



# **Commercial Series CM Radios**

Service Maintainability

## **Computer Software Copyrights**

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## SAFETY INFORMATION

Read this information before using your radio.

### PRODUCT SAFETY AND RF EXPOSURE FOR MOBILE TWO-WAY RADIOS INSTALLED IN VEHICLES OR AS FIXED SITE CONTROL STATIONS.

This document provides information and instructions for the safe and efficient operation of Motorola Mobile Two-Way Radios. The information provided in this document supersedes information contained in user guides published prior to **February 2002**.

#### RF Energy Exposure Awareness and Control Information, and Operational Instructions for FCC Occupational Use Requirements

**Note:** This radio is intended for use in occupational /controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC/ICNIRP limits. This radio device is NOT authorized for general population, consumer or any other use.

This 2-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organisations to develop standards for safe exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection.

All Motorola 2-way radios are designed, manufactured and tested to ensure they meet government-established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of 2-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Please refer to the following Web sites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

<http://www.fcc.gov/oet/rfsafety/rf-faq.html>

<http://www.osha.gov/SLTC/radiofrequencyradiation/index.html>

#### Federal Communications Commission Regulations (US markets only)

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for mobile 2-way radios before they can be marketed in the U.S. When 2-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information. Your Motorola 2-way radio has an RF exposure product label. Do not remove this RF exposure label from the device. Also, your Motorola user manual, or separate safety booklet, includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

#### Compliance with RF Exposure Standard

Your Motorola radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. **This radio complies with IEEE and ICNIRP exposure limits for occupational/controlled RF** exposure environments at duty factors of up to 50% talk–50% listen and is authorised by the IEEE/ICNIRP for occupational use. In terms of measuring RF energy for compliance with these exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

## Your Motorola two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2003
- ANATEL, Brasil Regulatory Authority, Resolution 256 (April 11, 2001) "additional requirements for SMR, cellular and PCS product certification."

## RF Exposure Compliance and Control Guidelines and Operating Instructions

To control exposure to yourself and others and to ensure compliance with the RF exposure limits, always adhere to the following procedures.

### Guidelines:

- User awareness instructions should accompany device when transferred to other users.
- Do not use this device if the operational requirements described herein are not met.

### Instructions:

- **Transmit no more than the rated duty factor of 50% of the time.** To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of measuring for standards compliance).
- **Transmit only when people outside the vehicle are at least the recommended minimum lateral distance away, as shown in Table 1, from the body of a vehicle with a properly installed antenna.** This separation distance will ensure that there is sufficient distance from a properly installed (according to installation instructions) externally-mounted antenna to satisfy the RF exposure requirements in the standards listed above.

**Note:** Table 1 lists the recommended lateral distance for bystanders in an uncontrolled environment from the body of a vehicle with an approved, properly installed transmitting antenna (i.e monopoles over a ground plane, or dipoles) at several different ranges of rated radio power for mobile radios installed in a vehicle.

**Table 1:** Recommended Lateral Distances

Mobile Radio Rated Power (see Note below)	Minimum Lateral Distance From Vehicle Body
Less than 7 Watts	20 cm (8 Inches)
7 to 15 Watts	30 cm (1 Ft)
16 to 39 Watts	60 cm (2 Ft)
40 to 110 Watts	90 cm (3 Ft)

If you are not sure of the rated power of your radio, contact your Motorola representative or dealer and supply the radio model number found on the radio model label. If you cannot determine the rated power out, then assure 90cms (3 feet) separation from the body of the vehicle.

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## Mobile Antenna Installation Guidelines

- These mobile antenna installation guidelines are limited to metal body motor vehicles or vehicles with appropriate ground planes.
- Antennas should be installed in the centre area of the roof or the trunk lid taking into account the bystander exposure conditions of backseat passengers and according to the specific instructions and restrictions in the Radio Installation Manual along with the requirements of the antenna supplier.
- Trunk lid installations are limited to vehicles with clearly defined flat trunk lids, and in some cases, to specific radio models and antennas. See the Radio Installation Manual for specific information on how and where to install specific types of approved antennas to facilitate recommended operating distances to all potentially exposed persons.
- **Use only Motorola-approved supplied antenna or a Motorola approved replacement antenna.** Unauthorised antennas, modifications, or attachments could damage the radio and may result in non-compliance with RF Safety Standards.

