MOTOROLA

Professional Radio

P Series

Basic Service Manual

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Issue: September 1999

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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

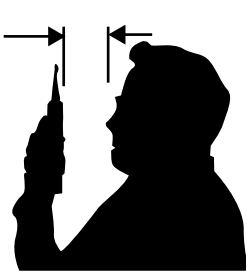
Your Motorola Two-Way Radio, which generates and radiates radio frequency (RF) electromagnetic energy (EME), is designed to comply with the following National and International Standards and Guidelines regarding exposure of human beings to radio frequency electromagnetic energy:

- 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 centimetres (one to two inches) away from the mouth. Keep antenna at least 2.5 centimetres (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 centimetres (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). 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 jewellery, 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

Section 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 1-3

Section 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

Section 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 Disassembling and Reassembling the Radio — General 3-3
5.0 Radio Disassembly — Detailed 3-4
5.1 Front Cover from Chassis Disassembly 3-4
5.2 Chassis Assembly Disassembly 3-6
5.3 Keypad/Option Board and Display Module Disassembly 3-7
5.4 Speaker, Microphone, and Wire Disassembly 3-8
5.5 PTT Disassembly 3-9
5.6 Control Top Disassembly 3-10
6.0 Radio Reassembly — Detailed 3-10
6.1 Control Top Reassembly 3-10
6.2 PTT Reassembly 3-10
6.3 Speaker Reassembly 3-10
6.4 Keypad Option Board, Microphone and Wire Reassembly 3-11
6.5 Chassis Assembly Reassembly 3-11
6.6 Chassis and Front Cover Reassembly 3-12

7.0 Option Board Installation 3-12
7.1 Configuring the Radio after Option Board Installation 3-14
7.2 Additional Configuration required by the DTMF Option Board 3-15
8.0 Mechanical View and Parts List 3-16
8.1 P Series Radio Exploded View and Parts List 3-16
9.0 Service Aids 3-18
10.0 Test Equipment 3-19
11.0 Programming/Test Cable 3-20

Section 4 PERFORMANCE TESTING

1.0 Introduction 4-1
2.0 Setup 4-1
3.0 Test Mode 4-2
3.1 RF Test Mode 4-2

Section 5 RADIO TUNING AND PROGRAMMING

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

Section 6 POWER UP SELF-TEST

1.0 Error Codes 6-1

Section 7 MODEL CHARTS AND TECHNICAL SPECIFICATIONS

1.0 Model Chart (VHF) 7-1
2.0 Model Chart (UHF) 7-2
3.0 Model Chart (UHF2) 7-3
4.0 Technical Specifications 7-4

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: 0049 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.

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

Africa & Middle East - Michael Berberich
Telephone: +49 (0) 6128 70 2573
Fax: +49 (0) 6128 95 1096
Email: C11999@email.mot.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: MDH34KDC9AA1AE)

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
MD = Motorola Internal Use	**H** = Portable	**34**	**K** VHF (136-174MHz)	**D** 4-5W	**C** P040	**9** Program-mable	**AA** Conventional	**1** P040	**A**	**E**
			R UHF (403-470MHz)		**H** P080			**6** P080		
			S UHF2 (450-527MHz)							

Chapter 2

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 above.





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 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:

- ❑ chassis opener
- ❑ 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 5.2)

Keypad/Option Board and Display Module Disassembly (Paragraph 5.3)

Speaker, Microphone, and Wire Disassembly (Paragraph 5.4)

PTT Disassembly (Paragraph 5.5)

Control Top Disassembly (Paragraph 5.6)

5.0 Radio Disassembly — Detailed

5.1 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.

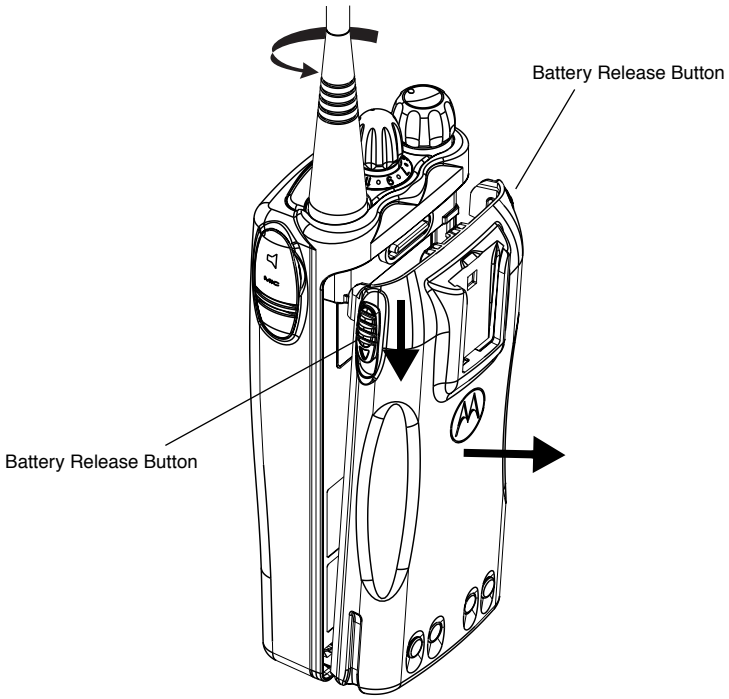


Figure 3-1 Battery Removal

3. Remove the antenna.

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

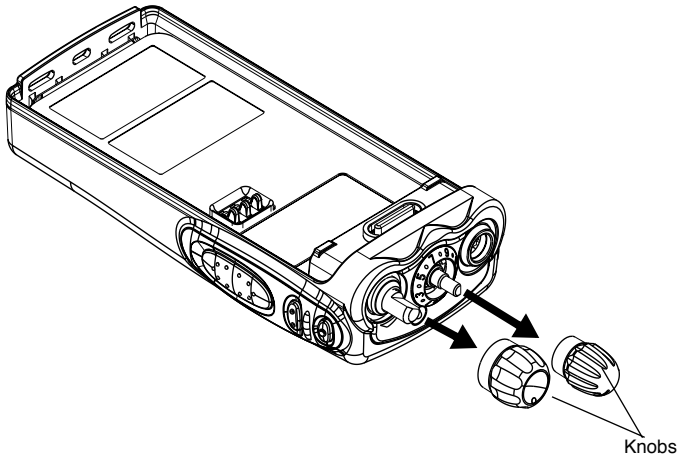


Figure 3-2 Knob Removal

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 by using the chassis opener (part number 6680702Z01). Place the broad side of the opener into the slots located at the base of the radio (see Figure 3-3). Press the handle of the opener downwards. This pressing action forces the thin inner plastic wall toward the base of the radio, releasing the two chassis base tabs.

