receiving bandwidths

Class of emission	**CCIR designation**	**3 dB bandwidth**
CW	A1A, A1B	±150 Hz
AME in RX mode	H2A, H2B, H3E	–100 to +2300 Hz
USB (and AME in RX/TX mode)	J3E, R3E	+300 to +2700 Hz
LSB		–300 to –2700 Hz
FSK narrow	F1A, F1B	±150 Hz
FSK medium		±150 Hz
FSK wide		±1200 Hz

Interference immunity

Image-frequency rejection	≥80 dB
IF rejection	≥80 dB
Spurious responses	≥80 dB down at Δf ≥30 kHz

Automatic gain control (RF)

Error of AGC	≤4 dB (1 µV to 3 V EMF)

General data

Rated temperature range	–25 to +55°C
Storage temperature range	–40 to +85°C
Protection against foreign matter and water (DIN 40 050, p. 1: IP54)	splash-proof, protected against dust deposits
Max. altitude above sea level	3000 m
Power supply	19 to 31 V DC, floating input
with additional Power Supply IN852C1	115/230 V, 47 to 63 Hz (max. 550 VA)

Ordering information

HF Transceiver 150 W	XK852C1	0645.6310.xx
Recommended extras and auxiliary equipment		
Shockmount for XK852	KS852C1	0647.3018...[1]
Remote Control Processor	GP2000	6092.3000.02
FSK Modem for direct connection of teletype (to be incorporated in transceiver)	GM852P2	0646.4710.02
ISB Modem	GM853C1	0648.6010...[1]
Power Supply	IN852C1	0648.7017...[1]
Control Unit	GB853C1	0649.4011...[1]
Antenna Tuning Unit, standard	FK852C1	0649.0016...[1]
Shockmount for FK852C1	KS852T1	0649.3715...[1]
Antenna Tuning Unit, navy	FK852C3	0703.0008...[1]
Shockmount for FK852C3	KS852T3	0703.4003...[1]
System Processor MERLIN	GR2000	6083.5478.02
Service Kit for XK852	KA852C1	0648.8513.02
Loudspeaker	GA852C7	0648.9603.03
Headphones	GA852	0648.9632.02
Handset	GA852C2	0655.5816.03
Morse Key	GA852C3	0655.5839.03

Cables (specify cable length), male and female connectors

Power supply		
Cable between IN852 and XK852 (compl.)	XK851Z4	0648.7017.03
Shielded cable, 2-wire		0025.0810.00
Female cable connector, 6-contact		0432.5760.00
Control of Antenna Tuning Unit FK852C1		
Cable between ATU and XK852 (compl.)	XK851Z2	0647.9316.01
Shielded cable, 26-wire		0611.7765.00
Male cable connector, 26-contact		0612.7400.00
Shrink sleeve 180°		0080.2463.00
(or shrink sleeve 90°)		0070.4986.00
Female cable connector, 26-contact		0511.9296.00
Shrink sleeve 180°		0080.2463.00
(or shrink sleeve 90°)		0070.4986.00
Control of Antenna Tuning Unit FK852C3		
Cable between ATU and XK852 (compl.)	XK851ZM	0703.3907.01
Shielded cable, 26-wire		0611.7765.00
Male cable connector, 26-contact		0612.7400.00
Shrink sleeve 180°		0080.2463.00
(or shrink sleeve 90°)		0070.4986.00
Female cable connector, 26-contact		0703.2117.00
Shrink sleeve 180°		0080.2463.00
(or shrink sleeve 90°)		0070.4986.00
Control of XK852 from Control Unit GB853		
Cable between GB853 and XK852 (compl.)	XK851Z3	0647.9368.00
Shielded cable, 32-wire		0645.8664.00
Male cable connector, 32-contact (2x)		0549.8474.00
Shrink sleeve 180° (2x)		0080.2457.00
(or shrink sleeve 90° [2x])		0070.4992.00
Control of external units		
Female cable connector, 32-contact		0549.8439.00
Shrink sleeve 180°		0080.2457.00
(or shrink sleeve 90°)		0070.4992.00
RF connection between XK852 and Antenna Tuning Unit FK852		
Cable	RG213C/U	0025.4580.00
Male cable connector, N crimp (2x)		0567.5973.00
RF connectors		
Cable	RG58C/U	0025.2071.00
Male cable connector (BNC crimp)		0241.1378.00
AF connectors (headset, Morse key)		
Male cable connector, 10-contact		0645.8270.00
Shrink sleeve 180°		0586.8245.00
(to shrink sleeve 90°)		0645.8287.00

1) On request

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400 W HF Transceiver XK855

CW, AME, USB, LSB,

ISB, FSK, data

Brief description

Uses

XK855 is a microprocessor-controlled HF transceiver primarily designed for land-mobile and shipboard use. It is suitable for establishing and maintaining simplex or half-duplex operation even under difficult conditions. The basic transceiver model featuring the operating modes CW, AME, USB and LSB can easily be adapted for FSK, ISB, fast data transmission, automatic link setup (ALIS), frequency hopping, ARQ, FEC and burst transmission by means of add-on modules.

Operation

The transceiver is operated from Control Unit GB853 (see page 55) which is usually used for the whole HF850 family. It continuously monitors all essential operating parameters and indicates deviations from standard performance as well as incorrect entries.

Interfaces

XK855 is fitted with a standard V.24/V.28 (RS-232-C) interface to CCITT for detached operation, remote control (via an additional control unit) or computer control.

Design

The transceiver is designed for 24-hour continuous operation. Its three-component design with separate receiver/exciter, amplifier and antenna tuning unit makes it ideal for use in mobile systems. The drip-proof, dust-protected and rugged design even allows XK855 to be used under severe environmental conditions.

Photo 39730

Basic unit

XK855 consists of two separate units: Receiver/Exciter GX855 and Amplifier VK855. Modular design which provides for a wide range of modules or options makes customized configuration possible. The overview (next page) shows the most important standard versions and relevant type indications.

Receiver/Exciter GX855 with built-in Control Unit GB853; designed for CW, AME, USB and LSB modes; 100 programmable channels; voice compressor; BFO; squelch; V.24/V.28 interface; BCD output for controlling external units; built-in test equipment (BITE).

400 W HF Amplifier VK855 with preamplifier, output stage, harmonics filter, directional coupler, TX/RX switch and power supply.

Alternative modules

- Filter
  - 30 MHz lowpass filter–
  - Digitally tuned filter
  - Motor-tuned filter
- Transmitter/receiver section
  - Standard TX/RX section (filters: ±150 Hz and 2400 Hz)
  - Data TX/RX section (filters: ±150 Hz and 3350 Hz)
- Power supply
  - AC power supply 115/230 V
  - DC power supply 19 to 31 V

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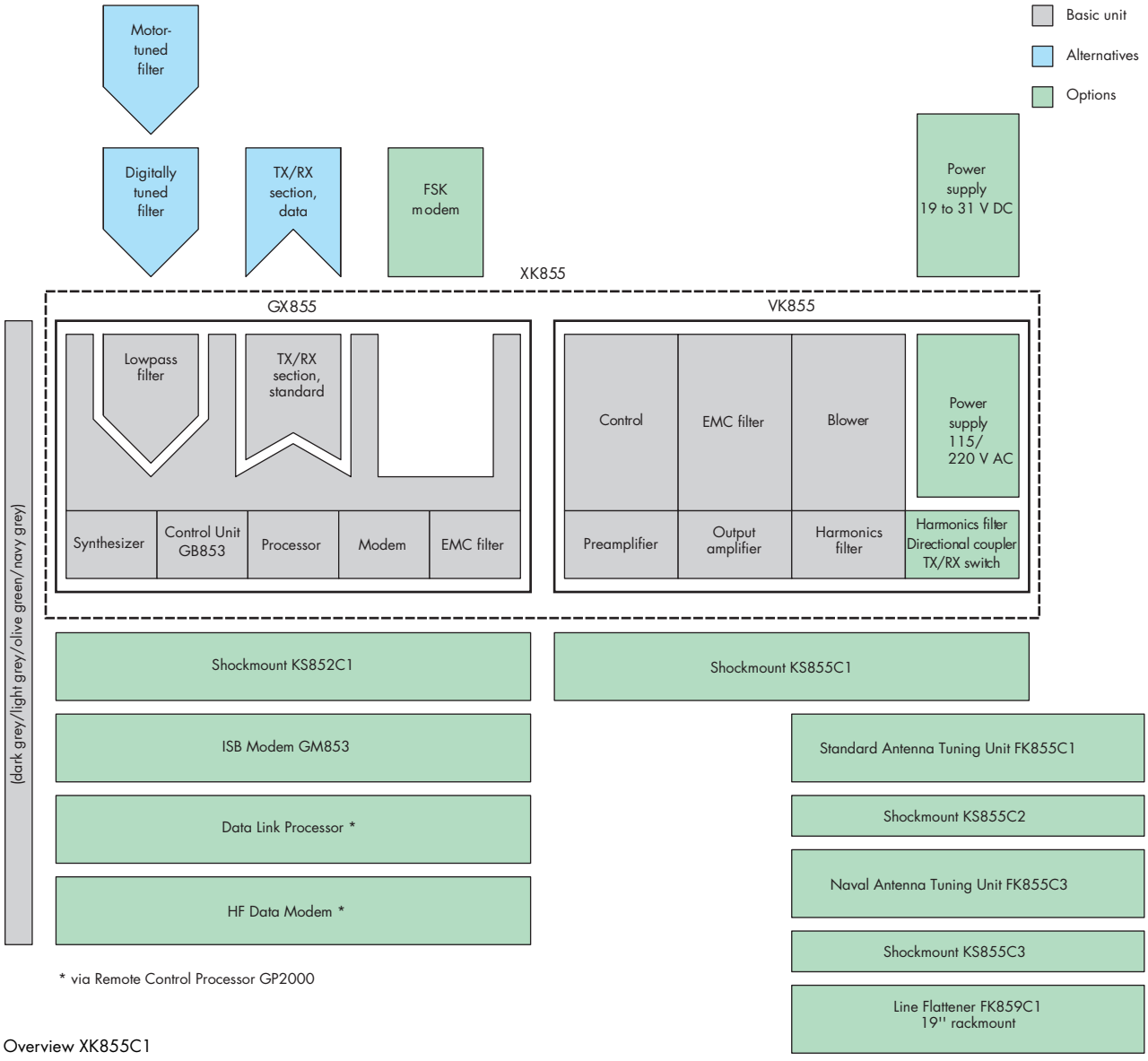

Overview XK855C1

Specifications

Common data of transmitter and receiver

Frequency range
- transmission: 1.5 to 29.99999 MHz
- reception: 0.4 to 29.99999 MHz

Frequency setting: decadic in 10 Hz increments

Frequency error
- after 10 min warm-up: $<3 \times 10^{-7}$ at 25 °C
- within one day: $<3 \times 10^{-8}$
- by aging: $<1 \times 10^{-6}$/year
- within rated temperature range: $<3 \times 10^{-7}$

Programmable channels: 100 (transmit and receive frequencies separately programmable for half-duplex operation)

Classes of emission: A1A (A1), J3E (A3J), upper and lower sidebands, switch-selected
H3E (A3H), upper sideband
J7B (A7J), data transmission
(via add-on units)

Options
- ISB modem: B8E (A3B, data link)
- FSK modem: F1B (F1) with three frequency shifts

Selectivity characteristics

Digitally tuned filter (alternative configuration)
- Frequency range: 1.5 to 30 MHz
- Selectivity ($\Delta f/f \geq 0.15$): ≥15 dB
- Lowpass filter in the range: <1 MHz
- Tuning time: ≈20 ms

Motor-tuned filter (alternative configuration)
- Frequency range: 1 to 30 MHz
- ($\Delta f/f \geq 0.1$): >40 dB, typ. 45 dB

Lowpass filter in the range: 0.5 to 1 MHz

Tuning time: <2 s

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Transmitter data

Output power into 50 Ω	400 W ±0.5 dB, PEP or CW
Forward power with	
VSWR <1.3	no power reduction
VSWR >1.3	continuous power reduction
Matching range of	
Line Flattener FK859C1	VSWR <3
Intermodulation products	
with two-tone modulation	≥36 dB referred to PEP

Receiver data

Antenna input	50 Ω
Max. input voltage in range	
0.4 to 30 MHz	100 V EMF
30 to 400 MHZ	50 V EMF
Oscillator reradiation	≤5 µV at antenna input with 50 Ω termination
Sensitivity (f=1.5 to 30 MHz) for	
A1A (A1)	<0.3 µV (<0.6 µV)[1] EMF for (S + N)/N = 10 dB, BW = 300 Hz
J3E (A3J), J7B (A7J), H3E (A3J)	<0.6 µV (<1.5 µV)[1] EMF for (S + N)/N = 10 dB, BW = 2.4 kHz

Receiving bandwidths

Class of emission	**CCIR designation**	**3 dB bandwidth**
CW	A1A, A1B	±150 Hz
AME in RX mode	H2A, H2B, H3E	–100 to +2300 Hz
USB (and AME in RX/TX mode)	J3E, R3E	+300 to +2700 Hz
LSB		–300 to –2700 Hz
FSK narrow	F1A, F1B	±150 Hz
FSK medium		±150 Hz
FSK wide		±1200 Hz

Interference immunity	
Image-frequency rejection	≥80 dB down (≥100 dB)
IF rejection	≥100 dB down
Spurious responses	≥80 dB down at Δf >30 kHz
Automatic gain control (RF)	
Error of AGC	≤4 dB (1 µV to 3 V EMF)

General data

Operating temperature range	–25 to +55°C
Storage temperature range	–40 to +85°C
EMC	to MIL-STD-461 B, class A3, A4
MTBF	3000 h
Fault location	built-in, can be called at module and subassembly level (digital display on control unit)
Power supply (incorporated in VK855) alternatively:	
IN855P2	19 to 31 V DC (<1750 W) floating
IN855P1	115/230 V AC, 47 to 63 Hz (<1800 VA)
Max. distance between	
receiver/exciter and amplifier	2 m
amplifier and antenna tuning unit	50 m

Ordering information

HF Transceiver 400 W consisting of basic units:	XK855C1	0686.7010.xx
Receiver/Exciter	GX855C1	
400 W Amplifier	VK855C1	
Options		
Remote Control Processor	GP2000	6092.3000.02
FSK Modem	GM852P1	646.4710.02
ISB Modem	GM853C1	648.6010...[1]
Line Flattener	FK859C1	680.3013.02
Antenna Selector	GV851	429.4620.02
Antenna Tuning Unit	FK855C1	729.1001.02
Suitable Shockmount	KS855C2	729.4800.02
Antenna Tuning Unit (navy)	FK855C3	724.8908.04
Suitable Shockmount	KS855C3	729.4900.04
Shockmount for GX855	KS852C1	647.3018.05
Shockmount for VK855	KS855C1	754.2509.00
Recommended extras and auxiliary equipment		
Control Unit	GB853C1	0649.4011.12
Suitable cabinet with EMC filter for distances <50 m	KK853C1	641.4010...[1]
with power supply for distances <1000 m	KK853C2	691.3510...[1]
Handset	GA852C2	655.8516.03/13
Headset	GA852C5	648.9549.03
Loudspeaker	GA852C7	648.9603...[1]
Headphones	GA852C8	648.9632.02
Morse Key	GA852C3	655.5839.03
Microphone + PTT	GA852C6	648.9578.03
Antenna Diversity Unit	GR046	on request
System Processor MERLIN	GR2000	6083.5478.02
Cables, male and female connectors		
Connector for external equipment		
32-contact female cable connector		549.8439.00[2]
Shrink sleeve (180°)		080.2457.00[2]
Shrink sleeve (90°)		070.4992.00[2]
Connectors for antenna tuning units		
26-contact male cable connector (for GX855)		612.7400.00[2]
26-contact female cable connector (for FK855)		511.9296.00[2]
Shrink sleeve (180°)		080.2463.00[2]
Shrink sleeve (90°)		070.4986.00[2]
Cable (26 x 0.6 mm²)		611.7765.00[2]
Connectors for detached Control Unit GB853		
32-contact male cable connector (for GX855)		549.8474.00[2]
32-contact male cable connector (for GX853)		549.8474.00[2]
Shrink sleeve (180°)		080.2457.00[2]
Cable (26 x 0.6 mm²)		645.8664.00[2]
Required cables		
Control Cable (GX855–VK855)	XK855Z1	744.7259...[1][3]
RF Cable (GX855–VK855)	XK855Z2	744.7309...[1][3]
Power Cable (AC)	XK855Z3	744.7359...[1]
Battery Cable (AC)	XK855Z4	744.7407...[1]
Battery Cable (DC)	XK855Z5	744.7459...[1]
Control cable (GX855–FK855)		647.9316...[1]
RF cable (VK855–FK855)		724.9856...[1]

1) Different lengths (eg .02 = 2 m)

2) Please specify cable length

3) Maximum length 2 m

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1 kW HF Transceiver XK859

CW, AME, USB, LSB,

ISB, FSK, data

Photo 38711-2

Brief description

Uses

XK859 is a microprocessor-controlled HF transceiver for stationary and shipboard use. It enables simplex or half-duplex communication in the operating modes CW, AME, USB and LSB. By means of add-on modules, the transceiver can easily be adapted for FSK, ISB and high-speed data transmission. Transmission is possible in the frequency range 1.5 to 30 MHz. The data link processor (option) extends the fields of application of XK859 by making it suitable for adaptive and EMC-resistant radio transmission methods.

Operation

The transceiver is operated from Control Unit GB853, which is commonly used for the whole HF850 family. A separate microprocessor allows simultaneous assignment of several settings by means of only one operational step and thus protects the transceiver against faulty operation and inadmissible settings. False operation is indicated by E (= error). The transceiver continuously monitors all essential parameters and indicates deviations from standard performance.

Interface

For remote control over short and long distances or for computer control, XK859 is fitted with a standard data interface to CCITT V.24/V.28 (RS-232-C). This interface allows the control of several transceivers from a central computer or central control unit and the control of peripheral equipment. When using an additional modem, remote control can also be easily performed via telephone lines or directional radio channels. Control Unit GB853 integrated in XK859 is also available as an independent equipment.

It has also a standard V.24/V.28 interface (RS-232-C) and can be used for remote control of XK859 over any distance.

Design

The transceiver is designed for 24-hour continuous operation. XK859 is drip-proof, dust-protected and sturdy and, therefore, able to withstand adverse conditions.

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Basic unit

XK859 is accommodated in a cabinet rack for stationary operation. It consists of Receiver/Exciter GX859, 1000-W HF Amplifier VK859 and Power Supply IN859.

Receiver/Exciter GX859 with built-in Control Unit GB853 is designed for the modes CW, AME, USB and LSB. It features 100 programmable channels, voice compressor, BFO, squelch and V.24/V.28 remote-control interface. GX859 is further fitted with a BCD output for the control of external units and with a built-in test equipment (BITE).

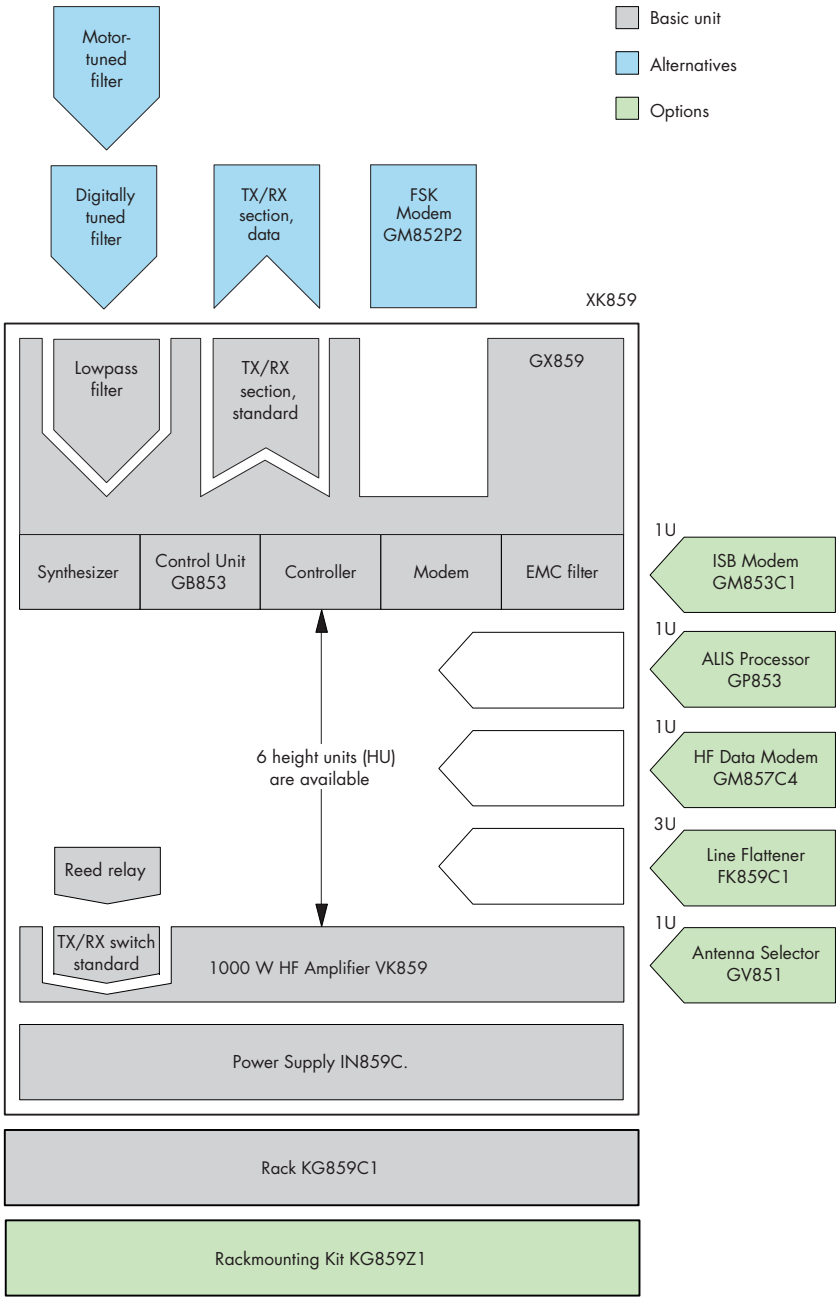
1000 W HF Amplifier VK859 includes preamplifier, output stage and harmonics filter.

Power Supply IN859C1 is designed for three-phase supply and 24 V DC, C2 for single-phase and 24 V DC.

Alternative modules

- Filters
  - 30 MHz lowpass filter
  - Digitally tuned filter
  - Motor-tuned filter
- Transmitter/receiver section
  - Standard TX/RX section (filter: ±150 Hz and 2400 Hz)
  - Data TX/RX section (filter: ±150 Hz and 2400 Hz)
- Harmonics filter with transmit/receive switch
  - Standard TX/RX switch (with relays)
  - TX/RX switch (reed relay)

Free space is provided in the rack to permit easy incorporation of options.



Overview XK859

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1 kW HF Transceiver XK859

Specifications

Common data of transmitter and receiver

Frequency range	
transmission	1.5 to 29.99999 MHz
reception	0.4 to 29.99999 MHz
Frequency setting	decadic in 10 Hz increments
Frequency error	
after 10 min warm-up	<3 x 10^{-7} at 25 °C
within one day	<3 x 10^{-8}
by aging	<1 x 10^{-6}/year
within rated temperature range	<3 x 10^{-7}
Programmable channels	100 (transmit and receive frequencies separately programmable for half-duplex operation)
Classes of emission	A1A (A1), J3E (A3J), upper and lower sidebands, switch-selected H3E (A3H), upper sideband J7B (A7J), data transmission via add-on units)
Options	
ISB modem GM853C1	B8E (A3B, data link)
FSK modem GM852P1	F1B (F1) with three frequency shifts

Selectivity characteristics

Digitally tuned filter (alternative configuration)	
Frequency range	1.5 to 30 MHz
Selectivity ($\Delta f/f \geq 0.15$)	≥15 dB
Bandpass filter in the range	0.4 to 1.5 MHz
Tuning time	approx. 20 ms
Motor-tuned filter (alternative configuration)	
Frequency range	1 to 30 MHz
($\Delta f/f \geq 0.1$)	>40 dB
Lowpass filter in the range	<1 MHz
Tuning time	<2 s

Transmitter data

Output power into 50 W	1000 W ±0.5 dB, PEP or CW, switch-selected to 250 W or 100 W
Incident power with	
VSWR <1.3	no power reduction
VSWR >1.3	continuous power reduction
with short or open circuit	no switching off
Matching range of	
Line Flattener FK859C1	VSWR <3

Intermodulation products

with two-tone modulation	≥36 dB referred to PEP

Receiver data

Antenna input	50 Ω
Max. input voltage	
in range 0.4 to 30 MHz	100 V EMF
Sensitivity (f = 1.5 to 30 MHz) for	
A1A (A1)	<0.3 µV (<0.6 µV) EMF for (S + N)/N = 10 dB, BW = 300 Hz
J3E (A3J), J7B (A7J), H3E (A3J)	<0.6 µV (<1.5 µV) EMF for (S + N)/N = 10 dB, BW = 2.4 kHz

Receiving bandwidths

Class of emission	**CCIR designation**	**3 dB bandwidth**
CW	A1A, A1B	±150 Hz
AME in RX mode	H2A, H2B, H3E	–100 to +2300 Hz
USB (and AME in RX/TX mode)	J3E, R3E	+300 to +2700 Hz
LSB		–300 to –2700 Hz
FSK narrow	F1A, F1B	±150 Hz
FSK medium		±150 Hz
FSK wide		±1200 Hz

Interference immunity

Image-frequency rejection	≥80 dB down
with motor-tuned filter	≥100 dB down
IF rejection	≥100 dB down
Spurious responses	≥80 dB down at Δf >30 kHz

Automatic gain control (RF)

Error of AGC	≤4 dB (1 µV to 3 V EMF)

Ordering information

HF Transceiver 1000 W	XK859C1	0680.1210.xx
Options		
Remote Control Processor	GP2000	6092.3000.02
FSK Modem	GM852P2	646.4710.02
ISB Modem	GM853C1	648.6010...
Line Flattener	FK859C1	680.3013.02
Antenna Selector	GV851	429.4620.02
Rackmounting Kit for mobile use	KG859Z1	681.5461...
Recommended extras and auxiliary equipment		
Antenna Tuning Unit	FK859	682.1018.02
Appropriate Shockmount	KS859	723.7508.02
Antenna Tuning Unit (navy)	FK859M1	4000.1802.14
Appropriate Shock Absorber Set	AK002Z1	4019.0501.04
System Processor MERLIN	GR2000	6083.5478.02
Control Unit	GB853C1	see data sheet 756.5940.11
Suitable cabinet housing with EMC filter for distances <50 m	KK853C1	641.4010...
with power supply for distances <1000 m	KK853C2	691.3510...
Service Kit	KA858C1	724.8508.02
Handset (piezo microphone)	GA852C2	655.5816.02
Handset (dyn. microphone)	GA852C2	655.5816.03
Handset	GA852C5	648.9549.03
Loudspeaker	GA852C7	648.9603.02/03
Headphones	GA852C8	648.9632.02
Morse Key	GA852C3	655.5839.02/03

Cables, male and female connectors

(Please indicate desired cable length when placing order)		
Connector for external equipment		
Female cable connector, 37-contact, with cable (37 x 0.25)		681.5410.03
Connectors for antenna tuning units		
Male cable connector, 26-contact, with cable (37 x 0.25)		681.5410.04
Male cable connector for Antenna Tuning Unit FK859		681.5410.05
Connectors for remote Control Unit GB853		
Male cable connector, 37-contact, with cable (37 x 0.25)		681.5410.06
Male cable connector for Control Unit GB853		681.5410.07
RF connector and RF cable		
Angular cable connector		017.7184.00
RF cable, 50 Ω	RG213U	025.4580.00
Cables for power supply		
380 V cable (4 x 2.5 mm²)	NY MHY	025.5458.00
Battery cable (2 x 4 mm²)	NSH DEU	025.5493.00
20 m cables (with connector) between transceiver and antenna tuning unit		724.9904.20
Transceiver and remote Control Unit	GB853	724.9956.20
RF cable between transceiver and antenna tuning unit		724.9856.20
Cable (with connector) between transceiver and antenna tuning unit (navy) (length on request)		724.9804.00

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Application-Specific Antenna Tuning Units (ATU) – Overview

Type	Power class	Model	Uses
FK852...	150 W	...C1 ...C3 ...H2	Standard model for land-mobile/stationary use Naval model, seawaterproof case, especially for low-impedance antennas Frequency hopping capability
FK855...	400 W	...C1 ...C3	Standard model for land-mobile/stationary use Naval model
FK859...	1000 W	... ...C1 ...M	Standard model for stationary or shelter use Line flattener for VSWR <3 Naval model

Antenna Tuning Unit FK852C1

Brief description

The fully automatic, self-learning Antenna Tuning Unit FK852C1 is used for matching electrically short antennas to transceiver output stages with output powers up to 150 W PEP in the frequency range 1.5 to 30 MHz.

The robust, waterproof and dustproof design allows land-mobile in addition to stationary use. FK852 complies with the relevant MIL standards such as

– MIL-STD-461 to 463
– MIL-STD-810C
– MIL-STD-1399

Photo 38739-2

Special features

- Fully automatic tuning in less than 1 s
- Silent tuning in 100 preselected channels in less than 20 ms
- High availability (MTBF <12000 h)

Specifications

Frequency range	1.5 to 30 MHz
Max. transmitter power	150 W PEP, 100 W CW
Input impedance	50 Ω, VSWR typ. 1.3
Suitable for	rod antennas (7 to 12 m) whip antennas (5 to 7 m) wire antennas (12 to 20 m) broadband antennas
Tuning time	≤1 s ≤20 ms for tuned channels
Power supply	19 to 31 V DC, floating (from HF transceiver)
Rated temperature range	–25 to +55°C
Dimensions (W x H x D)	202 mm x 198 mm x 382 mm
Weight	13 kg

Ordering information

Antenna Tuning Unit	FK852C1	0649.0016.12
Options		
Shockmount	KS852T1	0649.3715.02
Broadband Adapter 50 Ω	GH852C1	0649.3515.03

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Antenna Tuning Unit FK852C3 (naval model)

Brief description

Antenna Tuning Unit FK852C3 fully automatically matches the transceiver to electrically short antennas. It has a power-handling capacity of 150 W PEP and covers the frequency range from 1.5 to 30 MHz.

FK852C3 can be used with rod antennas, long-wire and 50 Ω broadband antennas.

Thanks to the sturdy, seawater-resistant design, FK852C3 is optimally suited for naval applications. It meets all relevant MIL standards and operates without any restrictions even under the most adverse environmental conditions.

Features and benefits

- Fully automatic, extremely fast tuning
- Digital control and tuning concept
- Suitable for ECM-resistant transmission methods (eg frequency hopping)
- Silent tuning in 1500 preselected channels over whole frequency range
- Tuning time typically 1 s, 20 ms for channel operation

Specifications

Frequency range	1.5 to 30 MHz
Power-handling capacity	150 W PEP, 120 W CW
Input impedance	50 Ω, VSWR typ. 1.3
Suitable for	rod antennas (7 to 12 m) wire antennas (12 to 20 m) broadband antennas
Tuning time between any two frequencies	1 s typ.
Channel operation (silent tuning)	<20 ms
Rated temperature range	–25 to +55°C
Power supply	19 to 31 V DC, floating
Protection against foreign matter and water	IP66 in accordance with DIN 40050, sheet 1
Dimensions (W x H x D)	202 mm x 198 mm x 382 mm
Weight	13 kg

Options

Shockmount	KS852T3	0703.4003.14
Repair Kit	KA853ZM	0729.4800.04

Ordering information

Antenna Tuning Unit	FK852C3	0703.0008.14

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Antenna Tuning Unit FK855C1/C3

Brief description

Uses

Antenna Tuning Unit FK855, which is part of Radio Equipment Family HF850, optimally matches the 400 W HF Transceiver XK855 to rod, whip and broadband antennas used in stationary, land-mobile (C1 version) or shipboard (C3 version) applications. It can handle powers up to 400 W CW and PEP. Operating in the frequency range 1.5 to 30 MHz, FK855 performs several functions:

– Antenna impedance transformation to 50 Ω in both transmit and receive modes
– Preselection in receive mode

The digital control and tuning concept enables silent tuning by storing the tuning parameters in 100 channels (C1) or 1500 channels (C3). Advanced RF switching technology (switching time <5 ms, lifetime 10^9 switching operations) makes FK855 suitable for frequency hopping up to 20 hops/s.

400 W Antenna Tuning Unit FK855C1 with shock absorbers (option) (Photo 38742-1)

Design

The rugged, waterproof and dustproof construction of FK855 allows its use in stationary, land-mobile and shipboard applications, even in harsh environments and continuous 24-hour operation.

Features and benefits

Operational characteristics

- Fully automatic tuning
- Matching of electrically short antennas for land-mobile and shipboard use
- Silent tuning in 100 preselected channels (LPI) for C1, 1500 for C3
- Suitable for ECM-resistant radio transmission methods such as frequency hopping, owing to
  – extremely short tuning time
  – long life of switching components

Logistic advantages

- Part of Radio Equipment Family HF850
- High availability (MTBF >12 000 h)
- Continuous monitoring of operational status (indication on receiver/exciter)
- Maintenance-free

Specifications

Frequency range	1.5 to 29.99999 MHz
Max. input power	450 W PEP and CW
Input impedance	50 Ω, VSWR ≤1.5, typ. 1.3
Preselected channels	
C1	100
C3	1500
Antennas suitable for FK855C1:	
Rod antennas	5 to 12 m
Whip antennas	5 to 8 m
Broadband antennas	50 Ω, VSWR <3
for FK855C3:	
Rod antennas	7 to 12 m
Broadband antennas	50 Ω, VSWR <3
Other antennas	on request
Antenna matching	
Tuning time	
First tuning	typ. <0.5 s
Repeated tuning	typ. <0.1 s
Silent tuning	<5 ms
Power supply (from 400 W HF Transceiver XK855)	19 to 31 V, approx. 1.2 A
RF tuning power	40 W ±1 dB, VSWR <2
Connectors	
RF connector	N female
Maximum distance between	
antenna base and FK855	≤30 cm
XK855 and FK855	≤50 m
Environmental conditions	
Rated temperature range	–40 to +55°C
Storage temperature range	–40 to +85°C
Safety class (DIN 40050)	IP56
EMC	to MIL-STD-461B
Dimensions (W x H x D)	202 mm x 198 mm x 382 mm
Weight	13 kg

Ordering information

Antenna Tuning Unit		
Stationary and land-mobile version	FK855C1	0729.1001.02
Shipboard version	FK855C3	0724.8908.04
Colour		
Dark/light grey	FK855C1	0729.1001.02
Navy grey	FK855C3	0724.8908.04
Recommended extras		
Shockmount KS855		
Dark/light grey	KS855C2	0729.4800.02
Navy grey	KS855C3	0729.4900.04
Cables and connectors		
Control cable (between XK855 and FK855)		647.9316...[1)]
Cable connector for XK855		511.9296.00
Cable connector for FK855		612.7400.00
RF cable (between XK855 and FK855)		724.9856...[1)]
Cable connector for XK855		017.7184.00
Cable connector for FK855		415.9502.00

1) Order number depending on cable length

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Antenna Tuning Unit FK859/FK859M1

1.5 to 30 MHz; 1.15 kW

Flexible operating concept permits selection between two applications

Brief description

Antenna Tuning Unit FK859 is rated for transmitter powers up to 1.15 kW. It allows full matching of antennas to a VSWR of less than 1.5 (typ. 1.1) in the frequency range from 1.5 to 30 MHz. The ATU is mainly used for matching linear radiators such as rod and wire antennas. Thanks to the universal design of the matching network, matching of some loop and notch antennas is also possible.

An ATU which is hardened for seaborne applications is also available (FK859M1).

Operation

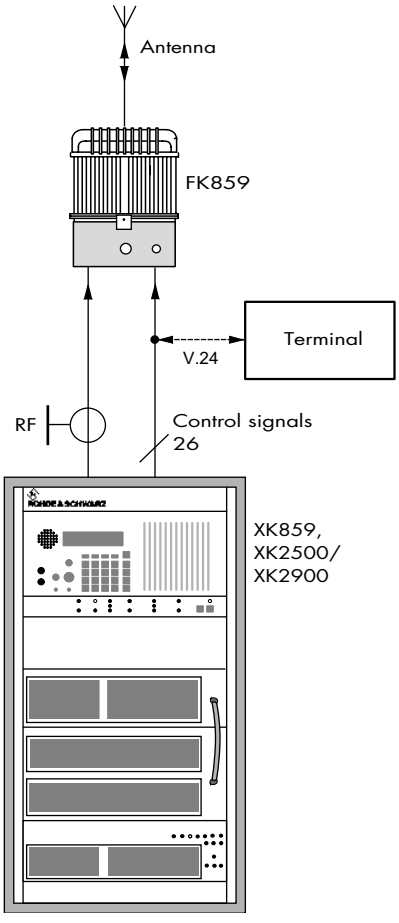
Operation with transceivers of HF850 series/XK2000 family

In this mode, tuning is triggered by the process controller of the transmitter. Silent tuning is also possible, ie no power is radiated during the matching process. Tuning time is minimized (56 ms) by taking over the frequency of the transmitter. The control panel of the Rohde&Schwarz transmitter (eg XK859) is used for status display and control of the ATU.

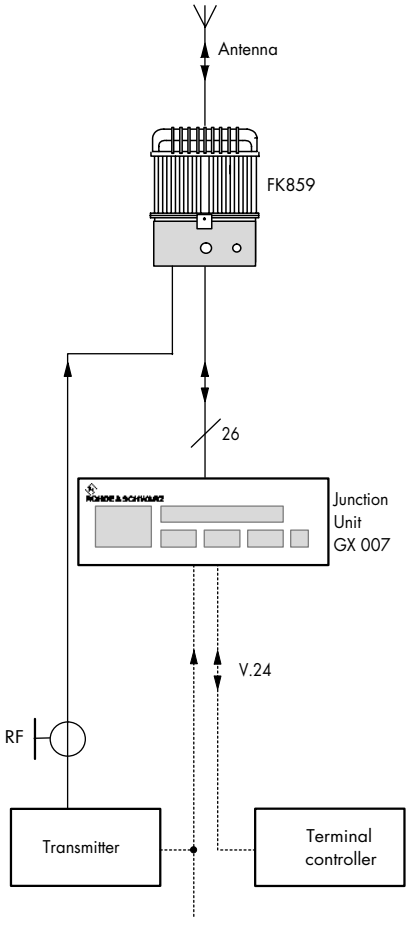
FK859M1
(Photo 40173-1)

Operation without control signals from transmitter

Frequency information from the transmitter is not required in this mode, so that practically any transmitter can be used. The RS-232-C interface of FK859 allows easy integration into systems. If Junction Unit GX007 is used, monitoring, display and power supply are combined in a single unit. GX007 also offers a choice of additional functions, eg narrowband or broadband reception and automatic tuning.



Operation with transceivers of HF850 series/ XK2000 family



Operation without control signals from transmitter

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Specifications FK859

Frequency range	1.5 to 30 MHz
Max. input power	1.15 kW (CW and PEP)
Nominal impedance	50 Ω
VSWR	≤1.5 (typ. ≤1.1)
Tuning time	
Silent tuning (with transmitters of HF850 series or process controller)	<60 ms (typ. 56 ms)
Without retuning (after initial tuning)	70 to 500 ms depending on operating mode and interface
Initial tuning (learn phase)	typ. ≤15 s
Tuning power	30 to 300 W
EMI/EMS	to MIL-STD-461 and 462
General data	
Rated temperature range	–30 to +55°C
Storage temperature range	–40 to +55°C
Power supply	21 to 32 V DC
Current drain	6.5 A max., 2.5 A average (supply voltage 28 V)
MTBF (at 25°C)	
when used with XK859 transmitters	10000 h
when used with other transmitters	6500 h
Dimensions (W x H x D)	510 mm x 740 mm x 510 mm
Weight	59 kg

Junction Unit GX007

Power supply	115/125/220/235 V, 47 to 63 Hz, 300 VA max.

Ordering information

Antenna Tuning Unit		
Colour RAL7011 iron grey	FK859	0682.1018.02
Colour RAL7001 (for shipboard use)	FK859M1	4000.1802.14
Recommended extras		
Junction Unit for FK859		
Desktop	GX007	0682.6010.02
19" rackmount	GX007	0682.6010.03
Control cable between GX007 and FK859		
length 40 m	FK859K1	0669.8112.40
length 60 m	FK859K1	0669.8112.60
length 80 m	FK859K1	0669.8112.80
Control cable connector (female)		0511.9296.00
Control cable connector (male)		0612.7400.00
Service Kit	ZR073	0686.6514.02

Line Flattener FK859C1

Brief description

Line Flattener FK859C1 with an input VSWR of ≤1.3 can be used for matching transmitting/receiving systems to shortwave broadband antennas (eg log-periodic antennas, cage antennas, broadband dipoles).

Matching is achieved with microprocessor control by switching binary-stepped line sections and series capacitors into circuit.

The tuning information for 100 channels can be stored in a nonvolatile memory. FK859C1 is accommodated in a 19" rackmount three units in height. Cooling is provided by a blower.

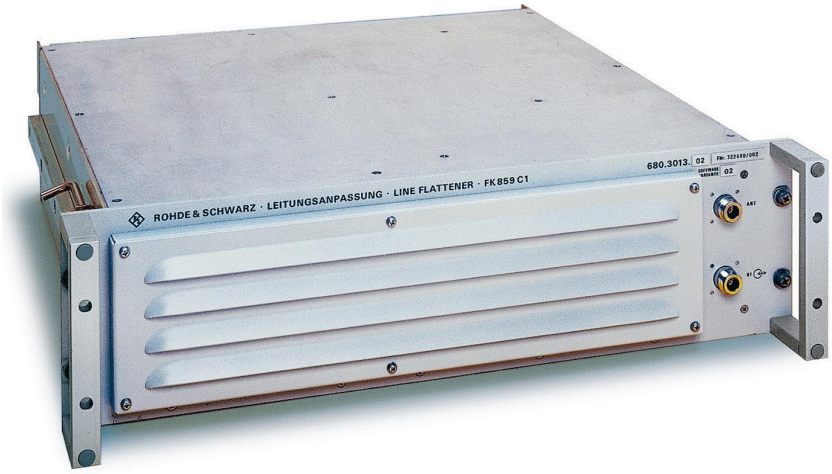

Photo 37351

Features and benefits

- Suitable for all kinds of shortwave broadband antennas
- Low insertion loss
- Integration in XK859 transceiver or XK2000 – KG2900 rack
- Short tuning time

Specifications

Frequency range	1.5 to 30 MHz
Power-handling capacity	1125 W
Input VSWR (transmitter)	≤1.3
Output VSWR (antenna)	≤3
Tuning time between any two	
frequencies	≤5 s
channels	≤20 ms
Required RF power	approx. 100 W
Power supply (from XK859)	19 to 31 V DC
Operating temperature range	–25 to +55°C
Storage temperature range	–40 to +60°C

Ordering information

Line Flattener FK859C1	680.3013.02

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Standard Length of Control/RF Cable for Stationary/Land-mobile HF850 Equipment

Power	Transceiver	ATU/Control unit	Order No.	Cable length
150 W/400 W	XK852/855C1	FK852/855C1	0647.9316.02 0647.9316.10 0647.9316.30	2 m 10 m 30 m
150 W/400 W	XK852/855	GB853	0647.9368.02 0647.9368.10 0647.9368.30	2 m 10 m 30 m
1000 W	XK859C1	FK859	0724.9904.02 0724.9904.10 0724.9904.30	2 m 10 m 30 m
1000 W	XK859C1	GB853	0724.9956.02 0724.9956.10 0724.9956.30	2 m 10 m 30 m

RF cable (for all power classes)

Order No.
0724.9856.02 (2 m)
0724.9856.10 (10 m)
0724.9856.30 (30 m)

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HF Airborne Voice/Data Radio XK516D

Brief description

Airborne Voice/Data Radio XK516 is designed for use in commercial aircraft. The system provides conventional voice and high-speed data communication air-to-ground, ground-to-air, and air-to-air over long distances. The data communication is suitable for aircraft operational communication (AOC), airline administrative communication (AAC) as well as air traffic communication (ATC).

The radio is a joint development of Rohde & Schwarz and Allied Signal Aerospace.

The exclusive distribution rights rest in Allied Signal Aerospace, 15001 N.E. 36th Street, Redmond, WA98073-9701, USA.

The equipment consists of two individual units:
Voice/Data Transceiver XK516D1, Order No. 964.0452.002, and
Antenna Coupler FK516, Order No. 964.0453.001.

If the transceiver is not equipped with data modules, ie it is a voice only transceiver, it is assigned a different order number:
Voice Transceiver XK516D1, Order No. 964.0452.001.

The data modules which provide the high-speed data function are fully integrated within the transceiver. The voice/data radio therefore fits into the space of the conventional HF voice radio. Additional space for the data capability is not needed.

Photo 42226

The functioning of the equipment is controlled by the integrated test system, that continuously monitors a number of function. After the test routine has been triggered, the faulty module will be located and indicated. BITE results are reported to the onboard CFDS/CMC system via two ARINC 429 busses. Interfaces to the central maintenance systems of

- Airbus
- Boeing
- McDonnell Douglas

are implemented in the radio, thus featuring one order number for nearly all aircraft types.

HF Airborne Voice/Data Radio XK516D is designed to meet the requirements of

- ARINC 719 (voice function)
- ARINC 753 and 635 (data dunction)

The integrated data communication capability meets the specifications of ARINC 753 and 635 providing high-speed data communication at a data rate of 1800 bits per second.

Global HF data
Communication is possible by strategically located data link groundstations, which provide access to ARINC and SITA airline networks as well as to Allied Signal´s global data center.

To provide full compatibility between existing and new equipment as well as aircraft wiring, three interfaces between transceiver and antenna coupler are simultaneously available:

- Multiwire serial interface according ARINC 753
- Conventional ARINC 719 control lines
- Single-wire coaxial interface

Thus interchangeability of the LRUs with existing voice transceivers and coupler is secured. The single-wire coaxial interface needs only the coaxial cable to transfer control and BITE information between transceiver and coupler. Therefore it has a high potential for weight saving. Retrofit in older

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HF Airborne Voice/Data Radio XK516D

aircraft is simply performed, because it does not depend on the existing aircraft wiring.

The antenna coupler is a digitally tuned coupler with very low tuning times, typically less than 3 s when first tuned on a frequency. The implemented learn mode provides even less tuning time (several 100 ms) after the coupler has »learned« the antenna. The digital design results in a high reliability coupler.

Specifications

Frequency range	
Wide	2.0 to 29.9999 MHz
Narrow	2.8 to 23.9999 MHz
Frequency accuracy	±20 Hz at –40°C to +55°C ambient temperature
Transmitter power	400 W PEP/125 W average, automatic power reduction for mismatch or thermal overloading
Modes of emission	AME/SSB (USB, LSB)
Operating modes	
Voice	USB, LSB, AM (E)
External data	audio input/output for connection of external modems and HF data unit for data communication up to 1800 bit/s
Internal high-speed data	1800 bit/s with integrated data modem and processor
Test	BIT according to ARINC 604, and ABD 0018, Issue C and ABD 0048 and BOEING D22OUO50, Issue C
SELCAL	according to ARINC 714
Interfaces for CMC for aircraft of	Airbus, Boeing, McDonnell Douglas

Ordering information

Voice/Data Radio	XK516D1	964.0452.002
Antenna Coupler	FK516	964.0453.001

If the transceiver is not equipped with data modules, ie it is a voice only transceiver, it is assigned a different order number:

Voice Radio	XK516	964.0452.001

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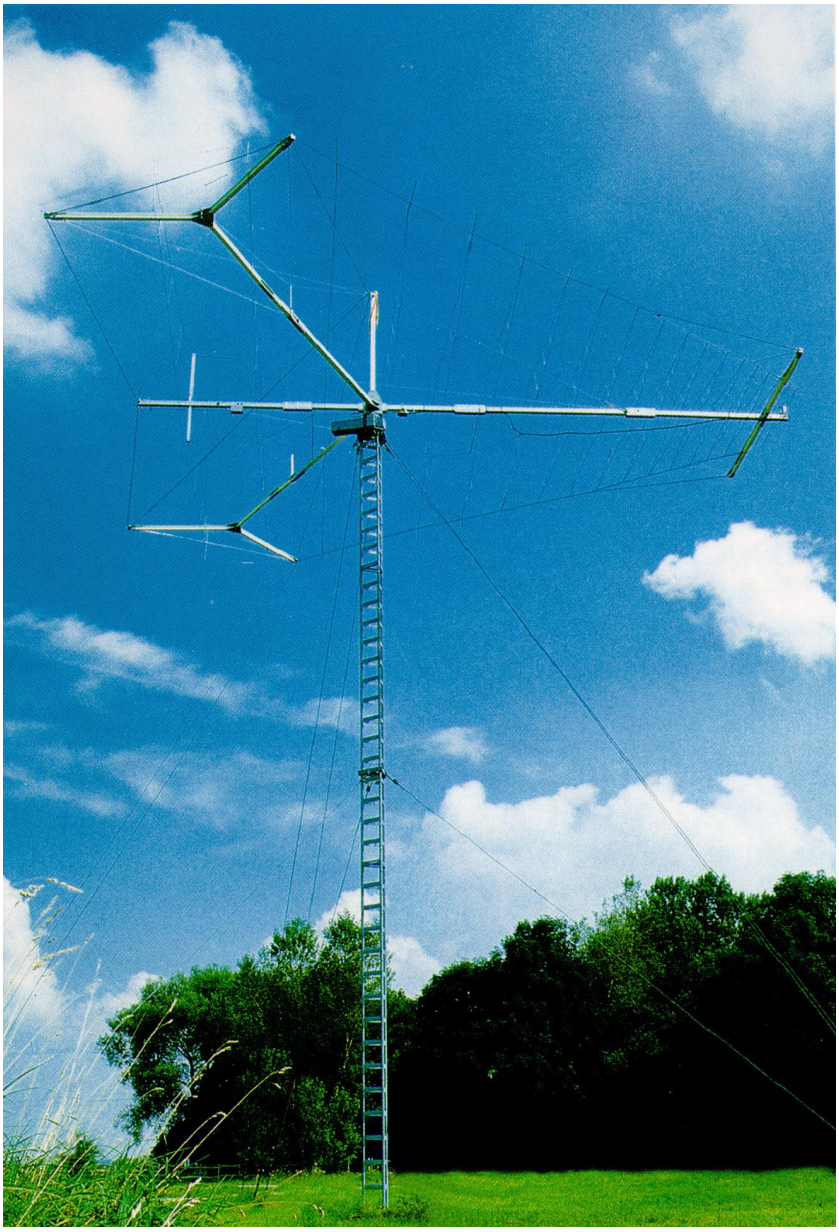
HF Antennas and Extras



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Active Rod Antennas HE010, HE011; Power Supply Units IN110, IN115

Brief description

Active rod antennas
The excellent characteristics of active receiving antennas are a result of carefully matching the passive antenna structure to the active circuitry.

- Wide frequency range
- Optimized for maximum dynamic range (high sensitivity, excellent large-signal characteristics)
- Small in size
- For use under extreme conditions (HE010)
- High immunity to nearby lightning strikes
- Length of radiator adjustable (HE011)

Power Supply Unit IN110, IN115
Power Supply Units IN110 and IN115 power active receiving antennas via the inner conductor of the RF cable.

- AC supply or battery operation
- Short-circuit-proof
- Three DC-feed sections for up to three active antennas (IN115)

Power Supply Unit IN115 (Photo 38691-1)

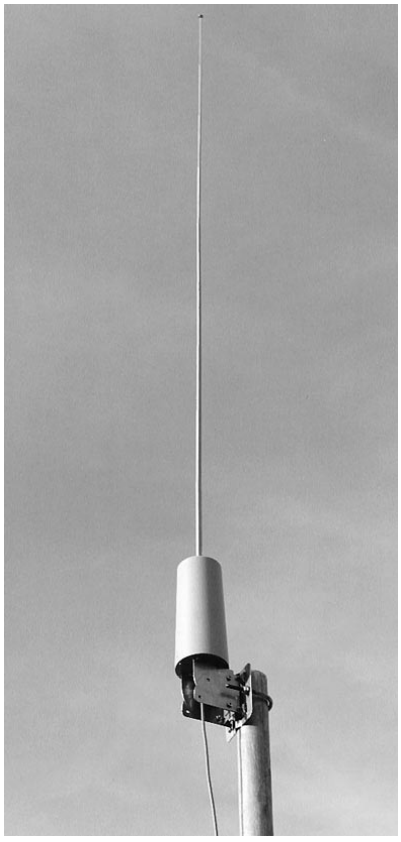
Photo 40221-1

Specifications

	HE010	HE011
Frequency range	10 kHz to 80 (120) MHz	50 kHz to 30 MHz (up to 200 MHz w/o specification)
Impedance	50 Ω	50 Ω
VSWR		
50 kHz to 120 MHz	<2	<2
10 kHz to 50 kHz	<3	<3
Antenna factor	17 dB	13 dB
Intercept point		
2nd order	≥50 dBm (typ. 60 dBm)	≥50 dBm (typ. 60 dBm)
3rd order	≥30 dBm	≥30 dBm
Crossmodulation	12 V/m up to 30 MHz, 6 V/m from 30 to 80 MHz	>10 V/m
Power supply	21 to 26 V DC (Power Supply Unit IN110 or IN115 recommended)	via RF cable; 24 V DC ±15%, 190 mA (power supply unit included)
Current drain	170 mA	190 mA
Connector	N female	N female
Permissible wind speed	188 km/h	130 km/h
Operating temp. range	–40 to +65 °C	–25 to +55 °C
Dimensions		
Max. length with radiator	1000 mm	1700 mm
Max. diameter	120 mm	90 mm
Weight	0.9 kg	0.9 kg

Power Supply Unit	IN115	IN110
DC supply	24 V DC +35/–20%	10 to 32 V DC
AC supply	115/125/220/235 V AC ±10%, 50 VA max.	100 to 240 V AC ±10%, 50 VA max.
Output voltage		
with AC operation	3 x 24 V ±5%	24 V
with battery operation	3 x 18 V ±5%	
Max. load current	500 mA/output	350 mA
Short-circuit current	200 mA	
RF frequency range	10 kHz to 1.3 GHz	10 kHz to 1.3 GHz
Connectors	N female	
Operating temp. range	–25 to +55 °C	0 to 40 °C
Dimensions in mm		
W x H x D	170 x 125 x 350	140 x 60 x 40
Weight	5.5 kg	approx. 250 g (w/o AC/DC adapter)

Ordering information

Active Rod Antenna	HE010	0523.1414.13
	HE011	4031.7654.03
Recommended extras		
Power Supply Unit	IN110	4040.8508.02
Power Supply Unit	IN115	4004.1707.02

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Active Antenna System HE016

10 kHz to 80 MHz (vertical)

600 kHz to 40 MHz (horizontal)

Omnidirectional reception also for horizontally polarized waves

Photo 43061

Brief description

This antenna system is a combination of Active Rod Antenna HE010 and two crossed HF dipole antennas. The two horizontal dipole antennas are combined via a 90° coupler to produce an omnidirectional antenna pattern for the reception of horizontally polarized signals.

Special features

- Extremely small dimensions
- High sensitivity – same system sensitivity as comparable passive antennas with more than three times the size
- High linearity
- High immunity to nearby lightning strikes
- Optimum results under any receiving conditions with minimum space requirement
- Omnidirectional reception of horizontally and vertically polarized signals

Specifications

Frequency range	
vertical polarization	10 kHz to 80 (120) MHz
horizontal polarization	600 kHz to 40 MHz
Nominal impedance	50 Ω
VSWR	<2 (10 to 20 kHz: <3)
Intercept point	
2nd order	≥50 dBm up to 30 MHz
3rd order	≥30 dBm up to 30 MHz
Power supply	21 to 26 V DC (460 mA)
Connector	2 x N female
Operating temperature range	–40 to +65°C
Max. wind speed	188 km/h (without ice deposit)
Dimensions (dia. × H)	3 m × 1.4 m
Weight	3 kg

Ordering information

Active Antenna System	HE016	4051.8504.02
Recommended extras		
Power Supply Unit	IN115	4004.1707.02
6 m Plug-In Mast	KM011	0273.9116.02

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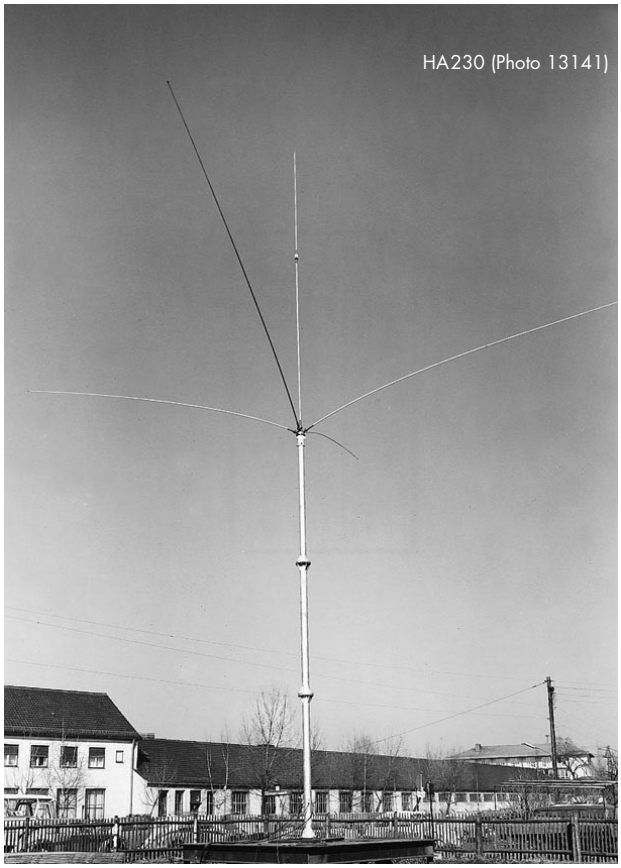
HF Receiving Antennas HA105, HA230


HA105 (Photo 3757)


HA230 (Photo 13141)

Brief description

Due to its small size and low weight, HF Receiving Antenna HA105 is particularly suitable for use in mobile stations and on ships. The V-shaped arrangement of the radiators enables this antenna to be used for the reception of both horizontally and vertically polarized signals.

- Wide frequency range, small size
- Omnidirectional horizontal pattern for reception of high-angle signals
- Suitable for mobile and stationary use

HF Receiving Antenna HA230 is a versatile shortwave antenna for both horizontally and vertically polarized waves. Made up of electrically isolated and decoupled individual elements, this antenna is particularly suitable for polarization-diversity reception.

- Individual radiators for horizontal and vertical polarization
- Suitable for polarization-diversity reception
- For mobile and stationary use

Specifications

	HA105/1/50	**HA105/11/50**	**HA230/401**	**HA230/403**
Frequency range	1.5 to 30 MHz	1.5 to 30 MHz	1.5 to 30 MHz	1.5 to 30 MHz
Polarization	horizontal and vertical	horizontal and vertical	horizontal and vertical	horizontal and vertical
Nominal impedance	50 Ω	50 Ω	50 Ω	50 Ω
Connector	N female	$^4/_{10}$ N female	3x N female	3x N female
Weight	14 kg (with stand)	5 kg	35 kg	85 kg
Particularly suitable for	mobile use	stationary use	mobile use	stationary use
Dimensions				
Length of radiators	3.5 m	3.8 m	5.7 m	5 m
Height			11.7 m	11 m

Ordering information

HF Receiving Antenna	0111.5816.11	0101.3262.50	0101.1160.02	0101.1176.02

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HF Dipole HX002; Junction Unit GX007

Brief description

HF dipole

HF Dipole HX002 permits optimum coverage of all distance ranges and is designed for both transmission and reception.

The fully automatic tuning unit integrated in the antenna provides perfect matching to the transmitting system. Since no external control signals are required, the dipole can also be used in existing systems without any modifications on the system.

- No skip zone
- Omnidirectional coverage with high-angle radiation (NVIS)
- Only little separation from neighbouring antennas required due to selectivity of integrated antenna tuner
- Fully automatic operation
- No control signals required
- Silent tuning possible
- Single-mast installation

HX002
(Photo 35834-4)

HX002F
(Photo 39691)

GX007 (Photo 34485)

Junction Unit GX007

Junction Unit GX007 is the control, display and power supply unit for HF Dipole HX002 and for Antenna Tuning Unit FK859. The control section permits selection of the required tuning mode (auto, hold, tune), switchover between antenna 1 and 2 and go/nogo test. The display section indicates the operating status of the ATU or the dipole. The power supply section provides the required DC voltage of 30 V.

Specifications

HF dipole

Frequency range	2 to 30 MHz
Nominal impedance	50 Ω
VSWR	≤1.5, typ. ≤1.1
Permissible input power	1.15 kW CW and PEP
Tuning time	
Without retuning	70 to 500 ms
Silent tuning (with HF850 or process controller)	≤60 ms, typ. 56 ms
With retuning	typ. 2 s
First tuning	typ. <15 s
Efficiency	
at 2 MHz	>20%
at 5 to 30 MHz	>75%
Power supply	21 to 32 V DC (6 A max., 2.5 A at 28 V)
Connector	N female
Permissible wind speed	150 km/h (without ice desposit)
Operating temperature range	–30 to +50°C
Dimensions	
Length of dipole	10 m
Height	1.13 m
Tuning unit (L x W)	0.51 m x 0.51 m
Weight	103 kg

Junction unit

AC supply	115/125/220/235 V, 47 to 63 Hz, 300 VA max. (with FK 859)
Connector	AC supply connector for FK859, 25-contact connector for V.24 interface, 9-contact connector for carrier loop, fault signals, transmit/receive switch
Visual displays	LEDs for operating voltage, carrier loop, READY, TUNING, power threshold, VSWR threshold, fault signals
Controls	on/off, wideband reception (RX mode), tuning mode, antenna 1/ antenna 2, test
Operating temperature range	–25 to +55°C
Dimensions (W x H x D)	492 mm x 116 mm x 392 mm
Weight	6.5 kg

Ordering information

HF Dipole	HX002	0682.3010.24
Recommended extras		
Junction Unit	GX007	0682.6010.02
Frequency Range Extension (down to 1.6 MHz)	HX002F	4017.9053.02

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Brief description

HF Dipole HX002A1 provides good coverage over all distances. In contrast to rod antennas, it features high transmission reliability especially over short and medium distances.

The antenna can easily be integrated into existing systems since no control line is required. All the control signals and the ATU supply are fed via the coaxial cable.

HF Dipole HX002A1 can be connected directly to HF Transceivers XK2100 from Rohde & Schwarz. For connection to other transmitters, Junction Unit GX002A1 is available to provide power supply and tuning control.

Special features

- No skip zone
- Omnidirectional coverage with high-angle radiation (NVIS)
- Only little separation from neighbouring antennas required
- Automatic adaptive operation
- No control line required
- Silent tuning
- Single-mast installation

Specifications

Frequency range	1.5 to 30 MHz
Polarization	horizontal
Nominal impedance	50 Ω
VSWR	≤1.5, typ. ≤1.3
Max. input power	150 W PEP/100 W CW
Tuning time	typ. 200 ms
Initial tuning	≤6 s, typ. 3 s
Silent tuning	≤30 ms
Tuning power	30 to 100 W
with GX002A1	50 to 100 W
Power supply	via GX002A1
AC supply	100/120/230 V ±10 %, 47 to 63 Hz (100 VA)
Battery	+22 to +32 V, typ. 2.5 A at +24 V
Connector	N female
Operating temperature range	−25 to +55 °C
Max. wind speed	188 km/h (without ice deposit)
Wind load (at 188 km/h)	960 N
Dipole length	10 m
Weight	35 kg

Ordering information

HF Dipole	HX002A1	4031.8009.02
Recommended extras		
Junction Unit	GX002A1	4031.9005.02
5 m Tiltable Mast for roofmounting	KM002A1	4035.7359.02
Auxiliary Mast for KM002A1	HX002Z1	4031.7002.02
15 m Lattice Mast	KM451B2	4028.3400.02
Mast Adapter for 15 m Mast	KM451Z5	4039.8308.02

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Brief description

Naval HF Dipole HX002 M1 enables optimum coverage over all distance ranges. It is particularly advantageous for radiocommunication over short and medium distances, since below 1000 km rod antennas can not guarantee sufficient transmission reliability because of their skip zone.

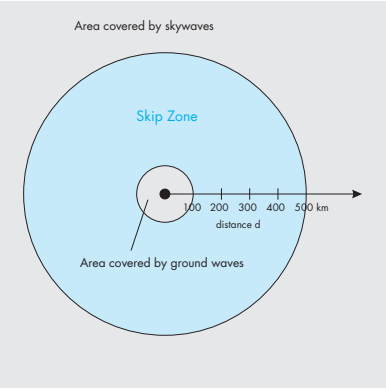
HF Dipole HX002 M1 enables high-angle radiation (NVIS: near vertical incident skywave) to ensure omnidirectional coverage at suitable frequencies, ie between 2 and 8 MHz. The antenna operates below 2 MHz as a top-fed monopole, thus ensuring omnidirectional coverage with ground waves in the frequency range suitable for this purpose.

HF Dipole HX002 M1 is designed for both transmission and reception. The fully automatic tuning unit, integrated in the antenna head, ensures continuous matching to the transmitting system with a VSWR of less than 1.5. No control signals are required from the transmitter for tuning, so the antenna can be used in existing systems without any modificiations.

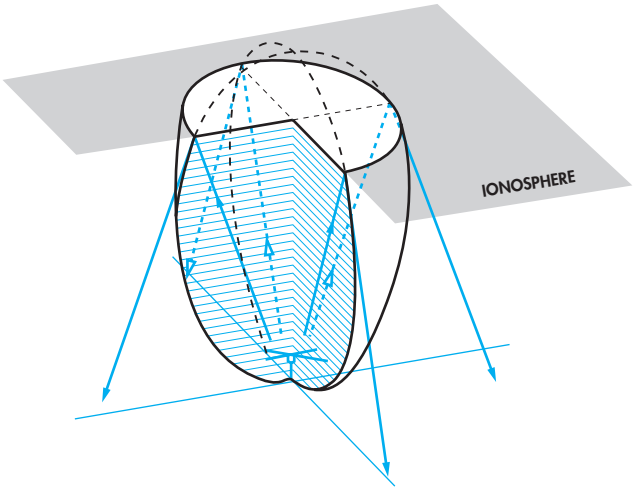
Conventional antennas: the problems
Conventional antennas for operation on ships such as rod antennas and loop antennas often cause communication problems and are incompatible with systems on the ship.

Rod antennas:
- Unfavourable radiation pattern over short and medium distances (skip zone)
- Poor electromagnetic compatibility with other systems on board, since for rod antennas the ship's structure acts as a ground plane

Loop antennas:
- Poor efficiency → low transmission reliability
- Small bandwidths



Skip zone at HF produced by vertically polarized antenna



Full coverage using high-angle radiation antenna (NVIS) with three-dimensional radiation pattern

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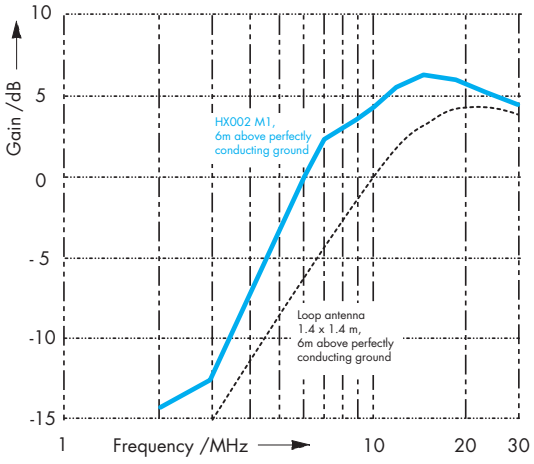
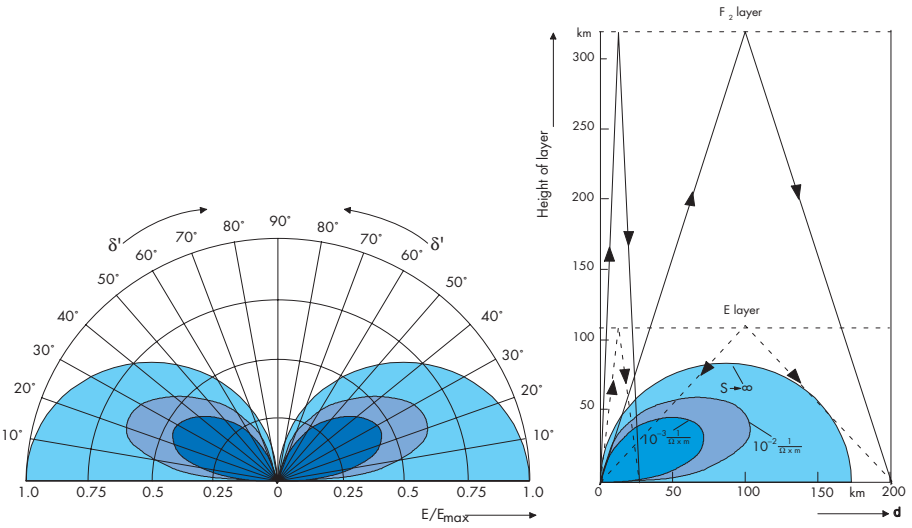
HX002 M1: the solution

150 W Dipole HX002M1 solves such problems since the reactive power has been minimized in the antenna feed system. It has therefore the following features:

- No skip zone
- Compact design and yet
- High efficiency
- No ground plane required, so ensuring
- Good EMC – even on GRP vessels



Gain of 150 W HF Dipole HX002M1 compared to a loop antenna



Vertical radiation pattern of λ/4 vertical antenna and transmission path for high-angle radiation

Specifications

Frequency range	1.5 to 30 MHz
Max. permissible transmitting power	150 W PEP 100 W CW
Input impedance	50 Ω nominal
SWR	typ. <1.3, max. 1.5
Gain	see diagram above
Tuning time	
Initial tuning	typ. 3 s, max. 6 s
Retuning	typ <0.2 s
Silent tuning	<30 ms
Tuning power	30 to 50 W 50 to 100 W with GX002A1
RF connector	N female
Power supply	from XK2100 or via GX002A1
AC supply	100/120/220/230 V ± 10 % 47 to 63 Hz (100 VA)
Battery	22 to 32 V, approx. 2.5 A at 24 V 23 to 32 V when a 60 m cable of type RG213/U is used

Mechanical data, environmental conditions

Dimensions	dipole length 5.2 m
Connection to mast	peg, 30 mm dia
Weight	approx. 34 kg
Dimensions of ATU (H x W x D)	133 mm x 483 mm x 390 mm,
Permissible wind speed	
without ice deposit	188 km/h
with radial ice deposit	130 km/h
Operating temperature range	–30 to 55°C to MIL-STD-810E Meth. 501.3 and 502.3
Storage temperature range	–40 to 85° C to MIL-STD-810E Meth. 501.3 and 502.3
Relative humidity	95 % up to 41°C, to MIL-STD-810E Meth. 507.3
Resistance to vibration	to MIL-STD-810E Meth. 514.4, random 80 Hz to 350 Hz, 0.04 g^2/Hz 20 to 80 Hz, 3dB/octave 350 to 2000 Hz –6 dB/octave
Resistance to shock	40 g, spectrum 45 to 2000 Hz acc. to MIL-STD-810E Meth. 516.4
Resistance to	
salt fog	to MIL-STD-810E
sand and dust	to MIL-STD-810E
EMP protection	lightning and NEMP protection integrated
EMC	to MIL-STD-461B

Ordering information

Naval HF Dipole	HX002M1	4021.6003.02

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HF Rod Antennas HA104, HA175

HA175 (Photo 11116)

Brief description

The HF rod antennas are suitable for vertically polarized ground waves and low-angle skywaves. In conjunction with an antenna tuning unit, they can also be used for transmission.

- Sturdy construction
- Shock- and vibration-proof
- For mobile use (HA104)
- For stationary and shipboard use (HA175)

Specifications

	HA104	**HA175**
Frequency range		
Reception	10 kHz to 30 MHz	10 kHz to 10 MHz
Transmission (with ATU)	1.5 to 30 MHz	1.5 to 30 MHz
Polarization	vertical	vertical
Permissible input power	150 W CW and PEP	1 kW CW and PEP
Horizontal pattern	omnidirectional	omnidirectional
Connector	screw terminal	screw terminal
Permissible wind speed	150 km/h without ice desposit	185 km/h without ice desposit
Height of antenna	5 m	7 m
Dismantling possible	yes	
Weight	4 kg	27 kg The antenna is available with base protection against salt deposits for shipboard use

Ordering information

HF Rod Antenna	0156.2039.02	0101.1101.02

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Mobile HF Antenna Systems AK501, AK501A4, AK503

AK501 (Photo 30646-1)

AK503 (Photo 33165-4)

Special features AK503

- Coverage of all distance ranges
- No skip zone
- Omnidirectional coverage with high-angle radiation (NVIS)
- Null fill-in plus omnidirectional coverage up to 1000 km
- Installation time approx. 10 min

Brief description

These HF antenna systems have been especially designed for mobile use. They combine short erection and disassembly times, little space requirement for installation and transportation with high-grade electrical characteristics. By optimum tailoring to the propagation conditions in the RT and shortwave range, the antenna systems ensure exceptionally high quality mobile radiocommunication. Antenna Systems AK501 and AK501A4 consist of two antennas (high-angle antenna and vertical antenna), which can be selected by remote control.

Special features AK501, AK501A4

- Reliable radiocommunication over any distance, no skip zone
- Complete omnidirectional coverage even at medium distances due to null fill-in
- Fixed operation using high-angle antenna and vertical antenna as well as mobile operation using whip antenna

AK501A4, disassembled (Photo 31865-1)

Specifications

	AK501	AK501A4	AK503
Frequency range	1.5 to 30 MHz	1.5 to 30 MHz	1.5 to 30 MHz
Polarization, switchable	horizontal or vertical	horizontal or vertical	
Nominal impedance	50 Ω with ATU	50 Ω with ATU	50 Ω with ATU
VSWR	<1.5 with FK859 (typ. 1.1)	depending on type of ATU	depending on type of ATU
Permissible input power	1.15 kW CW and PEP	400 W CW and PEP	150 W CW and PEP
Permissible wind speed	100 km/h (w/o ice)	100 km/h (w/o ice)	120 km/h (w/o ice)
Operating temperature range	–40 to +55°C	–40 to +55°C	–40 to +55°C
Operating modes			
Mode 1			1.5 to 30 MHz
Mode 2			optimized for 6 to 26 MHz for ground-wave communications and distances >2000 km
Mode 3			by movable clamp
Mode selection			
Length of guy rope	57 m	46 m	35 m
Height	16.5 m	11.5 m	7 to 11 m
Weight	30 kg	12 kg	6 kg

Ordering information

Mobile HF Antenna System	0280.4816.11	0425.8721.04	0448.3226.02
Recommended extras			
Antenna Tuning Unit FK859		0682.1018.02	

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Mobile TFD
Broadband Antennas HD420, HD421

1.5 to 30 MHz

For skywave transmission over short, medium and global distances

Photo 43262/1

Brief description

The TFD (terminated folded dipole) antenna operates as a loop antenna on which travelling waves are generated by means of a termination. A tuning unit is not required to attain the specified VSWR. The antenna is configured as an inverted V so that only one antenna support is needed.

Where space is limited, the length of the antenna can be reduced considerably by using two lateral 4 m masts.

Signals are fed in at the highest point in the middle of the antenna via a transformer. Corresponding to its geometry, the TFD antenna radiates horizontally polarized waves and is thus suitable for transmission of skywaves over any distance.

Special features

- Broadband operation
- No tuning unit required
- Coverage of any distance
- Omnidirectional coverage through high-angle radiation (NVIS)
- Quick assembly/disassembly (approx. 30 min)
- Extremely favourable price
- Suitable for stationary use

Specifications

Frequency range	1.5 to 30 MHz
Polarization	horizontal
Nominal impedance	50 Ω
VSWR	≤3 (typ.)
Max. input power	
HD420	400 W
HD421	1 kW
Connector	N female
Operating temperature range	–40 to 55°C
Dimensions	
Length	approx. 90 m approx. 30 m with 2× KM420A2
Recommended height of feedpoint	approx. 10 m
Mechanical interface	for KM420A1 and for 10 m tower from Geroh
Max. wind speed	180 km/h (without ice deposit) with KM420A1 and 2× KM420A2
Weight (without mast)	
HD420	13 kg
HD421	17 kg

Ordering information

Mobile TFD Broadband Antenna	HD420	4053.2503.02
	HD421	4053.3500.02
Recommended extras		
Tiltable Mast 10 m	KM420A1	4054.1023.00
Tiltable Mast 4 m	KM420A2	4054.1423.00

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Mobile TFD Broadband Antennas HD520, HD521

1.5 to 30 MHz

For skywave transmission over short, medium and global distances

Photo 42863-9

Brief description

The TFD (terminated folded dipole) antenna operates as a loop antenna on which travelling waves are generated by means of a termination. A tuning unit is not required to attain the specified VSWR. The antenna is configured as an inverted V so that only one antenna support is needed. Signals are fed in at the highest point in the middle of the antenna via a transformer. As a protection against infrared detection the termination is located in the shelter and connected to the antenna via a coaxial cable and a transformer. Corresponding to its geometry, the TFD antenna radiates horizontally polarized waves and is thus suitable for transmission of skywaves over any distance.

Special features

- Broadband operation
- No tuning unit required
- Coverage of any distance
- Omnidirectional coverage through high-angle radiation (NVIS)
- Quick assembly/disassembly (approx. 30 min)
- Protection against infrared detection

Specifications

Frequency range	1.5 to 30 MHz
Polarization	horizontal
Nominal impedance	50 Ω
VSWR	≤2.4
Max. input power	
HD520	150 W
HD521	1 kW
Connector	N female
Operating temperature range	–40 to 55°C
Dimensions	
Length	approx. 90 m
Recommended height of feedpoint	approx. 10 m
Mechanical interface	for 10 m tower from Geroh
Max. wind speed	108 km/h (without ice deposit)
Weight (without mast)	
HD520	44 kg
HD521	72 kg

Ordering information

Mobile TFD Broadband Antenna	HD520	4050.2002.03
	HD521	4050.1006.03

Recommended extra
10 m tower from Geroh

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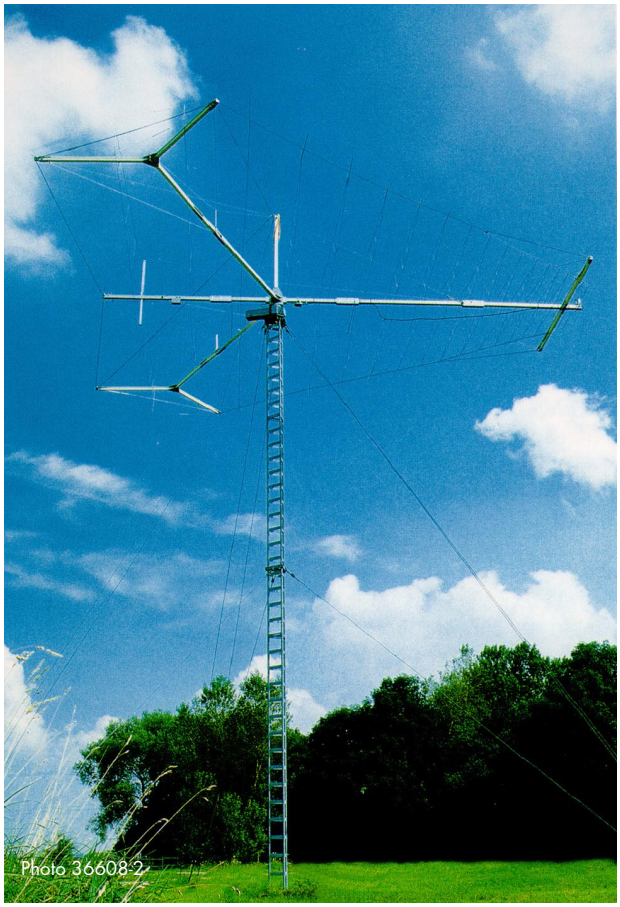
Rotatable Log-Periodic Antenna System AK451

5 to 30 MHz

For transmission and reception of horizontally polarized waves over medium to long distances



Brief description

The compact Rotatable Log-Periodic Antenna System AK451 is used for the transmission and reception of horizontally polarized waves. Due to a transmission frequency range from 5 to 30 MHz, the antenna system is particularly suitable for operation over medium to long distances despite its extremely small size. Reception is possible from 2 MHz thus covering all distances.

Special features

- Extremely small dimensions (size of loaded log-periodic antenna for 6.2 to 30 MHz)
- Transmission from 5 MHz, reception from 2 MHz
- Unrestricted half-wave elements leading to high antenna gain
- Easy and quick assembly
- Little maintenance required

Specifications

Frequency range	5 to 30 MHz (reception 2 to 30 MHz)
Polarization	horizontal
Nominal impedance	50 Ω
VSWR	≤2
Max. input power	1 kW
Gain	6 to 12.5 dBi
Radius of rotation	8.3 m
Range of rotation	±(n × 360°)
Max. wind speed	180 km/h (without ice deposit)
MTBF	>100000 h
Dimensions	
Length of antenna	15 m
Width of antenna	16 m
Weight of antenna	260 kg

Ordering information

Log-Periodic HF Antenna	HL451	0733.8507.02
Recommended extras		
Lattice Mast		
15 m (standard)	KM451B2	4028.3400.02
10 m (for rooftop mounting)	KM451B1	4028.3351.02
30 m		
(for long-range communications)	KM451B3	4028.3451.02
Antenna Rotator	RD008	0720.6300.02
Adaption Set/Rotary Joint	RD008Z1	0720.6400.02
Control Unit (manual)	RB040	4003.2100.02
Control Unit (remote/computer control)	BG030	0749.8501.02

Other configurations on request

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Rotatable Log-Periodic Antenna System AK471

7 to 30 MHz

For transmission and reception of horizontally polarized waves especially over long distances

Photo 37391-3

Brief description

The compact Rotatable Log-Periodic Antenna System AK471 is used for the transmission and reception of horizontally polarized waves. Due to its transmission frequency range from 7 to 30 MHz it is used especially over long distances. Reception is possible from 3 to 30 MHz leading to coverage of almost all distances. Its low weight and small size make the antenna system ideal for installation on roofs.

