



Professional Radio

GP600 Series

Basic Service Manual

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SAFETY INFORMATION

Read this information before using your radio.

SAFE AND EFFICIENT OPERATION OF MOTOROLA TWO-WAY RADIOS

This document provides information and instructions for the safe and efficient operation of Motorola Portable and Mobile Two-Way Radios. The information provided in this document supersedes the general safety information contained in user guides published prior to 1 January 1998.

For information regarding radio use in hazardous areas, please refer to the Factory Mutual (FM) approval manual supplement.

EXPOSURE TO RADIO FREQUENCY ENERGY

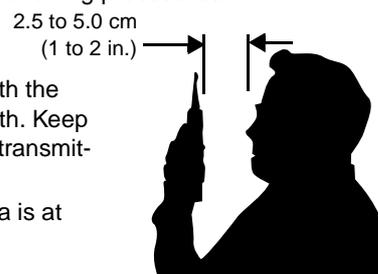
Your Motorola Two-Way Radio, which generates and radiates radio frequency (RF) electromagnetic energy (EME), is designed to comply with the following National and International Standards and Guidelines regarding exposure of human beings to radio frequency electromagnetic energy:

- Federal Communications Commission Report and Order No. FCC 96-326 (August 1996)
- American National Standards Institute (C95.1 - 1992)
- National Council on Radiation Protection and Measurements (NCRP-1986)
- International Commission on Non-Ionizing Radiation Protection (ICNRP- 1986)
- European Committee for Electrotechnical Standardization (CENELEC):
 - ENV 50166-1 1995 E Human exposure to electromagnetic fields Low frequency (0 Hz to 10 kHz)
 - ENV 50166-2 1995 E Human exposure to electromagnetic fields High frequency (10 kHz to 300 GHz)
 - Proceedings of SC211/B 1996 "Safety Considerations for Human Exposure to EMFs from Mobile Telecommunication Equipment (MTE) in the Frequency Range 30MHz - 6 GHz." (EMF - Electro-Magnetic Fields)

To assure optimal radio performance and to ensure that your exposure to radio frequency electromagnetic energy is within the guidelines in the above standards, always adhere to the following procedures:

PORTABLE RADIO OPERATION AND EME EXPOSURE

- When transmitting with a portable radio, hold radio in a vertical position with the microphone 2.5 to 5.0 centimeters (one to two inches) away from the mouth. Keep antenna at least 2.5 centimeters (one inch) from your head or body when transmitting.
- If you wear a portable two-way radio on your body, ensure that the antenna is at least 2.5 centimeters (one inch) from the body when transmitting.



ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY

NOTE Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or alternately configured for electromagnetic compatibility.

- To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so. Hospital or health facilities may be using equipment that is sensitive to external RF energy.
- When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with airline regulations or crew instructions.

OPERATIONAL WARNINGS

Vehicles with an air bag



WARNING: Do not place a portable radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of vehicle.

Potentially explosive atmospheres



WARNING: Turn off your Two-Way radio when you are in any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas (e.g. FM or Cenelec approved). Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

Batteries



WARNING: Do not replace or recharge batteries in a potentially explosive atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion.

Blasting caps and areas



WARNING: To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps. In a “*blasting area*” or in areas posted “*turn off two-way radio*”, obey all signs and instructions.

NOTE

The areas with potentially explosive atmospheres referred to above include fuelling areas such as: below decks on boats; fuel or chemical transfer or storage facilities; areas where the air contains chemicals or particles, such as grain, dust or metal powders; and any other area where you would normally be advised to turn off your vehicle engine. Areas with potentially explosive atmospheres are often but not always posted.

OPERATIONAL CAUTIONS

Damaged antennas



CAUTION: Do not use any portable two-way radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.

Batteries



CAUTION: All batteries can cause property damage and/or bodily injury such as burns if a conductive material such as jewelry, keys or beaded chains touch exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse or other container with metal objects.

Table of Contents

Chapter 1 INTRODUCTION

1.0	Scope of Manual	1-1
2.0	Warranty and Service Support.....	1-1
2.1	Warranty Period and Return Instructions	1-1
2.2	After Warranty Period	1-1
2.3	European Radio Support Centre (ERSC).....	1-2
2.4	Piece Parts	1-2
2.5	Technical Support.....	1-3
3.0	Radio Model Information.....	1-4

Chapter 2 INTRINSICALLY SAFE RADIO INFORMATION

1.0	FMRC Approved Equipment.....	2-1
2.0	Repair of FMRC Approved Products	2-2
2.1	Repair	2-2
2.2	Relabelling.....	2-2
2.3	Do Not Substitute Options or Accessories	2-3

Chapter 3 MAINTENANCE

1.0	Introduction	3-1
2.0	Preventive Maintenance	3-1
2.1	Inspection	3-1
2.2	Cleaning Procedures	3-1
3.0	Safe Handling of CMOS and LDMOS Devices.....	3-2
4.0	Repair Procedures and Techniques — General.....	3-3
5.0	Disassembling and Reassembling the Radio — General.....	3-3
6.0	Radio Disassembly — Detailed	3-4
6.1	Front Cover from Chassis Disassembly	3-4
6.2	Chassis Assembly Disassembly	3-6
6.3	Keypad, Display, and Keypad/Option Board Disassembly.....	3-7
6.4	Speaker, Microphone, and Universal Connector Flex Disassembly.....	3-8
6.5	PTT Disassembly	3-9
6.6	Control Top Disassembly	3-10
7.0	Radio Reassembly — Detailed	3-10
7.1	PTT Reassembly	3-10
7.2	Control Top Reassembly	3-10
7.3	Speaker, Microphone, and Universal Connector Flex Reassembly	3-10
7.4	Keypad, Display, and Keypad Option Board Reassembly	3-10
7.5	Chassis Assembly Reassembly	3-11
7.6	Chassis and Front Cover Reassembly	3-11

8.0	Option Board Installation	3-12
9.0	Mechanical View and Parts List.....	3-14
9.1	GP640 Exploded View and Parts List	3-14
9.2	GP680 Exploded View and Parts List	3-16
10.0	Service Aids.....	3-18
11.0	Test Equipment.....	3-19
12.0	Programming/Test Cable.....	3-20

Chapter 4 PERFORMANCE TESTING

1.0	Introduction.....	4-1
2.0	Receiver Performance Tests	4-1
3.0	Transmitter Performance Tests	4-2

Chapter 5 RADIO TUNING AND PROGRAMMING

1.0	Introduction.....	5-1
2.0	Global Radio Tuning Setup.....	5-1
2.1	Initial Test Equipment Setup	5-2
3.0	CPS Programming Setup	5-2

Chapter 6 MODEL CHART AND TEST SPECIFICATION

1.0	Model Chart (VHF).....	6-1
2.0	Model Chart (UHF)	6-1
3.0	Model Chart (UHF2)	6-2
4.0	Model Chart (300R1)	6-2
5.0	Specifications - Professional GP600 Series Radios	6-3

Chapter 7 POWER UP SELF-TEST

1.0	Error Codes	7-1
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Chapter 1

INTRODUCTION

1.0 Scope of Manual

This manual is intended for use by service technicians familiar with similar types of equipment. It contains service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete Manual revision or alternatively as additions.

NOTE Before operating or testing these units, please read the Safety Information Section in the front of this manual.

2.0 Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. Any "return for exchange" or "return for repair" by an authorised Motorola Dealer must be accompanied by a Warranty Claim Form. Warranty Claim Forms are obtained by contacting an Authorised Motorola Dealer.

2.1 Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only.

In instances where the product is covered under a "return for replacement" or "return for repair" warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to the appropriate Motorola warranty depot, please contact Customer Resources (Please see page 2 and page 3 in this Chapter). All returns must be accompanied by a Warranty Claim Form, available from your Customer Services representative. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

2.2 After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

1. Motorola's Radio Aftermarket and Accessory Division (AAD) offers a repair service to both end users and dealers at competitive prices.
2. AAD supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

2.3 European Radio Support Centre (ERSC)

The ERSC Customer Information Desk is available through the following service numbers:

Austria:	06 60 75 41	Italy:	16 78 77 387
Belgium:	08 00 72 471	Luxemburg:	08 00 23 27
Denmark:	80 01 55 72	Netherlands:	60 22 45 13
Finland:	08 00 11 49 10	Norway:	80 01 11 15
France:	05 90 30 90	Portugal:	05 05 49 35 70
Germany:	01 30 18 75 24	Spain:	90 09 84 902
Greece:	00 80 04 91 29 020	Sweden:	02 07 94 307
UK:	08 00 96 90 95	Switzerland:	1 55 30 82
Ireland:	18 00 55 50 21	Iceland:	80 08 147

Or dial Customer Care Centre:

Tel: +49 6128 70 2618

Please use these numbers for repair enquiries only

2.4 Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If the part number is appended with an asterisk, the part is serviceable by Motorola Depot only. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

All enquiries should be directed to:

**Motorola GmbH
European Parts Department
65232 Taunusstein
Germany.**

2.5 Technical Support

Motorola Product Services is available to assist the dealer/distributors in resolving any malfunctions which may be encountered.

UK/Ireland - Richard Russell
Telephone: +44 (0) 1256 488 082
Fax: +44 01256 488 080
Email: BRR001@email.mot.com

Central/East Europe - Siggý Punzenberger
Telephone: +49 (0) 6128 70 2342
Fax: +49 (0) 6128 95 1096
Email: TFG003@email.mot.com

Scandinavia - Bjorn Rambert
Telephone: +46 8 735 9282
Fax: +46 8 735 9280
Email: TCW275X@email.mot.com

Germany - Karin Struck
Telephone: +49 (0) 6128 70 2248
Fax: +49 (0) 6128 95 1082
Email: CKS026@email.mot.com

France - Lionel Lhermitte
Telephone: +33 1 6929 5722
Fax: +33 1 6929 5904
Email: TXE037@email.mot.com

Italy - Ugo Gentile
Telephone: +39 0 2822 0325
Fax: +39 0 2822 0334
Email: C13864@email.mot.com

Africa & Middle East - Ralph Schubert
Telephone: +33 (0)4 4230 5887
Fax: +33 (0)4 4230 4784
Email: ralph.schubert@Motorola.com

3.0 Radio Model Information

The model number and serial number are located on a label attached to the back of your radio. You can determine the RF output power, frequency band, protocols, and physical packages. The example below shows one portable radio model number and its specific characteristics.

