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DEC 24 1998



ROHDE & SCHWARZ

Radio Communications Division

FCC ID: KVV60439043

User Manual

VHF TRANSCEIVER 25 W

XU 221

6043.9343.22 to 27

6043.9343.42 to 47

8.33 / 25-kHz Version

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1098**

6075.6491.12.06 - 2

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Certificate No.: 9502182

This is to certify that:

Equipment type	Order No.	Designation
XU221	6043.9343.xx	VHF Transceiver

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

- relating to electrical equipment for use within defined voltage limits (73/23/EEC revised by 93/68/EEC)
- relating to electromagnetic compatibility (89/336/EEC revised by 91/263/EEC, 92/31/EEC)

Conformity is proven by compliance with the following standards:

EN60950 : 1992 + A1 : 1993
prETs 300339

Affixing the EC conformity mark as from 1995

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Munich, 04.12.95

Central Quality Management FS-QZ / Becker





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EVALUATION OF MANUALS

here:

User Manual, Id. No. 6075.6491.12.xx,
VHF TRANSCEIVER 25 W XU 221

Dear Sirs,

we constantly try to improve our technical manuals, so that you, our customer gets the best possible benefit from them.

In order to become better, we need your help and your opinion on the manuals. Therefore, we would like you to evaluate the accompanying manual and tell us your opinion about it. In order to make the job easy for you, we have designed the following matrix. Please tick where appropriate.

1. What is your general impression of the manual?

lousy

not so good

quite ok

good

excellent

2. How do you assess the detail and depth of information in general?

far too
detailed

too much
information

all information
contained

not enough
information

important items
missing

3. How do you assess the size of the manual in general?

far too
bulky

a bit too
thick

appropriate to
the equipment

a bit too
thin

too little
information

4. How do you assess the structure of the manual?

opaque

difficult to
understand

quite ok

easy to find
information

very user
friendly

5. How do you assess the understandability (language) of the manual?

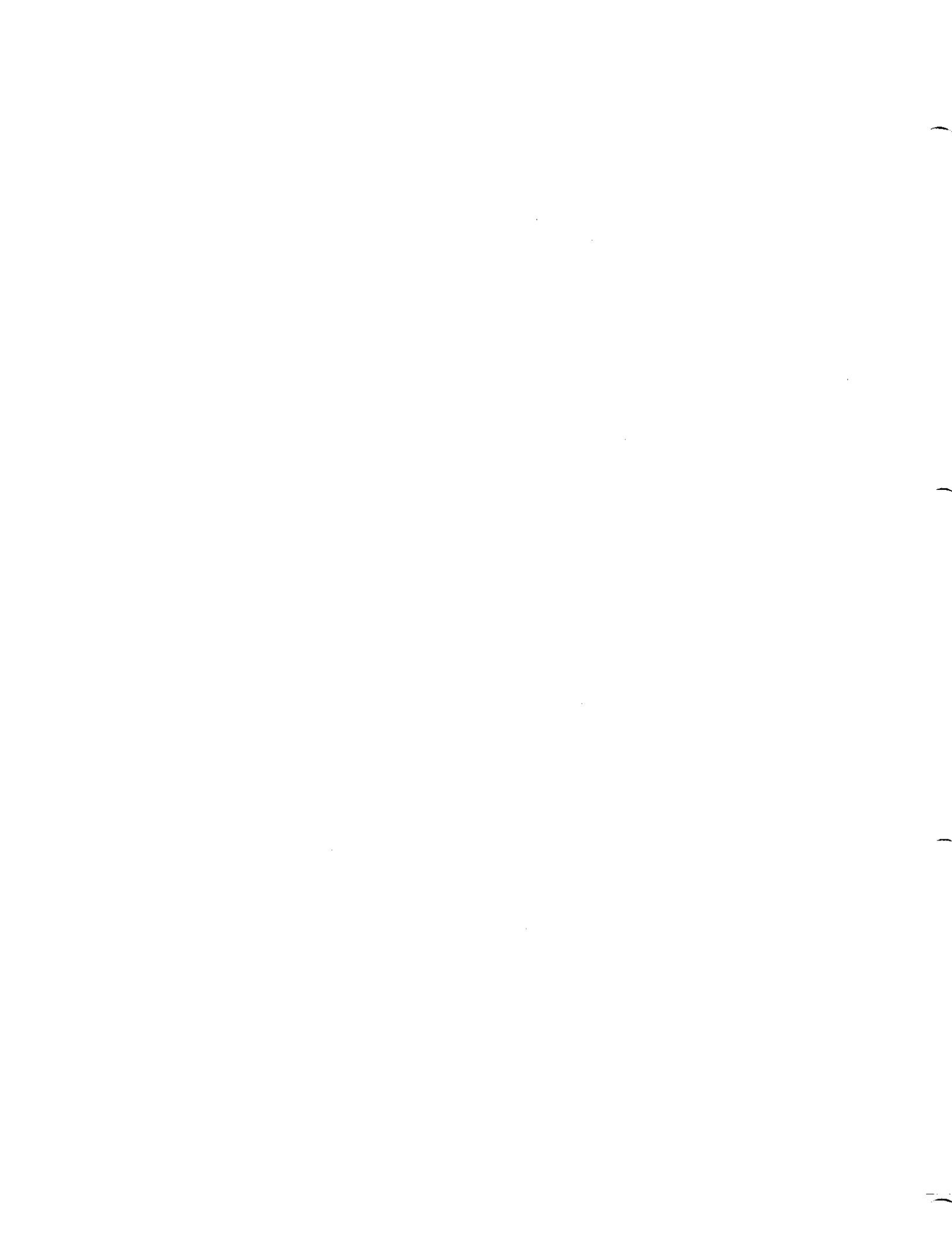
very difficult
to follow

complicated
language

normal to
understand

easy to
understand

very user
friendly



EVALUATION OF MANUALS

User Manual, Id. No. 6075.6491.12.xx, VHF TRANSCEIVER 25 W XU 221

6. How do you rate the number of illustrations?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
far too many	a bit too many	just about right	could be more	not enough illustrations

7. How do you rate the quality of illustrations?

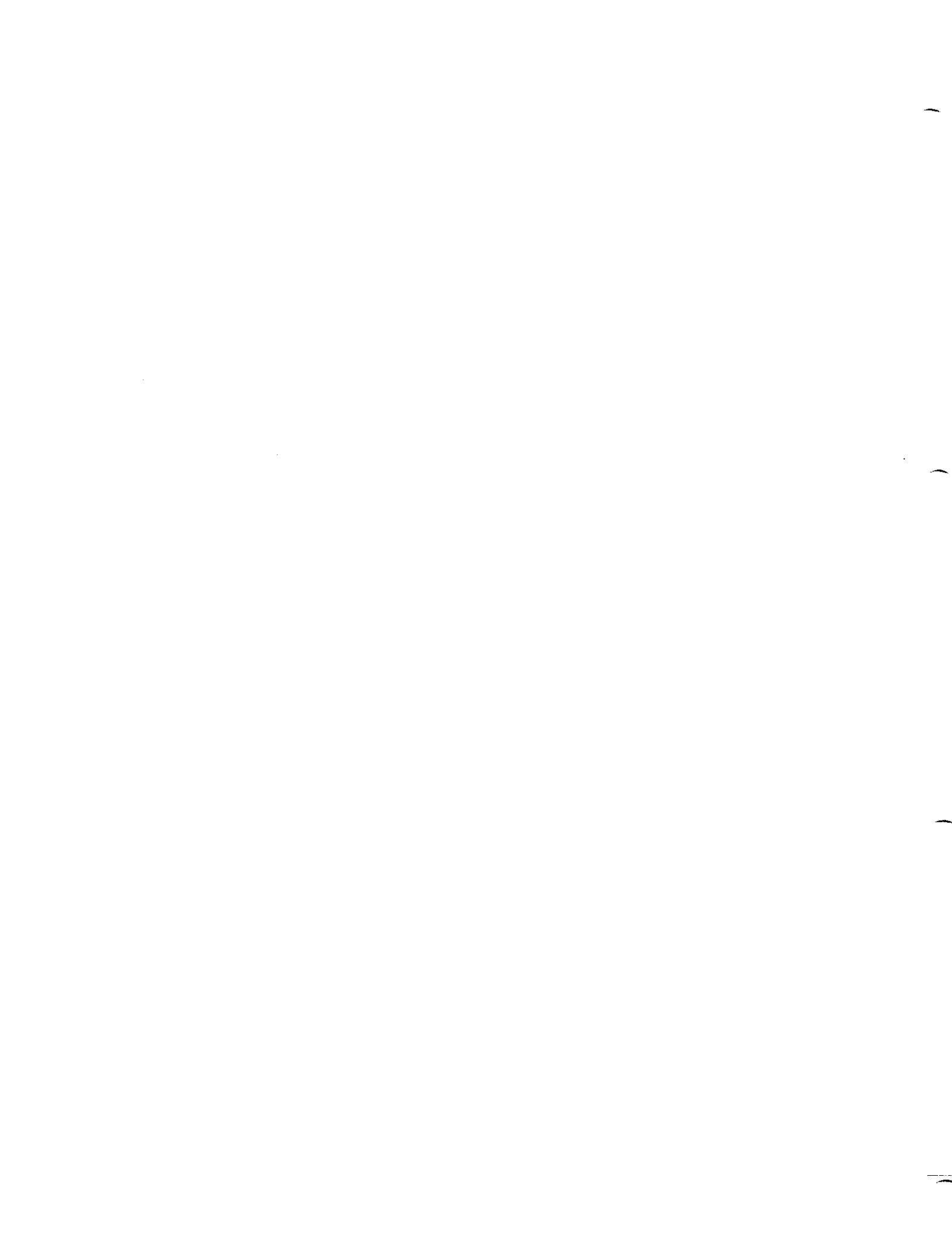
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
lousy	not so good	quite ok	good	excellent

8. How do you assess the balance of text to illustrations?

lousy not so good quite ok good excellent

Further Comments and Suggestions for Improvement:

Date / Signature / Department





ROHDE & SCHWARZ

Radio Communications Division

FCC ID: KVV60439043

NOTICE

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Safety Notes

This unit was built and tested in compliance with the enclosed EU Certificate of Conformity and left the factory in perfect condition as far as technical safety is concerned. In order to maintain this condition and guarantee safe operation, the user has to observe all notes as well as cautionary and warning information.

1. Operate the unit only in the operating states and positions specified by the manufacturer allowing sufficient ventilation. If not agreed otherwise, the following applies for R&S products:

Contamination level 2, class of overvoltage protection 2, IP system of protection 2X, operation up to 2000 m altitude

Operation is only permitted on supply networks fused with not more than 16 A.

2. For measurements in circuits carrying voltages $> 30 \text{ V}_{\text{rms}}$ take appropriate preventive measures so that any hazard can be excluded (e.g. suitable measuring equipment, fusing, current limiting, grounding, insulation etc.).

3. When a unit is installed and cabled for stationary operation, first of all establish the connection between the local protective ground contact and the equipment ground contact before any other connection. (Installation and cabling are to be carried out by qualified personnel only).

4. For stationary units without integrated fuse, circuit breaker or similar protection fuse the power circuit to provide sufficient protection of both equipment and user.

5. Before switching the unit on, make sure that the set nominal voltage and the available nominal mains voltage are identical. If a change of the voltage setting becomes necessary, also replace the respective mains fuse of the unit, as necessary.

6. For units of class of protection I with flexible mains power cord and connector, operation is only permitted on power outlets with protective ground contact and grounding conductor connected.

7. Any deliberate interruption of the grounding conductor both in the feeder and in the unit itself is inadmissible and can render the unit dangerous. When using extension cords or multiple outlets ensure that they are regularly checked for their safety condition.

8. If the unit is not fitted with a mains power switch for disconnection from the mains, the connector on the connecting cable is to be regarded as the disconnecting device. In such a case ensure that the mains connector is within reach and easily accessible at any time (length of connecting cable approx. 2 m). Function switches or electronic switches are not suitable for mains disconnection. If units without mains power switch are integrated into racks or systems, the disconnection facility is to be provided on system level.

9. In all operations observe the relevant local or national safety rules and regulations for accident prevention. Before carrying out any work on or opening a unit disconnect it from the mains.

Alignment, replacement of components, maintenance and repair are to be carried out only by expert staff authorized by R&S.

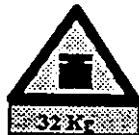
For replacement of safety-relevant components (e.g. power switch, mains transformer or fuses) only original parts are to be used. After each replacement of such safety-relevant components a safety check will have to be carried out (visual examination, check of grounding conductor, check of insulation resistance, leakage current measurement, functional check).

10. Also observe additional safety notes in this Manual.

Symbols Used on R&S Equipment and in Manuals:



Please observe operating instructions!



**Equipment mass for units with a
mass > 18 kg**



**Protective ground contact,
for protection only**



Ground contacts



**Caution,
Voltage involving shock hazard**



**Caution,
High temperature, Caution, Hot surfaces**



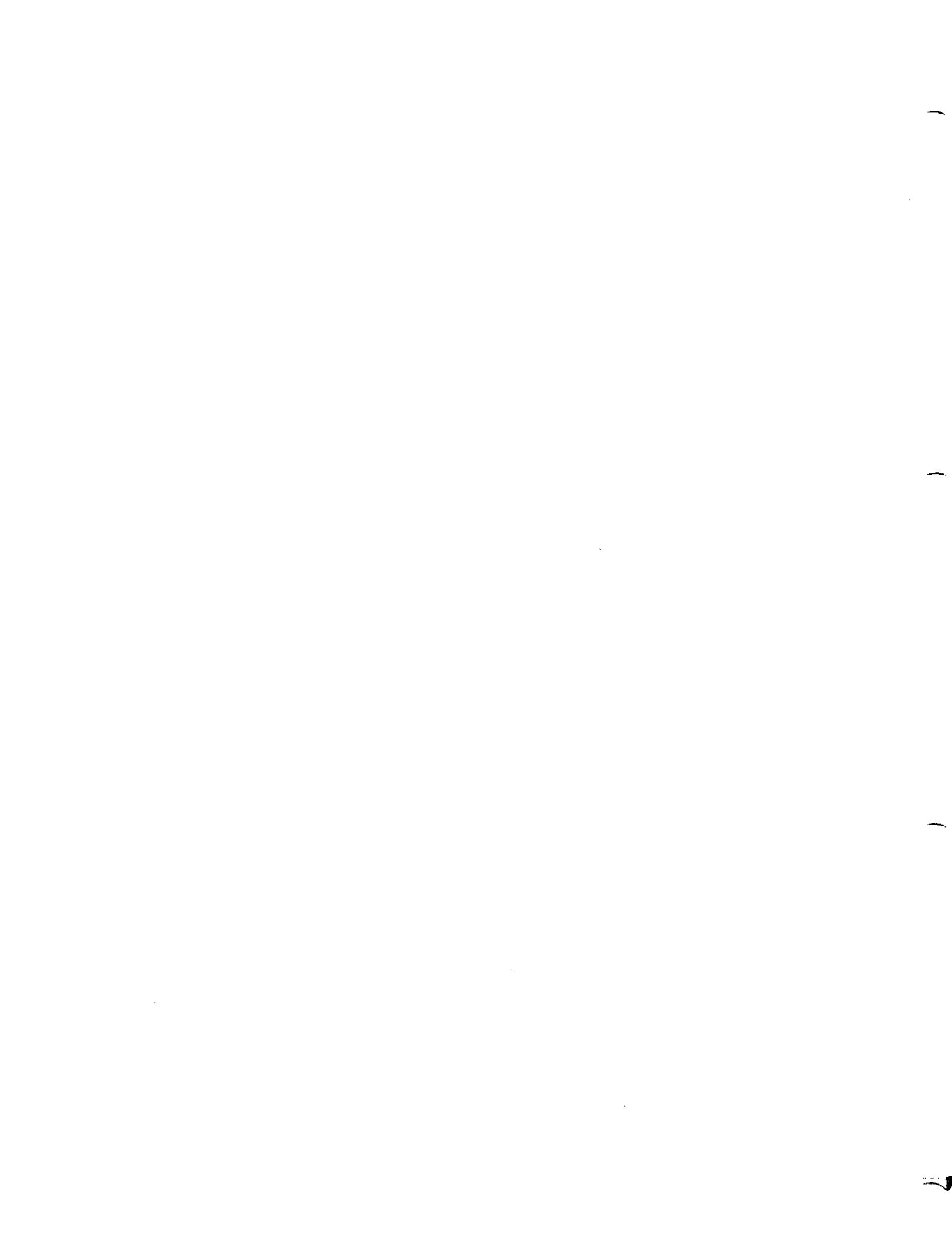
Ground

First Edition and Revisions

First edition 01 March 1996
 Fifth revision 06 October 1998

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List of Abbreviations

A = address line, e.g. A1	EPROM = erasable programmable read-only memory
A = ampere	EU = R&S designation for VHF receivers
AC = alternating current	EXT = external
AC/DC = alternating current / direct current	
ACIN = AC input	
AD-Select = address selection	
AF = audio frequency	FET = field effect transistor
AF-Mike = audio frequency microphone	FI = frequency input
AF-Rx = audio frequency receiver	FM = frequency modulation
AF-Tx = audio frequency transmitter	F = designation for fuse, e.g. F2
AGC = automatic gain control	GA = R&S designation for handsets
ALC = automatic level control	GD = R&S designation for circulator sets
AM = amplitude modulation	GF = R&S designation for synthesizers
AMP = amplifier	GI = R&S designation for interfaces
ANT = antenna	GM = R&S designation for modulators and similar modules
	GND = ground
B = bidirectional	
BLW = blower	
BNC = connector designation	
CAR = carrier	HCMOS = high-speed complementary metal oxide semi-conductor
CBIT = continuous built-in test	Hz = hertz
CH = channel	
CL = clock	I = input
CONV = conversion	IC = integrated circuit
D = data line, e.g. D1	ICAO = International Civil Aviation Organization
DA = data	IEC = International Electrotechnical Commission
DA-Select = data selection	IBIT = initiated built-in test
dB = decibel	IN = input
DC = direct current	
DC/AC = direct current / alternating current	KA = R&S designation for service kits
DC/DC = direct current / direct current	kHz = kilohertz
DCIN = DC input	KK = R&S designation for cases
DIGI IN = digital input	KR = R&S designation for adapters
DIGI OUT = digital output	KS = R&S designation for mating connector sets
DMIC = dynamic microphone	kW = kilowatt
DIL = dual in-line	LED = light-emitting diode
DISF = display forward power	LOC = local, e.g. local control
DISM = display modulation	LP = lowpass filter, e.g. LP1
	LSB = least significant bit
DISR = display reflected power	
DSP = digital signal processor	
EEPROM = electrically erasable and programmable read-only memory	m = modulation
EMC = electromagnetic compatibility	MHz = megahertz
EN = enable	MIC = microphone
	Mod = modulation
	Mod = model
	MSB = most significant bit
	MUX = multiplexer

VHF TRANSCEIVER 25 W • XU 221

User Manual

NB / WB = narrowband / wideband
NOPTT = no PTT (PTT see under PTT)
NORM = normal

O = output (with interfaces)
OC = oscillator
OCXO = oven-controlled crystal oscillator
OK = okay
ONCE = on-chip emulator
OPT = optocoupler
OPTO = optocoupler
OSEL = output select
OUT = output

PC = Personal Computer
Pc / W = RF output power in watt
PD = R&S designation for data sheets
PE = protective earth
PLL = phase-locked loop
PLOW = power low
ppm = parts per million
PTT = push-to-talk = carrier activation
PTT-INT = PTT interrupt

RAM = random access memory
RED = reduction
REL = relay, e.g. REL1
REM = remote, e.g. remote control
REM BUS = remote bus
RF = radio frequency
RI = reference input
RS = interface standard, e.g. RS 422
Rx = receiver
RxD = receive data
Rx / Tx = transceiver

S = R&S designation for switches, e.g. S30
SA = R&S designation for parts list
SCL = system clock
SDA = system data

SDAI = system data input
SDAO = system data output
SMA = connector designation
ST = R&S designation for connectors, e.g. connector ST3
SU = R&S designation for VHF transmitters
SYNTH = synthesizer
SYSTEST = synthesizer test

TCXO = temperature-compensated crystal oscillator
TestIB = test inband
TEMP = temperature
TTL = transistor-transistor logic
TR1 = transformer 1
Tx = transmitter
TxD = transmit data
Tx / Rx = transceiver

U-DEF2 = user-defined input or output, e.g. 2
UHF = ultrahigh frequency
USER-DEF-1 = user-defined input or output, e.g. 1
V = volt
VAC = volt alternating current
VCO = voltage-controlled oscillator
VDC = volt direct current
VDE = Verband Deutscher Elektrotechniker (association of German electrical engineers)
VFO = variable frequency oscillator
Vrms = root-mean-square voltage
VHF = very high frequency
VK = R&S designation for amplifiers
VMIC = amplifier microphone
VOP = operating voltage
VSWR = voltage-standing wave ratio

W = watt

X = R&S designation for connectors, e.g. X1
XU = R&S designation for VHF transceivers

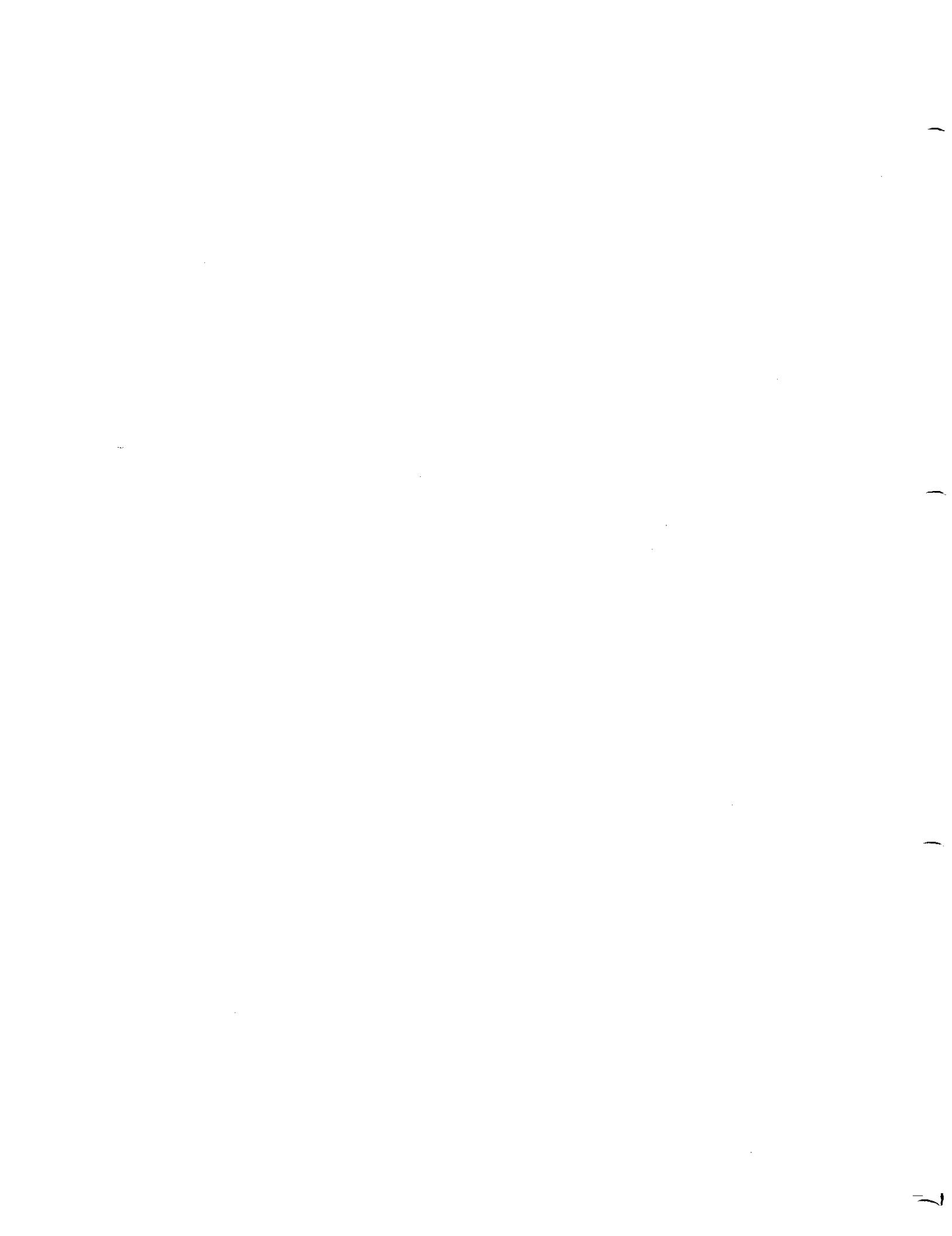
VHF TRANSCEIVER 25 W • XU 221

User Manual

FCC ID: KVV60439043

Definitions

Check	In appropriate measurements by means of the specified test equipment proper functioning of a unit or module is established.
Discolouration	Components such as e.g. connectors and printed circuit boards are examined if they have changed colour due to temperature effects and thus differ widely from their normal condition.
Disconnect	Pull off connector.
Examine	In case of trouble the unit / module or components such as e.g. connectors, are to be thoroughly checked for obvious mechanical damage.
Functional check	This means that components / modules / units are checked for proper functioning while installed.
Hazardous voltages	Voltages $> 30 \text{ V}_{\text{rms}}$ or 50 V_{pp} (AC) or 50 V (DC)
Make sure	Ascertain whether all mentioned requirements are met or all measures are taken to establish the required condition.
Open	Access is to be gained to the unit / module by observing the given instructions and safety precautions.
Perfect condition	This means that a component / module / unit has to be in a state which does not give cause to complaints.
Replacement	In case of trouble the replacement of modules is carried out in order to localize and eliminate the fault.
Replace	Components / modules / units which - due to damage and / or other defects - no longer meet the respective requirements or components / modules / units which during troubleshooting were identified as the cause of fault, are to be replaced.
REM BUS	The REM BUS is a serial bus connection defined by R&S for remote control. Via the REM BUS all units belonging to the 200 series can be remote-controlled without the need of additional options.
Rx REM BUS	The Rx REM BUS is a particular means for interconnection of the 200 series receivers and their combination with the integrated multicoupler. The receivers and the multicoupler form a unit which is remote-controlled via the REM BUS.



VHF TRANSCEIVER 25 W • XU 221

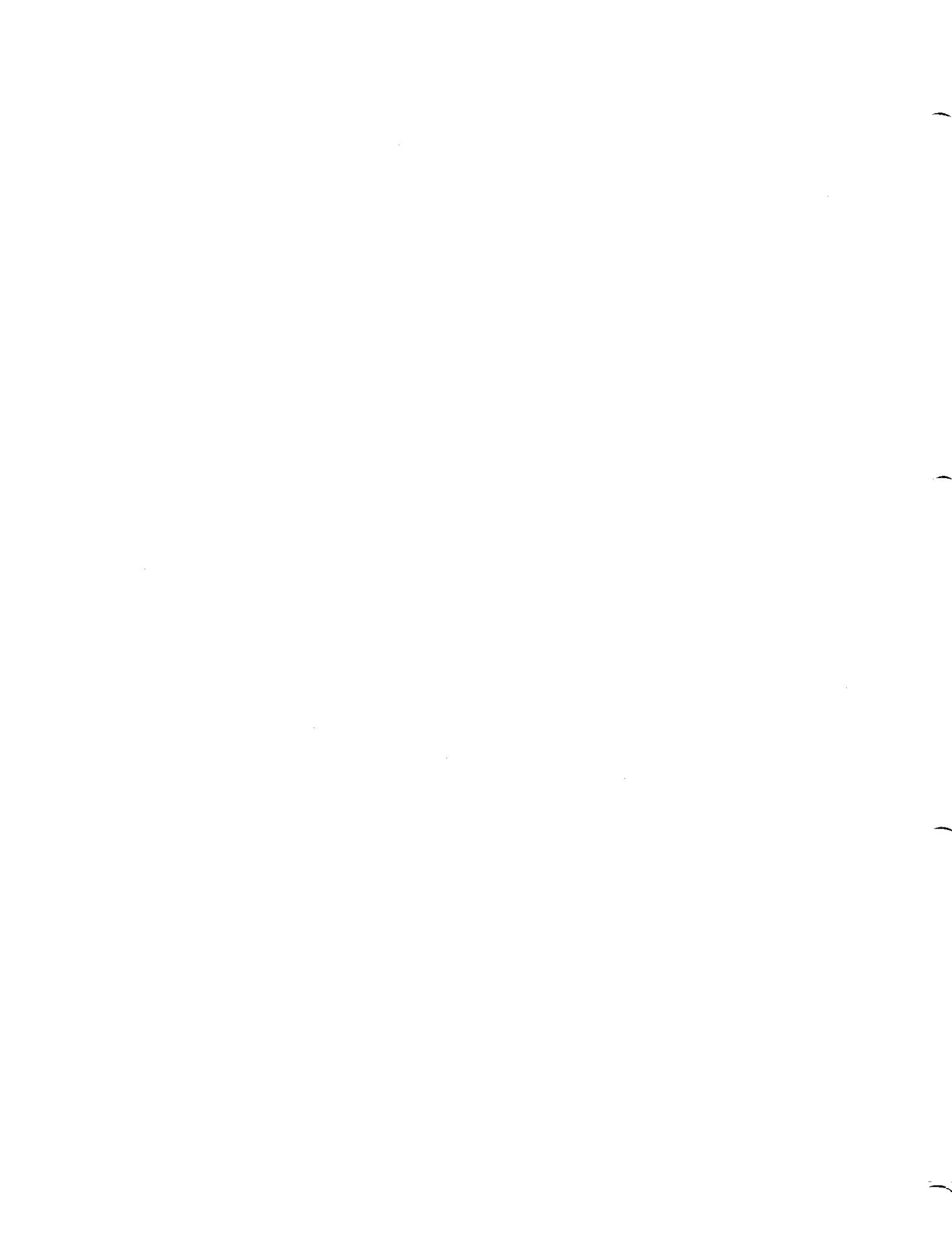
User Manual

5-km REM BUS

The REM BUS Drive Unit GV 201 additionally offers a 5-km REM BUS. To the REM BUS drive unit transmitters, receivers and transceivers can be connected. This permits the units of the 200 series to be remote-controlled over distances of up to 5 km without the need of modems.

Visual examination

This is a visual inspection of the outer appearance and completeness of a component / module / unit without manual interference by the examiner. This does not include the necessary preparations and finishing work such as e.g. opening and closing of covers or similar.



Display Types

The different display types used in this User Manual are preceded by the following headings:

WARNING

This heading is used to indicate that inaccurate observance or nonobservance of instructions or methods can cause injuries or even fatal accidents. It may also lead to hazardous substances escaping into the unit or system.

CAUTION

This heading is used to indicate that inaccurate observance or nonobservance of instructions or methods can cause damage to the unit.

Note:

This heading is used to draw the reader's attention to a particular fact.

This User Manual contains three displays classified as "Warning", namely

WARNING

- **Beware of risk of explosion when using isopropyl alcohol.**
Make sure to work in a well ventilated room when cleaning with isopropyl alcohol.
- **Wear goggles when working with compressed air in order to avoid any injuries to the eyes.**

WARNING

Before opening the cover make sure that the mains connector has been pulled off!

WARNING

Beware of touching the heat sink during transmission where temperatures may rise as high as 70 °C!



VHF TRANSCEIVER 25 W • XU 221

User Manual

User Information

Purpose of the Manual

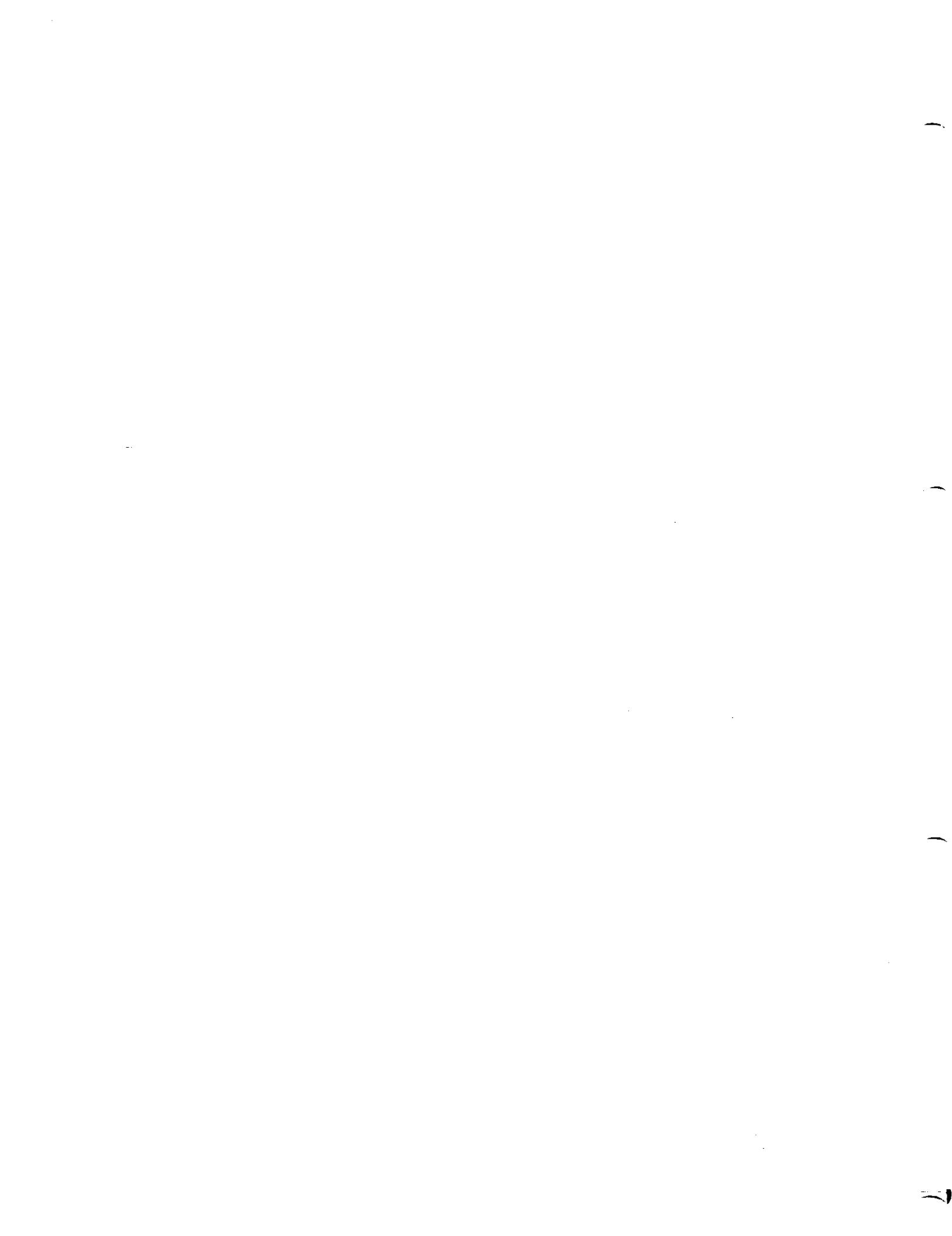
This Manual provides all information the operators and service staff need to maintain levels 1 and 2 of repairs.

It contains all necessary information and instructions concerning the installation, putting into operation and control of the unit, plus troubleshooting instructions down to module level. In case of trouble this allows straightforward error localization as well as easy replacement of the module concerned. This permits the unit to be put back into proper working order and operation with minimum delay.

We recommend to keep complete spare units / modules in store.

Measuring Units

In this Manual the basic SI measuring units and units coherently derived from them are used by preference. In exceptional cases units legally derived from the SI units acc. to DIN 1301 may also be used.



User Manual

VHF TRANSCEIVER 25 W XU 221

CHARACTERISTICS

Data Sheet, Application, Design and Functioning of the Transceiver, Design and Functioning of Modules

PREPARATION FOR USE

Unpacking and Checking, Accessories, Operating Functions Set Ex Works on Individual Modules, Cabling

OPERATION

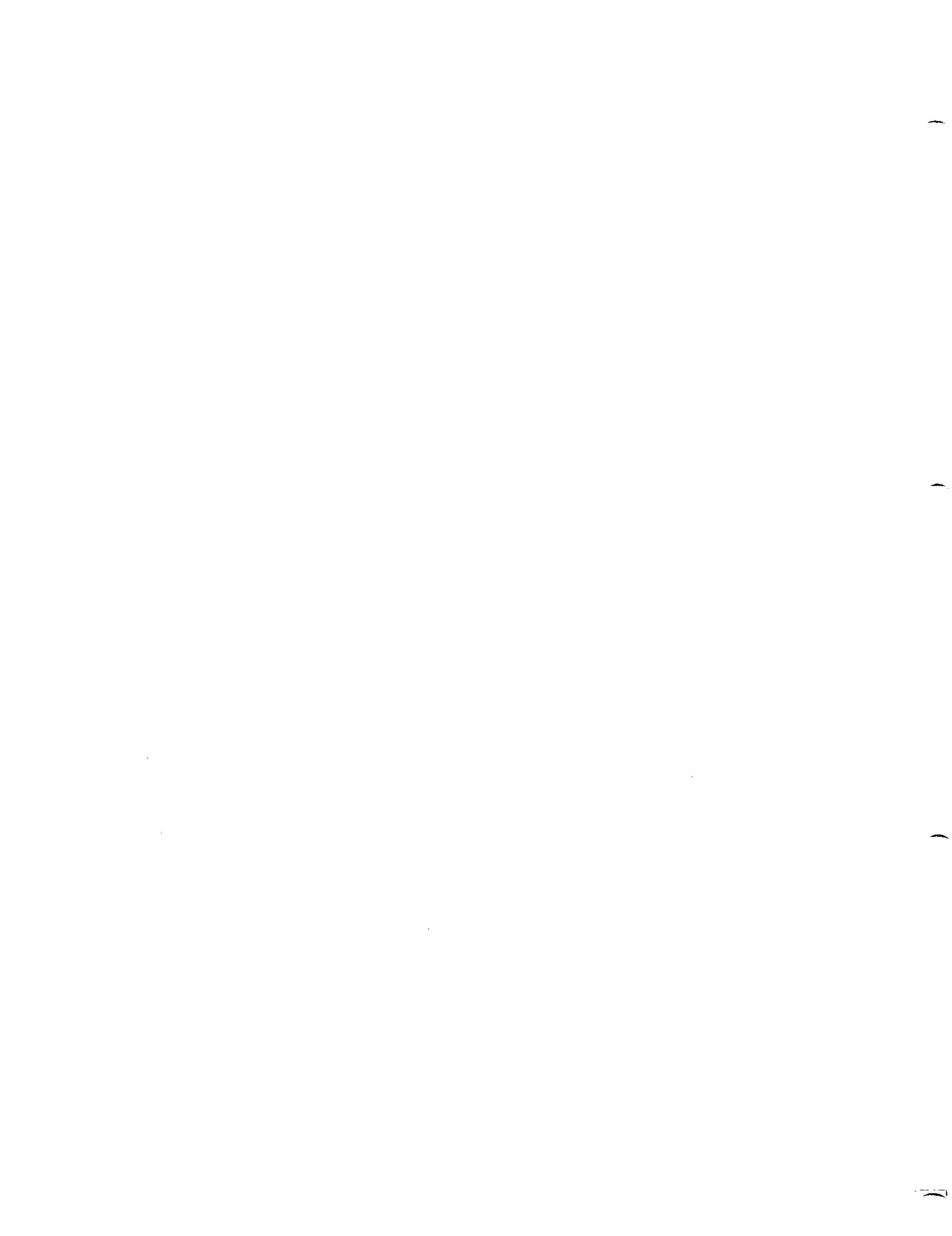
Start-up and Test, Local Control, Remote Control, Function of Controls and Indicators

MAINTENANCE AND TROUBLESHOOTING

Maintenance, Troubleshooting, Visual Examination, Troubleshooting Table, Replacement of Modules

APPENDIX

- 1: Settings
- 2: External Interfaces



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VHF TRANSCEIVER 25 W • XU 221

User Manual • Application

1. Characteristics

1.1 Application, Design and Functioning

1.1.1 Application

The VHF Transceiver 25 W XU 221 of the R&S equipment series 200 permits the transmission and reception of amplitude-modulated radio signals in the frequency range of 118 to 144 MHz.

This single-channel transceiver is mainly used for ground-to-board and ground-to-ground radio communication in air traffic control and organization.

The 19" Adapter KR 201 accommodates a complete VHF transceiver (see Fig. 1.2). In conjunction with Interface 2 GI 201, the transmitter allows to be used in switchover operation together with a second VHF transceiver (100% standby switchover).

The transceiver is suitable for both local and remote control. That is, it can be controlled from the front panel (local control) as well as via various remote-control interfaces (remote control). Remote control can be performed in three different ways:

- via single lines (parallel operation)
- serial REM BUS (remote-control bus-system especially devised for the radio equipment series 200)
- via control in the band of wanted AF signals (option inband interface), e.g. via telephone lines.

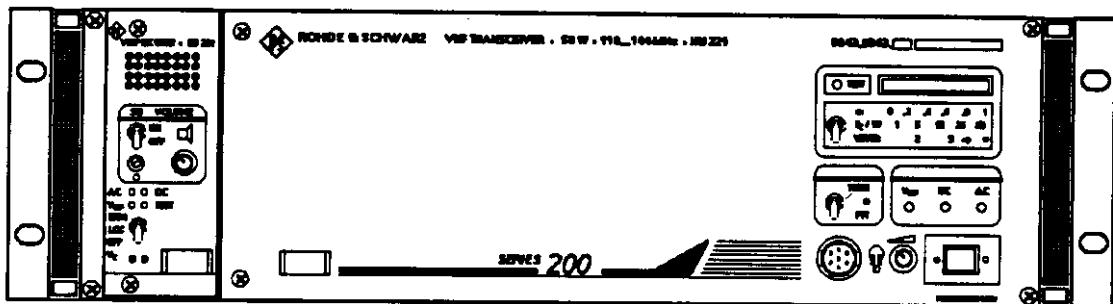


Fig. 1.1 VHF Transceiver 25 W XU 221

VHF TRANSCEIVER 25 W • XU 221

User Manual • Design

1.1.2 Design

(See Fig. 1.2)

The transceiver consists of several modules accommodated in a 19" frame, namely Adapter KR 201.

Due to the usage of flexible cables with clearly identified connectors the individual modules can be easily exchanged, thus also allowing short times to repair.

The VHF Amplifier VU 221V and the heat sink, both located on the rear, form a unit which can be folded out to the rear.

On the front left there is the VHF Rx Unit EU 231, plugged in from the front panel. All other modules are accessible from the top once the cover has been removed.

On the right-hand side of the VHF Rx unit the Modulator GM 201 as well as the VHF Synthesizer GF 201V are installed.

Again on the right-hand side space is provided for installation of a customer-specific option and Circulator Set GD 200V.

Directly on the rear of the front panel the display board is installed and behind the display board there is the regulator (DC supply).

Behind the regulator on the right-hand side panel, the optional Power Supply IN 251A is located.

The following list sums up the transceiver modules:

- Adapter KR 201
- Modulator GM 201
- Modulator Extension GM 201C8
- VHF Synthesizer GF 201V
- VHF Amplifier VU 221V
- VHF Rx Unit EU 231
- Interface 1 GI 201X
- VHF Lowpass Filter GH 200V (models 42 to 47 only)

In addition, Adapter KR 201 is suitable to accommodate the following optional modules:

- Power Supply IN 251A
- Interface 2 GI 201
- Inband Interface GM 211
- VHF Circulator Set GD 200V

For future applications, further optional modules may be installed in the adapter.

For use as a desktop unit, the transceiver may be housed in the optional

- Cabinet KK 251.

VHF TRANSCEIVER 25 W • XU 221

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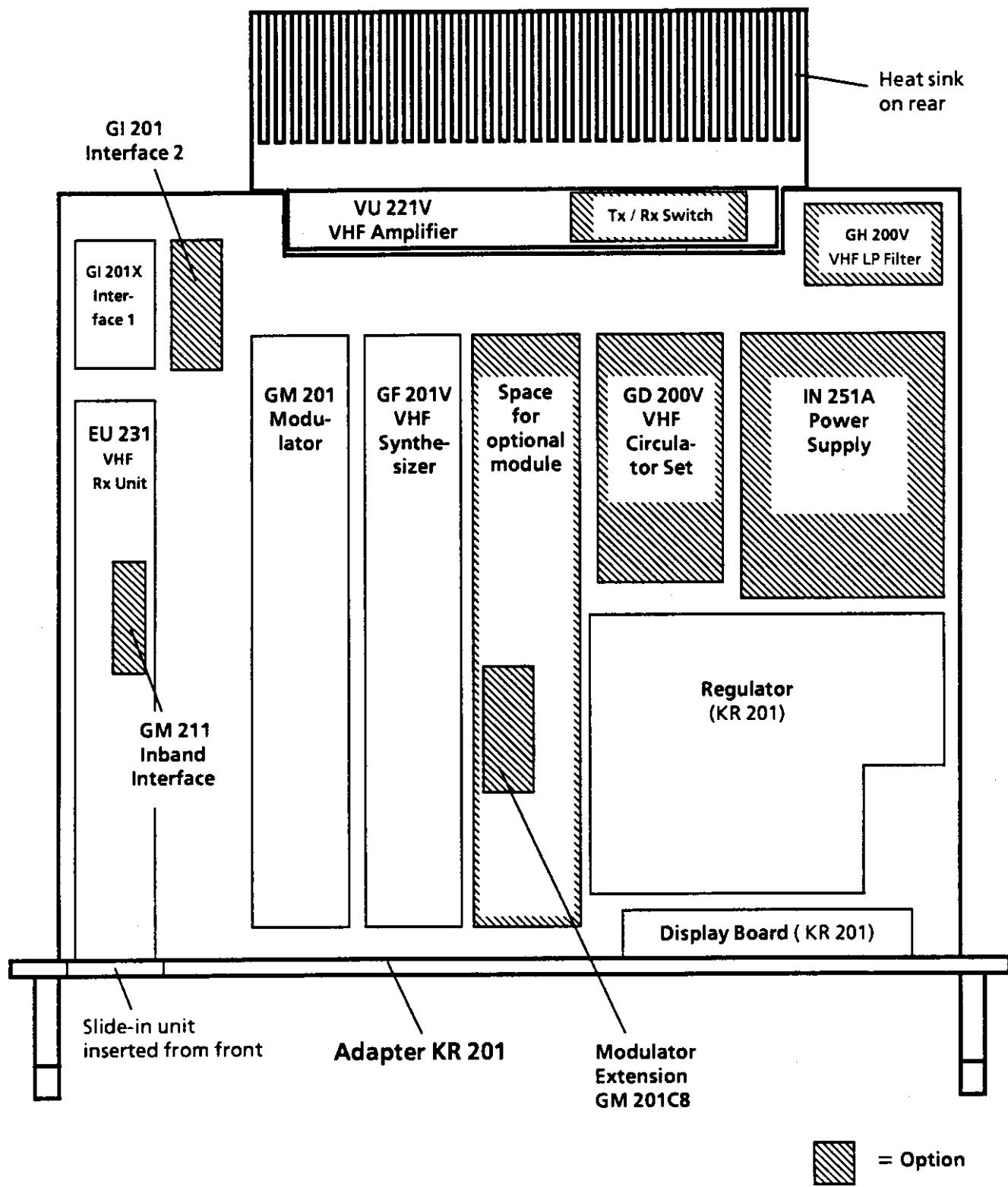


Fig. 1.2 VHF Transceiver 25 W XU 221, Design

1.1.3 Functioning

(See Fig. 1.3)

Receive operation

In receive operation (i.e., when no PTT key is pressed) the VHF receive signal is fed from the VHF antenna to the optional Tx / Rx diode switch.

Further the receive signal is routed to the VHF Rx Unit EU 231. Here it is applied to a three-circuit bandpass filter and further to the input of a Schottky diode ring mixer.

The oscillator frequency, higher by 10.7 MHz than the receive frequency, is generated by the synthesizer contained in the Rx unit. The first intermediate frequency of 10.7 MHz is routed via two crystal filters with decoupler stages to the second mixer.

Here the 10.7-MHz IF signal is fed to a ring mixer to be converted to the second intermediate frequency of 1.3 MHz. The crystal oscillator generates the required mixer signal. The 1.3-MHz IF signal is applied to a bandpass filter. Subsequently it is routed to an amplifier stage with automatic gain control (AGC). After demodulation it is subjected to combined signal-to-noise / carrier squelch evaluation. The AF signal is amplified and, having passed through an AF bandpass filter, is routed via an AF switchover circuit to the line output (600 Ω) and the loudspeaker on the front panel.

Transmit operation

In transmit operation (i.e., when the PTT key is being pressed) the AF signals are routed from a microphone or from the line input to the Modulator GM 201. The modulator carries out all control and monitoring functions, such as power control and conditioning of signals for the display board.

Via the modulation control circuit the AF modulation signal is fed to the input of the VHF Amplifier VU 221V. This amplifier module is of broadband design and is not tuned. It consists of a two-stage pre-amplifier, a two-stage driver amplifier as well as a push-pull output stage.

As an option a VHF Circulator Set GD 200V may be installed (in the factory) for better suppression of adjacent-channel interferences. In order to suppress the multiples of the transmit

frequency a harmonics filter is integrated. A directional coupler supplies analog voltages for evaluation of the forward power, VSWR, and modulation depth. These values are fed to the modulator and the interfaces.

For further reduction of unwanted emissions acc. to BZT-S standard FTZ 17TR2013 the transceiver is also available with integrated VHF Lowpass Filter GH 200V (Models 42 to 47).

The carrier frequency for the VHF amplifier is generated in the VHF Synthesizer GF 201V. Three voltage-controlled oscillators (VCOs) generate the frequency which is stabilized in a phase-locked loop. A crystal oscillator generates the reference frequency of 10 MHz. Via a serial bus, a microprocessor programs, controls and monitors the synthesizer IC which operates in the dual-modulus mode (7-bit A-divider / 12-bit N-divider).

A programmable divider is programmed with the frequency information in such a way that it divides the VCO output frequency to approx. 2.5 kHz (for 8.33-kHz frequency spacing to 4.16 kHz). In the discriminator the phase deviation is used to generate a control voltage tuning the VCO and keeping it in the locked state.

Via Interface 1 GI 201X control units can be connected which allow remote control of the system with the aid of the serial REM BUS.

The optional Power Supply IN 251A transforms the AC mains voltage to a lower value which is then rectified. In the case of a mains power failure a relay switches over to DC supply.

The regulator (DC supply - belonging to Adapter KR 201) filters the DC voltage and contains several DC voltage regulators and a DC / DC converter for generation of the various supply voltages.

The display board (belonging to Adapter KR 201) comprises an LED bargraph indicator as well as various control and display elements.

The optional Inband Interface GM 211 permits the transceiver to be remotely controlled via the AF line.

