



MOTOROLA

Mobile Products Division

M400

29.7-50 MHz Low Band
110 Watt Two-Way FM Radio

150-174 MHz VHF
100 Watt Two-Way FM Radio

450-470 MHz UHF
100 Watt Two-Way FM Radio



THIS MANUAL HAS BEEN
DISCONTINUED

Service Manual

6880901Z56-0



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Safe Handling of CMOS Integrated-Circuit Devices

Many of the integrated-circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open-circuit impedance, CMOS IC's are vulnerable to damage from static charges. Everyone involved in handling, shipping, and servicing them must be extremely careful not to expose them to such damage.

CMOS IC's do have internal protection, but it is effective only against overvoltages in the hundreds of volts, such as those that could occur during normal operations. Overvoltages from static discharge can be in the thousands of volts.

When a CMOS IC is installed in a system, the system's circuit elements distribute static charges and load the CMOS circuits. This decreases the vulnerability of the IC's to static discharge, but improper handling will probably cause static damage even when the IC's are so installed.

To avoid damaging CMOS IC's, take the following precautions when handling, shipping, and servicing them.

1. Before touching a circuit module, particularly after having moved around in the service area, touch both hands to a bare metal earth-grounded surface. This discharges any static charge you may have accumulated.

Note

Wear a conductive wrist strap (Motorola Part No. RSX-4015A) to minimize the buildup of static charges on your person while you are servicing CMOS equipment.

WARNING

When wearing a conductive wrist strap, be careful near sources of high voltage. By grounding you thoroughly, the wrist strap also increases the danger of lethal shock from accidental contact with such a source.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.
3. Check the INSTALLATION and MAINTENANCE sections of the service manual and the notes on the schematic to find out whether or not you can insert or remove circuit modules with power applied to the unit, and act accordingly.

4. When servicing a circuit module, avoid carpeted areas, dry environments, and the wearing of static-generating clothing.
5. Be sure that all electrically powered test equipment is grounded. Attach the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe before removing the ground lead.
6. When you remove a circuit module from the system, lay it on a sheet of aluminum foil or other conductive surface connected to ground through 100,000 ohms of resistance.

WARNING

If the aluminum foil is connected directly to ground, you may get a shock if you touch it and another electrical circuit at the same time.

7. When soldering, be sure the soldering iron is grounded.
8. Before connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary during the replacement of an integrated-circuit device), be sure to discharge any static buildup on your person (see Procedure 1, above). Because you can have a voltage difference across your body, you should use only one hand if you must touch the board wiring or any of the pins on the CMOS device.
9. When replacing a CMOS integrated-circuit device, leave the device in its metal rail container or conductive foam until you are ready to insert it into the pronged circuit module.
10. Connect any low-impedance test equipment such as a pulse generator to CMOS device inputs after you have applied power to the CMOS circuitry. Similarly, disconnect such low-impedance equipment before turning off the power.
11. Wrap CMOS modules in conductive material when transporting them from one area to another, even within the same room. Use wrapping material similar to that in which replacement modules are wrapped when they arrive from the factory. (You can also use aluminum foil.) Never use nonconductive material for packaging these modules.

1. General Safety Information

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard that applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave, and rural telephone RF equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

Installation Safety Warning

Consider the occupants' safety when you choose a location for the radio. Do not mount the radio overhead or on a sidewall unless you take special precautions.

If someone were to remove the radio and fail to replace it properly, road shock could bump the radio loose, and the falling radio could in some circumstances cause serious injury to the driver or a passenger.

If you must mount the radio overhead or on a sidewall, give it the added protection of a retaining strap. Custom-made straps are available from Motorola National Parts. Order kit number HLN4698A (M400).

WARNING

For vehicles equipped with electronic anti-skid braking systems, see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

WARNING

To gain full access to the Common Circuits Board for servicing, the regulator heat sink screw must be removed. When operating the radio with the regulator heat sink screw removed, care should be taken to avoid the exposed hot flange.

WARNING

It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard.

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP-gas container and its fittings are located.
2. Remote (outside) filling connections shall be used.
3. The container space shall be vented to the outside.

INSTALLATION NOTICE

THIS RADIO IS WEATHERPROOF, NOT WATERPROOF

This radio meets the standards of MIL810D. This means the radio must remain functional after undergoing a number of tests, including a rain test (exposure for two hours to water sprayed at various flow rates in an air stream moving over the radio at 40 mph), a dust test (exposure for 28 hours to air-blown sand at higher-than-normal ambient temperatures), and a salt fog test (exposure for 48 hours to a mist of a 5% solution of salt in water).

These tests do not immerse or submerge the radio in water or chemicals. They prove the radio to be weatherproof, not submersible. For installations that subject the radio to more stringent conditions, the radio must have extra protection.

CAUTION

If the radio is exposed to the weather, or if the area where the radio is cleaned by spraying with water, then DO NOT mount the radio with the handle up if you must mount it vertically. It is possible that moisture can accumulate in recessed areas of the radio and, if not removed promptly, that moisture will seep inside the radio and damage the electronic components.

The protection the radio requires varies with the circumstances, of course. It may be as simple as drain holes drilled in the bottom of a tool box, or the reorientation of the radio so that its cable connector area points down instead of up. A low platform of wood or sheet metal may raise the radio above the level of water that normally accumulates during cleaning operations in a vehicle. Some circumstances, however, demand that the radio be protected with a waterproof enclosure or shroud—or be installed in an altogether different location.

2. FCC LICENSING

FCC LICENSING INFORMATION

Your M400 radio operates on FM radio communication frequencies and is subject to the Rules and Regulations of the Federal Communications Commission (FCC). The FCC requires that all operators using Private Land Mobile or General Mobile Radio frequencies obtain a radio license before operating their equipment. Application for your FCC license is made on FCC Form 574 for low band, high band, and UHF frequencies. For a license in the 800 MHz band, you must complete the Form 574 and 574-A Supplemental form. These forms as well as a booklet entitled "Form 574 Instructions" can be obtained from the FCC Supply Section, Administrative Services Division, 1919 M St., NW, RM B-10, Washington DC 20554; telephone 202-632-7272.

The operator receives a license for use of the radio equipment under a specific eligibility and on a particular frequency or set of frequencies. To determine eligibility for use of Private Land Mobile Service frequencies, see FCC Rules and Regulations, Part 90. These may be found in the Code of Federal Regulations (CFR) at 47 C.F.R. Part 90. The following subparts describe general eligibility requirements:

Subpart B: Public Safety Radio Services

Subpart C: Special Emergency Radio Services

Subpart D: Industrial Radio Services, which include, among others, Business, Manufacturers and Special Industrial Services

Subpart E: Land Transportation Radio Service

Eligibility for use of the General Mobile Radio Service frequencies is found under Part 95 of the Rules and Regulations, 47 C.F.R. 95, subpart A.

Frequency coordination is now required for operation on most frequencies in the Private Land Mobile Radio Services. Once the license application form is completed it must be forwarded to the appropriate frequency coordination agency which is determined by the operator's eligibility classification. The coordination agency assigns a frequency or frequency pair to the application and forwards it on to the FCC for final processing. There is a frequency coordination fee which must be included with the license application. Current fee charges can be obtained by calling your appropriate frequency coordination agency.

An exception to the requirement for frequency coordination in the Private Land Mobile Radio Services is licensing for use of itinerant frequencies. Itinerant operation is defined by the FCC as operation of a radio station at unspecified locations for varying periods of time. Those applications do not need frequency coordination and may be sent directly to FCC. Frequency coordination is also NOT required for licenses in the General Mobile Radio Service and these applications are also sent to the FCC. See the reverse side for these FCC addresses.

The FCC charges a processing fee for all new, modified or renewal license applications. This fee is payable by check or money order made out to the "Federal Communications Commission" and MUST be enclosed with the application. Any application without a check will be returned. (Exception: Applicants who are governmental entities and all applicants in any Public Safety or Special Emergency Radio Service are exempt from the FCC license fee.) Applications requiring coordination must have the FCC check, as well as the coordinator's check, attached when mailed to the coordinating agency. The coordinating agency will remove their check and will forward the coordinated application and FCC check on to the FCC Licensing Division. Upon grant, the FCC will mail your radio station license to the address shown on your application Form 574.

If your eligibility is within the Business Radio Service, contact the National Association of Business and Education Radio (NABER) for the NABER fee schedule and supplemental form to be completed and forwarded with Form 574 to:

NABER Frequency Coordination
1501 Duke St., Suite 200
Alexandria, VA 22314
Tel 703-739-0300

The Business Radio Service itinerant frequencies are 27.49 MHz, 35.04 MHz, 151.625 MHz, 469.500 MHz pair and 464.550, 469.550 MHz pair. Complete Form 574 and send to:

FCC-Business Radio Service
PO Box 360291-M
Pittsburgh, PA 15251-6291
Tel 717-337-1212

If your eligibility is within the Special Industrial Radio Service, contact the Special Industrial Radio Service Association (SIRSA) for the SIRSA fee schedule. Complete Form 574 and send to:

SIRSA Frequency Coordination Dept.
1700 N. Moore St. Suite 910
Rosslyn, VA 22209
Tel 703-528-5115

The Special Industrial Radio Service itinerant frequencies are 43.04 MHz, 151.505 MHz, 158.400 MHz, and 451.800, 456.800 MHz pair. Complete Form 574 and send to:

FCC-Other Industrial Services
PO Box 360354-M
Pittsburgh, PA 15251-6354
Tel 717-337-1212

If your eligibility is within the Manufacturer Radio Service, contact Manufacturers Radio Frequency Advisory Committee (MRFAC) for the MRFAC fee schedule and supplemental form to be completed and forwarded with Form 574 to:

MRFAC, Inc.
6269 Leesburg Pike, Suite 304
Falls Church, VA 22044
Tel 703 532-7459

If you want to operate on General Mobile Radio Service frequencies, complete Form 574 and send to:

FCC-General Mobile Radio Service
PO Box 360373-M
Pittsburgh, PA 15251-6373
Tel 717-337-1212

For information on other frequency coordinating agencies or additional licensing information, contact the FCC, 205 M St. NW, Washington, DC 20554; telephone 202-632-7272.

3. Programming

The M400 radios can be programmed in the field to these parameters:

Receive and Transmit frequencies.
Transmit Frequency Adjustment (warp).
PL or DPL encode and decode Codes.
Transmit Power Output.
Transmit Deviation.
Time Out Timer.
Mode Slaved Scan List
Rapid Call

Configuration information for programming these parameters is contained in the Radius RADIO SERVICE SOFTWARE package (HVN9774).

A personal computer (PC.) and the appropriate software Diskette will be required in addition to the items listed in Recommended Test Equipment.

We strongly suggest the servicer become familiar with the programming techniques applicable to the Radius Radios.

4. Recommended Test Equipment

R2001D Communications System Analyzer

or

R2200B Service Monitor

R1011B Power Supply

R1037A Digital Multimeter

or

R1024B Digital Multimeter

5. Board Replacement and Calibration

Replacement of the Logic board, RF board, or Power Amplifier requires that recalibration must be performed with the Motorola Radio Service Software. **The procedures and tasks for calibration are covered in Part 4 in the M400 Radio Service Software Manual.**

Failure to perform the required calibration procedure will affect the performance of the Reference Oscillator, RF Power Leveling and Protection, and Transmitter Modulation over frequency and temperature. An uncalibrated radio may not comply with FCC rules and may be unreliable at temperature extremes.

The M400 Radio was designed to be serviced at the board level only. There are a number of non-field serviceable parts in the radio. They are identified in the schematic by the shaded areas. Field replacement of these parts will affect the factory calibrated numbers on the Tuning Label. If any of these parts fail, board replacement is the only way to service the radio.

Performance Specifications for Conventional Low Band M400 Radio

GENERAL

Channel Capability	99 Modes
Primary Power	12 VDC <i>negative ground only</i>
Dimensions	10.0" H x 14.5" W x 2.5" L
Weight	16 lb. (7.26 kg)
Metering	All adjustments and alignments are performed electronically using an IBM Personal Computer, a Radio Interface Box (RIB) and radio service software.
Environmental	Meets MIL-STD 810D environmental specifications for vibration, shock, rain, dust, and salt fog.

	Frequency (MHz)				Maximum Battery Current Drain			
	Range 1	Range 2	Range 3	Minimum RF Power Output	Off @ 13.8V	Standby @ 13.8V	Receiver @ 13.8V	Transmit @ Rated Power
	29.7-36	36-42	42-50	110 watts	60mA	.7 A	3.0 A	27 A

TRANSMITTER

Output Impedance	50 ohms
Spurious and Harmonic Emissions	More than 70 dB below carrier (for EIA spec. RS152B) except $F_c \pm 14.4$ MHz @ FCC
Frequency Stability	$\pm .0005\%$ of assigned center frequency
Modulation	0 to ± 5 kHz
Audio Sensitivity	0.080 V ± 4 dB for 60% maximum deviation @ 1000 Hz
Audio Response	EIA
Audio Distortion	Less than 3% @ 1000 Hz, 60% maximum deviation
Maximum Freq. Separation (MHz)	Range1-6.3; Range2-6; Range3-8
FM Hum and Noise: EIA Method	-45 dB

RECEIVER

Channel Spacing	20 kHz
Sensitivity: 12 dB EIA SINAD	(per EIA spec. RS204C) .30 μ V
Selectivity: EIA SINAD	-80 dB
Spurious & Image Rejection	-80 dB
Intermodulation: EIA SINAD	-80 dB
Input Impedance	50 ohms
Audio Output	10 watts @ less than 5% distortion (into 3.2 ohm load @ 1000 Hz)
Maximum Freq. Separation (MHz)	Range1-6.3; Range2-6; Range3-8
Frequency Stability	$\pm .0005\%$ of assigned center frequency

SPEAKER

Dimensions	5.5" x 2.5" (Excluding Mounting Bracket)
Weight	1.5 lbs. (0.7 kg)

CONTROL HEAD

Dimensions (Excluding Mounting Bracket)	6.5" H x 3.4" W x 1.7" L
Weight	.75 lb (0.4 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC TRANSCEIVER DESIGNATION

ABZ89FT1619

Performance Specifications for Conventional VHF M400 Radio

GENERAL

Channel Capability	99 Modes
Primary Power	12 VDC negative ground only
Dimensions	10.0" H x 14.5" W x 2.5" L
Weight	16 lb. (7.26 kg)
Metering	All adjustments and alignments are performed electronically using an IBM Personal Computer, a Radio Interface Box (RIB) and radio service software.
Environmental	Meets MIL-STD 810D environmental specifications for vibration, shock, rain, dust, and salt fog.

	Frequency (MHz)	Minimum RF Power Output	Maximum Battery Current Drain			
			Off @ 13.8 V	Standby @ 13.8 V	Receiver @ 13.8 V	Transmit \odot Rated Power
	150-174	75/100 watts	60mA	.7 A	3.0 A	27 A

TRANSMITTER

Output Impedance	50 ohms
Spurious and Harmonic Emissions	More than 70 dB below carrier (for EIA spec. RS152B) except $F_c \pm 14.4$ MHz @ FCC
Frequency Stability	$\pm .0005\%$ of assigned center frequency
Modulation	0 to ± 5 kHz
Audio Sensitivity	0.080 V ± 4 dB for 60% maximum deviation @ 1000 Hz
Audio Response	EIA
Audio Distortion	Less than 3% @ 1000 Hz, 60% maximum deviation
Maximum Frequency Separation	24 MHz
FM Hum and Noise: EIA Method	-45 dB

RECEIVER

Channel Spacing	30 kHz
Sensitivity: 12 dB EIA SINAD	(per EIA spec. RS204C) .30 μ V
Selectivity: EIA SINAD	-80 dB
Spurious & Image Rejection	-75 dB
Intermodulation: EIA SINAD	-75 dB
Input Impedance	50 ohms
Audio Output	10 watts @ less than 5% distortion (into 3.2 ohm load @ 1000 Hz)
Maximum Frequency Separation	24 MHz
Frequency Stability	$\pm .0005\%$ of assigned center frequency

SPEAKER

Dimensions	5.5" x 2.5" (Excluding Mounting Bracket)
Weight	1.5 lbs. (0.7 kg)

CONTROL HEAD

Dimensions (Excluding Mounting Bracket)	6.5" H x 3.4" W x 1.7" L
Weight	.75 lb (0.4 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC TRANSCEIVER DESIGNATION

ABZ89FT3731

Performance Specifications for Conventional UHF M400 Radio

GENERAL

Channel Capability	99 Modes
Primary Power	12 VDC negative ground only
Dimensions	10.0" H x 14.5" W x 2.5" L
Weight	16 lb. (7.26 kg)
Metering	All adjustments and alignments are performed electronically using an IBM Personal Computer, a Radio Interface Box (RIB) and radio service software.
Environmental	Meets MIL-STD 810D environmental specifications for vibration, shock, rain, dust, and salt fog.

Maximum Battery Current Drain

	Frequency (MHz)	Minimum RF Power Output	Off @ 13.8 V	Standby @ 13.8 V	Receiver @ 13.8 V	Transmit © Rated Power
	450-470	75/100 watts	60mA	.7 A	3.0 A	31 A

TRANSMITTER

Output Impedance	50 ohms
Spurious and Harmonic Emissions	More than 80 dB below carrier (for EIA spec. RS152B)FCC
Frequency Stability	±.00025% of assigned center frequency
Modulation	0 to ±5 kHz
Audio Sensitivity	0.080 V ±4 dB for 60% maximum deviation @ 1000 Hz
Audio Response	EIA
Audio Distortion	Less than 3% @ 1000 Hz, 60% maximum deviation
Maximum Frequency Separation	20 MHz
FM Hum and Noise: EIA Method	-40 dB

RECEIVER

Channel Spacing	25 kHz
Sensitivity: 12 dB EIA SINAD	(per EIA spec. RS204C) .30 uV
Selectivity: EIA SINAD	-75 dB
Spurious & Image Rejection	-75 dB
Intermodulation: EIA SINAD	-75 dB
Input Impedance	50 ohms
Audio Output	10 watts @ less than 5% distortion (into 3.2 ohm load @ 1000 Hz)
Maximum Frequency Separation	20 MHz
Frequency Stability	±.00025% of assigned center frequency

SPEAKER

Dimensions	5.5" x 2.5" (Excluding Mounting Bracket)
Weight	1.5 lbs. (0.7 kg)

CONTROL HEAD

Dimensions (Excluding Mounting Bracket)	6.5" H x 3.4" W x 1.7" L
Weight	.75 lb (0.4 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC TRANSCEIVER DESIGNATION

ABZ89FT4728

Model Chart for Low Band M400 Radio 29.7-36, 36-42, 42-50 MHz 110 Watt

CODE:

- = ONE ITEM SUPPLIED
- Ø = INDICATES BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION						ITEM	DESCRIPTION
		T81XTA7A7BK						
							Ø	UNIFIED CHASSIS
							•	HCN1052B ADVANCED CONTROL HEAD 99-MODE
							•	HLN5404A CONTROL HEAD HARDWARE
							•	HLN5406B ADVANCED CONTROL HEAD BOARDS
							•	HKN4321A POWER CABLE AND FUSE, ADVANCED
							•	HLN5064A ADVANCED TOOL
							•	HLN5383A ADVANCED BUTTON PLUG
							•	HMN1061A MICROPHONE
							•	HLN4921A TRUNNION
							•	HKN4051A RED FUSED LEAD
							•	HLN5372A SOFTWARE KIT
							•	HLN4022C INSTALLATION KIT
							•	HLN4023A TUNING TOOL KIT
							•	HHN4032A TOP COVER
							•	HLN4034C MOUNTING TRAY
							•	HSN4021A SPEAKER

● = ONE ITEM SUPPLIED

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Model Chart for VHF M400 Radio 150-174 MHz 75/100-Watts

CODE:

● = ONE ITEM SUPPLIED

Ø = INDICATES BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION						ITEM	DESCRIPTION
		T73XTA7A7BK						
							Ø	HUD1730A UNIFIED CHASSIS
							●	HCN1052B ADVANCED CONTROL HEAD 99-MODE
							●	HLN5404A CONTROL HEAD HARDWARE
							●	HLN5406B ADVANCED CONTROL HEAD BOARDS
							●	HKN4321A POWER CABLE AND FUSE, ADVANCED
							●	HLN5064A ADVANCED TOOL
							●	HLN5383A ADVANCED BUTTON PLUG
							●	HMN1061A MICROPHONE
							●	HLN4921A TRUNNION
							●	HKN4051A RED FUSED LEAD
							●	HLN5372A SOFTWARE KIT
							●	HLN4022C INSTALLATION KIT
							●	HLN4023A TUNING TOOL KIT
							●	HHN4032A TOP COVER
							●	HLN4034C MOUNTING TRAY
							●	HSN4021A SPEAKER

● = ONE ITEM SUPPLIED

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Model Chart for UHF M400 Radio 75/100-Watts 450-470 MHz

CODE:

● = ONE ITEM SUPPLIED

∅ = INDICATES BREAKDOWN IN SEPARATE CHART

MODEL	DESCRIPTION				ITEM	DESCRIPTION
	T74XTA7TA7BK					
					∅	HUE2107A UNIFIED CHASSIS
					●	HCN1052B ADVANCED CONTROL HEAD 99-MODE
					●	HLN5404A CONTROL HEAD HARDWARE
					●	HLN5406B ADVANCED CONTROL HEAD BOARDS
					●	HKN4321A POWER CABLE AND FUSE, ADVANCED
					●	HLN5064A ADVANCED TOOL
					●	HLN5383A ADVANCED BUTTON PLUG
					●	HMN1061A MICROPHONE
					●	HLN4921A TRUNNION
					●	HKN4051A RED FUSED LEAD
					●	HLN5372A SOFTWARE KIT
					●	HLN4022C INSTALLATION KIT
					●	HLN4023A TUNING TOOL KIT
					●	HHN4032A TOP COVER
					●	HLN4034C MOUNTING TRAY
					●	HSN4021A SPEAKER

● = ONE ITEM SUPPLIED

13

M400 Radio Service Aids

The following service aids are available through Motorola Communications Parts Division to facilitate servicing and programming the M400 Mobile Radio. Please contact 1-800-422-4210 for price and delivery.

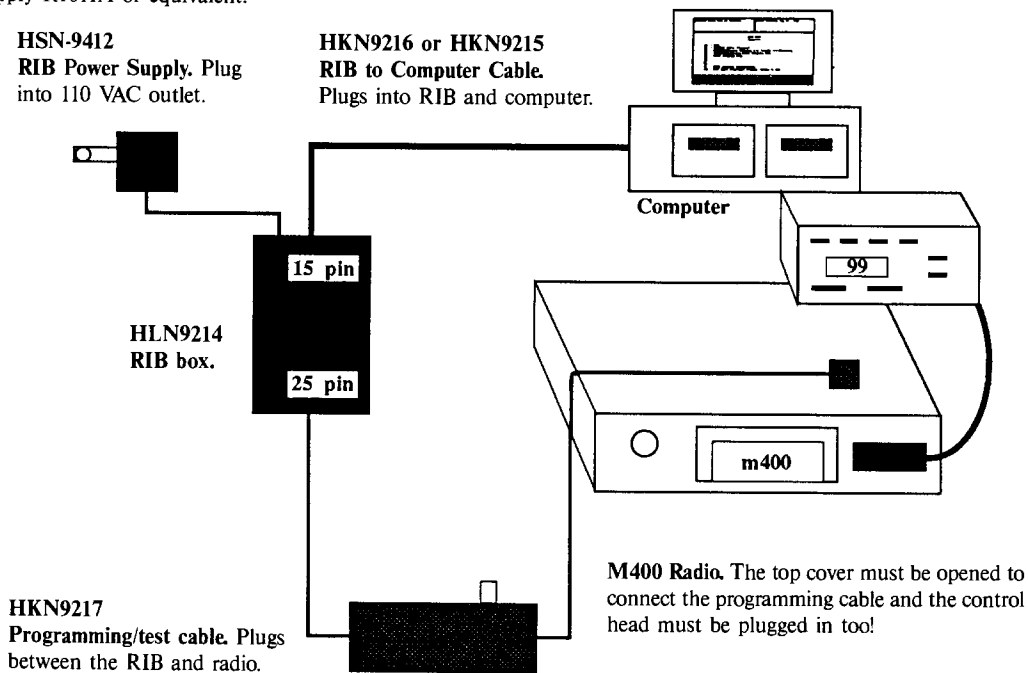
Model No.	Description
TEST CABLES AND ADAPTERS	
01-855414	TEST CABLE—BNC to BNC cable (4 ft) used with the 58-855270 adapter to connect the M400 mobile radio to the RF test instruments.
01-80355A09	TEST ADAPTER—Attaches to the Program/Test cable in place of the RIB; used to manually key the radio and to inject a tone for troubleshooting purposes.
30-80093P01	TEST CABLE—14 pin ribbon cable used to extend the RF board for servicing.
30-80373B41	VCO TEST CABLE—Provides the interface between the mobile's RF board and the test equipment for troubleshooting.
58-855270	TEST ADAPTER—BNC Female to UHF Male adapter used with the 01-855414 Test Cable to connect the M400 mobile radio to RF test instruments.
PROGRAMMING DEVICES	
HVN-9774	RADIO SERVICE SOFTWARE ON 5-1/4 INCH DISK AND 3-1/2 INCH DISK—Operates on the IBM PC, XT, AT, or PS/2 family of computers for programming and servicing of M400 mobile radios. IBM DOS 3.0 or higher, an RS-232 Asynchronous Serial Communications Adapter and RAM memory of 512 K bytes minimum are necessary for the programmer. (Includes users manual 6880901Z68.)
HLN-9214	RADIO INTERFACE BOX (RIB)—Voltage level shifter to enable communications between the radio and the computer's RS-232 Asynchronous Serial Communications Adapter. Requires the Wall Mount Power Supply (HSN-9412).
HSN-9412	WALL MOUNT POWER SUPPLY—Used to supply power to the RIB. For 120 VAC use only.
HKN-9217	PROGRAM/TEST CABLE—Provides the electrical interconnection from the programming receptacle inside the radio to the RIB (HLN-9214) for programming the M400 mobile radio.
HKN-9215A	COMPUTER INTERFACE CABLE—Used to connect the IBM PC-XT, or PS/2 computer's Asynchronous Serial Communications Adapter to the RIB.
HKN-9216A	COMPUTER INTERFACE CABLE—Used to connect the IBM PC-AT computer's Asynchronous Serial Communications Adapter to the RIB.

IBM, PC-XT, PC-AT, PS/2 are Trademarks of International Business Machines, Inc.

To run the RSS program, you will need the following equipment:

Required Equipment

1. IBM XT, AT, Convertible, or System/2 Model 30/50™ with 512K RAM, Dual Floppy Disk Drives OR one Floppy Disk and one Hard Disk
2. PCDOS™ or MSDOS™ 3.0 or later
3. Radio Interface Box (RIB) **HLN9214**
4. RIB to IBM AT cable **HKN9216** or **HKN9215** IBM XT cable
5. IBM AT cable to IBM XT computer adapter (optional) **HLN9390**
6. Programming/test cable **HKN9217**
7. RIB power supply **HSN9412**
8. Power Supply R1011A or equivalent.



Theory of Operation

1. Introduction

The M400 radio is a fully synthesized, microprocessor-controlled transceiver. All standard features are performed by software in the radio control processor.

2. Radio Features

2.1 INTERNAL STANDARD FEATURES

The M400 radio has the following standard features:

- Remote mount configuration
- High RF power
- Wide bandwidth
- 8, 16, and 99-mode models
- Microprocessor controlled
- Fully synthesized
- MDC-1200 DOS, Unit ID, Radio Check, and Emergency
- Quick-call II decode
- 10-watt audio
- Field programmable EEPROM

2.2 CONTROL HEAD

The following control head is available with the M400 radio:

An advanced control head is available for the M400 radio. This unit allows selection of up to 99 modes. Single priority scan is standard with either mode—programmable or operator—select scan list. A RCL button “recalls” the scan list for reviewing and a HOME button allows for a pre-programmed “home” mode. Also, the MPL button allows multiple PL access. This control head utilizes an electronic volume attenuator to control radio volume.

3. Electrical Characteristics

3.1 CIRCUIT BLOCKS

The radio is grouped into the following physical blocks:

- Interface board
- Squelch/Audio PA board
- Transceiver RF board
- Transceiver Controller board
- Transmitter Exciter board
- Transmitter PA

3.2 FUNCTIONAL DESCRIPTION (SEE FIGURE 1)

3.2.1 Microcomputer

The M400 radio uses the Motorola 68HC11A8 Microcomputer operating in an expanded bus mode to perform all basic radio control func-

tions. The processor is located on the transceiver controller board and operates with a 7.776 MHz clock. User information is stored in both the internal EEPROM and in a separate 2KX8 EEPROM.

3.2.2 Frequency Synthesizer

The frequency synthesizer uses a phase-locked loop (PLL) that consists of a reference oscillator, a voltage controlled oscillator (VCO), a variable modulus pre-scaler, a single chip synthesizer (which contains a programmable divider and a phase detector), a charge pump and a fixed loop filter. The frequency information, carried to the synthesizer IC via the serial clock and data line, is strobed by the synthesizer latch enable line. The reference oscillator is a discrete crystal-controlled oscillator that uses the radio processor to monitor and compensate for temperature variations.

3.2.3 Receiver

Incoming RF signals, directed by the antenna relay, pass into a 4-pole bandpass filter. From that filter, the RF signal passes through one stage of RF amplification, then to a 3-pole (4-pole LB) bandpass filter. The filtered signal then passes to the first mixer stage. Meanwhile, the synthesizer output is fed to the first mixer as a high side (10W side-VHF) local oscillator. The mixer produces a 45.1 MHz (10.7 MHz LB) first IF signal which is amplified before it passes through a 4-pole crystal filter. Additionally, blanking switches Q52 and Q53 are used on low band. Another stage of amplification occurs before the RF signal passes into the receiver subsystem IC, where the 45.1 (10.7 MHz LB) signal is mixed with 44.645 MHz (10.245 MHz LB) to produce a 455 kHz second IF signal. The second IF signal is amplified, filtered, limited, and detected by a quadrature detector.

3.2.4 Extender, LB only

After the first mixer stage CR1, the RF signal passes through the post mixer filtering comprised of bandpass selectivity circuits surrounding L51, L52, and L53. First IF amplification is provided by Q51. The IF signal divides at the base of Q51. The extender pulse detector and blanker circuits are fed by one path while the first IF amplifier Q51 is driven by the other.

The first IF amplifier Q51 amplifies the signal where it couples into the IF delay line section comprised of circuits associated with L55 and L56. After the signal passes through the delay line the signal can be blanked with the appropriated signal applied to Q52 and Q53. Post blanker isolation is provided by Q54. The signal then passes into the first 4 pole filtering section of the 10.7 MHz IF.

The Extender samples RF from the base of Q51 and drives the extender isolation amplifier Q351. Q351 in turn amplifies the signal and pulse which is then applied to the gain block U351. Q352 detects the output of U351 for further processing. Pulse shaping and amplification are accomplished by Q353, and Q354. Q355 is driven to toggle Q52 and Q53 in the IF to blank the noise pulse as it exits the IF delay line. The output of Q354 also drives a three stage AGC detector comprised of Q356, Q357, and Q358 which reduces the gain of U351 under large signal and high pulse repetition rate conditions.

3.2.5 Transmitter

The frequency synthesizer generates an RF signal at the required transmit frequency. This signal is buffered and fed to the RF exciter board for additional amplification. From the exciter board, which also contains drive and temperature limiting circuitry, the RF signal is fed to the RF PA compartment where it is amplified up to 100 watts. Finally, the antenna relay directs the RF PA output to the antenna connector.

4. Primary Power Source

The M400 radio is designed to operate from a negative ground 12-volt DC source. The negative lead is internally connected to the radio chassis.

5. Physical Characteristics

The M400 radio's rugged low-profile housing encloses its electronic circuitry. The front end of the radio houses the antenna connector, a mounting tray lock, the main cable connector, and the handle. On the back end are heatsink fins for cooling the RF PA amplifier. Inside the radio, partitions and shielding covers isolate the various radio circuits from each other. The top cover snaps on and off; four screws secure the bottom cover in place. A mounting tray is supplied with the radio.

The radio's electronic circuits are on printed circuit boards that plug together. Test points on the boards allow access to various metering points.

The radio, less control head, occupies 363 cubic inches and weighs 16 pounds (approximate values).

6. Operating Instructions

Note

Refer to the operator card supplied with each radio for information on the general use of the radio.

6.1 RADIO SELF-CHECK

When the radio is first turned on, the software executes a series of internal self-tests to check digital hardware. The following devices are tested in this order: internal RAM, external RAM, external ROM, external EEPROM, and internal EEPROM. The following audible diagnostic tones sound when a device fails:

7 beeps	Watchdog Failure
6 beeps	Internal RAM Failure
5 beeps	External RAM Failure
4 beeps	External ROM Failure
3 beeps	External EEPROM Failure
2 beeps	Internal EEPROM Failure

If one of the EEPROM areas has failed, the radio will sound five groups of error tones and then automatically enter "bootloader" mode to allow radio reprogramming. ROM and RAM failures are treated as critical errors and will not allow radio operation of any kind; the failure tones will be repeated indefinitely.

6.2 CHANNEL SCAN

The *Channel Scan* feature allows you to scan a previously defined list of valid channels (modes) for activity. One scan list mode can be assigned as the priority mode and the rest are assigned non-priority modes. The radio can be programmed such that, while scanning, if you take the microphone off-hook, the radio will either continue to scan in carrier squelch mode or it will stop scanning and revert to the selected mode. When the Monitor button is activated, the radio will scan in carrier squelch mode. When you press the PTT to talk, the transmission will take place on the selected mode.

Activate and deactivate Scan by momentarily pressing the Scan rocker. The Scan indicator light is on when Scan is activated. If no activity is detected by *Channel Scan*, the radio displays the selected mode. When activity is detected, the BUSY indicator lights solid to indicate the activity is from a non-priority mode, the active mode number is displayed, and the radio unmutes. If activity is detected on the priority channel, the BUSY indicator comes on, the PRI indicator flashes, the priority mode is displayed, and the radio unmutes. (A priority alert tone can be field programmed.) Using a field programmer, the scan list members (priority and non-priority) can be independently designated as either Mode-Slaved or Operator-Selectable. If designated as mode-slaved, the Scan list modes can only be reviewed by the operator. If designated as operator-selectable, the list can be reviewed and modified by entering the Scan Programming Mode as described below.

6.3 SCAN PROGRAMMING/CONFIGURATION MODE

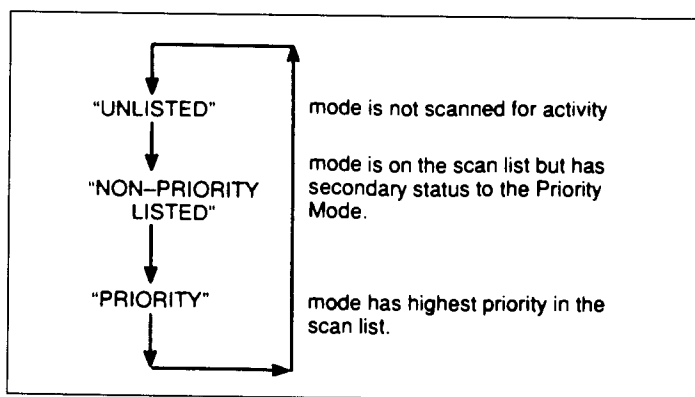
Operator-Selectable Scan lists can be reviewed and modified. Press and hold the SCAN button; an alert tone (if programmed) sounds and the SCAN indicator blinks to enunciate entry into the Scan configuration mode. Use the mode control to scroll to the desired mode. Press SEL to add the displayed mode to the list. Confirming the selection and defining the mode's "non-priority" status in the list, (1) on the handheld control head, the PRI indicator lights, or (2) on the advanced control head, the Non-Pri indicator lights. Raise the mode's status to "priority" by pressing SEL again; the PRI indicator flashes on either control head.

Note

If a different mode was previously selected as "Priority," the above procedure will affect that mode in one of two ways:

- If the non-priority scan list is programmed "operator-selectable," the mode is removed from the "priority" scan list and placed on the "non-priority" scan list.
- If the non-priority scan list is programmed "mode-slaved," the mode is no longer on any scan list.

The SEL button controls an endless loop program—that is, each press of the button changes its status from:



While in the Scan Programming mode, the radio will sound a "bad-chirp" (if programmed) when one of the following situations occur:

- You try to change the Scan status of a mode-slaved mode (priority or non-priority).
- You try to add a new mode to a non-priority scan list that is full (16 members maximum).

Exit the scan programming mode by momentarily pressing the SCAN button. The radio resumes normal operation. If Scan was activated before entering the configuration mode, the radio will resume scanning.

7. Detailed Theory of Operation

7.1 TRANSMITTER

(1) RF Circuits.

The synthesizer on the RF Board (J5) produces a low-level modulated RF signal at the carrier frequency when the microphone is keyed. The RF output level, between +12 and +16 dBm (+4.5 dBm-LB) is fed to J14 on the Exciter/Power Control board. Buffer transistor Q1601 amplifies the signal to about +16 to +19 dBm. The next stage of amplification, Q1701, amplifies the signal further before it is applied to the base of the controlled stage, Q1702 (VHF only). The power level at J11 can be as high as 2 to 3 watts (1 ohm W-1 W for UHF) when controlled B+ is near 8 volts. The output drive from J11 is applied to the RF Power Amplifier (RFPA) deck. The RFPA amplifies the signal up to rated power.

(2) Timing Circuits.

The transmit sequence is as follows: between 4 and 21 milliseconds after the PTT is pressed, the logic board sends frequency information to the RF board and the antenna relay energizes (9.6T). Between 34 and 51 milliseconds after the relay energizes, the synthesizer locks on frequency, and the DAC voltage to U451A-3 rises and brings up controlled B+ to Q1702, driving the RFPA deck and producing output power. When PTT is released, 9.6T and controlled B+ drop off, reducing output power to zero. The antenna relay drops out shortly thereafter, routing the antenna back to the receiver circuit.

(3) Power Control

As part of the tune-up procedure, the radio transmitter is adjusted for rated output power at 16 points distributed across the band. This process determines the proper DAC voltage versus carrier frequency to apply to U451A-3, in order to obtain rated power. At a given frequency, output power is controlled by maintaining a fixed current to the final amplifiers. Current to the finals is monitored from the voltage drop across R801 (R813-LB). U451B causes Q454 to conduct a small current which is proportional to the finals current. Q454 maintains a voltage drop across R902 and R911 that is identical to the voltage drop across R801 (R813-LB) on the RFPA. U451A compares the output of Q454 to the reference from the DAC (U801). U451 drives Q453, Q452, and Q451 to produce controlled B+ which supplies Q1702 the controlled stage and controls its gain in order to control RF drive to the RFPA stages. Controlled B+ fixes the amount of current that flows to the finals, resulting in a controlled amount of output power.

(4) R.F. Power Trim Potentiometer R911

Normally, potentiometer R911 is left at mid-rotation after TRANSMITTER POWER ALIGNMENT. However, potentiometer R911 may be used to trim transmitter power while the radio is in the vehicle. Antenna loading may require adjustment of R911 to increase power output. Adjust potentiometer R911 clockwise to increase power output and counter clockwise to decrease power output. Monitor all adjustments with a "thru-line" style wattmeter to measure forward and reflected powerflow. If the Output power requires adjustment more than $\pm 10\%$ to achieve rated output power, check the antenna VSWR.

(5) Protection Circuits

To prevent damage to the RFPA, the temperature of the RFPA and the drive level to the finals are monitored. Temperature is sensed by thermistor RT801 near the final transistors. Its resistance drops to about 5.4K at 97°C. This causes Q901 to conduct, dropping the voltage on the current sense low line to the logic board power control circuit. This makes it appear as if the RFPA deck is drawing too much current, and causes the power control circuit to reduce controlled B+. This reduces the drive to the RFPA deck, which reduces output power enough in extremely hot environments to prevent overheating and damage.

Operation of the drive sense circuit is similar to temperature sense. For high VSWRs at certain phase angles, less current flows through shunt resistor R801 (R813-LB). Controlled B+ rises to a high level in an attempt to produce rated power from the finals, causing an abnormally high level of RF drive to be produced by Q802 (V), Q804 (U), Q801 (LB), and possibly damaging the final transistors. This level is sensed and causes Q901 to conduct, and reducing the drive to a safe level without reducing output power significantly.

