clear. Verify proper microphone sensitivity setting during SET-UP adjustments prior to the first flight/on ground.

If possible, verify the communications capability also on both the low and high end of the VHF COM band.

If noise (both with Squelch On and Off) occurs only with the engine running, and if its frequency varies with the engine revolutions, it may be caused by an inadequate suppressed ignition system or alternator/voltage regulator equipment, or by poor stabilized on-board supply.

According to ED-14C / RTCA DO-160C requirements, the limits for ripple voltages at 14 Vdc supplies are 0.79 Vpp at 0.2 ... 1 kHz, or 1.98 Vpp at 1 ... 15 kHz. Double these limits for 28 V systems.

In the receive mode it is easy to determine between RF and AF (interference carried on the lines) by temporary removing the antenna plug at the transceiver. RF interference, which usually comes from the ignition or generator/regulator will then disappear.

Ripple on the lines can be detected with an oscilloscope. Its source is usually the generator equipment in conjunction with a poor battery, or poor wiring (bad contacts, defective switches, inadequate wiring dimensions, ground loops (more than one ground connection to the airframe).

Often will bad contacts in the antenna system, or other vibration dependent metal parts contacts, vary with the engine RPM cause RF interfering distortion. A noise attenuating headphone assists typical acoustic failure characteristics identification.

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Section 4 Functional Description

4.1 Introduction

This Section contains a functional description of each switch, push button, knob, indicator, display and socket located on the front or rear of the **FSG 90F(X)** together with operating instructions.

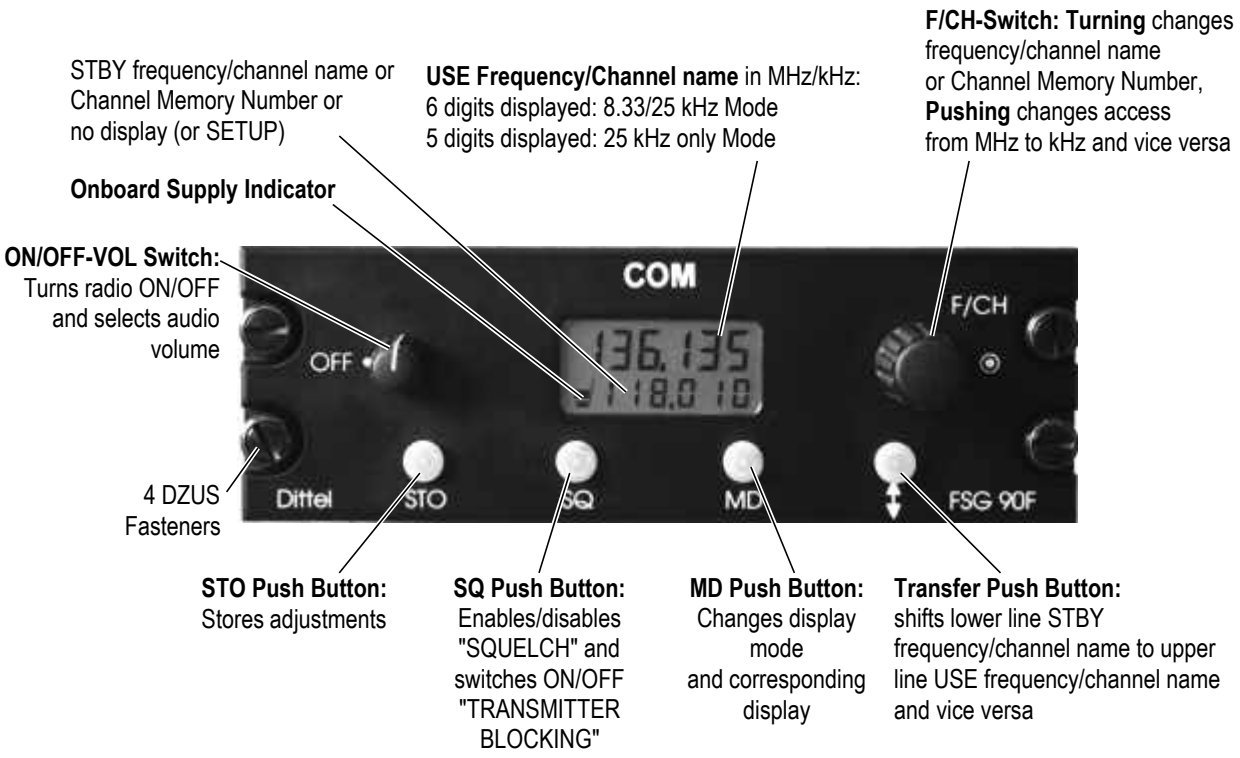
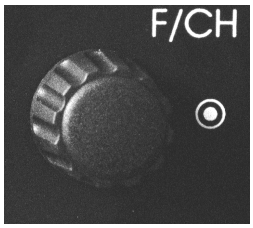


FIG. 4-1: OPERATOR'S CONTROLS AND INDICATORS

4.2 Operator's Controls

Control	Description/Function
ON/OFF-VOL	Rotary step switch To turn ON the radio rotate the **ON/OFF-VOL** knob clockwise from the OFF position (dot). When power is activated • all segments of the display are momentarily visible, • the automatic squelch is activated, • the display shows the frequency/ channel name in that operating mode, which was used before last turning OFF. Rotating the **ON/OFF-VOL** knob clockwise increases - turning counter-clockwise decreases the audio volume audible in the A/C loudspeaker (receive only) or connected headphone (TX Sidetone and receive). To turn OFF the radio rotate the **ON/OFF-VOL** knob fully counter clockwise (ccw) to the OFF position (dot). Blank display.

SQ (SQUELCH) 	Push button After turning ON the radio **FSG 90F(X)** the automatic squelch is always active. Momentarily pushing the **SQ** Button • puts the radio into the SQ-OFF mode (overrides the automatic squelch). Basic receiving noise is also audible during standby. Maximum receiving range. Increased current consumption. • 'Transmitter Blocking' is inactive, i.e. transmitting is possible even if the channel is busy. Momentarily pushing the **SQ** Button once again • puts the radio into the standard operating mode, automatic squelch is active. No receiving, noise during standby. Only reception of signals above SQ threshold to be heard. • When the squelch is active 'Transmitter Blocking' is active, i.e. transmitting is only possible if the channel is **not busy**. **Note:** For certain purposes 'Transmitter Blocking' may be permanently switched OFF during SET-UP procedure, Section 5.
MD (mode) 	Push button Repeatedly pushing the **MD** (mode)-button alters the display mode and display respectively: **Use/STBY Mode:** upper line USE frequency lower line STBY frequency **Channel Mode:** upper line USE frequency lower line channel memory number **Direct Tune Mode:** upper line USE frequency lower line blank
TRANSFER 	Push button Momentarily pushing the Transfer button • while in CHANNEL or DIRECT TUNE mode will return the radio to USE/STBY mode, **or** • while in USE/STBY mode the last USE frequency will become the new STBY frequency and the last STBY frequency will become the new USE frequency, **or** • while in the SET-UP mode will return the radio to the display mode used before without power down. Only programmed settings stored previously by pushing the **STO**-button will be active.

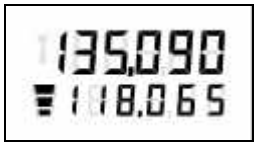
F/CH  	Rotary control <u>and</u> push button = dual function **Momentarily pushing the F/CH knob** • while in the USE/STBY or DIRECT TUNE mode changes the access from **kHz** to **MHz** or vice versa from **MHz** to **kHz**. • If there is no activity for 30 seconds the **F/CH** knob will return to the kHz access. • While in the CHANNEL mode pushing the **F/CH** knob is without function. **Rotating the F/CH knob** • while in the USE/STBY mode will increment or decrement the MHz or kHz portion of the STBY frequency with rollover at each band edge, • while in the CHANNEL mode changes the channel memory number and corresponding frequency. Only channel numbers which were programmed before will appear, • while in the DIRECT TUNE mode will increment or decrement the MHz or kHz portion of the USE frequency with rollover at each band edge.
STO (STORE) 	Push button Up to 99 frequencies/channel names in <u>each</u> operating mode (combined 8.33/25 kHz mode or '25 kHz only' mode) may be stored in a non-volatile memory. The channel memory numbers (1 …99) are user programmable. **Programming a frequency:** • Set the frequency or channel name to be stored in the upper line at the display! • Initialize storing by pushing the **STO** button. • The last used channel memory number is displayed in the lower line. • A flashing "**CH**" shows "ready to store". • Select appropriate (new) channel memory number (1 to 99) by rotating the **F/CH** knob. • On a free channel memory an additional "**F**" (free) is displayed. • To enter the new frequency/channel name push the **STO** button. The frequency/channel name will be stored under the adjusted channel memory number. A previously stored frequency/channel name will be overwritten. • The last used operating mode is displayed. **Programming in the SET-UP mode:** In the SET-UP mode all settings must individually be confirmed by pushing the **STO** button. Otherwise the settings are **not permanently** stored.

4.3 Frequency Display

5-digit or 6-digit Liquid Crystal Display (LCD),two lines, can be back-lit.

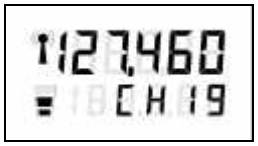
IMPORTANT!

- ***When the* FSG 90F *or* FSG 90F-H1 *shows a 6-digit display the radio is operating in the combined 8.33/25 kHz mode.***
- ***Frequency and channel name display complies with ICAO rules!***
- ***The following displays are examples only!***



Transceiver operates in the **8.33/25 kHz mode (6-digit display)**
Upper line: USE channel name (display 135.090 = 135.0916 MHz transmit and receive frequency)
Lower line: STBY channel name (display 118.065 = 118.0666 MHz transmit and receive frequency)
Supply indicator: 3 segments: ≥ 12.7 Vdc, supply OK
TX indicator: OFF, radio receives.

