CE A132 937J

No. LBA.O.10.911/98 JTSO
DFS-No.: B-7850/97

FSG 90
FSG 90-H1

118.000 ... 136.975 MHz

6W / 10W VHF/AM AIRBAND TRANSCEIVERS

Dual Mode: 8.33 kHz/25 kHz or "only 25 kHz" channel spacing

Maintenance & Overhaul

applies for FSG 90 **article no. F10185**
applies for FSG 90-H1 **article no. F10302**

Before maintaining the transceiver, read this manual thoroughly, please!

Keep for further use!

Document No.:	MRM 031.00
Article-No.:	D10019
Revision Number:	1
Date of Issue	November, 1999

Walter DITTEL GmbH Luftfahrtgerätebau
Avionics Division
Erpftinger Strasse 36 ★ D-86899 Landsberg ★ GERMANY
Telephone +49 (0)8191/ 3351-0 ★ Fax +49 (0)8191/ 3351-49
e-mail: firma@dittel.com ★ **Internet:** http://www.dittel.com

MAINTENANCE MANUAL REVISION INSTRUCTIONS AND HISTORY

MANUAL MRM 031.00
REVISION 1

Where R & R appears in the ACTION column, remove the page now in this Maintenance & Overhaul Manual and replace it with the enclosed page; otherwise ADD or DESTROY pages as listed. Retain these instructions in the front of the Maintenance/Overhaul Manual as a RECORD OF REVISIONS.

PAGE	ACTION	REASON FOR CHANGE
Title / ii	R & R	New JTSO Authorization number

TABLE OF CONTENT

TABLE OF CONTENT

LIST OF ILLUSTRATIONS

USED SYMBOLS

In this manual the following symbols are used:

DANGER!
describes an immediate threatening danger! Failing to observe the note may cause death or heavy injuries!

CAUTION!
describes a special note for operation. Failing to observe the note may cause damage of the transceiver and/or stored data may be deleted (SETUP or user programmed memory)!

IMPORTANT!
describes explanations and other useful hints. Failing to observe the note may cause degraded performance and/or unsatisfying operation!

ABBREVIATIONS AND ACRONYMS

A/C	Aircraft
A/N	Article Number (Walter Dittel)
AF	Audio Frequency
AGC	Automatic Gain Control
Ah	Ampere hour
AM	Amplitude Modulation
ANT	Antenna
Ass'y	Assembly
AWG	American Wire Gauge
ccw	Counterclockwise (turn left ↺)
CH	Channel
CTS	Ready-to-Transmit
cw	Clockwise (turn right ↻)
dB	Decibel
dia.	Diameter
EMF	Electromotive Force (voltage of an open circuit)
EUT	Equipment Under Test
F/CH	Frequency/Channel
FL	Flight Level
g	Acceleration due to gravity
GND	Ground
HI	High Power
Hz	Hertz
ICAO	International Civil Aviation Organization
IF	Intermediate Frequency
kHz	Kilohertz
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LO	Low Power
LOS	Line-Of-Sight
m	Modulation
mA	Milliamperes
MD	Mode
MHz	Megahertz
MIC	Microphone
mW	Milliwatt
NM	Nautical miles
nW	Nanowatt (10^{-9})
PEP	Peak Envelope Power
PLL	Phase-Locked Loop
ppm	parts per million
PTT	Push-To-Talk
pW	Picowatt (10^{-12})
PWR	Power
RF	Radio Frequency
rms	Effective value (root mean square)
RTS	Invitation to send
RX	Receive
RxD	Receive data
S+N/N	Signal-to-Noise Ratio
SINAD	Ratio: $\frac{\text{Signal} + \text{noise} + \text{distortion}}{\text{noise} + \text{distortion}}$
SPKR	Loudspeaker
SQ	Squelch
STBY	Standby
STO	Store
SWR	Standing-Wave Ratio
THD	Total Harmonic Distortion
TOT	Time out timer
TX	Transmit
TxD	Transmit data
VCO	Voltage-Controlled Oscillator
Vdc	Volts, direct current
VHF	Very-High Frequency
VOL	Volume
VSWR	Voltage Standing-Wave Ratio
W	Watt
Ω	Ohm
°C	Degrees Centigrade
°F	Degrees Fahrenheit

SECTION 7 THEORY OF OPERATION

7.1 General

The **FSG 90 System** consists of the following core modules:

1. Control Head
2. TX/RX Module
3. Audio Module.

Electrical function groups contain

a) DC Supply Level Control, Voltage Regulators
b) Frequency Synthesizer
c) Control Head, Display, Microprocessor, Channel Memory
d) Transmit-Receive Transfer Switching
e) Receiver (RX)
f) Transmitter (TX)
g) Audio Amplifier and Audio Switching

7.2 Basic Design

Referring to Block Diagram Figure 7 - 1 and Operational Diagram Figure 7 - 2, the basic design of the **FSG 90(X)** Dual Mode VHF/AM -System Transceivers will be discussed.

7.2.1 DC Power Supply, Voltage Regulation

The **FSG 90 System** operates from nominal 13.8 V or 14 V supply (10 ... 16.5 Vdc). Operation from 28 Vdc systems requires an external 28 Vdc to 14 Vdc converter.

Supply above 13.8 V to max. 16.5 Vdc is regulated internally to 13.3 Vdc.

Microprocessor controlled DC supply switching and stabilization circuitry sets the **FSG 90(X)** into ON or OFF mode, according to the **ON/OFF-VOL** switch position on front panel, if supply is present. DC Power ON detection automatically starts the microprocessor.

The power supply control and filtering circuitry monitors the allowed lowest supply voltage. Below 9.5 Vdc to 8.5 Vdc supply, the whole radio is automatically disconnected from DC supply. Reset to ON function is achieved automatically at some 10 Vdc.

An external (in-line) fuse prevents from overloading. Reversed DC supply polarity does not harm due to a reverse polarity protection diode, and this fuse.

The **FSG 90(X)** DC supply voltage input as well as all wiring interface is extensively filtered. This supplies the audio power amplifier, audio switching relay, and the Transmitter RF power amplifier (via modulation transformer). Integral voltage regulators provide stabilized 9.0 Vdc and 5.0 Vdc for the low power circuits.

A switched 12 Vdc output (max. 250 mA, protected by integral automatic, self-healing multi-fuse) provides power supply for accessories (e.g. display lighting).

7.2.1.1 Low Supply Voltage Warning / Indication

While being supplied between 10 to 11.0 Vdc, the processor controlled monitoring circuitry causes the 3-bar DC supply level display to flash in 1 second cycle continuously, for low supply user warning.

7.2.2 Frequency Synthesizer

The Frequency Synthesizer provides transmission and injection frequencies for

- selected ICAO radio channel names with 8.33/25 kHz channel spacing, and
- selected frequencies with 25 kHz channel spacing.

The frequency synthesizer requires less than 30 msec time to stabilize after switching from transmit to receive mode, and vice versa. During this switching time, "wrong" frequencies are blocked through the PLL control circuit (Phase Locked Loop).

Since the first heterodyne frequency operates 10.0 MHz above the channel frequency, the synthesizer frequency is 118.000 to 136.975 MHz in transmit mode. The Receiver injection frequency range is 128.000 to 146.975 MHz.

All VCO frequencies are PLL (Phase Locked Loop) controlled. The VCO output passes programmable frequency dividers. Their division ratio corresponds with selected operating frequency.

If any frequency or phase difference occurs between the accurate, and by the VCO output produced 25 kHz frequency (by division ratio according to the required frequency), the VCO frequency will be corrected, until any difference becomes balanced. This tunes the radio fast and exactly to the correct operating channel. Pulse or phase noise is eliminated in the VCO Loop filter. The synthesizer employs an appropriate customized hybrid.

The highly accurate, crystal-controlled 12.8 MHz reference oscillator is again comprehensively microprocessor controlled. Temperature calibration data are stored (individually on each module) over -25°C ... +60°C operating temperature range in 5°C steps. This ensures the required frequency accuracy of better than ± 1.5 ppm over the whole temperature range.

7.2.3 Control Head, Display, Microprocessor, Channel Memory

The Control Head Module includes:

a) Processor Controller Board with control switches.

b) LCD Liquid Crystal Display Board.

Processor Controller Board with control switches

This board contains rotary switches for **ON/OFF-VOL** and **F/CH**, and the push keys **STO**, **SQ**, **MD** and Transfer ⇳. Added to the **F/CH** switch is a push switch.

Three EEPROMs store unit operational settings, partially the calibration data, and user data (memory channels). One EEPROM is located on the Processor Board, one handles individual correction / calibration data on the TX/RX Board, and one handles individual correction / calibration data on the Audio Board.

The clock is produced by a crystal oscillator. With sufficient unit supply voltage, a reset circuit provides the micro controller reset.

Access to unit internal functions and their calibration requires customized control interface, and a specific control / alignment software, but this is available only for authorized parties.

The microprocessor handles following functions:

- Handshake for communication via the integral signal bus with integral interfaces, and with external control interface with proprietary PC computer program.
- EEPROM management of user memory channels.
- Cyclic status questioning of the user buttons (**STO**, **SQ**, **MD**, Transfer ⇳, and of the user selector switches **ON/OFF-VOL** and **F/CH**).
- Control of the LC display.
- Squelch switching logic voltages.

- Modulation depth control in connection with the voice processor.
- Monitoring of supply voltage range. Too low supply initiates flashing of the 3-bar DC supply symbol. Far too low supply disconnects the transceiver.
- Setting of various electronic potentiometer level control.
- 2-Minute Transmit Time-Out-Timer and complete display flashing.
- Transmitter blocking during Receive (if activated / deactivated in SETUP).
- SETUP management.

LCD (Liquid Crystal Display) Board

An LC display controller and the LCD are located on the Display Board. The Liquid Crystal Display can be illuminated.

The operator can choose one display mode out of three modes.

The operating frequency (in 25 kHz spacing only, with 5-digit display), or operating channel name (in 8.33 kHz and 25 kHz mode but with 6-digit display) is selectable by the (rotate and push) **F/CH** selector switch on the front panel. This knob is used also to select individual transceiver adjustments through SETUP.

If in the SETUP (e.g. for airfield vehicle) the free frequency / channel name user access is blocked, only preset channels are usable.

7.2.4 Transmit – Receive Switchover

Antenna switch-over between Transmitter output and Receiver input is performed using solid-state diode switching circuitry.

7.2.5 Receiver (RX)

A wide-band, fixed-tuned antenna high pass filter reduces interference caused by signals below 116 MHz. This avoids interference from FM broadcast transmissions (called ICAO Annex 10 FM Intermodulation immunity). The commonly used transmitter low pass antenna filter attenuates receiver interference input above 150 MHz.

Four resonant receiver RF input circuits are tuned by accurately temperature controlled Varicaps, followed by a FET RF pre-amplifier (source circuit), and a hybrid mixer.

The receiver is a dual heterodyne type. The first intermediate frequency (IF) is 10.0 MHz, the second IF = 455 kHz (Hybrid).

In accordance with the channel spacing selected, switched but separate 8.33 kHz and 25 kHz crystal IF filters provide necessary channel spacing selectivity.

The hybrid 455 kHz IF-amplifier contains the 10.455 MHz second conversion oscillator and mixer, automatic gain control (AGC) circuitry for the front-end PIN diodes, and a specific, automatic AM carrier / FM noise squelch gate circuit to control properly the received signal characteristics.

Again, processor controlled, temperature compensated squelch thresholds ensures accurate Squelch functionality.

At least 80 dB RF selectivity together with better than 70 dB inband intermodulation capability, within and outside the VHF/AM band (besides adjacent channels) employs also a tuned mirror attenuation notch. This complex RF filter arrangement requires accurate, temperature controlled alignment. The –5 dBm ICAO Annex 10 intermodulation immunity against FM broadcast interference again employs complex processor-controlled and temperature compensated front-end alignment.

The receiver RF gain control is capable to handle RF input signals between 1 µV/ -107 dBm and more than 1 V / +13 dBm, with less than 3 dB audio output level change.

The squelch circuitry adapts (again microprocessor controlled and temperature compensated) the SQ opening threshold in four steps (default approx. 1 µV /

-107 dBm), or by the SETUP determined 2.5 µV, or 4 µV, or for tests 8 µV RF levels to withstand RF interference. The AM/FM combined squelch circuits control the audio amplifier. Manual override provides the SQ control button on the unit's front panel.