Finally, a software controlled form of protection exists. Controlled B+ voltage is monitored by U802-45, an A/D input. When controlled B+ rises above 8 volts, the microprocessor reduces the DAC voltage for the duration of the transmission, dropping the controlled B+ voltage from over 8 VDC down to about 2 to 4 VDC after about 1/2 second. This prevents the controlled stage from overheating when the radio is operating at low line voltages or into high VSWRs.

7.2 AUDIO/SQUELCH CIRCUITS

(1) Audio and Squelch

The FM detector output is routed through a low pass filter, a high pass filter, de-emphasis circuitry, and then to the control head for application to the volume control. The adjustable output of this voltage divider is then routed to the audio/squelch board for application to the respective audio circuits.

The bridge audio power amplifier circuit provides a highly efficient audio output. The circuit uses two differential power amplifiers that provide a balanced push-pull output to the speaker.

Audio is applied from the audio buffer amplifier, U1102C, to the non-inverting input of U501. The output of U501 is applied to one side of the speaker and to U500. R504 and R505 form a voltage divider that attenuates the high level output of U501 before it is applied to the inverting input of U502. The output of U502 is equal in amplitude to the output of U501 but 180 degrees out of phase.

Squelch muting is controlled at two points: at series-connected transistor Q551 and at transistor Q550. Q551 is used for squelch muting as well as for muting in the priority *Channel Scan* mode while the priority channel is being sampled. When AUDIO PA MUTE is low, Q500 turns on, discharging C523 and forward biases CR500 and CR501. This allows internal bias of U501 and U502 to increase and turn off the audio power devices. By turning off the audio power devices, current in standby mode is substantially reduced.

(2) Squelch Operation

The output from the FM detector, a combination of noise and recovered audio, is shaped and amplified by the squelch circuitry. These stages consist of a noise amplifier U1102A, squelch control pot R1132, noise filtering/detection/integration quad operational amplifier U1101, and associated variable squelch—tail—control circuitry. This circuitry has good squelch characteristics because of the following:

- A high-pass filter ahead of the second amplifier, to attenuate the audio frequencies to a specific level;
- Capacitors C1103 and C1104, which attenuate noise at frequencies above 22 kHz, to leave the noise band susceptible to detection;
- An input network to the detector, which further attenuates audio and any harmonics generated by audio, to limit at the output of the third amplifier/limiter.

The filtered noise is routed to a positive-peak detector, which adds negative-going spikes at its output. These spikes are forwarded to the integrator and the variable squelch-tail-control circuitry. The integrator compares the average DC level of the detector's output with a reference level and generates a fast-responding output signal, V_o , as follows: V_o is greater than 4.5 V for squelched, and less than 4.5 V for unsquelched.

The detector's output also goes to Q1102 via a dual-time-constant network consisting of R1116, CR1103, and R1117. If the signal is weak, or in the absence of a signal, the noise spike rate becomes high enough

to keep C1110 discharged below the turn-on voltage of Q1102. The collector of Q1102 therefore has a potential of +9.6 V. When the signal level increases, Q1102 turns on and its collector voltage, V_o , begins to decrease. With a strong signal, the collector voltage reaches a minimum level of approximately 4 V. For a given level at the integrator output, the voltage across C1111 varies directly with V_o of Q1102.

Q1105 generates an output signal (SQUELCH DECISION) that is a delayed version of the integrator output. The microcomputer mutes the audio when the SQUELCH DECISION signal goes high (4.5 V) and unmutes the audio when the signal goes low (0 V). The Q1103 turn-on voltage at the node between R1118 and R1122 is approximately 4.5 V. This voltage is determined by the 9.6 V supply, R1120, C1111, and the dual-time-constant network comprised of R1118, R1119, and CR1104.

With loss of signal, the greater the voltage across C1111, the longer it takes the node voltage (R1118 and R1122) to increase above 4.5 V, and thus the longer the SQUELCH DECISION signal remains high after loss of signal. Since C1111 charges through R1119 and CR1104, the SQUELCH DECISION detect time is very short. The integrator output is inverted by Q1104 and supplied as a CHANNEL ACTIVITY signal. This is a fast responding output signal that is used only in *Channel Scan* operation.

7.3 INTERCONNECT BOARD

The interconnect board contains seven connectors that connect the logic board/RF board subassembly to the audio board, front connector, programming jack, and the internal option board. Connectors labeled J18 and J19 are combined into one cable assembly.

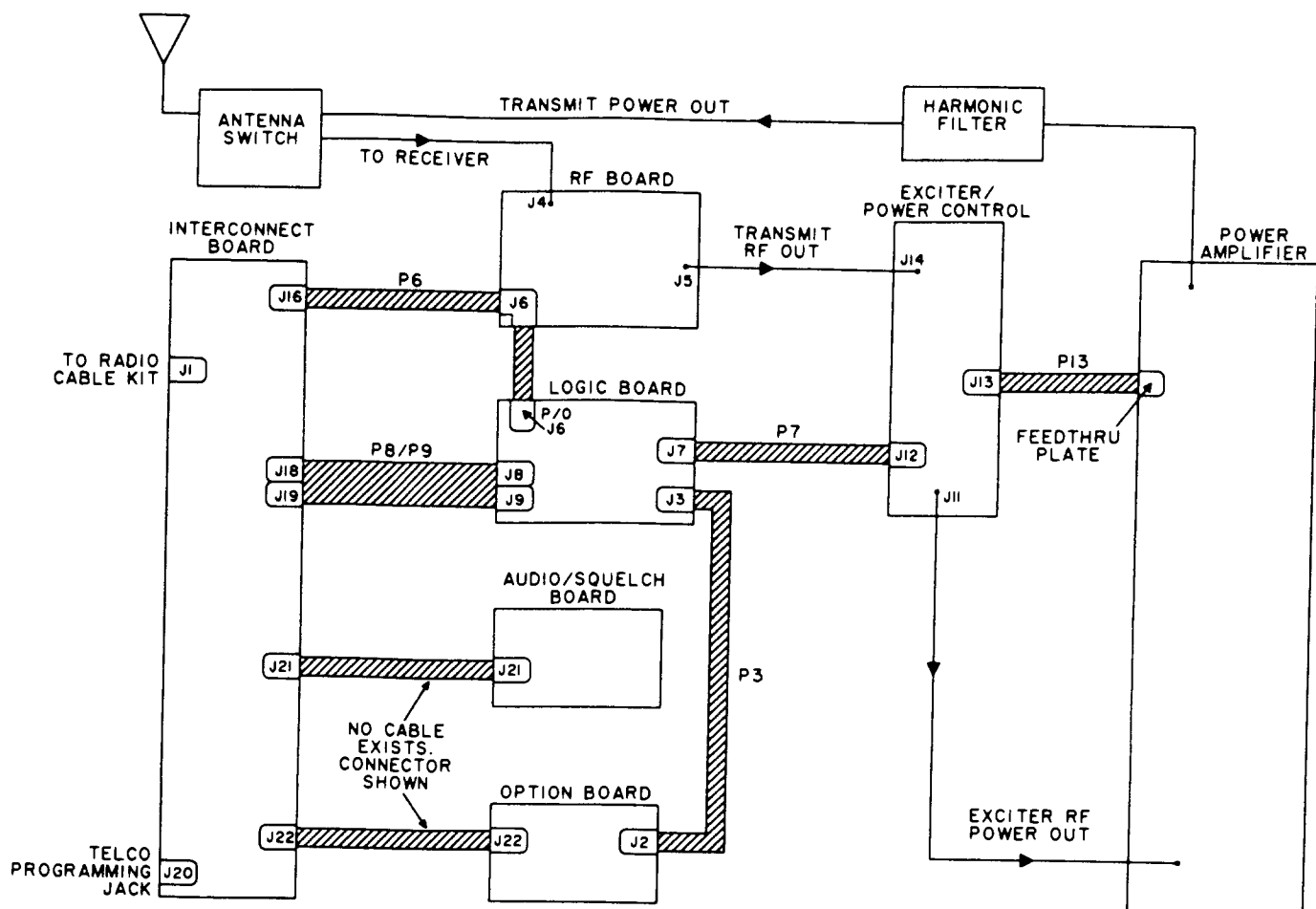
The serial data signal is logically ANDed with the DISPLAY ENABLE signal. Therefore, data out is always low unless DISPLAY ENABLE is high. The line labeled DATA OUT is used to send serial display data to the control head. Switch data is clocked from the control head and is received on the DATA IN line.

7.4 CONTROL HEAD

The control head is a display type control head, uses two seven segment displays to indicate selected mode.

The control head uses the CLOCK, DISPLAY ENABLE, and DATA IN lines to control data transmissions between the control head and the radio. Additionally, the handheld and advanced control heads use the DATA OUT line to receive display data from the radio. Both display data and switch/button data is shifted on the positive clock edge. The DISPLAY ENABLE line is used to control the state of the parallel/serial shift register in the control head. When DISPLAY ENABLE is low, the shift register operates in a parallel mode, reading the switch/button condition. When DISPLAY ENABLE goes high, the shift register latches the current switch condition and allows the data to be shifted serially to the radio.

M400 BLOCK DIAGRAM



PRE-INSTALLATION CONSIDERATIONS

POWER OUTPUT

This Motorola m400 FM two-way radio has been tested at the factory for proper transmitter power output. Each radio is set to the proper output level while connected to an accurate 50-ohm load impedance. Once the power level has been set, the internal power control/protection circuitry reduces the power output whenever it senses a load impedance significantly different from 50-ohms. The operation of this circuitry may be different from that of other Motorola products you have installed.

When you check the transmitter output levels during installation, be sure you use a good 50-ohm lead impedance and as-short-as-possible test cables. Any significant load variation from 50-ohms will cause an apparent reduction in output power due to the normal operation of the control/protection circuitry. These variations in power with degraded load impedance will be much more noticeable in the UHF band than in the VHF band since cables, meters, connectors, etc. have larger effects at UHF. If power seems to be unusually low (greater than can be explained by the normal calibration differences you experience), check your test set-up. If power output goes up as you improve the quality to the load impedance (approach 50 ohms), the control/protection circuitry is performing normally.

BENCH TESTS

- (1) Radio. Check frequency, power output, modulation, and receiver sensitivity before installing the radio.
- (2) Control Head. Verify operation of all controls and indicators on the control head before and after installation.

INSTALLATION PLANNING

ANTENNA LOCATION IMPORTANT SAFETY NOTE

Antennas must be installed at least two feet (0.6 meter) from vehicle operators and passengers unless shielded by a metallic surface.

(1) Be sure the antenna cable can be acceptably routed to the radio location before you mount the antenna. See the antenna instruction manual for details.

(2) Recommended location: in the center of the vehicle roof.

(3) Alternate location: in the center of the trunk lid. If this is used on Low Band installations, straps must connect the trunk lid to ground points on the vehicle body.

CONTROL HEAD LOCATION

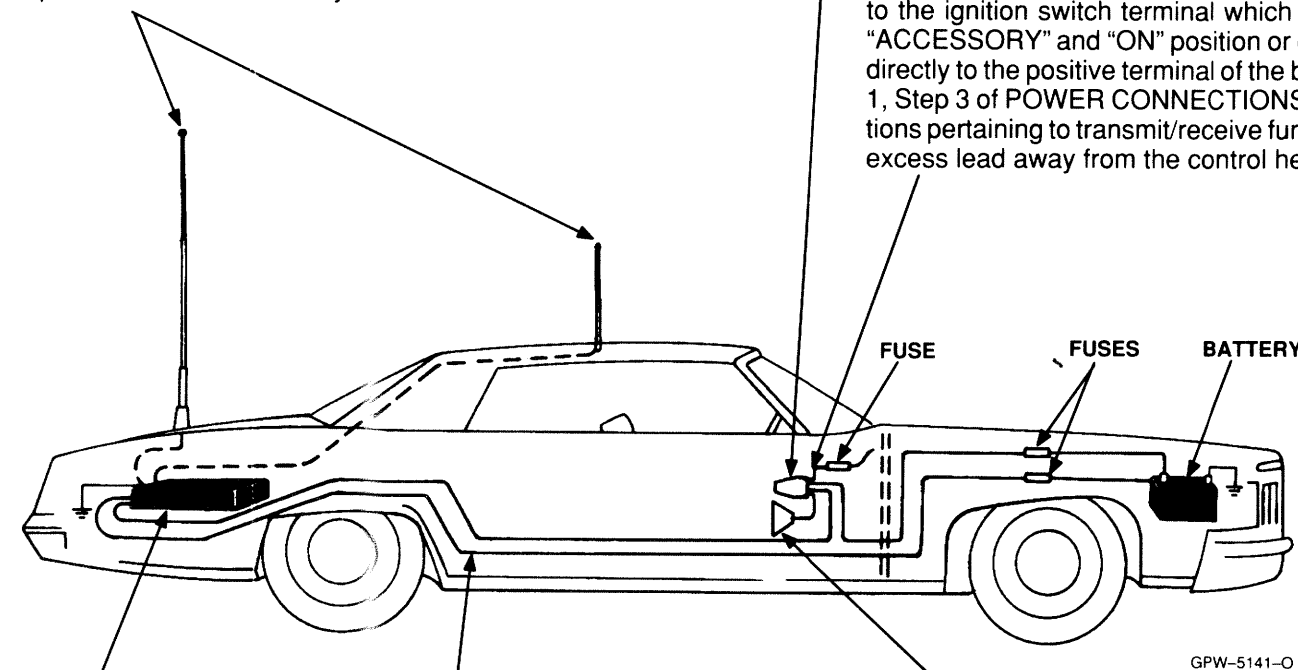
(1) Recommended mounting surfaces: under the dashboard; on the transmission hump; on the center console.

(2) The installation must not interfere with operation of the vehicle and its accessories, nor disturb passenger seating or leg space.

(3) The unit must be within convenient reach of the user(s).

IGNITION SENSE LEAD

The fused orange ignition sense lead can be connected to the ignition switch terminal which is hot in both the "ACCESSORY" and "ON" position or can be connected directly to the positive terminal of the battery. See Table 1, Step 3 of POWER CONNECTIONS for customer options pertaining to transmit/receive functions. Dress any excess lead away from the control head.



RADIO LOCATION

In most vehicles the best location for the radio unit is the floor of the trunk compartment. Regardless of the location choice, be sure the radio is protected from dirt and moisture and that there is enough space around the radio for cooling and removal.

SPEAKER

The trunnion bracket (included) allows a variety of mounting configurations on the dashboard or accessible firewall areas.

CONTROL AND POWER CABLE ROUTING

(1) If the vehicle has a built-in wire trough, route cables in it to provide maximum protection and to simplify cable installation.

(2) On vehicles with no wire troughs, route the control and power cables away from sharp edges, and away from areas where they might be crushed or pinched. A suggested route may be alongside the drive shaft hump under the carpet. Always use grommets where the cable passes through holes in metal panels. Dress any excess cable away from the radio.

PRIMARY POWER CONNECTIONS

(1) The best connection point for the hot primary power lead and the green lead is at the hot battery terminal. Be sure that the point chosen is always close to 13.6 volts. Some vehicles switch to a higher-than-normal voltage during starting. Dress any excess lead away from the control head or radio.

(2) Connect the radio negative primary power lead to a good ground point on the vehicle chassis—DO NOT connect it directly to the battery ground terminal. Dress any excess lead away from control head or radio.

DISASSEMBLY

RADIO REMOVAL

(1) Insert the key in the lock and turn clockwise. Pull the handle down.

(2) Pull forward on the handle to remove the radio from the mounting plate.

RADIO REPLACEMENT

(1) Lower the radio onto the mounting plate with the handle fully open.

(2) Slide the radio backward until the projections at the front and rear of the mounting plate engage the slots on the front and rear of the radio.

(3) Swing the handle up until it locks into position. Lift the front of the radio to ensure that the latching mechanism on the handle engages the latch plate on the front of the mounting plate.

TOP COVER REMOVAL

(1) Insert the key into the lock and turn it clockwise. Pull the handle down, exposing the release button.

(2) Push the release button. The top cover will pop open.

(3) Remove the top cover by raising the front and pulling it forward.

TOP COVER REPLACEMENT

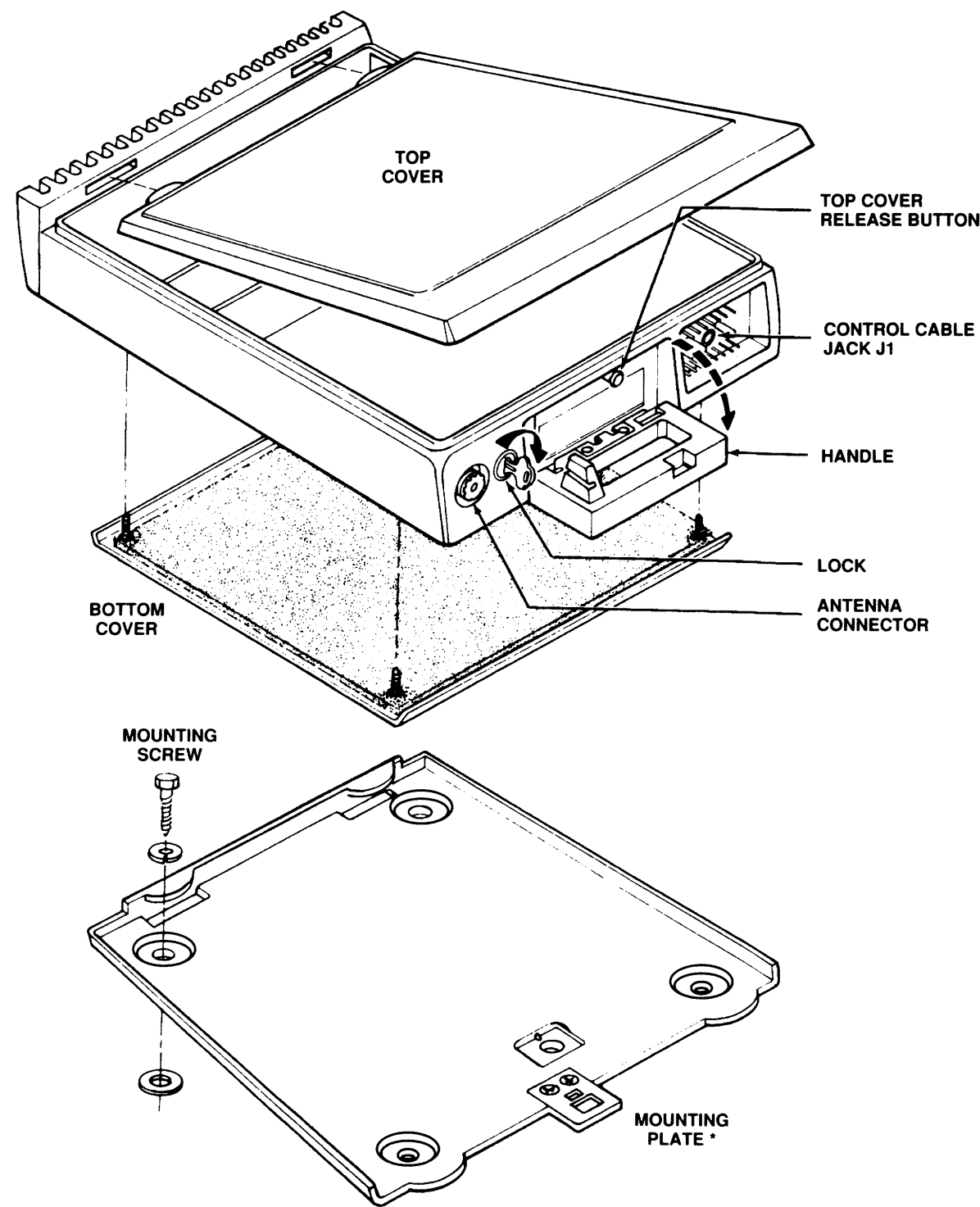
(1) Hold the cover with the front tipped slightly upward. Slip the projections at the rear of the top cover into the slots in the radio housing.

(2) Lower the front of the cover in place until it snaps. The top latch will then be engaged.

BOTTOM COVER REMOVAL

(1) Remove the radio from the vehicle and turn it upside down on a workbench.

(2) Unscrew the four Phillips-head screws securing the bottom cover and lift the cover from the radio.



*NOTE: m400 USES 4-CORNER MOUNTING HOLES

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CABLE ROUTING

WARNING

For vehicles equipped with electronic anti-skid braking systems, see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

(1) Work from the trunk space forward. In some cars, there is room above the fiberboard trunk partition to admit the cables. If not, make an opening through the partition.

(2) Remove the back seat. Pull the cables into the back seat area, under the seats and floor mats out the top of the floor mat under the dash. Where no specific channel is provided, route the cable under the floor mat along the side of the drive shaft hump.

(3) Pull the control cable connectors to the approximate location of the control head. Route the power cable to the engine compartment through an existing hole in the firewall. Use the grommet provided if the hole is not already grommeted. Pull the red power cable through the grommeted hole. Pull the green power cable through the grommeted hole.

(4) Install the fuse holder clip at a convenient location near the battery.

(5) The cable kit contains an additional separate green wire equipped with an in-line fuse. Pass the end of the green wire from the engine compartment side of the firewall, through the grommeted hole, into the passenger compartment.

(6) Connect the orange wire with fuse from the control head to the ignition switch, or to the positive battery terminal.

(7) Do not dress the wires at this time; proceed with mounting the radio.

parts list

HLN4022C Installation Kit		MXW-6475-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	03-12002A28	screw, self-drilling, 1/4-14 x 1-1/2" (3 used)
	04-00007688	lockwasher, 1/4
	29-00812980	terminal, closed-end
	37-00081057	grommet, rubber, 1/2"
	42-80366B66	cable tie (10 used)
	43-82292M01	bushing, spacer (3 used)

4/11/89

MOUNTING THE RADIO

CAUTION

It is not recommended that the radio be mounted vertically with the front connector facing up.

(1) Determine a location where the radio will be reasonably protected from dirt and moisture.

(2) Place the radio in the selected location and check for proper clearance as shown in the diagram.

(3) Determine the exact mounting location and place the radio mounting plate in position.

CAUTION

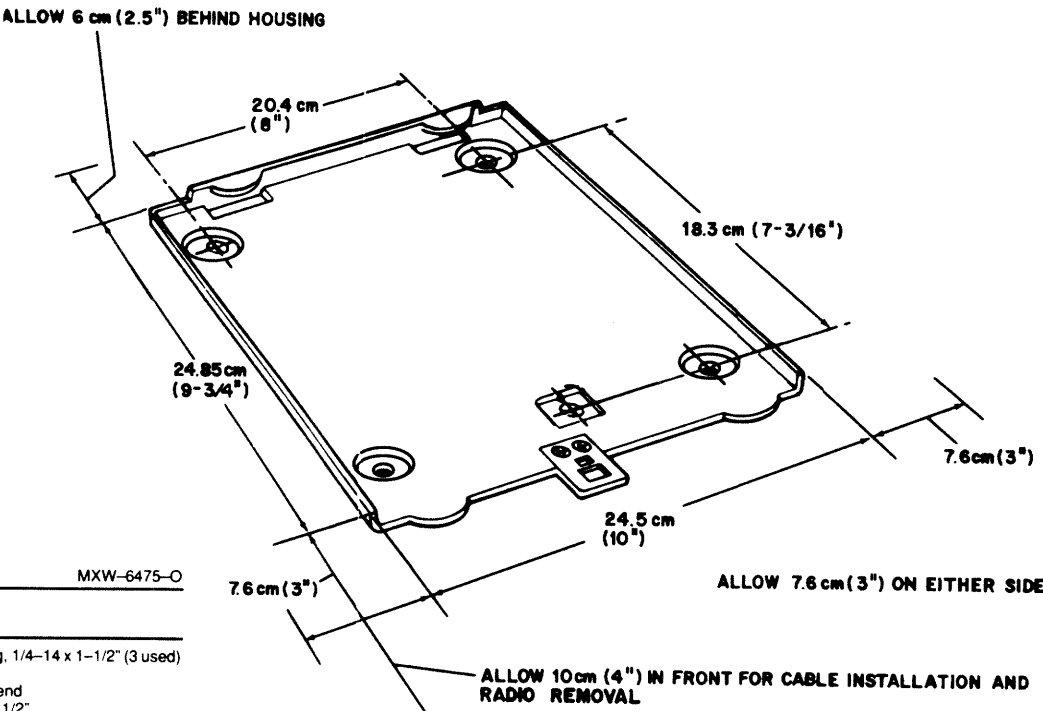
Check underneath the vehicle to be sure that the mounting screws will not puncture the fuel tank, fuel lines, or other obstacles.

Note

Use of self-drilling screws eliminates the need for predrilled holes

(4) Install the mounting plate with a mounting screw in each of four corners. These screws are self-locking and require no lockwashers or flatwashers. An assortment of additional spacers are provided for installing the mounting plate over extremely irregular surfaces.

(5) Install the radio.

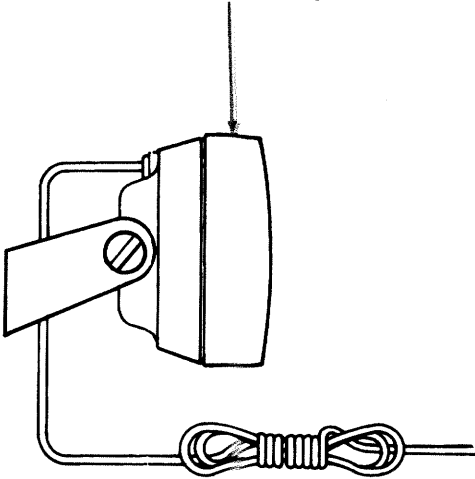


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SPEAKER AND ACCESSORIES

SPEAKER

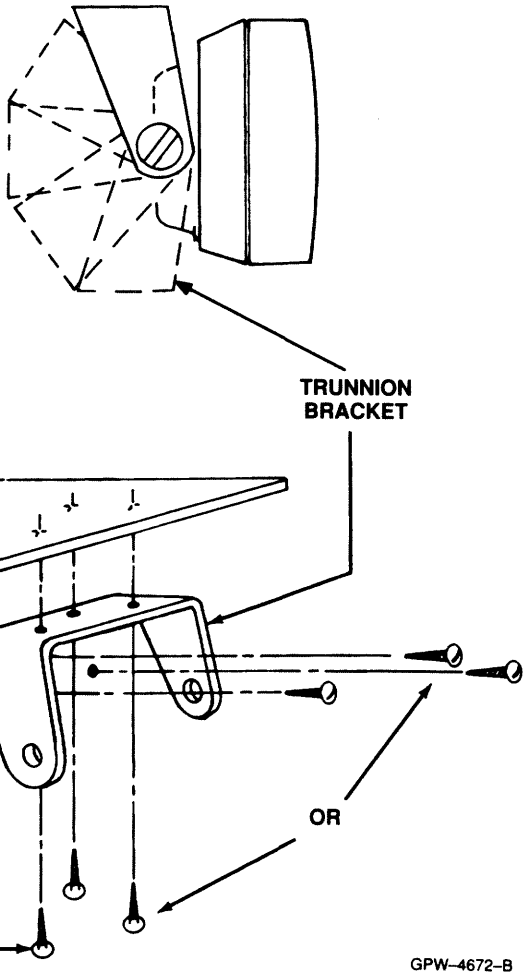
Position speaker in trunnion bracket and rotate to vertical position with **MOTOROLA** logo at bottom before tightening screws.



MICROPHONE

(1) Plug the microphone connector into the receptacle on the control head. Connect the S-hook to the right hole of the strain relief plate.

(2) Hang the microphone in the hangup box.



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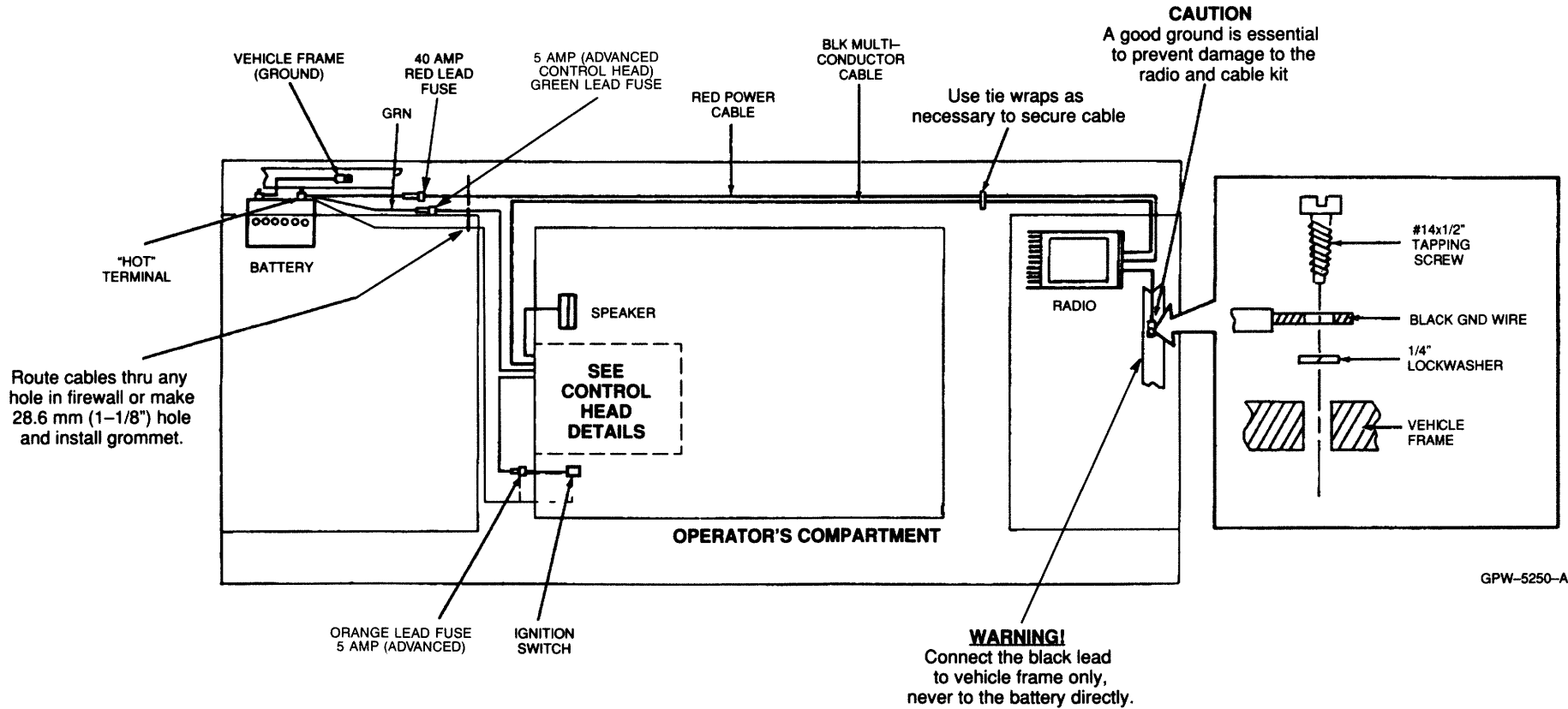
ANTENNA INSTALLATION

See the installation instruction supplied with the antenna.

POST-INSTALLATION CHECKOUT

Turn on the radio and perform a complete operational check. If ignition noise or alternator whine are noticed, refer to Motorola publication 68P81109E33, Reducing Noise Interference in Mobile Two-Way Radio Installations.

CABLE ROUTING DETAILS



Notes

In vehicles where the battery is grounded to the engine block, the frame and engine block must be connected with a heavy braided grounding strap.

Connect the hot lead directly to the battery; DO NOT connect it to the alternator or other points away from the battery terminal.

The m400 differs from the traditional green/orange lead function of past products. The green lead just connect to a "battery-hot" positive supply, regardless of the ignition option desired. The orange lead must connect to the side of the ignition switch that is hot when the switch is either in the ON or ACCESSORY positions or it must connect to the positive battery terminal.

THIS RADIO IS 12-VOLT DC
NEGATIVE GROUND ONLY.

(1) Connect the fused red power cable from the trunk to the positive battery terminal. (See Battery Hot Fuse Assembly details on page 4.)

(2) Connect the fused green wire from the control head to the positive battery terminal. (See Green/Orange Lead Fuse Assembly detail on page 4.)

(3) Connect the fused orange lead to either the ignition switch (hot side when in ON or ACCY position) or to the positive battery terminal. Refer to the following table for transmit/receive functions.

Table 1. Transmit/Receive Options

CUSTOMER OPTION	CONTROL HEAD JU1003	ORANGE LEAD CONNECTION
RX & TX enabled via ignition switch	OUT	Ignition Switch
RX & TX enabled by control head ON/OFF switch	**	Positive "Battery Hot" Terminal
RX enabled by control head ON/OFF switch; TX enabled by ignition switch	IN	Ignition Switch

*JU1003 is normally IN: see board overlays for jumper location.
** Don't care; can be IN or OUT.

Advanced Control Head (ACH) Notes

If your radio is wired to transmit only with the ignition ON (orange lead is connected to the ignition switch) and you wish to connect a Handset (HLN1220A) to the ACH (HCN1052), first open the ACH and remove JU1005 and install JU1006. This must be done to prevent transmitting while ignition is OFF.

With JU1003 removed and ignition sense connected to the ignition switch, the ignition switch controls both RX and TX.

(4) Locate a good site near the radio for the ground connection directly to the vehicle frame. Be sure you have clearance behind the hole location so that neither the drill nor mounting screw will puncture the fuel tank, fuel lines, or other obstacles. Drill a 5mm (0.199 inch) hole. Scrape or wire brush the surface around the hole to assure a good electrical connection.

(5) Attach the black power lead from the radio to the frame using a screw and the lockwasher supplied. The lockwasher should be between the mounting lug and the grounding surface; the mounting screw is self-locking—it needs no additional lockwasher.

(6) Dress all cables, securing them with the tie-straps supplied.

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POWER CONNECTIONS

NOTICE: THIS RADIO IS WEATHERPROOF,
NOT WATERPROOF

This radio meets the standards of MIL810D. This means the radio must remain functional after undergoing a number of tests, including a rain test (exposure for two hours to water sprayed at various flow rates in an air stream moving over the radio at 40 mph), a dust test (exposure for 28 hours to air-blown sand at higher-than-normal ambient temperatures), and a salt fog test (exposure for 48 hours to a mist of a 5% solution of salt in water).

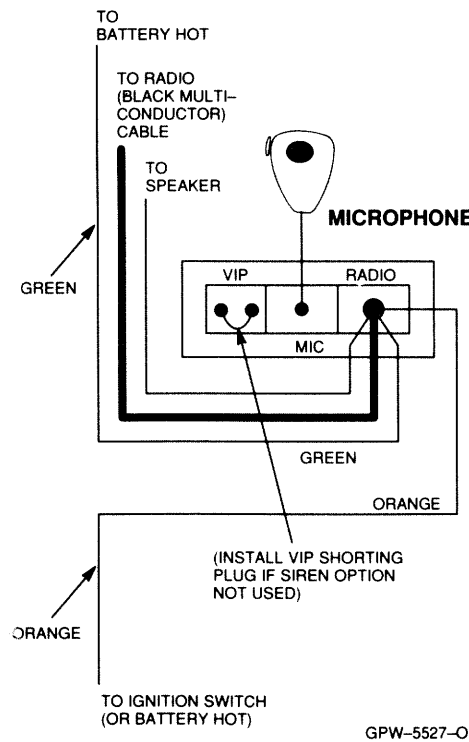
These tests do not immerse or submerge the radio in water or chemicals. They prove the radio to be weatherproof, not submersible. For installations that subject the radio to more stringent conditions, the radio must have extra protection.

CAUTION

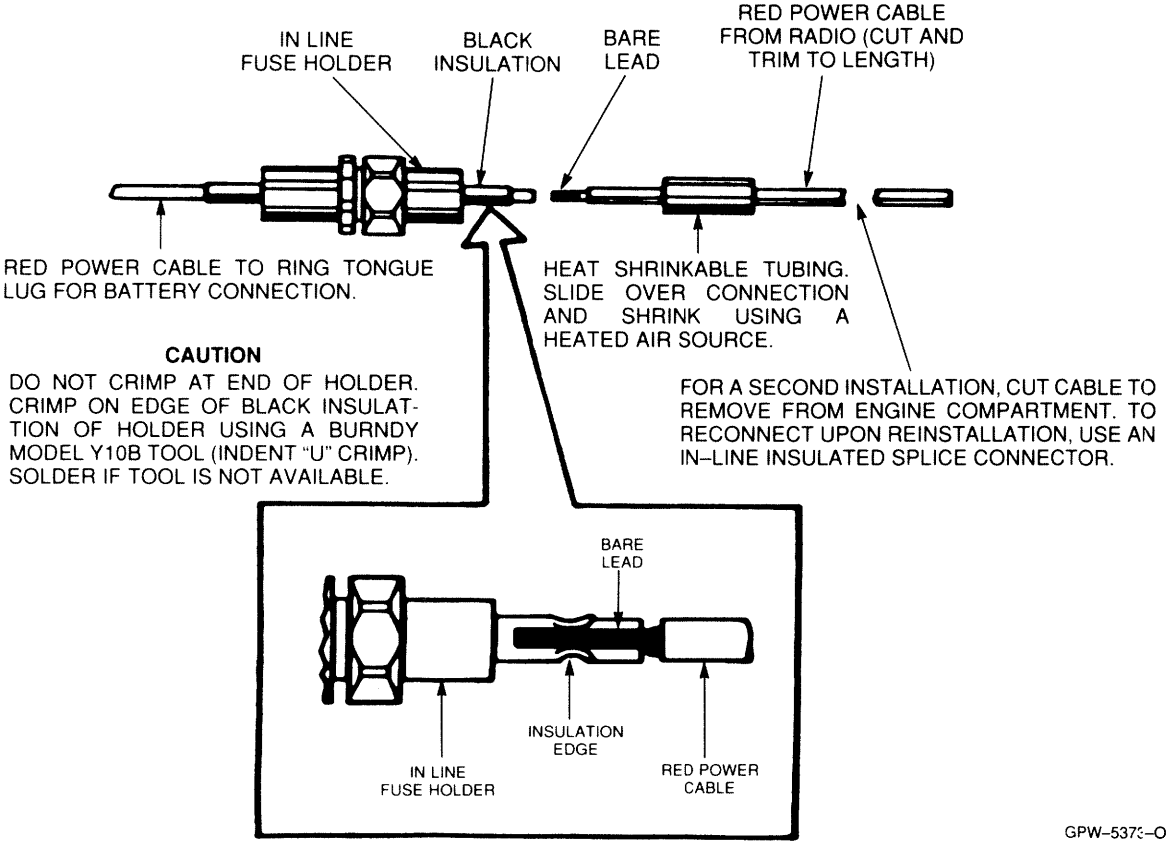
If the radio is exposed to the weather, or if the area where the radio is installed is cleaned by spraying with water, then DO NOT mount the radio with the handle up if you must mount it vertically. It is possible that moisture can accumulate in recessed areas of the radio and, if not removed promptly, that moisture will seep inside the radio and damage the electronic components.

The protection the radio requires varies with the circumstances, of course. It may be as simple as drain holes drilled in the bottom of a tool box, or the reorientation of the radio so that its cable connector area points down instead of up. A low platform of wood or sheet metal may raise the radio above the level of water that normally accumulates during cleaning operations in a vehicle. Some circumstances, however, demand that the radio be protected with a waterproof enclosure or shroud or be installed in an altogether different location.