Special features

- Extremely small dimensions
- Low weight
- Easy and quick assembly
- Little maintenance required

Specifications

Frequency range	7 to 30 MHz (reception 3 to 30 MHz)
Polarization	horizontal
Nominal impedance	50 Ω
VSWR	≤2
Max. input power	1 kW
Gain (with 15 m mast)	
7 to 8 MHz	0 to 6 dBi
8 to 30 MHz	6 to 12.5 dBi
Radius of rotation	5 m
Range of rotation	±(n × 360°)
Max. wind speed	180 km/h (without ice deposit)
MTBF	>100000 h
Dimensions	
Length of antenna	8.8 m
Width of antenna	11 m
Weight of antenna	100 kg

Ordering information

Log-Periodic HF Antenna	HL471	0755.3008.02
Recommended extras		
Lattice Mast		
15 m (standard)	KM451B2	4028.3400.02
10 m (for rooftop mounting)	KM451B1	4028.3351.02
30 m (for long-range communications)	KM451B3	4028.3451.02
Antenna Rotator	RD008	0720.6300.02
Adaption Set/Rotary Joint	RD008Z1	0720.6400.02
Control Unit (manual)	RB040	4003.2100.02
Control Unit (remote/computer-control)	BG030	0749.8501.02

Other configurations on request

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Antenna Rotator RD008

For azimuth positioning of antennas and antenna systems

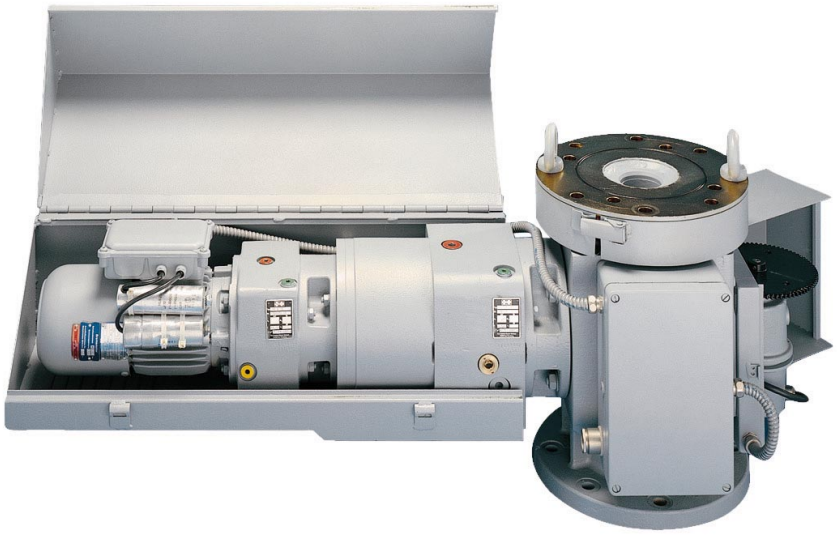

Photo 36008

Brief description

Antenna Rotator RD008 is used for azimuth positioning of antennas and antenna systems. It features a positioning accuracy of ±1°. A manual control unit (RB040) or computer-controlled model (BG030) is available for the rotator.

Special features

- Smooth start-up thanks to starting clutch
- Overload protection thanks to slip-friction clutch
- Easy to service
- High MTBF

Specifications

Range of rotation	±(n × 360°)
Max. vertical load	3000 N
Max. bending moment ref. to upper edge of drive flange	4250 Nm
Max. radial force on upper bearing	23500 N
Max. bending moment ref. to lower edge of base flange	6750 Nm
Drive speed	0.5 rpm
Power supply	220 V AC ±5%, 50 Hz, 2.2 A
Operating temperature range	−25 to +70°C
Weight	110 kg

Ordering information

Antenna Rotator	RD008	0720.6300.02
Recommended extras		
Control Unit	RB040	4003.2100.02
Control Unit	BG030	0749.8501.02
Adaption Set/ RF Rotary Joint	RD008Z1	0720.6400.02
Adaption Set/RF Rotary Joint and 4 Slip Rings	RD008Z3	4042.4200.02

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Control Units RB040, BG030

Brief description

Control Unit RB040
Control Unit RB040 for manual control of Antenna Rotator RD008 is used for positioning antennas, eg log-periodic antennas, preferably in radiomonitoring and radiolocation systems. RB040 is available as a desktop unit and as a 19" rackmount.

Control Unit BG030
Control Unit BG030 is used for controlling Antenna Rotator RD008 in local mode or in computer-controlled remote mode. BG030 is available with an IEC-625/IEEE-488 interface or a serial RS-232-C and RS-485 interface.

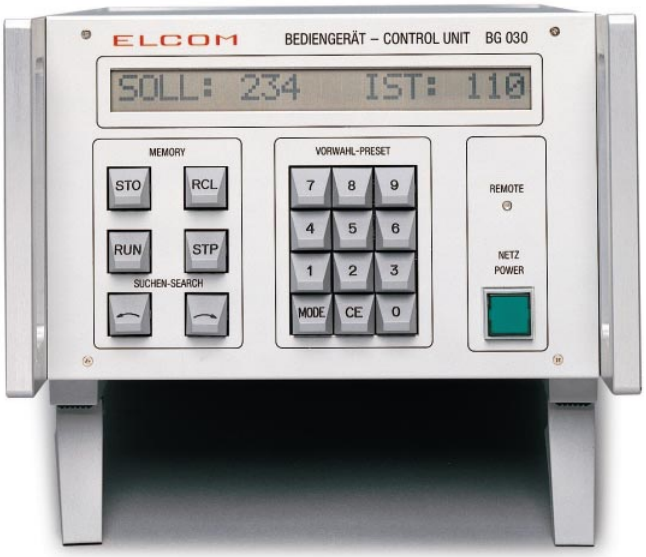
RB040
(Photo 37796)

Specifications

	BG030	RB040
Operation	local or computer control	manual control with three-position switch for CW and CCW rotation and standstill
Display error	±1°	±2°
Power supply	220 V AC +10/–15%, 47 to 63 Hz (45 VA, without rotator)	220 V AC +10/–15%, 47 to 63 Hz (max. 7.5 A, with rotator)
Operating temperature range	0 to +50°C	0 to +50°C
Dimensions (W x H x D)	220 mm x 133 mm x 312 mm	220 mm x 145 mm x 360 mm (½ 19", 3 HU)
Weight	6 kg	5.8 kg

Ordering information

Control Unit	BG030	0749.8501.02
	RB040	4003.2100.02



BG030 (Photo 36208-1)

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HF Postselectors FK852X1, FK859X1

Brief description

These filters with a power rating of 150 W (FK852X1), 1000 W (FK859X1) are used together with Transceivers XK2000 for suppressing mutual interference that may occur with co-sited transmit and receive antennas. Above all they are used for shipboard applications in order to meet colocation requirements if space for antennas is limited. Connected between the transceiver and the ATU, the filters effectively suppress spurious emissions due to their high selectivity of 30 dB (20 dB for f_o >15 MHz) at f_o ±10%. Tuning is digital by means of RF relays. The short tuning time of 50 ms (<100 ms with FK859X1) makes especially FK852X1 suitable also for frequency-agile systems. The frequency information is derived from the control line to the ATU which is looped through the filter. Alternatively, the frequency information can be derived directly from the RF signal. Both filters have a separate input for the receive antenna.

Specifications

Frequency range	1.5 to 30 MHz
Max. RF input power	FK852X1:100 W CW, 150 W PEP FK859X1:1000 W CW and PEP
Input impedance	50 Ω
Max. VSWR	1.4 : 1
Stopband attenuation	
1 kW Postselector FK859X1	1.5 to 15 MHz, f_0 ±10% >30 dB 15 to 30 MHz, f_0 ±10% >20 dB
150 W Postselector FK852X2	1.5 to 30 MHz, f_0 ±10% >8 dB
Tuning time	
1 kW Postselector FK859X1	<100 ms
150 W Postselector FK2101X1	<50 ms
Dimensions FK852X1 (19" rack mount, W x H x D)	483 mm x 221 mm x 566 mm
Dimensions FK859X1 (19" rackmount, W x H x D)	483 mm x 355 mm x 655 mm

Ordering information

HF Postselector 150 W	FK852X2	6012.8497.02
HF Postselector 1 kW	FK859X1	6012.5498.02

HF Postselector FK2101X1

Brief description

FK2101X is a postselector especially designed for HF Transceiver XK2100. Since XK2100 is capable of tuning without using a separate control line to the ATU, the control data transmitted together with the RF signal are taken via a modem bypass in FK2101X1. Featuring short tuning time (<50 ms), the filter is suitable for frequency-agile applications; however, the achievable stopband attenuation (only 8 dB at f_o ±10%) is limited as compared to FK852X1. The filter is controlled via External Control Interface GV2110.

Specifications

Electrical data	
Frequency range	1.5 to 29.999 MHz
Maximum input power	100 W + IdB CW 150 W + IdB PEP
Transmission loss	
without modem bypass	<1 dB
with modem bypass	<1.5 dB
Stopband attenuation	1.5 to 29.999 MHz for ± 10% ≥8 dB
Input impedance	50 Ω
Tuning time	50 ms
Power Supply IN2900	24 V
Current carrying capacity	≤3 A
Mechanical and environmental data	
Dimensions (H x W x D)	173 mm x 452 mm x 303 mm
Depth over all	345 mm
Weight	11 kg
Colour	RAL 7001
Safe shock load	30 g, 10 ms
Vibration	0 to 55 Hz, max. 1.5 g

Ordering information

HF Postselector 150 W	FK2101X1	6079.2010.02

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Contents of Chapter 2

Brief description

Software Radio System M3TR is a completely new generation of high-performance digital radios. It represents a revolutionary change, both technically and economically, in the tactical communications sector. The heart of the new integrated communication system are the lightweight Transceivers MR3000H (1.5 to 108 MHz) and MR 3000U (25 to 512 MHz) that offer a solution to all aspects of tactical communication as well as uniform and reduced interservice logistics. Excellent specifications, careful system engineering, proven quality and convincing logistics and serviceability as part of our philosophy are ruling this series.

As a software-programmable and modular communications system M3TR is the primary means of communications connectivity for warfighters in the digital battlefield environment. Almost all waveforms, protocols, encryption, and communications processes are implemented in common modular software. A modular hardware and software architecture reduces technology refresh insertion time and lowers costs by preplanned product improvement (P^{3}I).

Features

- Multiband capability
- Multiwaveform capability
- High data rate up to 64 kbit/s for real-time data and video
- Internet/Intranet access via IP interface (UDP/TCP)
- Software configurable and upgradable (P^{3}I)
- Simultaneous voice and data transmission in one channel
- OTAR (over-the-air rekeying)
- Wireless zeroing and rekeying of radios by ciphered transmission and access protection
- Independent selective links in one net with full orthogonality including:
- Point-to-point
- Point-to-multipoint
- Broadcast/multicast
- Lowest volume/weight
- Highest autonomy by strict power-saving management
- Integrated GPS and position report
- Removable front panel for flexible use and integration

Interoperability

M3TR addresses the migration from today's hardware-intensive communications system architectures to a software-centered systems architecture that satisfies the requirements of the various user domains. As a software-defined radio MR3000 can be made compatible with almost all existing EPM radios fielded. It is interoperable with legacy communication systems and supports growth for new requirements. M3TR is also scaleable to match the communication requirements of different users, extendible to support growth and change, and uses open systems standards and technology.

Internetworking functionality

M3TR provides easy integration into tactical communication networks. In addition to its use as a functional terminal in the respective subnet, eg CNR or PRN, it can also act as an interface between the individual subnets. M3TR can be used on diverse platforms and provides interfaces to fixed networks such as ISDN, WAN, LAN, as well as intelligent gateway

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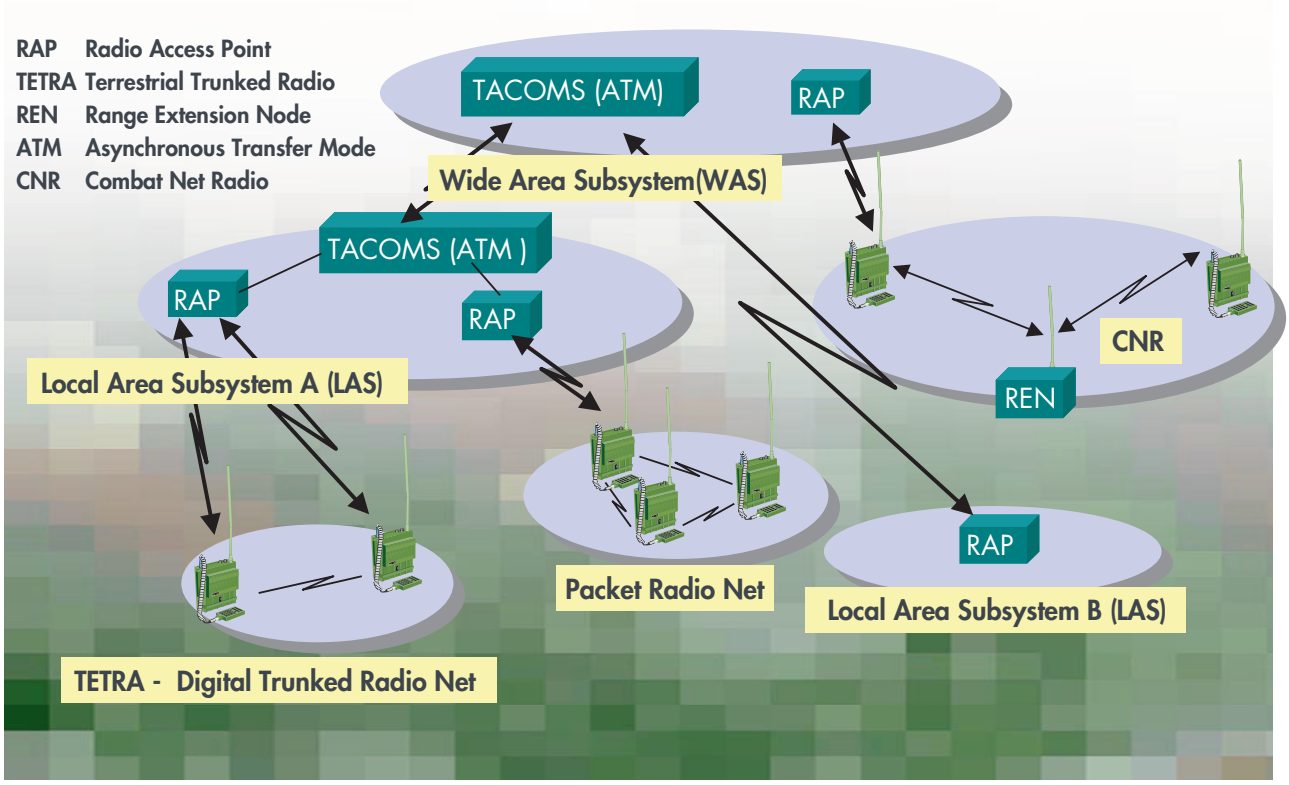
Software Radio System M3TR



and relay functions, such as autorouting of a selective call to subscribers outside the network. M3TR is not restricted to use in strictly military networks: by loading the appropriate software the transceivers can be used as terminals in civilian PMR (professional mobile radio) networks. Implementation of the latest ETSI standard TETRA25 is planned.

M3TR applications

MR3000 radios can be used for all applications as a manpack, for vehicular or stationary use.

Installation kits comprising one or two transceivers plus extras are available for land-mobile and stationary use. The 10 W RF output power of the manpack (20 W HF) can be boosted to 50 W (up to 400 W HF) using compact amplifiers. Frequency-hopping-compatible co-site filters in command vehicles ensure interference-free parallel operation of several lines. An optional switching unit provides interfaces for practically all land-based communication networks. Connections to ISDN/PSTN, TCP/IP, UDP as well as to serial and optical interfaces for data terminals are therefore supported. Furthermore there are comprehensive remote-control capabilities. The RC unit has the same MMI as the remote-controlled transceiver and can be sited several kilometers away.

Battery life is enhanced by using highly integrated low-voltage circuitry in combination with advanced power management.

M3TR offers high data rates up to 64 kbit/s for real-time data and video as well as Internet / Intranet access via radios integrated Ethernet interface.

The radios' simultaneous voice and data capability allows data transmission without occupying the channel for important voice messages.

OTAM (over the air management: rekeying, zeroising, transfer) provides wireless rekeying, zeroing and reprogramming of radios. This is done by ciphered transmission and access protection.

Up to 99 presets, each of them representing a complete EPM net, can be stored in the radio.

Communications management
The communications management system is used for initial planning of single- und multichannel frequency

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Software Radio System M3TR

requirements and network configurations dictated by the prevailing tactical situation.

It consists of software modules for key, frequency and network management as well as modules for the configuration of terminals and the distribution of device data. It supports the following applications:

- Network configuration (address management)
- Programming of terminals
- Frequency planning for overall networks and subnetworks
- Security management
- Mission planning
- Time planning
- Data distribution to terminals

The configuration data can be transmitted via any of the M3TR data interfaces, by means of a fill gun (loadable buffer memory) or even via the air interface by means of OTAM (over-the-air management). The link establishment to the transceivers thus set up is then convenient and easy. The operator chooses a mode (network) and activates the push-to-talk key or data transmission mode on the terminal. Everything else is done automatically.

Multirole services

- CNR – combat net radio: voice and data half-duplex transmission in combat networks
- PRP – Packet Radio Services: multi-hop functionality for packet data transmission, adaptive routing of messages in case of jamming or relocation of stations
- RAP – radio access point: full-duplex voice services to PSTN/ISDN networks
- TCP/IP-UDP LAN networking
- REN – for user voice and data services established among radios out of their range with different communication and security configurations
- Embedded GPS

Gateway/interfaces

- To WAN/LAN
- Between HF/VHF/UHF nets
- To ISDN/PSTN
- Serial interface
- Infrared interface
- Ethernet interface

Military waveforms, available or prepared for

- Beyond line of sight (BLOS)
  - ALE: to MIL-STD-188-141A, AM, FM SSB,8PSK (STANAG 4285) and others
    EPM to SECOM H (an adaptive proprietary EPM waveform optimised for HF)
- Line of sight (LOS)
  - EPM: HQ I,II, SATURN, SECOS, SECOM V (an adaptive proprietary EPM waveform optimized for VHF)

High data rate waveforms

Beyond line of sight (BLOS), eg HF up to 5.4 kbps user rate.
Line of sight (LOS), VHF FM, V/UHF up to 64 kbps, open for future extensions

Security

Embedded COMSEC, compatible with various external COMSEC devices

Digital voice

Vocoders adapted to mode of operation and bandwidth

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Software Radio System M3TR

Specifications

Frequency range
MR3000H 1.5 to 108 MHz, RX: 1.5 to 512 MHz
MR3000U 25 to 512 MHz, RX: 1.5 to 512 MHz

Channel spacing
MR3000H 10 Hz; 5 kHz; 6.25 kHz; 8.33 kHz; 12.5 kHz; 25 kHz; 50 kHz
MR3000U 5 kHz; 6.25 kHz; 8.33 kHz; 12.5 kHz; 25 kHz; 50 kHz

Output power
HF (1.5 to 30 MHz) 1 to 20 W, adjustable
VHF (25 to 108 MHz) 50 mW to 10 W, adjustable
V/UHF (25 to 512 MHz) 50 mW to 10 W, adjustable, up to 50/400 W with power amplifier

Net presets 99 (10 available on rotary switch)

Modulation

HF	VHF FM	UHF
J3E (USB, LSB)	F3E	A3E
B7E (ISB)	F1B	F3E
J2A (MCW)	F1D	F1B
A3E (AM)	A3E	F1D
H3E (AME)		
F3E		
F1B/F1D		

General data

Power supply
DC 10 V to 33 V
Batteries NiCd, LiIon, LiSO

Environmental conditions to MIL-STD-810E
Temperature range
Operation –40°C to + 70°C
Fully specified –25°C to + 55°C
Storage –40°C to + 85°C, method 501.3 and 502.3
Temperature shock method 503.3
Shock method 516.4
Vibration method 514.4
Waterproofness 1 m immersion during 2 hours, method 512.3
Sand and dust method 510.3
Solar radiation method 505.3
Icing and freezing rain method 521.1
EMI to MIL-STD-461 class A3 (harmonics, spurious and transmission frequency excluded)

Dimensions, weight
Dimensions (W x H x D) 199 mm x 74 mm x 234 mm
Weight 3.5 kg

Accessories

Audio
Handset
Secure handset (Scrambler)
Headset
Loudspeaker
External audio 3 W amplifier (CRA)

Power supply
Battery charger Li/NiCd
Mobile charger Li/NiCd
Solar panel battery charger
Hand crank generator
Power supply 110/220 V AC – 24 V DC – 400 W
12/24 V DC-DC 150 W converter

External control units, data terminals
Data terminal (DT) for field use
Fill gun with battery
Message handling PC SW
Mission planning PC SW
Remote control terminal
Remote control SW (PC)
Fill gun
Morse key
Data terminal
Ruggedized PC
Field telephone
Armoured car intercom
Field PABX
Vehicle transient suppresser

Antennas
Antenna 3 m (HF)
Antenna whip 1.3 to 2 m
Antenna UHF (15 cm)
Antenna whip 0.5 m with adapter
Antenna dipole HF
Ground plane HF
Antenna dipole VHF
Antenna long-wire HF
Antenna VHF vehic. broadband (1)
Antenna VHF stationary
Antenna HF vehicular
Antenna LOG HF
Antenna Yagi VHF
Antenna GPS (portable)
Antenna GPS (vehicular)
Antenna UHF vehicular

External power amplifiers
50 W VHF/UHF power amplifier
150 W HF power amplifier
400 W HF power amplifier

External antenna tuning units, post- and preselectors
Vehicular antenna tuning Unit HF 150 W
Vehicular antenna tuning Unit HF 400 W
External post-, preselector VHF for 3% to 5% cosite protection

Vehicular mounts
Vehicular mount for single radio installation with external amplifier
Vehicular mount frame for two radios, power amplifiers and switching unit
Vehicular mount adapter
VM car adapter
VM stationary adapter

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Ideal choice for use in military vehicles of all kinds

Brief description

RS150T will satisfy any HF communication needs as it meets the most demanding environmental conditions. Its small size, robust design and easy-to-use characteristics make it the ideal choice for use in vehicles of all kinds, including armoured vehicles with mortars. RS150 T is based on XK2000 technology and makes use of sophisticated DSP and ALE.

The transceiver features excellent high-frequency characteristics and intelligent internal control (continuous monitoring of functions at module level), can be easily operated from a detached control unit with an easy-to-read backlit display.

RS150T in its basic configuration is capable of transmitting morse, speech and teletype data. All common classes of emission such as SSB (USB, LSB), ISB, AME, CW, FSK, AFSK, weather fax and FM are available. The transceiver covers 1.5 MHz to 30 MHz for TX, 10 kHz to 30 MHz for RX, with 401 freely programmable channels. The unit meets MIL-STD-810 for environment, MIL-STD-461 and EN50081/50082 for EMC. State-of-the-art technologies have been used in RS150T, such as digital signal processing in the intermediate-frequency section of the transceiver and the automatic connection unit.

The transceiver comes equipped with ALIS (adaptive automatic link setup) or ALE (automatic link establishment) system (MIL-STD-188-141A).

Typical applications are shortwave telephone and fax, transmission of picture and computer data with 5400 bit/s, data services such as DATA LINK Y, LINK E, LINK 11/LINK 22 and MAHRS expandability.

Communication processors to international standards, fast and reliable data transmission as well as message handling (eg with MERLIN) allow XK2000 to be integrated into modern multimedia systems, thus providing the basis for reliable, worldwide communication independent of existing infrastructures.

ALE Processor GS2200 automatically sets up the optimum radiocommunication link using the adaptive Rohde & Schwarz ALIS 2000 procedure or FED-STD-1045/1046/1049 (MIL-STD-188-141A). As for ALIS, this procedure is 100% compatible with the HF850 family of radio equipment.

Data transmission: Up to 5400 bit/s are possible by means of the internal multimode HF Modem GM2100. Selectable waveforms are to Rohde & Schwarz standard, MIL-STD-188-110A and STANAG 4285/4481. This enables the transmission and reception of telefax messages, computer data, and colour video still pictures, for example. Connection between the data terminal (fax machine, video camera) and XK2000 is made by System Processor MERLIN from Rohde & Schwarz or an equivalent PC with the appropriate software.

HF Transceiver RS150T

RS150T (Photo 43140)

Shockmount for military vehicles
HF Transceiver RS150T with shockmount for military vehicles. Frequency range 1.5 MHz to 30 MHz, RF output power up to 150 W, 401 programmable user channels; available operating modes: USB, LSB, ISB, AM and CW; optional modules for ALE, EPM as well as fast data.

DO150TG

Control Unit DO150TG
Graphics LCD and menu-guided user interface. Direct entry of frequencies and channel parameters via hardkeys and softkeys. Direct access to all main settings via menus also in the manual mode. Storage of up to 400 presets, built-in loudspeaker; if desired, settings are confirmed by voice prompt. Default settings (user profile) can optionally be stored. Connectors for fill-gun, handset/headset, PC interface for data transmission and software update.

AD150T (Photo 43141-1)

Antenna Tuning Unit AD150T
250 programmable user channels, silent tuning in less than 30 ms, at a tuning power of 30 W, shockproof and immersible down to 4 m.

DO150T

Compact Control Unit DO150T
Selection of channel and operating modes by rotary switches, mode indication, alphanumeric display of channel number and frequency, storage of up to 100 presets, PC interface for data transmission and software update.

HF Transceiver RS 150T

HF e-mail
Rohde & Schwarz multimedia product line PostMan now provides the user with seamless online communication, based on wireless TCP/IP protocol, with an open system approach, offering errorfree, fast and reliable LAN/WAN connections via HF.

Features and benefits

- Compatible with XK 2000, HF 850 and R150 A
- High mechanical and weather resistance
- Simple and easy-to-operate via external control unit
- 100 presets each containing a complete list of parameters and classes of emission
- Configurable from fillgun or PC
- Transceiver, control unit and antenna tuner software upgradeable from PC
- Speech compressor, syllabic squelch
- Integrated ALIS or ALE system
- Optional HF modem with data transfer rate up to 5400 bps
- Single coaxial cable link between transceiver and antenna tuner
- Continuous monitoring of transceiver parameters and functions
- High reliability

Specifications

Frequency

Transmission	1.5 MHz to 30 MHz
Reception	10 kHz to 30 MHz
Frequency setting	decadic in 1 Hz steps
Frequency error	<1 x 10^{-9}/°C <1 x 10^{-9}/day
Aging	<1 x 10^{-7}/year
Channel memory	
User-programmable channels	401
Half-duplex channels thereof	100
Fixed-programmed channels (ITU)	401 to 2240
Additional channels for ALE	120
Transmit power	150 W PEP into 50 Ω 3 power levels
Classes of emission	– A1A (CW) – J3E (USB, LSB) – H3E (AME/USB) – J7B (A7J, J3E for data transmission) – B8E (ISB) – F1B (FSK, AFSK, baud rate 50 to 600 Bd, shift 42.5 kHz to 425 kHz) – F3E (FM) – F1C (FAX)
Switchover times	
Tx/Rx, Rx/Tx	<10 ms
Frequency change	<30 ms

Transmission

Output power into 50 Ω/VSWR <1.5	150 W +0.5/–1 dB PEP 100 W +0.5/–1 dB CW (power reduction according to VSWR, no switchoff for VSWR ∞)
Power levels	10/30/100 W
Spurious suppression	>70 dB, typ. 80 dB (into 50 Ω)
Harmonics suppression	>45 dB, typ. >60 dB (into 50 Ω)
Intermodulation products	>32 dB, typ. >36 dB (referred to PEP)
S/N ratio	>150 dB (referred to 1 Hz test bandwidth, Δf >1 MHz)
Weighted S/N ratio (H3E)	>50 dB (referred to PEP), weighted to CCIT (0.41/P53)
Carrier suppression	>60 dB, typ. >70 dB (referred to PEP)
Suppression of unwanted sideband	>60 dB (referred to PEP)
Voice compression	built -in

Reception

Input impedance	50 Ω, VSWR <3
Noise figure	
without preamplifier	17 dB
with preamplifier	9 dB
Input sensitivity (typ.) (for S/N = 10 dB, f = 0.2 MHz to 30 MHz)	
without preamplifier	
A1A (CW)	0.4 µV EMF, BW = 300 Hz
J3E (SSB), J7B	1.0 µV EMF, BW = 2.7 kHz
H3E (AME), 1 kHz, m = 60%	2.7 µV EMF, BW = 6 kHz
with preamplifier	
A1A (CW)	0.15 µV EMF, BW = 300 Hz
J3E (SSB), J7B	0.4 µV EMF, BW = 2.7 kHz
H3E (AME), 1 kHz, m = 60%	1.0 µV EMF, BW = 6 kHz

Receiving bandwidhts	3 dB	60 dB
	±75 Hz	±150 Hz
	±150 Hz	±225 Hz
	±300 Hz	±430 Hz
	±500 Hz	±770 Hz
	±750 Hz	±990 Hz
	±1050 Hz	±1600 Hz
	±1200 Hz	±1760 Hz
	±1350 Hz	±1900 Hz
	±1550 Hz	±2100 Hz
	±3000 Hz	±4200 Hz
	±4000 Hz	±5200 Hz

AGC	<3 dB (1 mV to 1 V EMF)
Response to a 60 dB step variation	
Attack time	<10 ms
Decay time	25/150/500 ms/1 s/3 s
AF distortion	
Line output 0 dBm	<1%
Loudspeaker	<10% at rated power
Weighted S/N ratio (H3E)	>46 dB SINAD for 1 mV EMF, weighted with filter to CCIT (0.41/P53)
Nonlinearities (1.5 MHz to 30 MHz)	
Blocking	3 dB signal attenuation (Δf = 30 kHz, useful signal 2 mV EMF, interfering signal 5 V EMF)
Desensitization	>20 dB SINAD (Δf >30 kHz, BW = 2.7 kHz, useful signal 30 µV, interfering signal 100 mV)
Intercept point IP_3	>30 dB (Δf >30 kHz, interfering signal 2 x 0 dBm)
Crossmodulation	<10% (Δf >30 kHz, useful signal 1 mV EMF, interfering signal 4 V EMF, 1 kHz, m = 30%)
Inherent spurious signal	<–113 dBm, with few exceptions
Immunity to interference (Δf >30 kHz)	
Image-frequency rejection	>80 dB, typ. >90 dB
IF rejection	>80 dB, typ. >90 dB
Oscillator reradiation	<10 µV (at antenna input)
Protection of receiver input	<100 V EMF (f <30 MHz)

HF Transceiver RS150T

General data

Operating temperature range	–25 °C to +55 °C
Storage temperature range	–40 °C to +85 °C
Supply voltage	+21 V to +31 V DC
Maximum altitude	3000 m above sea level, T_{amb} = 35 °C
Humidity	to MIL-STD-810E, Meth. 507.3, 26 °C/41 °C, 95% RH, 5 days
Mechanical test (with Shockmount OS150T1)	
Vibration	6 g / 5 Hz to 500 Hz
Shock	3000 g / 0.2 to 0.5 ms
EMC	MIL-STD-461
MTBF	>9600 h
Dimensions (W x H x D)	435 mm x 130 mm x 291 mm
Weight	15 kg
Remote Control Unit D0150T	
Channel memory	10
Selection	rotary switch (rotation >360°)
Indication	2 characters on LCD
Transmit indication	LED, green
Fault indication	LED, red + error message on LCD (13 characters max.)
Operational information	on LCD (13 characters wide)
Operating temperature range	–25°C to +55°C
Storage temperature range	–40°C to +85°C
Mechanical test	
Vibration	6 g / 5 Hz to 500 Hz
Shock	3000 g / 0.2 ms to 0.5 ms
EMC	MIL-STD-461
Dimensions (W x H x D)	175 mm x 67 mm x 52 mm
Weight	0.5 kg
Antenna Tuning Unit AD150T	
Frequency range	1.5 MHz to 30 MHz
Input power	150 W PEP, 100 W CW + 0.5 dB
Input impedance	50 Ω
VSWR	<1.5 (typ. 1.3)
Matchable antennas (1.5 MHz to 30 MHz)	5 to 7 m whip antenna 7 to 12 m rod antenna ≥3 m whip antenna (1.5 MHz to 2 MHz) duty cycle 1:1 long-wire and broadband antennas
Tuning time	
Initial tuning	typ. 1 s, max. 6 s
Repeated tuning	typ. <0.2 s
Silent tuning	<30 ms
Number of memory channels	approx. 250
RF tuning power	30 W ±1 dB (VSWR <3)
Connectors	
RF input	N connector
Antenna	ceramic insulator
Antenna for f <1.5 MHz	N connector (optional)
Control data	via inner conductor, 9600 Bd
Power supply	via inner conductor of RS150T (21 V to 31 V, approx. 1 A)
Permissible distances	
Antenna feedpoint – ATU	<0.3 m
ATU – transceiver	<50 m (coaxial cable)
Filling Device PK150T	
Memory	
SRAM	256 byte (battery buffered, min. 1 year)
EEPROM	8192 byte
SRAM erase	pushbutton
Battery condition indicator	LED, yellow
Filling	via RS-232-C (I^2C format)
Operation temperature range	–25°C to +55°C
Storage temperature range	–40°C to +85°C
Dimensions (diameter x length)	39.5 mm x 132 mm
Weight	0.2 kg
Interface	D0150T (connector type Amphenol 162GB-36T12-10-PN for direct connecting to D0150T)
Handset with Control MO150T	
Channel control	pushbutton up/down
Channel indication	00 to 99 on LCD
Squelch control	pushbutton SQ
ALE control	pushbutton CALL & SCAN
LCD light	pushbutton LITE (duration 10 s ±3 s)
Power supply	typ. +12 V DC
Speaker	
Impedance	25 Ω ±20%
Sensitivity at 80 mW	>72 dB
Volume change (pushbutton)	6 dB ±2 dB
Output power	0.5 W max.
Microphone output voltage (1 kHz, acoustic pressure 80 dB at mic., distance from tone source 20 mm)	>100 mV
Operating temperature range	–25°C to +55°C
Storage temperature range	–40°C to +85°C
Dimensions (W x H x D)	58 mm x 210 mm x 91 mm
Cable length (quiescent state)	645 mm
Weight	0.45 kg

Ordering information

HF Transceiver	RS150T	6091.9004.02
HF Modem	RM150T	6091.9104.02
Remote Control Unit	DO150T	6091.9204.02
Antenna Tunning Unit	AD150T	6091.9304.02
Filling Device	PK150T	6091.9404.02
Handset with Control	MO150T	6091.9504.02
Handset without Control	MB150T	6091.9604.02
Coaxial Cable	KA150T	6091.9704.02
Cable for Interconnection	KS150T1	6091.9804.02
Shockmount for Transceiver	OS150T1	6091.9904.02
Shockmount for ATU	OA150T1	6092.0000.02

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Rugged HF Transceiver XK2100T

Photo 42893-1

Brief description

XK2100T is the ruggedised version of XK2100 (see page 25). Its sturdy housing gives high tolerance to shock and vibration as well as extended temperature and humidity range. This makes XK2100T particularly suitable for operation under extreme environmental conditions, such as military applications. XK2100T is 100 % compatible with XK2100L, coulour is olive-green.

Ordering information

Rugged HF Transceiver	XK2100T	6091.6505.02

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VHF Transceiver XV3088

High-performance multirole combat radio

Brief description

VHF Transceiver XV3088 is a high-performance pouch radio that can be instantly redeployed as a long-duration patrol backpack and has logistic, tactical and cost advantages.

The heart of new integrated communication system is the high-performance lightweight VHF Transceiver XV3088 that a offers solution to all aspects of tactical communication. Up to 2320 channels (9 programmable), full data facility and an unparalleled simplicity of operation demonstrate latest technology. Its multirole characteristics are further enhanced by a carefully designed range of ancillaries producing an exceedingly cost-effective and logistically desirable system.

Mobile operation

XV3088 is upgraded to a complete vehicle communication system by means of Vehicle Mounting Frame KS3088 and Power Amplifier VV3088M/VV3088V with output power of 25 W or 50 W. The complete communication system is envisaged to be built into practically any military vehicle.

Features and benefits

- Built-in voice scrambler
- Preselection for up to 9 channels and their storage in memory
- Instantaneous erasure of preprogrammed data in case of imminent danger
- Keypad control from handset or transceiver control panel
- Data transmission at 2400 bps using internal modem
- Fill-gun programming
- Scanning
- POST (power-on self test)
- Semiduplex operation
- Detached operation by means of Remote Control Unit GB3088 for a range of at least 500 m using ordinary two-wire field cable
- Compatibility with most transceivers in use around the world
- Standard or 150 Hz subtone squelch

Secure transmission
The built-in voice scrambler provides digital voice encryption by sampling with 32-bit code, scrambling and transmission via the radio channel. The 10000 possible code combinations are entered by means of a fill gun.

Selective calling of up to 99 subscribers
Selective dialling to desired subscriber and fast transmission of message by 3-digit numerical code

Three power stages
High, moderate and low (high only available with 25/50 W RF amplifier).

Remote Control and Rebroadcast Unit GB3088 allows remote control of XV3088, ie traffic monitoring, ringing and transmitter keying from a field telephone using two-wire cable (Photo dr13-f1)

Two multifunction connectors
Providing both secure and fast data transmission with 2400 bit/s as well as remote-control capabilities and an audio interface, the transceivers can be extended with accessories, such as handset, headset etc.

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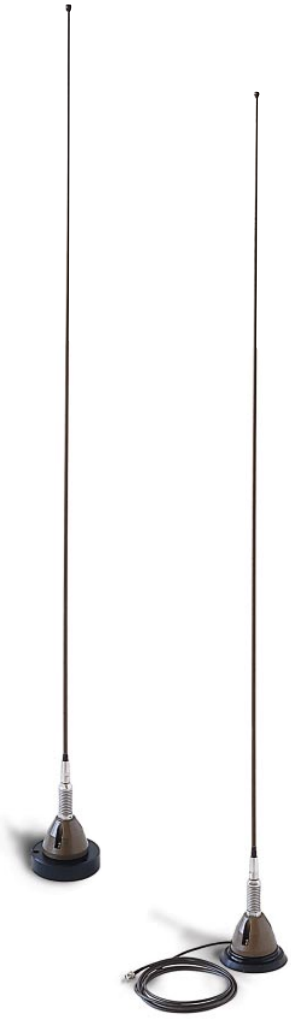
VHF Transceiver XV3088

Manpack Transceiver XV3088 (Photo xv3088-1)

Simplified operation
Clearly arranged keypad for point and shoot operation and clear override mode.



Vehicle Whip Antennas (left: M013.1 with magnetic holder, (Photo xv3088-a1), right: M013 (Photo xv3088-a2))

Compact size
One of the smallest and lightest manpack radios at a size of just 83 mm x 205 mm x 252 mm with battery pack attached. The rugged package is submersible and withstands harshest environmental and EMC conditions.

Antennas
The range of antennas available include a low-profile antenna that allows discreet operation, 1.5 m whip antenna to increase range as well as long-wire antennas and antennas for mobile use. In case of considerable mismatch, eg antenna damage, the TX LED signals the error by blinking in red.

Manpack Receiver XV3088 with Radio Data Modem GM3088 designed for data transmission through Transceiver XV3088 (Photo xv3088-2)

Mobile System XV3088 (XV3088C)
The basic unit is formed by Transceiver XV3088, built-in into various frames together with Power Amplifier VV3088M (VV3088V) 25 W (50 W) (Photos xv3088-4 (upper), xv3088-3 (lower))

Whisper mode
Increased microphone sensivity for discreet operation in silent environment.

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VHF Transceiver XV3088

Specifications

Transceiver XV3088

General data

Frequency range	30.000 MHz to 87.975 MHz
Channel spacing	25 kHz
Number of working channels	2320
Effective audio frequency range	F3 mode 300 Hz to 3.4 kHz data transmission 150 Hz to 9 kHz
Channel selection	from handset or control-panel keypad
Transmission modes	simplex or semiduplex telephony, data transmission of 1.2 kbps or 16 kbps
Voice scrambling	internal digital scrambler

Transmitter

Power output	nominal 5 W (+1.5 dB/–1 dB) reduced 0.2 W (±2 dB)
Modulation	frequency, max. shift 5.6 kHz
Harmonics suppression	–60 dB

Receiver

Sensivity	>0.5 µV at 12 dB SINAD
AF output power	adjustable, min. 200 mW into 4 Ω load
Squelch	standard or 150 Hz subtone

Power supply

Nominal supply voltage	12 V/4 A NiCd battery pack
Supply voltage range	10 V to 15 V
Period between charging	min. 14 hours at transmit/receive/standby ratio of 1:1:10 and nominal output power of transmitter

Other specifications

Operating temperature range	–30 °C to +60 °C
Transceiver weight	max. 2.7 kg (without batteries and accessories)
Battery pack weight	max. 2.5 kg
Transceiver dimensions with battery pack attached	83 mm x 205 mm x 252 mm
Weight of complete set in carrying bag with spare battery pack	<10.9 kg
Dimensions of complete set in carrying bag	250 mm x 380 mm x 450 mm
Waterproof	up to 1 m depth

Power Amplifier VV3088M (VV3088V)

Transmitter

RF output power	reduced 0.2 W nominal 5 W increased 25 W, 50 W (VV3088V)

Internal modem

PC interface	RS-232-C
Transmission speed via radio channel	2400 bps
Data modulation	FSK, 1200/2400 Hz

Power supply

Supply voltage	from vehicle battery 12 V or 27 V (VV3088V)
Supply voltage range	10 to 33 V, 18 V to 33 V (VV3088V)
Continuous transmission period	unlimited under normal conditions, 2 hours at 50 °C, 20 min with VV3088V
Power consumption (12 V/24 V)	
Reception	max. 0.5 A/0.5 A
Transmission 0.2 W	1 A/0.6 A
Transmission 5 W	2 A/1 A
Transmission 25 W	10 A/5 A
Transmission 50 W (VV3088V)	max. 7 A

Other specifications

Operating temperature range	–30 °C to +60 °C
Weight	max. 3.9 kg
Dimensions	183 mm x 129 mm x 173 mm

Additional accessories (on request)

Mobile set charger
Trickle charger
Vehicle operation accessory
Headset
AF, RF and antenna cable sets, cables for PC interconnection

Antennas

Vehicle antennas
Log-periodic antenna
Groundplane antenna
Discone antenna

Military standards XV3088 fulfills all relevant military standards

Ordering information

VHF Transceiver	XV3088	6092.1507.02
VHF Transceiver with Encryption Card	XV3088C	6092.1559.02
Recommended extras		
Battery Pack	IB3088	6092.1659.02
Handset with Control	GA3088	6092.1707.02
1.5 m Whip Antenna	HV3088L	6092.1759.02
0.5 m Whip Antenna	HV3088S	6092.1807.02
Hang-Up Antenna	HD3088	6092.1859.02
Vehicle Whip Antenna	M013	6000.0011.01
Vehicle Whip Antenna with magnetic holder	M013.1	6000.0011.02
Standard Battery Charger	IC3088S	6092.1959.02
Quick Charger	IC3088R	6092.2003.02
Power Amplifier 25 W	VV3088M	6092.2103.02
Power Amplifier 50 W	VV3088V	6092.2155.02
Radio Modem	GM3088	6092.2255.02
Fill Gun	GP3088	6092.2303.02
Vehicle Mounting Frame, horizontal	KS3088H	6092.2355.02
Voice Encryption Unit	GN3088	6092.2455.02
Remote Control Unit	GB3088	6092.2503.02
Manpack Bag	MZ3088	6092.2603.02

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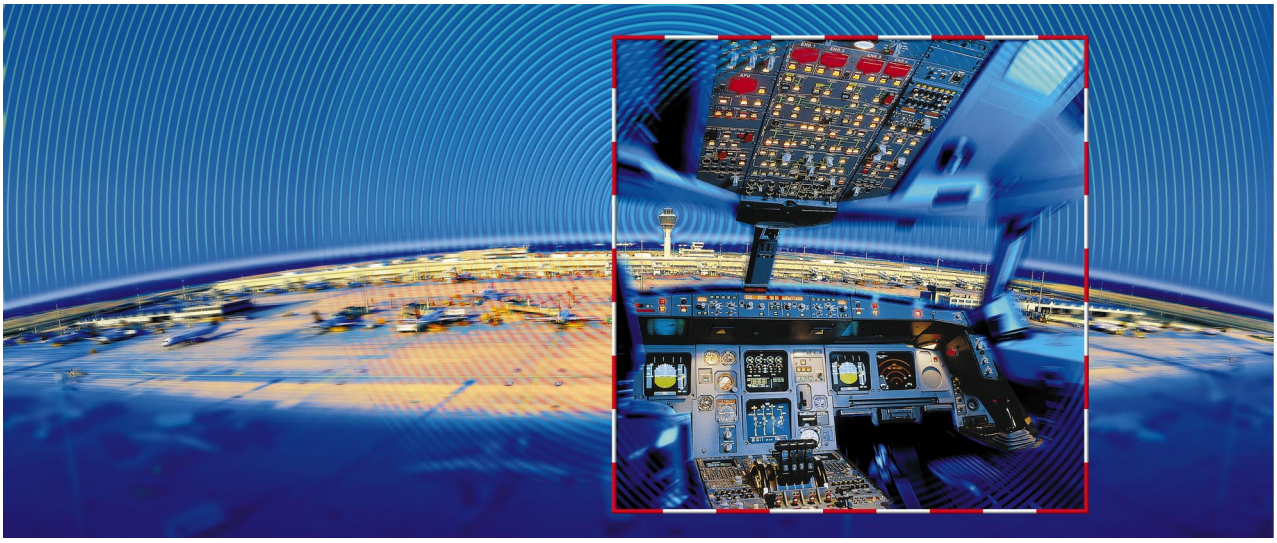
The right address for airport communications solutions



ATC and airport communications solutions

Air traffic control and airport communications are critical to airport safety and economy. As individual systems and interfaces between them become more complex, interference-free turnkey solutions are called for. Allowing civil aviation and airport authorities as well as airlines to get on with their real job.

Turnkey communications systems are our business. Whether ground-to-air VHF and UHF radio equipment for clear ATC communications en route and during approach, landing and take-off. Or shortwave radio for intercontinental routes. Radio direction finders for clear identification of each aircraft. Or ground systems to help keep things running smoothly – like our trunked mobile radio that helps to make sure that baggage and passengers, fuel and freight get to the right place at the right time. All supplied turnkey. And all with the renowned full support that goes with the name Rohde & Schwarz. No wonder civil aviation and airport authorities in over 80 countries have placed their trust in us.

Like to know more? Simply send a brief note to Rohde&Schwarz, Mühldorfstraße 15, D-81671 München, Germany, or to our Fax Hotline on +49 89 41 29 30 06. Or call us on +49 89 41 29 22 83. We'll get right back to you with the details you need.

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Basic product line information

Rohde & Schwarz VHF/UHF radio equipment program for ground-based and shipboard applications

Our product line includes a great variety of innovative radio equipment such as receiving equipment (incl. receivers, receive multicouplers, special test and mounting units), transmitters, transceivers, remote control units, power amplifiers, filters/multicouplers (combining filters), complete with useful options, accessories and auxiliary equipment for single and multichannel applications in the frequency range 100 to 400 MHz.

The catalog presents the latest product lines such as

- Series 200 for single and multichannel operation, especially for civil (voice) applications
- Series 400U and 4400 for multichannel operation, especially for use in defense (voice and data)
- Series XU100 for low-cost/low-performance VHF (preset only) multichannel operation, especially for civil AM voice and stand-alone applications

However, other applications are not to be neglected. As examples:

- Series 200 fulfils also the simple voice communication requirements of defense forces
- Series 400U multichannel radios are used as flexible standby solution in redundant AM/FM radio system configurations, eg in radio stations used for both civil and military services

The table summarizes the different market segments, ie the customers and their applications, of the three product series (main use in bold)

Customer	Applications	Series
Civil aviation authorities (CAA)	Air traffic control (ATC) for national and international airports	**200,** 400U, XU100
Airport operation authorities	Full or – in conjunction with CAA – partial ATC, eg TWR control	**200,** 400U, XU100
Regional governments	Full ATC for airfields under government control	**200,** XU100
Airlines	Airline-internal information (company radio)	**200,** XU100
Aviation industries, eg aircraft manu facturers	ATC and communication during all phases of aircraft flight tests (company-owned airfields)	**200,** 400U, XU100
Other industries, eg oil companies	Company-internal communication (eg for helicopter service from/to oil rigs or oil fields) or other communication (eg close cooperation with other services in case of emergency)	**XU100,** 200
Defense forces: air force/navy/army	Voice and data communication for military ATC and defense operations in fixed or ECCM (frequency hopping) mode, via fixed stations or transportable shelters or mobile towers	**400U, 4400,** 200
Special services: – Shuttle services etc – Border police (incl. coast guard) – SAR (search and rescue)	Special task communication	200, 400U, XU100
International organizations, eg UNO	Special task communication, eg via transportable communication shelters or mobile towers	**400U**

The new Series 200, 400U and XU100

- Substitute the preceding Series 400, which was very successful in more than 80 countries
- Shall be obligatory for any new radio project

Additional proven system components

- Hardware, such as linear amplifiers, filters and multicouplers (combining filters) up to 300 W, antennas, interfaces or control units
- Integrated firmware
- Sophisticated control software
- Supplement and round off the product line

The Rohde & Schwarz expertise in the system engineering of complete VHF/UHF air-traffic control and defense communication installations from the microphone through to the antenna is recognized worldwide.

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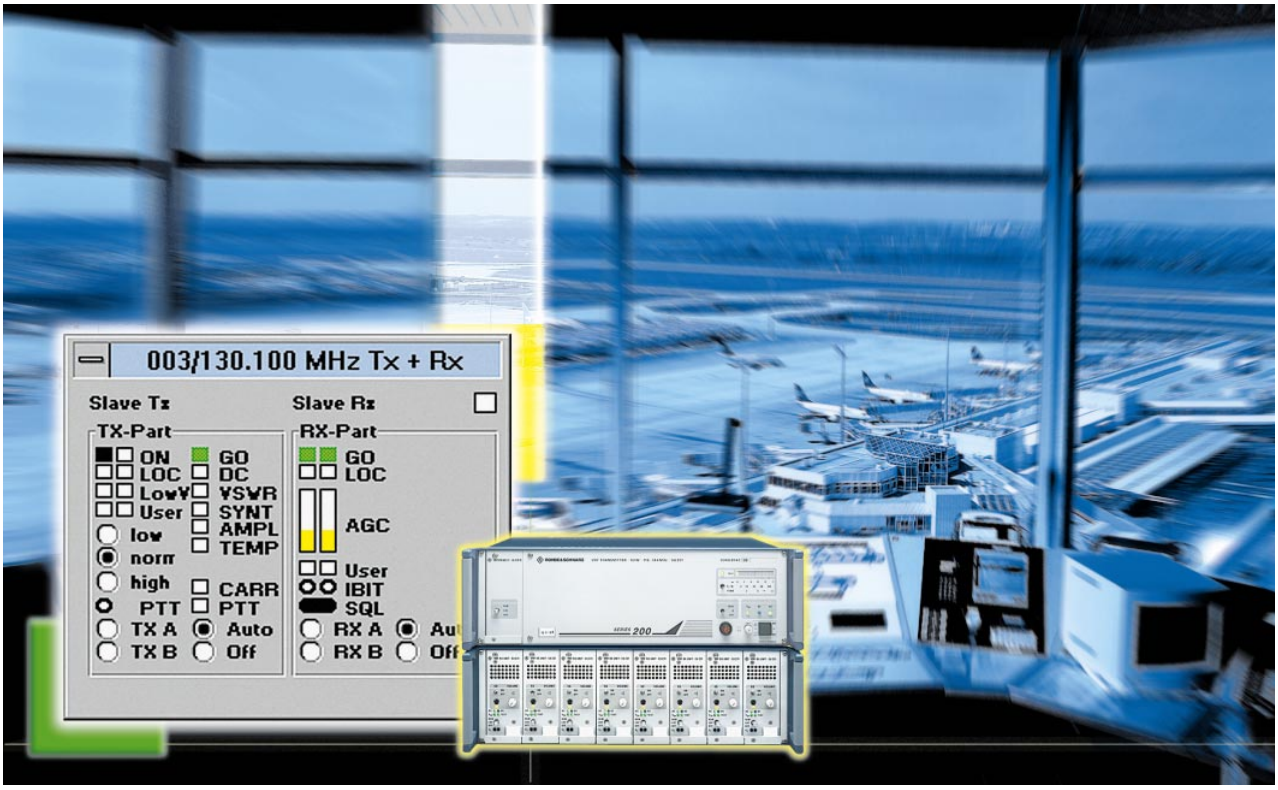
Series 200:
VHF/UHF Single- & Multichannel Communication System for Air Traffic Control – Overview



VHF system with eight single-channel Receivers EU231A and single-channel Transmitter SU251 as well as channel-specific RCMS window (Photo 42 570)

Brief description

The Series 200 VHF/UHF Communication System is a completely new generation of equipment. It represents a revolutionary change, both technically and economically, in the single- and multichannel ground-to-air radio sector. It covers a wide range of VHF and UHF equipment: basic radio equipment (receivers, transmitters and transceivers) and useful options, accessories and auxiliary equipment.

The main application of Series 200 is voice communication for air traffic control (ATC) in the 118 to 144 MHz VHF and 225 to 400 MHz UHF bands. For other customers and their special fields of application see the table under »Basic product line information«.

Series 200 is designed for ground or transportable installations in standard 19" racks. The modular concept provides cost-effectiveness. As the modules are of identical design and interchangeable they can be used with different types of equipment without modification.

Excellent specifications, careful system engineering, proven quality and convincing logistic and serviceability as part of our philosophy characterize this series. In the following the features and benefits demonstrate its excellent price/performance ratio in detail:

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Features and benefits

Features	Benefits for customer
Full range of – Basic radio units – Options – Accessories – Auxiliary equipment	– Complete system engineering from the microphone to the antenna – Advantage of ordering complete packages – Prewired and tested subsystems available – Delivery in complete lots – Responsibility in one hand
Excellent and guaranteed specifications	– Interference-free operation even under adverse co-site or environmental conditions
Modular design – Identical modules throughout the series – Mixed modular concept: plug-ins for external and internal loading – Clearly arranged modules – Guaranteed interface specifications	– Highest degree of universality – Reduced prices due to cost-effective production – Low-cost for logistics and training – Reduced service periods and costs: repair possible in some minutes, quick access to modules, no time-consuming realignments after module interchange (except basic setting for frequency or control bus address)
DC-supplied basic models of single-channel radios	– Economy for systems with central battery as sole power source
AC/DC supply – Both AC and DC can be connected in parallel – Automatic switchover to DC in case of AC failure – Automatic reset to AC (AC priority)	– Increased system reliability thanks to guaranteed continuous operation in case of power failure without any interruption – Unattended operation possible even under unstable power conditions
Individual power supplies for each radio unit (no central power supply)	– Maximum operational reliability in small receiving systems consisting of many receivers and one 19" adapter only
Synthesized frequency generation **Single-channel-specific features:** – Programming by switches – Adjustment by screwdriver – Visual prompting by LEDs (synthesizer) Helpful for RX: AGC output on front panel and options: – Frequency Tuning Kit KA231F – (RF) Test Generator GT231T1 or – (RF) Test Interface GT231T2 etc Multichannel-specific feature: – Frequency entry via keyboard	Frequency setting/change (with single-channel types): – Simple, fast and convenient – No frequency code lists required – In the radio station (transport to workshop not necessary) – In front of the radio rack – No sophisticated measuring equipment required: when using the GT231T1 a simple voltmeter is sufficient

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Features	Benefits for customer
Built-in functional tests – Continuous built-in test (CBIT) – Initiated built-in test (IBIT) in conjunction with the optionally integrated RF Test Generator GT231T1 for RX equipment – Tests included also in Remote Control and Monitoring System (RCMS) on REM BUS or INBAND[1)] basis – Internal diagnosis plugs and jumpers	– Reliable operational status – Preventive station checks are possible allowing detection of operational irregularities and organization of countermeasures in time – Reduced service costs and periods
Automatic main/standby switchover – Included as standard in basic units – Prefabricated connection cables available for dual (1+1) configuration – Significant (dynamic) switchover criteria also for receivers (special AGC) – Manual override – Full remote control and status monitoring – Common AF remote line for main and standby unit (split via local wiring distributor) – The defective radio is switched off	No extra units or system-specific black boxes needed: – Increased channel redundancy without extra costs – Reduced cabling/AF line effort (common line) – No noise interference from defective RX – Interruption-free removal of faulty radio unit
Remote Control and Monitoring System (RCMS) Series 200 features a wide variety of techniques: – Parallel technique – (Digital) REM BUS technique – (Audio) INBAND as option[1)] – Hybrid techniques (combination of above techniques)	Compatibility with conventional voice communication (switching) – Management of time-critical functions – Cost-saving and convenient centralized control and monitoring – Remote diagnosis of station status – Country-wide RCMS
High operational flexibility – Great configuration variety due to the comprehensive Series 200 product line – Wide variety of internal jumper settings for exactly adaptation to customer-specific operational needs	**In all:** – **Excellent price/performance ratio** – **Realization of (virtually) any operational requirement** – **Maximum operational flexibility** – **Minimum life-cycle costs**

Further features and benefits

Please refer to the presentations of the individual equipment types.

1) For single-channel radios: full performance (many functions)
For multichannel radios: PTT only

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Series 200: Quick Type Guide to Basic Units, Options and Auxiliary Equipment

Designation	Remarks	Supply	Types for RX equipment	Types for VHF 25 W	Types for VHF 50 W	Types for UHF 30 W
Basic units						
VHF Receivers, single-channel	RX	DC	EU231D			
	RX	AC/DC	EU231A			
VHF Receivers, multichannel	RX	AC/DC	EU230A			
UHF Receivers, single-channel	RX	DC	ED231D			
	RX	AC/DC	ED231A			
UHF Receivers, multichannel	RX	AC/DC	ED230A			
19" Adapter	for 8 RX/19" 3U slot		KR231A8			
Transmitters, single-channel	TX	DC		SU221	SU251	SD231
Transmitters, multichannel	TX	AC/DC		SU220A	SU250A	SD230A
Transceivers, single-channel	XCVR	DC		XU221	XU251	XD231
Transceivers, multichannel	XCVR	AC/DC		XU220A	XU250A	XD230A
Options						
INBAND Interface	Submodule[1)]		GM211	GM211	GM211	GM211
INBAND Software	[1)]		GM211-S	GM211-S	GM211-S	GM211-S
VHF/UHF Multicoupler (incl. REM BUS interface)	Module	DC from RX via RX REM bus cable	VT231			
Test Generator/MC	Module	DC from VT231	GT231T1			
Test Interface/MC	Module	DC from VT231	GT231T2			
Loudspeaker Unit	RX equipment[2)]		GA200			
Power Supply	Module[1)]	AC/DC		IN251A	IN251A	IN251A
Interface 2	Module[1)]			GI201	GI201	GI201
VHF Circulator Set	Module			GD200V	GD200V	
UHF Circulator Set	Module					GD200U
Auxiliary equipment						
Blower Unit	For continuous transmission			IZ200	IZ200	IZ200
Telephone Adapter	For 4 AF lines 1.5 kV isolation for operation via remote control lines to EN41003/ BZT guideline		GH200T	GH200T	GH200T	GH200T
Remote control and monitoring units for supervisor	See INBAND and REM BUS					

Further auxiliary equipment: see page 123.

1) For single-channel types only

2) For multichannel RX equipment only

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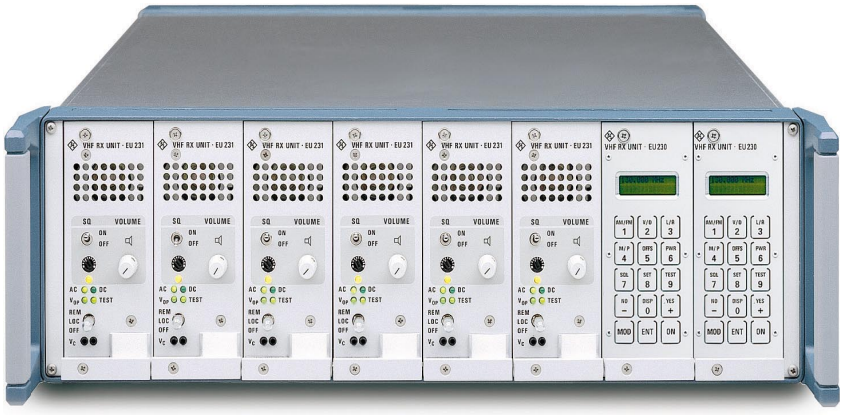
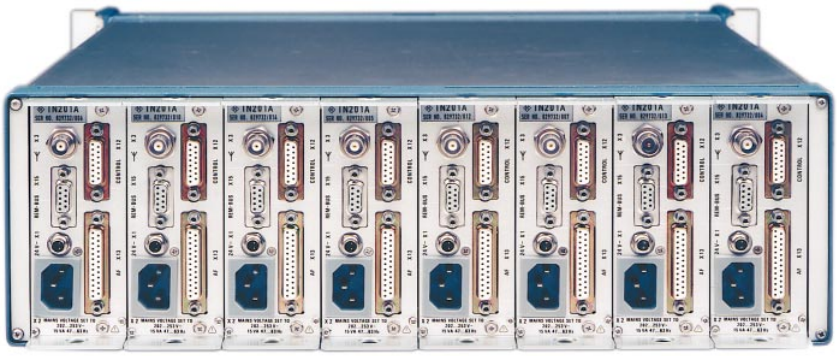
Series 200: VHF/UHF Single- & Multichannel Receiving Equipment

For basic Series 200 information (application etc) see overview on page 105.

For receiver or option-specific information refer to relevant description



Configuration of a receiving system: six single-channel RX EU231A and two multichannel RX EU230A accommodated in 19" Adapter Rack KR231A8



For a single- or multichannel receiving equipment up to eight Power Supplies IN201A/D can be inserted from the rear (Photo 40685)

Brief description

The following information refers to complete VHF/UHF receiving equipment which is more than just a receiver. The module architecture is completely new and extremely compact, flexible and cost-effective. The availability and skillful integration of options for operation, test and maintenance and the offered accessories like prefabricated cables, frequency tuning or service kits result in a complete and reliable equipment package with low overall life-cycle costs.

In detail

- One receiver eg EU231A
  - consists of 2 modules: RX unit EU231 (front module) and power supply (rear module) and
  - needs only a $^1/_8$ 19" 3 HU slot in a radio rack

Further details see under EU231A/D...

- A complete Series 200 receiving equipment is a 19" plug-in configuration, consisting of
  - one 19" Adapter KR231A8, a 3 HU mounting facility with slots for 8 front and 8 rear modules
  - up to 8 VHF receivers (single- and/or multichannel) or
  - up to 8 UHF receivers (single- and/or multichannel) or
  - up to 8 VHF or UHF receivers or
  - up to 7 VHF or UHF receivers and the options
  - Test Generator/MC GT231T1 or
  - Test Interface/MC GT231T2, each test unit together with one rear-panel VT231 (instead of power supply)
  - VHF/UHF Multicoupler VT231 Further options, eg INBAND Interface GM211 (submodule to single-channel RX unit), and accessories, eg prefabricated cables for RX REM BUS control or main/standby switchover, or Loudspeaker Unit GA200 for testing up to 7 multichannel receivers complete the receiving equipment

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Features and benefits

In the following, receiving-equipment-specific features and benefits are listed. For additional information please refer to the introduction notes of this section and the individual types.

Features	Benefits for customer
New compact and flexible module architecture – 8 receivers can be accommodated in one 19" 3 HU rack slot via 19" Adapter KR231A8 – A variety of options and auxiliary equipment for operation, tests, maintenance and service can be integrated in a convenient and space-saving manner	**Economical package** Reduced overall package costs for complete receiving equipment, taking into account all cost factors such as – purchase of basic units – purchase and integration of options – rack installation (less costly rack space required) – cabling – tests, maintenance and service
Automatically connected modules – RX unit + power supply – Multicoupler + test generator – Multicoupler + test interface 19" Adapter KR231A8 provides the mechanical adaptation to a standard radio rack	**Reliable and clearly arranged installation**
Individual power supply modules For DC or AC/DC For DC only (for single-channel RX only) For details see EU231A/D	**Reliable and versatile power supply**
Integrated test options (RF) Test Generator GT231T1or (RF) Test Interface GT231T2 For details see GT231…	**Maximum operational and service convenience and effectiveness** – Local and remote IBIT (initiated built-in test) on the true channel frequencies with both single- and multichannel receivers – Simple and fast frequency change
Integrated VHF/UHF Multicoupler VT231 This option replaces externally installed and separate VHF and UHF multicouplers and their RF cabling The VT231 is delivered with – mounted RF cables for 7 receivers – interface for test options GT231T1/T2 and – interface for REM BUS and RX REM BUS (for details see VT231 and REM BUS control)	**Economical antenna signal distribution** Convenient RF tests Sophisticated RCMS (remote control and monitoring) via serial REM BUS from supervising positions
Digital AGC outputs For details see EU231A/D etc	**Automatic receiving quality evaluation** – For RCMS applications – For receiver diversity applications
Rear interfaces and cabling – Prefabricated cables available – Externally accessible interface connectors For details see Accessories	**Easy to install and to test**

Specifications

For the specifications of Series 200 receiving systems please refer to

- Series 200 overview
- EU/ED231A/D, EU/ED231A/D, VT231, GT231T1, GT231T2 etc (extra pages)
- Auxiliary equipment, REM BUS and INBAND control and accessories

19" Adapter KR231A8 is a separate order item and specified as follows:

– Use and capacity:
Mechanical adaptation of up to 8 receivers or 7 receivers and options (as described above) into a standard 19" rack 3 HU slot
– Dimensions:
W x H x D = 482 mm x 132 mm (3 HU) x 492 mm (seated depth)
– Weight: 6 kg
– Design:
Compact, reinforced and EMC-proven frame with sliding aids for plug-in modules
– Installation:
Screw-in model with handles for rack installation; prefabricated cables for rear interconnections: see under Series 200 accessories
– Order No. 6047.8441.02

Loudspeaker Unit GA200 for testing up to 7 multichannel receivers:

– 1/8 19" screw-in module
– Order No. 6082.7019.02

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Series 200:
VHF Single-Channel Receivers EU231A/D, UHF Single-Channel Receivers ED231A/D
VHF Multichannel Receivers EU230A, UHF Multichannel Receivers ED230A

Brief description

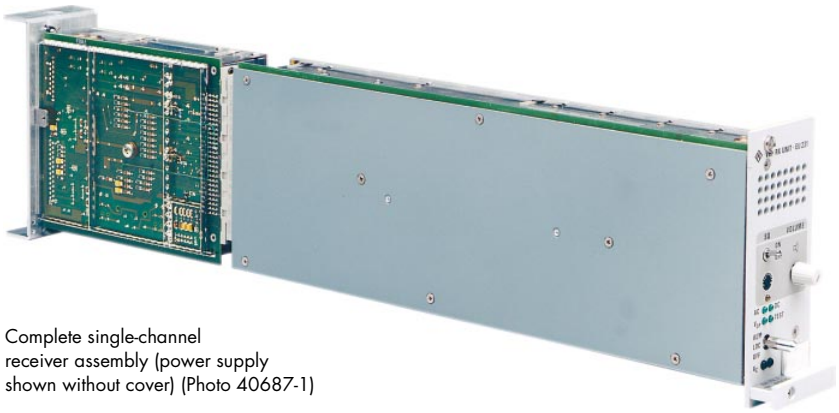
Application

The receivers are designed for the continuous reception of air-traffic control or other VHF or UHF radio transmissions primarily from aircraft during all phases under LOS (line-of-sight) conditions. This application requires the installation of a great number of simultaneously operating receivers and standby concepts to guarantee the reception of the desired frequencies at any time. Due to radio interference and propagation reasons the RX (receiver) stations are installed mostly at detached locations, so flexible and reliable remote control and monitoring systems (RCMS) and sometimes also receiver diversity operation over nearly unlimited distances are asked for. The Series 200 receiver program fulfils all these operational requirements and provides a lot of other features and benefits.

Design

A Series 200 receiver is a compact $^1/_8$ 19" 3 HU unit consisting of two interconnected modules, the front VHF or UHF RX unit and a rear power supply. To match different system requirements different receiver types are offered:

- EU/ED231D include a DC type power supply
- EU/ED231A and EU/ED230A include an AC/DC power supply with priority to AC



Complete single-channel receiver assembly (power supply shown without cover) (Photo 40687-1)

Up to 8 receivers together with the 19" Adapter KR231A8 form a 19" 3 HU plug-in for integration into a standard radio rack. For interesting options (test units, multicoupler etc) and other details see under VHF/UHF Single- and Multichannel Receiving Equipment, page 109.

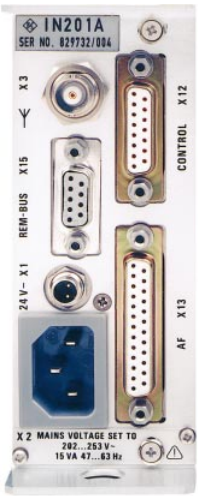
Features and benefits

Series 200 receivers guarantee clear voice communication even under adverse co-site or critical breakdown conditions. As a professional solution Series 200 receivers offer permanent remote control and status monitoring to enable immediate radio supervisor activities. Optimum serviceability and cost-effectiveness are the result of the true economy of Series 200 receivers.

In addition to the features and benefits described on page 106 (Series 200 overview) and page 110 (receiving equipment), receiver-specific benefits are listed in the following table:

VHF RX Unit EU231 (Photo 41660-3II)

VHF RX Unit EU230



Power Supply AC/DC IN201A (Photo 40687-2)

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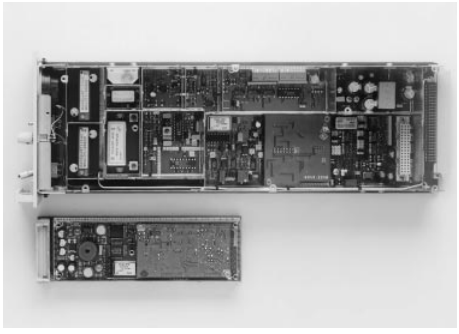
Features	Benefits for customer
Excellent RF specifications – High sensitivity together with wide dynamic range and best RFI suppression eg for intermodulation or desensitization – Sophisticated squelch circuitry	**Interference-free operation** even under adverse co-site conditions
Excellent environmental specifications to IEC standards, high MTBF	**High reliability**
Compact size: 1/8 19" only 8 receivers per 19" 3 HU slot	**Economy through reduced rack costs** In best case no extra rack required (integration into free slot of any existing rack)
Lowest MTTR (5 min) on modular LRU basis due to external modularity (mutually and automatically connected front and rear modules)	**Economy through shortest repair times**
Variety of test items/options In addition to the options – (RF) Test Generator GT231T1 – (RF) Test Interface GT231T2 – VHF/UHF Multicoupler VT231 single-channel receiver-specific items are – test loudspeaker integrated – synthesizer setting and loop locking procedure – front-panel analog AGC output (V_c sockets) – internal test socket – Frequency Tuning Kit KA231F – Service Kit RX KA231 multichannel receiver-specific items are – (test) Loudspeaker Unit GA200 – integrated ERROR indication (LCD) and WARNING indicator (LCD)	**Economy through excellent serviceability including** – simple, fast and convenient frequency change – remote receiver status indication and control – remote fault diagnosis
Digital AGC output for field-strength-significant signal, derived from 1st IF and graded in 4 steps from »no signal« to »best signal« (single-channel example)	**Optimum signal indication/selection** by automatic receiving quality evaluation – Continuous quality status indication to supervisor via RCMS (see page 126) – Automatic selection of best signal in receiver diversity application: various receivers (on the same frequency) are installed at different geographic sites to assure best reception of an airplane call – and mostly coupled – to ensure best transmission via an evaluation and channel handling (routing) technique



Interior view of EU231 with option GM211 (Photo 41659)

Specifications

- Series 200 overview
- Series 200 data sheet

Ordering information

Single-channel receivers:		
VHF Receiver (AC/DC; 8.33 kHz)	EU231A	6047.8006.22
VHF Receiver (AC/DC; 25 kHz)	EU231A	6047.8006.23
VHF Receiver (DC; 8.33 kHz)	EU231D	6047.7945.22
VHF Receiver (DC; 25 kHz)	EU231D	6047.7945.23
UHF Receiver (AC/DC 25 kHz)	ED231A	6047.8193.02
UHF Receiver (DC 25 kHz)	ED231D	6047.8258.02
Multichannel receivers:		
VHF Receiver (AC/DC; 25/8.33 kHz)	EU230A	6082.2917.02
UHF Receiver (AC/DC; 25 kHz)	ED230A	6082.3113.02
RX (DSP) Software extra order item per receiver unit	EU230-S	6082.4010.02
19" Adapter 3 HU for up to 8 receivers etc	KR231A8	6047.8441.02

Options, auxiliary equipment and accessories: see next pages and the chapters REM BUS and INBAND Control and Monitoring

Further details
Series 200 data sheets, technical information etc

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Series 200: VHF/UHF Multicoupler VT231

Loss-free distribution of VHF and UHF antenna signals to 8 outputs

Brief description

Application

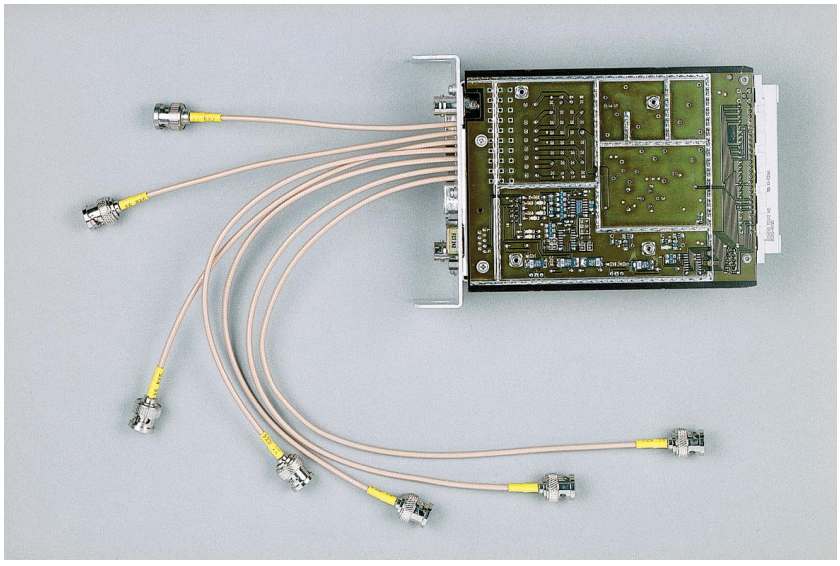
The VT231 is an option for Series 200 VHF/UHF receiving equipment and replaces separate VHF or UHF multicoupler units. It has 3 functions and is required

- for loss-free distribution of the antenna signal from a broadband VHF/UHF antenna (eg HK014) or a VHF or UHF antenna to 8 outputs: 7 outputs are fitted with RF cables provided the associated receivers are within the same adapter and an 8th output socket is offered for cascading eg to a 2nd multicoupler (if many receivers are to be connected to one antenna)
- for REM BUS control of Series 200 receiving equipment and
- for RF test (IBIT) purposes in connection with the front-panel options Test Generator GT231T1 or Test Interface GT231T2

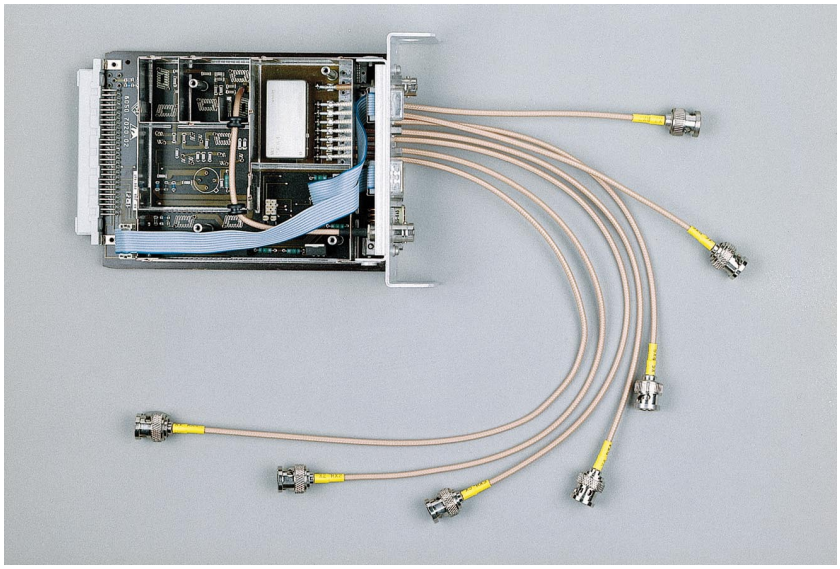
Design and integration

The VT231

- is designed as 1/8 19" rear module for slot 8 of 19" Adapter KR231A8
- is DC-supplied from the associated 7 receivers via two RX REM bus cables KS201C (.04)
- connects and supplies (DC) Test Generator or Interface GT231T1/T2 (mutually and automatically connected)



Bottom view with cover removed (Photo 41660-4)



Top view with cover removed (Photo 41660-3)

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Features and benefits

Features	Benefits for customer
Combined VHF and UHF multicoupler Replaces 2 separate units in mixed VHF/UHF receiving systems; with notch filter	**Economy through type reduction**
Designed as $^1/_8$ 19" 3 HU compact size unit For direct insertion into receiver adapter	**Economy through skillful integration**
7 RF output cables With graded lengths and fitted connector for receivers RX1 to RX7	**Convenient and foolproof connection** For trouble-free and unequivocal connection to the right receiver in case of (addressed) REM BUS operation
8th RF output socket	**Economy through a maximum reduction of antenna expenditure** if standby considerations are considered to be secondary
High intercept point ie low intermodulation	**Interference-free operation**
High output decoupling ie no RX-to-RX interference	**Interference-free operation**
Low noise figure and gain for loss compensation ie high sensitivity	**Reception of weak signals**
REM BUS and test-specific functions – Address preselection – Serial-to-parallel signal conversion (IBIT) – Directional coupler for RF test signal injection	**Remote control and monitoring** incl. testing

Specifications

Frequency

VHF range	118 to 144 MHz	
UHF range	225 to 400 MHz	
Attenuation		
VHF	102 MHz	3 dB
	161 MHz	3 dB
UHF	207 MHz	3 dB
	418 MHz	3 dB
VHF	<68 MHz	50 dB
UHF	>490 MHz	50 dB

Input/output

Inputs	1
Outputs	8 7 by cable (RX1 to RX7) + 1 socket (EXT) for cascading
Output decoupling	>15 dB
Connector types	
Antenna	BNC
RX1 to 7	BNC
GT231T1/T2	VG (internal)

Gain +1 dB ±1.5 dB

Noise figure 4.5 dB typ., 6 dB max.

Intercept point
3rd order IP3 referred to input +19 dBm

Power supply 17 to 30 V DC from receivers via RX REM BUS cables KS201C (.04)

General data
(Environment etc) IEC 68 etc (see Series 200)

Dimensions

Module	$^1/_8$ 19" 3 HU plug-in
W x H x D	50 mm x 128 mm x 185 mm

Ordering information

VHF/UHF Multicoupler	VT231 6050.7007.02
Cable (RX REM Bus; for horizontal connection of VT231 + 3 receivers or further 4 receivers)	KS201C 6047.9448.04

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Series 200: Test Generator/MC GT231T1

Initiated built-in test (IBIT), convenient frequency change

Brief description

Application

The GT231T1 is a very helpful option for Series 200 VHF/UHF receiving equipment and an innovative idea and system solution for integrated and in-channel RF tests of ATC receiving systems. Its integrated RF test generator offers two applications:

- Initiated built-in test (IBIT) of all associated single and multi-channel receivers to be performed locally and remotely via a REM BUS or, with single-channel receivers, also INBAND operated RCMS (Remote Control and Monitoring System)
- Convenient frequency change at the single-channel radio site without the use of an external RF test generator

The designation "Test Generator/MC" indicates its operation in connection with VHF/UHF Multicoupler VT231.