Table 1-1 Radio Model Number (Example: MDH25KDC9AA3AE)

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
MD ↑ MD = Motorola Internal Use	H ↑ H = Portable	25	K VHF (136-174MHz)	D 4-5W	C GP140, GP320, GP340, GP640.	9 Program-mable	AA Conventional MDC	O GP320	A	E
			R UHF1 (403-470MHz)	E 5-6W	H GP380, GP680		AN Conventional 5 Tone	3 GP140, GP340, GP640.		
			S UHF2 (450-527 MHz)		N GP1280		CK MPT	5 GP360		
			B LB1 29-42MHz		F GP360		PW MPT/5T	6 GP380, GP680		
			C LB2 35-50MHz					8 GP1280		
			E 300R1 (300-350MHz)							

INTRINSICALLY SAFE RADIO INFORMATION

1.0 FMRC Approved Equipment

Anyone intending to use a radio in a location where hazardous concentrations of flammable material exist (hazardous atmosphere) is advised to become familiar with the subject of intrinsic safety and with the National Electric Code NFPA 70 (National Fire Protection Association) Article 500 (hazardous [classified] locations).

An Approval Guide, issued by Factory Mutual Research Corporation (FMRC), lists manufacturers and the products approved by FMRC for use in such locations. FMRC has also issued a voluntary approval standard for repair service ("Class Number 3605").

FMRC Approval labels are attached to the radio to identify the unit as being FM Approved for specified hazardous atmospheres. This label specifies the hazardous Class/Division/Group along with the part number of the battery that must be used. Depending on the design of the portable unit, this FM label can be found on the back of the radio housing or the bottom of the radio housing. Their Approval mark is shown below.



WARNING: Do not operate radio communications equipment in a hazardous atmosphere unless it is a type especially qualified (e.g. FMRC Approved) for such use. An explosion or fire may result.

WARNING: Do not operate the FMRC Approved Product in a hazardous atmosphere if it has been physically damaged (e.g. cracked housing). An explosion or fire may result.

WARNING: Do not replace or charge batteries in a hazardous atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion or fire.

WARNING: Do not replace or change accessories in a hazardous atmosphere. Contact sparking may occur while installing or removing accessories and cause an explosion or fire.

WARNING: Do not operate the FMRC Approved Product unit in a hazardous location with the accessory contacts exposed. Keep the connector cover in place when accessories are not used.

WARNING: Turn radio off before removing or installing a battery or accessory.

WARNING: Do not disassemble the FMRC Approved Product unit in any way that exposes the internal electrical circuits of the unit.

Radios must ship from the Motorola manufacturing facility with the hazardous atmosphere capability and FM Approval labeling. Radios will not be "upgraded" to this capability and labeled in the field.

A modification changes the unit's hardware from its original design configuration. Modifications can only be done by the original product manufacturer at one of its FMRC audited manufacturing facilities.



WARNING: Failure to use an FMRC Approved Product unit with an FMRC Approved battery or FMRC Approved accessories specifically approved for that product may result in the dangerously unsafe condition of an unapproved radio combination being used in a hazardous location.

Unauthorized or incorrect modification of an FMRC Approved Product unit will negate the Approval rating of the product.

2.0 Repair of FMRC Approved Products

REPAIRS FOR MOTOROLA FMRC APPROVED PRODUCTS ARE THE RESPONSIBILITY OF THE USER

You should not repair or relabel any Motorola manufactured communication equipment bearing the FMRC Approval label ("FMRC Approved Product") unless you are familiar with the current FMRC Approval standard for repairs and service ("Class Number 3605).

You may want to consider using a repair facility that operates under 3605 repair service approval.



WARNING: Incorrect repair or relabeling of any FMRC Approved Product unit could adversely affect the Approval rating of the unit.

WARNING: Use of a radio that is not intrinsically safe in a hazardous atmosphere could result in serious injury or death.

FMRC's Approval Standard Class Number 3605 is subject to change at any time without notice to you, so you may want to obtain a current copy of 3605 from FMRC. Per the December, 1994 publication of 3605, some key definitions and service requirements are as follows:

2.1 Repair

A repair constitutes something done internally to the unit that would bring it back to its original condition Approved by FMRC. A repair should be done in an FMRC Approved facility.

Items not considered as repairs are those in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit. You do not have to be an FMRC Approved Repair Facility to perform these actions.

2.2 Relabelling

The repair facility shall have a method by which the replacement of FMRC Approval labels are controlled to ensure that any relabelling is limited to units that were originally shipped from the Manufacturer with an FM Approval label in place. FMRC Approval labels shall not be stocked by the repair facility. An FMRC Approval label shall be ordered from the original manufacturer as needed to repair a specific unit. Replacement labels may be obtained and applied by the repair facility providing satisfactory evidence that the unit being relabelled was originally an FMRC Approved unit.

Verification may include, but is not limited to: a unit with a damaged Approval label, a unit with a defective housing displaying an Approval label, or a customer invoice indicating the serial number of the unit and purchase of an FMRC Approved model.

2.3 Do Not Substitute Options or Accessories

The Motorola communications equipment certified by Factory Mutual is tested as a system and consists of the FM Approved portable, FM Approved battery, and FM Approved accessories or options, or both. This Approved portable and battery combination must be strictly observed. There must be no substitution of items, even if the substitute has been previously Approved with a different Motorola communications equipment unit. Approved configurations are listed in the FM Approval guide published by FMRC, or in the product FM Supplement. This FM Supplement is shipped with FM Approved radio and battery combination from the manufacturer. The Approval guide, or the Approval standard Class Number 3605 document for repairs and service, can be ordered directly through Factory Mutual Research Corporation located in Norwood, Massachusetts.

Chapter 3

MAINTENANCE

1.0 Introduction

This chapter provides details about the following:

- ❑ Preventive maintenance (inspection and cleaning)
- ❑ Safe handling of CMOS and LDMOS devices
- ❑ Disassembly and reassembly of the radio
- ❑ Repair procedures and techniques
- ❑ Installation of Option Boards

2.0 Preventive Maintenance

The radios do not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

2.1 Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

2.2 Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

NOTE Internal surfaces should be cleaned only when the radio is disassembled for service or repair.

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is isopropyl alcohol (70% by volume).



CAUTION: The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners, and other chemicals.

Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (70%) may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. After completing of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

NOTE Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).

3.0 Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of radios, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

Handling precautions are mandatory for CMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the radio without first referring to the following CAUTION statement.



CAUTION: This radio contains static-sensitive devices. Do not open the radio unless you are properly grounded. Take the following precautions when working on this unit:

- ❑ Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- ❑ Ground the working surface of the service bench to protect the CMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.
- ❑ Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number RSX-4015.)
- ❑ Do not wear nylon clothing while handling CMOS devices.
- ❑ Do not insert or remove CMOS devices with power applied. Check all power supplies used for testing CMOS devices to be certain that there are no voltage transients present.
- ❑ When straightening CMOS pins, provide ground straps for the apparatus used.
- ❑ When soldering, use a grounded soldering iron.
- ❑ If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

4.0 Repair Procedures and Techniques — General

Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part from the nearest Motorola Communications parts center listed in the “Piece Parts” section of this manual.

Rigid Circuit Boards

This family of radios uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed-through holes may interconnect multiple layers of the printed circuit. Therefore, exercise care to avoid pulling the plated circuit out of the hole.

When soldering near the 20-pin and 40-pin connectors:

- ❑ Avoid accidentally getting solder in the connector.
- ❑ Be careful not to form solder bridges between the connector pins.
- ❑ Examine your work closely for shorts due to solder bridges.

Flexible Circuits

The flexible circuits are made from a different material than the rigid boards, and require different soldering techniques. Excessive prolonged heat on a flexible circuit can damage the material. Therefore, avoid excessive heat and excessive bending.

For parts replacement, use the ST-1087 Temperature-Controlled Solder Station with a 600-700 degree tip, and use small diameter solder such as ST-633. The smaller size solder will melt faster and require less heat to be applied to the circuit.

To replace a component on a flexible circuit:

1. Grasp with seizers (hemostats) the edge of the flexible circuit near the part to be removed.
2. Pull gently.
3. Apply the tip of the soldering iron to the component connections while pulling with the seizers.

NOTE Do not attempt to puddle-out components. Prolonged application of heat may damage the flexible circuit.

5.0 Disassembling and Reassembling the Radio — General

Since these radios may be disassembled and reassembled with the use of only four (board to casting) screws, it is important to pay particular attention to the snaps and tabs, and how parts align with each other.

The following tools are required for disassembling the radio:

- ❑ Small flat blade screwdriver
- ❑ penknife-size screwdriver
- ❑ TORX™ T6 screwdriver

If a unit requires more complete testing or service than is customarily performed at the basic level, send this unit to a Motorola Authorized Service Center. (See Chapter 1 for a list of authorized service centers.)

The following disassembly procedures should be performed only if necessary:

Chassis Assembly Disassembly (Paragraph 6.2)

Keypad, Display, and Keypad/Option Board Disassembly (Paragraph 6.3)

Speaker, Microphone, and Universal Connector Flex Disassembly (Paragraph 6.4)

PTT Disassembly (Paragraph 6.5)

Control Top Disassembly (Paragraph 6.6)

6.0 Radio Disassembly — Detailed

6.1 Front Cover from Chassis Disassembly

1. Turn off the radio.
2. Remove the battery:
 - a. Pull down on the two battery-release buttons.
 - b. With the buttons pulled down, the top of the battery will fall from the radio.
 - c. Remove the battery from the radio.