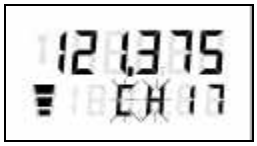
Transceiver operates in the **'25 kHz only' mode (5-digit display)**
Upper line: USE frequency (display 135.87 = 135.875 MHz transmit and receive frequency)
Lower line: STBY frequency (display 118.02 = 118.025 MHz transmit and receive frequency)
Supply indicator: 3 segments: ≥ 12.7 Vdc, supply OK
TX indicator: OFF, radio receives.



Transceiver operates in the **8.33/25 kHz mode (6-digit display)**
Upper line: USE channel name (display 127.460 = 127.4583 MHz transmit and receive frequency)
Lower line: Channel memory number (19) associated with the above USE channel name
Supply indicator: 2 segments: ≥ 12.0 Vdc, battery ½ charged
TX indicator: **ON**, radio transmits.

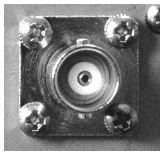
Transceiver operates in the **'25 kHz only' mode (5-digit display)**
Upper line: USE frequency (display 124.77 = 124.775 MHz transmit and receive frequency)
Lower line: Channel memory number (75) associated with the above USE frequency
Supply indicator: 2 segments: ≥ 12.0 Vdc, battery ½ charged
TX indicator: **ON**, radio transmits.

STO button got pushed (same function at 5-digit display).
Upper line: Channel name (6-digits) to be stored
Lower line: Free channel memory number **07** (**CH** is flashing)
After pushing the **STO** button once more the channel name 121.875 (= 121.875 MHz) will be stored in the channel memory **07**.
The last used operating mode is displayed.



STO button got pushed (same function at 5-digit display).
Upper line: Channel name (6-digits) to be stored
Lower line: Channel memory number **17** (**CH** is flashing)
After pushing the **STO** button once more the channel name 121.375 (= 121.375 MHz) will be stored in the channel memory **17**. A previously stored channel name will be overwritten.
The last used operating mode is displayed.

4.4 Connectors at rear side

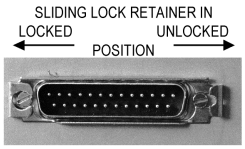


50 O BNC jack,

mating plug: BNC plug, UG 88/CU

Connects a suitable COM broad-band antenna with a frequency range of at least 118 - 137 MHz.

Refer to section 3.4.3 for Installation.



25-pole SUB-D receptacle, male, with sliding lock retainer

mating plug: 25-pole SUB-D, female, DA-25S, (A/N F10212: solder type, including shell and mounting hardware),

to connect the aircraft wiring. Refer to section 3.5 for wiring.

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Section 5 Set-Up Procedure

This section contains a description of the Set-Up procedure to be carried out by an **experienced avionics technician**. To carry out the Set-Up procedure the radio must be completely wired and ready to use.

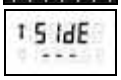
DANGER!

- ***During SET-UP procedure the radio is partly unable to work. The radio can neither receive nor transmit!***
- ***NEVER carry out a SET-UP during flight or whilst driving a car! Perform SET-UP only whilst standing safely on the ground!***
- ***Before the next flight or application check all settings of the radio and cockpit instruments for correct function!***

IMPORTANT!

- *The* **FSG 90F(X)** *is factory pre-set for check and testing purposes. To achieve maximum performance it is therefore absolutely necessary to* ***optimize*** *the radio and to adapt the accessories used.*
- *To carry out the Set-Up the radio must be ready for operation (antenna connected, power supply OK, operational microphone/s, headset/s).*
- *If headsets are used turn its volume control to maximum, if applicable.*
- *All frequencies, channel names, channel memory numbers etc., shown in the following illustrations, are* ***examples****!*

The following settings can be selected or adjusted (order):

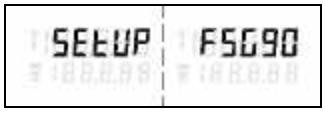
1. Adjusting the automatic squelch threshold
2. Adjusting the microphone sensitivity
3. Adjusting the Intercom volume (headset)
4.  Adjusting the Transmit Sidetone volume (headset)
5. Adjusting the headset volume (during Receive, independent from speaker volume)
6. Selecting '25 kHz only' channel spacing or combined 8.33 kHz / 25 kHz channel spacing. Confirmation with **STO** starts new mode at once.
7. Deleting occupied channel memories (one after the other)
8. Selecting AF External via A/C speaker ON (1) or OFF (0).
9. Selecting 'CHANNEL MODE' only (1) or 'Free Frequency Selection' (0)
10. Selecting 'Transmitter Blocking' during receive ON (1) or OFF (0)
11. Service, ON (1) or OFF (0)
12. Optional module, ON (1) or OFF (0)
13. Entering a password: protects against unauthorized changes of the radio parameters.

5.1 Calling Set-Up without password

Calling the Set-Up procedure without password is possible:

1. at ex works radios **FSG 90F(X)**, or
2. at radios which are reset to a factory basic setting (refer to chapter **RESET**), or
3. at radios which are not protected by a password against unauthorized changes of the set-up adjustments.

- Turn OFF the radio (**ON/OFF-VOL** knob fully ccw).
- **PUSH AND HOLD both MD and STO buttons**, then turn **ON** the radio (rotate **ON/OFF-VOL** knob clockwise, approximately mid position).
- All segments of the display appear for a short moment then the display gets blank.
- Release the buttons.

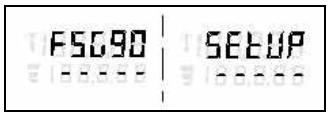


- After releasing the buttons the display shows in the upper line alternately **»FSG90«** and **»SETUP«.**
- If there is no activity for 60 seconds the radio will return to the mode used before.
- Momentarily pushing the **MD** button once will open the Set-Up menu to adjust the squelch threshold.
- Repeatedly pushing the **MD** button will open all other Set-Up menus in the order described before.

5.2 Calling SET-UP with password

Calling the SET-UP procedure with password must be carried out at radios which are protected by a password against unauthorized changes of the Set-Up adjustments.

- Turn OFF the radio (**ON/OFF-VOL** knob fully ccw).
- **PUSH AND HOLD both MD and STO buttons**, then turn **ON** the radio (rotate **ON/OFF-VOL** knob clockwise, approximately mid position).
- All segments of the display appear for a short moment then the display gets blank.
- Release the buttons.



- After releasing the buttons the display shows in the upper line alternately **»FSG90«** and **»SETUP«**, in the lower line **5 dashes.**
- If there is no activity for 60 seconds the radio will return to the mode used before.
- With the **F/CH** knob set the first digit of your password (the first dash changes to digit). Confirm the first digit by pushing the **F/CH** knob. The second digit is ready to be adjusted.
- With the **F/CH** knob set the second digit of your password (the second dash changes to digit). Confirm the second digit by pushing the **F/CH** knob.
- Continue till all five digits of your password are entered.
- Confirm the last digit input by pushing the **STO** button. This will open the Set-Up menu to adjust the squelch threshold. Repeatedly pushing the **MD** button will open all other Set-Up menus in the order described before.
- Entering a wrong password will return the Set-Up to the initial status (5 dashes).
- After the fourth attempt to open the Set-Up with a wrong password the radio returns to the operating mode used before trying to open the Set-Up. The **FSG 90F(X)** is operational.

5.3 Interrupt the SET-UP procedure

The SET-UP procedure may be interrupted at any time:

- Usually by turning OFF the power (**ON/OFF-VOL** knob fully ccw). All changed and individually stored adjustments (by pushing the **STO** button) are permanently stored and effective after turning ON the radio again.
- Or by pushing the **Transfer button** (⇳). The radio returns to the operating mode used before. All changed and individually stored adjustments up to now (by pushing the **STO** button) are permanently stored and effective.

5.4 SET-UP procedure

IMPORTANT!

- *The settings can be done in any order!*
- *Repeatedly pushing the **MD** button opens the menus step by step.*
- *Only settings confirmed by finally pushing the **STO** key are permanently stored and effective.*
- *When pushing the **STO** button the upper segment of the Onboard supply indicator will light up to confirm storing visually.*

5.4.1 Adjusting the automatic squelch threshold

The display shows in the upper line alternately **»SET«** and **»SQUEL«**, in the lower line **»LO«**, **»MED1«**, **»MED2«** or **»HI«**.

Adjust by rotating the **F/CH** knob the squelch threshold as required. The lower line shows:

LO	ca. 1.0 µV / -107 dBm (Standard setting)
MED1	ca. 2.5 µV / -99 dBm
MED2	ca. 5.0 µV / -93 dBm
HI	ca. 8.0 µV / -89 dBm (this setting exceeds the required minimum sensitivity, adjust only for test purposes at very strong interference levels!)

- Confirm your adjustment by pushing the **STO** button!
- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.2 Adjusting the microphone sensitivity (Dynamic or amplified/carbon microphones)

IMPORTANT!

- *This adjustment is important particularly when **FSG 90F(X)** is used in noisy environment like turboprop airplanes or vehicles:*
  *Turn your radio OFF (**ON/OFF-VOL** knob fully ccw).*
  *The **FSG 90F(X)** should be turned ON only after engine start-up.*
  Select a free frequency/channel name (no communication audible). Then call the SET-UP procedure.
- *During this adjustment the transmitter is keyed. Carry out adjustment quickly!*
- *Up to two microphones of the same type may be connected parallel to the MIC input (dynamic **or** amplified/carbon type).*
- *Parallel operated microphones must have the same specifications.*
- *This adjustment has to be repeated when changing microphones (brand, type or number)*

The display shows in the upper line alternately **»SET«** and **»MICRO«**.