The receiver is supplied with stabilized 9.0 Vdc.

The receiver audio output is fed to the audio amplifier for further processing.

7.2.6 Transmitter (TX)

The transmitter RF amplifier is of wideband design and includes three stages:

1) RF Isolation amplifier (MMIC)
2) RF Driver amplifier
3) RF power amplifier FET with Drain modulation

All RF amplifier stages are coupled by wideband LC networks, or through ferrite transformers.

The low pass antenna RF filter is used also by the receiver. Diode switching is employed to connect either receiver input, or transmitter output to the antenna.

Only properly tuned frequencies are generated. RF power radiation is accurately controlled by supply voltage switching of the MMIC isolation amplifier.

7.2.6.1 Transmitter (TX) Enunciator

The transmit mode is indicated by the steadily visible transmit LCD symbol (TX) Enunciator during transmit. Contrary to this, a continuously flashing complete display indicates, that the 2-minutes continuous transmit time-out-timer has disabled the transmitter. This indicates e.g. also stuck PTT button, or a defective PTT line.

After correction of the reason for PTT blocking and after switching the **FSG 90(X)** again ON, normal operation is resumed. In emergency situations, e.g. with continued stuck PTT button, every switching OFF and ON again of the **FSG 90(X)** allows another transmission period, for maximum 2 minutes duration. This allows repeated continuous transmission when required.

7.2.6.2 Automatic Transmit Blocking (can be disabled)

When this function is in the SETUP (normally) activated, the **FSG 90(X)** is capable to avoid Transmit, while Receive is active. This transmit protection function supports avoidance of channel blocking which is occupied by other users and RF interference / disturbance on the operating channel.

With the transmit blocking function activated in SETUP, and if transmitting is needed while Receive is active on this channel, after (momentary) disabling of the Squelch by pressing the **SQ** button, transmit blocking is deactivated / transmission is then instantly possible. In the SETUP, this transmit blocking can be continuously deactivated (not recommended!).

7.2.7 Audio Frequency Amplifier

The audio interaction circuitry for signal switching and audio leveling in Transmit and Receive is again extensively microprocessor-controlled. The low-noise microphone audio amplifier features separate inputs for dynamic non-amplified, and for carbon/amplified microphones. Received audio is leveled above 30% modulation depth.

A proprietary audio hybrid includes the voice processor and audio level compressor. This provides both the Transmitter and Receiver constant audio level control.

Active voice-audio band pass filtering 0.35 kHz ... 2.5 kHz ensures meeting of both the tough 8.33 kHz Transmitter RF spectrum mask requirements, and also sufficient

attenuation of audio interference / beat tones in areas, where the simultaneous 25 kHz CLIMAX Transmit operation mode is used.

Separate audio power amplifiers provide up to 8 Watts speaker output, and independent 100 mW phone audio output.

The microphone input level sensitivity (for maximum modulation depth plus level control) is adjustable in the SETUP from 0.5 mV ... 10 mV (for dynamic, non-amplified microphones), or from 80 mV ... 500 mV (for amplified dynamic, or amplified electret, or carbon/standard microphones).

The RF output power amplifier uses source amplitude modulation control circuitry. Together with the customized audio processor hybrid, this achieves optimized voice acoustics processing for very high AVERAGE VOICE modulation depth.

FSG 90(X) modulation sounds therefore always strong, loud and clear.

Proprietary **FSG 90(X)** voice audio processing achieves strong and "crisp" transmitter modulation voice quality at 25 kHz, and specifically also at 8.33 kHz channel spacing. Therefore, no audio quality difference exists!

The processor-controlled maximum modulation depth is individually optimized for high adjacent channel power attenuation during automatic final calibration at production testing and can again not be changed manually.

If required, through the SETUP, the user can properly match the mike output level to the modulation input level required to reach a higher than 80% AM modulation compression starting point.

This accurately ensures, for each unit produced, better than 60 dB (8.33 kHz, typically 64 dB), and better than 70 dB (25 kHz, typically 78 dB) adjacent channel attenuation!

Both, the transmit audio sidetone and the intercom phone levels are individually adjustable in the SETUP. They can be set independently to some lower than the speaker level. This allows optimized volume matching of different headset types.

The transmitter sidetone audio-frequency signal is derived from transmitted RF power output, which is demodulated and amplified processor controlled.

7.2.8 Audio Switching Control

In Receive mode, the External Audio input and the Receiver input are always audible through the headphone audio output.

Should in the SETUP the External Audio Input be disabled, approx. 30 mA current draw saving in standby is achieved. This reduces **FSG 90(X)** standby current to 80 mA.

Also with disabled External Audio input, amplified external audio input is not available on the speaker audio output, but will remain present in the phone audio output.

Receive audio of the assigned 25 kHz (frequency) or 8.33 kHz (channel name) is available either with an RF input signal strong enough to open the Squelch SQ, or weaker or as RX noise only, while the SQ is disabled manually.

During Transmit, only the microphone input is fed to the audio amplifier. All other audio input signals are disabled.

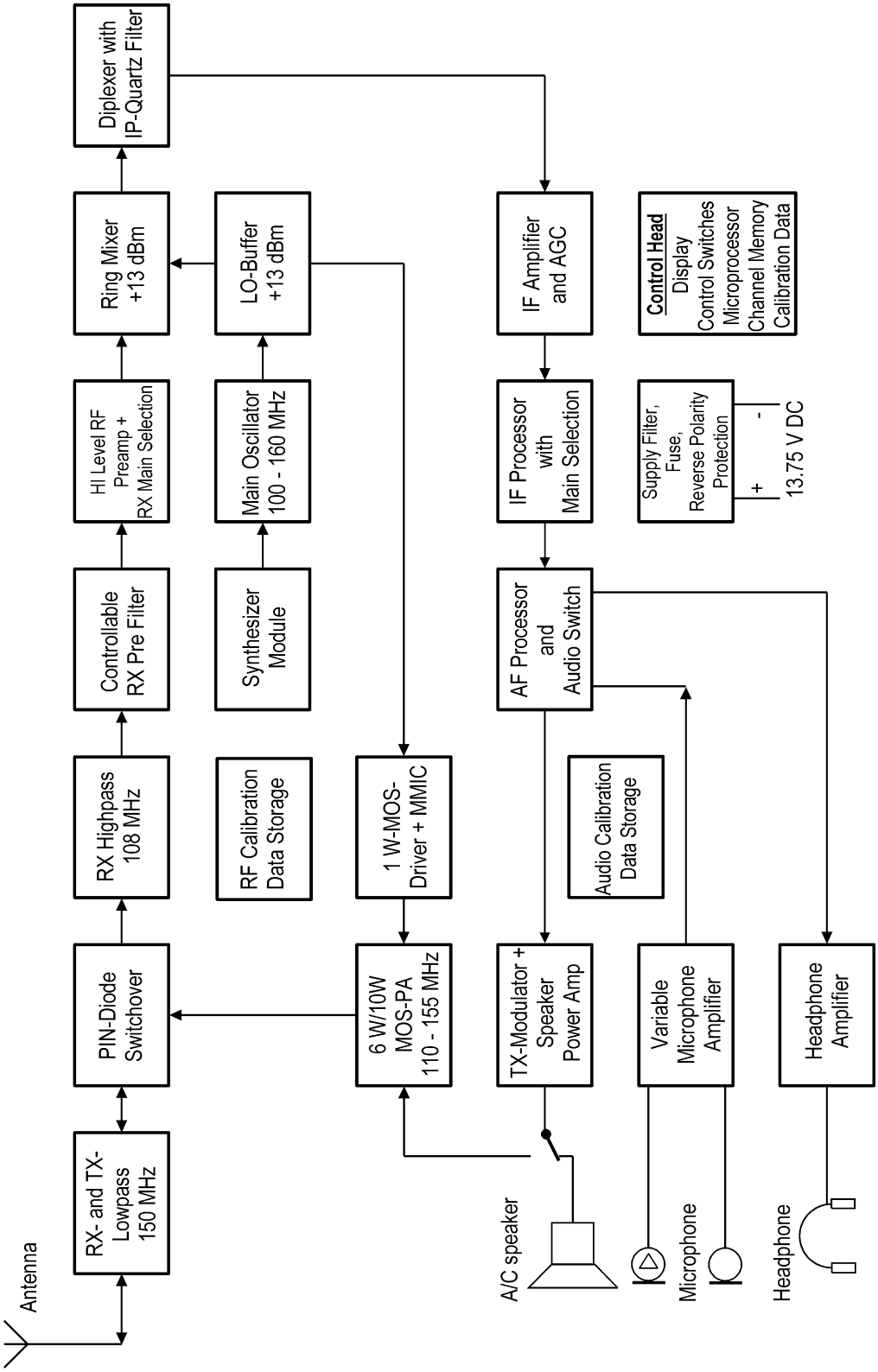


Figure 7-1 Block Diagram FSG 90(X)

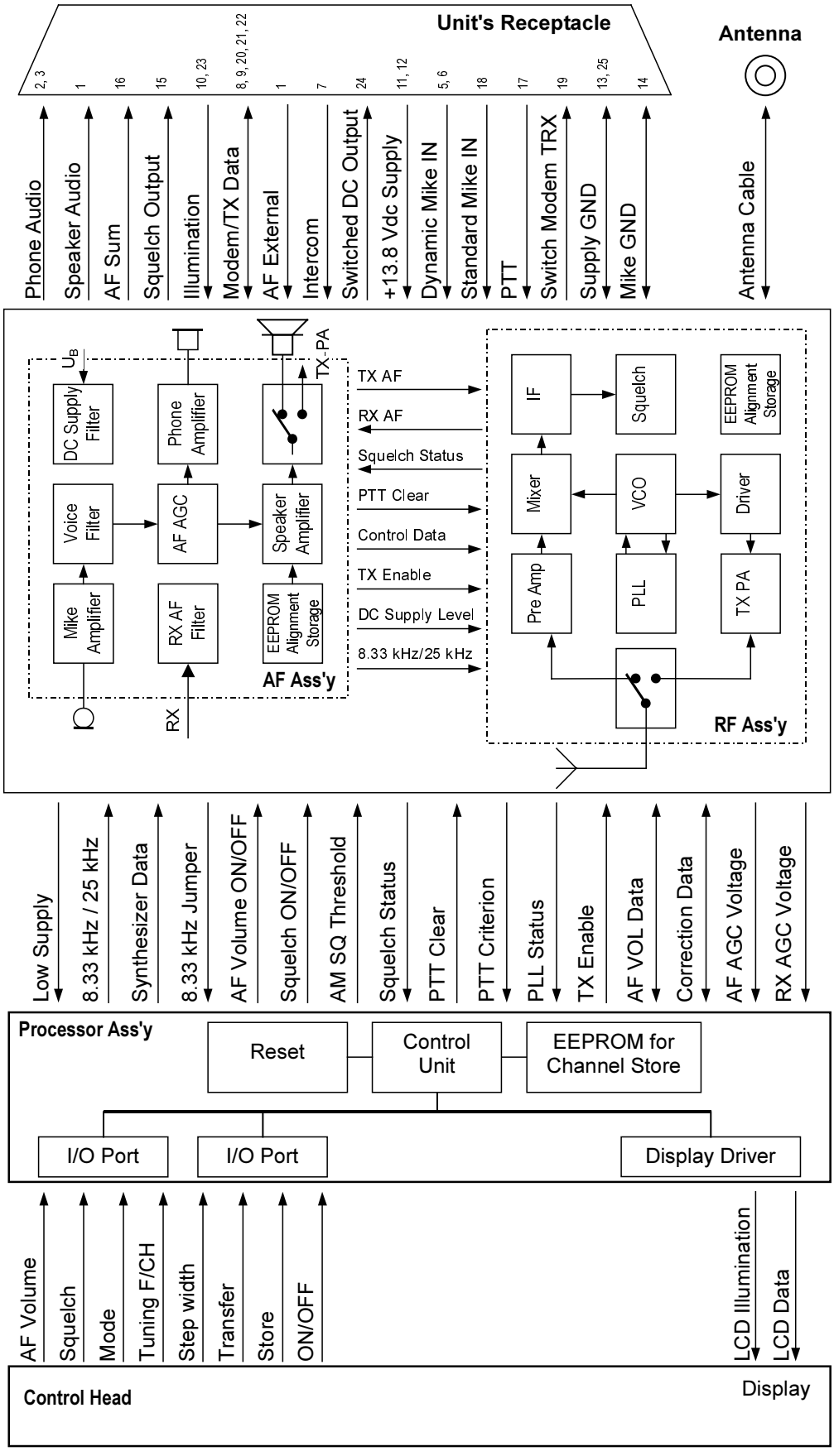


Figure 7-2 Operational Diagram FSG 90(X)

7.2.9 Operating Frequencies and assigned ICAO Channel Names

In the combined 8.33 kHz/25 kHz channel spacing mode, active Channel Names are displayed with 6 digits.