Design and integration

The GT231T1 is

- designed as 1/8 19" front module for slot 8 of 19" Adapter KR231A8
- connected mutually and automatically to the rear VHF/UHF Multicoupler VT231 which supplies DC, the central REM BUS and the individual RX REM BUS interface and the CBIT RF signal directional coupler and distribution via its RF outputs
- connected manually (front panel RF output) with the extended single-channel receiver for frequency change using the facilities of the Frequency Tuning Kit KA231F

Photo 41969

Features	Benefits for customer
Combined VHF and UHF RF generator and multiple applications – for IBIT; 7 test frequencies user-programmable – for frequency change	**Economic all-in-one solution**
Designed as 1/8 19" 3 HU compact unit – for direct insertion into receiver adapter – for automatic connection to VHF/UHF multicoupler VT231	**Economy through skillful integration**
Rear RF test output for IBIT via VT231	**Cost-effective and convenient RF test** – test on true frequencies – no expensive measuring equipment needed – no system cabling – full remote control (REM BUS and INBAND)
Front RF test output for frequency change – with integrated and switchable 40 dB attenuator – in connection with Frequency Tuning Kit KA231F	**Highly effective (easy, fast and convenient) frequency change** at radio site

Specifications

Frequency

VHF range	118 to 144 MHz
UHF range	225 to 400 MHz
Spacing	25 and 8.33 kHz
Functions	GT231T1 is a test RF source 1) for local and remote IBIT (initiated built-in test) of up to 7 receivers on true frequency 2) for frequency change
Power supply	DC from receivers via VT231 (for details see there)

General data
(Environment etc)
IEC 68 etc (see Series 200)

Dimensions

Module	1/8 19" 3 HU plug-in
W x H x D	50 mm x 128 mm x 365 mm

Ordering information

Test Generator/MC
GT231T1 6050.7507.22

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Series 200: Test Interface/MC GT231T2

Test input for an external test generator

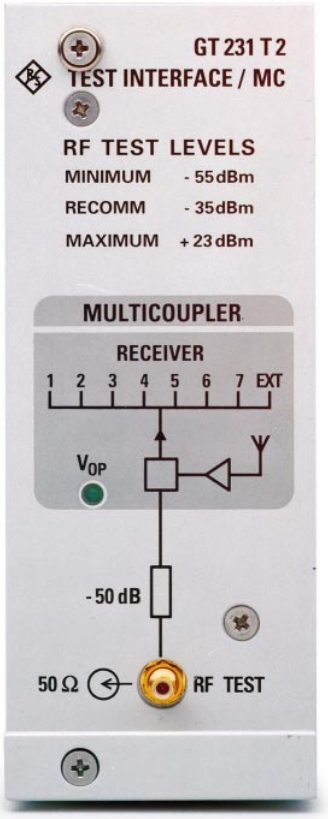

Photo 41971

Brief description

The GT231T2 is an option for Series 200 VHF/UHF receiving equipment and offers an RF test input for an external repairshop radiocommunication test generator to enable a local IBIT – in connection with the VHF/UHF Multicoupler VT231 – the applied VHF or UHF test signal is attenuated by 50 dB, fed into the antenna path and distributed to the associated receivers. For higher cost-effectiveness and convinience however, Test Generator/MC GT231T1 is recommended instead. The GT231T2 is designed as a $^1/_8$ 19" front module for slot 8 of 19" Adapter KR231A8 and is connected mutually and automatically to the rear VHF/UHF Multicoupler VT231. Compare the photo in the previous chapter (GT231T1).

Features	Benefits for customer
Front RF test input socket – For connection of an external radiocommunication test generator – For local IBIT – For test of all associated receivers	**Easy test access to receiving system** – Test on true frequencies – Without interruption of operation
Designed as $^1/_8$ 19" 3 HU compact unit – For direct insertion into receiver adapter – For automatic connection to VHF/UHF Multicoupler VT231	**Economy through skillful integration**
Printed test information on front panel – Functional test diagram – RF test level instructions – LED indication for multicoupler test	**User-prompting**

Specifications

Functions 1) passive RF interface (input for test signal)
2) LED indication for multicoupler test

Dimensions
Module W x H x D $^1/_8$ 19" 3 HU plug-in 50 mm x 128 mm x 365 mm

Ordering information

Test Interface/MC
GT231T2 6050.8003.02

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Series 200:
VHF Single-Channel Transmitters SU221, SU251; UHF Single-Channel Transmitter SD231
VHF Multichannel Transmitters SU220A, SU250A; UHF Multichannel Transmitter SD230A

For basic Series 200 information (application etc) see overview on page 105

VHF Multichannel Transmitter SU250A (Photo 40678)

Brief description

The program includes the VHF 25 W (SU221, SU220A), VHF 50 W (SU251, SU250A) and the UHF 30 W (SD231, SD230A) transmitter type. The applied module architecture is completely new and extremely compact, flexible and cost-effective: the Series 200 single-channel transmitters and transceivers are of nearly identical design, using the same 19" adapter and a maximum number of identical modules. Only frequency- and power-relevant modules differ. The same is valid for multichannel equipment with a multichannel-specific 19" adapter. The availability and skillful integration of alternative modules, options and accessories result in a complete and reliable equipment package. Thus various transmitter configurations are possible with low overall life-cycle costs.

Features and benefits

- For general Series 200 features and benefits please refer to the overview on page 106
- In the following, only transmitter-specific features and benefits are listed:

Features	Benefits for customer
Continuous operation – Convection cooling – Generously dimensioned heat sink – Gradual power degradation in case of adverse operating conditions – Automatic switching off at critical temperature – Continuous output via control of external Blower Unit IZ200 eg for ATIS or VOLMET service (see Series 200 accessories)	**High communication link reliability**
Rear heat sink	**Cost-effective installation in standard racks** – L-shape plug-in slide rails are sufficient – No need for telescopic rails

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Features	Benefits for customer
Variety of PTT (push-to-talk) techniques – Via front-panel switch: unmodulated (PTT) or modulated (TONE) – Via microphone key – Via a wide control voltage range: floating via optocoupler or negative pole to ground (via optocoupler or phantom circuit) – Via serial interface (REM BUS) Optional: – Via audio line – Via voice input (PTT VOX): on request	**High system flexibility** – Interface adaptable without problems – Easy to test
Excellent spectral purity – Low-noise synthesizer – Careful design of power amplifier etc (minimizing non-linearity product emission) – Harmonics filter – Special models with additional VHF or UHF Lowpass Filter GH200V/U to comply with German Telekom Guidelines for spurious emissions (if used without external filters) – VHF or UHF Circulator Set GD200V/U (option) provided for insertion in front of harmonics filter (maximum efficiency) to improve TX intermodulation characteristics	**Interference-free operation** even under co-site conditions
Alternative VHF synthesizer models – GF201V model 24: This latest model is provided with the required stability (TCXO), with 2.5 kHz frequency setting steps and with user-selectable channel spacing 25 kHz and future 8.33 kHz – GF201V model 25: This latest model is fitted with OCXO for extreme stability – Both models have single- and multichannel capability	**Future-proof and cost-effective transmitters** for multiple applications »all-in-one« Standard transmitter models – For standard operation or – For 2-, 3-, 4-carrier offset operation (with 25 kHz spacing) – For future 8.33 kHz mode: no need for an expensive change of synthesizer; for final 8.33 kHz upgrading the optional Modulator Extender GM201C8 has merely to be inserted into the customized option slot of the transmitter – For single- and multichannel operation, thus reduced logistics effort High-precision transmitter models for special applications
Alternative UHF TX synthesizer models – GF201U model 22: This latest standard model includes an TCXO – GF201U model 23: This latest model is fitted with an OCXO	**Same benefits as before** (except 8.33 kHz)

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Features	Benefits for customer
Alternative power amplifier models – Without TX/RX PIN diode switch – With TX/RX PIN diode switch	**Alternative transmitter models** – For use in transmit mode only – For use in transmit/receive mode; in connection with an external receiver: with this cost-effective feature customers can use their existing receivers together with new transmitters
Designed as 19" 3 HU plug-in unit – Internally and externally loaded modules – Prepared slots for present or future options – Space for future customer-specific options – No motherboard – Swivel-type design of rear power amplifier module for ideal accessibility in case tests during full operation; heat sink and flexible cabling remain connected	**Economical and future-proof design** **Excellent serviceability**
Clearly arranged control and monitoring elements on front panel	**Helpful service functions for fast status checks**

Specifications

- Series 200 overview
- Series 200 data sheet

Ordering information

Single-channel transmitters		
VHF Transmitter 50 W (DC)	SU251	6043.8947.xx
VHF Transmitter 25 W (DC)	SU221	6043.9043.xx
UHF Transmitter 30 W (DC)	SD231	6043.9143.xx
Multichannel transmitters		
VHF Transmitter 50 W (AC/DC)	SU250A	6082.2317.xx
VHF Transmitter 25 W (AC/DC)	SU220A	6082.2469.xx
UHF Transmitter 30 W (AC/DC)	SD230A	6082.2769.xx

The last two figures »xx« of the order number depend on the configuration with alternative synthesizer or amplifier models. They can also indicate (model 4x) the incorporated VHF or UHF Lowpass Filter GH200V/U. For details see data sheet.

Options

All Series 200 options can be additionally integrated into basic transmitter models (without change of transmitter order number).

Options have therefore to be offered and ordered as extra items.
All options provide upgrading capability, ie problem-free integration by customer at a later date

Power Supply Option for single-channel transmitters, for AC/DC, priority to AC, complete unit with cabled front-panel switch, AC fuse holder etc	IN251A	6044.8440.02
Interface 2 Option for single-channel transmitters: for automatic main/standby switchover, for control of external power amplifier	GI201	6044.2794.02
INBAND Interface Submodule for multichannel transmitters and all single-channel radios; for details see chapter INBAND, page 130	GM211	6047.8693.20
VHF Circulator Set **UHF Circulator Set** Both types are internal modules, complete with RF cables and fixing elements	GD200V GD200U	6044.8940.02 6044.9199.02
Modulator Extension For upgrading to 8.33 kHz channel spacing, for integration into customized module slot (connected to existing cable)	GM201C8	6044.4445.02

Auxiliary equipment and accessories
See pages 123

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Series 200:
VHF Single-Channel Transceivers XU221, XU251; UHF Single-Channel Transceiver XD231
VHF Multichannel Transceivers XU220A, XU250A; UHF Multichannel Transceiver XD230A

For basic Series 200 information (application etc) see overview on page 105

Brief description

The program includes the VHF 25 W (XU221, XU220A), VHF 50 W (XU251, XU250A) and the UHF 30 W (XD231, XD230A) transceiver type. The applied module architecture is completely new and extremely compact, flexible and cost-effective: the Series 200 single-channel transceivers and transmitters are of nearly identical design, using the same 19" adapter and a maximum number of identical modules. Only frequency- and power-relevant modules differ. The same is valid for multichannel equipment with a multichannel-specific 19" adapter. The availability and skillful integration of alternative modules, options and accessories result in a complete and reliable equipment package. Thus various transceiver configurations are possible with low overall life-cycle costs.

VHF Single-Channel Transceiver XU251 (Photo 40676)

VHF Multichannel Transceiver XU250A (Photo 42671)

Features and benefits

- For general Series 200 features and benefits please refer to the overview on page 106
- In the following, only transceiver-specific features and benefits are listed:

Features	Benefits for customer
Common modularity Transceivers and transmitters basically differ in some modules only	**Reduced costs** (see Series 200 overview)
Continuous operation – Convection cooling – Generously dimensioned heat sink – Gradual power degradation in case of adverse operating conditions – Automatic switching off at critical temperature	**High communication link reliability**
Rear heat sink	**Cost-effective installation in standard racks** – L-shape plug-in slide rails are sufficient – No need for telescopic rails

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Features	Benefits for customer
Variety of PTT (push-to-talk) and SQUELCH techniques	**High system flexibility** – Interface adaptable without problems – Easy to test
Excellent spectral purity – Low-noise synthesizer – Careful design of power amplifier etc (minimizing non-linearity product emission) – Harmonics filter – Special models with additional VHF or UHF Lowpass Filter GH200V/U to comply with German Telekom Guidelines for spurious emissions (if used without external filters) – VHF or UHF Circulator Set GD200V/U (option) provided for insertion in front of harmonics filter (maximum efficiency) to improve TX intermodulation characteristics	**Interference-free operation** even under co-site conditions
Transceivers include 2 synthesizers – Receive synthesizer in RX unit – Transmit synthesizer	**Half-duplex and full-duplex concepts** (relay stations) configurable
Automatic frequency offset of transmit synthesizer in case of reception. This concept prevents permanent synthesizer on/off switching following the TX/RX mode and thus prevents the generation of unwanted spurious frequencies	**High-quality reception** in TX/RX mode
Alternative EU231 and GF201V models and option GM201C8 available for different applications	**Future-proof and cost-effective transceivers** for multiple applications (eg 8.33 kHz channel spacing)
Alternative single-channel VHF RX models With 2.5 kHz stepped synthesizer (TCXO) and IF crystal filter: – EU231 model 23 for 25 kHz operation – EU231 model 22 for 8.33 kHz operation	**Same benefits as before**
Alternative VHF TX synthesizer models – GF201V model 24 with TCXO: This latest VHF model is fitted with the required stability, with 2.5 kHz frequency setting steps and with user-selectable channel spacing 25 kHz and future 8.33 kHz. For 8.33 kHz the optional Modulator Extension GM201C8 has to be inserted into the customized option slot of the transceiver in addition to usingof EU231 model 22. – GF201V model 25 with OCXO of extreme stability – Both models have single- and multichannel capability	**Same benefits as before** Standard transceiver models »all-in-one« – For standard operation or – For 2-, 3-, 4-carrier offset transmissions (with 25 kHz spacing) – For future 8.33 kHz mode: no need for an expensive change of TX synthesizer – For single- and multichannel operation, thus reduced logistics effort High-precision transceiver models for special applications

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Features	Benefits for customer
Alternative UHF TX synthesizer models – GF201U model 22: This latest standard model includes an TCXO – GF201U model 23: This latest model is fitted with an OCXO	**Same benefits as before** (except 8.33 kHz)
Alternative power amplifier models and use of 2nd RF socket for RX antenna – With highly reliable TX/RX PIN diode switch – Without TX/RX PIN diode switch The 2nd RF socket is wired for the RX antenna	**Interference-free co-site operation** – One-antenna transceiver model for standard stand-alone applications – Two-antenna mode available for separate transmit and receive antennas to master co-site environment – High MTBF (no mechanical coaxial TX/RX relay)
Designed as compact 19" 3 HU plug-in unit – Internally and externally loaded modules – No motherboard – Space for future customer-specific options – Swivel-type design of rear power amplifier module for ideal accessibility in case of tests during operation; heat sink and flexible cabling remain connected	**Economical and future-proof design** **Excellent serviceability** – No external connection of two separate (TX + RX) units
Clearly arranged control and monitoring elements on front panel	**Helpful service functions for fast status checks**

Specifications

- Series 200 overview
- Series 200 data sheet

Ordering information

Single-channel transceivers:		
VHF Transceiver 50 W (DC)	XU251	6043.9243.xx
VHF Transceiver 25 W (DC)	XU221	6043.9343.xx
UHF Transceiver 30 W (DC)	XD231	6043.9443.xx
Multichannel transceivers:		
VHF Transceiver 50 W (AC/DC)	XU250A	6082.2017.xx
VHF Transceiver 25 W (AC/DC)	XU220A	6082.2169.xx
UHF Transceiver 30 W (AC/DC)	XD230A	6082.2617.xx
RX (DSP) Software Extra order item per transceiver unit, standard DSP SW	EU230-S	6082.4010.02

The last two figures »xx« of the order number depend on the configuration with alternative models like RX unit, synthesizer or amplifier and with additional application-specific modules like Modulator Extension GM201C8 (8.33 kHz) or VHF or UHF Lowpass Filter GH200V/U. For details see data sheet and additional sales documentation or ask your local representative.

Options
All Series 200 options can be additionally integrated into basic transceiver models (without change of transceiver order number).
Options have therefore to be offered and ordered as extra items.
All options provide upgrading capability, ie problem-free integration by customer at a later date.

Power Supply Option for single-channel transceivers: for AC/DC, priority to AC, complete with cabling, switch etc	IN251A	6044.8440.02
Interface 2 Option for single-channel transceivers: for automatic main/standby switchover, for control of external power amplifier	GI201	6044.2794.02
INBAND Interface Submodule for single-channel transceivers; for details see chapter INBAND, page 130	GM211	6047.8693.20
VHF Circulator Set **UHF Circulator Set** Both types are internal modules, complete with RF cables and fixing elements	GD200V GD200U	6044.8940.02 6044.9199.02
Modulator Extension For upgrading to 8.33 kHz channel spacing, for integration into customized module slot (connected to existing cable)	GM201C8	6044.4445.02

Note: GM201C8 is an integral part of the special 8.33-kHz-capable VHF single-channel transceiver models. For a later upgrading, however, the GM201C8 is available as an option for all VHF transceivers.

Auxiliary equipment and accessories
See pages 123, 133

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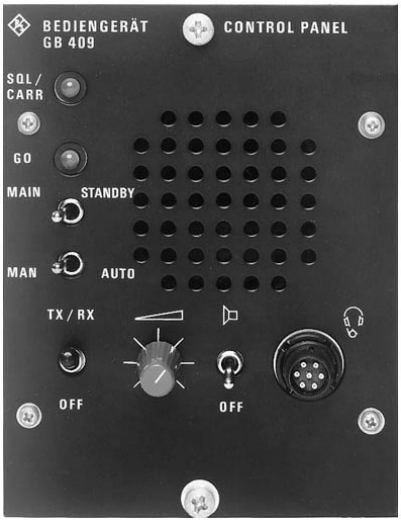
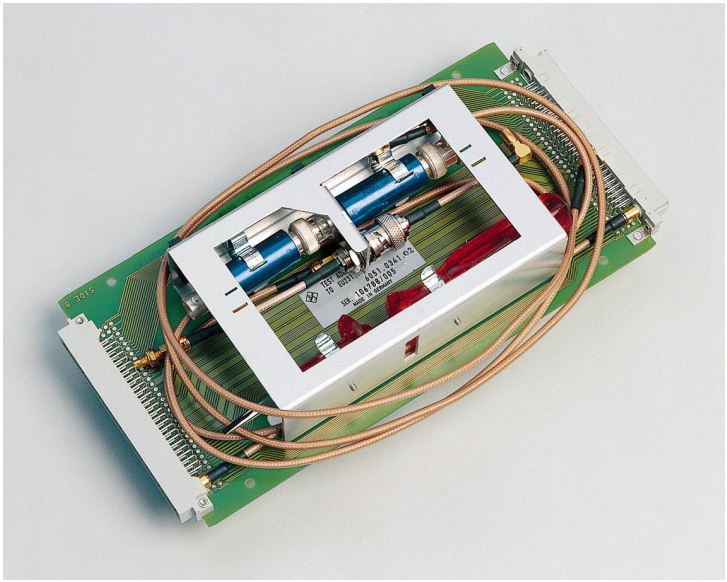
Series 200: Auxiliary Equipment

Service Kit RX KA231 (Photo 42013)

Service Kit TX KA251 (Photo 42015)

Control Panel GB409 (Photo 32665)





Frequency Tuning Kit KA231F (Photo 41989)

In contrary to options, which can be additionally integrated into basic modules or equipment, auxiliary equipment for Series 200 is defined to be stand-alone equipment for operation or service. The following types are important system components necessary for compiling complete VHF/UHF radio systems or for qualified maintenance, testing, troubleshooting and repair.

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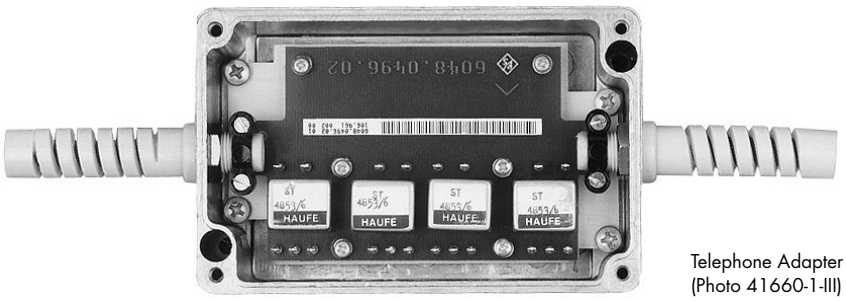
Designation	Type	Order No.	Uses, specifications, features and benefits
Blower Unit	IZ200	6045.2446.02	**Continuous transmission at nominal power** Typical application: VOLMET or ATIS information services of airports. Series 200 tailored 19" 1 HU plug-in for installation directly below the radio, optimum cooling efficiency by exact matching to the transmitter heat sink dimensions, powered by sensor-controlled DC supply from transmitter. Air flow from front to rear
Telephone Adapter	GH200T	6048.0444.xx xx = 02 xx = 03	**Safe operation of all radio types via remote-control/telephone lines** to EN41003/BZT guideline, safety: 1.5 kV isolation, capacity: 4 AF lines **Rack model for Rohde & Schwarz radio racks:** this model is a special-shape PCB for integration into racks **Cabinet model for integration into any radio rack or desk** Dimensions: W x H x D = 125 mm x 80 mm x 56 mm
Loudspeaker Unit	GA200	6082.7019.02	**Test loudspeaker for multichannel receiving equipment** 1/8 19" screw-in module for slot 8 of 19" Adapter KR231A8 with 1-out-of-7 RX selector switch
Control Panel	GB409	0637.6014.xx xx = 02 xx = 03 xx = 04	**Remote operation of a stand-alone single-channel transceiver** Typical application: airline-internal company radio Functions: the GB409 offers a minimum of functions (no main/standby or manual/auto etc) for Series 200; for more sophisticated control and monitoring refer to REM BUS or INBAND techniques Design: ¼ 19" 3 HU plug-in for desk integration (directly or via 19" Adapter KR405, depending on desk design) Dimensions (W x H x D): 100 mm x 132 mm x 175 mm **Functions: AF, S/N SQL, PTT, carrier, test, on/off** Distance: <50 m with 28 V DC from transceiver or some 100 m with local DC supply (22 to 30 V DC) Cabling: 6 DC permeable + 4 AF lines; shielded cable **Functions: AF, AF SQL, PTT (2040 Hz INBAND tone via TX AF)** Power supply: local AC or DC (alternatively wired) Distance: nearly unlimited Cabling: 2-pair AF channel (telephone or MW path) Additional radio requirement: GM211 (.20) and GM211-S (.25) **Functions: AF, AF SQL, PTT (2040 Hz INBAND tone via TX AF, 100% INBAND control and monitoring/test** (in connection with GM231A/D only) Power supply: local AC or DC supply (GB409 alternatively wired) Distance: nearly unlimited Cabling: a) Radio to GM231A/D: 2-pair AF channel (telephone or MW path) b) GM231A/D to GB409: 6 wires Additional radio requirement: GM211 (.20) and GM211-S (.22)



Telephone Adapter GH200T model 03
(Photo 41660-1-III)

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Designation	Type	Order No.	Uses, specifications, features and benefits
Control Unit	GB406C1	6016.1497.14	**Remote operation of multichannel radios** – For Series 200 transceivers or split TX + RX couples; – For RS-232 point-to-point operation or RS-485 bus operation via additional system components (see Series 200 RCMS) – Compare Series 400U: Auxiliary Equipment (page 148)
Control Software	GB406-S	6051.0993.92	**Application-specific and factory-loaded software** (EPROM for GB406C1) **Note:** The GB406-S has to be ordered as an extra order item together with the control units (equal quantities)
Cabinet	KK406	4029.7509.03	**For variable desk-top installation of GB406C1** Due to its swivel-type mounting holder the KK406 offers a fine-graded adaptability for optimum sight and operator convenience
19" Adapter	KR405	0504.6514.02	**Desk integration** of up to 4 Control Panels GB409, 19" 3 HU
INBAND technique	—	—	**RCMS** (remote control and monitoring systems) **via telephone channels:** see page 130
REM BUS technique	—	—	**RCMS via PC:** see page 126
Service Kit RX	KA231	6047.8993.02	**Maintenance and testing, troubleshooting and repair** Special-to-type test kit for – receiving equipment, – RX functions of transceivers and – INBAND functions (GM211, GM231A/D) The kit includes all necessary test adapters, cables and REM BUS test software, all packed in a handy portable case with individually shaped foam inserts and user information
Service Kit TX	KA251	6044.9447.02	**Special-to-type test kit for** – transmitters and – TX functions of transceivers For further details see KA231 above
Frequency Tuning Kit	KA231F	6051.0341.02	**Frequency change and realignment maintenance for single-channel receiving equipment and RX units in transceivers** The main application of this kit is for stand-alone transceivers eg for company radios. The kit includes a short extender board (for the RX unit), RF attenuators and cables to enable a quick frequency change at the radio site without external repairshop RF test generator by using Test Generator/MC GT231T1 (RX equipment integrated option) or – with a transceiver – by using its own TX section. The KA231F can be stored within the transceiver in the free option slot (if not occupied by Modulator Extender GM201C8 for 8.33 kHz or another customized option) or within Service Kit RX KA231

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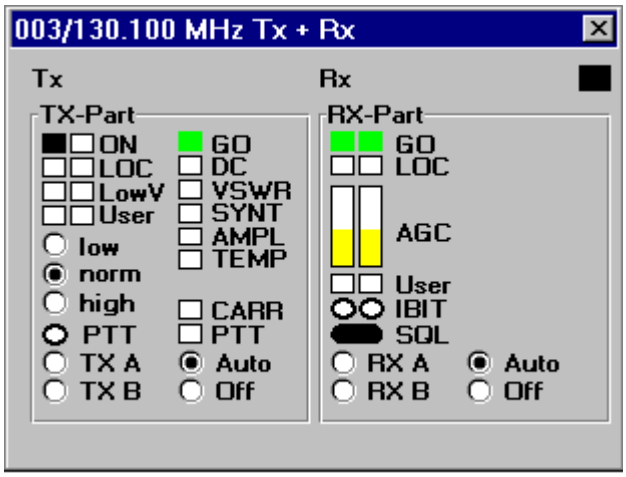
Series 200: REM BUS Control and Monitoring

Single-channel-specific PC window: example for channel 003 = 130.1 MHz, consisting of 2 TX and 2 RX, switched to 100% automatic standby mode, with manual override via TXA, TXB, RXA or RXB switchfields.



Brief description

Modern and convenient ATC radio systems need more than just a number of radios, antennas etc. They require an intelligent and comprehensive remote control and monitoring system (RCMS). Series 200 offers three different, but complementary remote control and monitoring (RCM) techniques: parallel, digital REM BUS and – for single-channel radios – audio INBAND techniques. Their selection and combination to hybrid solutions are essentially determined by operating convenience and economic requirements.

Application

Series 200 REM BUS technique enables:

- Operation from a supervising and/or maintenance center
- Unlimited distances
- Verification of changed operational requirements
- Start of initiated RF tests
- Reaction to operational irregularities
- PC operation based on the widely known MS-DOS/Windows program
- Cost reduction for service by remote status/failure diagnosis

Technique

The REM BUS is a fast digital bidirectional bus and is included as standard interface in all Series 200 radios and selected options such as VHF/UHF Multicoupler VT231 or Test Generator/MC GT231T1. In detail, there are 2 different but complementary REM BUS variations:

- REM BUS: interface to transmitters, transceivers and Multicoupler VT231 in receiving systems
- RX REM BUS: interface between receivers and multicoupler within one Adapter KR231A8

REM BUS-specific auxiliary equipment and software (see table below) together with commercial modems enable a PC-controlled operation over unlimited distances at an excellent price/performance ratio.

Features and benefits

The Series 200 REM BUS offers more benefits for the customer than may be assumed at the first glance: this concept sets new dimensions for control and monitoring of modern radio systems.

REM BUS features:

- **Economical**
  as regards purchase and life cycle
  - by avoiding costs for unnecessary service trips to detach outer stations
  - by saving costs for customized software: the Software GC201-S includes the operation of a great variety of possible system configurations
- **Versatile and flexible** in application: complex system configurations and unlimited distances are no problem
- **Highly compatible**
  with conventional parallel and the Series 200 audio INBAND control technique in complex control and monitoring scenarios. Thus hybrid solutions can be realized which may be the only way to satisfy customer-specific operational needs
- **Easy-to-use** for supervising and maintenance diagnosis:
  Via the colour monitor of the PC the operations and/or maintenance supervisor can control and monitor a great variety of functions:

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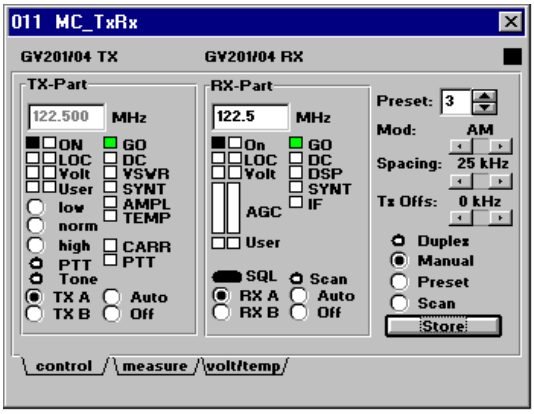
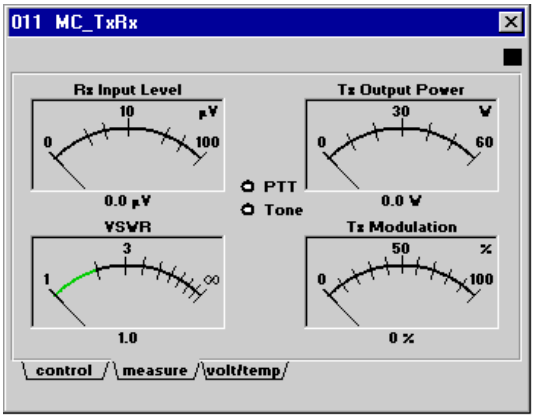
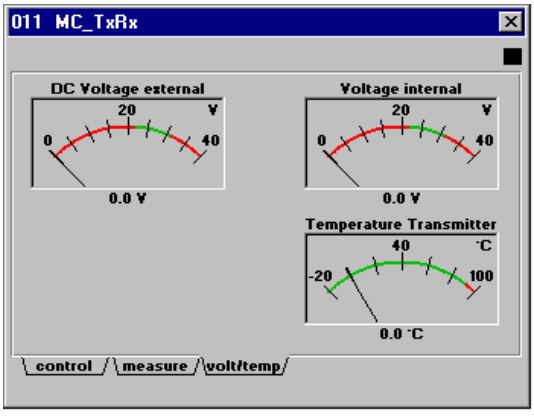
– **Control functions** for basic settings or periodic tests are manual (TXA or TXB, RXA or RXB) or automatic main/standby mode activation, PTT switching, low/normal/high RF power selection, SQL enable, user-definable functions (to switch on any customized device in the radio station) or IBIT activation, the latter enabling a vital receiver test at the actual frequency via an RF test generator as described earlier (see GT231T1).
With multichannel radios: storage of 100 preset channels, manual frequency setting, simplex or semiduplex/duplex mode, 25/8.33 kHz channel spacing, TX offset and TONE PTT (1 kHz)
– **Monitoring functions** for displaying the maintenance-relevant status of radios on the PC monitor, ie TX on/off, local/remote mode set, low/normal voltage, sum check CBIT GO/NOGO incl. PBIT (power-up test), detailed GO/NOGO checks of TX synthesizer and TX power amplifier, AC or DC powered, poor/good VSWR, nominal/overtemperature, receiving quality (AGC in 4 steps, including SQL) and user-definable indications from the radio station (eg burglar or fire alarm, emergency diesel generator activated upon AC supply defect, GO/NOGO from another equipment) – and all that integrated in the REM BUS data signals without extra devices.
With multichannel radios: quasi-analog indication (in 256 steps) of receiving quality (AGC incl. SQL), supply (V DC) and operating (V op) voltages, RF output power, modulation degree and VSWR

REM BUS Drive Unit GV201 (Photo 42000)







From top to bottom: multichannel-specific PC windows "CONTROL", "MEASURE" and "VOLT/TEMP" with a variety of new control and monitoring features

- **Convenient**
for commissioning and on-site maintenance, especially of larger systems with TX or RX stations on mountains far away from the RCM center. To enable easy and fast step-by-step commissioning of radio subsystems such as a TX station according to a precise time schedule (without being delayed by a defective or not yet available remote cable or microwave link) the installation of on-site remote RCM facilities (PC on REM BUS basis) is urgently recommended. The PC has undoubtedly great advantages for future and effective on-site maintenance.

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Series 200: REM BUS Control and Monitoring

Designation	Type	Order No.	Uses, specifications, features and benefits
REM BUS Drive Unit	GV201	6045.1440.xx	The GV201 includes circuitries for address decoding, symmetrical-to-asymmetrical signal conversion, logics, drivers, EMC filters and protections as well as AC/DC power supply. It enables diverse applications: – Connection of Series 200 single- and multichannel radios to one RS-232 COM port of the master PC (direct or via modems) – Connection of up to 7 split radio sites (with each GV201 installed within 1 km) via RS-485 bus – Connection of Control Units GB406C1 for multichannel radio access via RS-485 bus – Connection of a stationary or temporary (laptop) service PC – Automatic main/standby radio switchover of AF, PTT, SQL and other user signals eg TEST GO or ALARM (with special models 31 to 33): they enable the realization of the very economical "m+n" principle with "m" single- or multichannel main and "n" multichannel standby radios only See block diagram »Application examples for REM BUS based RCMS« on next page. Design: 19" 2 HU rackmount for installation into the radio rack Power supply: AC/DC supplied with auto switchover (with priority for AC)
		xx = 03	Model for **standard applications**
		xx = 31	Model for **"8+2" standby** concept (eg for 8+2 VHF TX)
		xx = 33	Model for **"dual 8+2" standby** concept (for 8 VHF + 8 UHF main units) or –
		xx = 32	model for **"16+2" standby** concept (16 VHF or 16 UHF main units)
RCMS PC Assembly Items	GC200-Z	6082.4110.xx	Project-specific RCMS components, finally selected for the actual contract, see Note 1
		xx = 02	4fold COM card, RS-232
		xx = 03	2fold COM card, RS-232
		xx = 04	Watchdog card
		xx = 05	Modem
		xx = 06	PC with keyboard and mouse
		xx = 07	Colour monitor 14"
		xx = 08	COM card, 8fold, RS-232
		xx = 09	Colour monitor 17"
		xx = 10	RCMS PC integration, configuration and test
		xx = 11	X-LINK maintenance and service package (X-LINK = Express LINK)
		xx = 14	Printer, ink-jet type
		xx = 17	8fold COM card, RS-422
		xx = 18	4fold COM card, RS-422
		xx = 19	Flat-panel display
		xx = ...	Other RCMS components; Note 2
RCMS Software	GC201-S	6045.1979.03	This universal and flexible software enables a great variety of radio system configurations including redundancy. It is installed on PC hard disk or comes on a 3.5" floppy disk and operates COM-card-controlled Series 200 single- and multichannel systems
REM BUS Accessories	—	—	Cable KS201C (.04) for RX REM BUS: see Series 200 accessories, page 133

Note 1: REM BUS controlled VHF/UHF radio systems are to be planned in close cooperation with Rohde & Schwarz headquarters. In case of contracted systems the project manager is in charge of final specifications, equipment definition and purchase.

Note 2: The REM BUS Controller GC201 (formerly used PC card in single-channel applications) is obsolete and no more used for new systems.

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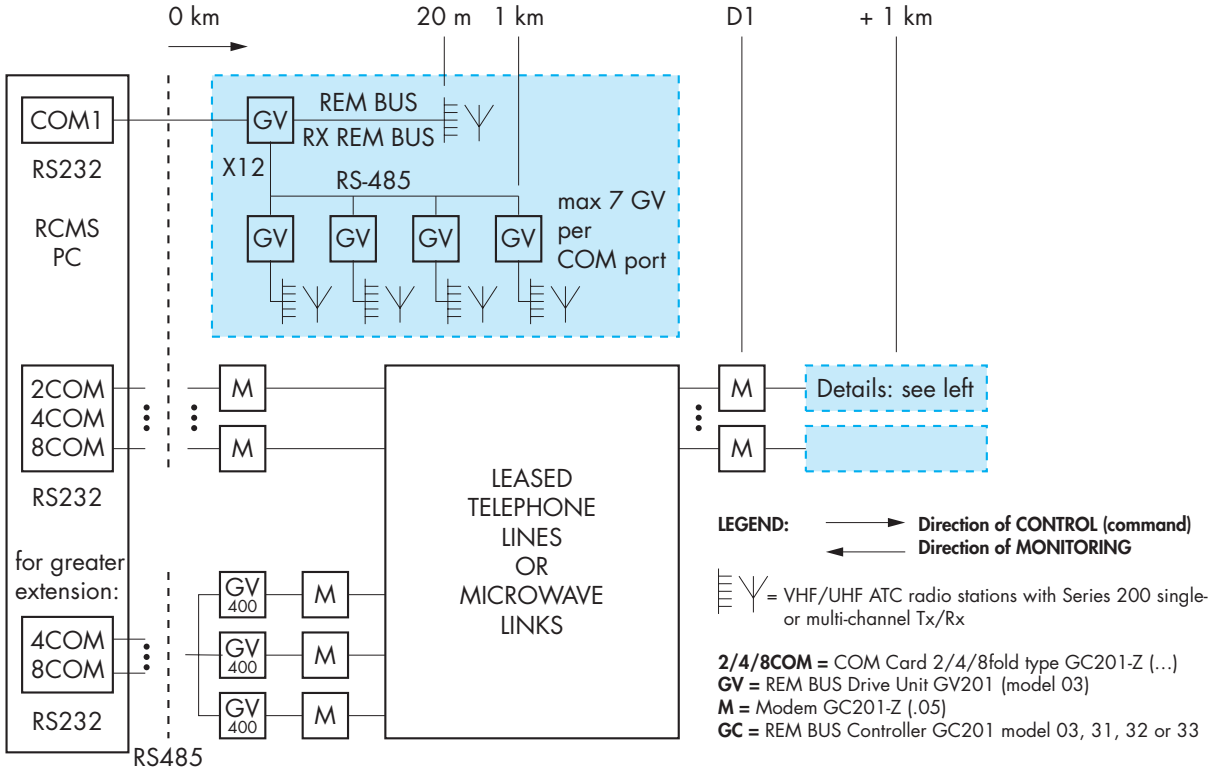
Application Examples for REM BUS Based RCMS



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Series 200: INBAND Control and Monitoring

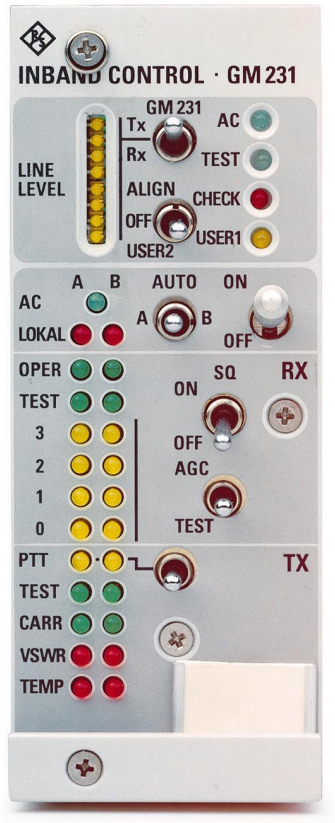

Photo 41981

Brief description

As mentioned in the section on REM BUS, modern and convenient ATC radio systems call for an intelligent and comprehensive remote control and monitoring system (RCMS). A Series 200 single-channel radio upgraded with the unique INBAND technique offers fast and simultaneous bidirectional voice and RCM data transmission via just one duplex (2-pair) telephone channel by cable or microwave link over unlimited distances. Use with multichannel equipment: on request.

Application

The INBAND technique offers RCM solutions for single-channel radios

- exclusively via a 2-pair duplex telephone channel per radio
- alternatively to REM BUS technique between the radio station and the supervisor's position and
- complementary to REM BUS technique: far off the radio station, in the supervision center, a special REM BUS interface for PC-controlled operation is also available in the INBAND Control Unit and with GM231A/D allowing hybrid solutions

The Series 200 INBAND technique enables:

- Operation from a supervising and/or maintenance center
- Remote status/failure diagnosis
- Unlimited distances
- Fast and simultaneous voice and RCM data transmission important for time-critical signal
- Verification of changed operational requirements
- Start of initiated RF tests
- Reaction to operational irregularities
- PC operation based on the widely known MS-DOS/Windows program (in hybrid systems, together with REM BUS technique)

INBAND-specific options and auxiliary equipment and firmware (see table on next page) enable supervision of radio stations

- via conventional control panels (GM231A/D) allocated to each channel and/or
- via a central PC workstation

Technique

The INBAND technique allows the simultaneous bidirectional transfer of more than 20 RCM functions via audio channels (cable or microwave link channel). The Series 200 INBAND technique is based on the intelligent combination of audio and special INBAND carrier frequencies:

- 2040 Hz for the direction to the radio
- 2440 Hz for the direction from the radio

These carrier frequencies are modulated with the RCM information. Modulations used are:

- FM (4-FSK) for time-critical information (PTT, AGC/SQL)
- AM for other information

These modulated carrier frequencies are superimposed onto the normal AF (audio) line or the 2nd pair of telephone lines respectively. At the receiving end the RCM information is filtered out again.

Features and benefits

Due to the variety of technical features the Series 200 INBAND technique offers a lot of benefits in respect of operation, convenience, maintenance and cost-efficiency:

- One duplex (2-pair) audio channel only per transceiver, transmitter or receiver or per 100%-redundant pair of said equipment, eg TXA + TXB, using the normal AF channel
- Easy integration:
  No need for DC wires or converters/modems; easy to integrate into the radios (plug-in type option INBAND Interface GM211) and existing infrastructures

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- Minimum life-cycle costs including expenditures for installation or leasing of telephone lines or microwave channels
- Excellent voice quality due to the applied decoupled 2-carrier method, the selection of the carrier frequencies from the range with low acoustic energy, the use of highly effective filtering (sharp notch filters) and microprocessor-controlled digital signal processing techniques
- High data transmission safety by integrated supervision and checks (parity bit), insensibility to induced voltages (DC-free coding), transmission-derived level correction factor for AGC, 4-bit telephone line level indication (LINE LEVEL LEDs of GM231A/D) to signal the line quality, and manually initiated frequency response correction (ALIGN switch of GM231A/D)
- Fast transmission of time-critical signals even in radio systems with a high number of channels due to the selected modulation
- Quick and safe channel performance check by CHECK LED of GM231 which stores any interim NOGO events of the radio
- Signalling of a user-definable function:
  The USER 1 LED on the GM231 front panel can indicate to the supervisor any event in the remote radio station, eg critical room temperature, burglar or fire alarm
- Transmission of a user-definable function:
  The USER 2 switch on the GM231 front panel enables the supervisor to initiate any event in the remote radio station: Series 200 radios offer an interface for switching user-specific installations on/off
- Customized INBAND firmware possible due to microprocessor and digital technology, eg numerical-controlled carrier-frequency oscillator or digital filtering

INBAND Options and Auxiliary Equipment

Designation	Type	Order No.	Uses, specifications, features and benefits
INBAND Interface	GM211	6047.8693.20	Option, plug-in module for – EU/ED231 (single-channel RX units of receivers or transceivers), – GI201S (interface 1 of single-channel transmitters) – GI200 (control unit of multichannel transmitter) or – GM231A/D
INBAND Control	GM231A/D		Auxiliary equipment, unit for an INBAND upgraded single-channel transceiver or TX + RX pair for one channel Installation site: central supervisor desk/rack RCM elements: control switches and LED indications for a great variety of RCM functions Design: 1/8 19" 3 HU plug-in module comparable to the Receivers EU/ED231A/D:
AC/DC	GM231A	6045.3142.20	GM231 + GM211 (integrated into GM231) + IN201A or GM231 + GM211 (integrated into GM231) + IN201D
DC	GM231D	6045.3242.20	Dimensions: same as EU/ED231A/D Power supply: same as EU/ED231A/D Housing: see KR 231A8 below
19" Adapter	KR231A8	6047.8441.02	Up to 8 GM231A8 can be housed in one KR231A8 for integration into a standard 19" desk/rack slot
INBAND Software	GM211-S[1)]	6045.3394.22	Standard software: factory-programmed into the INBAND Interface and INBAND Control (EPROM) for full-performance INBAND [3)]
		6045.3394.23	Customized software: 2040 Hz for PTT and SQL [2) 3)]
		6045.3394.25	Customized software: 2040 Hz for PTT [2)]
		6045.3394.xx	Other specifications: on request (eg with line equalizer/DFS)

1) GM211-S is an extra order item (same quantity as optional GM211 and GM231A/D units)

2) No other functions

3) For single-channel radios only

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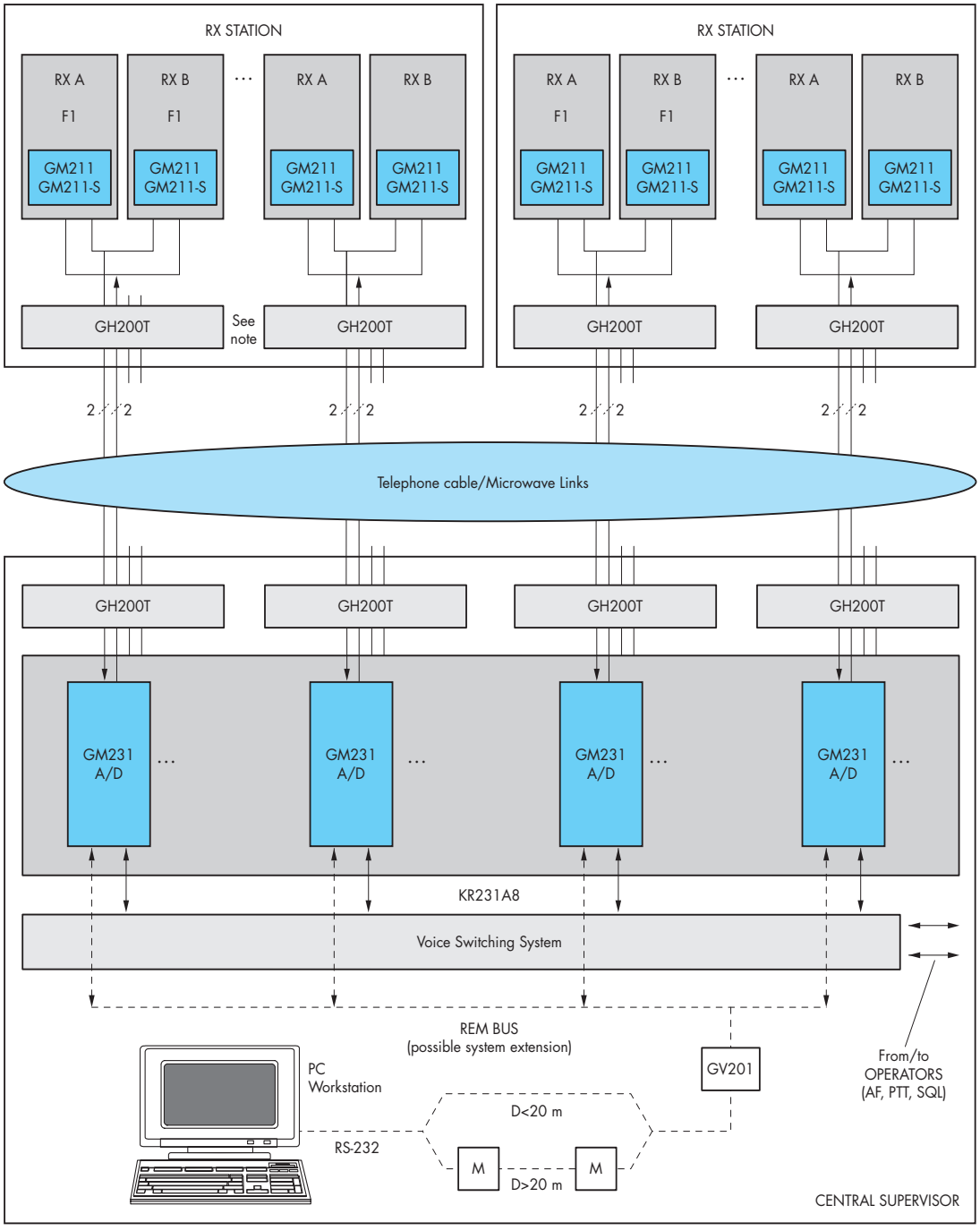
Application example for INBAND-based and hybrid RCMS



GM211 = INBAND Interface
GM211-S = INBAND Software
GM231A/D = INBAND Control (AC/DC or DC supply)
KR231A8 = 19" Adapter for 8 x GM231a/D
GH200T = Telephone Adapter (for 4 AF lines/1.5 kV isolation), needed to fulfil EN 41003/BZT safety guideline
GV201 = REM BUS Drive Unit

Notes:
1. The details for IBIT via VHF/UHF Multicoupler VT231 and Test Generator GT231T1 are not shown in the block diagram. The IBIT is initiated by the TEST switch of the GM231A/D.
2. The REM BUS extension is enhanced with some minor restrictions: slightly reduced control and monitoring functions, max. 32 GM231A/D, ie Fn = F16 maximum in the shown split site application

The block diagram demonstrates a hybrid solution of an INBAND-based single-channel radio system in connection with a REM BUS-operated PC workstation for the central supervisor as possible system extension.

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Series 200: Accessories

Designation	Type	Order No.	Uses, specifications, features and benefits
Audio Accessories			**Indispensable for local operation or test of transceivers and transmitters** (all types complete with mounted NF7 connector)
Headset	GA012	0693.7664.02	Including microphone, rugged type
Handset	GA013	0693.7712.02	Rugged type with handle-integrate PTT button and flexible coil cable
Headset	GA015	0583.6012.02	Including microphone
Microphone	GA016H1	0583.5568.02	Hand-held type
Cabinet	KK251	6044.7944.02	**For desktop installation of transceivers** 19" 3 HU; Series 200-specific design (eg with holes for rear power amplifier heat sink and cables)
Cable	KS201C	6047.9448.02	**For a RX main/standby pair** (RXA + RXB): for horizontal connection of 2 receivers installed in neighbouring slots of one 19" Adapter KR231A8
Cable	KS201C	6047.0448.03	**For a RX main/standby pair** (RXA + RXB): for vertical connection of 2 receivers installed in the same slot of two stacked 19" Adapters KR231A8
Cable	KS201C	6047.0448.04	**For RX REM BUS and DC supply** of VT231 (+ GT231T1), for connection of – Multicoupler VT231 and 3 receivers (RX5 to RX7) or – 4 receivers (RX1 to RX4). RX1 = RX in slot 1 Thus 2 cables are required for a completely equipped 19" Adapter KR231A8. This special flat-type bus cable has mating connectors to link two cables
Cable	KS201C	6047.0448.05	**For a TX main/standby pair (TXA + TXB):** for vertical connection of 2 transmitters, installed one above the other (with or without 1 U of 19" space)
Set of Mating Connectors	KS201	6047.9190.02	**For Power Supplies IN201A/D** which is part of the Receivers EU/ED231A/D or INBAND Control GM231A/D **Note:** The RF (BNC) plug type for the receive antenna cable depends on the feeder type and is therefore not included in the set. See comment on KS231.
Set of Mating Connectors	KS231	6050.8110.02	**For VHF/UHF Multicoupler VT231** IBIT (X11) and REM BUS (X15) connectors. The VT231 itself includes 7 fixed connected RF cables with mounted BNC plugs and graded lengths matching the associated receivers RX1 to RX7. **Note 1:** KS231 does not include RF connectors for antenna and cascading output (connector types depend on cable type) **Note 2:** For RX REM BUS connection X10 (including DC supply of VT231) with associated receivers the special cable KS201C model 04 is available (for details see above)
Set of Mating Connectors	KS251	6044.9699.02	**For all Series 200 transmitters and transceivers** (RF connectors excluded)
Service Kits, Frequency Tuning Kit			**See Series 200 Auxiliary Equipment (page 123)**

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Series 400U: VHF/UHF Multichannel Communication System – Overview

Brief description

Series 400U is a new AM/FM multichannel radio series for VHF (100 to 163 MHz) and UHF (225 to 400 MHz) for defense applications and civil aviation.

Example Series 400U: UHF Transceiver XD432U3 for SECOS ECCM application, shown with ECCM Processor GP407S1, Key Entry Device KED-370 and Control Unit GB406S (Photo 41977)

Overview

- Includes types for VHF, UHF and combined types for VHF and UHF
- Includes transceivers, transmitters and receivers
- Supplemented by power amplifiers, antenna filters and multicouplers for up to 300 W FM (UHF)
- Based on the very successful Series 400, which is in operation in over 80 countries with more than 18 000 radio units
- Combines the experience of the past with new design concepts to form an innovative program
- High-performance, reliable and cost-effective investment for the future with high upgrading potential

The main application of Series 400U is voice and data communication especially for defense use. For other customers and their special fields of application see also the table in the section »Basic product line information« for VHF/UHF on page 134.

Civil aviation

Series 400U radios are used for Emergency Backup ATC Communication, in addition to a conventional single-channel radio system for many simultaneous frequencies. They are added either as emergency radio units switched manually by the supervisor via the voice switching system to the controller's position or as standby transmitters embedded in redundant transmitting systems with automatic channel selection and main/standby switchover.

Defense

Series 400U has special features and benefits 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 complete the program. Series 400U includes HAVE QUICK ECCM radio equipment for the forces in NATO countries or associated countries or SECOS ECCM, with embedded COMSEC, for other export customers.

Fixed – transportable – mobile

Series 400U equipment is provided for fixed installation (in ground-to-air radio centers), for transportable use (in radio shelters) as well as for mobile application (in ships or vehicles). Series 400U is designed for installations in 19" racks. Its modular concept provides cost-effectiveness. As the modules are of identical design and interchangeable they can be used with different types of equipment without modification. Excellent specifications, careful system engineering, proven quality and convincing logistic and serviceability as part of our philosophy are prevalent in this series. In the following the features and benefits demonstrate its excellent price/performance ratio in detail.

Features and benefits

The complete program

The customers benefit from the fact that Series 400U is an integral part of a complete VHF/UHF program. Rohde & Schwarz has committed itself to system-engineering solutions »From the microphone to the antenna« for complex and interference-free radio systems. In detail the benefits for the customer are:

- Advantage of ordering complete packages
- Prewired and tested subsystems available
- Delivery in complete lots
- Responsibility in one hand

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Front-load and rear-load modularity
Extended and clearly arranged modular design on plug-in basis, the use of identical modules throughout the series and their guaranteed interface specifications guarantee:

- Highest degree of universality and system configuration flexibility
- Reduced prices due to cost-effective production
- Low-cost for logistics and training
- Reduced service periods and costs: quick access to the modules, repair by customer within minutes with MTTR values of 5 to 15 minutes on LRU basis, no time-consuming realignments after module interchange (except basic configuration settings by jumpers/switches)

Guaranteed specifications, tested and proven quality
Some arguments for »bought quality« are:

- Specifications to be within the assured tolerances are certified by protocol before delivery
- Highest QA (quality assurance) standards for hardware and software to DIN ISO 9001 and NATO AQAP-1
- 5-day burn-in of modules being switched on/off many times at temperature cycles from –20 to +55°C
- Customers' references for attained MTBF values

Implementation of customer-specific requirements
The high operational flexibility and adaptability of Series 400U is explained by:

- Great configuration variety by basic modules, optional or custom-tailored interfaces or auxiliary equipment
- Great variety of internal jumper settings for adaptation exactly to customer-specific operational needs

Extended operational flexibility and convenience
Compared with the preceding Series 400 the transceivers of Series 400U have new operational features, such as:

- 100 preset channels and prepared for up to
- 100 nets (ECCM)
- 50 RX + 50 TX half-duplex channels
- 100 scanning channels
- 8.33 kHz channel spacing
- 75 W UHF FM maximum
- 100 W UHF FM with IZ450 add-on
- Fast and robust TX/RX PIN diode antenna switch for special applications: FH, data link or 75 W/100 W UHF FM
- Improved interference-free operation (see below)
- Variety of growth potential (see below)
- High local and remote control convenient, eg self-test routine, LED display, keypad, RS-232-C/RS-485 control as well as DTMF-coded remote control via AF/telephone line (see below)

Improved interference-free operation, even under collocation conditions
To solve the collocation (co-site) problem where many transmitters and receivers – mostly under critical antenna decoupling conditions – have to work simultaneously and interference-free, Series 400U offers:

- Receivers with optimum large-signal behaviour: excellent specifications for desensitization, intermodulation etc together with high sensitivity and a wide dynamic range are achieved by large-scale multipole filters, wideband design and pure passive design (without any amplifier) of the front-end RF unit. For UHF even four subband filters are used for maximum efficiency
- UHF circulator (option), in front of the harmonics filter of the power amplifier offering effective reduction of backward intermodulation, ie high suppression of the retransmission of unwanted inband and outband 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 applications in RX mode
- TX/RX filters (option)
  - for fixed-channel and FH applications
  - for TX and RX mode
- RX protection devices integrated as standard
  - in the TX/RX PIN diode switch of transceivers and type U3 (SECOS) transmitters
  - in the EMP filter of the receivers

In addition

- highly selective and powerful filter/combiners
- highly decoupled stacked antennas and
- computerized frequency management programs etc

support successful system engineering and co-site operation.

Variety of growth potential
Due to the offered

- principle of front and rear modularity
- choice of alternative module types (eg for synthesizer, IF/AF unit, RF related interfaces)
- options (eg interfaces) and auxiliary units

the basic radio models can easily and cost-effectively be upgraded for different applications/operating modes in a single step.

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Local radio control

Via the keyboard and the alpha-numeric and window-structured LED display of Control Unit GB453 seven modes are possible:

– Frequency mode
– Channel mode
– Scanning mode (receivers and transceivers)
– Load mode (channels/nets)
– Setup mode

to define important parameters, eg 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 are helpful for fast status checks.

Remote control

Depending on the used interface options Series 400U communication equipment offers a great variety of remote control possibilities:

- V.24/RS-232-C/RS-485: point-to-point or bus operation via separate control lines from GB406-type control units or System Processor GB856C
- DTMF (Dual Tone Multiple Frequency) code according to CCITT recommendation Q 23: point-to-point operation via private or public telephone (= AF) line, saving costs for leased lines

To guarantee the backward compatibility with existing control units Series 400U radios can also be operated via the following interfaces:

- V.11 (X.27)/RS-422-A: symmetrical double-current serial F-type interface, known from radios like XT452F, thus backward compatibility with Control Units GB408 and GB404
- Parallel (N-type) interface: backward compatibility with Control Units GB403 as used with the former Series 400 N-type radios such as XT452N or with automatic switchover units

For Control Units GB406, Control Software (Firmware) GB406-S and Bus Coupler GV400 please refer to pages 148 to 150.

Further features and benefits

Please refer to the individual equipment types in the following.

Specifications – in brief [1]

Frequency	
VHF	100 to 162.975 MHz for details please refer to the »Quick Type Guide« and the relevant specifications
UHF	225 to 399.975 MHz
Channel spacing	25 kHz, 8.33 kHz on request, 75 kHz BW for conferencing (HQ)
Preset channels	
Simplex	100 TX/RX channels
Semi-duplex	50 TX and 50 RX channels
Operating modes	
Fixed-channel mode	simplex or semi-duplex
Scanning	
Offset (climax) mode	on request (U8 type TX)
ECCM	HAVE QUICK (SFH) and SECOS (MFH) types
COMSEC embedded	with SECOS ECCM
LINK 11	
Modulations	
Voice	A3E, F3E
Data NB	WBSV baseband AXX, FM (FSK)
Data WB	WBSV diphase AXX, FM (FSK) FSK/MSK, LINK Y, LINK 11 on request
Power supply	
Transmitters and transceivers	
AC	110/115/215/230 V –10/+15%, 47 to 63 Hz
DC	22 to 31 V
AC/DC	automatic switchover
Receiving equipment	
AC	115/230 V ±15%
DC	22 to 31 V
AC/DC	automatic switchover

Sensitivity	
for standard models without options for (S+N)/N = 10 dB, weighted to ITU-T, f_m = 1 kHz,	
AM (m = 0.3)	≤1.5 µV VHF ≤1.8 µV UHF
FM (3.5 kHz dev.)	≤1.2 µV VHF ≤1.5 µV UHF
RF carrier power	
for 50 Ω antenna load	
MEDIUM power	
Nominal power for nominal AC supply voltage –10/+15% or 24 to 31 V DC	
VHF	AM: 50 W +1/–0.5 dB FM: 75 W +1/–0.5 dB
UHF	AM: 30 W +1/–0.5 dB FM: 45 W +1/–0.5 dB
Increased UHF power	FM: up to 75 W, internally settable
LOW power	P/n, remotely selectable, with n = 1 to 5 internally settable
HIGH UHF power	100 W FM, >90 W FM (24 V DC) with additional Power Supply IZ450, switchable to MEDIUM power
Tests	
Power-up	automatic test routine (5 s/LED display)
Continuous built-in test (CBIT)	test LEDs on modules and control units
Remote control and monitoring	see pages 148 to 150
Environment	
Operating temperature	–20 to +55°C
Storage temperature	–40 to +70°C
Humidity, vibration, shock, EMC and electrical safety	to MIL-STD, DIN-IEC 68, VDE or EN standards

1) Depending on basic type, model or options/add-ons as per data sheet

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Series 400U: Quick Type Guide to Basic Units

Designation	Type	Remarks
Basic Units		For further application-specific details like – standard (fixed-channel) – SECOS – HAVE QUICK – DATA – special configurations see following sections and data sheet
Transceivers (XCVR) VHF: 100 to 162.975 MHz UHF: 225 to 399.975 MHz VHF/UHF combined	 XU452U(.) eg »U8« for 8.33 kHz channel spacing or HAVE QUICK application XD432U(.) eg »U3« for SECOS application XT452U(.)	 VHF band limits [1)] VHF band limits [1)]
Transmitters (TX) VHF: 100 to 162.975 MHz UHF: 225 to 399.975 MHz VHF/UHF	 SU452U(.) SD432U(.) ST452U(.)	 VHF band limits [1)] VHF band limits [1)]
Receivers (RX) VHF: 100 to 162.975 MHz UHF: 225 to 399.975 MHz VHF/UHF combined	 EU45(.)U ED45(.)U ET45(.)U	
Power Supply	IN404U	AC/DC, for 2 receivers
19" Adapter	KR400U model 12 KR400U model 22	for 1 receiver and power supply for 2 receivers and power supply
Options, Auxiliary Equipment and Accessories		see from page 144 onwords and Series 400U data sheet

1) VHF band limits (of TX/RX synthesizer) are user-programmable via GB453 in set-up mode

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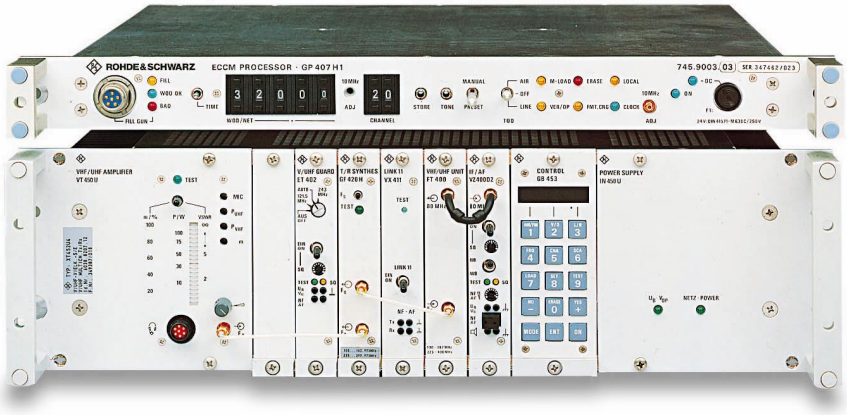
Series 400U: VHF/UHF Multi-Channel Transceivers

VHF XU452U(.)

UHF XD432U(.)

VHF/UHF XT452U(.)



VHF/UHF Transceiver XT452U4 and ECCM Processor GP407H1 for HAVE QUICK ECCM application in UHF and for fixed-channel application in VHF and UHF bands (Photo 41967)

Brief description

For basic information please refer to the »Basic Product line information« (page 99) and Series 400U overview (page 134).

Application

The transceivers can be used as stand-alone units for standby or in a multiple and simultaneously operating radio system if well-decoupled separate TX and RX stations cannot be realized eg on ships. Special features and options are provided so that co-site problems can be solvedto achieve interference-free operation. The Series 400U program includes VHF, UHF and combined VHF/UHF transceivers for standard voice, special data and/or ECCM applications described earlier in this catalog.

Design

The modular system is extremely compact, flexible and cost-effective. The Series 400U transceivers and transmitters are of nearly identical design and use the same 19" adapter, power amplifiers and power supplies with generously dimensioned heat sinks and a maximum number of identical modules. The availability and skillful integration of alternative modules, options and accessories result in a complete and reliable package. Thus various transceiver configurations are possible with low overall life-cycle costs.

Features and benefits

For general Series 400U features and benefits please refer to the overview (page 134). In the following, only transceiver-specific features and benefits are listed:

Features	Benefits for customer
Continuous operation – Convection cooling – Generously dimensioned heat sink – Gradual power degradation in case of adverse operating conditions – Automatic switching off at critical temperature – Increased 100 W FM UHF output with additional Power Supply IZ450	**High communication link reliability**
Excellent spectral purity – Low-noise synthesizer – Careful wideband design of power amplifier etc (minimizing non-linearity product emission) – Harmonics filter – UHF Circulator Set GD430U as optional submodule for installation into Power Amplifiers VD430U or VT450U: Integration in front of harmonics filter yields maximum efficiency. As a broadband type it featuresFH capability – TX/RX Filters F(.)403TR options provided for insertion into the TX and RX path and physical integration into special slots of the transceiver. They have FH capability	**Interference-free operation** even under co-site and ECCM (FH) conditions
Transceivers include a common TX/RX synthesizer for TX and RX mode	**Economical solutions also for special ECCM applications** Half-duplex operation via 50 preset RX and 50 TX channels
Alternative types for each of the following modules – TX/RX synthesizer – IF/AF unit	**Future-proof and cost-effective realization** and upgrading potential, eg for ECCM or 8.33 kHz channel spacing
Great variety of – basic units – type models – options	**High system flexibility,** including interface adaptability for control, monitoring and antenna requirements
Designed as 19" 3 HU plug-in unit – Front and rear loaded plug-in modules – Space for instant or future insertion of options – Swivel-type design of power amplifier submodules for ideal accessibility for tests under full operation; heat sink and flexible cabling between amplifier and submodules remain connected	**Economical and future-proof design, excellent serviceability**

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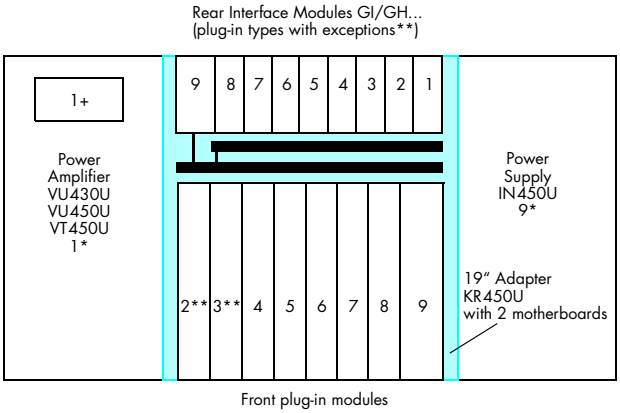

Top view of a transceiver

*) Screwed to 19" Adapter KR450U
**) All coax-related rear units, GI420U and side modules include additional manual cable connections

Slot	Front and side modules	Type
1	Power Amplifier VHF UHF VHF/UHF	 VU450U VD430U VT450U
1+	UHF Circulator Set	GD430U [1]
2	VHF/UHF Preselector	FT402 [1]
3	VHF/UHF Guard Receiver	ET402 [1]
2+ 3	Alternatively to 2/3 above: TX/RX Filter (fills both slots) VHF UHF VHF/UHF Loudspeaker	 FU403TR [1] FD403TR [1] FT403TR [1] GA400 [1]
4	TX/RX Synthesizer: Standard (in U1/U2 radios) HAVE QUICK (in U4 radios) SECOS (in U3 radios) Standard 8.33/12.5/25 kHz/HQ (in U8 radios)	 GF420 GF420H GF430 GF420U
5	LINK11 Module	VX411 [1]
6	RF Unit of RX: VHF UHF VHF/UHF	 FU420 FD400 FT400
7	IF/AF Unit: Standard (in U2 radios) WB/HQ/SECOS (in U1/U3/U4/U5/U8) Standard 8.33/25 kHz (in U8 radios)	 VZ400D VZ400D2(.03) VZ400D2(.08)
8	Control Unit	GB453
9	Power Supply	IN450U

[1] options

Modularity

The modular architecture includes different unit types:

- Central 19" Adapter KR450U (10) with 2 motherboards,
- Side modules (1 and 9) which are screwed to the 19" adapter to form a compact 19" plug-in unit
- Internal submodule (1+)
- Front plug-in modules (2 to 8) and
- Rear Interface Modules GI... (1 to 9)

For more details (basic, alternative and rear modules, options, applications etc) please refer to chapter »Series 400U: Options« (page 144) and Series 400U data sheet.

Specifications

- Series 400U overview and quick type guide
- Series 400U data sheet

Ordering information

Due to the extensive transceiver product line with various
- type versions, eg U3 or U8
- type models, eg 12, and
- options tailored to applications

Please refer to the designations listed in the Series 400U data sheet for correct order numbers.

Rear view of a Series 400U transceiver with optional interfaces (Photo 41962)

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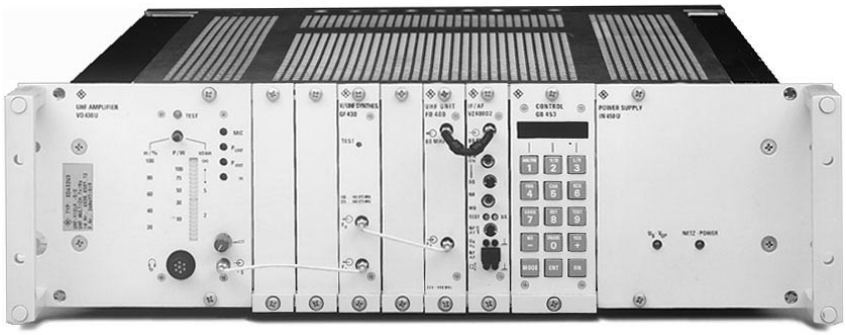
Series 400U: VHF/UHF Multichannel Transmitters

VHF **SU452U(.)**

UHF **SD432U(.)**

VHF/UHF **ST452U(.)**



UHF transmitter SD432U3 for SECOS ECCM application (Photo 41961)

Brief description

For basic information please refer to the »Basic Program Information« (page 104) and Series 400U overview (page 134).

Application

Separate transmitters and receivers are required for systems engineered for interference-free simultaneous operation on many frequencies and for installation in TX and RX stations. The Series 400U program includes VHF, UHF and combined VHF/UHF transmitters for standard voice, special data and/or ECCM applications described earlier in this catalog.

Design

The modular system is extremely compact, flexible and cost-effective. The Series 400U transmitters and transceivers are of nearly identical design and use the same 19" adapter, power amplifiers and power supplies with generously dimensioned heat sinks and a maximum number of identical modules. Frequency and power relevant modules differ as well as the antenna interface (see page 146). The availability and skillful integration of alternative modules, options and accessories result in a complete and reliable package. Thus various transmitter configurations are possible with low overall life-cycle costs.

Features and benefits

For general Series 400U features and benefits please refer to the overview (page 134). In the following, only transmitter-specific features and benefits are listed:

Features	Benefits for customer
Continuous operation – Convection cooling – Generously dimensioned heat sink – Gradual power degradation in case of adverse operating conditions – Automatic switching off at critical temperature – Increased 100 W FM UHF output with additional Power Supply IZ450	**High communication link reliability**
Excellent spectral purity – Low-noise synthesizer – Careful wideband design of power amplifier etc (minimizing non-linearity product emission) – Harmonics filter – UHF Circulator Set GD430U as optional submodule for installation into Power Amplifiers VD430U or VT450U. Integration in front of harmonics filter yields maximum efficiency. As a broadband type it features FH capability – TX/RX Filters F(.)403TR options provided for insertion into the TX and RX path and physical integration into special slots of the transmitter. They have FH capability	**Interference-free operation,** even under co-site and ECCM (FH) conditions

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Modularity

The modular design of the transmitters is comparable with that of the transceivers: see description and drawing on page 139.

Exceptions are:

- Receiving modules (RF unit, IF/AF unit, preselector and guard receiver)
- Antenna interface without TX/RX switch as standard, exception U3 type transmitters where a diode switch is used (to enable the SECOS-specific fast RF power-off switching when changing the frequency)

Specifications

- Series 400U overview and quick type guide
- Series 400U data sheet

Features	Benefits for customer
Alternative types for each of the following modules – Synthesizer – TX/RX diode switch (needed for SECOS even in TX mode)	**Future-proof and cost-effective realization** and upgrading potential, eg for ECCM or 8.33 kHz channel spacing
Great variety of – basic units – type models – options	**High system flexibility,** including interface adaptability for control, monitoring and antenna requirements
Designed as 19" 3 HU plug-in unit – Front and rear loaded plug-in modules – Space for instant or future insertion of options – Swivel-type design of power amplifier submodules for ideal accessibility in case of tests under full operation; heat sink and flexible cabling between amplifier and submodules remain connected	**Economical and future-proof design, excellent serviceability**

Ordering information

Due to the extensive transmitter product line with various
– type versions, eg U3 or U8
– options tailored to applications
please refer to the designations listed in the Series 400U data sheet for correct order numbers.

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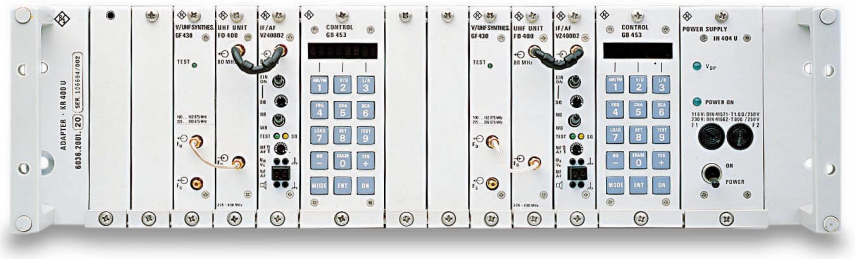
Series 400U: VHF/UHF Multichannel Receiving Equipment and Receivers

VHF **EU45(.)U**

UHF **ED45(.)U**

VHF/UHF **ET45(.)U**



Dual receiving equipment made comprising 2 receivers and Power Supply IN404U in 19" Adapter KR400U (Photo 42122)

Brief description

For basic information please refer to the »Basic product line information« (page 104) and Series 400U overview (page 134).

Application

Separate transmitters and receivers are required for systems engineered for interference-free simultaneous operation on many frequencies and for installation in detached TX and RX stations. The program includes VHF, UHF and combined VHF/UHF receivers for standard voice, special data and/or ECCM applications described earlier in this catalog.

Design

The modular system is extremely compact, flexible and cost-effective. Two receivers can be combined with one power supply to form a dual receiving equipment for 19" rack installation. The Series 400U receivers use a maximum number of identical modules. The availability and skillful integration of alternative modules, options and accessories result in a complete and reliable package. Thus various receiving equipment configurations are possible with low overall life-cycle costs.

Features and benefits

For general Series 400U features and benefits please refer to the overview (page 134). In the following, only receiver-specific features and benefits are listed:

Features	Benefits for customer
High sensitivity together with excellent specifications for large-signal behaviour and RFI suppression, eg for – desensitization – intermodulation – image rejection – IF rejection – Optional preselector or TX/RX filter plug-ins available for further improvement of specifications	**High communication link reliability** and interference-free operation, even under co-site and ECCM (FH) conditions
Alternative receivers using alternative module types: – Synthesizers – IF/AF units	**Future-proof and cost-effective realization** of receivers for special applications or simplified logistics; high upgrading potential, eg for ECCM or 8.33 kHz channel spacing
Great variety of – basic units – type models – options	**High system flexibility**, including interface adaptability for control, monitoring and antenna requirements
Same receiver modules used for – receiving equipment and – transceivers	**Cost-efficiency** and simplified logistics etc
Designed as 19" 3 HU dual plug-in unit – Two receiversplus one power supply can be accommodated in one 19" adapter – Front and rear loaded plug-in modules – Prewired slots for instant or future insertion of options	**Economial and future-proof design, excellent serviceability**

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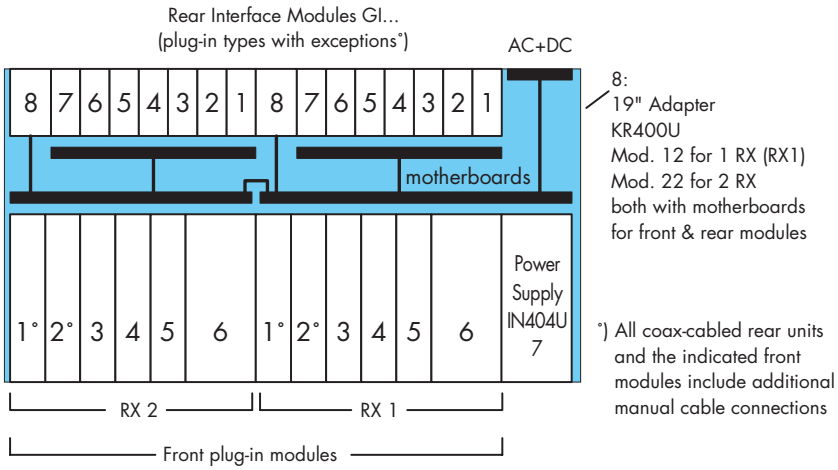
Modularity

The modular architecture includes different unit types:
- Central 19" Adapter KR400U (8) with 2 motherboards
- Front plug-in modules (1 to 7)
- Rear Interface Modules GI/GH… (1 to 8)

For more details (basic, alternative and rear modules, options, application etc) please refer to chapter »Series 400U: Options« (page 144) and Series 400U data sheet.



Top view of dual receiving equipment (with 2 RX)

Specifications

- Series 400U overview and quick type guide
- Series 400U data sheet

Ordering information

Due to the extensive receiver product line with various
- type versions, eg ED453U or EU458U
- type models, eg 12, and
- options tailored for applications

please refer to the designations listed in the Series 400U data sheet for correct order numbers.

Slot	Front modules	Type
1	VHF/UHF Preselector	FT402 [1]
2	VHF/UHF Guard Receiver	ET402 [1]
1 + 2	Alternatively to 1/2 above: TX/RX Filter (needs both slots) VHF UHF VHF/UHF Loudspeaker	 FU403TR [1] FD403TR [1] FT403TR [1] GA400 [1]
3	Synthesizer: RX Synthesizer TX/RX Synthesizer: Standard HAVE QUICK SECOS Standard 8.33/12.5/25 kHz/HQ	 GF400 GF420 GF420H GF430 GF420U
4	RF Unit of RX: VHF UHF VHF/UHF	 FU420 FD400 FT400
5	IF/AF Unit Standard Data WB/HQ/SECOS Standard 8.33/25 kHz	 VZ400D VZ400D2(.03) VZ400D2(.08)
6	Control Unit	GB453
7	Power Supply	IN404U

1) Options

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Series 400U: Options

Front and inside options

GD430U is an inside option, all the other listed types are front options. For the slot assignment of options, please refer to the drawings »Modularity« on page 139 (transceivers, valid also for transmitters) and page 141 (receiving equipment).