- **ONLY FOR ENGINE POWERED AIRPLANES AND VEHICLES: RUN THE ENGINE IN IDLE.**

Press and hold the PTT key. Talk in a loud, clear voice with the microphone one or two inches from your lips.

While talking the microphone level is measured. By turning the **F/CH** knob left or right set the upper dash line to three to four segments (the lower dash line shows only informative the actual range).

Release the PTT key and stop talking.

- **RUN THE ENGINE IN CRUISING SPEED.**

Press and hold the PTT key for at least 5 seconds, **do not talk!**

The upper dash line should show not more than one segment.

If the display shows more than one segment the MIC input is too sensitive. Repeat adjustment with less sensitivity (only two to three segments visible when talking).

- Confirm your adjustment by pushing the **STO** button!
- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.3 Adjusting the Intercom volume

IMPORTANT!

- *Intercom is only possible via headsets (microphones and headphones).*
- *The radio must be wired with an Intercom harness (IC switch) and two headsets connected.*

The display shows in the upper line alternately **»SET«** and **»INTCO«**.

Enable Intercom by switching ON the Intercom switch.

Talk in a loud, clear voice with one of the microphones one or two inches from your lips.

DO NOT PRESS THE PTT KEY!

While talking adjust with the **F/CH** knob a convenient headphone volume. The segments show the actual range. If more than four segments are shown overmodulation occurs.

- Confirm your adjustment by pushing the **STO** button!
- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.4 Adjusting the Sidetone volume

IMPORTANT!

- *Sidetone audible during transmit is only possible via headphones (if applicable set maximum volume at the headset)*
- *During this adjustment the transmitter is active. Carry out adjustment quickly!*
- *The microphone(s) sensitivity has to be adjusted properly (refer to section 5.4.2)*

The display shows in the upper line alternately **»SET«** and **»SIDE«**.
Press and hold PTT key. Talk in a loud, clear voice with the microphone one or two inches from your lips.
While talking adjust with the **F/CH** knob a convenient headphone volume. The segments show the actual range. If more than four segments are shown overmodulation occurs.
Release PTT key.

- Confirm your adjustment by pushing the **STO** button!
- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.5 Adjusting the headset volume

IMPORTANT!

- *Receiving is possible via aircraft loudspeaker <u>and</u> headphone.*
- *First set with the **ON/OFF-VOL** knob loudspeaker volume to a convenient level, then adjust with the set-up procedure a suitable headphone volume.*

The display shows in the upper line alternately **»SET«** and **»PHONE«**.
Via A/C speaker noise or communication is audible.
With the **ON/OFF-VOL** knob set A/C speaker output to a convenient level, then leave **ON/OFF-VOL** knob as it is.
Put on headphone.
By rotating the **F/CH** knob adjust headphone level to a suitable volume. The dashes show the range.
If the adjustment range is not sufficient increase or decrease with the **ON/OFF-VOL** knob.

- Confirm your adjustment by pushing the **STO** button!
- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.6 Selecting '25 kHz only' or combined 8.33/25 kHz channel spacing

IMPORTANT!

- ***Selecting either 8.33/25 kHz or '25 kHz only' may be necessary due to National Regulations!***

The display shows flashing in the upper line **»SET«**, in the lower line either **»25«** or **»8.33«**.

By rotating the **F/CH** knob select the required channel spacing:

»25« = '25 kHz only' channel spacing

»8.33« = combined 8.33 <u>and</u> 25 kHz channel spacing.

IMPORTANT!

- *Confirm the new channel spacing by pushing the **STO** button! The selected channel spacing becomes active and simultaneously SET-UP procedure will automatically closed down.*
  *The radio returns to the last used operating mode and the settings confirmed with the **STO** button became effective.*
- *If you want to carry on with the SET-UP procedure call again SET-UP. Push once or repeatedly the **MD** button till the required menu appears.*

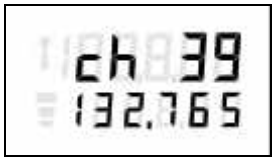
5.4.7 Deleting occupied channel memories

IMPORTANT!

- *Only channel memory numbers from 5 ¼ 99 can be deleted. Channel memories 1 to 4 can only be overwritten.*
- *On an occupied channel memory the channel memory number is displayed in the upper line, the associated frequency/channel name in the lower line.*
- *On a free channel memory the channel memory number is displayed in the upper line, the lower line shows **»FREE«**.*

EXAMPLE:

The display shows in the upper line alternately **»CLR 05«** and **»CH 05«** and in the lower line the associated frequency.



EXAMPLE: Channel memory number **»39«** (with the channel name 132.765) should be deleted.

By rotating the **F/CH** knob adjust the channel memory number **»39«** at the display.

If this channel memory should really be deleted confirm by pushing the **STO** button. In the lower line the frequency/channel name disappears, it appears **»FREE«**.

- If further memory channels should be deleted adjust with the **F/CH**

knob the channel memory number concerned and delete each by pushing the **STO** button.

- If you want to carry on with the SET-UP procedure push once or repeatedly the **MD** button till the desired menu appears.

5.4.8 Selecting AF EXTERNAL audible via A/C speaker ON or OFF

IMPORTANT!

- *Always switch OFF AF EXTERNAL ("0") when the radio* **FSG 90F** *is battery powered or no external audio sources like NAV, COM 2, etc are connected. It saves approximately 30 mA.*

The display shows in the upper line alternately **»SET«** and **»AF - E«**, in the lower line **»0«** or **»1«**.

Adjust by rotating the **F/CH** knob the lower line to "0" or “1”.

0 = AF EXTERNAL OFF, AF external audible only via headset

1 = AF EXTERNAL ON, audible via aircraft loudspeaker.

- Confirm the adjustment by pushing the **STO** button, if required!
- Carry on with the SET-UP procedure by pushing once or repeatedly the **MD** button till the desires menu appears..

5.4.9 Selecting 'CHANNEL MODE ONLY' or 'NO RESTRICTION'

IMPORTANT!

- *For certain applications (usually ground operation only) free selection of all frequencies by the operator may be restricted. Then transmitting and receiving is only possible in the* ***CHANNEL MODE****, pre-programmed before by authorized personnel.*

The display shows in the upper line alternately **»SET«** and **»FREQ«**, in the lower line **»0«** or **»1«**.

Adjust by rotating the **F/CH** knob lower line to "0" or "1".

0 = Standard operation, no restriction.

1 = **CHANNEL MODE only**, no other frequencies/channel names adjustable by operator.

- Confirm your adjustment by pushing the **STO** button!
- Carry on with the SET-UP procedure by pushing once or repeatedly the **MD** button till the desired menu appears.

5.4.10 Selecting 'Transmitter Blocking' during receive (ON/OFF)

IMPORTANT!

- *Whenever 'Transmitter Blocking' is ON and squelch is ON transmitting is disabled as long as the frequency/channel name is busy (communication audible). In addition TX Sidetone is OFF.*
- *Whenever the squelch is OFF the 'Transmitter Blocking' is OFF and transmitting is possible even on a busy channel.*

The display shows in the upper line alternately **»SET«** and **»BLOC«**, in the lower line **»0«** or **»1«**.
Adjust by rotating the **F/CH** knob the lower line to **»0«** or **»1«**.
0 = 'Transmitter Blocking' is OFF. Transmitting is always possible, even on a busy channel.
1 = 'Transmitter Blocking' is ON. With squelch ON transmitting is only possible on a free channel.

- Confirm your adjustment by pushing the **STO** button!
- Carry on with the SET-UP procedure by pushing once or repeatedly the **MD** button till the desired menu appears.

5.4.11 Service (ON/OFF)

IMPORTANT!

- ***For approved Avionics Shops only!***

The display shows in the upper line alternately **»SET«** and **»SERV«**, in the lower line **»0«**.
0 = STANDARD MODE, Service OFF.

- If required, confirm adjustment by pushing the **STO** button!
- Carry on with the SET-UP procedure by pushing the **MD** button.

5.4.12 Optional module (ON/OFF)

IMPORTANT!

- ***In this radio without function.***

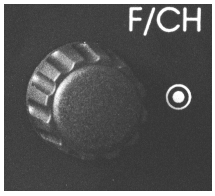
The display shows in the upper line alternately **»SET«** and **»OPTI«**, in the lower line **»0«**.
0 = STANDARD MODE, Optional module OFF.

- Carry on with the SET-UP procedure by pushing the **MD** button.

5.4.13 Entering a password

IMPORTANT!

- *When the SET-UP of your radio is protected by a password it cannot be changed by any unauthorized persons without knowledge of the password.*
- *Your password consists of five digits!*



The display shows in the upper line alternately **»SET«** and **»PASS«**, in the lower line **»00000«**.
If you don't want to enter a password and your SET-UP procedure is finished leave the SET-UP menu by pushing the TRANSFER (⇳) button, or turn OFF the radio (**ON/OFF-VOL** knob).
If you want to enter a password proceed as follows:
Rotate the **F/CH** knob. Adjust the first digit (0 …. 9). Confirm the first digit by pushing the **F/CH** knob.
Adjust the second digit of your password by rotating the **F/CH** knob. Confirm again by pushing the **F/CH** knob.

The third digit is ready now. Continue as described above for the third, fourth and fifth digit.

Make sure the complete password corresponds to your idea.