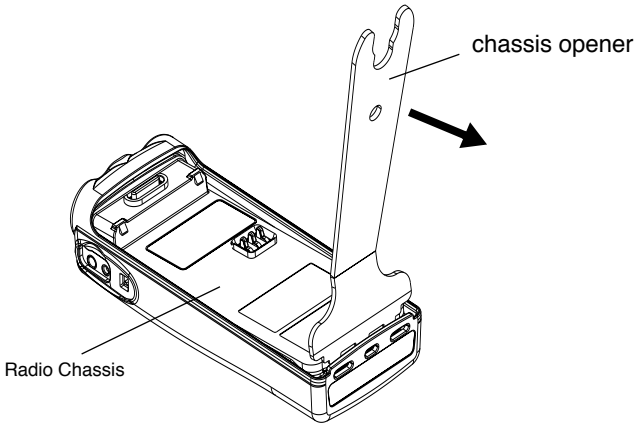


Figure 3-3 Chassis Removal

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

NOTE The jumper flex and wire assembly connecting the front cover assembly and the chassis prevent you from completely separating the two units.

6. Lay the chassis down. Rotate the front cover backward and slightly away from the chassis.
7. Lift the latch on the main circuit board to release the jumper flex from its connector.
8. Unplug the wires from the 4-pin connector.

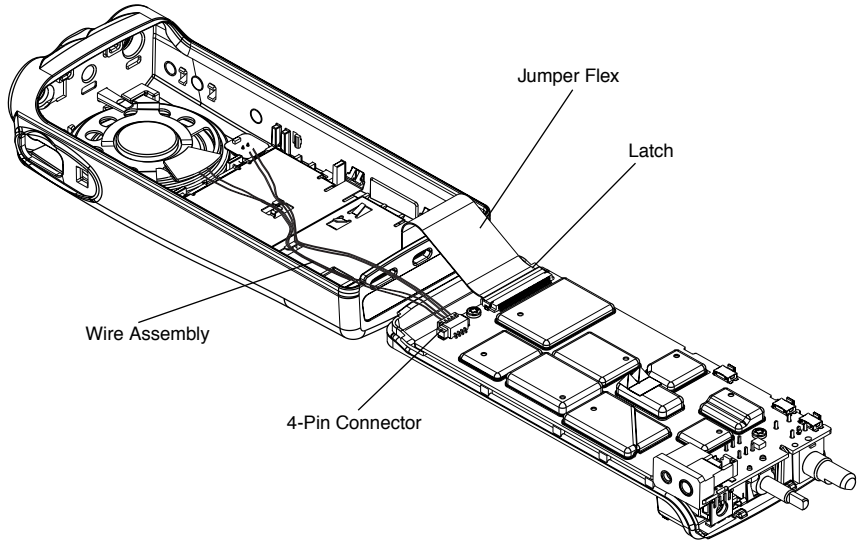


Figure 3-4 Unlatch Flex Connectors

5.2 Chassis Assembly Disassembly

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

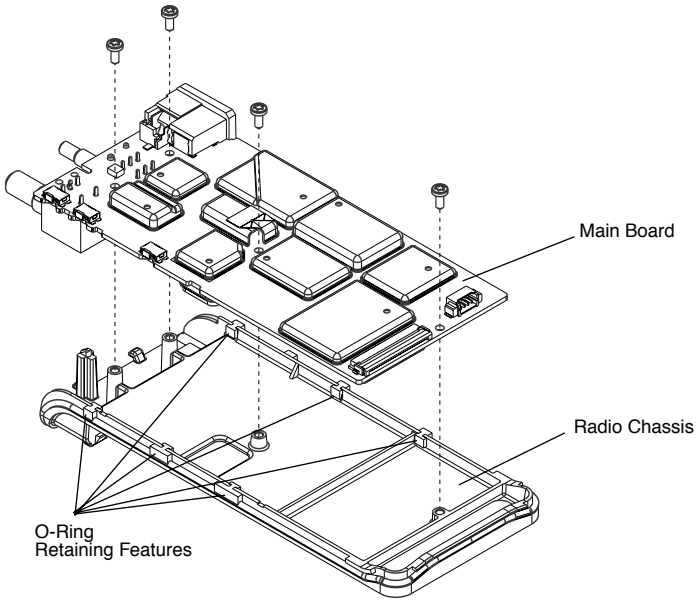


Figure 3-5 Remove Main Board from Chassis

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

CAUTION: Refer to the CMOS CAUTION paragraph on Page 3-2 before removing the main board. Be sure to use ESD protection when handling circuit boards.

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

5.3 Keypad/Option Board and Display Module Disassembly

1. If the disassembly of the keypad printed circuit board is required, open the catches on the keypad retainer and lift the wire assembly up. (See Figure 3-6.)
2. Lay this wire assembly 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.

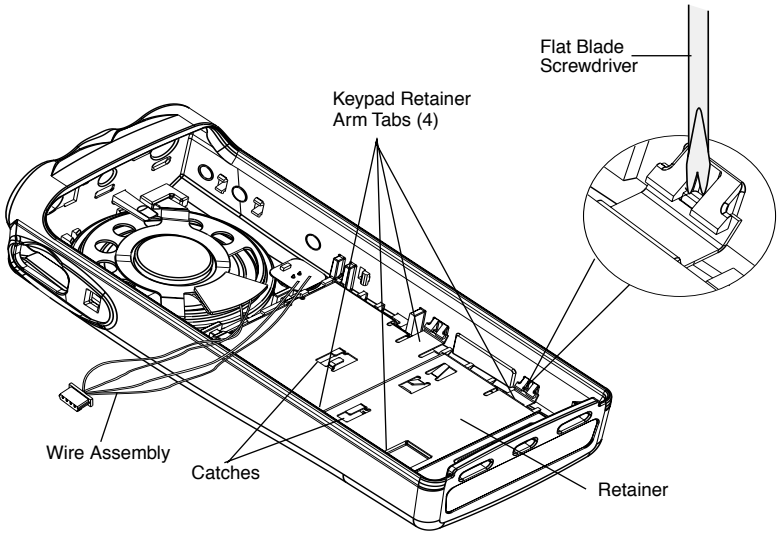


Figure 3-6 Remove Retainer

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

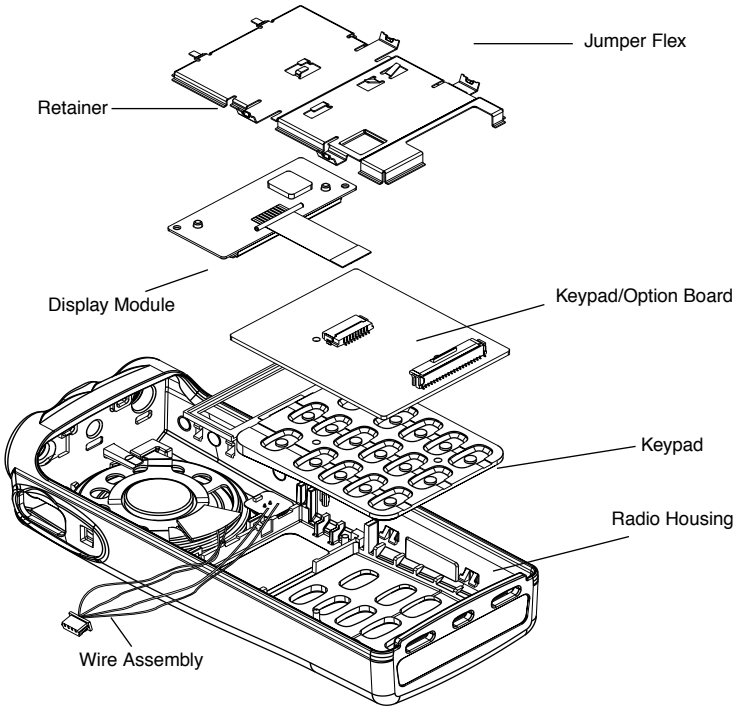


Figure 3-7 Removing the Keypad Retainer, Display Module and Other Boards from the Radio Housing

NOTE At this point, the Option Board Installation Procedure (Paragraph 7.0) should be performed, if necessary.