Designation **Order No.** **Type**	**Uses, specifications, features and benefits** Applicable to receivers (RX), transmitters (TX) or transceivers (X) →	**R X**	**T X**	**X**
VHF/UHF Guard Receiver 0621.8012.02 ET402	– Complete independent crystal-controlled dual receiver – For simultaneous reception (monitoring) of the normal operating frequency (main receiver) and the international distress frequencies in the VHF (121.5 MHz) or UHF range (243 MHz) – VHF/UHF switchover: – manual by front panel switch or – automatic depending on the main receiver frequency range – Antenna connection: – via main receiver or – via separate Guard RX Antenna Interface GI417U (option) – Special transceiver models (eg .27 + .28) allow two ET402 to be inserted in parallel for simultaneous monitoring of the VHF and UHF distress frequency – Sensitivity: ≤2.5 µV (VHF)/≤3 µV (UHF) (m = 0.3; f_m = 1 kHz; S + N / N = 10 dB, weighted to CCITT) – Image rejection: ≥80 dB – Design: $^1/_{16}$ 19" front modules	•		•
VHF/UHF Preselector 0622.1011.02 FT402	– Automatically tuned filter, interfaced in front of the receiver RF unit – For improvement of reception under critical collocation conditions: this option protects especially against strong far-off transmit frequencies. FT402 does not replace high-selectivity filters such as FD221 for nearby-interference suppression – Selectivity: bandwidth ≤13 (25)% VHF/≤16 (29)% UHF at 10 (15) dB – Permissible input level without damage: 50 V EMF (f ≤30 MHz)/15 V EMF (f >30 MHz) – Insertion loss: typ. 3 dB (≤4 dB) – Tuning time: ≤200 µs – Design: $^1/_{16}$ 19" front module	•		•
VHF/UHF TX/RX Filter 6074.5010.02 FT403TR **VHF TX/RX Filter** 6074.4014.02 FU403TR **UHF TX/RX Filter** 6074.4514.02 FD403TR	– Combined pre/postselector filters for receive and transmit mode – For improvement of reception quality (desensitization, IF and image rejection) under critical co-site conditions – For improvement of transmission quality (sideband noise) – For reduction of necessary TX-to-RX antenna decoupling for interference-free operation – For fixed-channel or FH mode – Automatically tuned, switched and interfaced – in front of RX VHF/UHF Unit FT400 (RX mode) or – between synthesizer and power amplifier (TX mode) – Included: – Logic circuits for frequency data encoding, go/nogo status etc – 2-pole filters – Fast GaAs FET switches – Low-noise amplifiers for loss compensation – Lowpass filters as lightning protection – Selectivity: bandwidth ≥2.2% at 3 dB and ≤13.3% at 30 dB – Tuning time: 10 µs – Design: $^2/_{16}$ 19" front module	•		•

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Designation Order No. Type	Uses, specifications, features and benefits Applicable to receivers (RX), transmitters (TX) or transceivers (X) →	RX	TX	X
Loudspeaker 0713.7405.02 GA400	– For local operation – In combination with handheld Microphone GA016H1 (transceivers)	•		•
LINK 11 Module 6009.6500.02 VX411	– For operation with wideband AF signals in LINK 11 mode for special data transmissions in defense applications (NATO) – For use in conjunction with IF/AF Unit VZ400D2 and Cipher/LINK 11 Interface GI412U – LINK 11 specification acc. to STANAG 5511 (2nd edition) and MIL-STD-188-203-1 (para. 4 and 5) – Design: $^{1}/_{16}$ 19" front module **Note:** For stand-alone RX equipment VX411 is not required for LINK 11 operation (VZ400D2 and GI412U are sufficient)		•	•

UHF Circulator Set
6063.6256.02
GD430U
	– For interference-free transmission under critical collocation conditions, ie many transmitting antennas cosited
	– For reduction of the TX intermodulation by increasing the backward intermodulation attenuation
	– Suppression or reduction of unwanted mixture products which are generated in the transmitter in an electromagnetic environment and which interfere with the actual frequency band
	– Integration: the circulator module 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
	
	Note: A VHF circulator can also be interfaced at jumper-supported soldering points in front of the harmonics filter. Due to its size it will be mounted into the radio structure
			•	•

Rear options (interfaces)

- The following information is extensively abbreviated. Details (other applications, module slot information etc) for exact system planning should be looked up in the relevant data sheets.
- For some applications (eg ECCM) several options and auxiliary equipment are required.
- Not listed are antenna-related interfaces which are part of the ordered basic radio model, eg TX/RX Diode Switch GI430, Antenna Interface GI418U (.12) for separate TX + RX antennas, TX Antenna Interface GI429U or EMP Filter GH415. The options are listed alphabetically to types:

Designation Order No. Type	Uses, specifications, features and benefits Applicable to receivers (RX), transmitters (TX) or transceivers (X) →	RX	TX	X
WB/FREQ Interface 6039.5001.02 GI411U	– WB AXX data communication – External AGC indication – ECCM operation	•	•	•
Cipher/LINK 11 Interface 6039.5501.02 GI412U	– Cipher operation with stand-alone KY-58 cipher unit (operated without HQ ECCM processor in fixed-channel mode) – Cipher operation with other COMSEC devices (TDB) – With control facility of plain or cipher text, baseband (NB) or diphase (WB) – LINK 11 modem connection	•	•	•

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Designation Order No. Type	Uses, specifications, features and benefits Applicable to receivers (RX), transmitters (TX) or transceivers (X) →	RX	TX	X
AF/V24 Interface 6039.6008.02 GI413U	– AF line connection (not required for AF in connection with DTMF) – PTT via separate or AF phantom line – V24/RS-232-C/RS-485 bus control – Cipher operation – ECCM operation – AF level control: ALC (automatic level control) amplifier included – Separate GUARD RX AF outputs – Relay outputs for TEST, CARRIER and/or MAIN RX SQUELCH and – SQUELCH of GUARD RX 1 + 2 (recommended for special transceiver type models for two ET402)	•	•	•
Filter/PA Interface 6039.6508.03/04 GI414U	– Control of 1 (2) automatically tuned filter(s) – Control of 1 (2) Rohde&Schwarz linear power amplifier(s) **Note:** Model 04 is for 2 filters and amplifiers each	•	•	•
MPA Interface GI415U	– Control of non-Rohde&Schwarz medium/high power amplifiers – Specifications: customized		•	•
DTMF Interface 6039.7504.03 GI416U	– DTMF (Dual Tone Multiple Frequency) code radio control (incl. AF) according to CCITT recommendation Q 23 for Control Units GB406C3/H3/S3 – V.11 (X.27)/RS-422-A (Series 400 F-type) radio control: for Control Units GB404 or GB408 – PTT by 2040 Hz tone via AF line (with tone-operated switch and filters) MAIN/STANDBY switching – Customer-specific I/O ports, controlled from a PC or by DTMF, allowing the display of user-definable tests (BIT) via Control Units GB406C/H/S…	•	•	•
Guard RX Antenna Interface 6040.8446.12 GI417U	– Connection of two additional and separate VHF and UHF guard RX antennas (or of one VHF/UHF Dipole HK014 via Diplexer FT224) – Additional multipurpose RF socket for special customized applications, eg for an external drive unit – 3 BNC sockets	•		•
Antenna Interface 6048.7449.13 GI418U	– Connection of additional antennas, eg in ECCM radio systems – Addition to TX/RX switch (in U3 type transceivers, model 13, this combination is included as standard) **Note:** There is also GI418U model 12 which is used as standard alternatively to the TX/RX switch in transceiver models 13 and 28 etc			•
AF/Telephone Interface 6076.3515.02 GI419U	– AF line connection – TX and RX AF/telephone line protection – With 1.5 kV isolated 600 Ω transformers to protect the radio/operator acc. to EN 4103/BZT guideline – With lightning fine protection – PTT via phantom circuit – Transmitting 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	•	•	•
DC/100 W FM Interface 6048.9941.02/03 GI420U	Model 02 and 03: DC supply of Control Units GB406C/H/S… Model 03: Connection of Power Supply IZ450 for 100 W FM UHF operation	•	•	•
Parallel Interface 6048.6994.02 GI421U	Parallel control via previous Series 400 N-type interface – from Control Unit GB 403 – from other N-type equipment	•	•	•
Link 11 Interface 6076. 6014.02 GI422U	– Link 11 modem connection if COMSEC is not required – Link 11 squelch signalling **Note:** VX411 is not required for this application	•	•	•

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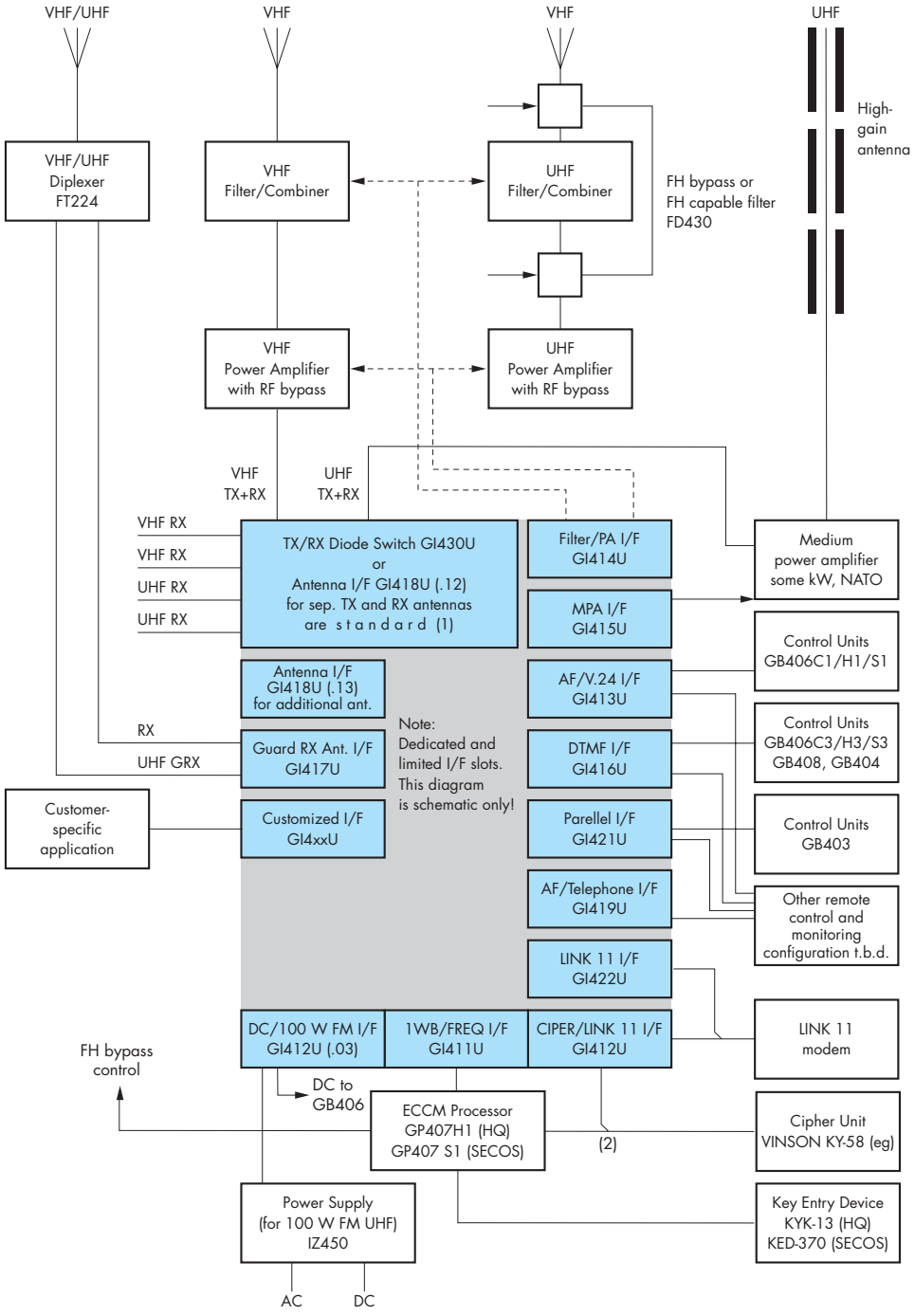
Series 400U: Interface Application



Legend: I/F = Interface
HQ = HAVE QUICK (NATO ECCM procedure)
SECOS = Secure ECCM Communication System
(1) Depending on model .umber
(2) VINSON KY-58 connected to GP407H1. For systems without ECCM processor VINSON KY-58 is connected to GI412U

Series 400U: Transceiver system block diagram

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Series 400U: Auxiliary Equipment

For ground-to-air and naval radiocommunications

A great variety of remote control possibilities is available for the Series 400U communication equipment, depending on the used interface options:

- V.24/RS-232-C/RS-485: point-to-point or bus operation via separate control lines from GB 406-type control units, or system processor GR2000/2000X
- DTMF (Dual Tone Multiple Frequency) code according to CCITT recommendation Q 23: point-to-point operation via private or public telephone (= AF) line, saving costs for leased lines

To guarantee the backward compatibility with existing control units the Series 400U radios can also be operated via the following interfaces:

- V.11 (X.27)/RS-422-A: symmetrical double-current serial F-type interface, known from radios like XT425F, thus backward compatibility with Control Units GB408 and GB404
- Parallel (N-type) Interface: backward compatibility with Control Units GB403 as used with the former Series 400 N-Type radios such as XT452N or with automatic switchover units

Control Unit GB406S1 (Photo 41973)

Control Units GB406 (.)

Uses, specifications

Control and monitoring units for operators or supervisors for
- point-to-point operation (1 GB 406 + 1 radio; D ≤ 2km)
- addressed operation (1 GB406 + n radios; D ≤ 2km)
- multiple bus operation (m GB 406 + n radios; D ≤ 2km with m + n ≤ 10);

bus access according to CSMA/CD procedure (Carrier Sensed Multiple Access with Collision Detection).
Note 1: In this connection a »radio« may be a TX/RX or separate transmitter plus receiver.
Note 2: DTMF-controlled radio systems require point-to-point operation.
Note 3: For m + n > 10 Bus Coupler GV400 (see next page) is required.

Features and benefits

GB 406 offers an illuminated keyboard, a 2 x 24 character LC display, AF facilities, standard NF7 type AF connector (suits available audio accessories); other specifications (eg LEMOSA connector) on request.

Built-in tests for covenient fault location:
- SBIT: start built-in test (automatically, after switch-on)
- CBIT: continuous built-in test (incl. radio)
- IBIT: initiated built-in test

Installation:
- Desk-mount types
- Desk-top installation with Cabinet KK406

DC supply:
- From the radio via the optional Interface GI420U
- From a local DC source (19 to 31 V)

Application-specific types are available:
- for fixed frequency or ECCM (HAVE QUICK or SECOS) operation and
- for different interface standards

Radio interface legend for the list below:
- »V.24« = RS-232-C/RS-485 bus, V.10 or V.11 level
- »DTMF« = Dual Tone Multiple Frequency code to CCITT recommendation Q23

In addition to the V.24 or DTMF interface there are:
- AF interfaces (transmit and receive)
- outputs for GO (radio CBIT) squelch/carrier and TX/RX status (relay output)
- serial interfaces for interconnection of DTMF type control units only

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Designation	Type	Order No.	Uses, specifications, features and benefits
Control Units	GB406C1	6016.1497.14	Fixed-channel operation, »V.24« interface to radio
	GB406C3	6016.2241.14	Fixed-channel operation, »DTMF« interface to radio
	GB406H1	6005.1255.14	HAVE QUICK II, »V.24« interface to radio
	GB406H3	6016.5240.14	HAVE QUICK II, »DTMF« interface to radio
	GB406S1	0504.7010.94	SECOS, »V.24« interface to radio; new model (incl. TDMA/4400 menue)
	GB406S3	6016.6499.14	SECOS, »DTMF« interface to radio
Cabinet	KK406	4029.7509.03	For variable desktop installation of GB406...; due to its swivel-type mounting holder the KK406 offers a fine-graded adaptability for optimum sight and operator convenience
Control Software	GB406-S	6051.0993.xx	**Application-specific and factory-loaded software** (EPROM for GB406-types) **Note:** GB406-S has to be ordered as an extra item together with the control units (equal quantities) xx = 21: for GB406S1; xx = 41: for GB406C1/H1; xx = 60: for GB406S3; xx = 80: for GB406C3/H3
	GB406-PC	on request	PC control and monitoring of Series 400U fixed-channel or ECCM radio systems
Control Cable	GB406Z1	6009.8948.xx	For the connection of Control Unit GB406C1/H1/S1 to Series 400U radio (via GI413U and GI420U), xx = 10: for 10 m; xx = 50: for 50 m

Bus Coupler GV400

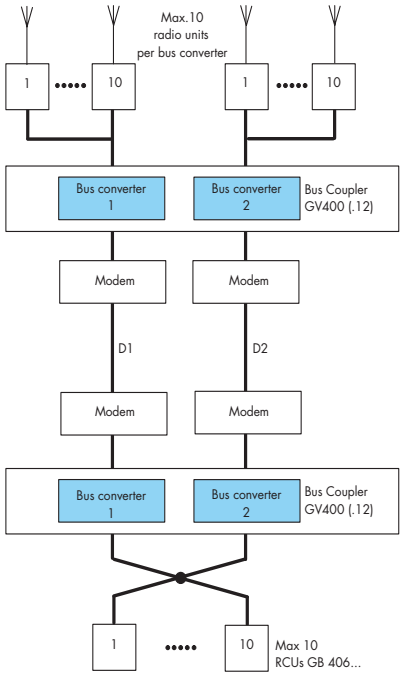
Bus Coupler GV400 (model 13 with 3 bus converters) (Photo 40754-1)

For the configuration of complex radio systems with several (m) Control Units GB406 and several (n) radios:

- Increased »fan-out« (increased number of loads)
- Interface load/system capacity: GV400 models are available with 1, 2 or 3 bus converters, each converter with an interface capacity for 10 loads; thus up to 99 radios can be addressed and operated individually in a multiple system or simultaneously in broadcasting mode (address 00) using the corresponding number and models of GV400[1)]
- Remote control distances ≤20 m (RS-232-C), ≤100 m (RS-485), ≤2 km (RS-422) or unlimited (with modems)
- Data conversions between the RS-232-C, RS-422 and RS-485 standards

Interface parameters (internally switchable):

- Level standards: V.10 (unbalanced)/V.11 (balanced)
- CTS and RTS signals with/without tristate
- Bit rate: 100 to 9600 bps (Bd)
- Operation/signal routing: depending on the required application the internally programmable switching matrix can be set to 4 possible operating modes which characterize the signal routing
- AF distribution: via aseparate voice switching system (audio matrix)
- PTT or other time-critical functions: their separate transmission and distribution (eg via the voice switching system) is recommended if unacceptably long transmission periods are calculated due to series transmission and great number of radio units
- Indicators: LEDs indicate the active signals per converter
- Power supply: AC: 115/230 V +10/-15%, 50/60 Hz, typ. 15 VA, <30 VA; DC: 24 V, typ. 500 mA (<1A); 15 to 32 V; AC/DC: automatic switchover with AC priority
- Dimensions, weight: 19" 1 HU rack plug-in; W x H x D = 483 mm x 44 mm x 329 mm (seated depth); 4 kg



Application examples for Bus Coupler GV400 with 100% link and radio redundancy

1) For 99 radios 11 bus converters are required in the radio station (see the block diagram overleaf, Example C)

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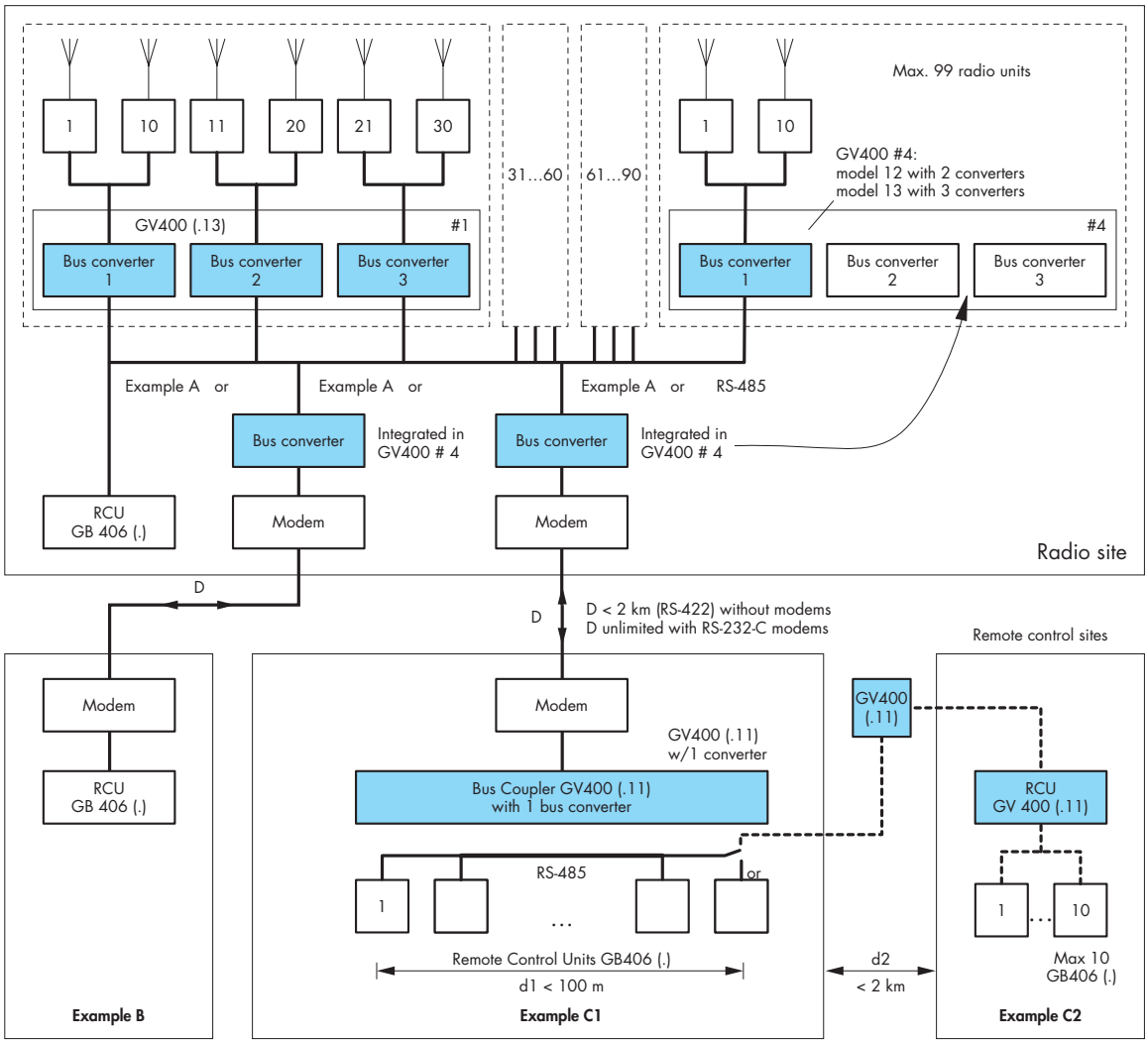
Designation	Type	Order No.	Uses, specifications, features and benefits
Bus Coupler	GV400	6049.7942.xx	xx = 11: with 1 bus converter xx = 12: with 2 bus converters xx = 13: with 3 bus converters

Application examples for Bus Coupler GV400 and Control Units GB406



Example A: 1 GB406(.) in radio station (eg for local operation/service)
Example B: 1 GB406(.) at remote control site B

Example C1: 10 GB406(.) at remote control site C1
Example C2: 10 GB406(.) at remote control sites C1 and C2; solution for d2 >2 km: on request

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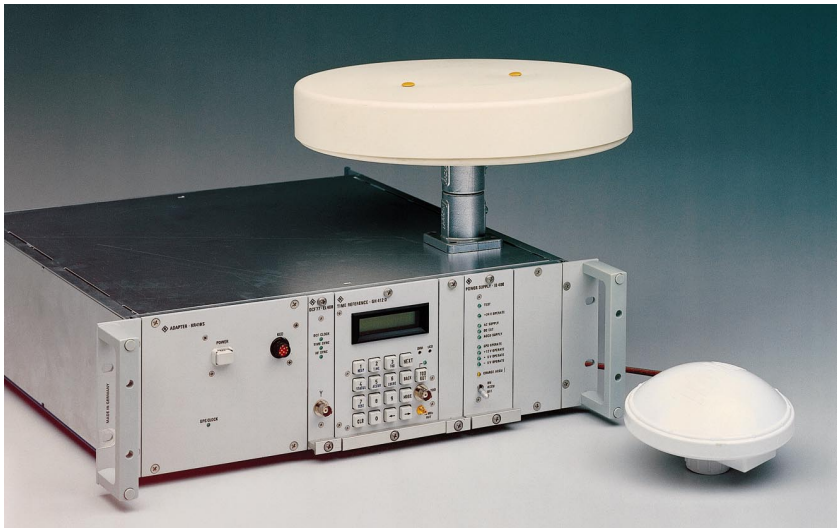
Timing Systems GT400

Uses, specifications, features and benefits

Designed to STANAG and other applicable specifications the timing systems GT400 family are able to synchronize HAVE QUICK as well as SECOS systems. They contribute to guarantee the interoperability of ECCM net members by receiving, maintaining and to transmitting Time Of Day (TOD).



Timing System GT432D3 (Photo 41999)

Time reception: The TOD is derived from UTC using NAVSTAR GPS as primary time source and (with GT432D3) DCF-77 VLF time code transmissions as secondary (back-up) source, the latter being effective throughout Europe (VLF transmitter near Frankfurt). Additional time sources can be: other HQ or SECOS radios or remote timing systems (transfer of HQ TOD via line). When synchronized to GPS the typical time accuracy of GT 400 is 10 µs.

Time keeping of GT400 is required when the above mentioned time sources are down. When using the GT432D2/D3 with GPS disciplined rubidium oscillator (with automatic frequency/time correction) the time is maintained for the worst case with a guaranteed accuracy of better than 1 ms/month.

Time transmission/distribution can be performed in different ways eg by air via a HQ/SECOS radio, by line (HQ TOD) or by cable, to load the time to the SECOS ECCM Processor GP407S1 directly or via the Key Entry Device KED-370.

Designation	Type	Order No.	Uses, specifications, features and benefits
Timing Systems	GT400...		19" 3 HU; AC + DC (automatic switchover) + battery (accumulator) set, all types complete with GPS receiver and GPS antenna; available types:
	GT430A2	on request	With TCXO time reference (GH410); without DCF-77 receiver/antenna
	GT432D2	6038.3705.03	With GPS-disciplined rubidium oscillator; without DCF-77 receiver/antenna
	GT432D3	6038.3805.03	With GPS-disciplined rubidium oscillator, DCF-77 receiver and antenna
Signal Distributor	GV430	6073.2518.02	**Option to »GT400« for distribution and amplification of 10 MHz rubidium oscillator reference signals** to 10 Rohde & Schwarz HQ or SECOS ECCM Processors GP407H/S1/S2; for other applications 5 MHz input signals can also be distributed; input level –0.5 dBm; output level +6 dBm (10x) and for special applications +13dBm (1x); external module for rear mounting to »GT400«: 12 V DC operated from »GT400«
Software	GT400-S	6035.9602.xx	Software (EPROM) for time reference unit of GT400 timing systems xx = 12: version for HAVE QUICK and SECOS (standard) xx = 13: version for HAVE QUICK only (German CRC project)

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Other Auxiliary Equipment

Designation	Type	Order No.	Uses, specifications, features and benefits
Power Supply	IZ450	6037.9500.02	**For upgrade of a transmitter or transceiver to 100 W FM UHF** – Generation of the collector voltage for this mode – Sensor-controlled forced air cooling of the radio (the sensors measure the heat sink temperature of Power Amplifier VD430U or VT450U) 19" 3 HU add-on unit for installation underneath the radio unit: the cooling air is sucked in from the front and routed upwards to the cooling fins of the amplifier heat sink; AC and DC with automatic switchover (priority to AC)
Shockmount	KS450	0615.7518.xx	**Transportable/mobile use of transceivers** xx = 02: Standard model xx = 06: Heavy-duty model with blower and additional 19" 1 HU space for 12 V/24 V Converter IN452 etc (tbd); incl. DC cable to IN452
19" Adapter	KR400U	6036.2001.xx	For integration of up to two receivers and one Power Supply IN404U to form a compact RX equipment; 19" 3 HU rack plug-in xx = 12: for 1 receiver, xx = 13: for 2 receivers
Power Supply	IN404U		For AC/DC supply of up to two receivers; $^1/_8$ 19" plug-in module
12 V/24 V Converter	IN452	0636.6010.02	For mobile operation of a transceiver with nominal RF output power – In older vehicles with 12 V DC board net – with negative pole to ground/chassis – Input specification: 10 to 16 V DC; 50 A maximum (current-limiter-protected) – Output specification: 26 V ±1 V, 350 V maximum – Efficiency: >80% – Principle: transformer-less and MOSFET-switched – 19" 1 HU plug-in; W x H x D = 483 mm x 44 mm x 452 mm; approx. 7 kg Installation, together with transceiver, in Shockmount IN452 model 06 (see below); delivered with high-current cable socket for DC input
ECCM Add-Ons	GP...		**Upgrade of fixed-channel radios to ECCM** Separate units for cabled connection to the basic radio unit (transceiver, transmitter or receiver); different versions are available:
ECCM Processor	GP407H1	0745.9003.03	For HAVE QUICK; DC operated from radio; 19" 1 HU
ECCM Processor	GP407S1	6052.4492.02	For SECOS (Secure ECCM Communication System) and for voice only; AC + DC; 19" 1 HU
Data Preprocessor	GP603P3	6048.2647.02	For SECOS (Secure ECCM Communication System) and for data; DC; W x H x D = 50 mm x 130 mm x 295 mm
Other ECCM accessories			For other project-related ECCM accessories, eg for key and frequency management, please contact Rohde & Schwarz
Service Kits	KA400		The kits include a great variety of special-to-type test devices for workshop maintenance/service, such as extender and test cables, extender cards, test adapters. They all are packed in a handy portable case with individually shaped foam inserts and user information. Available types:
	KA403U	6015.4992.12	For all Series 400U transmitters, receivers and transceivers
	KA406	6049.8190.02	For Control Units GB406C/H/S...
	KA407	6028.6999.02	For ECCM Processors GP407H1/S1 and timing systems of GT400 family

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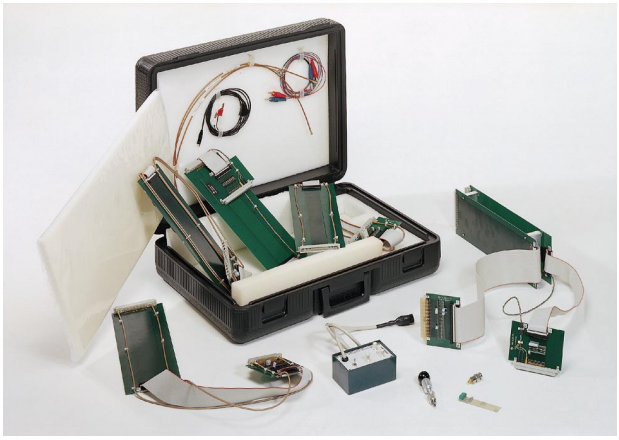
Designation	Type	Order No.	Uses, specifications, features and benefits
Automatic Filters			Preselectors and TX/RX filters: see »Options« (page 144) Other units: see »Multichannel Filters/Multicouplers« (page 169)
Power Amplifiers			See page 161
Antennas and Diplexers			See page 186



Left, top: front view of transceiver with 12 V/24 V Converter IN452 and Shockmount KS450 for mobile operation; shown with additional front cover
Left, bottom: ECCM Processor GP407H1
Right: Service Kit KA403U for servicing of all Series 400U radio units

Series 400U: Accessories

Designation	Type	Order No.	Uses, specifications, features and benefits
Audio Accessories			Indispensable for local operation or test of transmitters and transceivers; flexible coil-type cable and mounted NF7 connector; also suitable for Remote Control Units GB406C/H/S... (standard models)
Handset	GA013	0693.7712.02	Handle-integrated PTT button; rugged type
Headset (I)	GA015	0583.6012.02	Earphones-microphone combination, with cable-integrated PTT button; standard type
Headset (II)	GA012	0693.7664.02	Earphones-microphone combination, with cable-integrated PTT button; rugged type
Microphone	GA016H1	0583.5568.02	Dynamic; handheld type with PTT button
Set of Mating Connectors	XT452UZ	6049.5440.xx	For all Series 400U radios (transceivers, transmitters and receivers) xx = 12: standard set, incl. connectors for GI413/416/430U xx = 13: extended set with additional connectors for all slots The sets include RF connectors and are w/o AC connectors (as AC power cord is supplied with radio equipment)

For engineering
complex remotely controlled VHF/UHF radio systems or HAVE QUICK or SECOS radio systems and nets including timing systems please contact Rohde&Schwarz with full planning parameters.

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UHF DAMA SatCom Terminal XD482UD

UHF DAMA SatCom Terminal XD482UD (Photo 43244/1)

Application

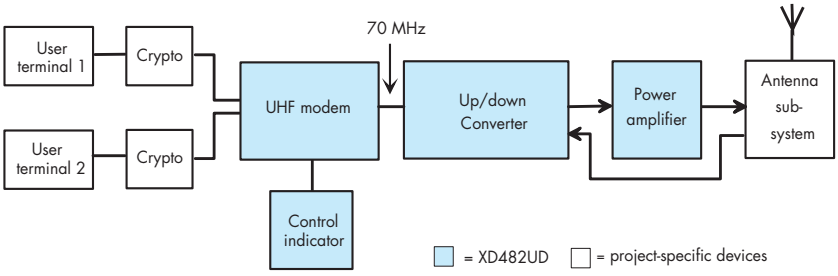
The Demand Assigned Multiple Access (DAMA) terminal provides the basis for stationary and mobile systems on land and at sea. The system enables users to "dial up" connections on demand, as opposed to reserving a channel full time. The extremely efficient use of resources such as bandwidth, time and transponder power provides the user with a wide range of opportunities. Therefore DAMA networks are replacing standard dedicated single channel per carrier (SCPC) links.

Brief description

UHF DAMA SatCom Terminal XD482UD is based on Series 400U equipment. It is designed in cooperation with VIASAT Inc., US, a worldwide leading supplier of DAMA modems.

XD482UD consists of four functional blocks:

- Control Indicator C-12480/U
- UHF DAMA Modem MD-1324/U
- Up/Down Converter ED450D
- Power Amplifier VD450D



Generic block diagram of XD482UD

In the transmit mode data are supplied to the system via the customer-specific user terminals. Both data and voice mode is possible. The crypto devices encrypt and decrypt the data and are linked with the DAMA modem. The modem performs modulation and demodulation of PSK waveforms for transmit and receive operation. The up/down converter transforms the 70 MHz signal into a UHF signal and vice versa. The amplified TX signal is routed to the antenna system and radiated. The antenna subsystem is of customized design. It has a diplexer for a common transmit-receive antenna (dual SatCom), or a low-pass and high-pass filter for separate antennas (independent SatCom) to achieve decoupling between transmit and receive path. The received signal passes through a LNA (low-noise amplifier) of the antenna subsystem and is supplied to the converter. The modem and the converter are remote-controlled by the control indicator.

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XD482UD is certified for the standards for interoperability according to the DAMA principle as per MIL-STD-188-181, -182 and -183. It is thus interoperable with any equipment that is in line with these standards.

For basic radio information please refer to Series 400U entries.

Features and benefits

In addition to the Series 400U features and benefits the DAMA terminal-specific features and benefits are as follows:

Features	Benefits for customer
Fully certified equipment	Interoperability with other certified equipment
Central system operation and control of system via control indicator for desk integration	High operational convenience
Modular design with separate converter, modem, power amplifier and control indicator; modular design of terminal components	High integration flexibility eg remote installation of power amplifier or control indicator Ease of maintenance and service
Small dimensions	Simple integration into existing environment
Proven technology	Savety of investment
No acoustic emissions	Quiet operation, special benefit for use in submarines

Specifications

General data

Frequency	225 to 399.995 MHz
optimized	245 to 270 MHz –> RX 290 to 320 MHz –> TX
Channel spacing	5 kHz and 25 kHz
Operation mode	half-duplex, duplex
User interfaces	2
Certified standards	MIL-STD-188-181, -182, -183
EMI	MIL-STD-461
Compatible COMSEC devices	AN/CSZ-1A; ANDVT Minterm, Tacterm, Airterm; KG-84 and others

Modem MD-1324/U

Data rates	user-selectable
25 kHz DAMA	75/300/600 bps, 1.2/2.4/4.8/16 kbps
5 kHz DAMA	75/300/600 bps, 1.2/2.4 kbps
non DAMA	1.2/2.4/9.6 kbps
Modulation modes	FSK, BPSK, QPSK, SOQPSK
Doppler correction	uplink
Order wire encryption	internal, can be switched off
IF_{in}	70 MHz, –28 dBm
IF_{out}	70 MHz, 0 dBm
Configuration data transfer	via Type I or II PC card
Data interfaces	MIL-STD-188-114
Control interfaces	MIL-STD-1553 bus MIL-STD-188-114 allowing interface to RS422, RS423 and RS232
Control units	control indicator or PC control workstation
Power supply	28 V DC nominal (16 to 40 V DC) 21 W nominal
Dimensions (H x W x D)	171 mm x 124 mm x 270 mm

Control Indicator C-12480/U

Presets	99
Control data transfer	via Type I or II PC card
Softkeys	five toggle switches with up/down control
Power supply	28 V DC nominal (16 to 30 V DC)
Luminance control	viewable under ambient conditions up to 10000 foot-candles
Glare source	up to 2000 foot-candles
Contrast ratio	as per MIL-L-85762
Angle of view	>60°
Dimensions (H x W x D)	86 mm x 146 mm x 131 mm

Up/Down Converter ED450D

Harmonics attenuation	>70 dBc
Spurious attenuation	>80 dBc
Sensitivity AM	–105 dBm for 10 dB S+N/N
Sensitivity FM	–105 dBm for 20 dB S+N/N
Power supply	
AC	100/115/215/230 V, –10/+15%, 47 to 63 Hz
DC	22 to 31 V
Dimensions (H x W x D)	132 mm x 483 mm x 516 mm; 19" 3 HU, plug-in

UHF Power Amplifier VD450D

RF output power	150 W
Power supply	28 V DC nominal
Dimensions (H x W x D)	393 mm x 350 mm x 195 mm

Ordering information

UHF DAMA SatCom Terminal	XD482UD	6107.0505.02

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Series 4400: HF/VHF/UHF/SHF Programmable Digital Radios

High-end software driven radios with extensive use of processor technology combined with excellent RF characteristics

Photo 43402-1

Brief description

One software driven hardware platform for all frequency bands characterizes the new radio concept. The software programmable design allows easy implementation of advanced waveforms and functions. The highly modular "sliced radio" design is based on a radio platform and plugged in radio and interface modules. A great variety of basic and optional modules including synthesizer, receivers, etc are available.

Each module plugged into the platform represents a functional unit and is completely independent of other modules. Thus various radio configurations are available like receivers, exciters, transmitters, transceivers, or multireceivers with up to 2 (4*) communication lines simultaneously. Its capability to implement different EPM methods like SATURN, HQ and SECOS makes Series 4400 the perfect tool for the main applications in military ATC and naval communications.

Series 4400 covers the following frequency bands:

- HF*
- VHF tactical*
- VHF
- UHF
- SHF*

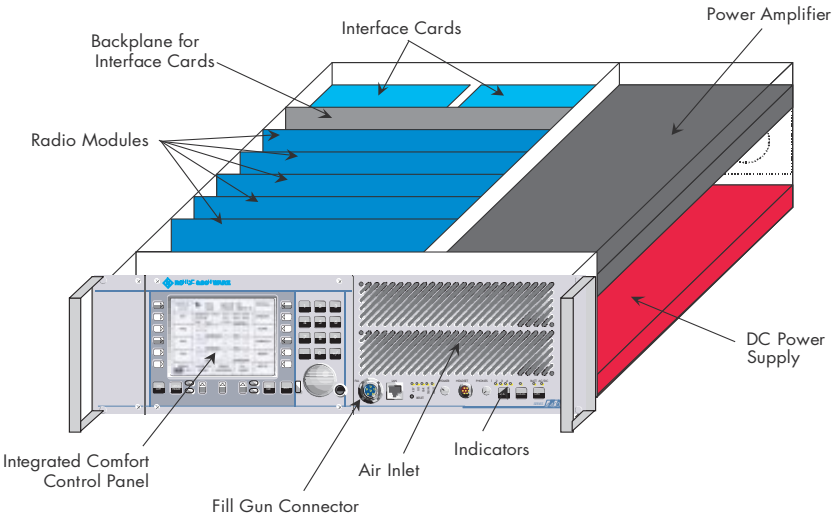
Main features

Implementation of customer-specific requirements

Functional improvement could easily be done by plugging in additional modules eg guard receiver or pre-post-selector. Due to the software based design of the radio a lot of customer-specific requirements and functions can be realized by software without any change of hardware.

Variety of interfaces

Various interfaces are already available on the platform. The availability of standardized bus systems like LAN, RS485 etc makes for easy integration into data networks. Additional standardized and customer-specific interfaces can be realized by special cards plugged-in at the rear of the radio.



Configuration scheme

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Ease of maintenance
Hardware is exchanged by replacing modules on the platform. "Plug-and-play" designed modules require no adjustments or realignments after replacement. Multiple built-in tests, integrated failure archive and remote failure diagnostics are of special interest. Remote control and monitoring of the radio are performed via external control units, ARCIS or IMCOS.

Upgrading potential
A high number of preplanned functions for later upgrading is implemented. This includes for example the extension of the frequency range and embedded COMSEC.

Operation
The graphical MMI is extremely user-friendly. The high-contrast colour active TFT display provided with softkeys makes control of the radio easy. The menu-driven user guidance allows convenient call-up of routines like IBIT. Results are displayed on the screen.

To ease the operation the local and remote control HMI are identical in use. Different passwords for different user levels can be stored in the radio.

Specifications

Common data

Frequency range	
LOS (line-of-sight) and SATCOM	100 to 512 MHz (without gap)
HF (VLF)	10 kHz to 30 MHz (receive)* 1.5 to 30 MHz (transmit)*
VHF/FM tactical	30 to 88 MHz*
SHF	up to 3 GHz*
Channel spacing	8.33 kHz, 25 kHz, 5 kHz (DAMA) and 75 kHz (HQ conferencing)
Frequency error (–20 to +55°C)	<1.5 ppm (10^{-6}) standard; <0.1 ppm (10^{-7}) with optional OCXO
Preset pages	200
Operating modes	fixed-freqency plain simplex, half-duplex and full-duplex HAVE QUICK I/II, SATURN/HQ, SECOS, DAMA
Number of EPM lines	1 (2 concurrent*) EPM communication lines per radio
Classes of emission	AM: A3E, AXX FM: F3E, FSK, PM
VHF/UHF pre-/postselector	FH-capable TX/RX filter (optional internal module)

Receiver data

Sensitivity for (S+N)/N = 10 dB and f_m = 1 kHz	2 modes are user-selectable: LN = low noise/LD = low distortion mode
Main receiver	
with AM (m = 0.3)	≤–107 dBm (LN) / ≤–101 dBm (LD)
with FM (±3.5 kHz deviation)	≤–110 dBm (LN) / ≤–104 dBm (LD)
Selectivity main RX	
BW 1 for 25 kHz channel spacing	≥26 kHz/6 dB, ≤50 kHz/80 dB
BW 2 for 8.33 kHz channel spacing	≥ 7 kHz/6 dB, ≤13 kHz/60 dB
BW 3 for data	≥50 kHz/6 dB, ≤150 kHz/70 dB
Guard (distress) frequencies	121.5 and 243 MHz

Transmitter data

Output power	
AM carrier power	30/50* W nominal
FM/FSK	100 W nominal
Duty cycle	continuous transmission
Harmonics suppression	
Standard	≥65 dB for 2nd harmonic
Option	≥80 dB for 3rd and higher harmonics, higher suppression with internal add-on filters

General data

Interfaces (selected)
RS-232/RS-422/RS-485 serial interfaces
DTMF (Dual Tone Multiple Frequency)
LAN
ISDN*
RF filter control interfaces
RF power amplifier (PA) control interfaces
AF interfaces
External reference frequency
Timing system
KDD interface
External COMSEC eg KY58
RF connectors for antennas and auxil-iary I/O
Customer-specific interfaces

Power supply	
DC operation	28 V nominal, 19 V to 31 V with restrictions, DC power supply module integrated
AC operation	90 to 264 V
Receivers	standard (integrated AC/DC PSU)
Transmitters/transceivers	with add-on AC power supply
AC/DC operation	automatic switchover; priority to AC
Environment	
Operating temperature range	–20 to +55°C
Storage temperature range	–40 to +70°C
Dust and water protection	IP 20
Vibration	DIN IEC 68-2-14, MIL-STD-167, STANAG 4138
Shock	DIN IEC 68-2-27, MIL-STD-810D
EMI/EMC (radio unit)	MIL-STD-461D, directive 89/336/EEC
Transients and spikes	STANAG 1008, MIL-STD-1139
Electrical safety	directive 72/23/EEC (CE mark), IEC950, VDE0804, VDE0805, VDE0866, EN60950
Cooling	sensor-controlled forced-air cooling by integrated fans
Dimensions, weight	
Dimensions	
Transceiver/transmitter/receiver (DC)	19" plug-in, 3 HU
Multiple receiver/exciter (AC/DC)	19" plug-in, 3 HU
Transceiver/transmitter set (AC/DC)	19" plug-in, 3 HU (radio, DC)+1 HU (PSU, AC)
Weight	21 kg to 27 kg, dependent on configuration

* preplanned product improvement

Detailed technical and ordering information on request

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Series XU100: VHF Multichannel Transceivers

XU105: 5 W

XU110: 10 W

XU120: 20 W

– **Ideal for emergency**

– **Medium performance**

– **Low cost**

Photo 42839-1

Brief description

Application

Series XU100 is a new low-power/ low-cost VHF multichannel transceiver series in the Rohde & Schwarz radio product line (System BECKER, German OEM). It is designed for ground-to-air voice communication (AM/A3E) in the 118 to 137 MHz VHF band for air-traffic control (ATC).

The XU100 transceivers are ideal for use on small air-fields or oil rigs or as an emergency station working independently of the main VHF radiocommunications system in case of a major downtime of the radio control network or external AC or DC supply.

System aspects

Note that the XU100 application range is limited.

For systems...

– where any frequency is to be remotely selectable (direct frequency selection without preset channel procedure),
– where 8.33 kHz channel spacing is required,
– where many operators have to work simultaneously under severe collocation conditions (needing antenna filters),
– where an integrated and PC-controlled remote control and monitoring system is to cover all radio units (to guarantee best operational system performance and communications reliability)...

... Series 200 transceivers, or separate transmitters and receivers, are the solution as they only feature

– remote and instantaneous selection of any frequency,
– 25 kHz and 8.33 kHz channel spacing,
– a control interface for the automatic tuning of antenna filters or multicouplers (required for simultaneous operation of many radios),
– a special remote control and monitoring system (RCMS) interface and
– the availability of special auxiliary equipment for bus-controlled multiple operation systems.

Design

The Series XU100 transceivers are designed as compact 19" 2 HU desktop units with internal modularity. A rackmounting kit for integration into standard 19" consoles or racks is included.

Features and benefits

Low-cost program

The low-power Series XU100 is the ideal low-budget and stand-alone solution for applications without any sophisticated operational/system requirements (as described above).

Convenience

- Best channel availability in case of emergency for hours (eg approx. 5 hrs with a duty cycle TX/RX = 1:9) due to the internal battery option and the graded power supply management with automatic AC/DC/ battery switchover sequence
- Integrated battery charging control circuit
- 20-channel SCANNING facility as economical alternative to simultaneous channel operation (for customers allowing this mode)
- User-friendly 2-line liquid-crystal display
- Automatic start-up selftest
- Fault diagnosis by detailed error indication (E-code)
- Password-protected configuration of equipment parameters or levels
- Automatic tape recording by integrated control interface

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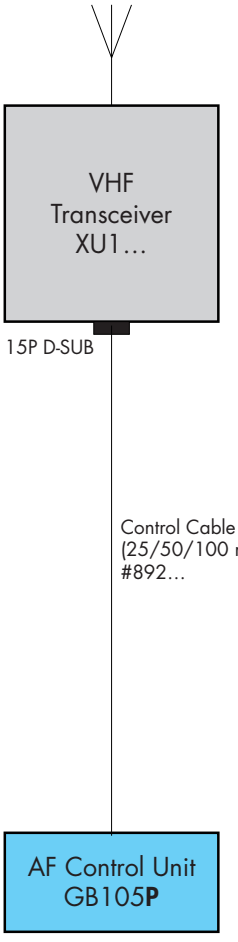
Remote control

- Remote AF/PTT control (without frequency/channel selection)
  - 100 m with standard multiwire AF Control Unit GB105P or
  - 10 km with optional 2-Wire Remote Control Interface 1OP102/BEC and AF Control Unit GB105T
- Remote AF/PTT + preset channel selection over up to 10 km via telephone line using Line Interface IF460 and AF Control Unit GB105P or GB105T

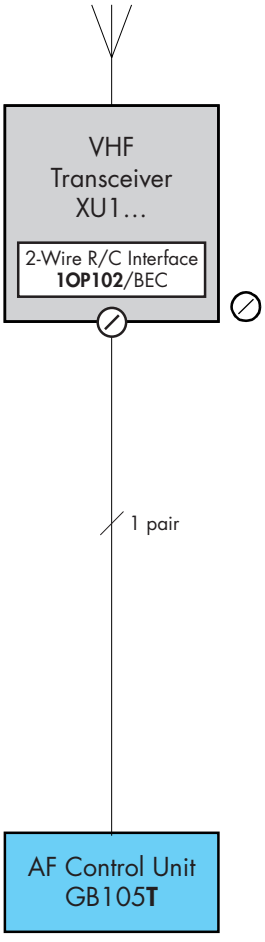
Control Unit GB105 P/T

PARALLEL R/C < 100 m
without
FRQ/CH selection

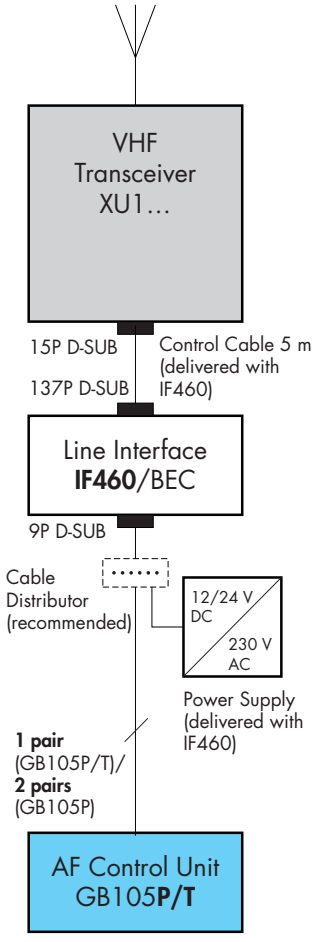


2-/4-WIRE REMOTE CONTROL up to 10 km

without
FRQ/CH selection



with
preset channel selection



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Specifications

Frequency
VHF 118 to 136.975 MHz
Channel spacing 25 kHz
Preset channels 20

Operating modes
Fixed-channel simplex
Offset no
ECCM no
Frequency error ≤15 ppm

Type of modulation A3E

Power supply
AC 85 to 240 V, automatic voltage detection

DC ext.
XU105 13.75 V nom. (12 to 16 V)
XU110/120 24 V nom. (+20%/-10%)
DC int. emergency operation with optional battery 1OP101 (12V/2.2 Ah accumulator)

Sensitivity
for (S+N)/N = 6 dB, (weighted to ITU-T) and f_m = 1 kHz, m = 0.3 ≤2 µV (4 µV EMF)

RF carrier power
for 50 Ω antenna load, with 2 mV mic input, m = 0.7 to 0.9
XU105: ≥ 5 W
XU110: ≥10 W
XU120: ≥20 W
Emergency operation (with 12 V emergency battery option) all types: 5 W

Test
Start-up selftest automatic test routine
Fault diagnosis with error code

Remote operation
Remote control AF, PTT, with or without preset channel selection depending on options and control units (for details see "remote control")
Remote monitoring system no

Environment
Operating temperature –15 to +55°C
Starage temperature –40 to +70°C
Humidity ≤95%/40°C without condensation

Designation	Type	Order No.	Uses, specifications, features and benefits
Basic transceivers			
VHF Transceivers 5 W 10 W 20 W	 XU105 XU110 XU120	 6084.5513.02 6084.5613.02 6084.5713.02	See above
Options			
Battery	1OP101/BEC	–	For emergency operation; internal battery set 12 V 2.2 Ah, lead accumulator for autonomous (5 W) emergency operation, eg for 5 hrs with a duty cycle TX/RX = 1:9
2-Wire Remote Control Interface	1OP102/BEC	–	For remote operation from Control Unit GB105T via a 1-pair telephone line (without frequency/preset channel selection capability); PCB for transceivers
Auxiliary Equipment			
Line Interface	IF460/BEC	–	For remote operation from Control Units GB105T or GB105P via a 1- or 2-pair telephone line (with preset channel selection capability); external stand-alone box Accessories: power supply 230 V AC and connecting cable Interface/transceiver (5 m)
AF Control Unit	GB105P	6084.5813.02	With multiwire (parallel) and 1-/2-pair interface For details: see above and block diagram
AF Control Unit	GB105T	6084.5913.02	With 1-pair line interface For details see above and block diagram
Accessories			
Microphone	1PM012/BEC		Dynamic hand-held type, complete with cable and 5-pin DIN connector; with PTT key
Headset	1PH028/BEC	–	Complete with cable and 5-pin DIN connector
Control Cable 25 m 50 m 100 m	 892.483-276/BEC 892.491-276/BEC 892.505-276/BEC	 – – –	For connection XU100-GB105P; multiwire type with mounted connectors

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VHF Power Amplifiers

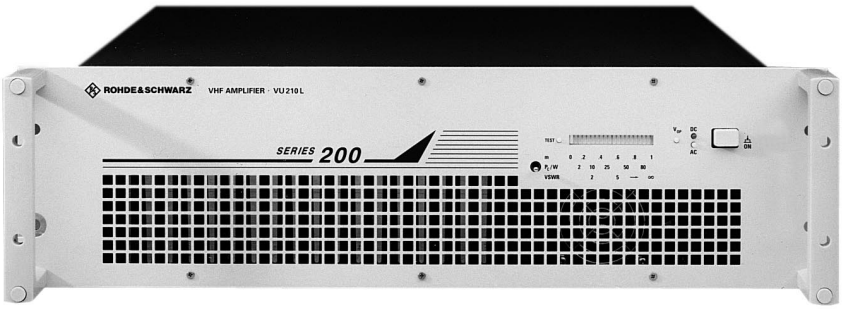
VU210L:

VHF 100 W AM/150 W FM

VU220L:

VHF 200 W AM/300 W FM

For ground-to-air and naval radiocommunications



VHF 100 W Amplifier VU210L
(Photo 42859: The photo does not yet show the latest 19" 4 HU layout version)

Brief description

In general high-power amplifiers are used in ground-to-air radio stations for improvement of the communication link reliability under extreme natural or operational, planned or unforeseen conditions. They offer:

- Extension of the usable propagation range beyond LOS (making use of the physical bending effect)
- Extension of communication range under adverse technical conditions: compensation of RF power losses of antenna filters, long antenna cables or unforeseen influences like poor coaxial cable, connector or antenna matching (reflection losses) as they can occur under critical circumstances
- Increase of the AJ (anti-jam) margin, ie increase ECM resistance in jammed communication environment

Applications

VHF Power Amplifiers VU210L and VU220L are designed for the following system applications:

- Single- and multichannel (broadband) application
- Control interfaces for Series 200 or 400U transmitters
- Linear amplifier operation together with other (non-Rohde & Schwarz) exciters
- Amplifiers with RF bypass relays for:
  - operation in standard transceiver mode via the only TX/RX antenna path
  - power management: normal/high power mode selectable
- Use in 90 to 265 V AC environment
- Use in radio systems with DC backup supply
- Automatic AC/DC switchover
- Use in collocated radio systems
- Continuous operation (100% duty cycle) under normal operating conditions

Design – modularity – functions

The design of VU210L and VU220L is based on broadband and linear techniques. Integrated test facilities continuously monitor the key functions.

VU210L (100 W) is designed as a compact 19" 4 HU plug-in for rack installation. Two rear fans suck the air from the front to the rear through the oversized heat sink to which the basic VHF amplifier I is mounted. VU210L consists of the following modules:

- 19" adapter, 4 HU, with central cooling duct
- VHF amplifier board 1
- Output unit
- Control board
- Power supply 1

For details of the modules see below.

VU220L (200 W) is designed as a compact 19" 4 HU plug-in for rack installation. It consists of:

- 19" adapter, 4 HU, with central cooling duct and heat sink (same as used in VU210L)
- VHF amplifier board 1: mounted on top of the heat sink
- VHF amplifier board 2: mounted on the lower side of the cooling duct and connected in parallel to VHF amplifier board 1
- Output unit
- Control board
- Power supply 2: connected in parallel to power supply 1

The most important internal modules of VU210L and VU220L and their functions are:

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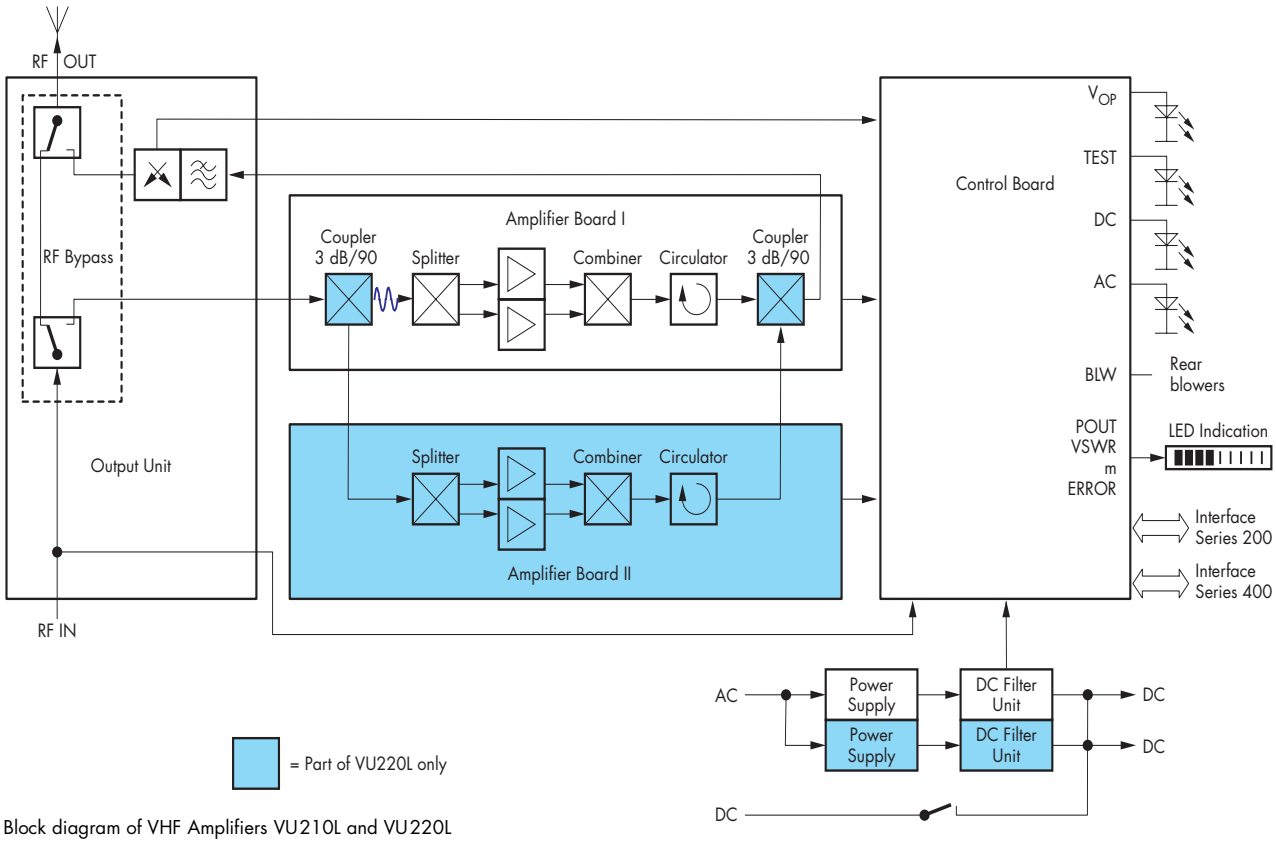

Block diagram of VHF Amplifiers VU210L and VU220L

- **VHF amplifier board 1:** it consists of two parallel amplifier stages in A/B mode, two 3 dB/90° devices (splitter and combiner) providing good matching and high load decoupling and a circulator. This component offers – together with its absorber – broadband decoupling of the antenna, ie it reduces the influence of the power reflected from the antenna output caused by mismatch and/or interference from co-sited transmitters. Thus, in conjunction with the circuit design of the basic amplifier modules, VU210L and VU220L feature a high backward intermodulation, the benefit of which is interference-free operation by suppression of unwanted intermodulation (IM3) products. This core technique can easily be used to build up the 200 W type VU220L: in this case the VHF amplifier board 1 is supplemented by two 3-dB couplers including their absorbers, inserted behind the RF bypass relay in the input stage and behind the circulator – in front of the (common) output unit. Thus two VHF amplifier boards 1 and 2 can be coupled in parallel for high-power application
- **VHF amplifier board 2** (in VU220L only): this board is in basically identical to the amplifier 1, complete with its own circulator, however without 3 dB coupling facility
- **Output unit:** this module includes the harmonics filter, the directional coupler and the RF bypass. The harmonics filter uses a low-loss Tschebyscheff lowpass filter. The front-panel indications for forward power and antenna matching (VSWR) as well as a power reduction criterium are derived from the directional coupler which is interfaced just in front of the antenna relay. Two RF relays, interfaced at the input and antenna side, are used to form an RF bypass for operation with normal exciter power or for transmit/receive mode
- **Control board:** this central unit comprises the microprocessor for control and monitoring of the amplifier stages, of the AC and DC supply and of the rear blowers and includes protective circuits. Separate interfaces for Series 200 or 400U are provided for optimum operation and ease of system integration. The status display (detailed BITE information on 20-element horizontal bargraph LED display), the switch for selection of modulation depth (m), RF output carrier power (P_C) or standing-wave ratio (VSWR), the TEST LED (GO/NOGO), other LEDs and the power switch are further elements of this unit

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- **Power supply 1 and 2:** both boards are of the same clocked type, accept AC and feature automatic switchover to emergency supply (DC) in case of AC failure. Each power supply contains a separate blower. Some supplementary components eg for filtering are mounted directly onto the 19" adapter
- **19" adapter:** this mechanical structure accommoates the described modules, incorporates additional components such as mains filter, DC filter coils and capacitors or reverse polarity protection and includes the electrical interface for RF, AC/DC, control and monitoring

Features and benefits

Features	Benefits for customer
Excellent cooling and monitoring – Oversized heat sink – Forced-air cooling of power supply (permanent) and core amplifier section (sensor-controlled) – Automatic switching to RF bypass mode in the event of malfunction eg high input power or test NOGO, poor VSWR at the output or other adverse operating conditions (eg over- or undervoltage or critical heat sink temperature)	**Continuous operation** **High communication reliability** **High MTBF**
Excellent spectral purity (with Series 200 or 400U exciters) through – Multistage high-pole harmonics filter – Circulator(s) most effectively integrated in front of the harmonics filter, both included as standard	**Interference-free operation**
Broadband design	**Guaranteed specifications** over the entire frequency range **Full multichannel capability** ie no readjustment after change of operating frequency
Application-specific control interface connectors (2) for Series 200 and 400U transmitters/transceivers	**Ease of system integration** **Optimum operation**
AC (main) and DC (standby) supply with automatic AC/DC switchover	**High system flexibility** **High communication reliability**
RF bypass integrated for normal power or transmit/receive operation	**High system flexibility**
Integrated test and service facilities – P_{OUT}, VSWR and m – TEST (sum GO/NOGO check) and 20-LED bargraph indicator for single and multiple errors (code 1 to 20) – Test interface integrated	**Quick failure diagnosis** **Ease of maintenance**
Modular design – Defined interfaces/specifications guaranteed	**Low MTTR on LRU basis** by change of module only

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Specifications

If not stated otherwise, the following specifications are valid for VHF Amplifiers VU210L and VU220L:

Frequency range	118 to 144 MHz
RF input power	into 50 Ω/VSWR ≤1.2
VU210L	10 W AMc/15 W FM
VU220L	20 W AMc/30 W FM
RF output power of VU210L	nominal, valid for the specified AC supply voltage and operating temperature ranges and for VSWR ≤2
AM carrier	100 W ±1.5 dB
FM	150 W ±1.5 dB
AM PEP (peak envelope power)	400 W
RF output power of VU220L	nominal, valid for the specified AC supply voltage and operating temperature ranges and for VSWR ≤2
AM carrier	200 W ±1.5 dB
FM	300 W ±1.5 dB
AM PEP (peak envelope power)	800 W
Continuous operation	guaranteed through eg – sensor-controlled forced-air cooling – automatic switching to RF bypass mode eg in case of extremely high or low supply voltage (AC or DC), VSWR >3 typ., heat sink temperature exceeding 80°C or negative TEST result (NOGO)
Unwanted emissions	
Harmonics attenuation	80 dBc [1]
Spurious attenuation	90 dBc [1]
Backward intermodulation products (with interfering signal 20 dB below wanted signal)	65 dB below wanted signal
Modulation characteristics	
Classes of emission	AM, FM, other on request
AF bandwidth	300 Hz to 10 kHz typ.
S/N ratio (AM) with 1 kHz, m=85% and S/N >50 dB of exciter	>45 dB
AF distortion	<10% [2]
Modulation depth (m)	90% AM
TX/RX switching time	10 ms
Power supply of VU210L	
AC standard supply	90 to 265 V, 47 to 63 Hz (due to automatic detection any voltage is accepted without damage)
DC backup supply [3]	26 to 31 V, operational down to 21.5 V, <25 A; protected against wrong polarity and reverse feed
AC/DC switchover	automatic
Power consumption (AC)	
TX mode	<900 VA
Standby mode	<70 VA
Power supply of VU220L	
AC standard supply	see above
DC backup supply [3]	see above, <45 A
AC/DC switchover	see above
Power consumption (AC)	
TX mode	<1.6 kVA
Standby mode	<120 VA
EMC	IEC801-2, -3 and -4, part 2
Mechanical data of VU210L	
Dimensions (W x H x D)	483 mm x 176 mm x 455 mm 19" 4 HU plug-in
Weight	21 kg
Mechanical data of VU220L	
Dimensions (W x H x D)	483 mm x 176 mm x 455 mm 19" 4 plug-in
Weight	24 kg
Environmental data	
Temperature range	
Operation	10 to +55°C
Storage	–40 to +70°C
Relative humidity	IEC68-2-3
Operation	95% (without condensation)
Storage	50 to 60% at –5 to +25°C
Shock	IEC68-2-27/MIL-STD-810D: 40 g shock spectrum
Vibration	
Sinusoidal	IEC68-2-6: 5 to 150 Hz
Random	IEC68-2-36: 10 to 300 Hz
Max. altitude (asl)	IEC68-2-40
Operation	2000 m; test condition: 795 hPa
Transport/storage	4500 m; test condition: 566 hPa
Electrical safety	EN 60950 (IEC 950)
Connectors	
AC	4-pin connector male
DC	2-pin Sub-D male
RF input	N-type female
RF output	N-type female
Series 200 control and monitoring interface	15-pin Sub-D female
Series 400U control and monitoring interface	25-pin Sub-D female
Ground	M6 screw
Front-panel control and monitoring	
AC voltage available	green LED "AC"
AC power on/standby	switch
External DC voltage available	green LED "DC"
Internal operating voltages OK	green LED "V_{op}"
Tests	
CBIT (GO/NOGO)	green LED "TEST"
Coded fault information	20-LED bargraph indicator for single or multiple errors, code 1 to 20
Modulation depth "m"	same LED bargraph indicator
RF output power "P_c"	see above
VSWR	see above
Test selector m/P/VSWR	switch

Ordering information

Designation	Type	Order No.	Uses, specifications, features and benefits
VHF Power Amplifier 100 W	VU210L	6083.2510.02	19" 4 HU plug-in; delivered with one set of accessories (AC mains cable 6083.3846, fuses)
VHF Power Amplifier 200 W	VU220L	6083.5317.02	19" 4 HU plug-in; delivered with one set of accessories (see above)

1) In addition, the exciter values are applicable

2) Ref. to AM (m=0.85; fm=1 kHz) and nominal supply voltage. In addition, the exciter values are applicable

3) Note that for DC backup operation the amplifier specifications are not valid in every respect

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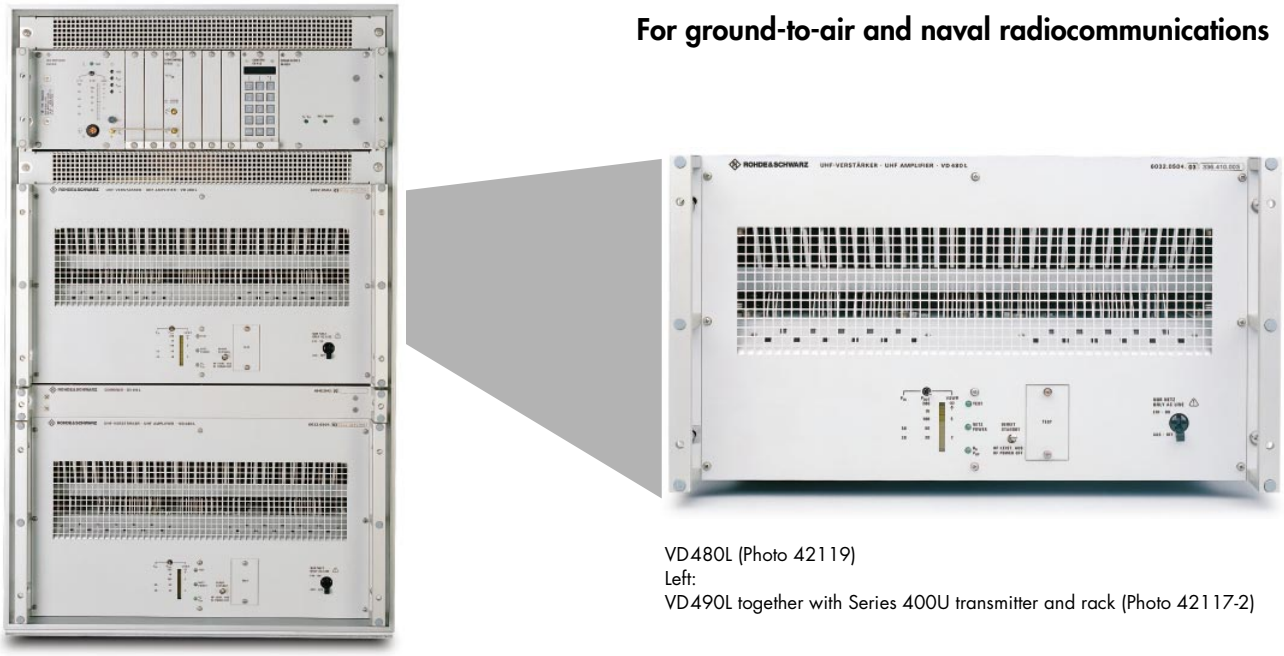
UHF Power Amplifiers

VD480L: UHF 100 W AM/150 W FM

VD490L: UHF 200 W AM/300 W FM

For ground-to-air and naval radiocommunications



VD480L (Photo 42119)
Left:
VD490L together with Series 400U transmitter and rack (Photo 42117-2)

Brief description

In general high-power amplifiers are used in ground-to-air radio stations for improvement of the communication link reliability under extreme natural or operational, planned or unforeseen conditions. They offer:

- Extension of the usable propagation range beyond LOS (making use of the physical bending effect)
- Extension of communication range under adverse technical conditions: compensation of RF power losses of antenna filters, long antenna cables or unforeseen influences like poor coaxial cable, connector or antenna matching (reflection losses) as they can occur under critical circumstances
- Increase of the AJ (anti-jam) margin, ie increase ECM resistance in jammed communication environment

Applications

UHF Power Amplifiers VD480L and VD490L are designed for the following system applications:

- Single- and multichannel (broadband) application
- Fixed-frequency and HAVE QUICK ECCM systems
- Data operation: 16 kbit eg for WBSV AM/FM baseband or diphase:
  VINSON KY-58 cipher unit compatible
- Amplifiers with RF bypass relays for:
  - operation in standard transceiver mode via the only TX/RX antenna path (for all above applications)
  - power management: normal/high power mode selectable
  - continued operation in case of amplifier failure
- SECOS ECCM and LINK 11 (with Series 400U transceivers with separate TX and RX antennas)[1)]
- SECOS ECCM and LINK 11 (with Series 400U transmitters)
- Use in 230 V AC or 110 V AC environment (different models available)
- Use in DC powered radio systems
- Automatic AC/DC switchover
- Use in collocated radio systems
- Optimum efficiency in connection with the Rohde & Schwarz Communication Systems Series 200 and 400U; for details see "Features and benefits"
- Linear amplifier operation together with other (non-Rohde & Schwarz) exciters
- Continuous operation (100% duty cycle)

1) Common TX/RX antenna with future amplifier option »PIN Diode Switch«: to be defined

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Design – modularity – functions

The design of VD480L and VD490L is based on broadband and linear techniques, with PIN diode input control of frequency response or power reduction under adverse VSWR conditions. Numerous automatic monitoring circuits and – with Series 200 or 400U – additional corrective procedures (frequency-dependent control) guarantee a customer-selectable and constant gain in multichannel mode. Integrated test facilities continuously monitor all the key functions: the service LED indication on the front panel shows 15 test results and also stores errors for fast failure diagnosis.

VD480L is designed as a compact 19" 6 HU plug-in for rack installation. Rear fans suck the air from the front to the rear via a well-dimensioned cooling duct to which the amplifier and other modules are mounted.

VD490L consists of three 19" plug-in units:
- 2 UHF Amplifiers VD480L (19" 6 HU), models without RF bypass, working in parallel and connected by
- 1 Combiner GV490L (19" 1 HU)
- 4 RF cables (for VD490L internal connections)
- 2 control cables (for VD490L internal connections)

Combiner GV490 includes the Wilkinson RF power splitting and combining circuitries, the two coaxial relays for TX/RX mode/bypass switching as well as the splitting and combining of the control information from/to the exciter.

The most important internal modules of VD480L (and VD490L) and their functions are:

- PIN diode control circuit: variable attenuator as function of several monitoring circuits and of the exciter frequency information (linearizing the frequency response of the RF power). A type-characteristic master EPROM stores the basic (including frequency-depending) control information, and a unit-specific and individually factory-programmed EEPROM delivers the control reference values
- Driver: amplification to the level required for 1-by-4 splitter; see also »Amplifier module«
- Splitter (1-by-4 Wilkinson): distributing the power to 4 parallel amplifier modules
- Amplifier module: the above mentioned driver and each of the 4 amplifiers are of identical design; they use a 3 dB/90° coupler, 2 parallel amplifier stages in A/B mode and a 3 dB/90° coupler providing good matching and high load decoupling
- Combiner (1-by-4 Wilkinson): adds the output powers of the four amplifier boards
- Circulator: this component offers – together with its absorber – a broadband decoupling of the antenna, ie it reduces the power reflected from the antenna output caused by mismatch and/or interference from cosited transmitters. Thus, in conjunction with the circuit design of the basic amplifier modules, VD480L/VD490L feature a high backward intermodulation, the benefit of which is interference-free operation by suppression of unwanted IM3 products. The absorber delivers the reflected power control information for the central power management
- Harmonics filter: by using a very efficient high-stage lowpass filter the harmonics are attenuated
- Directional coupler: the front-panel indications for forward power and antenna matching (VSWR) as well as a power reduction criterium are derived from this coupler
- Control: this central control circuit comprises a blower control, interconnecting (exciter interface) logic, protective circuits, frequency response linearization and status displays
- Power supply: a diversity of different functions are comprised: switch-on current limitation, power transformer, voltage regulator, auxiliary power supply, base bias regulator and supply for the PIN diode switch

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Features and benefits

Features	Benefits for customer
Excellent cooling and monitoring – Sensor-controlled forced-air cooling (in 2 steps) – Oversized heat sink – Gradual power degradation by PIN diode control circuit in the event of malfunction eg high input power, poor VSWR at the output or other adverse operating conditions – Automatic switching off at critical temperature	**Continuous and safe (self-protecting) operation** **High communication reliability** **High MTBF**
Excellent spectral purity (with Series 200 or 400U exciters) through – Multistage high-pole harmonics filter – Circulator integrated in front of the harmonics filter, both included as standard	**Interference-free operation**
Broadband design	**Wide range of system applications** including FH (frequency hopping); guaranteed specifications over the entire frequency range
Automatic AC/DC switchover and alternative AC supply – for 110 V AC etc and DC – for 230 V AC etc and DC	**High system flexibility**
Alternative RF bypass (TX/RX switch) solutions – VD480L models without RF bypass relays – VD480L models with RF bypass relays – VD490L models with RF bypass relays – Control output to any external TX/RX switch	**High communication reliability** **High system flexibility**
Integrated test and service facilities – TEST LED (summary NOGO check) and other green LEDs – Service field on front panel monitors up to 15 parameters and stores them (red LEDs) – Service connector on rear: 37-pin connector for failure diagnosis	**Quick failure diagnosis** **Ease of maintenance**

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Specifications

If not stated otherwise, the following specifications are valid for UHF Amplifiers VD480L and VD490L.

Frequency range 225 to 400 MHz

RF gain
Range 4 to 10 dB (factor 2.5 to 10)
Setting 1. factory-set via customized EEPROM
2. user-programmable with ZT480L

RF output power of VD480L	**Nominal**	**Maximum** [1]
AM carrier	100 W	
AM modulated		200 W rms
FM	150 W	200 W
AM PEP (peak envelope power)	400 W	500 W

RF output power of VD490L		
AM carrier	200 W	
AM modulated		400 W rms
FM	300 W	400 W
AM PEP (peak envelope power)	800 W	1000 W

Unwanted emissions
Harmonics attenuation >80 dBc [2]
Spurious attenuation >80 dBc [2]
Backward intermodulation products (with interfering signal 20 dB below wanted signal) 65 dB below wanted signal

Modulation characteristics
Classes of emission AM, FM, other on request
AF bandwidth according to exciter
S/N ratio (AM) >45 dB [2]
AF distortion <10% [2]

TX/RX switching time 20 ms

Power supply of VD480L
AC AC I: 100/110/120 V ±10%, 50 to 60 Hz
AC II: 210/220/230 V ±10%, 50 to 60 Hz
AC range depending on model
AC conversion kit: on request
DC 26.5 V ±10%, operational down to 21.5 V [1]
AC/DC switchover automatic
Power consumption
AC, TX mode 1 kW (AM)/1.4 kW (FM) typ.
1.6 kW/2.2 kVA max.
AC, standby mode 20 W (without blower)
DC, TX mode 27 A (AM)/34 A (FM) typ.
40 A max.
DC, standby mode 0.3 A (without blower)

Power supply of VD490L
AC 1 100/110/120 V ±10%, 50 to 60 Hz
AC 2 210/220/230 V ±10%, 50 to 60 Hz
AC range depending on model
AC conversion kit: on request
DC 26.5 V ±10%, operational down to 21.5 V [1]
AC/DC switchover automatic
Power consumption
AC, TX mode 2 kW (AM)/2.8 kW (FM) typ.
3.2 kW/4.4 kVA max.
AC, standby mode 40 W (without blower)
DC, TX mode 54 A (AM)/68 A (FM) typ.
80 A max.
DC, standby mode 0.3 A (without blower)

EMC MIL-STD-461B (with limitations)
MIL-STD-462

Mechanical data of VD480L
Dimensions (W x H x D) 483 mm x 265 mm x 471mm
19" 6 HU plug-in
Weight approx. 55 kg

Mechanical VD490L
Dimensions (W x H x D) 483 mm x 574 mm x 471 mm
19" 13 HU
3 plug-ins (6 HU + 6 HU + 1 HU)
Weight approx. 115 kg

Environmental data
Temperature range
Operation –20 to +55°C
Storage –40 to +70°C
Max. relative humidity
Operation 95% at +40°C (without condensation)
Storage 95% at +40°C
Permissible altitude
Operation 3000 m above sea level; +35°C
Storage/transport 5000 m above sea level
Shock 30 g for 6 ms; 3 shocks in 3 positions
Vibration 0.3 mm double amplitude;
10 to 55 Hz; total test period 30 min
Electrical safety IP 20, DIN 40050 page 165,
VDE 0899, VDE 0804

Ordering information

Designation	Type	Order No.	Uses, specifications, features and benefits
UHF Power Amplifier 100 W	VD480L	6032.0504.xx	19" 6 HU plug-in; delivered with accessories such as cables for RF, frequency information and control for connection with Series 400U transmitter/transceiver (fitted with option Filter/PA Interface GI414U), AC mains cable, DC cable socket, fuses etc [3]
		xx = 22	230 V etc; without bypass relay
		xx = 23	230 V etc; RF bypass dual relay
		xx = 32	110 V etc; without bypass relay
		xx = 33	110 V etc; RF bypass dual relay
UHF Power Amplifier 200 W	VD490L	6048.3489.xx	Consisting of 3 plug-in units: 2 x VD480L (6032.0504.22/32) 1 x GV490L (6048.3943.02) 1 x set of accessories including interconnection cables for above plug-in units and Series 400U transmitter/transceiver (fitted with option GI414U) [3]
		xx = 22	230 V etc; with RF bypass dual relay (in GV490L); with VD480L models 22
		xx = 32	110 V etc; with RF bypass dual relay (in GV490L) with VD480L models 32
Coding plug	–	6032.1652.00	For frequency coding in connection with Series 200 single-channel mode (frequency response linearization)
Programmer	ZT480L	6043.5948.02	STTE: special-to-type test equipment for reprogramming of EEPROM for optimum operation, eg after repair works or in connection with non-Rohde&Schwarz exciters

1) With reduced specifications
2) Ref. to AM (m = 0.85; fm = 1 kHz) and nominal supply voltage. In addition the exciter values are applicable
3) Control cable for Series 200 multichannel radios on request

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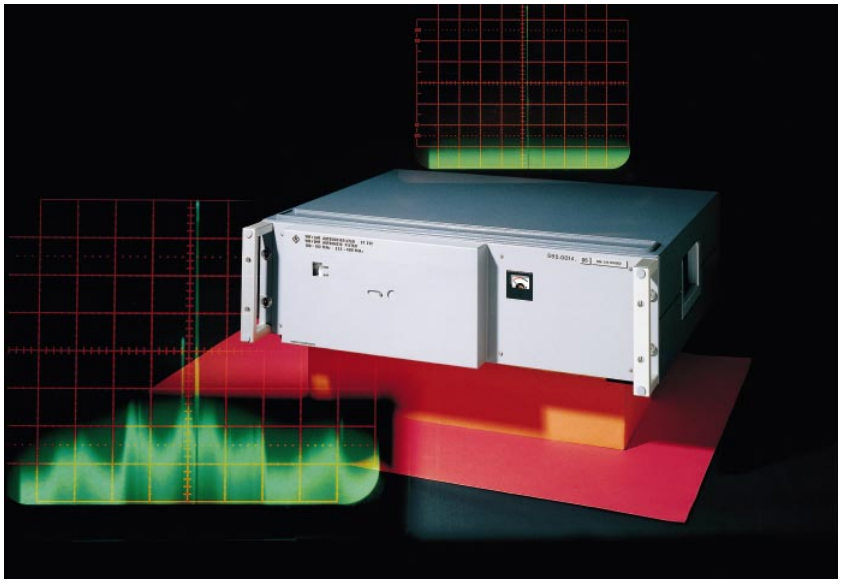
VHF/UHF Filters/Multicouplers – Overview

For ground-to-air and naval radiocommunications



Filters – indispensable for mastering challenges caused by collocation (Photo 30470)

Applications

Filters and combiners are indispensable system components
– to enable and
– to improve
quality radiocommunications, and their integration is a must for any responsible consultant or system engineer. This responsibility extends from failure-free system operation to that over the life of aircraft passengers when a vital ground-to-air ATC communication is interfered in a critical flight situation or when an avionics system is disturbed.

Definition: In the following »filters« are understood to be manually or automatically tuned system components operating at the wanted receive and/or transmit frequency. Bandpass, highpass or lowpass filters are not described. In contrary to bandpass-limited receive- only multicouplers (such as VT231), »Multicouplers« are defined here as highly selective filter-combiners tuned to the exact operating frequency and combining several radio units to one antenna.