- Confirm the password by pushing the **STO** button!
- **From now on a new SET-UP may be called only after entering the password first!**

5.4.14 Reset

CAUTION!
Every RESET to the factory setting

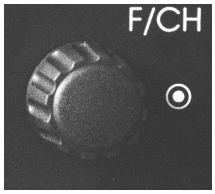
- ***deletes all your pre-set memory channels 5 to 99 (in both 8.33/25 kHz and 25 kHz only mode)! Memory channels 1 - 4 get programmed with 118.00 or 118.005 respectively***
- ***deletes your password!***
- ***delete all your individual SET-UP adjustments!***

To reset all adjustments proceed as follows:

- Turn OFF the radio (**ON/OFF-VOL** knob fully ccw).
- **PUSH AND HOLD simultaneously the buttons MD, STO and SQ, then turn ON the radio** (rotate **ON/OFF-VOL** knob clockwise, approximately mid position).
- All segments of the display appear for a short moment then the display gets blank.
- Release the buttons.

After releasing the three buttons the display shows in the upper line alternately **»SET«** and **»RESET«**, in the lower line **»0«**.

If there is no activity for 60 seconds the radio will return to the mode used before.



With the **F/CH** knob set lower line to "**1**".

Confirm **RESET** by pushing the **STO** button.

The upper segment of the Onboard Supply Indicator will light up momentarily.

- The VHF radio **FSG 90F(X)** is now operable in the factory setting.

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Section 6 Operating Instruction

6.1 Introduction

This section contain basic operating procedures for the **FSG 90F(X)** transceivers. This instruction is only applicable for a radio which is

- correctly installed and wired by a certified avionics shop
- checked together with the A/C system, and
- optimized by the set-up procedure (refer to Section 5, SET-UP PROCEDURE).

WARNING!

DO NOT OPERATE THIS RADIO IN AN EXPLOSIVE ATMOSPHERE (PETROLEUM FUELS, SOLVENTS, DUST, ETC.).

6.2 Turning ON - Selecting Frequency/Channel Name - Volume

CAUTION!

- ***The* FSG 90F(X) *should be turned on after engine start-up. This is a simple precaution which helps to protect the solid state circuitry and extends the operating life of your avionics equipment.***

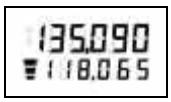
NOTICE: »Frequency« and »Channel Name« are ICAO terms!

Turn the radio **FSG 90F(X)** ON by rotating the **ON/OFF-VOL** knob clockwise. Momentarily all segments of the display are visible. Last used operating mode and frequency are displayed.

A warm-up period for the transmitter is not required. However, at temperatures of -20°C / -4°F, the LC display needs approximately one second until it is fully visible when the frequency or operating mode is changed.

To change the operating mode and therefore the display: Push once or twice the **MD** button.

Selecting the appropriate active frequency/channel name depends on operating mode:

EXAMPLE:	**STANDARD: USE/STBY (Standby) Mode**
	At the lower line select appropriate **kHz** portion by **rotating F/CH** knob. A clockwise rotation will increment the previous frequency while a counter clockwise rotation will decrement the previous frequency with rollover at each band edge. **Push F/CH** knob; this changes the access to MHz. At the lower line select appropriate **MHz** portion by **rotating F/CH** knob. A clockwise rotation will increment the previous frequency while a counter clockwise rotation will decrement the previous frequency with rollover at each band edge. **Push** the Transfer Button ⇕. The last standby frequency/channel name (lower line) will become the new active frequency/channel name (upper line) and the last active frequency/ channel name will become the new STBY frequency/channel name (lower line).

EXAMPLE: 119.655 CH23	**Channel Mode:** **Important:** The appropriate operating frequency must be stored already in a memory channel (refer to **STORING A NEW FREQUENCY/ CHANNEL NAME**). Select appropriate channel memory number together with the associated frequency/channel name by **rotating** the **F/CH** knob.
EXAMPLE: 123.435	**Direct tune Mode:** Select appropriate kHz portion by **rotating F/CH** knob. A clockwise rotation will increment the previous frequency while a counter clockwise rotation will decrement the previous frequency with rollover at each band edge. **Push F/CH** knob; this changes the access to MHz. Select appropriate MHz portion by **rotating F/CH** knob. A clockwise rotation will increment the previous frequency while a counter clockwise rotation will decrement the previous frequency with rollover at each band edge. The setting is the new active frequency/channel name.

- Rotate **ON/OFF-VOL** knob (1) clockwise, about half way.

Continue with either Receive or Transmit Operation

6.3 Receive (Listen) Operation

- After turning ON the radio the automatic squelch is always ON.
- If the operating mode shall be changed: Push once or twice the **MD** button.
- If the active frequency shall be changed: refer to **6.2 SWITCHING ON - SELECTING FREQUENCY/ CHANNEL NAME - VOLUME**
- **DO NOT** press the PTT (Push-To-Talk) key if you want to receive! Transmit Indicator at the display **must not** appear!
- Normal signals are received, weak signals and interfering pulses are disabled. Set the volume of the A/C loudspeaker or headphone to a comfortable level by rotating **ON/OFF-VOL** knob (in 15 steps).
- Weak signals can be received if the squelch circuit is switched OFF by pushing the **SQ** button. Then typical RX noise is heard during communication breaks.
- Pushing the **SQ** button again switches the squelch circuit ON again.

IMPORTANT!

- ***Switching OFF the squelch only makes sense if long range reception shall take place. Thus the radio is noisy during Standby operation, but no weak signals are suppressed and the full receiving range is available!***
- ***Notice increased current consumption!***

6.4 Transmit (Talk) Operation

IMPORTANT!

- ***Please keep radio discipline!***
- ***Transmit only on a clear channel.***
- ***Since 'Transmit Blocking' is normally activated (refer to Set-Up) TX is not possible on a busy channel.***
- ***Care for an all-round obstacle free antenna location; the called station should be within "line-of-sight" distance.***
- ***Never place the radio such as the antenna gets very close to, or touching, exposed parts of the body, especially the face, shoulder or the eyes.***
- ***The radio is equipped with a transmit time out timer (2 minutes). This is used to limit the duration of calls and to guard against accidental PTT locking.***

4. If the display mode shall be changed: Push once or twice the **MD** button.
5. If the USE frequency shall be changed: refer to **6.2 SWITCHING ON - SELECTING FREQUENCY/CHANNEL NAME - VOLUME.**
6. Transmitting is normally only possible on a clear channel (no communication audible).
7. If you have to transmit (e.g. emergency case) although the channel is busy, the "Transmit Blocking" circuit may be turned OFF by pushing the **SQ** button.
8. Press and hold the PTT (Push-To-Talk) key. Talk in a loud, clear voice with the microphone opening 2 to 4 cm (1" - 2") from your lips. Make each transmission as brief as possible. As long as the PTT key is pressed the **Transmit Indicator** at the display appears!
9. Release the PTT key to end transmission and to clear the channel for reception; the Transmit Indicator must disappear. Switch Squelch ON again, if necessary.
10. The radio is equipped with a transmit TOT time out timer. This is used to limit the duration of transmissions to 2 minutes. When the transmitter is keyed continuously longer than 2 minutes the display of the **FSG 90F(X)** starts flashing and transmission is disabled.
11. If you have to make calls longer than 2 minutes momentarily release the PTT key and press again.
12. Should the TOT disable the transmitter accidentally (e.g. stuck PTT key) and you have to transmit **turn radio OFF and ON again**. This allows another 2 minutes to transmit.

6.5 Storing a new Frequency/Channel Name

In each operating mode (8.33/25 kHz mode or '25 kHz only' mode) up to 99 non-volatile channel memories can be user programmed. Channel memories of the non-active mode remain stored in the background. They are accessible after calling up the respective mode.

IMPORTANT!

- *Free selection of frequencies and new storing may be disabled due to Set-Up adjustment (refer to Section 5.4.9)!*
- ***Channel memories 1 to 4 are always preset** and may be used when called. They can only be changed but not deleted. Ex works and after Master Reset channel memories 1 to 4 are preset with either **118.00 MHz or 118.005 MHz!***
- ***Storing can be initialized in all three display modes.***
- ***The USE frequency/channel name in the upper line of the display can be stored to any of the 99 channel memories.***

1. Set the frequency or channel name to be stored in the upper line at the display!
2. Initialize storing by pushing the **STO** button.
3. The last used channel memory number appears, "**CH**" flashes.
4. Select appropriate channel memory number (1 to 99) by turning the **F/CH** knob. On a free memory channel an "**F**" appears before "**CH**" and the memory number.
5. To enter the new frequency/channel name push the **STO** button. The frequency/channel name will be stored under the selected channel memory number. A previously stored frequency/ channel name will be overwritten.

6.6 Recall of stored Frequency/Channel Name

1. By pushing once or twice the **MD** button select the CHANNEL display mode.
2. By rotating the **F/CH** knob set appropriate channel memory number with its associated frequency/channel name at the display. Only channel numbers that have been programmed previously will appear.

6.7 Squelch (SQ) Operation

During standby (normal operation / no signal received), the squelch is active to disable continuous receiver noise; too weak signals are not heard. The squelch level (normally approx. 1 µV) can be adjusted in the SET-UP menu by 4 thresholds (low, med1, med2, high) to meet best operational requirements.

Signals above the SQ threshold open audio amplifiers for speaker and phone audio output. If, however, very weak signals below the SQ threshold are to be heard (e.g. aircraft far from base) then the **SQ** button is pushed to open SQ, This permits noise during pauses, but weak signals are no longer suppressed, and the full Receiver range is available.

SQ ON also results in significantly lower standby current consumption and extends battery supplied operating time.

DUAL FUNCTION while the SQ is disabled allows, that Transmit is possible even during simultaneous receiving on this channel, in order to enable transmit whenever necessary. Normally, in SET-UP the "BLOC" function is activated (set to "1") to prevent overcrowded channels caused by simultaneous transmissions.

6.8 Intercom

IMPORTANT!