## Approved Accessories

- This radio has been tested and meets the RF Safety Standards when used with the Motorola accessories supplied or designated for this product. Use of other accessories may result in non-compliance with RF Safety Standards.
- For a list of Motorola approved antennas, please see your dealer or local Motorola contact. Your nearest dealer can be found at the following web site:  
<http://www.motorola.com/cgiss/emea/dealerlocator.html>

## Additional Information

- For additional information on exposure requirements or other training information, visit <http://www.motorola.com/rfhealth>

## Compliance and Control Guidelines and Operating Instructions for Mobile Two-Way Radios Installed as Fixed Site Control Stations

If mobile radio equipment is installed at a fixed location and operated as a control station or as a fixed unit, the antenna installation must comply with the following requirements in order to ensure optimal performance and compliance with the RF energy exposure limits in the standards and guidelines listed on page iv:

- The antenna should be mounted outside the building on the roof or a tower if at all possible.
- As with all fixed site antenna installations, it is the responsibility of the licensee to manage the site in accordance with applicable regulatory requirements and may require additional compliance actions such as site survey measurements, signage, and site access restrictions in order to insure that exposure limits are not exceeded.

## Electromagnetic Interference/Compatibility

**Note:** Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed or otherwise configured for electromagnetic compatibility. It may be necessary to conduct compatibility testing to determine if any electronic equipment used in or around vehicles or near fixed site antenna is sensitive to external RF energy or if any procedures need to be followed to eliminate or mitigate the potential for interaction between the radio transmitter and the equipment or device.

### Facilities

To avoid electromagnetic interference and/or compatibility conflicts, **turn off your radio in any facility where posted notices instruct you to do so.** Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

### Vehicles

To avoid possible interaction between the radio transmitter and any vehicle electronic control modules, such as, ABS, engine, or transmission controls, the radio should be installed only by an experienced installer and that the following precautions be used when installing the radio:

1. Refer to the manufacturer's instructions or other technical bulletins for recommendations on radio installation.
2. Before installing the radio, determine the location of the electronic control modules and their harnesses in the vehicle.
3. Route all radio wiring, including the antenna transmission line, as far away as possible from the electronic control units and associated wiring.

### Driver Safety

Check the laws and regulations on the use of radios in the area where you drive. Always obey them. **When using your radio while driving, please:**

- Give full attention to driving and to the road.
- Pull off the road and park before making or answering a call if driving conditions so require.

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## OPERATIONAL WARNINGS

### Vehicles with an air bag



**WARNING:** Do not mount or place a mobile radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a 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 the vehicle.

### Potentially Explosive Atmospheres



**WARNING:** Turn off your radio prior to entering any area with a potentially explosive atmosphere. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

**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. Areas with potentially explosive atmospheres are often but not always posted.

### 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** For radios installed in vehicles fueled by liquefied petroleum gas, refer to the (U.S.) National Fire Protection Association standard, NFPA 58, for storage, handling, and/or container information. For a copy of the LP-gas standard, NFPA 58, contact the National Fire Protection Association, One Battery Park, Quincy, MA.





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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:	08 00 29 75 41	Italy:	80 08 77 387
Belgium:	08 00 72 471	Luxemburg:	08 00 23 27
Denmark:	80 88 05 72	Netherlands:	08 00 22 45 13
Finland:	08 00 11 49 910	Norway:	80 01 11 15
France:	08 00 90 30 90	Portugal:	08 00 84 95 70
Germany:	08 00 18 75 240	Spain:	90 09 84 902
Greece:	00 80 04 91 29 020	Sweden:	02 07 94 307
UK :	08 00 96 90 95	Switzerland:	08 00 55 30 82
Ireland:	18 00 55 50 21	Iceland:	80 08 147

Or dial the European Repair and Service Centre:

Tel: +49 30 6686 1555

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 part orders should be directed to :

**Motorola GmbH  
Customer Care  
AM Borsigturm 130  
13507 Berlin  
Germany.**

## 2.5 EMEA Test Equipment Support

Information related to support and service of Motorola Test Equipment is available via Motorola Online (Extranet), through the Customer Care organisation of Motorola's local area representation or by calling the the European Repair and Service Centre: Tel: +49 30 6686 1555

## 2.6 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**  
 Telephone: +46 8 735 9282  
 Fax: +46 8 735 9280  
 Email: C14749@email.mot.com

**Germany -Customer Connect Team**  
 Telephone: +49 (0) 30 6686 1539  
 Fax: +49 (0) 30 6686 1916  
 Email: cgiss.emea@europe.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** - Armand Roy  
 Telephone: +33 1 6929 5715  
 Fax: +33 1 6929 5778  
 Email: armand.roy@Motorola.com

## 2.7 Related Documents

The following documents are directly related to the use and maintainability of this product.

