



Professional Radio GM Series

Detailed Service Manual

6864115B62-B

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Professional Radio

GM Series

Service Maintainability

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SAFETY AND GENERAL INFORMATION

IMPORTANT INFORMATION ON SAFE AND EFFICIENT OPERATION

Read this information before using your radio.

The information provided in this document supersedes the general safety information contained in user guides published prior to July 2000. For information regarding radio use in a hazardous atmosphere please refer to the Factory Mutual (FM) Approval Manual Supplement or Instruction Card, which is included with radio models that offer this capability.

Radio Frequency (RF) Operational Characteristics

To transmit (talk) you must push the Push-To-Talk button; to receive (listen) you must release the Push-To-Talk button. When the radio is transmitting, it generates radio frequency (RF) energy; when it is receiving, or when it is off, it does not generate RF energy.

PORTABLE RADIO OPERATION AND EME EXPOSURE

Your Motorola radio is designed to comply with the following national and international standards and guidelines regarding exposure of human beings to radio frequency electromagnetic energy:

- 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
- National Council on Radiation Protection and Measurements (NCRP) of the United States, Report 86, 1986
- 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 1999 (applicable to wireless phones only)

To assure optimal radio performance and make sure human exposure to radio frequency electromagnetic energy is within the guidelines set forth in the above standards, always adhere to the following procedures:

Phone operation

When placing or receiving a phone call, hold your phone as you would a wireline telephone. Speak directly into the microphone.

Two-way radio operation

When using your radio hold the radio in a vertical position with the microphone 2.5 to 5 cm away from the lips.

Body-worn operation

To maintain compliance with FCC RF exposure guidelines, if you wear a radio on your body when transmitting, always place the radio in a Motorola approved clip, holder, holster, case, or body harness for this product. Use of non-Motorola-approved body worn accessories may exceed FCC RF exposure guidelines. If you do not use a Motorola approved body-worn accessory and are not using the radio in the intended use positions along side of the head in the phone mode or in front of the face in the two-way radio mode, then ensure the antenna and radio is kept the following minimum distances from the body when transmitting:

- Phone or Two-way radio mode: 2.5 cm (one inch)
- Data operation using any data feature with or without an accessory cable: 2.5 cm (one inch) .

Antenna Care

Use only the supplied or an approved replacement antenna. Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.

DO NOT hold the antenna when the radio is "IN USE". Holding the antenna affects call quality and may cause the radio to operate at a higher power level than needed.

Approved Accessories

For a list of approved Motorola accessories please contact your dealer or local Motorola representative.

ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY

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

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.

Aircraft

When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with applicable regulations per airline crew instructions.

Medical Devices

Pacemakers

The Health Industry Manufacturers Association recommends that a minimum separation of 15 cms (6 inches) be maintained between a handheld wireless radio and a pacemaker. These recommendations are consistent with those of the U.S. Food and Drug Administration.

Persons with pacemakers should:

- ALWAYS keep the radio more than 15 cms (6 inches) from their pacemaker when the radio is turned ON.
- not carry the radio in the breast pocket.
- use the ear opposite the pacemaker to minimize the potential for interference.
- turn the radio OFF immediately if you have any reason to suspect that interference is taking place.

Hearing Aids

Some digital wireless radio products may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer to discuss alternatives.

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from RF energy. Your physician may be able to assist you in obtaining this information.

Safety and General

Use While Driving

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.
- Use hands-free operation, if available.
- Pull off the road and park before making or answering a call if driving conditions so require.

OPERATIONAL WARNINGS

For 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 product may be propelled with great force and cause serious injury to occupants of vehicle.

NOTE

The areas with potentially explosive atmospheres referred to above include fueling 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.

Potentially Explosive Atmospheres



WARNING: Turn off your radio prior to entering any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas as "Intrinsically Safe" (for example, Factory Mutual, CSA, UL or CENELEC Approved). Do not remove, install, or charge batteries in such areas. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

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.