Features and benefits

Filters/multicouplers have manifold functions and benefits. Because of the importance of the topic the functions and benefits are described in the following in general and in detail:

In general
Highly selective filters and multicouplers …

- Protect and improve the operational quality of the customer's own VHF/UHF radio installations
- Protect the radio system from externally generated interfering signals from all kinds of civil or military in-band or out-of-band radio installations, including broadcasting, TV, microwave links or radar
- Protect other electromagnetically sensitive radio, navigation (DF, VOR, ILS etc) or radiomonitoring installations under the responsibility of the own or other services
- Provide frequency economy in an environment with high frequency congestion – filters/combiners make the use of already or newly assigned and critically spaced frequencies possible
- Provide space economy by installation of antennas on limited space – eg on the tower cabin roof, at the only available radio center, on board of a ship or in mobile or transportable systems (eg mobile towers)

In detail and in terms of communications engineering RF filters improve the characteristics of transmitting and receiving systems – depending on the RF path they are integrated into – as follows:

Receive filter benefits – in detail

- Suppression of out-of-band intermodulation products by additional attenuation of all signals and their harmonics which are outside of the receiving range and – due to non-linearities and mixing – could cause intermodulation products to fall within the useful VHF or UHF band and disturb the reception

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- Suppression of third-order cross-modulation products by the attenuation of strong interfering signals which could transfer their modulation to the wanted – but possibly weak – signal
- Increase of image-frequency rejection by the additional attenuation of signals defined as image frequency relative to the received frequency
- Increase of intermediate frequency (IF) rejection by additional attenuation of interfering signals on one of the intermediate frequencies
- Prevention of desensitization (reciprocal mixing) by the attenuation of strong interfering signals which could otherwise transfer the noise sidebands of the receiver oscillator, mixed onto the interfering signal, to the useful band, thus reducing sensitivity
- Prevention of blocking by the attenuation of strong interfering signals which could reduce the amplitude of the useful IF signal by overdriving the mixer stage

Transmit filter benefits – in detail

- Attenuation of broadband transmitter noise caused by the exciter oscillator or power amplifiers
- Suppression of spurious emissions, mainly occurring in the small-signal stages during frequency conditioning
- Suppression of harmonics, mainly generated in the power stages
- Attenuation of transmitter (backward) intermodulation products of the 3rd or higher order: these are generated – within a simultaneously operating system with co-sited transmitters – by the radiation of transmitter signals via the antennas into the output of an other transmitter. In this case the attenuation of the filter at the transmission end is effectively doubled and adds to the antenna-decoupling factors.

Benefits by filters	Background
No irritation of the operator	By unwanted response of the receiver carrier squelch
No degradation of the receive sensitivity	Also with weak wanted receive signals
No irritation of the operator by spurious reception (phantom signals)	Such interference may be generated by signals identical with the image frequencies or the intermediate frequency
No RF output power reduction of the transmitter	Interfering signals entering via the antenna socket influence the VSWR-depending gain control loop
No radiation of unwanted and interfering signals	Radiated TX intermodulation products can result in self-jamming of the own receive system or irritations of the aircraft pilot

Practical effects of improvement

Optimized radio installations using filters help to achieve the following vital operational benefits:

System engineering note

In addition to the use of filters described here, the following tools should be taken into consideration to master challenges by collocation:

- Preselector FT 402 (Series 400U option for RX path)
- TX/RX Filters FD/FU/FT 403TR (Series 400U option for TX and RX path; FH capability)
- Antenna management by
  - Alternative antenna sites
  - Alternative use of existing antennas
- Highly decoupled, eg collinear, antenna types (eg HK 353A)
- Circulators
- Frequency management (planning)

are useful for suppressing of inband interference.

- Bandpass filters
- High- or lowpass filters
- Notch filters
- Special interference suppression devices

are helpful for suppressing out-of-band interferences.

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Quick Type Guide and Basic Specifications

The following guide helps to identify the right filter or multicoupler for the actual system requirement by comparison. For additional specifications and ordering information please refer to the type-specific »additional specifications«, page 173.

Manually tuned

Type	Frequency range (MHz)	Tuning	RF input power AMc = AM carrier	3 dB BW (in % of f_o or in MHz)	Selectivity [1]	Insertion loss (filter)	Remarks, multicoupler capability: S = Starpoint T = T-coupler N = no
FU220 FU220Wx	100 to 162.025[4]	manual	200 W AMc 800 W PEP 300 W FM	≥0.05%	20 dB: ≤±0.4% 40 dB: ≤±1.0% 60 dB: ≤±4.0%	≤2.0 dB (0 to +40°C) ≤2.5 dB (–20 to +55°C) additional 0.5 dB at ≤108 MHz	S: up to 4 radios can be connected to one antenna (FU220W4)
FD220 FD220Wx	225 to 399.975	manual	200 W AMc 800 W PEP 300 W FM	≥0.05%	20 dB: ≤±0.4% 40 dB: ≤±1.0% 60 dB: ≤±4.0%	≤2.0 dB	S: up to 4 radios can be connected to one antenna (FD220W4)
FD225 FD225Wx	225 to 399.975	manual	200 W AMc 800 W PEP 300 W FM	≥0.05%	20 dB: ≤±0.4% 40 dB: ≤±1.0% 60 dB: ≤±4.0%	≤2 dB	T: up to 8 (FD225W8) or even more [3] radios can be connected to one antenna
Filters with 1 x HS9043/9 per port	100 to 156.000	manual	50 W AMc	≥0.2% (k3)	≥14 dB: 1% (k3)	≤2.0 dB (k3) ≤0.5 dB (k10)	S [2]
Filters with 1 x HS9043/0 per port	225 to 399.975	manual	50 W AMc 100 W FM	≥0.2% (k3)	≥17 dB: 1% (k3)	≤2.0 dB (k3) ≤0.5 dB (k10)	S [2]
Filters/ Multicouplers with 1 or 2 x HS9043 per radio port	see above	manual	see above	see above ≥0.25% (k5)	1 x HS9043 per port: see above 2 x HS9043 per port: VHF: ≥22 dB: 1% (k5); UHF: ≥32 dB: 1% (k5)	see above ≤1.5 dB (k5) ≤1 dB (k10)	A great variety of special filter and multicoupler combinations – with n radio ports and – with 1 or 2 cavity filters per radio port are available; details for project-specific solutions on request

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Automatically tuned

Type	Frequency range (MHz)	Tuning	RF input power AMc = AM carrier	3 dB BW (in % of f_o or in MHz)	Selectivity [1]	Insertion loss (filter)	Remarks, multicoupler capability: S = Starpoint T = T-coupler N = no
FU214A	100 to 162.025[4]	automatic ≤4 s 2 s typ.	50 W AMc 100 W FM	≥0.5 MHz	20 dB: ≤±2 MHz 35 dB: ≤±5 MHz 40 dB: ≤±7 MHz	≤1.5 dB (+10 to 40°C) ≤2.0 dB (–30 to +55°C)	N: filter with integrated bypass for distress channel
FD213A	225 to 399.975	automatic ≤4 s 2 s typ.	50 W AMc 100 W FM	≥1 MHz	20 dB: ≤±3 MHz 35 dB: ≤±7 MHz 40 dB: ≤±11 MHz	≤1.5 dB (+10 to 40°C) ≤2.0 dB (–30 to +55°C)	N: filter with integrated bypass for distress channel
FD213A2	225 to 399.975 (2x)	automatic ≤4 s 2 s typ.	50 W AMc 100 W FM (per radio)	≥1 MHz	20 dB: ≤±3 MHz 35 dB: ≤±7 MHz 40 dB: ≤±11 MHz	≤1.5 dB (+10 to 40°C) ≤2.0 dB (–30 to +55°C)	N: dual filter for 2 independently operating UHF radios; with integrated bypass for UHF distress channel
FT213A	100 to 162.025 and 225 to 399.975[4]	automatic ≤4 s 2 s typ.	50 W AMc 100 W FM	VHF: ≥0.5 MHz UHF: ≥1 MHz	VHF: 20 dB: ≤±2 MHz 35 dB: ≤±5 MHz 40 dB: ≤±7 MHz UHF: 20 dB: ≤±3 MHz 35 dB: ≤±7 MHz 40 dB: ≤±11 MHz	≤1.5 dB (+10 to 40°C) ≤2.0 dB (–30 to +55°C)	N: combined VHF/UHF filter with integrated bypass for VHF and UHF distress channels
FU221 FU221Wx	100 to 162.025[4]	automatic ≤10 s 6 s typ.	200 W AMc 800 W PEP 300 W FM	≥0.05%	20 dB: ≤±0.4% 40 dB: ≤±1.0% 60 dB: ≤±4.0%	≤2.0 dB (0 to +40°C) ≤2.5 dB (–20 to +55°C) Additionally 0.5 dB at ≤108 MHz	S: up to 4 radios can be connected to one antenna (FU 221W4)
FD221 FD221Wx	225 to 399.975	automatic ≤10 s 6 s typ.	200 W AMc 800 W PEP 300 W FM	≥0.05%	20 dB: ≤±0.4% 40 dB: ≤±1.0% 60 dB: ≤±4.0%	≤2.0 dB	S: up to 4 radios can be connected to one antenna (FD 221W4)

1) Attenuation at x % frequency offset from center frequency f_o

2) HS9043 filters have variable coupling degree (k1 to k10)

3) With lower RF input power

4) Nominal value is 162.025 MHz, but operation is guaranteed up to 162.975 MHz

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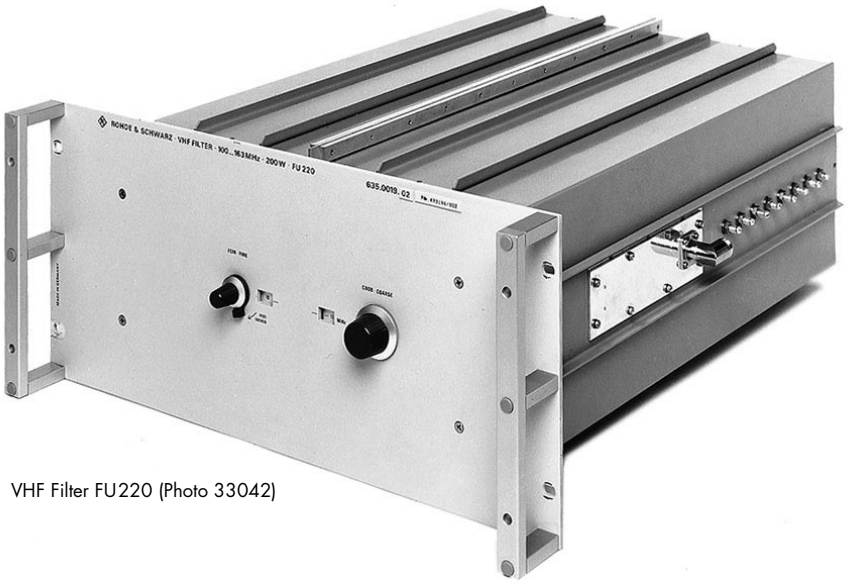
VHF Filters FU220
UHF Filters FD220
VHF Multicouplers FU220W(.)
UHF Multicouplers FD220W(.)

- **Manually tuned**
- **High RF power**
- **High selectivity**
- **4 ports or less**



VHF Filter FU220 (Photo 33042)

Brief description

Design and features

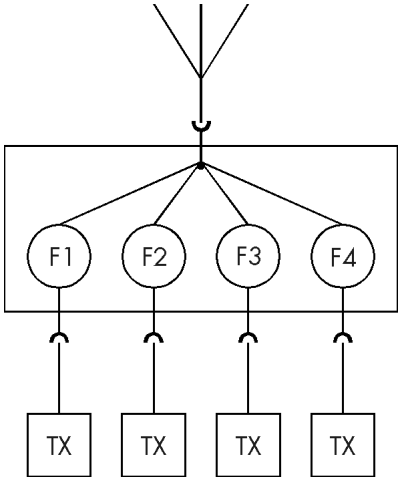
Filters FU220 and FD220 are made up of two coaxial resonators, fixed-coupled to form a compact two-section filter plug-in. Tuning is performed manually by altering the length of the longitudinally adjustable inner conductors via a gearing common to both resonators. From the gear unit, two axles are routed outward through the front panel on which the tuning knobs for coarse and fine tuning are fixed. The axles are connected each with a scale for manual tuning.

The robust and mechanically stiff layout and the use of temperature-stable INVAR (iron-nickel alloy) for filter bodies, spindles and coupling in connection with silver-coating guarantee the specifications

- throughout the entire temperature range and
- under 100% duty-cycle high-power operation

Multicoupler capability

To form a multicoupler (combining filter) to operate a number of either transmitters or receivers via a single antenna, up to 4 filters can be combined via a VHF or UHF 2- or 4-way combining array for rack integration. This array consists of a starpoint and a multistage quarter-wave transformation line towards the common antenna ensuring good matching of the filter inputs to the input impedance of the antenna over the entire VHF or UHF band. The multicouplers are thus suitable for operation at any frequency in the band.



Application example for 4-port multicoupler

Please note:

- Two differing filter models for standalone (screw-type RF sockets) or multicoupler use (plug-in RF sockets)
- Different filter arrangement in multicouplers for VHF (filters in horizontal position) or UHF (filters in vertical position: two upper and two lower units). The reason for this is the necessary short connection to the 2- or 4-way combining array
- Extension models of multicouplers available, 100% prepared for upgrading to a maximum of 4 ports. For details please refer to the ordering information.

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Specifications

Basic specifications

– Frequency range
– RF power handling
– Bandwidth
– Selectivity
– Insertion loss
see Quick Type Guide

Additional specifications

Circuit design characteristics	fixed-coupled 2-circuit (resonator) type
Input impedance (radio port)	50 Ω, VSWR: ≤1.6 : 1 (0 to +40°C) ≤2.0 : 1 (–20 to +55°C) valid for filters; multicouplers see below
Output impedance (antenna port)	50 Ω
RF connectors (radio or antenna port)	N-type female

Different specifications for multicouplers

Number of inputs (radio ports)	2 to 4 depending on type and model
Maximum total RF input power	2 to 4 x 200 W AM carrier, 100% mod. 2 to 4 x 300 W FM
Maximum total RF output power (antenna port)	800 W AM carrier, 100% mod.; 1200 W FM
Insertion loss	
FD220W2/W4	≤2.5 dB (–20 to +55°C)
FU220W2/W4	≤2.5 dB (0 to +40°C) ≤3.0 dB (–20 to +55°C) additionally 0.5 dB at f ≤108 MHz
Input impedance (radio port)	50 Ω, VSWR: ≤2.0 : 1 (0 to +40°C) ≤2.5 : 1 (–20 to +55°C)

General data

EMC	MIL-STD-461/462
Environmental testing	VG 95332
Storage at low temperature	page 22, grade 4 (–55°C)
Storage in dry heat	page 23, grade +75°C
Operating temperature	
Cold testing	page 3, grade –20°C
Dry heat	page 3, grade 7 (+55°C), but with 30% humidity
Damp heat	page 5, grade 8 (+40°C), 95% humidity without condensation
Mechanical	VG 95332
Vibration	page 24, group A (10 to 55 Hz), grade 2; unit in position of use for the whole test period of 30 min
Dimensions W x H x D (in mm)	
FU220	483 x 220 x 560 (seated depth)
FD220	483 x 220 x 500 (seated depth)
FU/FD220W2 (.02)	550 x 445 x 592 (rack requirement)
FU/FD220W4 (.02)	550 x 890 x 592 (rack requirement)
Weight	
FU/FD220	approx. 30 kg
FU/FD220W2 (.02)	approx. 65 kg
FU/FD220W4 (.02)	approx. 130 kg

Note: Specifications refer to filters and multicouplers, if not stated otherwise, and to nominal RF terminations (50 Ω).

Ordering information

UHF Filter Standard filter [1]	FD220	0636.9010.02
Spare model for multicoupler W2 Spare/extension model for upper two filters of W4 (.02/.03/.04) Spare model for W4 (.12) [2][3]	FD220	0636.9010.03
Spare/extension model for lower two filters of W4 (.02/.03/.04) [2][3]	FD220	0636.9010.04
UHF 2-Port Multicoupler Standard type, 19" 10 HU [3]	FD220W2	0643.2017.02
UHF 4-Port Multicoupler Standard type, 19" 20 HU [4]	FD220W4	0643.4010.02
Special model [5]	FD220W4	0643.4010.12
UHF 2-Port Multicoupler Special model, 19" 20 HU, extendiable to 4 ports by FD220 (.04) [6]	FD220W4	0643.4010.03
UHF 3-Port Multicoupler Special model, 19" 20 HU, extendiable to 4 ports by FD 220 (.04) [6]	FD220W4	0643.4010.04
VHF Filter Standard filter [1]	FU220	0635.0019.02
Spare model for multicouplers W2 or W4 Extension model for W4 [7]	FU220	0635.0019.03
VHF 2-Port Multicoupler Standard type, 19" 10 HU	FU220W2	0643.3013.02
VHF 4-Port Multicoupler Standard type, 19" 20 HU [7]	FU220W4	0643.5016.02
VHF 2-Port Multicoupler Special model, 19" 20 HU, extendiable to 4 ports [6]	FU220W4	0643.5016.03
VHF 3-Port Multicoupler Special model, 19" 20 HU, extendiable to 4 ports [6]	FU220W4	0643.5016.04

For multicoupler configuration examples please refer to page 181: the photo shows automatically tuned 4-port multicouplers, but manually tuned FD220W4 or FU220W4 look similar.

1) Horizontal 19" 5 HU rack plug-in with standard (screwed) RF connectors, for stand-alone filter (not multicoupler) use
2) Vertical ½19" 10 HU plug-in with plug-in RF connectors for automatic connection with the multicoupler combining array
3) FD220W2 (.02) consists of two UHF Filters FD220 (.03) and one UHF 2-way combining array
4) FD220W4 (.02) consists of two upper filter plug-ins FD220 (.03) side by side, two lower filter plug-ins FD220 (.04) side by side and one UHF 4-way combining array. For logistics advantage: see Note 5
5) FD221W4 (.12) can be used as special alternative to model 02: it includes 4 identical Filters FD221 (.03)
6) Delivered with 50 Ω terminations for open extension port(s)
7) FU220W4 (.02) consists of four VHF Filters FU220 (.03) and one VHF 4-way combining array

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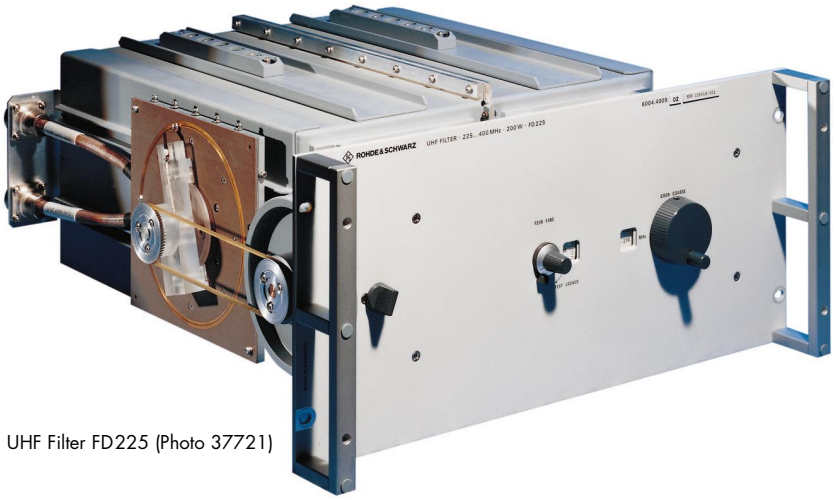
UHF Filters FD225
UHF Multicouplers FD225W(.)

- **Manually tuned**
- **High RF power**
- **High selectivity**
- **Up to 8 or more ports**



UHF Filter FD225 (Photo 37721)

Brief description

Design and features

The design of FD225 corresponds basically to that of the 2-circuit resonator filter FD220, where the tuning is performed by alternating the length of the inner conductors, but with the essential T-coupler add-on, integrated at the left end of the 19" 5 HU filter plug-in. For the design and features of the 2-circuit filter please refer to FD220.

Multicoupler capability

The integrated T-coupler enables the coupling of 8 high-power (or even more medium-power) transmitters to a single antenna. More than 8 transmitters can be combined for extremely complex applications taking into account engineering aspects like additional insertion loss per channel, maximum output power handling, standby concept or rack height.

The T-coupler, which is of low-loss stripline design, is a circuit-shaped 50-line device similar to a potentiometer, which enables the manual variation of the line length by moving the center arm. Thus impedances are transformed is such a way that the energy flow of T-coupled transmitters is always directed towards the antenna with an excellent VSWR over the entire UHF frequency range. Using appropriate dielectrical material a wide termination variation is achieved, while the dimensions are still constant and small.

Exact adjustment of each filter output to the antenna is performed manually from the filter front panel by tuning the T-coupler to minimum VSWR (shown on the TX-integrated indication). For the electrical multicoupler configuration RF cables of the Filters FD225 are required only (in addition to a short circuit termination for the T-coupler of the first filter). A complete UHF 8-Port Multicoupler FD225W8 consists eg of 8 Filters FD225, a rackmounting kit (rugged mechanical support structure to guarantee the rack statics, matching the dimensions of the 19" rack ordered as under an extra item), an RF cable set, accessories, compilation and a protocolled subsystem test.

UHF 7-Port Multicoupler FD225W7 (Photo 37808)

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Specifications

Basic specifications

– Frequency range
– RF power handling
– Bandwidth
– Selectivity
– Insertion loss
see Quick Type Guide

Additional specifications

Circuit design characteristics	fixed-coupled 2-circuit (resonator) type with integrated T-coupler
Input impedance (radio port)	50 Ω, VSWR: ≤1.6 : 1 (0 to +40°C) ≤2.0 : 1 (–20 to +55°C) valid for filters; multicouplers see below
Output impedance (antenna port)	50 Ω
RF connectors	
Radio port	N-type female
T-coupler ports (for next T-coupler or antenna)	7/16 female

Different specifications for multicouplers

Number of inputs (radio ports)	2 to 8 (or >8) depending on summarized power at antenna port; easy expansion capability eg from a 6-port to a 8-port multicoupler due to modular and broadband design
Maximum total RF output power (antenna port)	1600 W FM
Insertion loss	≤2.0 dB
Filter loss	≤0.1 dB per channel
Input impedance (radio port)	50 Ω, VSWR: ≤2.0 : 1 (0 to +40°C) ≤2.5 : 1 (–20 to +55°C)

General data

EMC	MIL-STD-461/462
Environmental testing	VG 95332
Storage at low temperature	page 22, grade 4 (–55°C)
Storage in dry heat	page 23, grade +75°C
Operating temperature	
Cold testing	page 3, grade 6 (–30°C)
Dry heat	page 3, grade 7 (+55°C), but with 30% humidity
Damp heat	page 5, grade 8 (+40°C), 95% humidity without condensation
Mechanical	VG 95332
Vibration	page 24, group A (10 to 55 Hz), grade 2; 30 min total testing time in operational position with unit switched off, followed by functional testing
Dimensions (FD225) W x H x D	483 mm x 220 mm x 500 mm (seated depth), 19" 5 HU plug-in
Weight (FD225)	approx. 30 kg

Note: Specifications refer to filters and multicouplers, if not stated otherwise, and nominal RF terminations (50 Ω).

Ordering information

UHF Filter		
Spare/extension model for multicouplers	FD225	6004.4009.02
UHF 8-Port Multicoupler		
Standard type	FD225W8	6004.6301.02
UHF n-port Multicoupler		
Standard type with n ports on request	FD 225W(.)	1)

1) For n = 2, 3 and 4 see also starpoint Multicouplers FD220W2 and W4

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VHF and UHF Filter Combinations
VHF and UHF Multicouplers
with HS9043 Cavities

– Manually tuned

– Medium RF power

– Medium selectivity

Cavity Filter HS9043
(Photo 19042)

Brief description

Design and features

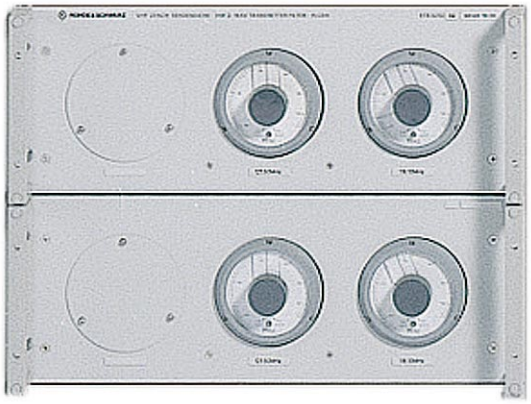
Cavity Filters HS9043 are proven »working horses« that have been used successfully for decades. Their

- excellent mechanical precision
- versatility in use for multiport filters or multicouplers
- reasonable size and
- good price/performance ratio

make these filters very attractive. They are applied to single-channel systems where medium power handling and medium selectivity are sufficient. For more stringent requirements, however, the Filters FD/FU220 or FD225 are unbeatable to overcome co-site conditions requiring highest selectivity and/or with high RF power rating.

There are 2 basic types: VHF Filter HS9043/9... and UHF Filter HS9043/0... which are of equal design and function principle, they only differ in respect of specifications and dimensions. The expression »HS9043« refers to both types.

HS9043 is cylinder-shaped and designed as coaxial resonant-line circuit with an inner and outer conductor. Between the free end of the inner conductor and the outer conductor there is – in axle direction – a variable capacitance which is designed as a coaxial tubular capacitor with contact springs to the outer conductor. By tuning the spindle with the scale knob one can vary the sunken depth of the capacitor along its longitudinal axis and adjust the wanted resonance frequency. The input and output coupling is made with variable coupling loops which can be rotated separately to vary the coupling degree (k) and thus the selectivity of the filter.



Filter configuration with 4 cavity filters HS9043
(Photo 38241)

Special filter and multicoupler capability

HS9043 can be configured to

- special filter types, eg
  - with 3 ports for 3 radios and 3 antennas or
  - with 2 filters per port (double-section filter) to increase selectivity
- starpoint multicouplers.

The appropriate number of Cavity Filters HS9043 is assembled together with a mechanical slide-in unit, special coaxial 2-, 4- or 8-way starpoints, RF cables, transformation stages etc to form a compact 19" plug-in for rack integration.

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Specifications

Basic specifications

- Frequency range
- RF power handling
- Bandwidth
- Selectivity
- Insertion loss

see Quick Type Guide

Additional specifications

Circuit design characteristics	variable-coupled cavity resonator filters
Input and output coupling degree	manually settable for both: k ≤10
Input impedance (radio port) of a single-section filter	50 Ω, VSWR: ≤1.1 : 1 (f_o) ≤2.0 : 1 (f_o ±0.1% at coupling degree k5), valid for filters; multicouplers see below
Input impedance (radio port) of a double-section filter	50 Ω, VSWR: ≤1.2 : 1 (f_o) ≤1.5 : 1 (f_o ±100 kHz)
Output impedance (antenna port)	50 Ω
RF connectors (radio or antenna port)	N-type female
Effect of temperature	≤3 kHz/°C
Maximum ambient temperature	+55 °C

Different specifications for multicouplers

Number of inputs (radio ports)	up to 8 depending on type and model
Total RF input power	up to 8 x 50 W AM carrier, 100% mod. (VHF) up to 8 x 30 W AM carrier, 100% mod. (UHF) [1]
Insertion loss	depending on project-specific filter settings

General data

Max. operating temperature	+55 °C
Dimensions W x H x D (in mm)	
HS9043/9 (VHF)	148 x 446 (diameter x length)
HS9043/0 (UHF)	148 x 290 (diameter x length)
VHF filter or multicoupler with 3 x HS9043/9, 19" 4 HU rack plug-in	483 x 177 x 446
UHF filter or multicoupler with 3 x HS9043/0, 19" 4 HU rack plug-in	483 x 177 x 446
Filter/multicoupler configurations with n x HS9043	n = 4 to 6: 19" 8 HU n = 7 to 9: 19" 12 HU
Weight	
HS9043/9 (VHF)	approx. 7 kg
HS9043/0 (UHF)	approx. 7 kg

Note: Specifications refer to filters and multicouplers, if not stated otherwise, and to nominal RF terminations (50 Ω).

Ordering information

VHF Cavity Filter Cylinder type filter	HS9043/9	0138.5746.02
UHF Cavity Filter Cylinder type filter	HS9043/0	0156.5738.02

VHF filters and combiners, configuration examples
19" plug-in assemblies with several ports[2]

VHF 1-Port Filter 1 x HS9043/9	FU432W1	0713.7305.02
VHF 2-Port Filter 1 x HS9043/9 per port	FU256	0682.7016.02
VHF 2-Port Filter 2 x HS9043/9 per port	FU255	0679.8815.02
VHF 3-Port Filter 1 x HS9043/9 per port	FU263	6009.3000.xx RX filter = mod 02 TX filter = mod 03
VHF 3-Port Filter 2 x HS9043/9 per port	FU265	6009.3100.xx RX filter = mod 02 TX filter = mod 03
VHF 1-Port Filter 1 x HS9043/9 Special model 19" 8HU, extendible to 4 ports	FU432W4	0712.4602.05
VHF 2-Port Multicoupler 1 x HS9043/9 per port	FU432W2	0712.4502.02
VHF 2-Port Filter 2x HS9043/9 Special model 19" 8HU, extendible to 4 ports	FU432W4	0712.4602.02
VHF 3-Port Multicoupler 1 x HS9043/9 per port	FU432W4	0712.4602.03
VHF 4-Port Multicoupler 1 x HS9043/9 per port	FU432W4	0712.4602.04
VHF 5-Port Multicoupler 1 x HS9043/9 per port	FU432W8	0712.4702.05
VHF 6-Port Multicoupler 1 x HS9043/9 per port	FU432W8	0712.4702.06
VHF 7-Port Multicoupler 1 x HS9043/9 per port	FU432W8	0712.4702.07
VHF 8-Port Multicoupler 1 x HS9043/9 per port	FU432W8	0712.4702.08

UHF filters and combiners, configuration examples

UHF 1-Port Filter 1 x HS9043/0	FD256	0682.7216.11
UHF 2-Port Filter 1 x HS9043/0 per port	FD256	0682.7216.02
UHF 3-Port Filter 1 x HS9043/0 per port	FD256	0682.7216.13
UHF 2-Port Filter 2x HS9043/0 per port	FD255	0679.8515.02
UHF 2-Port Multicoupler 1 x HS9043/0 per port	FD432W4	0745.6504.02
UHF 3-Port Multicoupler 1 x HS9043/0 per port	FD432W4	0745.6504.03
UHF 4-Port Multicoupler 1 x HS9043/0 per port	FD432W4	0745.6504.04

Further types to be defined

1) The maximum power-handling capacity is a function of the coupling degree. The values refer to Series 200 transmitters and low filter coupling degrees (ie high selectivity)

2) »Port« refers to radio ports

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VHF Filters FU214A, UHF Filters FD213A
UHF Filter (dual type) FD213A2, VHF/UHF Filter FT213A

- **Automatically tuned**
- **Medium RF power**
- **Medium selectivity**
- **Bypass for distress frequencies**
- **Stationary and mobile use**

VHF/UHF Automatic Filter FT213A; Note that the standard model 05 is fitted with 19" rack mount devices (instead of cabinet) (Photo 30474-1)

Brief description

Design and features

This filter series has outstanding features such as

- Compact 19" 3 HU design
- Combined VHF/UHF type available
- Integrated bypass for receiving VHF, UHF or VHF/UHF distress frequencies

A combined VHF/UHF Filter FT213A includes two capacitively tuned coaxial resonators per frequency range to form a two-section filter for the operating frequency. Tuning is carried out by means of a common[1)] axle which is driven and controlled by a microprocessor-controlled stepping motor by way of a gearing. Following a frequency change input from the radio, the filter tuning axle is first driven to the normal start (HOME) position. It is then moved to an angular position corresponding to the new frequency. The tuning is supported by a sophisticated and optically assisted motor control. If the frequency change is less than 100 kHz, retuning does not take place. The emission of RF power during the automatic tuning process is prohibited.

From the gear unit, an additional axle is routed outward on which a manual tuning knob can be fixed in the event of automatic tuning failure, supported by the integrated scales and tuning control meter.

The robust design and the use of selected temperature-stable materials and low-loss (silver-coated) surfaces guarantee the specifications

- throughout the entire temperature range and
- under 100% duty-cycle operation

The control cable between filter and radio unit provides the operating DC voltage as well as necessary frequency and other control information.

Bypass benefits

The 121.5 MHz bypass or 243 MHz bypass (VHF or UHF guard receiver bypasses) bridges the guard frequency across the receiver by active extraction. During transmit operation the bypass is disabled electronically by means of control information from the radio. Thus distress channel reception is possible automatically without any manipulations.

1) Common for the 2 resonators per frequency band and for VHF and UHF

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Specifications

Basic specifications

– Frequency range
– RF power handling
– Bandwidth
– Selectivity
– Insertion loss

see Quick Type Guide

Additional specifications

Circuit design characteristics	fixed-coupled 2-circuit (resonator) type
Input impedance (radio port)	50 Ω, VSWR: ≤1.6 : 1 (+10 to +40°C) ≤2.0 : 1 (–30 to +55°C) valid for filters; multicouplers see below
Output impedance (antenna port)	50 Ω
RF connectors	N-type female
Tuning control	
Interface	control from radio via optional Series 400U Filter/PA Interface GI414U or Series 200 multichannel radios
Code	BCD, TTL positive logic
Start	automatic start by change of BCD information
Power supply	
Interface	DC supply from radio via GI414U (see above)
Voltage	28 (+2/–6) V DC, negative to ground
Current (filter)	
During tuning	≤2.0 A
Quiescent current	≤0.7 A

Bypass filter characteristics and mutual influences

Insertion loss	±1 dB
Additional attenuation of bypass filter by main filter (with frequencies close together)	≤10 dB for worst case (details on request)
Additional attenuation of main filter by bypass filter (with frequencies close together)	≤10 dB for worst case (details on request)
Attenuation in stopband	
at ≥±8 MHz from 243.0 MHz	>30 dB
at ≥±4 MHz from 121.5MHz	>30 dB
Isolation	>50 dB

General data

EMC	MIL-STD-461/462
Environmental testing	VG 95332
Storage at low temperature	page 22, grade 4 (–55°C)
Storage in dry heat	page 23, grade +75°C
Operating temperature	
Cold testing	page 3, grade –20°C
Dry heat	page 3, grade 7 (+55°C), but with 30% humidity
Damp heat	page 5, grade 8 (+40°C), 95% humidity without condensation
Mechanical	VG 95332
Vibration	page 24, group A (10 to 55 Hz), grade 2; unit in position of use for the whole test period of 30 min
Dimensions W x H x D (in mm)	
Standard models (19" 3 HU)	485 x 132 x 450 (seated depth)
Shockmount models	485 x 200 x 450
Weight for standard models 05	
FT213A	approx. 18 kg
FD213A	approx. 11 kg
FD213A2	approx. 18 kg
FU214A	approx. 15 kg
Weight for shockmount models, in addition	approx. 4.5 kg

Note: Specifications refer to filters and multicouplers, if not stated otherwise, and to nominal RF terminations (50 Ω).

Ordering information

UHF Filter	FD213A	0637.4311.05
UHF Filter (2 x UHF)	FD213A2	0652.5815.05
VHF Filter	FU214A	0637.4611.05
VHF/UHF Filter Standard models for 19" rack installation	FT213A	0637.4011.05
Control Cable 2 m with 37-pin D-SUB and MIL connectors	FU214Z1	0637.4811.09

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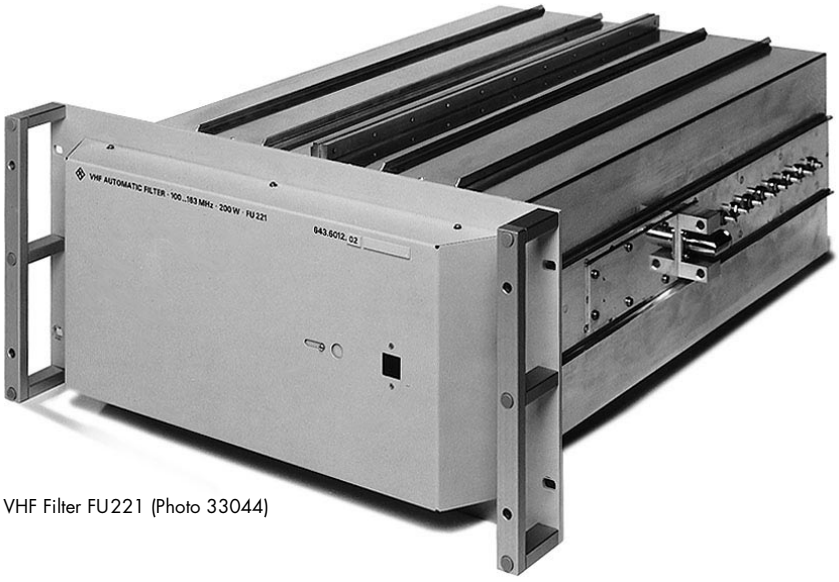
VHF Filters FU221
UHF Filters FD221
VHF Multicouplers FU221W(.)
UHF Multicouplers FD221W(.)

– Automatically tuned

– High RF power

– High selectivity

– 4 ports or less



VHF Filter FU221 (Photo 33044)

Brief description

Filters FU221 and FD221 are made up of two coaxial resonators, fixed-coupled to form a compact two-section filter plug-in. Tuning is performed manually by altering the length of the longitudinally adjustable inner conductors via a gearing common to both resonators.

The gear is driven by a microprocessor-controlled stepping motor. Following a frequency change input from the radio, the inner conductors of the cavity resonators are first driven to their start (HOME) position in mechanical mid-position. Subsequently, the automatic tuning is continued by counting the frequency-specific definite angle of rotation of the stepping motor which is supported by a sophisticated and optically assisted motor control, electronically stored frequency characteristic and built-in tests. Two light barriers prevent the filters from moving against the two stops. From the gear unit, an additional axle is routed outward on which a manual tuning knob can be fixed in the event of automatic tuning failure.

The robust and mechanically stiff layout and the use of temperature-stable INVAR (iron-nickel alloy) for filter bodies, spindles and coupling in connection with silver-coating guarantee the specifications

- throughout the entire temperature range and
- under 100% duty-cycle high-power operation

The control cable between filter and radio unit provides the operating DC voltage as well as necessary frequency and other control information.

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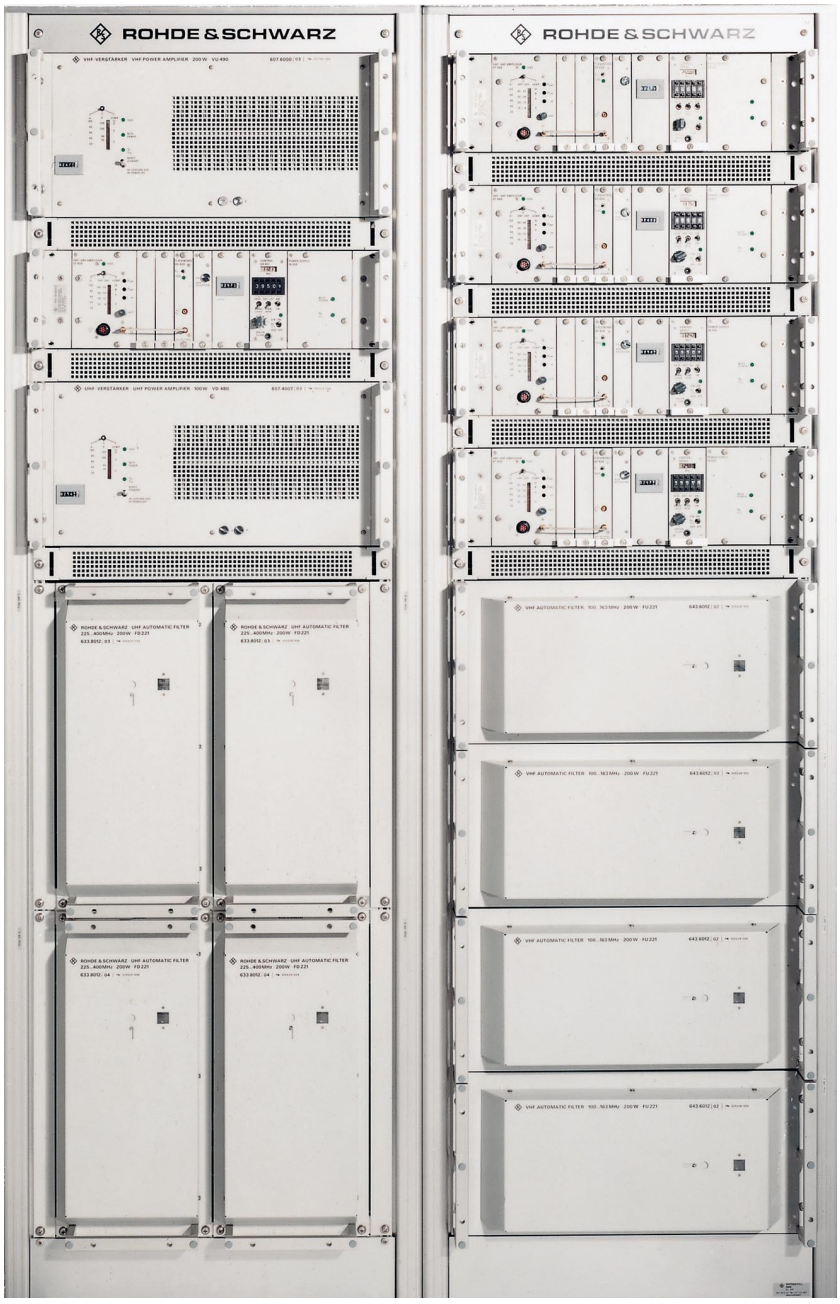
Multicoupler capability

To form a multicoupler (combining filter) to operate a number of either transmitters or receivers via a single antenna, up to 4 filters can be combined via a VHF or UHF 2- or 4-way combining array for rack integration. This array consists of a starpoint and a multistage quarter-wave transformation line towards the common antenna ensuring good matching of the filter inputs to the input impedance of the antenna over the entire VHF or UHF band. The multicouplers are thus suitable for operation at any frequency in the band.

Please note:

- Two differing filter models for standalone (screw-type RF sockets) or multicoupler use (plug-in RF sockets)
- Different filter arrangement in multicouplers for VHF (filters in horizontal position) or UHF (filters in vertical position: two upper and two lower units). The reason for this is the necessary short connection to the 2- or 4-way combining array
- Extension models of multicouplers available, 100% prepared for upgrading to a maximum of 4 ports. For details please refer to the ordering information



VHF/UHF radio station with Series 400 multichannel transmitters and 4-Port Multicouplers FU221W4 (VHF, right) and FD221W4 (UHF, left) (Photo 34072)

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Specifications

Basic specifications

- Frequency range
- RF power handling
- Bandwidth
- Selectivity
- Insertion loss

see Quick Type Guide

Additional specifications

Circuit design characteristics	fixed-coupled 2-circuit (resonator) type
Input impedance (radio port)	50 Ω, VSWR: ≤1.6 : 1 (0 to +40°C) ≤2.0 : 1 (–20 to +55°C) valid for filters; multicouplers see below
Output impedance (antenna port)	50 Ω
RF connectors (radio or antenna port)	N-type female
Tuning control	
Interface	control from radio via optional Series 400U Filter/PA Interface GI414U or Series 200 multi-channel radios
Code	BCD, TTL positive logic
Start	automatic start by change of BCD information
Power supply	
Interface	DC supply from radio via GI414U (see above)
Voltage	28 (+2/–6) V DC, negative to ground
Current (filter)	
During tuning	≤2.0 A
Quiescent current	≤0.25 A

Different specifications for multicouplers

Number of inputs (radio ports)	2 to 4 depending on type and model
Maximum total RF input power	2 to 4 x 200 W AM carrier, 100% mod. 2 to 4 x 300 W FM
Maximum total RF output power (antenna port)	800 W AM carrier, 100% mod., 1200 W FM
Insertion loss	
FD221W2/W4	≤2.5 dB (–20 to +55°C)
FU221W2/W4	≤2.5 dB (0 to +40°C) ≤3.0 dB (–20 to +55°C) additionally 0.5 dB at f ≤108 MHz
Input impedance (radio port)	50 Ω, VSWR: ≤2.0 : 1 (0 to +40°C) ≤2.5 : 1 (–20 to +55°C)

General data

EMC	MIL-STD-461/462
Environmental testing	VG 95332
Storage at low temperature	page 22, grade 4 (–55°C)
Storage in dry heat	page 23, grade +75°C
Operating temperature	
Cold testing	page 3, grade –20°C
Dry heat	page 3, grade 7 (+55°C), but with 30% humidity
Damp heat	page 5, grade 8 (+40°C), 95% humidity without condensation
Mechanical	VG 95332
Vibration	page 24, group A (10 to 55 Hz), grade 2; unit in position of use for the whole test period of 30 min
Dimensions W x H x D (in mm)	
FU221	483 x 220 x 560 (seated depth)
FD221	483 x 220 x 500 (seated depth)
FU/FD221W2 (.02)	550 x 445 x 592 (rack requirement)
FU/FD221W4 (.02)	550 x 890 x 592 (rack requirement)
Weight	
FU/FD221	approx. 30 kg
FU/FD221W2 (.02)	approx. 65 kg
FU/FD221W4 (.02)	approx. 130 kg

Note: Specifications refer to filters and multicouplers, if not stated otherwise, and to nominal RF terminations (50 Ω).

Ordering information

UHF Filter Standard filter [1]	FD221	0633.8012.02
Spare model for multicoupler W2 Spare/extension model for upper two filters of W4 (.02/.03/.04) Spare model for W4 (.12) [2][3]	FD221	0633.8012.03
Spare/extension model for lower two filters of W4 (.02/.03/.04) [2][3]	FD221	0633.8012.04
UHF 2-Port Multicoupler Standard type, 19" 10 HU [3]	FD221W2	0643.2517.02
UHF 4-Port Multicoupler Standard type, 19" 20 HU [4]	FD221W4	0643.4510.02
Special model [5]	FD221W4	0643.4510.12
UHF 2-Port Multicoupler Special model, 19" 20 HU, extendible to 4 ports by FD220 (.04) [6]	FD221W4	0643.4510.03
UHF 3-Port Multicoupler Special model, 19" 20 HU, extendible to 4 ports by FD 220 (.04) [6]	FD221W4	0643.4510.04
VHF Filter Standard filter [1]	FU221	0643.6012.02
Spare model for W2 or W4 Extension model for W4 [7]	FU221	0643.6012.03
VHF 2-Port Multicoupler Standard type, 19" 10 HU	FU221W2	0643.3513.02
VHF 4-Port Multicoupler Standard type, 19" 20 HU [7]	FU221W4	0643.5516.02
VHF 2-Port Multicoupler Special model, 19" 20 HU, extendible to 4 ports [6]	FU221W4	0643.5516.03
VHF 3-Port Multicoupler Special model, 19" 20 HU, extendible to 4 ports [6]	FU221W4	0643.5516.04
Control Cable 2 m 5 m 10 m	ZT297	0637.3838.xx xx = 02 xx = 05 xx = 10

1) Horizontal 19" 5 HU rack plug-in with standard (screwed) RF connectors, for stand-alone filter (not multicoupler) use

2) Vertical $^1/_2$ 19" 10 HU plug-in with plug-in RF connectors for automatic connection with the multicoupler combining array

3) FD221W2 (.02) consists of two UHF Filters FD221 (.03) and one UHF 2-way combining array

4) FD221W4 (.02) consists of two upper filter plug-ins FD221 (.03) side by side, two lower filter plug-ins FD221 (.04) side by side and one UHF 4-way combining array. For logistics advantage: see Note 5

5) FD221W4 (.12) can be used as special alternative to model 02: it includes 4 identical Filters FD221 (.03)

6) Delivered with 50 Ω terminations for open extension port(s)

7) FU221W4 (.02) consists of four VHF Filters FU221 (.03) and one VHF 4-way combining array

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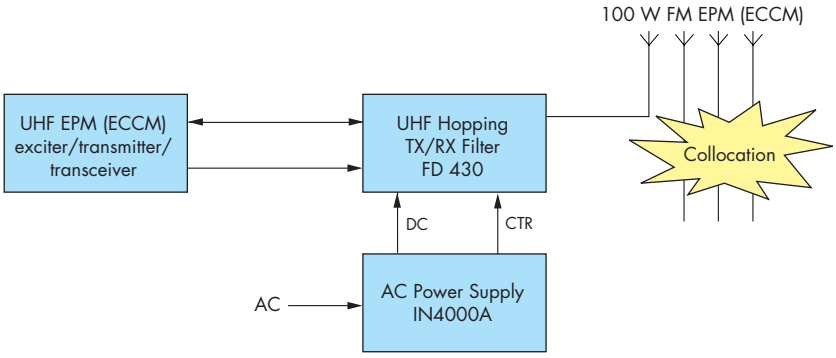
UHF Hopping TX/RX Filter FD430

Extends the interference-free operational communication range of collocated radios



Brief description

UHF Hopping TX/RX Filter FD430 is used in multiple collocated EPM (ECCM) radio system configurations where the proximity of antennas and frequency hopping operation cause undesired radio interference. The filter selectivity response improves both the transmit and receive characteristics, as the core filter and amplifier section is used for both the transmit and receive path. In addition to filtering, FD430 is used to amplify a low exciter RF power up to high power level, eg 100 W FM.

FD 430 is designed
– for HAVE QUICK, SECOS and other EPM (ECCM) systems eg SATURN (tbd)
– for fixed radio installations

and with additional shockmount devices also
– for transportable radio installations (shelters, mobile towers) and
– for shipboard installations.

The characteristics and interfaces of UHF Hopping TX/RX Filter FD 430 are compatible with the Series 400U communication System introduced to many armed forces worldwide and with the new Series 4400 product line (see page 154).

Features and benefits

In detail, FD430 extends the interference-free operational communication range of collocated radios
- by improving transmitter spectral purity and broadband noise
- by improving receiver crossmodulation, intermodulation and desensitization

In addition, FD430 offers an economical solution
- by amplifying a low-power exciter signal up to 30 W AM or 100 W FM
- with an extremely good noise figure of 8 dB

This benefit is due to the use of tree low-noise amplifiers (LNA) between the four filter sections. All internal switching is done by solid-state components, eg PIN diode TX/RX switches, ensuring fast, highly reliable and noiseless operation.

FD430 is DC-supplied. For AC supply the separate Power Supply IN4000A is available as an add-on unit with automatic AC/DC switchover in case of mains failure.

FD430 and IN4000A are 19" plug-ins; they are well shielded for best EMC.

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UHF Hopping TX/RX Filter FD430

Specifications

Common data

Frequency range	225 to 400 MHz		
Tuning time	45 ms max.		
Selectivity:			
Frequency separation at	225 MHz	300 MHz	400 MHz
±4 MHz	≥40 dB	≥35 dB	≥30 dB
±8 MHz	≥64 dB	≥60 dB	≥56 dB
±12 MHz	≥76 dB	≥72 dB	≥66 dB
Ultimate attenuation (valid for common TX/RX antenna)	85 dB at f < 185 MHz 90 dB at f > 450 MHz up to 1 GHz		
RX/TX switching time	<500 µs		
Digital control interface (X1) (frequency tuning, transmit/receive & 100 W FM control, BITE test signal to TX/RX etc)	parallel: BCD active high		

Transmit data

RF power	
Input power – nominal	15 W FM, 10 W AM carrier
Input power – max. without damage	50 W FM, 35 W AM carrier
Input impedance	50 Ω/VSWR =1.5
Output power (into 50 Ω with >24 V DC)	100 W FM ±1 dB, 30 W AM carrier ±1 dB
Output power reduction w/VSWR 2.5 or 22 V DC	≤1.5 dB
Duty cycle	
at ≤45°C	100%
at >45°C to ≤55°C	50%
Permissable mismatch without damage	VSWR ∞
Unwanted emissions	
Broadband noise	≤–120 dBm/Hz at ±4 MHz ≤–130 dBm/Hz at ±10 MHz
Harmonic emission	–100 dBc max. for f ≤1 GHz –115 dBc max. for f >1 GHz
Backdoor intermodulation product attenuation with 30 W carrier output	45 dB below interfering input (3rd order) 85 dB below interfering input (5th order)
Modulation characteristics	valid for A3E
Distortion with f_m = 1 kHz/m = 0.85 input	≤5% + exciter distortion
Modulation depth with input m = 0.85 at 1 kHz	0.8 to 0.9
AF response	30 Hz to 25 kHz: ≤3 dB
S/N ratio with m = 0.85	≥40 dB

Receive data

Input impedance	50 Ω, VSWR ≤2
Permissible input power (without damage)	50 W FM, 35 W AM carrier due to protection circuitry
Gain	2 to 5 dB
Noise figure	≤8 dB
Spurious responses	
at ≤±100 kHz	–90 dBc
at ±100 kHz to ±1 MHz	–105 dBc
at ±1 MHz to ±2 MHz	–110 dBc

General data

Monitoring (tests)

FD430 front-panel LED indications	1 LED (green) for DC power ON 5 LEDs (red) for faults: – ALC fault – invalid frequency – PS (power supply) fault – temperature fault (in PAs) – VSWR fault
IN4000A front-panel LED indications	1 LED TEST (green) for DC within tolerance 1 LED FAIL (red) for NOGO 1 LED TEMP/ϑ_{up} (red) for overtemperature
IN4000A rear connector signals	GO/NOGO test (power failure) and overtemperature

Power supply

DC input	22 to 31 V, negative to ground, protected against adverse polarization
DC power consumption	≤650 W/≤23 A (TX mode) ≤140 W (RX mode)
Remote ON/OFF switching	integrated (radio controlled via X1 interface)
AC (with separate Power Supply IN4000A)	100 to 240 V ±10%, 47 to 440 Hz
DC output of IN4000A to FD430	28 V ±1%; 25 A max., short-circuit protected

Cooling

forced air cooling with front-to-rear air flow through 2 rear-panel mounted (FD430) and temperature-sensor-controlled integrated (IN4000A) fans

Mounting

FD430/IN4000A: 19" rackmount; bore holes (M4) provided in side panels for mounting telescopic rails

Dimensions

W x H x D (seated depth), approx.	
FD430 (19" plug-in, 4 HU)	482.6 mm x 176.3 mm x 495 mm
IN4000A (19" plug-in, 1 HU)	482.6 mm x 43 mm x 420 mm

Weight

FD430	approx. 20 kg
IN4000A	approx. 6 kg

Design: high degree of internal modularity

Colour: light grey to RAL 7047 or similar (FD430: PANTONE 420 U)

Ordering information

UHF Hopping TX/RX Filter	FD430	6083.7012.02
Recommended extra		
AC Power Supply	IN4000A	6105.5500.02

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VHF/UHF Coaxial Dipoles HK001, HK012, HK014

UHF Coaxial Dipole HK001
(Photo 24215)

VHF Coaxial Dipole
HK012
(Photo 31166)

VHF/UHF Coaxial
Dipole HK014
(Photo 39646)

Brief description

The coaxial dipoles are vertically polarizing omnidirectional antennas with high suppression of current flow on the outside of cables. As a result of their rugged design, they are also suitable for mobile use and particularly for shipboard applications.

- Low weight
- Minimal wind load
- Very rugged
- Protected against lightning
- Wide frequency range (HK014)
- Null fill-in of vertical pattern (HK014)

Specifications, ordering information

	HK001	**HK012**	**HK014**
Frequency range	225 to 400 MHz	100 to 165 MHz	100 to 1300 MHz
Polarization	vertical	vertical	vertical
Nominal impedance	50 Ω	50 Ω	50 Ω
VSWR	≤2	≤2	≤2
Permissible input power	400 W (CW)	400 W (CW)	
up to 400 MHz			430 W + 100% AM
up to 1000 MHz			270 W + 100% AM
up to 1300 MHz			240 W + 100% AM
Gain	2 dBi typ.	2 dBi typ.	2 dBi typ.
Horizontal pattern	omnidirectional	omnidirectional	omnidirectional
Connector	N female	N female	N female
Permissible wind velocity (without ice deposit)	185 km/h	160 km/h	160 km/h
Operating temperature range	–40 to +85°C	–40 to +85°C	–40 to +85°C
Dimensions (diameter x H)	430 mm x 470 mm	250 mm x 1150 mm	308 mm x 1100 mm
Weight	1.6 kg	3 kg	5 kg
Order number	425.2781.03	459.7611.02	644.1514.02

Recommended extra for HK014
Diplexer FT224 for frequency ranges 100 to 162 MHz and 225 to 400 MHz

Diplexer FT224

Diplexer FT224 permits the connection of a broadband antenna, eg VHF/UHF Coaxial Dipole HK014, to transceivers with separate VHF and UHF outputs or to separate VHF and UHF transceivers.

- Wide range of applications
- Low passband attenuation
- High stopband attenuation
- Compact design

Photo 33369

Ordering information

Diplexer	FT224	525.5117.03

Specifications

Frequency range	100 to 162 MHz 225 to 400 MHz
Nominal impedance	50 Ω
VSWR	<1.5 (with 50 Ω termination) <2 (with HK014)
Insertion loss	
in passband	≤0.3 dB (VHF), ≤0.5 dB (UHF)
in stopband	>30 dB
Permissible input power	200 W CW, 800 W PEP per branch in simultaneous operation
Connector	N female
Operating temperature range	–20 to +55°C
Dimensions (W x H x D)	130 mm x 130 mm x 50 mm
Weight	0.5 kg

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VHF/UHF Omnidirectional ATC Antenna HK353A

100 to 156 MHz (VHF)/225 to 400 MHz (UHF)
Self-supporting antenna mast, VHF dipole, UHF dipole, specially developed decoupling units

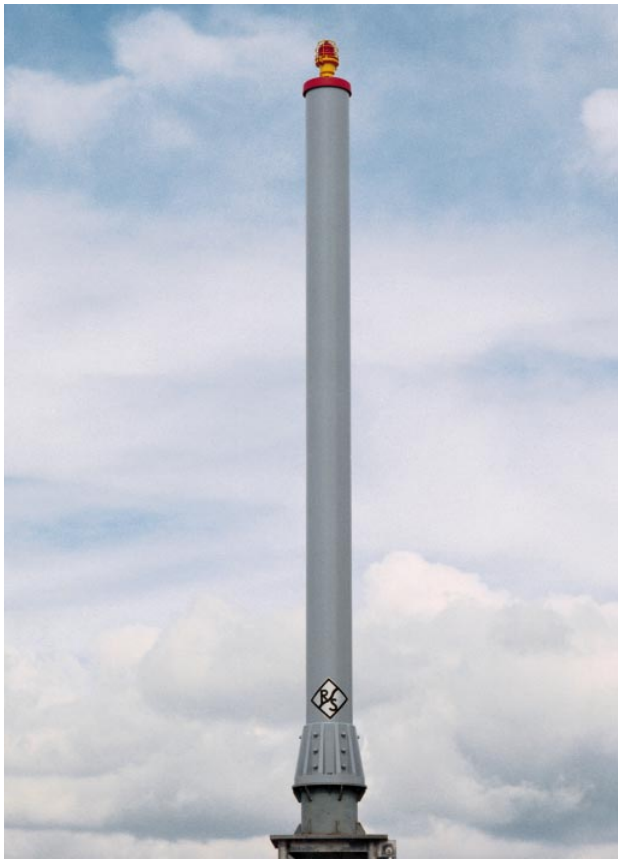

Photo 41617

Brief description

Antenna System HK353A is designed for ATC ground-to-air communications. Due to its modular design, any number of antenna configurations fitting into the mast can be set up. The most important components are the self-supporting antenna mast, the VHF dipole, the UHF dipole as well as specially developed decoupling units. The collinear arrangement of dipoles on the antenna mast permits several transmitting and receiving antennas to be set up.

With a view to easy transport, the antenna mast made of glassfiber-reinforced plastic (GRP) comes in two sections (starting from the 8 m version). The modular dipoles and the decoupling units are arranged inside the supporting cylinder.

Specifications

VHF Dipole HK153D2	
Frequency range	100 to 156 MHz
Polarization	vertical
Max. input power	1 kW per dipole
Nominal impedance	50 Ω
VSWR	<2.5 (in radome)
Gain	>2 dBi per dipole
Departure from circularity	<±1 dB
Connectors	R&S male for RG400
Dimensions	
Length	1850 mm (2 LU)
Diameter	248 mm
Weight	6 kg
UHF Dipole HK253D2	
Frequency range	225 to 400 MHz
Polarization	vertical
Max. input power	1 kW per dipole
Nominal impedance	50 Ω
VSWR	<2.5 (in radome)
Gain	>2 dBi per dipole
Departure from circularity	<±1 dB
Connectors	R&S male for RG400
Dimensions	
Length	925 mm
Diameter	248 mm
Weight	1.6 kg

Mechanical data of antenna system	
Max. wind speed	
without ice deposit	190 km/h
with 5 cm radial ice deposit	177 km/h
Max. height	10 m

Ordering information

VHF/UHF Omnidirectional ATC Antenna	HK353A	4002.1200

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VHF/UHF Direction Finders for VTS (Vehicle Traffic Service) Applications

High-tech in DF:

air traffic control and

vessel traffic service

Brief description

The classic application of traffic control direction finders lies in civil and military air traffic control, where they are used as approach navigation aids and serve for the identification of echoes on radar displays as well as for radiolocation by triangulation. In addition, traffic control direction finders are increasingly used in vessel traffic service, eg for identification and position finding, also in search and rescue operations, and for locating land-based vehicles.

Rohde & Schwarz has developed and manufactured Doppler direction finders for these applications for more than 30 years and delivered more than 1000 direction finding systems worldwide.

Main features

- High accuracy, up to 0.5°
- High reliability
- Life saving

Photo 37889-3

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VHF Direction Finding System PA030

Brief description

VHF Direction Finder PA030 is a system for air traffic control mainly. Applications include: approach aid, superposition on radar screens and position finding by triangulation. Furthermore and depending on the ordered software, the system is suitable for monitoring, identification, and direction finding of ship traffic at sea and of the coast. Search and rescue missions may be supported. The system is outstanding due to the flexible unit concept and the compact antenna, which favours the selection of an antenna position having good receiving conditions for direction finding. The equipment has an automatic built-in test routine, which controls functions and values at different levels. Any possible failure will be diagnosed and shown on the frequency display.

Photo 41739

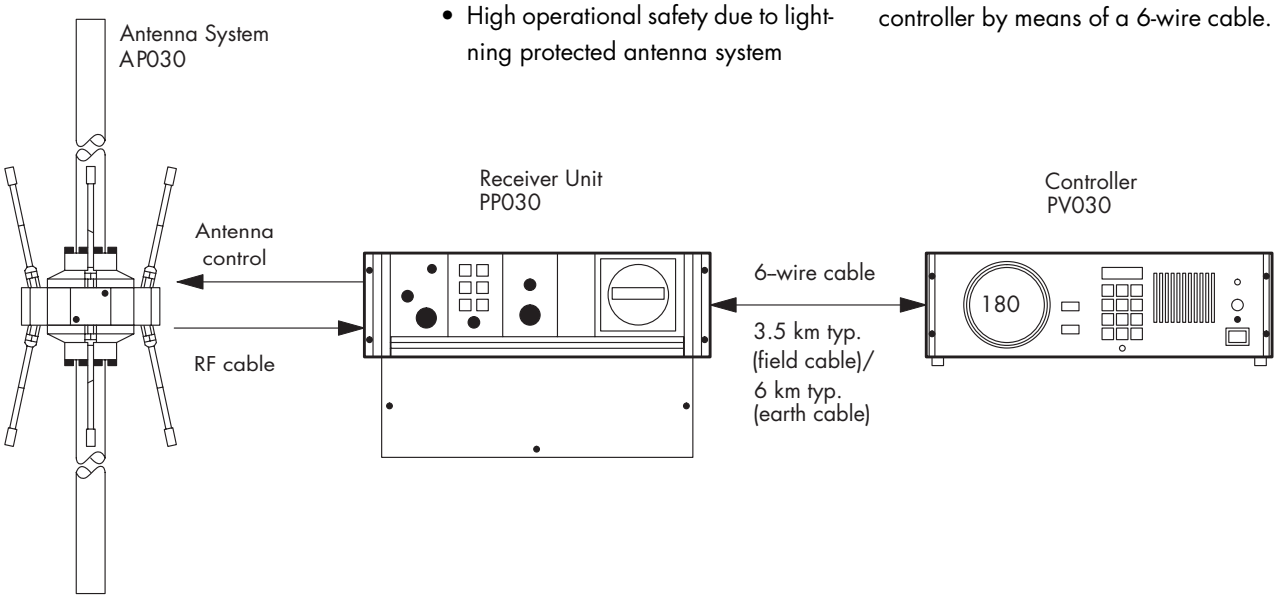
Characteristics

Special features

- Adaptable to any local situation due to the high flexibility of system components
- Unproblematic use even at unfavourable locations thanks to a new remote operation concept
- Direction finding of ELT transmitter and overmodulated signals
- Modulation-independent direction finding
- Compact antenna for easy installation
- Effective direction finding quality analysis with patented dual compass dial
- High operational safety due to lightning protected antenna system
- Noise-free message monitoring
- Prepared for additional standard interfaces
- Service-friendly due to comprehensive modular design
- AC supply and battery operation
- Failure status monitoring at frequency display

Description

The system operates in remote mode. The direction finding antenna is installed remotely from the controller at a location favourable for direction finding. Receiver, demodulator and antenna control module are integrated in a receiver unit located near to the antenna. They are connected to the controller by means of a 6-wire cable.



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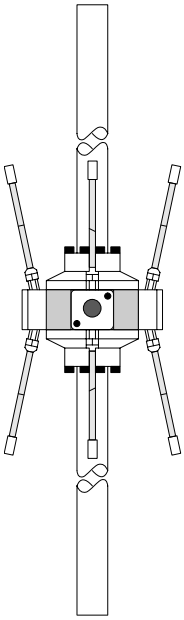
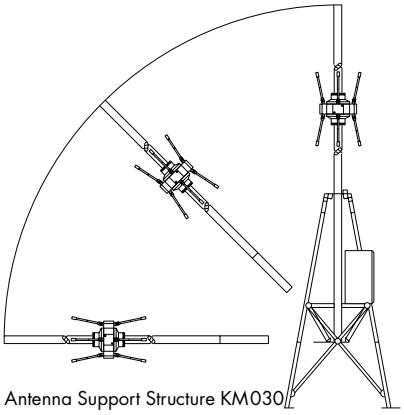


Antenna System AP030

Antenna system

The extremly compact Doppler direction finding antenna operates with just 4 dipoles. A rod at the top protects it against lightning. The low weight and the small dimensions significantly decrease the efforts for installation and maintenance as compared to conventional antenna systems. A simple radiator change makes it possible to adapt the antenna to various frequency ranges.



Antenna Support Structure KM030

Antenna support structure

The special mast KM030 is recommended for the antenna system. The mast has a fixture which makes it possible to tilt the antenna down to working level to facilitate assembly and maintenance of the antenna. The integrated rotating stand allows the antenna to be rotated in 10° steps to effectively check the direction finding system. In addition, there is a weatherproof housing for the receiver unit.

Specifications

Basic function	Doppler principle
Frequency range	depending on ordered software type PA030S(.):
with PA030S1:	ATC band 118 to 136.975 MHz
with PA030S3:	maritime band 156 to 174 MHz and ELT/EMERG frequency 121.5 MHz
with PA030S4:	ATC + maritime bands frequencies or channels can be blocked
Channel spacing	25 kHz
Scanning	integrated as standard
DF channel	1: standard 2: with PP030R2 etc (see below)
System accuracy	±2° rms (with antenna)
Sensitivity	≤10 µV/m (without antenna amplifier)
Interfaces, receiver-controller	serial V.24 (RS-232-C), parallel
Bearing display	
Response time	≤0.3 s
Digital (QDM)	3 digits with 7-segment LED indicator
Analog (QDR)	dual compass dial (= 2 concentric circles of LEDs)
Dimensions/weight	
Controller	PV030, 19" desktop 3 HU, prepared for rackmounting
Dimensions H x W x D	132.5 mm x 448 mm x 370 mm
Weight	7.2 kg
Receiver Onit	PP030, cabinet for wallmounting
Dimensions H x W x D	250 mm x 340 mm x 285 mm
Weight	6.5 kg
Antenna System	AP030
Dimensions (diameter x H)	400 mm x 1120 mm
With lightning rod and mast	400 mm x 3400 mm
Weight	3.6 kg
Power supply	
AC	115/230 V ±15%, 47 to 63 Hz
DC	24 V +20% –10%
Automatic switchover to DC voltage in case of AC supply failure	
Operating temperature range	
Antenna	–40 to +80°C
Receiver unit	–40 to +60°C
Controller	–20 to +55°C

Ordering information

VHF DF System Versatile basic set for 1 DF channel, prepared for aeronautical and maritime band (see PA030S...), expandable to 2nd DF channel, consisting of:	PA030	6002.8394.04
DF Antenna incl. mast tube, lightning rod, cable set AP/PP	AP030	6002.2796.02
Receiver Unit	PP030	6002.2815.04
Controller w/o cable	PV030	6002.2773.04
Software		
(see "frequency range")	PA030S1	6002.8459.02
	PA030S3	6002.8471.02
	PA030S4	6002.8488.02
Extra order items for a **2nd DF channel:**		
2nd DF Channel Integration Kit	PP030R2	60002.8394.02
Software	PA030S(.)	see above
Controller	PV030	see above
Recommended extras		
Antenna Support Structure consisting of: Rotatable antenna platform, tiltable mast for installation and maintenance, weatherproof housing for installation of receiver unit, lightning protection, installation material, manual	KM030	6002.2850.02
Emergency Power Supply 24 V DC Consisting of charger unit, 2 rechargeable batteries, switching device, manual	IN030A1	6002.8288.02
Hazard Light	HZ030	6002.8365.02
Cabinet Weatherproof, with lightning protection, installation material, manual, for installation of receiver unit at customer´s own antenna mast	PA030Z	6002.2996.02
Service Kit Consisting of antenna simulator, 4 x interface cables, extender cards, case and manual	PS030	6002.2838.02
Further extras		on request

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VHF/UHF Direction Finding Systems PA100, PA200, PA120

Photo 37413-3

Brief description

ATC Direction Finders PA100 for VHF, PA200 for UHF as well as PA120 for VHF/UHF combine well-proven technique with state-of-the-art technology. Extensive digitization using microprocessors, great flexibility regarding system configuration and powerful self-test facilities (BITE – built-in test equipment) as well as remote control via serial interfaces are the distinguishing characteristics of these direction finders.

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Basic features

Based on the use of the well-proven Doppler principle the following features are additionally provided:

- **Wide-aperture DF antenna**
  Wide-aperture antennas (diameter/wavelength >1) are relatively immune to field distortions due to reflections so that they can even be employed in an environment where direction finding might be difficult
- **Compensation of frequency deviation**
  As DF channel and reference channel are considered at the antenna as well as at the receiver, signal processing procedure is not influenced by any deviation between transmitter and receiver. Thus, sensitivity can be increased by reducing the bandwidth, and direction finding of FM transmitters, ELT (emergency locator transmitter) emission as well as of strongly overmodulated signals is possible
- **Compensation of delay**
  Scanning of the DF antenna elements by alternating clockwise and counterclockwise rotation compensates the influence of signal delay in the IF filters on the DF result and makes it largely independent of the frequency offset between transmitter and receiver.

Modules

Thanks to the modular design of the direction finders and integrated serial remote control interfaces high flexibility for system configuration is obtained: compact units with one DF channel can be implemented as well as VHF/UHF systems with simultaneous DF channels.

Every DF system consists of four basic units

- **DF antenna** including reference antenna (required for frequency compensation) and commutator. Three designs are available:
  – AP116 for 118 to 163 MHz, 16 dipoles arranged on an antenna circle of 2.9 m in diameter
  – AP132 for 118 to 163 MHz, 32 dipoles arranged on an antenna circle of 5.8 m in diameter (in comparison with AP116 higher immunity to reflections)
  – AP232 for 225 to 400 MHz, 32 dipoles arranged on an antenna circle of 2.4 m in diameter
  – AP120 for VHF and UHF, 16 dipoles arranged on an antenna circle of 1 m in diameter
- **Scanning unit** (installed at the base of the antenna mast for easy access) controls antenna scanning and comprises RF preamplifiers. It is available in four versions to match the antenna (PG116, PG120, PG132, PG232)
- **DF unit** (19" desktop, also suitable for rackmounting) comprises a combined control and processing section as well as a dual-channel receiver (DF and reference path for frequency compensation). The receiver is synthesizer-controlled and is made up of modules of the Series 400 VHF/UHF equipment. VHF, UHF and combined VHF/UHF receivers are available and thus a variety of DF units:
  – PP100, PP110 for 118 to 163 MHz (can also be supplied with limited frequency range)
  – PP200, PP210 for 225 to 400 MHz
  – PP120 for 118 to 163 MHz and 225 to 400 MHz
- **Operator Processor** PB100 (19" desktop, also suitable for rackmounting) serves for controlling operation and display at the operator's position and matches with all DF units. Control/Monitoring Unit PB100C and Display Unit PB100D can be removed and accommodated on workbenches.

The link between DF unit and operator processor is possible via two interfaces:

– FM VFT (300 Bd), with a direct connection to a telephone line
– V.24/RS-232-C (up to 9600 Bd), for longer distances using an external modem

As a protection against overvoltages all DF antenna elements are grounded by means of shorting links. The power supply connectors of the scanning unit are equipped with light-duty and heavy-duty protection. Heavy-duty protection can be retrofitted for coaxial connectors (option). The connecting lines of the DF unit and the operator processor are limited to light-duty protection. Heavy-duty protection is a must for lines entering the building or shelter.

All units can be powered from an AC or DC supply source (24 V).

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System configuration

Direction finders to be operated in the VHF or UHF band in the same DF channel are obtained by interconnecting the appropriate antenna/scanning unit combinations with DF Unit PP120.

Direction finders with several simultaneous DF channels are obtained by connecting several DF units to the same antenna/scanning unit combination via antenna splitters. In this case the DF unit of one channel is operated as a master, synchronizes the frequency generation in the other DF units (slaves) and controls one or, in combined VHF/UHF systems, both scanning units. If the master breaks down, another channel automatically takes over.

For multichannel systems the number of connecting lines between the DF site and the operator's positions can be reduced provided that the V.24 interfaces (DF unit/operator processor) are combined via Interface Multiplexer PU104.

Operator Processor PB100 (Photo 37384-1)

Several operator's positions may be assigned per DF channel and interconnected via serial interfaces (300 Bd modem, option). Whereas DF value and frequency are displayed at every operator's position, operation of the DF unit is only possible from the active operator's position. Any one of several operator's positions can be activated by means of a priority circuitry.

The direction finder can be extended to a DF transceiver by connecting a transmitter. Synchronous control of the transmit frequency and DF frequency from the operator processor or the DF unit is possible (BCD parallel, optional for operator processor). The operator processor is equipped with a microphone amplifier and a switching-tone generator to control a transmitter. A headset connector is provided at the front panel of Control/Monitoring Unit PB100C.

Options

Scanning Unit PG... (not valid for PG120)

Cable Set PG116A1
It is required if more than one DF test transmitter antenna is to be used. Up to three antennas are possible. Overvoltage protection incorporated.

Cable Set PG116A2
Same as PG116A1 but without overvoltage protection.

Overvoltage Protection PG116A3
It protects coaxial inputs/outputs of connecting cables to the DF unit. (The power supply input is protected as standard.)

Protection Cover PG116S
With lock and key. Locks the cover of the scanning unit, and protects all cable connections.

Multichannel DF Units

Synthesizer GF420
Signal source for testing the VHF and UHF frequency range. It can be housed in DF Unit PP... and effects frequency modulation for the audio test.

Test Signal Distributor PP120P2
It provides two outputs from Synthesizer GF420 and ensures amplitude modulation for the audio test (required when using GF420).

Operator Processor PB100

Data Output EXT PB100A1
Parallel data output for an external transmitter (channel and frequency information), also required for selective ground transmitter suppression, output of three additional bits and external alarm in case of system faults and distress calls.

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Data Output V.24 Radar PB100A2
Serial (RS-232-C) data output via which the bearing data are passed on to the radar or triangulation computer.

Modem Control Unit PB100A3
FSK modem to be incorporated in PB100 if an additional PB100 is to be connected in parallel.

Console Cable PB100A4
For PB100C or PB100D if these are to be used outside PB100, eg in an ATC console. Length: 2 m.

Analog-Radar Output PB100A5
Output, analog signal for radar equipment in form of x-/y-values, to indicate target from DF system on the radar screen.

Accessories

Cable Set PA100Z1 or PA120Z1
Connection between DF Antenna AP… and Scanning Unit PG…
Standard length: 5 m; other lengths on request.

Cable Set PA100Z2 or PA120Z2
Connection between Scanning Unit PG… and DF Unit PP…
Standard length: 25 m; other lengths on request.

Steel Mast KM100S1
Mast for DF Antenna AP116 or AP232.
Height: 4.67 m; no guying required.

Steel Mast KM100S2
Mast for DF Antenna AP132.
Height: 4.67 m; no guying required.

Aluminium Mast KM100A1
Mast for DF Antenna AP116 or AP232.
Height: 4.67 m; guying material included.

Aluminium Mast KM100A2
Mast for DF Antenna AP132.
Height: 4.67 m; guying material included.

Hazard Light HP007Z1
Twin lamp without connecting cable, without bulbs, to be attached to the antenna mast below the DF antenna system.

Service Kit PS100A
It contains all necessary adapter boards, extender boards and test cables for scanning unit and DF unit as well as a display module.

Service Kit PS100C
It contains all necessary adapter boards and extender boards for Operator Processor PB100.

VHF Antenna Simulator PK116
Replaces VHF DF Antenna AP116 when checking the DF system.

VHF Antenna Simulator PK132
Replaces VHF DF Antenna AP132 when checking the DF system.

UHF Antenna Simulator PK232
Replaces UHF DF Antenna AP232 when checking the DF system.

VHF/UHF Antenna Simulator PK120
Replaces VHF/UHF antenna AP120 when checking the DF system.

Interface Multiplexer PU104
See separate description.

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Specifications

Basic function

DF principle	wide-aperture Doppler principle direction finder with frequency and phase delay compensation PA120M: medium-aperture
Frequency range	
PA100	VHF: 118 to 162.975 MHz
PA200	UHF: 225 to 399.975 MHz
PA120, PA120M	VHF and UHF: both frequency bands
Channel spacing	25 kHz
Required signal duration	0.3 s
System accuracy	
DF equipment with antenna simulation or antenna system	±0.5° (PA120M: ±2°)
Sensitivity	
VHF	≤3 µV/m
UHF	≤6 µV/m (PA120M: ≤20 µV/m)

Interfaces

Data interface DF unit/ operator processor	two interfaces available: V.24/V.28 acc. to CCITT (RS-232-C) 300 to 9600 Bd (adjustable) and FSK 300 Bd, 2-wire operation

Bearing display

DF display	four-digit dot matrix display with 0.5° resolution
Reference direction	selectable as QTE, QUJ, QDR or QDM, lockable on QDM; magnetic declination adjustable in 0.1° steps
Orientation display	as light spot under a compass card, 5° resolution; north orientation adjustable in 10° steps
Other status displays	overhead pass, carrier (squelch), frequency, channel number, reference direction, distress call, BITE

Dimensions, weight

Scanning unit	345 mm x 478 mm x 310 mm, 20 kg
DF unit	435 mm x 192 mm x 462 mm, 22 kg
Operator processor	435 mm x 192 mm x 371 mm, 10 kg

DF antenna (diameter of aperture, weight without mast)

AP116	AP132	AP232	AP120
2.9 m	5.8 m	2.4 m	0.96 m
70 kg	200 kg	86 kg	40 kg

Power supply	110/127/220/237 V AC +10/–15%, 47 to 63 Hz or 21 to 28 V DC

General data

Nominal temperature range	
Antenna with scanning unit	–40 to +65°C
Other equipment	–20 to +55°C; relative humidity ≤95% at +40°C without condensation

Ordering information

VHF Direction Finding System	118 to 162.975 MHz antenna 16 dipoles	
1 DF channel	PA100A1	0740.4003.02
Consisting of:		
1 VHF DF Antenna System	AP116	
1 VHF Scanning Unit	PG116	
1 VHF DF Unit	PP100	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
VHF Direction Finding System	118 to 162.975 MHz antenna 32 dipoles	
1 DF channel	PA100A2	0740.4203.02
Consisting of:		
1 VHF DF Antenna System	AP132	
1 VHF Scanning Unit	PG132	
1 VHF DF Unit	PP100	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
UHF Direction Finding System	225 to 399.975 MHz	
1 DF channel	PA200A2	0740.4403.02
Consisting of:		
1 VHF DF Antenna System	AP232	
1 VHF Scanning Unit	PG232	
1 VHF DF Unit	PP200	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
VHF/UHF Direction Finding System	118 to 162.975 MHz antenna 16 dipoles 225 to 399.975 MHz antenna 32 dipoles	
1 DF channel	PA120A1	0628.3016.02
Consisting of:		
1 VHF DF Antenna System	AP116	
1 VHF Scanning Unit	PG116	
1 UHF DF Antenna System	AP232	
1 UHF Scanning Unit	PG232	
1 VHF/UHF DF Unit	PP120	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
VHF/UHF Direction Finding System	118 to 162.975 MHz antenna 32 dipoles 225 to 399.975 MHz antenna 32 dipoles	
1 DF channel	PA120A2	0628.3216.02
Consisting of:		
1 VHF DF Antenna System	AP132	
1 VHF Scanning Unit	PG132	
1 UHF DF Antenna System	AP232	
1 UHF Scanning Unit	PG232	
1 VHF/UHF DF Unit	PP120	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
VHF/UHF Direction Finding System	118 to 162.975 MHz antenna 32 dipoles 225 to 399.975 MHz antenna 32 dipoles	
1 DF channel	PA120M	4033.4500.03
Consisting of:		
1 VHF/UHF Antenna System	AP120	
1 VHF/UHF Scanning Unit	PG120	
1 VHF/UHF DF Unit	PP120	
1 Operator Processor (incl. Control/Monitoring Unit	PB100 PB100C)	
1 Display Unit	PB100D	
Options		
Cable Set	PG116A1	0741.5603.02
Cable Set	PG116A2	0741.3969.02
Overvoltage Protection	PG116A3	0741.3952.02
Protection Cover	PG116S	0741.5703.00
Synthesizer	GF420	0605.4016.02
Test Signal Distributor	PP120P2	0742.4017.02
Data Output EXT	PB100A1	0742.7374.02
Data output V.24 Radar	PB100A2	0742.7451.02
Modem Control Unit	PB100A3	0742.7439.02
Console Cable	PB100A4	0742.6626.02
Analog Radar	PB100A5	0742.6690.02
Accessories		
Cable Set	PA100Z1	0742.9502.02
	PA120Z1	4033.4700.02
Cable Set	PA100Z2	0743.0009.02
	PA120Z2	4033.4900.02
Steel Mast	KM100S1	0741.2204.02
	KM100S2	0741.2704.02
Aluminium Mast	KM100A1	0741.1208.02
	KM100A2	0741.1708.02
Hazard Light	HP007Z1	0274.3428.02
Service Kit	PS100A	0743.0509.02
	PS100C	0743.1005.02
VHF Antenna Simulator	PK116	0743.1505.03
	PK132	0743.2801.03
UHF Antenna Simulator	PK232	0743.3308.03
VHF/UHF Antenna Simulator	PK120	4035.6400.02
Interface Multiplexer	PU104	0652.5615.xx

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Interface Multiplexer PU104

Multiplexing DF signals on a single line

Photo 40450-1

Brief description

If the number of connecting lines in a multichannel system is not sufficient, several or all DF channels can be multiplexed on a single line using Interface Multiplexer PU104. Reducing the number of necessary lines means lower costs in installation and furthermore very often lower costs in leasing telephone lines. Additionally a common data output is provided for connection to a computer system. Interface Multiplexer PU104 consists of the basic unit and several optional interface/memory boards. The basic unit PU104G2 is a 19" frame, 4 height units, containing the CPU module and power supply, 15 slots free for further applications.