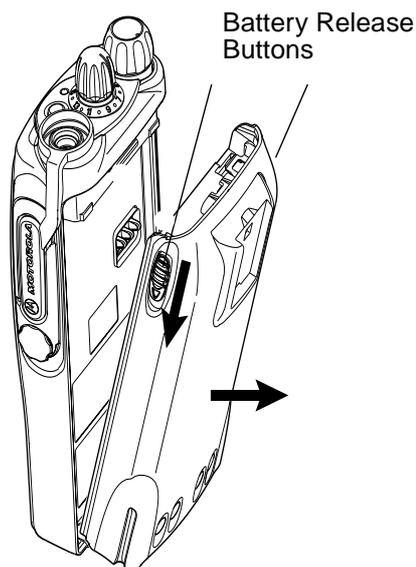


Figure 3-1 Battery Removal

3. Remove the antenna.

4. Pull the volume and channel selector knobs off of their shafts.

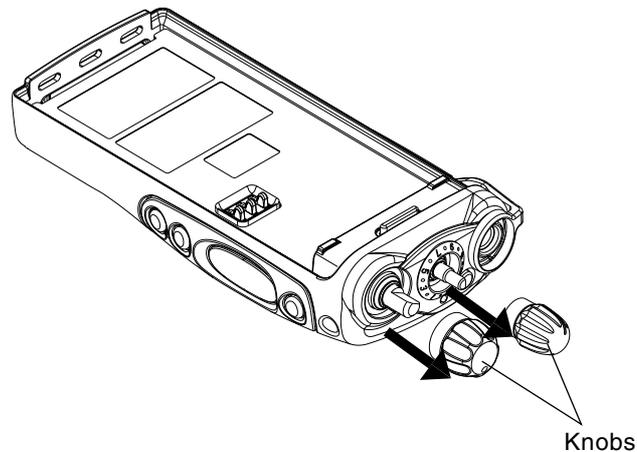


Figure 3-2 Knob Removal

NOTE Both knobs slide on and off. However, they are supposed to fit very tightly on their shafts.

5. Separate the chassis from the internal electronics front cover assembly as follows:
 - a. Insert a small, flat-blade screwdriver, or similar instrument, in between the thin retaining wall and the chassis at the bottom of the radio. Do not mar the O-ring sealing area on the housing.
 - b. Slowly pry the bottom of the chassis from the cover by pushing the small flat-blade screwdriver down, and rotating the handle of the tool over and behind the base of the radio. This prying action forces the thin inner plastic wall toward the base of the radio, releasing the two chassis base tabs.

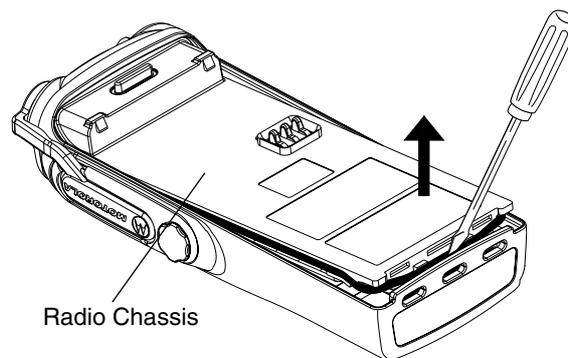


Figure 3-3 Chassis Removal



CAUTION: Marring the front cover O-ring sealing area will prevent the radio from sealing properly.

NOTE Flexible ribbon circuits (flexes) connecting the front cover assembly and the chassis prevent you from completely separating the two units. Display radios and radios with option boards have two flexes.

6. Lay the chassis down. Rotate the front cover backward and slightly away from the chassis.
7. Lift the latches on the main circuit board to release the flexes from their connectors.

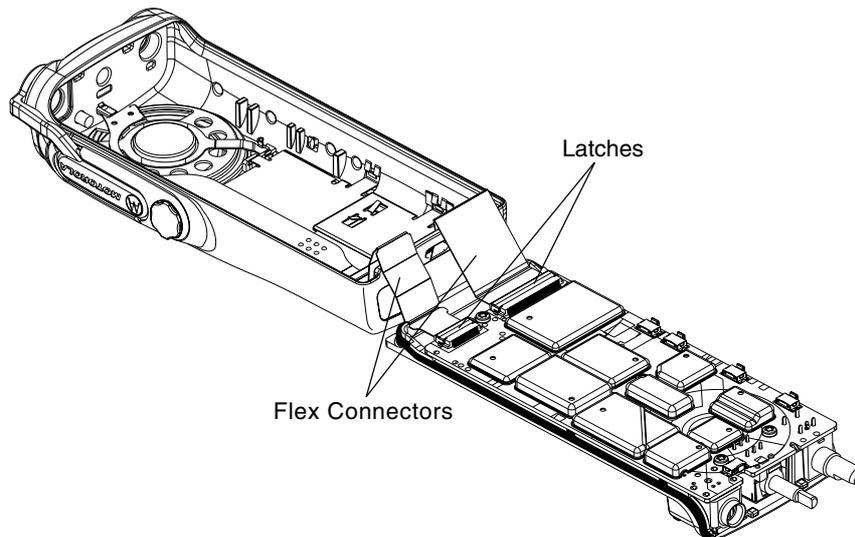


Figure 3-4 Unlatch Flex Connectors

6.2 Chassis Assembly Disassembly

Use a TORX™ screwdriver with a T6 head to remove the four screws holding the main board to the chassis.

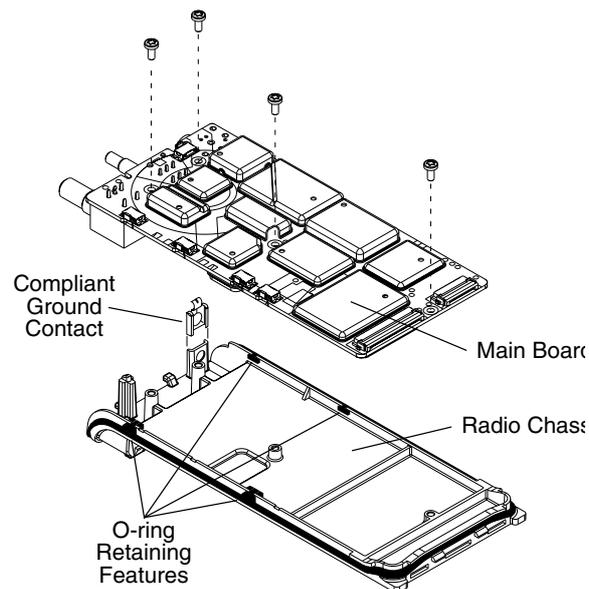


Figure 3-5 Remove Main Board from Chassis

1. Lift the main board from the chassis (See Figure 3-5).



CAUTION: Refer to the **CMOS CAUTION** paragraph on page 2 before removing the main board. Be sure to use ESD protection when handling circuit boards.

2. Remove the four small O-ring retainers from their slots in the chassis. Note the alignment of the retainers for reassembly.

3. Remove the O-ring.
4. Slide off the ground contact from the top corner boss of the radio chassis.

6.3 Keypad, Display, and Keypad/Option Board Disassembly

1. If the disassembly of the keypad, the keypad printed circuit board, or the display is required, lift the microphone flex circuit up, and carefully remove the microphone and its boot from the front cover pocket. (See Figure 3-6.)
2. Lay this flex circuit to one side.
3. To remove the keypad retainer shield:
 - a. Insert the tip of a “penknife size,” flat blade screwdriver in the opening at the end of the keypad retainer arm tab.
 - b. Pry the tab away from the side of the front cover until it moves past the ledges on the side wall. Duplicate this procedure for each of the four retainer arm tabs.

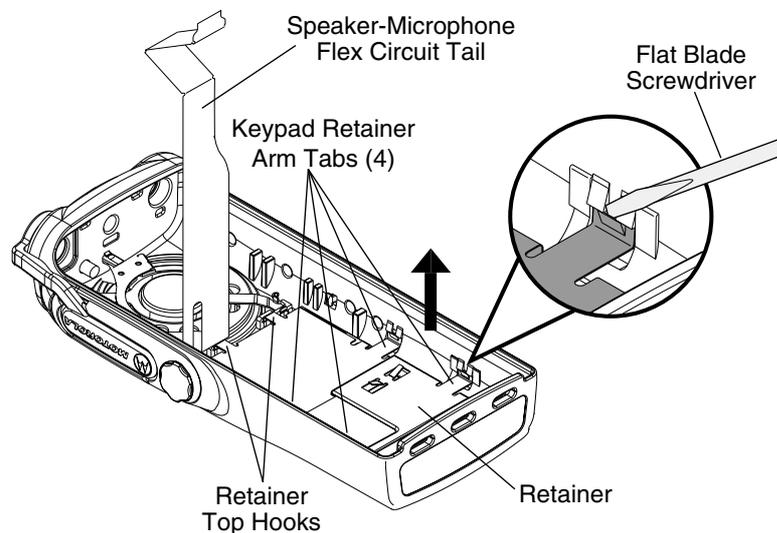


Figure 3-6 Remove Retainer

4. Note that the two “top hooks” are still held underneath the front cover—right below the speaker. Lift the keypad retainer out of the front cover; then, lift and pivot the two hooks out of the front cover.
5. If disassembly involves the removal of the display module, disconnect the display flex from the keypad option board connector by lifting the latch on the connector. (This is similar to the process for releasing the flexes.)
6. The display module is attached to the front cover with a double-sided adhesive pad. Carefully pull up on the display module, using a small screwdriver, if necessary, and remove it from the front cover. Use a new piece of double-sided adhesive to re-mount the display to the cover.



CAUTION: Take care not to damage the display. Do not cut, bend, or pinch the heat seal. Display modules contain CMOS devices. Be sure to use ESD protection.

- The keypad/option board, and the keypad, can be removed without the use of tools.

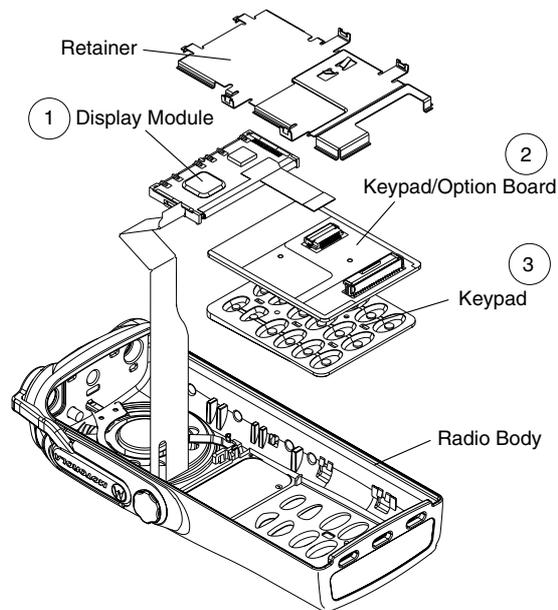


Figure 3-7 Removing the Keypad Retainer and Other Boards from the Radio Body

NOTE At this point, the Option Board Installation Procedure should be performed, if necessary.