OPERATIONAL CAUTIONS

Antennas

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

Batteries

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.

MOBILE RADIO OPERATION AND EME EXPOSURE

To assure optimal radio performance and that human exposure to radio frequency electromagnetic energy is within the guidelines referenced earlier in this document, transmit only when people outside the vehicle are at least the minimum lateral distance away from a properly installed, externally-mounted antenna. Table 1 lists the minimum distance for several different ranges of rated radio power.

Table 1: Table 1 Rated Power and Lateral Distance

Radiated Power of Vehicle-installed Mobile Two-way	Minimum Lateral Distance From Transmitting
Less than 7 Watts	20 cm (8 Inches)

Table 1: Table 1 Rated Power and Lateral Distance

Radiated Power of Vehicle-installed Mobile Two-way	Minimum Lateral Distance From Transmitting
7 to 15 Watts	30 cm (1 Ft)
16 to 50 Watts	60 cm (2 Ft)
More than 50 Watts	90 cm (3 Ft)

ANTENNA INSTALLATION

Mobile Antennas

Recommended mobile antenna installations are limited to metal body vehicles at the centre of the roof and centre of the trunk deck locations.

The antenna installation must additionally be in accordance with:

- a) The requirements of the antenna manufacturer/supplier
- b) Instructions in the Radio Installation Manual

Fixed Site Antennas

Mobile radio equipment is sometimes installed at a fixed location and operated as a control station or as a fixed unit. In such cases the antenna installation must comply with the following requirements in order to assure optimal performance and make sure human exposure to radio frequency electromagnetic energy is within the guidelines set forth in the above standards:

- The antenna must be mounted outside the building
- Mount the antenna on a tower if at all possible
- If the antenna is to be mounted on a building then it must be mounted on the roof.

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.

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:	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:	1 55 30 82
Ireland:	18 00 55 50 21	Iceland:	80 08 147

Or dial Customer Care Centre:

Tel: +49 6128 70 2618

Please use these numbers for repair enquiries only.

2.4 Parts Identification and Ordering

Request for help in identification of non-referenced spare parts should be directed to the Customer Care Organisation of Motorola's local area representation. Orders for replacement parts, kits and assemblies should be placed directly on Motorola's local distribution organisation or via Motorola Online (Extranet).

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 Motorola switchboard in Germany on telephone number: +49 6128 700.

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

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

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

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

Russian Regional Repair Operations:
 Telephone: +7 095 785 01 89

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

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

Central Europe (Germany, Benelux, Austria & Switzerland) - Customer Connect
 Telephone: +49 (0) 6128 70 2248
 Fax: +49 (0) 6128 95 1082
 Email: cgiss.emea@europe.mot.com

Motorola Support Centre South Africa:
 Telephone: +27 11 254 4000

2.7 Related Documents

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

Title	Language	Part Number
GM100 Series Product Manual	English	ENLN4147
GM300 Series Product Manual	English	ENLN4137
	German	ENLN4138
	French	ENLN4139
	Italian	ENLN4140
	Spanish	ENLN4141
GM600/GM1200 Series Product Manual	Russian	ENLN4142
	English	ENLN4143
	German	ENLN4144
	French	ENLN4145
	Russian	ENLN4146

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: MDM25KHC9AN1AE)

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
MD = Motorola Internal Use ↑	M ↑ M = Mobile	25	K VHF (136-174MHz)	H 1-25W	C GM140, GM340, GM640	9 Program- mable	AN Conventional 5 Tone	1 GM140 GM340 GM640	A	E
			R UHF 1 (403-470MHz)	K 25-40W 40-60W	N GM380, GM1280		AA Conventional MDC	O Databox (5Tone)		
			S UHF 2 (450-527MHz)		F GM160 GM360 GM660		CK MPT	5 GM160 GM360 GM660		
			B LB1 29-36MHz		A Databox			8 GM380 GM1280		
			C LB2 36-42MHz					7 Databox (MPT)		
			D LB3 42-50MHz							

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 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

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 (μF).
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 $1.2 \mu\text{H}$ choke in series with the voltage probe to prevent circuit loading.