The optional Interface 2 GI 201 is used for control of external power amplifiers and for automatic main / standby switchover.

VHF TRANSCEIVER 25 W • XU 221

User Manual • Block Diagram

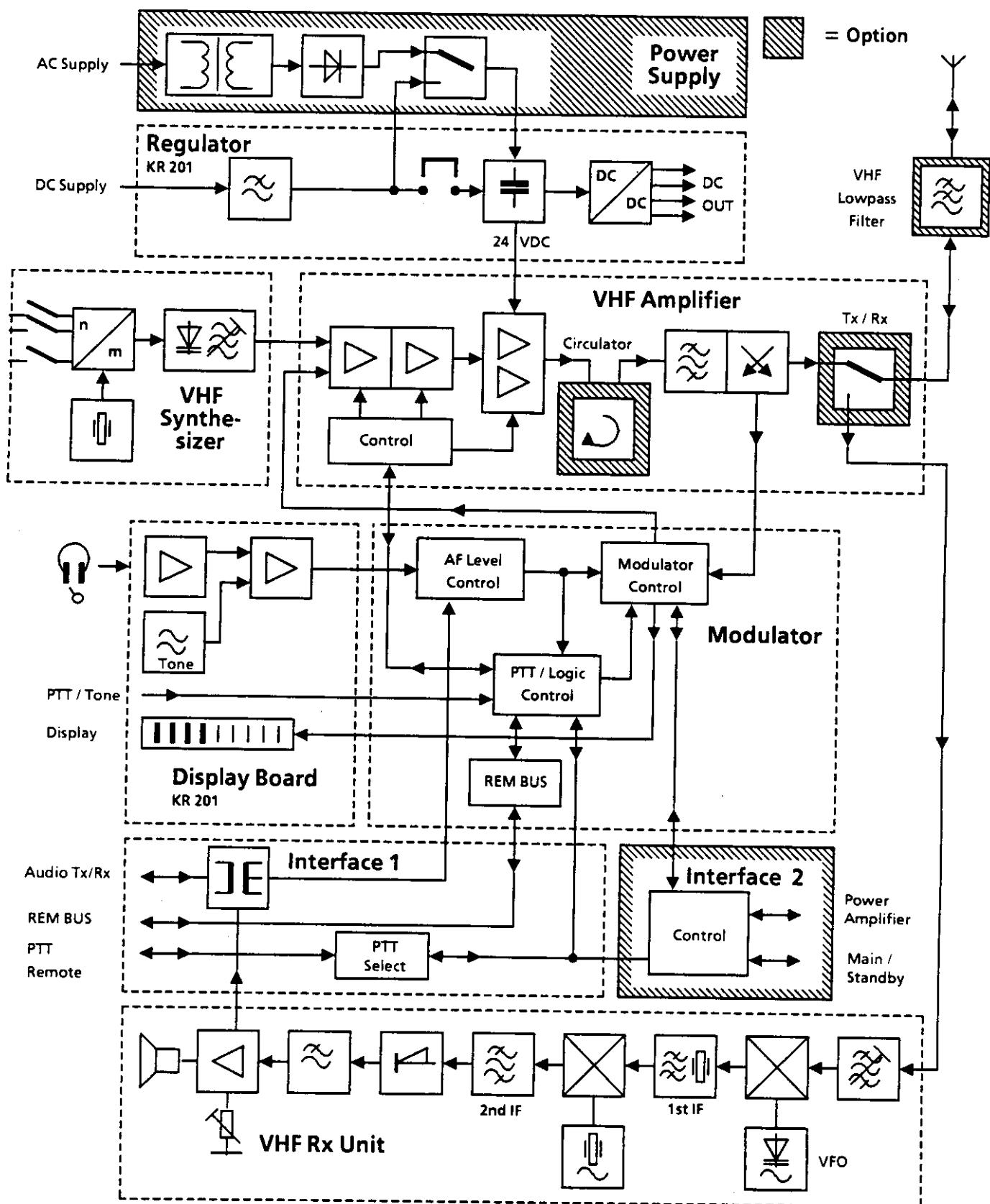


Fig. 1.3 VHF Transceiver 25 W XU 221, Block Diagram

1.2 Design and Functioning of Modules

1.2.1 Modulator GM 201

Application

The Modulator GM 201 is part of the R&S equipment series 200 and is used in VHF Transceiver XU 221 in the frequency range of 118 to 144 MHz.

Design

Modulator GM 201 is designed as a 35 mm wide module to be installed in the adapter (accessible after removal of the top cover).

All functional groups are accommodated on a printed circuit board fitted with screening walls and two screening covers.

On the printed circuit board five ribbon-cable connectors are located for connection of the interface 1, VHF synthesizer, VHF amplifier, regulator and display board.

Modulator GM 201 is inserted and installed from the top into Adapter KR 201 next to VHF Rx Unit EU 231 and fixed with two screws. The ribbon cables are plugged in on the top thus establishing the electrical connection between Modulator GM 201 and the other modules.

Functioning

(See Fig. 1.4)

The AF signal is fed in from the microphone (or a line input) via the display board or an interface.

The pre-amplification is carried out either with a fixed gain or by automatic level control. Next come an AF bandpass filter (0.3 to 3.4 kHz) and a limiting stage. For operation with a frequency spacing of 8.33 kHz, the optional Modulator Extension GM 201C8 is connected between the ALC section and the bandpass filter.

Having passed through these stages, the signal is fed to the input of a reduction stage. This amplifier stage reduces the power as a function of various control signals. In addition, the DC signal parts for the modulation signal are added up.

Subsequently, the power is switched over to either full power or partial power, depending on the setting of the internal variable controls.

The following integrator stage compares the nominal and actual values and compensates any deviations.

A voltage monitoring circuit prevents the power in the absence of the negative supply voltage from being switched to full load. Via an emitter follower, the modulation signal is routed to the VHF amplifier.

In addition, control and monitoring circuits for switch-on and off, PTT control and power indication (VSWR, modulation depth) are available. A circuit evaluating the serial remote control process via REM BUS completes the circuitry.

VHF TRANSCEIVER 25 W • XU 221

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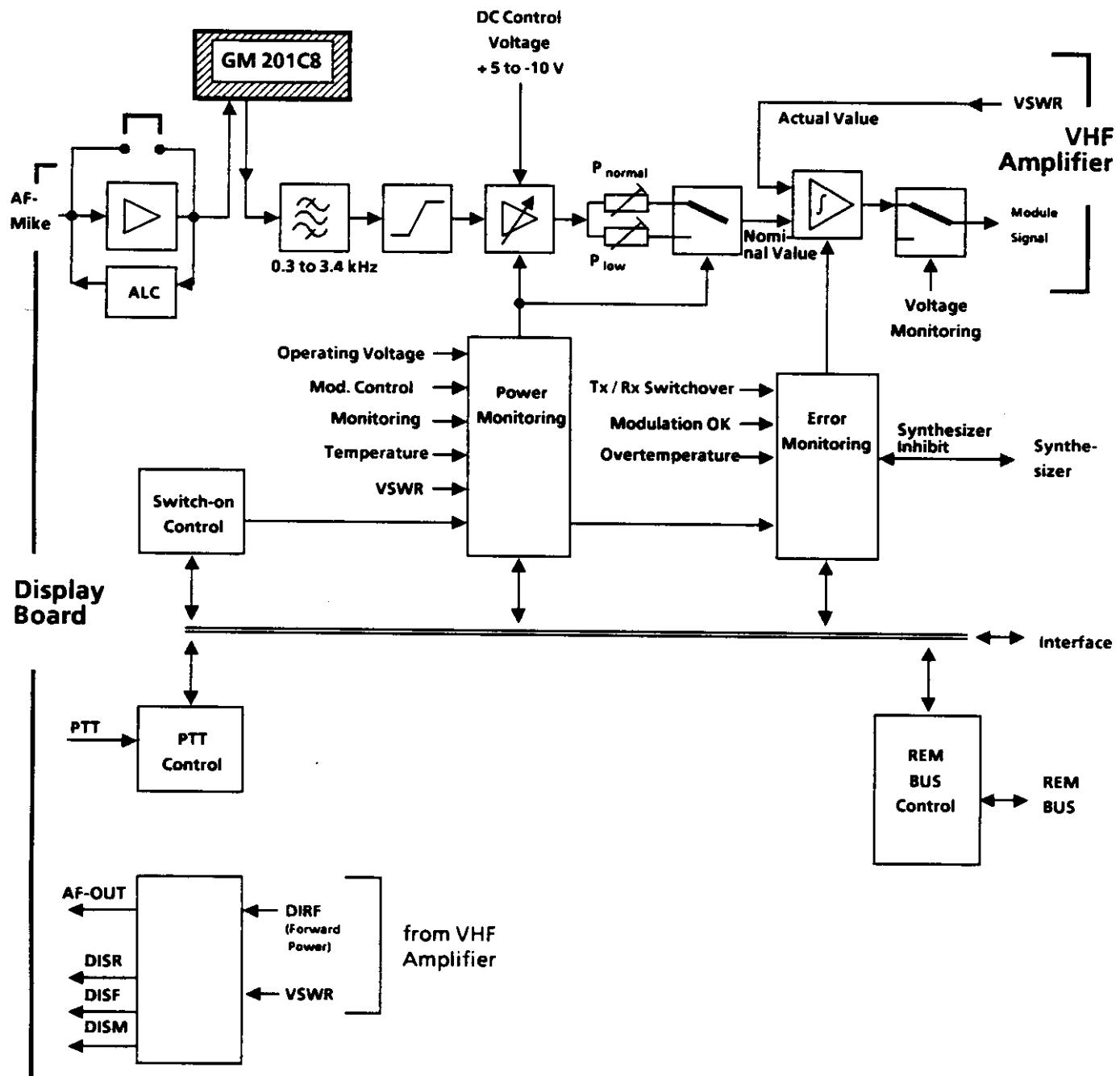


Fig. 1.4 Modulator GM 201, Block Diagram

1.2.2**Modulator Extension GM 201C8 (Option)**

This module is installed in Models 26, 27, 46 and 47.

Application

The optional Modulator Extension GM 201C8 is a filter module, which allows the Modulator GM 201 to be used in transmitters or transceivers of the R&S equipment series 200 with a frequency spacing of 8.33 kHz.

Design

All functional groups of Modulator Extension GM 201C8 are accommodated on a printed circuit board measuring 90 x 112 mm, which is screened and mounted on a support located at the space provided for options in the transmitter or transceiver (see Fig. 1.2).

At the top of the module there are two 26-way ribbon cable connectors. Via its connector X1, the modulator extension is connected to the connector X35 at the ribbon cable between Modulator GM 201 and the regulator of Adapter KR 201.

Functioning

(See Fig. 1.5)

The filter which basically forms this module is connected into the AF signal path of Modulator GM 201 between the ALC section and the standard filter (0.3 to 3.4 kHz).

AF path:

The AF input signal AF-OPT-2 is routed via a lowpass filter (anti-aliasing filter LP1) and the variable switched capacitance filter LP2 to clock filter LP3 and finally to output AF-OPT-3.

The lowpass filters LP1 and LP3 form a 4th-order Butterworth lowpass filter the cutoff frequency of which is $f_{cut} = 4.4$ kHz. The lowpass filter LP2 is a switched capacitance filter with firmly set Cauer Chebyshev characteristics of the 8th order. The cutoff frequency of this filter is clock-dependent, it is defined as clock frequency divided by 100.

Clock generation:

The crystal oscillator feeds a 3.57-MHz frequency to the programmable divider the division factor of which can be switched via coding switch S30. In this application the division factors 9 to 15 are used. The output frequency can be measured at test connector X30 (238 to 400 kHz). The digital control signal NB/*WB permits the filter to be switched to the highest cutoff frequency, independently of the coding switch.

Power supply:

The module is supplied by Modulator GM 201 with a + 10-VDC voltage. The voltage regulator consisting of N1, Zener diode V16 and series transistor V10 supplies all functional groups except N10.

VHF TRANSCEIVER 25 W • XU 221

User Manual • Design and Functioning of Modules

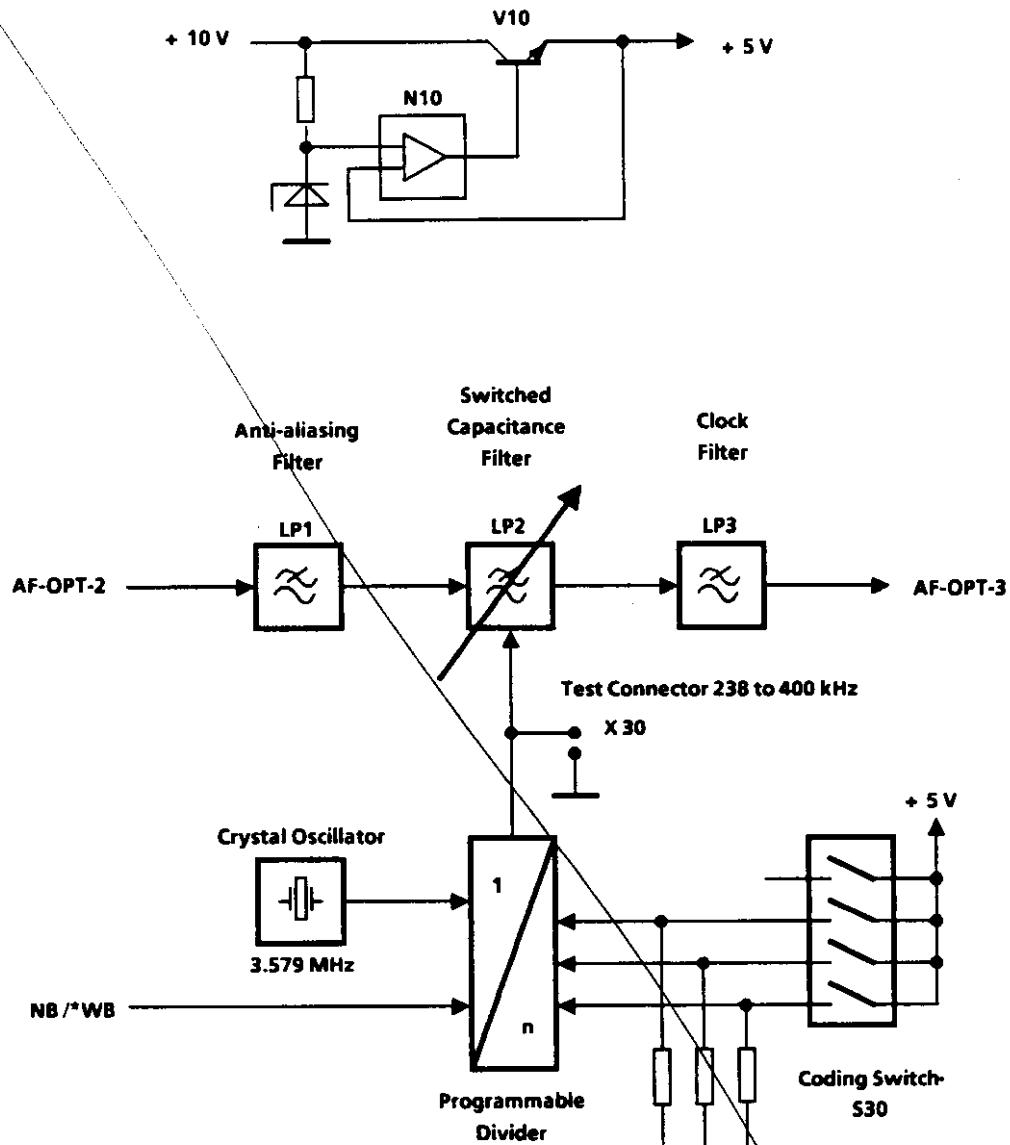


Fig. 1.5 Modulator Extension GM 201C8 (Option), Block Diagram

VHF TRANSCEIVER 25 W • XU 221

User Manual • Design and Functioning of Modules

1.2.3 VHF Synthesizer GF 201V

Application

The VHF Synthesizer GF 201V is part of the R&S equipment series 200 and is used in VHF Transceiver XU 221 for generating the oscillator frequencies of 118 to 144 MHz with variable frequency spacing (e.g. 8.33 kHz).

Design

VHF Synthesizer GF 201V is designed as a 25 mm wide module to be installed in the adapter on the right-hand side of Modulator GM 201 (see Fig. 1.2).

All functional groups of the synthesizer are accommodated on a single printed circuit board which is shielded on both sides.

On the upper side of the module there are a coaxial connector (connection of the VHF amplifier), a 10-way ribbon cable (X43, connection to the modulator with voltage supply) and DIL switches for setting the transmit frequency. In addition, a trimmer for alignment of the OCXO (with Model 23) for tuning the 10-MHz reference is available.

Functioning

(See Fig. 1.6)

A microprocessor programs, controls and monitors, via a serial three-wire bus, the synthesizer IC which operates in the dual-modulus mode (7-bit A / 12-bit N-divider).

The reference frequency is generated by a temperature-compensated 10-MHz crystal oscillator (TCXO) and divided by the reference divider of the IC.

With Model 23 a temperature-controlled crystal oven (OCXO) is used as the reference source.

Three voltage-controlled oscillators (VCOs) cover the entire frequency range. The VCO switched on at the time generates the transmit frequency. The latter is stabilized in a phase-locked loop (PLL). A programmable frequency divider is programmed with the frequency information in such a way that it divides the VCO output frequency to the 2.5-kHz reference (to 4.16 kHz for frequency spacing of 8.33 kHz).

This frequency is compared by a phase discriminator in the synthesizer IC with the reference frequency. From the frequency deviation a control voltage is generated which, via an integrator stage and two filter stages, tunes the VCO to the transmit frequency until the frequencies are identical and the signal is locked. In the discriminator the phase deviation is also used to form a control voltage keeping the VCO in the locked state. The locked state of the phase discriminator is signalled to the microprocessor by the signal UNLOCK.

The programmable divider consists of a variable pre-divider dividing the VCO signal by 64 or 65, an N divider and an A divider, both contained in the synthesizer IC, which also controls the pre-divider.

By means of the DIL switches controlled by the microprocessor, the division factor of both N divider and A divider is set. The output pulses are subsequently evaluated in the phase discriminator in the synthesizer IC for phase and frequency deviation.

An EPROM stores the program for the microprocessor. The latter disables the VCO in the case of impermissible values and emits an error signal.

In reception the VCO frequency is shifted by 50 kHz for the purpose of noise suppression.

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X43

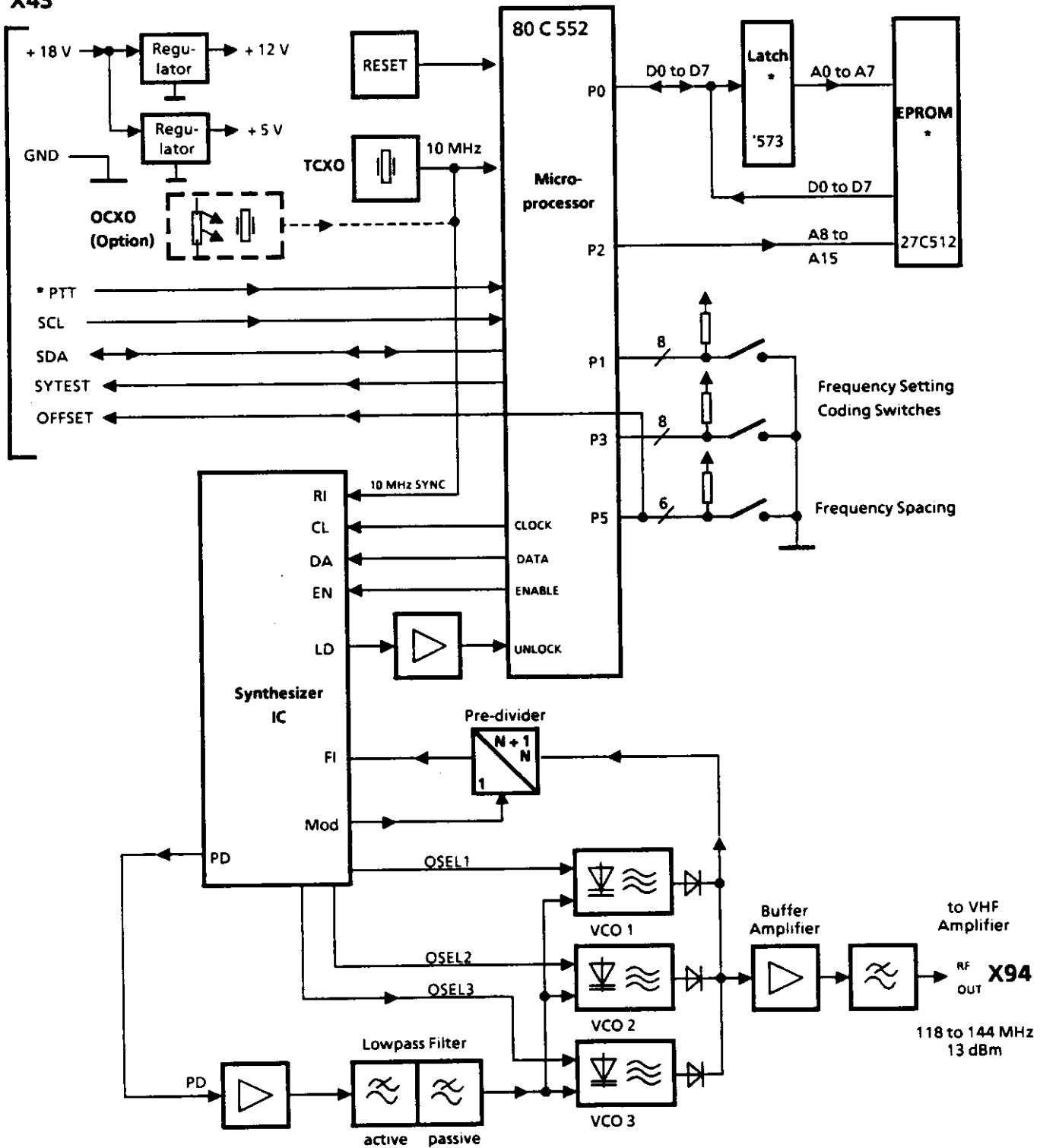


Fig. 1.6 VHF Synthesizer GF 201V, Block Diagram

1.2.4 VHF Amplifier VU 221V

Application

The VHF Amplifier VU 221V is part of the R&S equipment series 200. In the VHF Transceiver XU 221 it is used as 25-W amplifier.

In conjunction with a VHF synthesizer (e.g. GF 201V) the VHF amplifier is employed for amplitude modulation in the range of 118 to 144 MHz.

Design

VHF Amplifier VU 221V and a heat sink with cooling fins located on the rear of the amplifier together form a constructional unit. This unit is mounted to the equipment rear. To the inner side of the heat sink the shielded amplifier module is fixed.

For service and setting purposes the module can be folded out to the rear. In order to do so, there is no need to disconnect any cables. In the fixing strap provision has been made for this in the form of a mechanical guiding facility.

All electrical connections to the other modules are established via internal cables, a ribbon cable and two RF coaxial cables (plus two RF connections for the optional circulator set).

Functioning

(See Fig. 1.7)

VHF Amplifier VU 221V amplifies the VHF signal coming from Synthesizer GF 201V with a power of 20 mW to a carrier power of 25 W (AM).

The amplifier module is of broadband design and is not tuned. It consists of a two-stage pre-amplifier, a two-stage driver amplifier, a push-pull output stage, a harmonics filter as well as a directional coupler.

As an option, a Circulator Set GD 200V may be installed (in the factory) for better suppression of adjacent-channel interferences.

The harmonics filter suppresses the multiples of the transmit frequency. The directional coupler supplies analog voltages for evaluating the VSWR, modulation depth and power control. These values are fed to the modulator, the interfaces and the display board, followed by the optional PIN diode Tx / Rx switch (for Model 23).

The working points of the pre-stage, the driver stage and the push-pull output stage are set by means of quiescent-current regulators (four variable adjusting elements).

The output signals of the directional coupler are amplified by amplifier stages and decoupled (internally adjustable with three variable control elements).

Amplitude modulation is carried out by way of collector voltage regulation in the pre-stages. Here the AF voltage obtained by demodulation in the directional coupler is compared with a nominal value in the modulator and adjusted. The modulator module carries out the required control and monitoring functions.

The power of the VHF amplifier is reduced for:

- Under- or overvoltage
- VSWR > 2
- Overtemperature

The power of the VHF amplifier is cut out for:

- Failure of control loop
- Failure in Tx / Rx diode switch
- Overvoltage in power transistors.

VHF TRANSCEIVER 25 W • XU 221

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 = Option

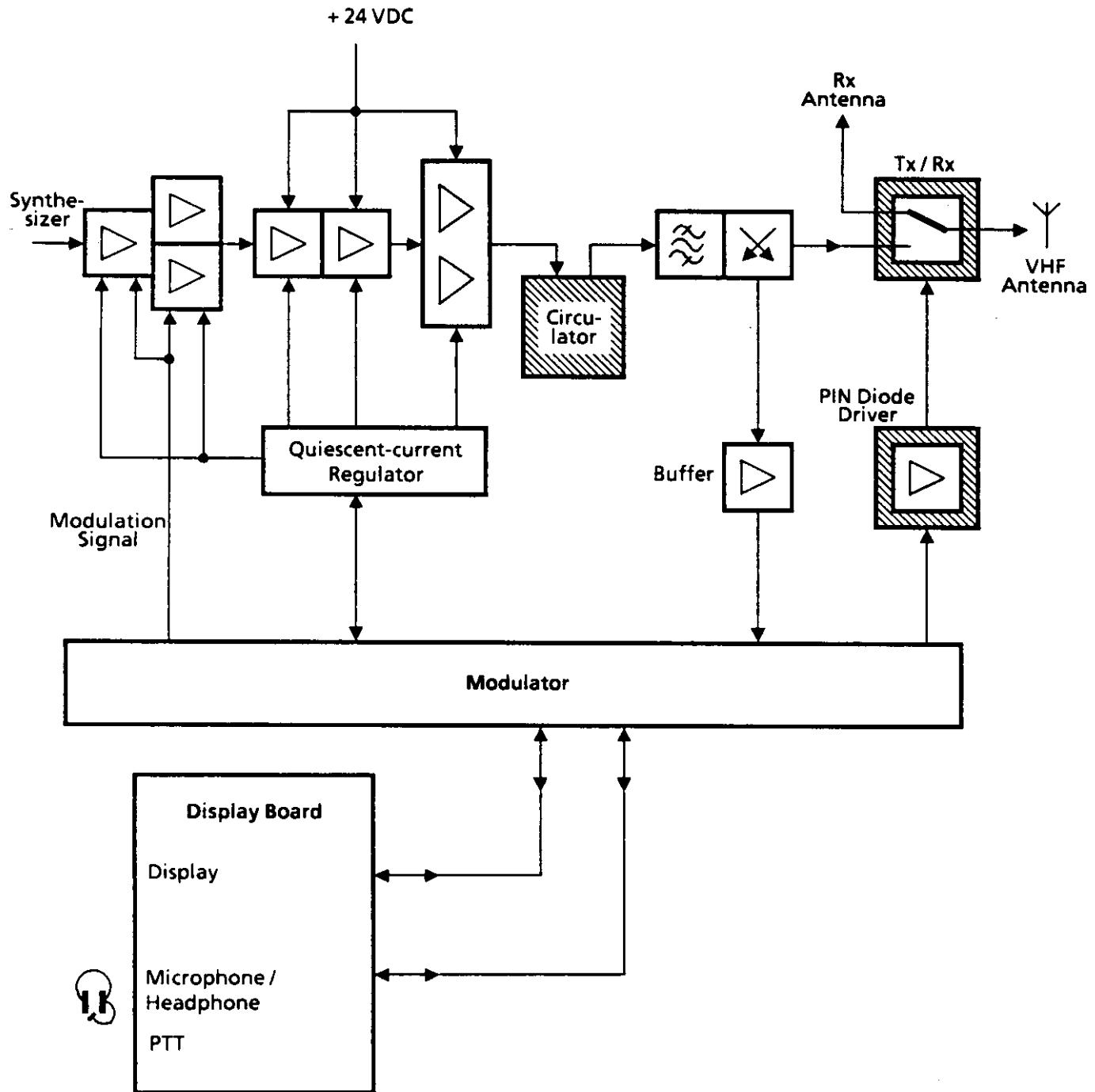


Fig. 1.7 VHF Amplifier VU 221V, Block Diagram

VHF TRANSCEIVER 25 W • XU 221

User Manual • Design and Functioning of Modules

1.2.5 VHF Rx Unit EU 231

Application

The VHF Rx Unit EU 231 is used in receivers and transceivers of the R&S series 200.

Design

Rx Unit EU 231 is designed as a slide-in module. All functional groups are accommodated on a single PCB to which screens and two covers are fixed. On the front panel there are a loudspeaker and control elements.

Rx Unit EU 231 is connected to Power Supply IN 201A/D via plug-in connector strips. Thus the electrical connection between the Rx unit and the system periphery is established via the Power Supply IN 201A/D.

Functioning

(See Fig. 1.8)

RF Section

In the first control stage, the antenna signal is attenuated by the PIN diodes (depending on the signal strength) and routed to the first bandpass filter. The signal then passes through the second control stage and is amplified. Having passed the second bandpass filter, the signal is converted in the mixer stage into the first intermediate frequency of 10.7 MHz.

Synthesizer

A microprocessor programs, controls and monitors the synthesizer via a serial bus. The synthesizer consists of a prescaler, a synthesizer IC, a VCO and a phase-locked loop (PLL). The reference frequency is obtained from a temperature-compensated 10-MHz crystal oscillator (TCXO). With Mod. 23, an oven-controlled crystal oscillator is used as the reference source. By means of coding switches the frequency is set. The locked state of the PLL-VCO is indicated by a green LED.

IF Section

The 10.7-MHz IF signal from the mixer passes through several amplifier stages and two crystal filters. The second mixer converts the signal to the intermediate frequency of 1.3 MHz, and this signal is fed via the following filter to the amplifier stage and the demodulator.

In addition, an AGC control voltage is generated. From the first IF, a logarithmic amplifier generates a signal which can be employed for evaluating the receive-signal quality and driving the PIN diodes of the RF section.

AF Section

The AF signal is preamplified and noise can be suppressed by the noise blower. Subsequently the AF signal is fed to the AF AGC control circuit and the filter board. Via various AF switches the output is regulated. The volume of the loudspeaker is adjusted with a volume control. The S/N evaluation circuit generates the squelch criterion.

AF Switchover Section (MAIN / STBY)

In the automatic switchover mode with two correlated receivers the AF switchover circuit determines that the receiver with the better signal quality becomes main receiver, whereas the other receiver operates as standby unit.

Sum Test - CBIT

Via the sum test the entire receiver is continuously monitored (continuous built-in test). The signals from the oscillators, the synthesizer, the IF stages and the remote control are combined to form the sum signal. The operating voltages are monitored in just the same way. A test plug simplifies fault detection.

Remote Control

The serial signals of the REM BUS are stored and converted into parallel signals. The logic circuit combines the control signals for the receiver. In the other direction, status signals of the receiver are converted into serial data telegrams via the REM BUS. At the connectors CONTROL and AF the control and status signals are available and permit remote control via parallel lines. The optional inband interface converts data telegrams via control tones (in the AF voice channel) into parallel control signals. In the other direction, status signals of the receiver are converted into control tones.

Power Supply

The input voltage of nominally 24 VDC is converted by a DC/DC converter with regulator to +12, +5, and -5 VDC.

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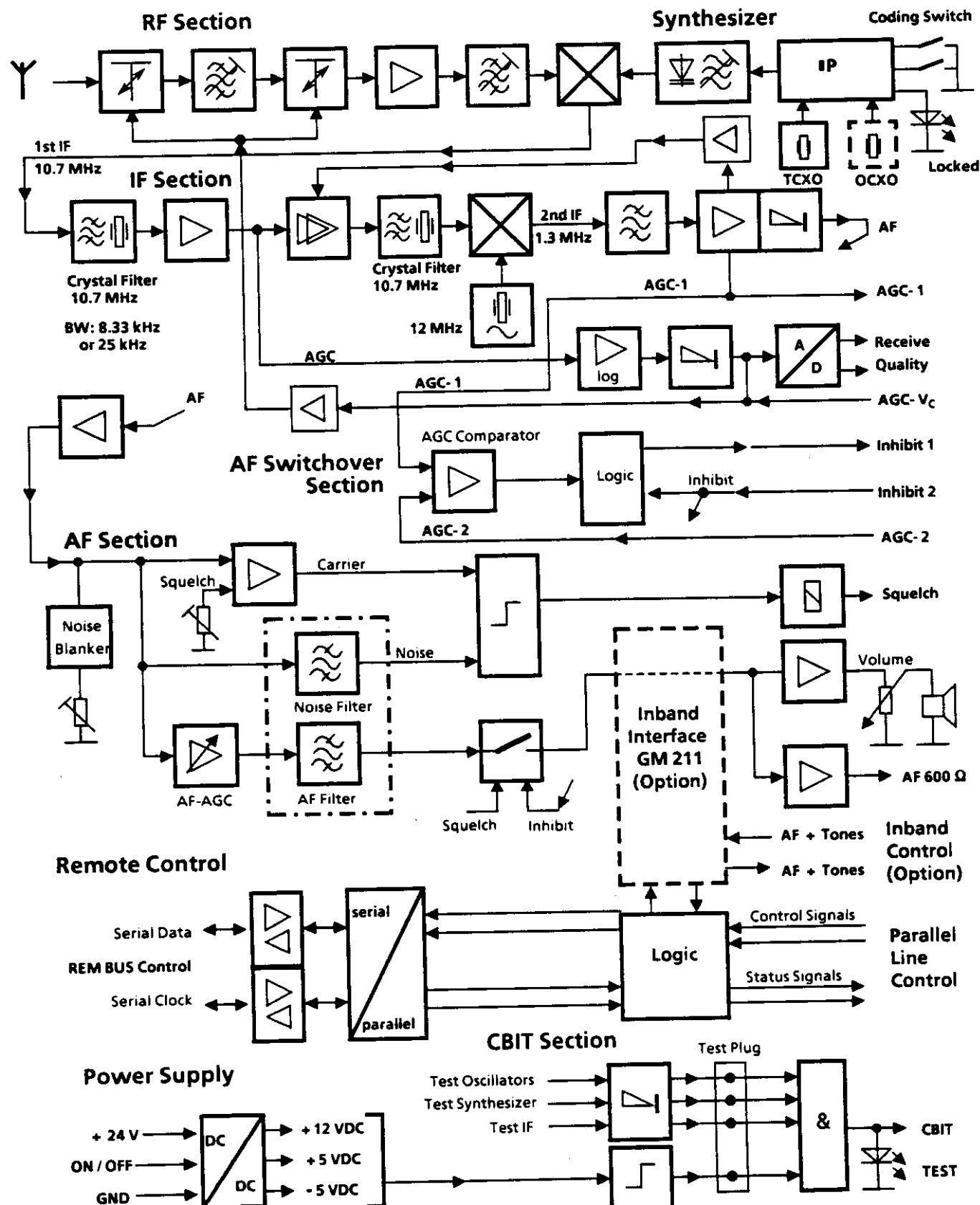


Fig. 1.8 VHF Rx Unit EU 231, Block Diagram

1.2.6 Adapter KR 201

The Adapter KR 201 is part of the R&S equipment series 200 and is used to accommodate the modules of VHF Transceiver XU 221.

The adapter consists of the mechanical parts of the 19" frame, the regulator plus associated cooling and mounting plate and the display board fixed to the front panel of the adapter.

1.2.6.1 Regulator

Design

The regulator is arranged on a U-shaped cooling and mounting plate of approx. 250 x 115 mm. Onto this plate the printed circuit board with the voltage regulators and switching and control transistors (DC board) is mounted. The power rectifier V1 and the electrolytic capacitor C4 are located outside the printed circuit board on the mounting plate. The temperature switch (S1) monitoring the temperature of the U-shaped cooling plate is fixed to the mounting plate by means of screws.

Functioning

(See Fig. 1.9)

The DC voltage (DC IN, 22 to 31 VDC) is routed from the input filter to the rectifier V1. The latter secures the input against polarity confusion and together with the optional Power Supply IN 251A ensures automatic switchover in the

case of a mains power failure (AC / DC switch-over); in addition, a connected battery is protected during mains operation.

Electrolytic capacitor C4 is an energy store and serves as filter capacitor for both DC and AC operation.

Directly to electrolytic capacitor C4, the voltage supply for the VHF amplifier (24 VDC, 10 A), and via fuse F1 the voltage supply for the Rx unit (-24 V, 1 A) are connected.

Via fuse F2, the integrated voltage regulator N5 (8-VDC output) for generating the control voltage for switchover operation is connected.

Via fuse F2 and the FET switching stage V3 the voltage regulators are connected to the input voltage. By means of a control voltage (switch-on control) the operating voltages of the transmitter can be switched. In the case that the mounting plate has heated up excessively, the thermoswitch cuts out, in order to prevent any damage due to overheating.

The integrated voltage regulators N2, N3 and N4 produce the operating voltages of + 5 V, + 10 V and + 18 V.

Derived from the operating voltage + 18 V, the negative voltage is generated in an integrated voltage converter (N6 = switched-capacitor voltage converter). Subsequently, the voltage passes through a voltage-regulation stage with series transistor and stabilizing Zener diode.

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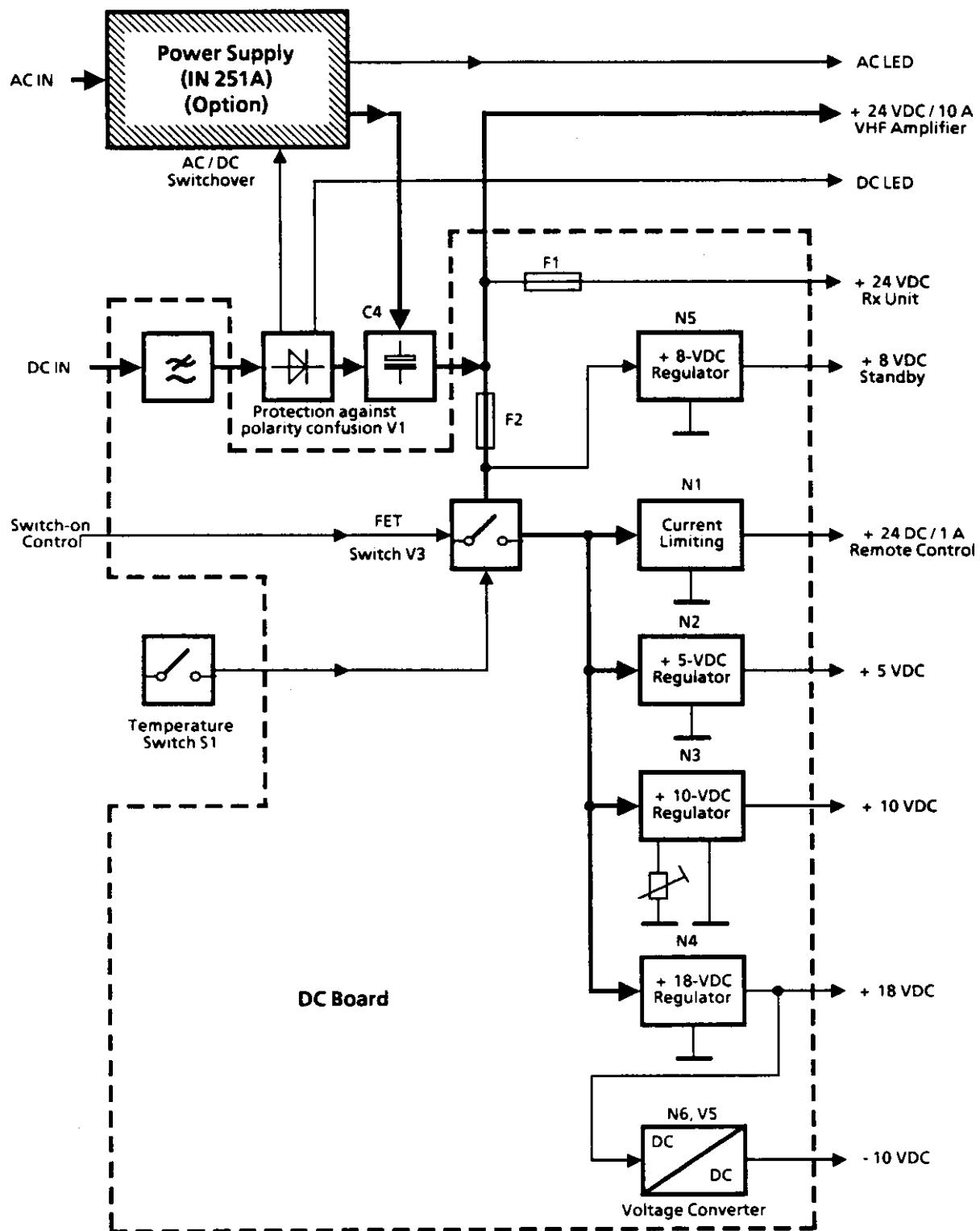


Fig. 1.9 Regulator, Block Diagram

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1.2.6.2 Display Board

Design

The display board is designed as a module measuring approx. 100 x 110 mm to be installed into the adapter. It is mounted on the right-hand side directly behind the front panel of the adapter frame thus permitting the display and control elements to be seen and operated from the front. The display board is connected via a ribbon cable and connector X13 to the modulator. The headset connector X5 is located on the front panel.

The display board is designed in the form of a printed circuit board which is partly shielded. The shielded part accommodates the EMC filters for connector X5.

Functioning

(See Fig. 1.10)

In the display section, the LED bargraph indicator is driven by the three analog signals which come from the directional coupler and are conditioned in the modulator. The analog signal DISR is equivalent to the reflected power, the signal DISF to the forward power and the signal DISM to the modulation deviation.

By means of switch S2 the measuring range of the LED bargraph indicator is selected. Via a digital switching logic and multiple demultiplexers the relevant analog signals are switched through to the divider circuit and the

respective factors are set. The resulting analog voltage is digitized in the following driver circuit and the driver current for the LED column (20 segments) is switched through.

The display board also contains four light-emitting diodes. Availability of the +5-VDC operating voltage is indicated by the green LED V_{OP} , supply with mains power is shown by the green LED AC and supply with battery power by the green LED DC. "All test signals in order" is indicated by the green LED TEST.

The AF section contains, in a shielded part of the printed circuit board, the EMC filters for the AF inputs and outputs for the headset and the PTT key (connector X5). The volume of the headphone output can be adjusted with a control element on the front panel.

The microphone input for dynamic microphones has an amplifier stage and an internal trimmer by way of which the level can be set.

The amplifier input of the microphone is also suited as line input (600- Ω impedance). The level at this input, too, can be adjusted by means of a control element.

For test purposes, a tone generator can be connected in circuit and its tone be used as modulation signal for the transmitter. The level of the Wien-bridge generator is kept constant by an automatic level-control circuit.

A sum amplifier decouples the signals and at the same time functions as compensating amplifier. Subsequently, the AF signal is switched through to the modulator.

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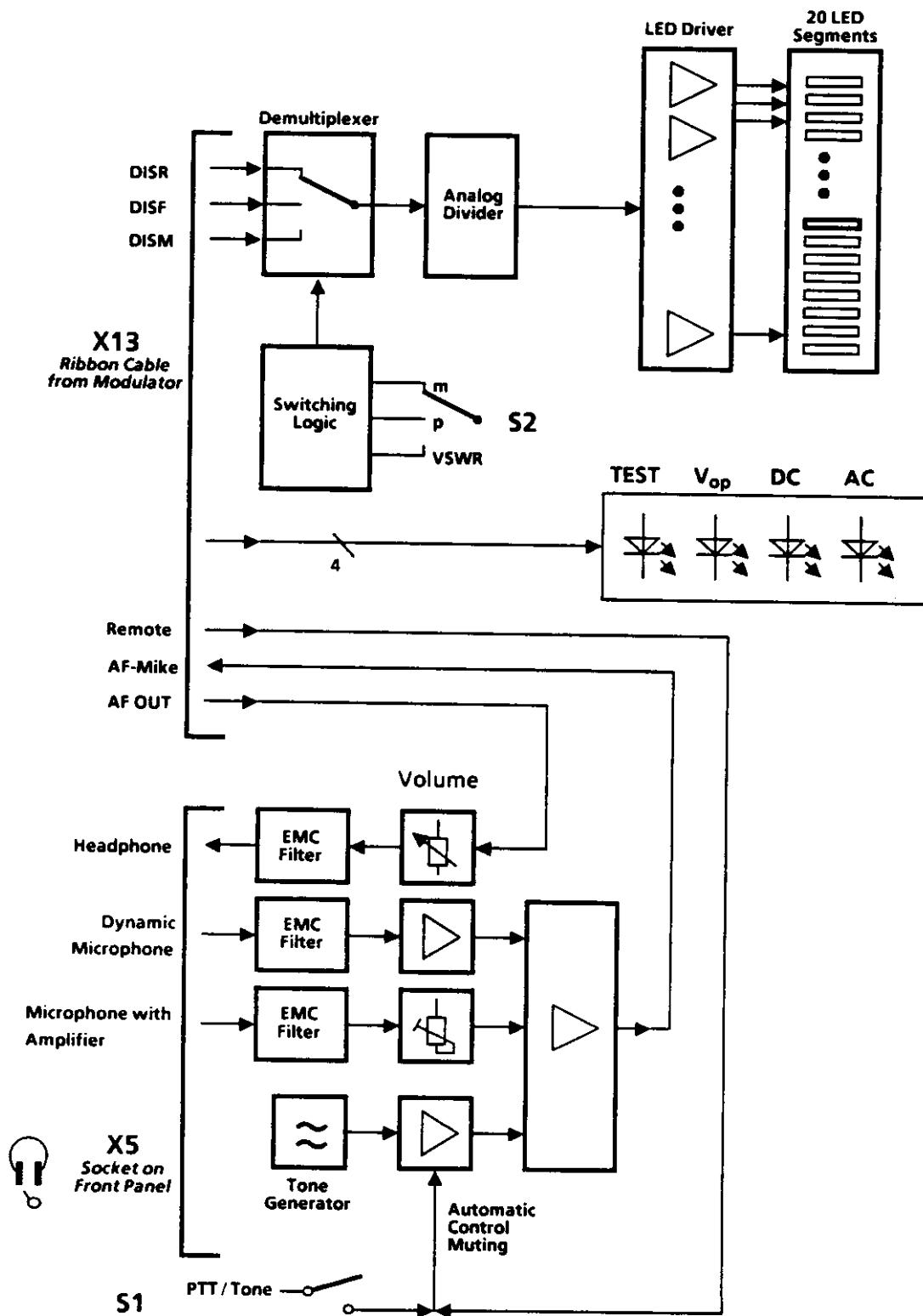


Fig. 1.10 Display Board, Block Diagram

1.2.7 Interface 1 GI 201X

Application

The Interface 1 GI 201X is part of the R&S equipment series 200 and is used in VHF Transceiver XU 221 as interface between the Rx unit, the modulator, the (optional) Interface 2 GI 201 and the external interfaces (REMOTE and REM BUS).

Design

Interface 1 GI 201X is designed as a 25 mm wide module which is installed from the top into the adapter while the cover is removed.

All functional groups of the interface are located on a single printed circuit board extending from the rear panel to connector X27 of the VHF Rx unit. The Rx unit is inserted from the front into the adapter.

Following installation, the connectors X8 (REM BUS) and X9 (REMOTE) extend through the rectangular openings in the rear panel, thus permitting connection even if the equipment covers are fixed.

The ribbon cable X73 firmly soldered to the interface PCB establishes the connection to the modulator. For this it has to be connected to the modulator once the housing cover has been removed. To connector X78 the optional interface 2 can be connected.

Between connectors X8 and X9 on the rear, a potentiometer for AF level adjustment (using a screw driver) is accessible through a small drilling.

Functioning

(See Fig. 1.11)

Interface 1 GI 201X basically performs three functions: establishing the connection to external interfaces, level matching and through-

connection of AF lines as well as through-connection and amplification of various digital control signals.

Interface 1 switches the supply voltages through to the VHF Rx unit and the different interface modules.

The external modulation AF (e.g. from a connected control unit) is fed from connector X9 (line input) via an EMC filter and an overvoltage limiter to the transformer (separation of potentials).

Via a level-adjustment facility, the modulation AF is routed to the modulator. The alternative signal path is via the inband interface (with control tones) and back (control tones filtered out) to the modulator.

By means of the directional coupler of the VHF amplifier and the modulator, a monitoring signal is obtained which is switched via a transformer for potential separation and an EMC filter to connector X9.

As an alternative (made possible by the insertion of jumpers), the control tones of the optional inband interface can also be output for signalling the different operating states of the transceiver.

For realizing the function PTT from an external unit, the interface 1 offers several possibilities of internal wiring: positive or negative logic signal, connection to ground potential or phantom circuit. Via jumpers these functions can be activated. The interface is completed by a serial REM BUS connection and an additional feature, allowing a number of digital signals to be output.