5.4 Speaker, Microphone, and Wire Disassembly

NOTE 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.

1. 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.

2. Pull the rubber microphone boot from its seated position. Unless you are replacing the microphone, leave it in the boot.

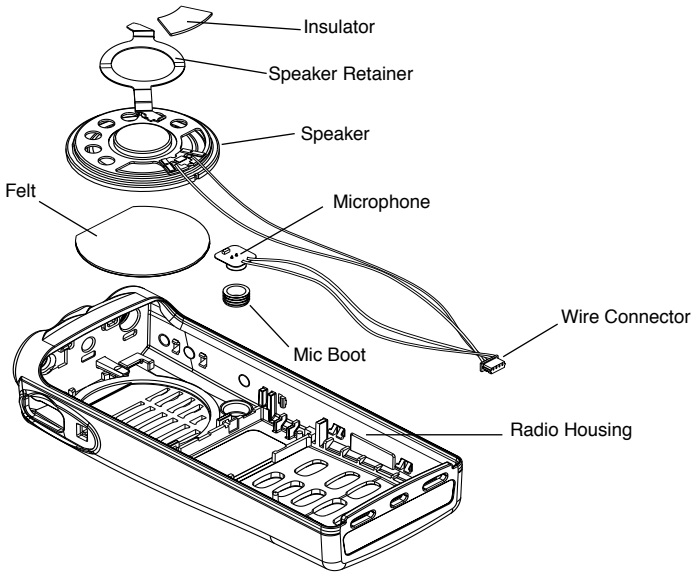


Figure 3-8 Removal Speaker-Microphone Assembly

3. When reassembling the microphone in its boot, make sure the microphone port faces the round hole in the bottom of the boot.

5.5 PTT Disassembly

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

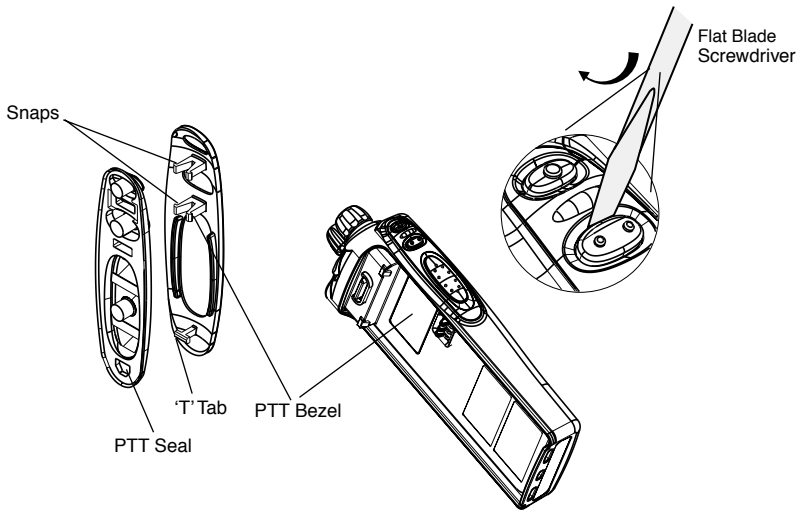


Figure 3-9 PTT Removal

a. Insert the tip of a small screwdriver in between the bezel and side button 2 (refer to Figure 3-9).

b. Insert the tip of a small screwdriver in between side button 2 and PTT button (refer to Figure 3-9).

c. Pry the PTT bezel away from the radio housing.

d. If required, the PTT seal can be easily lifted from the bezel without the use of tools.

5.6 Control Top Disassembly

1. To remove the control top assembly, place a screwdriver next to the antenna boss, and pry it against the top escutcheon. This will lift the top escutcheon away from the top of the front housing.
2. Remove the control top seal and transmit light pipe.

6.0 Radio Reassembly — Detailed

6.1 Control Top Reassembly

1. Replace transmit light pipe and control top seal.
2. Peel off the liners from a new top adhesive, and place it in the recess in the front cover. Press the top escutcheon down uniformly.

6.2 PTT Reassembly

1. Put the PTT seal in the PTT bezel.
2. Place the bezel 'T' tab in the 'T' slot inside the front cover PTT opening. Slightly slide down the bezel so that the two snaps can be aligned and inserted into the two rectangular slots.
3. Press the PTT assembly against the front cover opening.

NOTE Look inside the front cover to make sure the T-tab and snaps are fully engaged with the front cover.

6.3 Speaker Reassembly

1. Align the notch in the speaker at the six o'clock position with the tab on the front cover.
2. 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.

6.4 Keypad Option Board, Microphone and Wire Reassembly

1. Replace the keypad/option board.
2. 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 Ensure the speaker-microphone wire is not damaged during reassembly.

3. Re-insert the microphone and boot into the pocket in the front cover.
4. Lay the speaker-microphone wire on top of the keypad/option board retainer, align them onto the catches and close the catches.

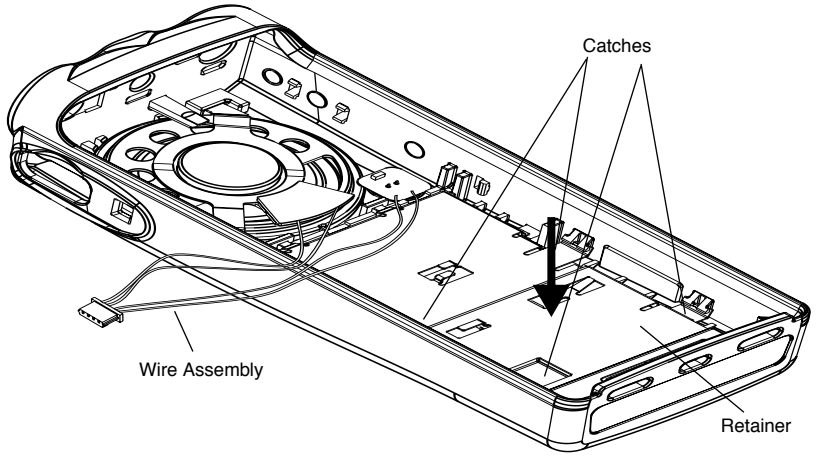


Figure 3-10 Lock retainer catches to the radio housing

6.5 Chassis Assembly Reassembly

1. Replace the O-ring. The tabs on the O-ring should reach around the chassis and point down.
2. 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.