In the '25 kHz only' channel spacing mode, frequencies are displayed with 5 digits (e.g. Frequency 118.075 MHz is displayed as 118.07 MHz).

Of course this assignment also applies to all other frequencies between 118.1000 MHz and 136.9750 MHz.

Channel frequency (MHz)	Channel Spacing (kHz)	**8.33/25 kHz Mode** Channel Name = Display at **FSG 90**	**25 kHz Mode** Frequency = Display at **FSG 90**
118.0000	**25**	**118.000**	**118.00**
118.0000	8.33	118.005	
118.0083	8.33	118.010	
118.0166	8.33	118.015	
118.0250	**25**	**118.025**	**118.02**
118.0250	8.33	118.030	
118.0333	8.33	118.035	
118.0416	8.33	118.040	
118.0500	**25**	**118.050**	**118.05**
118.0500	8.33	118.055	
118.0583	8.33	118.060	
118.0666	8.33	118.065	
118.0750	**25**	**118.075**	**118.07**
118.0750	8.33	118.080	
118.0833	8.33	118.085	
118.0916	8.33	118.090	
118.1000	**25**	**118.100**	**118.10**
118.1000	8.33	118.105	
etc	etc	etc	etc

Figure 7-3 Operating Frequencies and assigned ICAO Channel Names

7.2.9.1 8.33 kHz and 25 kHz channel spacing, schematic overview

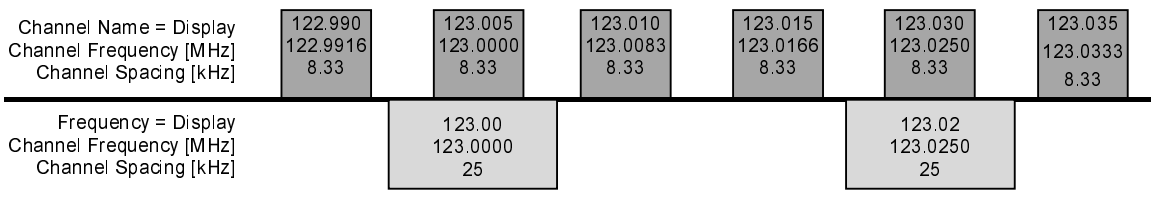


Figure 7-4 Schematic overview, 8.33 kHz and 25 kHz channel spacing

SECTION 8 SERVICE AND REPAIR

8.1 General

All **FSG 90(X)** functions and processor-controlled interactions which may be affected by temperatures and by various supply voltage levels are automatically and individually corrected and calibrated, on each **FSG 90(X)** unit produced.

Therefore, each TX/RX and Audio Module contains its own non volatile alignment correction data memory. The microprocessor uses these individual calibration data to achieve system specification compliance.

Should for repair a P.C. board replacement be required, only such automatically and comprehensively during final temperature tested P.C. boards with their individually stored alignment data will achieve full scale system performance.

Manual repair will therefore in almost all cases affect this individual P.C. board calibration.

Other repair work than readily assembled Module replacement, and/or performance verification testing as per Section 9 below is therefore not allowed!

WARNING!

- *Only a qualified and for handling of processor controlled equipment experienced Avionics Technician shall perform* **FSG 90(X)** *transceiver service and repair.*
- *In any case, every repair which is not limited to replacement of pre-calibrated printed circuit board module(s) MUST be accomplished by specified, comprehensive re-calibration, and at all temperatures in 5° C steps from -25° C to +60° C!*
- *Without use of specialized, accurately computer controlled test equipment, and without use of customized test and calibration software, plus sufficient* **FSG 90(X)** *service training and experience, no successful repair can be performed.*
- *A strict requirement is also the mandatory use of a suitable computer controlled temperature test chamber for ALL automatic temperature controlled transceiver calibrations, and for comprehensive performance tests.*

8.2 Circuit Diagrams

All **FSG 90(X)** circuitry is included in the circuit diagrams. Due to automatic computerized system technology, wiring diagrams are normally not published.

Only especially manufacturer-certified service facilities are provided with all such alignment, calibration and servicing information.

This is therefore to advise, that due to above mentioned extensive processor controlled **FSG 90(X)** operation, no individual component repair shall be performed without capability for extensive computer controlled performance pre-investigation, testing and alignment calibration.

8.3 Levels

It is sufficient to make performance testing through the 25 pole receptacle and the antenna connector.

All performance measurements are possible by test equipment interfaced via these connectors. Test Levels and measurement procedures are mentioned in Section 8.11.

8.4 Overhaul

8.4.1 General

As electronic equipment continues to become more miniaturized and complex, service and repair procedures must also be improved commensurately.

Most of the SMD technology is already known in the service facilities, however, there are always new information coming in and the special knowledge which is required is expanding in a manner which is difficult to keep under control, we wish to mention the most important points.

Before using electronic equipment to look for electrical malfunctions, defective units should be visually inspected first for mechanical faults.

Short circuit or open conducting path's are often found with the accessories. On the P.C. boards, without computerized calibration facilities, it is even not helpful when overheated / burned components can be found through simple visual inspection.

This is again to highlight, that alignment should never be attempted without using prescribed, comprehensive, over the full operating temperature range computer-controlled, automatic test equipment in conjunction with proprietary Test Software and suitable interconnection adaptation.

8.4.2 Soldering Work

As already implied before, the compactness and processor-controlled complexity does not allow ANY manual component repair work without automatic, comprehensive, computer-controlled testing and failure analysis.

Therefore, any repair must be limited to the replacement of the following thoroughly by the manufacturer individually pre-aligned and calibrated replacement modules:

Description	Article No.
6 Watt RF Module (Transmitter / Receiver / Synthesizer)	E56003
AF Module (Audio, Power Supply, Interfacing)	E56017
10 Watt RF Module (Transmitter / Receiver / Synthesizer)	E57277
AF Module (Audio, Power Supply, Interfacing) -H1 model	E57301
Control Head Module (Microprocessor, Memory / Switches and Display)	E56009

All replacement Modules are readily calibrated and mechanically assembled with its housing. This allows for quick and safe exchange.

8.5 Handling of Electrostatic Devices

Care must be exercised in handling any CMOS device. Although CMOS devices have a built-in protective diode network which protects against damage due to static electric discharge, additional precautions should be followed to assure trouble-free performance after assembly.

All sensitive CMOS devices and assemblies are marked.

The following guidelines for handling CMOS devices are suggested:

- Keep CMOS devices in conductive or anti-static containers, never use untreated plastic!
- Keep operators at ground potential (by conductive wrist band and a 1 MOhm resistor to ground)!
- Never touch the edge connections - only take hold of the case!
- Ground all working surfaces, tools and testing equipment!
- Do not insert or remove boards with power turned ON!

8.6 Cleaning

- Using a clean, lint-free cloth lightly moistened with a mild cleaning detergent, remove all foreign matter from the equipment case and unit front panels. Wipe dry using a clean, dry, lint-free cloth.
- Using a hand controlled dry air jet (not more than 15 psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.
- Clean the receptacle and antenna plug with a hand controlled dry air jet (not more than 25 psi), and a clean, lint-free cloth lightly moistened with an approved mild cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

8.7 Disassembling the FSG 90(X) transceiver

CAUTION!

- ***The* FSG 90(X) *shall be disassembled only to such extent, as it is necessary to replace a defective module!***
- ***REPLACEMENT MODULES SHALL NOT BE DISASSEMBLED FURTHER!***

Special tools and test methods are required to locate and repair malfunction, and to perform re-calibration before reassembling.

Therefore, and in order to avoid damage caused by wrong disassembling or re-assembling, it is required to dismantle the transceiver unit strictly following the guidance of disassembling / reassembling instructions. The dismantling sequence listed below must be followed (refer to drawing next page).

- **Disconnect power!**
- Remove four flat head screws (8) on Control Head.
- Carefully pull off the Control Head from Chassis, do not twist or tilt.
- Remove two screws (3) and washers (4) on rear panel.
- Remove Front Partition (5) by removing 4 screws (6).
- Carefully separate the two main modules, do not twist or tilt.
- Carefully disconnect the coaxial and the jumper cable.
- Replace respective defective complete module. Verify correct part No. and Jumper P2 position (8.7.1), enable or disable 8.33 kHz function (if built-in).

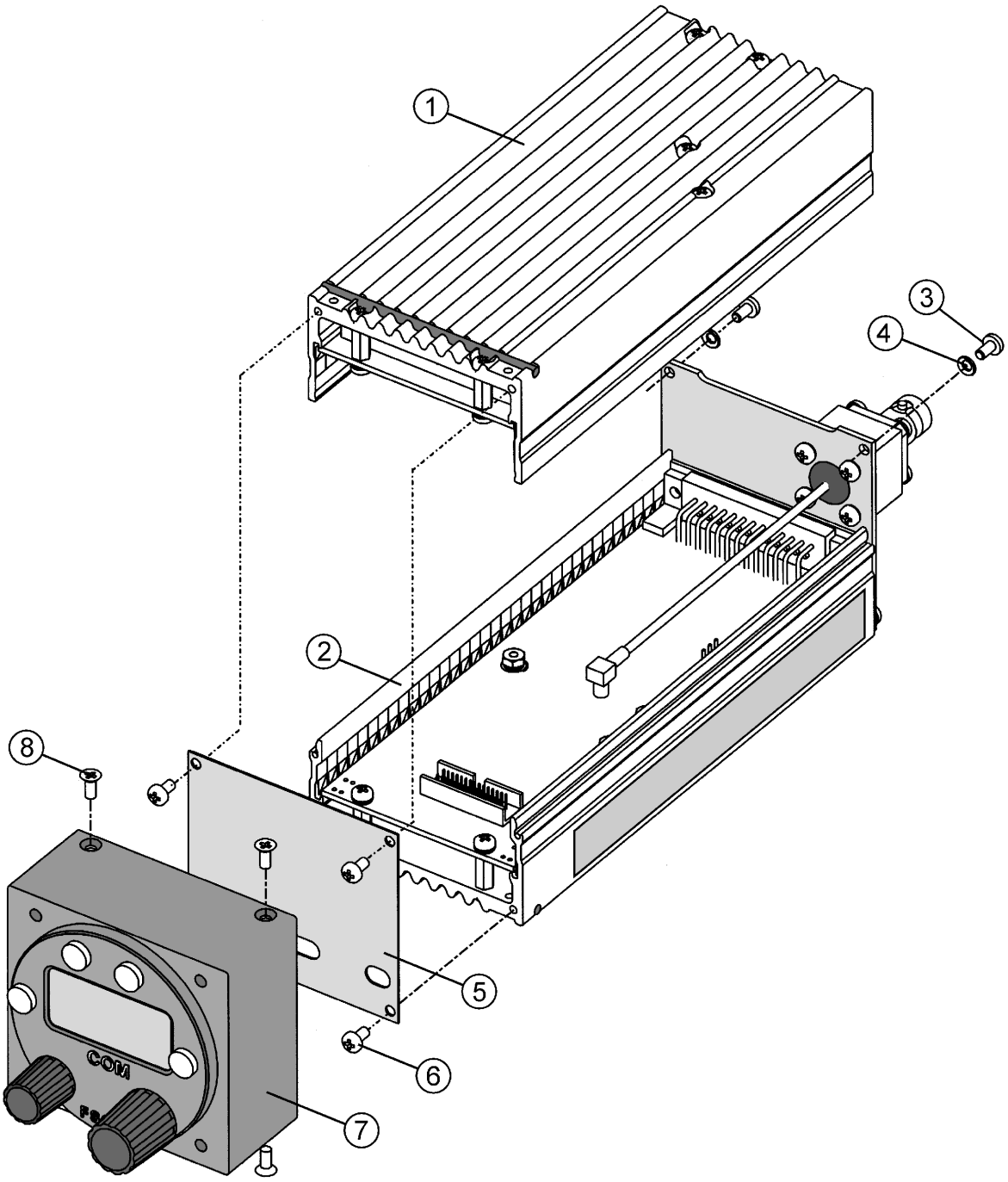


Figure 8-1 FSG 90(X), Exploded view

8.7.1 Assembly Procedure

In general, assembly may be accomplished by following the above steps in reverse order. The assembly drawings are contained in section 10.