- *To achieve best cabin noise suppression, especially during speech pauses, optimized microphone sensitivity adjustment must be performed during SET-UP-Procedure.*
- *Intercom headset audio volume may be adjusted through SET-UP.*

1. Switch ON Intercom. This activates simultaneously the microphones, while the speaker is disabled.
2. During Receive, through acoustic accessories (headphones with microphones), the **FSG 90F(X)** allows intercommunications between pilot(s) and/or other crew members. Always speak loud and clear, while the microphone opening is located close to the lips.
3. By pressing the PTT key the radio switches to transmit -without switching Off Intercom. The "true active" sidetone is heard during transmit. This allows all intercom parties to monitor also actual cockpit radio communication.
4. Releasing the PTT key turns the radio into Intercom mode again.
5. In addition, both Receive as well as External Audio is audible while Intercom is ON. During Receive, all other audio inputs are reduced in volume. This allows safer listening to the radio signal.
6. Audio volume of external audio signals are adjusted only on the external units.

6.9 AF External

In Standby and Receive mode only, through the External Audio Input, the audio signals of additional units (another COM, VOR, Localizer, Marker, ADF, electric variometer, etc.) are audible simultaneously.

Such complex interfacing requires, that audio volume is set directly on each unit individually.

The VOL control on the **FSG 90F(X)** front panel is not affected by external audio sources, and vice versa.

The External AF Input is disabled during transmit.

6.10 Lighting

Lighting the frequency display is activated by turning ON the lighting switch or dimmer, if applicable.

6.11 Turning OFF

Turn OFF the radio by rotating the **ON/OFF-VOL** switch to the fully ccw position to prevent unnecessary discharge of the A/C battery.

6.12 Checking the A/C onboard supply

Transceivers of the **FSG 90F System** include an onboard supply level display with a 3-bar symbol. At dc levels below 11 V those three bars start flashing as a warning!

Radio supplied from a 13.75 V battery bus:

The following operating times may be obtained depending on battery's capacity and transmitter duty cycle:

Reference:	approximately +20°C / +68°F, battery 6.5 Ah, only radio is supplied.
Duty cycle:	10% Transmit, 20% Receive, 70% STBY
Flashing symbol only during Transmit:	ca. 4 hrs left
Flashing symbol also during Receive:	ca. 45 min. left. Recommendation: Reduce utmost transmitting!
Short-time flashing symbol during Standby (SQ ON, clear channel)	ca. 45 min. left. Cease transmitting!
Continuous flashing symbol during Standby (SQ ON, clear channel)	Radio will soon switch OFF itself! Recharge battery as soon as possible (refer to **Section 6.14, Emergency Operation**)

Remark: These transitions are fluent. Recovery effect after load reduction may be possible.

Radio supplied from a 13.75 Vdc generator bus (aircraft or vehicle):

Flashing symbol:	Urgently check aircraft's or vehicle's electrical system (generator, battery, regulator) and/or installation!

Radio supplied from a 28/14 V Regulator (28 Vdc aircraft or vehicle supply):

Flashing symbol:	Urgently check 28/14 V Regulator, aircraft's or vehicle's electrical system (generator, battery, regulator) and installation!

6.13 Operating times with radio supplied from 12 V battery only

The following duty cycle of Transmit (TX), Receive (RX) and Standby (STBY) results in available operating time (hours). Both the worst and the most favorable operation conditions are considered, e.g. maximum receiver volume combined with maximum speaker load (2 speakers, 4 Ohms each).

Higher current consumption will degrade the nominally available battery capability, as well as lower temperatures. The following tables show significant time differences depending on current consumption during Receive, and at temperatures.

Prerequisite: Maximum RX audio volume, AF External ON

Max. current drain	**.11 A**	**2.5 A**	**1.0 A**	**.11 A**	**2.5 A**	**1.0 A**	**.11 A**	**2.5 A**	**1.0 A**	**.11 A**
Lead Accumulator 12 Volts **6.5 Ah**	**STBY, w/out RX**	5% TX	5% RX	90% STBY	10% TX	20% RX	70% STBY	20% TX	40% RX	40% STBY
Temperature **- 20°C/-4°F**	38 hrs	12.30 hrs			6.00 hrs			3.10 hrs		
Temperature **+20°C/68°F**	62 hrs	20.10 hrs			10.00 hrs			5.20 hrs		
Temperature **+50°C/122°F**	66 hrs	22.10 hrs			11.10 hrs			6.00 hrs		

Prerequisite: Minimum RX audio volume, AF External OFF (power saving)

Max. current drain	**.08 A**	**2.5 A**	**.25 A**	**.08 A**	**2.5 A**	**.25 A**	**.08 A**	**2.5 A**	**.25 A**	**.08 A**
Lead Accumulator 12 Volts **6.5 Ah**	**STBY, w/out RX**	5% TX	5% RX	90% STBY	10% TX	20% RX	70% STBY	20% TX	40% RX	40% STBY
Temperature **-20°C/-4°F**	57 hrs	15.50 hrs			8.50 hrs			4.40 hrs		
Temperature **+20°C/68°F**	85 hrs	26.10 hrs			14.30 hrs			7.50 hrs		
Temperature **+50°C/122°F**	90 hrs	28.40 hrs			16.20 hrs			8.40 hrs		

6.14 Emergency Operation

Even under low / emergency supply conditions, the **FSG 90F(X)** can be operated reliably from as low as 10 Volts supply. This however will reduce both the RF output level and audio output power.

Batteries must be recharged after discharge. However, the **FSG 90F(X)** automatic switch-OFF feature at too low supply avoids battery damage, even if the radio is stored in switched ON condition! This is true for all types of 12 V batteries.

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Appendix A Technical Summary

A1 General

Type: Frequency Range: Number of Channels: Number of Channel Memories: Nominal Supply Voltage: Nominal TX carrier output:	**FSG 90F,** A/N F10194 118.000 MHz to 136.975 MHz with 25 kHz spacing or 118.000 MHz to 136.975 MHz with 8.33/25 kHz spacing 25 kHz spacing: 760 8.33/25 kHz spacing: 2,278, totally 3,038 Channels 99 for Channel names with 8.33/25 kHz spacing. Additional 99 channel memories for frequencies with 25 kHz spacing. 13.75 Vdc = 6 Watt
Type: Frequency Range: Number of Channels: Number of Channel Memories: Nominal Supply Voltage: Nominal TX carrier output:	**FSG 90F-H1,** A/N F10306 118.000 MHz to 136.975 MHz with 25 kHz spacing or 118.000 MHz to 136.975 MHz with 8.33/25 kHz spacing 25 kHz spacing: 760 8.33/25 kHz spacing: 2,278, totally 3,038 Channels 99 for Channel names with 8.33/25 kHz spacing. Additional 99 channel memories for frequencies with 25 kHz spacing. 14.0 Vdc = 10 Watt

Supply Voltage Range	11.0 - 16.5 Vdc, continuous
Emergency Operation (below 11 Vdc)	Good communication from 10 Vdc on
Automatic Turn-Off	Approx. 8.5 … 9.5 Vdc Supply
Automatic Turn-On (reset)	Approx. 9.5 … 10 Vdc Supply
Input Current at 13.75 Vdc: Standby (Power Saving Mode) Additionally Squelch, Intercom + AF Ext. Receive Mode (70% AM voice) Transmit Mode (carrier / 70% AM voice) Display Lighting	**6 Watt model:** = 80 mA (no volume, no AF External, no Intercom) add 30 mA w/out AF volume, add 250 mA with max volume = 1 A (into 2 Ohm speaker) = 2.5 A / = 3.0 A = 30 mA additionally
Input Current at 14.0 Vdc: Standby (Power Saving Mode) Additionally Squelch, Intercom + AF Ext. Receive Mode (70% AM voice) Transmit Mode (carrier / 70% AM voice) Display Lighting	**10 Watt model:** = 80 mA (no volume, no AF External, no Intercom) add 30 mA w/out AF volume, add 250 mA with max volume = 1 Amp (into 2 Ohm speaker) = 3.5 A / = 4.5 A = 30 mA additionally
DC Supply indicator	3 segments visible: = 12.7 Vdc Battery full 2 segments visible: = 12.0 Vdc Battery ca. ½ capacity 1 segment visible: = 11.0 Vdc Battery nearly discharged 3 flashing segments: 11 V … 10 Vdc Emergency operation

A2 Dimensions, Weight, Fuses

Front Panel	Rectangular, fits standard ARINC opening, 4 DZUS fasteners
Depth behind panel	183 mm/7.2 in. (allow 30 mm/1.2 in. for plugs and harness)
Overall Dimensions	Width = 146 mm/5.75 in., Height = 47.5 mm/1.87 in., Depth = 206.5 mm/8.13 in.
Weight **FSG 90F(X)**	1.20 kg/2.65 lb. without harness and mating connectors
External Fuse	**6W model:** Cartridge fuse 3.15 Amp, quick acting, or automatic circuit breaker, 3 Amp **10W model:** Cartridge fuse 5 Amp, quick acting, or automatic circuit breaker, 5 Amp
Inline Fuse, switched/regulated DC Output	315 mAmp, medium time lag

A3 Approvals

Airborne Radio (Regulatory Authority For Telecommunications and Posts)	"EC Type-Examination Certificate" no. B132705J, and "TYPE-EXAMINATION CERTIFICATE" no. A132937J
Airborne Radio (Regulatory Authority For Telecommunications and Posts, and LBA)	Reg TP 321 ZV 034 (issued July 1998) EUROCAE ED-23B: Receiver Class C 25 kHz spacing CLIMAX operation, and Receiver Class E 8,33 kHz spacing Transmitter Class 4 100 NM with 25 kHz spacing, and Transmitter Class 6 100 NM with 8.33 kHz spacing Environmental Requirements EUROCAE ED-14C / RTCA DO-160C: Categories D1-AA(BMN)XXXXXXZBBBATZXXXX
JTSO-Authorization (LBA, **airborne**)	JTSO-2C37e and JTSO-2C38e No. LBA.O.10.911/98 JTSO
Ground Operation (Regulatory Authority For Telecommunications and Posts)	"EC Type-Examination Certificate" no. B132705J, and "TYPE-EXAMINATION CERTIFICATE" no. A132937J"
Ground Operation (DFS)	No. B-7850/97
Requirements for **ground operated** radios	Reg TP 321 ZV 039 (issue March 1998) ETSI ETS 300 676 (8.33 kHz CH spacing, ground operation) DIN / ISO 6737-1 (12 V Vehicle Power System)
Software	EUROCAE ED-12B / RTCA DO-178B, Level D