Features

- Highly flexible since it may be freely programmed and configured
- Cost-effective step-by-step system extension possible
- High reliability
- Suitable for use even under adverse environmental conditions
- AC supply and battery operation
- Self-test with error indication

To simplify the high number of possibilities some often used typical options are listed as follows:

RAM-ROM Module PU104M1
The RAM-ROM card affords 128 Kbyte extra storage capacity, which can be used as static RAMs or EPROMs as required in units of 16 Kbyte.

V.24 Interface PU104S1
PU104S1 is a data interface to CCITT Rec. V.24/28 and RS-232-C and a DC telegraphy interface for distances ≤20 m (depending on line quality and required transmission rate).

2 x V.24 Interface PU104S2
Same as PU104S1, but two V.24/RS-232-C interfaces (A and B) are provided.

2 x 300 Bd Modem PU104S3
This module contains two independent modem interfaces. To each interface a 600 Ω twin-wire line can be connected. The two interfaces can be connected internally so that the data arriving at one modem are output at the other modem unchanged without delay. Data can thus be evaluated for either direction of transmission.

2 x RS-232/422 Interface PU104S5
This module contains two independent data interfaces (A and B) which can be optionally operated by internal switchover according to RS-232 (V.24/V.28) or RS-422.

IEC Bus Interface PU104B1
Interface PU104B1 is an interface for data transfer to IEC625-1 (IEEE488).

Parallel Interface PU104P1
PU104P1 has 32 parallel line inputs/outputs that can be programmed as inputs or outputs in groups of eight as required. The inputs are overvoltage-protected. They are to be operated with TTL levels or via grounded contacts.

Specifications

Dimensions (W x H x D)	
Desktop model	436 mm x 183 mm x 462 mm
Rackmount model	437 mm x 176 mm x 467 mm
Nominal temperature range	–20 to +55 °C
Storage temperature range	–40 to +85 °C
Relative humidity	max. 80% (at +55 °C)
Weight	15 kg (depending on configuration level)
Number of free slots	15
Power supply	
AC supply	110/230 V AC +10/–15%, 47 to 400 Hz
Battery	21 to 28 V DC, max. 75 W

Ordering information

Interface Multiplexer, basic unit	PU104G2	
Desktop model		0652.2016.02
Rackmount model		0652.2016.03
Interface Multiplexer, complete	PU104XX	0652.5615.xx
Options		
RAM-ROM Module	PU104M1	0652.4619.02
V.24 Interface	PU104S1	0652.5215.03
2 x V.24 Interface	PU104S2	0652.3812.03
2 x 300 Bd Modem	PU104S3	4024.0006.03
IEC Bus Interface	PU104B1	0652.4919.03
Parallel Interface	PU104P1	0652.3912.03
2 x RS-232/422 Interface	PU104S5	6002.3705.03

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Series 610/620: Avionics Equipment

Photo 43105-1

The products at a glance

- UHF transceivers for voice and data
- UHF equipment sets based on avionics design, used for shipboard and vehicular application
- UHF transceivers with ECCM capability:
  - HAVE QUICK I/II
  - SECOS
  - SATURN
- Control and display units
- Test equipment STTE

Leading communications system supplier for military aircraft

Rohde & Schwarz is the leading supplier of radiocommunication equipment to the German airforce. The high reliability of our airborne systems is demonstrated by our solutions for Alpha Jet, Phantom, Tornado, Transall, and the very new generation of antitank helicopters NH90, Tiger, as well as the Eurofighter 2000.

Overview

As air traffic control is a vitally important factor in civil and military aircraft operation, Rohde & Schwarz avionics equipment is developed with a backup of several decades of experience, using the latest technology, produced under strong quality control to attain outstanding reliability. The avionics equipment program in short:

Series 610 radios

- UHF transceiver, 10 W carrier power, cockpit version XD610 or remote controlled version XD611 with Control Unit GB600, or XD611S with built-in preselection, for plain voice operation, simple, very small dimensions, low price
- UHF equipment sets based on avionics design, UHF, 10 W power, XD611A4 or XD611A5 for mobile and shipboard application, as well as retrofit sets, eg XD611C4 for replacement in German airforce fighters

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- UHF transceiver, 10 W power, cockpit version XD610H1 or remote control version XD611H1 for military operation of ECCM/ Have Quick, as requested by NATO forces
- UHF transceiver, 10 W power, cockpit version XD610H3 or XD611H3 remote controlled with Control Unit GB603, designed most sophisticated hopping/ciphering technology, combining TRANSEC and COMSEC inside one processor: ECCM/SECOS

Series 620 radios

- VHF/UHF transceiver, 15 W/AM and 20 W/FM, XT621P1 with built-in ECCM/SATURN processor, designed for operation onboard French and German armed forces helicopters Tiger, NATO NH90, E101
- VHF/UHF transceiver, 20 W/AM and 30 W/FM, XT622P1, latest ECCM/SATURN technique, designed to be used in Eurofighter 2000

Special-to-type test equipment STTE

As ground time for an avionics radio while under maintenance or repair is very costly, fast checking of functions and values is of great importance.

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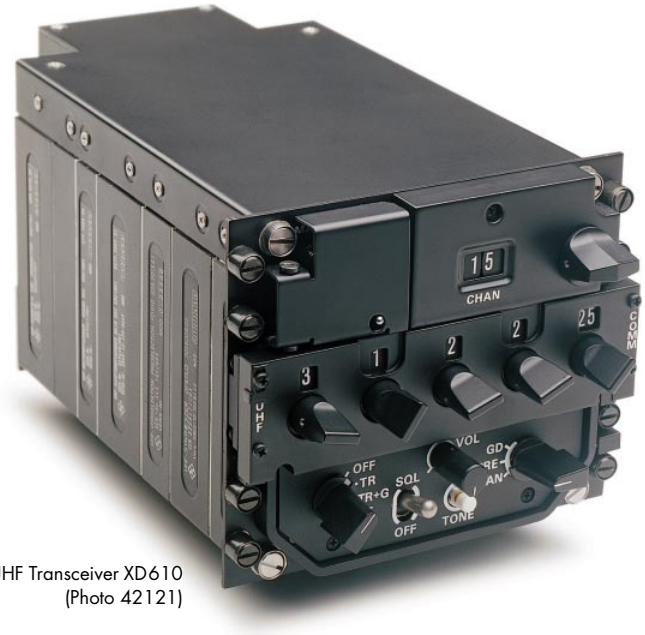
Series 610: UHF Transceivers XD610, XD611

Avionic transceivers, 10 W, for plain voice and data operation

- **Favourable price/performance ratio**
- **High reliability, high MTBF of more than 1200 hours**
- **–54 to +71 °C operating temperature range, according to MIL standards**



UHF Transceiver XD610
(Photo 42121)

Brief description

Radio Transceivers XD610 and XD611 are designed for air-to-air and air-to-ground communication, for civil and military aircraft applications. Operating in the UHF band the typical application is voice and data communication in AM mode. Compact units for cockpit installation or remote controlled versions are available.

Improvement of interference-free reception of messages can be obtained using the built-in preselector.

Outstandingly high reliability is mainly achieved by the use of high-quality components and burn-in tests at temperature limits, testing each radio before delivery.

Features and benefits

- Excellent large-signal characteristics for interference-free reception
- Emergency operation possible, even in case of voltage down to 16 V DC
- No forced cooling required
- Quality control according to AQAP1 (NATO standard) and ISO9000
- NVG-compatible

Specifications

Transceivers

Frequency range	225 to 399.975 MHz
Channel spacing	25 kHz
Frequency accuracy	≤6 x 10^{-6}
Classes of emission	A3, A9
Preselected channels	30, plus guard channel
Carrier power	≥10 W
Sensitivity	
XD610	≤2.5 µV
XD610S1, XD611S1	≤1.5 µV
Adjacent-channel selectivity	≥60 db
Crossmodulation	≥85 db
Guard receiver	
Frequency	243 MHz
Sensitivity	≤2.5 µV
Power supply	28 V DC, MIL-STD-704A
Emergency operation	down to 16 V DC
Operating temperature range	
XD610, XD610S1	–54 to +55°C
XD611S1	–54 to +71°C
Dimensions W x H x D (in mm)	
XD610	146 x 124 x 165
XD610S1	146 x 124 x 187
Weight	≤5 kg

Ordering information

UHF Transceiver 10 W		
Cockpit version	XD610	0578.1000.xx
Cockpit version with built-in preselector	XD610S1	0703.6358.xx
Remote controlled version with built-in preselector	XD611S1	0629.1617.xx

xx: variant of order number depends on colour of illumination and individual application of transceiver

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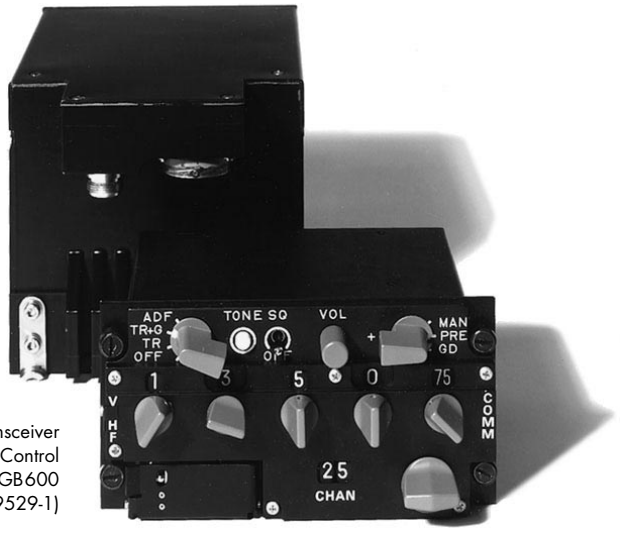
Relevant standards

- MIL-E-5400: General Specification for Aerospace Electronic Equipment
- MIL-STD-454: Standard General Requirements for Electronic Equipment
- MIL-STD-461: Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
- MIL-STD-462: Measurement of Electromagnetic Interference Characteristics
- MIL-STD-704A: Aircraft Power Characteristics
- MIL-STD-810C: Environmental Test Methods
- MS25212: Installation of Control Unit in Aircraft
- MIL-P-7788: Panels, Information, Integrally Illuminated
- MIL-C-6781: Control Units (dimensions)
- VG 95211: Qualification Test, Qualification Approval and Quality Assurance for Electronic and Electrical Parts



UHF Transceiver XD611 with Control Unit GB600 (Photo 29529-1)

- DIN and VDE: Specifications
- ZDV 19/1: Testing and Approval

Control Unit GB600

Control Unit GB600 is designed for remote control of UHF transceiver series XD610, taking into consideration of the same stringent standards for aircraft operation as for the basic transceivers.

The control unit is suitable for installation in an aircraft cockpit according to MS 25212.

Front panel engineered for easy operation. Maximum distance to transceiver 20 m.

Specifications

Control unit

MTBF	12 000 h
Power supply	5 V DC from transceiver
Dimension (W x H x D)	146 mm x 76.2 mm x 100 mm
Weight	1.3 kg

Ordering information

Control Unit	GB600	0525.0015.xx

xx: variant of order number depends on colour of illumination (white or red), with ECCM or without ECCM operation

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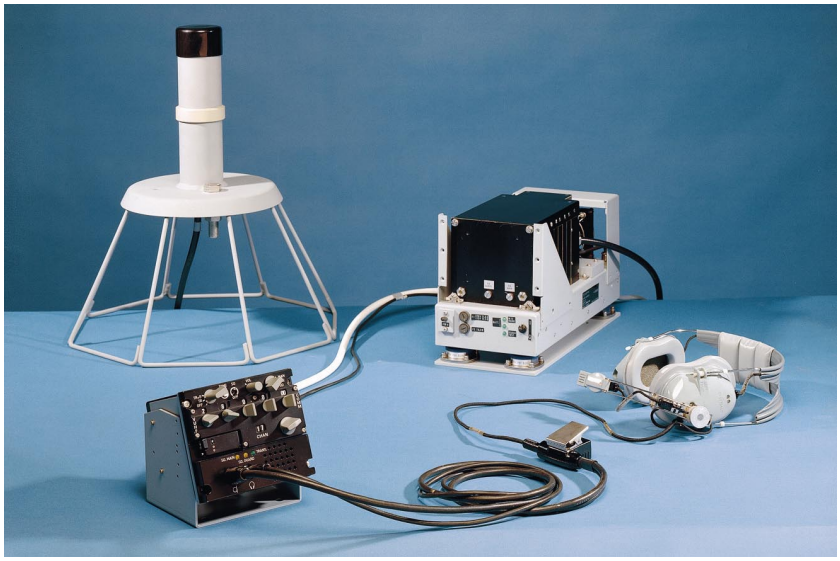
Series 610: UHF Transceiver Systems XD611A4, XD611A5

UHF transceiver systems for shipboard and vehicular applications

Brief description

UHF Transceiver Systems XD611A4 and XD611A5 have been developed especially for shipboard and vehicular applications. Adapters are provided to match the transceivers to the mechanical and the electrical interfaces of the ship or vehicle. Available output power is 10 W.



UHF Transceiver XD611A4 for shipboard use (Transceiver XD611, Adapter KS615, Control Unit GB605 and Antenna HK001) (Photo 31282)

Features and benefits

Low costs during the entire life time of the equipment – from purchase to maintenance – and great flexibility due to the modular design are the most outstanding features of this equipment family.

- UHF frequency range, 7000 channels, 30 channels preset
- Remote control with Control Unit GB605
- Data transmission up to 16 kbit/s
- High MTBF
- In line with MIL standards, STANAG, DIN and other requirements
- Simple maintenance
- Low current drain

Each transceiver system consists of the basic UHF transceiver, an adapter unit and the control unit.

Control Unit GB605 enables operation of the transceiver, providing all the AF connections. The rugged unit is ergonomically designed and easy to operate. Loudspeaker, volume control and non-volatile memory for 30 preselectable channels are incorporated. Remote control is effective over a distance of 20 m.

Specifications

Transceiver

Frequency range	225 to 399.975 MHz
Channel spacing	25 kHz
Frequency accuracy	≤6 x 10^{-6}
Classes of emission	A0, A3, A9
Switchover time (TX/RX, RX/TX)	<50 ms

Transmitter

Carrier power	10 W
Modulation distortion	≤10%
Modulation depth	≤90%
Reduction of output power due to VSWR = 2	1 dB

Main receiver (with preselector)

Sensitivity and S/N ratio	1.5 µV
in range 238 to 248 MHz	3.7 µV
Selectivity (bandwidth)	≤6 dB at 23 kHz ≥60 dB at 50 kHz
IF rejection	≥100 dB
Image frequency rejection	≥90 dB

General data

Power supply	
AC operation, XD611A4	115/230 V (+10/–15%), 47 to 440 Hz
Battery operation, XD611A5	28 V DC
Operating temperature range	–30 to +55°C
Dimensions (W x H x D), transceiver fixed on adapter (without GB605)	
XD611A4	170 mm x 220 mm x 510 mm
XD611A5	170 mm x 220 mm x 400 mm
GB605	146 mm x 125 mm x 120 mm
Weight	
XD611A4 or XD611A5 with adapter	5.2 kg + 1.8 kg
GB605	1.9 kg

Ordering information

UHF Transceiver System 10 W	XD611A4	0631.2017.03
Shipboard model, consisting of XD611S2, KS615Z1, GB605		
Vehicular model, consisting of XD611S1, KS616, GB605	XD611A5	0631.2417.02

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Series 610: UHF Transceivers XD610H1, XD611H1

- **ECCM/HQ**
- **Simplex air-to-air and air-to-ground communication for military air traffic control**
- **–54 to +71 °C**

UHF Transceiver XD610H1 (Photo 41596)

Brief description

UHF Transceivers XD610H1 and XD611H1 are used for simplex air-to-air and air-to-ground communication in the UHF band 225 to 400 MHz, operating in plain mode and ECCM mode Have Quick I/II.

ECCM-resistant, interference-proof radio transmission methods are of increasing importance in the military UHF range. Rohde & Schwarz has a great experience in the development and production of high-quality radios as well as in the field of retrofit programs for NATO applications.

Have Quick I/II is currently the only ECCM-resistant voice communication technology for the UHF range introduced to NATO. Rohde & Schwarz is manufacturer in Europe for the HQ technology which has been developed by the American company Magnavox under the system management of MITRE and under contract to the US Department of Defense. HQ II is a frequency hopping method developed according to the relevant STANAG 4246.

Selection of HQ functions via front-panel controls; loading of WOD/MWOD by front-panel control from fill-gun.

Developed for a wide range of climatic conditions, this equipment can be used in any worldwide mission without restrictions due to climate.

Features and benefits

- 10 W internal power amplifier, improving range and reliability of communication link
- Including HQ anti-jam frequency hopping mode, compatible with single channel non-hopping mode for a wider range of operation within one unit only
- Built-in guard receiver, improving safety for aircraft and pilot
- Readiness for operation within 1 second, important for fast reaction in tactical missions
- Cleverly designed control panel for error-free easy operation
- High reliability, high availability of communication link, MTBF more than 1200 hours, high-quality development and production, strong environmental tests for humidity, vibration, shock and temperature

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Series 610: UHF Transceivers XD610H1, XD611H1

Relevant standards

- MIL-E-5400: General Specification for Aerospace Electronic Equipment
- MIL-STD-454: Standard General Requirements for Electronic Equipment
- MIL-STD-461: Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
- STD-462: Measurement of Electromagnetic Interference Characteristics
- MIL-STD-704A: Aircraft Power Characteristics
- MIL-STD-810C: Environmental Test Methods
- MS 25212: Installation of Control Unit in Aircraft
- MIL-P-7788: Panels, Information, Integrally Illuminated
- MIL-C-6781: Control Units (dimensions)
- VG 95211: Qualification Test, Qualification Approval and Quality Assurance for Electronic and Electrical Parts
- DIN and VDE: Specifications
- ZDV 19/1: Testing and Approval

Specifications

Transceiver

Frequency range	225 to 399.975 MHz
Frequency setting	25 kHz
Frequency accuracy	$\leq \pm 2.5 \times 10^{-6}$
Number of channels	30 preset plus guard channel
Modulation	A0, A3, A9
Changeover time channel-to-channel	<50 ms acc. to STANAG 4246
Duty cycle TX/RX	1 min/5 min, without additional cooling

Transmitter

Carrier power/modulated power	≥10 W/≥13.5 W

Receiver

Sensitivity	≤2.5 µV
from 238 to 248 MHz	≤3.7 µV
Selectivity, narrowband	≤6 dB at 23 kHz ≥60 dB at 50 kHz
broadband	≤6 dB at 70 kHz ≥60 dB at 210 kHz
IF rejection	≥90 dB
Crossmodulation	≥85 dB

Guard receiver

Frequency	243 MHz
Frequency accuracy	$\leq \pm 2.5 \times 10^{-5}$
Sensitivity	≤2.5 µV
Illumination	LED yellow or red, LED green (NVG-compatible)

General data

Operating temperature range	
XD610H1	–54 to +55°C, MIL-E-400
XD611H1	–54 to +71°C, MIL-E-400
Power supply	acc. to MIL-STD-704A
Supply voltage	28 V DC (22.5 to 30 V DC)
Emergency operation	16 to 30 V DC
Environmental conditions	acc. to MIL-STD-810C
Dimensions (W x H x D)	
XD610H1	127 mm x 124 mm x 167 mm
XD611H1	127 mm x 124 mm x 187 mm
Weight	
XD610H1	≤5.6 kg
XD611H1	≤5 kg

Control Unit GB600

Serial interface, 4 wires, AFD automatic direction finding	max. 20 m distance receive capability
Power supply	from XD611H1

Ordering information

UHF Transceiver 10 W ECCM/HQ II		
Cockpit version	XD610H1	6043.6196.08
Remote control version	XD611H1	0688.8514.02
Control Unit	GB600	0525.0015.13

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Series 610: UHF Transceivers XD610H3, XD611H3/P3

ECCM/SECOS air-to-air and air-to-ground operation in military communication networks

UHF Transceiver XD610H3
(Photo 37663)

Brief description

UHF Transceivers XD610H3 and XD611H3/P3 (AM 10 W, FM 15 W carrier power) are designed for air-to-air and air-to-ground operation in military communication networks to ensure collision-free and simultaneous operation of several networks between fixed, airborne, shipboard and mobile units.

Based on an extraordinarily powerful technical solution, combining TRANSEC and COMSEC features, the built-in processors enables medium-rate frequency hopping in a **S**ecure **E**CCM **C**ommunication **S**ystem: SECOS.

Uninterruptible, secure voice and data communication, even in the face of today's electronic threat from hostile activities.

Features and benefits

High level of protection against
- Interception
- Monitoring
- Signal analyzing
- Deception
- Intrusion/spoofing
- Identification
- Jamming

COMSEC security
- Digital voice and data encryption
- High data transmission rate
- Highly secure cryptographic algorithm
- Large key variety
- Excellent speaker recognition
- Clear voice comprehension

TRANSEC security
- Medium-rate frequency hopping
- Dwell time variation
- High process gain
- Excellent transmission quality
- Use of voice/data compression and expansion technique

All transceivers are down-compatible for operation with conventional radios and were developed jointly by two experienced companies in the field of wireless communication and ciphering: Rohde & Schwarz, Germany, and Crypto AG, Switzerland.

Control Unit GB603
Enables remote control of airborne Transceivers XD611H3 in fixed frequency or in ECCM/SECOS mode. Installation in cockpits according to MS 25212 standard.

Relevant standards

- MIL-E-5400: General Specification for Aerospace Electronic Equipment
- STANAG 5020
- MIL-STD-454: Standard General Requirements for Electronic Equipment
- MIL-STD-461: Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
- MIL-STD-462: Measurement of Electromagnetic Interference Characteristics
- MIL-STD-704A: Aircraft Power Characteristics
- MIL-STD-810E: Environmental Test Methods
- MIL-P-7788: Panels, Information, Integrally Illuminated
- VG95211: Qualification Test, Qualification Approval and Quality Assurance for Electronic and Electrical Parts
- DIN and VDE: Specifications
- ZDV 19/1: Testing and Approval

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Series 610: UHF Transceivers XD610H3, XD611H3/P3

Each transceiver is part of a communication network. In addition to the basic radio equipment, data preprocessor DPP and key entry device KED are necessary for operation:

Data Preprocessor GP603P3
The DPP enables transmission and reception of data via Series 610 radio equipment. The following modes are possible:

- COMSEC: encrypted data at fixed frequencies
- COMSEC/TRANSEC: encrypted data combined with frequency hopping

Forward error correction is included and can be combined with repeat transmission to improve ECCM performance and error detection.

The DPP is transparent for data of any content and format, is able to recognize its own address when receiving data containing this address.
Addressed data can be sent to a single participant inside the net as well as in form of a broadcast call to all inside the network.

Key Entry Device KED370
To run a SECOS network properly, several network management tasks must be organized, ie key management, frequency management, time management and parameter management.

Key management means regular generation of new keys, distribution to the stations, activation at the correct times, and erasure if necessary.

KED370 is designed to load all these functions into the transceivers at the radio stations.

UHF Transceiver XD611P3
This version is especially designed for remote control of the transceiver via MIL bus according to MIL-STD-1553B.

It is suitable for installation in electronic bays of aircraft according to ARINC 404. Service and maintenance are simple, as the transceiver consists of 6 plug-in modules only, so exchange of modules is possible without new alignment or special tools.

The ECCM processor contains high-technology circuits for voice/data encryption and control of the SECOS frequency hopping system.

Specifications

Transceiver

Frequency range	225 to 399.975 MHz
Frequency setting	25 kHz
Frequency accuracy	±1 ppm
Number of channels	80 ECCM nets in 8 groups
Modulation	AM/FM
User data rate	up to 12 kbit/s
Changeover time, TX/RX	50 ms
Readiness for operation	<1 s
Duty cycle TX/RX	1/5, without additional cooling

Transmitter

Carrier power	10 W/AM, 15 W/FM

Receiver

Sensitivity	≤2.5 µV
from 238 to 248 MHz	≤5.7 µV
Selectivity	≤6 dB at 23 kHz ≥60 dB at 50 kHz
IF rejection	≥90 dB
Crossmodulation	≥85 dB

Guard receiver

Frequency	243 MHz
Sensitivity	≤2.5 µV

General data

Operating temperature range	
Cockpit version	–40 to +55°C
Remote control version	–54 to +71°C
Environmental conditions	MIL-E-5400
Power supply	22.5 to 30 V DC
Emergency operation	16 to 30 V DC
Dimensions (W x H x D)	127 mm x 124 mm x 220 mm
Weight	5.8 kg

Ordering information

UHF Transceiver ECCM/SECOS		
Cockpit version	XD610H3	6036.8800.03
Cockpit version ARINC	XD610H3	6036.8800.04
Remote control version	XD611H3	6036.8900.03
Remote Control Unit ECCM/SECOS	GB603	6006.9508.xx
UHF Transceiver ECCM/SECOS MIL-bus control	XD611P3	6036.8700.09
Data Preprocessor ECCM/SECOS MIL-bus control	GP603P3	6048.2647.02
Key Entry Device	KED370	6008.9905.02

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Series 620: VHF/UHF Transceiver XT621P1

ECCM/SATURN

for helicopter application,

eg TIGER, NH-90, EH101

VHF/UHF Transceiver XT621P1 (Photo 41760-1)

Brief description

To guarantee interoperability within the combined NATO forces for the next generation of ECM-protected VHF/UHF radios, the new equipment provides operation in SATURN mode: **S**econd Generation **A**nti-jam **T**actical **U**HF **R**adios for **N**ATO.

Electronic measurements have reached an extraordinarily high level of efficiency. To meet the challenges of communications to the year 2000 and beyond, this digital radio system is designed to withstand the threat from conventional jammers as well as future threat from follower-jammers.

For each project leading companies from several European countries have formed cooperations to combine their extensive experience in order to achiev joint solutions.

Features and benefits

- Uninterruptible, clear voice communication in fast frequency hopping mode
- Use of all channels in VHF/UHF aeronautical frequency range
- 10 to 30 W RF carrier power, AM and FM
- Highest reliability, use of high quality components
- Production and quality control according to AQAP1 (NATO standard) and ISO 9000
- Resistant against monitoring, spoofing, intrusion and jamming
- Encrypted frequency hopping, combining TRANSEC/COMSEC (option)
- Interoperable with HQ I/II and conventional AM fixed mode radios

Specifications

Frequency range	VHF 118 to 156 MHz (option 156 to 174 MHz) UHF 225 to 400 MHz
RF output power	15 W/AM mode 20 W/FM MSK mode
Guard receiver	built-in
Power supply	28 V DC
Operating temperature range	–40 to +71 °C
NATO ECCM standards interoperability	HQ I/II, SATURN (options for COMSEC, LINK 11)
Chassis	ARINC600, utilizing air cooling, mechanical interface
Bus interface	dual-redundant avionics MIL-STD-1553B
Interface for test and backup control	RS-422
Dimensions	3 MCU
Weight	≤7.5 kg

Ordering information

VHF/UHF Transceiver 15/20 W ECCM/SATURN	XT621P1	6025.0002.xx

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Series 620: VHF/UHF Transceiver XT622P1

ECCM/SATURN – for Eurofighter 2000

Relevant standards

- STANAG 4205
- STANAG 4246 (HAVE Quick I/II)
- STANAG 4372 (SATURN)
- STANAG 551 (LINK 11)

VHF/UHF Transceiver XT622P1 (Photo 42019)

Specifications

Frequency range	
VHF	108 to 156 MHz
UHF	225 to 400 MHz
Channel spacing	
VHF	12.5 kHz
UHF	25 kHz
Preset channels	24
RF output power	20 W/AM mode 30 W/FM MSK mode low-power mode selectable
Built-in guard receiver	VHF/UHF
Power supply	28 V DC
NATO ECCM standards interoperability	HQI/II, SATURN, embedded COMSEC
Chassis	according to EF2000 design
Bus interface	dual-redundant fiber-optic EF2000
Serial maintenance interface	RS-232
Operating temperature range	–40 to +71 °C
Dimensions	3/8 LRU short L-shape
Weight	≤7.5 kg

Ordering information

VHF/UHF Transceiver 20/30 W ECCM/SATURN	XT622P1	6027.0000.xx

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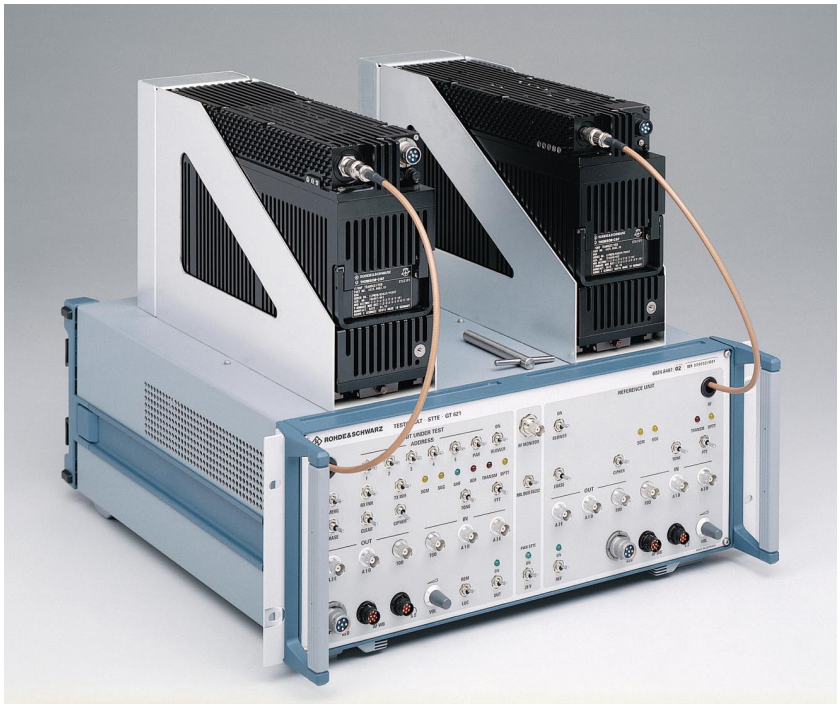
Special-To-Type Test Equipment (STTE) GT611, GT621, GT622

Fast performance verification of airborne radios



Special-To-Type test equipment (STTE) GT611, GT621, GT622 (Photo 41762-1)

Brief description

The STTE (**S**pecial to **T**ype **T**est **E**quipment) enables fast performance verification of an airborne radio at ground facilities for maintenance and repair, thus reducing ground costs significantly.

Depending on the test objective, the test set up can be configured to check a transceiver unit or to provide an easy end-to-end testing, using a second transceiver as reference unit.

Furthermore the STTE can be used as a single unit only or operated from a PC. In connection with the PC and further measuring instruments, many functions can be tested and values measured very fast, reducing the necessary time for maintenance or repair:

- Basic transmitter functions
- Receiver functions
- All ECCM modes
- Ciphering procedures
- Simulation of operating modes

The STTE GT621 is especially designed for testing VHF/UHF Transceiver XT621P1 onboard the Tiger helicopter for the French and German armed forces.

Similar STTE such as GT611 for testing UHF Transceiver XD611A7, or GT622 for testing VHF/UHF Transceiver XT622P1 (Eurofighter) are available.

Features and benefits

- High number of functions and values tested in short time
- All known interface standards considered
- Large reduction of test time and costs

Specifications

Interfaces	serial, MIL-BUS, parallel
Operating voltage	+28 V DC (24 to 32 V DC)
Dimensions (W x H x D)	483 mm x 191 mm x 510 mm
Weight	14 kg

Ordering information

Test Equipment STTE	GT611	0650.6014.02
	GT621	6024.8497.02
	GT622	6027.8998.02

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The products at a glance

- VHF/UHF transceivers for voice and data with EPM capability
  - HAVE QUICK I/II, SATURN, SECOS for cockpit or avionic bay installation
- Control units
- Accessories
  - Test equipment STTE
  - Communication Management and Handling System (CMHS)
  - Key Distribution Device KDD-3700
  - Adapters

Brief description

The Rohde & Schwarz Series 6000 of airborne VHF/UHF transceivers has evolved from decades of experience, especially in the design and development of airborne radio equipment and ECM-resistant radio transmission techniques.

The multiband, multimode, multifunction communications system of Series 6000 is designed to provide multimode UHF and VHF, AM and FM, voice and high data communication in normal or EPM (Electronic Protection Measures) mode with embedded COMSEC and TRANSEC.

The transceivers of Series 6000 are software radios with preplanned product improvement (P^3I) features, which allows upgrade to new developments in the EPM scenario simply by loading software.

The airborne Series 6000 is capable of establishing two-way communication links for voice and data for a wide range of fixed- and rotary-wing aircraft.

Overview

Series 6000 radios

- VHF/UHF and UHF transceivers, 10 W AM and 15 W FM versions featuring plain voice, data, built-in EPM processor for HAVE QUICK I/II, SATURN, SECOS and built-in data preprocessor or Link 4/Link 11
- Panel mount (local control or MIL-BUS) or remote-controlled versions with control unit or MIL-BUS

Series 6000 control units

- Suitable for cockpit installation for remote control of Series 6000 radios, enabling rapid in-flight operation

Special-to-type test equipment STTE

- For fast checking during maintenance or repair

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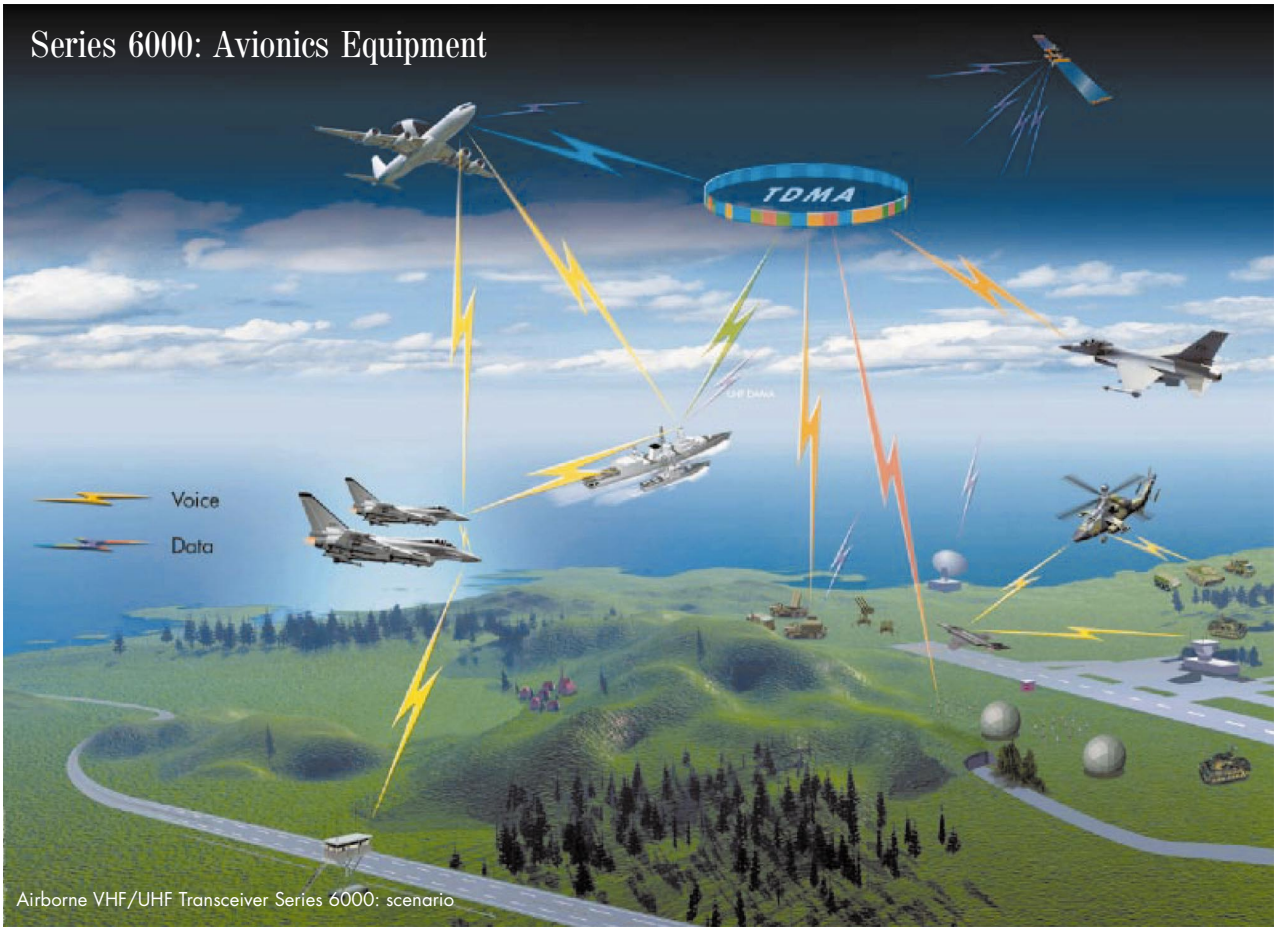

Airborne VHF/UHF Transceiver Series 6000: scenario

Multitude of platforms

Rohde & Schwarz airborne radios support armed services worldwide on a multitude of airborne platforms including Tornado, F/A-18 Hornet, Phantom F4, Alpha Jet, PAH1 anti-tank and UH-1D helicopters and recently the Eurofighter TYPHOON as well as the TIGER and NH90 helicopters

Future applications of Series 6000 radios may include further platforms like the F-16, Mirage 2000, MIG-29, HAWK, AL-X, the Apache, Puma or Gazelle helicopters or transporters like FLA, Hercules C-130 or CN-235.

Retrofit

Retrofit kits are available for replacing practically any type of existing AN/ARC aircraft radio equipment. The compact design of Series 6000 as well as the serial or parallel interface between control unit and transceiver make integration into existing systems easy. The versatility of the control units also adds to the high flexibility.

EPM techniques

As a leading authority in the field of electronic warfare, Rohde & Schwarz has developed techniques using a broadband ECM simulator to test and verify that its family of transceivers is impervious to all forms of jamming threats whilst operating on a wide variety of waveforms. This wealth of experience has enabled Rohde & Schwarz to develop the most radical of ECM-resistant techniques, unsurpassed in the world of secure communications. With our vast knowledge and expertise in the development and manufacture of professional radio equipment, benefiting from the most advanced component technology, Rohde & Schwarz can offer a superlative radio containing all the features necessary for any organization requiring the ultimate in secure communications well into the next century.

Uniquely, the system provides for the use of both NATO (HAVE QUICK I/II and SATURN) and non-NATO (SECOS) waveforms in all combinations.

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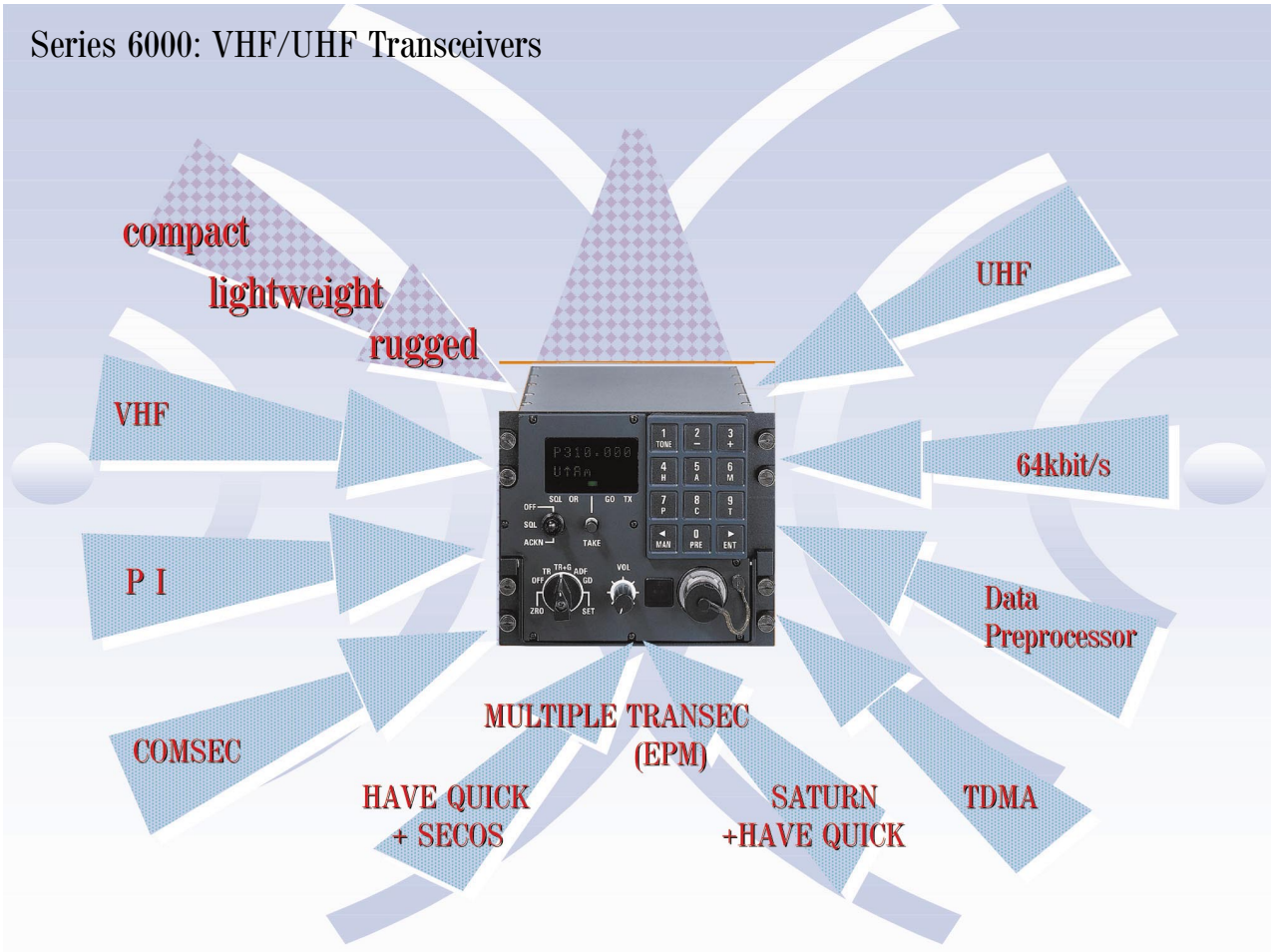

Airborne VHF/UHF Transceiver Series 6000: the one-box solution for all requirements – multimode, multifunction, multiband

Cockpit version (photo 43251-8)

Available versions

Cockpit version

Full form, fit, function replacement for AN/ARC radio types such as ARC164 is offered by Series 6000 with these features:

- VHF/UHF, AM/FM, voice/data
- EPM HAVE QUICK I/II, SECOS, SATURN
- Channel spacing 25 kHz and 8.33 kHz
- Modular design, SMD technology
  - BITE down to module level
  - High reliability
- Remote control
  - ARC164 serial
  - ARC164 parallel
  - ARINC629 (optional)
  - RS485

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Series 6000: VHF/UHF Transceivers

Remote-control version (photo 43251-3)

Rear view of MIL-BUS version (photo 43251-4)

Remote-control version (photo 43251-6)

Remote-control version
Features as for the cockpit version, plus

- Control of one radio from more than one remote-control unit
- Serial control
  - RS485
  - ARINC629 (optional)
- Remote BITE

MIL-BUS version
MIL-BUS versions are available for integration into airborne platforms that provide MIL-BUS control systems. In addition to the above features, the following performance is guaranteed:

- MIL-BUS control in full accordance with MIL-STD-1553B
- Emergency control by discrete lines

Control Unit Series 6000

Control Unit Series 6000 allows the remote control of airborne VHF/UHF transceivers of Series 6000 in fixed-channel or in EPM (SECOS) mode. The control unit is suitable for installation in cockpits according to MS 25212. The equipment provides take over capability of the transceiver control functions in systems with two control units.

Rapid in-flight operations
– OFF
– Transmit/receive (guard receiver disabled)
– Transmit/receive + guard (guard receiver enabled)
– ADF
– Volume control
– Squelch (main receiver) on/off

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Series 6000: VHF/UHF Transceivers – Reliability, Maintainability, Testability

Reliability, maintainability and testability have been three prevalent objectives in the Series 6000 development program, implemented to support the drive towards low life-cycle costs

Modular structure of Series 6000 (photo 43251-1)

Outstanding reliability

Of paramount importance to all our customers is the assurance of high reliability. Through the use of strictly controlled production processes using only qualified components from renowned, quality-approved suppliers and thanks to our experience in thermal and power management techniques supported by detailed failure analysis, Rohde & Schwarz can guarantee equipment reliability of the highest order.

Maintainability features

All the necessary features to allow rapid and economical repair have been integrated into Series 6000. These include the following:

- Plug-in modular design
- High accessibility
- Interchangeability without adjustment or alignment
- Component standardization
- Minimal tools required
- Functional packaging of components
- Minimized scheduled maintenance

Testability and diagnostics

In order to support the need for accurate fault diagnosis, testability has been an integral part of the design process. Testability features incorporated allow detailed diagnosis of failures at all levels of maintenance. Aspects addressed are:

- Built-in test (BIT) with high diagnostic capability
- Test access, observation and control
- User-friendly test methods
- Special-to-type test equipment (STTE)
- Manual and automated testing

Special-to-type test equipment (STTE): Test System TS612 (photo 43134)

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Series 6000: VHF/UHF Transceivers – Mission Management

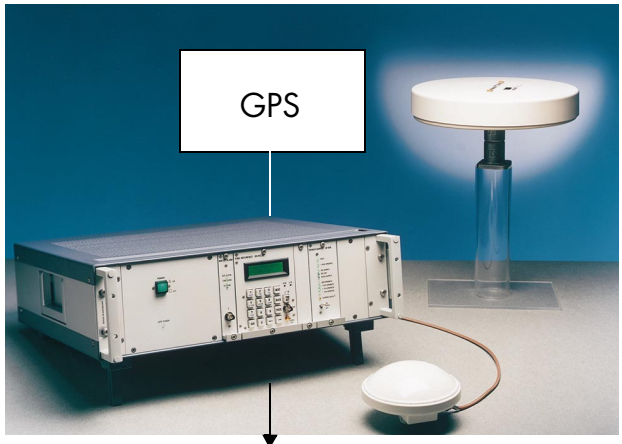
Communication Management and Handling System (CMHS)

Modern communication systems need vast amounts of data for mission planning. Therefore Rohde & Schwarz has introduced the Communication Management and Handling System CMHS to provide for complete turnkey solutions for networks with the most secure operational radiocommunication needs of any armed service.

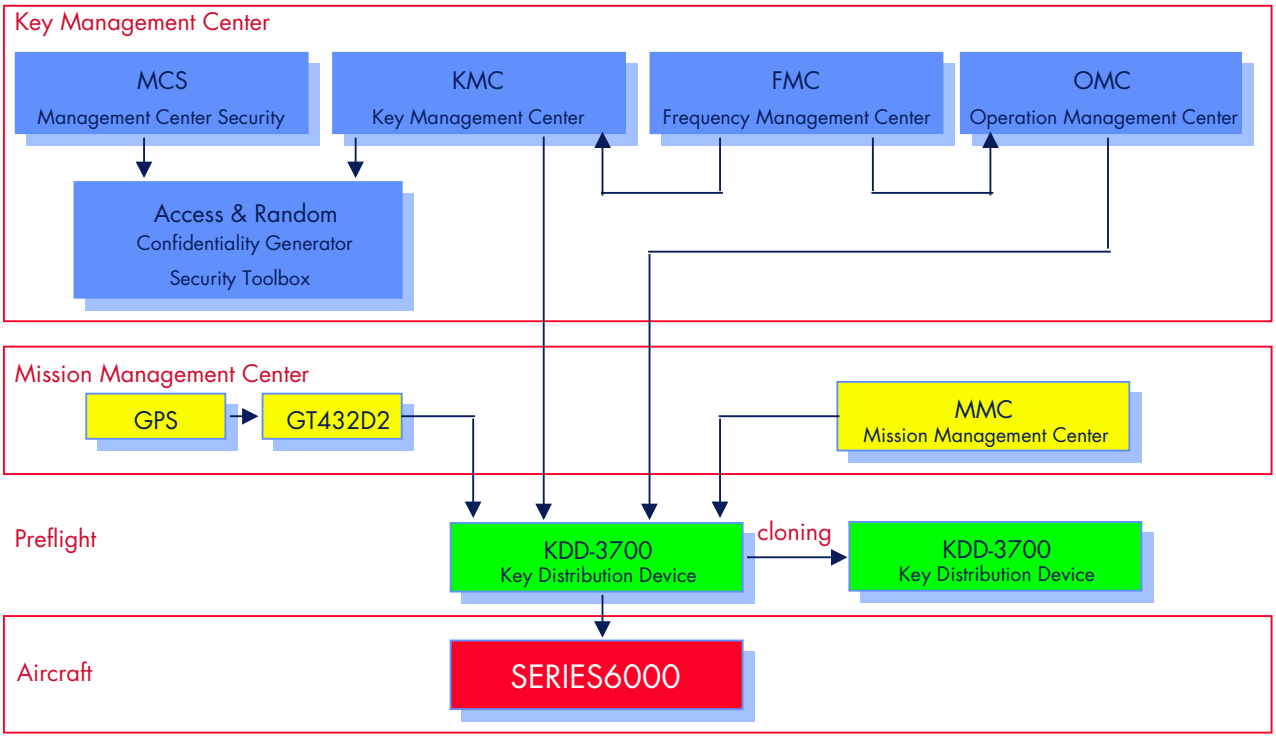
Key Distribution Device (KDD)

EPM key, frequency and operating data must be the same in all radios which require mission interoperability. The tool to manage the necessary data loading is the handheld Key Distribution Device KDD-3700.

Timing System GT432D2 (photo 40398)



Remote-control version with Key Distribution Device KDD-3700 (photo 43251-2)



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Series 6000: VHF/UHF Transceivers

Standards

- MIL-E-5400 General Specification for Aerospace Electronic Equipment
- MIL-STD-454 Standard General Requirements for Electronic Equipment
- MIL-STD-461 Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
- MIL-STD-462 Measurement of Electromagnetic Interference Characteristics
- MIL-STD-704 Aircraft Power Characteristics
- MIL-STD-810 Environmental Test Methods
- VG 95211 Qualification Test, Qualification Approval and Quality Assurance for Electronic and Electrical Part
- DIN and VDE Specifications
- ZDV 19/1 Testing and Approval

Specifications

Frequency bands

FM tactical (option)	30 MHz to 88 MHz
AM receive only	108 MHz to 118 MHz
AM ATC	118 MHz to 156 MHz
FM maritime/secure voice	136 MHz to 174 MHz
SECOS	118 MHz to 174 MHz
Guard channel	121.5 MHz
AM standard/secure voice	225 MHz to 400 MHz
FM standard/secure voice	225 MHz to 400 MHz
SECOS	225 MHz to 400 MHz
SATURN	225 MHz to 400 MHz
Guard channel	234 MHz

Channel spacing

All bands	25 kHz
118.000 MHz to 136.99167 MHz	8.33 kHz

Tuning capability 12.5 kHz, 8.33 kHz

Preset channels 100 simplex frequencies in standard mode

Frequency accuracy <±1 ppm

User data rate plain mode up to 64 kbit/s (synchronous)

Duty cycle

Transmit/receive	
Radiation cooling	<1 min : 5 min
Forced air cooling (external)	>1 min : 5 min

TSEC/KY-58 compatible
ADF AF wideband output for automatic direction finding and homing

Receiver characteristics

Sensitivity (10 dB (S+N)/N)	–101 dBm
Audio response	
Standard	300 Hz to 3.4 kHz
Wideband	30 Hz to 25 kHz
ADF	50 Hz to 10 kHz
Audio output	250 mW into 600 Ω or 200 mW into 150 Ω

Transmitter characteristics

Output power	
AM	10 W
FM	15 W
LINK 11	15 W
Load	50 Ω

General data

Power supply	according to MIL-STD-704A
Supply range	22.5 to 30 V DC (neg. ground)
Emergency operation	16 V DC
Transients	MIL-STD-704A
Spikes	MIL-STD-461
RF connector	TNC, Z = 50 Ω
Weight	<4.0 kg
Dimensions (W x H x D)	
Remote-control version	127 mm x 120 mm x 176 mm (without connector) 127 mm x 120 mm x 192 mm (with covers and connector)
Cockpit version	146 mm x 123 mm x 165 mm (without front panel, connector) 146 mm x 123 mm x 210 mm (with front panel and connector)

Ordering information

VHF/UHF Transceiver 225 to 400 MHz, 10 W/ 15 W/ AM/FM, SECOS		
Cockpit Version	XD6510	6085.0015.13
Cockpit Version + MIL-BUS	XD6512	6089.2512.13
Remote-Control Version	XD6511	6085.0515.02
Recommended extra		
Control Unit	GB6500	6087.0012.04

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Terrestrial Flight Telecommunication System TFTS »JETCALL«

Total system and operation

TFTS allows passengers to make telephone calls during flights
Operation is effected at 1.6/1.8 GHz in Line Of Sight (LOS) connection. Picked up by the nearest ground station of a cellular network, signals from aircraft are decoded and passed on to the public switched telephone network for transmission anywhere in the world.

It is the only available standard in Europe for direct air-to-ground communication and public telephone application.
Based on ETS 300-326, formed by ETSI, it is the unique communication system in Europe.
TFTS will be used by many more service providers in the Middle East, Asia, Africa and Australia.

– telecom authorities: offering their ground networks
– manufacturers of equipment: development, production, delivery and maintenance of products
- High flexible implementation and extension at low starting investments
- Global coverage within Europe
- High on features, low on cost

The total service is organized by the following partners
– Service providers: investment of ground and airborne equipment, servicing, billing
– Airlines: contracting with service providers and manufacturers of equipment
– Credit card organizations

Photo 43129

Features and benefits

- Integrated voice, fax, data transmission and paging, all in one
- Featuring today's digital signal processing technique
- Revenue earner for service providers as well as for airlines
- Ground stations: Managing the radio connections to all aircraft, each station is transmitting at a specific frequency to all aircraft inside their coverage range
- Onboard equipment: consists of radio subsystem and cabin equipment
- The radio subsystem according to ARINC 752 enables transmission and reception of signals
- Cabin equipment: The use of passenger handsets, a choice of seatback installations or cordless telephones shows the high flexibility onboard. Great convenience in the air!

Airborne radio equipment/ TFTS shipset

TFTS JETCALL is provided for full-duplex voice communication – simultaneous on four channels, extendible to eight channels and service for fax/ data communication from air to ground. Furthermore alphanumeric paging messages can be transmitted from ground to air. The airborne equipment enables a radiocommuni-

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cation link between aircraft and ground stations, which have access to fixed ground telephone networks. Each radio subsystem according to ARINC 752 consists of antenna, diplexer, transmitter/receiver unit and modem processor unit.

Further features and benefits

- Easy to install at low costs
- Crystal-clear understanding of voice thanks to digitization
- Voice coded; prepared for 4.8 kbit/s;
  implementation by software updating, doubling the number of channels from 4 to 8, thus greater availability and higher return of investment
- Fax/data capability;
  software update allows additional service: additional return of money
- Low power dissipation;
  superior engineering with multiple benefits, eg lower cooling requirement, longer component service, lower maintenance and higher reliability
- Data loader;
  allows cockpit software updates for smooth commissioning, quick and easy updating and simplified logistics
- On-board maintenance system interface;
  the cockpit OMS interface means faster servicing and allows transmission of data to the ground maintenance center

Description

TFTS operates in the frequency range from 1670 to 1675 MHz (downlink) and from 1800 to 1805 MHz (uplink). The modulation method is differential quadrature phase shift keying (DQPSK), the transmission method is time division multiplex access (TDMA) for the air-ground link and time division multiplex (TDM) in the opposite direction. The data rate for signal transmission at the air interface is 44.2 kbit/s. Each transmission channel is subdivided into timeslots so that four user channels with a rate of 9.6 kbit/s are available in addition to the service channel.

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Technical data

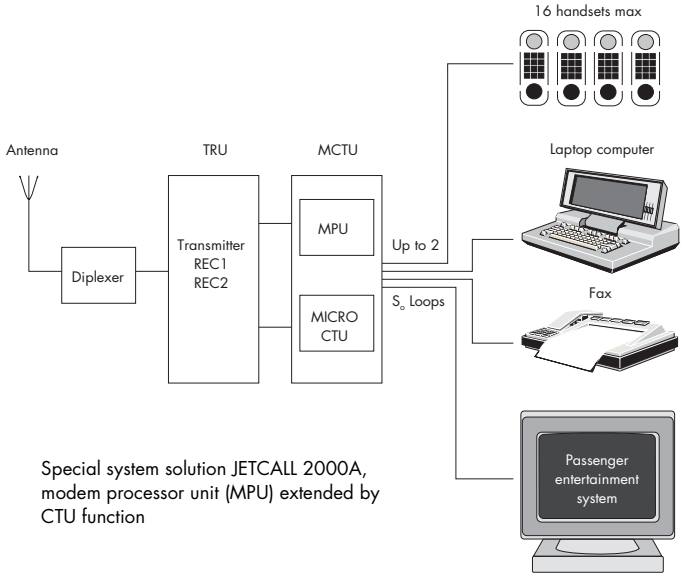
- 4 voice/fax/data channels on one CODEC board
- Space provided for a second 4-channel CODEC board inside the MPU
- BITE initiation by pushbutton on frontend of MPU or via OMS
- Test down to module level
- Easy maintenance and replacement of modules, low maintenance costs

Quality assurance – design and production – according to ISO 9000 and the British Standard BS 5750.

Documentation standard according to ATA100: Maintenance Manual and Component Maintenance Manual

Considered standards

WARC		General recommendations
ETSI	ETS 300-326	Terrestrial Flight Telecommunication System, specification
ARINC	600, 604, 752	Terrestrial Flight Telecommunication System, airborne radio system, and others
ARINC	746	Cabin communication system
ARINC	413A	Guidance for Electrical Power Utilization and Transient Protection
ARINC	609	Design Guidance for Aircraft Electrical Power Systems
RTCA	DO-160C EUROCAE ED-14C	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA	DO-178B EUROCAE ED-12B	Software Conditions in airborne system and equipment specifications



Special system solution JETCALL 2000A, modem processor unit (MPU) extended by CTU function

Specifications

Frequency range	1800 to 1805 MHz, air to ground 1670 to 1675 MHz, ground to air
Channel spacing	30.3 kHz
Management of emission power	16 levels (12.5 W to 0.4 µW at antenna output)
Modulation	π/4 DQPSK
Bit rate	44.2 kbit/s (4 x 9.6 kbit/s + 1 x 5.8 kbit/s)
Transmission mode	TDMA, air to ground TDM, ground to air
Channel capacity	4 voice channels extendible to 8 channels
Voice/data compression	9.6 kbit/s, extendible to 4.8 kbit/s
Handover	automatic cell selection/reselection

Shipset
Each airborne radio equipment set, the so-called »shipset«, consists of
– Antenna AD711
– Diplexer FD711
– Transmit/Receive Unit TRU XD711
– Modem Processor Unit MPU GX711

Ordering information

Antenna		
Chelton 10-108-01	AD711	6071.6416.12
Starec 62020	AD711	6071.6416.03
Diplexer		
Chelton 7-736	FD711	6055.2003.02
Starec D13T16P15	FD711	6055.2003.03
Transmitter/Receiver Unit TRU	XD711	6051.1290.02
Modem Processor Unit MPU Four voice channels	GX711	6051.1390.02
JETCALL 2000A for up to 16 handsets Antenna, diplexer, transmitter/receiver unit same as with JETCALL 2000, but modem processor unit extended by MICRO CTU. Order:		
Modem Cabin Telecommunication Unit	GX711M	6083.4013.02

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System Processor MERLIN together with HF Transceiver XK2100 and fax unit (Photo 41269)

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System Processor MERLIN GR 2000/GR 2000 X

Brief description

The powerful System Processor MERLIN is suitable for use under extremely severe environmental conditions so that it offers reliable operation at temperatures from 0 to 50 °C.

In combination with message handling programs from Rohde&Schwarz and intelligent interface modules the system processor ensures reliable and fast data transmission via a variety of media.

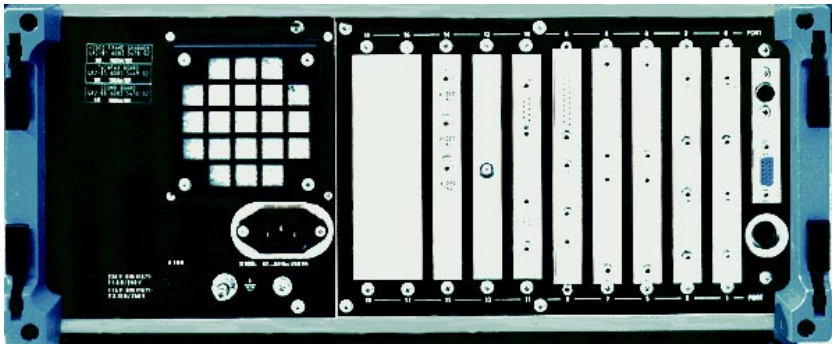
It is compatible with the industry standard and features far more expansion capabilities than conventional industrial PCs.

The EMC shielding allows versatile applications of MERLIN. Even its use in the close vicinity of radio systems and antenna arrays with high field strength is no problem. The rugged construction permits vehicular and shipboard applications.

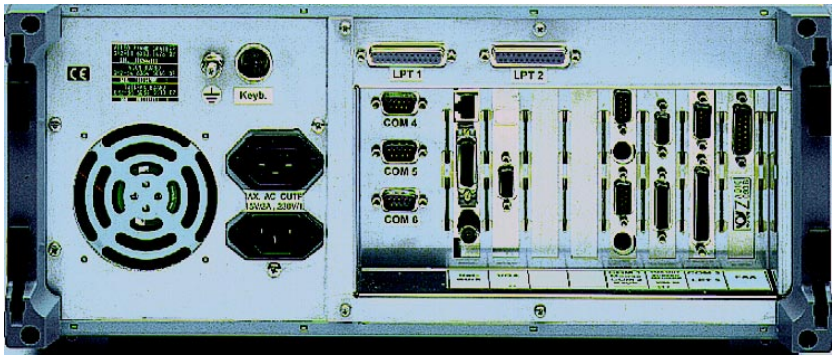
In addition to the high computing power, MERLIN has the following outstanding features:

- Excellent RF shielding
- Extremely rugged construction
- Mounting in 19" standard racks
- High thermal load
- Modular design
- Up to 20 interfaces
- Different standards/methods

Front view of GR 2000 X and GR 2000 (Photo 42562)



Rear view of GR 2000 X (Photo 42564)



Rear view of GR 2000 (Photo 42566)

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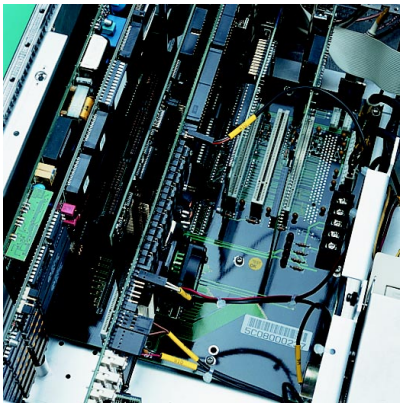
System Processor MERLIN GR 2000/GR 2000 X



Future-oriented design: all there is to do is to change the CPU plug-in card and System Processor MERLIN is again completely in line with the latest state of the art (Photo 42568-3)

Full-featured basic model – versatile expansion capabilities

The basic model of MERLIN features the following configuration:

- High-speed PCI VGA graphics card
- Exchangeable hard disk
- 3½" disk drive
- CD-ROM drive
- PCI Ethernet card
- Two serial RS-232 and one parallel Centronics interfaces
- PCMCIA Type III internal + external

Thanks to the modular design and the versatile expansion capabilities the system processor can be tailored to customer's specific application needs.

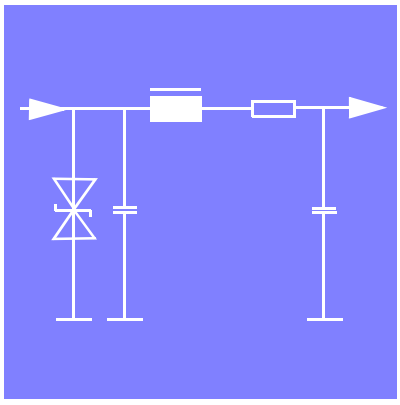
The passive backplane can accommodate up to eight plug-in cards (PCI/ISA). Rohde&Schwarz offers a variety of intelligent interface cards:

- Fax
- Video frame grabber
- Encryption
- Digital voice

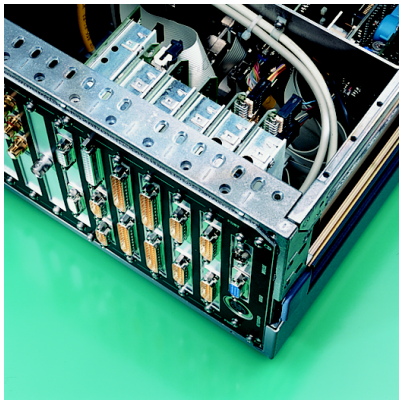
The basic configuration provides five additional slots with PCI or ISA bus for further expansion. The modular design allows customized CPU upgrades, making the equipment future-safe.

A choice of universal power supplies is available for System Processor MERLIN. As an alternative to the standard power supply Rohde&Schwarz offers power supply models which satisfy the stringent requirements for use on board ships in line with STANAG 1008. They can withstand high voltage fluctuations and power-line-related spikes of up to 2.5 kV. DC power supplies are of course also available.

All standard keyboards and monitors can be connected. Rohde&Schwarz also supplies special versions for more sophisticated demands.



Block diagram of EMC filters in MERLIN GR2000 X



No chance for RF leakage and pickup: elaborate filter banks at the inputs and outputs of GR 2000 X essentially contribute to the excellent EMC shielding (Photo 42568-4)

Excellent EMC shielding – no chance for RF leakage and pickup

High-grade filters at the inputs and outputs of GR2000X as well as elaborate shielding measures make MERLIN extremely RF-leakage- and pickup-proof. The shielding is effective both for radiated and conducted interference and allows the system processor to be used even in the immediate vicinity of radio systems and their antennas or other strong interfering sources. On the other hand, the system processor itself does not affect RFI-sensitive equipment. Tempest-qualified and RF-leakage-proof versions are available.

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System Processor MERLIN GR 2000/GR 2000 X

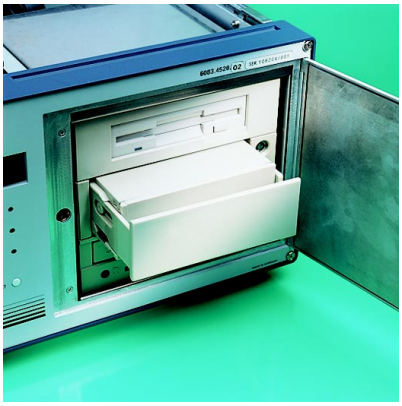
Case and frame withstand extreme environmental conditions

The case is of an extremely sturdy construction. MERLIN can be used even in splashwater environments and – thanks to a pressure cooling system with the air sucked in via filters – in very dusty environments. The frame is reinforced and designed to withstand extremely high mechanical stress. This ensures problem-free operation under extremely high vibration, impact and shock loads. The instrument is available as a bench model or can be incorporated in a 19" rack. The 19" rackmount is especially designed for use in vehicles and on board ships.

Extremely high vibration, impact or shock loads? Dust and splashwater?
No problem for System Processor MERLIN: its rugged case and reinforced frame withstand even the most adverse environmental conditions

Exchangeable hard disk: well-prepared for any eventuality

The exchangeable hard disk features maximum versatility so that any operating system can be loaded simply and quickly. Sensitive data can conveniently be stored in a safe place. Special high-capacity storage media are available for applications subject to extremely high levels of vibration.



Exchangeable hard disk provided in basic model: convenient loading of other operating systems or storing of sensitive data in a safe place (Photo 42568-1)

Versatile and flexible in practical use

In conjunction with message handling programs and intelligent interfaces, reliable and fast data transmission can be implemented and combined via external media. HF, VHF/UHF radio links, telephone lines as well as satellite and LAN links can quickly and easily be established. The handling programs support the transmission of fax files and video still pictures and they optimize the use of e-mail networks. Access to different communication networks is thus possible simply from the familiar office environment.

MERLIN has proven itself as a system processor and data terminal in a large variety of applications at a great number of customers. In its function as a data terminal MERLIN is equipped with an ICOM-8 card. This card provides eight serial channels, eases the workload of the CPU through its own processor and also supports the 5-bit teletype mode (Baudot code). It allows more instruments to be simultaneously controlled than a conventional standard PC. MERLIN can thus utilize several media at a time and avoid delays in data transmission.

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MERLIN GR2000 and GR2000X – Specifications

Basic configuration		**GR 2000 and GR 2000 X**	
CPU		Latest PC processor generation available	
Coprocessor		on chip	
Cache		256 Kbyte, L2	
HD/FD controller		PCI-IDE on board	
RAM		128 Mbyte (expandable)	
Graphics card		PCI VGA with 8 Mbyte RAM	
Drives		3½" floppy disk, 1.44 Mbyte; CD-ROM drive	
		PCMCIA Type III internal + external	
Exchangeable hard disk		>4 Gbyte	
I/O interface		2 x serial (SIO 16550), 16 byte (FIFO), 1 x parallel (SPP/ECP/EPP)	
Network card		PCI Ethernet, 10 Mbit/s, IEEE 802.3i 10BASE-T	
Operation		keyboard, mouse (PS2)	
Free slots		PICMG standard: 2 x PCI + 4 x ISA depending on configuration	

Operational reliability		**GR 2000**	**GR 2000 X**
MTBF		>15000 h	>15000 h
MTTR		<0.5 h	<0.5 h
Availability		99.9 %	99.9 %
EMS/EMI		EN 50081-1, EN 50082-1 (CE), EN 61000-3-2	EN 50081-1, EN 50082-1 (CE), EN 61000-3-2, MIL-STD-461C Part 4, Test CE03, RE02, CS01, CS02, CS06, RS03, Tempest version on request
Electrical safety	AC supply	EN 60950	EN 60950, STANAG 1008
	DC supply	–	EN 60950

General data		**GR 2000 and GR 2000 X**
Rated temperature range		+5 to +45 °C
Operating temperature range		0 to +50 °C
Storage temperature range		–40 to +70 °C
Cooling		pressure cooling system with easily replaceable air filter
Noise level		42 dB (A) at 1 m from front panel
Max. height above sea level		3000 m
Relative humidity		95 % at 40 °C; without condensation
Protection class		IP 41 on front panel, IP 21 for total unit (EN 60529)
Vibration test[1])		10 to 300 Hz, 0.01 g^2/Hz and 300 to 500 Hz, 0.003 g^2/Hz, each test 30 min and approx. 1.9 g (rms)
Shock test[1])		shock spectrum 0 to 40 g with 45 Hz transition frequency and acceleration of 30 g with a pulse duration of 11 ms, halfsine; in line with VG 95332, severity level 7
Quality management		developed and manufactured in line with ISO 9001
Colour of front panel		light grey RAL 7035
Power supply	AC supply	115 V: 85 to 132 V, 230 V: 180 to 265 V, 47 to 63 Hz
	DC supply	– 19 to 31 V
Power consumption		44 W 51 W
Dimensions (W x H x D in mm)		435 x 177 x 475 435 x 177 x 590
Weight (basic model)		12.7 kg 17.5 kg

Ordering information

Order designation	**System Processor MERLIN**	
	GR 2000	**GR 2000 X**
Basic configuration with: – Intel Pentium – VGA graphics card – 128 Mbyte RAM – CD-ROM drive – 3.5" disk drive (1.44 Mbyte) – >4 Gbyte hard disk, – 2 serial and 1 parallel interfaces – PS2 mouse – Ethernet card – AC power supply – PCMCIA Type III	6084.2520.02	6083.4520.02, additional filters at serial and parallel interfaces

Options		**GR 2000**	**GR 2000 X**
Video Frame Grabber Card			
Win3.1x	GR2-B1	6083.5478.02	6083.5478.02
WindowsNT	GR2-B12	6083.6668.02	6083.6668.02
Encryption Card			
ISA	GR2-B2	6083.5561.02	6083.5561.02
PCMCIA	GR2-B2	6083.5561.03	6083.5561.03
4 COM: 4 x RS-232-C	GR2-B4	6084.3040.02	–
with EMC filter	GR2-B3[2])	–	6083.5510.02
TwinFax Card	GR2-B5	–	6083.5449.02
	GR2-B6	6084.3010.02	–
RSX.25 Interface Card	GR2-B7	–	6083.5710.02
ICOM 8: 4 x RS-232-C and 4 x RS-485 with EMC filter	GR2-B8[2])	–	6083.5410.02
DC Power Supply (alternative to standard power supply)	GR2-B9	–	6083.6516.02

Recommended extras		
Keyboard		
Cherry		6084.3710.02
English	GR2-K1	
German	GR2-K2	6084.3762.02
Metal keyboard, broad, EMC; IP65		
English	GR2-K3	6083.6768.02
German	GR2-K4	6083.6816.02
Metal keyboard, 19" rackmount		
English	GR2-K5	6083.6868.02
German	GR2-K6	6083.6916.02
Display		
CRT 17", bench model	GR2-D1	6084.3510.02
21", bench model	GR2-D2	6084.3562.02
19", rackmount	GR2-D3	6084.3610.02
TFT 15"	GR2-D4	6084.3662.02

1) Harddisk (HDD) protection during shock/vibration. System is fully operable without HDD access

2) Simultaneous use of GR2-B3 and GR2-B8 not possible

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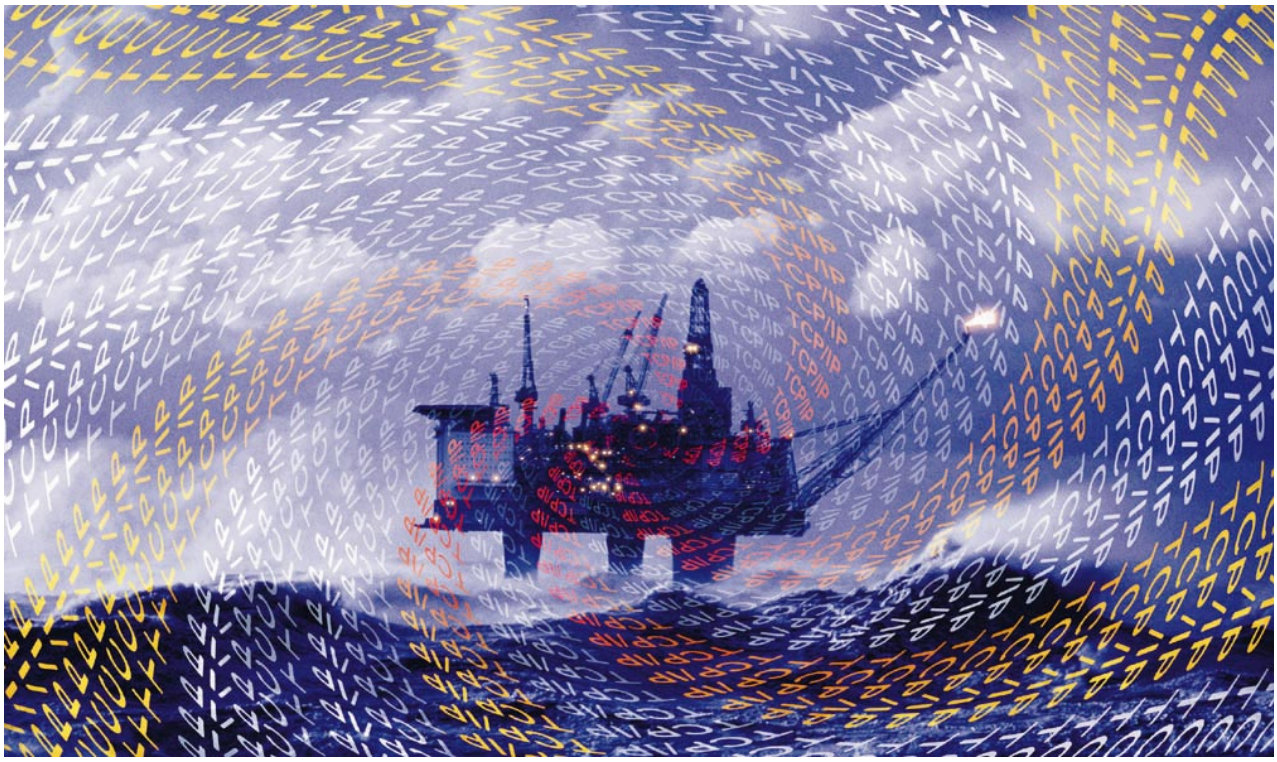
DS 100: PostMan



Wireless TCP/IP and intelligent e-mail system

Brief description

Rohde & Schwarz is one of the first manufacturers to have used the international network protocol TCP/IP in HF/VHF/UHF communication and to have developed a radio driver which is based on this standard. To be able to use the TCP/IP protocol in radiocommunication, a number of parameters, among other things, had to be adapted to the new transmission conditions (eg different signal propagation times). This driver is part of the Message Handling Software PostMan, which opens up the following possibilities:

- Connection of isolated stations that could previously only be reached via radio to e-mail (electronic mail) networks
- Extension of the transmission media of a modern workstation (LAN, SatCom, GSM, telephone line, etc) by the medium radio (HF/VHF/UHF)
- Integration of all known word and image processing programs used for producing information (eg WinWord, Designer, Excel, etc)
- Transmission and processing of fax messages and video stills
- Access to international communication networks
- Internet/Intranet applications via HF, VHF, UHF radios

With the aid of PostMan, e-mails can be exchanged between in-house stations or sent to and received from addresses in the international communication networks. The information is transmitted to the selected destination in the network automatically and without any further user interaction (see FIG 1).

Detailed description

Operating system

The new software product is based on the Microsoft Windows NT operating system, which is considered the future standard for professional applications. It is a pure 32-bit operating system that will run on any Intel-based or RISC high-end PC. It allows networks to be set up without the need for extra products and complies with the security requirements for the transmission of protection-relevant information. Windows NT in conjunction with the Microsoft Exchange e-mail product offers as standard the most commonly used protocols and connection of wired

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media to international communication networks. PostMan sets up on the MAPI interface (messaging application programming interface) of Exchange. Windows NT and Exchange serve as a gateway to communication networks such as X.400, Microsoft Mail or Internet.

User interface

The PostMan user interface is tailored to customer requirements and its functions are restricted to basic e-mail operations such as transmitting or passing on of messages and replies. This optimized, application-oriented user interface is the ideal environment for the average user and excludes far-reaching operating errors. It allows direct processing of fax files and video stills without the need for auxiliary programs. The interface also supports the entry of radio-specific parameters, which is only possible to a limited extent with MS Exchange (see FIG 2).

Word and image processing

Previously, special word and image processing programs had to be developed for separately operating radio network subscribers and their specific system solutions. PostMan and its Windows NT operating system now permit any commercially available program to be integrated using an OLE (object linking and embedding) server. With the aid of this server all future word, fax and image-processing programs available under Windows NT can be integrated in the PostMan.

E-mail networks

Existing e-mail networks are basically of two types: the client/server architecture and the peer-to-peer network.