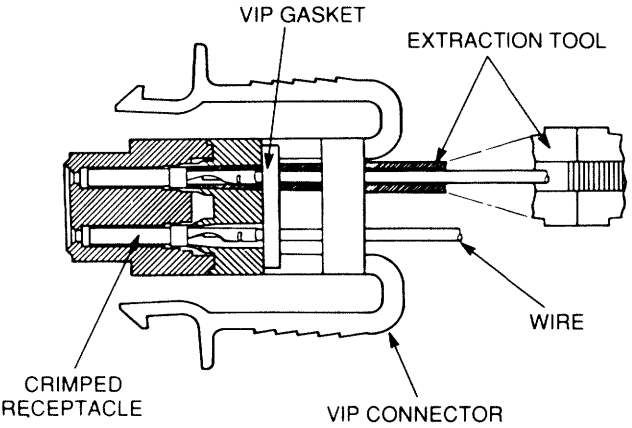
Advanced



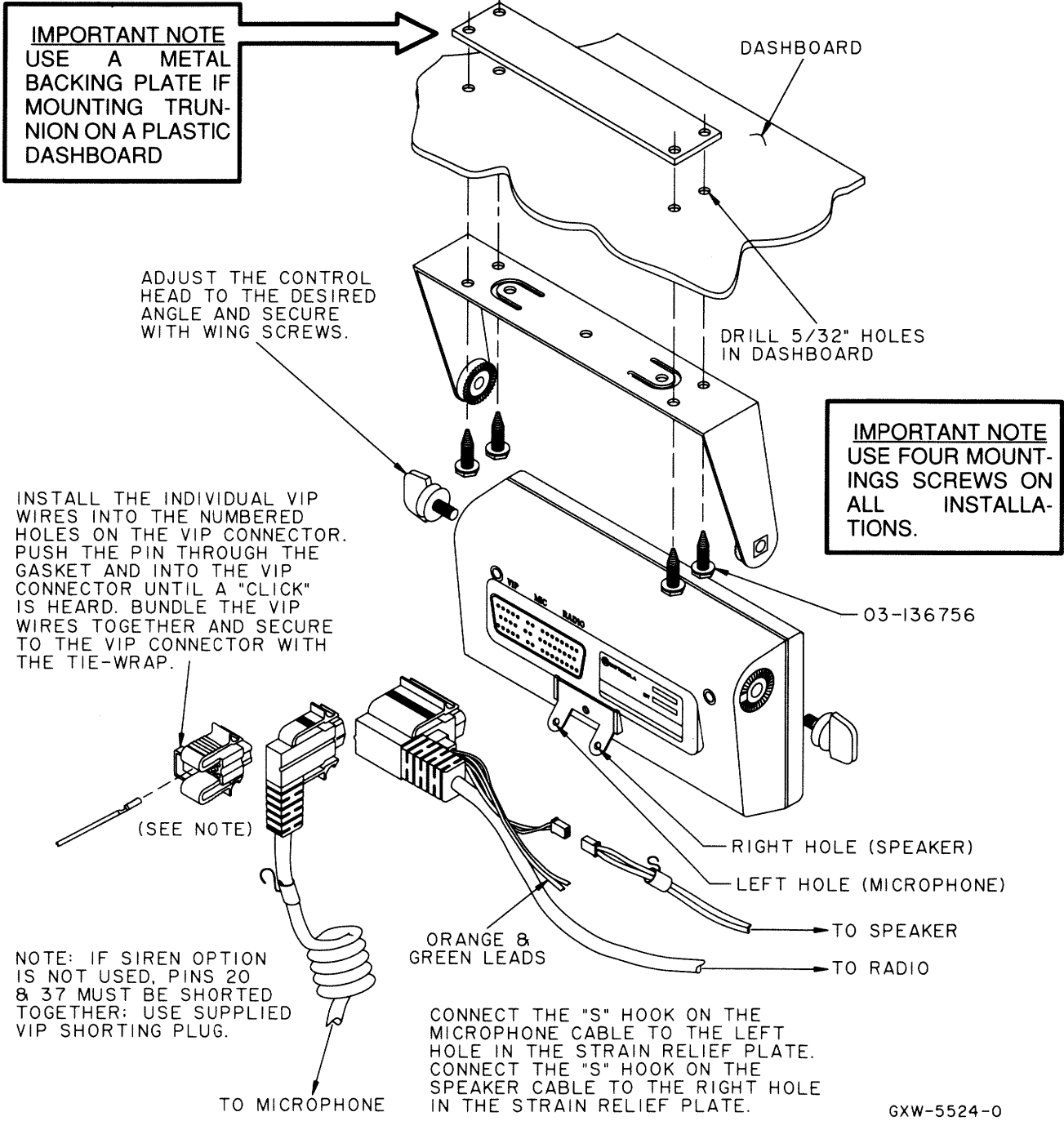
m400
INSTALLATION GUIDE
INSTALLATION DETAILS



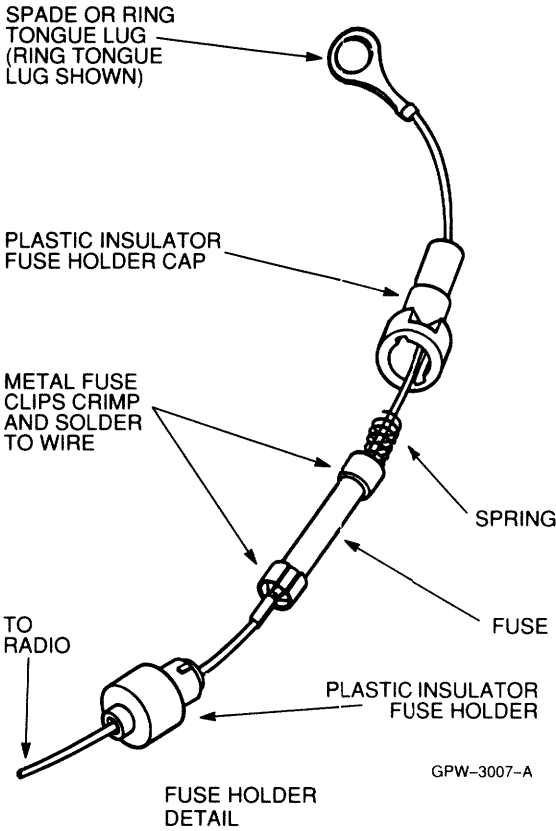
Battery Hot In-Line Fuse Installation



VIP Connector Details



Control Head Installation Exploded View



Green/Orange Lead Fuse Assembly

parts list

Fuse Kit for Green and Orange Leads			MXW-5591-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
	14-82882A01	insula or. fuse holder body	
	14-82883A01	insula or. fuse holder cap	
	29-00136968	lug	
	29-00824456	ring tongue lug	
	29-00865065	ring tongue lug	
	41-82885A01	compression fuse spring	
	42-82884A01	fuse clip	
	65-00052293	fuse, 5A, 250V, 2 used	

6/15/88

1. Emergency Alert Switches

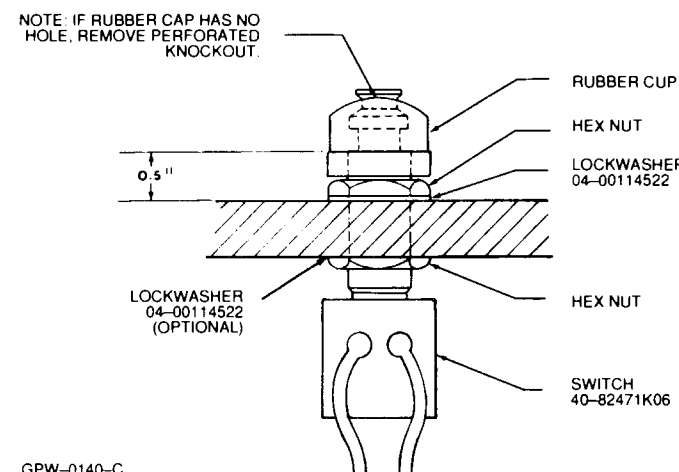
The MDC-1200 system has two optional alert switches—a footswitch and a panel mounted push-button switch.

Note

Because the emergency alert switches are normally closed, they must be installed and connected before the radio is operated. This will avoid inadvertent emergency transmissions.

1.1 FOOTSWITCH

The location of the footswitch is important. Mount it where the driver will not step on it accidentally while performing his normal duties, but where it is readily accessible when needed. Perform the following steps (see Figure 1):



GPW-0140-C

Figure 1. Footswitch Installation

- (1) Drill a 41/64 (.640) inch diameter hole at the selected location.
- (2) Screw a hex nut (included in the footswitch and mounting kit) onto the mounting stem.
- (3) Insert the stem through the mounting surface.
- (4) Adjust the hex nut until the threaded portion of the mounting stem is 0.5 inch above the top of the mounting surface.
- (5) Put a lockwasher on the stem.
- (6) Screw a second hex nut onto the stem and tighten it to secure the stem in the hole.
- (7) Screw the rubber cap onto the mounting stem loosely and pop the shaft through the rubber boot top.

- (8) Screw the rubber cap down to secure it.

- (9) Connect the two wires from the switch to the cable supplied with the kit. Polarity is not important.

- (10) Complete connections by using the following step:

- ADVANCED CONTROL HEAD—Install the two pins into the VIP connector at locations 3 and 19, polarity is not important.

1.2 PANEL-MOUNTED SWITCH

Install the panel-mounted emergency alert switch (Figure 2) as follows:

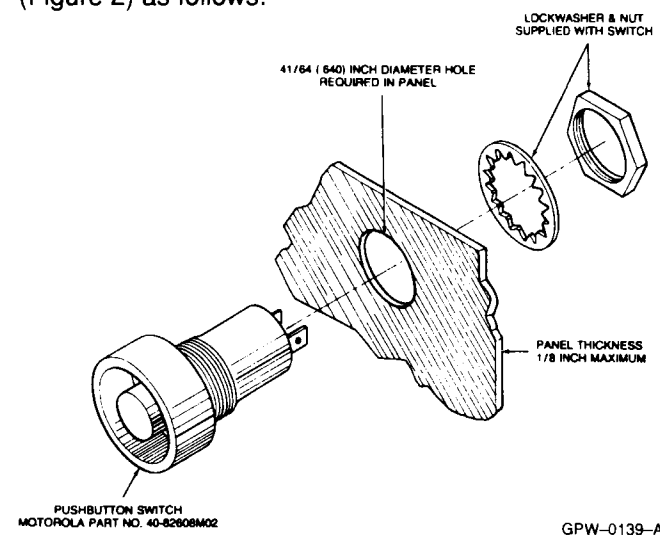


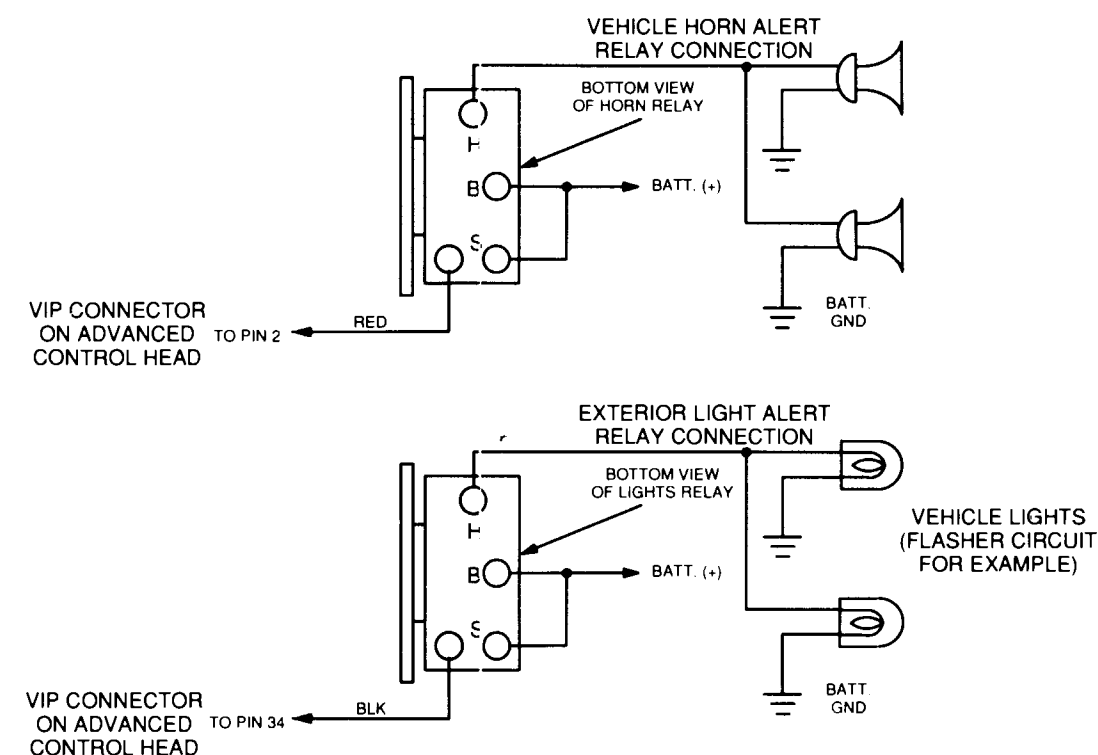
Figure 2. Panel-Mounted Switch Installation

- (1) Find a convenient spot on the panel, where the panel is less than 1/8 inch thick.
- (2) Drill a 41/64 (.640) inch diameter hole in the selected location.
- (3) Insert the switch in the hole and secure it there with the lockwasher and nut supplied with the switch.
- (4) Connect the two leads from the cable furnished with the kit to the terminals of the switch.
- (5) Complete the connections according to Step 10 in paragraph 1.1.

2. External Alarms (Advanced Control Head)

The two external alarms, Horn and Lights, are only compatible when a decode option is available (e.g. MDC-1200 SelCall). The alarms are activated by two separate relays, one for horn alert and one for light alert.

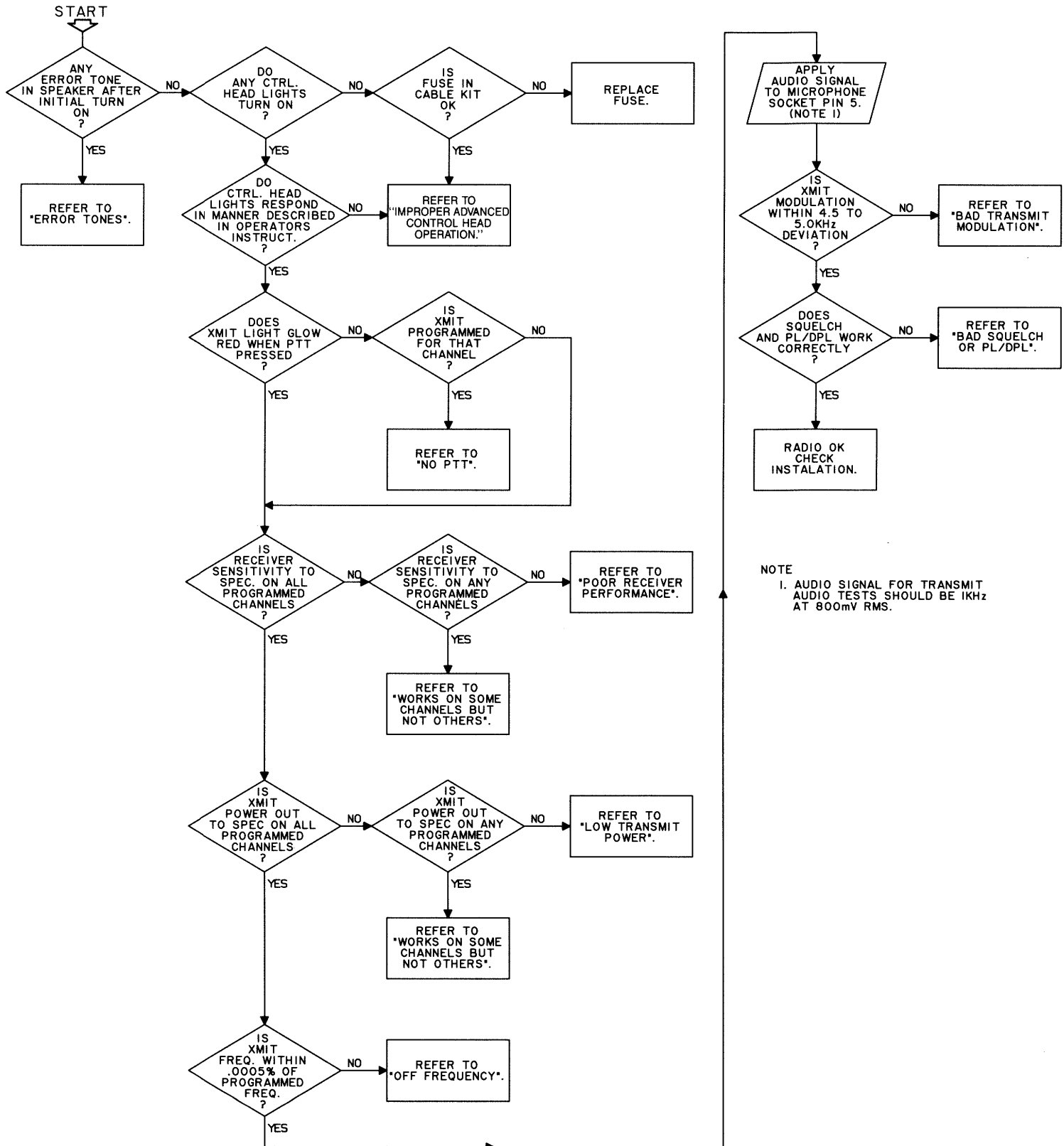
Attach the horn and light relays, if used, in a secure position, such as on the firewall in the engine compartment, and wire the relays into the vehicle's electrical system as shown in Figure 3.



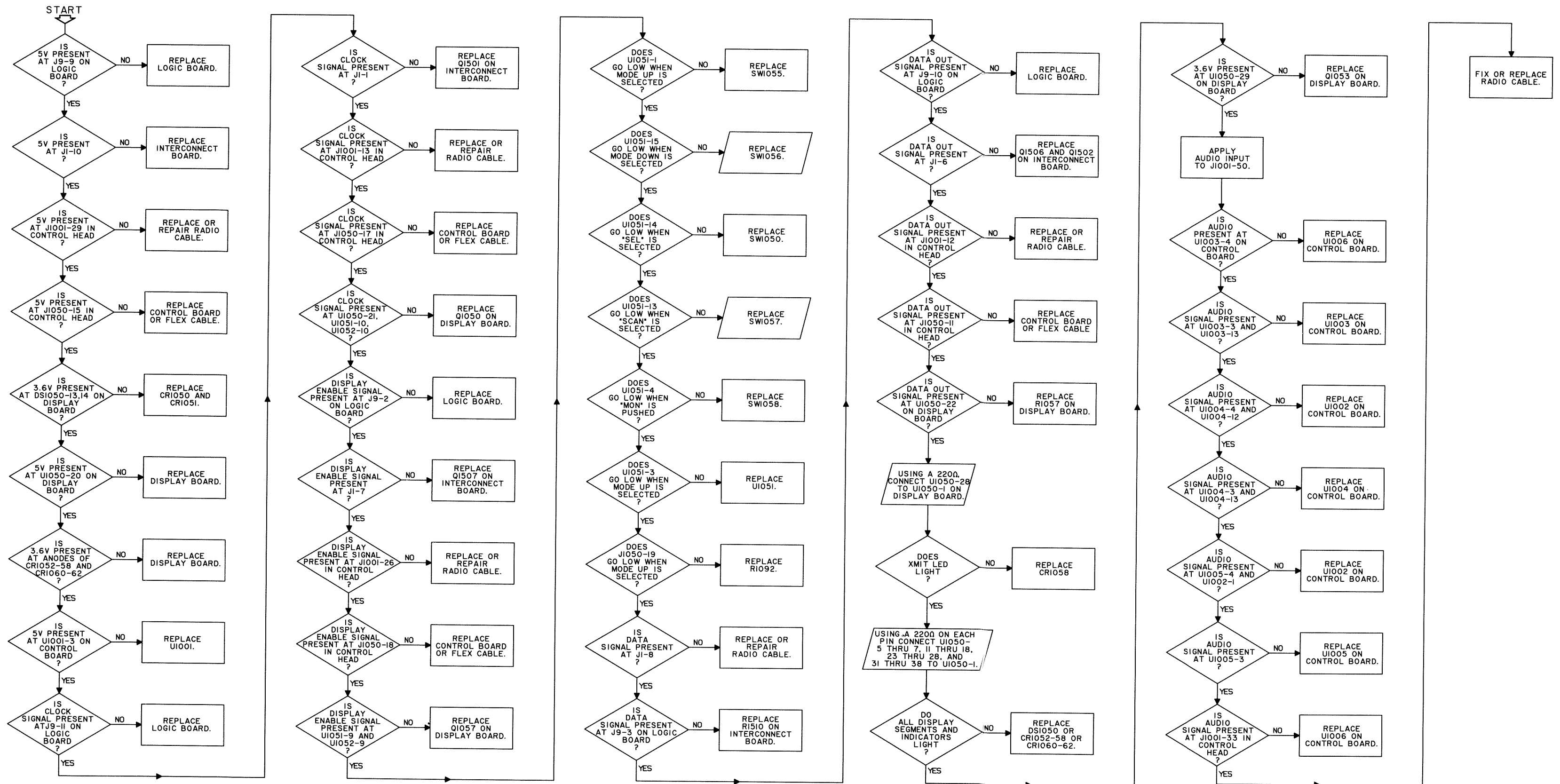
GPW-5589-O

Figure 3. Horn/Lights Relay Connection

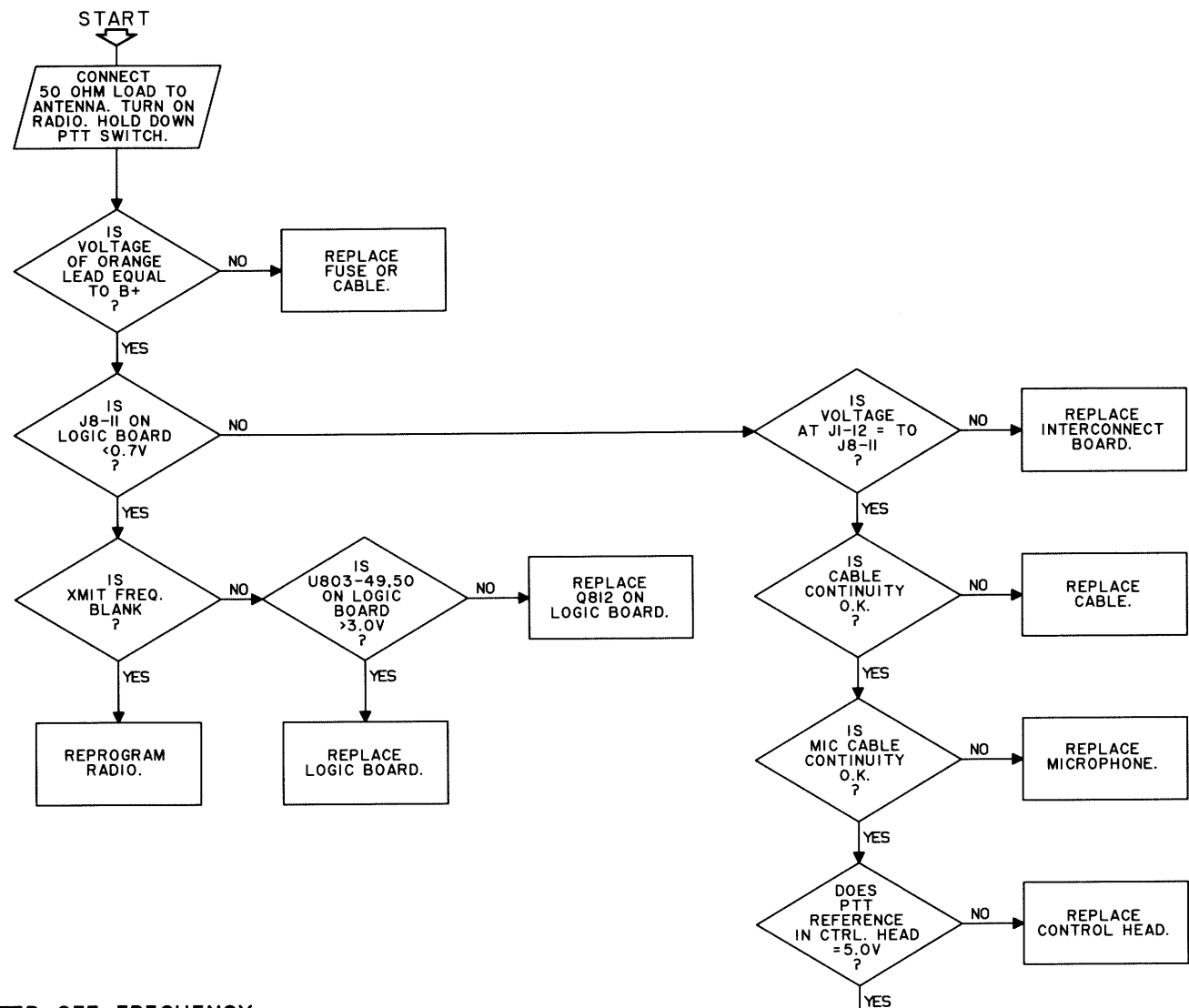
RADIO SYSTEM TROUBLESHOOTING CHART (START ALL TROUBLESHOOTING HERE)



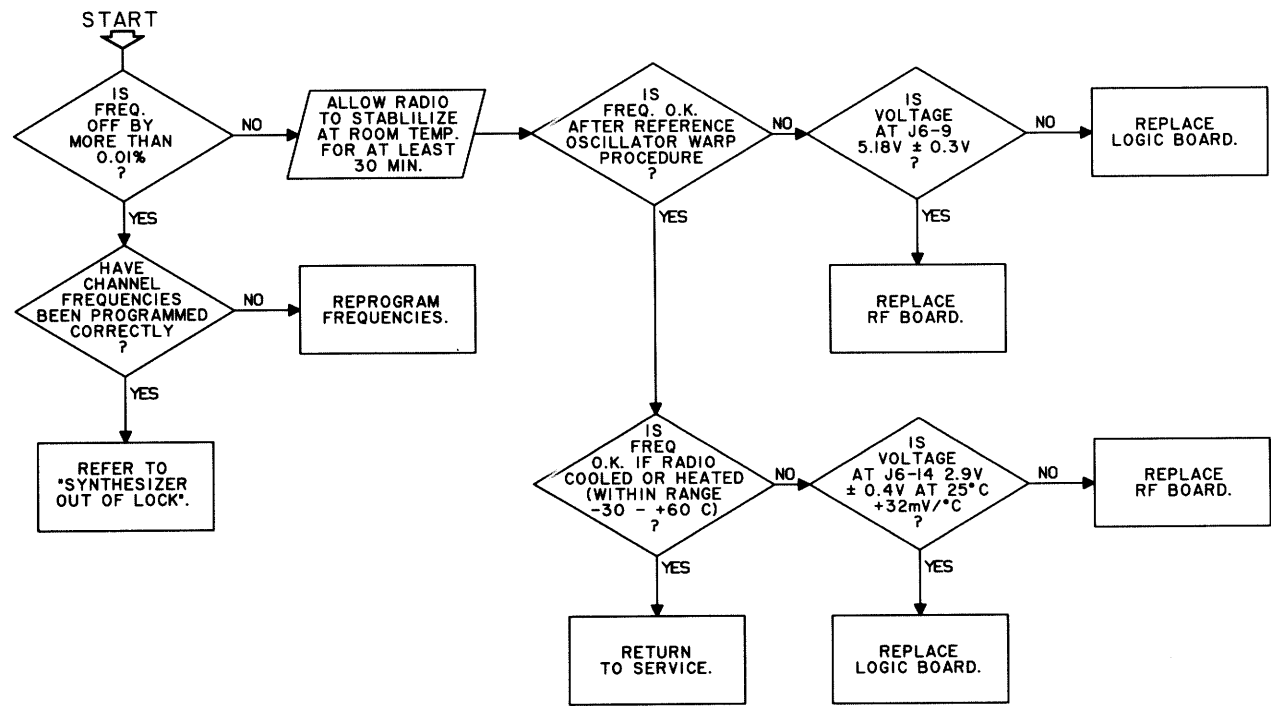
IMPROPER ADVANCED CONTROL HEAD OPERATION



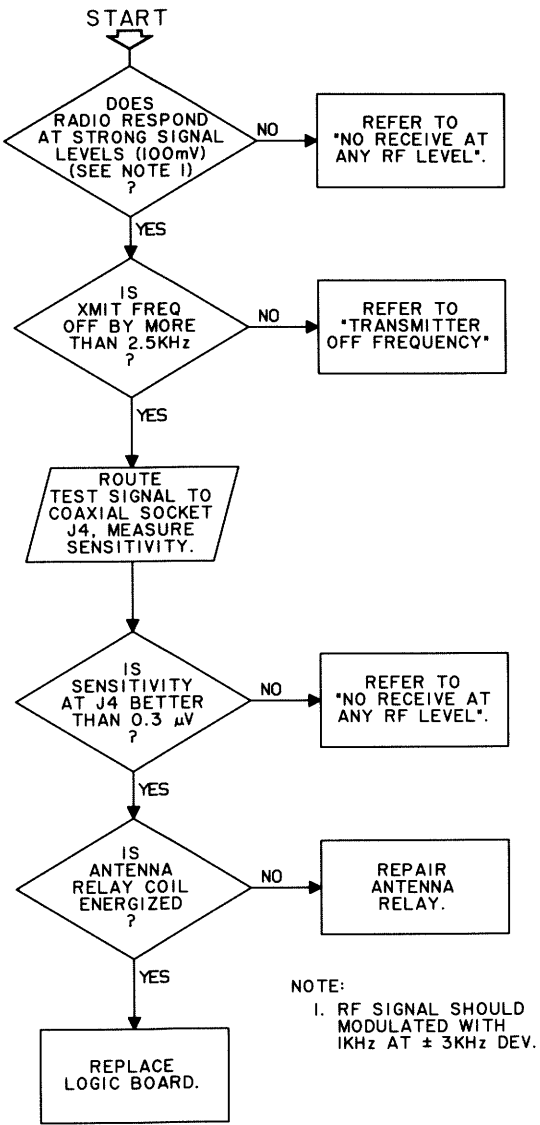
NO PTT



TRANSMITTER OFF FREQUENCY



POOR RECEIVER PERFORMANCE



LOW TRANSMIT POWER

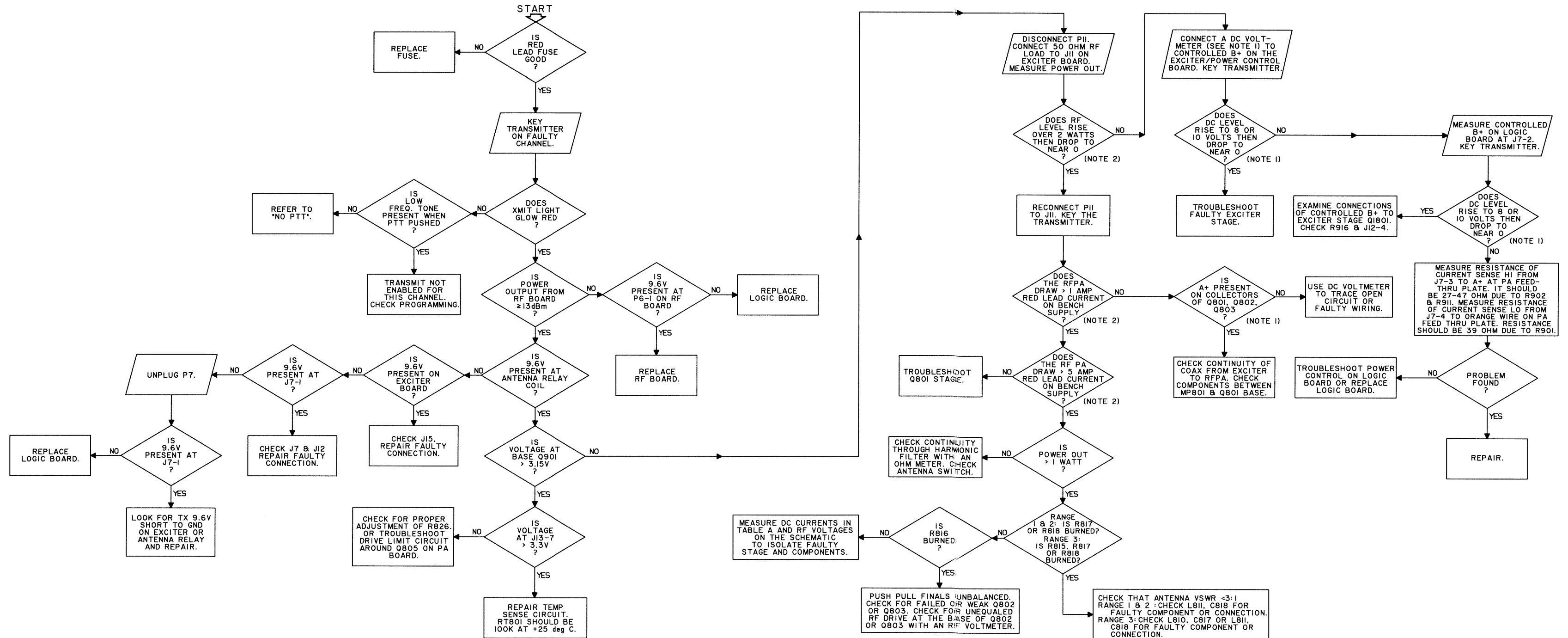
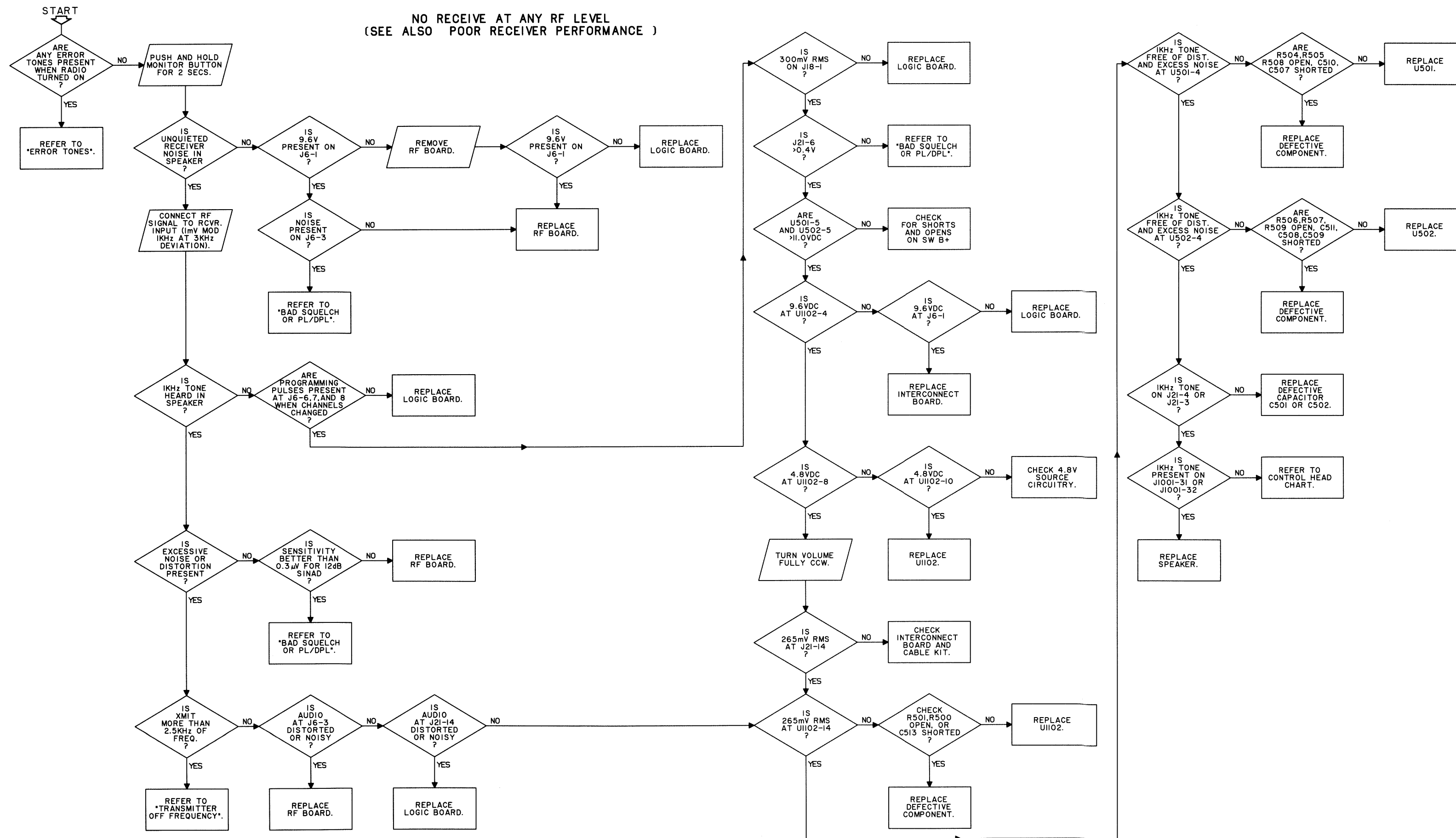


TABLE A
DC CURRENT DRAW -- PA STAGES (SEE NOTE 2)

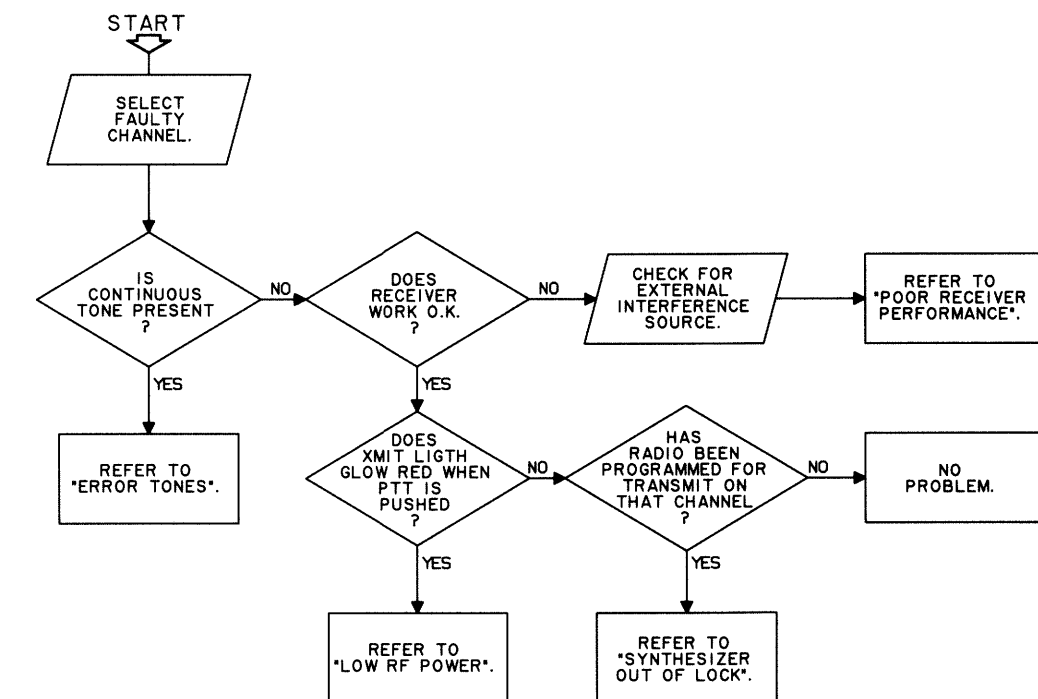
STAGE	CONNECT AMMETER IN SERIES WITH:	TYPICAL CURRENT DRAW (AMPS) AT 120 WATTS OUTPUT									
		RANGE 1			RANGE 2			RANGE 3			
		29.7 MHz	33 MHz	36 MHz	36 MHz	39 MHz	42 MHz	42 MHz	46 MHz	50 MHz	
Q801	L802 AND R812 R813	2.0	1.9	1.8	2.4	2.2	2.2	2.9	2.3	1.7	
Q802, Q803		16-19	15-19	16-19	15-18	15-19	16-20	17-21	17-21	17-19	

NOTES:

1. USE SIMPSON MODEL 260 OR EQUIVALENT. SOME DVM'S MAY GIVE ERRONEOUS DISPLAY IN THE PRESENCE OF HIGH POWER RF.
2. IF MEASUREMENT CANNOT BE TAKEN BEFORE CONTROLLED B+ DROPS TO NEAR ZERO, DISCONNECT J12-4 AND SUPPLY 6 VOLTS TO THE EXCITER BOARD AT J12-4.

