MOTOROLA

Professional Radio
GP Series

Detailed Service Manual

68P64115B32E

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Contents

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SAFETY AND GENERAL INFORMATION

IMPORTANT INFORMATION ON SAFE AND EFFICIENT OPERATION
Read this infomation 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 cm (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 cm (6inches) 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.

Professional Radio
GP Series

Service Maintainability

Issue: June 2002

Computer Software Copyrights

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Chapter 1
INTRODUCTION

1.0 Scope of Manual

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

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

2.0 Warranty and Service Support

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

2.1 Warranty Period and Return Instructions

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

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

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

2.2 After Warranty Period

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

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

2.3 European Radio Support Centre (ERSC)

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

Austria:	06 60 75 41	Italy:	16 78 77 387
Belgium:	08 00 72 471	Luxemburg:	08 00 23 27
Denmark:	80 01 55 72	Netherlands:	60 22 45 13
Finland:	08 00 11 49 10	Norway:	80 01 11 15
France:	05 90 30 90	Portugal:	05 05 49 35 70
Germany:	0800 1875240	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 2164

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.

Parts identification and ordering

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

EMEA Test Equipment Support

Information related to support and service of Motorola Test Equipment is available via Motorola Online (Extranet), through the Customer Care Organization of Motorola's local area representation or by calling the Motorola switchboard in Germany using phone no. +49 6128 700.

2.5 Technical Support

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

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

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

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

Scandinavia
Telephone: +46 8 735 9282
Fax: +46 8 735 9280

Central Europe (Germany, Benelux, Austria & Switzerland) - Customer Connect
Telephone: +49 (0) 6128 70 2266
Fax: +49 (0) 6128 95 1685
Email: cgiss.emea@europe.mot.com

France - Armand Roy
Telephone: +33 1 6929 5715
Fax: +33 1 6929 5904
Email: armand.roy@motorola.com

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

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

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

2.6 Related Documents

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

Title	Language	Part Number
GP140 Product Manual	English Russian	ENLN4071 ENLN4072
GP300 Series Product Manual	English German French Italian Spanish Russian	ENLN4073 ENLN4074 ENLN4075 ENLN4076 ENLN4130 ENLN4077
GP600 Series Product Manual	English German French Russian	ENLN4078 ENLN4079 ENLN4080 ENLN4081
GP1280 Product Manual	English German French	ENLN4082 ENLN4083 ENLN4084
GP200/GP500 Series Product Manual	English	ENLN5000

3.0 Radio Model Information

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

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

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
MD = Motorola Internal Use	**H** = Portable	**25**	**K** VHF (136-174MHz)	**D** 4-5W	**C** GP140, GP320, GP240, GP340, GP540. GP640.	**9** Program-mable	**AA** Conventional MDC	**O** GP320	**A**	**E**
			R UHF 1 (403-470MHz)	**E** 5-6W	**H** GP280 GP380 GP580 GP680	**6** Non Program-mable	**AN** Conventional 5 Tone	**3** GP140 GP240 GP340 GP540 GP640		
			S UHF 2 (450-527MHz)	C 2-2.5W	**N** GP1280		**CK** MPT	**5** GP360		
			B LB1 29-42MHz		**F** GP360		**PW** MPT/5T	**6** GP280 GP380 GP580 GP680		
			C LB2 35-50MHz				**FB** Privacy Plus	**8** GP1280		
			E 300R1 (300-350MHz)				**FC** SmartZone			
			U 800 MHz (806-870MHz)							

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

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 20-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.

Flexible Circuits

The flexible circuits are made from a different material than the rigid boards and different techniques must be used when soldering. Excessive prolonged heat on the flexible circuit can damage the material. Avoid excessive heat and excessive bending.

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

To replace a component on a flexible circuit:

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

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

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.

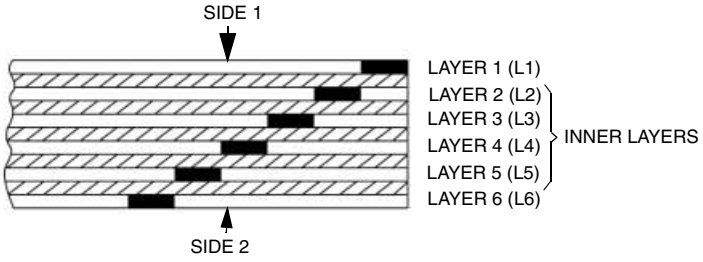
1. Unless otherwise stated, resistances are in Ohms (k = 1000), and capacitances are in picofarads (pF) or microfarads (µF).

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 µF choke in series with the voltage probe to prevent circuit loading.

3. Interconnect Tie Point Legend:

UNSWB+	=	Unswitch Battery Voltage (7.5V)
SWB+	=	Switch Battery Voltage (7.5V)
R5	=	Receiver Five Volts
CLK	=	Clock
Vdda	=	Regulated 3.3 Volts (for analog)
Vddd	=	Regulated 3.3 Volts (for digital)
CSX	=	Chip Select Line (not for LVZIF)
SYN	=	Synthesizer
DACRX	=	Digital to Analog Voltage (For Receiver Front End Filter)
VSF	=	Voltage Super Filtered (5 volts)
VR	=	Voltage Regulator