3. Replace the battery contact seal (if necessary) surrounding the battery contact.
4. 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.

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

6.6 Chassis and Front Cover Reassembly

1. Align the chassis assembly end-to-end with the front cover assembly.
2. Insert the tails of the jumper flex and wire assembly into their respective connectors at the bottom of the front cover.
3. Push down the latches on the connectors to hold the flex circuit 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.

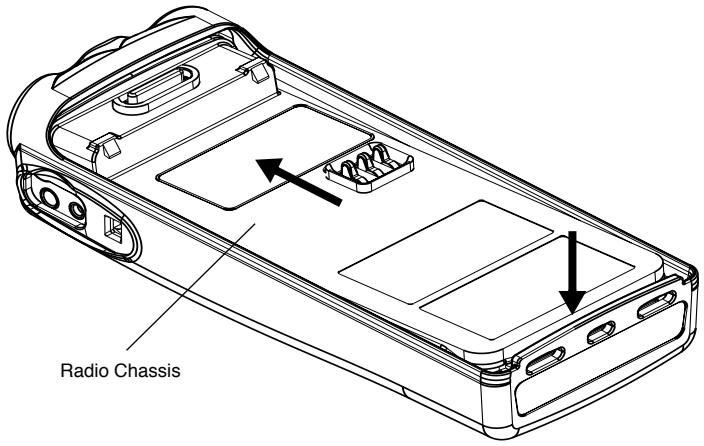


Figure 3-11 Fastening the Chassis

7.0 Option Board Installation

1. With the keypad retainer removed, the keypad 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. Remove the keypad board.

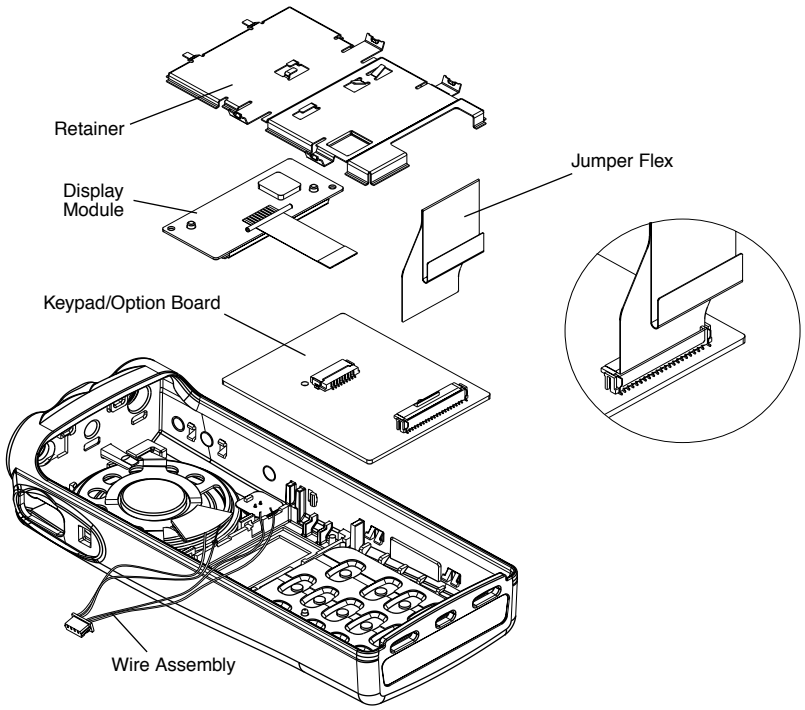


Figure 3-12 Changing the Keypad/Option Board

4. Reassemble the option board to the front cover assembly.
5. Insert the display flex circuit into the connector on the option board.
6. 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.
7. 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.
8. With the keypad option board and retainer correctly in place, the front cover assembly can now be reassembled as described in paragraph 6.6.

7.1 Configuring the Radio after Option Board Installation

1. Connect the radio to the computer following instructions outlined in Chapter 5.
2. Start up the CPS, and read the radio's codeplug.
3. Open the Radio Configuration dialog box, and proceed to the Option Board tab. From the pull-down menu, choose the option board type that you just installed (choose Simple Decoder for the DTMF option board).



Figure 3-13 Option Board tab of the Radio Configuration dialog box.

4. Open the Personality dialog box. For every personality that you want the option board features to be activated, click on the Option Board Feature check box of the Advanced tab.



Figure 3-14 Advanced tab of the Personality dialog box.

7.2 Additional Configuration required by the DTMF Option Board

1. In the Tree View window of your CPS, expand the Signalling node. Also expand the DTMF System node. Open each of the DTMF System dialog boxes under this node, and fill in the relevant information pertinent to your DTMF system.