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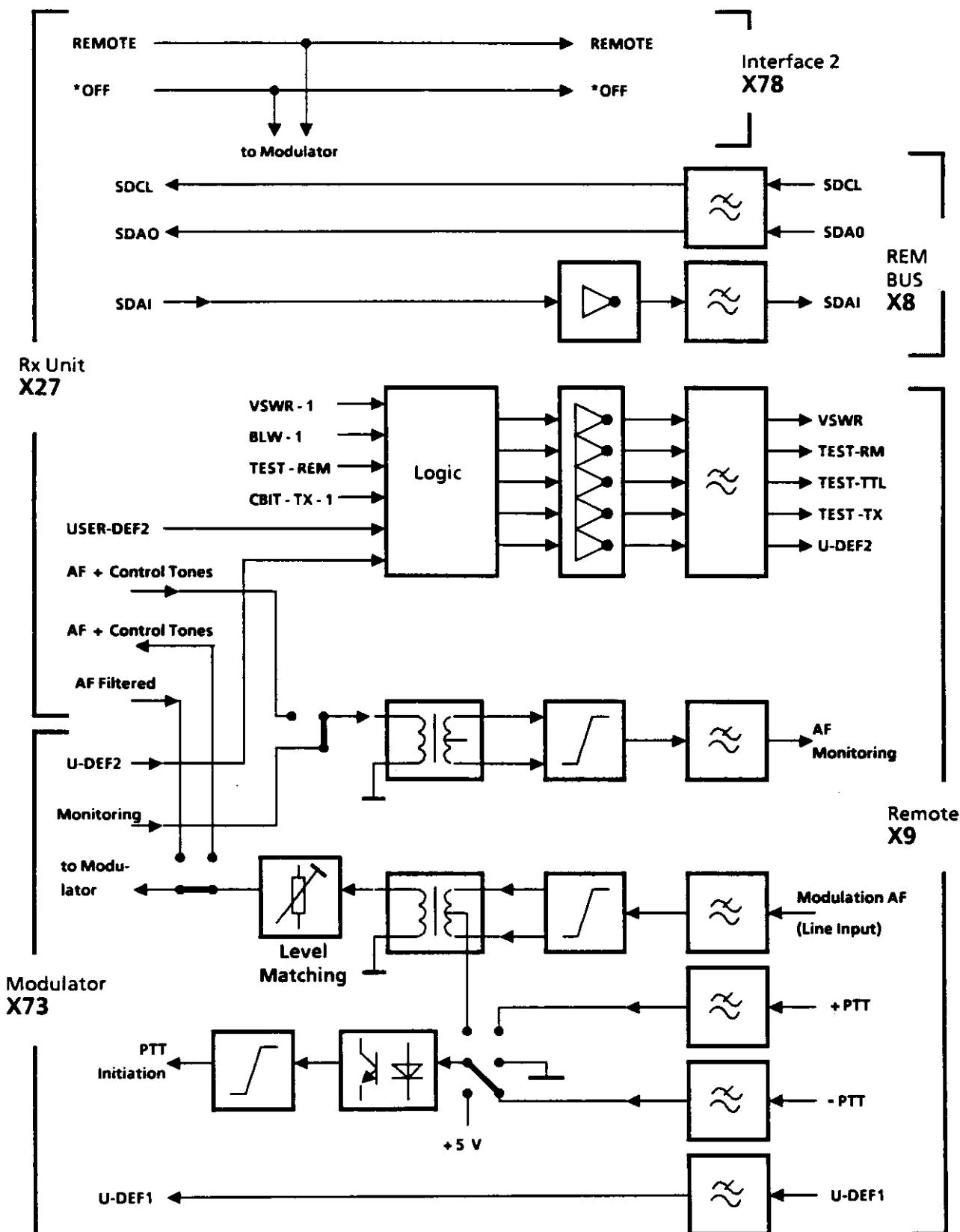


Fig. 1.11 Interface 1 GI 201X, Block Diagram

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1.2.8 Interface 2 GI 201 (Option)

Application

The optional Interface 2 GI 201 is part of the R&S equipment series 200 and is used e.g. in the VHF Transceiver XU 221.

The interface 2 is required for

- operation of a transceiver in conjunction with an external power amplifier (regulated or unregulated),
- main / standby operation with two transceivers with extended functions.

Design

Interface 2 GI 201 is designed as a plug-in module to be connected laterally to Interface 1 GI 201S within the transceiver.

All functional groups of the interface are located on a single PCB extending from the equipment rear to connector X78 of interface 1.

After installation the connectors X8 (REM BUS) and X9 (REMOTE) extend through rectangular openings in the rear panel, thus permitting connection even if the equipment covers are fixed.

Functioning

(See Fig. 1.12)

Interface 2 GI 201 provides the external interfaces for connection of a power amplifier (X6, POWER AMP) and a second transceiver (X7, MAIN / STANDBY).

In addition, it establishes the connection to Interface 1 GI 201X via the 48-way connector X78.

Connector X6 POWER AMP

At the 15-way connector X6 (POWER AMP) a regulated or unregulated external power amplifier can be connected. Via X6 all control and test signals required for control of the external power amplifier are transmitted.

The carrier activation signal PTT-AMP (X78.B12) of Interface 1 GI 201S is available via transistor V30 and L / C lowpass filter L30 / C30 at contact 3 of connector X6 (open collector).

All other signals are routed via R / C and L / C lowpass filters to connector X78 (Interface 1 GI 201X).

Connector X7 MAIN / STANDBY

At the 25-way connector X7 (MAIN / STANDBY) a second transceiver can be connected.

All input and output signals of connector X7 are routed via R / C lowpass filters to connector X78.

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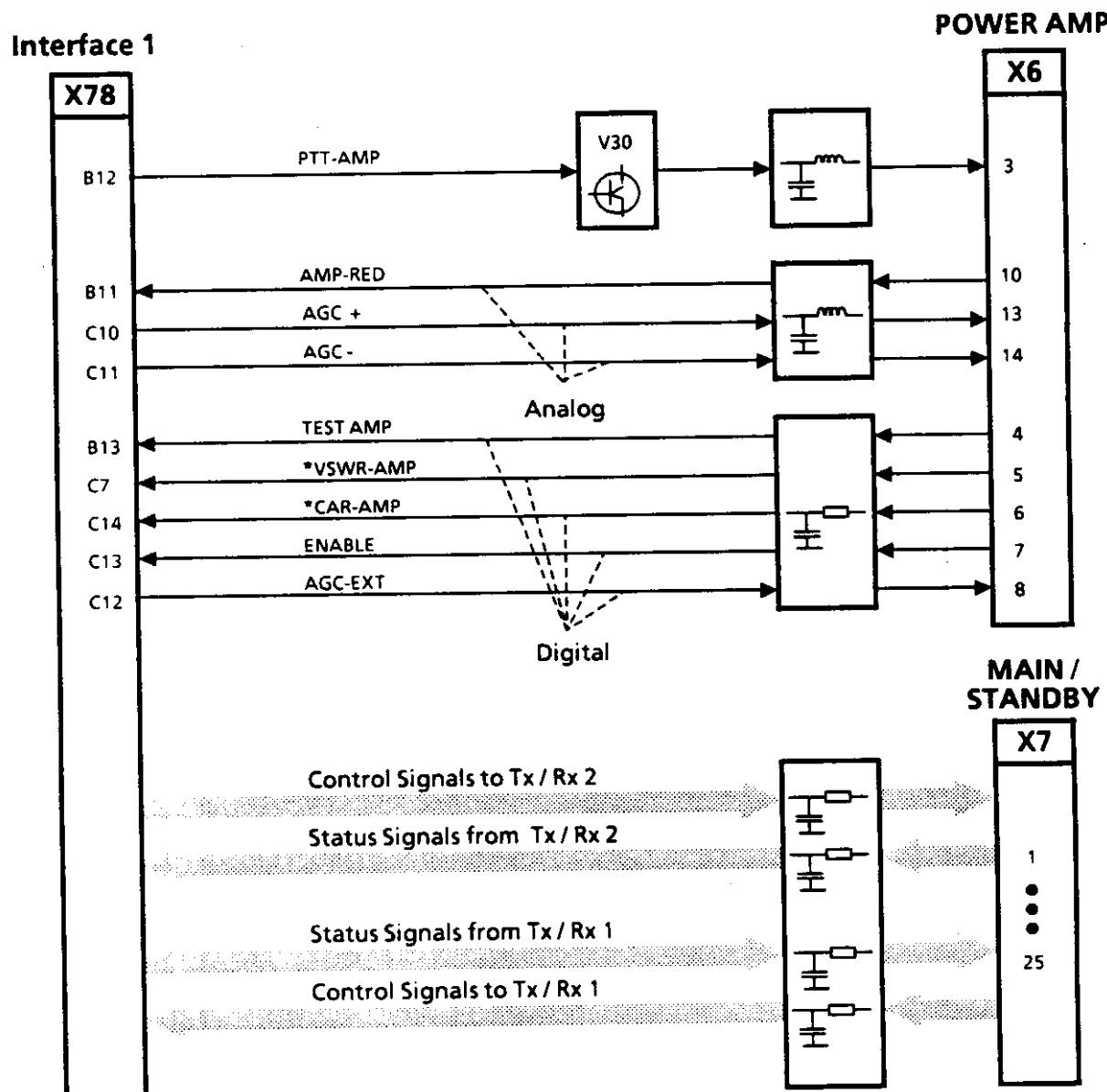


Fig. 1.12 Interface 2 GI 201 (Option), Block Diagram

1.2.9 Power Supply IN 251A (Option)

Application

The optional Power Supply IN 251A is part of the R&S equipment series 200. It is used in VHF Transceiver XU 221 in the event of mains operation and provides the required supply voltage for AC or AC/DC switchover operation.

Depending on the setting of the voltage selector the power supply can be operated on mains voltages of 115 to 230 VAC with a tolerance of -10 to +15 %. The power supply leaves the factory set to 230 VAC.

Design

Power Supply IN 251A is designed as a module to be installed into the adapter. Being partly covered by rugged sheet-metal walls, the power supply is screwed to the side and the bottom panel of the transceiver.

The mains connection is established via a mains connector combination with filter, voltage selector and fuse holder.

All supply voltage outputs are connected via flat connectors to the other transceiver modules.

Functioning

(See Fig. 1.13)

The mains voltage is supplied via a mains noise filter and two fuses (F1 and F2) to the power switch. Subsequently the primary voltage is fed via a contact of relay 4 to the voltage selector.

Due to the high remanence of the toroidal-core transformer, a switch-on current limiter is required. This circuit is made up of a resistor array and auxiliary circuits controlling relay 4.

Following activation of the power switch, first the reduced switch-on current flows through the resistor array. After a certain delay, the relay switches the transformer directly to the mains voltage.

In the case of a mains voltage interruption the start and reset circuit relay 4 deenergizes immediately, discharging time capacitor C6. After the RC time delay (C6 and R12) the relay 4 again bypasses the current limiter.

The secondary voltage generated in toroidal-core transformer TR1 is routed via the fuses F3 and F4 and rectified by diodes D1 and D2. By means of capacitors, the DC voltage is decoupled RF-wise and fed to the 24-V output.

In the presence of a battery supply, if no AC voltage is present the AC/DC switchover circuit initiates a DC switchover. The 24-V input of the battery (22 to 31 VDC on ST1 / ST2) is fed via relay contacts to the DC output connector ST3 / ST4. The DC voltage is locked by relay 3 (via contact 3.1) if an AC voltage is present.

This circuit brings about an AC / DC switchover, AC supply always having priority over DC supply. The switchover circuit only reacts to the correct polarity and limits the switch-on current by time-staggered switching with a series resistor (via relay 2).

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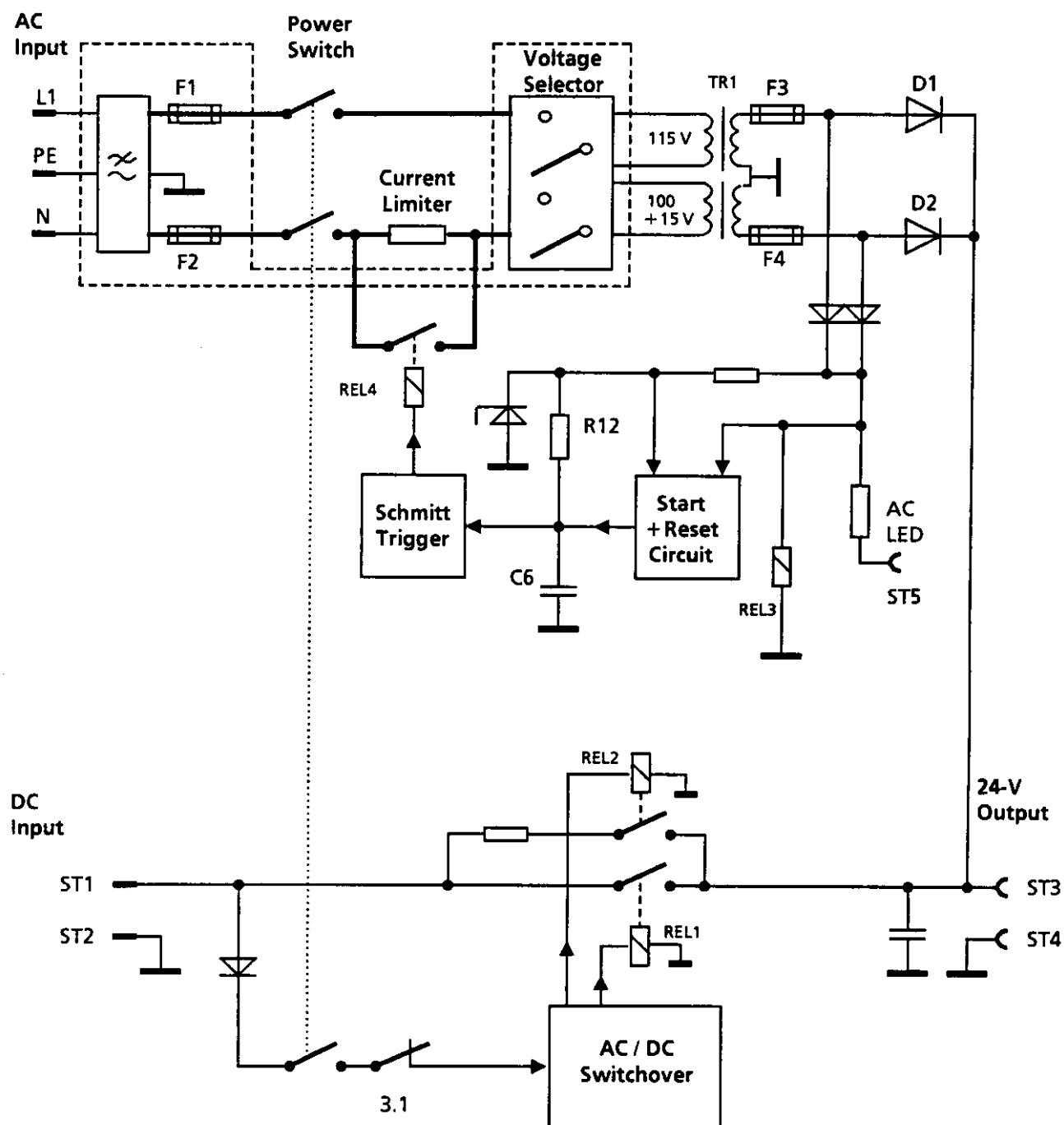


Fig. 1.13 Power Supply IN 251A (Option), Block Diagram

1.2.10 Inband Interface GM 211 (Option)

~~Application~~

The optional Inband Interface GM 211 is part of the R&S equipment series 200. In conjunction with a 4-way telephone line, the inband interface allows remote control of several receivers, transmitters or transceivers in all their functions from a central control station.

The telephone line conveys not only voice signals, but also control and status signals. For this purpose a narrow frequency band containing the control information is filtered out of the voice spectrum. The time-critical commands and signals (e.g. Tx / Rx switchover and field strength monitoring) are transmitted in frequency-modulated form, all other commands and messages being amplitude-modulated.

The software implemented in the inband interface is available in five versions thus realizing a variety of application-dependent functions.

SW Version	22	23	25	26	27
Full functionality	x				
PTT 2 040 Hz		x	x	x	
Squelch 2 040 Hz		x			
Line equalizer				x	
Tx muting					x
AGC 30 dB	x	x	x	x	x

~~Design~~

Inband Interface GM 211 is designed as a 55 mm wide and 174 mm long plug-in module inserted in Rx Unit EU 231.

The functional groups are located on a printed circuit board fitted with screening walls and two screening covers. One of the covers at the same time forms the upper screening cover of Rx Unit EU 231. The electrical connection to the interface 1 is established via the 48-way connector X1.

Inband Interface GM 211 contains two plug-in submodules: a power supply and a DSP module with a digital signal processor as well as RAM and EEPROM ICs.

~~Functioning~~

(See Fig. 1.14)

Analog section, A / D converter

Signal processing is carried out by a digital signal processor. In order to be able to use a single A / D (or D / A) converter for the two required channels, a switchover facility has been provided.

Each of the two analog input signals is fed via an EMC filter and a 4-way lowpass filter (anti-aliasing filter with amplification) as well as the multiplexer (16 kHz) to the A / D converter (32 kHz). In the other direction, the 12-bit data word is converted by an D / A converter into an analog signal to be switched via a demultiplexer to the two output channels. Via a 3-way lowpass filter, an amplifier and an EMC filter the AF signals are routed to the output. The required clock is obtained from a 16-MHz generator by way of frequency division.

Digital section and DSP processor

The DSP module with the digital signal processor and the RAM and EEPROM components provides for control, AF signal generation and evaluation as well as filtering of the AF and control signals (lowpass, bandpass and notch filter functions). Depending on the application, sixteen digital lines can be switched as inputs or outputs.

Power supply

On the basis of the +24-VDC input voltage, a DC / DC switching regulator generates a stabilized voltage of +5 VDC. Also from the +24-VDC input voltage two linear voltage regulators produce the stabilized DC voltages of +12 VDC and -5 VDC.

Monitoring circuit

The monitoring circuit contains a watchdog for processor monitoring and reset control as well as test circuitry for all operating voltages. The resulting signals are combined by a logic circuit to form the monitoring signal CBIT.

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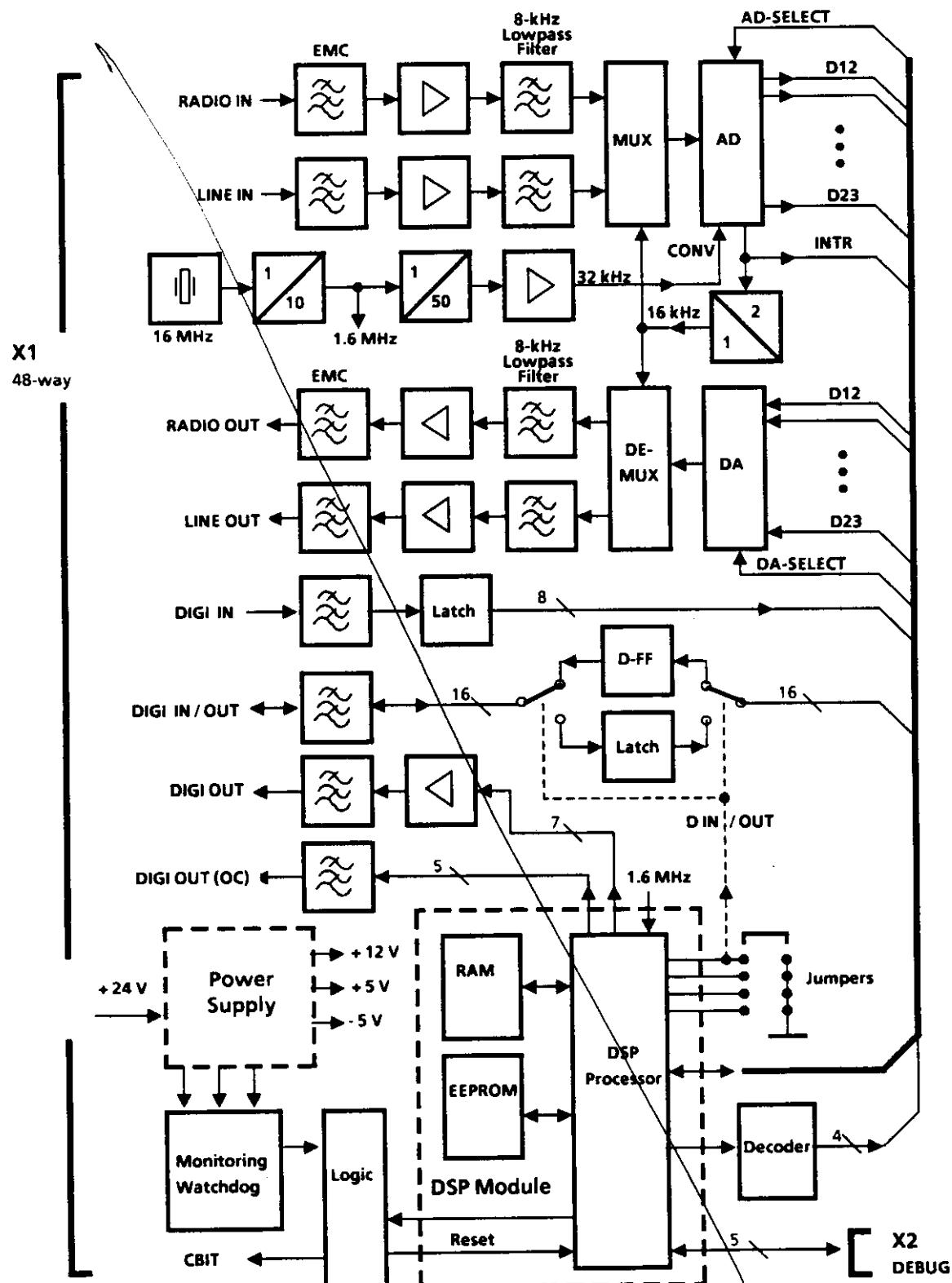
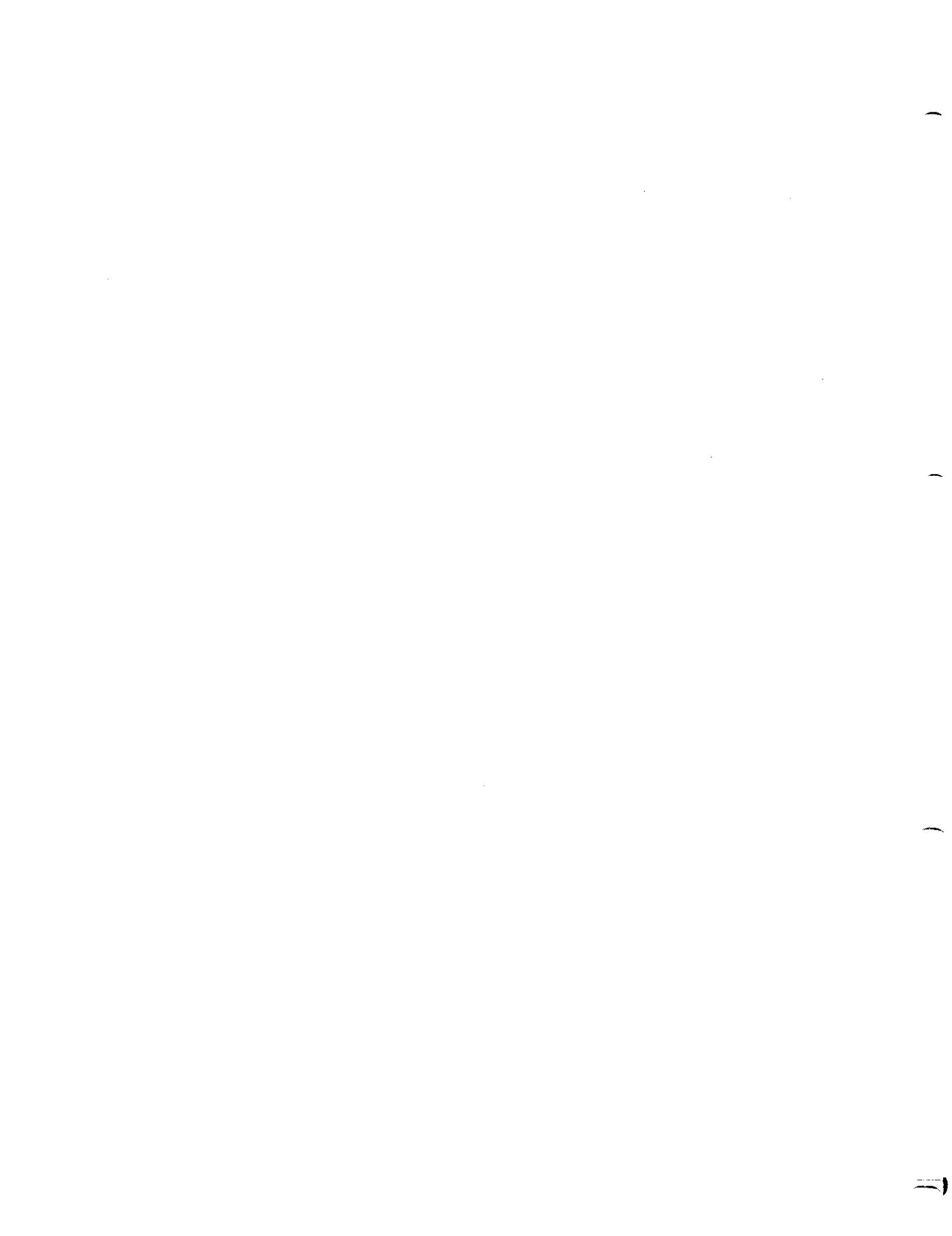


Fig. 1.14 Inband Interface GM 211 (Option), Block Diagram



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Parts list for

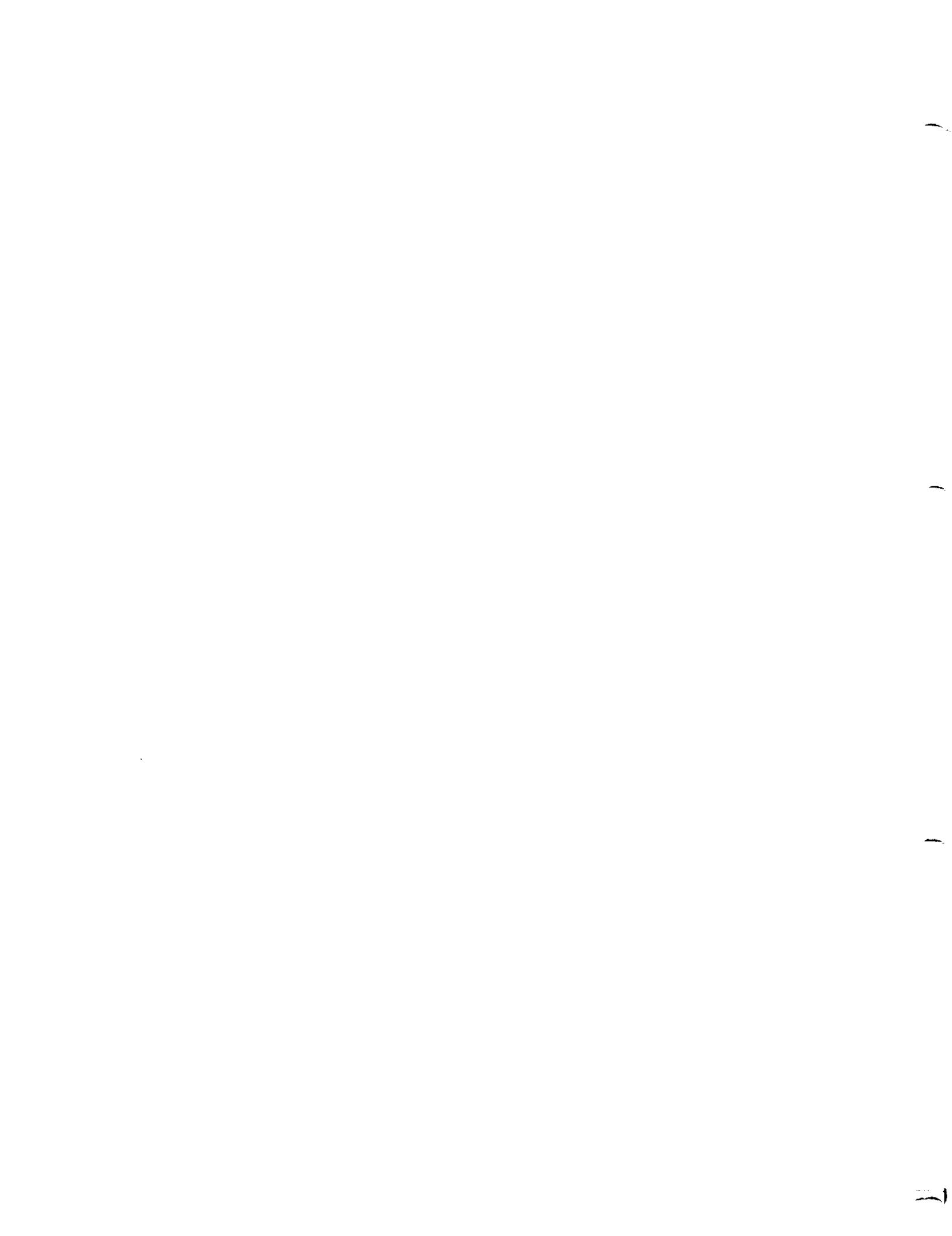
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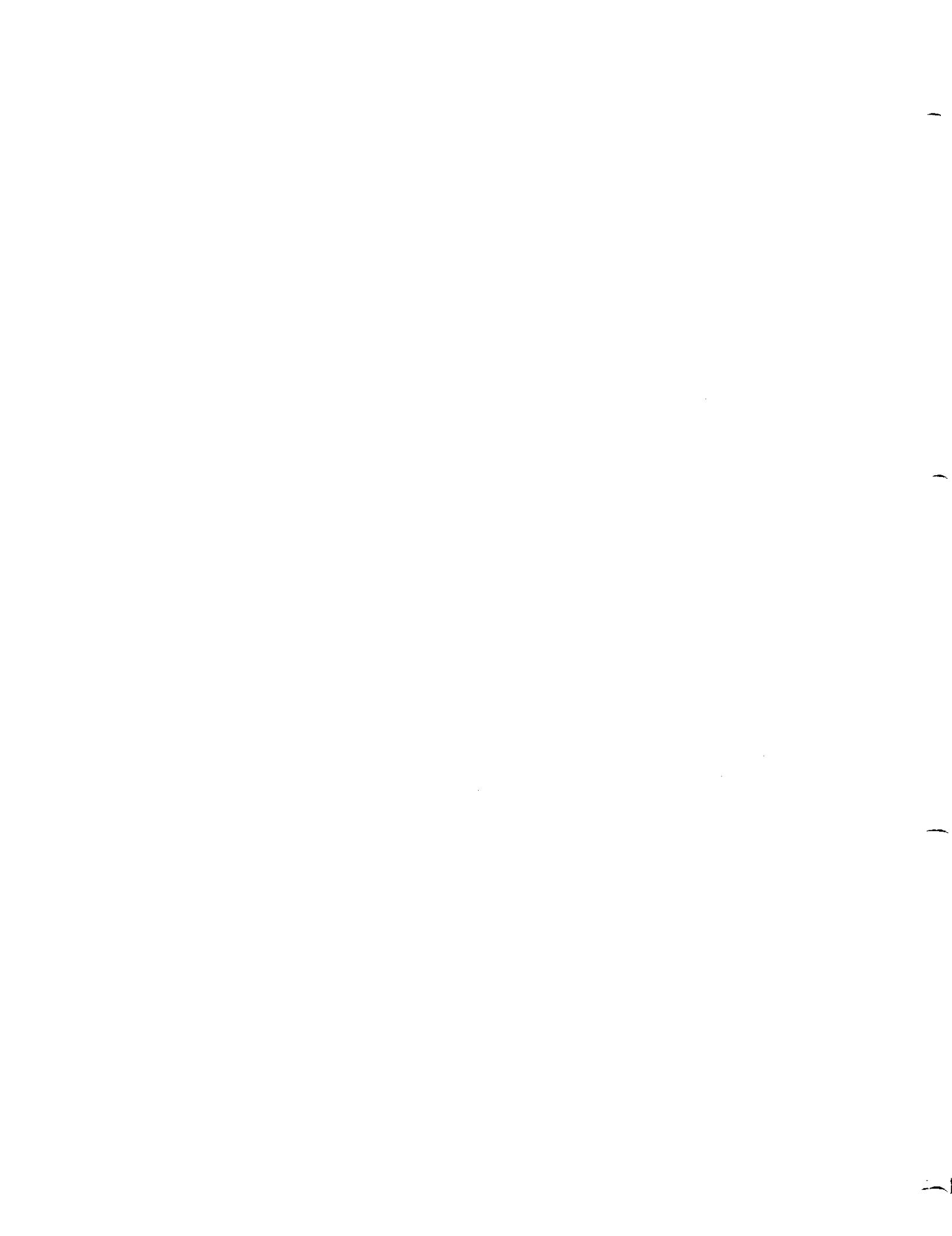
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A2	GG EU231 VHF RX UNIT NUR VAR/ONLY MOD: 02 03 04 05 06 07 08 09 10 11 12 13	6043.1942.02			
A2	GG EU231 VHF RX UNIT NUR VAR/ONLY MOD: 26 27 46 47	6043.1942.22			
A2	GG EU231 VHF RX UNIT NUR VAR/ONLY MOD: 22 23 24 25 42 43 44 45	6043.1942.23			

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A3	GG GM201 MODULATOR NUR VAR/ONLY MOD: 46 47	6044.6948.02			
A4	GG GF201V VHF SYNTHESIZER NUR VAR/ONLY MOD: 02 03 08 09	6044.6948.12			
A4	GG GF201V VHF SYNTHESIZER NUR VAR/ONLY MOD: 04 05 10 11	6044.6948.13			
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A4	GG GF201V VHF SYNTH. NUR VAR/ONLY MOD: 22 23 26 27 42 43 46 47	6044.6948.23			
A4	GG GF201V VHF SYNTH. NUR VAR/ONLY MOD: 24 25 44 45	6044.8440.02			
A6	GG IN251A POWER SUPPLY JE NACH AUFTAG DEPENDING ON ORDER	6044.2442.02			
A7	GG GI201X INTERFACE 1	6044.2794.02			
A8	GG GI201 INTERFACE 2 JE NACH AUFTAG DEPENDING ON ORDER	6044.2794.02			
A9	GG VU221V VHF AMPLIF.25W NUR VAR/ONLY MOD: 02 04 06 08 10 12 22 24 26 42 44 46	6044.2942.02			
A9	GG VU221V VHF AMPLIF.25W NUR VAR/ONLY MOD: 03 05 07 09 11 13 23 25 27 43 45 47	6044.2942.03			
A10	GS GD200V VHF ZIRK.SATZ GD200V VHF CIRC.SET JE NACH AUFTAG DEPENDING ON ORDER	6044.8940.02			
A11	GG KA231F FREQ.TUNING KIT JE NACH AUFTAG DEPENDING ON ORDER	6051.0341.02			
A12	GG GM211 INBAND INTERFACE GM211 INBAND INTERFACE JE NACH AUFTAG DEPENDING ON ORDER	6047.8693.02			
A13	GG GH200V VHF LP FILTER NUR VAR/ONLY MOD: 42 43 44 45 46 47	6048.0644.02			
A15	GG GM201C8 MODULATOR EXT. NUR VAR/ONLY MOD: 26 27 46 47	6044.4445.02			
A111	GG GM211-S INB. SOFTWARE JE NACH AUFTAG DEPENDING ON ORDER	6045.3394.02			
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A111	GG GM211-S INB. SOFTWARE JE NACH AUFTAG DEPENDING ON ORDER	6045.3394.04			



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2. Preparation for Use

2.1 General

The preparation for use of the VHF Transceiver XU 221 involves unpacking and checking, connecting the mains voltage as well as the connection of external devices.

This chapter also contains details about the functions set ex works on the individual modules.

For setting the modules to different functions at a later stage, appendix A1 contains all information required.

- 6 jumpers FP 0491.7042.00
- Mains connecting cable DS 025.2365
- User Manual 6075.6491.12.xx

2.3.2 Mating Connector Set Tx KS 251 (Option)

The Mating Connector Set Tx KS 251 contains a complete number of mating connectors in accordance with the modules installed on the equipment rear side.

2.2 Unpacking and Checking

1. Unpack the VHF Transceiver XU 221.
2. Check that nothing has been damaged in transport.
3. Check that nothing is missing.
4. If damage is discovered, notify the forwarding agency immediately.

2.3.3 Frequency Tuning Kit KA 231F (Option)

The Frequency Tuning Kit KA 231F contains hardware components as well as tools. It can be installed in the transceiver at the space reserved for options. For frequency tuning a digital voltmeter is required in addition.

2.3.4 Service Kit KA 251 (Option)

The Service Kit KA 251 contains hardware components (adapter boards and cable set) as well as a disk with test software for the transmit functions of the transceiver. For frequency tuning on the transmitter side no external measuring equipment is required.

2.3 Accessories

2.3.1 Accessories for VHF Transceiver XU 221

- 2 spare fuses M 20 A 6.3 x 32 mm (32 V) for battery connection
 - F1 (rear panel) SS 520.4858
- 2 spare fuses M 1 A 5 x 20 mm (32 V) for DC supply
 - F1 SS 020.7430
- 2 spare fuses M 3.15 E 5 x 20 mm (32 V) for DC supply
 - F2 SS 333.0725

2.3.5 VHF Circulator Set GD 200 V (Option)

The optional Circulator Set GD 200V can be used for improved suppression of spurious emission.

2.3.6 Cabinet KK 251 (Option)

The optional Cabinet KK 251 is intended to accommodate the VHF transceiver in its desktop version.

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2.4 Operating Functions Set Ex Works on Individual Modules

2.4.1 Power Supply IN 251A (Option)

Ex works the power supply is set to a mains voltage of 230 VAC (-10 to + 15 %).

The set mains voltage is indicated by the label on the transceiver rear side (above the mains connector).

Make sure that the mains voltage on which the Power Supply IN 251A is to be operated, corresponds to the set mains voltage. Otherwise alter setting by means of voltage selector and replace fuses F1 and F2.

CAUTION

If this is not observed, the transceiver can malfunction or even be destroyed!

The Power Supply IN 251A can be connected to the following mains voltages:

- 100 VAC - 10 to + 15% F2, F1 = T8 A
- 120 VAC - 15 to + 10% F2, F1 = T8 A
- 220 VAC - 12 to + 12% F2, F1 = T4 A
- 230 VAC - 10 to + 15% F2, F1 = T4 A

2.4.2 VHF Synthesizer GF 201V

The synthesizer is set ex works to the transmit frequency indicated by the label on the front panel (15, Fig. 3.1). How the frequency can be changed is described in appendix A1.

2.4.3 Modulator GM 201

The Modulator GM 201 is set ex works to the following operating functions:

- AF filter only internal
- ALC cut in
- VHF operation
- Normal operation, integrating control loop
- No switchover for failure
- PTT time limiting cut out
- Monitoring via directional coupler
- Primary address REM BUS: 56

- Cut-out for failure
- Carrier message switched to CBIT-Tx-1
- VSWR message switched to CBIT-Tx-1

2.4.4 Interface 1 GI 201X

The Interface 1 GI 201X is set ex works to the following operating functions:

- AF input AF TX (A/B) connected with modulator AF Tx (C/D)
- PTT control: PTT initiation via -PTT (contact to ground)

2.4.5 VHF Rx Unit EU 231

Rx Unit EU 231 is set ex works via jumpers for the following operating functions:

- Single receiver operation
- First threshold AGC bit linked with squelch
- Noise blanker disabled
- Both AGC bits linked with field strength evaluation
- Carrier squelch enabled
- AF inhibit for PTT signal enabled
- AF AGC disabled
- Monitoring for signal PTT enabled
- Remote control switched to parallel line
- Test socket switched to field strength evaluation

2.4.6 Inband Interface GM 211 (Option)

Via jumpers Inband Interface GM 211 is set ex works to the following operating functions:

- Use in device "A"
- Use on the "radio side"
- User-defined function switched via software

Note:

For more details, also on how all these settings can be altered, refer to appendix A1.

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2.5

Cabling

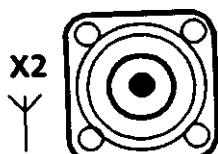
The connectors are listed in accordance with the numbering in Fig. 2.1.

1. Connection of an External Synthesizer



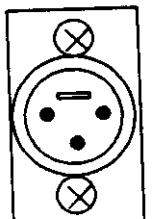
With Transceiver XU 221, the recessed BNC socket X1 is intended for the connection of an external synthesizer. For this purpose, the internal RF cable must be pulled off connector X94 of the internal synthesizer and be re-connected to X1.

2. Connection of the VHF Antenna



In the event that the antenna is to be connected directly, that is, without transmit filter in between, the connection is to be made directly to the recessed N-type socket X2.

3. Connection of the DC Supply

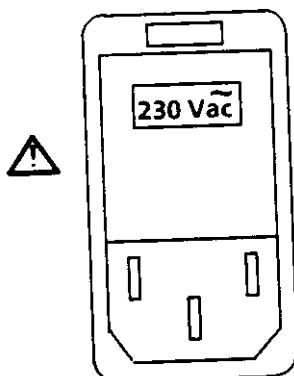


X3
BATT.
22...31 V

Via the 3-way recessed plug X3, VHF Transceiver XU 221 is connected to an external 24-VDC source (22 to 31 VDC). For AC / DC switchover operation both mains and battery connector are connected, switchover is made within the optional Power Supply IN 251A.

4. Connection of the Mains Voltage (only with Option Power Supply IN 251A)

Via the combination of recessed plug with fuse holder and voltage selector X4, VHF Transceiver XU 221 is connected to the mains supply.



X4 47...63 Hz
500 VA

CAUTION

Make sure that the set and indicated voltage corresponds to the available mains voltage!

Appendix A1 contains details on how to set the power supply to other mains voltages.

CAUTION

Be sure to connect the mains cable only after all other connections have been established!

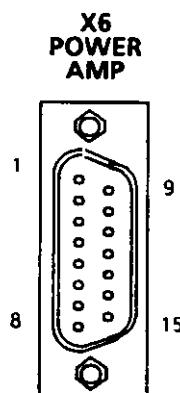
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5. Connection of a Handset

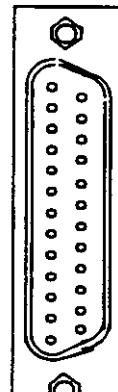


The 7-way socket X5 permits the connection of a microphone or a handset at the transceiver front panel (see Fig. 2.2).



6. Connection of an External Power Amplifier (only with Option Interface 2)

The 15-way female connector strip X6 is used to connect an external power amplifier.

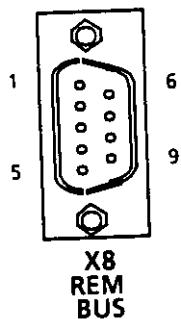


7. Connection of a Second Transceiver (Main / Standby Operation) (only with Option Interface 2)

The 25-way female connector strip X7 is used to connect a second transceiver for main / standby operation.

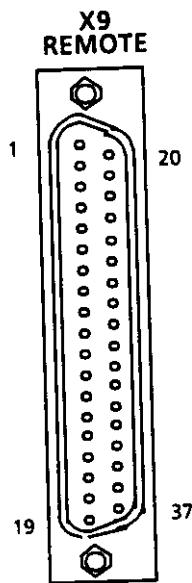
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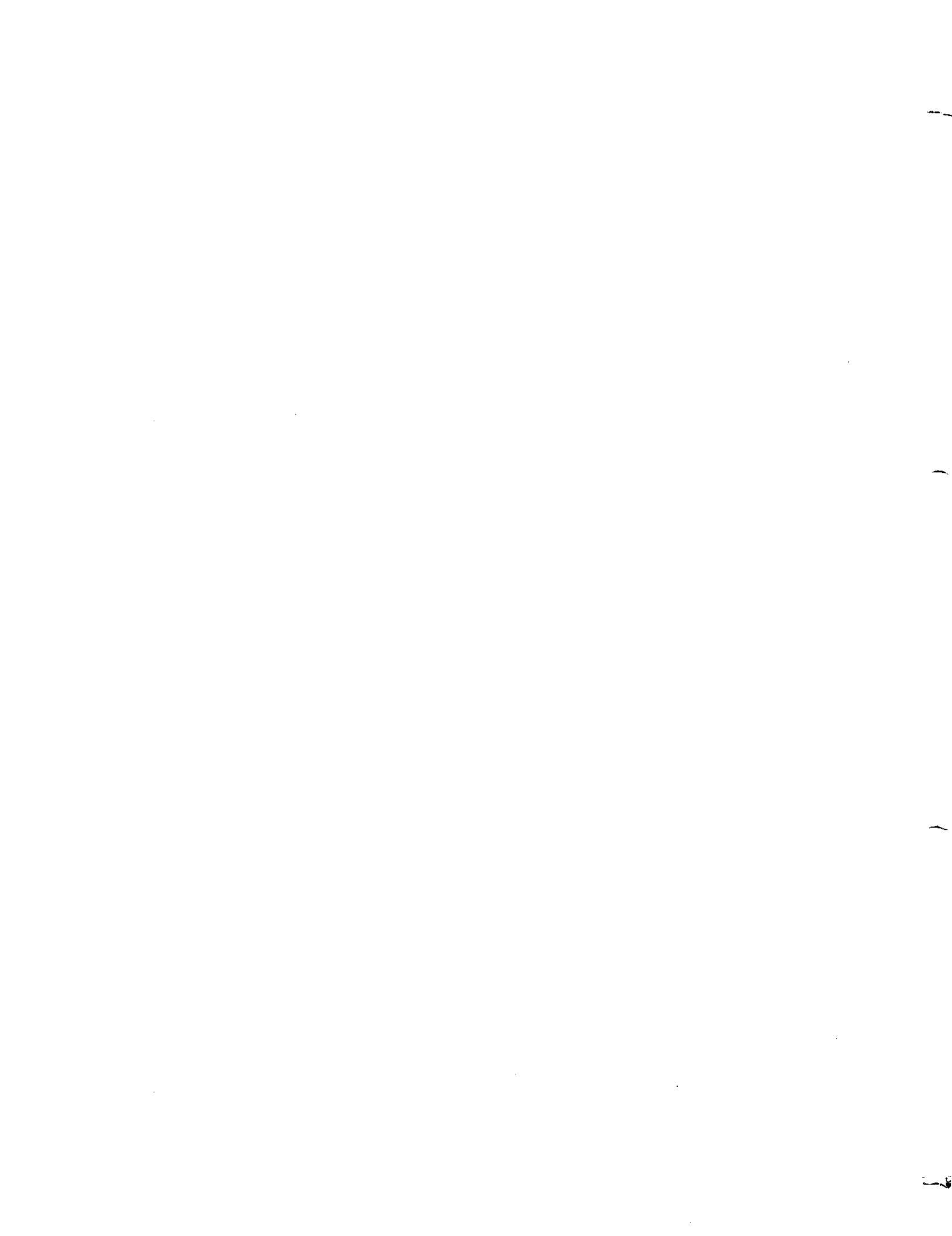
8. Connection of the REM BUS

The 9-way female connector strip X8 is intended for remote control via the serial REM BUS by a REM BUS Drive Unit GV 201 or a REM BUS Controller GC 201.



9. Connection of the Control and AF Lines (REMOTE)

The 37-way female connector strip X9 permits the parallel connection of AF and control lines for remote control of the transceiver. All AF inputs and outputs (e.g. monitoring), several PTT control lines and various test and monitoring signals are available at this connector. For remote control via parallel connection see example Fig. 2.5.



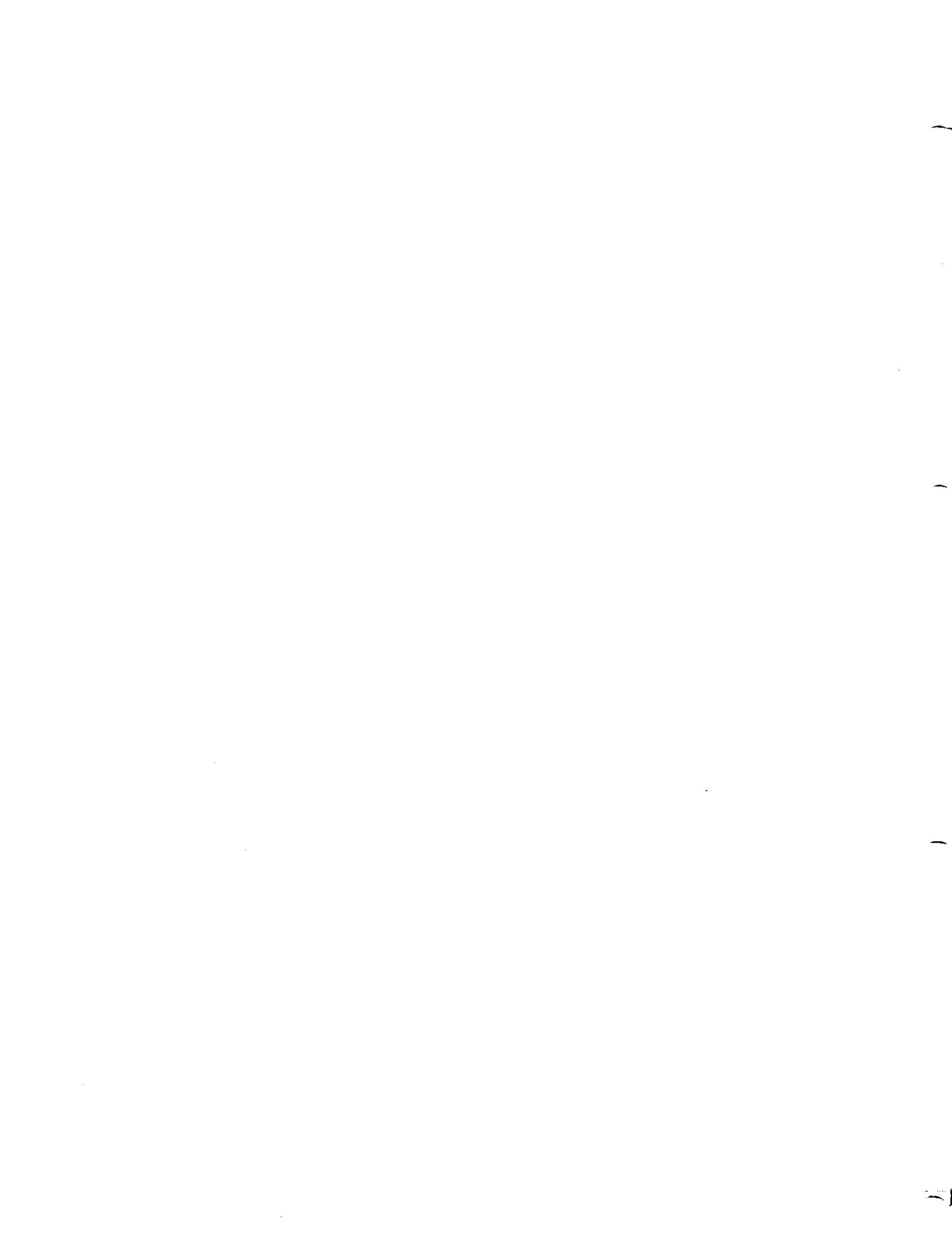
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3.3 Remote Control of the Series 200	3.2
3.3.1 Introduction	3.2
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Fig.	Title	Page
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3. Operation

3.1 Start-up and Test

(See Fig. 3.1)

1. Make sure that the cabling has been made in line with section 2.
2. In the case the optional Power Supply IN 251A is installed, switch on VHF Transceiver XU 221 by means of power switch (11).
3. Readiness for operation of the optional power supply (AC voltage available) is indicated by illumination of the green LEDs AC (10 and 22).
4. The presence of an external DC supply is indicated by illumination of the green LEDs DC (9 and 17).
5. Switch on VHF Transceiver XU 221 by setting the toggle switch REM / LOC / OFF (20) to LOC (or REM).
6. If LEDs V_{OP} (8 and 21) are illuminated, the transceiver is switched on.
7. If LEDs TEST (6 and 18) are illuminated, the transceiver is functioning properly, i.e., all operating voltages are available, the synthesizer works correctly.

If one of the LEDs is not illuminated, perform troubleshooting in line with chapter 4.2.

3.2 Local Control

(See Fig. 3.1)

For local control of VHF Transceiver XU 221 proceed as follows:

1. In the case the optional Power Supply IN 251A is installed, switch on VHF Transceiver XU 221 by means of power switch (11).
2. Switch on VHF Transceiver XU 221 by setting the toggle switch REM / LOC / OFF (20) to LOC.
3. Connect a microphone with PTT key or a headset at connector (13) on the front panel.
4. For transmission talk into the microphone and simultaneously press the PTT key.
5. Adjust the volume of the monitoring tone by means of the volume control (12).
6. Once transmission has been completed, release the PTT key.