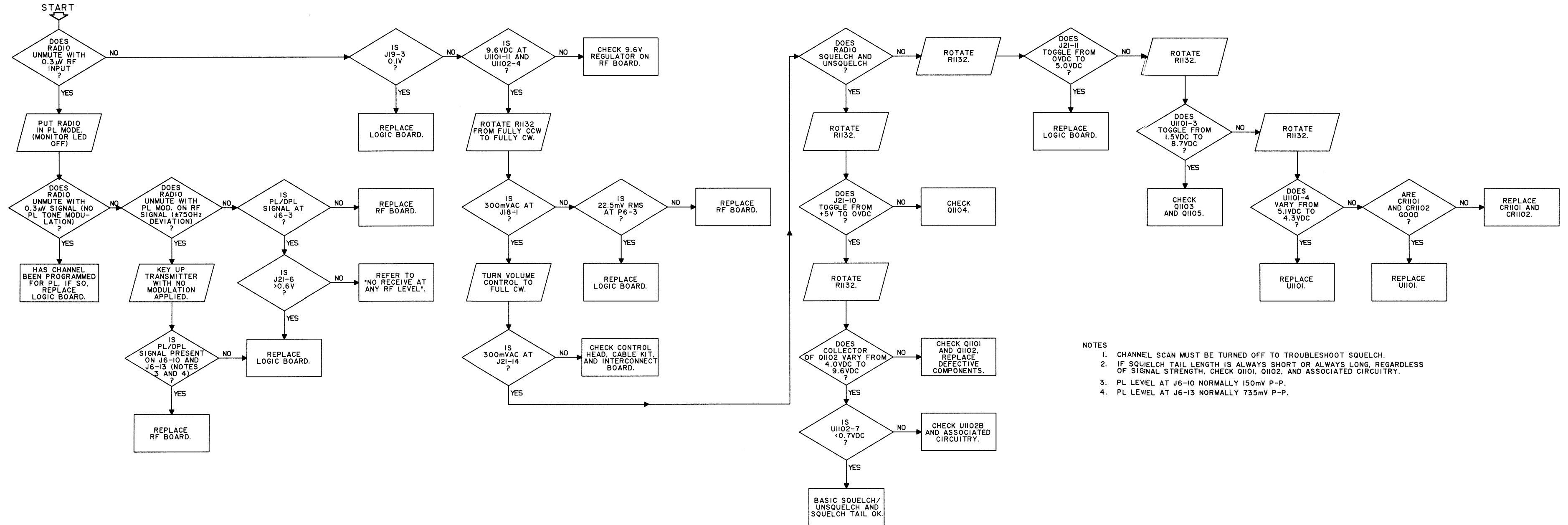


RADIO WORKS ON SOME CHANNELS BUT NOT OTHERS



BAD SQUELCH OR PL/DPL

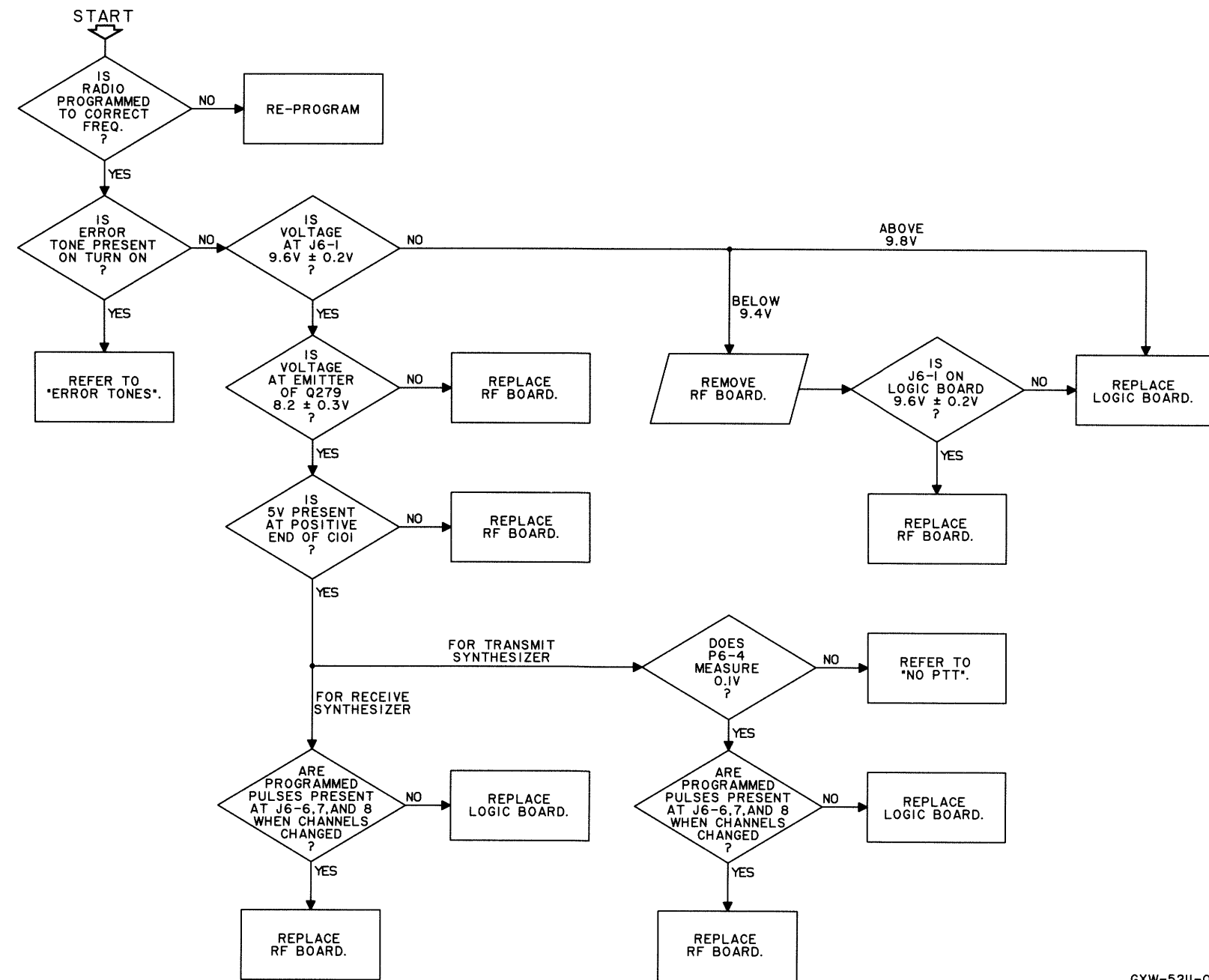
SEE NOTES 1 AND 2.



NOTES

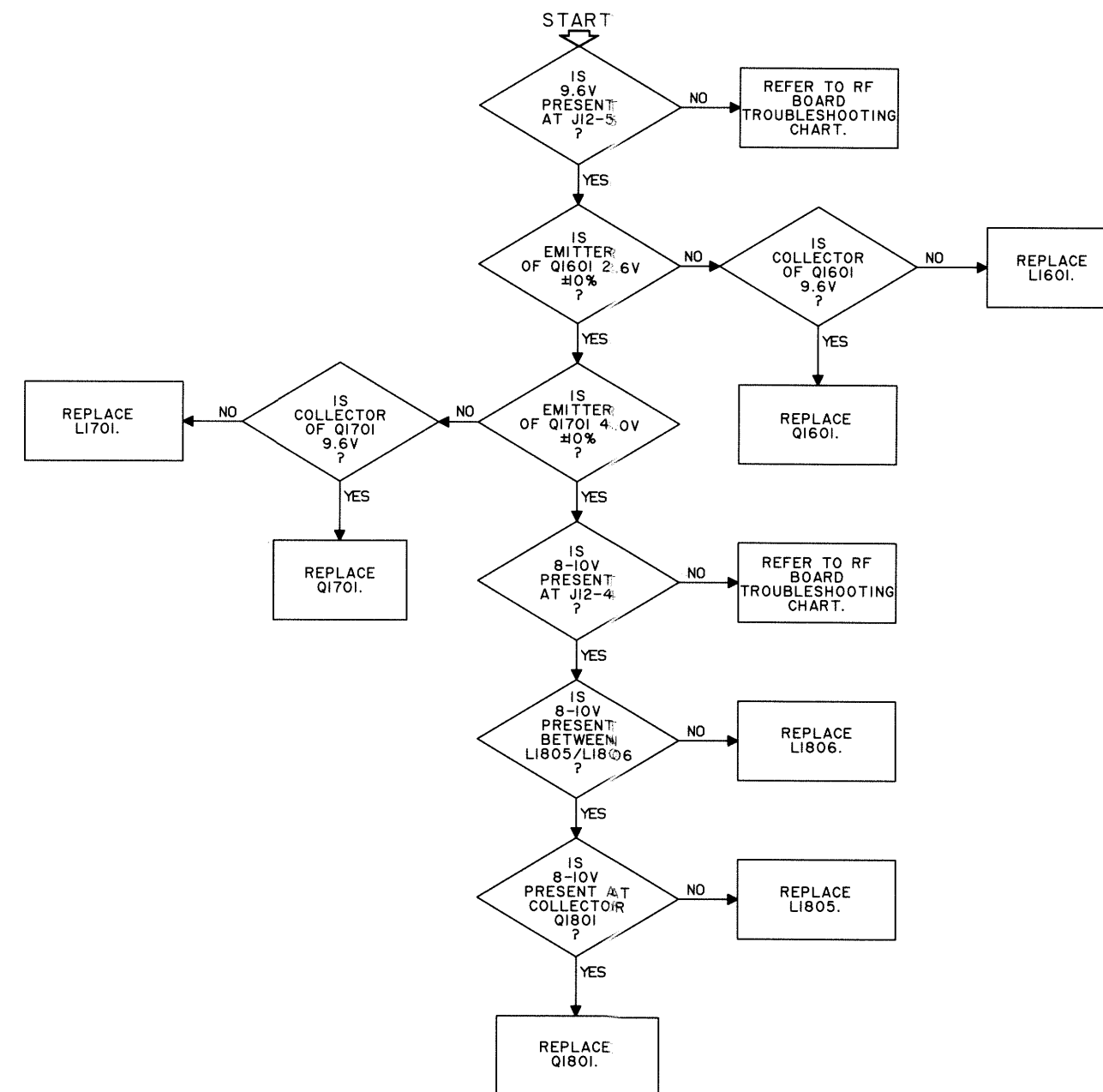
1. CHANNEL SCAN MUST BE TURNED OFF TO TROUBLESHOOT SQUELCH.
2. IF SQUELCH TAIL LENGTH IS ALWAYS SHORT OR ALWAYS LONG, REGARDLESS OF SIGNAL STRENGTH, CHECK Q101, Q102, AND ASSOCIATED CIRCUITRY.
3. PL LEVEL AT J6-10 NORMALLY 150mV P-P.
4. PL LEVEL AT J6-13 NORMALLY 735mV P-P.

SYNTHESIZER OUT OF LOCK

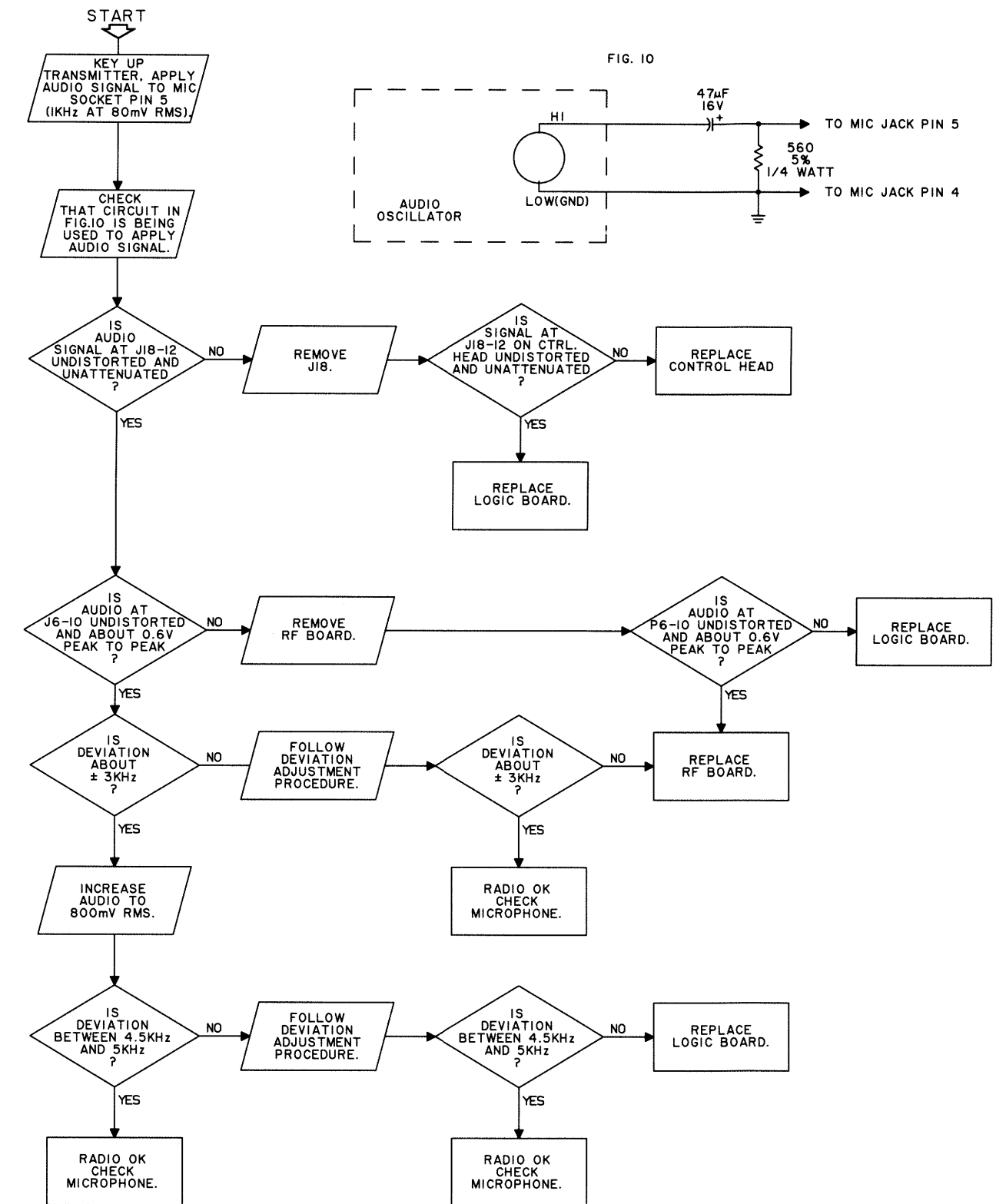


GXW-5211-0

EXCITER PROBLEMS



BAD TRANSMIT MODULATION



parts list

HLN5406B Advanced Control Head, 99F (Control Board) MXW-5584-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±5%, 50V (unless otherwise stated)		
C1001	23-11048C11	10, ±20%, 35V, electrolytic
C1003-1005	23-11048C11	10, ±20%, 35V, electrolytic
C1006,1007	08-11051A17	0.47, 63V
C1008-1011	21-13740B57	220 pF
C1012	08-11051A17	0.47, 63V
C1013,1014	21-13741N21	.001
C1015-1021	21-13741N45	0.01, ±10%
C1022	21-13741N21	.001
C1023	08-11051A11	0.047, 63V
C1024	21-11032A09	.001
C1025-1028	21-11031A47	220
C1029-1045	21-11032A21	0.01, ±10%
diode (see note)		
CR1001,1002	48-80236E08	rectifier, silicon
CR1004	48-80236E08	rectifier, silicon
CR1005-1007	48-82466H18	rectifier, silicon
CR1010	48-80060M01	rectifier, silicon
connector receptacle		
J1001	28-80228J01	connector, 50 position
jumper		
JU1003	06-11077A01	0-ohm resistor
JU1005	06-11077A01	0-ohm resistor
transistor (see note)		
Q1001	48-11043C08	PNP
Q1002	48-11043C07	NPN
Q1004	48-80141L03	PNP, type 41L03
Q1005	48-11043C07	NPN
Q1006	48-80141L04	NPN, type 41L04
Q1007,1008	48-11043C07	NPN
Q1009	48-80141L04	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1001	06-11077A98	10k
R1002	06-11077A90	4.7k
R1003	06-11077A74	1k
R1004,1005	06-11077A98	10k
R1006-1012	06-11077B11	33k
R1013	06-11077A98	10k
R1014,1015	06-11077A98	10k
R1017	06-11077B07	22k
R1018	06-11077A82	2.2k
R1019	06-11077A62	330
R1020	06-11077A42	47
R1021	06-11077A82	2.2k
R1022	06-11077A86	3.3k
R1023	06-11077A74	1k
R1024	06-11077A54	150
R1025,1026	06-11077A78	1.5k
R1027	06-11077A74	1k
R1028	06-11077A70	680
R1029	06-11077A74	1k
R1030	06-11077A68	560
R1031,1032	06-11077A74	1k
R1033	06-11077A58	220
R1034	06-11077A98	10k
R1035	06-11077A62	330
R1036-1038	06-11077A98	10k
R1039	06-11077A28	12
R1040	06-11077A74	1k
R1041	06-11077A82	2.2k
R1042	06-11077A74	1k
R1043	06-11077A62	330
R1044	06-11077A86	3.3k
R1045,1046	06-11077A74	1k
R1047	06-11077A68	560
R1048	06-11077A58	220
R1049	06-11077A68	560
R1050	06-11077B07	22k
R1051	06-11077A58	220
R1052	06-11077A28	12
R1053	06-11077A58	220
R1054	06-11077A98	10k
R1101	06-11027A98	10k
R1102	06-11077B07	22k
switch		
SW1001	40-80033K01	toggle
integrated circuit (see note)		
U1001	51-84621K27	voltage regulator
U1002	51-84621K32	quad op amp
U1003,1004	51-80073C06	analog multiplexer, CMOS
U1005	51-84887K26	analog multiplexer/demultiplexer
U1006	51-84621K32	quad op amp
voltage regulator (see note)		
VR1001	48-11034A19	zener, 10V, 25 mA
VR1002,1003	48-80140L15	zener, 10V, 5 mA

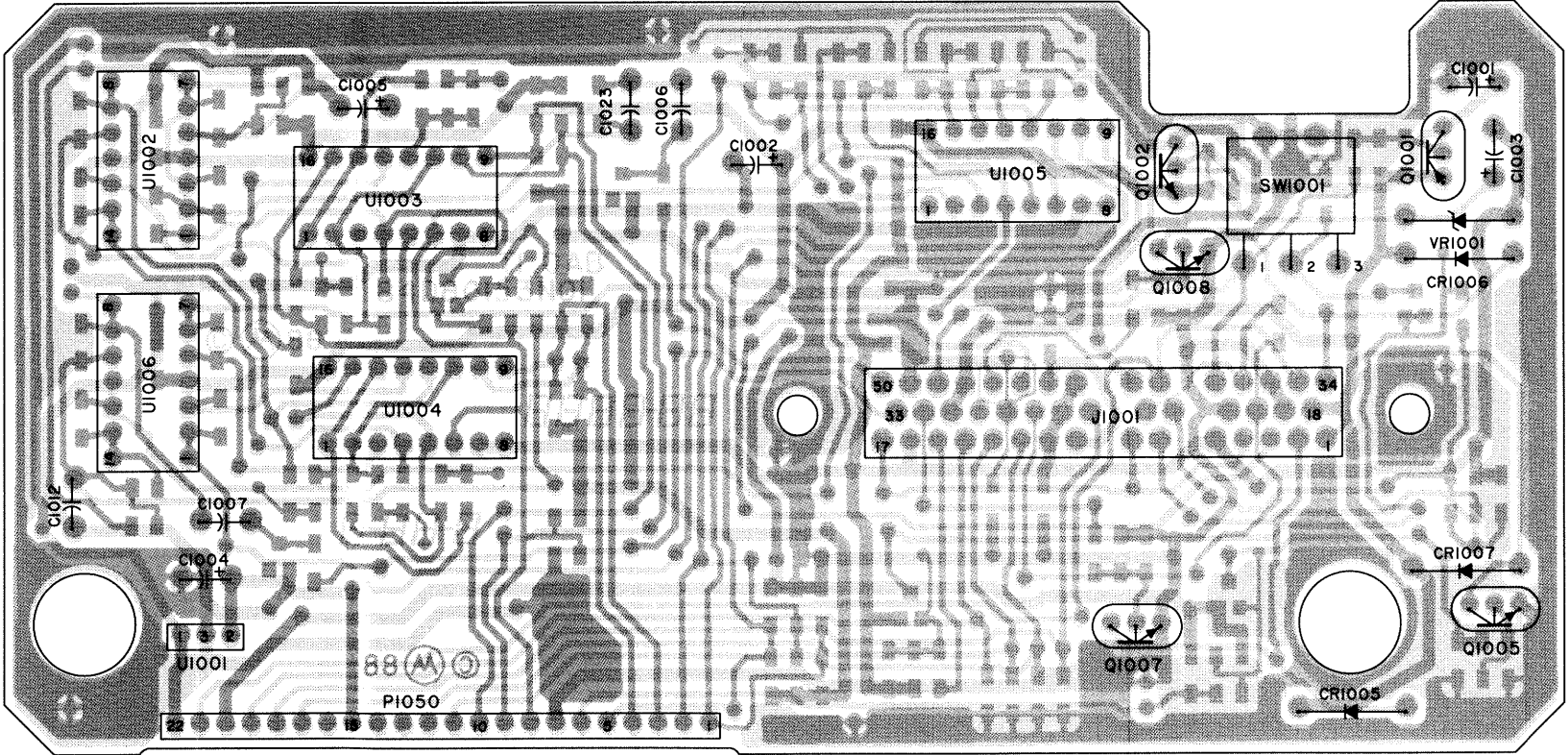
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematics, Circuit Boards Diagrams, and Parts Lists for HCN1052B Advanced Control Head

(Sheet 1 of 4)

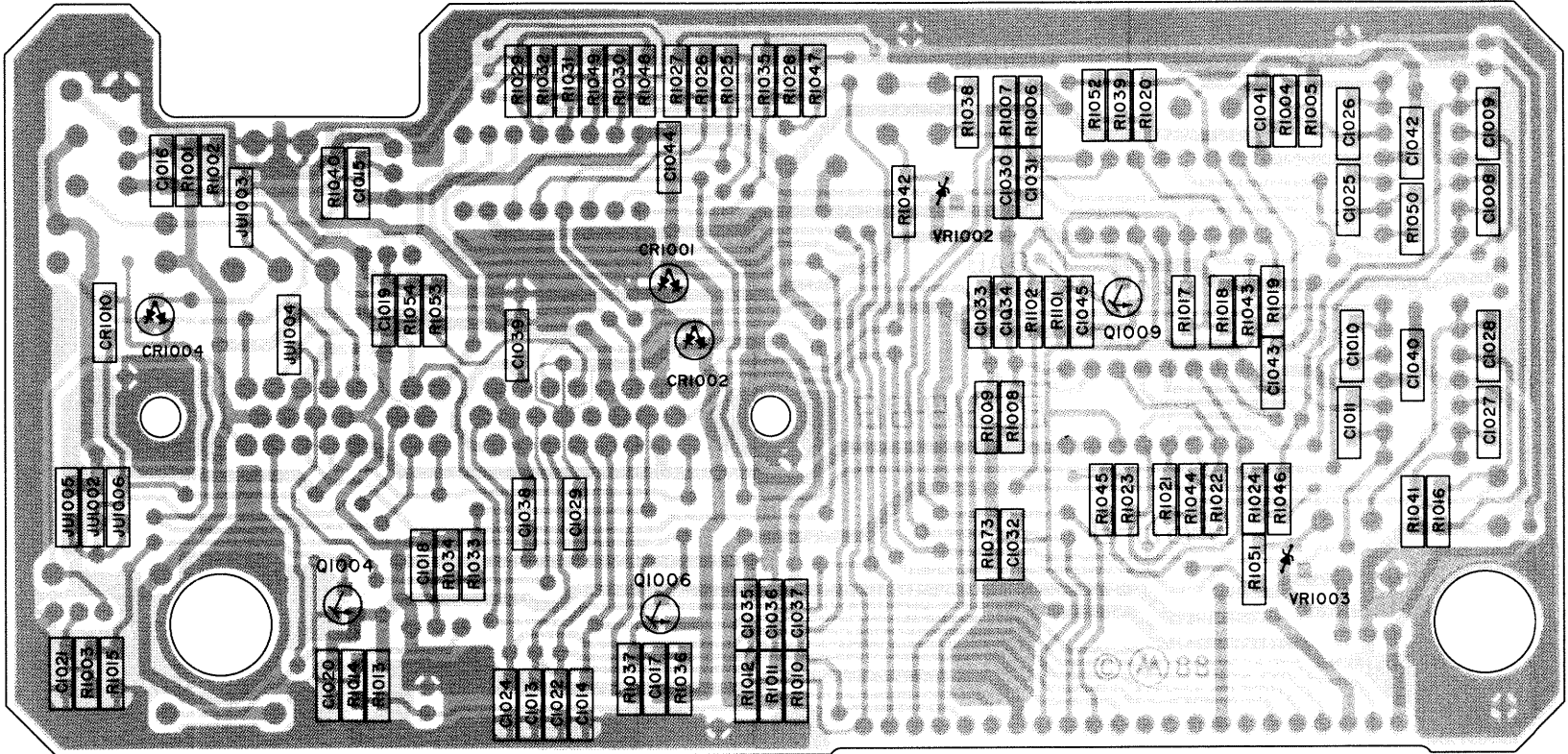
6/30/89

CONTROL BOARD



SOLDER SIDE GPW-5558-0
COMPONENT SIDE GPW-5559-0
OVERLAY GXW-5556W01-0

COMPONENT SIDE



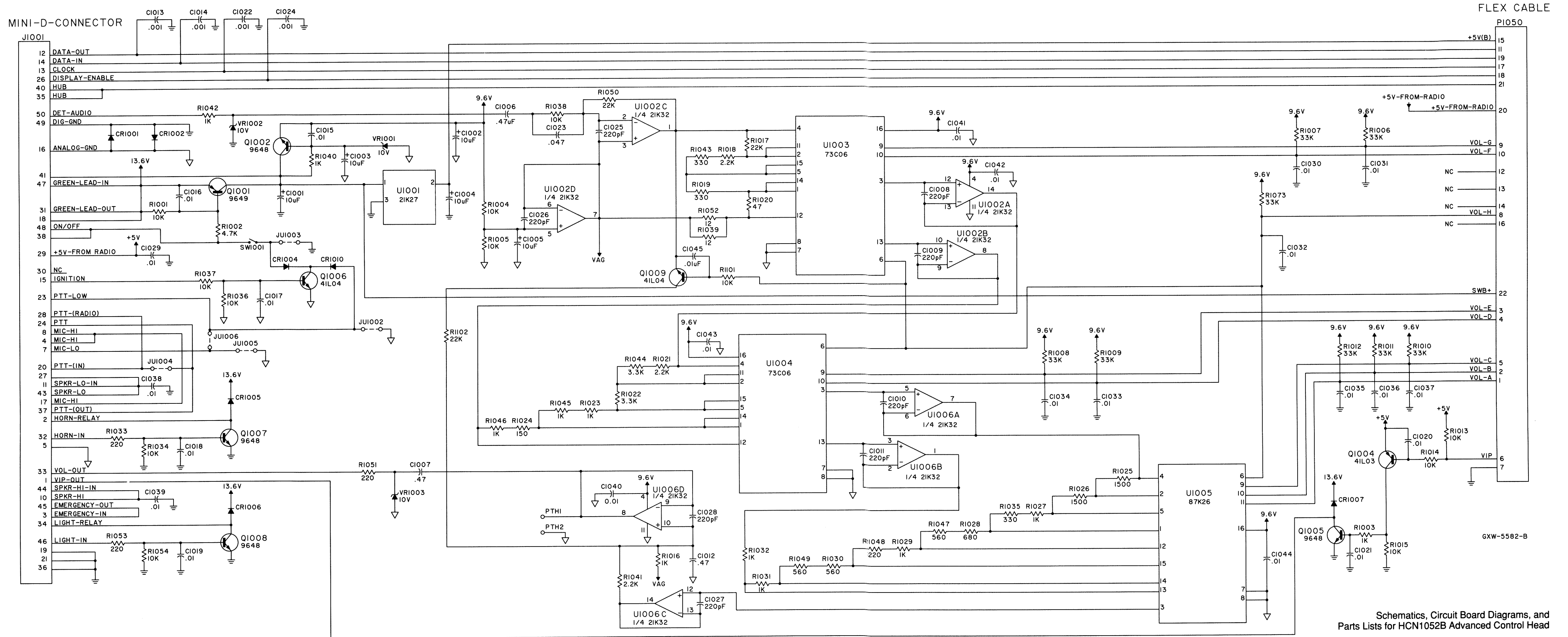
SOLDER SIDE GPW-5558-0
COMPONENT SIDE GPW-5559-0
OVERLAY GXW-5556W02-A

SOLDER SIDE

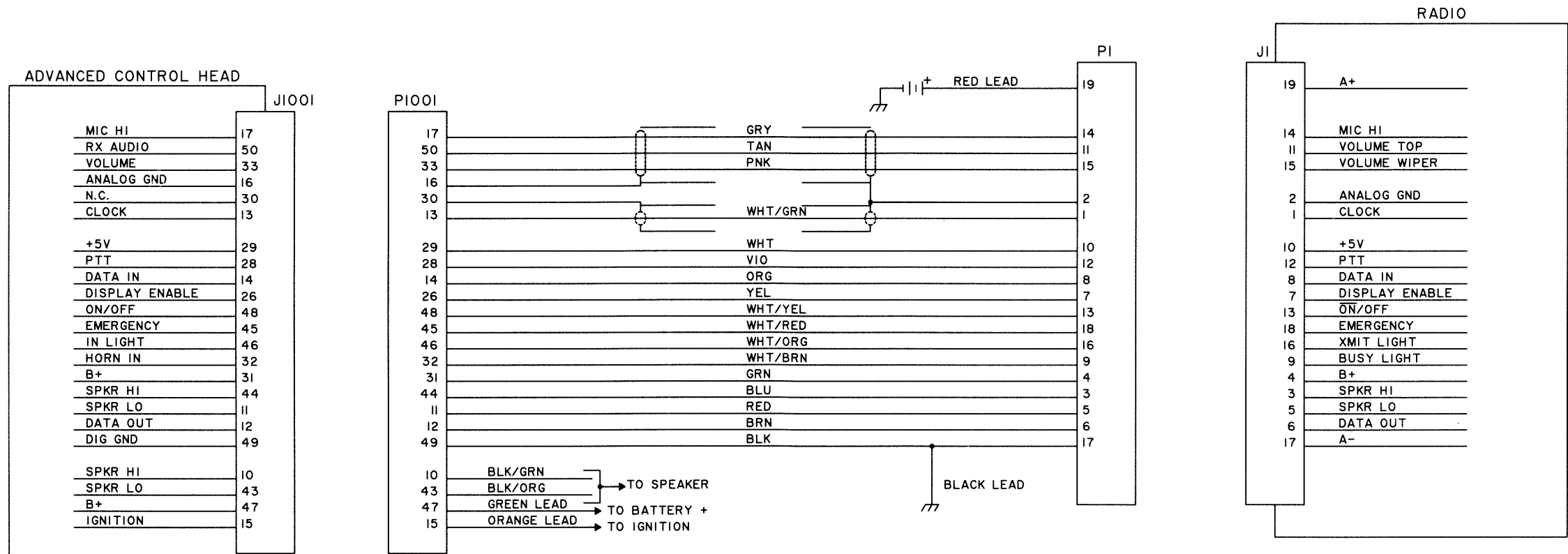
JUMPER CONFIGURATION	
JUMPER	FUNCTION
CR1010	CONNECTS PTT LOW TO IGNITION SENSE WHICH PREVENTS TRANSMITTING WHEN IGNITION IS OFF.
JU1002	CONNECTS PTT LOW TO ANALOG GROUND TO ALLOW TRANSMITTING REGARDLESS OF IGNITION SENSE.
JU1003	CONNECTS ON/OFF SWITCH TO DIGITAL GROUND ALLOWING RECEIVER OPERATION REGARDLESS OF IGNITION SENSE.
JU1004	CONNECTS PTT TO PTT IN WHICH ALLOWS REMOVAL OF EXTERNAL VIP JUMPER PLUG.
JU1005	CONNECTS MIC LO TO ANALOG GROUND WHEN HANDSET IS NOT USED.
JU1006	CONNECTS MIC LO TO PTT LOW WHEN HANDSET IS USED.

NORMALLY, THE FOLLOWING JUMPERS ARE INSTALLED, JU1001, JU1003, AND JU1005.

CONTROL BOARD



Schematics, Circuit Board Diagrams, and
Parts Lists for HCN1052B Advanced Control Head



GXW-5580-0

parts list

HLN5406B Display Control Head, 99F (Display Board) MXW-5588-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, $\pm 10\%$, 50V (unless otherwise stated)		
C1050, 1051	21-13741N21	0.001
C1052-1070	21-13741N69	0.1
C1072-1073	21-13741N45	0.01
diode (see note)		
CR1050, 1051	48-82466H18	rectifier, silicon
CR1052, 1053	48-80026P03	LED, red
CR1054	48-80026P04	LED, yellow
CR1055, 1056	48-80026P03	LED, red
CR1057	48-80026P04	LED, yellow
CR1058	48-80026P03	LED, red
CR1059	48-11034A01	rectifier, silicon
CR1060-1062	48-80026P03	LED, red
CR1063-1070	48-80246K04	LED, green
indicator		
DS1050	48-80055M01	LED, 7-segment, 2-digit, green
transistor (see note)		
Q1050, 1051	48-80141L04	NPN, type 41L04
Q1052	48-11043C08	PNP
Q1053	48-80141L04	NPN, type 41L04
resistor, fixed, ohm, $\pm 5\%$, 1/8 watt (unless otherwise stated)		
R1055, 1056	06-11077A54	150
R1057	06-11077A74	1k
R1058-1069	06-11077A98	10k
R1070	06-11077A90	4.7k
R1071	06-11077A68	560
R1072	06-11077A74	1k
R1073	06-11077B11	33k
R1074-1089	06-11077A98	10k
R1090	06-11077A74	1k
R1091	06-11077A98	10k
R1092	06-11077A74	1k
R1093-1100	06-11077A98	10k
integrated circuit (see note)		
U1050	51-80236C01	driver, LED display
U1051, 1052	51-84887K36	shift register, CMOS
voltage regulator (see note)		
VR1051, 1052	48-80140L06	zener, 5.1V
VR1053	48-80140L07	zener, 5.6V
VR1054	48-80140L06	zener, 5.1V
VR1058	48-80140L06	zener, 5.1V

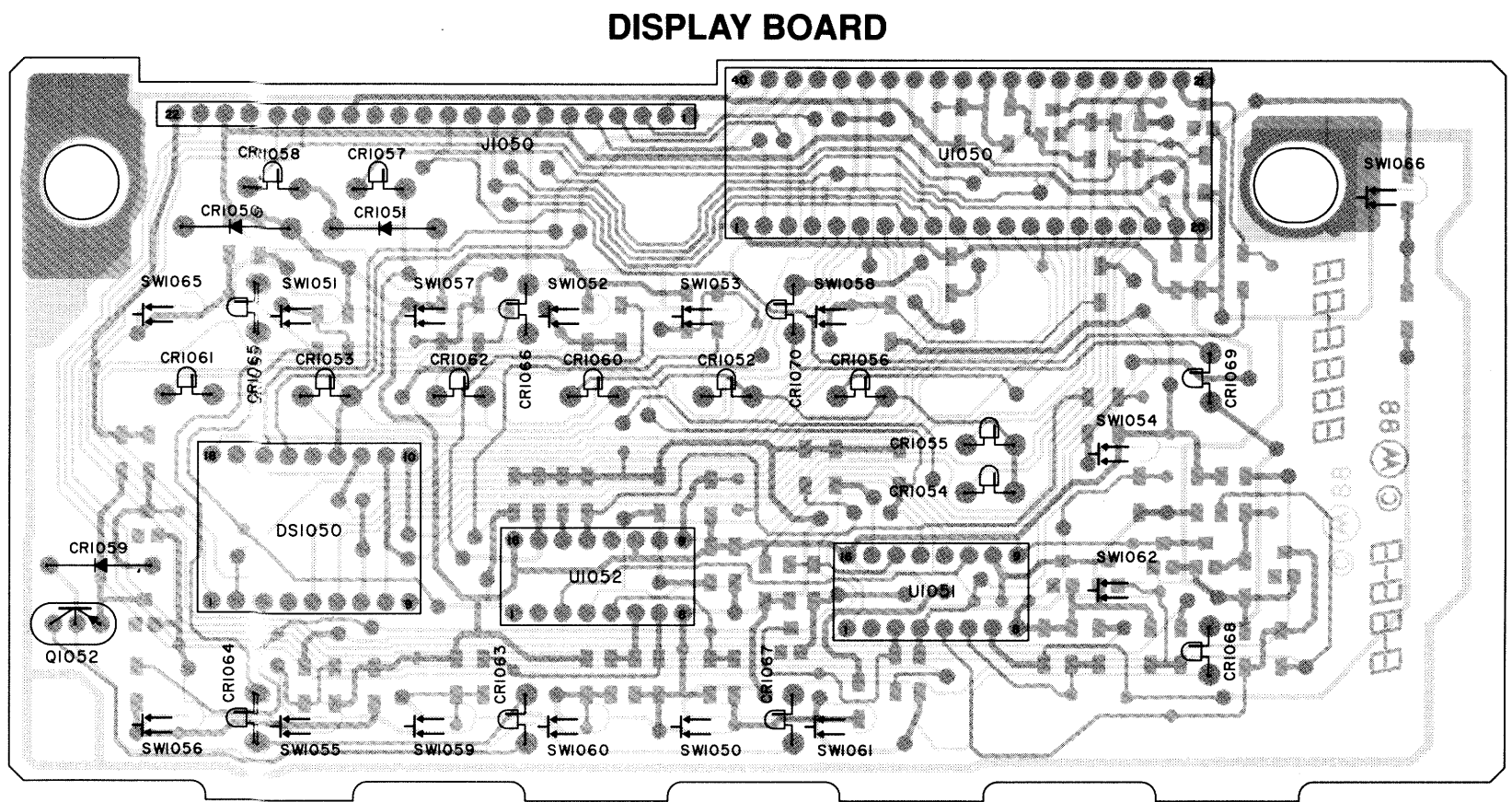
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

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Schematics, Circuit Boards, Diagrams, and Parts Lists for HCN1052B Advanced Control Head (Sheet 3 of 4)

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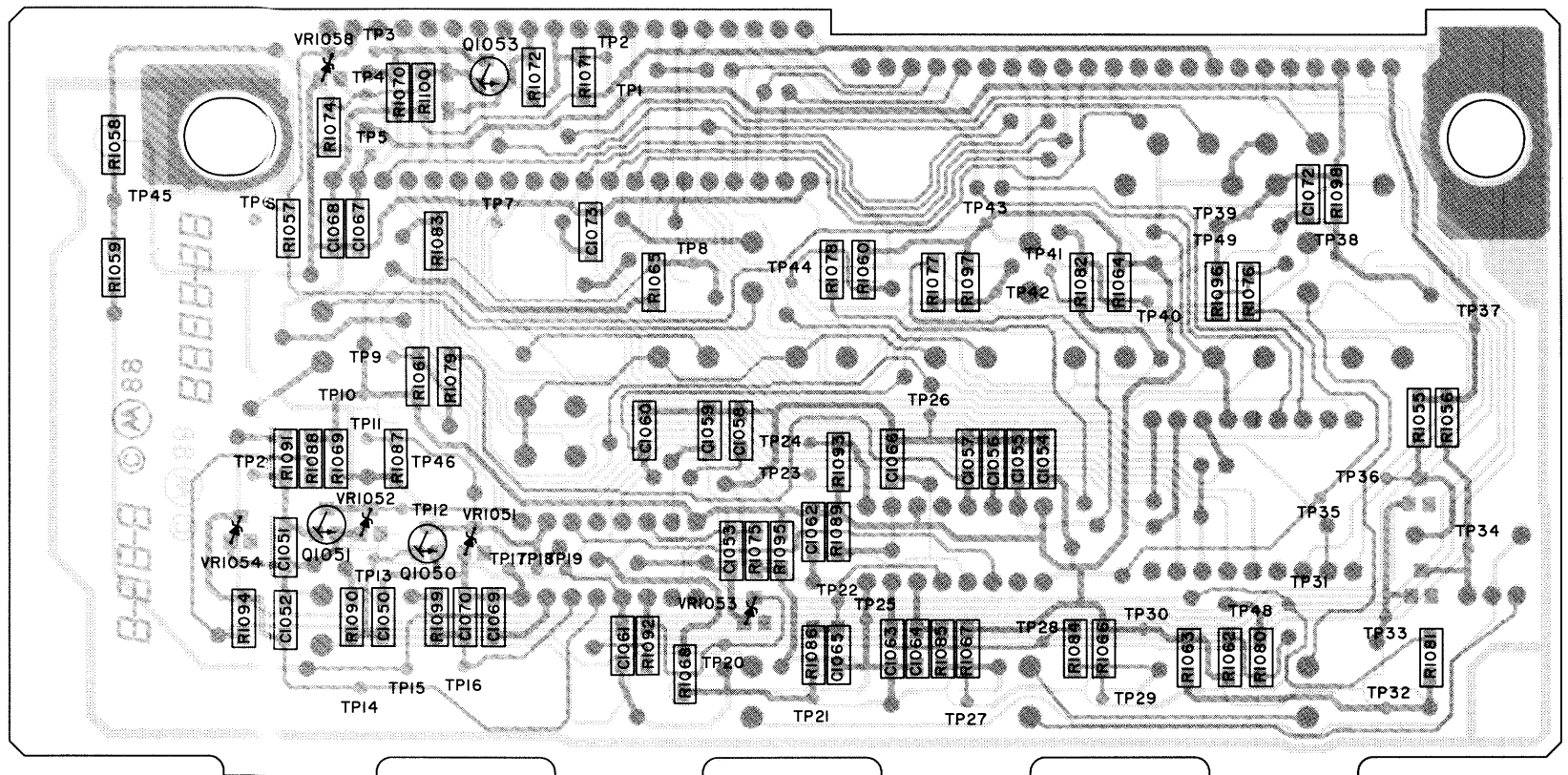