A4 Receiver Characteristics

Receiver Type	Dual Superhet
IF Frequencies	First IF 10.0 MHz, second IF 455 kHz, high injection
Sensitivity (m = 30% / 1,000 Hz)	= 2 µV EMF (= -107 dBm/50 ?) for 6 dB S+N/N
Selectivity	SINAD decreased from 12 dB to 6 dB Reference level m = 60%/1,000 Hz for 12 dB SINAD Interference level m = 60%/400 Hz = 6 dB for ± 8 kHz (25 kHz CH spacing) = 60 dB for ± 17 kHz (25 kHz CH spacing) = 70 dB for ± 25 kHz (25 kHz CH spacing) = 6 dB for ± 3 kHz (8,33 kHz CH spacing) = 50 dB for ± 7.37 kHz (8,33 kHz CH spacing)
Squelch Type	Automatic (FM/AM), adjustable (SET-UP); manual override.
AGC Characteristic	= 6 dB, 2 µV EMF (-107 dBm) ... 2 V EMF (+13 dBm/50 O), m = 30%/1,000 Hz
AGC Delay (RX)	= 0.1 sec, 200 mV EMF (-1 dBm) … 2 µV EMF (-107 dBm / 50 O), m = 30%/1,000 Hz)
AGC Recovery after TX	= 0.1 sec at 10 µV EMF (-93 dBm / 50 O), after TX end
Transfer time TX / RX	= 50 msec
Modulation distortion (AF Processor OFF)	= 10%, 350 ... 2,500 Hz (m = 85%)
Audio Frequency Response / AF Fidelity	= -6 dB, 350 ... 2,500 Hz, 25 kHz and 8,33 kHz CH spacing = -20 dB, 4,000 Hz, 25 kHz CH spacing (Climax Offset Operation)
Nominal AF Output (Speaker)	= 4 Watt / 4 O, or = 8 Watt / 2 O (at 13.75 Vdc) = 1.5 Watt / 4 O (at 10 Vdc)
Nominal AF Output (Phone)	= 100 mW / 600 O (at 13.75 Vdc) = 50 mW / 600 O (at 10 Vdc)
AF Noise Level	= 40 dB, m = 30%/1,000 Hz 200 µV EMF (-67 dBm/50 ?) ... 10 mV EMF (-33 dBm/50 ?)
AF External Input	= 1 Volt into 600 O for rated AF output (13.75 Vdc supply)
Spurious Response	= 10 mV EMF (-33 dBm), m = 30%/1 kHz, for S+N/N = 6 dB a) 108 - 156 MHz (of any Test Channel = ± 8 kHz), at other than the assigned channel and the adjacent channels b) 50 kHz – 1,215 MHz (except 108 - 156 MHz)
Cross Modulation (AF Processor OFF)	Max. AF output level = 10 dB <u>below</u> nominal AF output level: a) Wanted signal 20 µV EMF (-87 dBm) ... 500 µV EMF (-59 dBm/50 ?), unmodulated at RX frequency, additional b) Unwanted signal 10 mV EMF (-33 dBm), m = 30%/1,000 Hz, frequency 100 - 156 MHz (frequency = ± 2 RX channels)
Intermodulation (AF Processor OFF)	= 6 dB AF Quieting (-5 dBm/50 ? , 87.5 – 107.9 MHz), 2 signals

Desensitization	Wanted signal 20 µV EMF (-87 dBm), m = 30%/1,000 Hz, at RX frequency, for S+N/N = 6 dB, in the presence of Unwanted signal **A** 10 mV EMF (-33 dBm/50 ?), unmodulated, frequency 108 ... 156 MHz, except used CH, but includes = 1 RX CH, or Unwanted signal **B** 200 mV EMF (-7 dBm/50 ?); minimum 10 mV EMF (-87 dBm), unmodulated, frequency 50 kHz – 1,215 MHz, except 87.5 MHz ... 156 MHz, or Unwanted signal **C** 250 mV EMF (-5 dBm), unmodulated, frequency 87.5 ... 107.9 MHz
Receiver Spurious Emission	= 400 pW / -64 dBm (50 kHz ... 1,215 MHz)
Channel Selection Time	= 0.4 sec, AF level within 3 dB, max. 99 Channel memories
Receiver Muting, Squelch (CLIMAX)	Simultaneous input at RX frequency: a) Wanted Signal **A**: 10 µV EMF (-93 dBm) +8 kHz (m = 30%/1,000 Hz), Squelch is open. b) Unwanted Signal **B**: More than 24 µV EMF (-85 dBm), m = 30% / 1,000 Hz, vary this frequency slowly from -8 kHz to +4 kHz. Squelch must remain open.

A5 Transmitter Characteristics

FSG 90F: Nominal TX RF Output Power (normal operation)	= 6 Watt / 50 ? (carrier), = 20 Watt PEP, at 13.75 Vdc -0.5 dB … +1.5 dB
FSG 90F-H1: Nominal TX RF Output Power (normal operation)	= 10 Watt / 50 ? (carrier), = 30 Watt PEP, at 14.0 Vdc -0.5 dB … +1 dB
FSG 90F: Nominal TX RF Output Power (emergency operation)	= 1.5 Watt / 50 ? (carrier) at 10 Vdc supply
FSG 90F-H1: Nominal TX RF Output Power (emergency operation)	= 3.5 Watt / 50 ? (carrier) at 10 Vdc supply
TX Duty Cycle	1 : 4 (1 minute TX / 4 minutes RX)
TX Time Out Timer	After 2 minutes continuous TX. Transmitter is unkeyed automatically and the radio display flashes as a warning.
Modulation	Amplitude modulation, AM (A3E)
Depth of Modulation	= 75% (Voice processor with dynamic compression)
Modulation Distortion	= 10% (m = 70% / 1,000 Hz) = 15% (m = 70% / 350 ... 2,500 Hz)
Modulation Audio Frequency Response	= +2 dB / -4 dB (350 ... 2,500 Hz)
Modulation AF Input for m = 70%	Dynamic Microphone: = 0.5 ... 10 mV symmetrical, sensitivity adjustable in SET-UP. Amplified/Carbon Microphone: = 80 ... 500 mV unsymmetrical, sensitivity adjustable in SET-UP.
True Transmit Sidetone (derived from modulated TX RF signal)	= 100 mW / 600 ? (at 13.75 Vdc supply), = 50 mW / 600 ? (at 10 Vdc), volume adjustable in SET-UP, independent from speaker volume
Carrier Noise Level	= 45 dB (m = 70%/1,000 Hz)
Emission of RF Energy (= 1000 MHz)	= 0,25 µW (-36 dBm) / 71 dB µV / 3.54 mV / 50 ? = 4 nW (-54 dBm) / 53 dB µV / 446 µV / 50 ? , from 47 ... 68, 87.5 ... 137, 162 ... 244, 328 ... 336, 470 ... 862 MHz
Emission of RF Energy (= 1000 MHz)	« 1 µW / « -30 dBm / « 77 dB µV / « 7 mV / 50 ?
Transmitter Spectrum Mask	Max. +2 / -4 dB at 350 … 2,500 Hz modulation (8.33 kHz spacing) = 45 dB at 3,200 Hz modulation (8.33 kHz spacing) = 60 dB at = 5,000 Hz modulation (8,33 kHz spacing)
Channel Selection Time	= 0.5 sec
Frequency Tolerance	= 1 ppm (0°C ... + 40°C / 32°F ... 104°F), = 1.5 ppm (-20°C ... + 55°C / -4°F ... + 131°F)
Unwanted FM (Frequency modulation)	= 1.0 kHz at m = 70% / 1,000 Hz
TX Intermodulation	= 45 dB
Antenna Mismatching	VSWR = 3 : 1, normal operation At VSWR 3 : 1 the requirements for modulation distortion, spurious and harmonics output as well as frequency stability are met. In addition, the RF output is = 40 % **FSG 90 :** ≥ 2.4 Watt into 50 Ω @ 13.75 Vdc **FSG 90-H1 :** ≥ 6 Watt into 50 Ω @ 14.00 Vdc. At VSWR = 5 : 1 still functional.

Appendix B Environmental Performance Classification

Compliance measurements according to EUROCAE ED-14C / RTCA DO-160 C were performed and the following Environmental Categories fulfilled.