Title	Language	Part Number
CM Series Product Manual	English	GMLN1062_
	German	GMLN1063_
	French	GMLN1064_
	Italian	GMLN1065_
	Spanish	GMLN1066_
	Russian	GMLN1067_

### 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 mobile radio model number and its specific characteristics.

**Table 1-1** Radio Model Number (Example: MDM50FNC9AN2\_N)

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
<b>MD</b> = Motorola Internal Use ↑	<b>M</b> ↑ <b>M</b> = Mobile	50	<b>F</b> Midband (66-88MHz)	<b>N</b> 1-25W	<b>C</b> CM140 CM340	<b>9</b> Program- mable	<b>AA</b> Conven- tional MDC	<b>1</b> RF Connector : Mini-UHF	<b>A</b>	<b>N</b>
			<b>J</b> VHF1 (136-162MHz)							
			<b>K</b> VHF2 (146-174MHz)							
			<b>Q</b> UHF1 (403-430MHz)							
			<b>R</b> UHF2 (438-470MHz)	<b>Q</b> 25-45W						
			<b>S</b> UHF3 (465-495MHz)							

# Chapter 2

## MAINTENANCE

### 1.0 Introduction

This chapter of the manual describes:

- preventive maintenance
- safe handling of CMOS devices
- repair procedures and techniques

### 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

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 servicing 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. Aerosol sprays, tuner cleaners, and other chemicals should be avoided.**

#### 1. Cleaning External Plastic Surfaces

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

#### 2. Cleaning Internal Circuit Boards and Components

Isopropyl alcohol 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. Upon completion 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

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of radios. CMOS characteristics make them 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 CMOS CAUTION paragraph in the Disassembly and Reassembly section of the manual.

## 4.0 General Repair Procedures and Techniques

### IC Pre-Baking

No pre-baking of components is required in the repair of this product.

### Parts Replacement and Substitution

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

### Rigid Circuit Boards

The 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 through-plated holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.

When soldering near the 18-pin and 40-pin connectors:

- avoid accidentally getting solder in the connector.
- be careful not to form solder bridges between the connector pins
- closely examine your work for shorts due to solder bridges.



## Chip Components

Use either the RLN4062 Hot-Air Repair Station or the Motorola 0180381B45 Repair Station for chip component replacement. When using the 0180381B45 Repair Station, select the TJ-65 mini-thermojet hand piece. On either unit, adjust the temperature control to 370 °C (700 °F), and adjust the airflow to a minimum setting. Airflow can vary due to component density.

### ■ To remove a chip component:

1. Use a hot-air hand piece and position the nozzle of the hand piece approximately 0.3 cm (1/8") above the component to be removed.
2. Begin applying the hot air. Once the solder reflows, remove the component using a pair of tweezers.
3. Using a solder wick and a soldering iron or a power desoldering station, remove the excess solder from the pads.

### ■ To replace a chip component using a soldering iron:

1. Select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads.
2. Using a pair of tweezers, position the new chip component in place while heating the fresh solder.
3. Once solder wicks onto the new component, remove the heat from the solder.
4. Heat the remaining pad with the soldering iron and apply solder until it wicks to the component. If necessary, touch up the first side. All solder joints should be smooth and shiny.

### ■ To replace a chip component using hot air:

1. Use the hot-air hand piece and reflow the solder on the solder pads to smooth it.
2. Apply a drop of solder paste flux to each pad.
3. Using a pair of tweezers, position the new component in place.
4. Position the hot-air hand piece approximately 0.3 cm (1/8" ) above the component and begin applying heat.
5. Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

## Shields

Removing and replacing shields will be done with the R1070 station with the temperature control set to approximately 215°C (415°F) [230°C (445°F) maximum].

### ■ To remove the shield:

1. Place the circuit board in the R1070 circuit board holder.
2. Select the proper heat focus head and attach it to the heater chimney.
3. Add solder paste flux around the base of the shield.
4. Position the shield under the heat-focus head.
5. Lower the vacuum tip and attach it to the shield by turning on the vacuum pump.
6. Lower the focus head until it is approximately 0.3 cm (1/8") above the shield.
7. Turn on the heater and wait until the shield lifts off the circuit board.
8. Once the shield is off, turn off the heat, grab the part with a pair of tweezers, and turn off the vacuum pump.
9. Remove the circuit board from the R1070 circuit board holder.