6.4 Speaker, Microphone, and Universal Connector Flex Disassembly

- Turn the screw at the bottom of the dustcover counterclockwise with your fingers. Lift the dustcover out of its pocket.

NOTE The dustcover must be removed to remove the speaker-microphone assembly flex circuit. The speaker is held in place with a two-legged retainer bracket. The bracket legs are secured by the front cover slots. Be careful not to damage the speaker when removing the retainer bracket.

- Using a screwdriver, push down on the portion of the speaker retainer bracket pointing toward the bottom of the radio. Then, remove the retainer by slightly pushing it toward the top of the radio until you slide it past the front cover slot.
- Pull the rubber microphone boot from its seated position. Unless you are replacing the microphone, leave it in the boot.

NOTE The speaker-microphone assembly flex circuit goes through the front cover wall to the outside wall. To replace this assembly, you must peel-off the universal connector escutcheon label. The existing escutcheon cannot be reassembled; a new part must be used. (See item number 10 on the exploded view drawing.)

- Peel-off the universal connector flex circuit escutcheon (label).
- Pry the flex circuit (adhesive held) backer board away from the front cover, and remove the universal connector tail of the speaker-microphone assembly through its opening in the front cover.

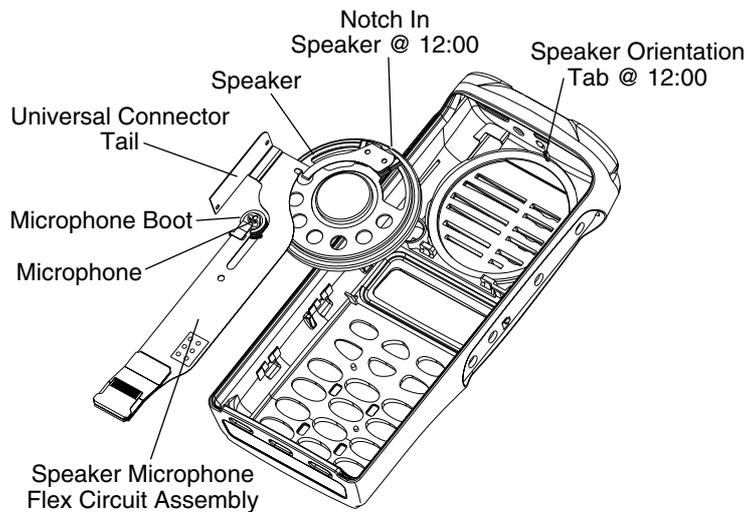


Figure 3-8 Removal Speaker-Microphone Assembly

6. After the universal connector tail of the speaker-microphone assembly is removed, the assembly can be completely removed. If it is necessary to replace the speaker or microphone, or both, do it while the flex circuit is removed from the front cover. When reassembling the microphone in its boot, make sure the microphone port faces the round hole in the bottom of the boot.

6.5 PTT Disassembly

1. If required, the PTT bezel, and the PTT seal assembly, can be disassembled using a small screwdriver, as follows:

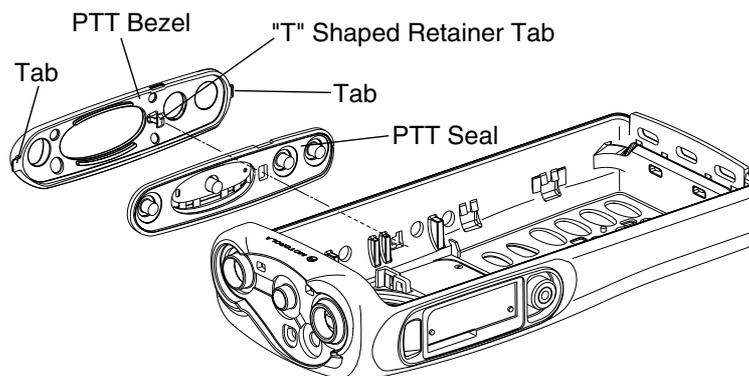


Figure 3-9 PTT Removal

- a. Pry back the T-tab found inside the front cover (in between the four buttons on the PTT assembly).
- b. Remove the PTT bezel by slightly bowing it until the top and bottom tabs are released from the slots in the front cover.
- c. The PTT seal can be easily lifted from the bezel without the use of tools.

6.6 Control Top Disassembly

1. To remove the control top assembly, place a screwdriver next to the antenna boss, and pry it against the control top escutcheon. This will lift the control top escutcheon away from its double-sided adhesive. Grab the double-sided adhesive near the volume potentiometer, and lift it away.
2. Remove the control top seal, emergency button, and transmit light pipe.

7.0 Radio Reassembly — Detailed

7.1 PTT Reassembly

1. Replace transmit light pipe and control top seal.
2. Place a new control top escutcheon adhesive against the front cover. Press the control top escutcheon tightly against the adhesive.
3. Put the PTT seal in the PTT bezel.

7.2 Control Top Reassembly

1. Place the bezel top tab in the top slot inside the front cover PTT opening. Slightly bow the bezel so that the bottom tab can fall inside the bottom slot.
2. Press the PTT assembly against the front cover opening.

NOTE Look inside the front cover to make sure the T-tab is fully engaged with the front cover. If necessary, press the T-tab toward the top of the radio until it becomes fully engaged.

7.3 Speaker, Microphone, and Universal Connector Flex Reassembly

1. Feed the universal connector tail of the speaker-microphone flex assembly through the opening in the side wall of the front cover.
2. Peel-off the adhesive liner on the back of the universal connector tail of the flex circuit. Attach the flex tail to the front cover using the guide pins for correct alignment.
3. Replace the universal connector escutcheon. Make sure that all the connector openings align with the gold pads on the flex circuit.
4. Align the notch in the speaker at the twelve o'clock position with the tab on the front cover. (See Figure 3-8.)
5. Place the speaker retainer bracket into the hole on the top of the front cover, and bend the retainer down to fit underneath the boss below the speaker.

7.4 Keypad, Display, and Keypad Option Board Reassembly

1. If you are replacing the display, use a new double-sided adhesive display pad (item number 17 on the exploded view diagram).
2. Replace the keypad, and the keypad/option board. Make sure the display module flex tail is connected correctly to the connector on the keypad/option board.
3. Insert the “top hooks” of the keypad retainer into the slots below the speaker (above the display) in the front cover. Snap all four of the retainer arm tabs in place in the front cover.

NOTE Pull the speaker-microphone flex circuit out of harm's way during reassembly.

4. Re-insert the microphone and boot into the pocket in the front cover.
5. Lay the speaker-microphone flex on top of keypad/option board retainer.

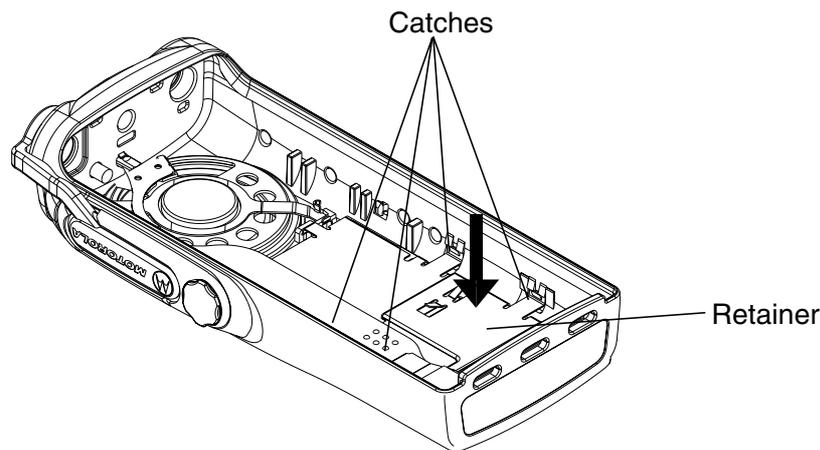


Figure 3-10 Lock retainer catches to the radio's body

7.5 Chassis Assembly Reassembly

1. Slide on the ground contact (if necessary) on the top corner boss of the chassis.
2. Replace the O-ring. The tabs on the O-ring should reach around the chassis and point down.
3. Stretch the O-ring to place it into the retaining pocket at the bottom end of the chassis.

NOTE When properly assembled, the retainers on the O-ring should align with the slots on the chassis. If this is not the case, remove and replace the O-ring until it is aligned with the chassis and completely seated in place around the perimeter.

4. Ensure that the antenna nut insulator is correctly replaced by pushing it all the way to the top of the antenna nut.
5. Replace the battery contact seal (if necessary) surrounding the battery contact.
6. Place the main circuit board straight down on top of the chassis.

NOTE Be sure the battery contact seal protrudes through the chassis and is not pinched under the chassis.

7. Use the T6 TORX screwdriver to fasten the screws holding the main board to the chassis.

7.6 Chassis and Front Cover Reassembly

1. Align the chassis assembly end-to-end with the front cover assembly.
2. Insert the tails of the flex circuits into their respective connectors at the bottom of the front cover.
3. Push down the latches on the connectors to hold the flex circuits to the main board.
4. Slide the volume potentiometer and frequency switch shafts into their respective holes in the front cover.

5. Push the chassis assembly completely into the top of the front cover until it settles in place.
6. Be sure the O-ring is properly seated.
7. Snap the bottom of the chassis into the front cover.
8. Reassemble the knobs, dust cover, antenna, and battery.