IMPORTANT!

- *Be careful not to pinch any leads under solid parts when reassembling.*
- *When tightening the screw of the **ON/OFF- VOL** knob, notice the position of the knob.*
- *Make visual inspection for broken wires, not secured pots, screws and ferrite cores etc.*
- *Ensure two chassis rubber seal's position.*
- *Before closing the unit investigate whether the position of jumper P2 for continuous enabling / disabling the 8.33 kHz function is set properly.*
- ***IF YOU HAVE TO DISABLE THE 8.33/25 kHz MODE PERMANENTLY DUE TO NATIONAL REGULATIONS, PLEASE CONTACT THE WALTER DITTEL SERVICE DEPARTMENT! IT REQUIRES NEW IDENT TAG AND TYPE LABEL. OTHERWISE APPROVALS EXPIRE, OPERATION IS ILLEGAL!***

Model	Article Number	8.33 built-in	8.33/25 kHz Mode enabled ?	Jumper P2 closed (on Audio Board)
FSG 90	F10185	Yes	Yes	Yes
FSG 90-H1	F10302	Yes	Yes	Yes

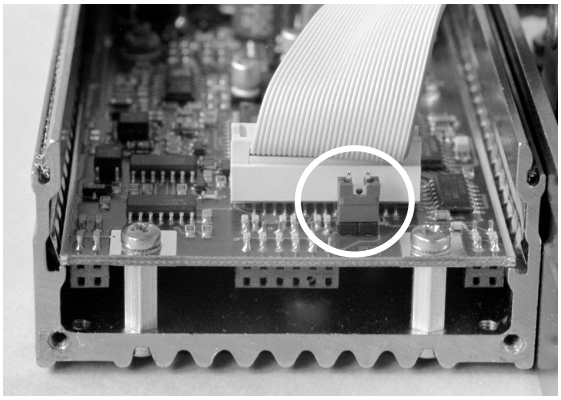


Figure 8-2 Jumper P2 position: 8.33 kHz/25 kHz Mode enabled

8.8 Necessary Equipment for Testing, Repair, Setup

Service and repair for **FSG 90(X)** transceiver require test equipment, which in terms of accuracy and handling are suitable for precise measurements.
If such units are not available, similar or better specified test equipment is required.

Description	Recommended Type	Recommended Manufacturer
VHF Signal Generator	CMT or CMTA	Rohde & Schwarz
RF Wattmeter (50 Ohm)	CMT or CMTA	Rohde & Schwarz
Audio Generator	CMT or CMTA	Rohde & Schwarz
Oscilloscope	CMT or CMTA	Rohde & Schwarz
Multimeter	3 digit resolution	Any
Audio Volt- / Distortion-Meter	CMT or CMTA	Rohde & Schwarz
DC Power Supply	0 ... 20 Vdc / 5 A	Any
Modulation Analyzer	CMT or CMTA	Rohde & Schwarz
Frequency Counter, min. 10^{-8}	CMT or CMTA	Rohde & Schwarz
RF Throughline Attenuator	CMT or CMTA	Rohde & Schwarz

8.9 Recommended Test setup (to be self arranged)

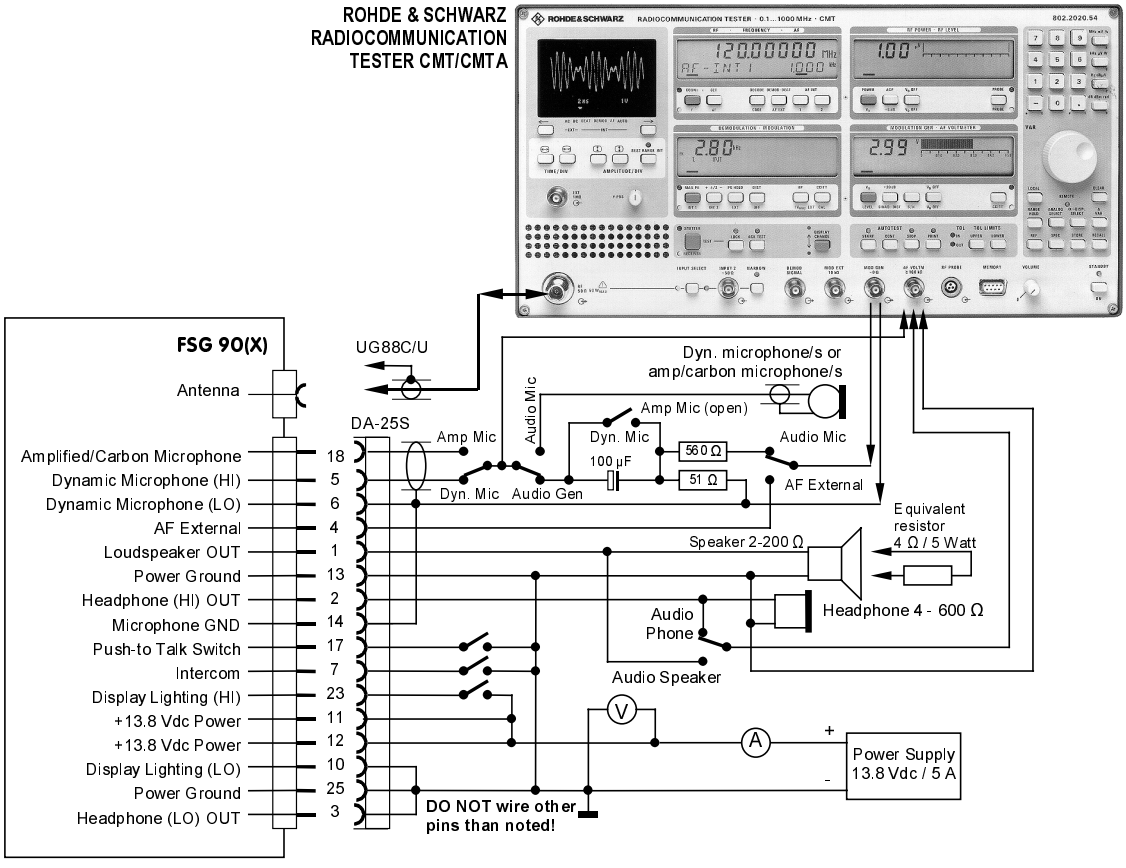


Figure 8-3 Recommended Test Setup

8.10 Trouble Shooting

This section is intended as a guide in isolating malfunctions of the **FSG 90(X)** transceiver. Certainly, the guidance presented here does not cover all failure but is intended as a guide to locate the specific module problem area.

IMPORTANT!

- ***After trouble shooting and successful repair, the complete unit must be checked using the procedures of Section 9, and the protocol in Paragraph 9.4 or 9.5.***

THIS PAGE
INTENTIONALLY
LEFT BLANK

SECTION 9 GENERAL PERFORMANCE TEST AND INSPECTION AFTER REPAIR

IMPORTANT!

- *The following **GO/NO GO** tests are applicable for testing only by licensed Avionics Service personnel and for such **FSG 90(X)** equipment, which is in factory production (functional) condition. Or, this may be performed only after completion of specified repair procedures (these will be eligible and available for especially by* Walter Dittel GmbH *authorized repair facilities only)!*
- *Please do not use these tests for very detailed performance verification!*

Extensive interaction between microprocessor and hardware requires specified test methods for accurate and comprehensive performance evaluation.

Equipment Pre-setting, Test Equipment used and the Test Sequence listed below ensure, that all functions comply with specified requirements.

9.1 Presetting Requirements (necessary for correct test value evaluation)

IMPORTANT!

- ***Be sure Transmitter is only keyed when instructed!***

- Use Test Protocol (Form listed in Section 9.4 or 9.5).
- Interconnect the **FSG 90(X)** EUT (Equipment Under Test) with Test Harness and Test Equipment, refer to paragraph 8.9.
- Adjust DC Power Supply for 13.8 Vdc (6 W version), or 14.0 Vdc (10 W Version), connected and measured at **FSG 90(X)** Pins 11 / 12 (+) and Pins 13 / 25 (-).
- Before executing General Reset, it is recommended to record separately all **FSG 90(X)** customer SETUP settings, as well as ALL customer Channel Memory Settings (of the 8.33 kHz/25 kHz mode and of the 25 kHz channel spacing mode).
- These customer settings are to be re-entered after testing completion!
- Execute **GENERAL RESET BEFORE TESTING** (press and hold **STO**, **SQ** and **MD** simultaneously while switching the **FSG 90(X)** from OFF to ON).

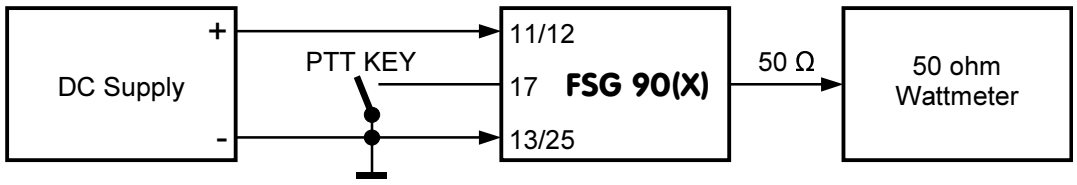
CAUTION!

- ***GENERAL RESET deletes User Password, all operational SETUP adjustments and MEMORY CH settings (replaced by manufacturer DEFAULT SETTING)!***

9.2 TRANSMITTER Performance Tests

9.2.1 TX TEST: RF Power Output, Transmit Symbol

a) Connect RF output to 50 ohm wattmeter



b) Set **FSG 90(X)** to CH 118.005 or 118.000 MHz
c) Key PTT, verify RF power output. Is TX symbol visible?
d) Unkey PTT
e) Repeat RF power measurements at 127.000 MHz, and at 136.000 MHz.

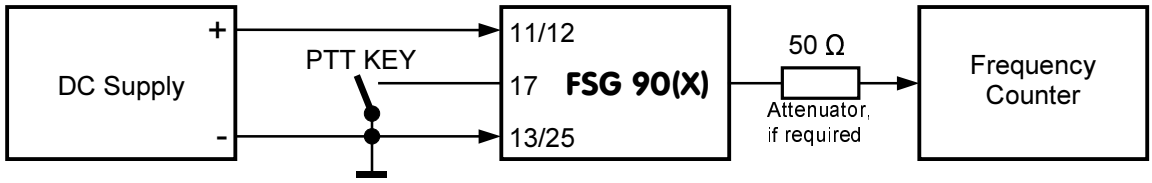
Results:

..... W at 118 MHz, ... W at 127 MHz, ... W at 136 MHz (≥ 6 or ≥ 10 W)

Transmit Symbol is present in TX mode? Yes / No

9.2.2 TX TEST: Transmitter Frequency Tolerance

a) Ensure that frequency counter accuracy is better than ± 0.01 ppm / 10^{-8}
b) Connect EUT, via a Throughline Attenuator if required, with Freq. Counter



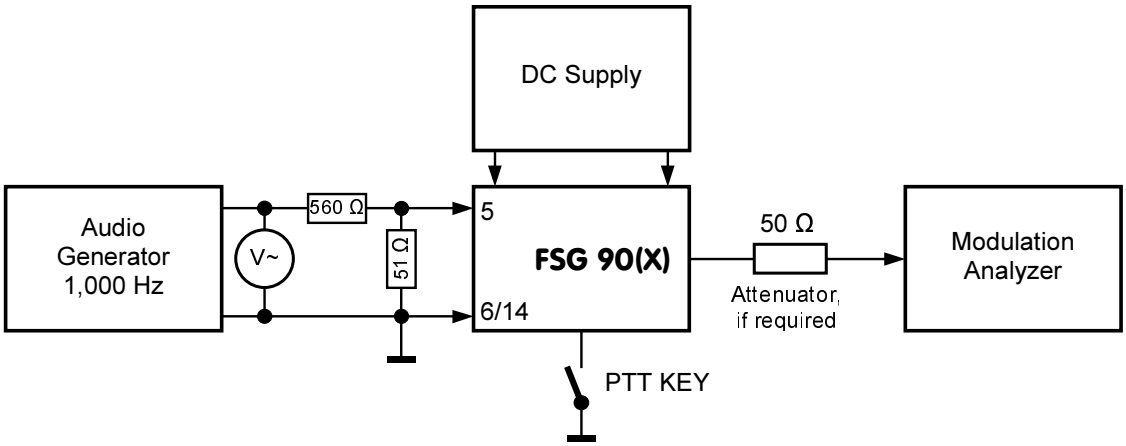
c) Set EUT to 136 MHz
d) Key PTT
e) Verify Frequency Accuracy
f) Unkey PTT