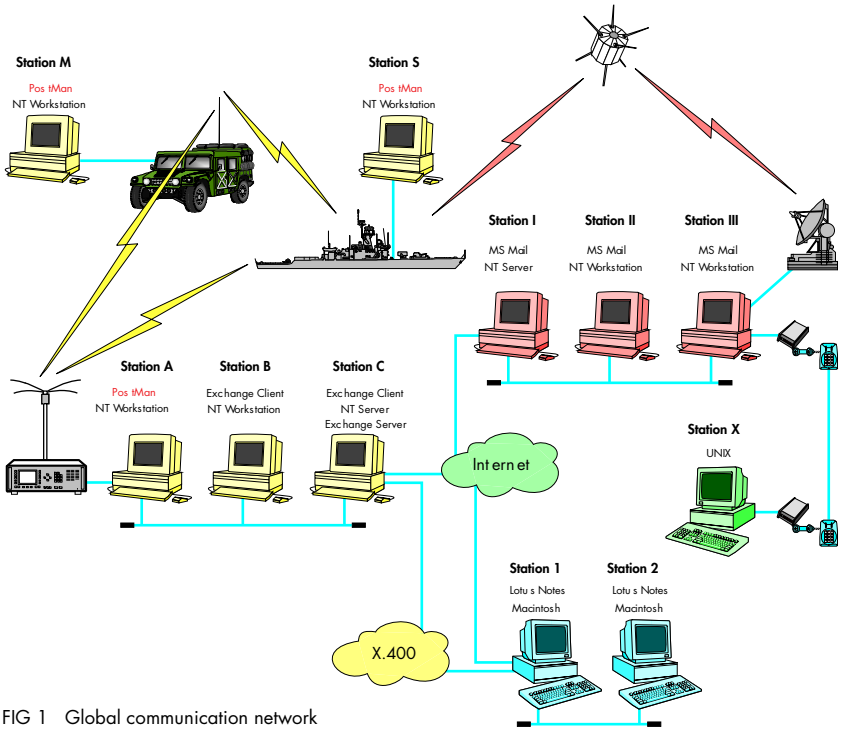

FIG 1 Global communication network

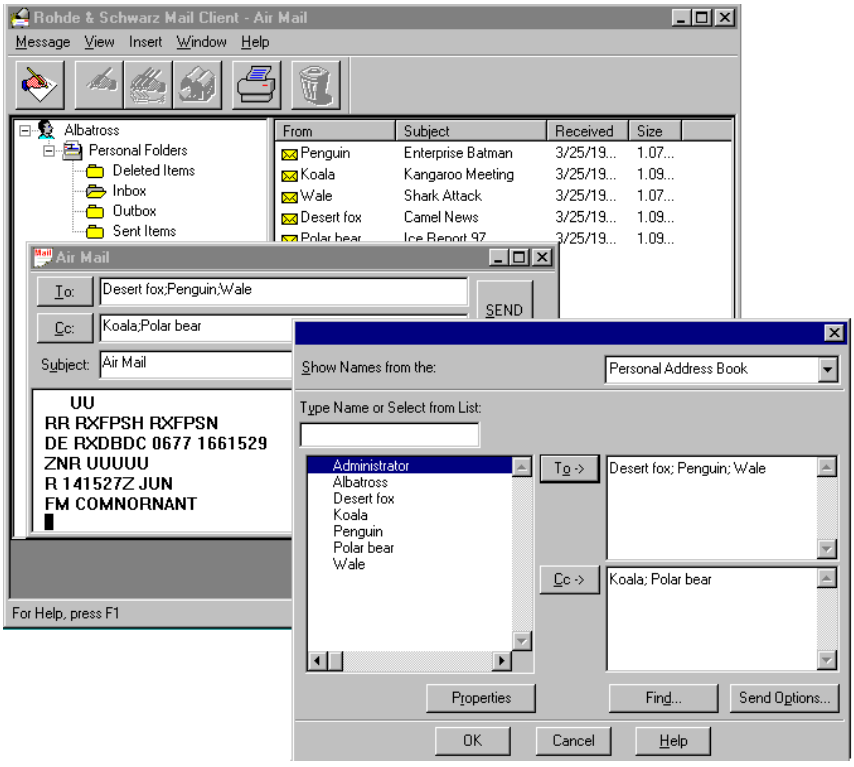

FIG 2 User interface of PostMan

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In a radio-based e-mail system, message management by a central post office is not economical. The e-mail addressing of PostMan can manage without a post office. To this end the known address formats were extended by the RSPeer format. Messages are sent direct to the addressed station where they are physically present. This procedure must be adopted in radio networks, as communication links would be unduly loaded through the polling of a post office. What is more, routing messages via a post office means that messages would have to be sent twice, a solution that is impractical particularly in shortwave communication.

In addition to HF/VHF/UHF radio, PostMan can integrate all transmission media listed below in its e-mail operations:

- X.400
- LAN
- X.25 network
- ISDN
- GSM network (incl. short message service)
- PSTN (dedicated and switched lines)
- Satellite radio networks

PostMan optimizes the use of all available media by alternative routing. If the medium intended for transmission is interrupted, PostMan dynamically and automatically changes to an alternative one (governed by a list of priorities) and continues transmission there. Before switchover to another medium, a check is made to see whether transmission can be continued on the same medium but on an alternative path (eg via a relay station). The automatic change to an alternative transmission medium is a special characteristic of PostMan and offered by none of the other e-mail systems.

In conjunction with the Exchange server, PostMan permits free access to and data transfer via other standard e-mail networks. Depending on the configuration the following gateways are supported:

- X.400 network (via X.25 – CompuServe, Lotus Notes, cc:Mail)
- Internet (SMTP protocol)
- MS-Mail (Microsoft mail product) – MS-Net
- GSM

The system can be easily extended to future networks by integrating standard transport providers.

Transmitting on a particular medium is not always favourable but depends on the time of the day (eg there are times when telephone charges are low or the quality of shortwave communication is good). With PostMan several optimum transmission times can be specified for the different media over the day. The exact transmission time of a ready-to-send message may be entered up to 30 days in advance.

Security

PostMan of course allows the integration of encryption methods. Being able to protect messages against unauthorized access by third parties may be of interest to all users. Messages can be encrypted with the aid of a PCMCIA card which is to be inserted in the PC, if required.

Ordering information

Message Handling Software PostMan		
Standard		
Radio Driver E-Mail Client	DS100	6083.8260.02
Exchange		
Radio Driver E-Mail Client RSPeer Connector	DS100	6083.8260.03
Client		
E-Mail Client	DS100	6083.8260.04

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DS 101: SpaceMan

Combined shortwave-satellite transmission system

SpaceMan DS101 system for combined shortwave-satellite transmission consisting of HF Transceiver XK2000, PC with Message Handling Software PostMan, decoder and satellite dish (Photo 42 700/1)

Brief description

With its SpaceMan DS101 system, Rohde & Schwarz is the first supplier worldwide to combine broadband satellite transmission systems with radiocommunication. Requests to the Internet are made via radio (HF/VHF/UHF), and transmission of requested data via fast satellite links. Access to this modern information technology (IT) with radio linkup is realized by means of PostMan DS100, a well-known software product which allows transparent TCP/IP radio data transmission. PostMan in conjunction with shortwave transceivers of the XK2000 family provides unrestricted access to wired communication networks via radio links from any point on the earth. Reception of satellite signals is implemented in SpaceMan by commercial system solutions adapted to radio technology. This provides wireless Internet access unimpeded by the constraints of low data rates.

Uses

Through the combined use of two transmission techniques – radio and TV satellite – SpaceMan achieves data rates far above those of terrestrial post office lines with telephone modems. A user browsing on the Internet from a ship in the North Sea for example, using shortwave and satellite links provided by SpaceMan, is at no disadvantage compared with his mainland workstation. Using satellite transmission and radio technology from Rohde & Schwarz, large volumes of data such as digital maps, data bases and software upgrades can be downloaded to the PC far from any infrastructure at data rates considered so far unattainable in radiocommunication. Even realtime multimedia applications can be implemented in this way.

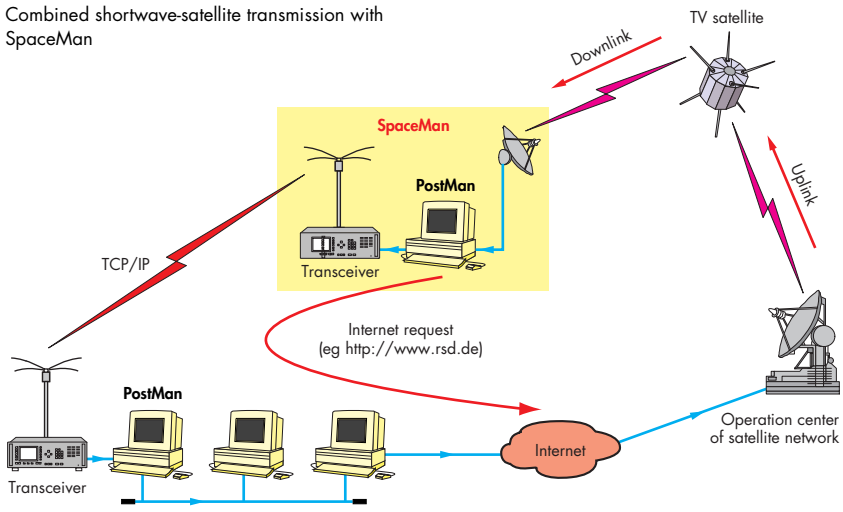
Summary

Thanks to SpaceMan, users who so far could not access wired communication networks due to the lack of suitable infrastructure, now for the first time can enter the Internet from any point on the earth via radio links and at data rates unattainable for wired users up to now. SpaceMan thus opens wired communication networks also for users at sea, on islands or in other remote areas, and for land-mobile applications.

Ordering information

Combined Shortwave-Satellite Transmission System SpaceMan DS101 6097.9006.02

Combined shortwave-satellite transmission with SpaceMan



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DS110: Radio Remote Control

Controlling radio equipment on Intranet

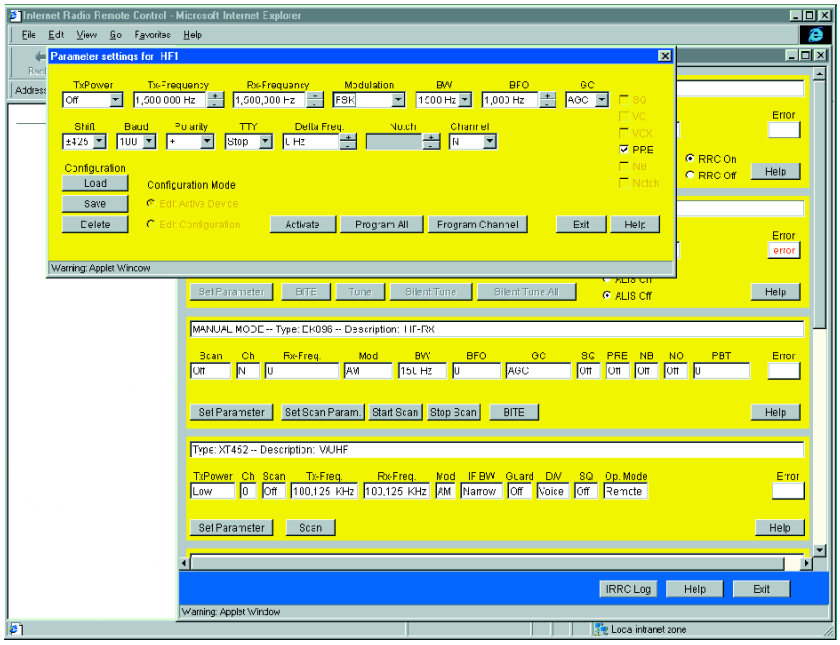

FIG 1 Radio Remote Control Software DS110 makes use of browsers that are destined to become standard

Brief description

The latest development in radio control from Rohde & Schwarz – Radio Remote Control Software DS110 (RRC software) – makes use of the most advanced technologies to be found in computer networks today and its concept sets standards for future developments. The software incorporates a wide variety of tools, Java-based web browsers and relational database management systems as well as client/server architectures.

This radio control software allows configurations and settings such as frequency and modulation to be made from any workstation in a computer network. And, in the other direction, parameters and settings of remotely controlled radio transceivers can be queried and monitored. Errors, for example, can be detected rapidly through continuous monitoring. Settings no longer have to be performed on the transceivers themselves, but can be made from any PC within the computer network. The RRC software package has a clear menu structure, offering operational ease that transceivers with their relatively limited graphic display cannot match. As an added convenience, the panels of any transceivers can be individually grouped together (FIG 1). Settings can be both sent to the transceivers and stored in configuration files.

There is basically no limit to the number of transceivers that can be controlled by this software in the 3 kHz to 3 GHz range (VLF, HF, VHF, UHF). The transceivers are addressed via a serial bus. RS-232-C or RS-485 interfaces are used, depending on whether distances up to 20 m or of several hundred meters are involved. The number of serial lines as well as the number of transceivers can be freely selected and depends on the system (FIG 2).

Ordering information

Radio Remote Control
DS110 6083.8419.xx

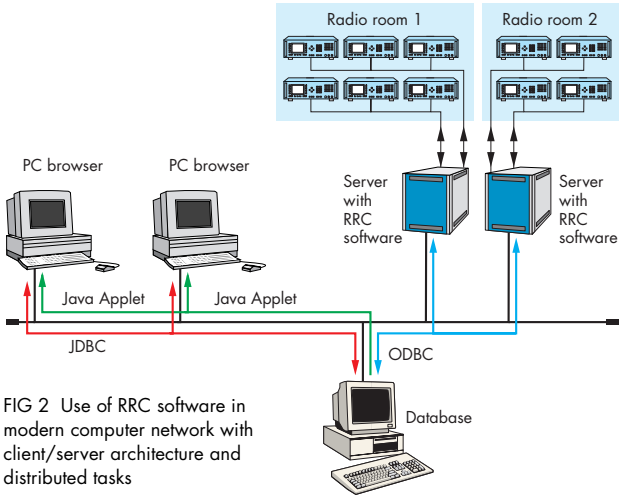

FIG 2 Use of RRC software in modern computer network with client/server architecture and distributed tasks

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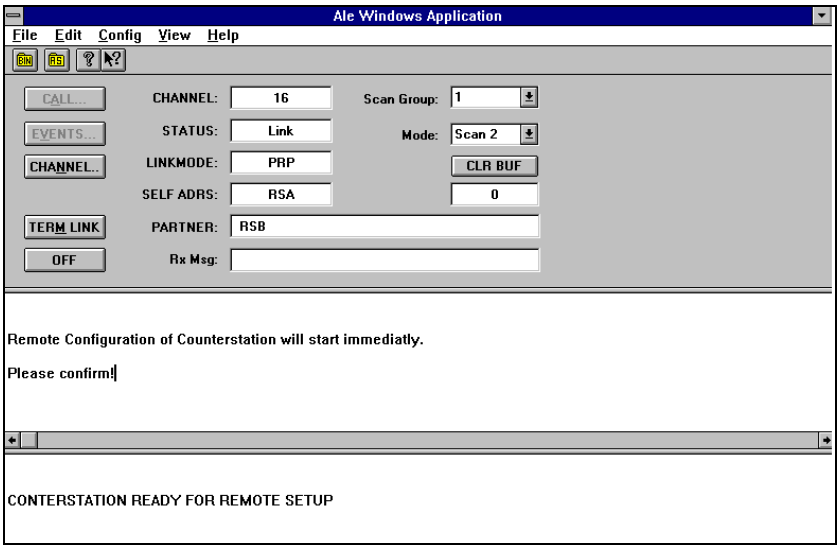
DS120: COM2000

Data transfer and configuration software



Brief description

COM 2000 is a multifunctional software package for supporting shortwave communications. The self-explanatory menus enable even the inexperienced user to configure Communication Processors ALIS and ALE-1045 (FED-STD 1045/1046) of Transceiver XK2000 as well as data transfer with the counterstation (ALE: automatic link establishment).

Modern Windows menus allow easy and convenient remote control of Communication Processors ALIS and ALE-1045.

With the installation of the software package COM 2000 two programs are offered to the user – one for the configuration of the ALE database and a terminal program for data transfer.

Database

With the aid of the database program all data for configuration of Communication Processors ALIS/ALE-1045 can be entered on the PC and stored. Configuration files already stored can be loaded in the menu and edited, if required.

The menu-supported Windows interface means a considerable improvement on the previous choice of configurations. COM 2000 allows any configuration of Communication Processors ALIS/ALE-1045 to be generated, stored, edited and loaded in the transceiver.

Terminal

The terminal program is a data transfer system ensuring convenient data exchange with a counterstation. In addition it enables an upload of the database configuration to the communication processor of XK 2000.

With the aid of a clearly arranged Windows menu the user can conveniently send and receive ASCII and other binary files. The program supports in particular the transfer of fax messages. Fax files received can be output on a fax machine and fax files to be sent can be read in.

Direct communication with the counterstation is possible via the dialog box with the aid of the keyboard. The text to be sent is displayed in the upper half of the dialog box. After pressing the ENTER key the message is transferred to the counterstation. The text received from the counterstation is displayed in the lower half of the dialog box.

Ordering information

Data Transfer and Configuration Software COM 2000
DS120 6083.8519.02

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DS 130: Propagation Wizard – PropWiz

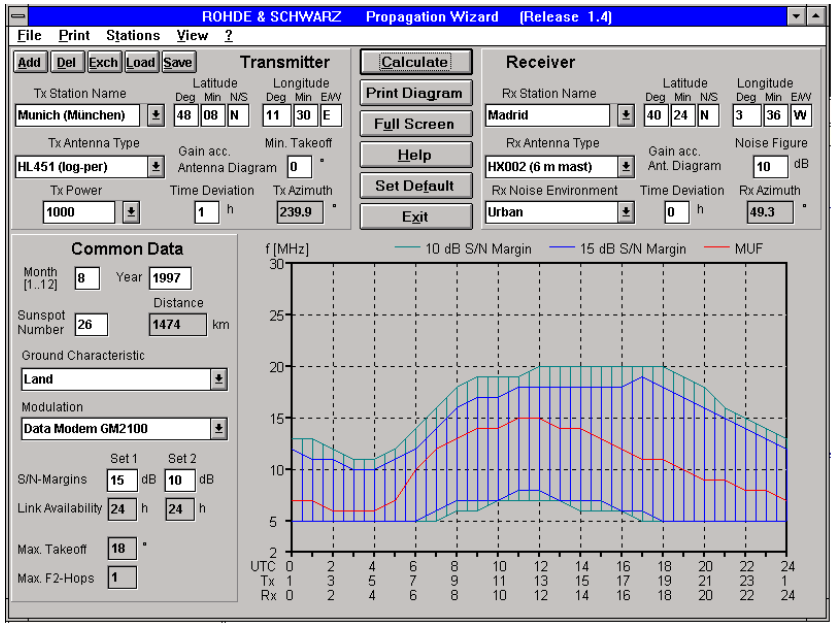
Program for shortwave link prediction

Brief description

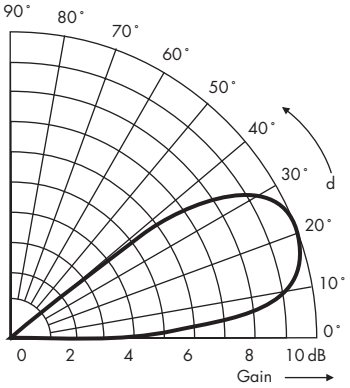
Communication via shortwave is influenced by a variety of factors that make it appear a rather changeable medium. The quality of shortwave transmission is substantially affected by weather conditions, position of sun, geographical location and number of sunspots, to name just a few parameters, which sometimes make it even impossible to establish a link between two points on the earth. Therefore, attempts have been made worldwide for quite some time to find solutions that enable reliable prediction of shortwave link quality. Propagation Wizard from Rohde & Schwarz, abbreviated PropWiz, is one of the most convenient and powerful software programs for shortwave radio link prediction available on the market.

PropWiz not only calculates the MUF (maximum usable frequency) but also determines the availability of a radio link for the various times of day as well as the appropriate frequency ranges. Results are output in easy-to-read graphical form.

In addition to environmental effects, device parameters such as transmitting power, modulation methods and antenna characteristics are taken into account. Especially as far as antenna parameters are concerned, PropWiz stands out from competitive products. While most prediction programs take ideal isotropic radiators as a basis for calculations, PropWiz takes into account the antenna types actually available at the transmission and reception sites. Users can choose among a large number of Rohde & Schwarz antennas (dipoles, log periodic antennas, rod antennas, etc) and also define antenna types of their own. Each antenna has its own characteristic (gain), which is determined by the frequency and the elevation angle. This antenna characteristic is described by the vertical radiation pattern.



The PropWiz user interface shows link availability at a desired S/N ratio versus time of day as well as the appropriate frequency range



Example of vertical antenna pattern

Antenna patterns are stored under PropWiz in tabular form in files. An editor enables easy generation of new patterns for non-R&S antennas as well as modification of existing patterns.

For the calculation of the signal-to-noise ratio, the field strength at the receiver is determined taking into account the local atmospheric, galactic and man-made noise according to ITU-R (CCIR) recommendations.

Thanks to PropWiz, the complex calculations and evaluations required until now are made in no time. It is thus possible to assess the quality of a radio link, ie the data rate at which transmission via shortwaves is possible or if a shortwave link can be established at all with the antennas selected and the transmitting power available. PropWiz also indicates the range of frequencies which should be used at a given time of day.

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PropWiz is a program designed for PC or laptop/notebook computers. It requires Microsoft Windows 3.x, Windows 95/98 or Windows NT.

Why PropWiz saves a lot of time

To determine the availability of a short-wave link, the following steps had to be performed up to now:

- Calculation of the field strength at the receiver by means of a MUF program
- Determination of the man-made noise, atmospheric noise and galactic noise at the receiver to ITU-R recommendations (depending on location, time of day and season of year)
- Calculation of the signal-to-noise ratio considering the bandwidth, the receiver noise and the Rx antenna gain
- Comparison of the calculated signal-to-noise ratio with the signal-to-noise ratio required for the used modulation
- 24-fold repetition of steps 1 to 4 to get the availability in hours per day
- To obtain results for modified parameters, like different antennas, adapted Tx power, other month, etc, the complete calculations and evaluations had to be done again
- For different locations the complete calculations had to be done again
- To get an overview with necessary details, the calculated results had to be put into a graphical display

The Propagation Wizard frees you from all these efforts and delivers the desired results in a very short time. The results are given in a graphical display to allow an overview with all the necessary details. The calculations can be quickly repeated as often as desired. Of course the results can be printed out to get a hardcopy.

The outstanding features of the Propagation Wizard are:

- Extremely easy operation through self-explanatory Windows user interface
- Online Windows help function
- Based on proven algorithm for MUF and field-strength calculation
- Consideration of all important link parameters
- Consideration of specific Rohde & Schwarz hardware (transceiver power classes, antennas, data modems)
- Characteristics of Rohde & Schwarz antennas taken into account. It is no longer necessary to enter values for antenna gain and elevation
- Generation of radiation patterns for user-specific antennas supported by included editor
- Calculation of the availability of a link for a pair of predefined signal-to-noise ratios in hours per day
- Graphical display of the usable frequency range versus time of day, which is very easy to interpret
- Link parameters can be saved for later recalculation
- Supports 800 x 600 pixels and 640 x 480 pixels screen resolution

The Propagation Wizard is protected by a hardware dongle, without dongle the software runs in demo mode. The demo mode is restricted as far as the Rx station is concerned, which is fixed and cannot be modified. All other features (including printing) are fully supported.

Since PropWiz can be freely accessed without dongle, customers can gain an impression of the performance of this software product conveniently and without any obligation.

Specifications

Demo version and update

Available via Internet	Internet address: http://www.rsd.de
Scope of delivery	3.5" disk, dongle
Software requirements	MS Windows 3.x, Windows 95/98 Windows NT

Ordering information

PropWiz	DS130	6083.7512.02

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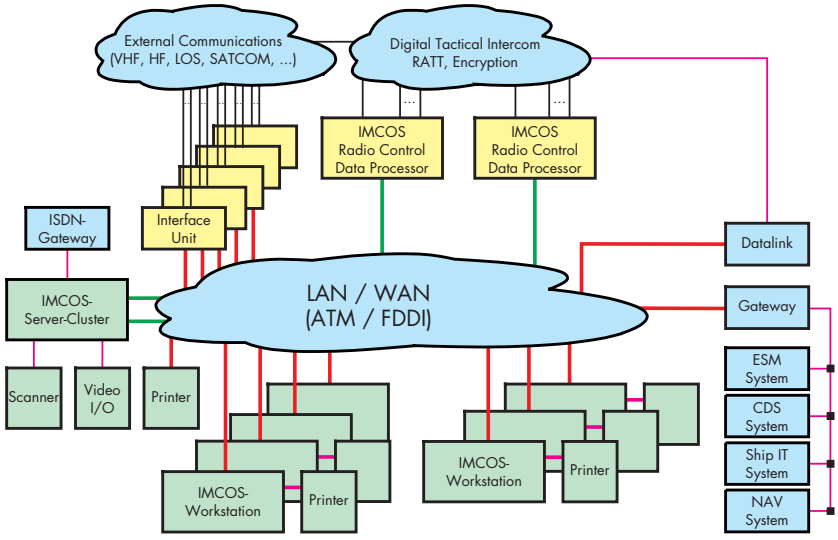
DS 140: COCOS

Communication and control system for naval forces



Communication and Control System COCOS
The system platform for the application shown is based on workstations of appropriate design

Brief description

Modern naval vessels are highly complex systems not only with regard to the technologies involved, but also because of the permanent exchange of information taking place between the subsystems of the vessel and other vessels or land-based stations, which makes effective communication means essential.

COCOS covers all tasks essential for communication: message handling, controlling external and internal transmission equipment, automatic or manual selection of transmission equipment and of course administration of all messages in a database.

Message handling functions

The message handling functions include everything required for correctly receiving and sending messages as well as editing, approving, releasing, archiving and encoding them and handling incomplete messages.

Control function

Controlling external and internal transmission equipment means that radio links optimally suited for the current situation are selected, configured and controlled.

Transmission equipment selection function

The transmission equipment selection function serves for choosing the transmission equipment that will transmit a message optimally under time/cost aspects. For radio transmission, the **frequency and antenna management** may be used for support. This system proposes the radio link (antenna, transmission facility, power, etc) that is optimally suited for a particular situation (time of day, user location, receiver location).

User interface

Whether or not a system like this is taken up by the user depends largely on the user interface. COCOS has been specially designed for use in military environments. All essential functions have the same graphical user interface laid out according to the principle that "what you see is what you get". This guarantees a brief period of familiarization with the system. The user is supported by an integrated online manual, a comprehensive fault message system and macros allowing the simplification of standard procedures.

Ordering information

Communication and Control System COCOS	DS 140	6083.7664.xx

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DS150: ACP-MHS

Military ACP-127 Message Handling System

Brief description

Even though the combination of radio and teletype (RATT) is generally no longer regarded as a modern means of information exchange, it is often the only available basis for data transmission due to its widespread use. Whether onboard a ship or in an embassy, teletype is still frequently used for sending text messages by radio.

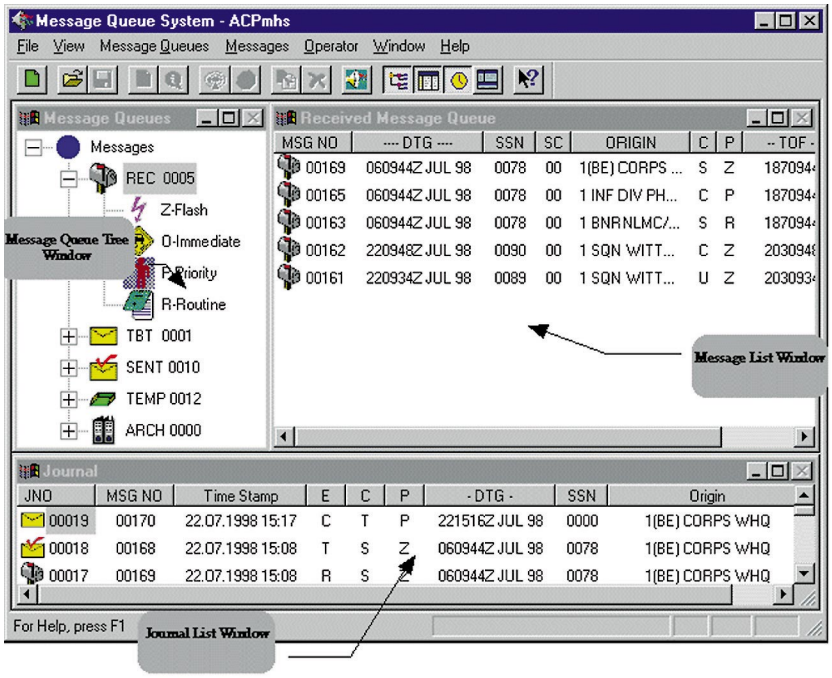

FIG 2 User interface of log book with various sorting criteria

Texts are normally written in the internationally defined format ACP-127 (allied communication protocol).The ACP-127 format, which also serves for automatic archiving, addressing, prioritizing and classification, requires the observance of strict formal guidelines and involves a great deal of effort, especially in the preparation of texts and handling of received messages. If large numbers of messages are to be received or transmitted, management tools that support the user are indispensable.

A tool of this type is now offered by Rohde & Schwarz in the form of the software product ACP Message Handling System DS150 (ACP-MHS DS150). It runs under Windows NT and allows data exchange on a radio path between a PC at one end and a teletype unit at the other (FIG 1). With the aid of this program, texts can be generated on a PC, and the teletypewriter at the distant station prints them out on paper or as punched tape.

Conversely, conventional teletype messages are intelligible to ACP-MHS stations, which store them as files. The user is thus able to replace the teletypewriter by a PC and the program DS150 without losing teletype as a medium. DS150 also supports the administration and logging of all received and transmitted messages in log books (FIG 2).

A special mask-oriented editor simplifies errorfree generation of teletype messages in line with strict ACP-127 guidelines. Depending on the individual requirements, HF, VHF or UHF radio equipment may be used for transmitting the generated messages.

Besides RATT operation, the software also allows automatic reception of broadcast messages. Messages received in this way are automatically analyzed and placed in receive queues according to priority. The messages can be sorted within the queues according to various criteria such as date time group (DTG) or station serial number (SSN). ACP-MHS Software DS150 does away with the restricted interoperability between teletype and other computer-based data services.

Ordering information

ACP-MHS	DS150	6097.0509.02

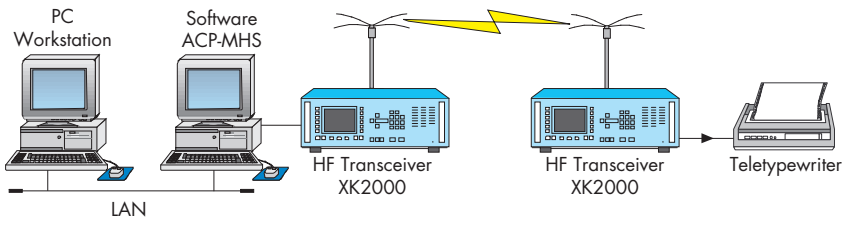

FIG 1 Radio data transmission with teletypewriter and ACP Message Handling System DS150

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VHF/UHF Data Modem GM858C1

Connecting any VHF/UHF radio to the System Processor MERLIN

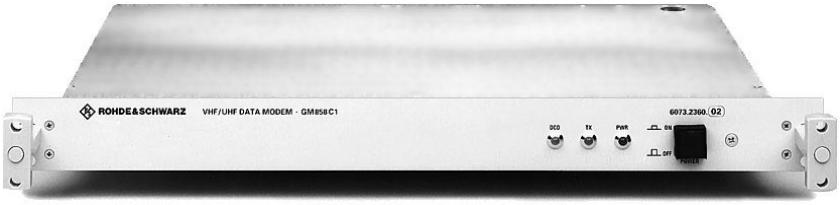


Photo 42227

Brief description

With VHF/UHF Data Modem GM858C1, any VHF/UHF radio may be connected to the System Processor MERLIN. The RSX.25 card in MERLIN forms the interface to the data modem.

The data modem modulates and demodulates serial, binary and synchronous data to/from a serial waveform. The data modem which can be used both for transmission and reception attains a data transfer rate of 2400 bits/s in the VHF/UHF voice channel (0.3 to 3.0 kHz). The modem can be configured for data rates of 1200, 1500 or 3000 bits/s in line with requirements.

The type of modulation employed is FFSK which is highly resistant against the typical disturbances of a VHF/UHF link. In conjunction with the RSX.25 card and its ARQ protocol, the modem provides a 100% error-free data transmission via the VHF/UHF channel.

The modem is a flat 19" plug-in specially designed for incorporation into a 19" rack. Together with the RSX.25 card System Processor MERLIN which is widely used in HF radio systems allows any VHF/UHF unit to be connected to a previously unused output thus expanding the system in a simple way.

Features and benefits

- Any VHF/UHF radio may be used
- Transmission rate 2400 bits/s
- Two-level FFSK as modulation
- 100% error-free data transmission when used together with RSX.25 card

Specifications

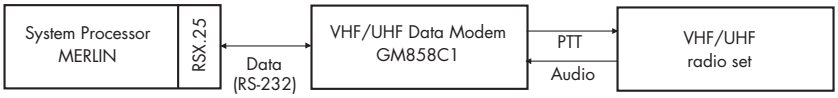
Power Supply	230 V AC (optional 24 V DC)
Inputs/outputs	
Audio + PTT	9-pin, D-SUB socket
Data	synchronous RS-232, 25-pin, D-SUB socket
Data rate	2400 bps (1200/ 1500/3000 optional)
Type of modulation	FFSK
Case	19" bench model, 1 HU

Ordering information

VHF/UHF Data Modem

230 V AC	GM858C1	6073.2360.02
24 V DC	GM858C1	6073.2360.02

(front panel RAL 7035)



Example of a combined HF/VHF/UHF Radio Set with System Processor MERLIN

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Interior view of ATC Mobile Tower MX400 (Photo 40783-3)

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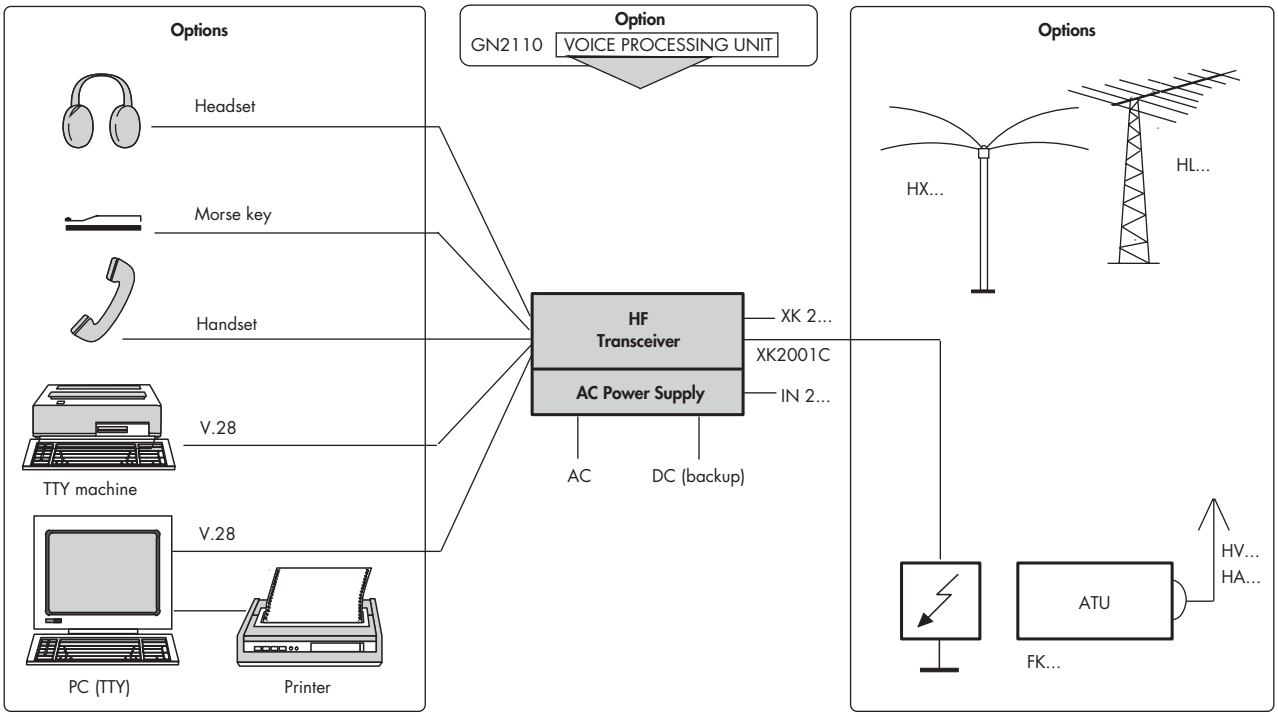
Standard HF Radio Set for Voice and Data (TTY)



Block diagram (for details see parts list)

Optional with voice processing unit (VPU) for noise and interference reduction, voice privacy (scrambling)

Key features

- All standard operating modes included in basic version
- 11 selectable bandwidths for optimal selection (DSP)
- Passband tuning and notch filter for elimination of interferences
- Selectable preamplifier for increased receiver sensitivity
- Switchable voice compression for higher talk power
- Highly effective, automatic noise blanker for suppression of all types of pulse interferences
- Strictly protected by EMC measures
- Digital voice processing (NRU) and speech privacy options (SCR)

Recommended antennas	for power ratings
HX002A1, HX002M1, AK503[1)], HV071[1)], HA104[1)]	150 W
HX002, AK501A4[1)], HV071[1)]	500 W
HX002, HL471, HV071[1)]	1000 W

1) With ATU

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Standard HF Radio Set for Voice and Data (TTY)

Ordering information

Parts list for standard HF Transceiver System 150 W

Transceiver 150 W with local control	XK2100L	6033.0508.02
AC/DC Power Supply	IN2100	6050.1996.02

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Parts list for standard HF Transceiver System 500 W

Transceiver 400/500 W with local control, consisting of:	XK2500L	6071.0518.02
Receiver/Exciter	GX2900L	
Power Amplifier	VK2500	
AC Power Supply	IN2500	

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Parts list for standard HF Transceiver System 1000 W

Transceiver 1000 W with local control, consisting of:	XK2900L	6057.9992.02
Receiver/Exciter	GX2900L	
Power Amplifier	VK2900	
AC Power Supply	IN2900	

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Note: For further options, alternatives, add-ons and accessories, please see data sheet and/or XK2000 price list.

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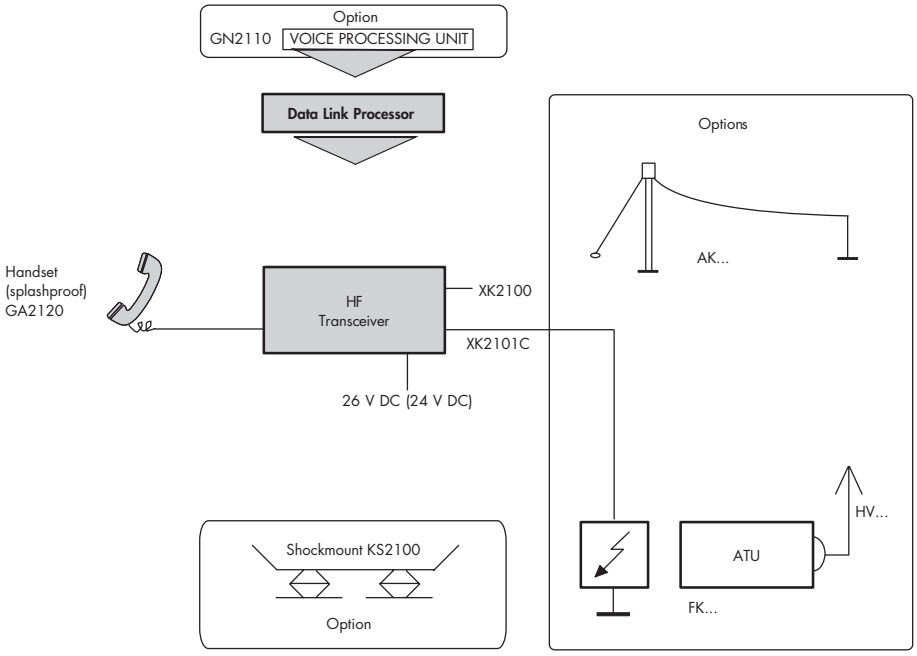
HF Telephone System, Mobile Terminal



Block diagram (for details see parts list)

Integrated automatic link processor (ALE 1045/46)

Key features

- Simple installation in vehicles, jeeps, trucks etc
- Operates with short rod antennas (>2.7 m) over entire frequency
- range and covers groundwave as well as skywave propagation
- Phone dialling call-ringing from transceiver front panel
- Withstands harsh temperature, shock, vibration as well as supply voltage fluctuations
- Selects automatically the best call frequency (out of a pool)
- Suppresses background noise by VPU (option)
- Ensures voice privacy by VPU (NRU + SCR) option

Recommended antennas (150 W)	for power ratings
Rod Antenna[1], HA104[1], AK503[1]	150 W

Ordering information

Parts list for standard HF Transceiver System 150 W

Transceiver 150 W with local control, consisting of:	XK2100L	6033.0508.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
Handset, splashproof	GA2120	6064.6008.02

1) With ATU

Options, add-ons

Shockmount	KS2100	6050.3999.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Shock Adapter for XK2100	KS2100	6050.3999.xx
Antenna Cable, 25 m	XK2001C	6063.5508.25

Note: For further options, alternatives, add-ons and accessories, please see data sheet and/or XK2000 price list.

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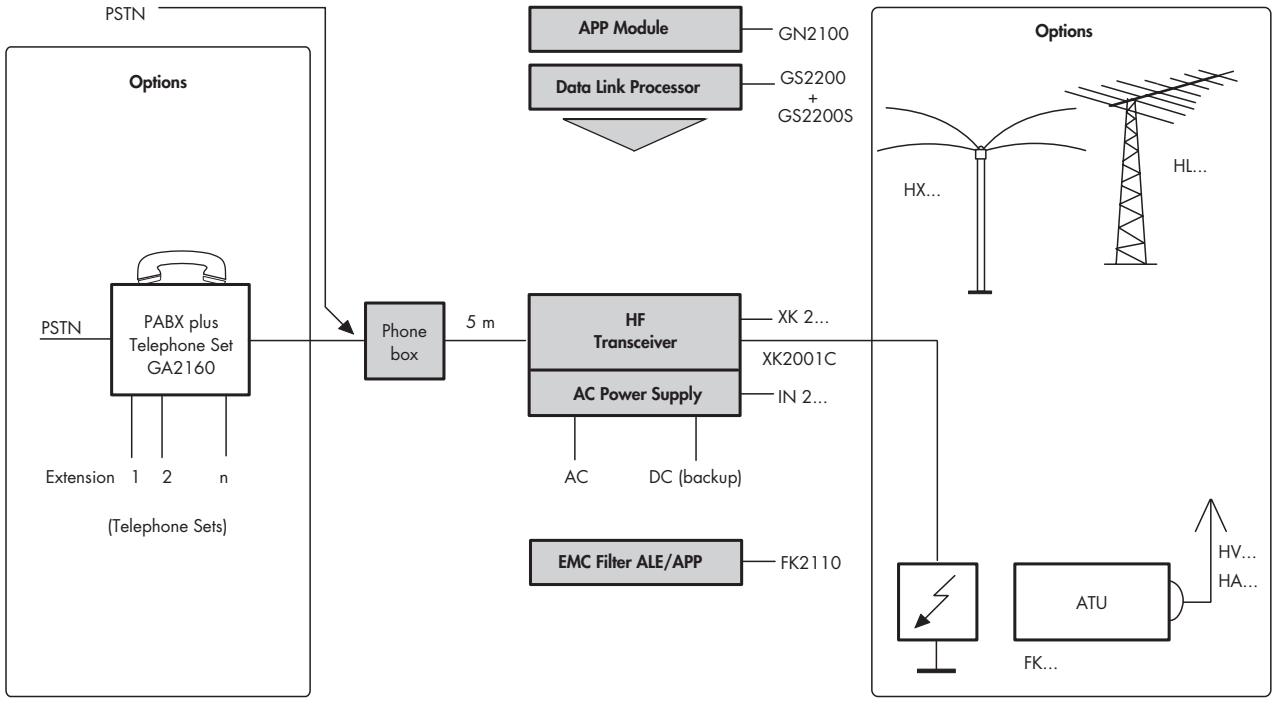
HF Telephone System, Fixed Terminal



Block diagram (for details see parts list)

Integrated automatic link processor (ALE 1045/46/49) and automatic phone patch (APP)

Key features

- Connection of standard (locally accepted/used/available) PABX and telephone sets
- Access from/to PSTN possible
- Phone-set-controlled/operated systems
- Intercom between PABX and the radio's handset
- Automatic landline quality matching for optimal performance
- Digital voice enhancement by VPU (noise interference reduction – optional)

Recommended antennas	for power ratings
HX002A1, HX002M1, AK503[1)], HV071[1)], HA104[1)]	150 W
HX002, AK501A4[1)], HV071[1)]	500 W
HX002, HL471, HV071[1)]	1000 W

[1)] With ATU

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Ordering information

Parts list for standard HF Transceiver System 150 W

Transceiver 150 W	XK2100L	6033.0508.02
with local control, consisting of:		
APP Module	GN2100	6033.9505.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02
AC/DC Power Supply	IN2100	6050.1996.02

Options, add-ons

PABX + Telephone Set	GA2160	6064.9507.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Parts list for standard HF Transceiver System 500 W

Transceiver 500 W	XK2500L	6071.0518.02
with local control, consisting of:		
Receiver/Exciter	GX2900L	
Power Amplifier	VK2500	
AC Power Supply	IN2500	
APP Module	GN2100	6033.9505.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

PABX + Telephone Set	GA2160	6064.9507.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Parts list for standard HF Transceiver System 1000 W

Transceiver 1000 W	XK2900L	6057.9992.02
with local control, consisting of:		
Receiver/Exciter	GX2900L	
Power Amplifier	VK2900	
AC Power Supply	IN2900	
APP Module	GN2100	6033.9505.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

PABX + Telephone Set	GA2160	6064.9507.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Antenna Cable, 25 m	XK2001C	6063.5508.25

Note: For further options, alternatives, add-ons and accessories, please see data sheet and/or XK2000 price list.

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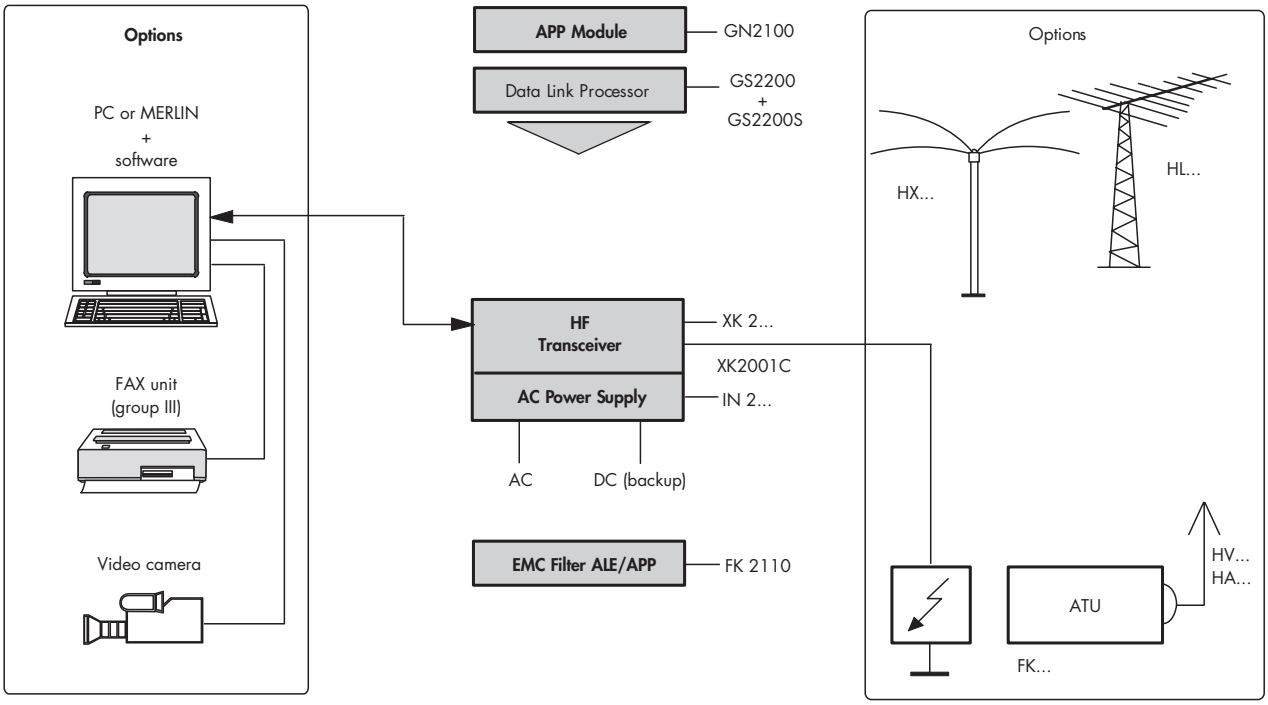
Fax and Video Transmission System (Fast Data)



Block diagram (for details see parts list)

Integrated automatic link processor (ALE 1045/46), internal HF modem (5400 bit/s)

Key features

- Flexible and easily extendable data transmission system
- High speed data (5400 bit/s) with data protection (FEC)
- MERLIN system processor (option) representing TEMPEST-proof EMC and rugged-design PC
- Offering a highly professional, collocation-proof system solution, eg in connection with Digital Selection FK2010 (option)

Recommended antennas	for power ratings
HX002A1, HX002M1, AK503[1)], HV071[1)], HA104[1)]	150 W
HX002, AK501A4[1)], HV071[1)]	500 W
HX002, HL471, HV071[1)]	1500 W

[1)] With ATU

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Ordering information

Parts list for standard HF Transceiver System 150 W

Transceiver 150 W	XK2100L	6033.0508.02
with local control, consisting of:		
HF Modem (5400 bit/s)	GM2100	6079.4264.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02
AC/DC Power Supply	IN2100	6050.1996.02
Blower Unit	KL2100	6050.2992.02

Options, add-ons

Cable Set XK... – PC-MERLIN, with COM port	XK2002C	6063.6504.02
Antenna Cable, 25 m	XK2100C	6063.5508.25

Parts list for standard HF Transceiver System 500 W

Transceiver 400/500 W	XK2500L	6071.0518.02
with local control, consisting of:		
Receiver/Exciter	GX2900L	
Power Amplifier	VK2500	
AC Power Supply	IN2500	
HF Modem (5400 bit/s)	GM2100	6079.4264.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

Cable Set XK... – PC-MERLIN, with COM port	XK2002C	6063.6504.02
Antenna Cable, 25 m	XK2100C	6063.5508.25

Parts list for standard HF Transceiver System 1000 W

Transceiver 1000 W	XK2900L	6057.9992.02
with local control, consisting of:		
Receiver/Exciter	GX2900L	
Power Amplifier	VK2900	
AC Power Supply	IN2900	
HF Modem (5400 bit/s)	GM2100	6079.4264.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

Cable Set XK... – PC-MERLIN, with COM port	XK2002C	6063.6504.02
Antenna Cable, 25 m	XK2001C	6063.5508.25

Note: For further options, alternatives, add-ons and accessories, please see data sheet and/or XK2000 price list.
Software for HF Modem GM2100 has to be ordered separately.

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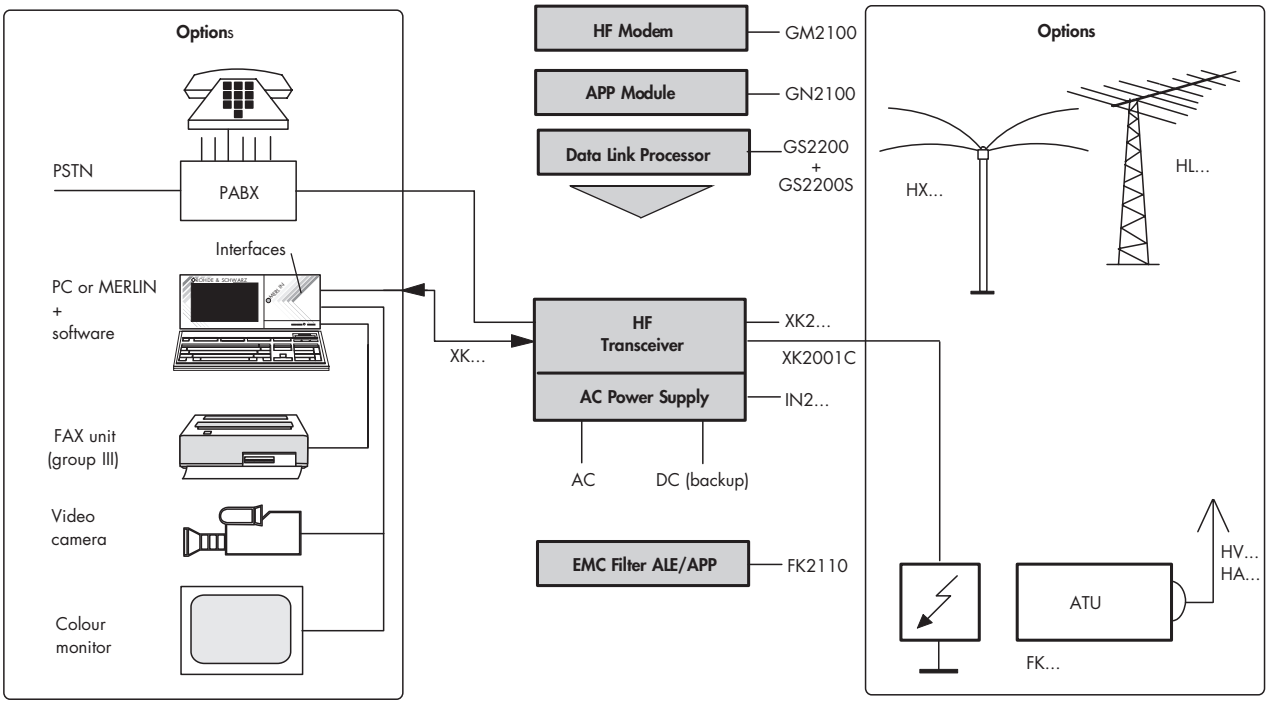
HF Telephone and Fax and Video (Stills) System



Block diagram (for details see parts list)

Integrated automatic link processor (ALE 1045/46), automatic phone patch (APP) and internal HF modem (5400 bit/s)

Key features

- Extremely convenient and flexible communication system solution, easily extendable
- In connection with Rohde & Schwarz message handling system (MERLIN + Software), automatic message routing, distribution etc possible either to MIL-MH standard ACP 127 or to CCITT-X.400, or customer-specific
- Colour video and PC-to-PC options can easily be added (hardware and software)

Recommended antennas	for power ratings
HX002A1, HX002M1, AK503[1)], HV071[1)], HA104[1)]	150 W
HX002, AK501A4[1)], HV071[1)]	500 W
HX002, HL471, HV071[1)]	1000 W

[1)] With ATU

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Ordering information

Parts list for standard HF Transceiver System 150 W

Transceiver 150 W	XK2100L	6033.0508.02
with local control, consisting of:		
HF Modem (5400 bit/s)	GM2100	6079.4264.02
APP Module	GN2100	6033.9505.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02
AC/DC Power Supply	IN2100	6050.1996.02
Blower Unit	KL2100	6050.2992.02

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Cable Set XK… – PC-MERLIN, with COM port	XK2002C	6063.6504.02
Antenna Cable, 25 m	XK2100C	6063.5508.25

Parts list for standard HF Transceiver System 500 W

Transceiver 400/500 W	XK2500L	6071.0518.02
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Receiver/Exciter	GX2900L	
Power Amplifier	VK2500	
AC Power Supply	IN2500	
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APP Module	GN2100	6033.9505.02
ALE Processor	GS2200	6091.5009.02
ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Cable Set GX… – PC-MERLIN, with COM port	XK2002C	6063.7500.02
Antenna Cable, 25 m	XK2100C	6063.5508.25

Parts list for standard HF Transceiver System 1000 W

Transceiver 1000 W	XK2900L	6057.9992.02
with local control, consisting of:		
Receiver/Exciter	GX2900L	
Power Amplifier	VK2900	
AC Power Supply	IN2900	
HF Modem (5400 bit/s)	GM2100	6079.4264.02
APP Module	GN2100	6033.9505.02
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ALE Software 1045/46	GS2200S	6091.5709.02
EMC Filter ALE/APP	FK2110	6054.9491.02

Options, add-ons

Microphone, handheld	GA2100	6064.5001.02
Voice Processing Unit (NRU function)	GN2110	6033.7502.02
Voice Processing Unit (NRU + SCR function)	GN2110	6033.7502.03
Cable Set GX… – PC-MERLIN, with COM port	XK2002C	6063.7500.02
Antenna Cable, 25 m	XK2001C	6063.5508.25

Note: For further options, alternatives, add-ons and accessories, please see data sheet and/or XK2000 price list.
Software for HF Modem GM2100 has to be ordered separately.

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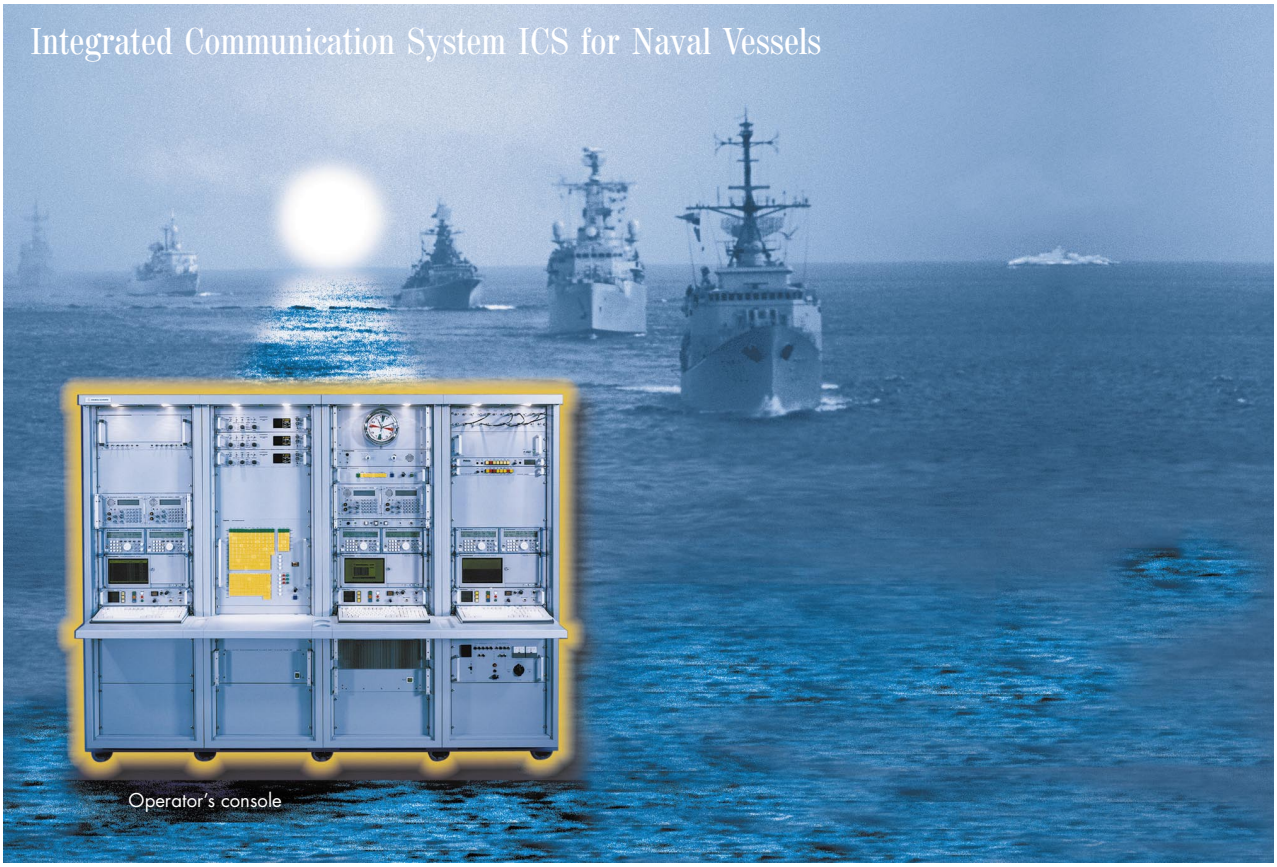

Brief description

This description specifies the proposed performance for a general solution of an integrated internal/external communication system for naval vessels. The overall system concept, the functioning of the various subsystems and their interaction are described. Technical specifications of the individual subsystems and units will be provided in a specific proposal.

System objectives

Modern warships, especially those with several decks, require highly reliable and extremely simple-to-operate voice and data communication systems to meet the increasingly complex and changing demands during action and routine situations.

The integrated communication system provides the ship with a modern, reliable voice and data communications system (internal and external) in both clear and secure mode. The system thus enables all necessary tactical and strategic communication

- ship-to-shore
- ship-to-ship
- ship-to-aircraft and helicopters

and other tasks. The system has been developed to satisfy the user's requirements for voice, telegraphy and teletype communication and is prepared for data link operation (eg Link 11/ Link Y). Central computerized control and message handling is in the system layout.

For interoperation with other national and international forces the communications system is prepared to operate with the relevant NATO and/or specific regional standards for encryption, ECM-protected data link (eg HQII, SECOS, Link 11) and message handling procedures (eg ACP 127).

System design approach

The Rohde&Schwarz integrated communication system is based on the latest technology in communication systems engineering. The subsystems are built with solid-state circuits and implemented using a modular design concept.

The system design of the Rohde&Schwarz integrated communications system is dedicated to the following objectives:

- Compliance with the customer's performance requirements
- Interfacing with the overall system
- Cost-efficiency
- User-friendliness
- Centralized, computer-aided one-man operation and supervision of the system (option)

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- Enhanced end-to-end communication reliability in both external and internal communications operations
- Inherent upgrading capabilities
- Simplicity of design, interfacing and installation
- Ensuring high availability, high survival probability and excellent maintainability
- Easy and inexpensive maintenance
- Minimum downtime
- Ease of reconfiguration without rewiring
- Reduced weight of cables and equipment
- Ensuring minimum and efficient cable routing
- Simultaneous radiocommunication
- Minimum electromagnetic interference and crosstalk

System configuration

The block diagrams on page 249 and 250 of the integrated communication systems show the overall system layout. The functional descriptions of the various subsystems are provided in this section.

Detailed technical specifications will be given in a specific proposal. In general, the integrated communication system can be divided into the following major subsystems:

External communication system
Consisting of radio equipment which will enable the ship to communicate with other platforms or shore stations, it makes use of voice communication, clear and secure mode, morse, RATT and is prepared for data link modes. It consists of radio sets connected to the switching and control equipment and of stand-alone equipment, eg for SOLAS or GMDSS requirements.

COMSEC, TRANSEC, MHS, central control/management facilities are available as well as link automation and emission control systems.

The major subsystems of the external communication system are:

- VLF-HF subsystem
- VHF and UHF subsystem
- SATCOM-INMARSAT
- Crew paging system
- Antenna subsystem
- Safety equipment and emergency arrangements
- Central control
- Message handling

The major subsystems of the internal communication system are:

- Tactical intercom subsystem
- Sound-powered telephone subsystem
- Public address, alarm and recreation subsystem
- Multichannel tape recorder subsystem
- Automatic ship telephone subsystem
- Flight deck and engine room subsystem (magnetic loop)
- Underwater telephone system

Subsystem description

External communication system
The external communication supports the following communication circuits:

- Maintaining constant HF broadcast on RATT (or morse in a backup mode) radiated from communication shore stations
- Communication on HF using RATT or morse for ship-to-shore messages with communication shore stations
- Ship-to-ship communication on HF or V/UHF using RATT or morse for operational or administrative messages
- Ship-to-ship data link for tactical picture compilations using data link or equivalent, either on HF or V/UHF
- For ship-to-ship HF and/or V/UHF voice tactical communication
- Helicopter control using V/UHF voice communications for surveillance or related air tasks
- Ship-to-air V/UHF voice communications with maritime patrol aircraft
- Ship control of boarding or landing party using man-portable VHF communications sets in voice mode
- Control of forecast and stern parties during berthing and unberthing of ship and other seaman ship execution parties using hand-portable VHF communication sets
- Communications with merchant ships and harbour authorities using internationally recognized VHF radio
- SATCOM as backup for long-range communications in data and voice mode

Internal communication system
The interior subsystem proposed by Rohde & Schwarz is dedicated to the following main objectives:

- User-friendliness
- Minimum cabling
- High transmission security
- Reduced weight and size of equipment
- Resistance to shock, vibration and environmental effects
- Ensuring high availability, high survival probability
- Easy and inexpensive maintenance
- Ease of reconfiguration without rewiring
- Simplicity of design and interfacing

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Integrated Communication System ICS for Naval Vessels

Configuration

General

The internal communications system consists of the following subsystems:

- Tactical intercom
- Automatic ship telephone subsystem
- Public address, alarm and entertainment
- Sound-powered telephone
- Flight deck subsystem and engine room subsystem (magnetic loop)
- Multichannel tape recorder
- Underwater telephone subsystem

TABLE: Example of external/internal communication for **fast patrol boats**

Point-to-point connections: •	Audio units	Wheelhouse operator	Wheelhouse OOW	CIC radar/ESM	Wheelhouse helmsman	CIC-fire control	CIC SAM operator	Steering gear room	Generator room	Wheelhouse engineer	Main engine port	Main engine stbd	Junior rates mess	Officers cabin	SR cabin	CO's cabin	Radio operator No. 1	Radio operator No. 2	Ammunition store	Machine gun	30 mm gun	SAM launcher	Deck forward	Deck aft	Group calls/ conferences: × WC: weapon control EC: engine control		Radio access: o	Radio silence: +	Watch receivers: z WR1: watch RX1 WR2: watch RX2	
No.	Audio units	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	WC	EC			WR1	WR2
1.	Wheelhouse operator			•				•					•	•	•		•	•							×	×	o	+	z	
2.	Wheelhouse OOW							•								•	•						•	•	×	×	o	+		z
3.	CIC radar/ESM	•				•	•										•								×		o			
4.	Wheelhouse helmsman																									×				
5.	CIC fire control			•				•											•		•				×					
6.	CIC-SAM operator			•				•														•			×					
7.	Steering gear room	•	•			•	•																			×				
8.	Generator room									•																×				
9.	Wheelhouse engineer								•				•	•	•	•										×				
10.	Main engine port																									×				
11.	Main engine stbd																									×				
12.	Junior rates mess	•								•																				
13.	Officers cabin	•								•																				
14.	SR cabin	•								•																				
15.	CO's cabin		•							•																×	o			
16.	Radio operator No. 1	•	•	•																					×		o	+		
17.	Radio operator No. 2	•																							×		o			
18.	Ammunition store					•																			×					
19.	Machine gun																								×					
20.	30 mm gun					•																			×					
21.	SAM launcher						•																		×					
22.	Deck forward		•																							×				
23.	Deck aft		•																							×				

Message handling subsystem MERLIN

General

The Message Handling System MERLIN-MHS offers computer-aided handling of the teletype, data and fax and video communication of warships and is an attractive alternative to the conventional RATT teletype subsystem. The Rohde & Schwarz message handling system is designed according to an open-system approach and allows easy extension of hardware and software functions.

By performing routine tasks automatically and supporting the remaining tasks of the operators, the system considerably reduces the workload for the personnel.

In addition, the physical volume of the message files is reduced by using diskette records (floppy disk, hard disk or magnetic optical disk) instead of paper records. Convenient access to these storage media is provided by retrieval using various search criteria.

System layout

The message handling system consists of the following items:

1 x central message handling station, MERLIN Processor GR856, including MHS software package for support, with ACP 127 protocol, message-filing features and printer.

The typical software according to ACP127 is described in a specific proposal.

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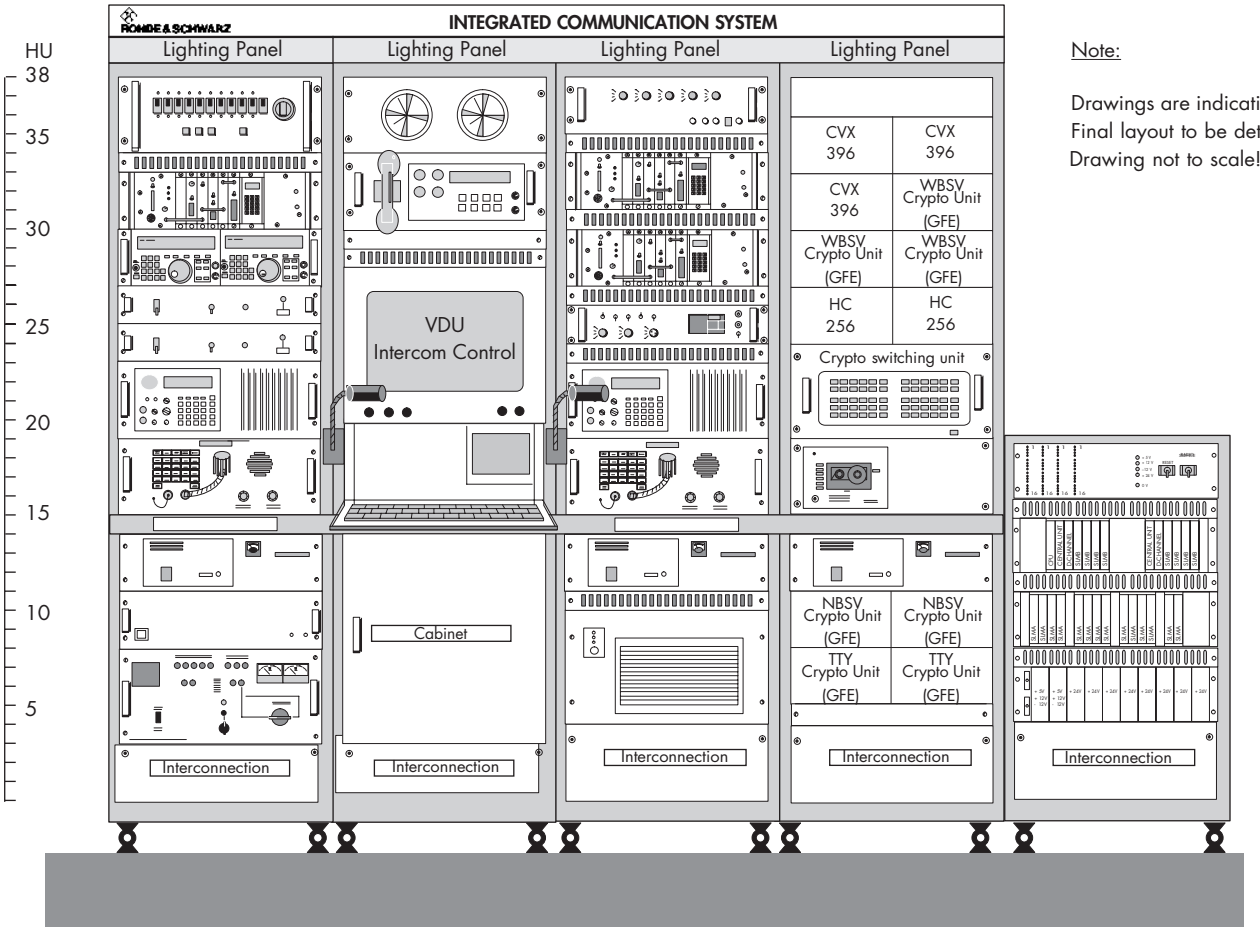
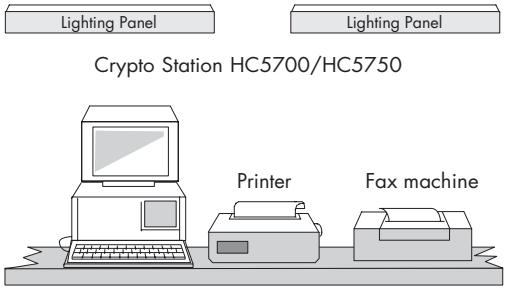
1 HU=44.45 mm

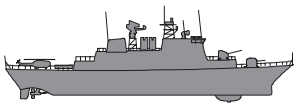


Note:

Drawings are indicative only.
Final layout to be determined during design review.
Drawing not to scale!

Stand-alone units





Typical example of an operator's console for a **fast patrol boat**

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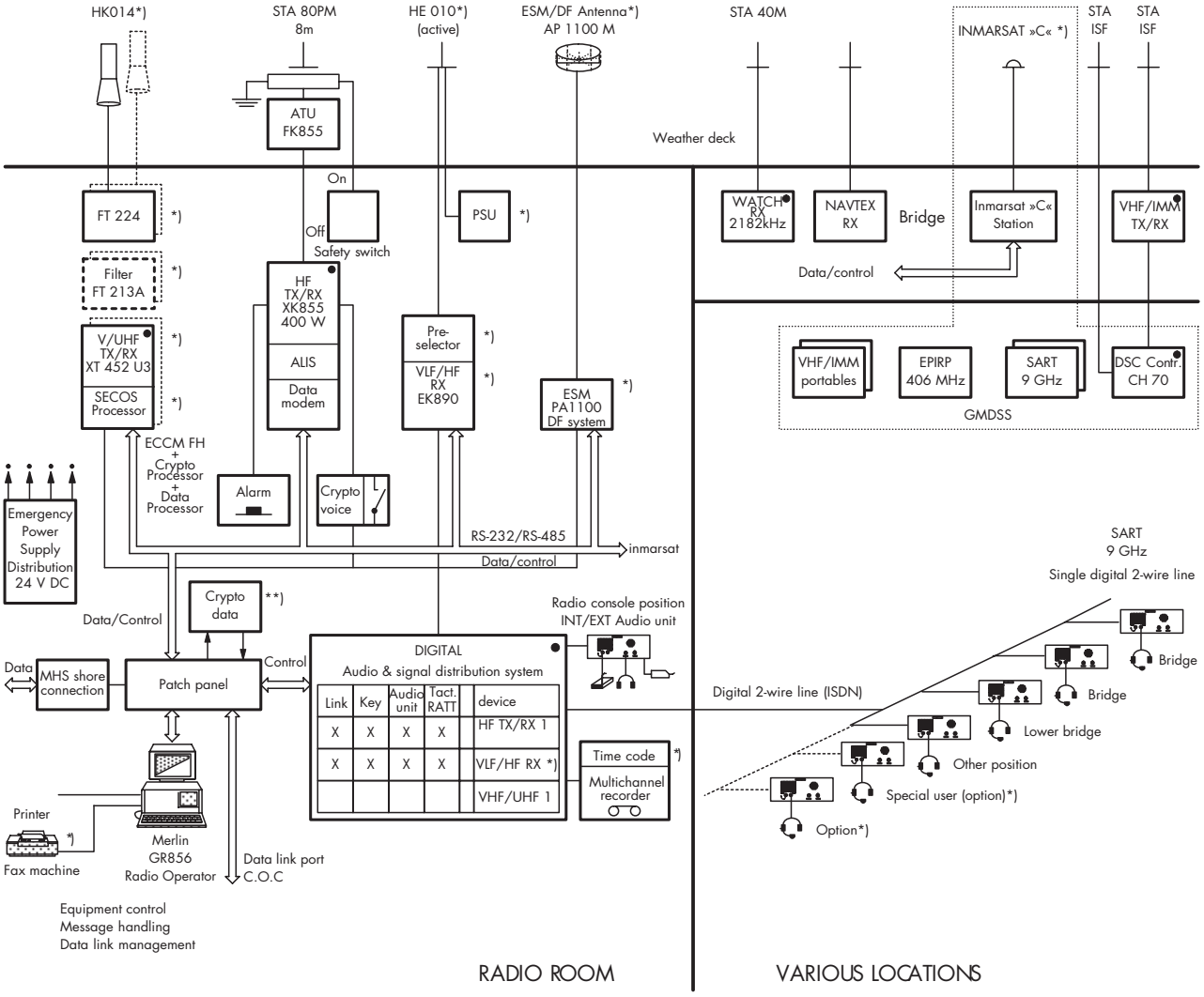
Integrated Communication System ICS for Naval Vessels



LEGEND

*) OPTION
**) GFE (GOVERNMENT FURNISHED EQUIPMENT)
• 24 V EMERGENCY POWER

SECOS: Secure Communication System with built-in Crypto and ECCM processor

ALIS: Automatic Link Setup for Data Transmission incl. Adaptive Reaction and ECCM-FH for Data and Frequency Management

Typical example of an integrated communication system for a **corvette**

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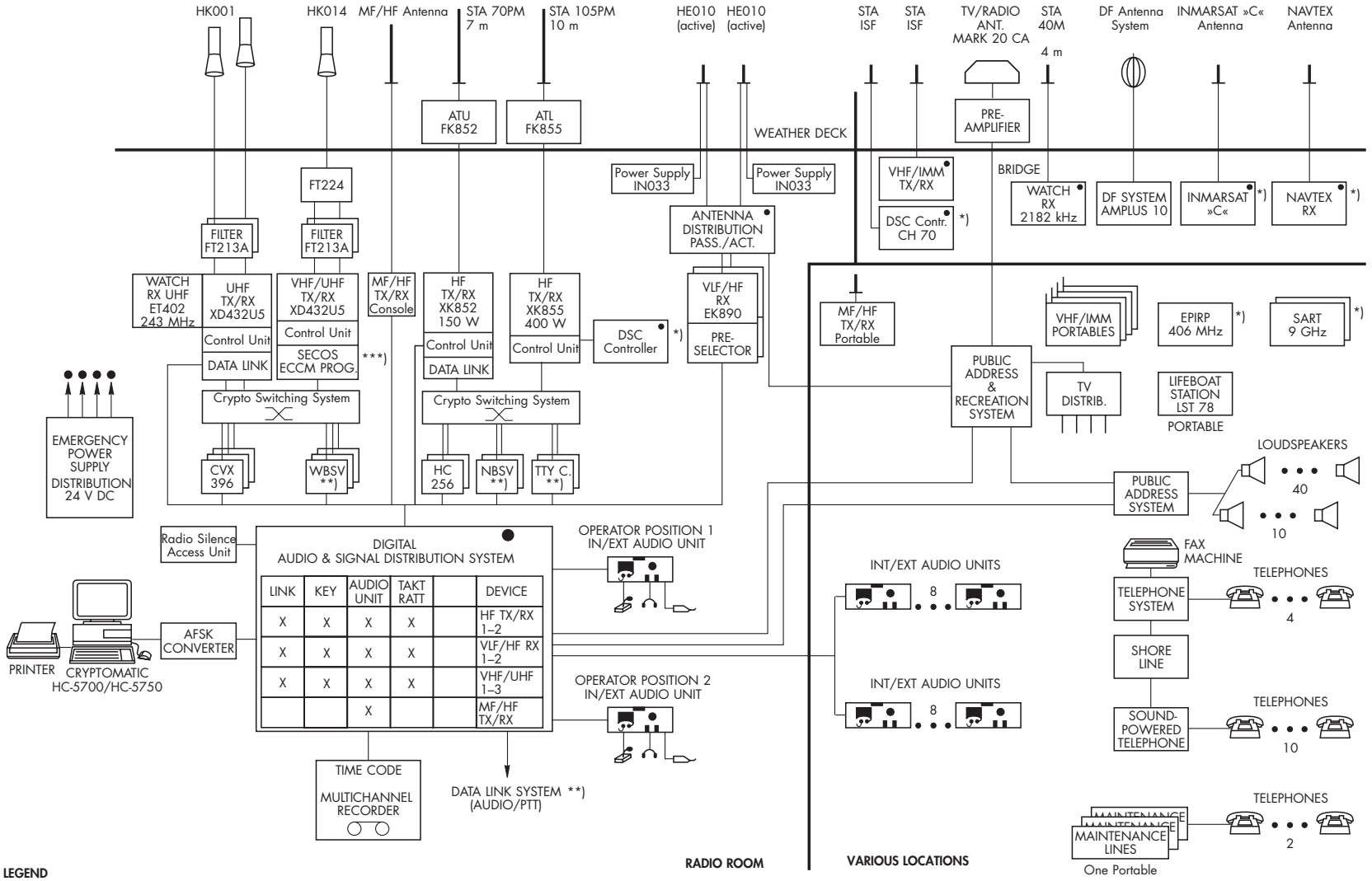

LINK	KEY	AUDIO UNIT	TAKT RATT		DEVICE
X	X	X	X		HF TX/RX 1–2
X	X	X	X		VLF/HF RX 1–2
X	X	X	X		VHF/UHF 1–3
		X			MF/HF TX/RX

LEGEND

*) OPTION GMDSS EQUIPMENT
**) GFE (GOVERNMENT FURNISHED EQUIPMENT)
***) OPTION ECCM UPGRADE with SECOS SYSTEM
• 24 V EMERGENCY POWER

Typical example of an integrated communication system for a **fast patrol boat**

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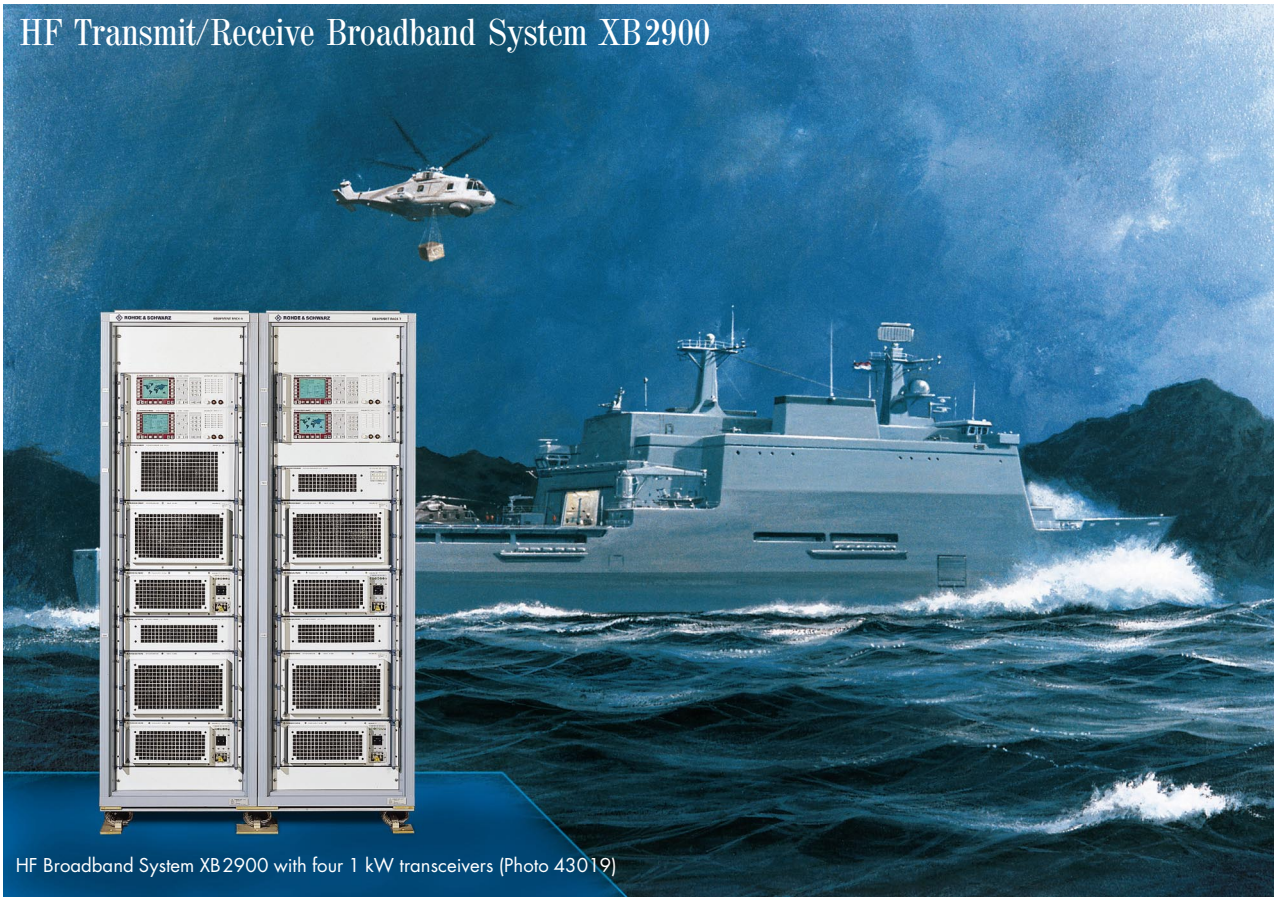
HF Transmit/Receive Broadband System XB2900



HF Broadband System XB2900 with four 1 kW transceivers (Photo 43019)

Brief description

HF Broadband System XB2900 is a modern and high performance communications system especially designed for the naval operational environment. It is based on proven components which have already been selected and introduced by NATO navies.