SOLDER SIDE GPW-5560-0

COMPONENT SIDE GPW-5561-0

OVERLAY GXW-5557W01-A

COMPONENT SIDE

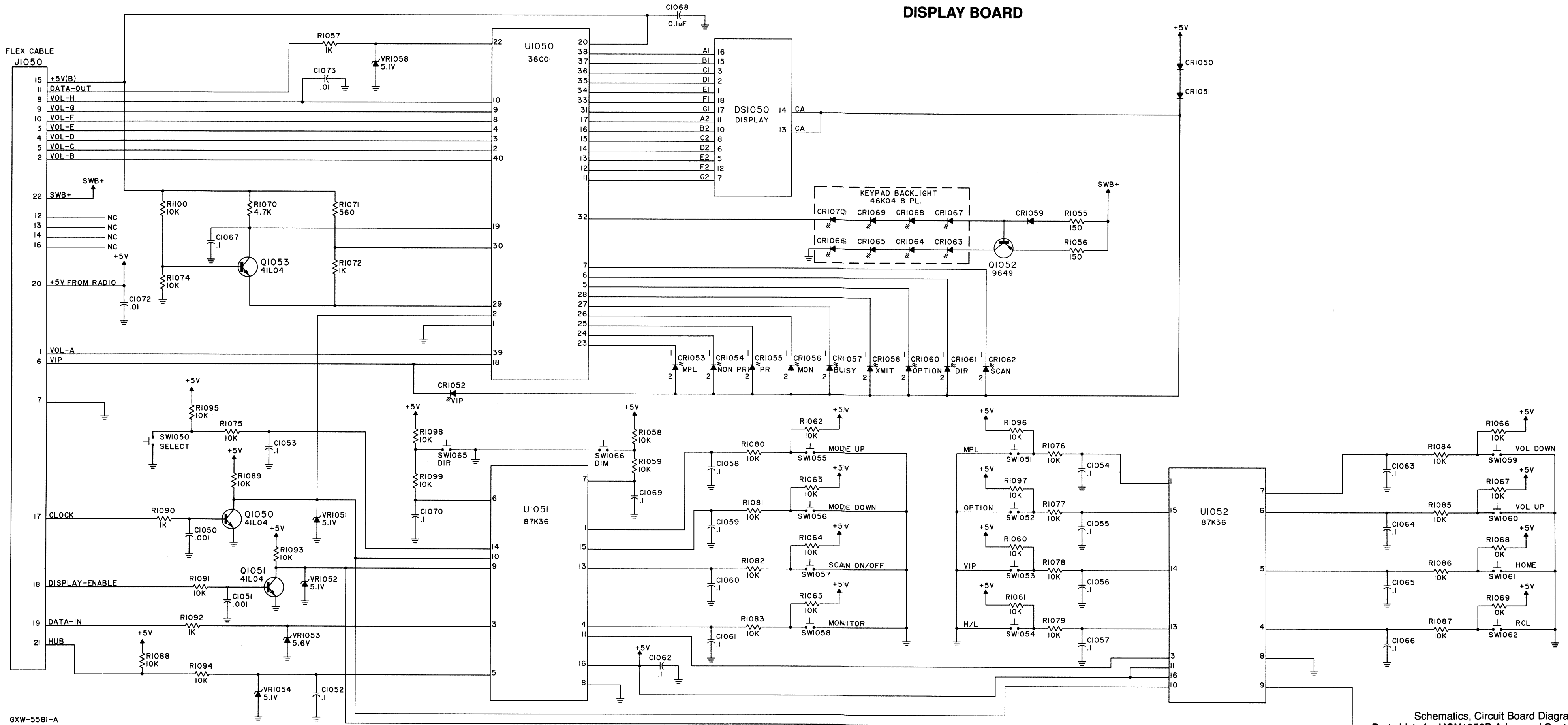


SOLDER SIDE GPW-5560-0

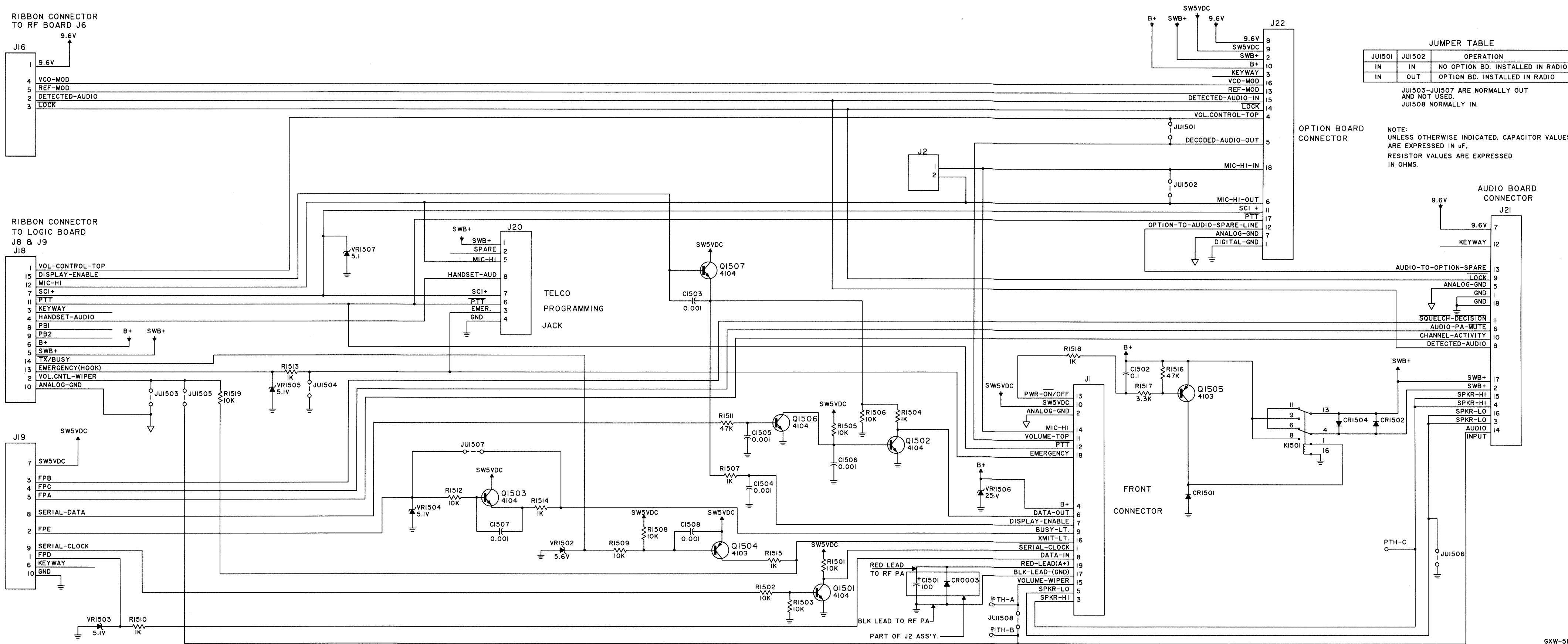
COMPONENT SIDE GPW-5561-0

OVERLAY GXW-5557W02-A

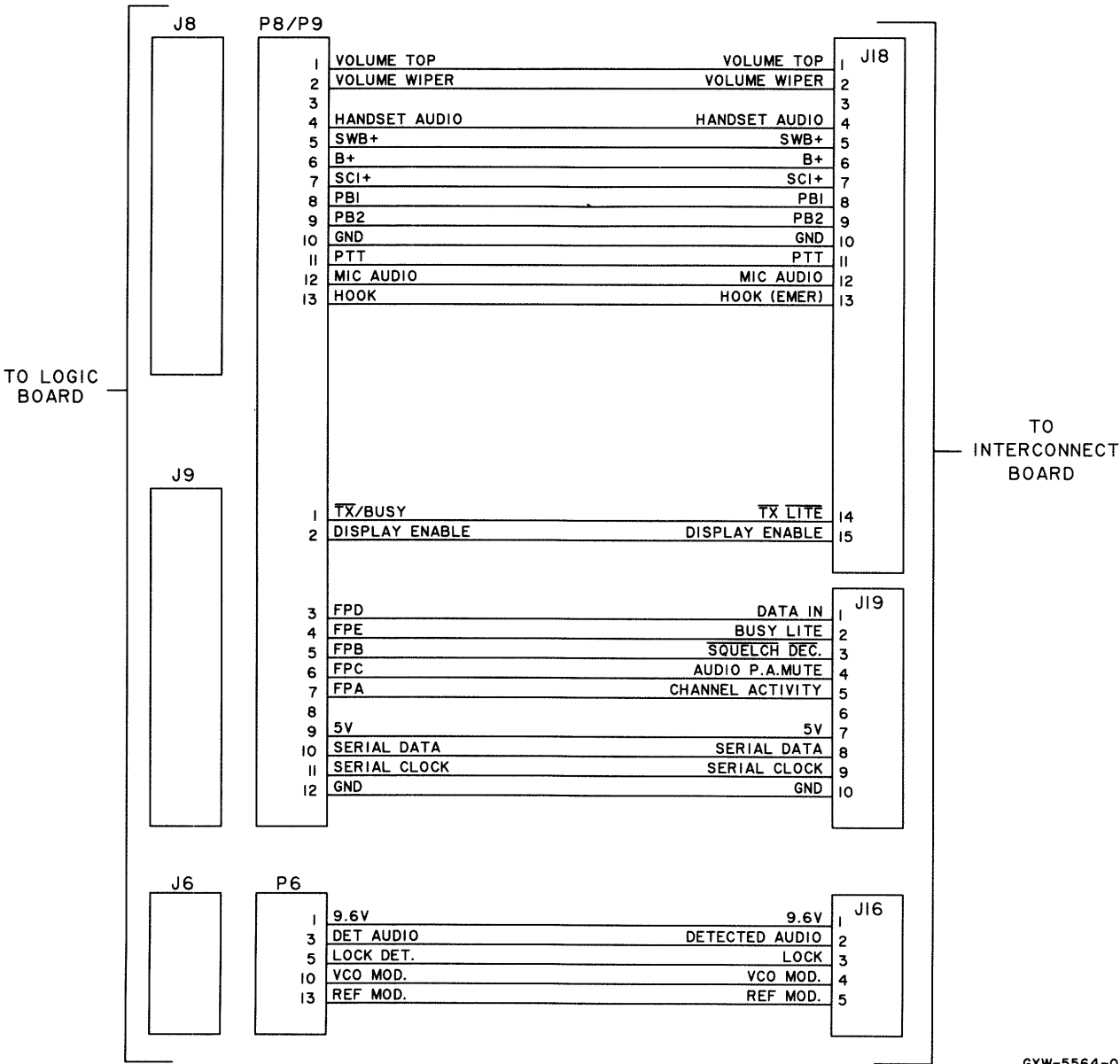
SOLDER SIDE



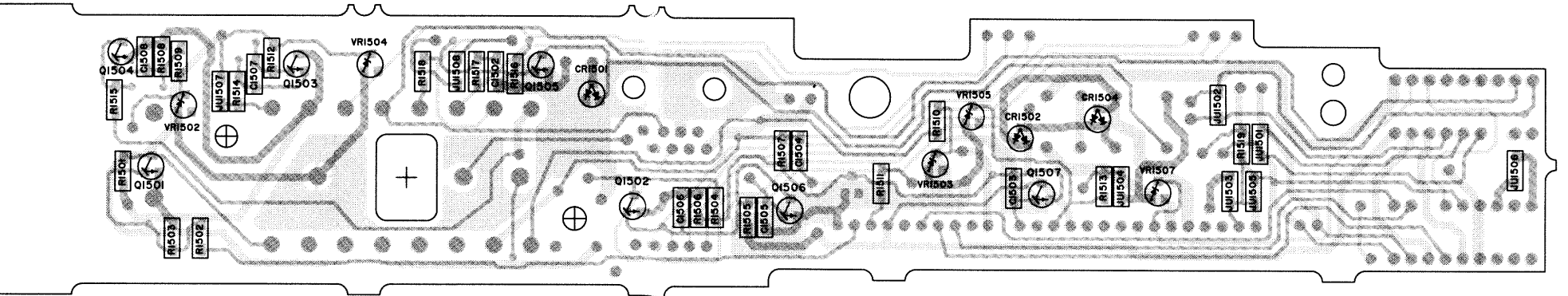
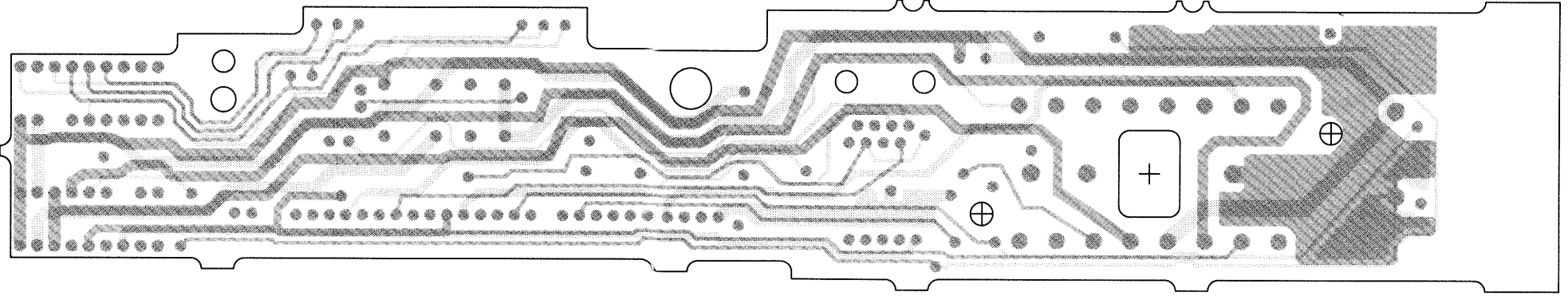
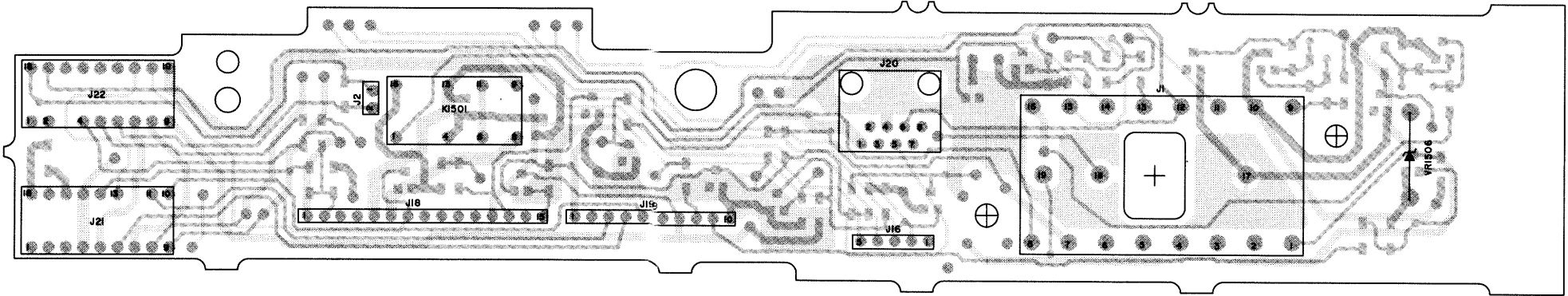
Schematics, Circuit Board Diagrams, and
Parts Lists for HCN1052B Advanced Control Head



Schematic, Circuit Board Diagram, and
Parts List for HLN5343B Interconnect Board



INTERCONNECT RIBBON
DIAGRAM



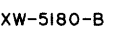
parts list

HLN5343B m400 Interconnect Board MXW-6593-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 10\%$, 50V (unless otherwise stated)		
C11-28	21-84874K01	470 pF, $\pm 20\%$, 250V
C1501	23-80167C03	1000 uF, $\pm 20\%$, 25V, electrolytic
C1502	21-13741N69	0.1
C1503-1508	21-13741N21	0.001
diode (see note)		
CR3	48-80153A01	silicon
CR1501,1502	48-80236E08	silicon
CR1504	48-80236E08	silicon
connector receptacle		
J1	28-80011A01	male, 19-pin
J20	09-80132M01	telco, 8-pin
J21,22	09-80103M05	female, 18-contact
Jumper		
JU1501,1502	06-11077A01	0-ohm resistor
JU1508	06-11077A01	0-ohm resistor
relay		
K1501	80-80075G03	220V, 2 amps
transistor (see note)		
Q1501-1503	48-80141L04	NPN
Q1504,1505	48-80141L03	PNP
Q1506,1507	48-80141L04	NPN
resistor, fixed, ohm, $\pm 5\%$, 1/8 watt (unless otherwise stated)		
R1501-1503	06-11077A98	10k
R1504	06-11077A74	1k
R1505,1506	06-11077A98	10k
R1507	06-11077A74	1k
R1508,1509	06-11077A98	10k
R1510	06-11077A74	1k
R1511	06-11077B15	47k
R1512	06-11077A98	10k
R1513-1515	06-11077A74	1k
R1516	06-11077B15	47k
R1517	06-11077A86	3.3k
R1518	06-11077A74	1k
voltage regulator (see note)		
VR1502	48-80140L07	zener, 5.6V
VR1503-1505	48-80140L06	zener, 5.1V
VR1506	48-80236E07	zener, 28V
VR1507	48-80140L06	zener, 5.1V
non-referenced parts		
MP101	26-80191P01	heatsink (2 used)
	64-80264A01	cable plug
	03-10904A02	screw, machine M3.5 x 0.6 x 6 (2 used)

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematic, Circuit Board Diagram, and
Parts List for HLN5343B Interconnect Board





SOLDER SIDE



MXW-6653-A (2)		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
U1102	51-84621K32	quad op-amp
voltage regulator (see note)		
VR500	48-80140L15	zener, 10V
non-referenced parts		
26-80129P01		heatsink, audio final (HLN5342C only)
03-1090A18		M3 x .5 x .6 (2 used) (HLN5342C only)

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number

Schematic, Circuit Board Diagram, and
Parts List for HLN5342B/C Audio Squelch Board

parts list

HLD4335A M400 Exciter and Power Control MXW-5173-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C901-903	21-13741N45	0.01
C1600,1601	21-13741N45	0.01
C1602	23-13749M35	2.2, 35V, tantalum
C1603	21-13741N45	0.01
C1604	21-13740B29	15 pF, ±5%
C1606	21-13741N45	0.01
C1702,1703	21-13741N45	0.01
C1704	23-13749M35	2.2, 35V, tantalum
C1705	21-13740B22	7.5 pF, ±25 pF
C1706	21-13741N45	0.01
C1707	21-13740B39	39 pF, ±5%
C1708-1710	21-13741N45	0.01
C1711	21-13740B23	8.2 pF, ±25 pF
C1712	21-13740B35	27 pF, ±5%
C1713	21-13741N45	0.01
C1714	21-13740B49	100 pF, ±5%
diode (see note)		
CR901	48-11034A01	silicon
connector receptacle		
J11	09-80001F01	female, 1-contact
J12	28-80164N01	5-pin
J13	28-80071H06	6-contact, keyed
J14	29-80014A01	female
J15	28-84324M01	male, 2-pin
J26	28-84318M06	male, 2-pin
coil, RF		
L1601	24-11030D06	86.6 nH
L1701	24-11030B09	33.9 nH
L1702	24-80293D02	ferrite bead
L1703	24-80002E01	1200 nH
L1705	24-80293D02	ferrite bead
L1706	24-82723H11	200 nH
L1707	24-11030B05	18.6 nH
L1708	24-80293D02	ferrite bead
transistor (see note)		
Q901,902	48-11043C07	NPN
Q1601	48-11043C49	NPN
Q1701	48-00869591	NPN
Q1702	48-00869859	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R900	06-11077A01	jumper
R902	06-11077A34	22
R903	06-11077A01	jumper
R905	06-11077B15	47k
R906	06-11077A92	5.6k
R907	06-11077A68	560
R908	06-11077A80	1.8k
R909	06-11077A90	4.7k
R910	06-11077A86	3.3k
R911	18-80205N02	20, 10%, 1/2W, potentiometer
R916	06-11077A01	0-ohm jumper
R1600	06-11077A50	100
R1601,1602	06-11077A68	560
R1603,1604	06-11077A54	150
R1606,1607	06-11077A26	10
R1608	06-11077A43	51
R1609	06-11077A54	150
R1701	06-11077A74	1k
R1702	06-11077A64	390
R1703	06-11077A50	100
R1704	06-11077A46	68
R1705	06-11077A28	12
R1706	06-11077A68	560
R1707	06-11077A28	12
R1708	06-11077A50	100
R1709	06-11077A68	560
mechanical parts		
14-80001C01	insulator, transistor (2 used)	
26-80003M02	shield, high IF (3 used)	
26-80006M01	shield, second VCO	

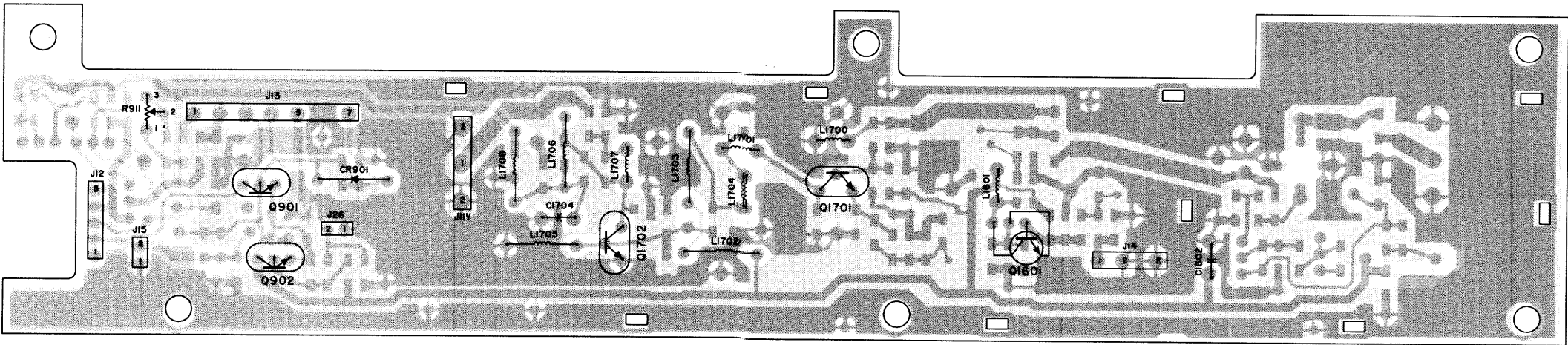
8/31/89
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematic, Circuit Board Diagram, and Parts List for HLD4335A for VHF Exciter/Power Control Board

(Sheet 2 of 2)

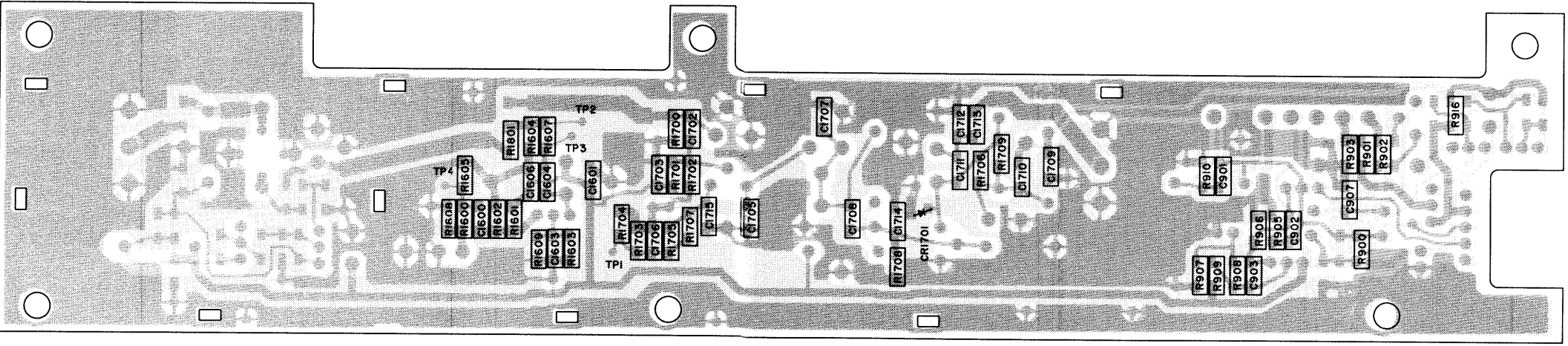
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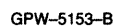
SOLDER SIDE GPW-5311-0
COMPONENT SIDE GPW-5312-0
OVERLAY GXW-5282W01-A

COMPONENT SIDE



SOLDER SIDE GPW-5311-0
COMPONENT SIDE GPW-5312-0
OVERLAY GXW-5282W02-A

SOLDER SIDE



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HLD4337B PA Board 100W Range 2 MXW-5216-C

capacitor, fixed, pF, +5%, 500V (unless otherwise stated)		
	-----	(jumper used)
C80 1.802		
C803	21-83406D77	30
C804	21-84493B859	39
C805,806	21-83406D777	39
C807,808	21-84493B865	100
C809	21-84493B866	150
C810	21-83596E10	220 +20%
C811-814	21-84493B864	91
C816	08-82096J18	0.1 uF, +10%, 250V
C817	21-83596E10	220 +20%
C818	08-82096J08	0.22 +10%, 250V
C819-822	21-826110C13	27 100V
C823,824	21-84493B856	40 200V
C825,826	21-80069B01	310 350V
C827,828	21-82372C10	0.05 uF, +20%, 25V
C830-837	21-80169A53	51 200V
C838	21-84395B804	120 250V
C840	21-83596E10	220 +20%
C842	21-84395B846	66, 250V
C843	21-84395B841	95 350V
C845	21-84395B846	150, 250V
C847	21-84395B835	240 +10%, 35uV
C848	21-84395B851	16 250V
C849	21-84395B828	32 350V
C850,851	21-84395B836	40 350V
C852	21-84395B839	30 350V
C853	21-84395B830	14 250V
C856,857	21-83596E10	220, +20%
C858	23-84538G04	15 uF, +20%, 20V tantalum
C859	08-82096J20	0.22 uF, +10%, 250V
C864		(jumper used)
C866,867	21-84395B839	30 350V
C868	21-83596E21	0.01 uF, +80-20, 200V
C870	21-83596E10	220, +20%
C882	08-11051A08	0.015 uF 63V
C899	08-11051A07	0.01 uF, 63V

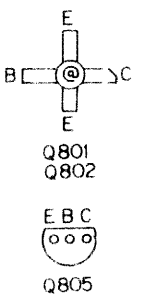
coil, RF		
L801	24-83884G01	50 uH
L802	24-82723H27	1.2 uH
L803	24-80036A02	ferrite bead, 1.2 turn
L804	24-80277A10	airwound, 12.5 turns
L805	07-80062B02	bracket
L806	24-80036A01	ferrite bead, 1/2 turn
L807	24-80036A02	ferrite bead, 1/2 turn
L808	24-80277A14	airwound, 1.5 turns
L809-B10	24-82549C48	2.2 uH
L811	24-80277A13	airwound, 7.5 turns
L812	07-80062B04	bracket
L813	24-80277A17	airwound, 1.5 turns
L814	24-80277A18	airwound
L815-B18	24-80277A11	airwound, 6.5 turns
L820	24-82723H41	0.14 uH
L821	24-80036A02	1/2 turn

thermistor		
RT801	06-83600K09	100k

R801	17-80165C02	shunt
R804	06-11009D23	0-ohm jumper
R806	06-11009C15	39
R807	06-11045A41	470, 1/2W
R808,R09	06-11009C09	22
R810	06-11045A41	470, 1/2W
R811	06-11045A01	10, 1/2W
R812	06-11086C27	47, 2W
R813	17-82036G07	1.5 + 10%, 2W
R814	06-11045B26	47, 1/2W
R815,R16	06-11045A03	12, 1/2W
R817,R18	17-82036G11	33, +10%, 2W
R822	17-82291B24	0.1, 3W
R823	06-11009C42	510
R824	06-11009C91	56k
R825	06-11009C37	330
R826	18-80087E08	potentiometer, 10k
R827	06-11045B26	47, 1/2W
R828	06-11009D23	0-ohm jumper (in place of CR801)
R830	06-11009C97	100k
R831	06-11045A29	150, 1/2W

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CURRENT SENSE
LOW VIA C881
 TEMP SENSE
HI VIA C882
 TEMP SENSE
LOW VIA C883
 A+ VIA
C884
 DRIVE LIMIT
VIA C887
 A- VIA
C885
 B- VIA
C886

FEED-THRU PLATING CAPACITORS

COMPONENT SIDE	BD -	GEW-3110-A
SOLDER SIDE	BD -	GEW-3111-A
	OL -	GEW-5104-B

HLN4046A Feed Thru Plate MXW-4502-A

capacitor, fixed, pF, 500V (unless otherwise stated)

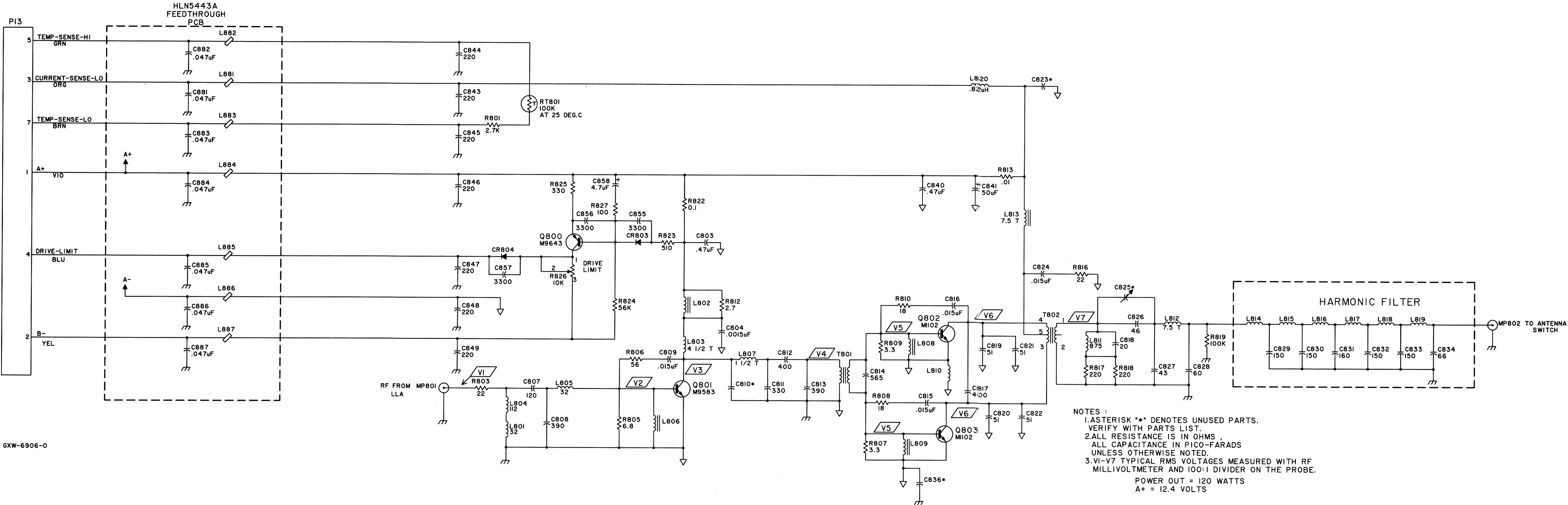
64-80005A01 plate, feed thru

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(Sheet 2 of 2)

RANGE 2 LOW BAND POWER AMPLIFIER SCHEMATIC



NOTES :
1.ASTERISK "*" DENOTES UNUSED PARTS.
2.ALL RESISTANCE IS IN OHMS ,
ALL CAPACITANCE IN PICO-FARADS
UNLESS OTHERWISE NOTED.
3.V1-V7 TYPICAL RMS VOLTAGES MEASURED WITH RF
MILLIVOLTMETER AND 100:1 DIVIDER ON THE PROBE.
POWER OUT = 120 WATTS
A+ = 12.4 VOLTS

(SEE NOTE 3)

FREQUENCY (MHZ)	V1 INPUT	V2 Q801 B-E	V3 Q801 C-E	V4 T801 PRIM.	V5 Q802,Q803 B-E	V6 Q802,Q803 C-E	V7 T802 SEC.
36.0	6.5	1.5	7.8	7.4	1.2-2.0	13.5	150
39.0	5.4	1.3	8.9	9.0	1.2-2.0	12.6	155
42.0	5.6	1.3	9.4	9.2	1.2-2.0	14.3	180

Schematic, Circuit Board Diagram, and
Parts Lists for Low Band Power Amplifier
Range 2, 36-42 MHz

parts lists

HLB4118A m400 PA Board, 110W Range 2 MXW-6905-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5% (unless otherwise stated)		
C803	08-11051A17	0.47 uF, 63V
C804	08-11051A02	0.0015 uF, 63V
C807	21-84494B06	120, 500V
C808	21-84494B18	390, 500V
C809	08-11051A08	0.015 uF, 63V
C811	21-84494B16	330, 500V
C812	21-84395B14	400, 250V
C813	21-84494B18	390, 500V
C814	21-84857K06	565, 500V, ±3%
C815,816	08-11051A08	0.015 uF, 63V
C817	21-84395B14	400, 250V
C818	21-80067A40	20
C819-822	21-84494B01	51
C824	08-11051A08	0.015 uF, 63V
C826	21-84395B44	46, 250V
C827	21-84395B19	43, 250V
C828	21-84395B07	60, 250V
C829,830	21-84395B06	150, 250V
C831	21-84395B26	160, 250V, ±2%
C832,833	21-84395B06	150, 250V
C834	21-84395B22	66, 250V
C840	08-11051A17	0.47 uF, 63V
C841	23-84669A05	50 uF, -10+150, 25V, electrolytic
C843-849	21-11015B05	220, ±10 pF, 100V
C855-857	21-11015B19	3300, ±10 pF, 100V
C858	23-11054H04	4.7 uF, ±10%, 25V, tantalum
diode (see note)		
CR803,804	48-82466H13	rectifier, silicon
coil, RF		
L801	24-11030D03	32 nH
L802	24-80036A02	1/2 turn
L803	24-84235B04	4-1/2 turns, airwound
L804	24-11030B14	9-1/2 turns, airwound
L805	24-11030D03	32 nH
L806	24-83977B01	choke
L807	24-80277A17	1-1/2 turns, airwound
L808,809	24-83977B01	choke
L810	24-11030E01	fixed RF
L811	24-80071P13	897 nH
L812	24-80135J06	7-1/2 turns, airwound
L813	24-80110B13	7-1/2 turns
L814	24-80110B02	7-1/2 turns
L815	24-80110B03	8-1/2 turns
L816,817	24-80110B04	9-1/2 turns
L818	24-80110B03	8-1/2 turns
L819	24-80110B02	7-1/2 turns
L820	24-11047A12	82 uH
transistor (see note)		
Q800	48-11043C06	PNP
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, ±5%, 1/4 watt (unless otherwise stated)		
R801	06-11009A59	2.7k
R803	06-11086C19	22, 2W
R805	06-11086A09	6.8, 1W
R806	06-11086C29	56, 2W
R807	06-11086A06	3.3, 1W
R808	17-82036G27	18, 2W
R809	06-11086A06	3.3, 1W
R810	17-82036G27	18, 2W
R812	06-11045B24	2.7, 1/2W
R813	17-80165C02	shunt, 0.01, ±10%, 12W
R816	06-11086C19	22, 2W
R817,818	06-11086C43	220, 2W
R819	06-11045A97	100k, 1/2W
R822	17-82291B24	0.1, 3W
R823	06-11009A42	510
R824	06-11009A91	56k
R825	06-11009A37	330
R826	18-80087E08	potentiometer, 10k, ±20%, 1/2W
R827	06-11009A25	100
transformer		
T801	24-80099B01	fixed RF
T802	25-80229J03	high power
mechanical parts		
MP801,802	29-80014A01	clip, coax (2 used)

10/15/89

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

HLB4077A Power Transistor Kit MXW-6382-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
transistor (see note)		
Q801	48-00869583	power, NPN
Q802,803	48-84411L02	power, NPN

3/1/89

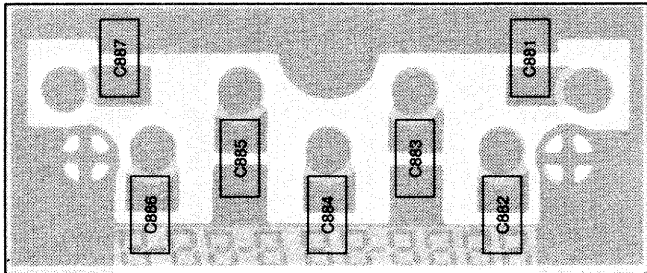
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

HLN5443A Feedthru Plate Assembly MXW-6381-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 500V (unless otherwise stated)		
C881-887	21-84547A07	047 uF, ±20%, 100V
connector		
	28-80155K01	male header

3/31/90

HLN5443A FEEDTHRU PLATE

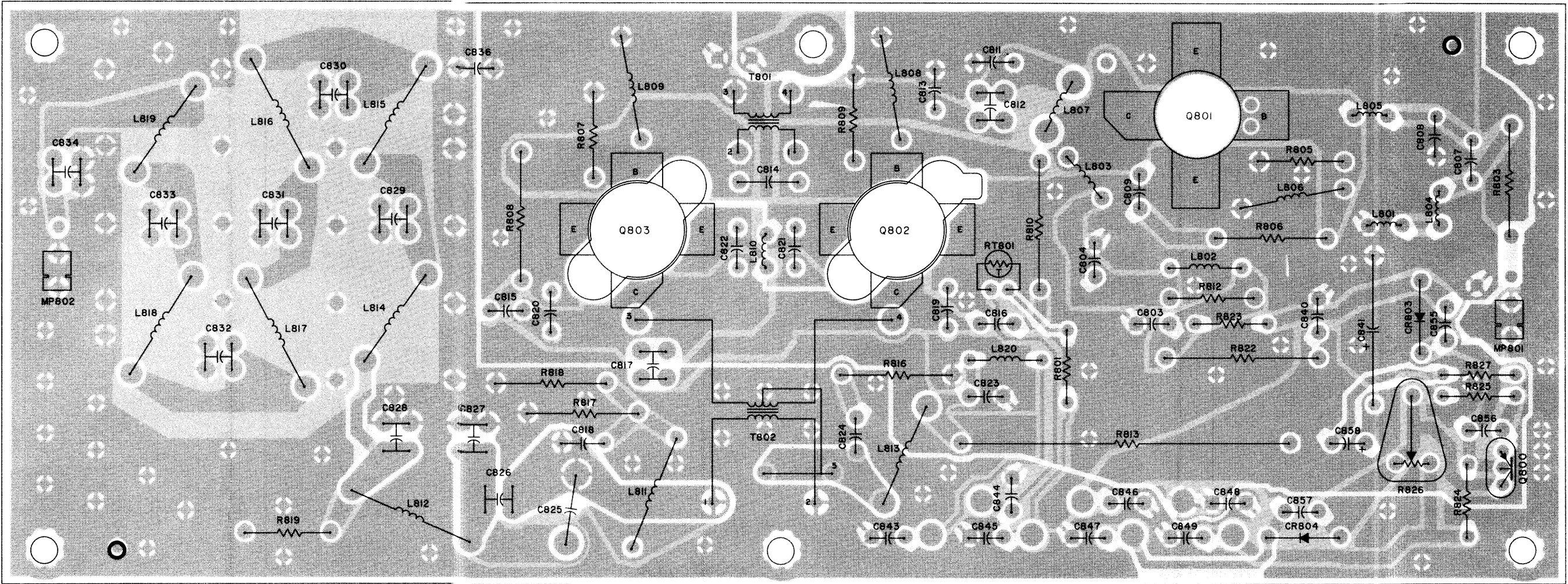


SOLDER SIDE VIEW

SOLDER SIDE
COMPONENT SIDE
OVERLAY

GPW-7744-O
GPW-7745-O

RANGE 2 LOW BAND POWER AMPLIFIER CIRCUIT BOARD



SOLDER SIDE
COMPONENT SIDE
OVERLAY

GPW-6908-O
GPW-6907-O

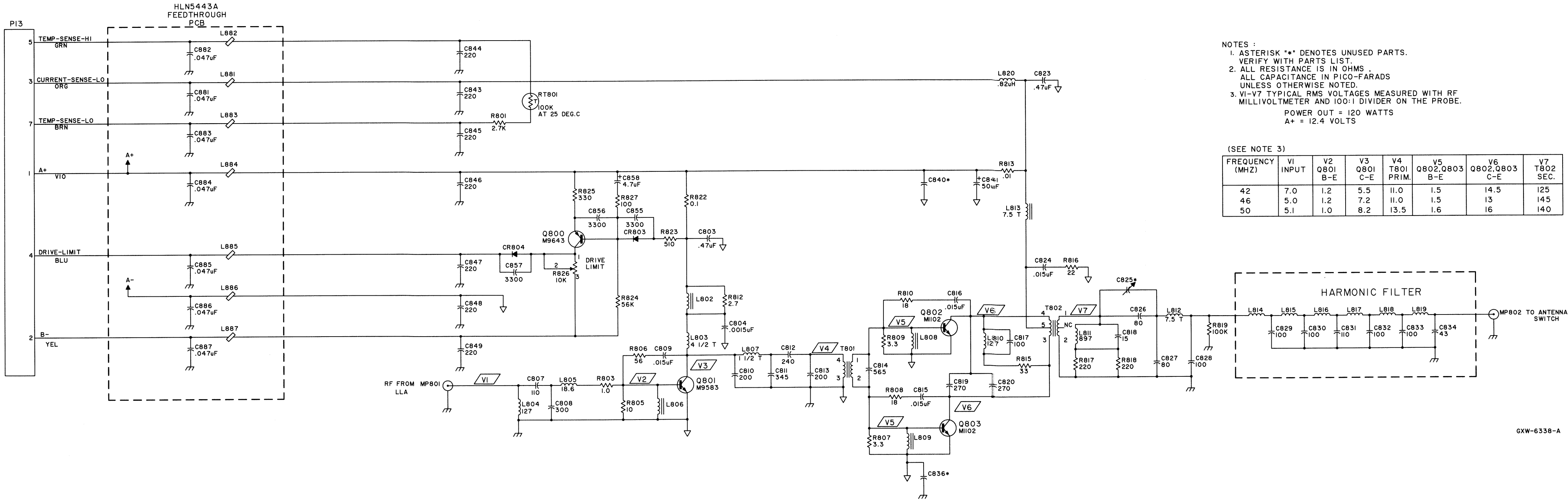
Schematic, Circuit Board Diagram, and
Parts Lists for Low Band Power Amplifier
Range 2, 36-42 MHz