3. Interconnect Tie Point Legend:

16_8MHz	16.8MHz Reference Frequency
3V3	Regulated 3.3V Supply Voltage for Voice Storage
5V	Regulated 5V Supply Voltage for RF Circuitry
5V	Regulated 5V Supply Voltage (Control Head)
5V RF	Regulated 5V Supply Voltage for RF Circuitry
5V SOURCE	5V Signal to Switch On Control Head
5VD	Regulated 5V Supply Voltage for Digital Circuitry
9V3	Regulated 9.3V Supply Voltage
9V3FLT	Filtered 9.3V Supply Voltage
A+	13.2V Supply Voltage
ADDR	*P Address Lines
AN	Analog Lines to Analog to Digital Converter
ANALOG INPUT 2	External Keypad Matrix Column Signal
ANALOG INPUT 3	External Keypad Matrix Row Signal
BATTERY VOLTAGE	Battery Voltage Sense Line
BL A GREEN	Back Light Anode Green
BL A RED	Back Light Anode Red
BL GREEN	Green Back Light Control
BL K GREEN	Back Light Cathode Green
BL K RED	Back Light Cathode Red
BL KP Green	Green Keypad Back Light Control
BL KP RED	Red Keypad Back Light Control
BL LCD GREEN	Green Display Back Light Control
BL LCD RED	Red Display Back Light Control
BL RED	Red Back Light Control
BOOT CNTRL	Bootstrap Mode Enable Signal
BOOT MODE	Boot Mode Select
BOOT PWR ON	Control Head Switch On Signal
BOOT SCI RX	Serial Communication Interface Receive Line
BOOT SCI TX	Serial Communication Interface Transmit Line
BOOT VPP	Boot Mode Select
BUS+	Bi-directional Serial Communication Line
BWSELECT	Signal to select between the Ceramic Filter Pairs

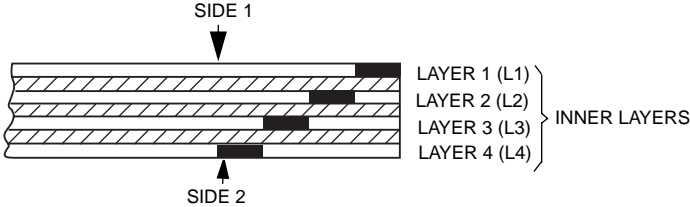
CH ACT	Channel Activity Indicator Signal (Fast Squelch)
CH KP ID	Control Head Keypad ID (Data) Lines
CH REQUEST	Control Head Request from Control Head *P
CLK	Clock Signal
CNTLVLTG	PA Power Control Voltage
CNTR AUDIO	Audio Lines of the Controller
COL x	Keypad Matrix Column x
CSX	Chip Select Line PCIC / FRACN
DATA	Data Signal
DC POWER ON	Electronic Switching On or Off of the Radio's Voltage Regulators
DISCAUDIO	Audio Output Signal from the Receiver IC
ECLK	Clock (not used)
EE CS	EEPROM Chip Select
EMERGENCY CONTROL	Emergency Line to switch on the Radio's Voltage Regulators
EXP BD REQ	Service Request Line from Expansion Board
EXP1 CS	Expansion Board Chip Select 1
EXP2 CS	Expansion Board Chip Select 2
EXT KP COL	External Keypad Matrix Column Signal
EXT KP ROW	External Keypad Matrix Row Signal
EXT MIC	External (from Accessory Connector) Microphone Input
EXT SWB+	External Switched 13.2V Supply Voltage
F1200	Interrupt Line from ASFIC CMP
FECTRL 1	Control Voltage for Front End Filter
FECTRL 2	Control Voltage for Front End Attenuator Switch
FLASH CE	Flash Chip Select
FLASH OE	Flash Output Enable
FLAT RX SND	Option Board Audio Output Signal
FLAT TX RTN	Flat TX Input from Option Board and Accessory Connector
FLT A+	Filtered 13.2 V Supply Voltage
GP x IN	General Purpose Input x
GP x IN ACC y	General Purpose Input x from Accessory Connector Pin y
GP x IN OUT ACC y y	General Purpose Input /Output x from Accessory Connector Pin y
GP x OUT	General Purpose Output x
GP x OUT ACC y	General Purpose Input x from Accessory Connector Pin y
GPIO	General Purpose Input Output Lines
HANDSET AUDIO	Handset Audio Output
HOOK	Hang-up Switch Input
HSIO	High Speed Clock In / Data Out
IF	First Intermediate Frequency Signal
IGNITION CONTROL	Ignition Line to switch on the Radio's Voltage Regulators