Normally no further operation will be necessary.

Note:

While the transceiver is operating, the TONE / 0 / PTT switch (14) must be in the off-position (0)!

3.3 Remote Control of the Series 200

3.3.1 Introduction

Remote control can be carried out in three different ways:

1. via single line, mainly in main / standby parallel operation
2. via the serial REM BUS, remote control from a PC and
3. via inband control, with control tones inside the AF signal bandwidth (e.g. via telephone lines). For this Inband Interface GM 211 and Inband Control GM 231 (options) are required.

Note:

Please note that combinations of various remote control modes are also possible.

3.3.2 Remote Control Via Single Line

This mode is normally used in conjunction with main / standby applications.

In such a case the lines for the headset with PTT key are connected at connector X9. The headset is detached from the transceiver by several meters.

1. Make sure that the cabling was made acc. to section 2, Figure 2.5.
2. Set toggle switch REM / LOC / OFF (20, Fig. 3.1) on the relevant transceiver to REM.
3. For transmission talk into the microphone and simultaneously press the PTT key.

Note:

There are other application modes, where the CBIT information or the ON / OFF control (via REMOTE, AF, and AGC-inhibit signals) is used.

3.3.3 Remote Control via REM BUS (Serial)

REM BUS Concept

All 200 series devices can be remotely controlled without the necessity of employing additional options.

The serial REM BUS uses four wires:

- SCL serial data clock
- SDAI serial data input
- SDAO serial data output
- GND ground

The transceivers, transmitters and VHF/UHF multicouplers of series 200 are all equipped with such a REM BUS connection for remote control.

REM BUS Capability

With the REM BUS 64 addresses are available.

A VHF Transceiver XU 221 occupies two addresses.

It is possible to operate 32 transceivers on one REM BUS.

REM BUS Devices

A REM BUS Drive Unit GV 201 contains eight Rx REM BUS output connectors.

The Rx REM BUS outputs may also be used as REM BUS connections (in this case the additional select lines are not used).

Normally, a REM BUS Drive Unit GV 201 is controlled by a REM BUS Controller GC 201.

5-KM REM BUS

This is a serial point-to-point connection with V.11 level, push-pull drivers and difference frequency receivers (acc. to RS 422, for line lengths up to max. 5 km). The REM BUS Controller GC 201 has two such output connections, and the REM BUS Drive Unit GV 201 has one input connection.

Central Control Via REM BUS

The central control of radio devices of the series 200 is carried out via a standard PC, fitted with one or two special plug-in card(s), the REM BUS Controller GC 201 and special control software under Microsoft Windows.

Modems

Due to the use of modems the distance otherwise limited to 5 km may be extended. In this case, however, a standard PC and a REM BUS Controller GC 201 plus a modem will be required.

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Overview of REM BUS Commands / Messages

REM BUS device	Bit	Command / message to radio	Message from radio
Receiver	0	ON/OFF the currently active receiver <i>switches this particular receiver on / off</i>	
	1	SQL ENABLE / DISABLE <i>switches the squelch function on / off</i>	Rx CBIT GO / NOGO <i>readiness for operation</i>
	2	.....	AGC BIT 0 (LSB) 00 no signal
	3	.....	receive signal quality 01 poor
	4	.....	AGC BIT 1 (MSB) 10 average
	5	.....	11 good
	6	ON/OFF the other receiver <i>state of the (hitherto) other receiver</i>	User-defined input state of this input
	7	.....	LOCAL / REMOTE <i>state of the LOC / REM switch at front panel</i>
Transmitter	0	PTT <i>activates the transmitter carrier</i>	
	1	ON / OFF <i>switches the transmitter on / off</i>	
	2	Reduce RF POWER <i>switches power reduction on / off</i>	
	3	RF POWER amplifier ON / OFF <i>switches power amplifier on / off</i>	
	4	User-defined output (jumper) <i>setting to "0" or "1" via remote control</i>	Message of user-defined input <i>only if set to "1" (= input)</i>
	5	Low-voltage operation <i>undervoltage of power supply</i>
	6 <i>(contd. on next page)</i>	Tx switched OFF <i>Transmitter switching state</i>

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REM BUS device	Bit	Command / message to radio	Message from radio
Transmitter	7	LOCAL / REMOTE <i>state of REMOTE switch</i>
	8	.....	Tx CBIT Go / NoGo <i>readiness for operation of transmitter</i>
	9	.....	Carrier existent <i>RF carrier power is emitted</i>
	10	.....	VSWR too high
	11	.....	Synthesizer OK
	12	.....	Amplifier OK <i>power amplifier functioning properly</i>
	13	.....	PTT key pushed <i>confirmation that PTT was initiated</i>
	14	.....	High temperature <i>signals overtemperature</i>
	15	.....	DC / AC operation <i>AC operation</i>

For more information on the REM BUS system refer to the User Manuals for REM BUS Controller GC 201 and the REM BUS Drive Unit GV 201.

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3.3.4 Remote Control via Inband Interface (Option)

For inband operation the optional Inband Interface GM 211 is installed in the Rx unit of the transceiver.

Inband Control GM 231 is additionally required on the operator side. For more information on the inband interface and inband control refer to the User Manual of GM 231.

Overview of Commands and Messages

Direction		Command	Message	Remarks
OP → TxRx	fast data / FM	*PTT		Tx mode switchover
OP → TxRx	slow data / AM	*SQUELCH-ON	.....	Squelch on / off
OP → TxRx		TRX - A - ON	.....	Device A on / off
OP → TxRx		TRX - A - ON	.....	Device B on / off
OP → TxRx		USER - DEF - 2	.....	User-defined function
OP → TxRx		IBIT	.....	Built-in test
Rx → OP	fast data / FM	.....	AGC - BIT0 - 1	AGC main Rx
Rx → OP		.....	AGC - BIT1 - 1	AGC main Rx
Rx → OP	s | o | w data / AM	.....	RX - A / *B	Active Rx (0 ≠ B)
Rx → OP		.....	CBIT - RX1	Continuous built-in test Rx1
Rx → OP		.....	*REMOTE1	Remote switch Rx1 (0 ≠ remote)
Rx → OP		.....	CBIT - RX2	Continuous built-in test Rx2
Rx → OP		.....	*REMOTE2	Remote switch Rx2 (0 ≠ remote)
Rx → OP		.....	AGC - BIT0 - 2	AGC standby Rx
Rx → OP		.....	AGC - BIT1 - 2	AGC standby Rx
Tx → OP	s | o | w data / AM	.....	MAIN - TX	Active Tx (0 ≠ B) 1)
Tx → OP		.....	CBIT - TX	Continuous built-in test Tx 1)
Tx → OP		.....	VSWR	VSWR > 3 1)
Tx → OP		.....	TEMP	Overtemperature 1)
Tx → OP		.....	CARRIER	Power > 1 / 4 P _N 1)
Tx → OP		.....	*PTT	PTT acknowledgement 1)
Rx → OP	slow data / AM	.....	USER - DEF - 1	User-defined function
Rx → OP		USER - DEF - 3	User-defined function

1) refers to the currently active device

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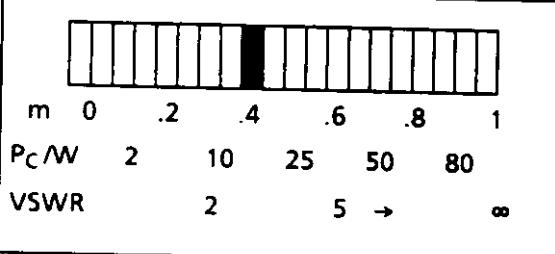
3.4 Function of Controls and Indicators

(See Fig. 3.1)

No.	Designation	Design	Function
1		Variable control	The squelch response threshold can be set between 8 and 14 dB (S + N/N). Ex works it is set to 10 dB.
2		Toggle switch, two positions	<ul style="list-style-type: none"> • Toggle switch in position ON: squelch enabled, i.e., the receive signal is only audible above the response threshold. • Toggle switch in position OFF: squelch disabled, i.e., the receive signal / noise is continuously audible.
3		Loudspeaker	Built-in loudspeaker, volume adjustable with volume control (4)
4		Variable control	By means of the volume control the volume of the built-in loudspeaker can be adjusted.

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User Manual • Function of Controls and Indicators

No.	Designation	Design	Function																					
5	 m Pc/W VSWR	Toggle switch, 3 positions	<p>Switchover of measuring range for bargraph indicator</p> <ul style="list-style-type: none"> • Toggle switch in position m : Modulation depth in % • Toggle switch in position Pc / W : RF output power in W • Toggle switch in position VSWR : VSWR (1 to ∞) 																					
6	 TEST	Green LED	If LED TEST is illuminated, the transceiver is in order (i.e. all operating voltages are available and the oscillators and the synthesizer of the Rx unit work correctly).																					
7		<p>LED bargraph indicator 20 segments</p>  <table border="1"> <tr> <td>m</td> <td>0</td> <td>.2</td> <td>.4</td> <td>.6</td> <td>.8</td> <td>1</td> </tr> <tr> <td>Pc/W</td> <td>2</td> <td>10</td> <td>25</td> <td>50</td> <td>80</td> <td></td> </tr> <tr> <td>VSWR</td> <td>2</td> <td></td> <td>5</td> <td>→</td> <td>∞</td> <td></td> </tr> </table>	m	0	.2	.4	.6	.8	1	Pc/W	2	10	25	50	80		VSWR	2		5	→	∞		Measurement depending on setting: m , Pc / W , VSWR
m	0	.2	.4	.6	.8	1																		
Pc/W	2	10	25	50	80																			
VSWR	2		5	→	∞																			
8	V_{OP} 	Green LED	If LED V_{OP} is illuminated, the transceiver is switched on.																					

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No.	Designation	Design	Function
9	DC	Green LED 	If LED DC is illuminated, a 24-VDC battery supply (22 to 31 VDC) is connected (in parallel to LED (17)).
10	AC	Green LED 	If LED AC is illuminated, an AC supply is connected and cut in (in parallel to LED (22)).
11		Pushbutton green 	Switch-on of AC supply (with optional Power Supply IN 251A only).
12		Variable control 	This control permits volume setting of the headphones connected.
13		Connector, 7-way 	Headset connection

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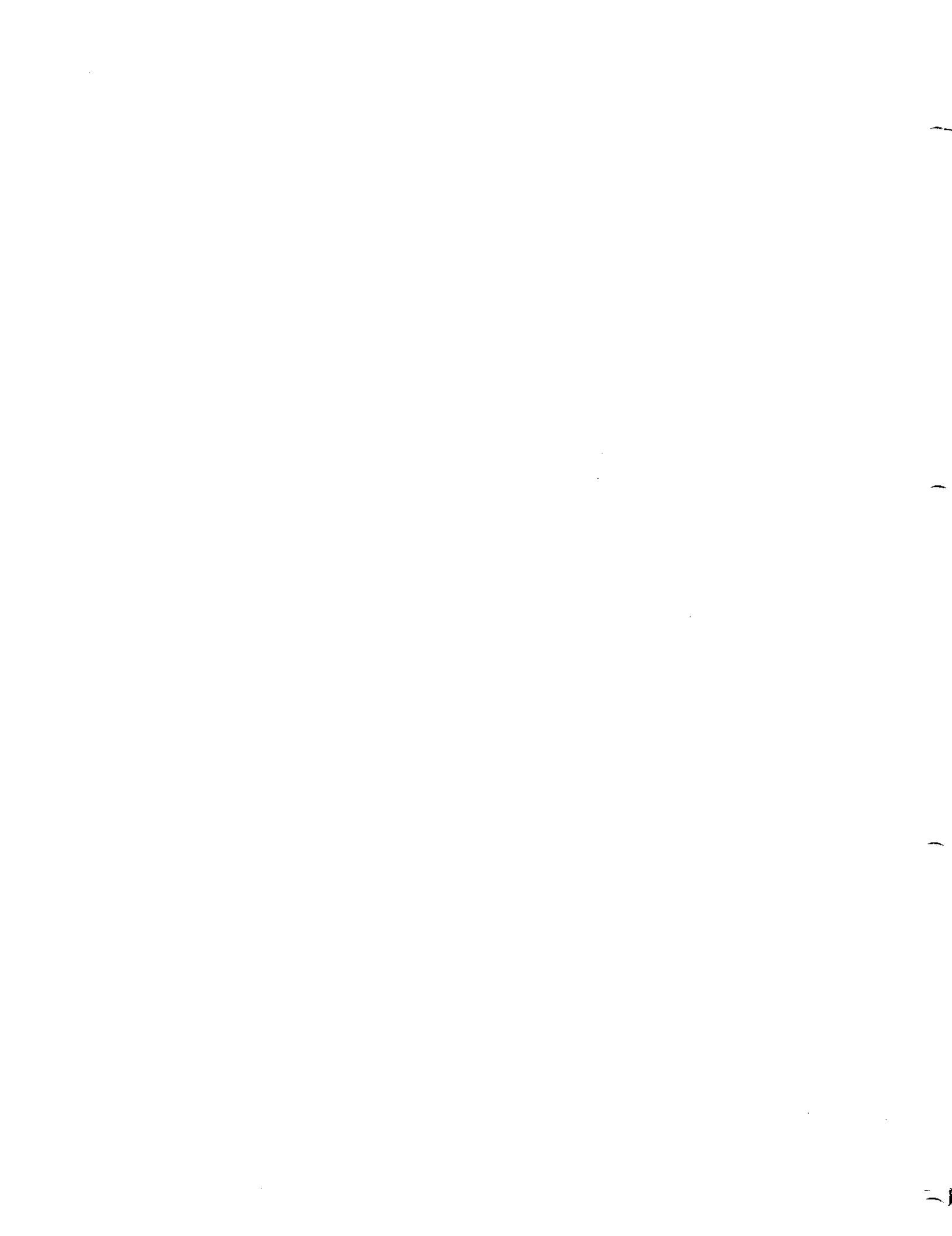
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No.	Designation	Design	Function
14	 TONE 0 PTT	Toggle switch, two positions	<p>Switchover test tone / PTT:</p> <ul style="list-style-type: none"> • Toggle switch set to TONE: Tone generator switched on for system test (in local operation only) • Toggle switch set to PTT: Transceiver carrier activated (in local operation only)
15	 123,325 MHz	Label	<p>Label indicating the set transmit frequency</p> <p>(for altering the frequency refer to appendix A1)</p>
16	 123,325 MHz	Label	<p>Label indicating the set receive frequency</p> <p>(for altering the frequency refer to appendix A1)</p>
17	 DC	Green LED	If LED DC is illuminated, an external DC source is connected (in parallel to LED (9)).
18	 TEST	Green LED	If LED TEST is illuminated the VHF Rx unit is in order (i.e., all operating voltages are available and the oscillators and the synthesizer of the Rx unit work correctly).

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No.	Designation	Design	Function
19	V_C 	Test socket 2 mm	Test socket for measuring the internal control voltage for alignment of the VHF Rx unit
20	REM LOC  OFF	Toggle switch, three positions	<ul style="list-style-type: none"> ● Toggle switch in position OFF: The VHF Rx unit is switched off. Only the operating voltages + 24 VDC and + 5 VDC for remote switch-on are active. ● Toggle switch in position LOC: The VHF Rx unit is switched on. Local control is enabled. ● Toggle switch in position REM: Remote control is enabled.
21	V_{OP} 	Green LED	If the LED V_{OP} is illuminated the DC / DC converter of the Rx unit is switched on and the DC supply voltages are available.
22	AC 	Green LED	If the LED AC is illuminated, AC mains supply of the transceiver is switched on (in parallel to LED (10)).
23		Yellow LED	As long as the receive signal is above the response threshold (S / N squelch) set by means of the SQ control, the LED SQ will remain illuminated.



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4. Maintenance and Troubleshooting

4.1 Maintenance

4.1.1 General

Natural aging of the crystal oscillator makes it advisable to check the frequency offset every three years and readjust it, if necessary.

4.1.2 Taking Care

Such measures involve cleaning and touching up slight damage to the paint work of the unit. The following materials are required:

No.	Description
1	Soft brush
2	Duster
3	Isopropyl alcohol
4	Paint, light grey RAL 7911 / 7035

CAUTION

- For use of compressed air first direct the air jet towards the ground until it is free of condensation water.
- For use of compressed air the distance to the unit must be at least 20 cm.

1. Pre-clean the surface of the unit by means of compressed air.
2. Clean the surface using a soft brush or duster.
3. Clean extremely dirty surfaces, in particular grease stains, carefully using a soft, non-fuzzy cloth moistened with isopropyl alcohol.
4. Clean open PC board carefully using a soft brush and / or compressed air.

4.1.2.2 Touching up the Paint Work

Touch up paint work on the housing of VHF Transceiver XU 221 as follows:

4.1.2.1 Cleaning

WARNING

- Beware of risk of explosion when using isopropyl alcohol.
Make sure to work in a well ventilated room when cleaning with isopropyl alcohol.
- Wear goggles when working with compressed air in order to avoid any injuries to the eyes.

1. Carefully remove loose particles of paint around the area to be touched up.
2. Clean area to be painted using a soft, non-fuzzy cloth moistened with isopropyl alcohol.
3. Wait until isopropyl alcohol has dried.
4. Carefully apply paint and let dry completely.
5. Subsequently apply second coat of paint and also let dry completely. Touching up is now terminated.

4.2 Troubleshooting

4.2.1 General

A disturbance in VHF Transceiver XU 221 will generally make itself noticeable in that wanted signals are missing or corrupted.

For troubleshooting first of all the external cabling including plugs and sockets should be checked.

Subsequently the troubleshooting in line with the table in section 4.2.4.3 is to be performed. For this the given sequence as stated in the table should be adhered to.

If by these measures the fault cannot be found either, the modules should be substituted one at a time to try to find the one that is defective.

2. Unfasten the cover by undoing 18 Phillips screws and remove.
3. Check all connectors for firm seating and the power supply cable and RF coaxial cables at the rear for mechanical damage.
If necessary, replace cables systematically one after the other until the defective connection is detected.
4. Pull out transceiver after undoing two Phillips screws on the front and check connector strips for mechanical damage (bent or corroded pins). Subsequently re-insert and ensure that the connection is made properly.

4.2.2 Visual Examination

1. Check the external cabling between the complete VHF transceiver and the peripheral equipment.

CAUTION

If a contact is discoloured, the connector and the mating connector will both be damaged and must be replaced.

4.2.3 Replacement of Fuses

4.2.3.1 Replacement of Fuses on Rear (only with Option IN 251A)

1. Disconnect all connecting cables from Power Supply IN 251A. Fuse type: H 260 acc. to IEC
2. Open cover of combination with mains connector by means of screw driver (see Fig. 4.1a).
3. Ease fuses F1 and F2 carefully out of their holders acc. to Fig. 4.1b by means of screw driver.

	F1 115 V:	T 8 A	5 x 20 mm
	230 V:	T 4 A	5 x 20 mm
F2	115 V:	T 8 A	5 x 20 mm
	230 V:	T 4 A	5 x 20 mm

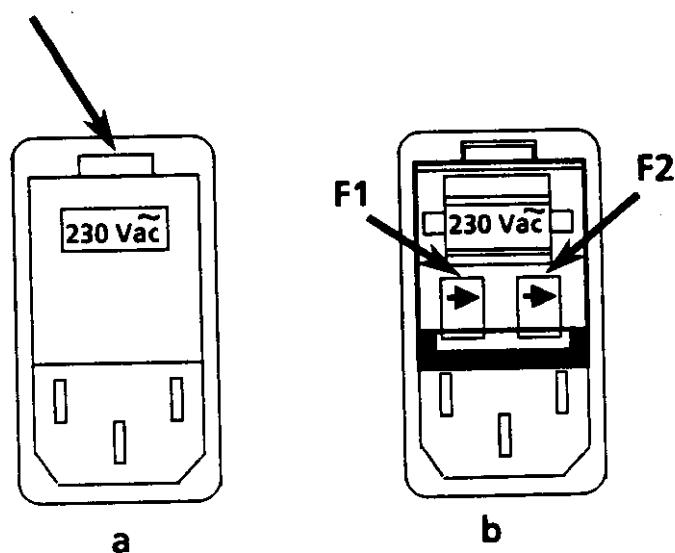


Fig. 4.1 Replacement of Fuses on Rear

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4.2.3.2 Replacement of Internal Fuses in Power Supply IN 251A (Option)

1. Disconnect mains and battery cables from VHF Transceiver XU 221. holders acc. to Fig. 4.2 by means of screw driver and replace.
2. Remove cover of transceiver after undoing 18 Phillips screws.
3. Ease fuses F3 and F4 carefully out of their holders acc. to Fig. 4.2 by means of screw driver and replace.

F3	32 V	T 20 A	6.3 x 32 mm
F4	32 V	T 20 A	6.3 x 32 mm

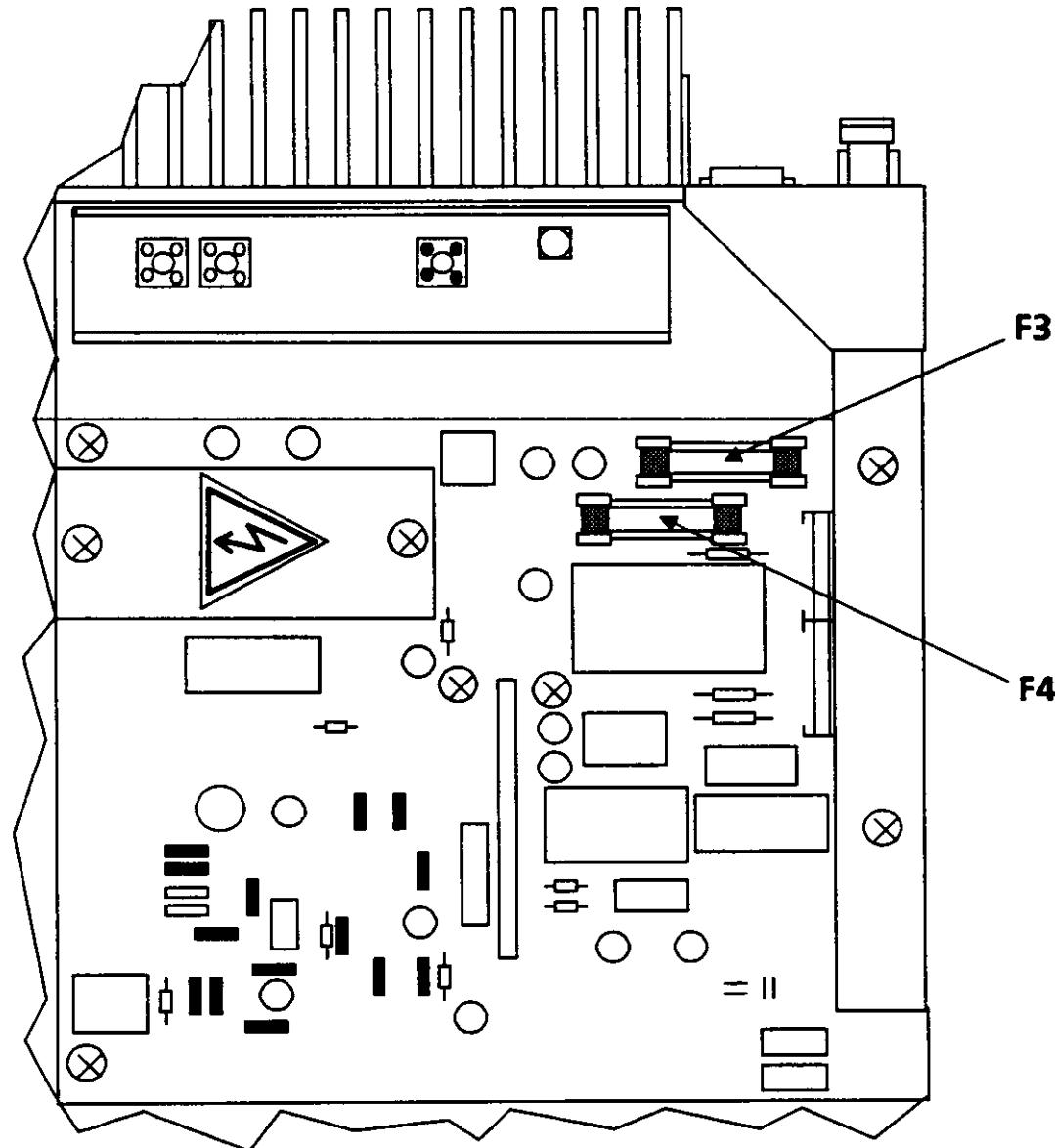


Fig. 4.2 Replacement of Internal Fuses (Option IN 251A)

4.2.3.3 Replacement of Fuses on Regulator

The regulator is part of Adapter KR 201.

1. Set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Switch off power by means of power switch (11, Fig. 3.1) and disconnect both mains and battery cable.

3. Remove cover on top of VHF Transceiver XU 221 after undoing 18 Phillips screws.
4. Ease fuses F1 and F2 carefully out of their holders by means of screw driver and replace (see Fig. 4.3).
5. Fix cover of VHF Transceiver XU 221 by means of 18 Phillips screws.

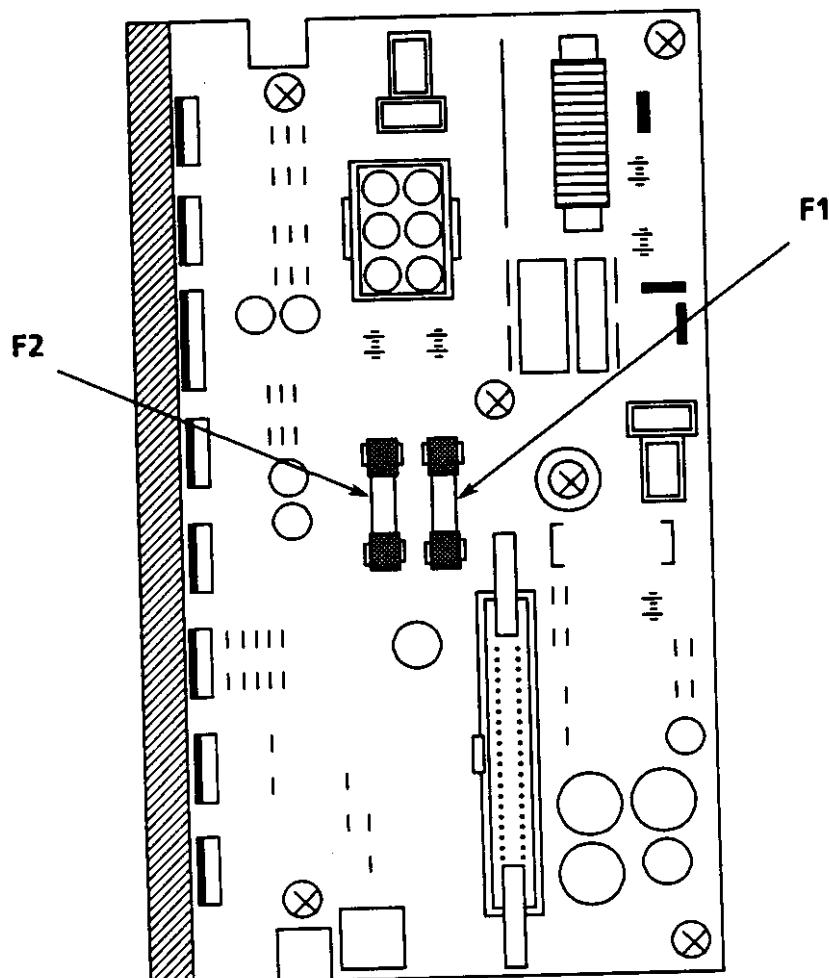


Fig. 4.3 Replacement of Fuses on Regulator

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4.2.4 Troubleshooting Instructions

The troubleshooting table is designed for fault localization in the VHF Transceiver XU 221.

Once a module has been found to be defective it must be sent for repair.

4.2.4.1 Requirements for Troubleshooting

Make sure that the VHF Transceiver XU 221 is connected to the mains or the battery supply, respectively (see Fig. 2.2).

Make sure that the cause of the fault is not in the peripherals and / or connecting cables (including plugs and sockets) between the peripherals and the VHF transceiver.

Perform troubleshooting in the sequence given in the table. The numbers given in brackets refer to Fig. 3.1.

4.2.4.2 Required Test Equipment

For checking the voltages a conventional digital multimeter is required.

For checking the frequency error a frequency counter with an accuracy of at least 0.1 ppm is required.

Further, the adapter card from Frequency Tuning Kit KA 231F or the long extension cable from Service Kit KA 251 is required (see section 2.3). Test adapters 1 to 5 used for the following checks are also part of the service kit.

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4.2.4.3 Troubleshooting Table

(See Fig. 3.1)

No.	Fault	Possible cause	Remedy
1	LEDs AC (10, 22) not illuminated	Mains connector not plugged in, power switch set to OFF or no mains voltage available. Fuse F1 or F2 (in connector combination) defective. Fuses F3 / F4 defective. VHF Amplifier VU 221V defective.	Plug in mains connector, check mains voltage, check voltage selector. Replace fuse F1 or F2 (in connector combination) (see 4.2.3). Replace fuses F3 / F4 (see 4.2.3). Pull off X19 at regulator of amplifier and reconnect. If another fuse blows, replace VHF Amplifier VU 221V.
2	LEDs DC (9, 17) not illuminated	Battery connector X3 not plugged in or no DC voltage available (or confusion of polarities). Fuse F1 (on rear panel) defective. VHF Amplifier VU 221V defective.	Plug in battery connector, check battery voltage. Replace fuse F1 (see 4.2.3). Pull off X19 at regulator of amplifier and reconnect. If another fuse blows, replace VHF Amplifier VU 221V.
3	LED V_{OP} (8) not illuminated	Toggle switch (20) set to OFF or remote control with external "Off" command. Power supply IN 251A defective. Regulator defective. Regulator defective. Modulator GM 201 defective.	Set toggle switch (20) to LOC. Disconnect X16 from ST3 / ST4 and measure voltage. If the voltage at ST3 / ST4 is below 25 V, replace Power Supply IN 251A. Replace fuse F2 on the regulator. Disconnect X31 and X313. Connect test adapter 2 "low power supply" * (26-way) to X31 and check all voltages. If necessary, replace the regulator. Disconnect X93, X73 and X43 from modulator; if LED V_{OP} remains dark, replace the modulator.

* The test adapters 1 to 5 are part of Service Kit KA 251 (see section 2.3).

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No.	Fault	Possible cause	Remedy
4	LED V_{op} (21) not illuminated	Toggle switch (20) set to OFF or remote control with external "Off" command. Power Supply IN 251A defective. Regulator defective (fuse F1). Rx Unit EU 231 defective.	Set toggle switch (20) to LOC. Disconnect X16 from ST3/ST4 and measure voltage. If the voltage at ST3/ST4 is below 25 V, replace Power Supply IN 251A. Check fuse F1 on the regulator and replace, if necessary. Replace Rx Unit EU 231.
5	LED TEST (6) not illuminated	Operating voltage missing. Synthesizer is not on nominal frequency. Synthesizer defective. VHF Amplifier VU 221V defective. Modulator GM 201 defective.	Refer to steps 1 to 3. Open cover of case, check whether tuning indicator LED (green) is illuminated. If necessary, align to nominal frequency in line with appendix A1.3. Replace Synthesizer GF 201V. Disconnect cables at X93 and X73 from modulator, at X93 connect test adapter 1 "power amplifier control" (16-way)*. If LED TEST (6) is illuminated now, replace VHF Amplifier VU 221V. Disconnect cables at X93 and X73 from modulator, at X93 connect test adapter 1 "power amplifier control" (16-way)*. If LED TEST (6) is now dark, replace Modulator GM 201.
6	LED TEST (18) not illuminated	The synthesizer in Rx Unit EU 231 is not on nominal frequency. Rx Unit EU 231 defective.	Remove Rx Unit EU 231 and check position of DIL switch. Adjust to nominal frequency acc. to A1.6, if necessary. Replace Rx Unit EU 231.

* The test adapters 1 to 5 are part of Service Kit KA 251 (see section 2.3).

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No.	Fault	Possible cause	Remedy
7	LED TEST (6) not illuminated for transmit operation with PTT switch (14)	Antenna or termination not connected. VHF Amplifier VU 221V defective. Modulator GM 201 defective.	Bargraph (7) shows end-scale deflection for VSWR setting. Terminate RF connector! Disconnect cables at X93 and X73 from modulator, at X93 connect test adapter 1 "power amplifier control" (16-way)*. If LED TEST (6) is illuminated now, replace VHF Amplifier VU 221V. Disconnect X93, X73 and X43 from modulator; at X93 connect the test adapter 1 "power amplifier control" (16-way)*. If LED TEST (6) remains dark, replace Modulator GM 201.
8	Remote control not in order	Interface 1 GI 201X (or Modulator GM 201) defective.	Check signals and voltages at X73. If they are in order, replace Modulator GM 201, otherwise replace Interface 1 GI 201X.
9	No monitoring tone	Volume control (12) turned fully counter-clockwise.	Set volume control (12) to mid-position.
10	LED bargraph (7) not illuminated	Display board disconnected.	Check flat cable connector X13 at modulator, check voltages. If necessary, replace display board.

* The test adapters 1 to 5 are part of Service Kit KA 251 (see section 2.3).

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4.3 Replacement of Modules

4.3.1 Replacement of VHF Rx Unit EU 231

(See Fig. 4.4)

1. Set power switch (11, Fig. 3.1, only with the optional Power Supply IN 251A) to off-position.
2. On Rx Unit EU 231 set toggle switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
3. At the equipment rear disconnect mains (AC) and battery (DC) connectors.
4. Undo two Phillips screws (4, Fig. 4.4) on the front of the Rx Unit EU 231 and pull the unit out to the front.

Installation is to be performed in the reverse order of removal.

4.3.2 Replacement of Interface 1 GI 201X

(See Fig. 4.4)

1. Remove the Rx unit acc. to 4.3.1.
2. Open cover after undoing the Phillips screws and disconnect flat cable connector X73.
3. Undo two Phillips screws (2) on the rear and two screws (1) on the left side panel, with option interface 2 also undo two additional screws (3) on the rear panel.
4. Pull Interface 1 GI 201X to the top and out of the transceiver case.

Installation is to be performed in the reverse order of removal.

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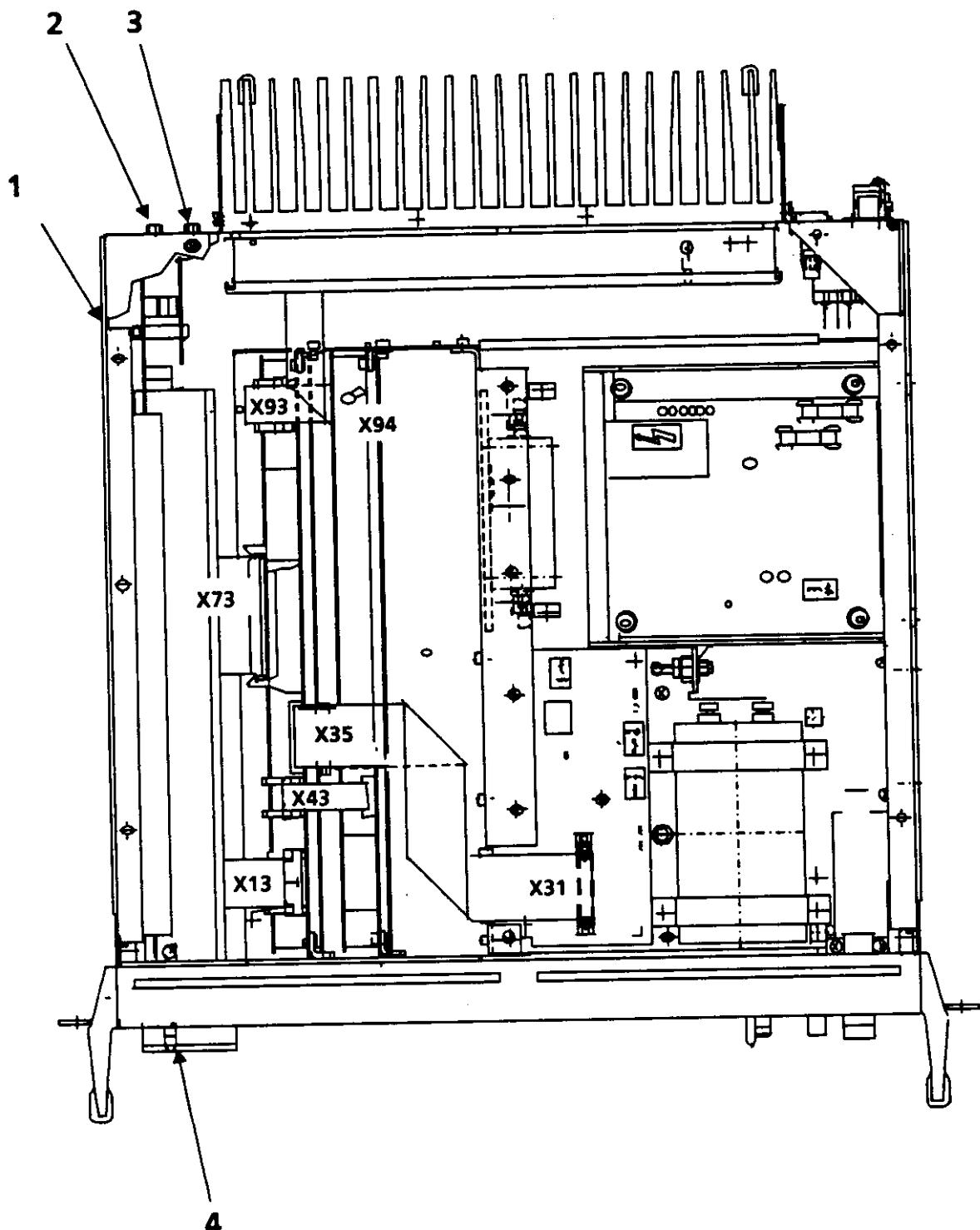


Fig. 4.4 Replacement of VHF Rx Unit and Interface 1

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4.3.3 Replacement of Modulator GM 201

(See Fig. 4.5)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only).
4. Open cover of case after undoing Phillips screws and pull off ribbon cable at connectors X31 (on regulator) and X35 (on plug-in slot provided for option).

Then disconnect ribbon cables X13, X43, X73 and X93 on modulator.

5. Undo two screws on fixing brackets (1) and pull modulator out to the top.

Installation is to be performed in the reverse order of removal.

4. Open cover of case after undoing Phillips screws. Undo soldered ribbon cable at connectors X31 and X35 (plug-in slot for options) (4).
5. Undo two screws on fixing brackets (3) and pull modulator extension together with the fixing plate out to the top.

Installation is to be performed in the reverse order of removal.

4.3.5 Replacement of VHF Synthesizer GF 201V

(See Fig. 4.5)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only).
4. Open cover of case after undoing Phillips screws.
5. Disconnect ribbon cable X43 on modulator and RF cable X94 on synthesizer.
6. Undo two screws on fixing brackets (2) and pull synthesizer out to the top.

Installation is to be performed in the reverse order of removal.

4.3.4 Replacement of Modulator Extension GM 201C8

(See Fig. 4.5)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only).

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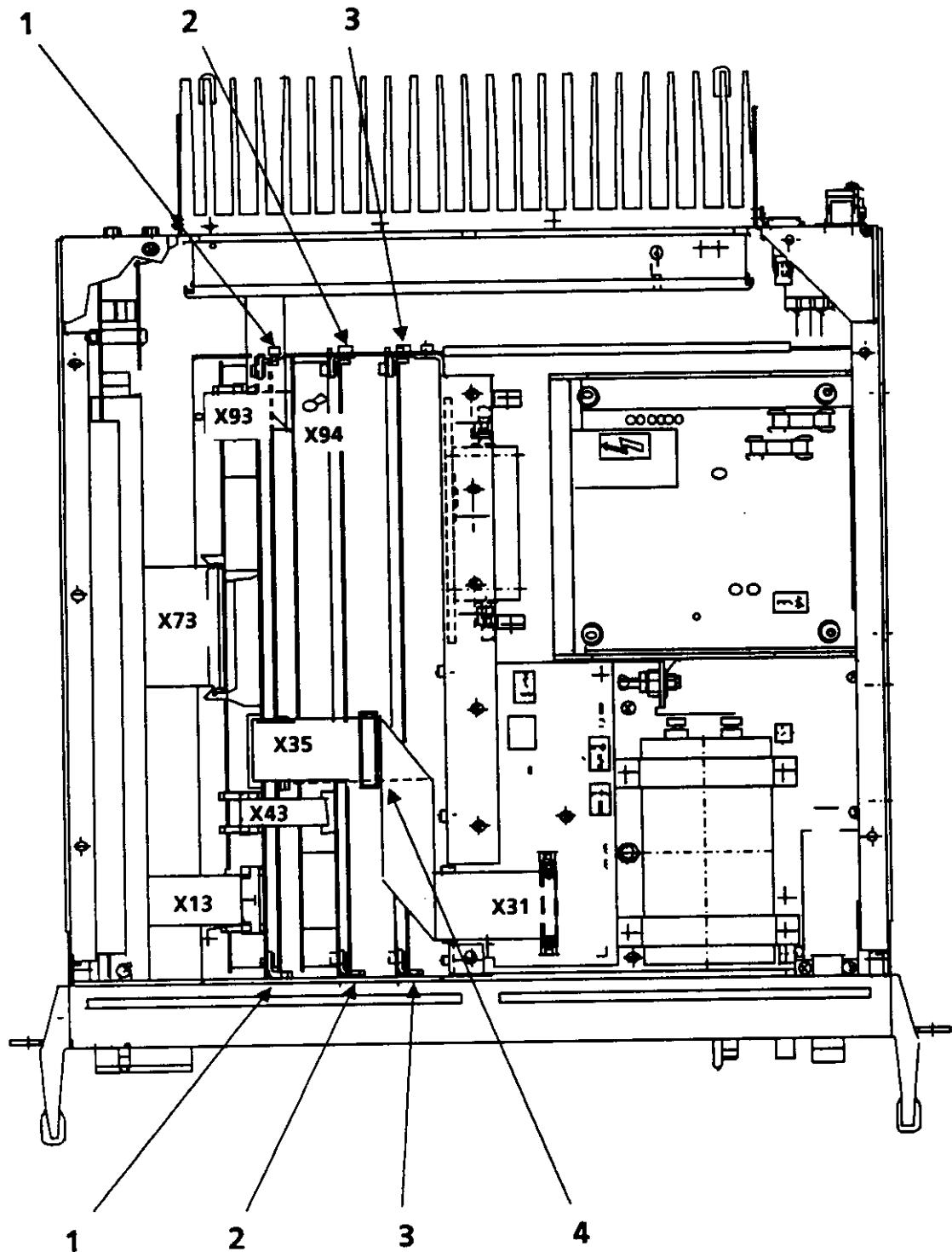


Fig. 4.5 Replacement of Modulator, Modulator Extension and VHF Synthesizer

4.3.6 Replacement of Regulator

(See Fig. 4.6)

The regulator is part of Adapter KR 201. Remove the regulator as follows:

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off ribbon-cable connectors X3 (battery connection) and AC mains (with optional power supply only). Also pull off connectors X6, X7, X8 and X9.
4. Open cover of case after undoing Phillips screws.
5. Disconnect ribbon cable X31 (to modulator), supply cable X19 (to VHF amplifier) and flat connectors X3 / X13 (to battery supply).
6. If the optional Power Supply IN 251A is installed, undo connection ST3 / ST4 on the power supply as well as connections X16 / X62, X26 / X61 and flat connector X611 (AC LED) on regulator.
7. On front panel remove small cover plate of the power switch (1, Fig. 4.6) after undoing two Phillips screws (M1.6).
8. Unscrew two Phillips screws M3 behind the cover plate and pull line of power switch to the interior of the unit.
9. Open three cable clips (3) and undo three Phillips screws M3.
10. Undo eight fixing screws (4) on base plate and two on right-hand side panel (5).
11. Take out regulator completely together with fixing bracket.

Installation is to be performed in the reverse order of removal.

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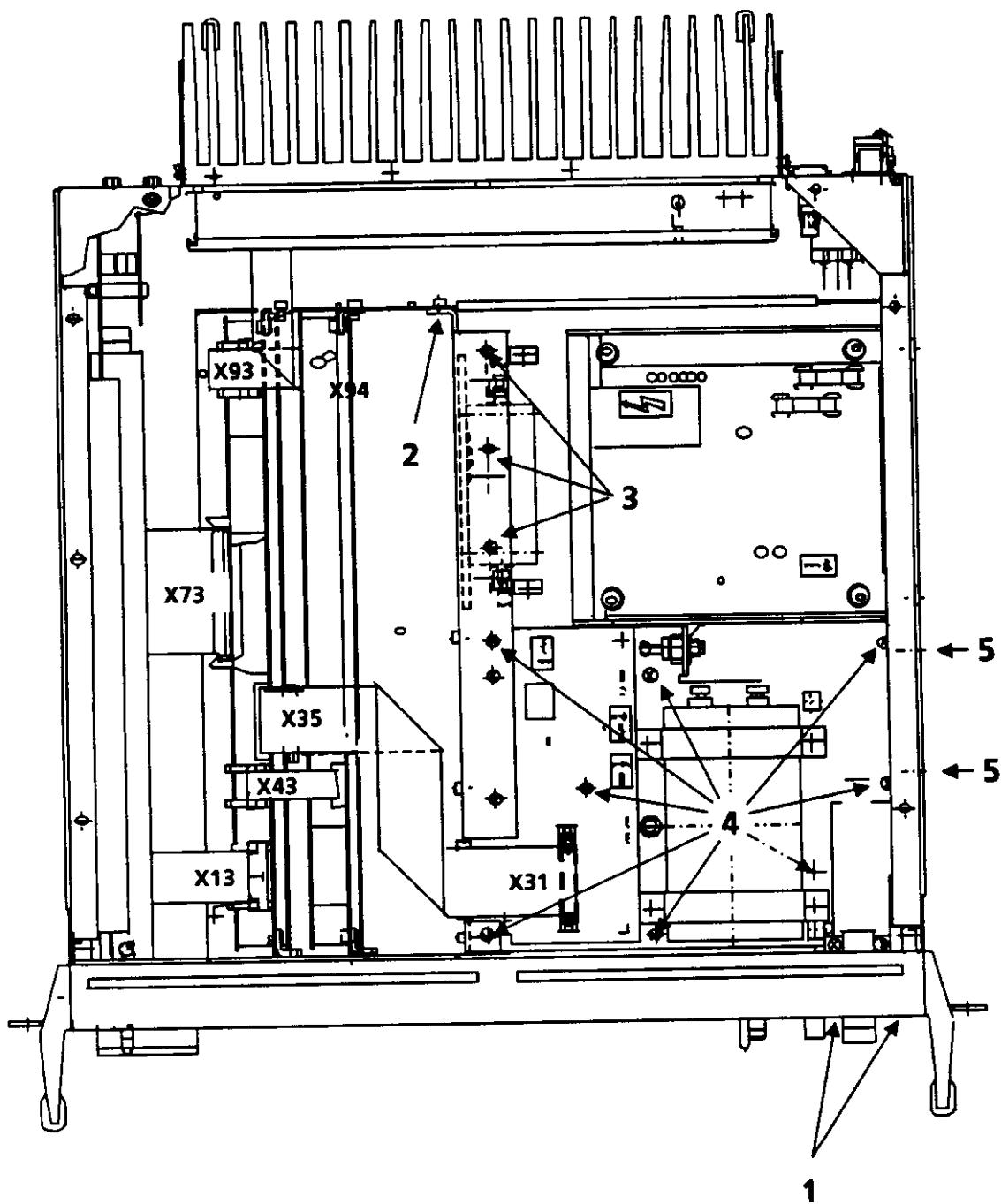


Fig. 4.6 Replacement of Regulator

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4.3.7 Replacement of Display Board

(See Fig. 4.7)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only). Also pull off connectors X6, X7, X8 and X9.
4. Open cover of case after undoing the Phillips screws.
5. Disconnect ribbon cable X13 on modulator.
6. Undo and remove four fixing screws (1) on front panel, and remove the front panel.
7. Undo fixing nuts on headset connector and toggle switches on front of mounting plate.
8. Undo two upper fixing screws (2) on display board and three lower fixing screws (3) on mounting plate and pull display board carefully out to the interior.

Installation is to be performed in the reverse order of removal.

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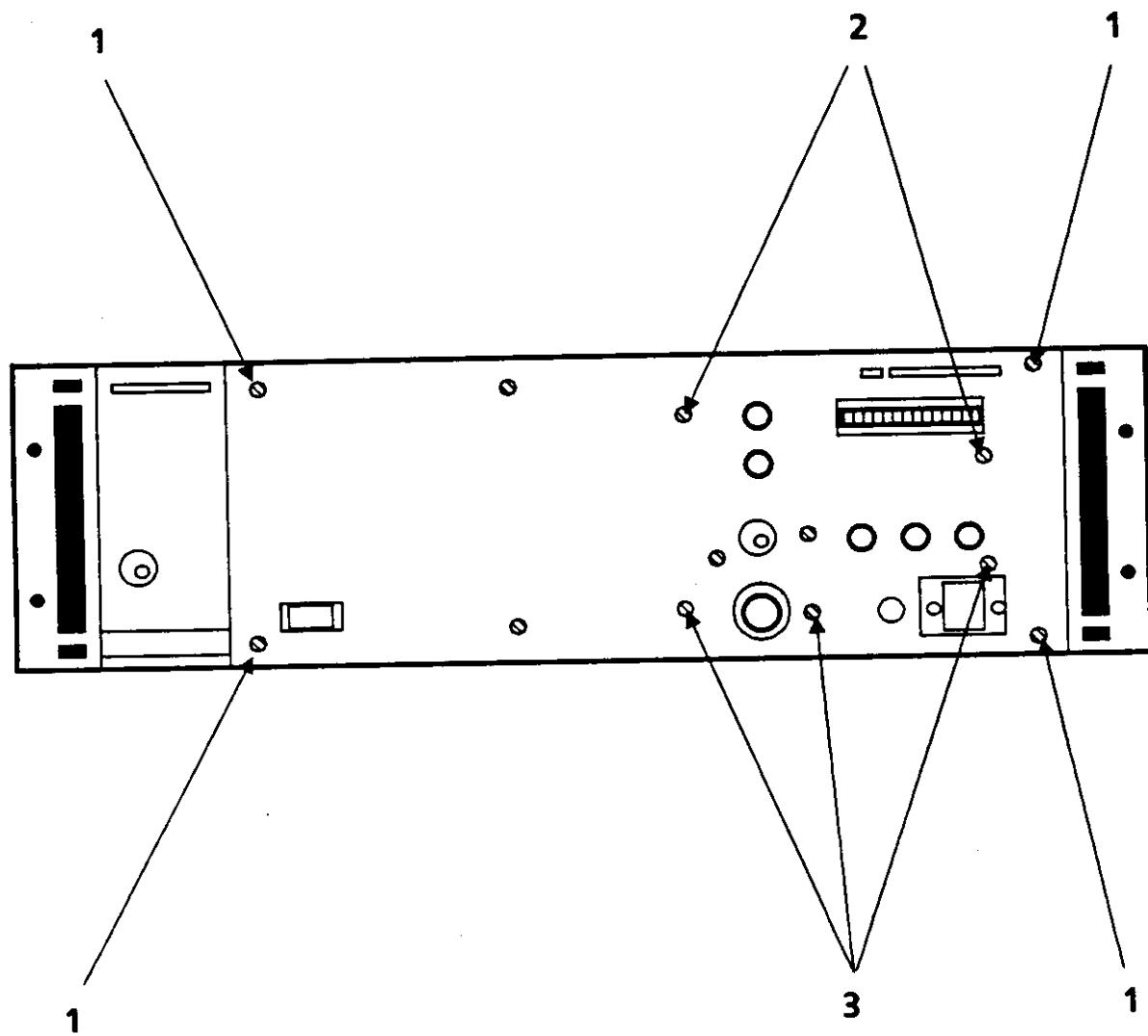


Fig. 4.7 Replacement of Display Board

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4.3.8 Replacement of VHF Amplifier VU 221V

(See Fig. 4.8)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only).
Also pull off connectors X6, X7, X8 and X9.
4. Open cover of case after undoing Phillips screws.
5. Undo four fixing screws (5) at the bottom of equipment rear panel (those shown are at the top).
6. Undo four lateral fixing screws (2) on heat sink.
7. Push VHF amplifier together with heat sink to the rear and up, then fold back by 90° to the service position.