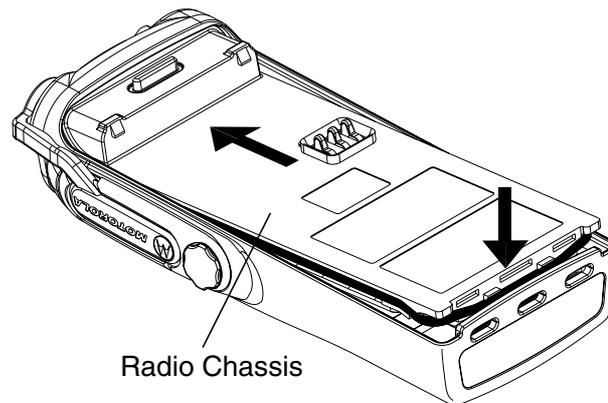


Figure 3-11 Fastening the Chassis

8.0 Option Board Installation

1. With the keypad retainer removed, the keypad backer board can be removed without the use of tools.
2. Remove the jumper flex from the connector on the keypad board. Notice the orientation of the flex to the connector. Arrows on the jumper flex point to the correct way of inserting the flex into the connector.
3. Discard the keypad backer board.
4. The “breakaway” tab at the top of all option boards contains an extra row of keys and is used to accommodate other radio models.
5. Break-off and discard the option board tab, taking care not to damage the option board. Trim any tab fragments that may remain on the option board.

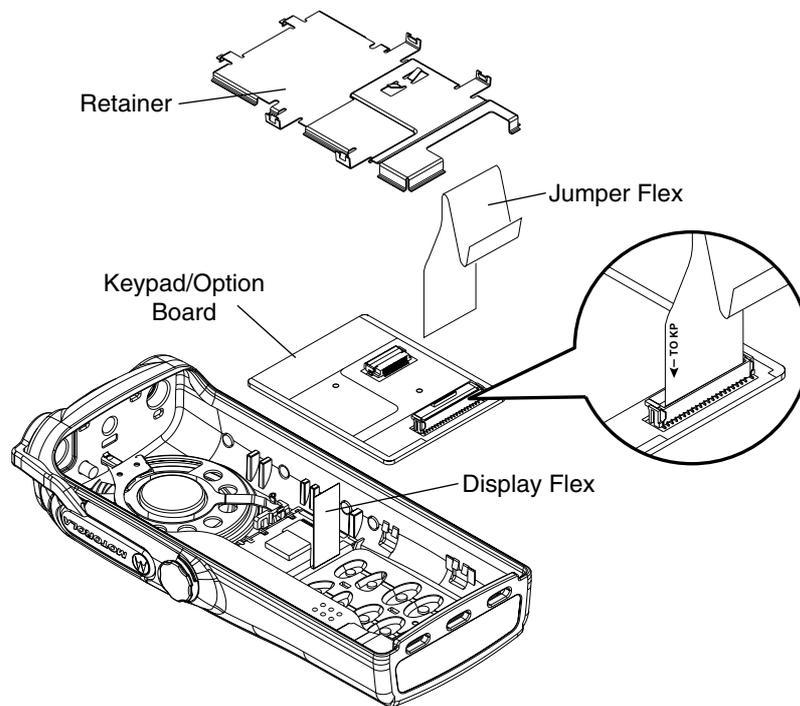


Figure 3-12 Changing the Keypad/Option Board

6. Reassemble the option board to the front cover assembly.
7. Insert the display flex circuit into the connector on the option board.
8. Insert the jumper flex circuit into the connector on the option board. Notice the orientation of the flex circuit. Arrows on the jumper flex point to the correct way of inserting the flex into the connector.
9. Replace the retainer by placing the two top hooks into the slots below the speaker in the front cover; then, pivot the retainer into the front cover. Ensure that all four tab arms snap correctly into the front cover.
10. With the keypad option board, display, and retainer correctly in place, the front cover assembly can now be reassembled as described in Paragraph 7.6 (Chassis and Front Cover Reassembly).

9.0 Mechanical View and Parts List

9.1 GP640 Exploded View and Parts List

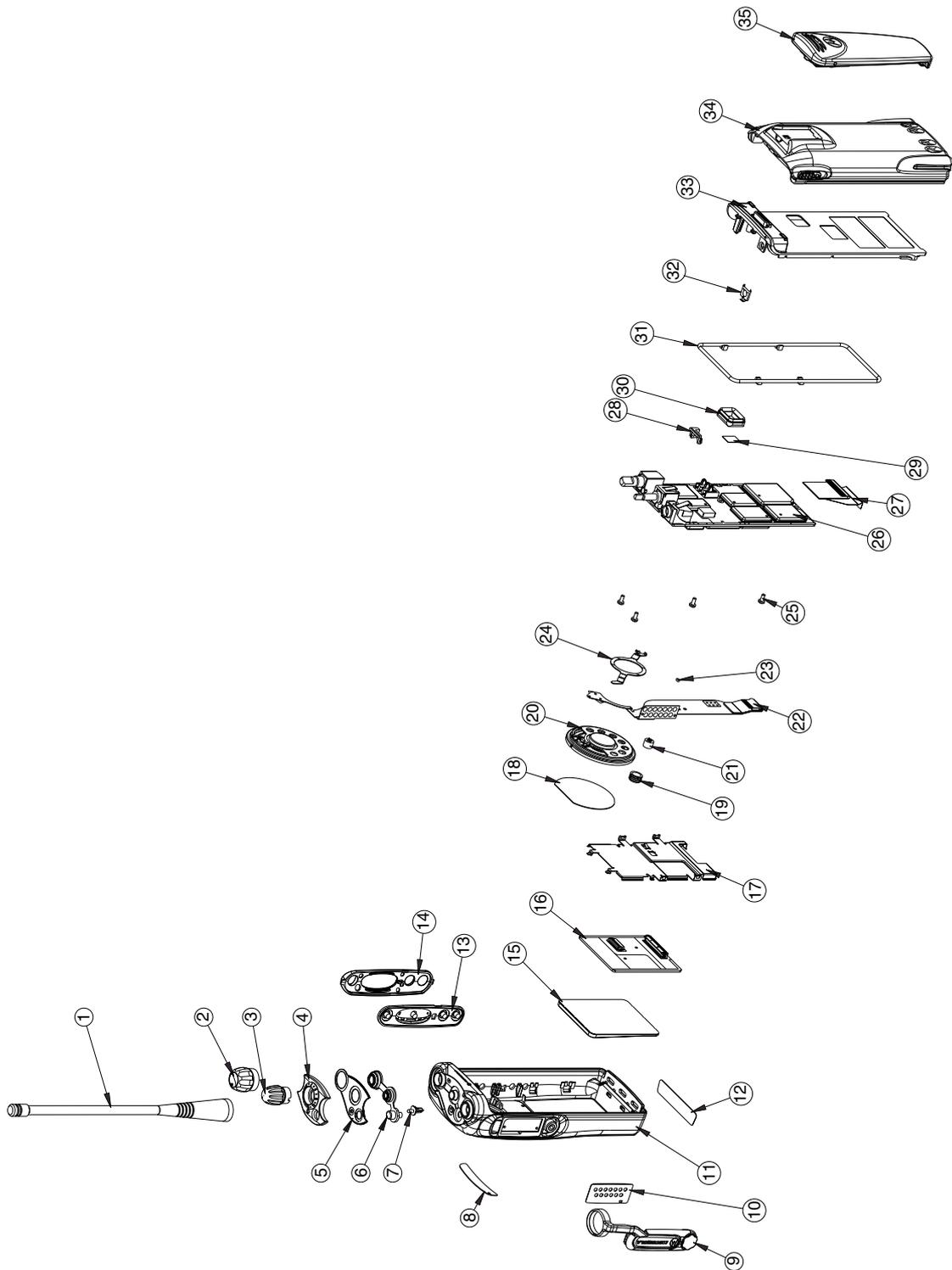


Figure 3-13 GP640 Radio Exploded Mechanical View

Item	Motorola Part Number	Description
1	See Chapter 6	Antenna
2	3680529Z01	Knob, Volume
3	3680530Z01	Knob, Frequency
4	1380525Z01	Escutcheon, Top
5	3380644Z01	Escutcheon, Label
6	3280533Z01	Seal, Control Top
7	6180527Z01	Litepipe, Tx
8	1364279B06	Front, label
9	1586059A01	Dust Cover, Universal Connector
10	1386058A01	Escutcheon, Universal Flex
11	1580666Z03	Front Cover, Basic
12	Not Field Replaceable	Escutcheon, FM
13	7580532Z01	Keypad, Side Control
14	1380528Z01	Bezel, Side Control
15	7580620Z03 7580620Z04	Keypad, Blank Keypad, Full
16	0104007J99	Keypad Board Assembly
17	4280498Z01	Retainer, Keypad PCB
18	3586057A01	Felt Speaker
19	1480577C01	Boot, Microphone
20	5085962A02	Speaker
21	5013920A04	Microphone
22	8480549Z01	Flex, UC
23	2113740A41	Capacitor, 33pF
24	4280504Z01	Retainer, Speaker
25	0304726J04	Screw
26	See Chapter 6	Back Cover Kit incl. chassis main board
27	8480475Z02	Flex, Keypad/Controller
28	1480652Z01	Insulator, Antenna
29	7580556Z01	Pad, Thermal

Item	Motorola Part Number	Description
30	3280534Z01	Seal, Contact
31	3280536Z01	Gasket, o-Ring
32	3980698Z01	Contact, Ground, Compliant, VHF
33	2780518Z01	Chassis
34	See Chapter 6	Battery
35	HLN9714A	Beltclip