IN 5V RF REG	Supply Voltage for 5V Regulator in RF Section
INT KP COL	Internal Keypad Matrix Column Signal
INT KP ROW	Internal Keypad Matrix Row Signal
INT MIC	Internal (from Control Head) Microphone Input
INT SWB	Internal Switched 13.2V Supply Voltage
INT SWB+	Internal Switched 13.2V Supply Voltage
IRQ	Interrupt Request from Control Head
K9V1	9.1V in Transmit Mode
KEYPAD ID	Keypad Identification Line
LCD A0	LCD Control / Display Data Select
LCD CS	LCD Chip Select
LCD DATA	LCD Data Lines
LCD E RD	LCD Enable Read
LCD RW WR	LCD Read Write Control
LED CNTRL	LED Control Lines
LED GREEN	Green LED Control
LED RED	Red LED Control
LED YELLOW	Yellow LED Control
LOCK	Lock Detect Signal from Synthesizer
LSIO	Low Speed Clock In / Data Out
LVZIF CS	LVZIF Chip Select (not used)
MIC	Microphone Input
MISO	Serial Peripheral Interface Receive Line
MODIN	Modulation Signal into the Synthesizer
MOSBIAS 2	PA Bias Voltage for second Stage
MOSBIAS 3	PA Bias Voltage for third Stage
NOISE BLNKR	Noise Blanker Enable (Low Band only)
ON OFF CONTROL	Service Request Line from Control Head / Manual Switching On of the Radio's Voltage Regulators
ON OFF SENSE (Control Head)	On Off Sense Line to Control Head *P
ON OFF SENSE (Controller)	Service Request Line from Control Head
OPT CS	Option Board Chip Select
OPT PTT	PTT from Option Board
PA PWR SET	ASFIC Output Voltage to set the Transmitter Power
PA SWB	Switches Supply Voltage for PA Current Control Circuitry
PASUPVLTG	13.2 V Supply Voltage of the Transmitter PA
PCIC MOSBIAS 1	PA Bias Voltage for first Stage
PRESC	Prescaler Signal from VCO to Synthesizer
PTT IRDEC	Microphone PTT Input
PTT IRDECODER	Microphone PTT Input
R W	Read Write Signal for RAM / Flash