Note:

This position permits any service measures to be performed on the VHF amplifier.

8. Disconnect ribbon cable on modulator X93 (1).
9. Pull off connector X19 (3) to regulator and RF cable on connector X94 (4). Then unscrew RF connector X191.
If the optional circulator set is installed, the two RF cables to the circulator set must also be undone (unscrew SMA connector).
10. Undo lateral guiding bolts of heat sink.
11. Remove VHF amplifier together with heat sink.

Installation is to be performed in the reverse order of removal.

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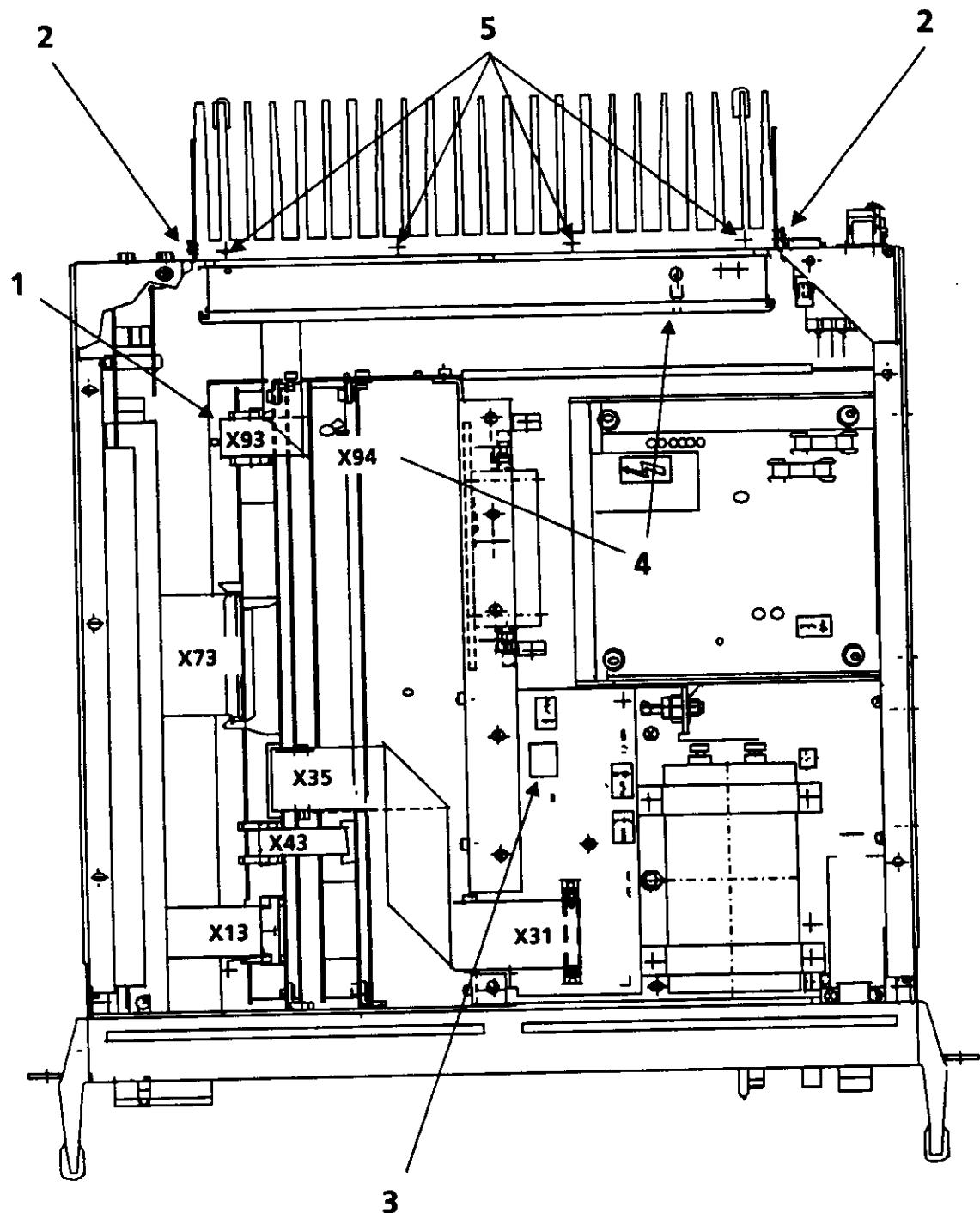


Fig. 4.8 Replacement of VHF Amplifier

6075.6491.12.01

4.3.9 Replacement of Power Supply IN 251A (Option)

(See Fig. 4.9)

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1) on front panel to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and AC mains (with optional power supply only). Also pull off connectors X6, X7, X8 and X9.
8. Undo protective earth connection on M3 screw (6).
9. On front panel remove small cover plate of power switch (7) after undoing two Phillips screws (M1.6).

Unscrew two Phillips screws M3 behind the cover plate and pull line of power switch to the interior of the equipment.

WARNING

Before opening the cover make sure that the mains connector has been pulled off!

4. Open cover of case after undoing Phillips screws.
5. Disconnect X16 (2-way) (1) from ST3 / ST4 on power supply.
6. On regulator disconnect 2-way flat connector X26 / X61 (3) and flat connector X611 (AC LED) (4).
7. Undo two Phillips screws (5) on mains connector combination and pull mains connector combination to equipment interior.
10. Undo four fixing screws M4 (8) on the right-hand side panel of VHF transceiver.
11. Undo four fixing screws M4 (9) on bottom of base plate. Then carefully take out power supply.

Installation is to be performed in the reverse order of removal.

Note:

If the optional Power Supply IN 251A is installed at a later stage, the 2-way connector X16 / X62 (2) must be disconnected from the regulator and re-connected to connector ST3 / ST4 (1) of the power supply. In addition, the cable X61 of the power supply must be connected to X26 / X61 (3) of the regulator.

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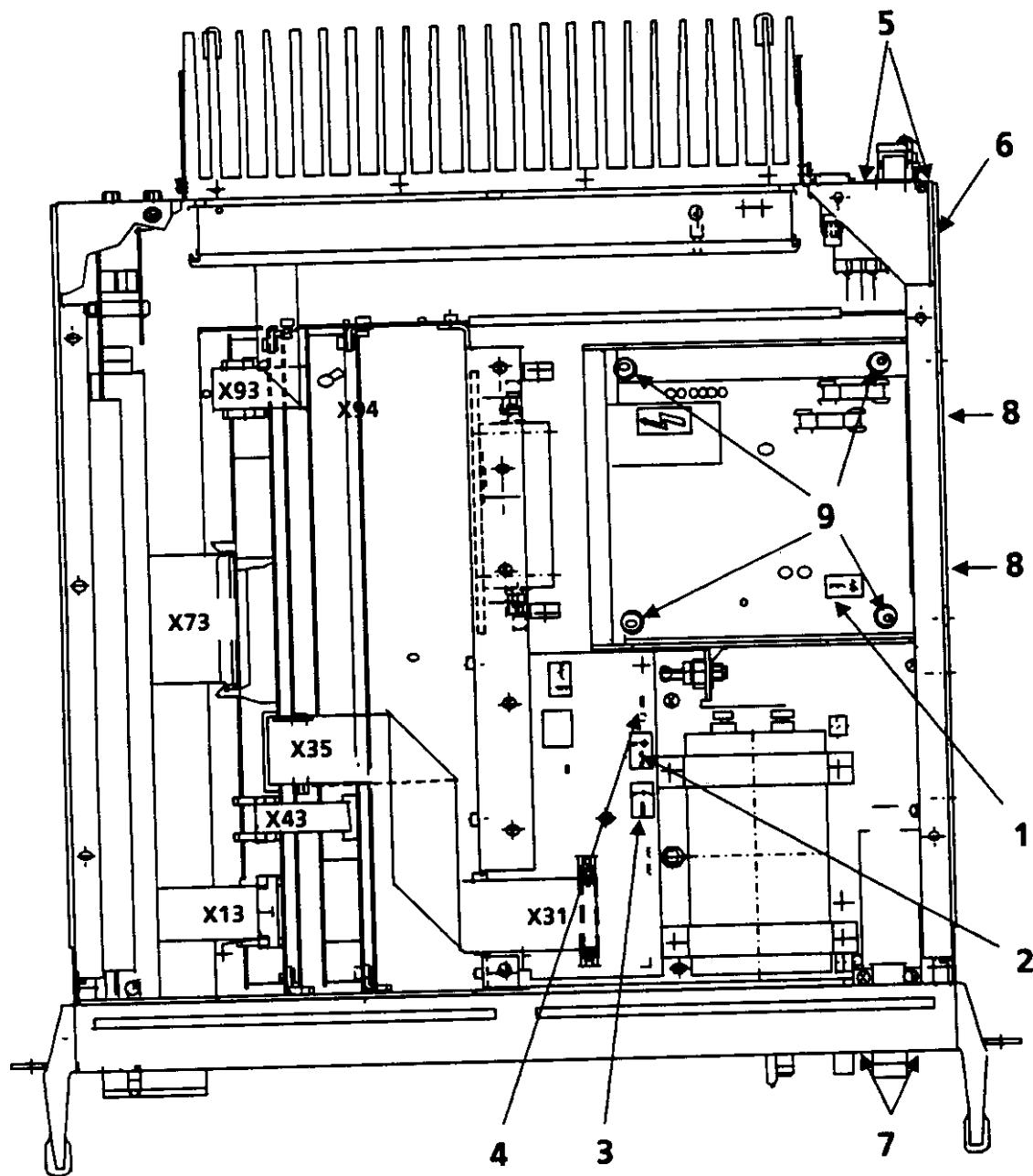


Fig. 4.9 Replacement of Power Supply (Option)

4.3.10 Replacement of Inband Interface GM 211 (Option)

(See Fig. 4.10)

1. Remove VHF Rx Unit EU 231 acc. to 4.3.1.
2. Undo nine Phillips screws on the cover of the Rx unit.

CAUTION

Do not undo screws marked with a square symbol!

The inband interface itself is mounted to the inside of the cover (see Fig. 4.10 below).

4. Undo and remove four Phillips screws fixing the inband interface to the cover of the Rx unit.

3. Carefully remove the cover towards the top. Undo the connection X1 / X69.

Installation is to be performed in the reverse order of removal.

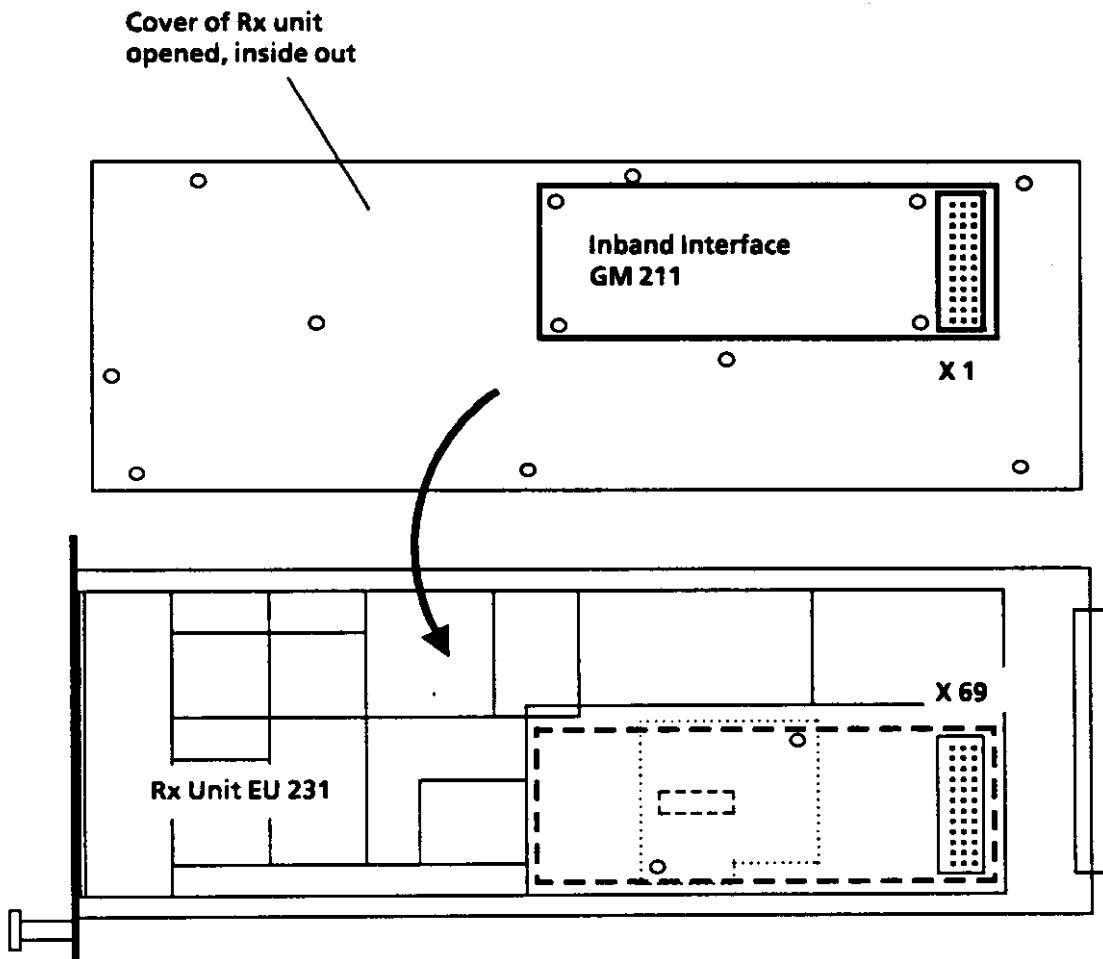


Fig. 4.10 Replacement of Inband Interface (Option)

4.3.11 Replacement of Crystal Filter

(See Fig. 4.11)

When changing from 25-kHz to 8.33-kHz frequency spacing (and vice versa), the crystal filter will have to be replaced. The required filters can be supplied by R&S upon request. Please state the respective Ident. No.:

R&S Ident. No. EP 6043.2384 for 8.33 kHz

R&S Ident. No. EP 6024.3650 for 25 kHz

1. Remove VHF Rx Unit EU 231 acc. to 4.3.1.
2. Undo nine Phillips screws on the cover of the Rx unit.

CAUTION

Do not undo screws marked with a square symbol!

3. Carefully remove the cover towards the top without slanting. This also undoes the connection to the optional inband interface, if installed.
4. Carefully pull the crystal filter off the pins without slanting.

Installation is to be performed in the reverse order of removal.

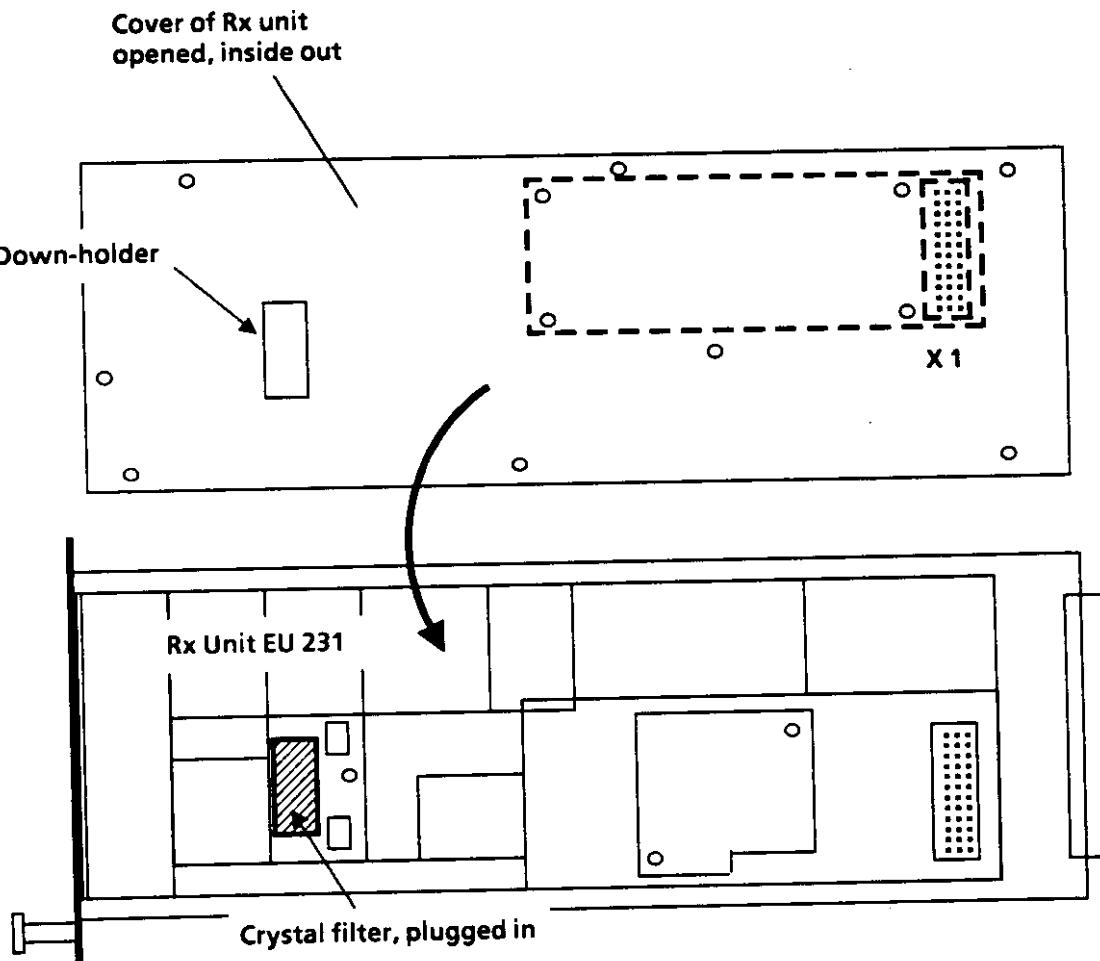


Fig. 4.11 Replacement of Crystal Filter

4.3.12 Retrofit of Options

4.3.12.1 Installation of Tx / Rx Diode Switch

Due to the rather complex soldering and alignment required, the Tx / Rx diode switch must be installed at the factory only.

WARNING

Beware of touching the heat sink during transmission where temperatures may rise as high as 70 °C!

4.3.12.2 Installation of Cabinet KK 251

For desktop applications the optional Cabinet KK 251 is available.

The heat sink of the transmitter's power section, which may heat up considerably depending on the conditions of transmission, protrudes beyond the cabinet rear.

There is no protection against accidental contact.

CAUTION

The maximum permitted unit temperature can only be guaranteed under the following conditions:

- *ambient temperature of max. 40 °C*
- *duty cycle (transmission / reception) max. 1:5*

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4.3.12.3 Retrofit of VHF Circulator Set GD 200V

CAUTION

For retrofitting the circulator set rather complex soldering on the amplifier PCB is required. Therefore this job should be done by qualified personnel only!

(See Fig. 4.12)

Preparations

1. On front panel set switch REM / LOC / OFF (20, Fig. 3.1) to position OFF.
2. Set power switch (11, Fig. 3.1, with optional Power Supply IN 251A only) to off-position.
3. On equipment rear pull off connectors X3 (battery connection) and X4 (AC mains, with optional Power Supply IN 251A only).
4. Open cover after undoing Phillips screws.

5. Remove Modulator GM 201 (1), Synthesizer GF 201V (2) and, if present, Modulator Extension GM 201C8 (3) acc. to the previous chapters of this manual.
6. If present, remove the optional Lowpass Filter GH 200V (4).
7. Remove two cable clips (5).
8. Undo and remove four fixing screws (7) at the bottom of the heat sink. The figure shows the four respective screws at the top.
9. Undo four fixing screws (6) at the heat sink, two at the top and two at the bottom.
10. Push VHF amplifier together with heat sink to the rear and up, then fold back by 90° to the service position.

This position now allows the connection to the VHF amplifier.

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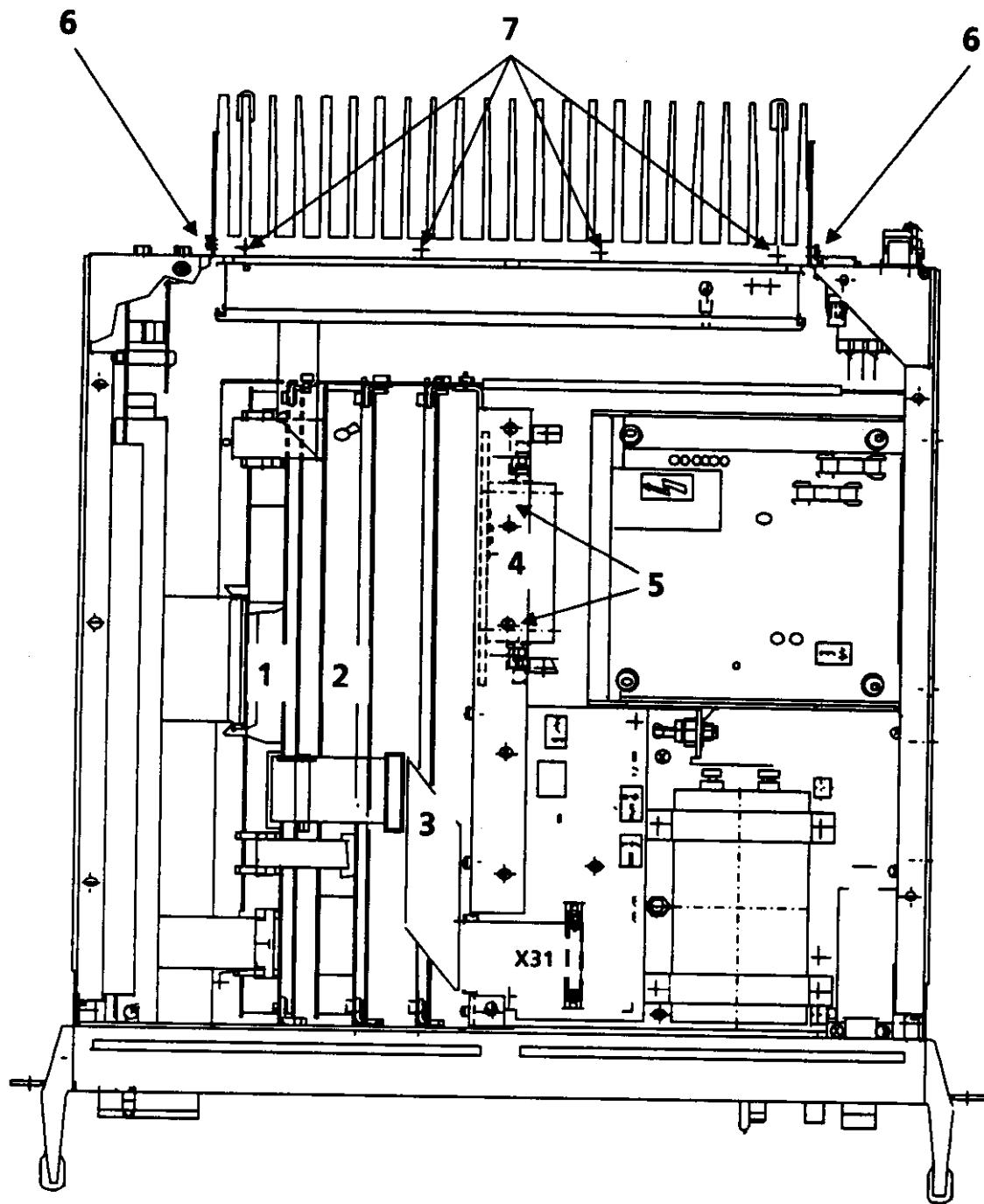


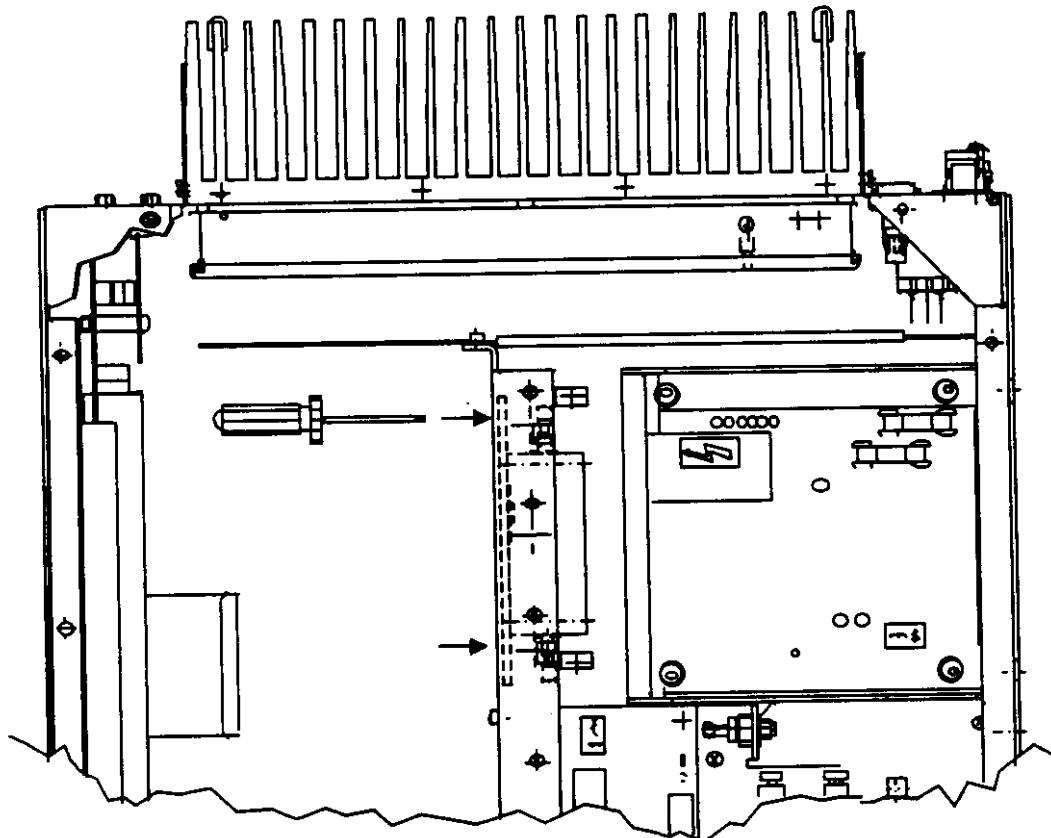
Fig. 4.12 Preparations for Retrofit of Circulator Set (Option)

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Installation

1. a) Screw the two supplied RF cables with straight SMA connectors loosely to circulator connectors.
- b) Apply heat-conducting compound to mounting surface of circulator.
- c) Attach circulator from the rear to the intermediate wall by means of four screws (see figure below). For this use a short screw driver or angular screw driver.

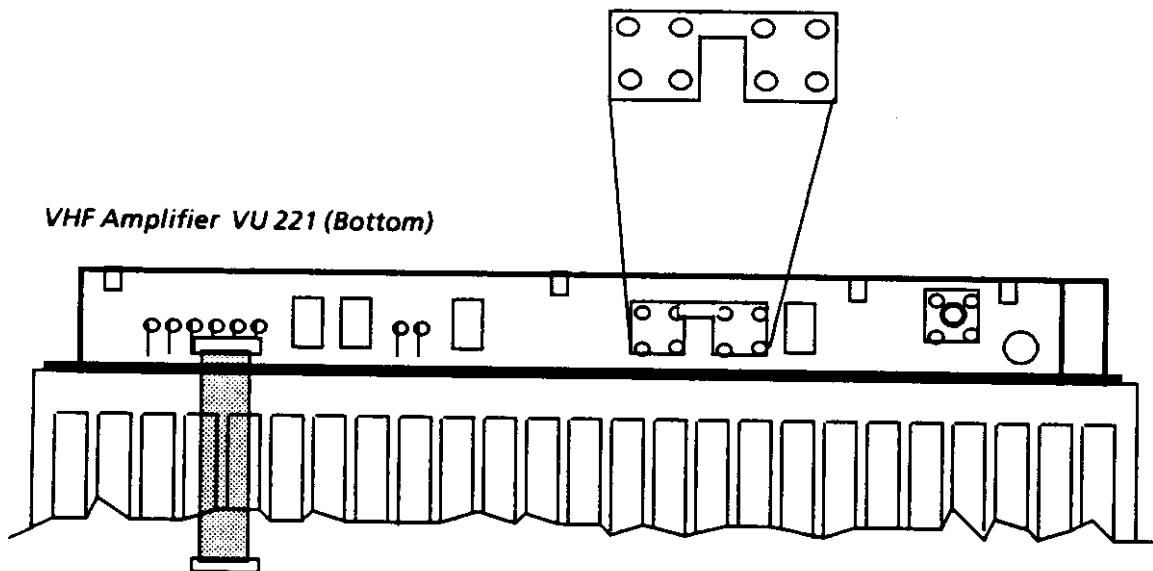


2. Remove screening cover of VHF Amplifier VU 221 after undoing the Phillips screws (torque 35 Ncm).

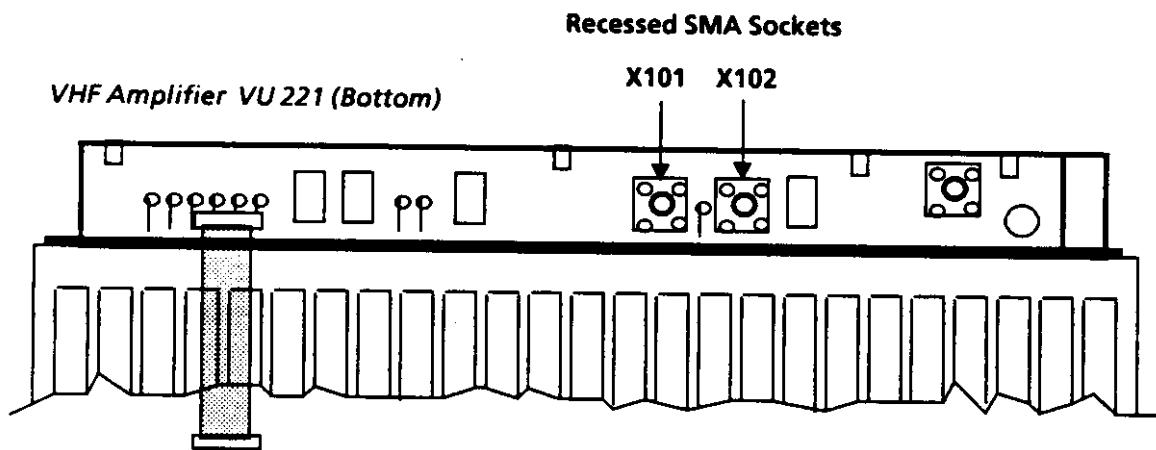
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3. On VHF amplifier remove dummy plate (X101 / X102) after undoing and removing the eight screws. Keep the screws and washers for fixture of SMA sockets X101 and X102.



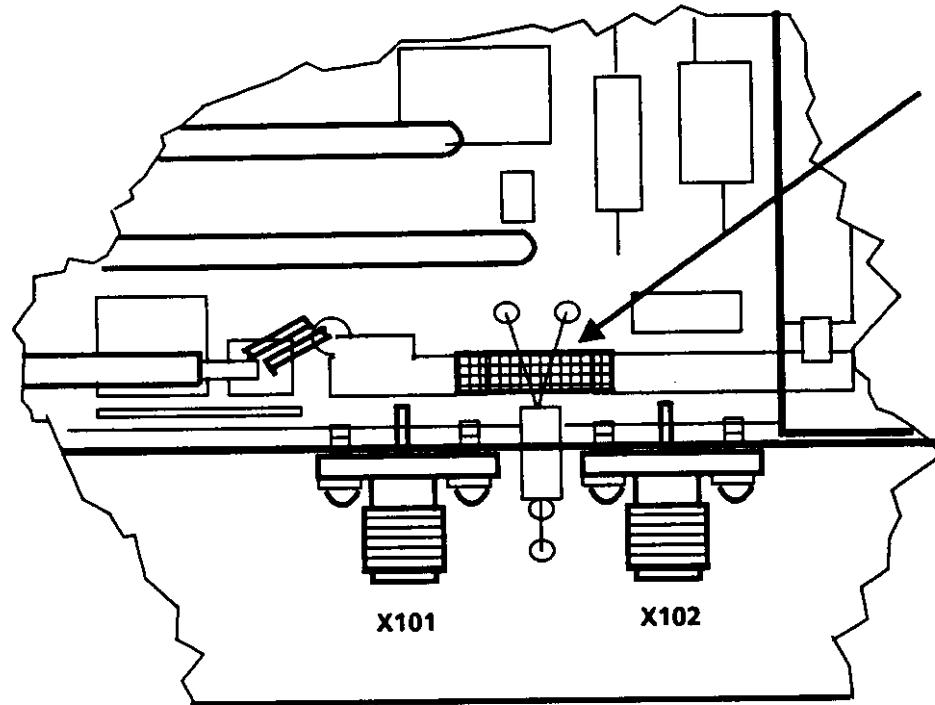
4. Fix recessed SMA sockets to the screening wall by means of eight screws.



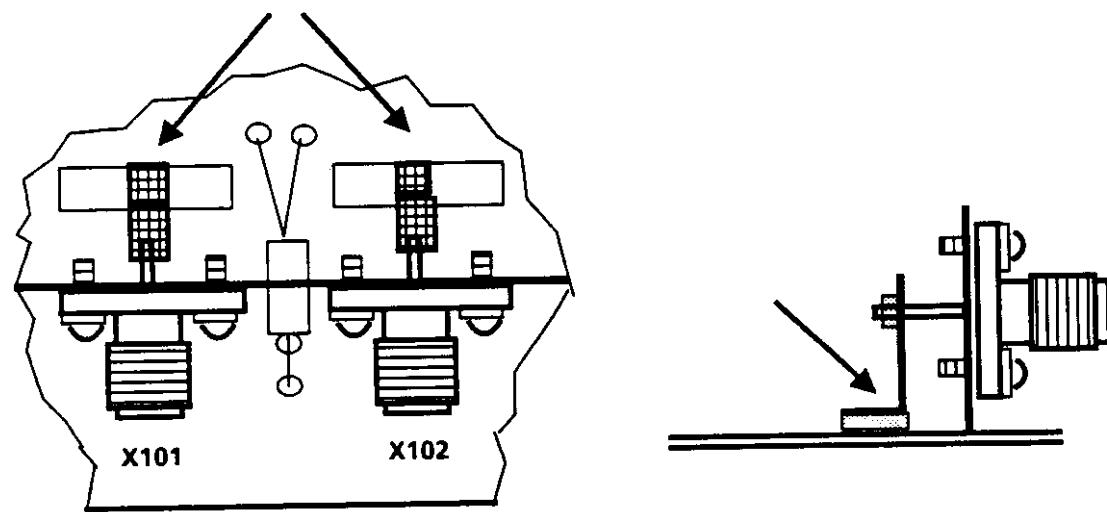
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5. On PCB unsolder strap between X101 and X102 (see arrow in figure below) by means of soldering iron and remove.



6. Solder angles to inner conductors of SMA sockets X101 and X102.



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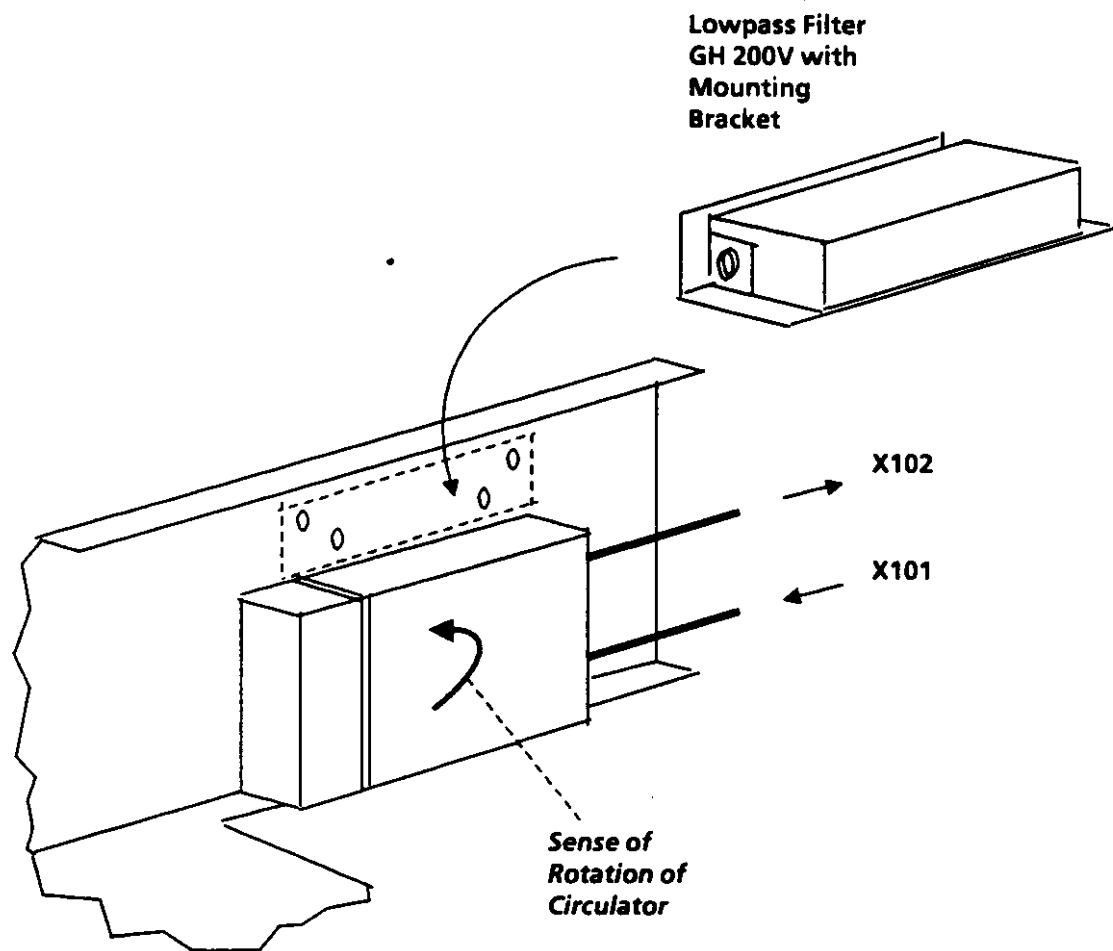
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7. Cable-connect the circulator to SMA sockets X101 and X102 with the angular connectors on the amplifier side and the straight connectors on the circulator side. Tighten SMA connectors by using an 8-mm open-end wrench (torque 100 Ncm).

CAUTION

Be absolutely sure to turn the circulator in the correct direction!

8. If present, screw the optional Lowpass Filter GH 200V to the mounting bracket above the circulator.



9. Re-assembly is to be carried out in the reverse order of disassembly.



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A1. Settings

A1.1 General

The following slide-in and plug-in modules of VHF Transceiver XU 221 can be set to particular operating functions, as required:

- Power Supply IN 251A (option)
- VHF Synthesizer GF 201V
- Modulator GM 201
- Interface 1 GI 201X
- VHF Rx Unit EU 231
- Inband Interface GM 211 (option)
- Modulator Extension GM 201C8

The optional Power Supply IN 251A is set ex works to a mains voltage of 230 VAC. With the voltage selector (equipment rear) the power supply can be set to other mains voltages.

The Synthesizer GF 201V contains several DIL switches serving to select the transmit frequency.

The Modulator GM 201 contains pin contacts onto which jumpers are attached.

By positioning these jumpers onto other contact pairs various operating functions may be set.

The Interface 1 GI 201X contains pin contacts onto which jumpers are attached. By positioning these jumpers onto other contact pairs various operating functions may be set.

The Rx Unit EU 231 contains several contacts onto which jumpers are attached. By positioning these jumpers onto other contact pairs various operating functions may be set.

The optional Inband Interface GM 211 contains pin contacts onto which jumpers are attached. By positioning these jumpers onto other contact pairs various operating functions may be set.

The Modulator Extension GM 201C8 contains a coding switch for setting the frequency increment.

The following sections provide detailed information on the possible jumper and switch positions and their respective functions. In addition, setting procedures are described.

A1.2 Settings on Power Supply IN 251A (Option)

A1.2.1 Setting of Mains Voltage

1. For mains operation first of all check which mains voltage is available.

CAUTION

The Power Supply IN 251A installed in the transceiver is set ex works to a mains voltage of 230 VAC.

A window in the combination with mains connector on the equipment rear (Fig. 2.1) indicates the set voltage. For mains voltages available at the installation site other than 230 VAC the power supply has to be switched over accordingly.

2. Alter internally set mains voltage as follows:
 - a) Disconnect mains and battery cables. Open cover of combination with mains connector by means of screw driver (see Fig. A1.1a).

- b) Alter setting of voltage selector by turning cylindrical switch with screw driver (see Fig. A1.1b).
- c) Close cover of combination with mains connector.

A1.2.2 Replacement of Fuses after Altering the Mains Voltage Setting

1. Disconnect all connecting cables from power supply.
2. Open cover of combination with mains connector by means of screw driver (see Fig. A1.1a).
3. Ease fuses F1 and F2 carefully out of their holders acc. to Fig. A1.1c by means of screw driver (fuse type H 260 according to IEC).

F 1	115 V:	T 8 A	5 x 20 mm
	230 V:	T 4 A	5 x 20 mm
F 2	115 V:	T 8 A	5 x 20 mm
	230 V:	T 4 A	5 x 20 mm

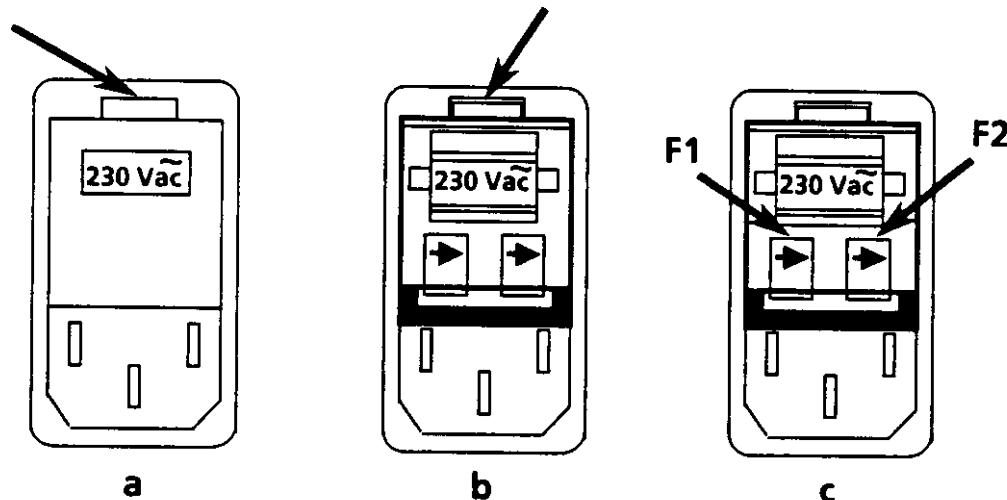


Fig. A1.1 Setting of Voltage Selector / Replacement of Fuses

A1.3 Settings on VHF Synthesizer GF 201V

On the VHF synthesizer the following settings can be made:

- Transmit frequency for different frequency spacings
- Transmit frequency offset and
- Reference frequency.

Depending on the model of the VHF synthesizer different reference oscillators are used. The respective reference frequency also is set by using different methods. In order to find out the relevant method more easily, at this point an overview of the different synthesizer models is given.

A1.3.1 Explanation of Models

Ident. No. XU 221	Ident. No. GF 201V	Version	Reference oscillator	Frequency spacing	Frequency shift *
6043.9343.22 6043.9343.23	6044.6948.22	standard	TCXO 1.5 ppm	8.33 / 12.5 kHz switchable	50 kHz
6043.9343.26 6043.9343.27					
6043.9343.42 6043.9343.43					
6043.9343.24 6043.9343.25	6044.6948.23	high frequency precision	OCXO 0.2 ppm	8.33 / 12.5 kHz switchable	50 kHz
6043.9343.44 6043.9343.45					
6043.9343.46 6043.9343.47					

TCXO: *temperature-compensated crystal oscillator*

OCXO: *oven-controlled crystal oscillator*

*) *automatic shift of synthesizer frequency for reception*

A1.3.2 Setting of Transmit Frequency for 12.5-kHz Frequency Spacing

(See Fig. A1.2)

1. Set switch REM / LOC / OFF (20, Fig. 3.1) on the transceiver front panel to OFF. Set power switch (11) to off-position and disconnect mains and / or battery cable.
2. Remove cover at the top of the VHF transceiver after undoing the Phillips screws.
3. Set Synthesizer GF 201V by means of DIL switches S1 to S3 (at the top of the synthesizer) to new transmit frequency.

The frequency values of all DIL switches set to ON are added up.

Note:

Make sure that DIL switch S1.8 CH (frequency spacing) is set to position 12.5.

The permitted frequency range is between 118 and 144 MHz. Setting of an impermissible frequency causes all three VCOs to be inhibited.

The entry of a pseudotetradecade also inhibits all VCOs, that is, per BCD decade no sum value higher than "9" is permitted to be set.

Example: 4 MHz + 8 MHz >9 MHz not allowed

The correct setting would be: 10 MHz + 2 MHz

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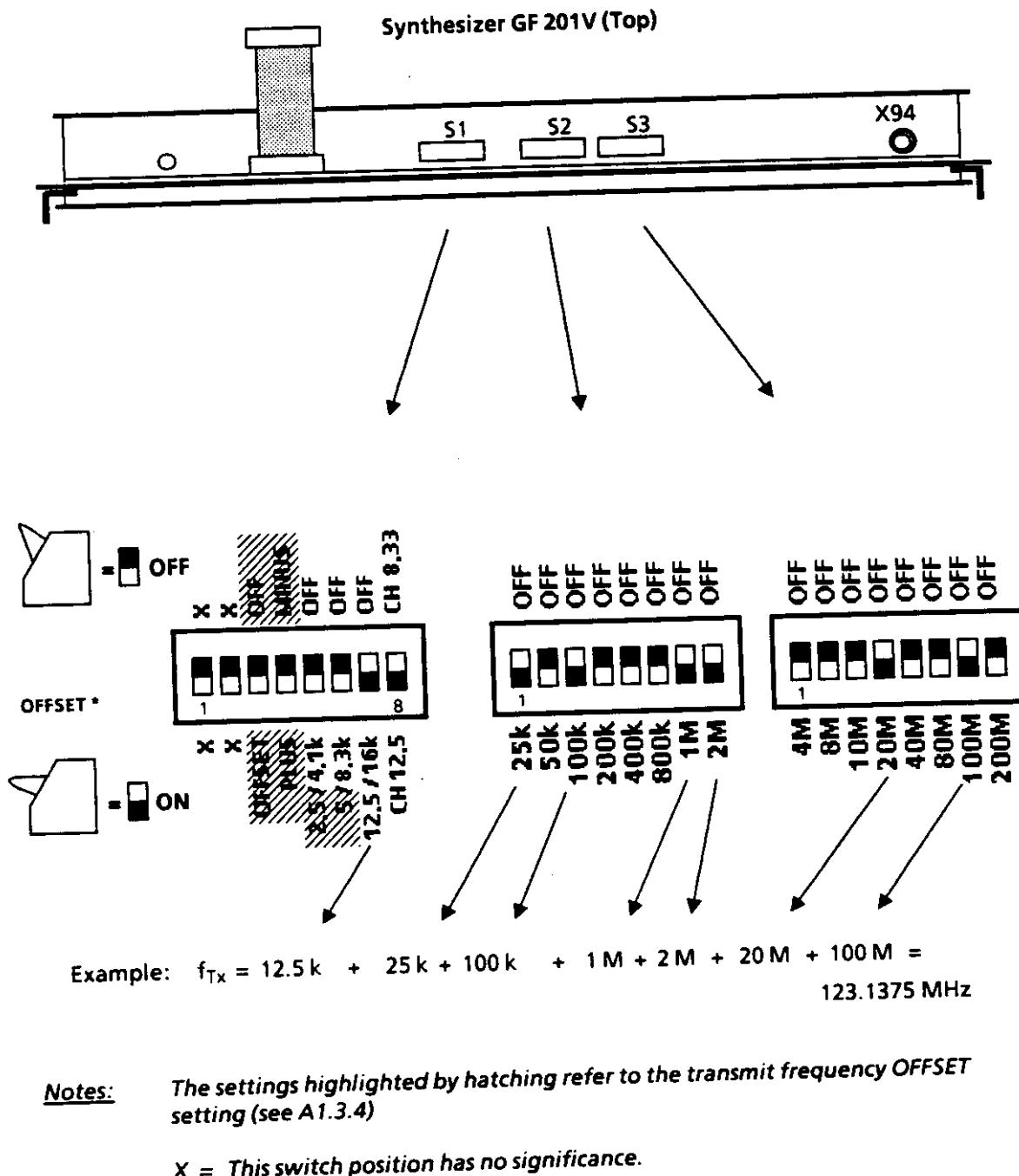


Fig. A1.2 Setting of Transmit Frequency for 12.5-kHz Frequency Spacing

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A1.3.3 Setting of Transmit Frequency for 8.33-kHz Frequency Spacing (See Fig. A1.3)

1. Set switch REM / LOC / OFF (20, Fig. 3.1) on the transceiver front panel to OFF. Set power switch (11) to off-position and disconnect mains and / or battery cable.
2. Remove cover at the top of the VHF transceiver after undoing the Phillips screws.
3. Set Synthesizer GF 201V by means of DIL switches S1 to S3 (at the top of the synthesizer) to new transmit frequency.