Results:

At ≥ 10 Watts, ≤ ±136 Hz:	At ≥ 6 Watts, ≤ ± 136 Hz:
..... Hz (8.33 kHz or 25 kHz)	..... Hz (8.33 kHz or 25 kHz)

9.2.3 TX TEST: Amplitude Modulation, dynamic / non-amplified Microphone input

a) Connect Audio Generator to dynamic / non-amplified Microphone input, and the RF output via a Throughline Attenuator, if required, to a modulation analyzer, use following test setup:



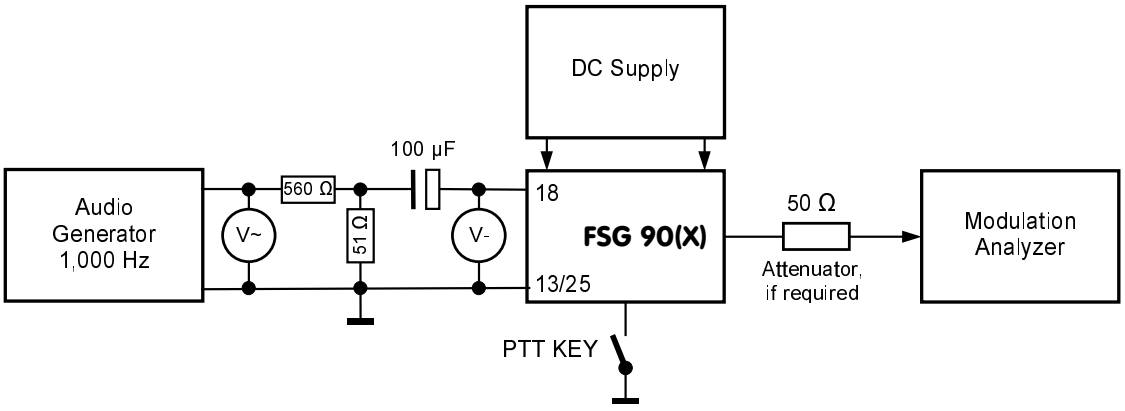
b) Connect transmitter RF output
c) Adjust Audio Generator for 15 mV rms / 1 kHz output
d) Set EUT to 118 MHz
e) Key PTT
f) Verify modulation depth at 118 MHz
g) Unkey PTT
h) Repeat measurements at 127 and 136 MHz

Results:

≥ 82 % ... ≤ 92 % at **8.33 kHz**	≥ 84% ... ≤ 92% at **25 kHz**
..... % AM at 118 MHz (8.33 kHz)	..... % AM at 118 MHz (25 kHz)
..... % AM at 127 MHz (8.33 kHz)	..... % AM at 127 MHz (25 kHz)
..... % AM at 136 MHz (8.33 kHz)	..... % AM at 136 MHz (25 kHz)

9.2.4 TX TEST: Amplitude Modulation, Carbon Standard Microphone Input

a) Connect Audio Generator to carbon standard / amplified Microphone input, use following test setup:



b) Connect transmitter RF output (via Attenuator) with a modulation analyzer
c) Adjust Audio Generator for 3,600 mV output
d) Set EUT to 118 MHz
e) Key PTT
f) Verify modulation depth at 118 MHz
g) Release PTT
h) Repeat measurements e) to g) at 127 MHz and 136 MHz

Results:

≥ 82 % ... ≤ 92 % at **8.33 kHz** ≥ 84% ... ≤ 92% at **25 kHz**

..... % AM at 118 MHz (8.33 kHz) ..... % AM at 118 MHz (25 kHz)

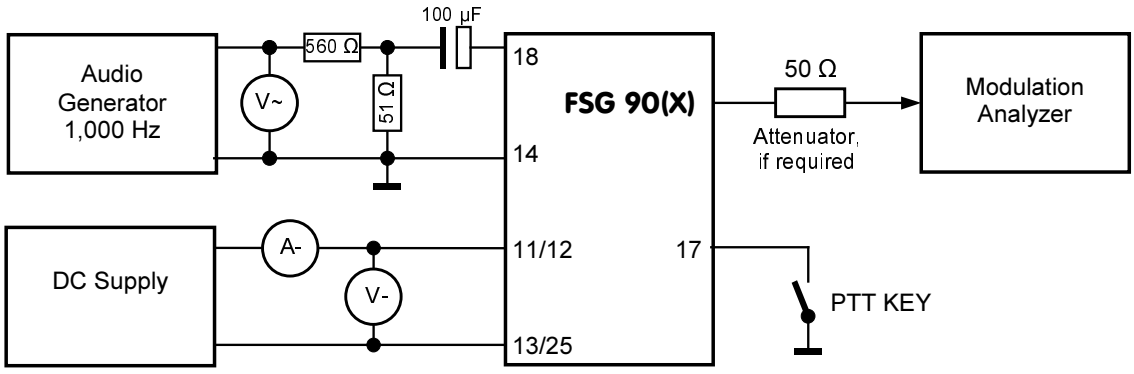
..... % AM at 127 MHz (8.33 kHz) ..... % AM at 127 MHz (25 kHz)

..... % AM at 136 MHz (8.33 kHz) ..... % AM at 136 MHz (25 kHz)

Measure the DC voltage at pin 18: ..... V (9 Vdc)

9.2.5 TX TEST: Current Consumption, with maximum Modulation

a) Connect audio generator to carbon standard / amplified Microphone input, use following test setup:



b) Set EUT to 127 MHz
c) Set DC supply during TX to 13.8 Vdc (6 Watt model), or to 14 Vdc (10 Watt model)
d) Key PTT
e) Verify Current Consumption, modulated with 3,600 mV

Results:

modulated, 6 Watt, ≤ 2.5 A: modulated, 6 Watt, ≤ 2.5 A:

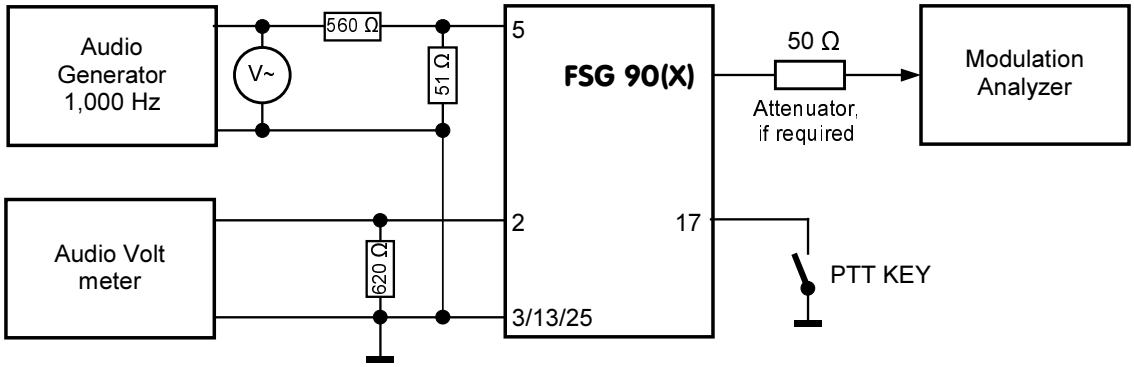
..... A (8.33 kHz), ... A (25 kHz)

modulated, 10 Watt, ≤ 3.5 A: modulated, 10 Watt, ≤ 3.5 A

..... A (8.33 kHz) ..... A (25 kHz)

9.2.6 TX TEST: AF Sidetone audio output power, with max. Modulation

a) Connect Audio Generator to dynamic / non-amplified Microphone input, use following test setup:



b) Set EUT to CH 127.005 / 127 MHz
c) Set audio generator to 3,600 mV rms / 1 kHz
d) Key PTT
e) Verify Phone AF Output Level
f) Unkey PTT

Results:

6 watts model:	2.9 ... 4.5 V (8.33 kHz)	2.9 ... 4.5 V (25 kHz)
	 V	 V
10 watts model:	2.9 ... 4.5 V (8.33 kHz)	2.9 ... 4.5 V (8.33 kHz)
	 V	 V

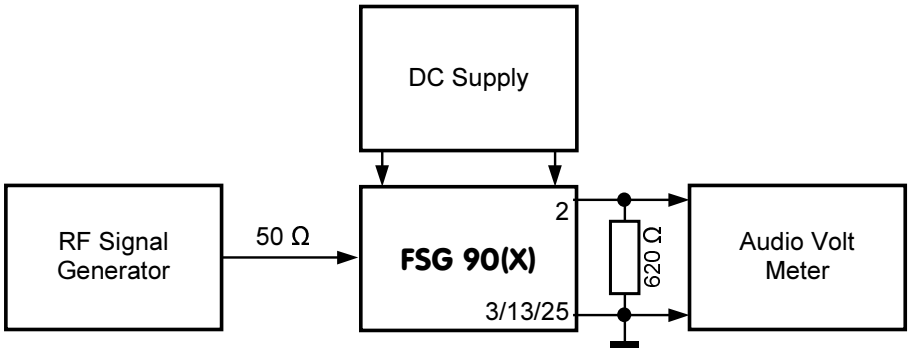
9.3 RECEIVER Performance Tests

IMPORTANT!

- ***Be sure Transmitter is NOT keyed!***

9.3.1 RX TEST: Phone AF Output Power

a) Connect EUT to the Signal Generator and 620 Ω Phone Load Resistor



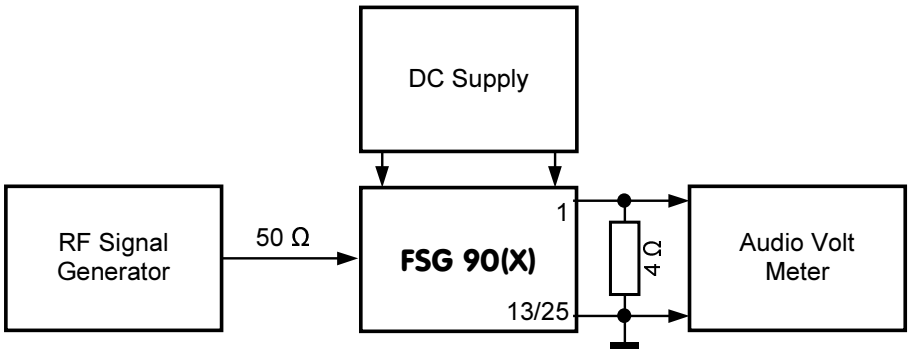
b) Set EUT to CH 127.005 / 127 MHz
c) Set RF Signal Generator Level to -67 dBm, m = 1 kHz / 85%
d) Set EUT VOLUME control to maximum

Results:

..... V (8.33 kHz, ≥ 5.5 ... 7 V_{rms}) ..... V (25 kHz, ≥ 5.5 ... 7 V_{rms})

9.3.2 RX TEST: Speaker AF Output Power

a) Ensure that PTT is not keyed!
b) Connect EUT to the Signal Generator and 4 Ω load resistor



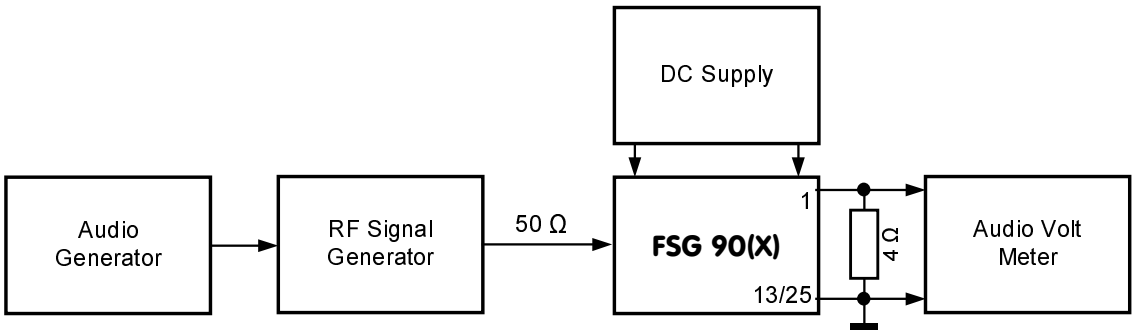
c) Set EUT to CH 127.005 / 127 MHz
d) Set RF Signal Generator Level to -67 dBm, m = 1 kHz / 85%
e) Set EUT VOLUME control to maximum