Environmental Conditions	ED-14C DO-160C	Description of conducted tests	Category
Temperature and Altitude	4.0	Equipment tested to category	**D1**
• Low Temperature	4.5.1	Operation -20°C (-4°F) Storage -55°C (-67°F)	
• High Temperature	4.5.2	Operation +55°C (131°F) Storage +85°C (185°F)	
• in-flight Loss of Cooling	4.5.3	No auxiliary cooling required	**-**
• Low Pressure (Altitude)	4.6.1	50,000 ft /15,240 m	
• Decompression	4.6.2	No test required in category D1	
• High Pressure	4.6.3	No test required in category D1	
Temperature Variation	5.0	10°C/min (18°F/min), Equipment tested to category	**A**
Humidity	6.0	Equipment tested to category	**A**
Shock	7.0	Equipment tested to	
• Operational shocks	7.2	6 g	
• Crash safety	7.3	15 g	
Vibration	8.0	Equipment tested to category	**BMN**
Explosion	9.0	No test required	**X**
Waterproofness	10.0	No test required	**X**
Fluids Susceptibility	11.0	No test required	**X**
Sand and Dust	12.0	No test required	**X**
Fungus	13.0	No test required	**X**
Salt Spray	14.0	No test required	**X**
Magnetic Effect	15.0	= 13 cm/1°, Equipment tested to category	**Z**
Power Input	16.0	Equipment tested to category	**B**
Voltage Spike	17.0	Equipment tested to category	**B**
Audio Frequency Susceptibility	18.0	Equipment tested to category	**B**
Induced Signal Susceptibility	19.0	Equipment tested to category	**A**
Radio Frequency Susceptibility	20.0	Equipment tested to category	**T**
Radio Frequency Emission	21.0	Equipment tested to category	**Z**
Lightning Induced Susceptibility	22.0	No test required	**X**
Lightning effects	23.0	No test required	**X**
Icing	24.0	No test required	**X**
Other Test	---	No test required	**X**

Appendix C ICAO Frequency-Channel pairing plan for combined 8.33 kHz /25 kHz Operation

The table below shows TX and RX frequency, respective channel spacing and the corresponding channel name or frequency which is shown at the display of the Dual Mode **FSG 90F** in the range from 118.000 MHz to 118.1000 MHz.

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

In "25 kHz only" channel spacing mode, frequencies are displayed with 5 digits.

This allows unique identification of the mode used.

Of course this frequency-channel pairing plan also applies to all other frequencies between 118.1000 MHz and 136.9750 MHz.

Operating frequency (MHz)	Channel Spacing (kHz)	**8.33/25 kHz Mode** Channel Name = Display at **FSG 90F**	**25 kHz Mode** Frequency = Display at **FSG 90F**
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

Appendix D Certificates

CETECOM ICT Services GmbH

beliehen nach der Beleihungs- und Akkreditierungsverordnung vom 10. Dezember 1997
als Benannte Stelle der Bundesrepublik Deutschland, vertreten durch die
recognised in accordance with the Recognition and Accreditation Ordinance of December 10, 1997
as Notified Body for the Federal Republic of Germany, represented by

Regulierungsbehörde für Telekommunikation und Post

DEUTSCHE BAUMUSTERPRÜFBESCHEINIGUNG
GERMAN TYPE-EXAMINATION CERTIFICATE

Registriernummer: Registration No.: **A132937J**

Bescheinigungsinhaber: Certificate Holder:
Walter Dittel GmbH
Luftfahrtgerätebau
Erpftinger Str. 36
D-86899 Landsberg

Produktbezeichnung: Product Designation:
FSG 90, FSG 90F, FSG 90L , FSG 90FL
FSG 90-H1, FSG 90F-H1, FSG 90L-H1 , FSG 90FL-H1

Produktbeschreibung: Product Description:
Funkanlage des beweglichen Flugfunks als Bodenfunkstelle oder an Bord eines Luftfahrzeuges als VHF - Sprechfunkanlage

Produkthersteller: Product Manufacturer:
Walter Dittel GmbH
Luftfahrtgerätebau
Erpftinger Str. 36
D-86899 Landsberg

Vorschriften: Specifications:
FTZ 17 TR 2010 , Ausgabe März 1988
FTZ 17 TR 2013 , Ausgabe Juni 1989
BAPT 211 ZV 034 (Entwurf) , Ausgabe Januar 1997
BAPT 211 ZV 039 (Entwurf) , Ausgabe Januar 1997
RegTP 321 ZV 034 , Ausgabe Juli 1998
RegTP 321 ZV 039 , Ausgabe März 1998

Prüfergebnis: Examination Result:
Das geprüfte Baumuster ist konform zu den genannten Vorschriften.
The examined type meets the requirements of the above mentioned specifications

Diese Bescheinigung ist erstellt in Übereinstimmung mit der Telekommunikationszulassungsverordnung vom 20. August 1997 und gilt nur in Verbindung mit der nachfolgenden **Anzahl** von Anlagen.
The certificate is issued in accordance with the Telecommunications Approval Ordinance from August 20, 1997 and is only valid in conjunction with the following **number** of annexes .
Diese Baumusterprüfbescheinigung ersetzt die Baumusterprüfbescheinigung der Benannten Stelle Regulierungsbehörde für Telekommunikation und Post mit gleicher Registriernummer und Datum vom 13.01.1998 .
This certificate replaces the certificate with the same registration number dated 13.01.1998 by Notified Body Regulierungsbehörde für Telekommunikation und Post .

Anzahl der Anlagen: Number of annexes: **1**

Saarbrücken, 02.12.1998
Ort, Ausstellungsdatum
Place, Date of Issue

Unterzeichnet von / Signed by Michael Klos
Benannte Stelle / Notified Body

GERMAN NOTIFIED BODY · DEUTSCHE BENANNTE STELLE

CETECOM ICT Services GmbH, Untertürkheimer Straße 6-10, D-66117 Saarbrücken, Germany

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Anlage 1 zur Deutschen Baumusterprüfbescheinigung Registriernummer: A132937J Datum: 02.12.1998 Seite 1 (2)	Annex 1 of the German Type-Examination Certificate Registration no.: A132937J Date: 02.12.1998 Page 1 of 2

PRODUKT-EIGENSCHAFTEN:
Product characteristics

1.) Produktbestandteile („FSG 90 mit:6 Watt Sender")

- **FSG 90** P/N : F10185 oder F10191
- **FSG 90F** P/N : F10194 oder F10195
- **FSG 90L** P/N : F10208
- **FSG 90FL** P/N : F10210

Produktmerkmale:

Sende-/ Empfangsfrequenzbereich	:	**118,000 MHz ... 136,975 MHz**
Kanalraster	:	**25 kHz und/oder 8,33 kHz**
Betriebskanäle	:	**760 Kanäle** bei 25 kHz - Kanalraster
Betriebskanäle	:	**2278 Kanäle** bei 8,33 kHz - Kanalraster
RF-Leistung	:	**7 W**
Sendeart nach VO-Funk	:	**A3E**
Spannungsversorgung	:	**13,75 VDC (Bereich : 10,5 - 16,5 VDC)**

2.) Produktbestandteile („FSG 90 mit:10 Watt Sender")

- **FSG 90-H1** P/N : F10302 oder F10303
- **FSG 90F-H1** P/N : F10306 oder F10307
- **FSG 90L-H1** P/N : F10310
- **FSG 90FL-H1** P/N : F10312

Produktmerkmale:

Sende-/ Empfangsfrequenzbereich	:	**118,000 MHz ... 136,975 MHz**
Kanalraster	:	**25 kHz und/oder 8,33 kHz**
Betriebskanäle	:	**760 Kanäle** bei 25 kHz - Kanalraster
Betriebskanäle	:	**2278 Kanäle** bei 8,33 kHz - Kanalraster
RF-Leistung	:	**10 W**
Sendeart nach VO-Funk	:	**A3E**
Spannungsversorgung	:	**14,0 VDC (Bereich : 10,5 - 16,5 VDC)**

TECHNISCHE DOKUMENTATION:
Technical Documentation

Prüfberichte:
Testreports

- Nummer: **5234/59632.2/97**
  Number

Prüflabor: BAPT (BZT) , Untertürkheimer Str. 6-10 , 66117 , Saarbrücken

Prüfberichte:
Testreports

- Nummer: **2-0539-A/98** Seiten: **24** Pages Datum: **09.09.1998** Date
  Number

Prüflabor: CETECOM ICT Services GmbH , Untertürkheimer Str. 6-10 , 66117 , Saarbrücken

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Anlage 1 zur Deutschen Baumusterprüfbescheinigung Registriernummer: A132937J Datum: 02.12.1998 Seite 2 (2)	Annex 1 of the German Type-Examination Certificate Registration no.: A132937J Date: 02.12.1998 Page 2 of 2

Technische Beschreibungen / Handbücher / Schaltpläne / Stromlaufpläne etc.:
Technical Descriptions / Manuals / Circuit schematics :

- Baumusterprüfbescheinigung der Benannten Stelle Regulierungsbehörde für Telekommunikation und Post , Reg.-Nr.: A132937J vom 13.01.1998 mit Verweis auf folgende technische Dokumente :
  - Handbuch FSG 90 Dual-Mode 8.33 kHz / 25 kHz VHF/AM Flugfunkgerät , Stand : Februar 1997
  - Declaration of Design and Performance , Document No.: DDP 031.00, Issue : B , Date of Issue : December 01/1997
  - Prüfbericht : 5234/59632.2/97
- Declaration of Design and Performance , Document No.: DDP 031.00, Issue : D , Date of Issue : November 24 ,1998

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DFS Deutsche Flugsicherung

Zertifikat

Zertifikat

Eine	***Funkanlage des beweglichen Flugfunks in Bodenfunkstellen als VHF-Sprechfunkanlage***
Typen	***FSG 90, FSG 90F, FSG 90L, FSG 90FL, FSG 90-H1, FSG 90F-H1, FSG 90L-H1, FSG 90FL-H1***
Frequenzbereich	***118,00 – 136,975 MHz***
der Firma	***Walter Dittel GmbH Postfach 1261 86882 Landsberg/Lech***
bestehend aus	***Sender/Empfänger mit Stromversorgung aus dem Niederspannungsnetz oder Batterien***
für die Betriebsart	***A 3 E***

ist auf Einhaltung der Forderungen der DFS Deutsche Flugsicherung GmbH, die in der technischen Vorschrift der Regulierungsbehörde für Telekommunikation und Post (Reg TP 321 ZV 039 Ausgabe März 1998) niedergelegt ist, geprüft worden. Das Gerät entspricht den Vorschriften, die von der DFS Deutsche Flugsicherung GmbH und der Regulierungsbehörde für Telekommunikation und Post auf Grund der Vollzugsordnung für den Funkdienst (VO Funk) des internationalen Fernmeldevertrages aufgestellt wurden, sowie den Forderungen des Bundesministers für Verkehr (BMV) und den Richtlinien und Empfehlungen der internationalen Zivilluftfahrt-Organisation (ICAO) für den Flugfernmeldeverkehr. Es wird daher mit den umseitig aufgeführten Auflagen als Muster zur Herstellung und zum Vertrieb in der Bundesrepublik Deutschland zugelassen.