The frequency values of all DIL switches set to ON are added up.

In this example the 8.33-kHz spacing is selected by means of DIL switch S1.6.

Note:

Make sure that DIL switch S1.8 CH (frequency spacing) is set to position 8.33.

The permitted frequency range is between 118 and 144 MHz. Setting of an impermissible frequency causes all three VCOs to be inhibited.

The entry of a pseudotetradecade also inhibits all VCOs, that is, per BCD decade no sum value higher than "9" is permitted to be set.

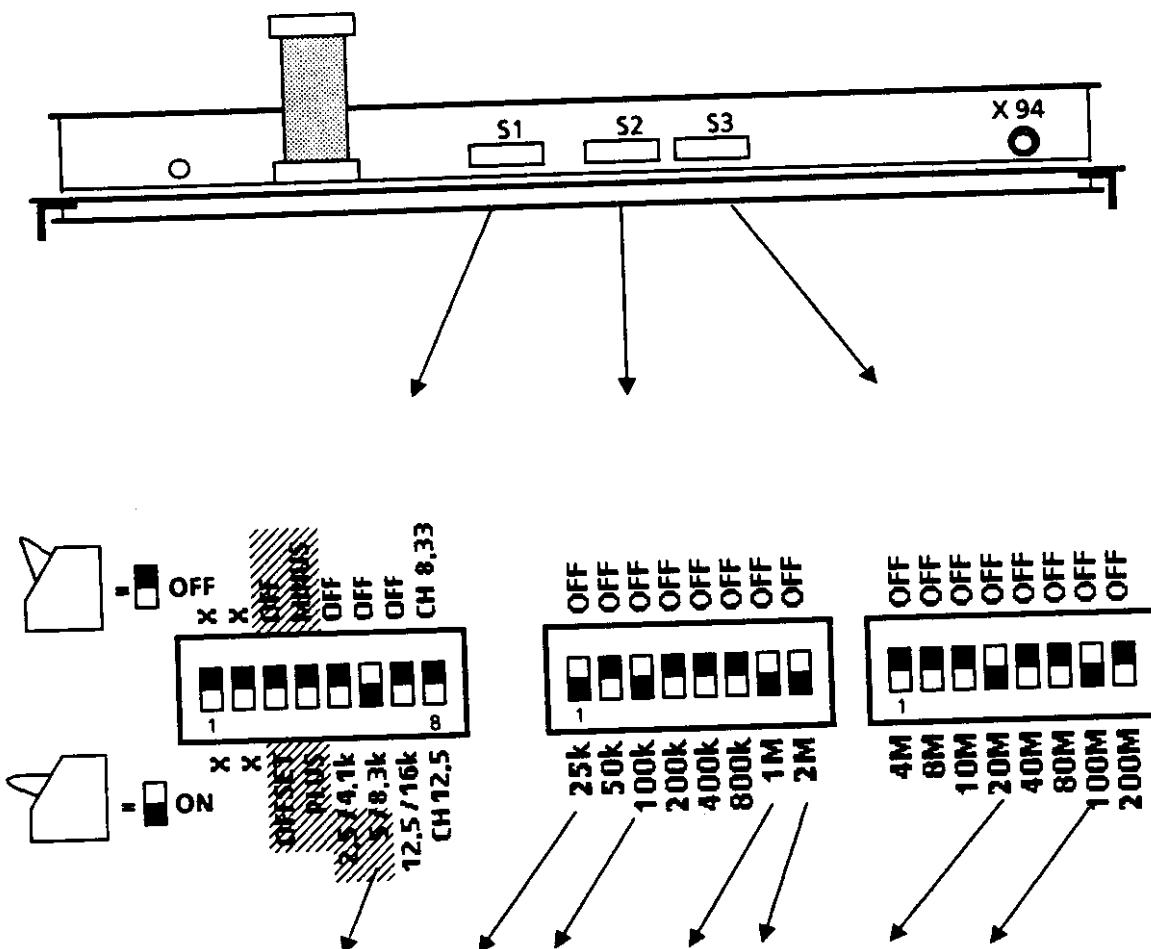
Example: $4 \text{ MHz} + 8 \text{ MHz} > 9 \text{ MHz}$ not allowed

The correct setting would be: $10 \text{ MHz} + 2 \text{ MHz}$

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Synthesizer GF 201V (Top)



Example: $f_{TX} = 8.33\text{ k} + 25\text{ k} + 100\text{ k} + 1\text{ M} + 2\text{ M} + 20\text{ M} + 100\text{ M} = 123.13333\text{ MHz}$

Notes: The settings highlighted by hatching refer to the transmit frequency OFFSET setting (see A1.3.4)

X = This switch position has no significance.

Fig. A1.3 Setting of Transmit Frequency for 8.33-kHz Frequency Spacing

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A1.3.4 Setting of Transmit Frequency Offset

(See Fig. A1.4)

1. Set switch REM / LOC / OFF (20, Fig. 3.1) on the transceiver front panel to OFF. Set power switch (11) to off-position and disconnect mains and / or battery cable.

sizer) to new transmit frequency (see A1.3.2).

2. Remove cover at the top of the VHF transceiver after undoing the Phillips screws.

Note:

Make sure that for setting the transmit frequency offset DIL switch S1.8 CH (frequency spacing) is set to position 12.5.

3. Set Synthesizer GF 201V by means of DIL switches S1 to S3 (at the top of the synthe-

For setting the transmit frequency offset refer to the table below.

	S1.3	S1.4	S1.5	S1.6
OFF	OFFSET off	OFFSET -	0 kHz	0 kHz
ON	OFFSET on	OFFSET +	2.5 kHz	5 kHz

Synthesizer GF 201V (Top)

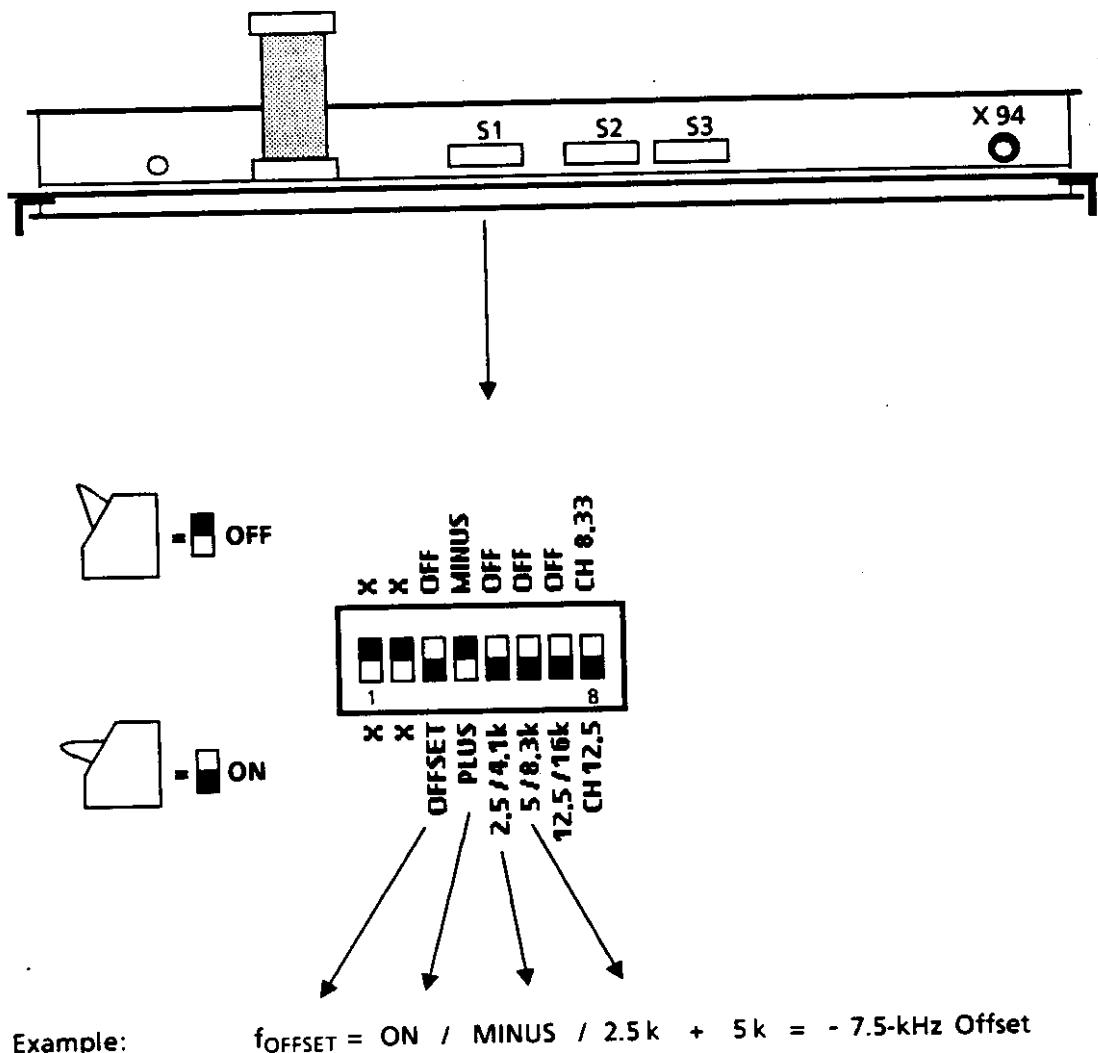


Fig. A1.4 Setting of Transmit Frequency Offset

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A1.3.5 Alignment of Crystal Reference Frequency (Mod. 22 / 23 - TCXO)

(See Fig. A1.5)

Note:

Normally, this alignment of the temperature-compensated crystal oscillator (TCXO) will be required at intervals of approx. three years.

1. Set switch REM / LOC / OFF (20, Fig. 3.1) on the transceiver front panel to OFF.
2. Set power switch (11) to off-position and disconnect mains and / or battery cable.
3. Remove cover at the top of the VHF transceiver after undoing the Phillips screws.
4. At X94 connect a frequency counter (accuracy better than 0.1 ppm).
5. By means of DIL switches S1 to S3 set frequency of 120 MHz (no offset).
6. Re-connect mains and / or battery cable, set power switch to on-position and set switch REM / LOC / OFF to LOC.
7. Switch transceiver on and allow approx. half an hour to warm up.
8. In the event of a frequency deviation, at variable control R101 align frequency to $120\text{ MHz} \pm 10\text{ Hz}$ by means of a screw driver.
9. Switch off transceiver and disassemble test setup.
10. Re-attach top cover of VHF transceiver by means of the Phillips screws.

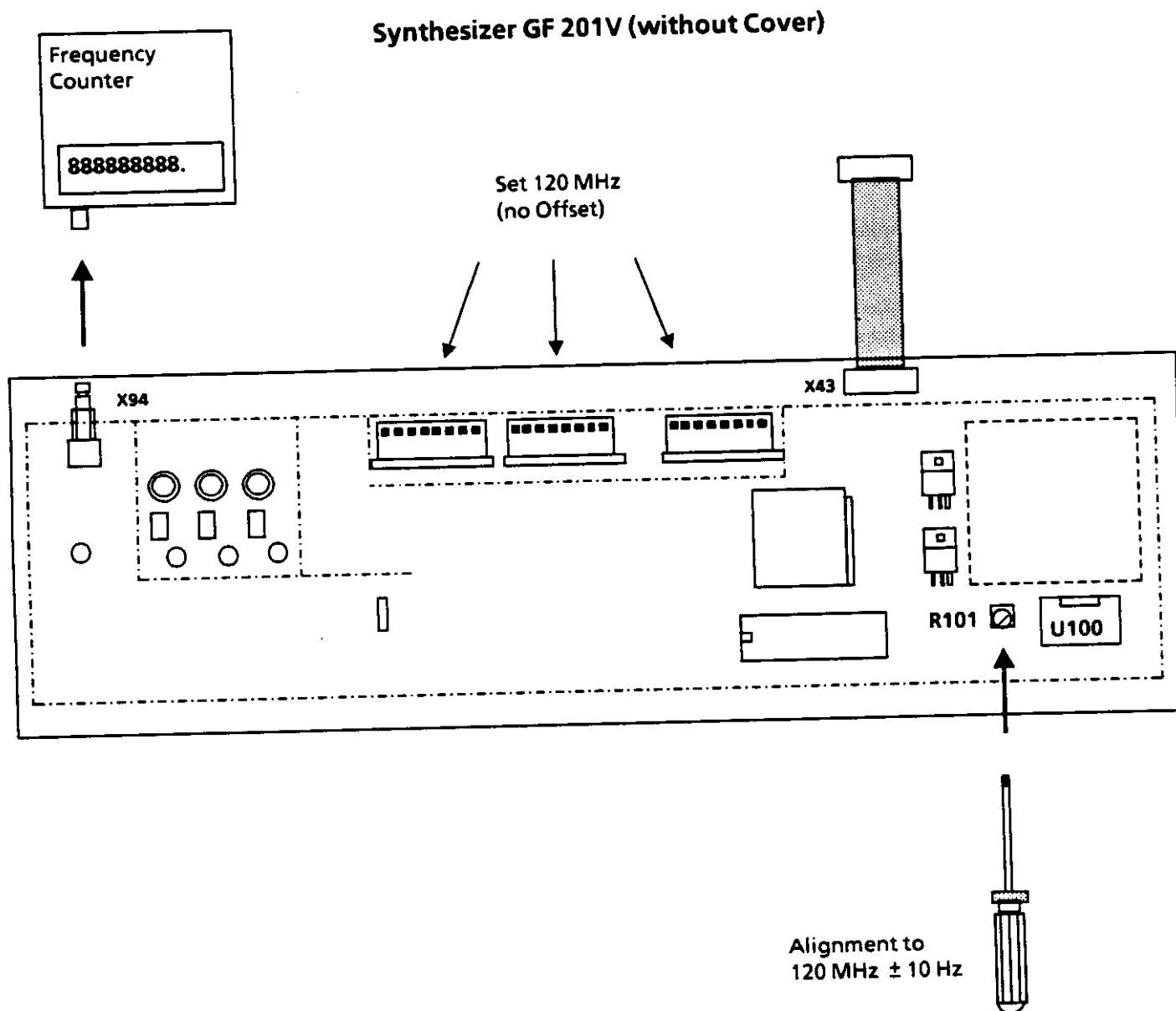


Fig. A1.5 Alignment of Reference Frequency on Synthesizer (Mod. 22 / 23 - TCXO)

A1.3.6 Alignment of Reference Frequency of Oven-controlled Crystal Oscillator (Mod. 24 / 25 - OCXO)

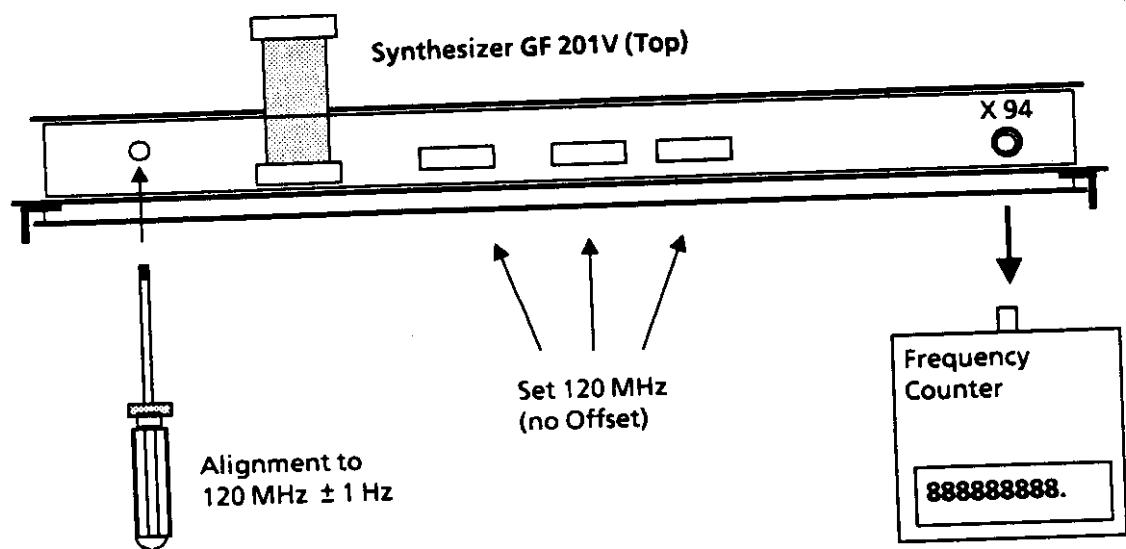
(See Fig. A1.6)

Note:

Normally, this alignment of the oven-controlled crystal oscillator (OCXO) will be required at intervals of approx. three years.

1. Set switch REM / LOC / OFF (20, Fig. 3.1) on the transceiver front panel to OFF.
2. Set power switch (11) to off-position and disconnect mains and / or battery cable.
3. Remove transceiver top cover after undoing the Phillips screws.
4. At X94 connect a frequency counter (accuracy better than 0.1 ppm).
5. By means of DIL switches S1 to S3 set frequency of 120 MHz (no offset).
6. Re-connect mains and / or battery cable, set power switch to on-position and set switch REM / LOC / OFF to LOC.
7. Switch transceiver on and allow approx. half an hour to warm up.
8. In the event of a frequency deviation, at the variable control of the OCXO align frequency to 120 MHz ± 1 Hz by means of a screw driver.
9. Switch transceiver off again and disassemble test setup.
10. Re-attach top cover of VHF transceiver and tighten Phillips screws.

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**Fig. A1.6 Alignment of Reference Frequency on Synthesizer
(Mod. 24 / 25 - OCXO)**

A1.4 Settings on Modulator GM 201**A1.4.1 Jumpers**

This chapter deals with the jumpers by means of which operating functions can be altered. The text on the following pages applies to **Model 03 of Modulator GM 201 only!**

In order to check or alter any settings remove Modulator GM 201 as described in 4.3.2. Open the modulator on its top after undoing 12 Phillips screws. Consequently, all jumpers and pin contacts are accessible.

(See Fig. A1.7, page 1)

AF filter**X10 Setting ex works:**

Jumper on contacts X10.1 and .2

Jumper on contacts X10.3 and .5

Jumper on contacts X10.10 and .12

The external 8.33-kHz filter in the optional Modulator Extension GM 201C8 is connected in series with the internal filter (0.3 to 3.4 kHz).

Or: Jumper on contacts X10.2 and .4 and jumper on contacts X10.10 and .12

Only the internal AF filter is used.

ALC**X110 Setting ex works:**

Jumper on contacts X110.2 and X110.3

ALC (Automatic Level Control) is enabled.

Or: Jumper on X110.1 and X110.2

AF gain is firmly set.

RF power reduction**X250 Setting ex works:**

No jumper on X250

Normal operation, RF power reduction is effective.

Or: Jumper on X250.1 and X250.2

For service purposes only; RF power reduction is ineffective.

VHF / UHF**X322 Setting ex works:**

Jumper on contacts X322.1 and X322.2

Equipment operates in VHF range.

Or: Jumper on X322.2 and X322.3

Equipment operates in UHF range (not used for XU 221).

Control loop**X323 Setting ex works:**

No jumper on X323

Normal operation, with integrating phase-locked loop

Or: Jumper on X323.2 and X323.3

For service purposes only; integrating part of phase-locked loop is disabled.

Inband control**X411 Setting ex works:**

Jumper on contacts X411.1 and X411.2

Transceiver is cut out by Inband Control GM 211 in the event of a failure.

Or: No jumper on X411

Transceiver is not cut out by Inband Control GM 211 in the event of a failure.

PTT time limiting**X532 Setting ex works:**

Jumper on contacts X532.1 and X532.2

PTT time limiting is disabled.

Or: Jumper on X532.2 and X532.3

PTT time limiting is enabled.

Monitoring**X715 Setting ex works:**

Jumper on contacts X715.2 and X715.3

Monitoring is via directional coupler.

Or: Jumper on contacts X715.1 and X715.2

Monitoring is via the receiver.)

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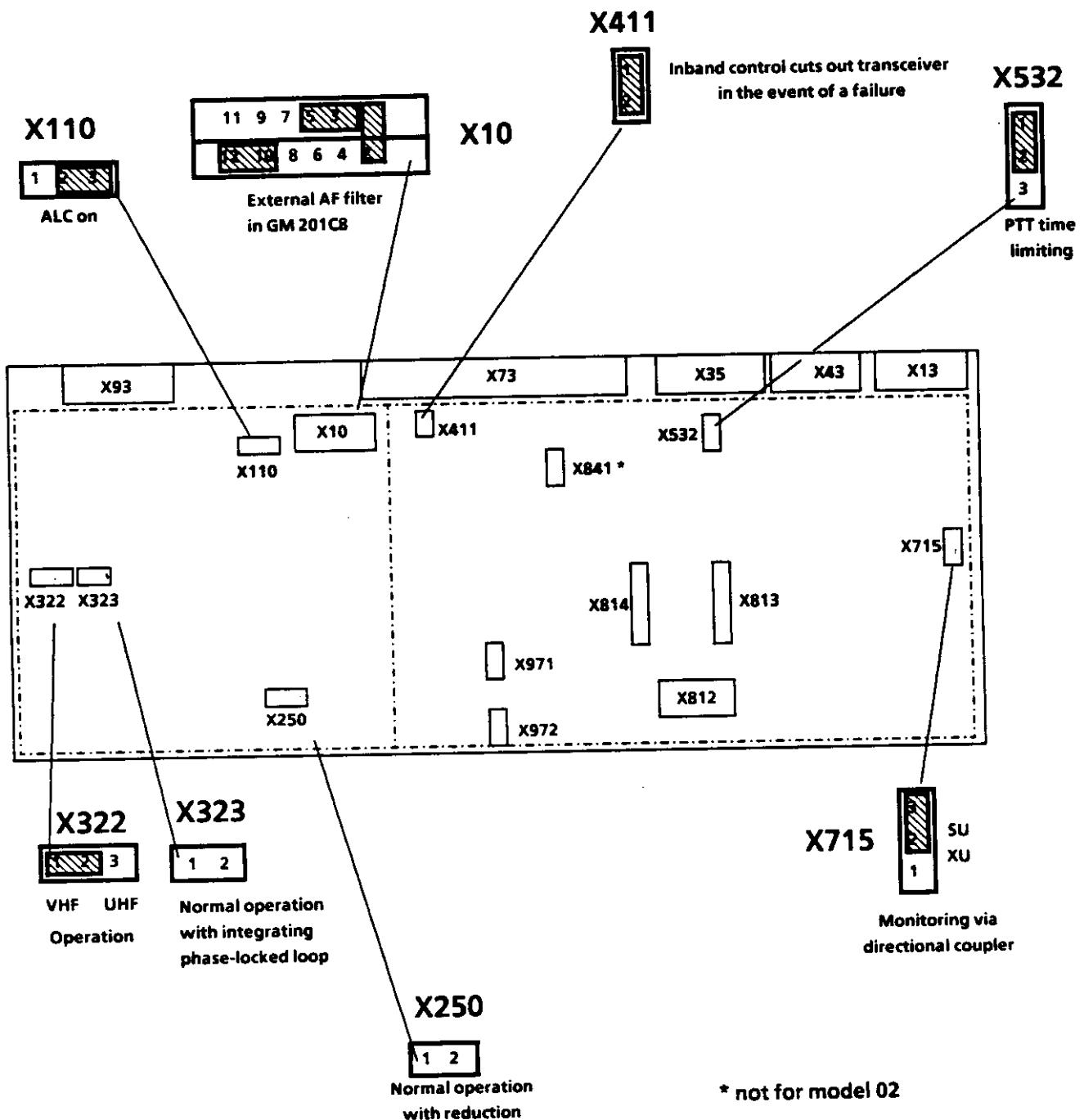


Fig. A1.7 Jumpers in Modulator GM 201 (page 1 of 4)

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(See Fig. A1.7, page 2)

User-defined bit

X841 Not for Model 02 !

Setting ex works:

Jumper on X841.2 and X841.3

User-defined bit: only output (XU 221)

Or: Jumper on contacts X841.1 and .2

User-defined bit: input / output (SU 221)

Or: Jumper on X971.2 and X971.3

If value of VSWR is above limit, then sum test result is NoGo, transmission is blocked (*the error is stored*).

Sum test / carrier message

X972 Setting ex works:

Jumper on X972.1 and X972.2

If value of carrier is below limit, then sum test result is NoGo, but transmission is still possible (*the error is not stored*).

Or: No jumper on X972

Sum test is independent of carrier message.

Or: Jumper on X972.2 and X972.3

If value of carrier is below limit, then sum test result is NoGo, transmission is blocked (*the error is stored*).

Sum test / VSWR

X971 Setting ex works:

Jumper on X971.1 and X971.2

If value of VSWR is above limit, then sum test result is NoGo, but transmission is still possible (*the error is not stored*).

Or: No jumper on X971

Sum test is independent of VSWR message

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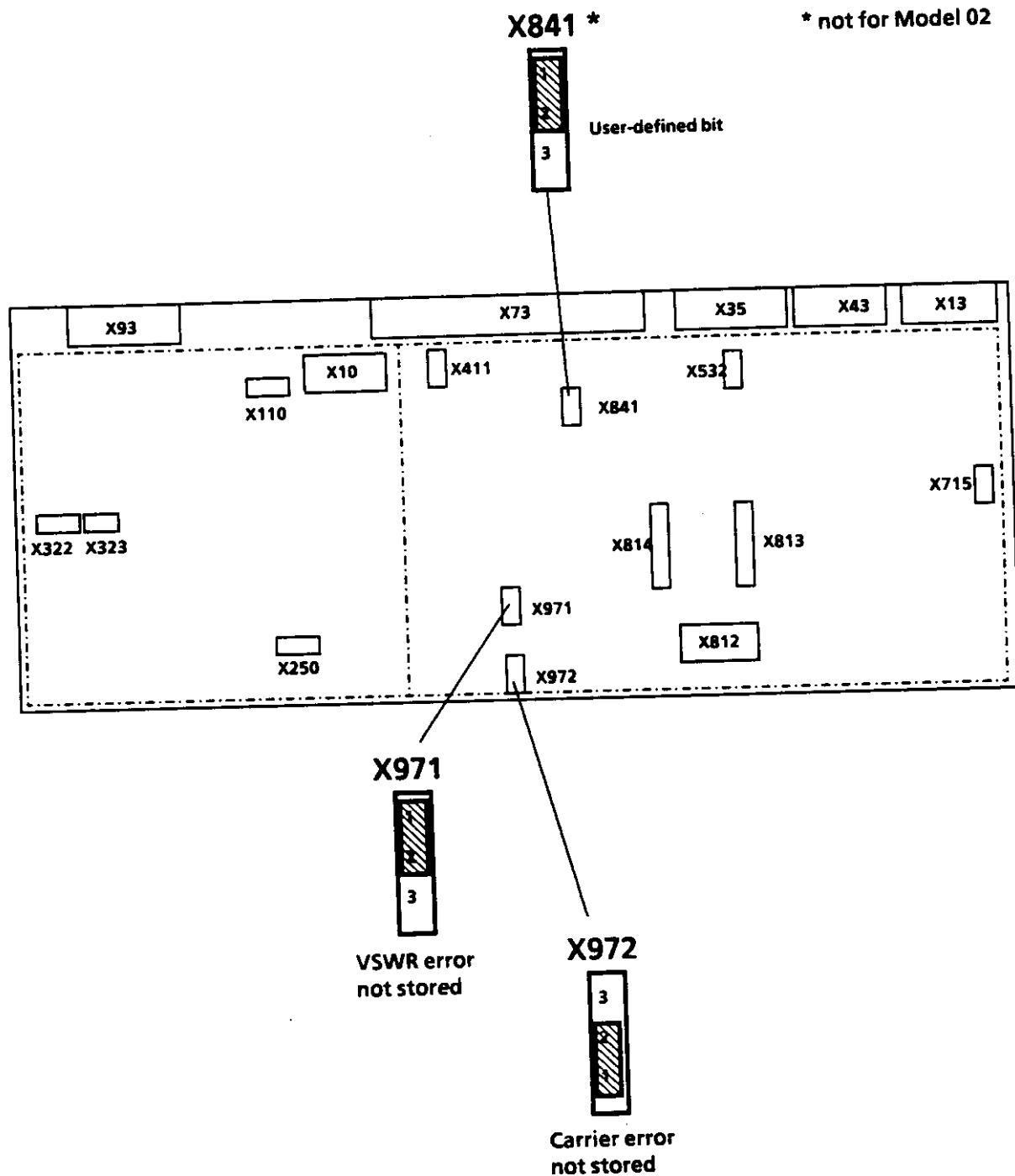


Fig. A1.7 Jumper in Modulator GM 201 (page 2 of 4)

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REM BUS Addressing

(See Fig. A1.7, page 3)

The binary addresses set on jumpers X812 and X813 / X814 are added up. On X812 the MSB address is set.

All jumpers connecting contacts of X812 horizontally do not have any function; this position is used for "parking" only.

X812 Setting ex works:

No jumper on X812

MSB packet address REM BUS ("56")

For further variable settings see Fig. A1.7, page 4.

X813 Setting ex works:

Jumper on contacts X813.1 and X813.2
LSB packet address REM BUS (address "0")

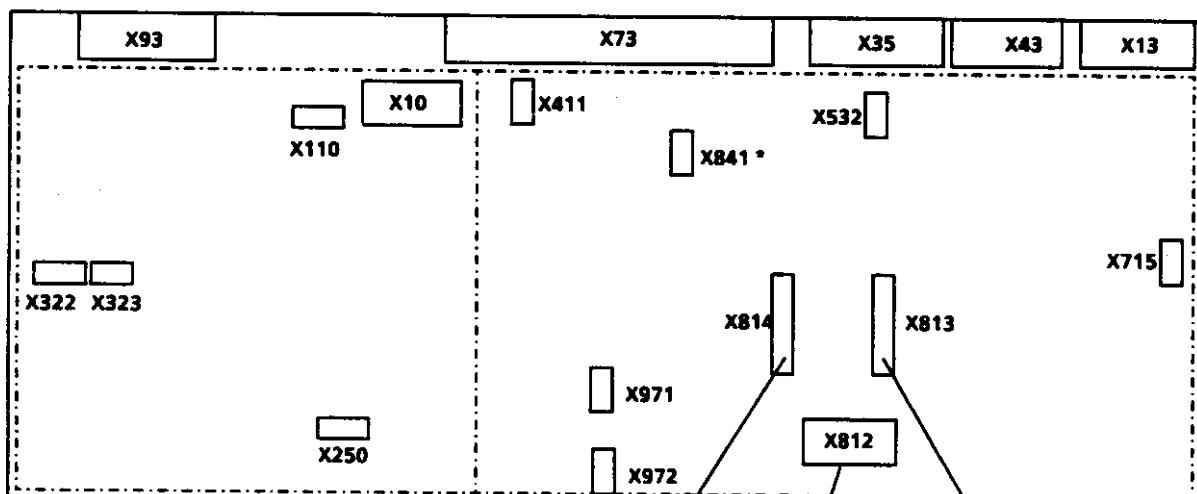
For further variable settings see Fig. A1.7, page 4.

X814 Setting ex works:

No jumper on X814

LSB packet address REM BUS (address "0")

For further variable settings see Fig. A1.7, page 4.



* not for model 02

X814



X813



Setting of
LSB packet
addresses
(see Fig. A1.7,
page 4)

Setting of MSB packet
address
(see Fig. A1.7, page 4)



X812

Fig. A1.7 Jumpers in Modulator GM 201 (page 3 of 4)

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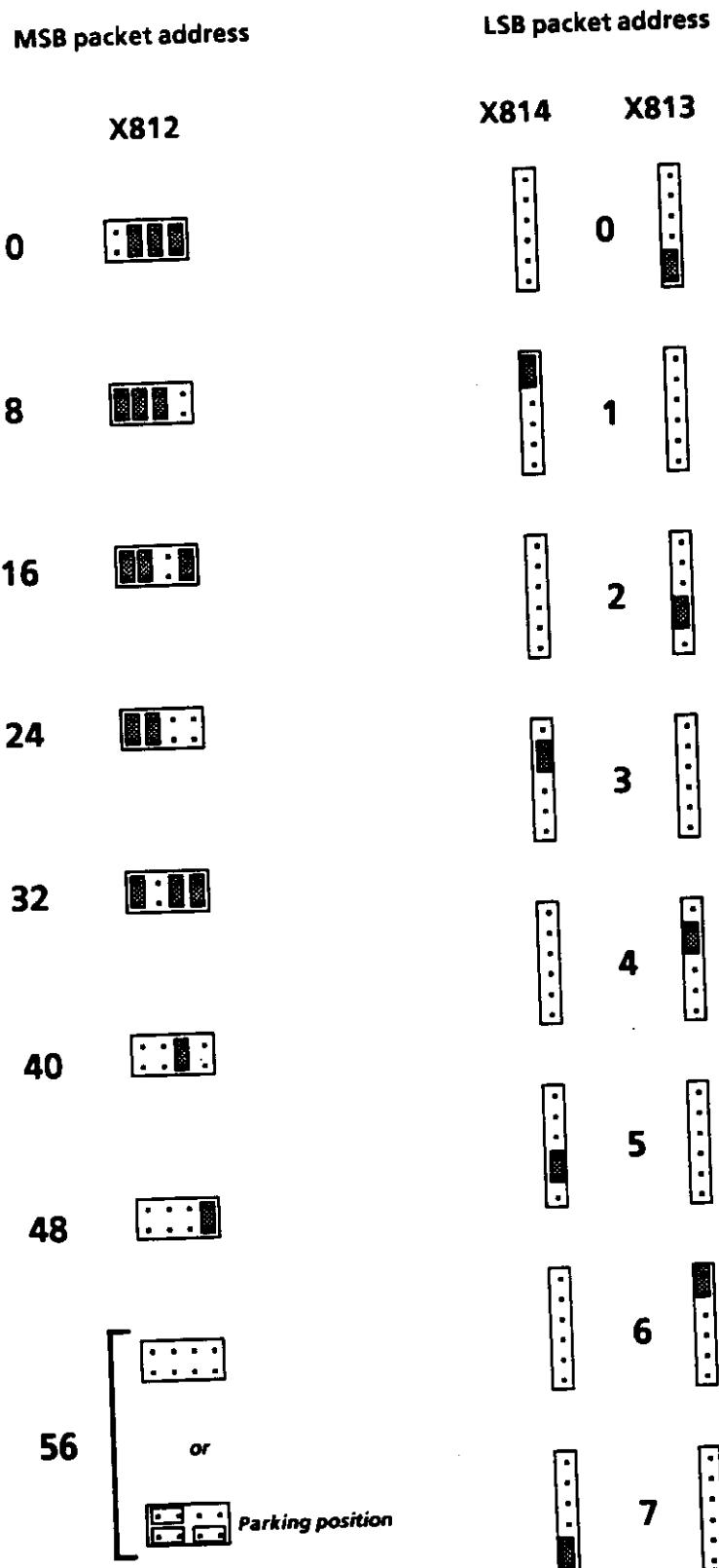


Fig. A1.7 Jumper settings in Modulator GM 201 (page 4 of 4)

A1.4.2 Setting of Output Power and Modulation Depth

(See Fig. A1.8)

CAUTION

The following settings are only to be made by service staff with the necessary qualifications, provided appropriate test equipment is available. Careless detuning of values can impair the transceiver's technical data and be the cause of failures!

Setting of normal output power

By means of variable resistor R303 the output power for normal operation is set (PH = Power High).

CAUTION

For power adjustment the antenna connector X2 must be terminated with a sufficient dummy load, failing which the transceiver might be damaged!

Setting of reduced output power

By means of variable resistor R304 reduced output power is set (PL = Power Low).

Setting of nominal value:

By means of a power meter measure the output power and with variable resistor R303 adjust to desired value.

Setting of modulation depth

By means of variable resistor R254 the modulation depth is set (M = modulation). For this a modulation meter (e.g. FMA from R&S) is required which is connected via an attenuator (e.g. RBU 100 from R&S) to antenna output X2 of the transceiver.

Nominal value: 89 to 91%

Setting of nominal value:

By means of a power meter measure the output power and with variable resistor R303 adjust to 50 W max.

CAUTION

Overmodulation will lead to distortions!

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Modulator GM 201 (Top)

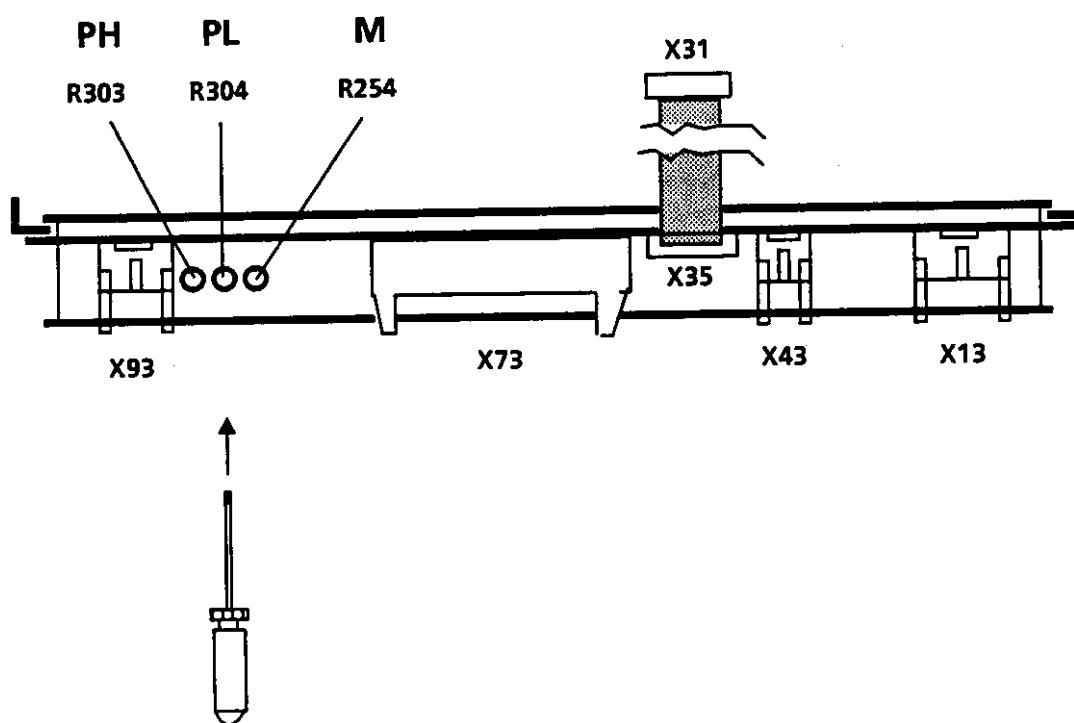


Fig. A1.8 Variable Resistors for Setting of RF Power and Modulation Depth

A1.5 Settings on Interface 1 GI 201X

A1.5.1 Jumpers

This chapter deals with jumpers by means of which operating functions can be altered.

For this purpose remove Interface 1 GI 201X as described in chapter 4.3.2.

(See Fig. A1.9, page 1)

X110 Setting ex works:

Jumpers on the following contacts of X110

.1 and .3, .2 and .4, .5 and .7, .6 and .8

The AF signal from the REMOTE connector (e.g. from remote control unit) is fed in at AF / TX / A (X9.2) and AF / TX / B and routed via transformer T110 and variable resistor R110 for level adjustment to the modulator (X73.31 AF-TX-A / C and X73.32 AF-TX-B / D).

Or:

Jumpers on contacts .1 and .2, .3 and .4, .5 and .6, .7 and .8

The AF signal from the REMOTE connector (e.g. from remote control unit) is fed in at AF / TX / A (X9.2) and AF / TX / B and looped via transformer T110 and variable resistor R110 for level adjustment through the inband interface (X1.C4 / C5 AF-TX-A / B) and routed further to the modulator (X73.31 AF-TX-A / C and X73.32 AF-TX-B / D).

X115 no function!

X120 Setting ex works:

Jumpers on the following contacts X120.1 and .3, X120.7 and .8

- PTT OPTO / VOP: At the anode of the optocoupler LED a positive voltage is available (V_{OP}). If -PTT (X9.16) is connected to ground potential, a current will flow through the optocoupler and initiate carrier activation.

Or: Jumpers on .3 and .4, .7 and .8

- PTT OPTO / FLOAT: Carrier activation is initiated, if between +PTT (X9.17) and -PTT (X9.16) a voltage of 5 to 35 V is applied.

Or: Jumpers on contacts .3 and .4, .7 and .9

PTT OPTO / GND: Carrier activation is initiated, if between +PTT (X9.17) and GND (X9.20) a voltage of 5 to 35 V is applied.

Or: Jumpers on contacts .2 and .4, .8 and .10

- PTT NORM: Carrier activation is initiated, if PTT (X9.16) and GND (X9.20) are interconnected.

Or: Jumper on contacts .3 and .5, .7 and .9

- PTT PHANTOM: Carrier activation is initiated, if AF / TX / A (X9.2) and / or AF / TX / B (X9.3) are connected DC-wise to GND (X9.1).

Or: Jumpers on .2 and .4, .10 and .12

PTT PHANTOM / GND: Carrier activation is initiated, if at AF / TX / A and / or AF / TX / B a voltage of +5 to 35 V referred to ground (X9.1) is fed in.

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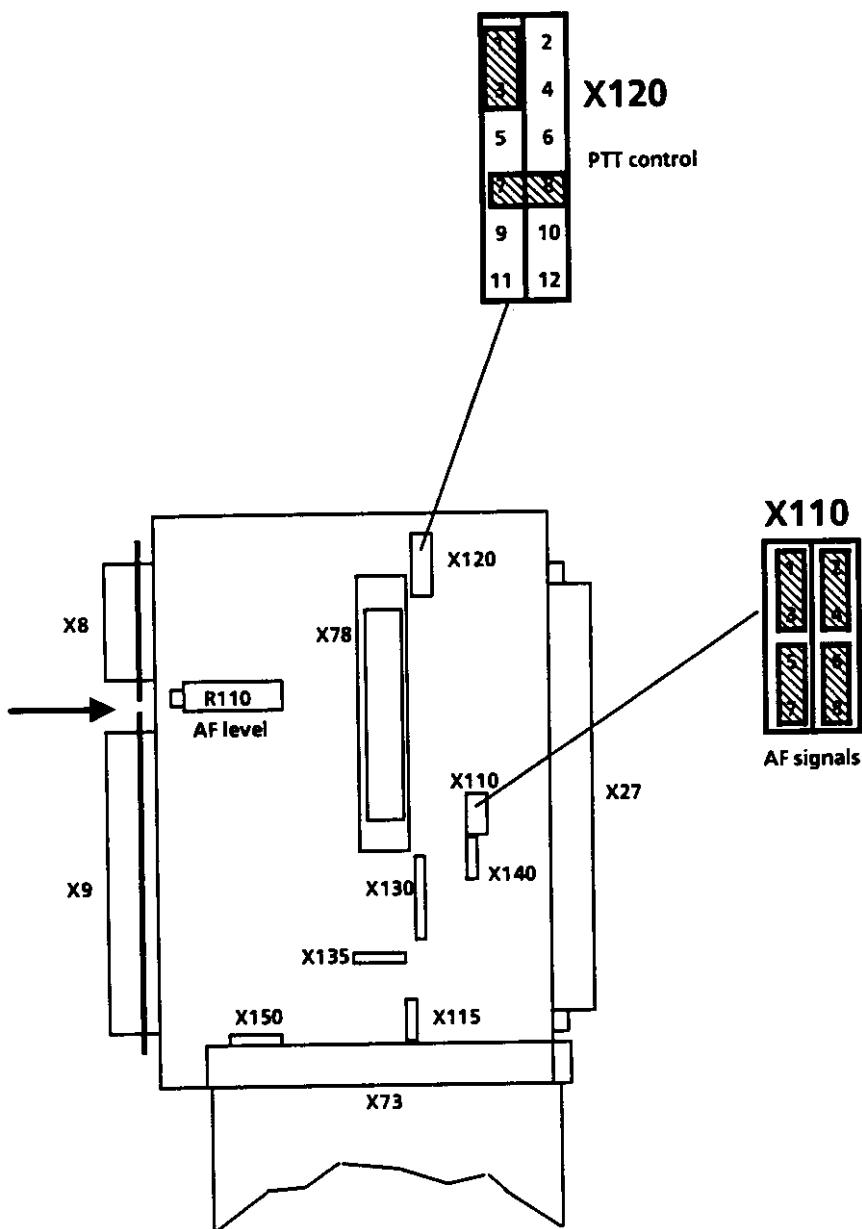


Fig. A1.9 Jumpers on Interface 1 GI 201X (page 1 of 2)

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(See Fig. A1.9, page 2)

X130 Setting ex works:

Jumper on X130.1 and X130.2

The monitoring tone coming from the receiver is output via transformer T130 to the REMOTE connector (X9.5 AF / RX / A and X9.6 AF / RX / B).

Or: Jumper on contacts X130.2 and X130.3

The monitoring tone coming from the directional coupler of the transmitter output stage is fed in via the modulator at (X73.19) AF-TX and output via transformer T130 between (X9.5) AF / RX / A and (X9.6) AF / RX / B to the REMOTE connector.

Or: Jumper on X140.2 and X140.3

Phantom Carrier Enable:

AF / RX / A (X9.5) and AF / RX / B (X9.6) DC-wise connected via R132 / R133 to PH-CAR (open collector). (Carrier message due to DC voltage at REMOTE connector).

X150 Setting ex works:

Jumper on contacts X150.1 and X150.2

No climax: climax (X9.25) open (transmit frequency offset cut out).

Or: Jumper on X150.2 and X150.3

Climax (X9.25) connected to GND (X9.24) (transmit frequency offset cut in).

X135 no function!

A1.5.2 Level Adjustment

(See Fig. A1.9, page 2)

X140 Setting ex works:

Jumper on contacts X140.1 and X140.2

Phantom Carrier Disable:

no DC voltage at AF / RX / A (X9.5) and AF / RX / B (X9.6).

(Carrier message disconnected by DC voltage at REMOTE connector).

By means of potentiometer R110, the AF level of the signal AF-TX, fed in on the REMOTE connector, can be adjusted. Ex works the variable control is set for an input level of 0 dBm.

On the rear panel, there is a small drilling between connectors X8 and X9 through which the potentiometer R110 is accessible.

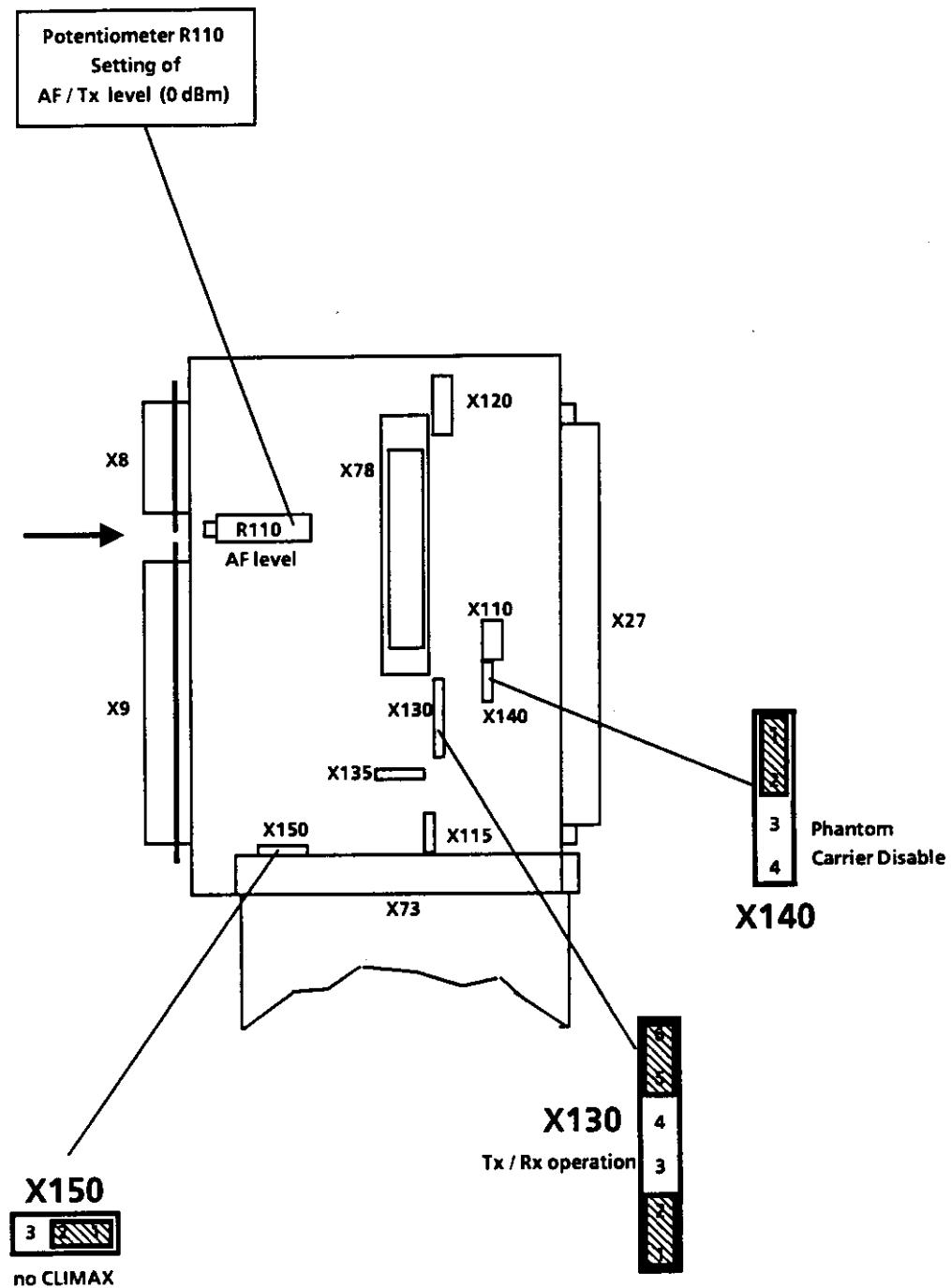


Fig. A1.9 Jumpers on Interface 1 GI 201X (page 2 of 2)

A1.6 Settings in Rx Unit EU 231

A1.6.1 Setting of Receive Frequency

(See Fig. A1.10)

1. Set switch REM / LOC / OFF (20, Fig. 3.1) to OFF.
2. Undo two Phillips screws and remove Rx Unit EU 231 from the adapter.
3. By means of coding switches S1 to S9 at the top of the Rx unit, program synthesizer to new receive frequency.
4. After a frequency change input filter and synthesizer have to be aligned anew (see A1.6.2).