9.2 GP680 Exploded View and Parts List

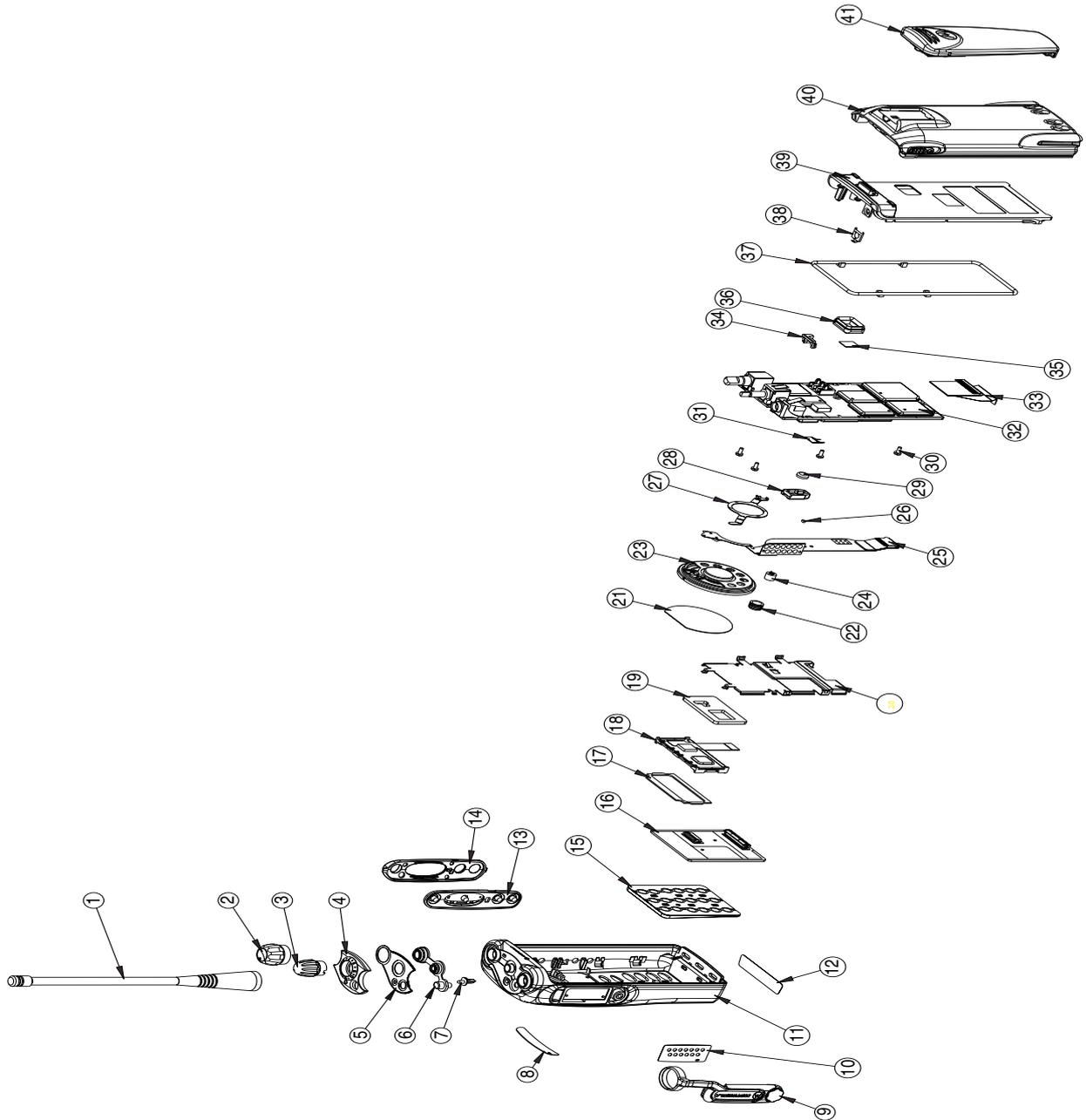


Figure 3-14 GP680 Radio Exploded View

Item	Motorola Part Number	Description
1	See Chapter 6	Antenna
2	3680529Z01	Knob, Volume
3	3680530Z01	Knob, Frequency
4	1380525Z03	Escutcheon, Top
5	3380644Z01	Escutcheon, Label
6	3280533Z01	Seal, Control Top
7	6180527Z01	Litepipe, Tx
8	1364279B07	Front, label
9	1586059A01	Dust Cover, Universal Connector
10	1386058A01	Escutcheon, Universal Flex
11	1580666Z04	Front Cover with Keypad (DTMF)
12	Not Field Replaceable	Escutcheon, FM
13	7580532Z01	Keypad, Side Control
14	1380528Z01	Bezel, Side Control
15	7580620Z05	Keypad
16	0104007J99	Keypad Board Assembly
17	7580540Z01	Pad, Display
18	5104949J07	LCD Module
19	7580637Z01	Pad, LCD Back
20	4280498Z01	Retainer, Keypad PCB
21	3586057A01	Felt Speaker
22	1480577C01	Boot, Microphone
23	5085962A02	Speaker
24	5013920A04	Microphone
25	8480549Z01	Flex, UC
26	2113740A41	Capacitor, 33pF
27	4280504Z01	Retainer, Speaker
28	1480503Z01	Boot, Backup Battery
29	6062884G01	Backup Battery

Item	Motorola Part Number	Description
30	0304726J04	Screw
31	3980667Z01	Contact, finger
32	See Chapter 6	Back Cover Kit incl. chassis main board
33	8480475Z02	Flex, Keypad/Controller
34	1480652Z01	Insulator, Antenna
35	7580556Z01	Pad, Thermal
36	3280534Z01	Seal, Contact
37	3280536Z01	Gasket, O-Ring
38	3980698Z01	Contact, Ground, Compliant
39	2780518Z01	Chassis
40	See Chapter 6	Battery
41	HLN9714A	Beltclip

10.0 Service Aids

Table 3-1 lists service aids recommended for working on the GP640/GP680 Radios. While all of these items are available from Motorola, most are standard shop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

Table 3-1 Service Aids

Motorola Part No.	Description	Application
RLN4460_	Portable Test Set	Enables connection to the audio/accessory jack. Allows switching for radio testing.
RKN4075_	Ribless Programming Cable	Connects radio to Computer.
RKN4074_	Programming Cable/Test Cable	Connects radio to RIB (RLN4008).
RLN4008_	Radio Interface Box (RIB)	Enables communications between the radio and the computer's serial communications adapter.
HLN9756_	BNC Adaptor	Adapts radio's antenna port to BNC cabling of test equipment.
HKN9743_	MAP27 Cable	Connects radio to computer for MAP27 applications in MPT requirements.
HLN9742_	Flash Upgrade Adapter	Provides connections to the computer or RIB programming /test cable
0180305G54	Shop Battery Eliminator	Interconnects radio to power supply.
8180384F66	Bench Test Housing Eliminator for long housing.	Provides for troubleshooting of the radio when the housing is removed.
8180384F68	Bench Test Housing Eliminator for short housing.	Provides for troubleshooting of the radio when the housing is removed.
RLN4510	Battery Eliminator 7.5V	Interconnects radio to power supply.
EPN4040	Wall-Mounted Power Supply	Used to supply power to the RIB (UK).
EPN4041	Wall-Mounted Power Supply	Used to supply power to the RIB (Euro)
3080369B71 or 3080369B72	Computer Interface Cable	Use B72 for the IBM PC AT. All other IBM models use B71. Connects the computer's serial communications adapter to the RIB. (RLN4008)

11.0 Test Equipment

Table 3-2 lists test equipment required to service the GP640/GP680 Radios and other two-way radios.

Table 3-2 Recommended Test Equipment

Motorola Part No.	Description	Characteristics	Application
R2600_NT	Comms System Analyzer (non MPT)	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
R2680_NT to be ordered with RLN1022_ (H/W) RLN1023_ (S/W)	Comms System Analyzer (MPT1327)	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1072_	Digital Multimeter		AC/DC voltage and current measurements
*R1377_	AC Voltmeter	100 μ V to 300 V, 5Hz-1MHz, 10 Megohm input impedance	Audio voltage measurements
WADN4133_	Delay Oscilloscope	2 Channel 40 MHz bandwidth, 5 mV/cm - 20 V/cm	Waveform measurements
R1440_ 0180305F22 0180305F30 0180305F39 RLN4610_ *T1013_	Wattmeter, Plug-in Element Plug-in Element Plug-in Element Carry case RF Dummy Load	Thru-line 50-Ohm, \pm 5% accuracy 10W, 50 - 125 MHz 10W, 100 - 250 MHz 10W, 200 - 500 MHz Wattmeter and 6 elements	Transmitter power output measurements
S1339_	RF Millivolt Meter	100mV to 3 VRF, 10 kHz to 1.2 GHz	RF level measurements
S1348_	220V Power Supply	0-20V, 5A	Programmable