Die Gerätetypen haben die Serienprüfnummer ***B-7850/97*** erhalten

Das Zertifikat für o.g. Serienprüfnummer mit Ausstellungsdatum 20.3.1998 wird hiermit ungültig.

Offenbach/Main, den 17.2.1999

i. V. W. Bellen
Leiter Navigation

i. A. H. Günzel

Auflagen

1. Jedes Gerät mit der Bezeichnung FSG 90, FSG 90F, FSG 90L, FSG 90FL, FSG 90-H1, FSG 90F-H1, FSG 90L-H1 und FSG 90FL-H1 das mit der umstehenden Serienprüfnummer und mit der Registriernummer der Baumusterprüfbescheinigung der Regulierungsbehörde für Telekommunikation und Post versehen ist, muß mit dem durch die Regulierungsbehörde für Telekommunikation und Post und der DFS Deutsche Flugsicherung GmbH geprüften Mustergerät elektrisch und mechanisch übereinstimmen.

2. Jede Änderung oder Ergänzung des Aufbaues oder der Schaltung des Gerätes gegenüber dem Mustergerät macht eine Nachprüfung dieses Gerätes durch die Regulierungsbehörde für Telekommunikation und Post und die DFS Deutsche Flugsicherung GmbH erforderlich.

3. Bei Herstellung von Seriengeräten die dem Mustergerät entsprechen, bleiben der DFS Deutsche Flugsicherung GmbH Stichproben in Form einer Stückprüfung vorbehalten.

4. Dieses Zertifikat allein berechtigt nicht zum Betrieb eines Gerätes. Einrichten, Errichten und Betreiben einer Funkstelle unter Verwendung dieses Gerätes, auch wenn es sich um eine Vorführung handelt, sind vom Besitz einer Genehmigung der Regulierungsbehörde für Telekommunikation und Post abhängig.

5. Dieses Zertifikat ersetzt keine Zertifizierung nach dem Telekommunikationsgesetz (TKG) oder nach dem Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG).

6. Aus der Zertifizierung durch die DFS Deutsche Flugsicherung GmbH können keine Ansprüche auf Zulassung gegenüber anderen Zertifizierungsstellen abgeleitet werden.

7. Aus der Ausstellung des Zertifikates der DFS Deutsche Flugsicherung GmbH können keine Forderungen patentrechtlicher Art hergeleitet werden. Sie befreit in keinem Fall von der Beachtung fremder Schutzrechte und stellt keinen Rechtsschutz, ähnlich dem im Patentgesetz vorgesehen, dar.

8. Für die Einhaltung der Sicherheitsforderungen, die sich aus den Deutschen Normen ergeben und auf das Gerät anzuwenden sind, ist der Hersteller selbst verantwortlich. Die Einhaltung der in Deutschland gültingen Normen ist nicht Gegenstand der Musterprüfung.

BUNDESREPUBLIK DEUTSCHLAND

LUFTFAHRT-BUNDESAMT

a member of

JOINT AVIATION AUTHORITIES

JOINT TECHNICAL STANDARD ORDER (JTSO) AUTHORISATION

Pursuant to the National Regulations for the time being in force and subject to the conditions specified below, the National Aviation Authority Luftfahrt-Bundesamt in accordance with the JAA Procedures for JTSO Authorisation hereby grants

Walter Dittel GmbH

Luftfahrtgerätebau
D-86899 Landsberg/Lech

POA No. LBA.G.0100

a JTSO AUTHORISATION
No. LBA.O.10.911/98 JTSO

according to JAR-21, Subpart O and JAR-TSO,
JTSO-2C37e and JTSO-2C38e

for

8,33kHz and 25kHz 6W/10W VHF Communications Transceiver Families
FSG 90(X) and FSG 90(X)-H1
DDP No. 031.00

CONDITIONS:

1. The JTSO Authorisation Holder is only authorised to identify an article with this JTSO marking whilst remaining in compliance with the conditions for the issue of this Authorisation.

2. This AUTHORISATION shall remain valid until surrendered, withdrawn or otherwise terminated.

Date of issue: 27.10.1999

LUFTFAHRT-BUNDESAMT BRAUNSCHWEIG 10

Approved

Hentschel

REGULIERUNGSBEHÖRDE FÜR TELEKOMMUNIKATION UND POST
Regulatory Authority For Telecommunications and Posts

EG-BAUMUSTERBESCHEINIGUNG
EC Type-Examination Certificate

Registriernummer: / Registration no.: B132705J — **Anlage(n): 1** / Annex(es):

Benannte Stelle: / Notified Body: Regulierungsbehörde für Telekommunikation und Post

Bescheinigungsinhaber: / Certificate Holder: Walter Dittel GmbH, Erpftinger Straße 36, D-86899 Landsberg/Lech

Produktbezeichnung: / Designation of product: FSG 90(X) oder FSG 90(X)-H1, Modellvarianten siehe Anlage 1

Produktbeschreibung: / Product description: VHF/AM Sprechfunkgerätefamilie im beweglichen Flugfunkdienst / VHF/AM Air Band Communications Transceiver Family

Angewandte Normen: / Used Norms:
- **Störaussendung:** / (Emission): DRAFT prETS 300 339 (01/97), EN 55022
- **Klasse:** / (Class): B
- **Störfestigkeit:** / (Immunity): DRAFT prETS 300 339 (01/97)

Die EG-Baumusterbescheinigung mit Ausstellungsdatum 13.01.98 wird hiermit ungültig.

Diese Bescheinigung ist erstellt in Übereinstimmung mit der Richtlinie 89/336/EWG (Amtsblatt der Europäischen Gemeinschaften Nr. L 139 v. 23. Mai 1989)
This certificate is issued according to the directive 89/336/EEC (Office Journal of the European Communities L 139 from 23. May 1989)

Ort, Datum: / Place, Date: Saarbrücken, 10.02.99

Unterschrift: / Signed: Stefan Bach

Regulierungsbehörde für Telekommunikation und Post, Talstraße 34-42, D-66119 Saarbrücken, Tel.:(06 81) 9330-9, Fax: (06 81) 9330-700

Anlage 1 zur EG-Baumusterbescheinigung
Nr. B132705J vom 10.02.99
Seite 1 (2)

Annex 1 to EC Type-Examination Certificate
No. B132705J Date: 10.02.99
Page 1 of 2

Modellvarianten:
System variants

FSG 90	Model 90-25/8.33 Model 90-25/000	**FSG 90-H1**	Model 90-25/8.33-H1 Model 90-25/000-H1
FSG 90E	Model 90E-25/8.33 Model 90E-25/000	**FSG 90E-H1**	Model 90E-25/8.33-H1 Model 90E-25/000-H1
FSG 90F	Model 90F-25/8.33 Model 90F-25/000	**FSG 90F-H1**	Model 90F-25/8.33-H1 Model 90F-25/000-H1
FSG 90FE	Model 90FE-25/8.33 Model 90FE-25/000	**FSG 90FE-H1**	Model 90FE-25/8.33-H1 Model 90FE-25/000-H1
FSG 90L	Model 90L-25/000	**FSG 90L-H1**	Model 90L-25/000-H1
FSG 90EL	Model 90EL-25/000	**FSG 90EL-H1**	Model 90EL-25/000-H1
FSG 90FL	Model 90FL-25/000	**FSG 90FL-H1**	Model 90FL-25/000-H1
FSG 90FEL	Model 90FEL-25/000	**FSG 90FEL-H1**	Model 90FEL-25/000-H1

Technische Eigenschaften:
Technical Characteristics

Frequenzbereich: / Frequency range: 118,000 - 136,975 MHz [all models without suffix (E)] oder/or 118,000 - 149,975 MHz [all models with suffix (E)]

Kanalabstand: / Channel spacing: 25 kHz und/oder and/or 8,33 kHz

Sendeleistung: / Transmitter power: 6 W [FSG 90(X)] bzw. 10 W [FSG 90(X)-H1]

Spannungsversorgung: / Power supply: 10,5 - 16,5 V; DC

Anlage 1 zur EG-Baumusterbescheinigung
Nr. B132705J vom 10.02.99
Seite 2 (2)

Annex 1 to EC Type-Examination Certificate
No. B132705J Date: 10.02.99
Page 2 of 2

Wesentliche Teile der technischen Dokumentation:
Relevant parts of the technical documentation

Prüfbericht Nr.: / Test Report No.: 1388/00089/97 vom: / of 17.06.1997

Prüfbericht Nr.: / Test Report No.: 1388/00099/97 vom: / of 16.07.1997

Prüfbericht Nr.: / Test Report No.: 2_0539-A/98 vom: / of 09.09.1998

Declaration of Design and Performance, Document No.: DDP 031.00, Issue D
Date of Issue: November 24, 1998

Bemerkung(en):
Remark(s)

Betrieb in

a) Luftfunkstellen oder

b) Bodenfunkstellen (stationär, portabel oder mobil) des beweglichen Flugfunks

Operation in

a) aircraft stations or

b) ground-based stations (fixed, portable or mobile use) in the aeronautical mobile service

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