Figure 3-15 DTMF System dialog box

8.0 Mechanical View and Parts List

8.1 P Series Radio Exploded View and Parts List

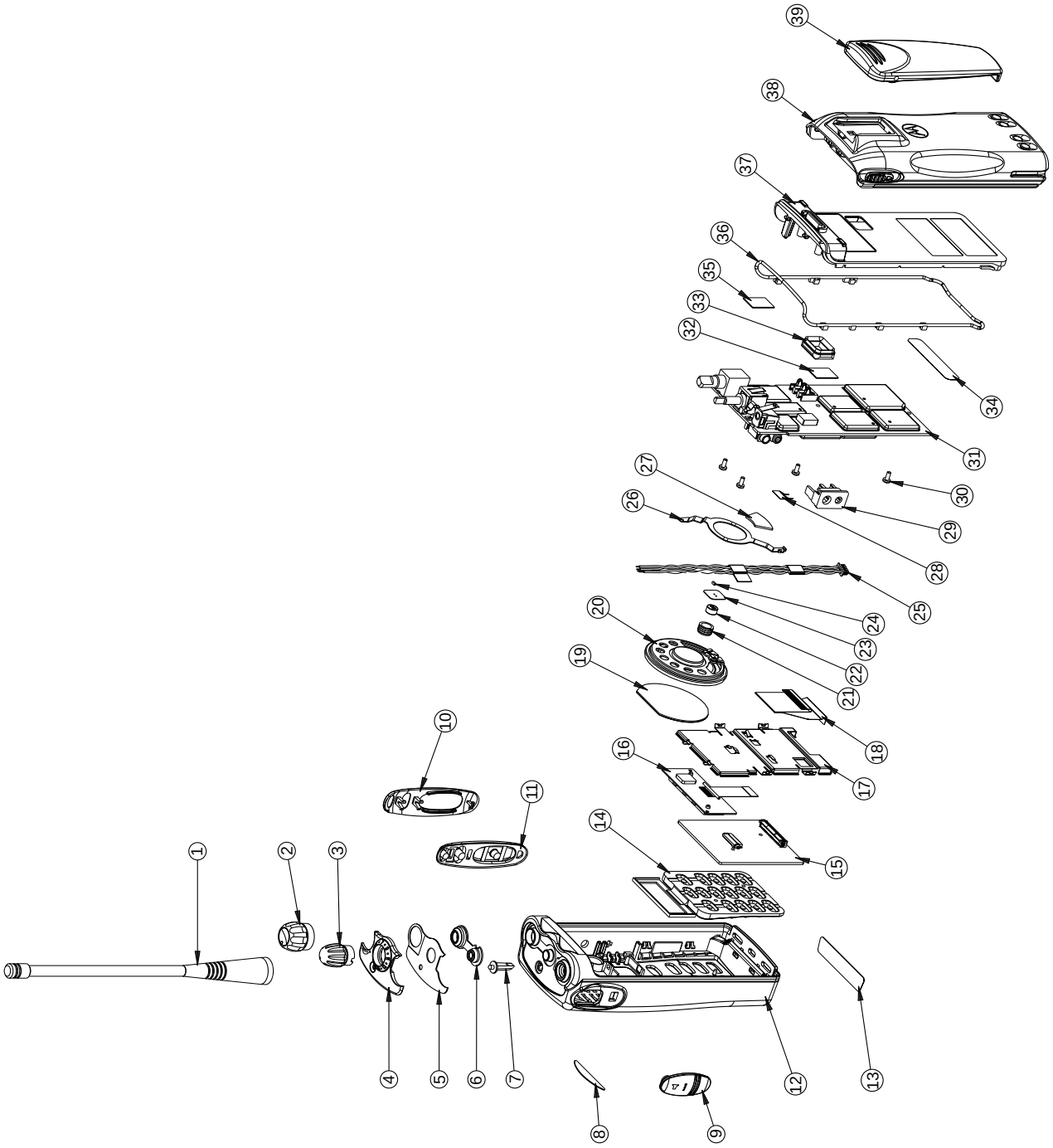


Figure 3-16 P Series Radio Exploded View

Item	Motorola Part Number	Description
1	See Chapter 7	Antenna
2	3680529Z01	Knob, Volume
3	3680530Z02	Knob, Frequency
4	1385620Z01 1385620Z02	Escutcheon, Top (16 Ch.) Escutcheon, Top (4 Ch.)
5	3385703Z01	Label, Escutcheon
6	3280722Z01	Seal, Control Shaft
7	6185621Z01	Lightpipe, Tx
8	3385629Z02 3385630Z01	Label, Name (P040) Label, Name (P080)
9	3885617Z01	Cap, Dust
10	1385619Z01	Bezel, Side Control
11	7585618Z01	Keypad, Side Control
12	1585616Z01 1585616Z02	Housing, Front (P040) Housing, Front (P080)
13	1380649Z03	* Escutcheon, FM
14	7585623Z01	Keypad, Front
15	0104009J11	Keypad Board Assembly
16	5104949J08	Display Module
17	4285609Z01	Retainer Plate
18	8480475Z02	Flex, Keypad/Controller
19	3585606Z02	Felt, Speaker
20	5085962A02	Speaker
21	1480577C01	Boot, Microphone
22	5013920A04	Microphone
23	8485687Z01	Flex, Microphone
24	2113740A55	Cap, 100pF
25	0980727Z01	Connector, Wire
26	4285601Z01	Retainer, Speaker
27	1480724Z01	Insulator, Speaker
28	3980667Z01	Contact Finger
29	1585608Z01	Shroud, Jack

Item	Motorola Part Number	Description
30	0304726J04	Screw
31	0104008J60 0104008J90	Ctrl/RF Bd Assembly (VHF) Ctrl/RF Bd Assembly (UHF)
32	7580556Z01	Pad, Thermal
33	3280534Z01	Seal, Contact
34	3380564Z01	Label, Warning
35	7585706Z01	Pad, Chassis
36	3280536Z01	Gasket, O-ring
37	2780518Z03	Chassis
38	See Chapter 7	Battery
39	HLN9714 HLN9844.	Beltclip, large (2in. wide belt) Beltclip, medium (1,5in.belt)

* Not field replaceable

9.0 Service Aids

Table 3-1 lists service aids recommended for working on the P Series Radios. While all of these items are available from Motorola, most are standard workshop 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.
0180305G54 8180384F66	Shop Battery Eliminator Bench Test Housing Eliminator	Interconnects radio to power supply. 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)

10.0 Test Equipment

Table 3-2 lists test equipment required to service the P Series Radios and other two-way radios.

Table 3-2 Recommended Test Equipment

Motorola Part No.	Description	Characteristics	Application
R2600CNT	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
R2680ANT	Comms System Analyzer (MPT1327) to be ordered with RLN1022A (H/W) RLN1023A (S/W)	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 μV 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
R1440A 0180305F14 0180305F30 0180305F39 RLN4610A T1013	Wattmeter, Plug-in Element Plug-in Element Plug-in Element Carry case RF Dummy Load	Thruline 50-Ohm, ±5% accuracy 10W, 25 - 60 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	20V 5A	Programmable