12.0 Programming/Test Cable

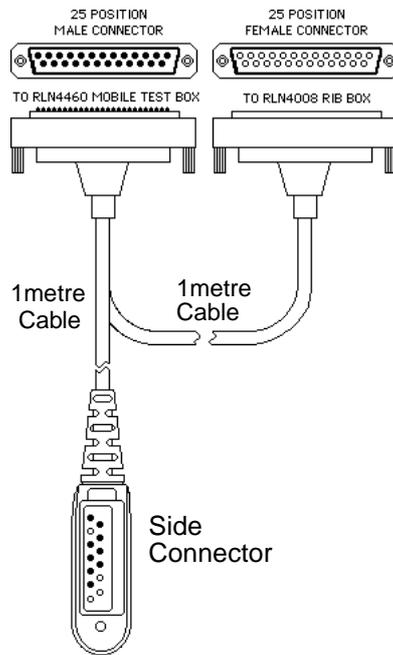


Figure 3-15 Programming/Test Cable

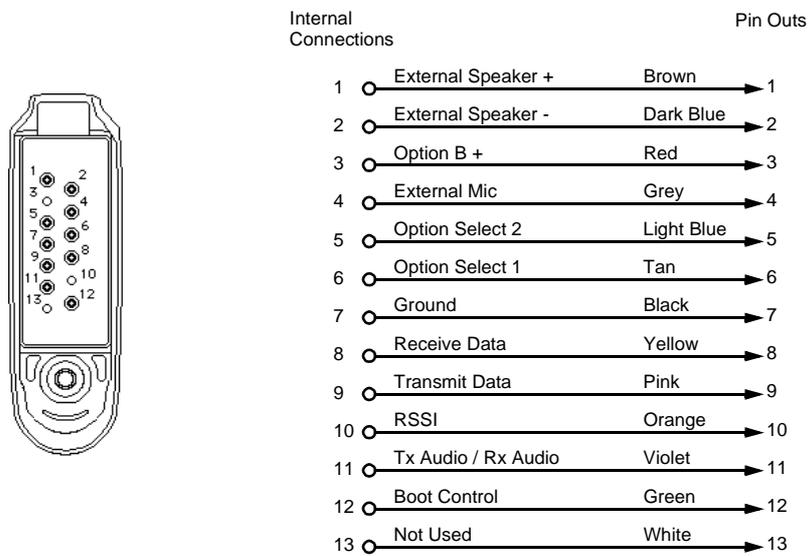


Figure 3-16 Pin Configuration of the Side Connector

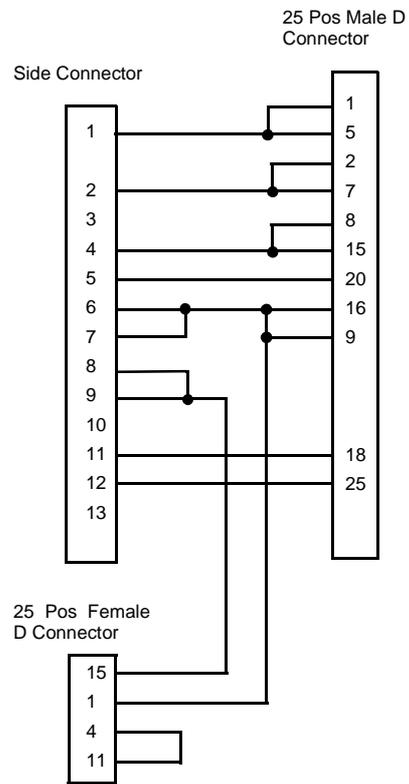


Figure 3-17 Wiring of the Connectors

Chapter 4

PERFORMANCE TESTING

1.0 Introduction

The receiver and transmitter performance tests are contained in Tables 4-1 and 4-2 respectively. Refer to Chapter 5 for the test equipment set up. Note that all test measurements are taken at 25°C.

2.0 Receiver Performance Tests

The receiver performance tests are described in Table 4-1 below.

Table 4-1 Receiver Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch out- put at antenna	PTT to continu- ous (during the performance check)	Frequency error to be $\pm 200\text{Hz}$ VHF $\pm 600\text{Hz}$ UHF
Rated Audio	Mode: GEN Output level: 1.0mV RF Mod: 1kHz tone at 3kHz deviation Monitor: DVM: AC Volts	TEST MODE Test Channel 4 carrier squelch	PTT to OFF (centre), meter selector to Audio PA	Set volume control to 3.16Vrms
Distortion	As above, except to distort- ion	As above	As above	Distortion 3.0% Typical
Sensitivity (SINAD)	As above, except SINAD, lower the RF level for 12dB SINAD.	As above	PTT to OFF (centre)	RF input to be 0.25 μV
Noise Squelch Threshold (only radios with conven- tional sys- tem need to be tested)	RF level set to 1mV RF	As above	PTT to OFF (centre), meter selection to Audio PA, spkr/ load to speaker	Set volume control to 3.16Vrms
	As above, except change fre- quency to a conventional system. Raise RF level from zero until radio unsquelches.	out of TEST MODE; select a conventional system	As above	Unsquelch to occur at <0.25 μV . Preferred SINAD = 9-10dB

3.0 Transmitter Performance Tests

The transmitter performance tests are described in Table 4-2 below.

Table 4-2 Transmitter Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch	PTT to continuous (during the performance check)	Frequency error to be $\pm 200\text{Hz}$ VHF $\pm 600\text{Hz}$ UHF
Power RF	As above	As above	As above	Refer to Maintenance Specifications
Voice Modulation	Mode: PWR MON atten to -70, input to RF In/Out Monitor: DVM, AC Volts Set 1kHz Mod Out level for 0.025Vrms at test set, 80mVrms at AC/DC test set jack	As above	As above, meter selector to mic	Deviation: VHF, UHF, $\geq 4.0\text{kHz}$ but $\leq 5.0\text{kHz}$. (25 kHz Ch Sp)
Voice Modulation (internal)	Mode: PWR MON atten to -70, input to RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	Remove modulation input	Press PTT switch on radio. Say "four" loudly into the radio mic. Measure deviation: VHF, UHF, $\geq 4.0\text{kHz}$ but $\leq 5.0\text{kHz}$ (25 kHz Ch Sp)
DTMF Modulation	As above,	TEST MODE, Test Channel 4 DTMF output at antenna	As above	Deviation: VHF, UHF, $\geq 3.05\text{kHz}$ but $\leq 3.45\text{kHz}$ (25 kHz Ch Sp).
PL/DPL Modulation	As above BW to narrow	TEST MODE, Test Channel 4 TPL DPL	As above	Deviation: VHF, UHF, $\geq 500\text{Hz}$ but $\leq 1000\text{Hz}$. (25 kHz Ch Sp).

RADIO TUNING AND PROGRAMMING

1.0 Introduction

This chapter provides an overview of the Customer Programming Software (CPS) and tuner program which are designed for use in a Windows 95/98 environment. These programs are available in separate kits as listed in the Table 5-1. An Installation instruction manual is also included with each kit.

NOTE Refer to the appropriate program on-line help files for the programming procedures.

Table 5-1 Software Installation Kits Radio Tuning Setup

Description	Kit Number
EMEA CD	ENLN4116_
Installation Card	68P64113B14_

2.0 Global Radio Tuning Setup

A personal computer (PC) using Windows 95/98 and a global tuner program are required to tune the radio. To perform the tuning procedures, the radio must be connected to the PC, radio interface box (RIB), and test equipment shown in Figure 5-1.

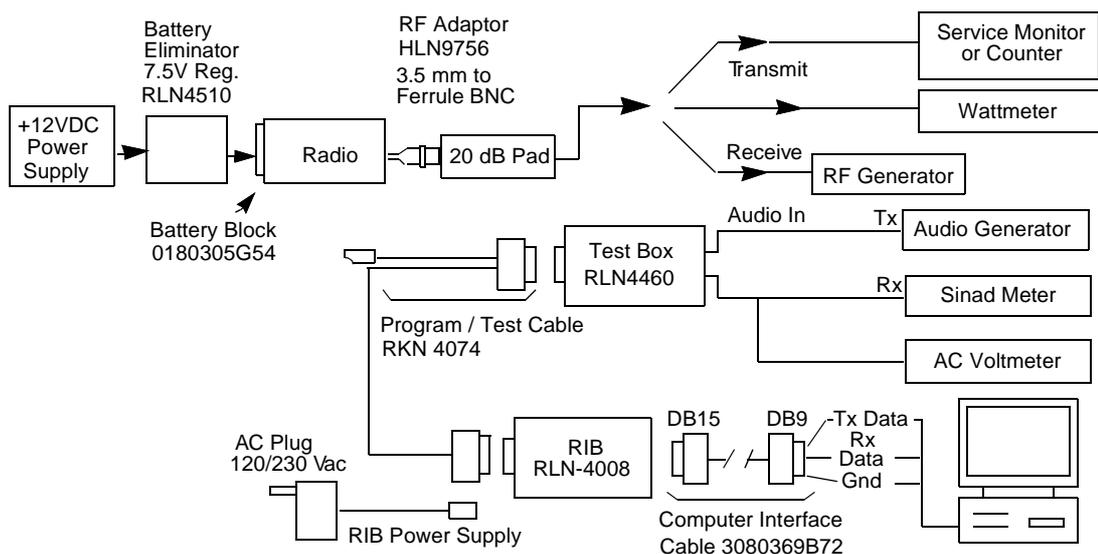


Figure 5-1 Radio Tuning Test Equipment Setup

2.1 Initial Test Equipment Setup

The supply voltage is connected to the radio using a Motorola battery eliminator, P/N 0180305G54. The initial test equipment (Figure 5-1) control settings are listed in Table 5-2.

NOTE Refer to appropriate program on-line help files for the tuning procedures.

Table 5-2 Initial Equipment Control Settings

Service Monitor	Test Set	Power Supply
Monitor Mode: Power Monitor	Speaker set: A	Voltage: 7.5Vdc
RF Attenuation: -70	Speaker/load: Speaker	DC on/standby: Standby
AM, CW, FM: FM	PTT: OFF	Volt Range: 10V
Oscilloscope Source: Mod Oscilloscope Horizontal: 10mSec/Div Oscilloscope Vertical: 2.5kHz/Div Oscilloscope Trigger: Auto Monitor Image: Hi Monitor BW: Nar Monitor Squelch: mid CW Monitor Volume: 1/4 CW		Current: 2.5A

3.0 CPS Programming Setup

The CPS programming setup, shown in Figure 5-2, is used to program the radio codeplug.

NOTE Refer to appropriate program on-line help files for the codeplug programming procedures.

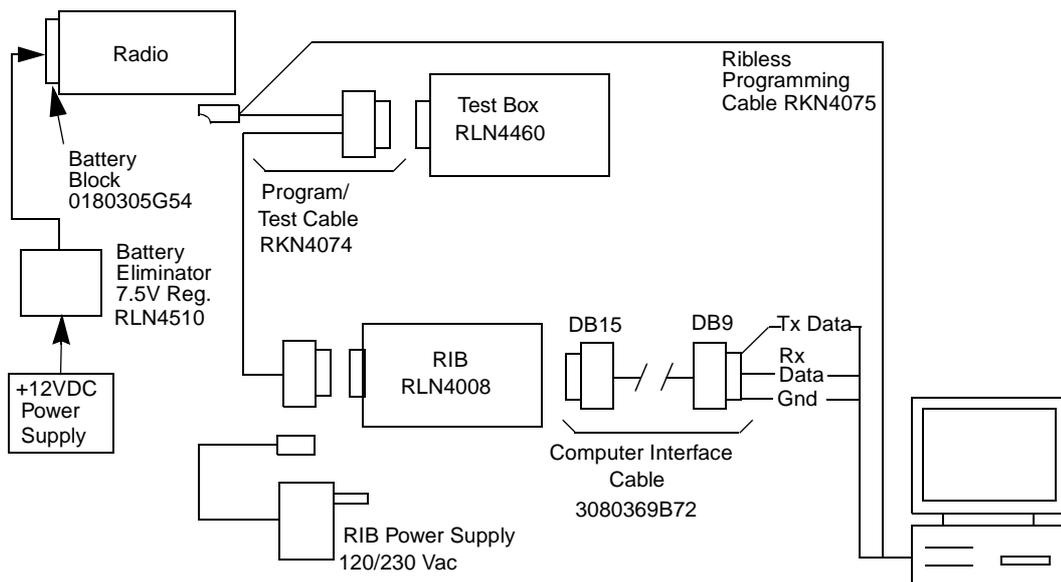


Figure 5-2 CPS Programming Setup

MODEL CHART AND TEST SPECIFICATION

1.0 Model Chart (VHF)

Professional GP600 Series (VHF)			
Model		Description	
MDH25KDC9CK3_E		GP640 VHF 136-174 MHz 5W	
MDH25KDC9CK6_E		GP680 VHF 136-174 MHz 5W	
		Item	Description
X		PMLD4113_	GP640 VHF Back Cover Kit
X		PMLN4216_	GP640 VHF Front Cover Kit
	X	PMLD4114_	GP680 VHF Back Cover Kit
	X	PMLN4304_	GP680 VHF Front Cover Kit
X		6864110B14_	GP640 Basic User Guide
	X	6864110B19_	GP680 Basic User Guide
X	X	PMAD4023_	VHF 14cm (150-161 MHz) Antenna
X	X	HNN9008_	Battery, NiMH Standard

x = Indicates one of each is required.