Results:

..... V (8.33 kHz, ≥ 4 V_{rms}) ..... V (25 kHz, ≥ 4 V_{rms})

9.3.3 RX TEST: AF Frequency Response

a) Ensure that PTT is not keyed!
b) Connect EUT to the Signal Generator and 4 Ω Load Resistor



c) Switch OFF the **FSG 90(X)**
d) To start SETUP, press the **STO** and **MD** button, while switching **FSG 90(X)** ON.
e) Push MD repeatedly until "SEru" (SERV) appears. Turn **F/CH** knob to select "1", and confirm by pressing **STO** (AF leveling will be switched OFF)
f) Perform following measurement, but do not switch OFF the radio before:
g) Set EUT to CH 127.005 / 127 MHz
h) Set Audio Volume level to step 4
i) Set RF Signal Generator Level to -67 dBm, m = 1 kHz / 85%
j) Set Audio Voltmeter to 0 dB (reference)
k) Consecutively set the Audio generator to 350 Hz, 2,500 Hz, 4,000 Hz
l) Verify audio level change
m) Switch OFF and ON **FSG 90(X)** to end the Service Mode

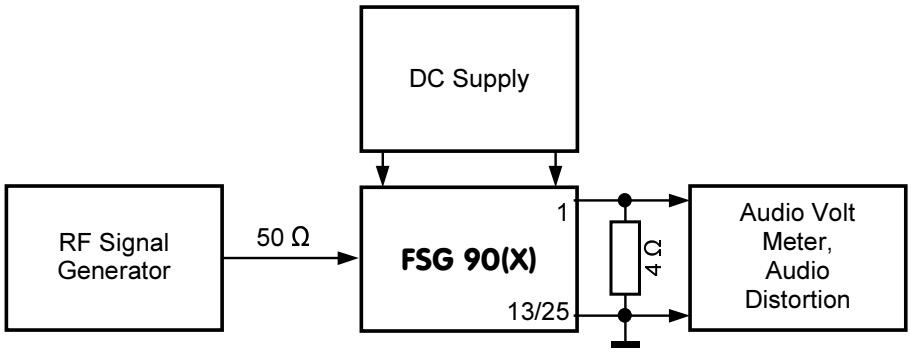
Results:

..... dB (≤ -4 dB ... +2 dB at 350 ... 2,500 Hz) response (8.33 kHz)

..... dB (≥ 20 dB at 4,000 Hz) response (25 kHz)

9.3.4 RX TEST: Sensitivity, Squelch, AGC

a) Ensure that PTT is not keyed!
b) Connect EUT to the Signal Generator and 4 Ω Load Resistor



c) Set EUT VOLUME control to MID position
d) Set EUT to CH 118.005 / 118 MHz
e) Set RF Signal Generator level to 1.5 µV / -103 dBm, m = 1 kHz / 30 %

f) Set Squelch to Mute

Results:

≥ 10 dB S+N/N, SQ lifted	≥ 10 dB S+N/N, SQ lifted
..... dB (8.33 kHz, CH 118.005)	..... dB (25 kHz, 118 MHz)
..... dB (8.33 kHz, CH 127.005)	..... dB (25 kHz, 127 MHz)
..... dB (8.33 kHz, CH 136.005)	..... dB (25 kHz, 136 MHz)

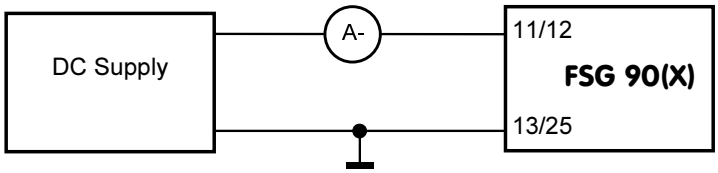
g) Repeat steps d) and h) with 500 mV / +7 dBm RF input level
h) Determine S+N/N by switching modulation OFF temporarily
i) Repeat steps e) to g) at CH 127.005 / 127 MHz and CH 136.005 / 136 MHz

Results:

Audio harmonic distortion .....% (≤ 10%)

9.3.5 RX TEST: Standby Current Consumption

a) Ensure that PTT is not keyed!
b) Connect EUT to 13.8 / 14 Vdc Power Supply



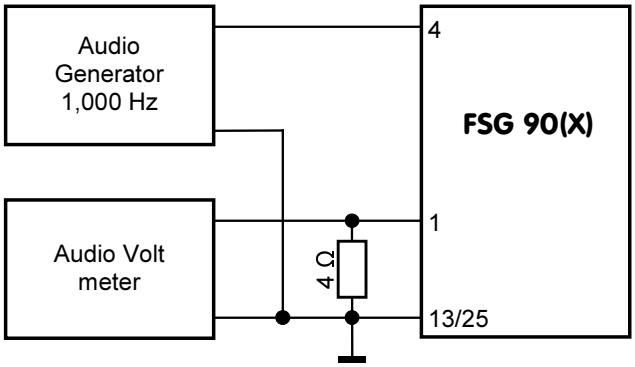
c) Ensure that no antenna RF input exists
d) Ensure that Squelch is muted
e) Ensure that External AF input is disabled (0) in SETUP
f) Repeat Measurement with External Audio input enabled (1) in SETUP

Results:

75 - 85 mA (AF Ext. OFF)	75 - 85 mA (AF Ext. OFF)
..... mA (8.33 kHz, CH 118.005),	..... mA (25 kHz, 118 MHz)
105 - 115 mA (AF Ext. ON)	75 - 85 mA (AF Ext. ON)
..... mA (8.33 kHz, CH 118.005),	..... mA (25 kHz, 118 MHz)

9.3.6 RX TEST: AF External Input Function

a) Ensure that PTT is not keyed!
b) Connect EUT to Test Equipment (independent of CH / Freq. Setting)



c) Set AF Generator to 1 V / 1 kHz

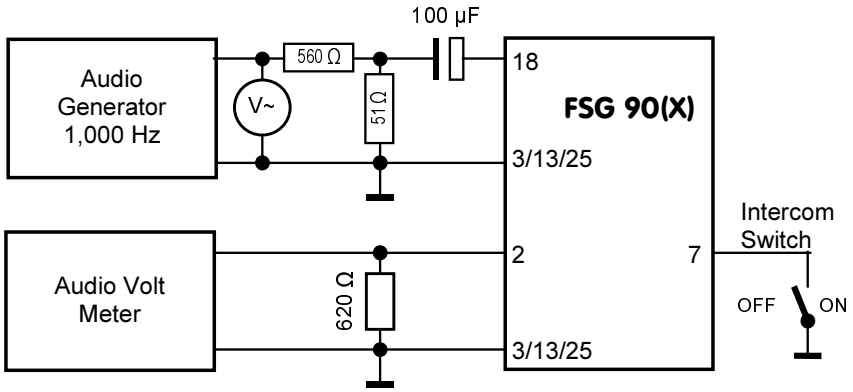
Result:

2.5 ... 3.5 V

..... V

9.3.7 RX TEST: Intercom Function

a) Ensure that PTT is not keyed!
b) Connect EUT to Test Equipment (independent of CH / Freq. Setting)



c) Set Audio Generator to 3,600 mV / 1 kHz
d) Set Intercom Switch to ON (no AF output with Intercom = OFF)

Result:

0.8 ... 1.5 V

..... V

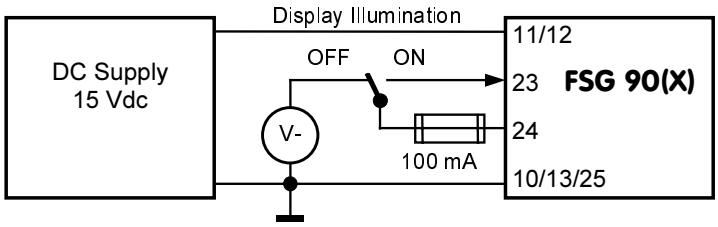
e) Set intercom switch OFF

Result:

No Audio output

9.3.8 RX TEST: Switched / Regulated DC output, and L.C. Display Illumination

a) Connect EUT to 15 Vdc DC Supply (independent of CH / Freq. Setting)



b) Switch **FSG 90(X)** ON
c) Switch L.C. Display Illumination ON, observe display illumination
d) Verify regulated / switched D.C. output voltage

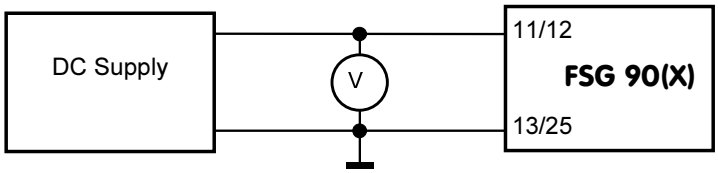
Result:

Illumination visible Yes / No with illumination switch ON

..... Vdc (13.3 Vdc ± 0.2 Vdc)

9.3.9 RX TEST: DC Supply Levels / Battery Status Segments

a) Connect EUT to DC Power Supply (independent of CH / Freq. Setting)



b) Switch **FSG 90(X)** ON
c) Observe DC supply segment presence, and AUTO OFF and ON
d) Operate any front accessible push button or F/CH knob for instant processor controlled recalculation of the voltage display.

Results:

..... V, 3 segments visible (≥ 12.7 Vdc)

..... V, 2 segments visible (≥ 12.0 Vdc)

..... V, 1 segment visible (≥ 11.0 Vdc)

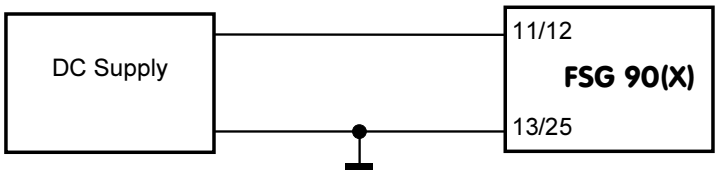
Yes / No All 3 segments flashing (10.0 ... 11.0 Vdc)

Yes / No **FSG 90(X)** Automatic switching OFF, at ≤ 9.5 Vdc supply

Yes / No **FSG 90(X)** Automatic switching ON, above 10 Vdc supply

9.3.10 RX TEST: (Re-) Entry of SETUP and CHANNEL presetting

a) Connect EUT to DC Power Supply (independent of CH / Freq. Setting)



b) Switch **FSG 90(X)** ON

c) Check consecutively all Operating Modes **MD**, **SQ**, ⇳, re-store channels

d) Perform SETUP adjustments, enter previously noted customer settings, and optimize mike / phone settings with actually used headphone(s) mike(s)

e) Check proper **FSG 90(X)** labeling and mechanical overall condition

Results:

All settings, labels and condition positively verified: Yes / No.

THIS PAGE
INTENTIONALLY
LEFT BLANK

9.4 FSG 90 TEST PROTOCOL, 6 Watt model

FSG 90(X), 6 Watt Airworthiness Test Protocol

These tests apply only for units in factory supplied condition, or after specified repair performed!
Before testing, perform **GENERAL RESET!** **Note: SETUP** and **CHANNEL MEMORY** settings are changed!