11.0 Programming/Test Cable

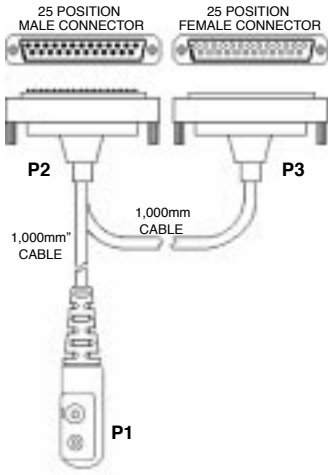


Figure 3-17 Programming/Test Cable

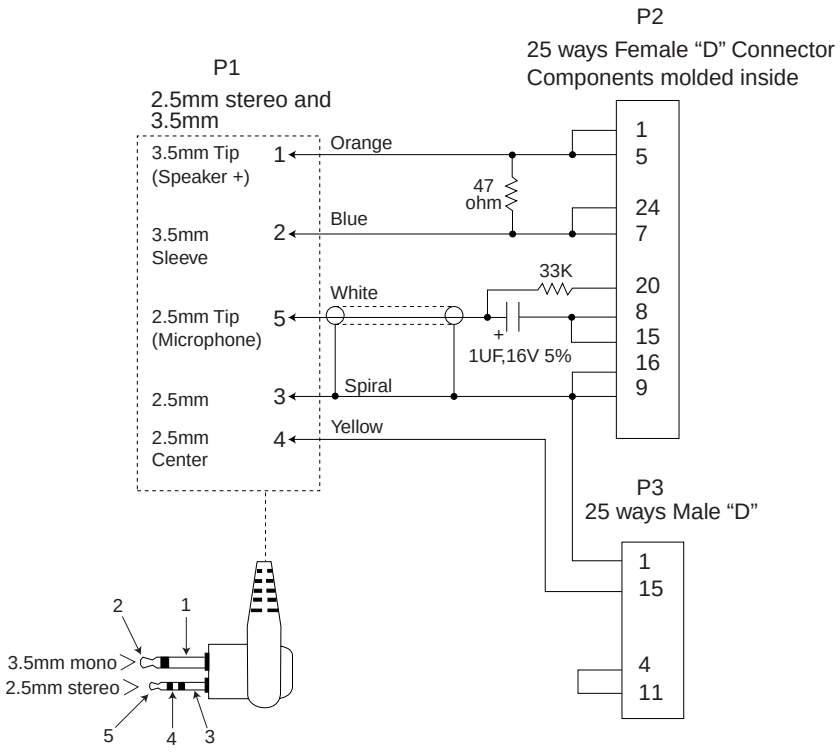


Figure 3-18 Wiring of the Connectors

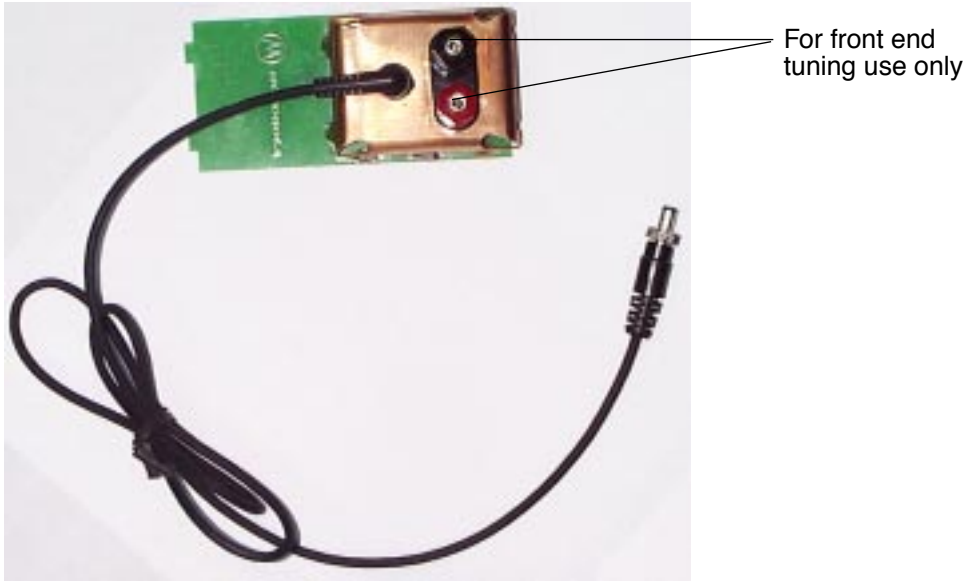


Figure 3-19 Front-end Filter Tuning Using 3rd Battery Contact



Figure 3-20 Battery Terminals

Chapter 4

PERFORMANCE TESTING

1.0 Introduction

The radios have been prepared to meet published specifications through their manufacturing process, with the use of laboratory-quality test equipment of highest accuracy. The recommended field service equipment approaches the accuracy of the manufacturing equipment with a few exceptions.

Accuracy of the equipment must be maintained in compliance with the manufacturer's recommended calibration schedule.

2.0 Setup

Supply voltage can be connected from the battery eliminator. The equipment required for alignment procedures is connected as shown in the Radio Alignment Test Setup diagram.

Initial equipment control settings should be as indicated in the following table and should hold for all alignment procedures except as noted in Table 4-1.

Table 4-1 Initial Equipment Control Settings

Service Monitor	Test Set	Power Supply
Monitor Mode: Power Monitor	Spkr set: A	Voltage: 7.5Vdc
RF Attn: -70	Spkr/load: Speaker	DC on/standby: Standby
AM, CW, FM: FM	PTT: OFF	Volt Range: 10V
O'scope Source: Mod O'scope Horiz: 10mSec/Div O'scope Vert: 2.5kHz/Div O'scope Trig: Auto Monitor Image: Hi Monitor BW: Nar Monitor Squelch: mid CW Monitor Vol: 1/4 CW		Current: 2.5A

3.0 Test Mode

3.1 RF Test Mode

When the radio is operating in its normal environment, the radio's microcontroller controls the RF channel selection, transmitter key-up, and receiver muting. However, when the unit is on the bench for testing, alignment or repair, it is removed from its normal environment. It cannot receive commands from its system and, therefore, the internal microcontroller will not key the transmitter nor unmute the receiver. This prevents the use of normal tune-up procedures. To solve this problem a special routine, called TEST MODE or "air test," has been incorporated in the radio.

To enter test mode:

- ❑ Turn the radio on.
- ❑ Within ten seconds after the self test is complete, press the side button 2, (SB2) five times in succession.
- ❑ After "CSQ XX" appears in the display, the radio is on channel XX, carrier squelch mode.
- ❑ Pressing SB1 will scroll through and access test environments as shown in Table 4-2.
- ❑ Pressing SB2 will scroll through the channel spacing available as shown in Table 4-3 and a corresponding set of tones will be heard.
- ❑ Pressing SB2 for 3 seconds will switch the radio to the Control Head Test mode. "**LCD**" appears on the display.
- ❑ Pressing SB1 will cause the radio to turn on all the segments of the first character. Another SB1 press will turn on all the segments of the next character and so on until the last character (character 7).
- ❑ Pressing SB1 at the end of the LCD test will activate the Icon Test. "**ICON**" appears on the display. The next SB1 press will turn on the first icon.
- ❑ Pressing SB1 at the end of the Icon test will activate the Button Test. "**BUTTON**" appears on the display. Pressing any side button (except SB1) or any keypad button during the LCD test of Icon test will immediately activate this test.
- ❑ Pressing SB2 for 3 seconds in the Control Head Test mode will cause the radio to return to the RF Test mode.

NOTE **XX - channel number (01 - 14)**

Table 4-2 Test Environments

Display	No. of Beeps	Description	Function
"CSQ XX"	1 GKC	Carrier Squelch	RX: if carrier detected TX: mic audio
"TPL XX"	1 BKC	Tone Private-Line	RX: unsquelch if carrier and tone (192.8Hz) detected TX: mic audio + tone (192.8Hz)
"DPL XX"	2 BKC	Digital Private-Line	RX: unsquelch if carrier and digital code (131) detected TX: mic audio + digital code (131)

Table 4-2 Test Environments

Display	No. of Beeps	Description	Function
“DTMF XX”	3 BKC	Dual-Tone multiple frequency	RX: unsquelch if carrier detected TX: selected DTMF tone pair
“OPEN XX”	5 BKC	Unsquelch Open	RX: constant unsquelch TX: mic audio
“CMP XX”	11 BKC	CMP	RX: if carrier detected TX: mic audio
“LLE XX”	12 BKC	LLE	RX: if carrier detected TX: mic audio

Table 4-3 Test Channel Spacing

Display	No. of BKC	Channel Spacing
“SP 25”	1	25 kHz
“SP 12_5”	2	12.5 kHz
“SP 20”	3	20 kHz