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RANGE 3 LOW BAND POWER AMPLIFIER SCHEMATIC



parts lists

HLB4115A m400 110W PA Range 3 MXW-6339-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 500V (unless otherwise stated)		
C803	08-11051A17	0.47 uF, 63V
C804	08-11051A02	0.0015 uF, 63V
C807	21-84494B53	110
C808	21-84494B15	300
C809	08-11051A08	0.015 uF, 63V
C811	21-84494B11	200
C812	21-00868B23	345, ±3%
C813	21-84395B35	240, ±10%, 350V
C814	21-84494B11	200
C815, 816	21-84857K06	565, ±3%
C817	08-11051A08	0.015 uF, 63V
C818	21-84494B04	100
C819, 820	21-80067A35	15
C823	21-84494B14	270
C824	08-11051A17	0.47 uF, 63V
C826, 827	08-11051A08	0.015 uF, 63V
C828-830	21-84395B03	80, 250V
C831	21-84395B02	100, 250V
C832, 833	21-84395B20	110, 250V
C834	21-84395B02	100, 250V
C834	21-84395B19	43, 250V
C841	23-84669A05	50 uF, -10, ±150%, 25V electrolytic
C843-849	21-11015B05	220, ±10 pF, 100V
C855-857	21-11015B19	3300, ±10 pF, 100V
C858	23-11054H04	4.7 uF, 10%, 25V, tantalum
diode (see note)		
CR803, 804	48-82466H13	rectifier, silicon
coil, RF		
L802	24-80036A02	1 1/2 turns
L803	24-84235B04	4-1 1/2 turns, airwound
L804	24-11030B15	10-1 1/2 turns, white
L805	24-11030B05	2-1 1/2 turns, green
L806	24-83977B01	choke
L807	24-80277A17	1-1 1/2 turns, airwound
L808, 809	24-83977B01	choke
L810	24-11030B15	10-1 1/2 turns, white
L811	24-80071P13	897 nH
L812	24-80135J06	7-1 1/2 turns, airwound
L813	24-80110B13	7-1 1/2 turns
L814	24-80110B06	7-1 1/2 turns
L815	24-80110B07	8-1 1/2 turns
L816, 817	24-80110B08	9-1 1/2 turns
L818	24-80110B07	8-1 1/2 turns
L819	24-80110B06	7-1 1/2 turns
L820	24-11047A12	0.82 uH
transistor (see note)		
Q800	48-11043C06	PNP
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, ±5%, 1/4 watt (unless otherwise stated)		
R801	06-11009A59	2.7k
R803	06-11086A03	1, 1W
R805	06-11045A01	10, 1/2
R806	06-11086C29	56, 2W
R807	06-11086A06	33, 1W
R808	17-82036G27	18, 2W
R809	06-11086A06	33, 1W
R810	17-82036G27	18, 2W
R812	06-11045B24	2.7, 1/2W
R813	17-80165C02	shunt, 0.01, ±10%, 12V
R815	06-11086C23	33, 2W
R816	06-11086C19	22, 2W
R817, 818	06-11086C43	220, 2W
R819	06-11045A97	100k, 1/2W
R822	17-82291B24	0.1, 3W
R823	06-11009A42	510
R824	06-11009A91	56k
R825	06-11009A37	330
R826	18-80087E08	potentiometer, 10k, ±21%, 1/2W
R827	06-11009A25	100
transformer		
T801	24-80099B01	fixed RF
T802	25-80228J02	high power
non referenced parts		
	26-80206A02	shield, harmonic filter
	15-80205A02	cover, harmonic filter shield
	29-80014A01	clip, coax

HLB4077A Power Transistotr Kit MXW-6382-O

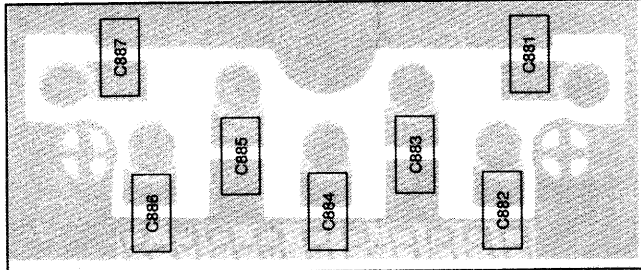
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
transistor (see note)		
Q801	48-00869583	power, NPN
Q802, 803	48-84411L02	power, NPN

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number

HLN5443A Feedthru Plate Assembly MXW-6381-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 500V (unless otherwise stated)		
C881-887	21-84547A07	047 uF, ±20%, 100V
connector		
	28-80155K01	male header
coil, RF		
L881-887	76-84069B04	ferrite bead

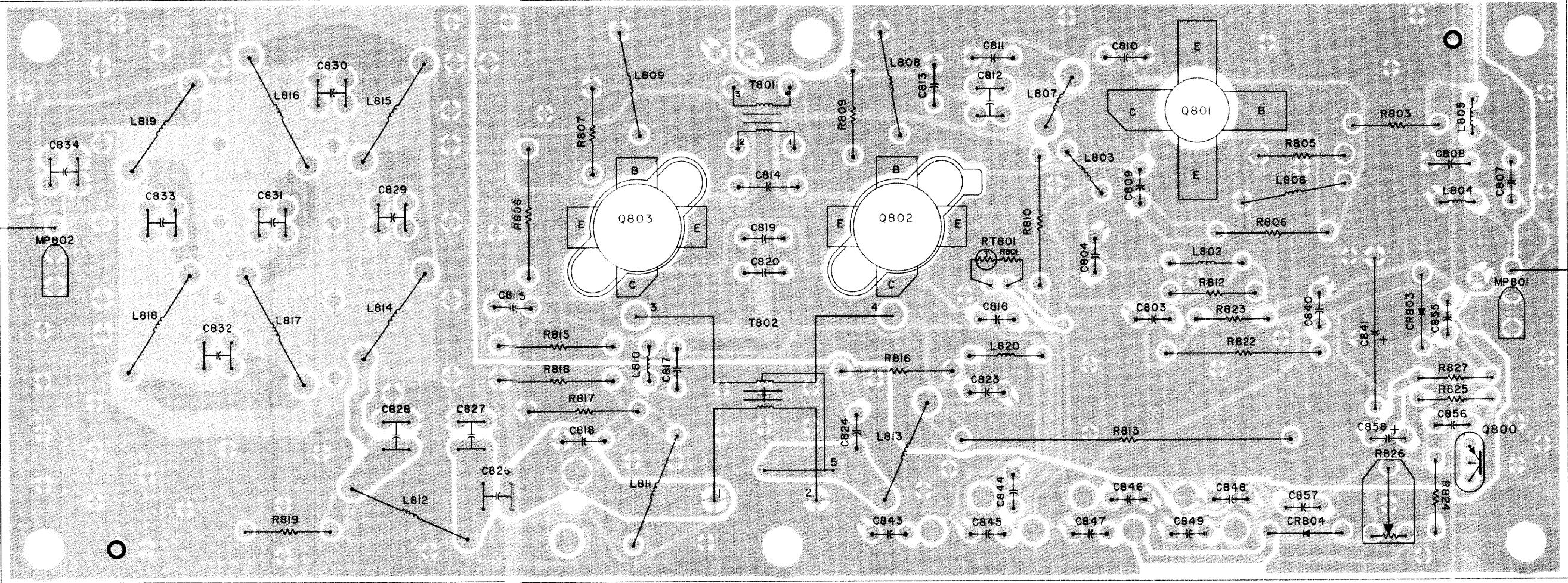
HLN5443A FEEDTHRU PLATE



SOLDER SIDE VIEW

SOLDER SIDE GPW-7744-O
COMPONENT SIDE
OVERLAY GPW-7745-O

RANGE 3 LOW BAND POWER AMPLIFIER



SOLDER SIDE GPW-6340-O
COMPONENT SIDE GPW-6341-O
OVERLAY GPW-6342-A

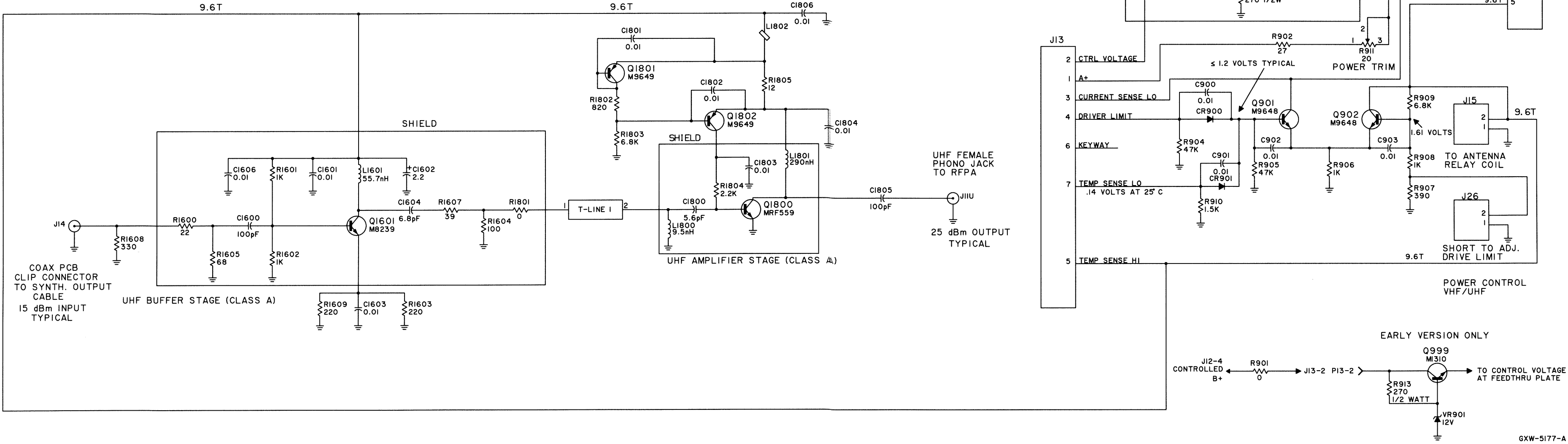
Schematic, Circuit Board Diagram, and Parts Lists for Low Band Power Amplifier Range 3, 42-50 MHz

parts list


HLE4444B Exciter/Power Control Board MXW-5233-B

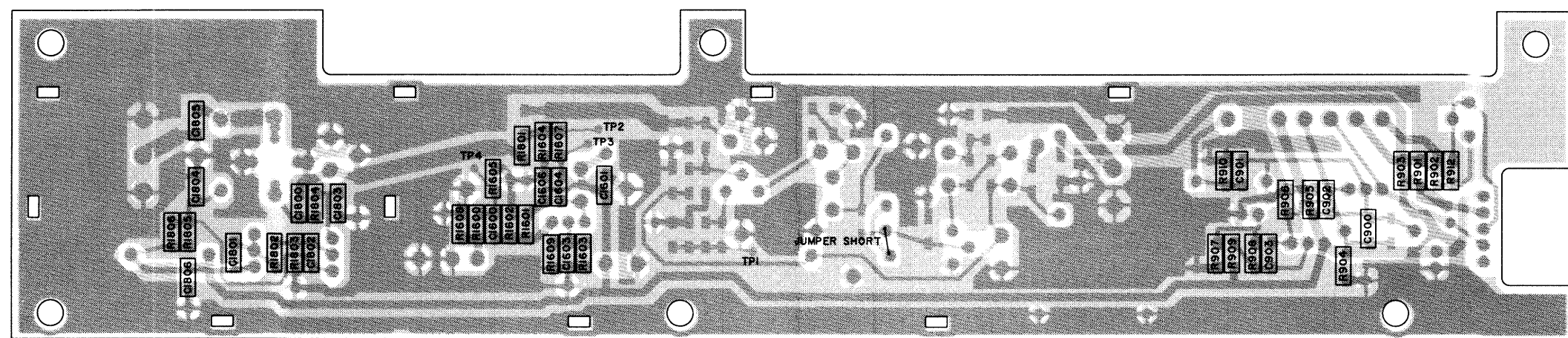
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF ±10% 50V (unless otherwise stated)		
C900-903	21-11032A21	.01
C904	08-11051A13	0.1 uF
C905-907	21-11032A09	0.001 uF
C1600	21-11031A39	100 pF ±5%
C1601	21-11032A21	.01
C1602	23-11054M01	2.2, 35V tantalum
C1603	21-11032A21	.01
C1604	21-11031A11	6.8 pF ±5 pF
C1606	21-11032A21	.01
C1800	21-11031A10	5.6 pF, ±5 pF
C1801-1804	21-11032A21	.01
C1805	21-11031A39	100 pF, ±5%
C1806	21-11032A21	.01
diode (see note)		
CR900,901	48-11034A01	silicon
VR901	48-82256C25	zener, 12V
connector receptacle		
J11U	09-80001F01	female, 1-contact
J12	28-80164N01	5-pin
J13	28-80071H06	male, 7-pin
J14	29-80014A01	female
J15	28-84324M01	male, 2-contact
J26	28-84318M06	male, 2-pin
coil, rf		
L1601	24-11030B10	55.7 nH (5.5 turns)
L1800	24-11030E04	1/2 turn, yellow
L1801	24-80002E02	.29 uH
L1802	24-80293D02	ferrite bead
transistor (see note)		
Q901,902,904,905	48-11043C07	silicon
Q903	48-00869619	PNP silicon
Q999	48-84413L10	NPN silicon
Q1601	48-11043C49	silicon
Q1800	48-82233P39	NPN
Q1801,1802	48-11043C08	silicon
resistor, fixed, Ω ±5%, 1/8 watt (unless otherwise stated)		
R901	06-11077A01	0 ohm jumper
R902	06-11077A36	27
R904,905	06-11077B15	47k
R906	06-11077A74	1k
R907	06-11077A64	390
R908	06-11077A74	1k
R909	06-11077A94	6.8k
R910	06-11077A78	1.5k
R911	18-80205N02	20, ±10%, 1/2W, potentiometer
R913	06-11045A35	270 ohm 1/2W
R914,915	06-11077A74	1000 ohm chip
R1600	06-11077A34	22
R1601,1602	06-11077A74	1k
R1603	06-11077A58	220
R1604	06-11077A50	100
R1605	06-11077A46	68
R1607	06-11077A40	39
R1608	06-11077A62	330
R1609	06-11077A58	220
R1801	06-11077A01	0 ohm jumper
R1802	06-11077A72	820
R1803	06-11077A94	6.8k
R1804	06-11077A82	2.2k
R1805	06-11077A28	12




5/15/89
note: For best performance, order diodes, transistors, and intergrate circuit devices by Motorola part number.



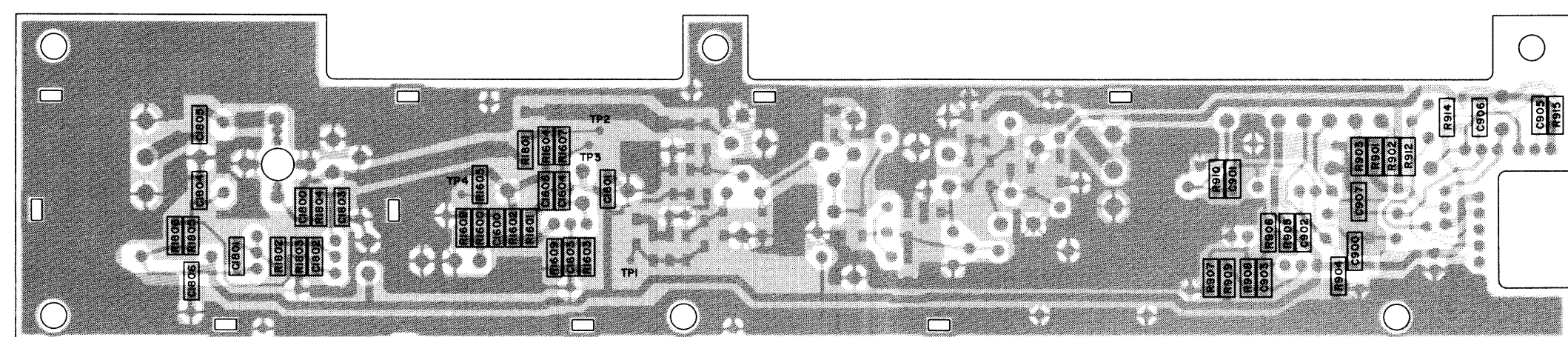
Schematic, Circuit Board Diagram, and Parts List for UHF Exciter/Power Control Board

SOLDER SIDE		GPW-5174-0
COMPONENT SIDE		GPW-5175-0
OVERLAY		GXW-5176W01-A



SOLDER SIDE		GPW-5174-0
COMPONENT SIDE		GPW-5175-0
OVERLAY		GXW-5176W02-A

SOLDER SIDE		GPW-5311-0
COMPONENT SIDE		GPW-5312-0
OVERLAY		GXW-5612W01-0

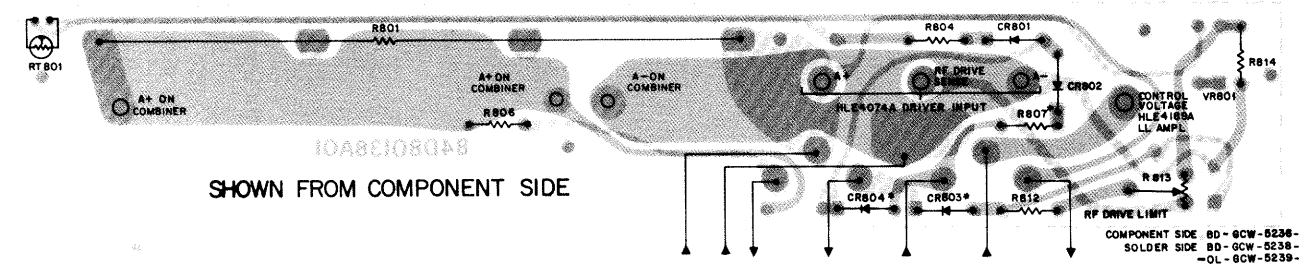


SOLDER SIDE		GPW-5311-0
COMPONENT SIDE		GPW-5312-0
OVERLAY		GXW-5612W02-0



(Sheet 1 of 2)
1/31/90
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HLE4449A POWER DISTRIBUTION BOARD



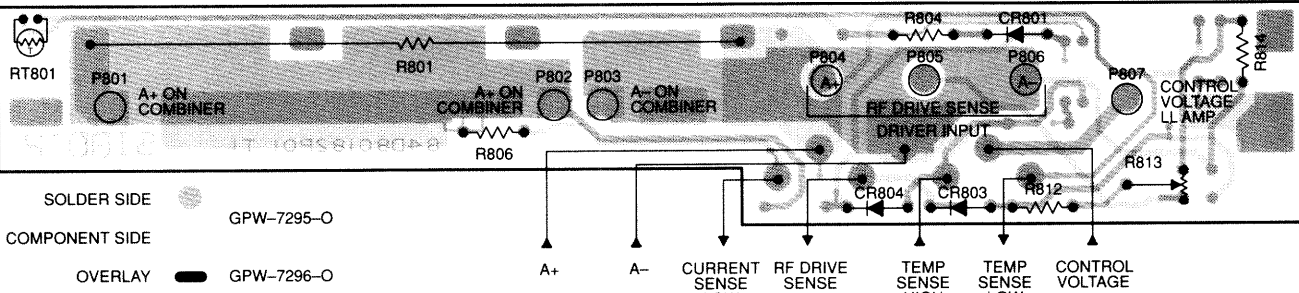
* COMPONENT TABLE		
ITEM	EARLY VERSION	LATER VERSION
CR801	0-ohm Resistor	0-ohm Resistor
CR802	0-ohm Resistor	NOT USED
CR803	0-ohm Resistor	0-ohm Resistor
CR804	NOT USED	0-ohm Resistor
R807	0-ohm Resistor	Jumper Wire

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
diode		
CR801	06-11009D23	0-ohm jumper resistor
CR802	06-11009D23	0-ohm jumper resistor (earlier version)
CR803	06-11009D23	0-ohm jumper resistor
CR804	06-11009D23	0-ohm jumper resistor (later version)
connector, plug		
P801-807	09-80155A02	male, 1 contact
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, $\pm 5\%$, 1/4 watt (unless otherwise stated)		
R801	17-82155M01	shunt, .012 ohms
R804	06-11009D23	0-ohm jumper resistor (earlier version)
R804	06-11009C49	1k (later version)
R806	06-11009C15	39
R812	06-11009C57	2.2k
R813	18-80268B01	potentiometer, 2.5k
R814	06-11009C25	100

5/15/89

HLE4449B POWER DISTRIBUTION BOARD



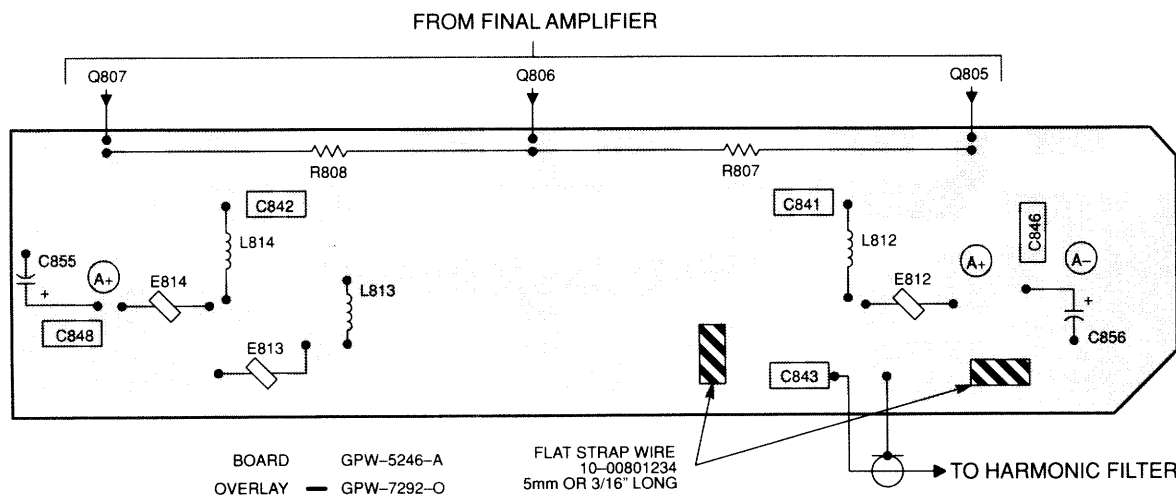
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
diode		
CR801	06-11009B23	0-ohm jumper resistor
CR803,804	06-11009B23	0-ohm jumper resistor
connector, plug		
P801-807	09-80155A02	male, 1 contact
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, $\pm 5\%$, 1/4 watt (unless otherwise stated)		
R801	17-82155M01	shunt, .012 ohms
R804	06-11009A49	1k
R806	06-11009A15	39
R812	06-11009A57	2.2k
R813	18-80268B01	2.5k, potentiometer
R814	06-11009A25	100

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

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HLE4450A COMBINER



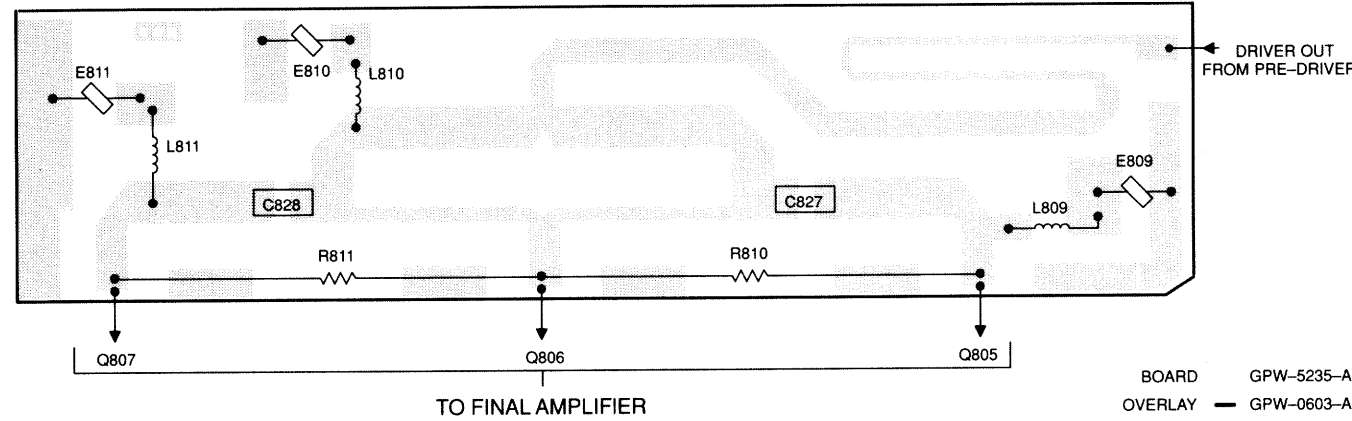
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 5\%$, 100V (unless otherwise stated)		
C841-843	21-11078B42	100
C846	21-13740A55	100, 50V
C848	21-13740A55	100, 50V
C855,856	23-82783B24	15 uF, $\pm 10\%$, 25V, tantalum
coil, rf		
L812-814	24-80090G01	airwound
resistor, fixed, Ω, $\pm 10\%$, 1 watt (unless otherwise stated)		
R807-808	06-00126D63	5.6

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

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HLE4070A SPLITTER

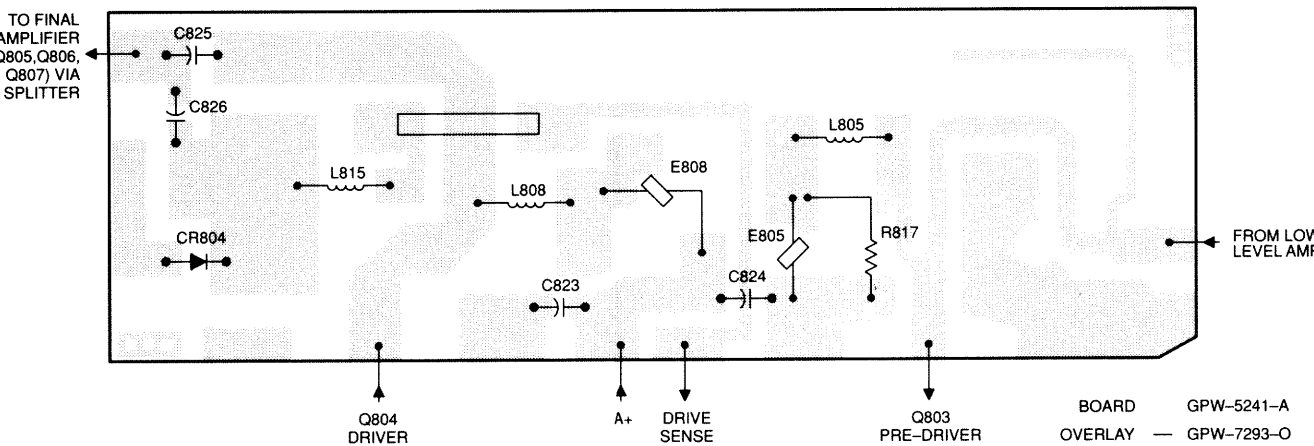


parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 5\%$, 100V (unless otherwise stated)		
C827,828	21-11078B42	100
coil, RF		
L809-811	24-80090G01	airwound
resistor, fixed, ohm, $\pm 10\%$, 1 watt (unless otherwise stated)		
R810,811	06-00126C01	10
mechanical parts		
E809-811	76-83960B01	ferrite bead
	84-80321A01	substrate

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HLE4451A PRE-DRIVER



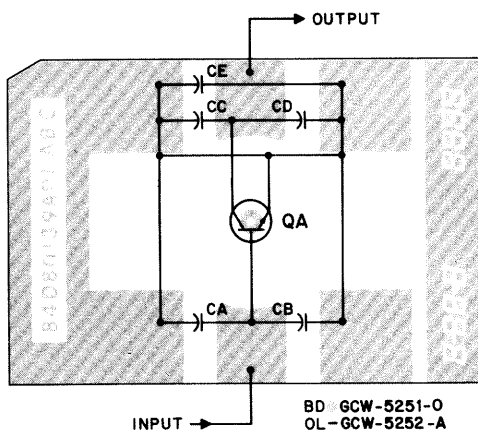
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 5\%$, 50V (unless otherwise stated)		
C823	21-13740A55	100
C824	21-84547A13	.1 uF
C825	21-11078B42	100, 100V
C826	21-05632D43	1.8, ± 25 pF
coil, rf		
L805	24-80090G01	airwound
L808	24-80090G01	airwound
resistor, fixed, Ω, $\pm 5\%$, 1/4 watt (unless otherwise stated)		
R817	06-11009C03	12
non-referenced parts		
E805	76-83960B01	ferrite bead
E808	76-83960B01	ferrite bead
	55-80065B01	strap drive limit
	84-80323A01	substrate

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

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TRANSISTOR SUBSTRATE



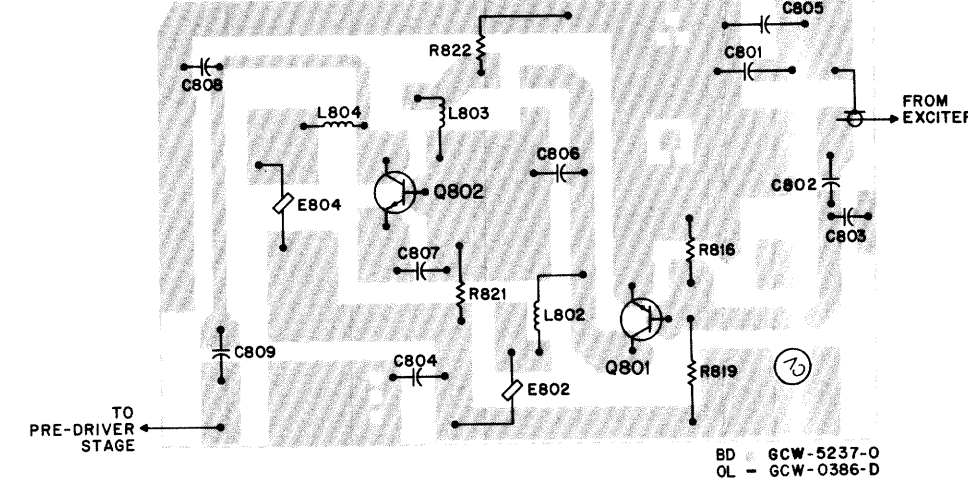
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 5\%$, 250V (unless otherwise stated)		
C819-821	21-84366F04	30
C822	21-84366F06	45
transistor (see note)		
Q890	48-80225C02	NPN
mechanical parts		
	07-80195B02	lead frame (2 used)
	84-80139A01	circuit board

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

1/12/90

HLE4189A LOW LEVEL AMPLIFIER



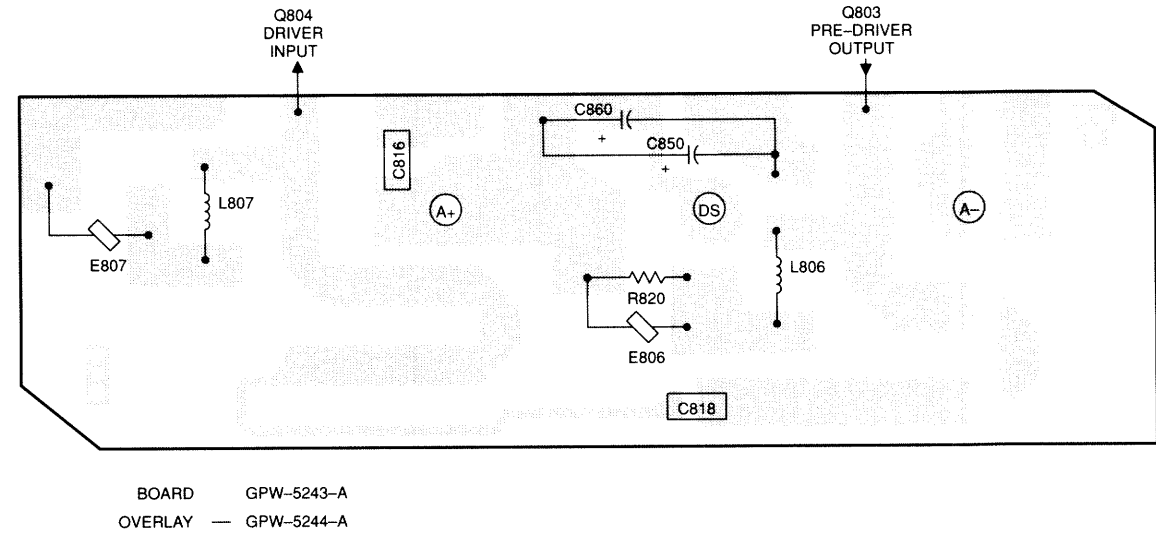
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 5\%$, 50V (unless otherwise stated)		
C801	21-13741C17	0.1 uF, $\pm 20\%$, 25V
C802	21-13740A55	100
C803	21-05632D37	240, 25V
C804	21-84547A05	0.01 uF, $\pm 20\%$
C805	21-11078B42	100, 100V
C806	21-13740A55	100, $\pm 20\%$
C807	21-13740A31	12, $\pm 10\%$
C808	21-05632D37	7.7, ± 25 pF, 25V
C809	21-13740A55	100, $\pm 20\%$
coil, RF		
L802	24-80092G60	airwound
L803,804	24-80090G02	airwound
transistor (see note)		
Q801	48-00869657	NPN, type M9657
Q802	48-80225C09	NPN, type M25C09
resistor, fixed, ohm, $\pm 5\%$, 1/4 watt (unless otherwise stated)		
R816	06-11009C27	120
R819	06-11009C55	1.8k
R821	06-11009C49	1k
R822	06-11009C21	68
mechanical parts		
	76-83960B01	ferrite bead (2 used)
	84-80319A01	substrate

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

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HLE4074A DRIVER INPUT



parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, $\pm 20\%$, 50V (unless otherwise stated)		
C816	21-84547A05	.01 uF
C818	21-13740A55	100
C850	23-82783B24	15 uF, $\pm 10\%$, 25V, tantalum
C860	23-82783B24	15 uF, $\pm 10\%$, 25V, tantalum
coil, RF		
L806,807	24-80090G01	airwound
resistor, fixed, ohm, $\pm 5\%$, 1/4 watt (unless otherwise stated)		
R820	06-11009C18	51
non-referenced parts		
E806,807	76-83960B01	ferrite bead
	84-80322A01	substrate

1/31/90

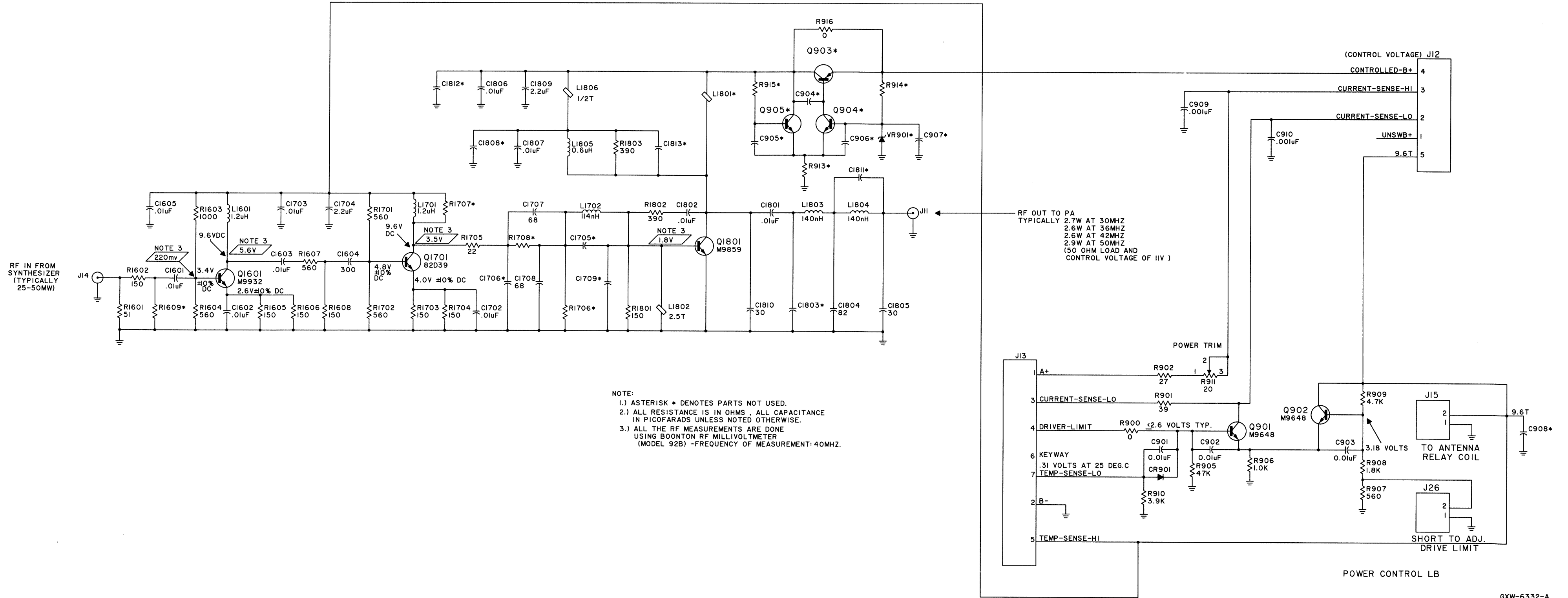
Schematic, Circuit Board Diagrams, and Parts Lists for UHF Power Amplifier

(Sheet 2 of 2)