The frequency to be set is the sum of the values for coding switches S1 to S9 as listed in the table to the right.

Fig. A1.11 shows examples of switch settings for 12.5-kHz and 8.33-kHz frequency spacing.

Rx Unit EU 231 (Top)

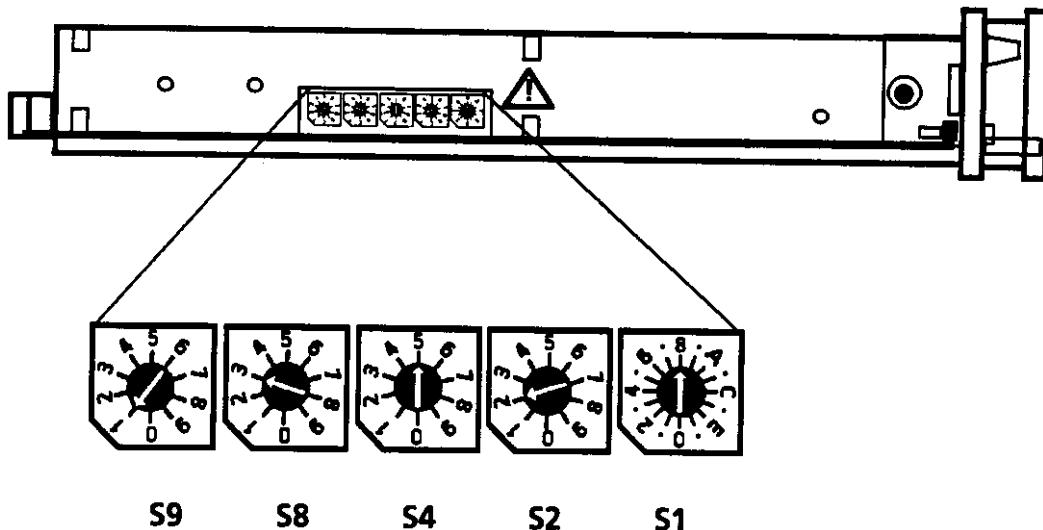


Fig. A1.10 Location of Coding Switches

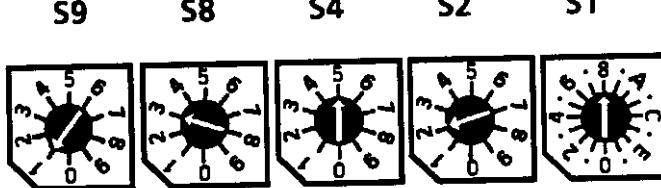
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Inscription on Covers:

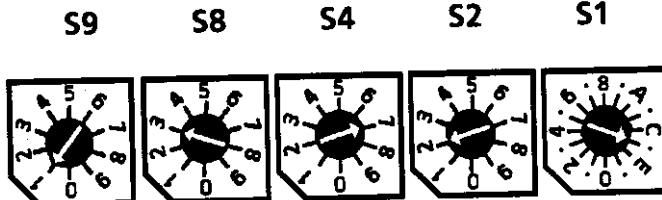
Pos.	S9 [MHz]	S8 [MHz]	S4 [MHz]	S2 [kHz]	S1 [kHz]
0	-	0	0	0	0
1	100	10	1	100	8.33
2	-	20	2	200	12.5
3	-	30	3	300	16.66
4	-	40	4	400	25.0
5	-	50	5	500	33.33
6	-	60	6	600	37.5
7	-	70	7	700	41.66
8	-	80	8	800	50
9	-	90	9	900	58.33
A	-	-	-	-	62.5
B	-	-	-	-	66.66
C	-	-	-	-	75.0
D	-	-	-	-	83.33
E	-	-	-	-	87.5
F	-	-	-	-	91.66

Example of setting
for 12.5 kHz:



$$100 \text{ MHz} + 30 \text{ MHz} + 5 \text{ MHz} + 200 \text{ kHz} + 50 \text{ kHz} = 135.25 \text{ MHz}$$

Example of setting
for 8.33 kHz:



$$100 \text{ MHz} + 30 \text{ MHz} + 7 \text{ MHz} + 200 \text{ kHz} + 83.33 \text{ kHz} = 137.28333 \text{ MHz}$$

Fig. A1.11 Frequency Setting in Rx Unit EU 231 (Examples)

A1.6.2 Alignment of Synthesizer and Input Filter

Note:

Please note that Frequency Tuning Kit KA 231F (part of Service Kit KA 231) will be required for the following alignment.

Alignment of Synthesizer

1. Set switch REM / LOC / OFF (20, Fig. 3.1) to OFF.
2. Undo two Phillips screws and remove Rx Unit EU 231 from the adapter.
3. Remove cover on components side after undoing nine Phillips screws.

CAUTION

Do not undo screws marked with a square symbol!

4. Remove protective caps from trimming capacitors C81 to C83, C91 to C93 and C31 (see Fig. A1.17).
5. Plug Rx unit onto adapter card (part of Frequency Tuning Kit KA 231F) and insert into adapter (see Fig. A1.18). Ensure that the connection to the power supply is established correctly. Set switch REM / LOC / OFF (20, Fig. 3.1) to LOC.
6. If the red LED H5 is illuminated, turn C31 carefully clockwise by means of a screw driver.

If the red LED H3 is illuminated, turn C31 carefully counter-clockwise, until the green LED H4 lights up. Set C31 to the centre of the green range (see Fig. A1.17).

CAUTION

Do not turn out alignment screws completely! Do not turn them in any further once the slightest resistance is felt!

Alignment of Input Filter

For alignment of the input filter use either an external RF signal generator or the installed Synthesizer GF 201V (see Figs. A.17 and A1.18).

First make preparations as for the synthesizer, steps 1 to 4.

1. For mechanical coarse alignment, tune trimming capacitors C81 to C83 and C91 to C93 to low frequency (rotor fully turned in), medium frequency (rotor in mid-position) or high frequency (rotor approx. 3 mm below upper edge).
2. In the case of an external RF signal generator feed in a test signal of f_{Rx} , 100 mV on the adapter card.

If the internal synthesizer is used, set a Tx frequency lower by 50 kHz (refer to A1.6). The reason for this is the Rx frequency shift. Connect the synthesizer output without attenuators to the adapter card (see Fig. A1.18 c).

Using a digital multimeter, measure the voltage at test socket VC on the front panel of the Rx unit (applies to both of the above cases).

3. For pre-alignment, tune to maximum voltage (without attenuators) at VC by using C81 to C83 and C91 to C93. (In the case of an external signal generator: begin at 0 dB and reduce the signal level correspondingly.)
4. For fine alignment by means of an external signal generator reduce the output signal to 30 μ V.

For fine alignment by means of the internal synthesizer first use one (Fig. A1.18 b) and then two 40-dB attenuators (Fig. A1.18 a). Proceed as detailed in step 3.

5. Switch off Rx unit (set switch REM / LOC / OFF to OFF) and remove adapter card.
6. Screw protective caps onto the seven trimming capacitors, use clamping screw driver, if necessary.

Install the Rx unit in the reverse order to its removal described above.

A1.6.3 Alignment of AF Level / Noise Blanker / AF-Tx Level for Inband Interface

Alignment of level AF 600 Ω

If required, the AF level of the output AF 600 Ω can be set by means of control element R235 at the bottom of the Rx unit (see Fig. A1.12). For this purpose, the Rx unit is to be plugged onto the adapter card as shown in Fig. A1.18. Turning the control R235 clockwise by means of a screw driver leads to a higher AF level.

Alignment of noise blanker

The degree of noise blanking can be set by means of control element R154 at the bottom of the Rx unit (see Fig. A1.12). For this purpose plug the Rx unit onto the adapter card as shown by Fig. A1.18. Turning the control clock-

wise by means of a screw driver leads to improved noise blanking.

Alignment of AF-Tx level for inband interface

If required, the AF-Tx level for the optional inband interface can be set by means of control element R455 at the bottom of the Rx unit (see Fig. A1.12). For this purpose, the Rx unit is to be plugged onto an adapter card (see Fig. A1.18). Turning the control clockwise by means of a screw driver leads to a higher AF level which can be measured at X143.

Setting of nominal level: To X13.24/.25 (AF-3/AF-4) apply a level of -6 dBm / 1 kHz ($R_i = 600 \Omega$). Measure level at X143 and with control element R455 set to 50 ± 3 mV.

Rx Unit EU 231 (Bottom)

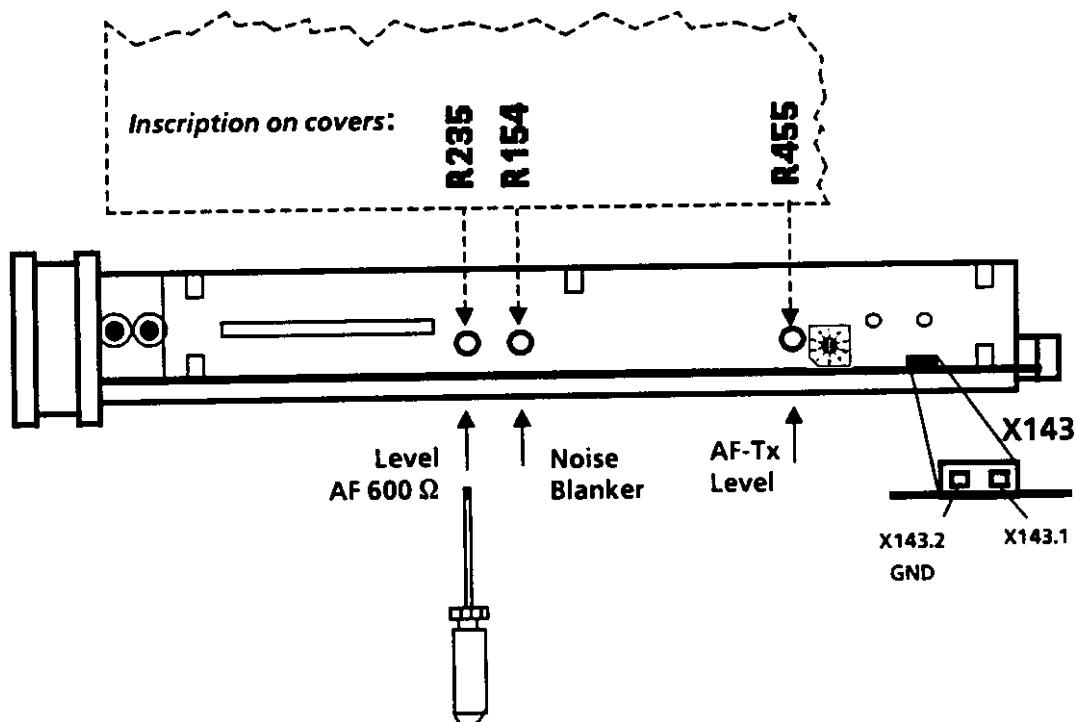


Fig. A1.12 Controls for Setting of AF Levels and Noise Blanking

A1.6.4 Function of Jumpers

This chapter deals with the jumpers by means of which the operating functions can be altered.

Jumpers which are exclusively used for test or service purposes are shown in Fig. A1.19.

(See Fig. A1.13, page 1)

AGC evaluation**X40 Setting ex works:**

Jumper on contacts X40.1 and X40.2
AGC bit 01 (1st threshold AGC bit) linked to field strength evaluation

no other setting possible

X42 Setting ex works:

Jumper on contacts X42.2 and X42.3
AGC bit 11 linked to field strength evaluation

no other setting possible

X40 / X42 Setting ex works:
No jumper on contacts

Or:

Jumper on X42.1 and X40.3
Inband without monitoring

X90 Setting ex works:

Jumper on contacts X90.2 and X90.3
AGC line linked to field strength evaluation

Or:

Jumper on X90.1 and X90.2
AGC line linked to AGC-L = AGC-1

X52 Setting ex works:

No jumper on contacts

no other setting possible

X54 Setting ex works - Without Inband:
Jumper on contacts X54.1 and X54.2
AF AGC disabled

Setting ex works - With Inband:
Jumper on X54.2 and X54.3
AF AGC enabled

Or:

Jumper on X54.2 and X54.3
without Inband (AF AGC enabled)

Carrier squelch**X29 / Setting ex works:**

Jumper on contacts X29.1 and X30.1
Carrier squelch enabled

Or:

Jumper on X29.2 and X30.2
Carrier squelch disabled

SQ / phantom circuit**X47 Setting ex works:**

No jumper on X47
Squelch phantom circuit disabled

Or:

Jumper on X47.2 and X47.3
Phantom circuit enabled, squelch relay on line AF-Rx-M

Squelch relay**X49 Setting ex works:**

No jumper on X49

Squelch relay contacts off DC potential

Or:

Jumper on X49.2 and X49.3
+ 12 V at output SQ-2

Jumper on X49.1 and X49.2
Ground at output SQ-2

X53 Setting ex works:

No jumper on X53

Squelch relay contacts off DC potential

Or:

Jumper on X53.1 and X53.2
+ 12 V at output SQ-3
Jumper on X53.2 and X53.3
Ground at output SQ-3

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Alternative setting of X49 / X53:

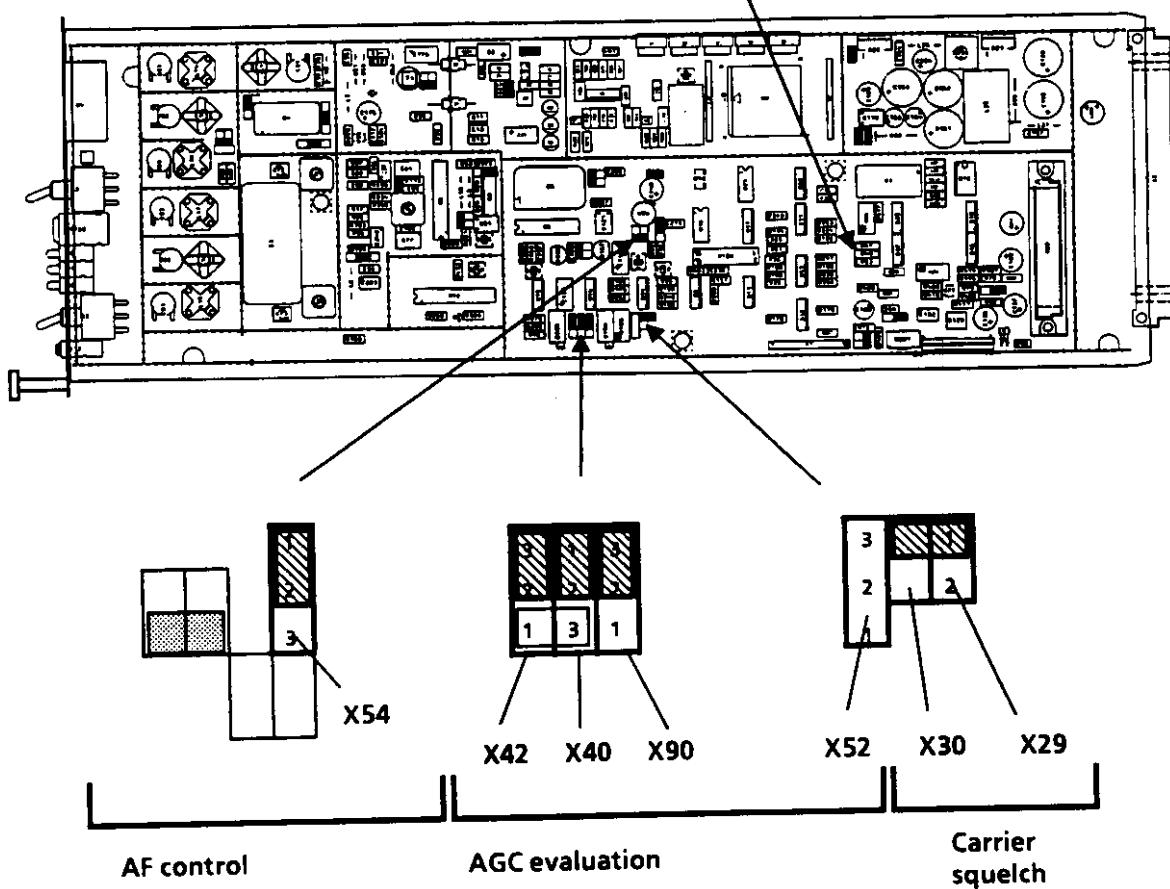
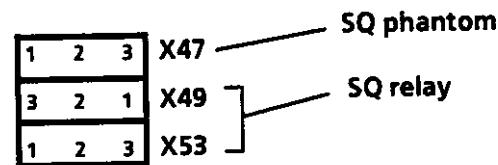
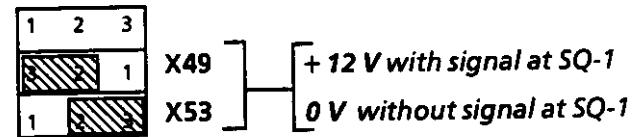
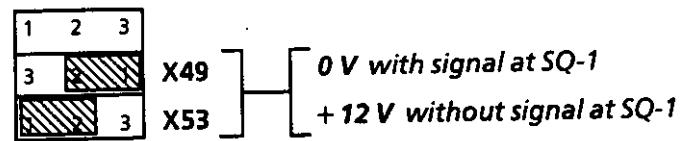


Fig. A1.13 Jumper settings in VHF Rx Unit EU 231 (page 1 of 2)

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(See Fig. A1.13, page 2)

PTT functions

X44 / Setting ex works:

X46 Jumper on contacts X44.2 and X46.2
Squelch enabled for PTT

Or:

Jumper on X44.1 and X46.1
Squelch and AF inhibit for PTT

Noise blanking

X32 / Setting ex works:

X33 No jumper on X32 / X33
Noise blanking disabled

Or:

Jumper on X32.1 and X33.1
Noise blanking enabled

X56 Setting ex works:

Jumper on contacts X56.2 and X56.3
for PTT loudspeaker and AF 8 Ω inhibited, AF 600 Ω not inhibited

Or:

Jumper on X56.1 and X56.2
for PTT loudspeaker, AF 8 Ω, AF 600 Ω monitor and AF Rx inhibited

Or:

No jumper on X56
for PTT loudspeaker, AF 8 Ω, AF 600 Ω and AF Rx not inhibited

Parallel interface / inband interface / REM BUS

X60 / Setting ex works:

X63 Jumper on contacts X60.2 and X63.1
without option inband interface

Or:

Jumper on X60.1 and X63.2
with option inband interface

Stand-alone / switchover operation (600 Ω / 1200 Ω)

X100 Setting ex works:

Jumper on contacts X100.1 and .2
Rx stand-alone operation

Or:

Jumper removed: switchover operation

Monitoring

X64 Setting ex works:

No jumper on X64
Monitoring possible via Rx

No other setting possible

Main / standby switchover

X134 Setting ex works:

Jumper on contacts X134.1 and .2
Tx-NoGo also switches over Rx

Or:

Jumper on contacts X134.3 and .2
Rx-NoGo switches over Rx - independently of Tx-NoGo

X133 Setting ex works:

Jumper on X133.1 and X133.2
for PTT 50-dB attenuation for Rx cut in

Or:

No jumper on X133
for simplex relay operation with separate Rx / Tx operation:
Monitoring via Rx disabled 1)

1) In the Rx and Tx sections of the transceiver matching jumper combinations must be selected.

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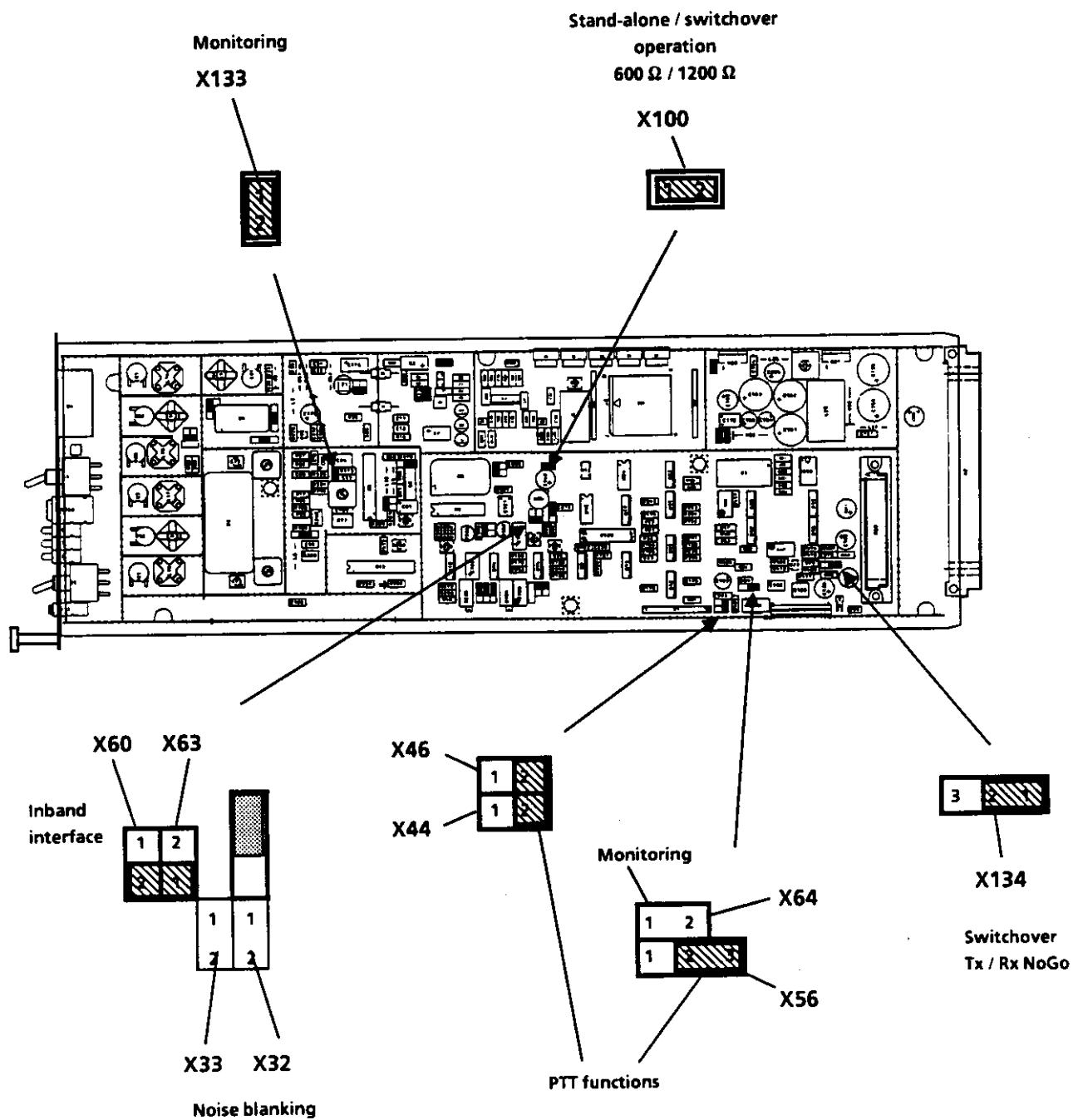


Fig. A1.13 Jumpers in Rx Unit EU 231 (page 2 of 2)

A1.6.5 Setting the Slot Address

Note:

The Rx units EU 231 used in receivers and transceivers are the same and can be exchanged one for the other. This is why here the setting information is given nevertheless for the sake of completeness.

If in an Adapter KR 231A8 up to seven Receivers EU 231A / EU 231D are operated with one VHF/ UHF Multicoupler VT 231, the slot address for the Rx REM BUS will have to be set.

For more details concerning the Rx REM BUS system see chapter 3.4 of this User Manual.

At the bottom of the Rx unit the coding switch S7 is located (see Fig. A1.14).

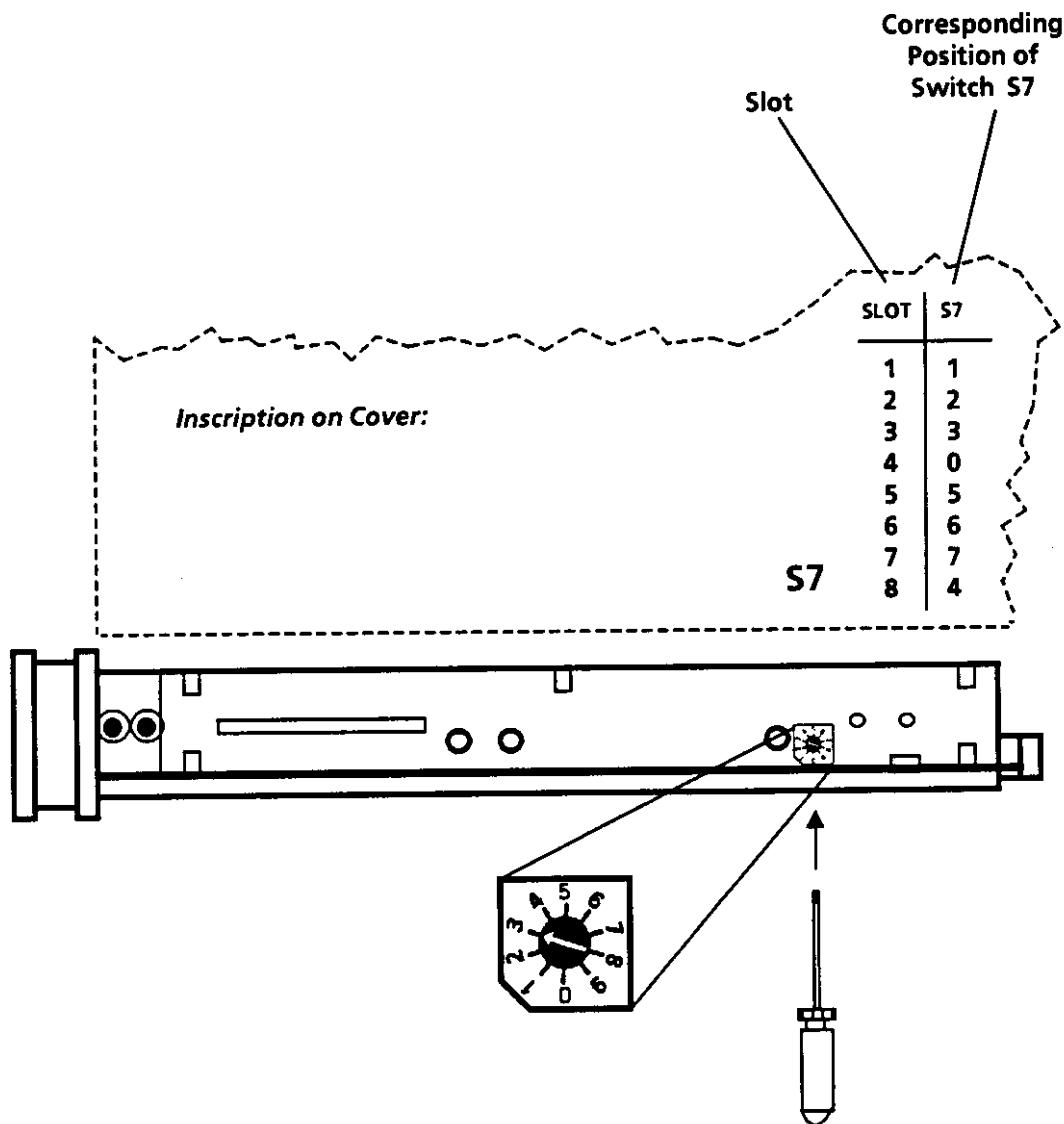
On the cover of the Rx Unit EU 231 the table SLOT / S7 is provided. Set coding switch S7 in accordance with this table.

For use in transceivers the address of S7 has to be set to 3.

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Rx Unit EU 231 (Bottom)



For use of Rx Unit EU 231 in transceivers set switch S7 to "3"!

Fig. A1.14 Setting the Slot Address

A1.7 Settings on Inband Interface GM 211 (Option)

(See Fig. A1.15)

This chapter deals with the jumpers by means of which the operating functions can be altered.

For this purpose remove the Inband Interface GM 211 as described in section 4.3.

The Inband Software GM 211S implemented in the inband interface is available in various versions. The table below gives a survey of these versions.

The setting of jumpers varies depending on the software version. Jumpers X2, X11 and X12 are identical for all software versions.

X2 BOOT_SCI Setting ex works:

Jumper on X2.1 and .2
DSP software is loaded from EPROM.

or:

No jumper on X2
DSP software is loaded via serial interface,
for servicing only.

X11 Setting ex works:

Jumper on X11.1 and .2
Output of DC/DC converter (+24 V /
+5 V) is connected with operating voltage
input of Inband Interface GM 211.

or:

No jumper on X11:
for servicing only

X12 ONCE

for servicing only (ONCE = On Chip Emulator)

Software Version 22:

X5 OPT Setting ex works:

No jumper on X5
(optional supplementary function OFF, to
be defined via software)

or:

Jumper on X5
(optional supplementary function ON, to
be defined via software)

X6 OPT Setting ex works:

No jumper on X6
(optional supplementary function OFF, to
be defined via software)

or:

Jumper on X6
(optional supplementary function ON, to
be defined via software)

Function	Vers. 22	Vers. 23	Vers. 25	Vers. 26	Vers. 27
Full functionality	x				
PTT 2 040 Hz		x	x	x	
Squelch 2 040 Hz		x			
Line equalizer				x	
Tx muting					x
AGC 30 dB	x	x	x	x	x

Versions of Inband Software GM 211S

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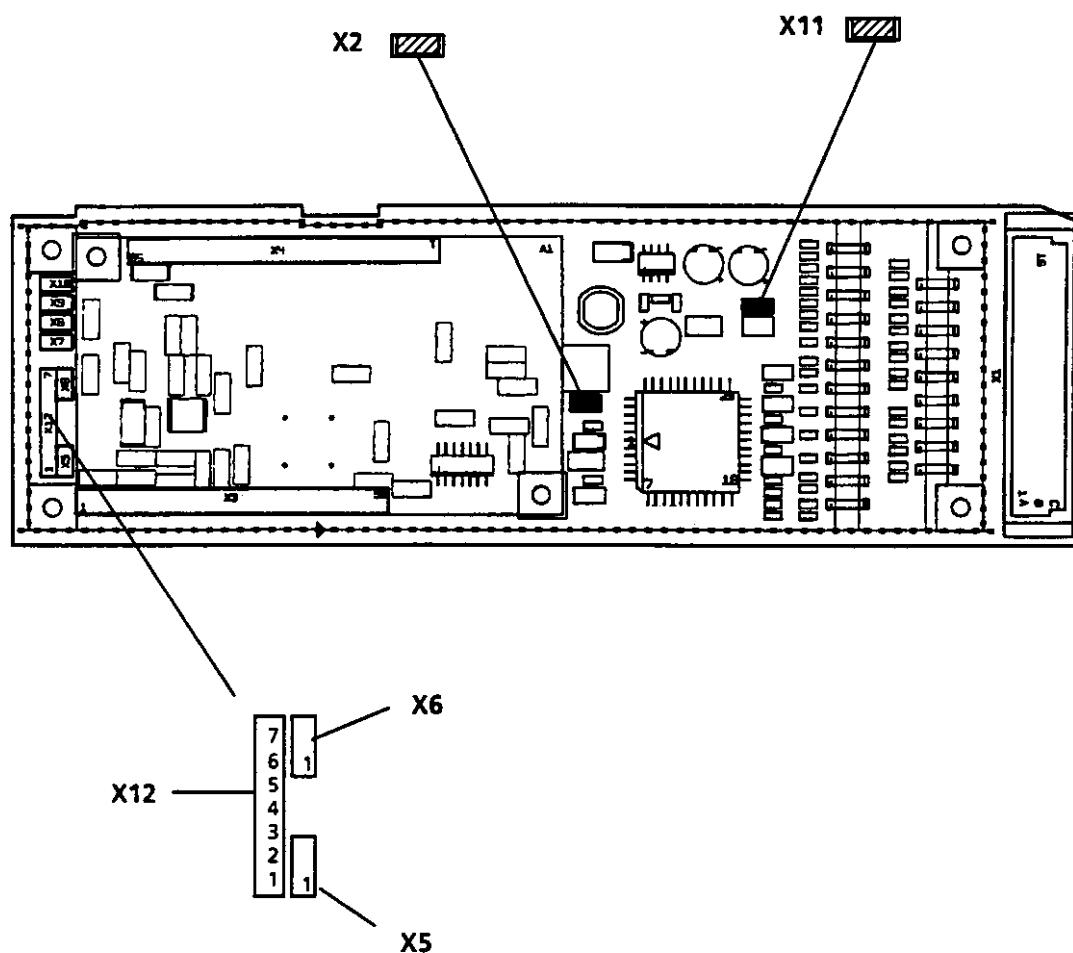


Fig. A1.15 Jumpers in Inband Interface GM 211 (page 1 of 4)

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(Software version 22, continued)

X7 OPT Setting ex works:

No jumper on X7
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X7
(optional supplementary function ON, to be defined via software)

X8 OPT Setting ex works:

No jumper on X8
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X8
(optional supplementary function ON, to be defined via software)

X9 RAD/OP (Radio / Operator)

Setting ex works:

No jumper on X9
Inband interface is installed on radio side (Tx / Rx).
or:
Jumper on X9:
Inband interface is installed on operator side.

X10 A/*B Setting ex works:

No jumper on X10 (A /* B = high)
Inband interface is installed in device A.
or:
Jumper on X10 (A /* B = low):
Inband interface is installed in device B.

X6 OPT Setting ex works:

No jumper on X6
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X6
(optional supplementary function ON, to be defined via software)

X7 OPT Setting ex works:

No jumper on X7
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X7
(optional supplementary function ON, to be defined via software)

X8 OPT Setting ex works:

No jumper on X8
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X8
(optional supplementary function ON, to be defined via software)

X9 OPT Setting ex works:

No jumper on X59
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X9
(optional supplementary function ON, to be defined via software)

Software Versions 23 and 25:

X5 OPT Setting ex works:

No jumper on X5
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X5
(optional supplementary function ON, to be defined via software)

X10 OPT Setting ex works:

No jumper on X10
(optional supplementary function OFF, to be defined via software)
or:
Jumper on X10
(optional supplementary function ON, to be defined via software)

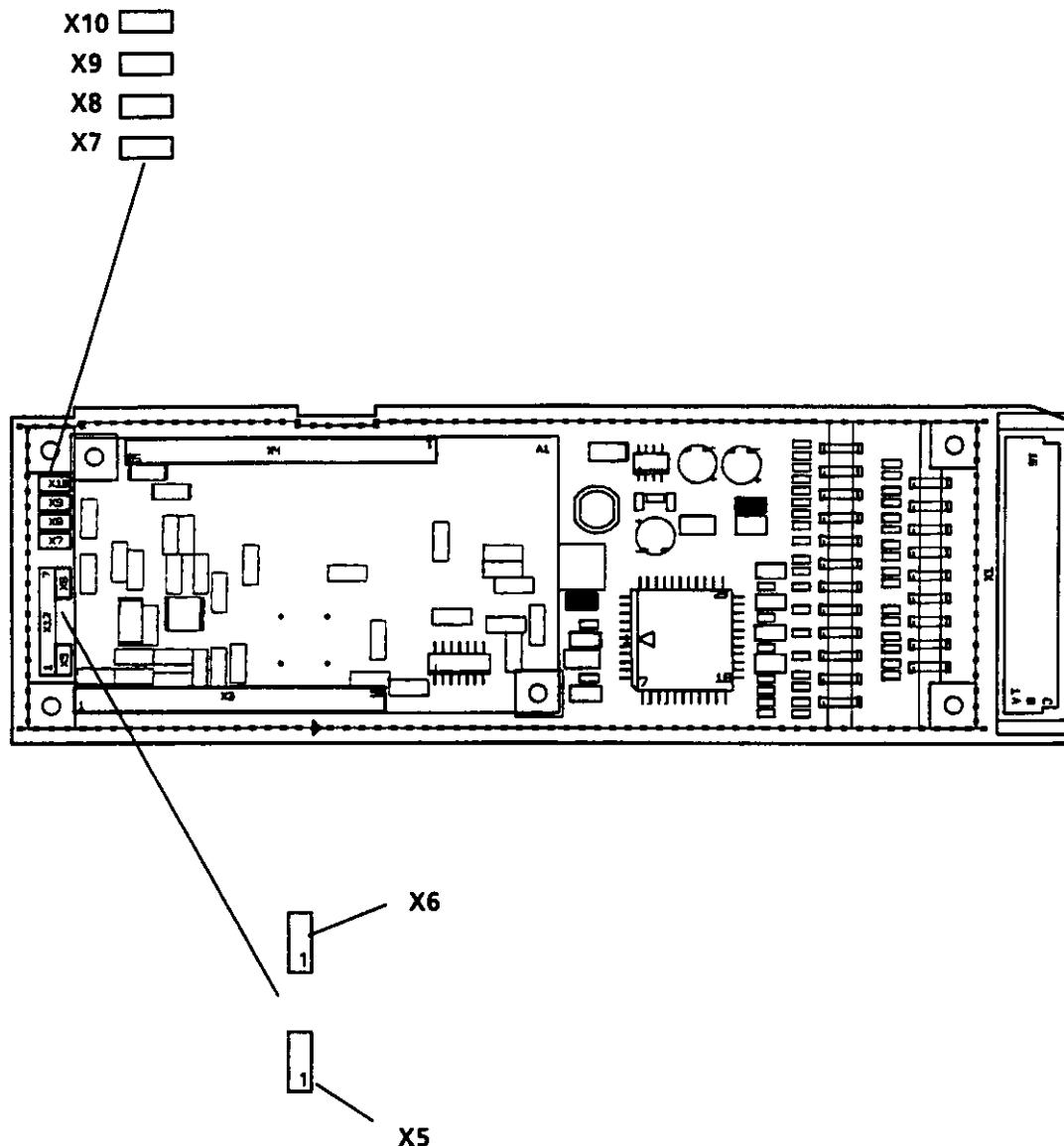


Fig. A1.15 Jumpers in Inband Interface GM 211 (page 2 of 4)

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Software Version 26:

X5 OPT Setting ex works:

No jumper on X5
(optional supplementary function OFF, to be defined via software)

or:

Jumper on X5
(optional supplementary function ON, to be defined via software)

X7	X8	Rel. level of 2 040-Hz tone ref. to wanted signal of 60 mV _{rms}
o	o	-24 dB
o	x	-18 dB
x	o	-12 dB
x	x	-6 dB

X = jumper in place, o = no jumper

X6 OPT Setting ex works:

No jumper on X6
(optional supplementary function OFF, to be defined via software)

or:

Jumper on X6
(optional supplementary function ON, to be defined via software)

X9, X10 Setting of line equalizer

Setting ex works:

No jumpers on X9, X10
(line equalizer, 0 dB)

or:

X7, X8 Trigger response threshold for PTT control with 2 040-Hz tone

Setting ex works:

No jumpers on X7, X8
(PTT control via 2 040-Hz tone, level -24 dB)

or:

X9	X10	Frequency response attenuation at 800 Hz ref. to 3 400 Hz
o	o	0 dB
o	x	5 dB
x	o	10 dB
x	x	15 dB

X = jumper in place, o = no jumper

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X10
X9
X8
X7

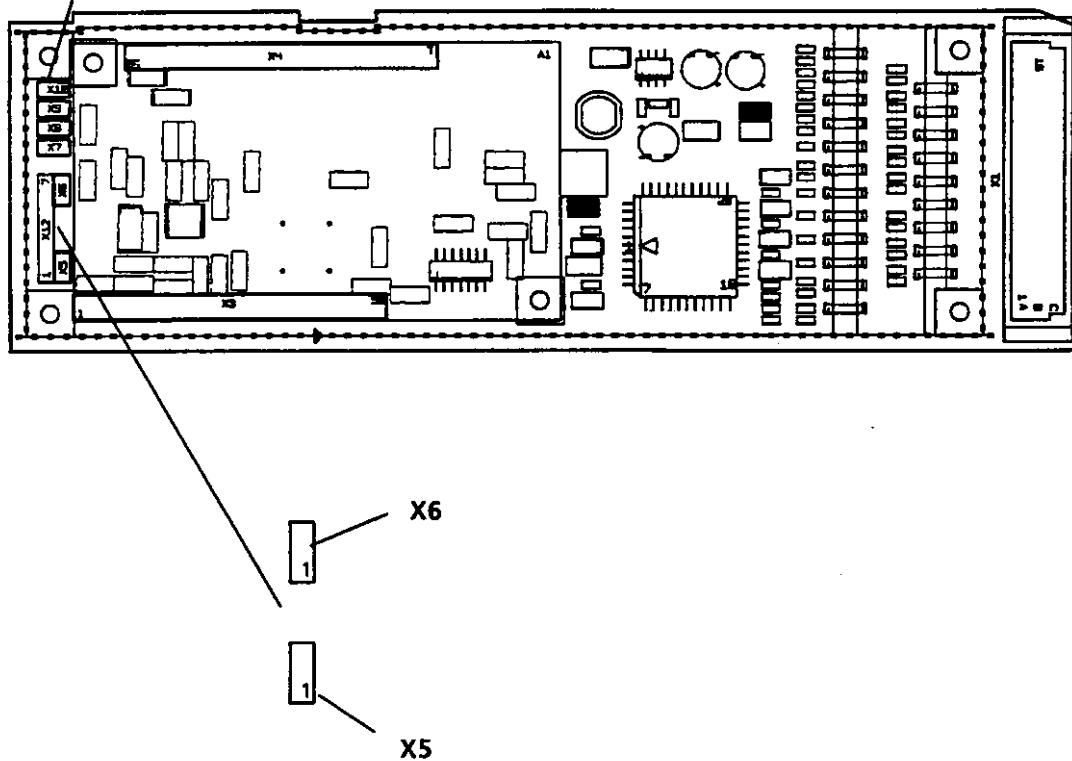


Fig. A1.15 Jumpers in Inband Interface GM 211 (page 3 of 4)

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Software Version 27:

X5, X7, X8 Setting of delay for disconnection of AF output signal **X6 OPT** Setting ex works:

Setting ex works:

No jumpers on X5, X7, X8
(AF disconnection disabled)

or:

X5	X7	X8	Delay
x	x	x	no AF disconnection
x	x	o	0.5 s
o	x	x	1.0 s
o	x	o	1.5 s
x	o	x	2.0 s
x	o	o	2.5 s
o	o	x	3.0 s
o	o	o	no AF disconnection

X = jumper in place, o = no jumper

No jumper on X6
(optional supplementary function OFF, to be defined via software)

or:

Jumper on X6
(optional supplementary function ON, to be defined via software)

X9 No jumper allowed on X9!

X10 Activation of AGC for AF signal

Setting ex works:

Jumper on X10
(AGC enabled)

or:

No jumper on X10
(AGC disabled)

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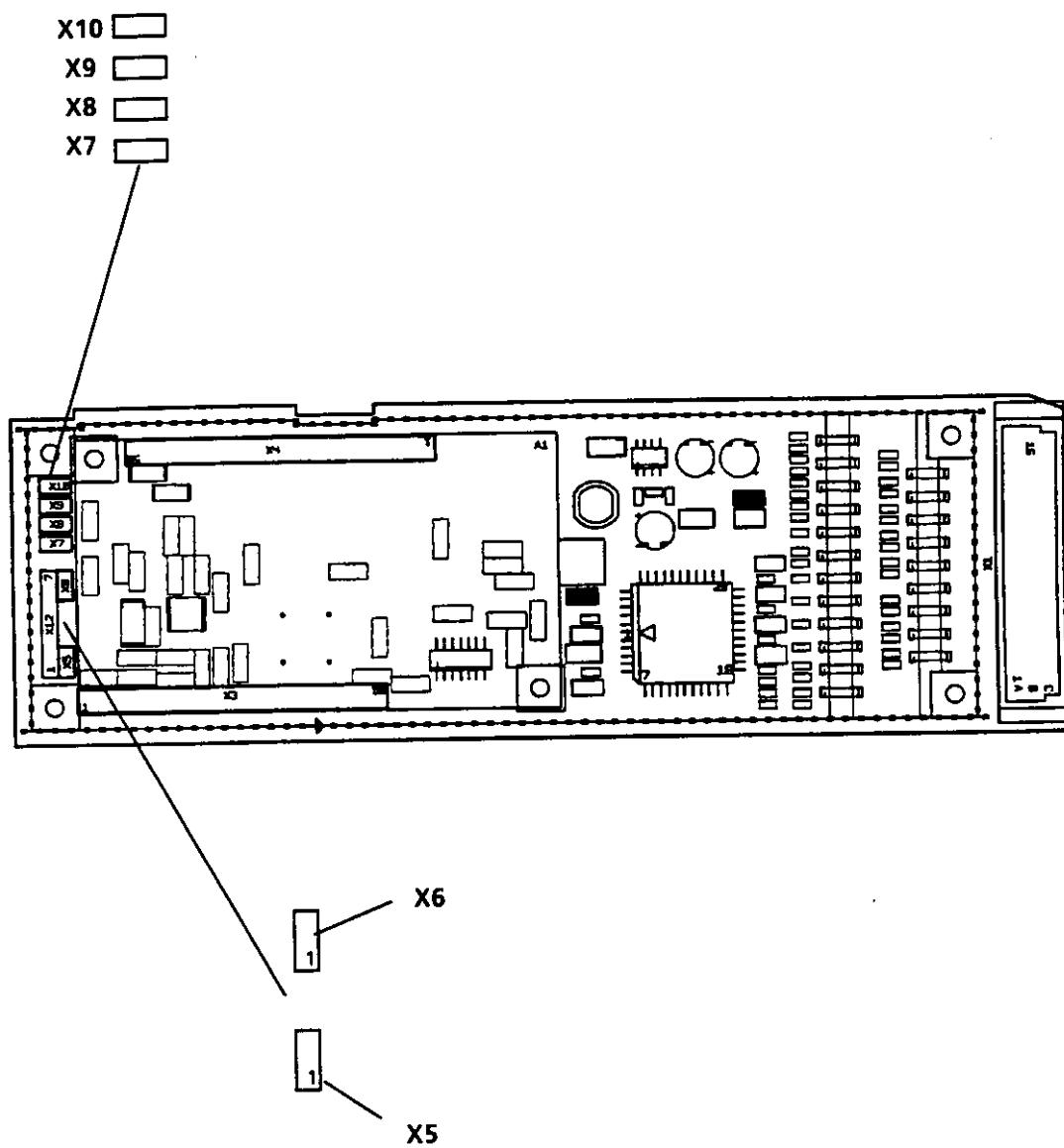


Fig. A1.15 Jumpers in Inband Interface GM 211 (page 4 of 4)

A1.8 Settings on Modulator Extension GM 201C8

(See Fig. A1.16)

This chapter deals with the elements by means of which the operating functions can be altered.

For this purpose remove the complete modulator extension together with the mounting plate acc. to 4.3.4.

Remove the top screening plate after undoing three Phillips screws.

X30

Setting ex works:

Coding switch S30 in position 6
for 8.33-kHz frequency spacing
(i.e. cutoff frequency of 2.55 kHz and
clock frequency of 255.672 kHz)

At test connector X30 the clock frequency can
be measured.

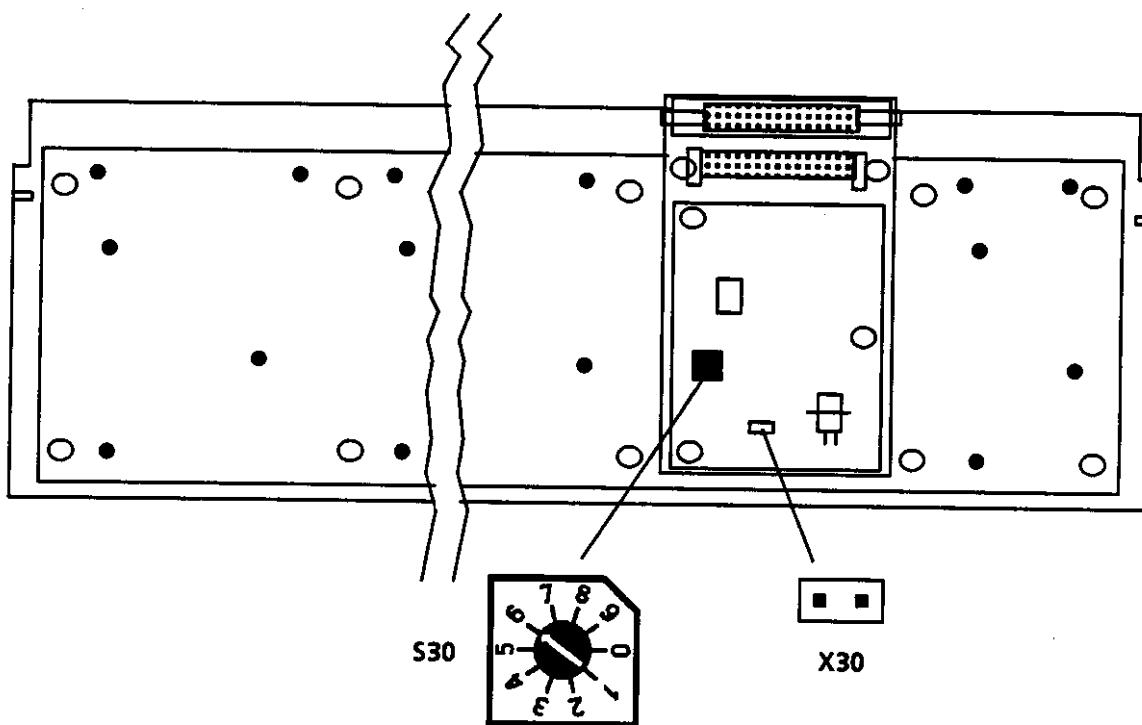


Fig. A1.16 Coding Switch on Modulator Extension GM 201C8

A1.9 Jumper Settings Ex Works

Module	Meaning	Jumper	Position	Remarks
Modulator GM 201	GM 201C8	X10	1 - 2, 3 - 5, 10 - 12	Filter in GM 201C8 is switched on.
	ALC	X110	2 - 3	ALC is enabled.
	RF level reduction	X250	removed	Reduction is effective.
	VHF/UHF	X322	1 - 2	System operates in VHF range.
	Phase-locked loop	X323	2 - 3	Phase-locked loop is enabled.
	Switch-off by receiver in case of failure	X411	1 - 2	Switch-off in case of failure
	PTT time limiting	X532	1 - 2	PTT time limiting is disabled.
	Monitoring	X715	2 - 3	Monitoring is via directional coupler.
	User-defined bit	X841	1 - 2	Input or output
	VSWR message	X971	1 - 2	VSWR message does not block transmit operation.
	Carrier message	X972	1 - 2	Carrier message does not block transmit operation.
	REM BUS address MSB	X812	removed	MSB = 56
	REM BUS address LSB	X813	1 - 2	LSB = 0
	REM BUS address LSB	X814	removed	LSB = 0
Modulator Extension GM 201C8	Filter setting (coding switch)	S1	6	Filter is set for 8.33-kHz channel spacing.