Table 4-4 Test Frequencies

Channel Selector Switch Position	Test Channel	VHF	UHF
1 Low Power 8 High Power	TX#1 or #8 RX#1 or #8	136.025 136.025	403.025 403.025
2 Low Power 9 High Power	TX#2 or #9 RX#2 or #9	142.325 142.325	415.025 415.025
3 Low Power 10 High Power	TX#3 or #10 RX#3 or #10	148.625 148.625	425.025 425.025
4 Low Power 11 High Power	TX#4 or #11 RX#4 or #11	154.925 154.925	436.025 436.025
5 Low Power 12 High Power	TX#5 or #12 RX#5 or #12	161.225 161.225	449.025 449.025
6 Low Power 13 High Power	TX#6 or #13 RX#6 or #13	167.525 167.525	460.025 460.025
7 Low Power 14 High Power	TX#7 or #14 RX#7 or #14	173.825 173.825	469.975 469.975

Table 4-5 Receiver Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	PTT to continuous (during the performance check)	Frequency error to be ±200 Hz VHF ±600 Hz UHF
Rated Audio	Mode: GEN Output level: 1.0mV RF 4th channel test frequency* Mod: 1kHz tone at 3kHz deviation Monitor: DVM: AC Volts	TEST MODE Test Channel 4 carrier squelch	PTT to OFF (center), meter selector to Audio PA	Set volume control to 3.16Vrms
Distortion	As above, except to distortion	As above	As above	Distortion <3.0%
Sensitivity (SINAD)	As above, except SINAD, lower the RF level for 12dB SINAD.	As above	PTT to OFF (center)	RF input to be <0.35μV
Noise Squelch Threshold (only radios with conventional system need to be tested)	RF level set to 1mV RF	As above	PTT to OFF (center), meter selection to Audio PA, spkr/ load to speaker	Set volume control to 3.16Vrms
	As above, except change frequency 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 <0.25μV. Preferred SINAD = 9-10dB

* See Table 4-4 Test Frequencies

Table 4-6 Transmitter Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	PTT to continuous (during the performance check)	Frequency error to be ±200 Hz VHF ±600 Hz UHF
Power RF	As above	As above	As above	Refer to Maintenance Specifications
Voice Modulation	Mode: PWR MON 4th channel test frequency* 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 ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp).
Voice Modulation (internal)	Mode: PWR MON 4th channel test frequency* 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 ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp)
DTMF Modulation	As above, 4th channel test frequency*	TEST MODE, Test Channel 4 DTMF output at antenna	As above	Deviation: VHF, UHF ≥ 3.05 kHz but ≤ 3.45 kHz (25 kHz Ch Sp)
PL/DPL Modulation	As above 4th channel test frequency* BW to narrow	TEST MODE, Test Channel 4 TPL DPL	As above	Deviation: VHF, UHF ≥500Hz but ≤ 1000Hz (25 kHz Ch Sp).

* See Table 4-4 Test Frequencies

Chapter 5

RADIO TUNING AND PROGRAMMING

1.0 Introduction

This chapter provides an overview of the Customer Programming Software (CPS) and Tuner Software which are designed for use in a Windows 95/98 environment. These programs are on the CD provided with this manual. A Software Installation manual is also provided to guide through the installation process.

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

Table 5-1 Software Installation and Radio Tuning Setup

Description	Kit Number
Software CD Customer Programmable Software Tuner Software	ENLN4131_ ENVN4020_ ENVN4014_

2.0 Radio Tuning Setup

A personal computer (PC) using Windows 95/98 and a 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.

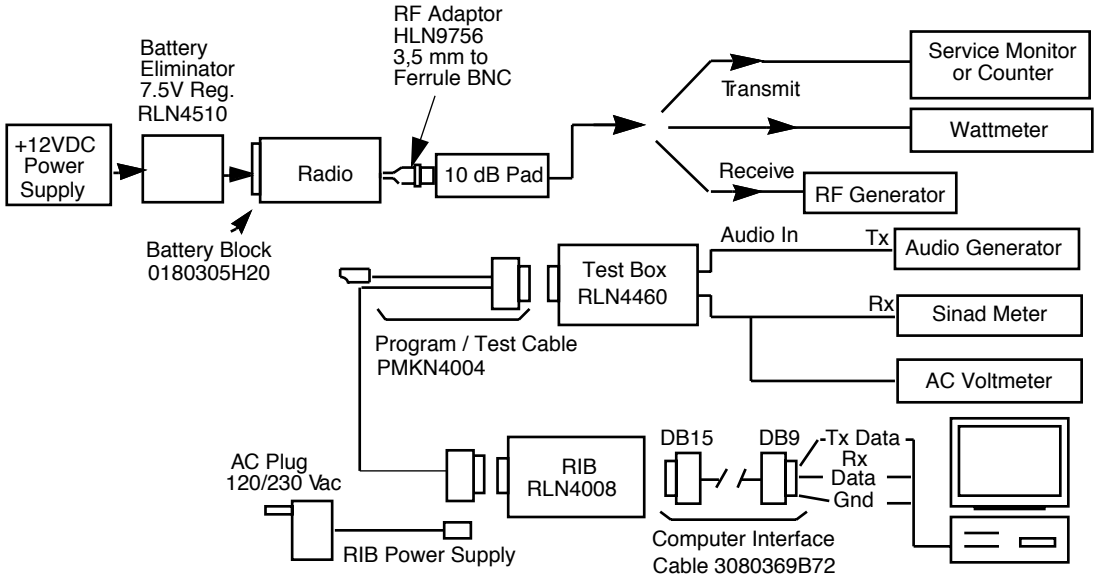


Figure 5-1 Radio Tuning Test Equipment Setup

2.1 Initial Test Equipment Setup

The supply voltage is connected to the radio using a Motorola battery eliminator, P/N 0180305H20. 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.

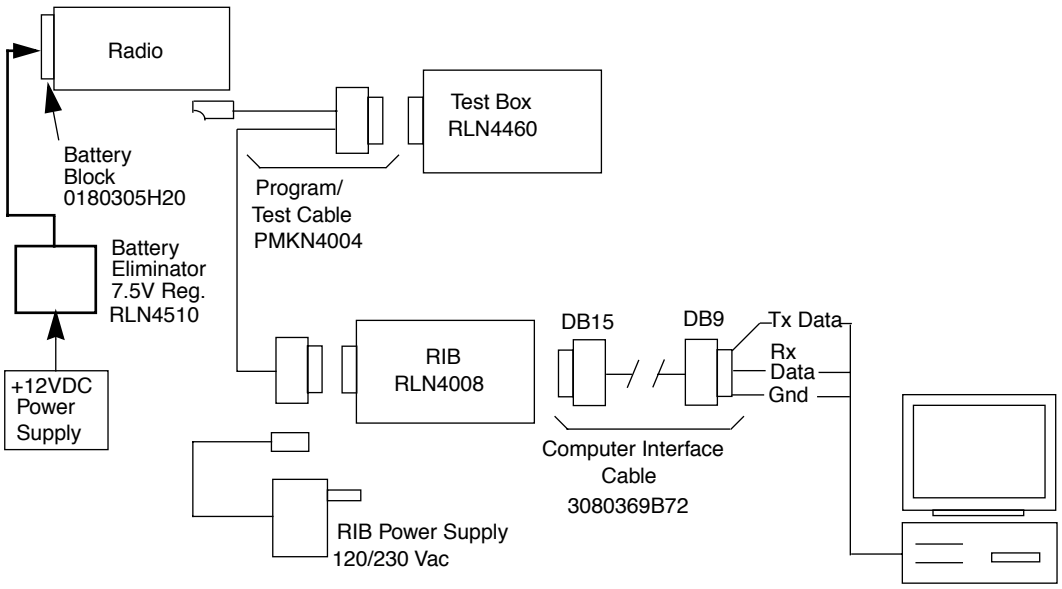


Figure 5-2 CPS Programming Setup

Chapter 6

POWER UP SELF-TEST

1.0 Error Codes

Turning on the radio using the on/off volume control starts a self-test routine which checks the RAM, ROM checksum, EEPROM hardware and EEPROM checksum. If these checks are successfully completed, the radio will generate the Self-Test Pass Tone. If the self-test is not successful one of the following error messages will be displayed and a 300 Hz tone is heard.