FSG 90 Model Identifier ..... **FSG 90** Serial Number ..... ☐ **A/N F10185**

Supply Voltage ..... Vdc (13.8 Vdc, 6 Watt model) Regulated Output ..... V (13.3 ± 0.2 Vdc)

TRANSMITTER

Test No.	Description		Result	Required
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**118 MHz**	..... W / Symbol ( )	≥ 6 Watt
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**127 MHz**	..... W / Symbol ( )	≥ 6 Watt
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**136 MHz**	..... W / Symbol ( )	≥ 6 Watt
9.2.2	TX Frequency Tolerance ≤± 1 ppm	**8.33 kHz**	..... Hz	≤± 136 Hz
9.2.3	TX Modulation (15 mV_{rms} dyn. Non-amplified Mike in via interface)	**CH 127.005**	..... %	82-92% AM
9.2.4	TX Modulation (3.6 V_{rms} Carbon Mike in via interface). 9 V= present?	**127.000 MHz**	..... % / V	84-92% AM / 9V=
9.2.5	TX Current Consumption (3.6 V_{rms} Carbon Mike in via interface)	**25 kHz**	..... A	≤ 3.5 A
9.2.6	TX Sidetone AF Output into 620 Ω (3.6 V_{rms} Carbon Mike in via interface)	**25 kHz**	..... V_{rms}	2.9 ... 4.5 V_{rms}

RECEIVER

9.3.1	Phone Output (5.5 - 7 V_{rms} / 620 Ω), -67 dBm / 30%	**8.33 kHz**	..... V_{rms}	5.5 - 7 V_{rms}
9.3.2	Speaker Output (≥ 4 V_{rms} / 4 Ω), -67 dBm / 30%	**8.33 kHz**	..... V_{rms}	≥ 4 V_{rms}
9.3.3	AF Response 350 ... 2,500 Hz (**8.33 kHz)** / 4,000 Hz (**25 kHz)**		..... dB / ..... dB	≤+2 ... -4 / ≥20dB
9.3.4	Sensitivity (–103 dBm / 1 kHz / 30% in, set SQ to mute before testing)	**8.33 kHz**	..... dB	≥ 10 dB S+N/N
9.3.4	Sensitivity (–103 dBm / 1 kHz / 30% in), check whether SQ is opened	**25 kHz**	Yes / No	SQ open ?
9.3.4	With +7 dBm RF Input / m = 30%, Audio distortion ≤ 10%	**8.33 kHz**	..... %	≤ 10%
9.3.4	With +7 dBm RF Input / m = 30%, Audio distortion ≤ 10%	**25 kHz**	..... %	≤ 10%
9.3.5	STBY Current Consumption, no RF input	**ext. AF input disabled**	..... mA	75 ... 85 mA
9.3.5	STBY Current Consumption, no RF input	**ext. AF input enabled**	..... mA	105 ... 115 mA
9.3.6	External AF Input 1 V_{rms}, Phone AF Output (into 620 Ω)		..... V_{rms}	2.5 ... 3.5 V_{rms}
9.3.7	Intercom ON, Phone out (3.6 V_{rms} Carbon Mike in via interface)		..... V_{rms}	0.8 ... 1.5 V_{rms}
9.3.8	Regulated DC output / Display Illumination		..... Vdc	13.3 ± 0.2 Vdc
9.3.8	Illumination visible with illumination switch ON		Yes / No	
9.3.9	3 bar DC Level Indication, 1 segment		..... Vdc	≥ 11.0 Vdc
9.3.9	3 bar DC Level Indication, 2 segments		..... Vdc	≥ 12.0 Vdc
9.3.9	3 bar DC Level Indication, 3 segments		..... Vdc	≥ 12.7 Vdc
9.3.9	Low Supply Warning	**all 3 bars flashing**	Yes / No	10 ... 11 Vdc
9.3.9	Auto – Switch – OFF		..... Vdc	Approx. ≤ 9.5 Vdc
9.3.9	Auto – Switch – ON		..... Vdc	≥ 10 V

GENERAL

9.3.10	**Customer set SETUP** Adjustments	**re-programmed**	Yes / No	Recommended
9.3.10	**Customer set CHANNELS** (8.33/25 kHz Mode and 25 kHz Mode)	**re-programmed**	Yes / No	Recommended
9.3.10	Correct Labels at the Transceiver	**checked**	Yes / No	Required
9.3.10	Mechanical Condition / all Controls Operate properly	**checked**	Yes / No	Required
9.3.10	Customer Audio Accessories Matched	**(if applicable)**	Yes / No	Recommended

JTSO Form 1, Number ..... **issued** (if applicable) **Date** .....

Date ..... (if applicable) **Inspector** .....

THIS PAGE
INTENTIONALLY
LEFT BLANK

9.5 FSG 90-H1 TEST PROTOCOL, 10 Watt model

FSG 90-H1, 10 Watt Airworthiness Test Protocol

These tests apply only for units in factory supplied condition, or after specified repair performed!
*Before testing, perform **GENERAL RESET!** **Note**: **SETUP** and **CHANNEL MEMORY** settings are changed!*

FSG 90-H1 Model Identifier ..... **FSG 90-H1** Serial Number ..... ☐ **A/N F10302**

Supply Voltage ..... Vdc (14 Vdc, 10 Watt model) Regulated Output ..... V (13.3 ± 0.2 Vdc)

TRANSMITTER

Test No.	Description		Result	Required
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**118 MHz**	..... W / Symbol ( )	≥ 10 Watt
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**127 MHz**	..... W / Symbol ( )	≥ 10 Watt
9.2.1	RF Power Output into 50 Ω, at nominal DC supply / TX symbol visible?	**136 MHz**	..... W / Symbol ( )	≥ 10 Watt
9.2.2	TX Frequency Tolerance ≤± 1 ppm	**8.33 kHz**	..... Hz	≤± 136 Hz
9.2.3	TX Modulation (15 mV_{rms} dyn. Non-amplified Mike in via interface)	**CH 127.005**	..... %	82-92% AM
9.2.4	TX Modulation (3.6 V_{rms} Carbon Mike in via interface). 9 V= present?	**127.000 MHz**	..... % / V	84-92% AM / 9V=
9.2.5	TX Current Consumption (3.6 V_{rms} Carbon Mike in via interface)	**25 kHz**	..... A	≤ 3.5 A
9.2.6	TX Sidetone AF Output into 620 Ω (3.6 V_{rms} Carbon Mike in via interface)	**25 kHz**	..... V_{rms}	2.9 ... 4.5 V_{rms}

RECEIVER

9.3.1	Phone Output (5.5 - 7 V_{rms} / 620 Ω), -67 dBm / 30%	**8.33 kHz**	..... V_{rms}	5.5 - 7 V_{rms}
9.3.2	Speaker Output (≥ 4 V_{rms} / 4 Ω), -67 dBm / 30%	**8.33 kHz**	..... V_{rms}	≥ 4 V_{rms}
9.3.3	AF Response 350 ... 2,500 Hz (**8.33 kHz)** / 4,000 Hz (**25 kHz)**		..... dB / ..... dB	≤+2 ... -4/≥20dB
9.3.4	Sensitivity (–103 dBm / 1 kHz / 30% in, set SQ to mute before testing)	**8.33 kHz**	..... dB	≥ 10 dB S+N/N
9.3.4	Sensitivity (–103 dBm / 1 kHz / 30% in), check whether SQ is opened	**25 kHz**	Yes / No	SQ open ?
9.3.4	With +7 dBm RF Input / m = 30%, Audio distortion ≤ 10%	**8.33 kHz**	..... %	≤ 10%
9.3.4	With +7 dBm RF Input / m = 30%, Audio distortion ≤ 10%	**25 kHz**	..... %	≤ 10%
9.3.5	SBY Current Consumption, no RF input	**ext. AF input disabled**	..... mA	75 ... 85 mA
9.3.5	STBY Current Consumption, no RF input	**ext. AF input enabled**	..... mA	105 ... 115 mA
9.3.6	External AF Input 1 V_{rms}, Phone AF Output (into 620 Ω)		..... V_{rms}	2.5 ... 3.5 V_{rms}
9.3.7	Intercom ON, Phone out (3.6 V_{rms} Carbon Mike in via interface)		..... V_{rms}	0.8 ... 1.5 V_{rms}
9.3.8	Regulated DC output / Display Illumination		..... Vdc	13.3 ± 0.2 Vdc
9.3.8	Illumination visible with illumination switch ON		Yes / No	
9.3.9	3 bar DC Level Indication, 1 segment		..... Vdc	≥ 11.0 Vdc
9.3.9	3 bar DC Level Indication, 2 segments		..... Vdc	≥ 12.0 Vdc
9.3.9	3 bar DC Level Indication, 3 segments		..... Vdc	≥ 12.7 Vdc
9.3.9	Low Supply Warning	**all 3 bars flashing**	Yes / No	10 ... 11 Vdc
9.3.9	Auto – Switch – OFF		..... Vdc	Approx. ≤9.5 Vdc
9.3.9	Auto – Switch – ON		..... Vdc	≥ 10 V

GENERAL

9.3.10	**Customer set SETUP** Adjustments	**re-programmed**	Yes / No	Recommended
9.3.10	**Customer set CHANNELS** (8.33/25 kHz Mode and 25 kHz Mode)	**re-programmed**	Yes / No	Recommended
9.3.10	Correct Labels at the Transceiver	**checked**	Yes / No	Required
9.3.10	Mechanical Condition / all Controls Operate	**checked**	Yes / No	Required
9.3.10	Customer Audio Accessories Matched	**(if applicable)**	Yes / No	Recommended

JTSO Form 1, Number ..... **issued** (if applicable) **Date** .....

Date ..... (if applicable) **Inspector** .....

THIS PAGE
INTENTIONALLY
LEFT BLANK

SECTION 10 ILLUSTRATED PARTS LIST

applies for FSG 90 article no. F10185

applies for FSG 90-H1 article no. F10302

10.1 Introduction

This **Illustrated Parts List** is intended for easy and accurate identification and ordering of spare parts for the VHF/AM radios **FSG 90(X)**. Exploded views in parallel perspective presentation have been chosen to identify electrical and mechanical equipment, assemblies and components. The text pages contain all information necessary for spare part or equipment orders.

10.2 Listing System

A. Text pages

Every text page is divided into four columns.

Item No. Pos. No. ①	W. Dittel Article No. ②	Nomenclature/Description ③	Units per Module ④

Column ① contains the item numbers **or** the position numbers of the parts listed.

Column ② contains the Walter Dittel article numbers of the spare parts. This number can also designate a standard or a part number of a supplier.

Column ③ contains the description of the spare part.

Column ④ contains the quantity of each listed spare part. For parts whose exact quantity can only be assessed during installation (e.g. adhesive, sealant), the abbreviation AR (as required) is entered.

B. Abbreviations

Pos. No.	Position number
Ass'y	Assembly
AR	As required
N/A	Not applicable
pcs.	pieces

10.3 Spares Order

When ordering spares always provide the complete article no. F10XXX, the ID No. (90-XXXX) and the Serial-No. of your VHF/AM radio **FSG 90(X)**.
Additionally the following information is required:

- Article Number of the module
- Nomenclature/Description
- Quantity required

Orders for spares shall be directed to your Walter Dittel representative or to:

Walter Dittel GmbH Luftfahrtgeraetebau
Erpftinger Strasse 36
D-86899 Landsberg am Lech
Germany

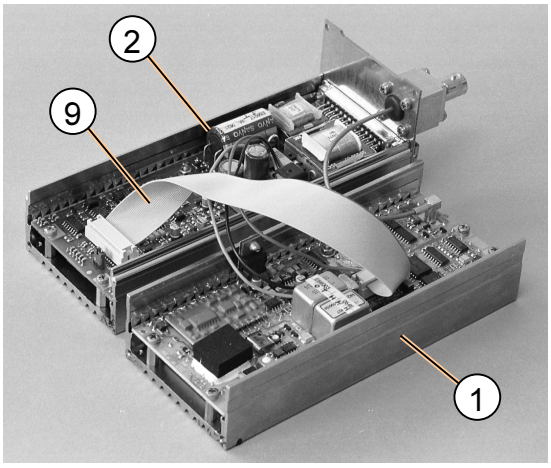
10.4 Important Notes

- ***To fulfil the stringent specifications of the European Telecommunication Standard prETS 300676, only original replacement modules, tested and calibrated by Walter Dittel GmbH, are released to repair any* FSG 90(X).**
- ***Every module requires calibration, a comprehensive temperature test and finally individually stored alignment data, to control and determine the transceiver's system performance.***
- ***This require extensive technical and commercial efforts to use high performance computer-controlled test equipment hardware, as well as customized test software.***
- ***Up to now, only the manufacturer*** (Walter Dittel GmbH) ***is capable to supply those modules!***
- ***It is therefore strictly forbidden to repair any component or de-tune any part of any (replacement) module!***
- ***When replacing modules DO NOT TOUCH ALIGNMENT and/or CALIBRATION!***
- ***After replacing any module a General Performance Test is obligatory (refer to section 9)!***

The following Illustrated Parts List is therefore limited to completely pre-aligned replacement modules, and to some mounting hardware.