RAM CS	RAM Chip Select
RDY	Service Request Line from Option Board
REF CS	Reference Chip Select (not used)
RESET	Reset Line
ROW x	Keypad Matrix Row x
RSSI	Received Signal Strength Indicator
RX ADAPT	Flat TX Path Disable during Transmitter Key-up
RX AUD RTN	Option Board Input / Output of Receiver Audio Path
RX FLAT FILTERED AUDIO	Flat or Filtered Audio to Accessory Connector
RXIN	RF Signal from Antenna Switch into the Receiver
RXINJ	RF Signal from the VCO into the Mixer
SCI RX	Serial Communication Interface Receive Line
SCI TX	Serial Communication Interface Transmit Line
SPI	Serial Peripheral Interface Bus
SPKR-	Negative Audio PA Speaker Output
SPKR+	Positive Audio PA Speaker Output
SQ DET	Squelch Detect Signal
SYN	*P Clock Signal
TEMP SENSE	Temperature Sense Line for LCD
TEMPSENSE	Temperature Sense Line from PA to *P
TRB	TX/RX VCO Switch Signal
TX AUD RTN	Option Board Output to Transmit Audio Path
TX AUD SND	Microphone Audio to Option Board
TXINJ	RF Signal from the VCO into the Transmitter PA
U DRIVER	Supply Voltage for PA Driver
U PREDRIVER	Supply Voltage for PA Pre-driver
UNSW 5V	Permanent 5V Supply
URX SND	Filtered Audio Signal to Option Board
VAG	2.5V Reference Voltage for Analog Circuitry
VCBIAS 1	Switch Signal from Synthesizer
VCBIAS 2	Switch Signal from Synthesizer
VCOMOD	Modulation Signal into VCO
VCTRL	VCO Frequency Control Voltage
VDDA	Regulated 5V for Digital Circuitry in RF Section
VOLTAGE SENSE	Voltage Sense Line from LCD
VOLUME	Volume Pot Output
VOX	Voice Operated Transmit Level
VPP	Boot Mode Select
VS AUDIOSEL	Switch Signal to Enable Option Board Audio Output Signal
VS GAINSEL	Voice Storage Gain Select Line
VS INT	Voice Storage Interrupt Line

VS MIC	Voice Storage Audio Signal into Microphone Path
VS RAC	Voice Storage Row Address Clock Signal
VSF	Voltage Super Filtered (5V)
VSTBY	5V Supply for *P when the Radio is switched off

4-LAYER CIRCUIT BOARD DETAIL VIEWING
COPPER STEPS IN PROPER LAYER SEQUENCE



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 Number	Description	Application
RLN4460_	Portable Test Set	Enables connection to audio/accessory jack. Allows switching for radio testing.
RKN4081_	Programming Cable with Internal RIB	Includes radio interface box (RIB) capability.
RLN4853_	10 to 20 Pin Adapter	Connects RKN4081_ to the radio accessory connector.
RKN4083_	Mobile Programming/Test Cable	Connects radio to RIB (RLN4008_).
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)
8180384J59	Housing Eliminator (short)	Test Fixture used to bench test the radio pcb
8180384L95	Housing Eliminator (short + top)	Test Fixture used to bench test the radio pcb. (Radio using pressure pads to retain pcb)
8180384J60	Housing Eliminator (medium)	Test Fixture used to bench test the radio pcb
8180384J61	Housing Eliminator (long)	Test Fixture used to bench test the radio pcb
3080369B71	Computer Interface Cable	Connects the RIB to the Computer (25-pin)
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.

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 Number	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 widerange troubleshooting and alignment
R2680_NT	Comms System Analyzer (MPT1327) to be ordered with RLN1022_ (H/W) RLN1023_ (S/W)	This monitor will substitute for items with an asterisk*.	Frequency/deviation meter and signal generator for widerange troubleshooting and alignment
*R1072_	Digital Multimeter		AC/DC voltage and current measurements
*R-1377_	AC Voltmeter	100 μ V to 300V, 5Hz - 1MHz, 10Megohm input impedance	Audio voltage measurements
WADN133	Delay Oscilloscope	2 Channel 40MHz bandwidth, 5mV/cm - 20 V/cm	Waveform measurements
R1440_ 0180305F17 0180305F31 0180305F39 RLN4610 T1013_	Wattmeter, Plug-in Elements Plug-in Elements Plug-in Elements Carry case RF Dummy Load	ThruLine 50-Ohm, \pm 5% accuracy 100W, 25 - 60MHz 25W, 100-250MHz 10W, 200-250MHz Wattmeter and 6 elements	Transmitter power output measurements
S1339_	RF Millivolt Meter	100mV to 3 VRF. 10kHz to 1.2GHz	RF level measurements
R1011_/220V	220V Power Supply	0 - 40V 0 - 40A	Programmable