### ■ To replace the shield:

1. Add solder to the shield if necessary, using a micro-tipped soldering iron.
2. Next, rub the soldering iron tip along the edge of the shield to smooth out any excess solder. Use solder wick and a soldering iron to remove excess solder from the solder pads on the circuit board.
3. Place the circuit board back in the R1070 circuit board holder.
4. Place the shield on the circuit board using a pair of tweezers.
5. Position the heat-focus head over the shield and lower it to approximately 0.3 cm (1/8") above the shield.
6. Turn on the heater and wait for the solder to reflow.
7. Once complete, turn off the heat, raise the heat-focus head and wait approximately one minute for the part to cool.
8. Remove the circuit board and inspect the repair. No cleaning should be necessary.

## 5.0 Notes For All Schematics and Circuit Boards

\* Component is frequency sensitive. Refer to the Electrical Parts List for value and usage.

1. Unless otherwise stated, resistances are in Ohms ( $k = 1000$ ), and capacitances are in picofarads (pF) or microfarads ( $\mu F$ ).
2. DC voltages are measured from point indicated to chassis ground using a Motorola DC multimeter or equivalent. Transmitter measurements should be made with a  $1.2 \mu H$  choke in series with the voltage probe to prevent circuit loading.
3. Interconnect Tie Point Legend:

Signal Name	Signal Description
16_8MHz	16.8MHz Reference Frequency from Synthesizer to ASFIC
3V	3V RF regulator
5V	5V RF regulator
5V_CH	Optional 5V for Control Head
9V	Regulated 9.3V Supply Voltage
9R	9V to enable RX_INJ when RX_EN is active
ASFIC_CS	ASFIC Chip Select
B+	13.8V Supply Voltage
BATT_SENSE	Battery Voltage Sense Line
BOOT_EN_IN_CH	Boot Mode Select
BW_SEL	Select BW (12.5 KHz, 25 KHz)
CH_ACT	Channel Activity Indicator Signal (Fast Squelch)
COMM_DATA_SEL_CH	Display Driver Command/ Data Select
D3_V3	Regulated 3.3V supply voltage for Voice Storage
DEM0D	Audio Output Signal from the Receiver IC
DETECTOR_AUDIO_SEND_BRD	Flat Audio to Option Board
DISPLAY_CS_CH	Control Head Chip Select
EMERGENCY_ACCES_CONN	Emergency line to switch on the radio voltage regulators
EMERGENCY_SENSE	Emergency sense to $\mu P$
EXTERNAL_MIC_AUDIO_ACCES_CONN	External (from accessory connector) microphone input
F1200	Interrupt line from ASFIC CMP
FILT_SW_B+	Switched 13.8 V supply voltage
FLAT_TX_AUDIO_INPUT_ACCESS_CONN	Flat TX input from accessory connector
HANDSE_RX_AUDIO_CH	Handset Audio Output
HOOK_CH	Hang-up switch input
HSIO	High Speed Clock In / Data Out
IGNITION	Ignition Line to switch on the radio's voltage regulator
KEYPAD_COL_CH	Keypad Matrix Column
LOC_DIST	Enable Attenuator for RX line
LSIO	Low Speed Clock In / Data Out
MIC_AUDIO_CH	Microphone Input

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MIC_PTT_CH	Microphone PTT Input
MOD_IN	Modulation Signal from ASFIC
MOD_OUT	Modulation Signal to the Synthesizer
ONOFF_SENSE	On off sense switch
OPT_DATA_R_OPRD	DATA/Ready Request from Option Board
OPT_EN_OPBD	Option Board Chip Select
PA_BIAS	PA Control bias voltage
PA_CURRENT	Not used
POST_LIMITER_TX	Flat TX Input from Option Board
AUDIO_RETURN_OPT_BRD	
PROG x IN ACC y	General Purpose Input x accessory connector Pin y
PROG x INOUT ACC y	General Purpose Input/Output x accessory connector Pin y
PROG x OUT ACC y	General Purpose Input x accessory connector Pin y
PWR_SET	PA Power Control Voltage
RESET	Reset Line
RSSI	Received Signal Strength Indicator
RX	RX signal
RX AUD RTN	Option Board Input/Output of Receiver Audio Path
RX_AUDIO_OUTPUT_ACCESS_CONN	Flat or filtered audio to accessory connector
RX_EN	Enable Receiving
RX_INJ	RF signal from VCO into the Receiver
SCI_CH	Bi-directional serial communication line
SHIFT_R_CS	SPI Chip select for the Control Head
SPI_CLK	Serial peripheral interface bus CLOCK
SPI_MISO	Serial peripheral interface bus data IN
SPI_MOSI	Serial peripheral interface bus data OUT
SPKR-	Negative Audio PA Speaker Output
SPKR-	Negative Audio PA Speaker Output
SPKR+	Positive Audio PA Speaker Output
SQ_DET	Squelch Detect Signal
SYNTH_CS	Synth Chip Select
SYNTH_LOCK	μP Clock Lock Signal
TX AUDIO_RETURN_OPT_BRD	Option Board Output to Transmit Audio Path
TX AUDIO_SEND_OPT_BRD	Microphone Audio to Option Board
TX_INJ	RF signal from the VCO to transmitter PA
TX_EN	Enable transmitting
UNMUTED RX_AUDIO_SEND_OPT_BRD	Unmuted filtered audio to option board
uP_CLK	μP Clock signal
VoL_INDIRECT	Volume Pot Input
VOX	Voice operated transmit level