10.5 Transceiver Replacement Module Identification

FSG 90(X) Transceiver Models ∅ 57 mm Front	Complete Unit Article Number	Transceiver ID No. Identifier Label Text	Control Head, complete	Audio Module, complete	TX/RX Module, complete
FSG 90, 8.33/25 kHz 6 W	F10185	90-25/8.33	E56009	E56017	E56003
FSG 90-H1, 8.33/25 kHz 10 W	F10302	90-H1-25/8.33	E56009	E57301	E57277



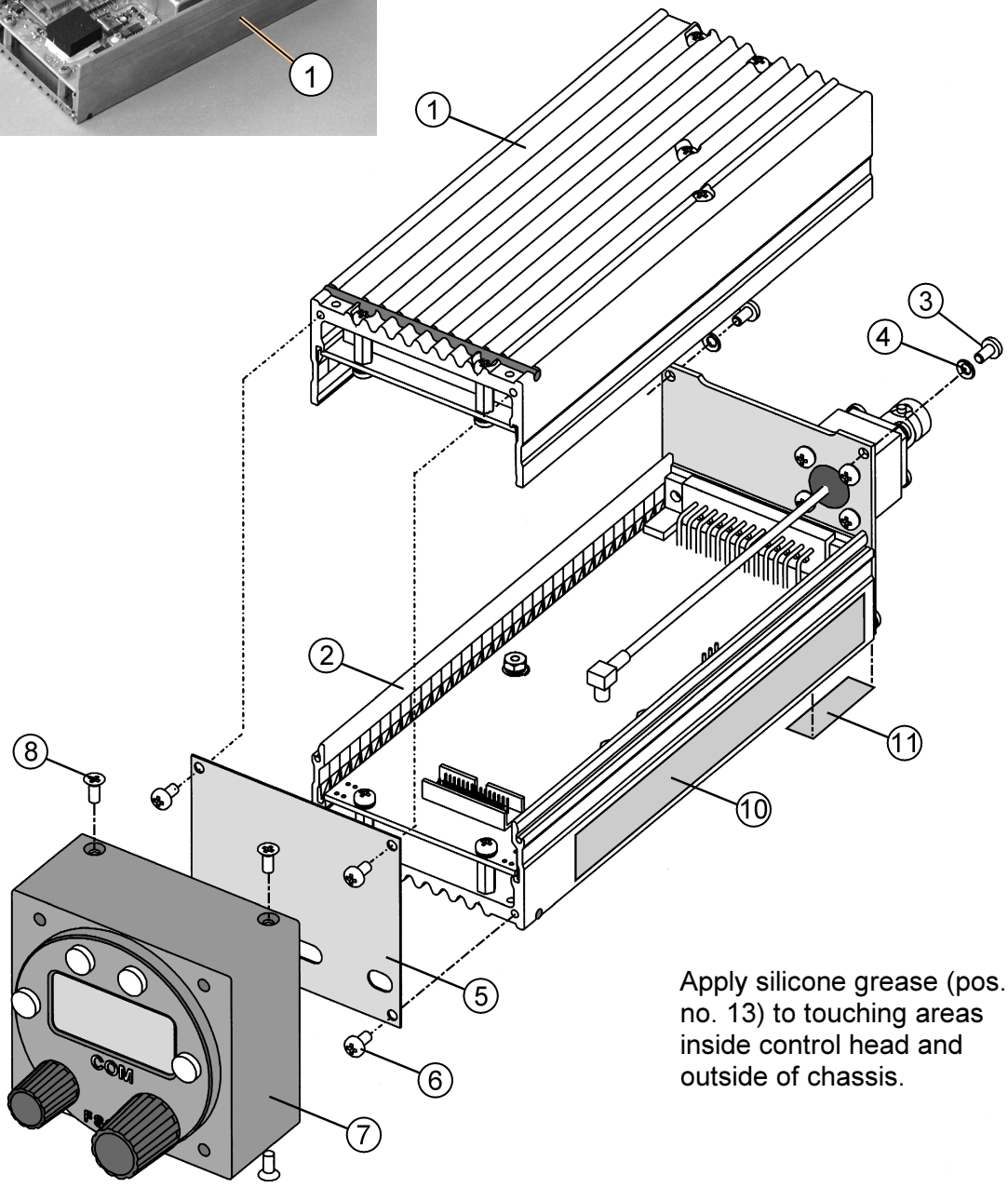
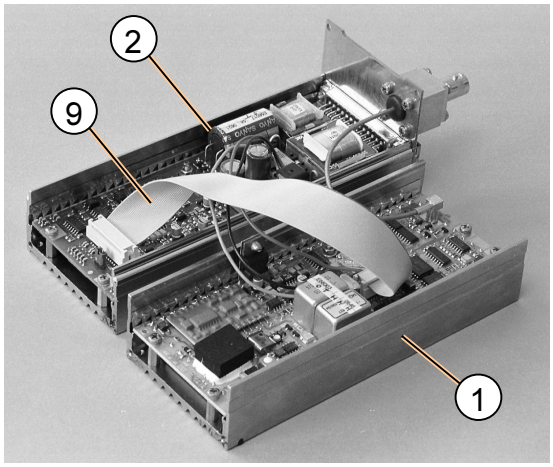
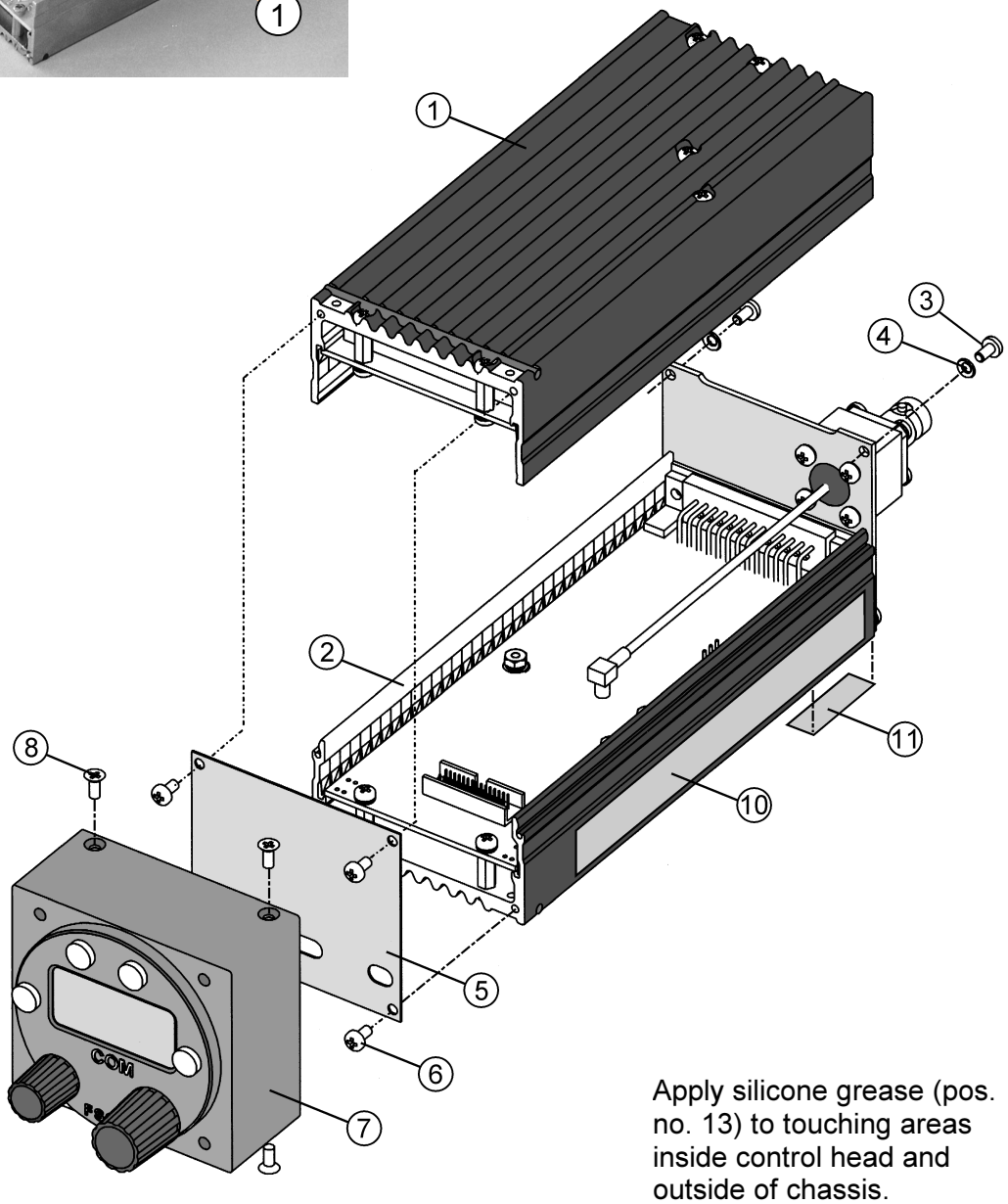


Fig. 10-1 FSG 90
Article No. F10185
Final Assembly

FSG 90, 6 Watt, Final Assembly — Article No.: F10185

Item No. Pos. No.	W. Dittel article no.	Nomenclature/Description	Units per Module
Fig. 10-1	**F10185**	**FSG 90, Dual Mode 8.33/25 kHz, 6 W output, complete**	**X**
- 1	E56003	• TX/RX Module, 6 Watts, complete	1
- 2	E56017	• Audio Module, complete	1
		(Fixing material, pos. no. 1 & 2)	
- 3	-	• Cross recessed raised cheese head screw, M 2.5 × 5, DIN 7985	2
- 4	-	• Lock washer, S2.5, stainless	2
		--- * ---	
- 5	-	• Front partition	1
		(Fixing material, pos. no. 5)	
- 6	-	• Cross recessed raised cheese head screw, M 2.5 × 5, DIN 7985	4
		--- * ---	
- 7	E56009	• Control Head	1
		(Fixing material, pos. no. 7)	
- 8	-	• Cross recessed flat head screw, M 2.5 × 6, DIN 965	4
		--- * ---	
- 9	E25276	• Jumper Cable, 30-pole, complete	1
- 10	-	• Type label	1
- 11	-	• Model and Ident tag	1
		(Fixing material, pos. no. 3, 6 & 7)	
- 12	-	• Threadlocking product, low strength, LOCTITE 222; 50 ml can	AR
		--- * ---	
		(Auxiliary material, pos. no. 7)	
- 13	-	• Lubricant, UNISILIKON L250 L (750 g tin)	AR
		--- * ---	
		(Fixing screws, complete radio)	
packed separately	-	• Cross recessed raised cheese head screw, M 4 × 12, black, DIN 7985	4
		--- * ---	





Apply silicone grease (pos. no. 13) to touching areas inside control head and outside of chassis.

Fig. 10-2 FSG 90-H1
Article No. F10302
Final Assembly

FSG 90-H1, 10 Watt, Final Assembly — Article No.: F10302

Item No. Pos. No.	W. Dittel article no.	Nomenclature/Description	Units per Module
Fig. 10-2	**F10302**	**FSG 90-H1, Dual Mode 8.33/25 kHz, 10 W output, complete**	**X**
- 1	E57277	• TX/RX Module, 10 Watts, complete	1
- 2	E57301	• Audio Module, complete	1
		(Fixing material, pos. no. 1 & 2)	
- 3	-	• Cross recessed raised cheese head screw, M 2.5 × 5, DIN 7985	2
- 4	-	• Lock washer, S2.5, stainless	2
		--- * ---	
- 5	-	• Front partition	1
		(Fixing material, pos. no. 5)	
- 6	-	• Cross recessed raised cheese head screw, M 2.5 × 5, DIN 7985	4
		--- * ---	
- 7	E56009	• Control Head, complete	1
		(Fixing material, pos. no. 7)	
- 8	-	• Cross recessed flat head screw, M 2.5 × 6, DIN 965	4
		--- * ---	
- 9	E25276	• Jumper Cable, 30-pole, complete	1
- 10	-	• Type label	1
- 11	-	• Model and Ident tag	1
		(Fixing material, pos. no. 3, 6 & 7)	
- 12	-	• Threadlocking product, low strength, LOCTITE 222; 50 ml can	AR
		--- * ---	
		(Auxiliary material, pos. no. 7)	
- 13	-	• Lubricant, UNISILIKON L250 L (750 g tin)	AR
		--- * ---	
		(Fixing screws, complete radio)	
packed separately	-	• Cross recessed raised cheese head screw, M 4 × 12, black, DIN 7985	4
		--- * ---	

THIS PAGE
INTENTIONALLY
LEFT BLANK