1/31/90

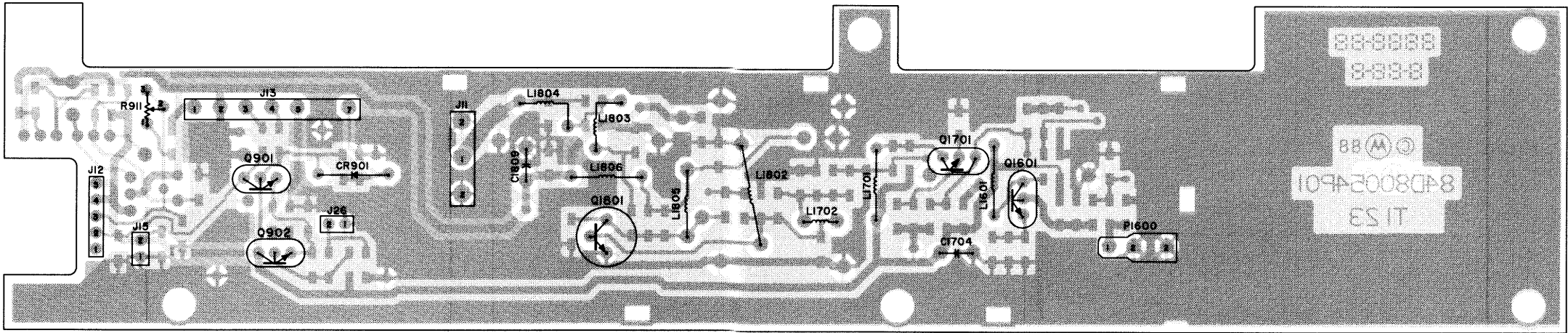
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LOW BAND EXCITER BOARD SCHEMATIC

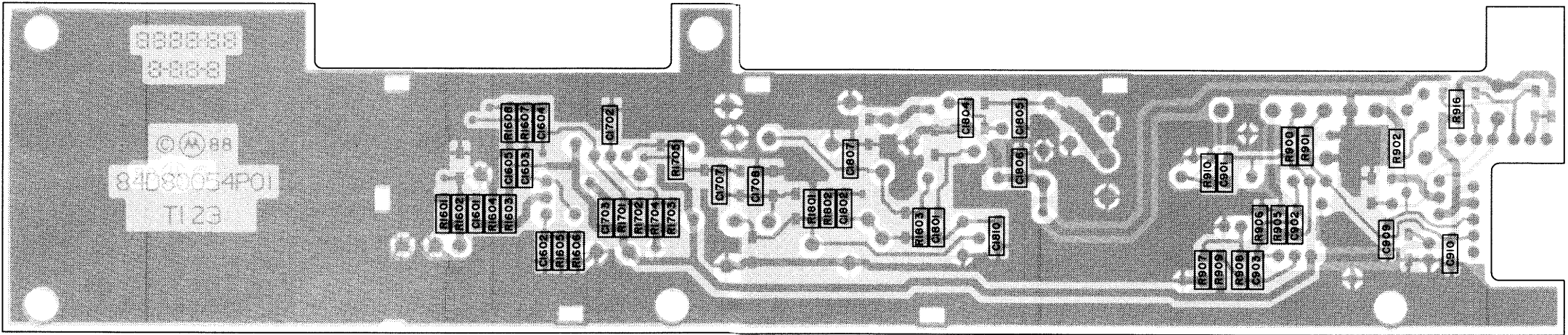


Schematic, Circuit Board Diagrams, and Parts List
for HLB4116A Low Band Exciter/Power Control Board

EXCITER/POWER CONTROL BOARD



COMPONENT SIDE



SOLDER SIDE

parts list

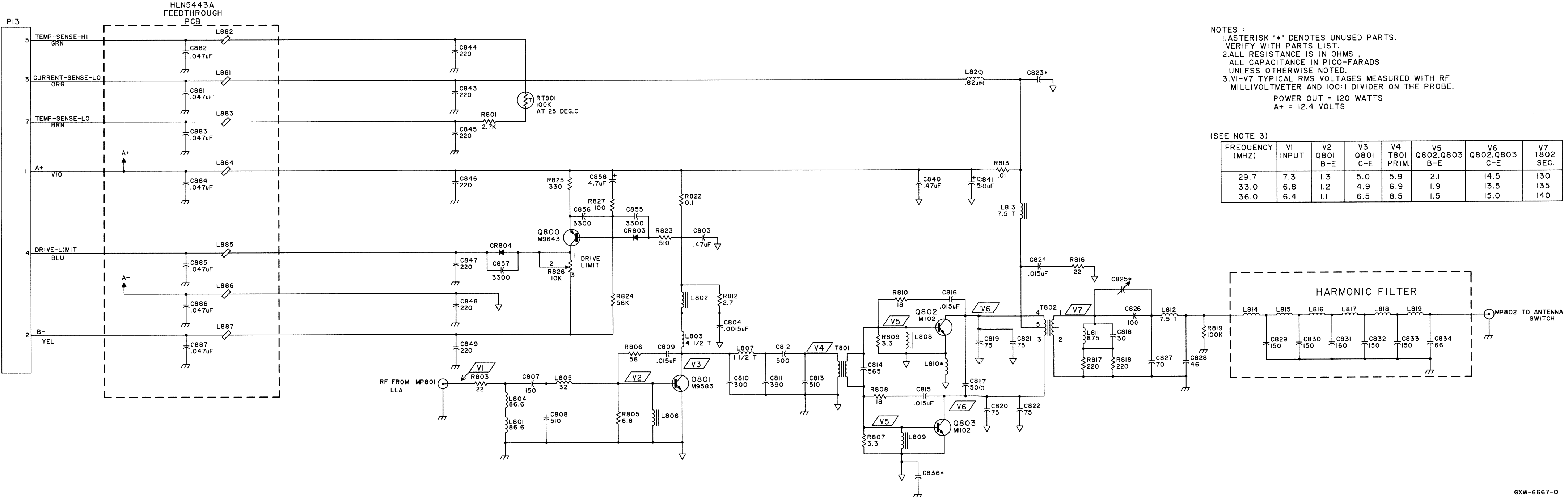
HLB4116A m400 Low Band Exciter/Power Control Board

MXW-6333-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C901-903	21-13741N45	0.01
C909,910	21-13741N21	1 pF
C1601-1603	21-13741N45	0.01
C1604	21-13740B60	.300 pF
C1605	21-13741N45	0.01
C1702,1703	21-13741N45	0.01
C1704	23-11054M01	2.0, 35V, tantalum
C1707,1708	21-13740B45	68 pF
C1801,1802	21-13741N45	0.01
C1804	21-13740B47	82 pF
C1805	21-13740B36	30 pF
C1806,1807	21-13741N45	0.01
C1809	23-11054M01	2.2, 35V, tantalum
C1810	21-13740B36	30 pF
diode (see note)		
CR901	48-11034A01	silicon
connector receptacle		
J11	09-80001F01	jack, phono
J12	28-80164N01	header, 5 pin
J13	28-80071H01	circuit board, 7 contact
J15	28-84324M01	2 contact
J26	28-84318M06	circuit board, 2 pin
coil, RF		
L1601	24-83397L12	1.2 uH
L1701	24-83397L12	1.2 uH
L1702	24-11030B15	114 nH
L1802	24-83977B02	choke, 2-1/2 turns
L1803,1804	24-84411B04	140 nH
L1805	24-82835G32	640 nH
L1806	24-80036A01	ferrite bead
connector plug		
P1600	29-80014A01	clip, coax terminal
transistor (see note)		
Q901,902	48-11043C07	NPN
Q1601	48-11043C16	NPN
Q1701	48-11043C49	NPN
Q1801	48-00869859	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R900	06-11077A01	jumper
R901	06-11077A40	39
R902	06-11077A36	27
R905	06-11077B15	47k
R906	06-11077A74	1k
R907	06-11077A68	560
R908	06-11077A80	1.8k
R909	06-11077A90	4.7k
R910	06-11077A88	3.9k
R911	18-80205N02	20, ±10%, 1/2W, potentiometer
R916	06-11077A01	jumper
R1601	06-11077A43	51
R1602	06-11077A54	150
R1603	06-11077A74	1k
R1604	06-11077A68	560
R1605,1606	06-11077A54	150
R1607	06-11077A68	560
R1608	06-11077A54	150
R1701,1702	06-11077A68	560
R1703,1704	06-11077A54	150
R1705	06-11077A34	22
R1801	06-11077A54	150
R1802,1803	06-11077A64	390
mechanical parts		
	09-80265N01	coax (2 used)
	14-80001C01	insulator, transistor
	26-80006M01	shield, second VCO (4 used)
	29-80146B01	terminal

Schematic, Circuit Board Diagram, and Parts List for
HLB4116A Low Band Exciter/Power Control Board

RANGE 1 LOW BAND POWER AMPLIFIER SCHEMATIC



Schematic, Circuit Board Diagram, and
Parts Lists for Low Band Power Amplifier
Range 1, 29.7-36 MHz

parts list

HLB4117A m400 PA Board, 110W Range 1 MXW-6671-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5% (unless otherwise stated)		
C803	08-11051A17	0.47 uF, 63V
C804	08-11051A02	0.0015 uF, 63V
C807	21-84494B07	150
C808	21-84494B20	510, 300V
C809	08-11051A08	0.015 uF, 63V
C810	21-84494B15	300
C811	21-84494B18	390
C812	21-84395B62	500, 250V
C813	21-84494B20	510, 300V
C814	21-84857K06	565, ±3%
C815,816	08-11051A08	0.015 uF, 63V
C817	21-84395B62	500, 250V
C818	21-80067A45	30
C819-822	21-84494B31	75
C824	08-11051A08	0.015 uF, 63V
C825	21-84395B02	100, 250V
C827	21-84395B40	70, 350V
C828	21-84395B44	46, 250V
C829,830	21-84395B06	150, 250V
C831	21-84395B26	160, ±2%
C832,833	21-84395B06	150, 250V
C834	21-84395B22	66, 250V
C840	08-11051A17	0.47 uF, 63V
C841	23-84669A05	50 uF, -10±150, 25V, electrolytic
C843-849	21-11015B05	220, ±10 pF, 100V
C855-857	21-11015B19	3300, ±10 pF, 100V
C858	23-11054H04	4.7 uF, ±10%, 25V, tantalum
diode (see note)		
CR803,804	48-82466H13	rectifier, silicon
coil, RF		
L801	24-11030D06	86.6 nH
L802	24-80036A02	1/2 turn
L803	24-84235B04	4-1/2 turns, airwound
L804	24-11030D06	86.6 nH
L805	24-11030D03	32 nH
L806	24-83977B01	choke
L807	24-80277A17	1-1/2 turns, airwound
L808,809	24-83977B01	choke
L811	24-80071P13	897 nH
L812	24-80135J06	7-1/2 turns, airwound
L813	24-80110B13	7-1/2 turns
L814	24-80110B02	7-1/2 turns
L815	24-80110B03	8-1/2 turns
L816,817	24-80110B04	9-1/2 turns
L818	24-80110B03	8-1/2 turns
L819	24-80110B02	7-1/2 turns
L820	24-11047A12	.82 uH
transistor (see note)		
Q800	48-11043C06	PNP
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, ±5%, 1/4 watt (unless otherwise stated)		
R801	06-11009A59	2.7k
R803	06-11086C19	22, 2W
R805	06-11086A09	6.8, 1W
R806	06-11086C29	56, 2W
R807	06-11086A06	3.3, 1W
R808	17-82036G27	18, 2W
R809	06-11086A06	3.3, 1W
R810	17-82036G27	18, 2W
R812	06-11045B24	2.7, 1/2W
R813	17-80165C02	shunt, 0.01, ±10%, 12W
R815	06-11086C19	22, 2W
R817,818	06-11086C43	220, 2W
R819	06-11045A97	100k, 1/2W
R822	17-82291B24	0.1, 3W
R823	06-11009A42	510
R824	06-11009A91	56k
R825	06-11009A37	330
R826	18-80087E08	potentiometer, 10k, ±20%, 1/2W
R827	06-11009A25	100
transformer		
T801	24-80099B01	fixed RF
T802	25-80229J03	high power
mechanical parts		
MP801,802	29-80014A01	clip, coax (2 used)

6/1/89

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

HLB4077A Power Transistotr Kit MXW-6382-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
transistor (see note)		
Q801	48-00869583	power, NPN
Q802,803	48-84411L02	power, NPN

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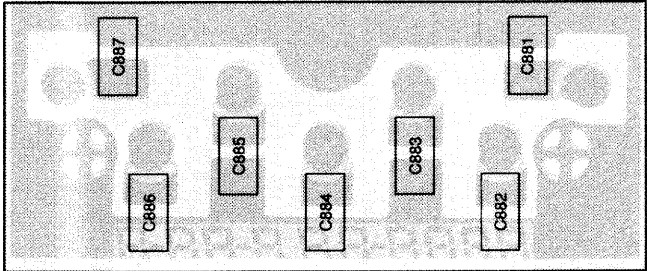
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

HLN5443A Feedthru Plate Assembly MXW-6381-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 500V (unless otherwise stated)		
C881-887	21-84547A07	.047 uF, ±20%, 100V
connector		
	28-80155K01	male header
coil, RF		
L881-887	76-84069B04	ferrite bead

3/31/90

HLN5443A FEEDTHRU PLATE

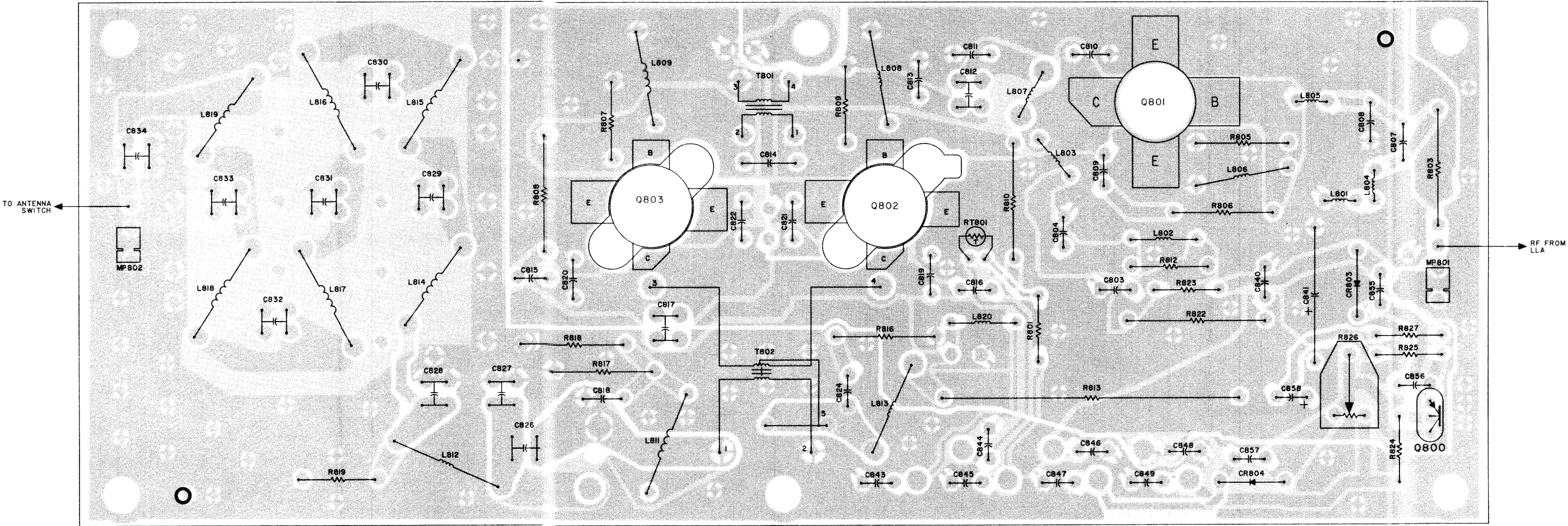


SOLDER SIDE VIEW

SOLDER SIDE
COMPONENT SIDE
OVERLAY

GPW-7744-O
GPW-7745-O

RANGE 1 LOW BAND POWER AMPLIFIER



COMPONENT SIDE VIEW

SOLDER SIDE
COMPONENT SIDE
OVERLAY

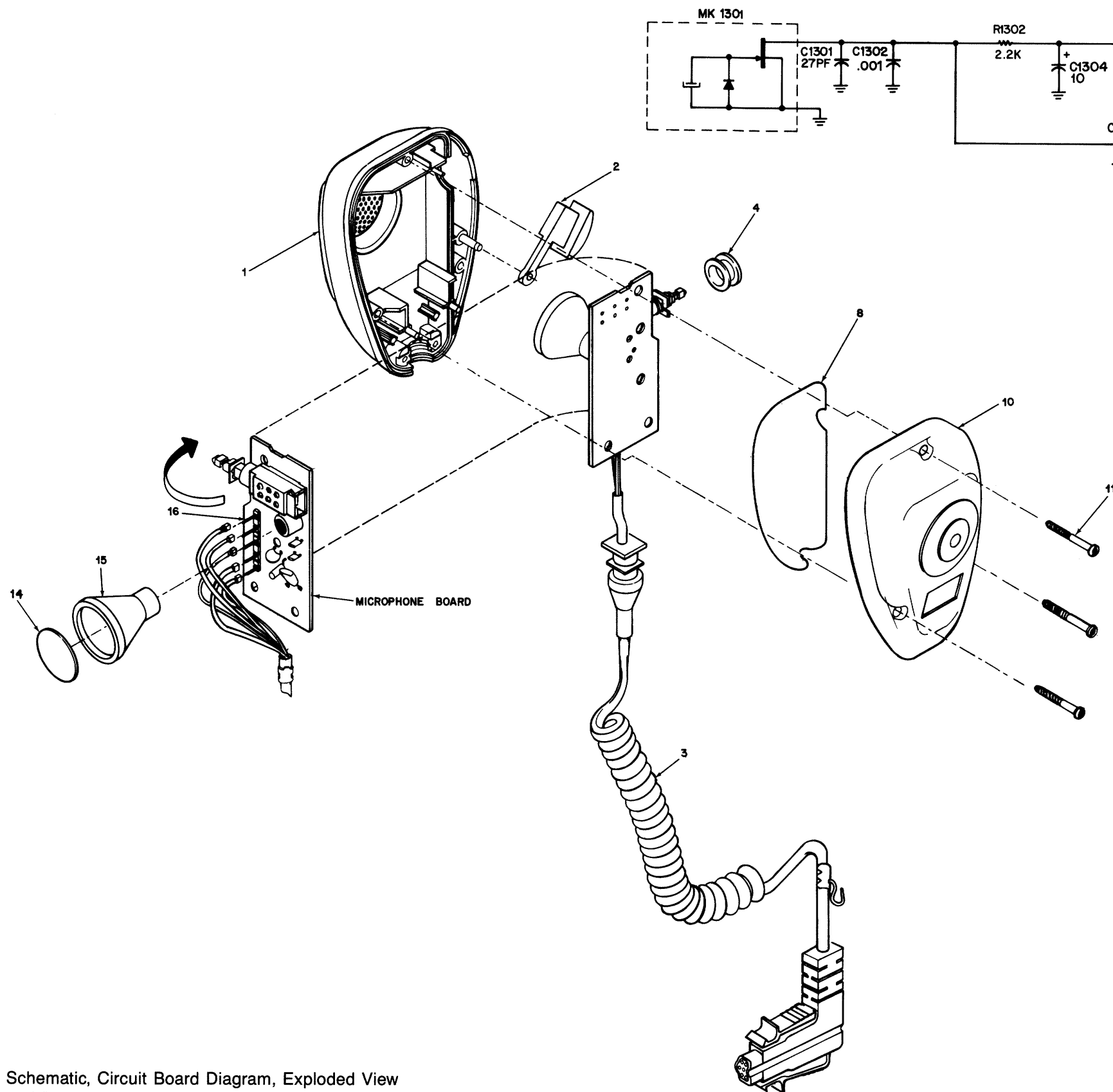
GPW-6668-O
GPW-6669-O
GXW-6670-O

Schematic, Circuit Board Diagram, and
Parts Lists for Low Band Power Amplifier
Range 1, 29.7-36 MHz

(Sheet 2 of 2)

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ADVANCED CONTROL HEAD MICROPHONE SCHEMATIC

parts list

HLN5389A Microphone Hardware

MXW-5475-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15-80137D05	front housing
2	38-80144D03	mic button
3	30-80223J01	6 conductor cable
4	05-80221K01	PTT switch grommet
8	32-80058H03	housing gasket
10	15-80137D03	rear housing (p/o housing assembly)
11	03-80076E04	hi-lo metric screw, 3 used
14	35-80089D01	felt baffle
15	05-80148D01	mic cartridge grommet
16	39-10184A10	contact plug, 5 used

non referenced items

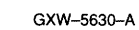
03-10943M09	tapping screw (3 x 0.5 x 6)
54-84962K01	safety tag
33-80016P01	nameplate
04-80093E01	flat washer (p/o housing assembly)
46-80297N01	hang-up stud (p/o housing assembly)
46-80281G01	mic weight (p/l housing assembly)

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Schematic, Circuit Board Diagram, Exploded View
and Parts Lists for Advanced Control Head
Microphone
(Sheet 1 of 1)

ADVANCED CONTROL HEAD MICROPHONE

parts list



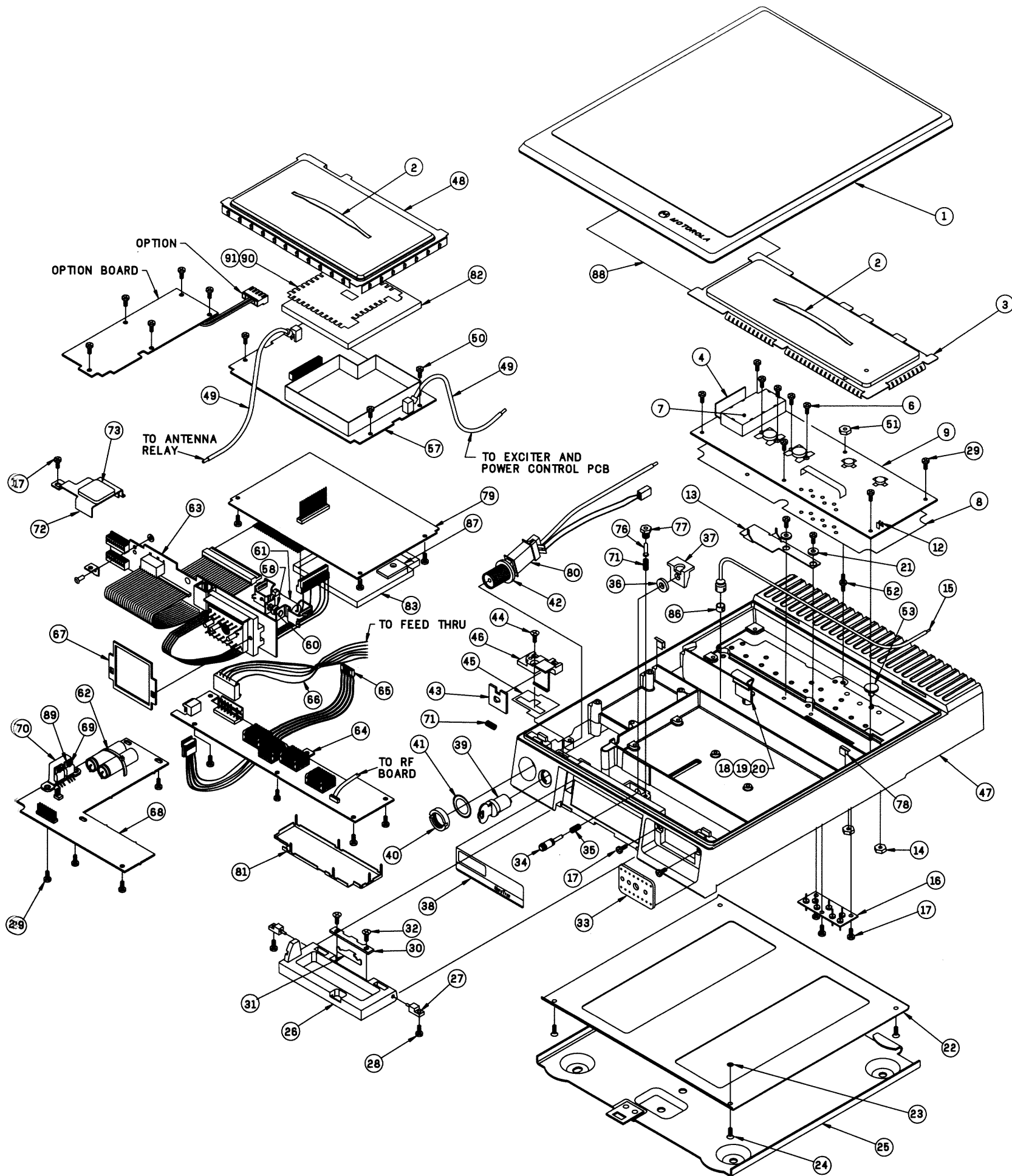
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parts list

m400 VHF Radio Exploded View

MXW-7672-O



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	—	top cover assembly
2	55-84300B04	handle, nylon (2 used)
3	26-80070B01	shield, PA compartment
4	26-80019C01	heatsink, harmonic filter
5	—	not used
6	03-10911A11	machine screw, 3 x 0.5 x 8 (4 used)
7	15-80053B01	cover shield
8	14-80143A04	insulator, PA
9	—	100W PA circuit board assembly
10-11	—	not used
12	29-80014A01	clip coax (HLD4337) (2 used)
13	26-80205C01	heatsink
14	02-00119913	nut 8-32 x 11/32 x 1/8 hex (2 used)
15	01-80750T31	coax cable assembly
16	—	pre-amp feedthru plate assembly
17	03-10908A26	machine screw, 3.5 x 0.6 x 6 (6 used)
18	02-00007005	nut 6-32 x 1/4 x 8/32 hex
19	26-80254A01	heatsink, LL AMP
20	26-80238N01	heatsink, TO5
21	04-80207C01	washer shoulder (2 used)
22	—	bottom cover assembly
23	04-80149A01	washer, captivating (4 used)
24	03-10913A29	machine screw, 3.5 x 0.6 x 13 (4 used)
25	—	mounting tray assembly
26	55-80002A01	handle
27	47-80176P01	pin, pivot (2 used)
28	03-10943R55	tapping screw 3 x 0.5 x 8 (2 used)
29	03-10943M16	tapping screw 3.5 x 0.6 x 10 (19 used)
30	64-80019A01	plate, backup
31	07-80113B01	bracket, latch
32	03-80001P01	screw, 3.5 x 0.6 x 6 (2 used)
33	32-80020C01	gasket, front cable connector
34	47-80027A01	pushbutton
35	41-80029A01	spring, latch
36	32-800295C01	gasket
37	07-80030A01	bracket, latch
38	33-80028N04	nameplate, radio
39	55-80370A01	lock
40	02-80006A01	nut, spanner
41	04-00114522	lockwasher, 5/8"
42	32-80080A01	gasket, antenna connector
43	07-80016A02	bracket, lock slide
44	03-10936E14	tapping screw, B3.5 x 1.27 x 13
45	32-80000P01	gasket, lock support
46	07-80015A02	support, lock slide
47	27-80003P01	chassis
48	26-80092P01	shield, RF
49	30-80231N01	cable, coaxial
50	03-10943M10	tapping screw, 3.5 x 0.6 x 8 (12 used)
51	02-10971A63	nut, hex
52	43-80013B01	stand off
53	32-80084A02	gasket, stud device
54-56	—	not used
57	—	RF circuit board
58	48-80153A01	diode, pellet
59	—	not used
60	26-80191P01	heatsink (2 used)
61	23-80167C03	capacitor, electrolytic
62	42-10217A32	strap, cable harness (2 used)
63	—	interconnect circuit board
64	—	exciter/power control circuit board
65	30-80159N01	cable, power control
66	30-80234N01	cable, feedthru
67	32-80074A02	gasket, cable plug
68	—	audio/squelch circuit board
69	03-10908A18	screw, 3 x 0.5 x 6 (2 used) (HLN5342)
70	26-80129P01	heatsink (HLN5342)
71	41-80022A01	lock, spring (2 used)
72	07-80126P01	bracket, relay
73	75-82200H01	pad
74-75	—	not used
76	46-80151A01	stud, cover release
77	43-80150A01	sleeve, cover release
78	42-80013A01	clip, coaxial (2 used)
79	—	logic circuit board
80	—	antenna relay assembly
81	26-80163N01	shield, solder side
82	15-80953T01	cover, VCO shield
83	15-80124M01	cover, logic shield
84-85	—	not used
86	42-84733F04	ring, compression
87	75-80202C01	pad, compression
88	54-80166K01	label
89	51-80065C03	IC audio (2 used) (HLN5342)
90	11-80924T01	adhesive pad
91	26-80923T01	shield, RF to chassis
non-referenced items		
30-10286A06		cable, 14 gage red
30-10286A04		cable, 14 gage black
42-10217A02		tie strap

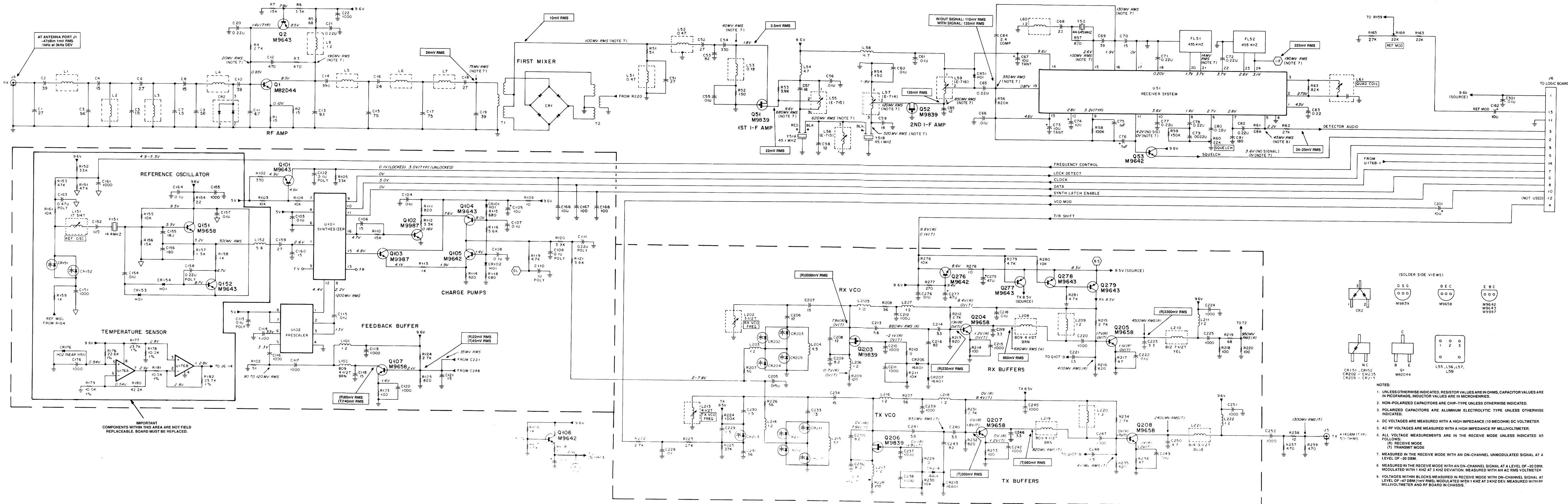
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VHF Radio Exploded View

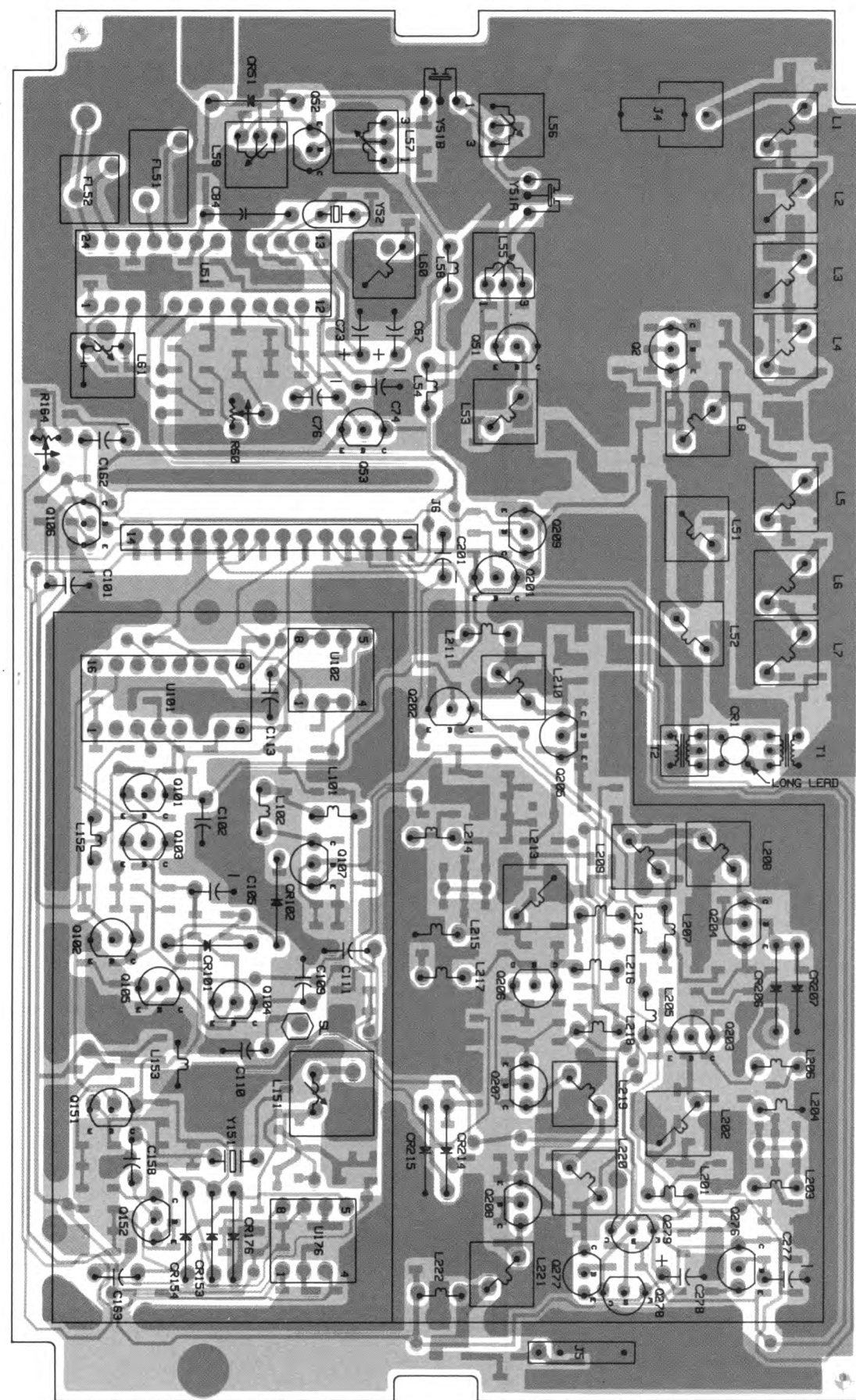
3/30/90

VHF RF Board Transistor D.C. Voltage Table

Transistor Ref. No.	VOLTAGE			VOLTAGE		
	BASE	EMITTER	COLLECTOR	GATE	SOURCE	DRAIN
Q1	.83	.12	8.5	—	—	—
Q2	7.9	8.5	1.1	—	—	—
Q51	—	—	—	0	1.8	9.6
Q52	—	—	—	0	1.8	9.6
Q53	4.2	3.6	9.6	—	—	—
Q101	5.0	5.0	.1 (LOCKED)	—	—	—
Q102	0.7	0	0	—	—	—
Q103	4.8	4.1	9.6	—	—	—
Q104	8.1	7.6	2-8v	—	—	—
Q105	1.4	1.9	2-8v	—	—	—
Q106	5.7	4.9	9.6	—	—	—
Q107	2.1	1.4	9.6	—	—	—
Q151	5.5	5.2	9.5	—	—	—
Q152	8.7	9.5	6.7	—	—	—
Q203	—	—	—	-2.1(R)	.7(R)	7.9
Q204	1.9(R)	1.2(R)	8.5	—	—	—
Q205	1.7(R)	1.1(R)	9.6	—	—	—
Q206	—	—	—	-1.9(T)	.95(T)	7.9
Q207	1.8(T)	1.2(T)	8.5	—	—	—
Q208	1.7(T)	1.2(T)	9.6	—	—	—
Q276	9.5	8.6	9.6	—	—	—
Q277	9.6	8.5(T)	8.5	—	—	—
Q278	9.6(R)	8.5	8.5	—	—	—
Q279	7.6(R)	8.5	8.5	—	—	—

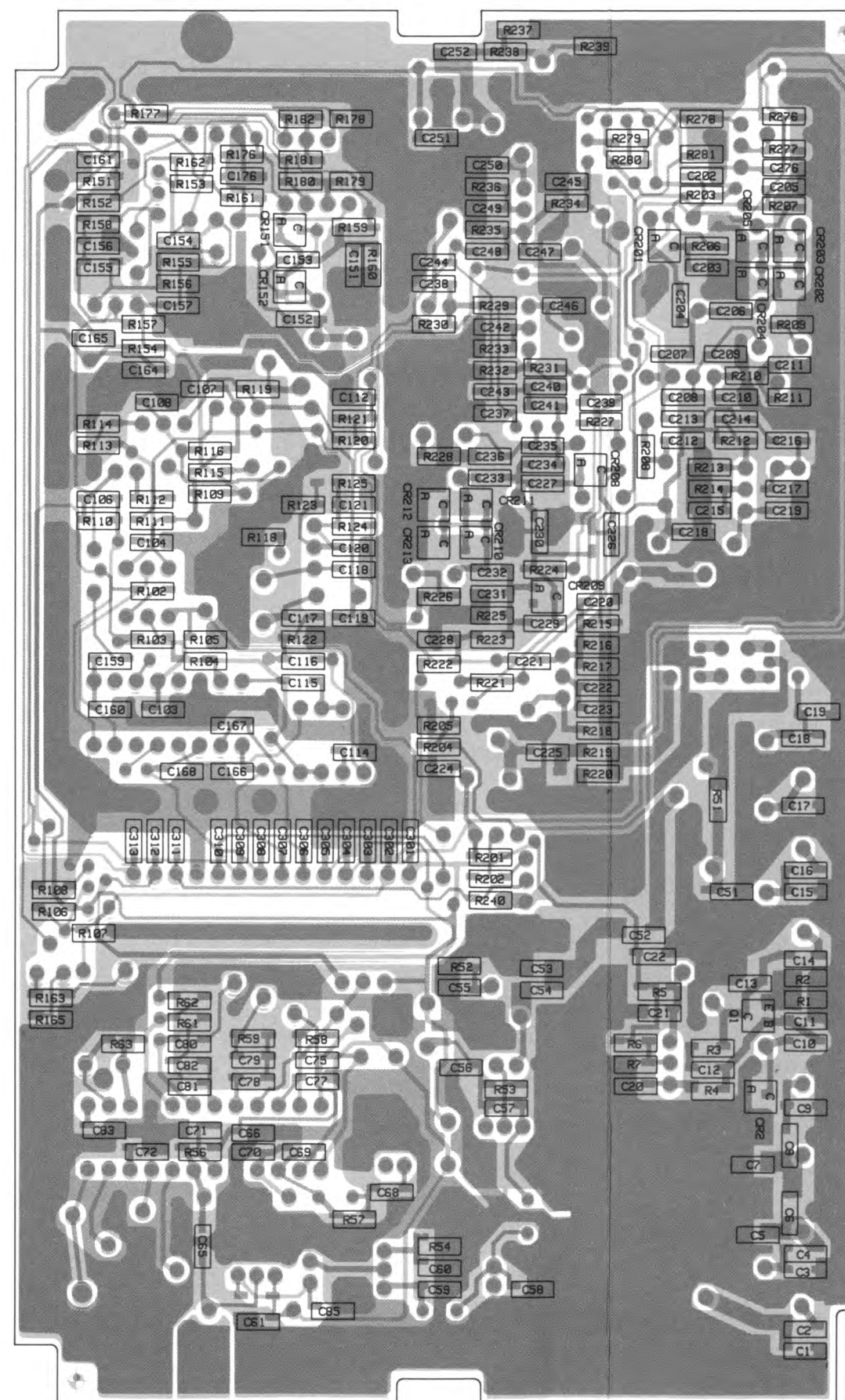


Schematic, Circuit Board Diagrams, and Parts List for HLD4322B VHF RF Board



COMPONENT SIDE VIEW

SOLDER SIDE ● RED GAW-7702-O
 COMPONENT SIDE ● GREY GAW-7701-O
 OVERLAYS ● BLACK GDW-7703-O



SOLDER SIDE VIEW

Schematic, Circuit Board Diagrams, and
 Parts List for HLD4322B VHF RF Board

(Sheet 2 of 3)