6-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 & Mobile Test Set	Enables connection to the audio/ accessory jack. Allows switching for radio testing.
RKN4074_	RIB/Radio/Test Set Interconnect Cable (for all Models except GP1280).	Connects radio to Computer.
RKN4075_	Programming Cable with internal RIB (for all Models except GP1280).	Connects radio to Computer.
RLN4008_	Radio Interface Box (RIB).	Enables communications between the radio and the computer's serial communications adapter.
5885705M01	BNC Adaptor	Adapts radio's antenna port to BNC cabling of test equipment.
5880384G68	SMA to BNC Adaptor	Adapts radio's antenna port to BNC cabling of test equipment, 800MHz only.
HKN9743_	MAP27 Cable (for GP1280 only).	Connects radio to computer for MAP27 applications in MPT requirements.
HLN9742_	Flash Upgrade Adapter	Provides connections to the computer or RIB programming /test cable.
RLN4510_	Battery Elliminator 7.5 VDC	Includes protection circuit.
0180305G54	Battery Adapter to RLN4510	Connects radio to Battery Elliminator.
8180384F68	Bench Test Housing Eliminator (for all Models except GP1280).	Provides for troubleshooting of the radio when the housing is removed.
8180384F66	Bench Test Housing Eliminator (long housing, GP1280 only).	Provides for troubleshooting of the radio when the housing is removed.
EPN4040_	Wall-Mounted Power Supply (UK).	for RLN4008
EPN4041_	Wall-Mounted Power Supply (220VAC).	for RLN4008
3080369B71	Computer Interface Cable	25 to 9 pin (RLN4008_ to IBM PC).
3080369B72	Computer Interface Cable	9 to 9 pin (RLN4008_ to IBM PC).

Table 3-2 lists the recommended tools used for maintaining this family of radios. These tools are also available from Motorola..

Table 3-2 Recommended Test Tools

Motorola Part Number	Description	Application
6680702Z01	Chassis opener and knob removal tool.	Disassembly tool
RSX4043_	Torx Driver	Tighten and remove chassis screws.
6680387A70	T-6 Torx Bit	Removable Torx driver bit (2 pcs).
WADN4055_ 6604008K01 6604008K02	Portable soldering station 0.4mm replacement tip 0.8mm replacement tip	Digitally controlled For WADN4055_ soldering Iron For WADN4055_ soldering Iron
1010041A86	Solder (RMA type), 63/37, 0.5mm diameter 1 lb. spool.	
0180386A78	Illuminated magnifying glass with lens attachment.	
0180386A82	Anti-static grounding kit.	Used during all radio assembly and disassembly procedures.
0180303E45	SMD tool kit incl. probers and brush.	
R1321_	Shields and surface-mounted component and IC removal/rework station (order all heat-focus heads separately).	Removal and assembly of surface-mounted integrated circuits and shields.
6680332E82 6680332E84 6680333E55 6680332E90	Nozzle 20.3 x 20.3 mm Nozzle 12.7 x 12.7 mm Nozzle 16.5 x 25.4 mm Nozzle 24.1 x 24.1 mm	Heat-focus heads for R1321_ work station.

2.0 Test Equipment

Table 3-3 lists test equipment required to service the radio and other two-way radios.

Table 3-3 Recommended Test Equipment

Motorola Part Number	Description	Characteristics	Application
R2600_	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.
RLN5069_	Tracking Generator Option.		Option for R2600_
RLN4361_	CCITT Filter.	with 600 Ohm Meter Load.	Option for R2600_
RLN4423_	Spectrum Analyzer and Oscilloscope with Markers.	High Performance option.	Option for R2600_
RLN4485_	Test Set Ups Memory.	Programmable	Allows storage of complete screen values.
1580357B77	Canvas Case	Protects Units	When used in the Field.
or			
R2680_HS	Comms System Analyzer (MPT1327)	This monitor will substitute for items with an asterisk*.	Frequency/deviation meter and signal generator for widerange troubleshooting and alignment.
RLN1022_	MPT1327 Hardware		Option for R2680_HS
RLN1023_	MPT1327 Software		Option for R2680_HS
RLN4361_	CCITT Filter	with 600 ohm Meter Load	Option for R2680_HS
RLN4423_	Spectrum Analyzer and Oscilloscope with Markers	High Performance option.	Option for R2680_HS
1580357B77	Canvas Case	Protects Units	When used in the Field.
or			
R2670_	Comms System Analyzer with FDMA.	This monitor will substitute for items with an asterisk*.	Frequency/deviation meter and signal generator for widerange troubleshooting and alignment.
RLN4498_	Analog Trunking Smartnet/Zone.		Option for R2670_
1580357B77	Canvas Case	Protects Units	When used in the Field.
* WADN4133_	Oscilloscope	Analog 2 Channel 40MHz bandwidth, 5mV/cm - 20 V/cm.	Waveform measurements.
* R1072_	Digital Multimeter		AC/DC voltage and current measurements.
* R1377_	AC Voltmeter	100µV to 300V, 5Hz - 1MHz, 10Mohm input impedance.	Audio voltage measurements.

Motorola Part Number	Description	Characteristics	Application
* R1440_ * 0180305F14 * 0180305F29 * 0180305F38 * 0180305F46 * RLN5417 * T1013_	Wattmeter, Plug-in Element Plug-in Element Plug-in Element Plug-in Element Carry case for Wattmeter RF Dummy Load	Thruline 50-Ohm, ±5% accuracy 10W, 25 - 60MHz 5W, 100-250MHz 5W, 200-500MHz 5W, 400-1000MHz plus elements	Transmitter power output measurements.
WADN4243_	Power Supply (220V)	Bench top	Programmable
S1339_/220	RF Millivolt Meter	100mV to 3 V RF. 10kHz to 1.2GHz	RF level measurements.
0100855414	RF Cable	2 male BNC Conn. 1.5m (3 pcs needed)	