2.0 Model Chart (UHF)

Professional GP600 Series (UHF)			
Model		Description	
MDH25RDC9CK3_E		GP640 UHF 403-470 MHz 4W	
MDH25RDC9CK6_E		GP680 UHF 403-470 MHz 4W	
		Item	Description
X		PMLE4133_	GP640 UHF Back Cover Kit
X		PMLN4216_	GP640 UHF Front Cover Kit
	X	PMLE4134_	GP680 UHF Back Cover Kit
	X	PMLN4304_	GP680 UHF Front Cover Kit
X		6864110B14_	GP640 Basic User Guide
	X	6864110B19_	GP680 Basic User Guide
X	X	NAE6483_	UHF Whip (403-470 MHz) Antenna
X	X	HNN9008_	Battery, NiMH Standard

x = Indicates one of each is required.

3.0 Model Chart (UHF2)

Professional GP600 Series (UHF2)			
Model		Description	
MDH25SDC9CK3_E		GP640 UHF2 450-527 MHz 4W	
MDH25SDH9CK6_E		GP680 UHF2 450-527 MHz 4W	
		Item	Description
X		PMLE4122_	GP640 UHF2 Back Cover Kit
X		PMLN4216_	GP640 UHF2 Front Cover Kit
	X	PMLE4123_	GP680 UHF2 Back Cover Kit
	X	PMLN4304_	GP680 UHF2 Front Cover Kit
X		6864110B14_	GP640 Basic User Guide
	X	6864110B19_	GP680 Basic User Guide
X	X	PMAE4008_	UHF 14cm (465-527 MHz) Antenna
X	X	HNN9008_	Battery, NiMH Standard

x = Indicates one of each is required.

4.0 Model Chart (300R1)

Professional GP600 Series (300R1)			
Model		Description	
MDH25EDC9CK3_E		GP640 300R1 300-350 MHz 4W	
MDH25EDH9CK6_E		GP680 300R1 300-350 MHz 4W	
		Item	Description
X		PMLD4125_	GP640 300R1 Back Cover Kit
X		PMLN4216_	GP640 300R1 Front Cover Kit
	X	PMLD4126_	GP680 300R1 Back Cover Kit
	X	PMLN4304_	GP680 300R1 Front Cover Kit
X		6864110B14_	GP640 Basic User Guide
	X	6864110B19_	GP680 Basic User Guide
X	X	PMAD4022_	VHF 9cm (300-344 MHz) Antenna
X	X	HNN9008_R	Battery, NiMH Standard

x = Indicates one of each is required.

5.0 Specifications - Professional GP600 Series Radios

Data is specified for +25°C unless otherwise stated.

General Specifications											
Channel Capacity	16 (Conventional)										
Power Supply	Rechargeable battery 7.5v										
Dimensions: H x W x D (mm) With standard high capacity NiMH battery With ultra high capacity NiMH battery With NiCD battery With Lilon battery	Height excluding knobs 137 x 57.5 x 37.5 137 x 57.5 x 40.0 137 x 57.5 x 40.0 137 x 57.5 x 33.0										
Weight: (gm) With Standard high capacity NiMH battery With Ultra high capacity NiMH battery With NiCD battery With Lilon battery	<table border="1"> <thead> <tr> <th>GP640</th> <th>GP680</th> </tr> </thead> <tbody> <tr> <td>420</td> <td>428</td> </tr> <tr> <td>500</td> <td>508</td> </tr> <tr> <td>450</td> <td>458</td> </tr> <tr> <td>350</td> <td>358</td> </tr> </tbody> </table>	GP640	GP680	420	428	500	508	450	458	350	358
GP640	GP680										
420	428										
500	508										
450	458										
350	358										
Average Battery Life @5/5/90 Cycle: With Standard high capacity NiMH battery With Ultra high capacity NiMH battery With NiCD battery With Lilon battery	<table border="1"> <thead> <tr> <th>Low Power</th> <th>High Power</th> </tr> </thead> <tbody> <tr> <td>11 hours</td> <td>8 hours</td> </tr> <tr> <td>14 hours</td> <td>11 hours</td> </tr> <tr> <td>12 hours</td> <td>9 hours</td> </tr> <tr> <td>11 hours</td> <td>8 hours</td> </tr> </tbody> </table>	Low Power	High Power	11 hours	8 hours	14 hours	11 hours	12 hours	9 hours	11 hours	8 hours
Low Power	High Power										
11 hours	8 hours										
14 hours	11 hours										
12 hours	9 hours										
11 hours	8 hours										
Sealing:	Withstands rain testing per MIL STD 810 C/D /E and IP54										
Shock and Vibration:	Protection provided via impact resistant housing exceeding MIL STD 810-C/D /E and TIA/EIA 603										
Dust and Humidity:	Protection provided via environment resistant housing exceeding MIL STD 810 C/D /E and TIA/EIA 603										

Transmitter	
*Frequencies - Full Bandsplit	VHF: 136-174 MHz UHF: 403-470 MHz UHF2: 450-527 MHz 300R1: 300-350 MHz
Channel Spacing	12.5/20/25 kHz
Frequency Stability (-25°C to +55°C, +25° Ref.)	±2.5 ppm ±5.0 ppm (UHF2, 300R1)
Power	136 - 174: 1-5W 403 - 470: 1-4W 450 - 527: 1-4W 300 - 350: 1-4W
Modulation Limiting	±2.5 @ 12.5 kHz ±4.0 @ 20 kHz ±5.0 @ 25 kHz
FM Hum & Noise	-40 dB Typical
Conducted/Radiated Emission	-36 dBm <1 GHz -30 dBm >1 GHz
Adjacent Channel Power	-60 dB @ 12.5 kHz -70 dB @ 20/25 kHz
Audio Response (300 - 3000 Hz)	+1 to -3 dB
Audio Distortion	<3% Typical (UHF, UHF2, VHF) <5% Typical (300R1)

Receiver	
*Frequencies - Full Bandsplit	VHF: 136-174 MHz UHF: 403-470 MHz UHF2: 450-527 MHz 300R1: 300-350 MHz
Channel Spacing	12.5/20/25 kHz
Frequency Stability (-25°C to +55°C, +25° Ref.)	±2.5 ppm
Sensitivity (12 dB SINAD) EIA	.25 µV Typical (UHF, UHF2, VHF) .35 µV Typical (300R1)
Sensitivity (20 dB SINAD) ETS	.50 µV Typical (UHF, UHF2, VHF, 300R1)
Intermodulation EIA	-70 dB (UHF, VHF) -65db, (UHF2, 300R1)
Adjacent Channel Selectivity	60 dB @ 12.5 kHz 70 dB @ 20/25 kHz
Spurious Rejection	>70 dB
Rated Audio	0.5W
Audio Distortion @ Rated Audio	<3% Typical
Hum & Noise	-40 dB @ 12.5 kHz (UHF, VHF) -45 dB @ 12.5 kHz (UHF2, 300R1) -50 dB @ 20/25 kHz
Audio Response (300 - 3000 Hz)	+1 to -3 dB
Conducted Spurious Emission	-57 dBm <1 GHz -47 dBm >1 GHz ETS 300 086

*Availability subject to the laws and regulations of individual countries.

Chapter 7

POWER UP SELF-TEST

1.0 Error Codes

Turning on the radio starts a self-test routine that checks the radio functionality. If the checks are successful, the radio generates two high-pitched self-test pass tones, or a musical tone (selected in CPS). If the self-test is not successful, one low-pitched tone is heard. Radios with displays are able to display the error codes. The displayed error codes and related corrections are listed in Table 7-1.

Table 7-1 Power Up Error Codes

If the error code displayed is...	then, there is a...	To correct the problem...
"Chan Spacing"	Invalid channel spacing.	Reprogram codeplug with correct spacings.
"EEPROM Cksum"	Codeplug structure mismatch or non-existence of codeplug.	Reprogram codeplug with correct version and retest radio. If message reoccurs, replace main board or return it to the nearest Motorola depot.
"Synth Lock"	Channel frequency invalid for radio model.	Reprogram codeplug with correct frequency and channel range.
"RF Config"	Channel frequency outside allowed range or invalid channel number for channel frequency plan.	Reprogram codeplug with valid frequencies/channels.
"RAM Test"	RAM test failure	Turn radio off-on. If message reoccurs replace main board or return it to the nearest Motorola depot.
"Personality D"	Personality data invalid	Reprogram codeplug with valid personality.
"Dynamic CP"	Dynamic codeplug failure.	Turn radio off then on. If message reoccurs replace main board or return it to the nearest Motorola depot.
"Flash Cksum"	Radio EPROM failure.	Turn radio off then on. If message reoccurs replace main board or return it to the nearest Motorola depot.
"Hardware Test"	Radio hardware failure.	Turn radio off-on. If message reoccurs replace main board or return it to the nearest Motorola depot.
No Display	Display module is not connected. Display module faulty.	Check connection between main board and the display module. Replace display module.
300Hz Tone (Radio Without Display)	Radio hardware failure or invalid codeplug.	Turn radio off then on. If tone still sounds reprogram codeplug and retest. If tone continues to sound replace the main board or return it to the nearest Motorola depot.