- ❑ “RAM ERR” for <RAM Test Error>
- ❑ “ROM CS” for <ROM Checksum Error>
- ❑ “EPM ERR” for <EEPROM Hardware Test Error>
- ❑ “EPM CS” for <EEPROM Checksum Error>

NOTE A radio without a display emits only the 300 Hz tone if it fails the self-test.

Error Code	Explanation	Corrective Action
“RAM ERR”	RAM Test Failure	Retest radio by turning it off and turning it on again. If message re-occurs, replace main board or send radio to nearest Motorola Depot.
“ROM CS”	ROM Checksum is wrong.	Reprogram FLASH Memory, then retest. If message re-occurs, replace main board or send radio to nearest Motorola Depot.
“EPM ERR”	Codeplug structure mismatch, non existence of codeplug.	Reprogram codeplug with correct version and retest radio. If message re-occurs, replace main board or send radio to nearest Motorola Depot.
“EPM CS”	Codeplug checksum is wrong.	Reprogram codeplug.
No Display	Display module is not connected properly. Display module is damaged.	Check connection between main board and display module. Replace with new display module.
300Hz Tone (Radio without display)	1. RAM Test Failure 2.Codeplug Check sum is wrong. 3. ROM Checksum is wrong	Retest radio by turning it off and turning it on again. Reprogram Codeplug and retest. Reprogram FLASH Memory, then retest. If message re-occurs, replace main board or send the radio to the nearest Motorola Depot.

Chapter 7

MODEL CHARTS AND TECHNICAL SPECIFICATIONS

1.0 Model Chart (VHF)

P040 /P080 VHF (136 - 174 MHz)				
Model				Description
MDH34KDC9AA1AE				P040 VHF 136 - 174 MHz 4W
	MDH34KDH9AA6AE			P080 VHF 136 - 174 MHz 4W
			Item	Description
X			PMLD4167_	P040 Back Cover Kit
	X		PMLD4169_	P080 Back Cover Kit
X			PMUD1623_	P040 Tanapa
	X		PMUD1626_	P080 Tanapa
X			PMLN4351_	P040 Front Housing Kit
	X		PMLN4353_	P080 Front Housing Kit
X			6864110B67	P040 Basic User Guide
	X		6864110B68	P080 Basic User Guide
X	X		PMAD4023_	VHF 150-161 MHz Antenna
X	X		PMNN4018_	Battery, NiMH Standard

x = Indicates one of each is required.

2.0 Model Chart (UHF)

P040 / P080 UHF (403 - 470 MHz)				
Model				Description
MDH34RDC9AA1AE				P040 UHF 403-470MHz 4W
	MDH34RDH9AA6AE			P080 UHF 403-470MHz 4W
			Item	Description
X			PMLE4182_	P040 UHF Back Cover Kit
	X		PMLE4184_	P080 UHF Back Cover Kit
X			PMUE1626_	P040 Tanapa
	X		PMUE1629_	P080 Tanapa
X			PMLN4351_	P040 Front Housing Kit
	X		PMLN4353_	P080 Front Housing Kit
X			6864110B67	P040 Basic User Guide
	X		6864110B68	P080 Basic User Guide
X	X		NAE6483_	UHF Whip (403-470 MHz) Antenna
X	X		PMNN4018_	Battery, NiMH Standard

x = Indicates one of each is required.

3.0 Model Chart (UHF2)

P040 / P080 UHF2 (450 - 527 MHz)				
Model				**Description**
MDH34SDC9AA1AE				P040 UHF2 450-527MHz 4W
	MDH34SDH9AA6AE			P080 UHF2 450-527MHz 4W
			Item	**Description**
X			PMLE4185_	P040 Back Cover Kit
	X		PMLE4187_	P080 Back Cover Kit
X			PMUE1630_	P040 Tanapa
	X		PMUE1632_	P080 Tanapa
X			PMLN4351_	P040 Front Housing Kit
	X		PMLN4353_	P080 Front Housing Kit
X			6864110B67	P040 Basic User Guide
	X		6864110B68	P080 Basic User Guide
X	X		PMAE4008_	UHF 14cm (465-527MHz) Antenna
X	X		PMNN4018_	Battery, NiMH Standard

x = Indicates one of each is required.

4.0 Technical Specifications

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

General Specifications	VHF/UHF/UHF2
Channel Capacity **P040** **P080**	 4 16
Power Supply	7.5v ± 20%
Dimensions: H x W x D (mm) With standard high capacity NiMH battery With NiCD battery	 137 x 57.5 x 37.5 137 x 57.5 x 40
Weight: (gm) With Standard high capacity NiMH battery With NiCD battery	 429 454
Average Battery Life @5/5/90 Duty Cycle: With Standard high capacity NiMH battery With NiCD battery	Low Power / High Power 10 hours / 8 hours 10 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 UHF1 403 - 470MHz UHF2 450 - 527MHz
Channel Spacing	12.5/20/25 kHz
Frequency Stability (-30°C to +60°C) (+25°C reference)	0.00025%
Power (NiMH @ 7.5V)	Low High 1W 5W
Modulation Limiting	±2.5 @12.5kHz ±4.0 @20kHz ±5.0 @25kHz
FM Hum & Noise	-40 dB typical
Conducted/Radiated Emission	-66 dBw
Audio Response: (From 6dB/Octave pre-emphasis, 300 - 3000 Hz)	+1 to -3 dB
Audio Distortion: @ 1000 Hz, 60% Rated Maximum Dev.	3% typical

Receiver	
*Frequencies - Full Bandsplit	VHF 136 - 174 MHz UHF1 403 - 470MHz UHF2 450 - 527MHz
Frequency Stability (-30°C to +60°C) (+25°C reference)	0.00025%
Sensitivity (12 dB SINAD) EIA	0.25 μV
Intermodulation EIA	70 dB
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%
Hum and Noise	-45dB@ 12.5kHz -50dB@25kHz
Audio Response (300-3000Hz)	+1 to -3dB
Conducted Spurious Emission	-57dBm<1GHz -47dBm>1GHz

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

All specifications shown are typical. Radios meet applicable regulatory requirements.