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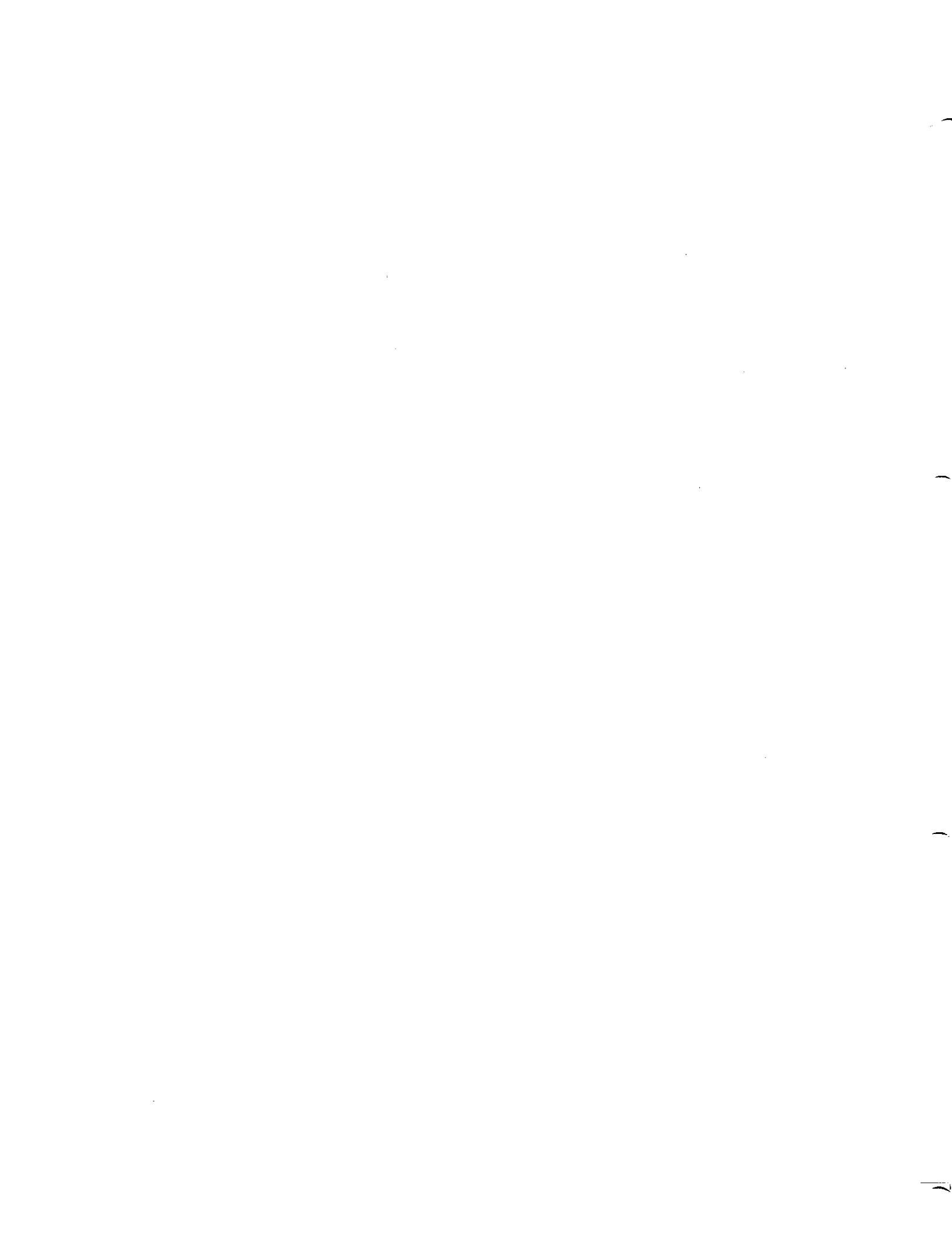
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Module	Meaning	Jumper	Position	Remarks
Interface GI 201X	AF signal path	X110	1 - 3, 2 - 4, 5 - 7, 6 - 8	AF signal path from X9 via transformer T110 and variable resistor R110 to modulator (without inband interface)
	PTT connection	X120	1 - 3, 7 - 8	-PTT OPTO/VOP: If X9.16 is connected to GND, current flows via the optocoupler and initiates PTT.
	Monitoring	X130	1 - 2, 5 - 6	Monitoring tone from receiver via transformer T130 to X9.5 - X9.6 (without inband interface).
	Phantom Carrier Disable	X140	1 - 2	Phantom Carrier Disable (no DC voltage at AF/RX (X9.5 - X9.6)
	Climax	X150	1 - 2	No climax (transmit frequency offset disabled)
Inband Interface GM 211	SW version 22:	X5 to X8 X9 X10	removed removed removed	additional optional function OFF GM 211 on radio side GM 211 installed in device A
	SW versions 23 and 25:	X5 to X10	removed	additional optional function OFF
	SW version 26:	X5, X6 X7, X8 X9, X10	removed removed removed	additional optional function OFF PTT control via 2 040-Hz tone Line equalizer, 0 dB
	SW version 27:	X6 X5, X7, X8 X10	removed removed attached	additional optional function OFF AF disconnection disabled AGC enabled
	all SW versions:	X2 X11	1 - 2 1 - 2	DSP software loaded from EPROM Output of DC/DC converter connected with operating voltage input of GM 211

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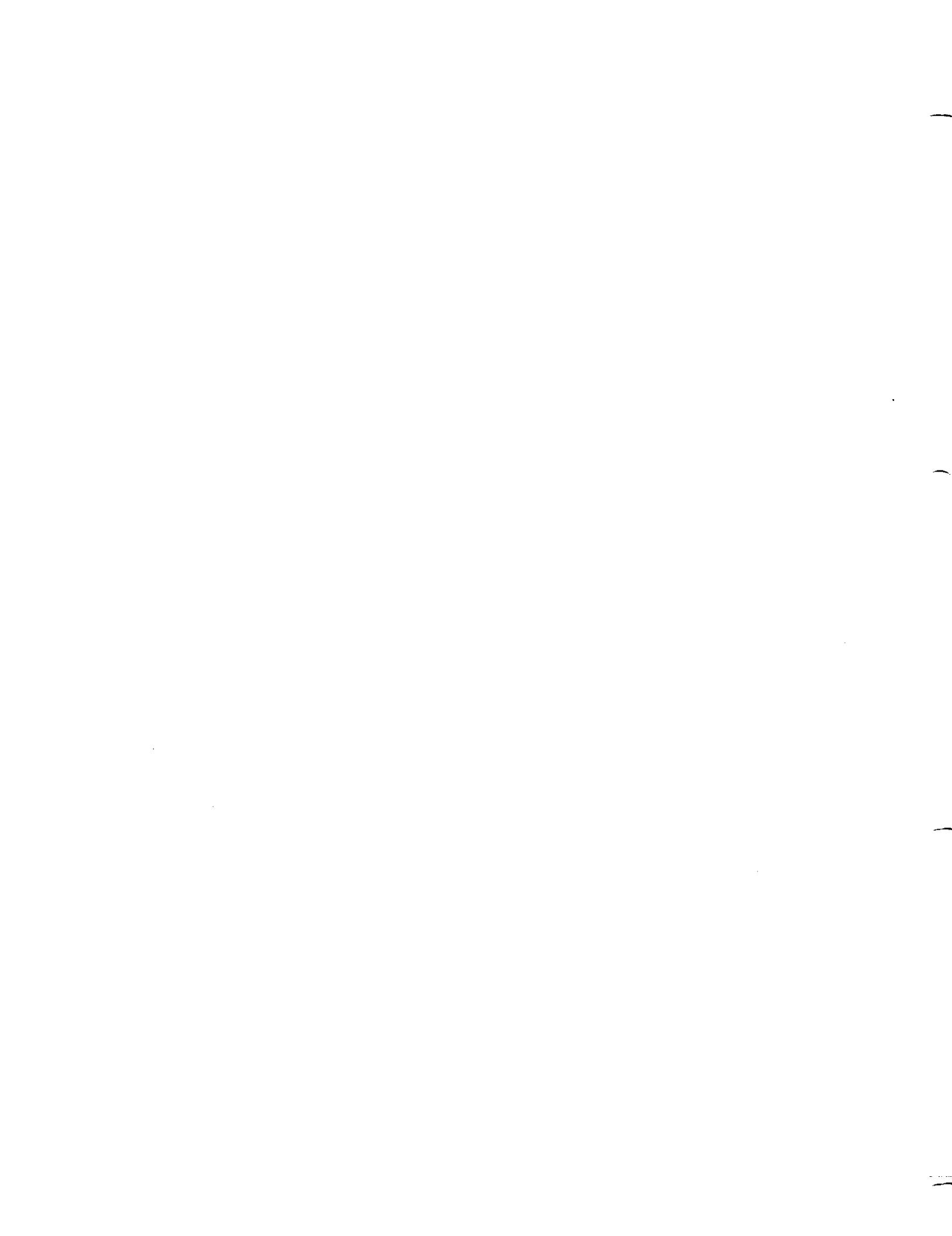
Module	Meaning	Jumper	Position	Remarks
Rx Unit EU 231	Carrier squelch	X29/X30	X29.1-X30.1	Carrier squelch enabled
	Noise blanking	X32/X33	removed	Noise blanking disabled
	AGC bit 01	X40	1 - 2	AGC bit 01 linked with field strength evaluation
	AGC bit 11	X42	2 - 3	AGC bit 11 linked with field strength evaluation
	PTT squelch	X44/X46	X44.2 - X46.2	Squelch for PTT operation
	SQ phantom circuit	X47	removed	SQ phantom circuit disabled
	Squelch relay	X49	removed	Squelch relay contacts off DC potential
	AGC-1 evaluation	X52	1 - 2	AGC bit 01 linked with squelch
	Squelch relay	X53	removed	Squelch relay contacts off DC potential
	AGC control	X54	1 - 2	AGC control disabled
	PTT AF inhibit	X56	2 - 3	For PTT loudspeaker and AF-8- Ω inhibited, AF-600- Ω not inhibited.
	Inband interface	X60 / X63	X60.2 - X63.1	Option inband interface not installed
	Monitoring via Rx	X64	removed	Monitoring via Rx enabled
	AGC LINE	X90	2 - 3	AGC line linked with field strength evaluation
	Stand-alone/ switchover operation	X100	1 - 2	Rx stand-alone operation
	Monitoring/ attenuation	X133	1 - 2	For PTT 50 dB attenuation for Rx
	Main / standby operation	X134	1 - 2	Tx-NoGo switches over Rx.



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Appendix 2 External Interfaces

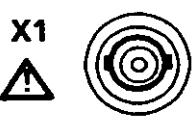
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A2.1 Additional RF Input X1	A2.1
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A2.4 Mains Connection X4	A2.2
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A2. External Interfaces

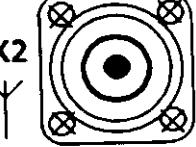
(See Fig. 2.1)

A2.1 Additional RF Input X1 (depending on order)

Connector	Contact	Designation, function, direction, level			
BNC recessed socket FJ 080.2270  X1		For the optional external synthesizer. For this disconnect the internal RF cable for X94 and re-connect to X1!			

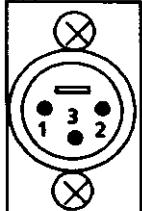
B = bidirectional, I = input, O = output

A2.2 VHF Antenna Connection X2

Connector	Contact	Designation, function, direction, level			
N-type recessed socket FJ 503.4830  X2		For the optional external antenna. For this disconnect the internal RF cable for X95 and re-connect to X2!			

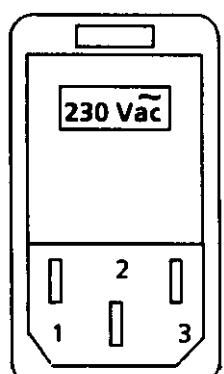
B = bidirectional, I = input, O = output

A2.3 24-V Battery Connection X3

Connector	Contact	Designation, function, direction, level		
 X3 BATT. 22...31	1 2 3	+ 24 V DC DC input GND 24 V 0 VDC Not used	I GND	22 to 31 VDC < 14 A

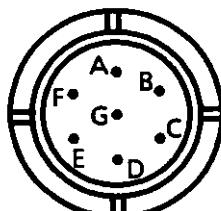
B = bidirectional, I = input, O = output

A2.4 Mains Connection X4 (only with Option IN 251A)

Connector	Contact	Designation, function, direction, level		
 X4 47...63 Hz 500 VA	1 2 3	Mains connection: 100 / 120 / 220 / 230 VAC 47 to 63 Hz 300 VA (typ.). The set mains voltage is indicated in the window. For settings refer to Appendix A1.	I B I	90 to 132 VAC / 194 to 264 VAC

B = bidirectional, I = input, O = output

A2.5 Headphone Connection X5 (on Front Panel)

Connector X5	Contact	Designation, function, direction, level			
7-way recessed plug R&S 0586.7855  (shown enlarged)	A	HEAD-A	headphones	O	0 to 1 V _{rms}
	B	HEAD-B	headphones GND	O	0 to 1 V _{rms}
	C	DMIC-A	dyn. microphone	I	0 to 25 mV _{rms}
	D	DMIC-B	dyn. microphone GND	I	
	E	VMIC-A	ampl. microphone	I	0 to 1 V _{rms}
Mating connector: 7-way R&S 0586.8239 and R&S 0586.8245	F	* PTT-MIC	microphone PTT	I	low = Tx on pull-up 10 kΩ / 10 V
	G	VMIC-B	ampl. microphone GND	I	

B = bidirectional, I = input, O = output, * = low-active, HCMOS level: 0 to + 5.5 V

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A2.6 VHF Power Amplifier Connection X6 (only with Optional Interface 2 GI 201)

Connector	Contact	Designation, function, direction, level			
Female connector strip, 15-way 447.0452	1	GND	ground		
	2	Not used			
	3	* PTT - AMP	PTT for power amplifier	O	low = PTT
	4	TEST - AMP	sum error power amp.	I	low = no error HCMOS
	5	* VSWR - AMP	VSWR power amp.	I	low = VSWR HCMOS
	6	* CAR - AMP	carrier message power amp.	I	low = carrier HCMOS
	7	ENABLE	power amp. ready	I	high = ready HCMOS
	8	AGC - EXT	AGC via power amp.	I	high = external control loop
	9	Not used			
	10	AMP - RED	reduction via power amp.	I	analog - 10 to + 10 V
	11	Not used			
	12	GND	ground		
	13	AGC +	control voltage positive	I	0 to + 5 V
Mating connector: 15-way Min D plug 273.4037 and 586.9564	14	AGC -	control voltage negative	I	
	15	GND	ground		

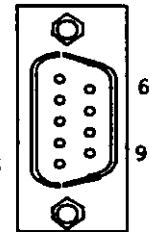
B = bidirectional, I = input, O = output, * = low-active, HCMOS level: 0 to + 5.5 V

A2.7 Main / Standby Connection X7 (only with Optional Interface 2 GI 201)

Connector	Contact	Designation, function, direction, level			
Female connector strip, 25-way 243.0962	1	CBIT-TX-1	sum error Tx message	O	high = no error
	2	CBIT-RM-1	error inband message	O	high = no error
	3	TEMP-1	overtemp.	O	high = overtemp.
	4	* OFF-TX-1	transmitter switched off	O	low = off
	5	CARRIER-1	carrier message	O	high = carrier act.
	6	VSWR-1	VSWR message	O	high = VSWR
	7	GND	ground		
	8	VSWR-2	VSWR input (inband interface)	I	high = VSWR only to inband i.
	9	CARRIER-2	carrier input (inband interface)	I	high = carrier act. only to inband i.
	10	*OFF-TX-2	Tx off (inband interface)	I	low = off only to inband i.
	11	TEMP-2	overtemp. (inband interface)	I	high = overtemp. only to inband i.
	12	CBIT-RM-2	error inband interface input	I	high = no error only to inband i.
	13	CBIT-TX-2	sum error transmitter input	I	high = no error only to inband i.
	14	Not used			
	15	Not used			
	16	Not used			
	17	Not used			
	18	Not used			
	19	* REMOTE-1	remote control message	O	low = remote control
	20	* REMOTE-2	remote control input	I	low = remote only to inband i.
	21	Not used			
	22	Not used			
	23	Not used			
	24	Not used			
	25	Not used			
Mating connector: 25-way Min D plug 063.4861 and 627.1826					

B = bidirectional, I = input, O = output, * = low-active, logic level: 0 to +5.5 V

A2.8 REM BUS Connection X8

Connector	Contact	Designation, function, direction, level		
<p>Female connector strip 9-way 680.9634</p>  <p>X8 REM BUS</p> <p>Mating connector for single connec- tion: 434.9362 and 586.9870</p>	1	Not used		
	2	Not used		
	3	SCL	clock input REM BUS	I HCMOS
	4	SDA0	data input REM BUS	I HCMOS
	5	SDAI	data output REM BUS	O open collector
	6	GND	ground	
	7	+ 24 VDC	supply for REM BUS	17 to 31 VDC
	8	Not used		
	9	GND	ground	

B = bidirectional, I = input, O = output, HCMOS level: 0 to + 5.5 V

A2.9 REMOTE Connection X9

Connector	Contact	Designation, function, direction, level			
Female connector strip, 37-way 436.1723	1	GND	ground		
	2	AF / TX / A	AF input balanced	I	-15 to + 6 dBm
	3	AF / TX / B	AF input balanced	I	-15 to + 6 dBm
	4	GND	ground		
	5	AF / RX / A	AF output balanced	O	- 6 dBm
	6	AF / RX / B	AF output balanced	O	- 6 dBm
	7	GND	ground		
	8	TEST-TX	sum test Tx	O	low = no error open collector
	9	TEST-TTL	sum test Tx	O	high = no error TTL compatible
	10	TEST-RM	test signal inband	O	low = no error open collector
	11	*OFF-1	switch off Tx	I	low = off open collector
	12	CARRIER	carrier message	O	low = carrier open collector
	13	VSWR	VSWR message	O	low = VSWR open collector
	14	NOPTT	PTT inhibit	I	high = PTT inhibit open collector
	15	U-DEF-1	User-defined input	I	0 to 5.5 V
	16	- PTT	PTT input	I	acc. to jumper setting
	17	+ PTT	PTT input	I	acc. to jumper setting
Mating connector: 37-way Min D plug 436.1717 and 586.9570					

B = bidirectional, I = input, O = output, * = low-active, HCMOS level: 0 to + 5.5 V

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Connector	Contact	Designation, function, direction, level			
Female connector strip 37-way 436.1723 cont.	18	*PTT-2	PTT universal	B	open coll.
	19	VOPSW	switched voltage	O	22 to 31 VDC
	20	GND	ground		
	21	SQ-1	Squelch Relay C **	B	0 V/+12 V/open
X9 REMOTE	22	SQ-2	Squelch Relay NO **	B	0 V/+12 V/open
	23	SQ-3	Squelch Relay NC **	B	0 V/+12 V/open
	24	*SQ-ON	Squelch on	I	HCMOS, only with remote
	25	CLIMAX	Tx detection bit	O	open / GND
	26	SQ-LINE	Squelch answer	O	open coll.
	27	SQ / TTL	Squelch answer	O	TTL
	28	GND	ground		
	29	AF-8-OHM	Loudspeaker output	O	adjustable in Rx Unit
	30	AF-8-GND	ground	O	
	31	U-DEF-2	User-defined output	O	open coll.
	32	AF RELAY	high level input	I	0 to 3 V _{rms}
	33	*OFF-2	Rx Unit 1 manual	I	HCMOS
	34	AGC-LINE	Control Voltage	O	0 to 5 V, 5 mA
	35	*PHIGH	cut-in power ampl.	I	open coll.
	36	*PLOW	low power	I	open coll.
Mating connector: 37-way Min D plug 436.1717 and 586.9570	37	*BLW	external blower	O	open drain

B = bidirectional, I = input, O = output, * = low-active, HCMOS level: 0 to +5.5 V, TTL= Transistor-Transistor logic, ** according to jumper setting - see chapter A1.6

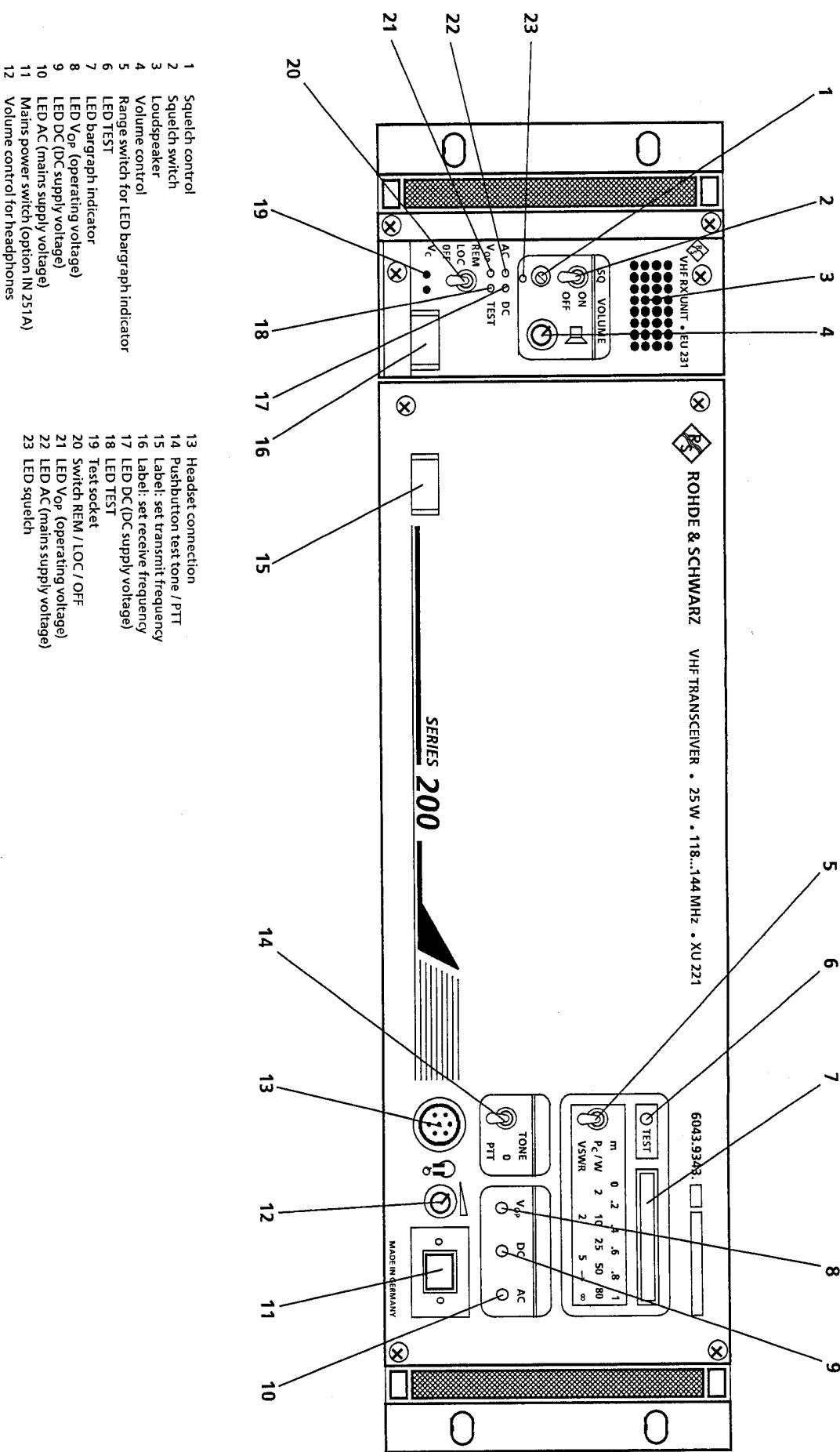


Fig. 3.1 VHF Transceiver XU 221, Controls and Indicators

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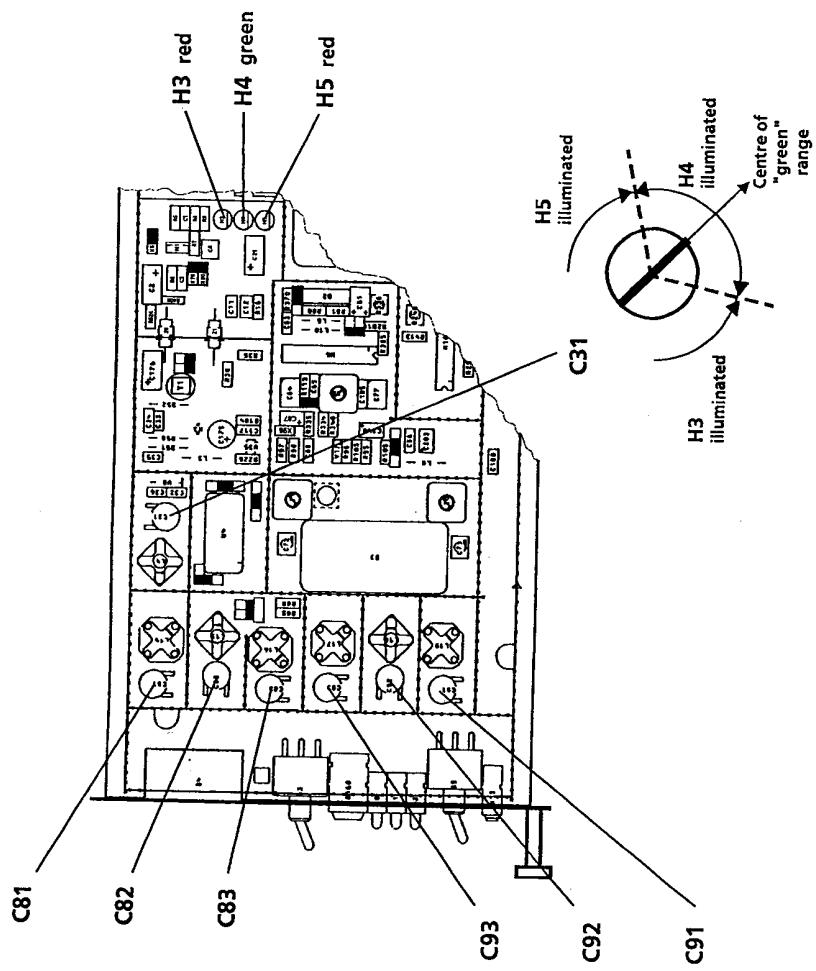


Fig. A1.17 Alignment of Synthesizer and Input Filter in Rx Unit EU 231

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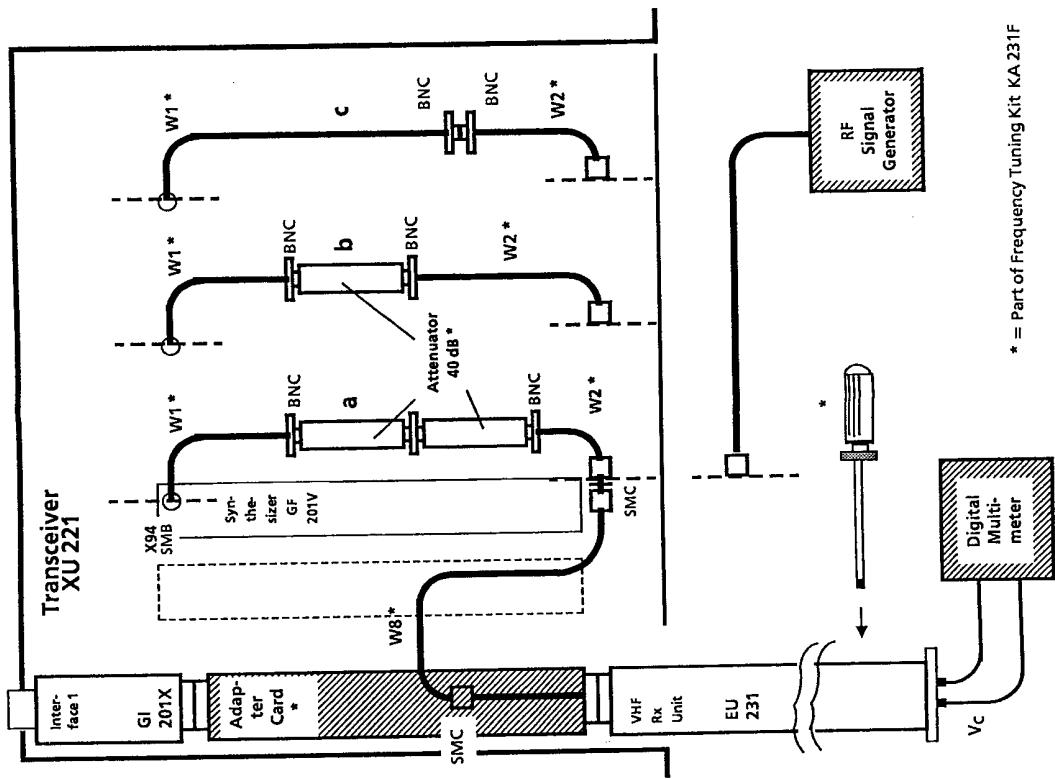


Fig. A1.18 Alignment of Rx Unit EU 231: Equipment Setup

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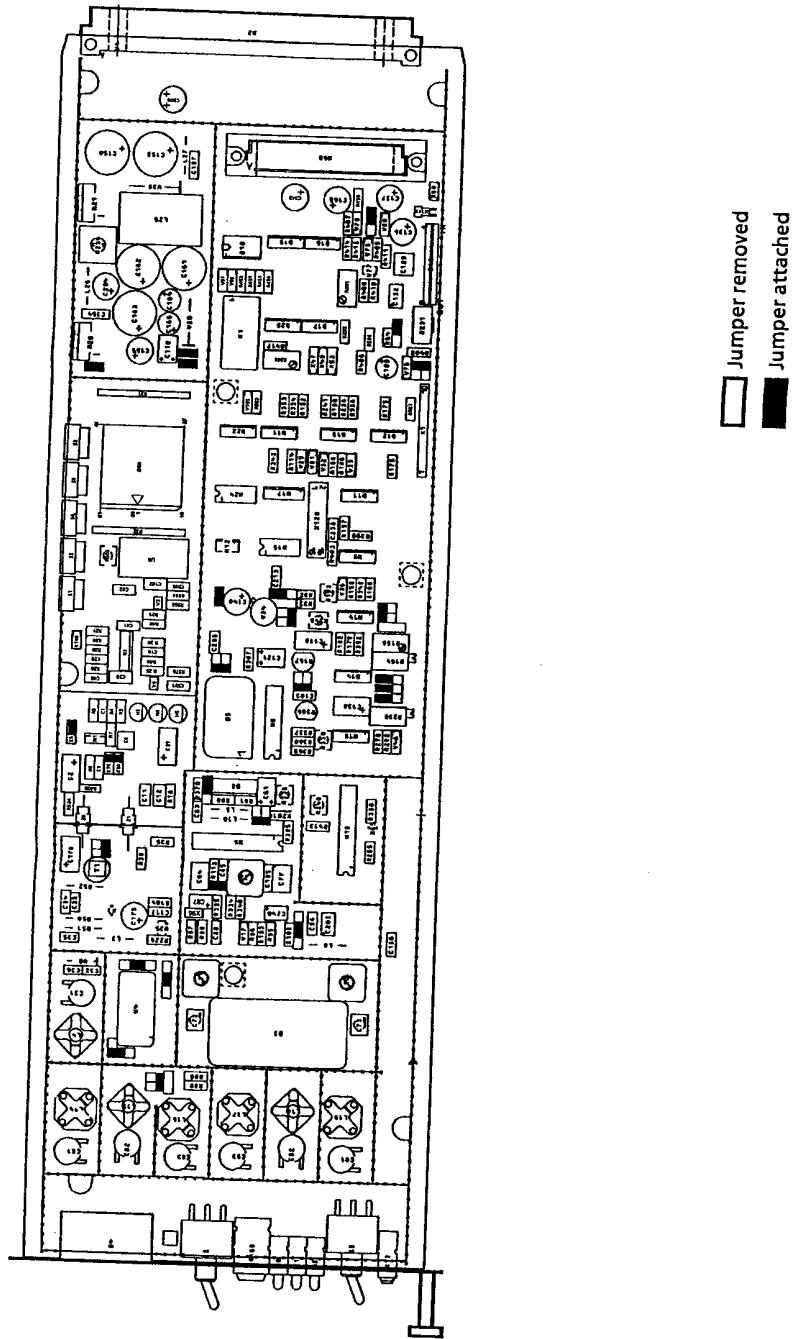


Fig. A1.19 Jumpers in Rx Unit EU 231 (Setting Ex Works)

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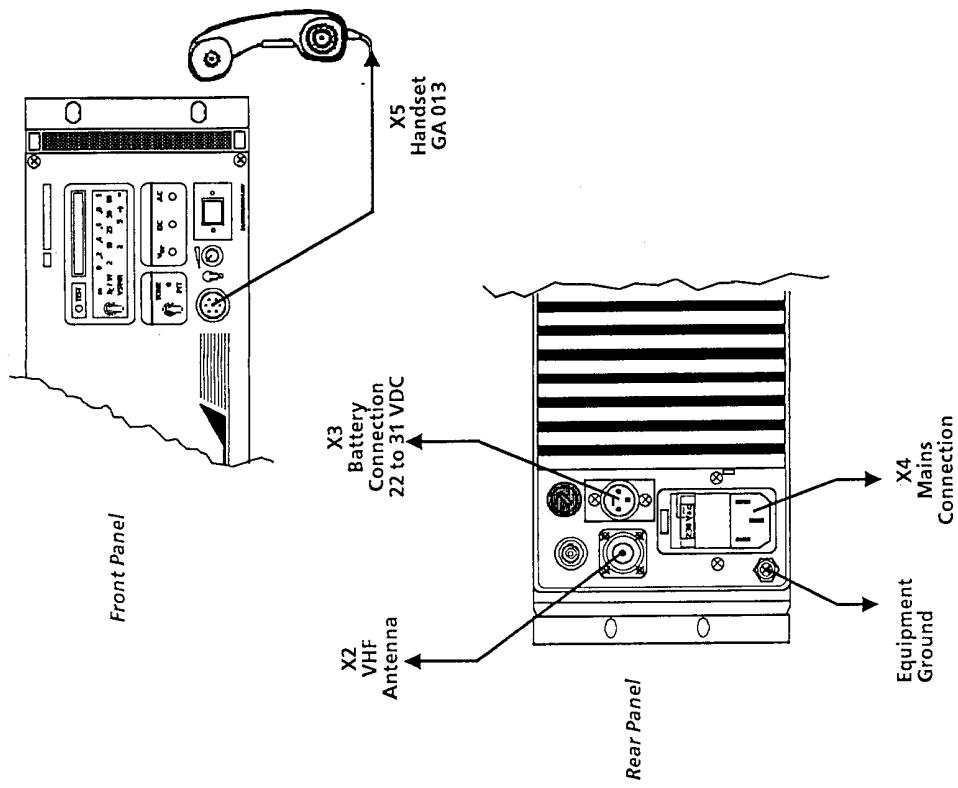


Fig. 2.2 VHF Transceiver XU 221, Basic Cabling

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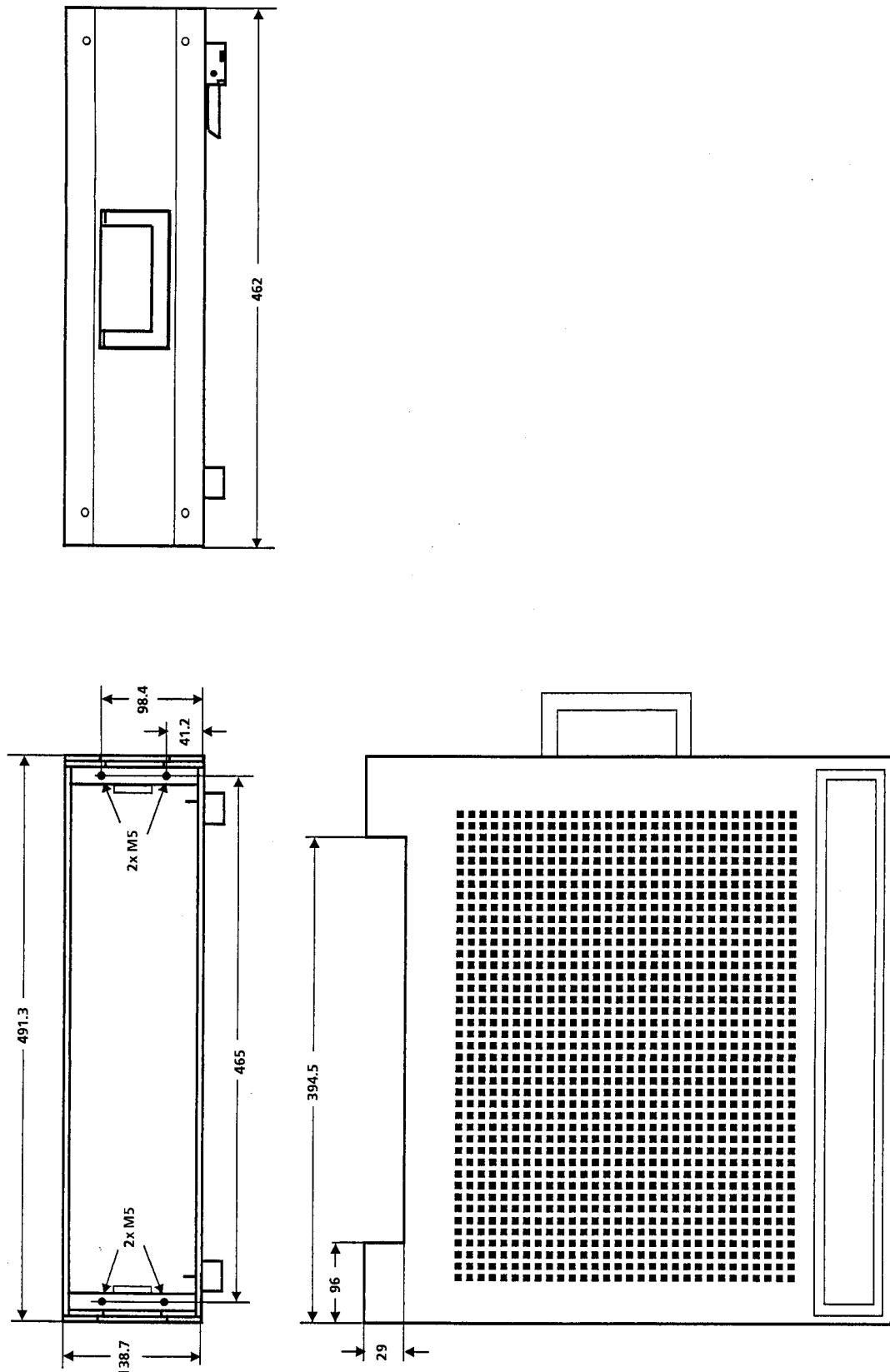


Fig. 2.4 Cabinet KK251 (Option), Installation Drawing

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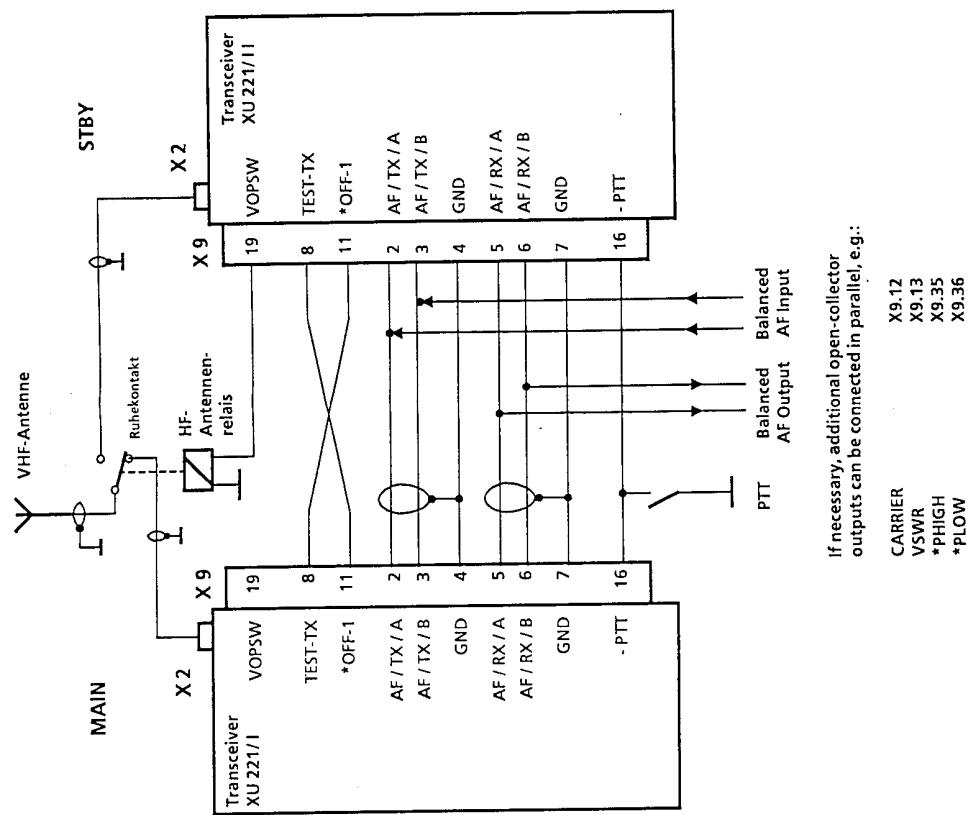


Fig. 2.5 Cabling Example: Main / Standby Connection of Two Transceivers XU 221

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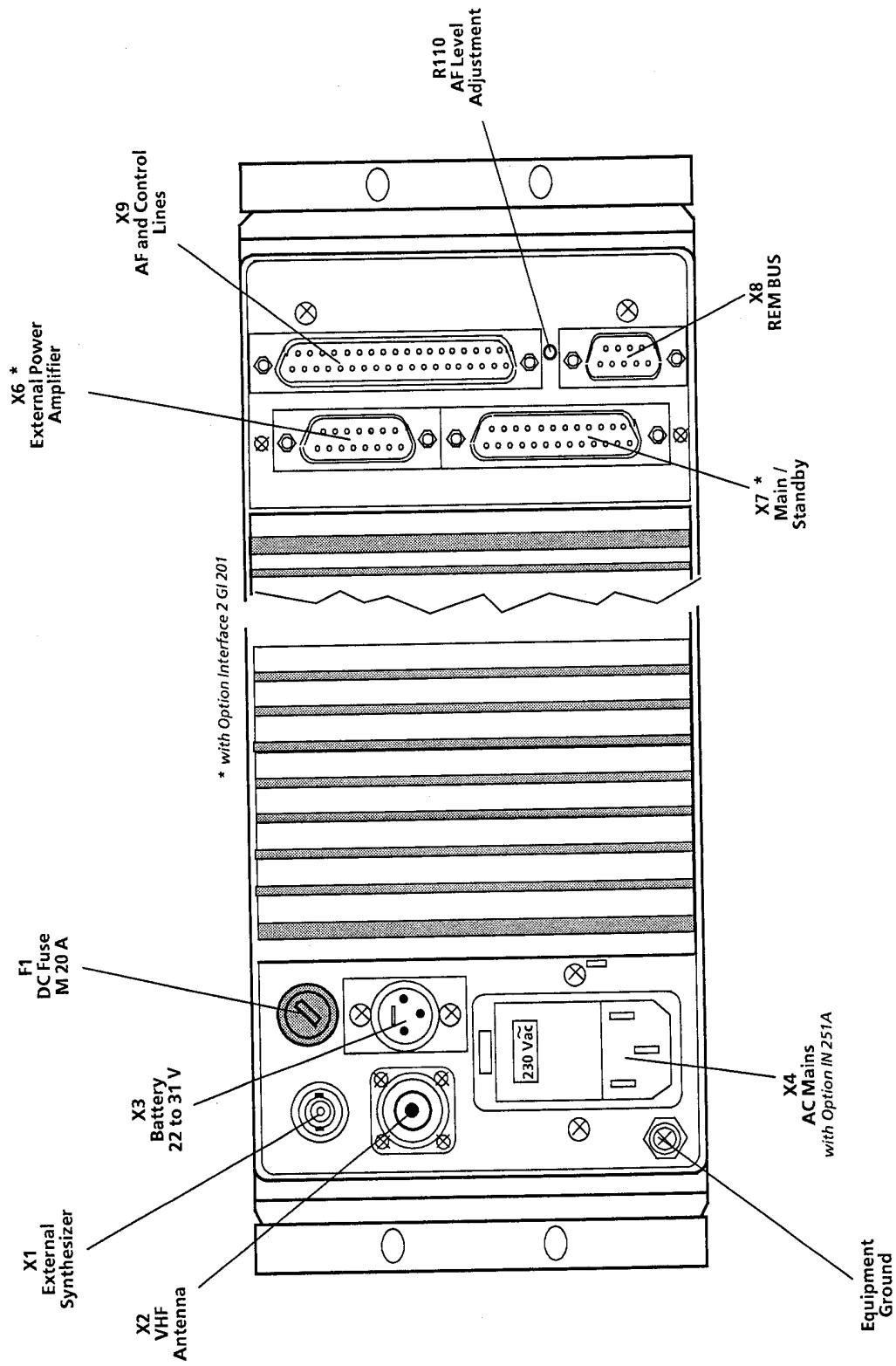


Fig. 2.1 VHF Transceiver XU 221, Rear View

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1.2.11 Explanation of Models

Type	Designation	R&S No.	Remarks	22	23	24	25	26	27	42	43	44	45	46	47
XU 221	VHF Transceiver 25 W	6043.9343.XX	Model												
VU 221V	VHF Amplifier	6044.2942.02		X	X	X	X	X	X	X	X	X	X	X	
VU 221V	VHF Amplifier	6044.2942.03	with Tx / Rx switch		X	X	X	X	X	X	X	X	X	X	X
EU 231	VHF Rx Unit	6043.1942.22	8.33 kHz with TCXO					X	X					X	X
EU 231	VHF Rx Unit	6043.1942.23	25 kHz with TCXO	X	X	X	X			X	X	X	X		
GM 201	Modulator	6044.5341.03		X	X	X	X	X	X	X	X	X	X	X	X
GM 201C8	Modulator Extension	6044.4445.02	8.33 kHz					X	X					X	X
GF 201V	VHF Synthesizer	6044.6948.22	8.33/25 kHz with TCXO	X	X	X	X	X	X	X	X	X	X	X	X
GF 201V	VHF Synthesizer	6044.6948.23	8.33/25 kHz with OCXO		X	X	X	X	X					X	X
G1201X	Interface 1	6044.2442.02		X	X	X	X	X	X	X	X	X	X	X	X
KR 201	Adapter	6044.0940.02		X	X	X	X	X	X	X	X	X	X	X	X
GH 200V	VHF Lowpass Filter	6048.0644.22	with cables					X	X	X	X	X	X	X	X

* for 8.33 kHz Operation order option GM 201C8 as an extra

Models 42 to 47: according to German BZT (Telekom) regulations

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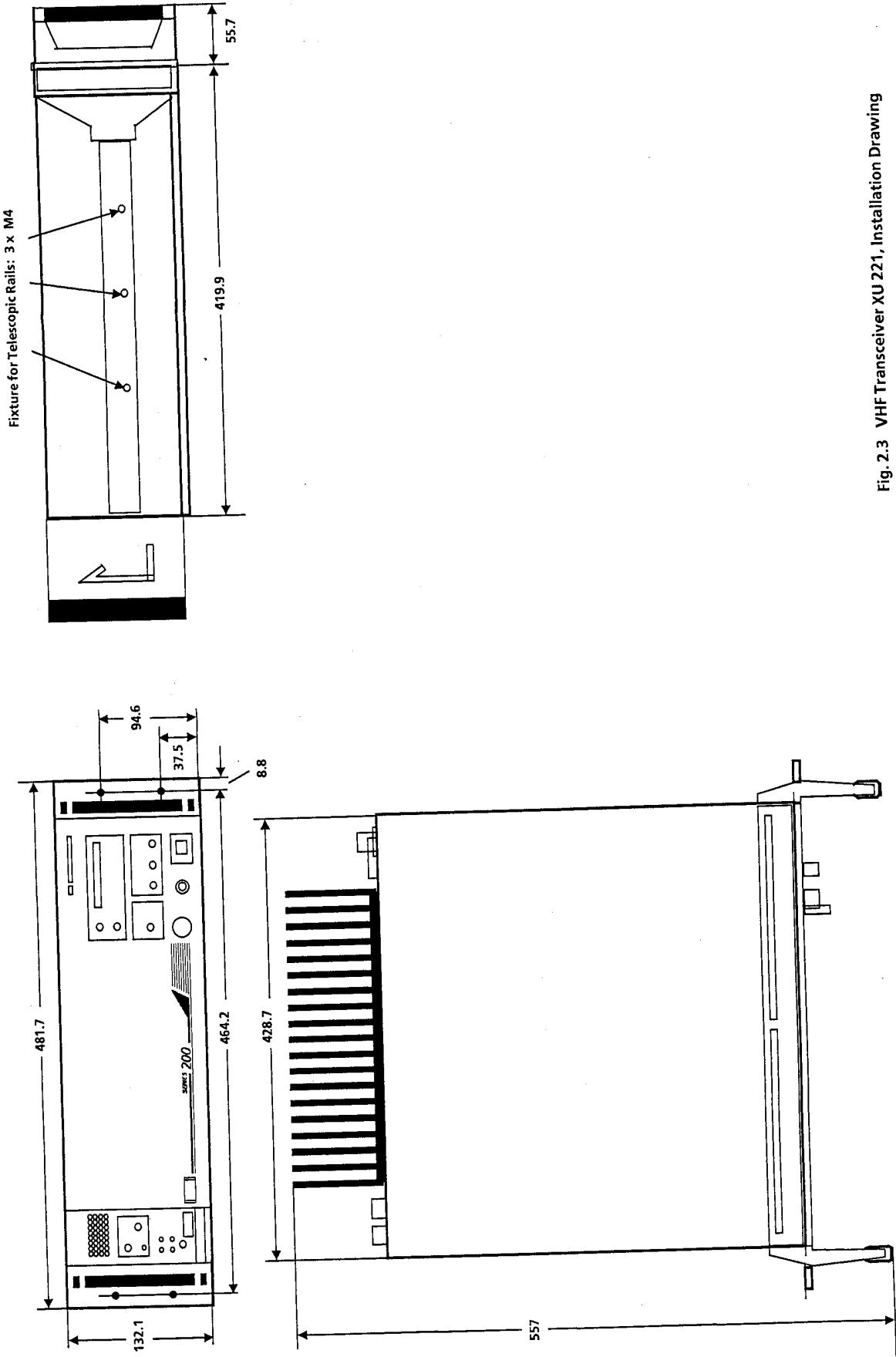


Fig. 2.3 VHF Transceiver XU 221, Installation Drawing