XB2900 is based on the idea of combining the ship's various HF transmission signals at the high power level and using with only one broadband antenna system.

The system can independently operate on any circuit, in any available mode of operation, such as voice, RATT, high speed data, data link 11/link 22, automatic link establishment (ALE) or GMDSS (DSC) etc depending on the embedded functions or optional modules used within the basic exciter/receiver units. HF Broadband System XB2900 is prepared to be enhanced for the upcoming new NATO mode STANAG 4539 for adaptive radio control system operation (ARCS).

The figures on pages 254 and 255 show an alternative block diagram for a typical integrated communications system for a corvette/frigate making use of this HF broadband system.

It operates in the frequency range 1.5 to 30 MHz (RX down to 10 kHz) with an antenna system consisting of two or three broadband antennas.

The configuration of the system is based on standard Rohde & Schwarz components, such as:

- Exciters GX2900
- Connection Matrix (Power Management Unit - PMU), GV2900
- Power Amplifiers, 1 kW VK2900
- Power Supply Units IN2900
- Combiners at two levels, 2 kW and 4 kW, FK2910 and FK2920
- Load Resistors RBS1000
- Triplexer FK2950
- Broadband antenna system (to be defined to match the requirements of the vessel to achieve maximum ERP)

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Logistic aspects

A significant logistic advantage of both broadband and narrowband systems is that all power amplifiers and exciters are components of the same transceiver type, ie XK2900. These identical transceivers provide extremely high system availability and reliability. Power amplifier and exciter – including a receiver section – are physically combined in Transceiver XK2900. From a functional and logistic point of view it is easy to separate the amplifier from the exciter.

Tailored to your specific requirements

Using these standard components the system can be precisely configured to the number of lines and power requirements for each line needed, ie tailored to the actual operational requirements, eg 5 HF lines to two broadband antennas.

Each HF broadband line is equipped with a digital exciter/receiver section, which operates in the frequency range 10 kHz to 30 MHz and provides all the technical features of the individual VLF-HF receivers.

The HF receiver sections are connected to a separate receive antenna distribution system.

Functional description

The AF input signals are routed to the associated exciters by the tactical intercom system. Each input signal is amplified as a narrowband signal, which together with the highly linear power amplifier stages yields very low intermodulation levels for the total HF transmit spectrum.

Power management

The power management system provides a high variety of RF power levels for the output signals by combining several transmit lines and presetting power levels for each individual power amplifier stage and for each output signal (up to 4 kW and more).

The RF high-power signals are combined in highly linear 3 dB coupler units, so that there are no active switching elements at the high power levels.

ALE and EPM

Because high power switching is avoided in this concept, the system is capable of operating in ALE and EPM modes across the full HF frequency range (1.5 to 30 MHz) and the frequency spacing of the transmit channels can be reduced to 1% separation. Built-in ALE processor and HF fast data modems (5400 Bit/s user data rate), compliant with MIL-STD and NATO STANAG) are provided as plug-in modules.

Embedded modules/interfaces are available for eg:

- Fast high-speed data modem
- Programmable multiple waveforms such as
  MIL-STD-188-110A
  STANAG 4285/4481/4529
  R&S 2.7 kbps waveform
  R&S 5.4 kbps waveform
- Data link operation eg:
  LINK 11 (CLEW) & LINK 11 (SLEW)
  LINK 22
  LINK Y (Mk II)
- Automatic link establishment module for ALE according to FED STD 1045/1046/1049 or R&S ALIS adaptive system
- Automatic phone patch module, providing automatic or manual ship-shore telephone communication

RF distribution

RF output signals are routed via an antenna diplexer or triplexer to the broadband antennas.

The frequency ranges of the different antenna ports overlap so that coverage of the total HF frequency band is ensured.

The fact that output signals are transmitted by two antennas in slightly overlapping frequency ranges has no particular influence on the radiation pattern, since the overall ship superstructure determines the radiation characteristics of the antenna system.

Operation and control

The control of the Rohde&Schwarz HF broadband system is performed either by an RS-232/RS-485 data interface (ASCII Protocol), which allows remote control and monitoring of the overall system by a central control system, or by front panels of each individual HF broadband line for backup control operation.

The integration of HF Broadband System XB2900 into a central remote control system (RCMU) provides the control and monitoring functions by one control terminal with a standard man machine interface for all operations of the overall ship communication system.

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Outstanding reliability and survivability

The RF power amplifier stages are based on MOSFET semiconductor technology giving very high linearity and very low RF noise figures.

The passive RF combining system, without active electronic elements at high power levels and with very simple power management techniques, results in a very high reliability and MTBF figure for the overall system and each individual communication line.

The total power consumption of the HF broadband system depends on the number of transmit lines actually in use and their output power.

Power amplifier stages which are not transmitting operate in idle mode, ie their power consumption is less than 250 W per amplifier.

The overall system consists of a small number of proven standardized components, which are also used in narrowband HF transmit/receive systems from Rohde &Schwarz.

All components are equipped with extensive continuous monitoring and BITE facilities, which provides status information to the central control system and to the front-panel displays of the individual units.

The system components can be changed easily and quickly without recalibration. Due to the compact design of the standard components the system can be installed in a minimum number of 19" standard racks.

Summary

- Full HF frequency band (1.5 to 30 MHz), for voice, data, ALE and EPM operation
- Operating frequency separation of 1%
- Very low levels of intermodulation and RF noise
- Very high flexibility with regard to system configuration and power management
- High system reliability and MTBF figures
- Extensive BITE and continuous monitoring facilities
- Exciter/receiver sections with optional plug-in modules for:
  - ALE operation
  - Fast data transmission
  - Pre/post-selection
  - Digital speech processing (noise reduction)
  - Automatic phone patch
- High efficiency through optimum use of power amplifier stages
- Full Integration into a central remote control system
- Common proven standard components for narrowband and wideband systems

The use of HF Transmit/Receive Broadband System XB2900 is not limited to naval applications, but it is also very effective in stationary scenarios.

Ordering information

Exciter	GX2900	6058.0499.02
Power Amplifier, 1 kW	VK2900	6058.4494.02
Power Supply Unit	IN2900	6058.8990.02
Power Management Unit	GV2900	6077.3519.02
Combiner 2 kW	FK2910	6077.8510.02
Combiner 4 kW	FK2920	6090.0003.02
Load Resistor	RBS1000	0207.4010.55
Triplexer	FK2950	6090.3502.02

For further options and acessories please refer to chapter 1, HF Transceivers XK2000

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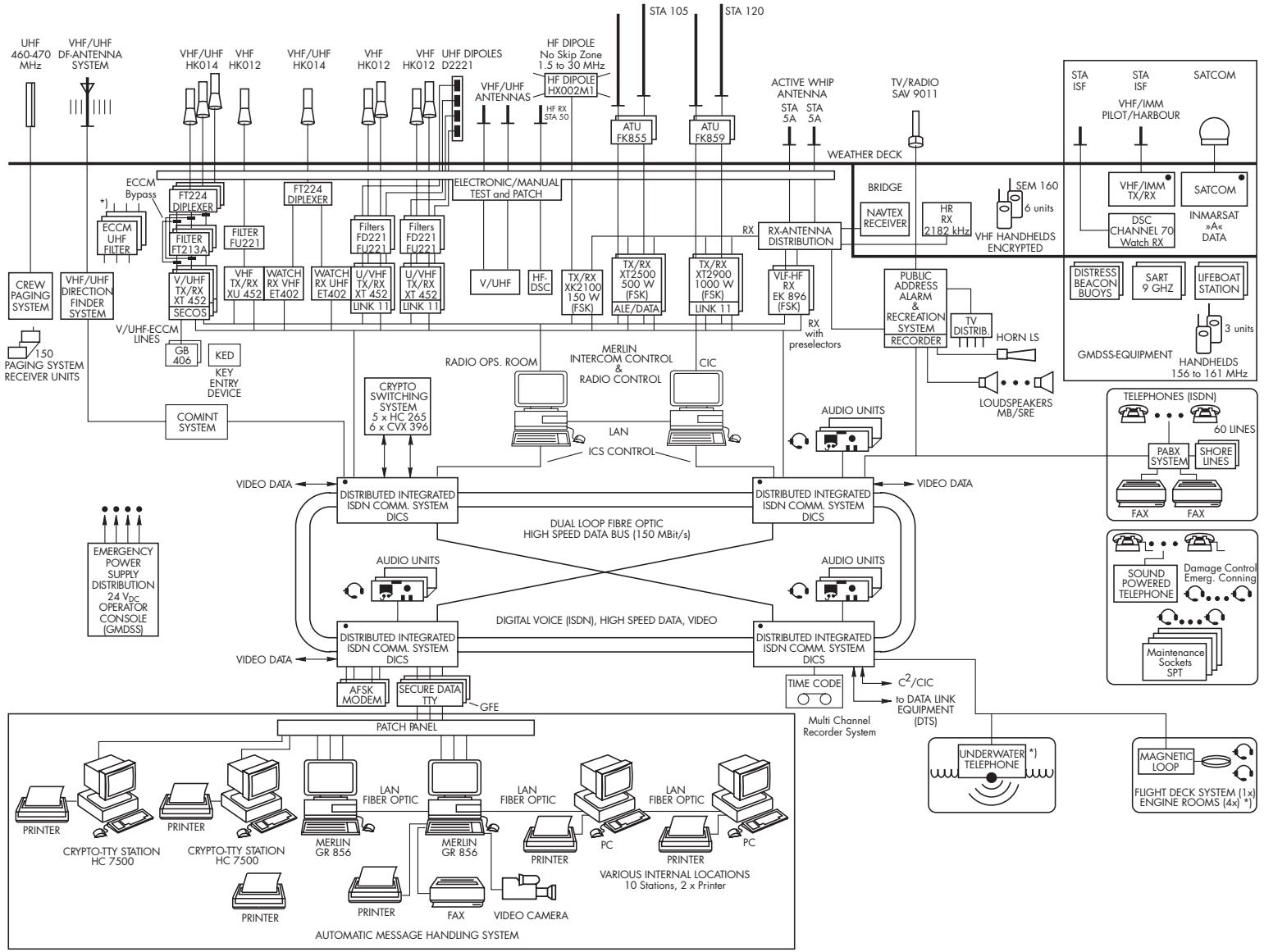
Typical solution for an integrated external/ internal communication system incl. message handling (HF single transmit line solution)



LEGEND

*) OPTION

•) 24 V EMERGENCY POWER

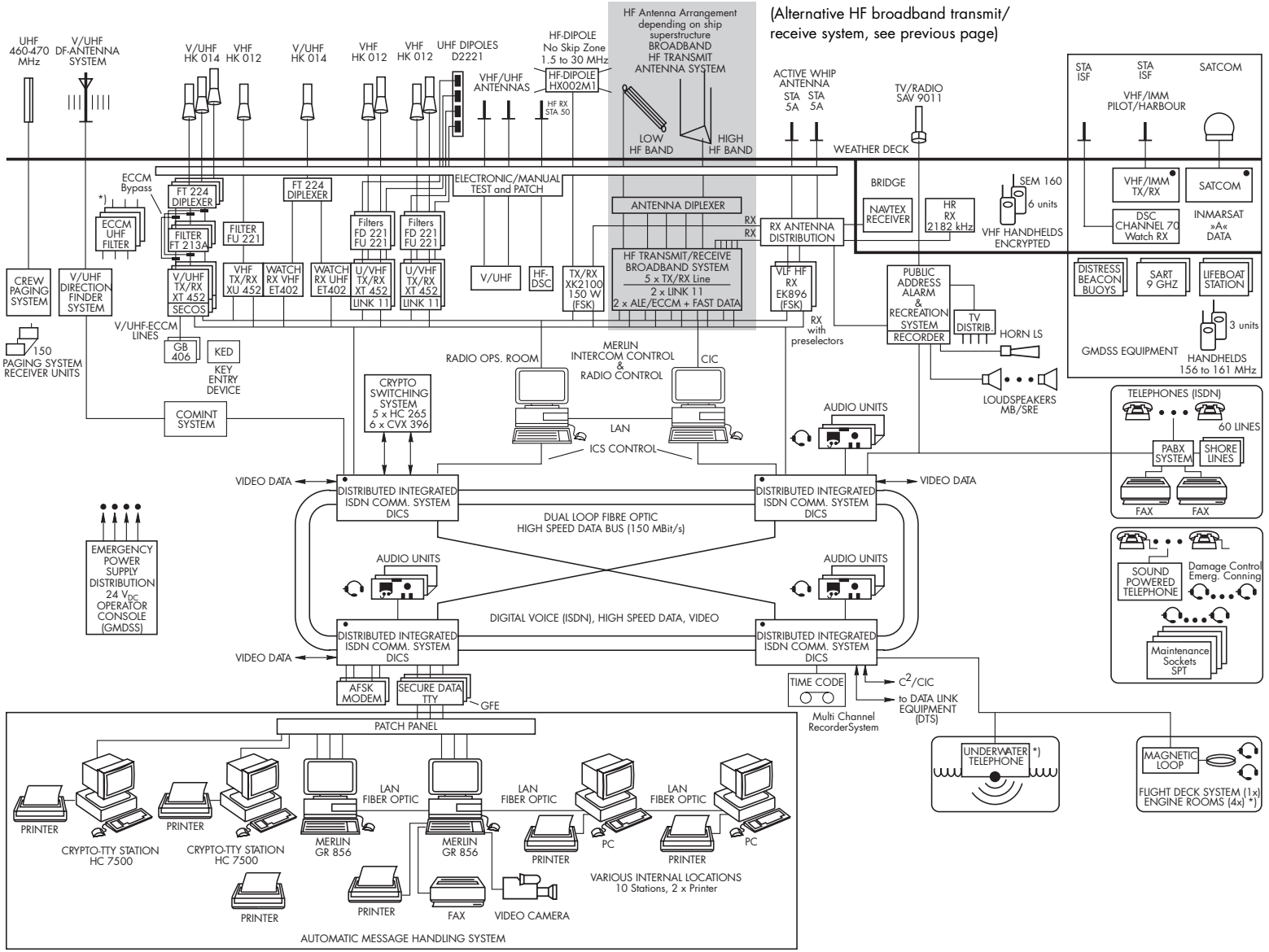
GFE Government Furnished Equipment

MHS: Elect. Message Handling System

SECOS: Secure Communication System with built-in Crypto and ECCM Processor

ALIS: Automatic Link Set up (ALE) for data transmission incl. Adaptive reaction and ECCM for data and Frequency Management

Typical solution for an integrated external/internal communication system incl. message handling (HF broadband system solution)



LEGEND

*) OPTION

•) 24 V EMERGENCY POWER

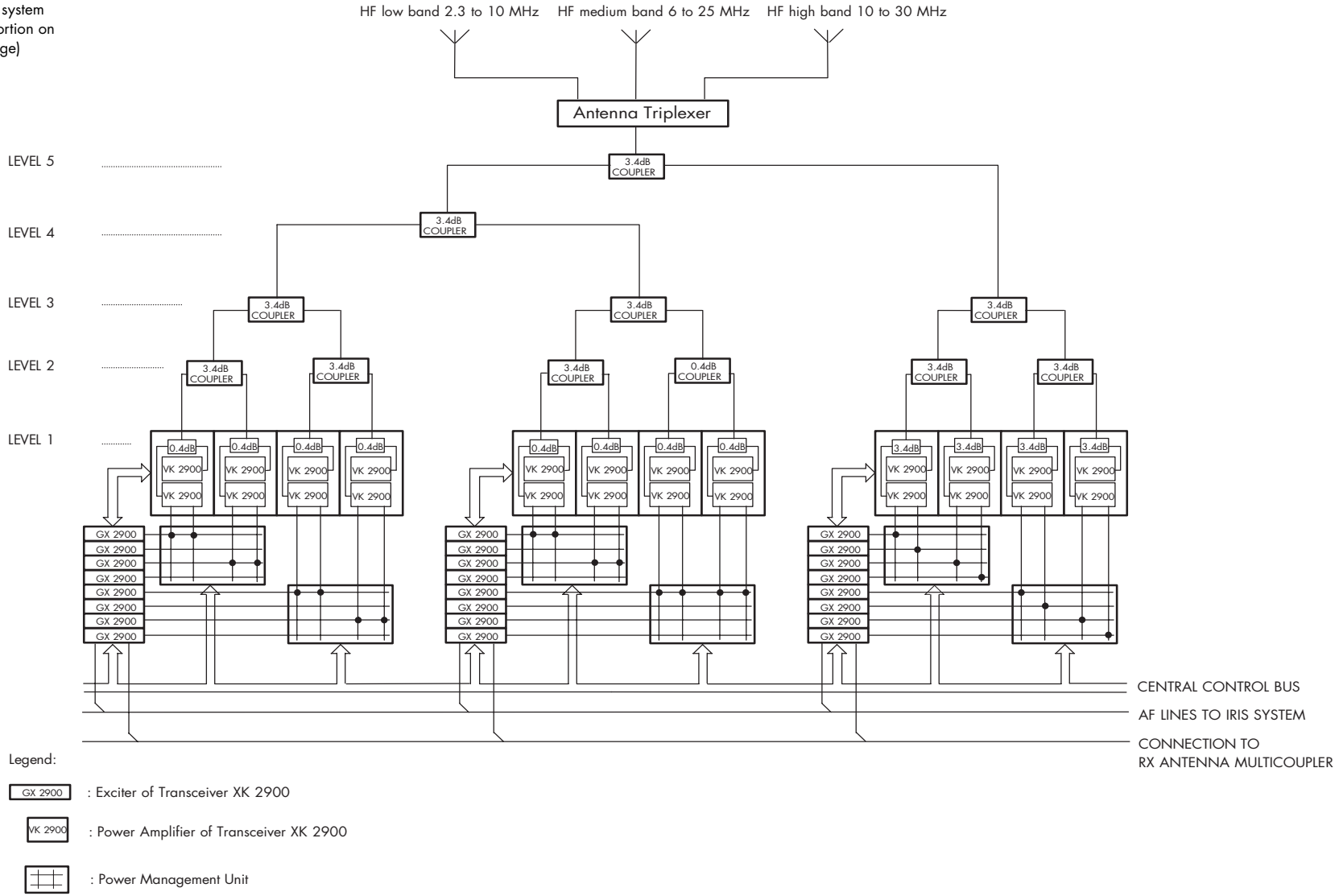
GFE Government Furnished Equipment

MHS: Elect. Message Handling System

SECOS: Secure Communication System with built-in Crypto and ECCM Processor

ALIS: Automatic Link Set up (ALE) for data transmission incl. Adaptive reaction and ECCM for data and Frequency Management

Typical solution for an HF broadband transmit/receive system (see grey portion on previous page)



Legend:

GX 2900 : Exciter of Transceiver XK 2900

VK 2900 : Power Amplifier of Transceiver XK 2900

: Power Management Unit

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Typical Configuration of a Communication System with Series 200 (VHF/UHF)

Brief description

Due to operational and infrastructural requirements we distinguish for air traffic control between systems with

- transmitters and receivers (separate) and
- transceivers

For every system a detailed calculation has to be done. Among others,

- antenna distances
- frequency separation and
- remote-control requirements

are the main deciding criteria for the system configuration.

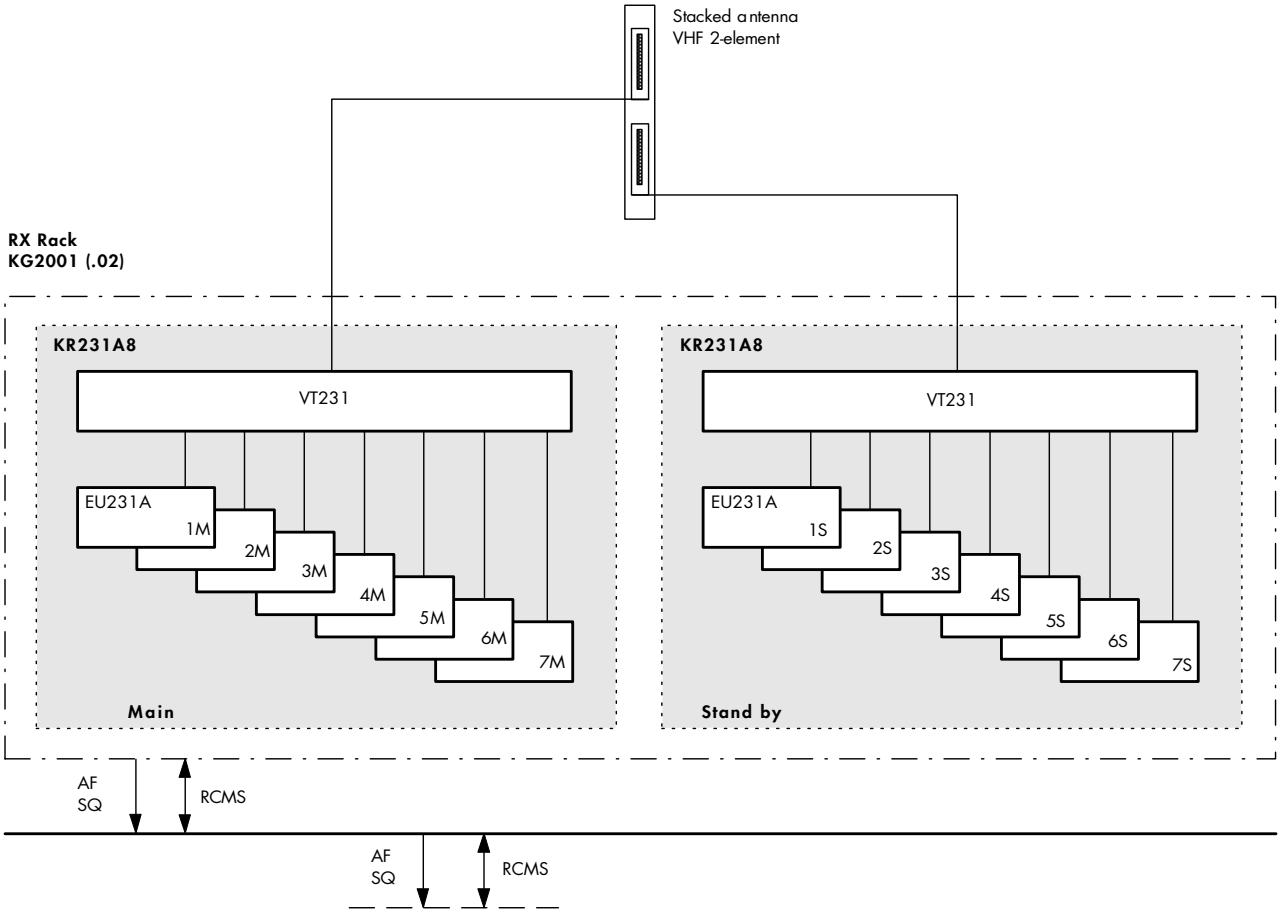
Each system is different and customized!
In the following, some examples are described in principle. Details of integrated system tests, distribution of the AF, PTT, squelch, GO or other system features are not described.

Separate transmitters and receivers

Receiver station with up to 7 frequencies and 100% standby
As is shown in the block diagram seven VHF Single-Channel Receivers EU231A are combined via one Multicoupler VT231 to one VHF antenna as the main system. To obtain 100% redundancy there is the same configuration as a backup system.

Separate antenna systems for the main and standby system are used to obtain 100% redundancy.

The receivers are accommodated in two 19" frames fitted in a standard 19", 45 HU RX Rack KG2001 (model 02), together with all cables from the power supply and remote cabling interface to the antenna output connector.



Interface from rack to transmission lines

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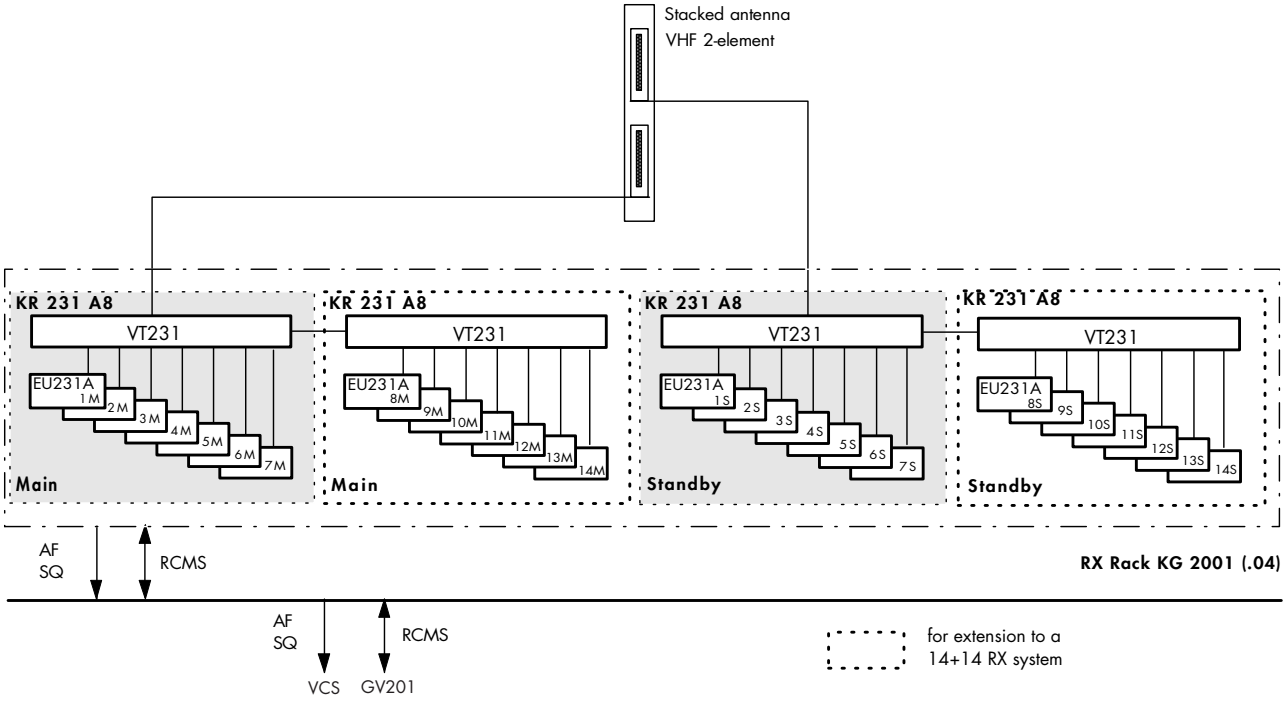
Typical Configuration of a Communication System with Series 200 (VHF/UHF)

Multicouplers VT231 of Series 200 also allow a 14-RX-frequency-system main/standby 1 : 1 with one stacked antenna:

As is shown in the block diagram according to customers requirements, 14 Receivers EU231A are cascaded in two groups with seven units via Multicoupler VT231 to one VHF antenna as the main system. To obtain 100% redundancy there is the same configuration as a backup system. Separate antenna dipoles are used for main and standby operation.

The receivers are accommodated in four 19" Adapters KR231A8 fitted in a standard 19", 45 HU RX Rack KG2001 (model 04). This configuration can also be used for an extension of the receiver equipment up to 14 + 14 receivers in the future, without any impairment of the noise factor or quality loss of the received signal.



Legend:

EU231A = VHF Receiver
VT231 = Multicoupler
KR231A8 = 19" Adapter
VCS = Voice Communication System
GV201 = REM BUS Drive Unit. For details see page 261

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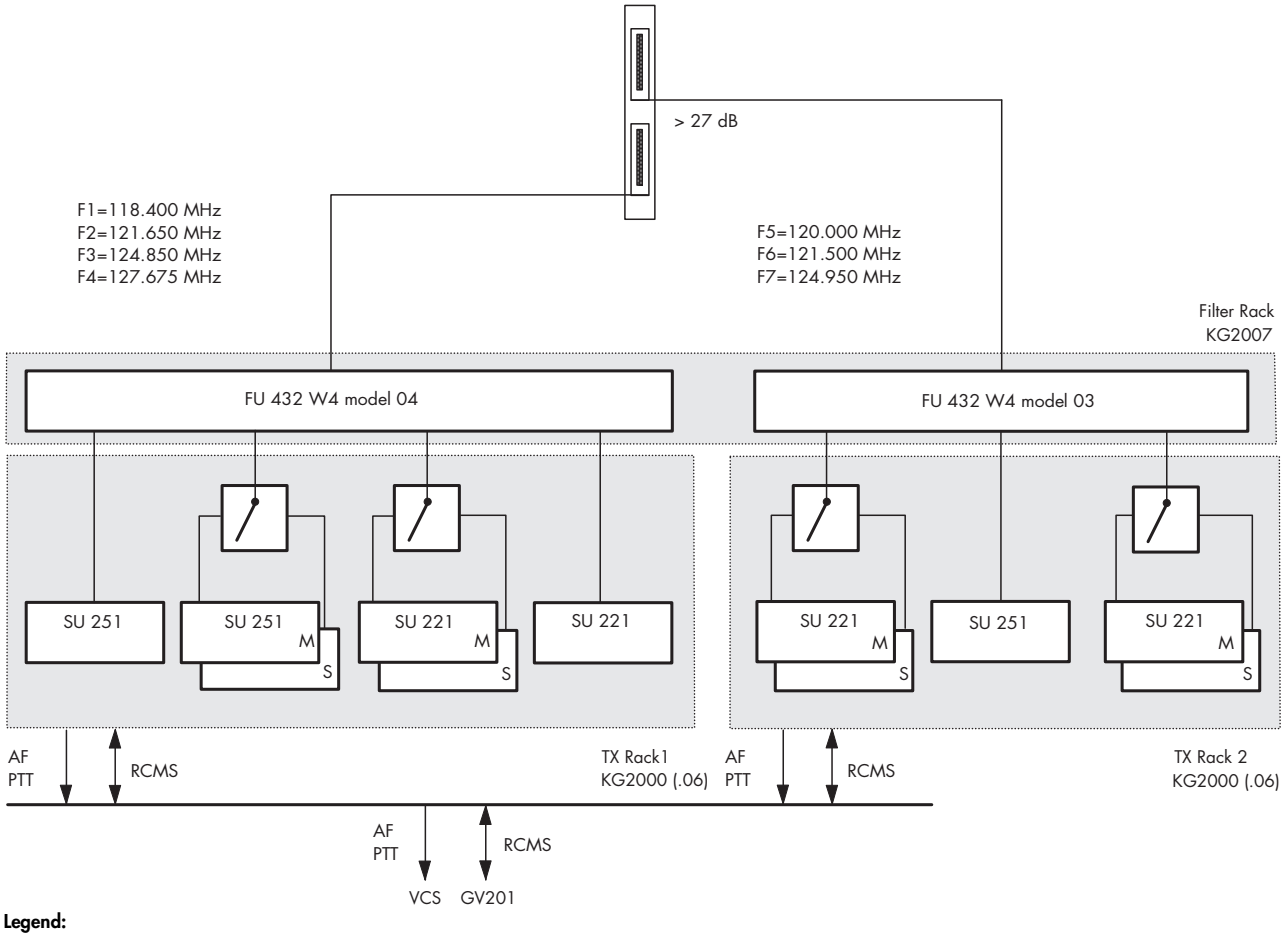
Typical Configuration of a Communication System with Series 200 (VHF/UHF)

Transmitter station
A transmitter station is shown in the following block diagram.

The system includes some main/standby transmitters. These Transmitters SU251/SU221 with an output power of 50/25 W are connected via switchover relays to a VHF multicoupler with three/four ports. Every multicoupler is connected to one VHF antenna.

Several types of multicouplers for the VHF range are available from Rohde & Schwarz to allow simultaneous operation of critically spaced frequencies under adverse collocation conditions.

The transmitter and multicoupler equipment is configured into 19", 45 HU TX racks, together with all cables from the power supply and remote cabling interface to the antenna output connectors.



Legend:

SU221	= 25 W VHF Transmitter
SU251	= 50 W VHF Transmitter
IN251A	= AC/DC Power Supply
VCS	= Voice Communication System
GV201	= REM BUS Drive Unit. For details see page 261

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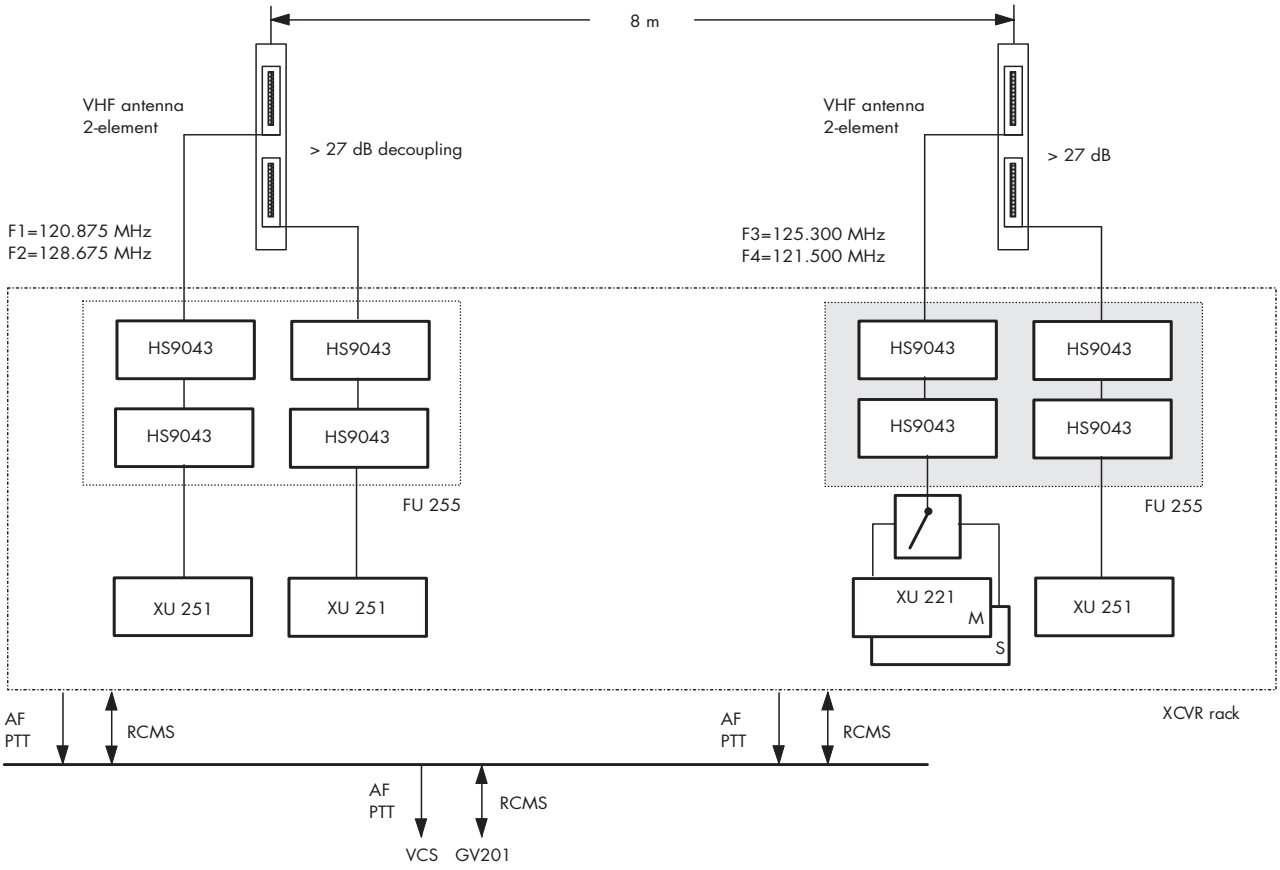
Typical Configuration of a Communication System with Series 200 (VHF/UHF)

Transceiver solution

If antenna distances and frequency separation allow it and infrastructural requirements force it, Rohde & Schwarz offers a transceiver solution. An example of a transceiver station is shown in the following block diagram.

Four transceivers (one with main/standby capability) are connected via two VHF 2-Port Filters FU255 (each consisting of 4 cavity-type antenna filters) with two 2-element VHF antennas.



Legend:

XU221	= 25 W VHF Transceiver
XU251	= 50 W VHF Transceiver
VCS	= Voice Communication System
GV201	= REM BUS Drive Unit

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Typical Configuration of a Communication System with Series 200 (VHF/UHF)

Remote Control and Monitoring System (RCMS) for Receivers, Transmitters and Transceivers of Series 200

System description

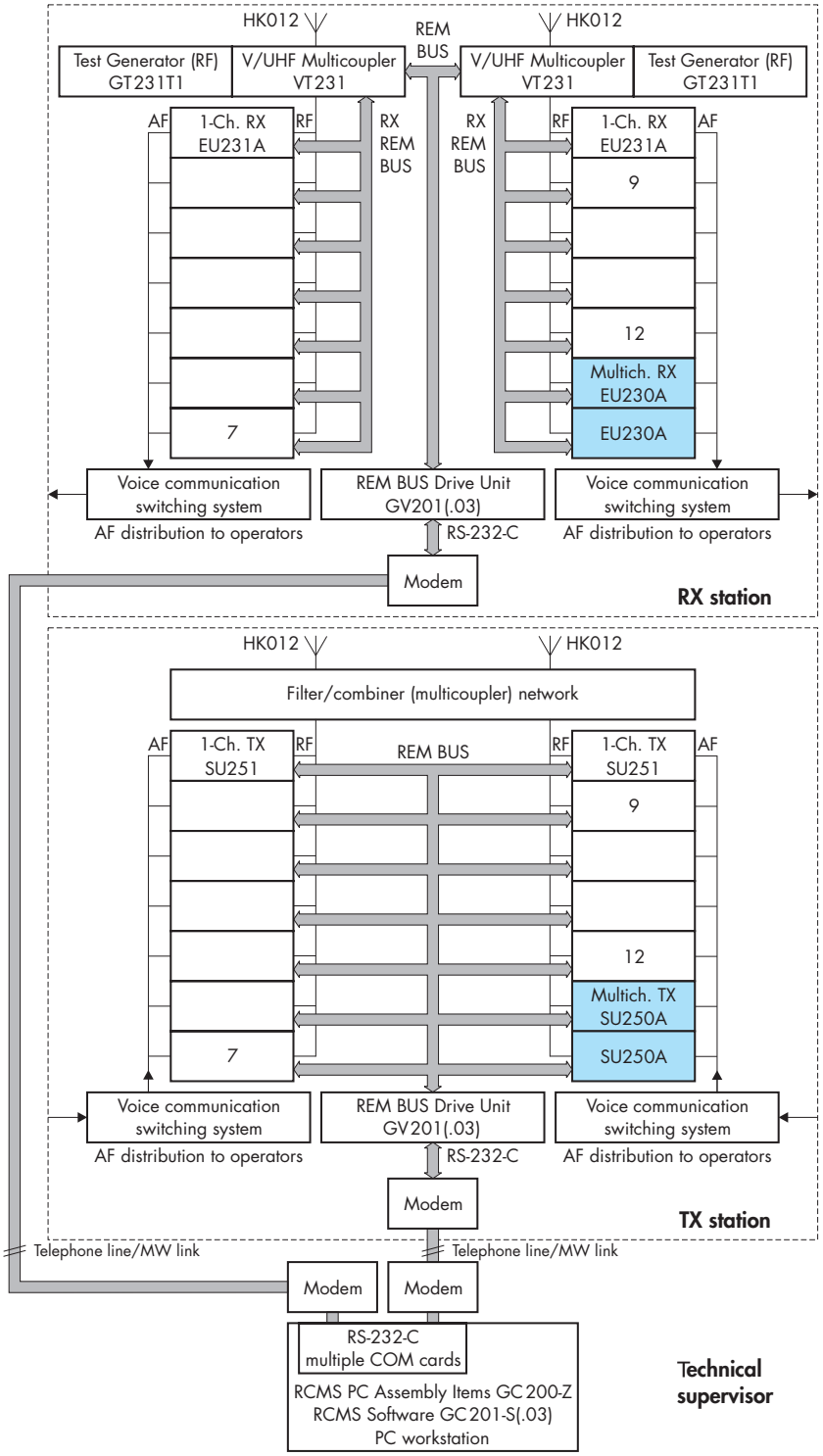
It is the task of the RCMS system
- to configure the communication system,
- to monitor the operation of the equipment and
- to control it

remotely. With this RCMS system, supervisors and maintenance staff have full control over all radios of Series 200.

The great benefits are to know the status of each radio equipment connected to the remote control. Alarms and failures, eg brake down of one of the main/standby radios or no further redundancy available, are indicated. To know what radio units and modules have to be changed will lead to a more sophisticated strategy for maintenance and repair. Also included: one user bit for each receiver and transmitter to implement customer-specific control like door contacts, alarms, switch on and off of electrical goods.

The basic unit of the control and monitoring station consists of a complete PC which contains multiple COM cards as interface to the modems.

An extension of the system is also possible to supervise separate airports or receive/transmit stations used for country-wide ATC from one control center.



Application example:

Digital RCMS for 14-channel VHF split-site transmitting/receiving station, with 2 multichannel communication lines in parallel to 12 single-channel lines

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Typical Configuration of a Communication System with Series 200 (VHF/UHF)

The application »Remote Control and Monitoring System« runs under Windows 3.11 or NT (ask us). It is necessary to have MS-DOS 6.22 installed.

REM BUS devices

Transceivers, transmitters, receivers and multicouplers include the REM BUS remote-control interface as standard. The receivers' bus is the special "RX REM BUS", which needs a multicoupler (for max. 7 receivers) or a REM BUS Drive Unit GV201 (for up to 24 receivers) for connection to the normal REM BUS.

REM BUS capacity

The REM BUS capacity of one REM BUS Drive Unit GV201 is 64 addresses, ie 64 transmitters or transceivers or 64 Adapters KR231A8 with VT231 or mixed (64 in total).

For further information please refer to »Series 200 – REM BUS Control and Monitoring« on page 126 or contact Rohde & Schwarz headquarters.

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UHF ECCM Ground-to-Air Communications System (Have Quick II or SECOS) with Series 400 U

Brief description

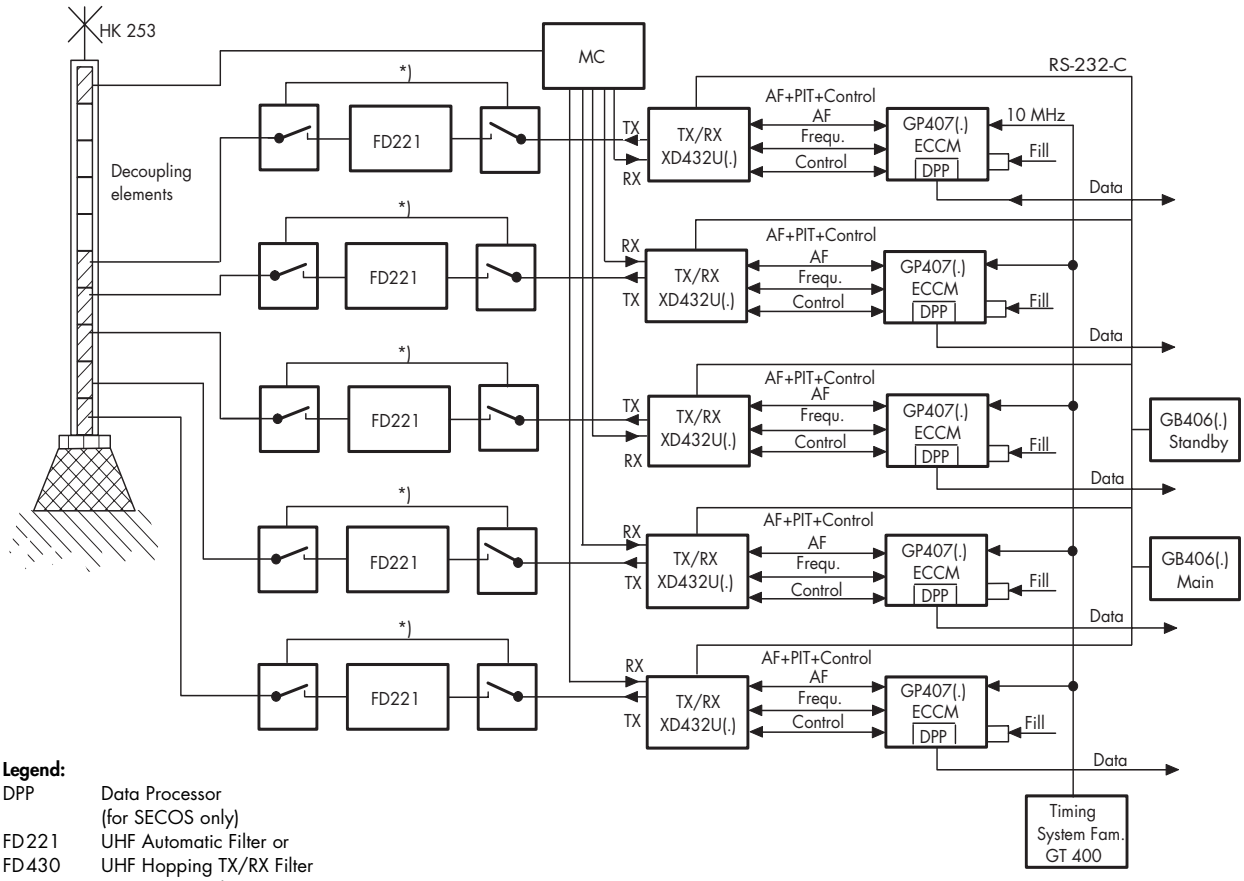
The tactical and operational requirements in the C³I field demand the use of secure and reliable air-to-air, air-to-ground, ground-to-air radiocommunication links.

This section deals with the radiocommunication equipment used for ground-based applications. In addition to the COMSEC/TRANSEC aspects, the smooth interplay of radio set, amplifier, filter/multicoupler, remote-control unit and antenna will ensure secure and reliable radiocommunication as well.

A ground-based radio system usually consists of a large number of fixed and hopping frequency channels. This requires special and individual system solutions to avoid mutual interference caused by cositing.

Different system solutions are available with the use of transceivers or separate transmitters and receivers together with antennas.

For two typical system configurations – based on Series 400U – see the following block diagrams.



Legend:

DPP	Data Processor (for SECOS only)
FD221	UHF Automatic Filter or
FD430	UHF Hopping TX/RX Filter
GB406(.)	Remote Control Unit
GP407(.)	ECCM Processor
HK253	Stacked UHF Antenna
XD432U(.)	UHF Transceiver with optional interfaces
MC	UHF RX Multicoupler
*)	Bypass for ECCM (not used for alternative UHF Filter FD430)
(.)	Type depends on ECCM procedure

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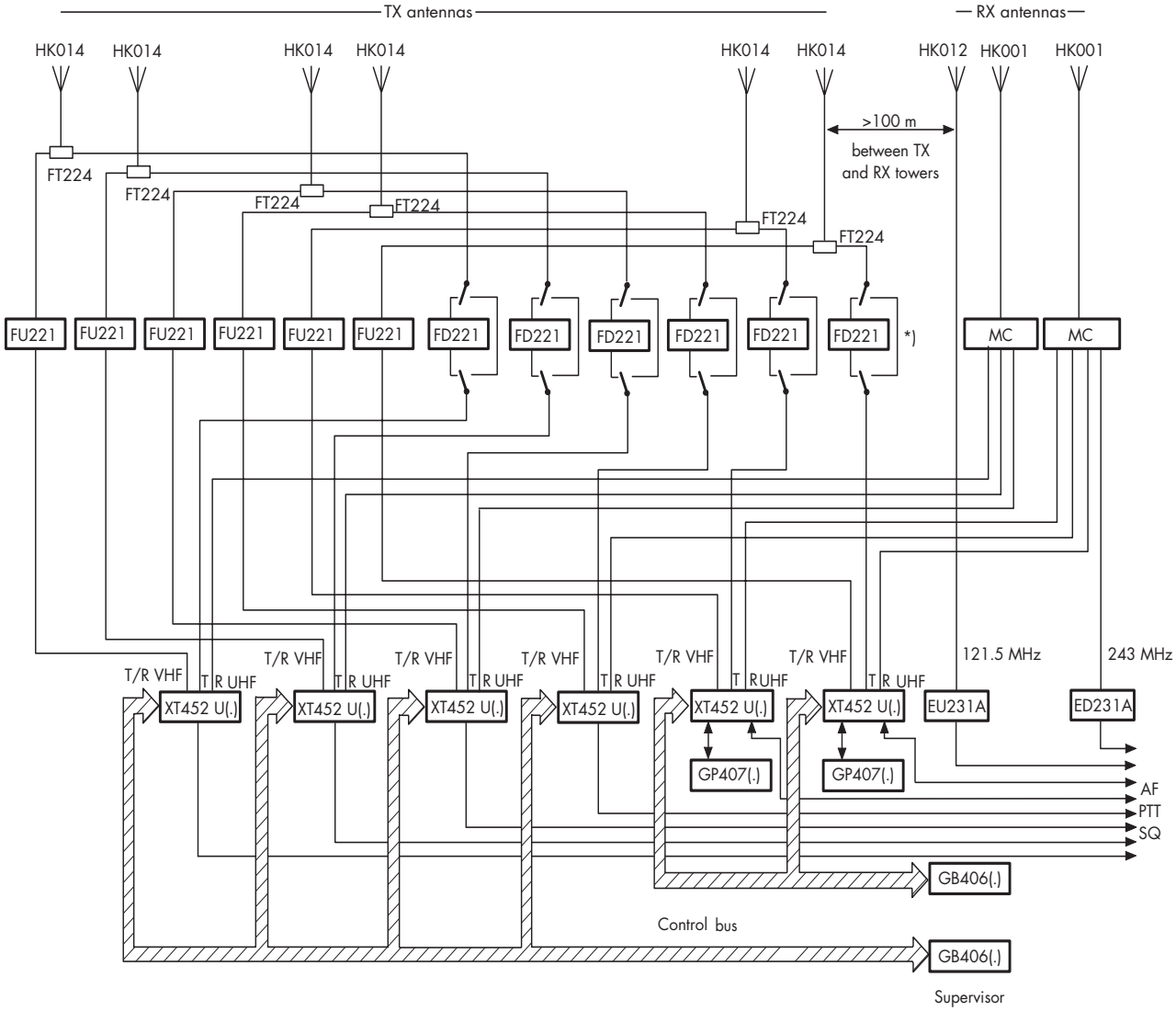
UHF ECCM Ground-to-Air Communications System (Have Quick II or SECOS) with Series 400U



Legend:

ED231A	UHF Receiver (guard frequency)
EU231A	VHF Receiver (guard frequency)
FD231	UHF Automatic Filter or
FD430	UHF Hopping TX/RX Filter
FD221	VHF Automatic Filter
FT224	VHF/UHF Diplexer
GB406(.)	Remote Control Unit
GP407(.)	ECCM Processor
HK001	UHF Dipole
HK012	VHF Dipole
HK014	VHF/UHF Dipole
MC	UHF RX Multicoupler
XT452U(.)	VHF/UHF Transceiver with optional interfaces
*)	Bypass for ECCM (not used for alternative UHF Filter FD430)
(.)	Type depends on ECCM procedure

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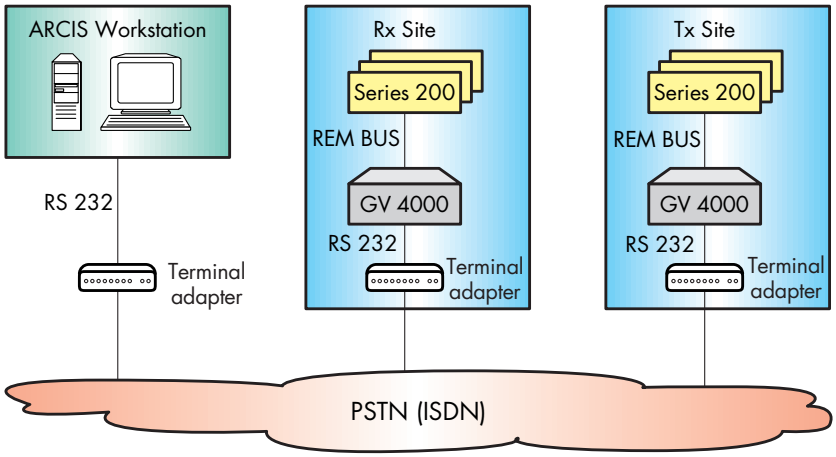
Advanced Remote Control, Monitoring and Information System ARCIS

ARCIS is an acronym for advanced remote control, monitoring and information system



ARCIS system with Series 200 (split-site configuration) and dial line (ISDN)

Brief description

ARCIS is an innovative, powerful and future-proof software product. With the aid of selected COTS products and, in some applications, with Multi-Link Processor GV4000 ARCIS supports the management of local and in particular country-wide networked systems for

– radiocommunications and DF
– navigation
– other applications

of civil and military air traffic control (ATC) and air defense. ARCIS fulfils diverse operational tasks such as

- System control for test and service
- System monitoring (status display with alarm function)
- Remote error diagnosis and elimination
- Central database
- System configuration (eg device assignment and setup of device parameters)

ARCIS is not only designed for standard Rohde & Schwarz units (eg Series 200 or 4400) but its open system architecture also provides for easy adaptation to project-specific non-R&S units. Its modern network technology, intelligent redundancy concepts as well as versatile and ergonomic graphical user interface offer a maximum of convenience, security, reliability and economy.

Features and benefits

Features	Benefits for customer
Open system architecture	**Universal use in radio equipment** (Series 200, 400, 400U, 4400, etc), **VHF/UHF Doppler direction finders** (PA100/200, etc) and also **non-R&S units** (option)
Intuitive and multistage graphical user interface	**Optimum operating convenience at every level of operation with user prompting**
Window 1	**Topographical representation of complete network** with station name and colour code status (green = "no errors", red = "errors")
Window 2	**Status overview of all units of a selected station or area,** eg for split-site installations
Window 3	**Status overview of operating parameters of selected unit** with display of normative range and errors and with possibility of triggering tests of subfunctions (IBIT) and, if authorized, changing operating parameters

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Advanced Remote Control, Monitoring and Information System ARCIS

Features	Benefits for customer
Remote setup of operating parameters and mission data	**Fast, convenient and economic startup of operations**
Standardized transmission protocols; use of COTS products and Internet technology: ISO/OSI, ARCIS application/presentation/ session layer, TCP transport layer, IP network layer, PPP data layer and Ethernet, modem V.34, RS-232/RS-485, X.25, ISDN as physical layer	**Simple administration** **High flexibility through optimum adaption to:** – wide variety of operational units (eg different radio equipment generations and control units), – desired infrastructure and networking, – existing installations (eg Series 200 with REM BUS Drive Unit GV201)
Wide varity of links – Leased lines – Analog and digital dial lines of PSTN (public switched telephone network) – Packet-switched network X.25 – Microwave links – Satellite links	**Universal use** **High flexibility through optimum adaptation** to desired infrastructure (transmission medium) **Reduction of costs** – by using public networks, – by operating the equipment only if required
Integrated network management software	**Network monitoring** – Network and memory disk utilization – Status display of network elements
Alternative hardware and software platforms The following operating systems are possible – UNIX in high-end quality and performance platforms with UNIX servers (eg SUN workstations) or – Windows NT 4.0 with standard PCs	**High operational reliability** **Adaptation to customer requirements**
Integrated CA-INGRES database	**Effective information management based on high expertise** – Event logging – Alarm logging
Support of different redundancy concepts **Physical redundancies:** – Radio-equipment-controlled automatic 100% standby switchover via simple 2-wire connections (eg Series 200) – Automatic 100% standby switchover via GV4000 or ARCIS PC – Automatic m+n standby switchover (Series 200) via GV4000 Redundancy at controller end (control units, PC, server, modems, lines, GV4000): further details on request	**Increase in operational reliability by** – automatic and – fast hardware and line switchover
Logical redundancies: Software mechanisms such as – distribution of data or – several logical routing paths	**Increase in operational reliability by** – automatic data protection, – information deviation to alternative operational supervisor (for networked stations)
High certified IT security – Highly sophisticated authentication mechanism – Configurable operating configuration that can be changed any time – Certified by an independent company	**Ultrahigh protection against unauthorized use:** ARCIS thus takes full account of customer's high security requirements (air traffic control, air defense). A critical aspect since the public switched telephone network (ISDN) may also be used as transmission medium
Clear alarm concept	**Unambiguous optical and acoustic alarms**
Event and error logging with filter functionality	**Reliable, fast and informative documentation** – for logging system behaviour, – for specific error diagnosis and cost-efficient service

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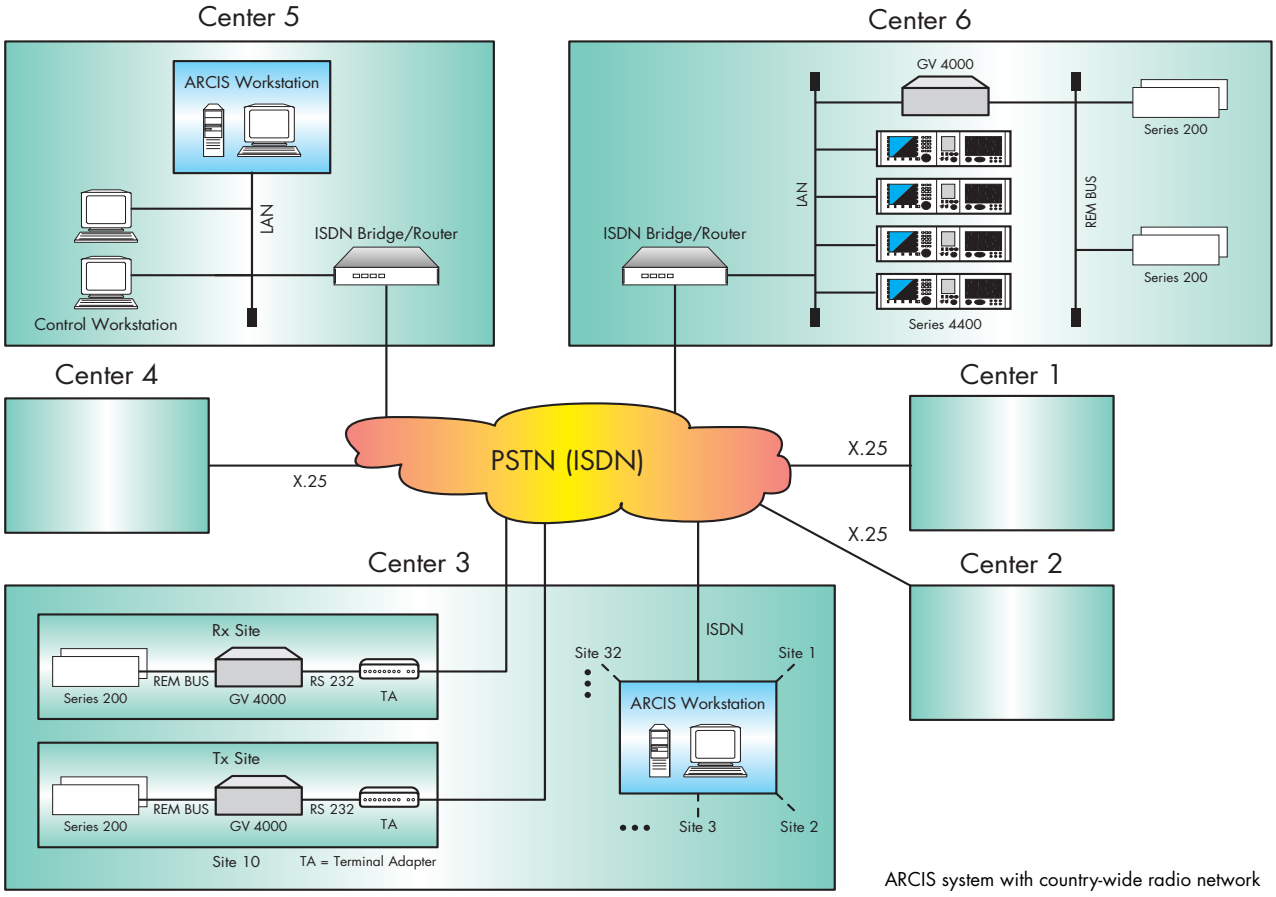
Advanced Remote Control, Monitoring and Information System ARCIS

Features	Benefits for customer
Scalable system architecture	**Easy, flexible and cost-efficient adaptation** – to current and – future system requirements from local airports (LAN) to country-wide networked systems (WAN)
Additional communication services (fax, e-mail) integrated on the same routing path	**Convenient, efficient and cost-effective additional service**
Configurable task assignment – For time-controlled routines, eg cyclical tests (IBIT or polling of specific parameters) – For event-controlled routine actions	– **High service convenience** – **Time and cost efficiency** – **Reliable status and error reporting**
Temporary use	**Interruption-free operation and monitoring** Even temporary monitoring of unmanned stations, eg at night



ARCIS system with country-wide radio network

Ordering information

Multi-Link Controller	GV4000	6106.8002.xx
Basic model without relay board		xx= 03
Model with 1 relay board for (8+2) redundancy		xx= 31
Model with 2 relay boards for (8+16) redundancy		xx= 32
Model with 2 relay boards for 2 x (8+2) redundancy		xx= 33
Multi-Link Software	GV4000S	6106.8254.02
Multi-Link Configuration Tool	GV4000T	6106.8402.02
ARCIS assembly items: system components like workstation, PC, server, ISDN bridge/router, TA	XXX	on request
ARCIS software + licence	XXX	on request
ARCIS system service: integration, configuration, administration and test	XXX	on request

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Mobile Tower for ATC (MATC) MX400

Brief description

The MATC is a completely self-contained system designed for quick installation and for long-term deployment under adverse weather conditions. It comprises all ATC equipment needed for rapid, safe and reliable operations.

The MATC system consists of a two-axle trailer with an integrated lifting mechanism and a detachable ATC cabin. A separate one-axle trailer with a diesel generator provides power for airfield operation wherever and whenever required. The whole system can be towed by any suitable truck. The cabin, built as a fully working ATC system, is equipped according to the operational requirements of the ICAO.

A typical operational scenario: MATC implemented by Rohde & Schwarz (Photo 40528-17)

The basic equipment consists of

- Up to three controller positions fitted with control and indicating instruments
- VHF or VHF/UHF communication sets in the frequency ranges 100 MHz to 163 MHz and 225 MHz to 400 MHz (Series 400U)
- VHF/UHF guard receiver for the international distress frequencies 121.5 MHz/243.0 MHz (integrated in Series 400U transceiver for detached Series 200 receiver)
- Provision for HF communication set XK2000 in the frequency range 1.5 MHz to 30 MHz
- VHF/UHF DF equipment (optional)
- Digital multichannel voice recorder for all radio transmission and intercom conversations
- Voice communication system
- Telephone equipment
- One set of meteorological sensors and indicators
- Accurate position and time through GPS
- Complete accessory package (signal projector, fire extinguisher, binoculars, obstruction lights, crash alarm etc)
- Split air-conditioning system
- Filing cabinets for supplies and equipment
- DC power supply system with backup batteries for emergency operation

Inner view of MATC tower (Photo 40783-3)

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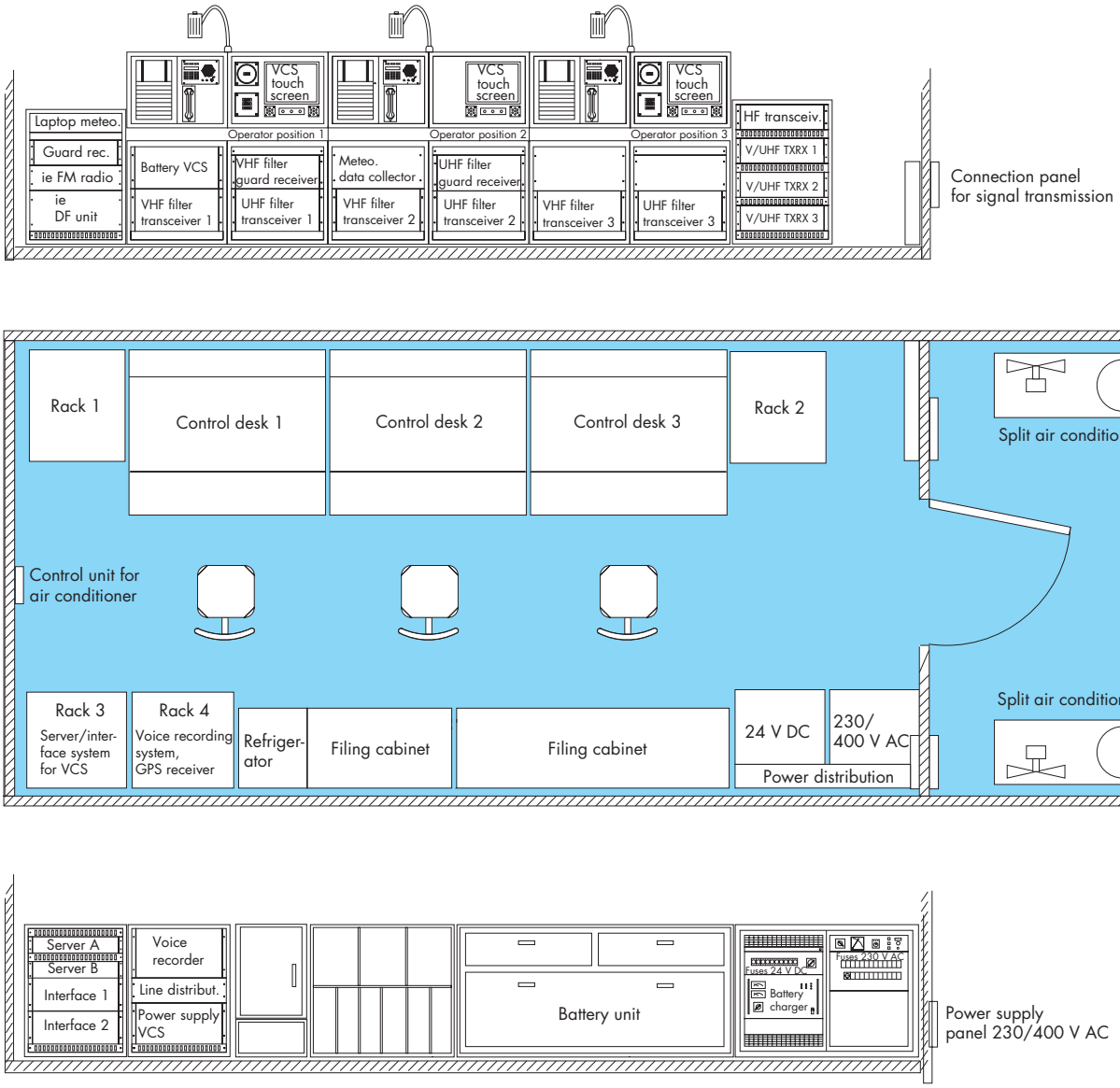
Mobile Tower for ATC (MATC) MX400

A special lifting mechanism on the two-axle trailer is designed to lift the cabin to the operational height of 6.5 m above ground (working position).

The detachable ATC cabin complies with the international standard ISO 20-feet container dimensions, which allows problem-free transport by ship, truck, aircraft, helicopter or trailer.

The power supply of the complete mobile ATC tower can be either by landline or diesel generator. The proposed generator is designed to operate on standby, ie the generator will be started automatically when the local power supply fails.

The mobile ATC tower is based on a modular system design. The final system design will be tailored to the needs of the customers.



System layout (example) of MATC MX400

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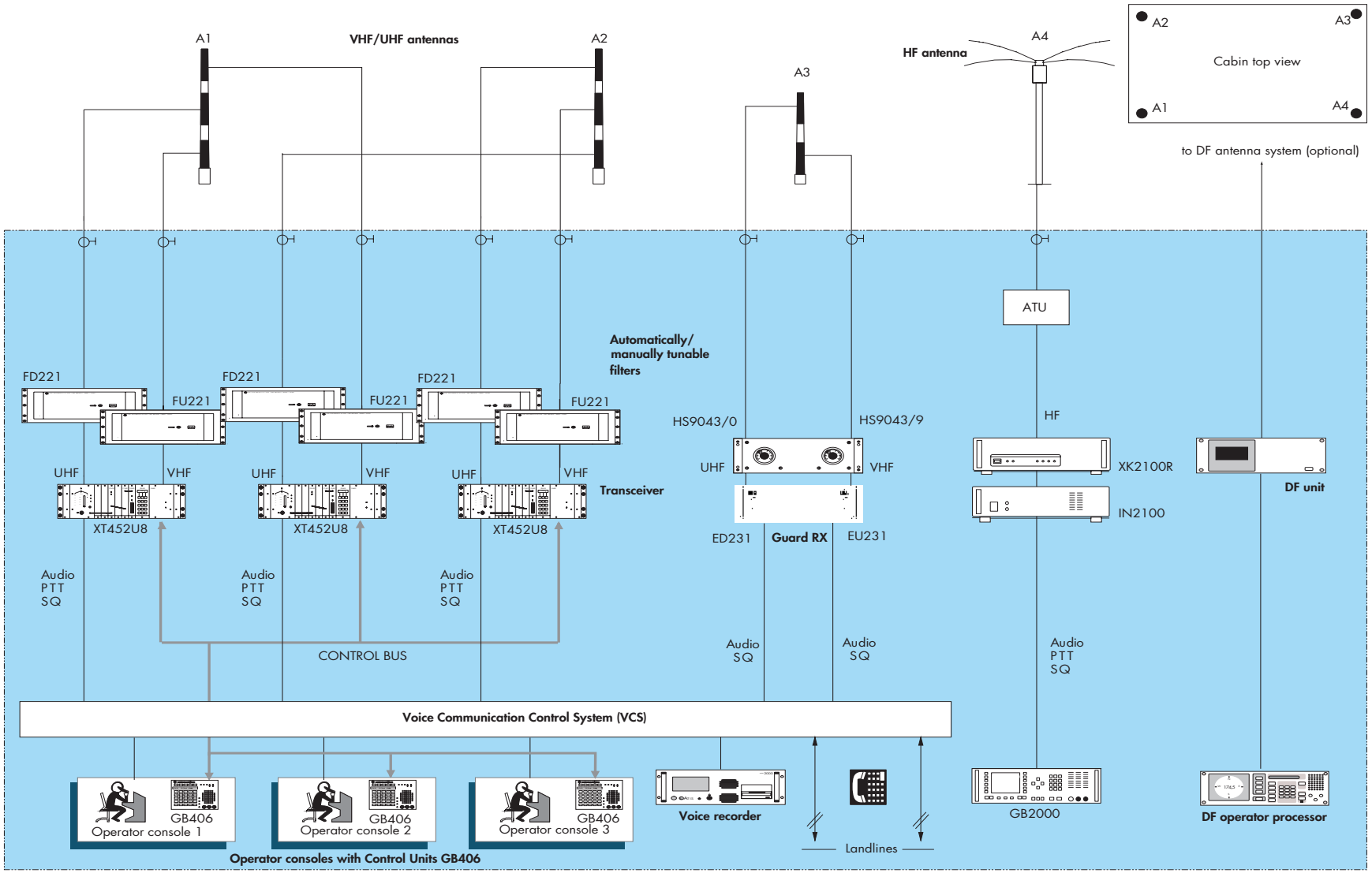
Mobile Tower for ATC (MATC) MX400



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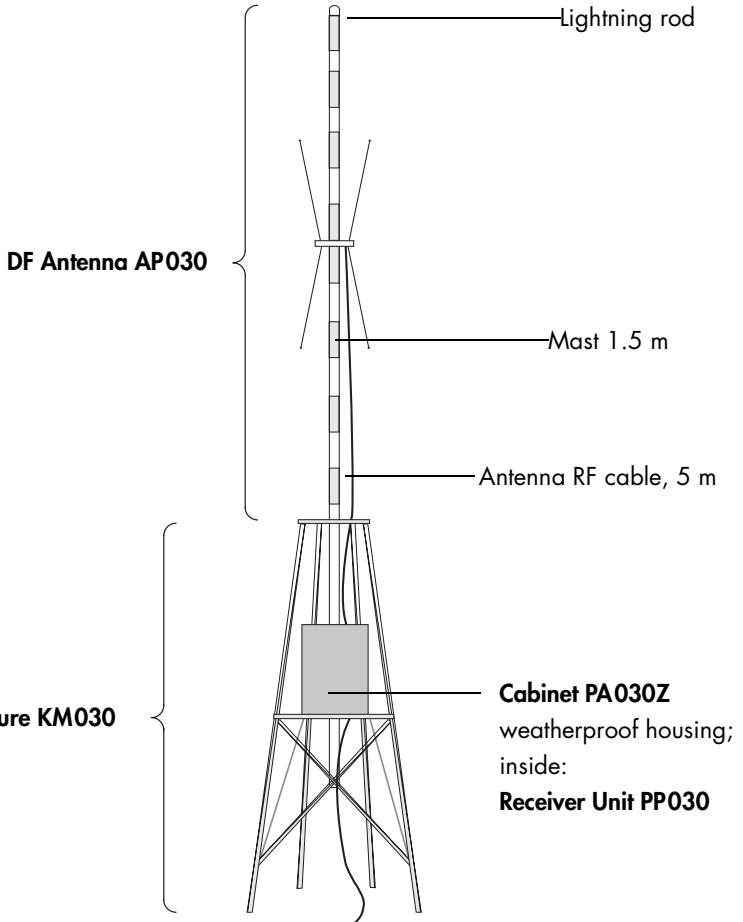
Typical DF System Configurations: VHF Direction Finding System PA030

Brief description

Consulting-experienced engineers as well as site measurement effected by a qualified expert team are recommended to decide on a suitable antenna site.



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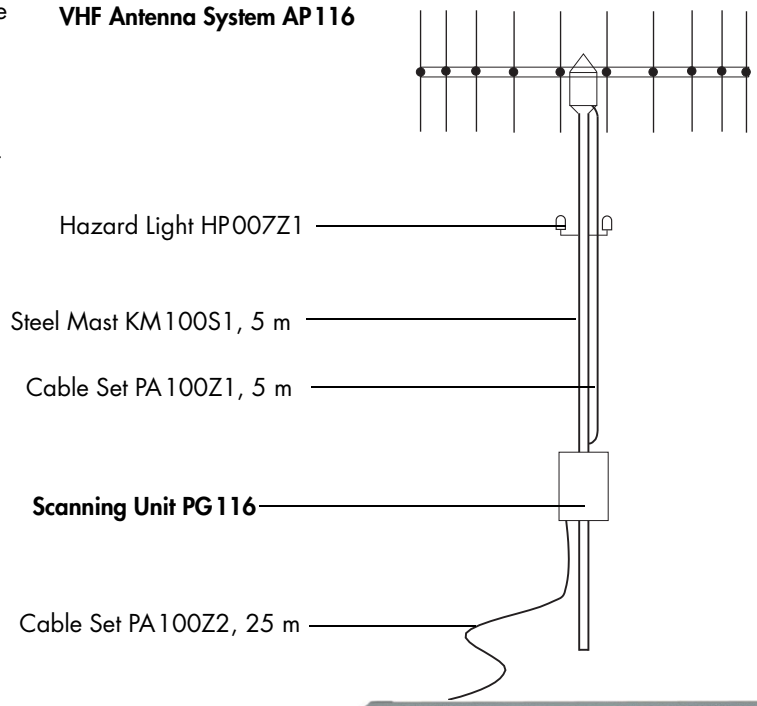
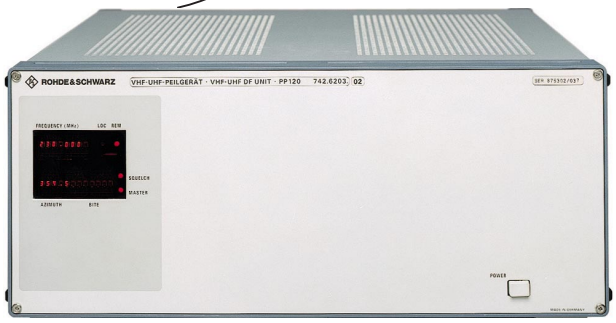
VHF Direction Finding System PA 100

Brief description

DF Systems PA 100/200/120 will be tailored to operational requirements and the local situation.

Many other combinations and extensions are possible.





VHF DF Unit PP 100
4-wire cable required (not included in delivery)
2-wire data connection
plus 2-wire for AF
(Photo 37979-3b)

Operator Processor PB 100
Including:
Control/Monitoring Unit PB 100C
Display Unit PB 100D (shown)
(Photo 37977)

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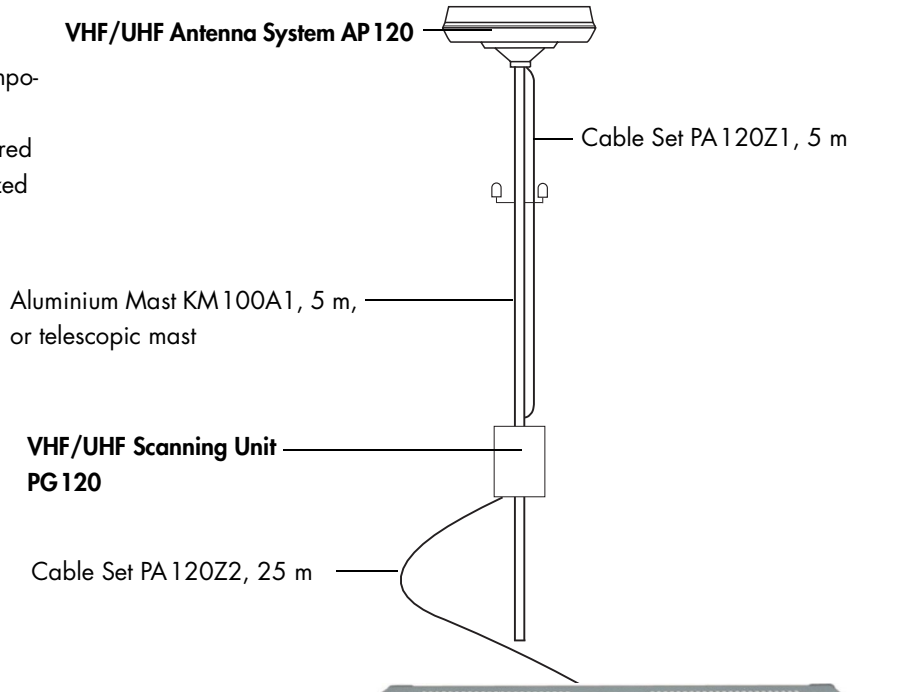
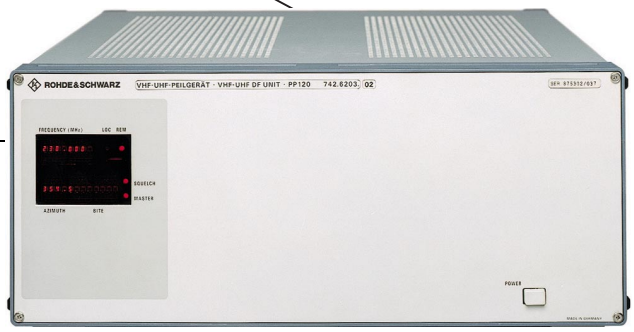
VHF/UHF Direction Finding System PA120M

Brief description

Combination of several system components according to operational requirements, local situation, required camouflage, to configure customized systems.



VHF/UHF DF Unit PP120
4-wire cable required (not included in delivery)
2-wire data connection
plus 2-wire for AF
(Photo 37979-3b)



Operator Processor PB100
Including:
Control/Monitoring Unit PB100C
Display Unit PB100D (shown)
(Photo 37977)

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