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VS AUDIO_SEL	Switch signal to Enable option board audio output signal
VS GAIN_SEL	Voice Storage Gain Select line
VS_MIC	Voice Storage Audio Signal to microphone path
VS_INT	Voice Storage Interrupt line
VS_RAC	Voice storage Row Address Clock Signal
VSTBY	3.3 V supply for $\mu$ P when the radio is switched off



# Chapter 3

## SERVICE AIDS

### 1.0 Recommended Test Tools

Table 3.1 lists the service aids recommended for working on the radio. 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 audio/accessory jack. Allows switching for radio testing.
GMVN5034_	Customer Programming Software (CPS) and Tuner CDROM (MDC)	Programs customer options and channel data. Tunes hardware parameters, front end, power, deviation etc.
GMVN5033_	Customer Programming Software (CPS) and Tuner CDROM (5-Tone)	Programs customer options and channel data. Tunes hardware parameters, front end, power, deviation etc.
RKN4081_	Programming Cable with Internal RIB	Includes radio interface box (RIB) capability.
FKN8096_	Data/Flash Adapter	Used with RKN4081 (10 to 8 pin adapter for front Telco connector with CPS/Flash switch for programming/flashing only).
RKN4083_	Mobile Programming/Test Cable	Connects radio to RIB (RLN4008_) via rear accessory connector
FKN8113_	Adapter Cable	Used with RKN4083 (20 to 16 pin adapter for rear accessory connector).
GTF374_	Program Cable	Connects RIB to Radio microphone input.
RLN4008_	Radio Interface Box	Enables communications between radio and computer's serial communications adapter.
HLN8027_	Mini UHF to BNC Adaptor	Adapts radio antenna port to BNC cabling of test equipment.
GPN6133_	Power Supply	Provides the radio with power when bench testing.
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).
8180384N64	Housing Eliminator (25W)	Test Fixture used to bench test the radio pcb.
3080369B71	Computer Interface Cable	Connects the RIB to the Computer (25-pin).

**Table 3-1** Service Aids

<b>Motorola Part No.</b>	<b>Description</b>	<b>Application</b>
3080369B72	Computer Interface Cable	Connects the RIB to the Computer (9-pin) (Use for IBM PC AT - other IBM models use the B71 cable above).
6686119B01	Removal Tool	Assists in the removal of radio control head.
6680334F39	Hex Tool	Assists in the removal of antenna connector.
WADN4055A	Portable Soldering Station	Digitally controlled soldering iron.
6604008K01	0.4mm Replacement Tip	For WADN4055A Soldering iron.
6604008K01	0.8mm Replacement Tip	For WADN4055A Soldering iron.
0180386A82	Anti-static Grounding Kit	Used for all radio assembly/disassembly procedures.
6684253C72	Straight Prober	
6680384A98	Brush	
1010041A86	Solder (RMA type)	63/37, 0.5mm diameter, 1lb. spool.



## 2.0 Test Equipment

Table 3-2 lists test equipment required to service the radio 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
*R1072_	Digital Multimeter		AC/DC voltage and current measurements
*R1377_	AC Voltmeter	100 $\mu$ 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_ 0180305F17 0180305F31 0180305F40 RLN4610_ T1013_	Wattmeter, Plug-in Elements Plug-in Elements Plug-in Elements Carry case RF Dummy Load	Thru-line 50-Ohm, $\pm$ 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
R1011_/220V	220V Power Supply	0-40V, 0-40A	Programmable