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parts list

HLD4322B m400 VHF RF Board

MXW-7404-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed (unless otherwise stated)		
C0001	21-13740B35	27 pF, ±5%, 50V
C0002	21-13740B39	39 pF, ±5%, 50V
C0003	21-13740B43	56 pF, ±5%, 50V
C0004	21-13740B29	15 pF, ±5%, 50V
C0005	21-13740B05	1.5 pF, ±5%, 50V
C0006	21-13740B11	2.7 pF, ±5%, 50V
C0007	21-13740B05	1.5 pF, ±5%, 50V
C0008	21-13740B29	15 pF, ±5%, 50V
C0009	21-13740B43	56 pF, ±5%, 50V
C0010	21-13740B39	39 pF, ±5%, 50V
C0011	21-13740B17	4.7 pF, ±5%, 50V
C0012	21-13740B65	470 pF, ±5%, 50V
C0013	21-13740B24	9.1 pF, ±5%, 50V
C0014	21-13740B63	390 pF, ±5%, 50V
C0015	21-13740B46	75 pF, ±5%, 50V
C0016	21-13740B34	24 pF, ±5%, 50V
C0017	21-13740B46	75 pF, ±5%, 50V
C0018	21-13740B35	27 pF, ±5%, 50V
C0019	21-13740B39	39 pF, ±5%, 50V
C0020,0021	21-11032B15	.22 uF, +80, -20%, 50V
C0022	21-13740B73	.001 uF, ±5%, 50V
C0051,0052	21-13740B35	27 pF, ±5%, 50V
C0053	21-13740B47	82 pF, ±5%, 50V
C0054	21-13740B61	330 pF, ±5%, 50V
C0055,0056	21-13741B45	.01 uF, ±5%, 50V
C0057	21-13740B31	18 pF, ±5%, 50V
C0058	21-13740B27	12 pF, ±5%, 50V
C0059	21-13740B31	18 pF, ±5%, 50V
C0060,0061	21-13741B45	.01 uF, ±5%, 50V
C0065	21-11032B15	.22 uF, +80, -20%, 50V
C0066	21-13741B45	.01 uF, ±5%, 50V
C0067	23-13749C39	10 uF, ±10%, 50V, tantalum
C0068	21-13740B33	22 pF, ±5%, 50V
C0069	21-13740B39	39 pF, ±5%, 50V
C0070	21-13740B29	15 pF, ±5%, 50V
C0071,0072	21-11032B15	.22 uF, +80, -20%, 50V
C0073	23-13749C39	10 uF, ±10%, 50V, tantalum
C0074	23-11048B13	10 uF, ±20%, 16V, electrolytic
C0075	21-13741B69	.1 uF, ±5%, 50V
C0076	23-11048B05	1 uF, ±20%, 50V, electrolytic
C0077,0078	21-11032B15	.22 uF, +80, -20%, 50V
C0079	21-13741B29	.0022 uF, ±5%, 50V
C0080	21-11032B15	.22 uF, +80, -20%, 50V
C0081	21-13740B55	180 pF, ±5%, 50V
C0082,0083	21-11032B15	.22 uF, +80, -20%, 50V
C0084	21-82450B14	2.4 pF, ±5%, 500V
C0085	21-13740B27	12 pF, ±5%, 50V
C0101	23-11048B13	10 uF, ±20%, 16V, electrolytic
C0102	08-11051A13	.1 uF, ±5%, 63V
C0103,0104	21-13741B45	.01 uF, ±5%, 50V
C0105	23-11048B13	10 uF, ±20%, 16V, electrolytic
C0106	21-13740B29	15 pF, ±5%, 50V
C0107,0108	21-13741B69	.1 uF, ±5%, 50V
C0109	08-11051A13	.1 uF, ±5%, 63V
C0110	08-11051A19	1 uF, ±5%, 63V
C0111	08-11051A09	.022 uF, ±5%, 63V
C0113	08-11051A13	.1 uF, ±5%, 63V
C0114	21-13740B73	.001 uF, ±5%, 50V
C0115	21-13741B45	.01 uF, ±5%, 50V
C0116,0117	21-13740B73	.001 uF, ±5%, 50V
C0118	21-13740B29	15 pF, ±5%, 50V
C0119,0120	21-13740B73	.001 uF, ±5%, 50V
C0121	21-13740B29	15 pF, ±5%, 50V
C0151	21-13740B73	.001 uF, ±5%, 50V
C0152	21-13740B50	110 pF, ±5%, 50V
C0154	21-13741B45	.01 uF, ±5%, 50V
C0155,0156	21-13740B55	180 pF, ±5%, 50V
C0157	21-13741B45	.01 uF, ±5%, 50V
C0158	08-11051A15	.22 uF, ±5%, 63V
C0159	21-13740B35	27 pF, ±5%, 50V
C0160	21-13740B29	15 pF, ±5%, 50V
C0161	21-13740B73	.001 uF, ±5%, 50V
C0162	23-11048B13	10 uF, ±20%, 16V, electrolytic
C0163	08-11051A17	.47 uF, ±5%, 63V
C0164	21-13741B69	.1 uF, ±5%, 50V
C0165	21-13740B73	.001 uF, ±5%, 50V
C0166-0168	21-13740B49	100 pF, ±5%, 50V
C0176	21-13740B73	.001 uF, ±5%, 50V
C0201	23-11048B13	10 uF, ±20%, 16V, electrolytic
C0205	21-13741B49	.015 uF, ±5%, 50V
C0206	21-13740B27	12 pF, ±5%, 50V
C0207	21-13740B29	15 pF, ±5%, 50V
C0208	21-13740B27	12 pF, ±5%, 50V
C0209	21-13740B23	8.2 pF, ±5%, 50V
C0210-212	21-13740B73	.001 uF, ±5%, 50V
C0213	21-13740B19	5.6 pF, ±5%, 50V
C0214	21-13740B13	3.3 pF, ±5%, 50V
C0215	21-13740B73	.001 uF, ±5%, 50V
C0216	21-13740B47	82 pF, ±5%, 50V

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C0218	21-13741B45	.01 uF, ±5%, 50V
C0219	21-13740B13	3.3 pF, ±5%, 50V
C0220	21-13740B73	.001 uF, ±5%, 50V
C0221	21-13740B05	1.5 pF, ±5%, 50V
C0222	21-13741B45	.01 uF, ±5%, 50V
C0223	21-13740B13	3.3 pF, ±5%, 50V
C0224,0225	21-13740B73	.001 uF, ±5%, 50V
C0228	21-13741B45	.01 uF, ±5%, 50V
C0229,0230	21-13740B05	1.5 pF, ±5%, 50V
C0231	21-13740B38	36 pF, ±5%, 50V
C0233	21-13740B37	33 pF, ±5%, 50V
C0234	21-13740B29	15 pF, ±5%, 50V
C0235,0236	21-13740B23	8.2 pF, ±5%, 50V
C0237-0239	21-13740B73	.001 uF, ±5%, 50V
C0240	21-13740B13	3.3 pF, ±5%, 50V
C0241	21-13740B19	5.6 pF, ±5%, 50V
C0242	21-13740B73	.001 uF, ±5%, 50V
C0243	21-13740B47	82 pF, ±5%, 50V
C0245	21-13740B73	.001 uF, ±5%, 50V
C0246	21-13740B13	3.3 pF, ±5%, 50V
C0247	21-13740B73	.001 uF, ±5%, 50V
C0248	21-13740B05	1.5 pF, ±5%, 50V
C0249	21-13741B45	.01 uF, ±5%, 50V
C0250	21-13740B17	4.7 pF, ±5%, 50V
C0251,0252	21-13740B73	.001 uF, ±5%, 50V
C0253	21-13740B29	15 pF, ±5%, 50V
C0276	21-13741B45	.01 uF, ±5%, 50V
C0277,0278	23-11048B19	47 uF, ±20%, 16V, electrolytic
C0301	21-13741B45	.01 uF, ±5%, 50V
diode (see note)		
CR0001	48-80236E16	Schottky
CR002	48-80154K03	Schottky
CR0051	48-83654H01	silicon
CR0101,0102	48-83654H01	silicon
CR0151,0152	48-80006E10	silicon
CR0153,0154	48-83654H01	silicon
CR0176	48-83654H02	silicon
CR0202-0205	48-80006E10	silicon
CR0206,0207	48-84616A01	hot carrier
CR0209-0213	48-80006E10	silicon
CR0214,0215	48-84616A01	hot carrier
filter		
FL0051	91-80097D06	6 element, ceramic
FL0052	91-80098D06	3 wire, ceramic
connector receptacle		
J0004,0005	09-80135M01	2 pin coax
J0006	09-80130M03	14 position socket
RF coil		
L0001-0007	24-80148M06	82 nH, 4.5 turns
L0008	24-80063M14	1.2 uH
L0051,0052	24-80063M09	.47 uH
L0053	24-80063M04	.18 uH
L0054	24-80063M21	4.7 uH
L0055	24-80164M02	1.8 turns, variable
L0056	24-80164M01	1.6 ratio, variable
L0057	24-80164M04	5.2 turns, variable
L0058	24-80063M21	4.7 uH
L0059	24-80164M03	4.3 turns, variable
L0060	24-80063M14	1.2 uH
L0061	25-80000E01	transformer
L0101	24-80063M14	1.2 uH
L0102	24-11030B09	4.5 turns, brown
L0151	24-80299D01	17.75 turns, orange
L0152	24-80063M22	5.6 uH
L0202	24-80148M05	62 nH, 3.5 turns
L0203	24-80063M14	1.2 uH
L0204	24-11030B08	4.5 turns, brown
L0205-0207	24-80063M14	1.2 uH
L0208	24-11030B09	4.5 turns, brown
L0209	24-80063M14	1.2 uH
L0210	24-11030B12	7.5 turns, yellow
L0211	24-80063M14	1.2 uH
L0213	24-80148M08	82 nH, 4.5 turns
L0214	24-80063M14	1.2 uH
L0215	24-11030B12	7.5 turns, yellow
L0216-0218	24-80063M14	1.2 uH
L0219	24-11030B09	4.5 turns, brown
L0220	24-80063M14	1.2 uH
L0221	24-11030B14	9.5 turns, blue
L0222	24-80063M14	1.2 uH
transistor (see note)		
Q0001	48-80182D44	NPN
Q0002	48-00869643	N-channel
Q0051,0052	48-00869839	NPN
Q0053	48-00869642	NPN
Q0101	48-00869643	PNP
Q0102,0103	48-80182D20	NPN

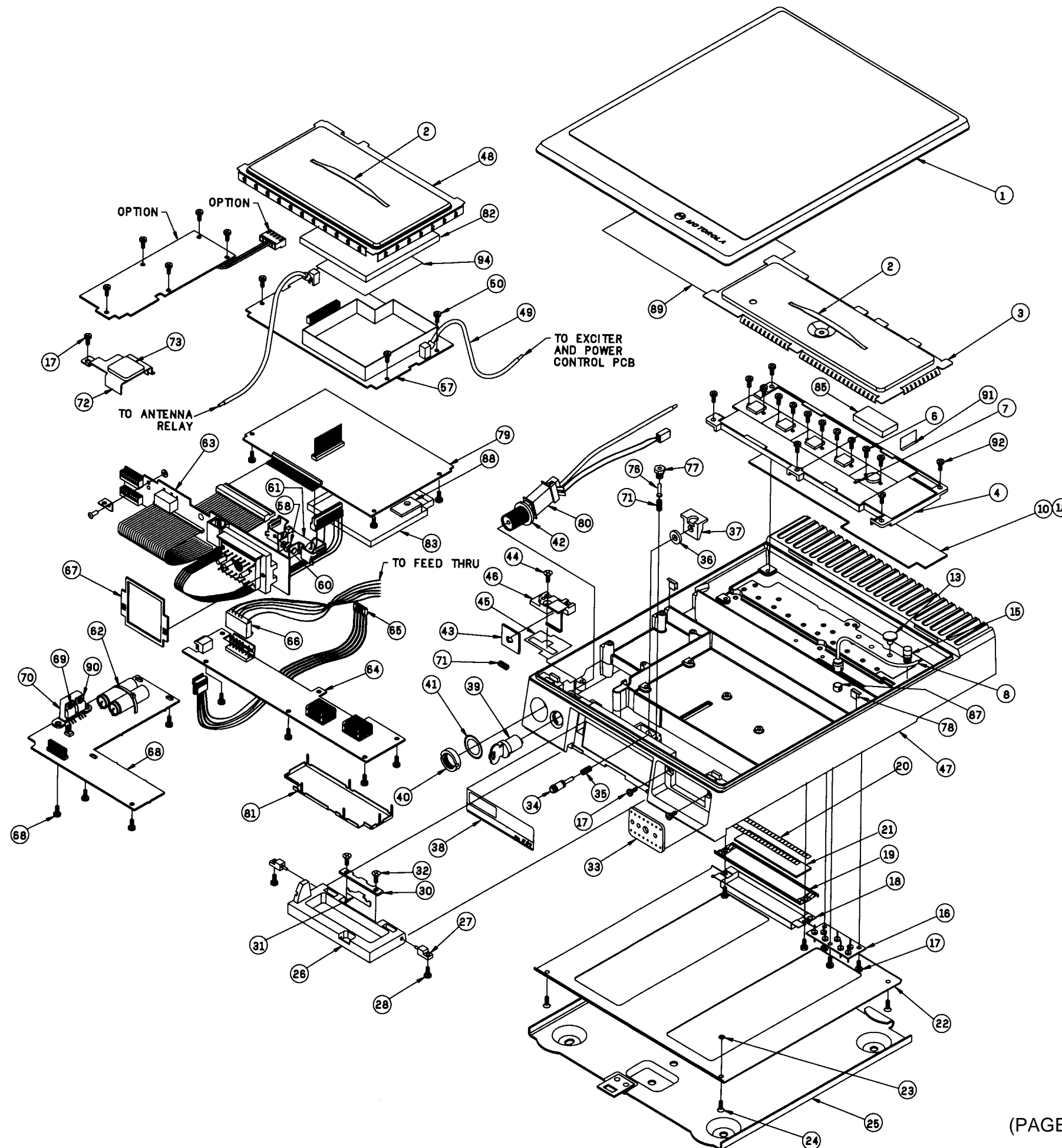
MXW-7404-O (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R0053	06-11077A88	3.9k
Q0104	48-00869643	PNP
Q0105,0106	48-00869642	NPN
Q0107	48-00869658	NPN
Q0151	48-00869658	NPN
Q0152	48-00869643	PNP
Q0203	48-00869839	N-channel
Q0204,0205	48-00869658	NPN
Q0206	48-00869839	NPN
Q0207,0208	48-00869658	NPN
Q0276	48-00869642	NPN
Q0277-0279	48-00869643	PNP
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R0001,0002	06-11077A30	15
R0003	06-11077A66	470
R0004	06-11077A84	2.7k
R0005	06-11077A46	68
R0006	06-11077A86	3.3k
R0007	06-11077B03	15k
R0051	06-11077A43	51
R0052	06-11077A54	150
R0054	06-11077A54	150
R0056	06-11077B45	820k
R0057	06-11077A72	820
R0058	06-11077B31	220k
R0059	06-11077B27	150k
R0060	18-05500L08	22k, +20%, potentiometer
R0061	06-11077B19	68k
R0062	06-11077B09	27k
R0063	06-11077B21	82k
R0102	06-11077A62	330
R0103,0104	06-11077A98	10k
R0105	06-11077B11	33k
R0106	06-11077A74	1k
R0107	06-11077A78	1.5k
R0108,0109	06-11077A26	10
R0110	06-11077B03	15k
R0111	06-11077A72	820
R0112	06-11077A86	3.3k
R0113	06-11077A74	1k
R0114	06-11077A72	820
R0115	06-11077A70	680
R0116	06-11077A92	5.6k
R0118	06-11077A70	680
R0119	06-11077A90	4.7k
R0120,0121	06-11077A88	3.9k
R0122	06-11077A43	51
R0123	06-11077A50	100
R0124	06-11077A84	2.7k
R0125	06-11077A72	820
R0151	06-11077B15	47k
R0152	06-11077B11	33k
R0153	06-11077B15	47k
R0154	06-11077A34	22
R0155	06-11077A98	10k
R0156	06-11077B03	15k
R0157	06-11077A78	1.5k
R0158,0159	06-11077A74	1k
R0161	06-11077A98	10k
R0163	06-11077B07	22k
R0164	18-05500L08	22k, ±20%, potentiometer
R0165	06-11077B09	27k
R0176	06-11077G26	22.6k, ±1%
R0177	06-11077G28	23.7k, ±1%
R0178,0179	06-11077F91	10k, ±1%
R0180	06-11077G52	42.2k, ±1%
R0181	06-11077F91	10k, ±1%
R0182	06-11077G28	23.7k, ±1%
R0207,0208	06-11077A44	56
R0209	06-11077A52	120
R0210	06-11077A01	0 ohm
R0211	06-11077A98	10k
R0212	06-11077A84	2.7k
R0213	06-11077A72	820
R0214	06-11077A50	100
R0215	06-11077A84	2.7k
R0216	06-11077A72	820
R0217	06-11077A42	47
R0218	06-11077A50	100
R0219	06-11077A46	68
R0220	06-11077A50	100
R0222	06-11077A84	2.7k
R0223	06-11077B09	27k
R0224	06-11077B23	100k
R0225	06-11077B09	27k
R0226,0227	06-11077A44	56
R0228	06-11077A50	100
R0229	06-11077A01	0 ohm
R0230	06-11077A98	10k

MXW-7404-O (3)

MXW-7404-O (4)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R0231	06-11077A84	2.7k
R0232	06-11077A72	820
R0233	06-11077A50	100
R0234	06-11077A84	2.7k
R0235	06-11077A72	820
R0236	06-11077A42	47
R0237	06-11077A66	470
R0238	06-11077A28	12
R0239	06-11077A66	470
R0241	06-11077B23	100k
R0276	06-11077A98	10k
R0277	06-11077A60	270
R0278	06-11077A26	10
R0279	06-11077A90	4.7k
R0280	06-11077A98	10k
R0281	06-11077A90	4.7k
transformer		
T0001,0002	25-80163M02	500 MHz balance transformer
integrated circuits (see note)		
U0051	51-05479G05	linear
U0101	51-84704M75	synthesizer
U0102	51-84810F66	dual divider
U0176	51-84621K89	dual opamp
crystal (see note)		
Y0051	91-80022M02	45.1 MHz
Y0052	48-80008K02	44.645 MHz
Y0151	48-80174D05	14.4 MHz
non-referenced parts		
M0201-0211	14-05160A01	insulator
	26-80098M01	coil can shield
	26-80097M01	coil can shield
M0004	26-80228L01	coax connector shield
M0005	26-80228L01	coax connector shield
M0002	26-80229L03	VCO shield
M4016	26-80256L02	coax connector bottom shield
	30-10288A72	24 strand wire, white
	54-80111F01	PROM label
	75-05295B07	crystal base pad, 2 used
	84-80927T01	circuit board



parts list

m400 UHF Radio Exploded View

MXW-7673-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	—	top cover assembly
2	55-84300B04	handle, nylon (2 used)
3	26-80261C01	shield, PA compartment
4	42-80137A03	clamp, substrate
5	—	not used
6	03-10911A11	machine screw, 3 x 0.5 x 8 (4 used)
7	42-84510M04	strap, PA (4 used)
8	01-80750T30	coax cable
9	—	not used
10	—	power distribution board
11	—	not used
12	14-80142A02	insulator, power distribution board
13	32-80084A02	gasket, stud device (3 used)
14	—	not used
15	26-80254A01	heatsink, LLA
16	—	pre-amp feedthru plate assembly
17	03-10908A26	machine screw, 3.5 x 0.6 x 6 (6 used)
18	15-80066B01	cover, harmonic filter
19	26-80079B01	shield, harmonic filter gasket
20	32-80074B01	gasket, harmonic filter (2 used)
21	—	harmonic filter
22	—	bottom cover assembly
23	04-80149A01	washer, captivating (4 used)
24	03-10913A29	machine screw, 3.5 x 0.6 x 13 (4 used)
25	—	mounting tray assembly
26	55-80002A01	handle
27	47-80176P01	pin, pivot (2 used)
28	03-10943R55	tapping screw 3 x 0.5 x 8 (2 used)
29	—	not used
30	64-80019A01	plate, backup
31	07-80113B01	bracket, latch
32	03-80001P01	screw, 3.5 x 0.6 x 6 (2 used)
33	32-80020C01	gasket, front cable connector
34	47-80027A01	pushbutton
35	41-80029A01	spring, latch
36	32-80295C01	gasket
37	07-80030A01	bracket, latch
38	33-80028N04	nameplate, radio
39	55-80370A01	lock
40	02-80006A01	nut, spanner
41	04-00114522	lockwasher, 5/8"
42	32-80080A01	gasket, antenna connector
43	07-80016A02	bracket, lock slide
44	03-10936E14	tapping screw, B3.5 x 1.27 x 13
45	32-80000P01	gasket, lock support
46	07-80015A02	support, lock slide
47	27-80003P01	chassis
48	26-80092P01	shield, RF
49	30-80231N01	cable, coaxial
50	03-10943M10	tapping screw, 3.5 x 0.6 x 8 (12 used)
51-56	—	not used
57	—	RF circuit board
58	48-80153A01	diode, pellet
59	—	not used
60	26-80191P01	heatsink (2 used)
61	23-80167C03	capacitor, electrolytic
62	42-10217A32	strap, cable harness (2 used)
63	—	interconnect circuit board
64	—	exciter/power control circuit board
65	30-80159N01	cable, power control
66	30-80234N01	cable, feedthru
67	32-80074A02	gasket, cable plug
68	—	audio/squelch circuit board
69	03-10908A18	screw, 3 x 0.5 x 6 (2 used) (HLN5342)
70	26-80129P01	heatsink (HLN5342)
71	41-80022A01	lock, spring (2 used)
72	07-80126P01	bracket, relay
73	75-82200H01	pad
74-75	—	not used
76	46-80151A01	stud, cover release
77	43-80150A01	sleeve, cover release
78	42-80013A01	clip, coaxial (2 used)
79	—	logic circuit board
80	—	antenna relay assembly
81	26-80163N01	shield, solder side
82	15-80953T01	cover, VCO shield
83	15-80124M01	cover, logic shield
84	—	not used
85	75-82200H14	pad, compression (2 used)
86	—	not used
87	42-84733F01	ring, compression
88	75-80202C01	pad, compression
89	54-80166K01	label
90	51-80065C03	IC audio (2 used) (HLN5342)
91	14-80135H01	insulator, hybrids (3 used)
92	03-10943M16	screw, 3.5 x 0.6 x 10 (20 used)
93	—	not used
94	14-80932U01	insulator, RF cover

non-referenced items

30-10286A04 cable, 14 gage black

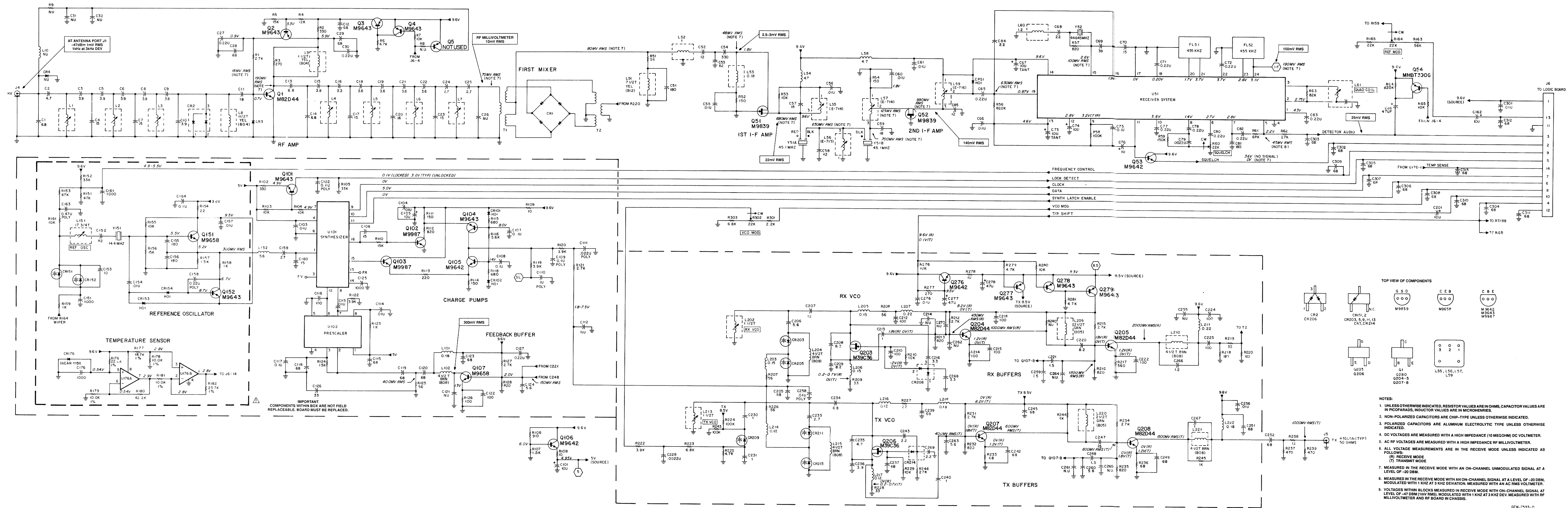
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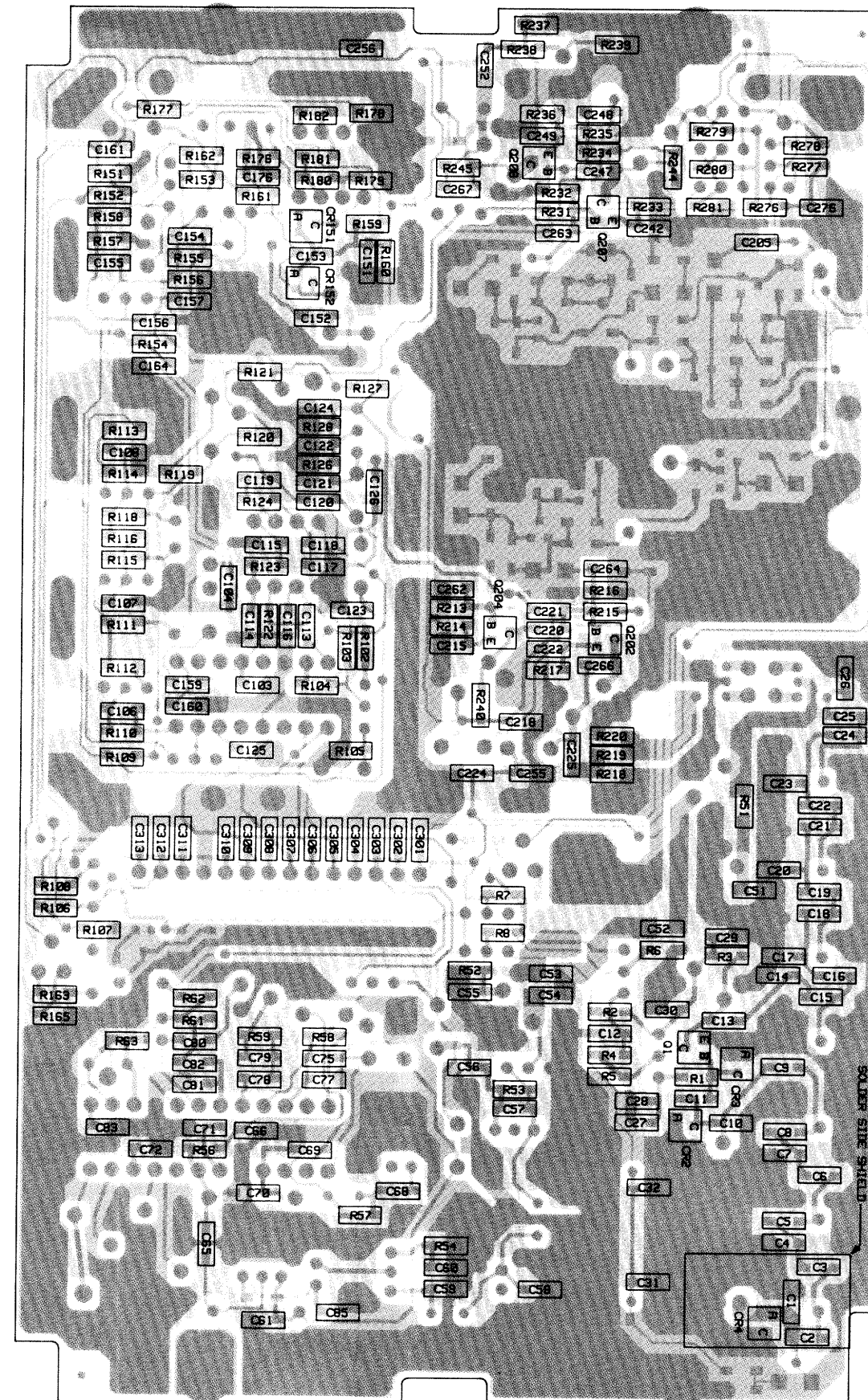
UHF Radio Exploded View

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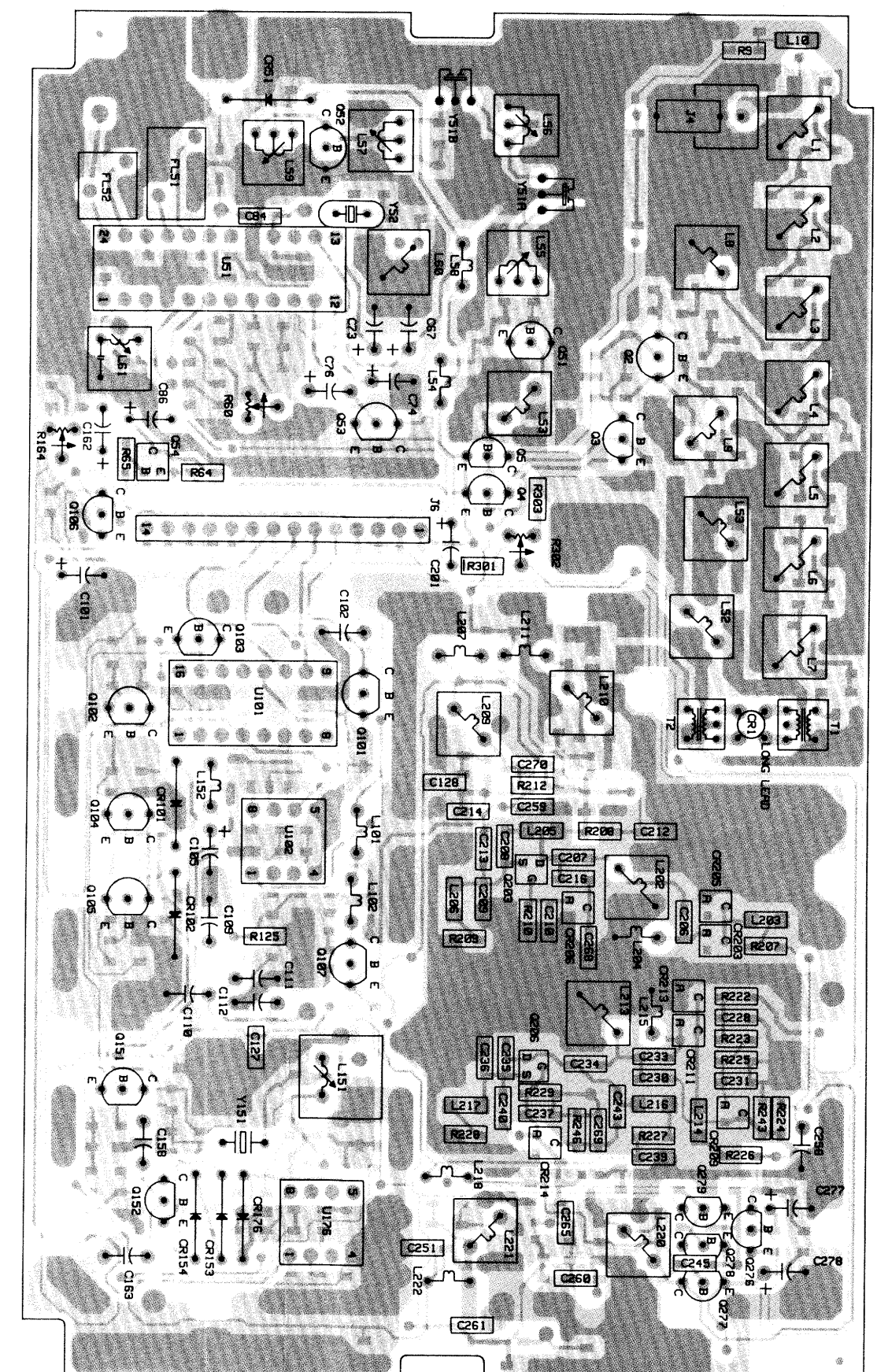
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Transistor Ref. No.	VOLTAGE			VOLTAGE		
	BASE	EMITTER	COLLECTOR	GATE	SOURCE	DRAIN
Q1	.7	0	5.9	—	—	—
Q2	5.3	5.9	.9	—	—	—
Q51	—	—	—	0	1.8	9.6
Q52	—	—	—	0	1.8	9.6
Q53	0	0 (W/SIG)	9.6	—	—	—
Q101	5.0	4.9	.1 (LOCKED)	—	—	—
Q102	.7	0	0.1	—	—	—
Q103	5.0	4.4	9.6	—	—	—
Q104	8.1	2.8v	2-8v	—	—	—
Q105	1.4	VAR.	2-8v	—	—	—
Q106	6.0	5.0	9.6	—	—	—
Q107	2.0	1.3	9.6	—	—	—
Q151	5.5	5.2	9.5	—	—	—
Q152	8.7	9.5	6.7	—	—	—
Q201	—	9.6	0(U) 9.3(L)	U=UPPER L=LOWER RANGE		
Q202	0(U) 7(L)	0	6.7(U) 0(L)	—	—	—
Q203	—	—	—	2.6(R)	4.8(R)	7.9(R)
Q204	1.8(R)	1.2(R)	8.2(R)	—	—	—
Q205	1.8(R)	1.2(R)	9.6	—	—	—
Q206	—	—	—	-5(T)	1.1(T)	7.8(T)
Q207	1.8(T)	1.2(T)	8.5(T)	—	—	—
Q208	1.8(T)	1.2(T)	9.6	—	—	—
Q276	9.5	8.6	9.6	—	—	—
Q277	9.6	8.5(T)	8.5	—	—	—
Q278	9.6	8.3	7.6(R)	—	—	—
Q279	7.6(R)	8.5	8.5	—	—	—



SOLDER SIDE VIEW



COMPONENT SIDE VIEW

Schematic, Circuit Board Diagrams, and
Parts List for HLE9310B UHF RF Board

(Sheet 2 of 3)

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SOLDER SIDE RED
COMPONENT SIDE GREY
OVERLAYS BLACK
GAW-7704-O
GAW-7705-O
GDW-7706-O

parts list

HLE9310B UHF RF Board

MXW-7584-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed (unless otherwise stated)		
C1	21-13740B21	6.8 pF, ±5%, 50V
C2	21-13740B17	4.7 pF, ±5%, 50V
C3	21-13740B15	3.9 pF, ±5%, 50V
C4	21-13740B29	15 pF, ±5%, 50V
C5,6	21-13740B15	3.9 pF, ±5%, 50V
C7	21-13740B29	15 pF, ±5%, 50V
C8	21-13740B15	3.9 pF, ±5%, 50V
C9	21-13740B14	3.6 pF, ±5%, 50V
C10	21-13740B15	3.9 pF, ±5%, 50V
C11	21-13740B31	18 pF, ±5%, 50V
C12	21-13740B45	68 pF, ±5%, 50V
C13,14	21-13740B21	6.8 pF, ±5%, 50V
C15	21-13740B15	3.9 pF, ±5%, 50V
C16	21-13740B13	3.3 pF, ±5%, 50V
C17	21-13740B29	15 pF, ±5%, 50V
C18,19	21-13740B14	3.6 pF, ±5%, 50V
C20	21-13740B30	16 pF, ±5%, 50V
C21,22	21-13740B14	3.6 pF, ±5%, 50V
C23	21-13740B29	15 pF, ±5%, 50V
C24,25	21-13740B11	2.7 pF, ±5%, 50V
C27	21-11032B15	.22 uF, +80, -20%, 50V
C28,29	21-13740B45	68 pF, ±5%, 50V
C30	21-11032B15	.22 uF, +80, -20%, 50V
C51	21-13740B55	180 pF, ±5%, 50V
C52	21-13740B27	12 pF, ±5%, 50V
C53	21-13740B47	82 pF, ±5%, 50V
C54	21-13740B61	330 pF, ±5%, 50V
C55,56	21-13741B45	.01 uF, ±5%, 50V
C57	21-13740B31	18 pF, ±5%, 50V
C58	21-13740B27	12 pF, ±5%, 50V
C59	21-13740B31	18 pF, ±5%, 50V
C60,61	21-13741B45	.01 uF, ±5%, 50V
C65	21-11032B15	.22 uF, +80, -20%, 50V
C66	21-13741B45	.01 uF, ±5%, 50V
C67	23-13749C39	10 uF, ±10%, 50V, tantalum
C68	21-13740B33	22 pF, ±5%, 50V
C69	21-13740B39	39 pF, ±5%, 50V
C70	21-13740B29	15 pF, ±5%, 50V
C71	21-11032B15	.22 uF, +80, -20%, 50V
C72	21-11032B15	.22 uF, +80, -20%, 50V
C73	23-13749C39	10 uF, ±10%, 50V, tantalum
C74	23-11048B13	10 uF, ±20%, 16V, electrolytic
C75	21-13741B69	.1 uF, ±5%, 50V
C76	23-11048B05	1 uF, ±20%, 50V, electrolytic
C77,78	21-11032B15	.22 uF, +80, -20%, 50V
C79	21-13741B29	.0022 uF, ±5%, 50V
C80	21-11032B15	.22 uF, +80, -20%, 50V
C81	21-13740B55	180 pF, ±5%, 50V
C82,83	21-11032B15	.22 uF, +80, -20%, 50V
C84	21-13740B09	2.2 pF, ±5%, 50V
C85	21-13740B27	12 pF, ±5%, 50V
C86	23-11048B49	47 uF, ±20%, 16V, electrolytic
C101	23-11048B13	10 uF, ±20%, 16V, electrolytic
C102	08-11051A13	.1 uF, ±5%, 63V
C103,104	21-13741B45	.01 uF, ±5%, 50V
C105	23-11048B13	10 uF, ±20%, 16V, electrolytic
C106	21-13740B29	15 pF, ±5%, 50V
C107,108	21-13741B69	.1 uF, ±5%, 50V
C109	08-11051A13	.1 uF, ±5%, 63V
C110	08-11051A19	1 uF, ±5%, 63V
C111	08-11051A09	.022 uF, ±5%, 63V
C113-114	21-13741B45	.01 uF, ±5%, 50V
C115	21-13740B45	68 pF, ±5%, 50V
C116	21-13740B49	100 pF, ±5%, 50V
C117	21-13741B69	.1 uF, ±5%, 50V
C118-120	21-13740B45	68 pF, ±5%, 50V
C121		not used
C122	21-13740B49	100 pF, ±5%, 50V
C123	21-13740B45	68 pF, ±5%, 50V
C124	21-13740B19	5.6 pF, ±5%, 50V
C125	21-13740B73	.001 uF, ±5%, 50V
C126	21-13740B37	33 pF, ±5%, 50V
C127	21-11032B15	.22 uF, +80, -20%, 50V
C151	21-13740B73	.001 uF, ±5%, 50V
C152	21-13740B47	82 pF, ±5%, 50V
C153	21-13740B25	10 pF, ±5%, 50V
C154	21-13741B45	.01 uF, ±5%, 50V
C155,156	21-13740B55	180 pF, ±5%, 50V
C157	21-13741B45	.01 uF, ±5%, 50V
C158	08-11051A15	.22 uF, ±5%, 63V
C159	21-13740B35	27 pF, ±5%, 50V
C160	21-13740B29	15 pF, ±5%, 50V
C161	21-13740B73	.001 uF, ±5%, 50V
C162	23-11048B13	10 uF, ±20%, 16V, electrolytic
C163	08-11051A17	.47 uF, ±5%, 63V
C164	21-13741B69	.1 uF, ±5%, 50V
C165		not used
C166		not used
C167		not used
C168		not used
C176	21-13740B73	.001 uF, ±5%, 50V
C201	23-11048B13	10 uF, ±20%, 16V, electrolytic
C205	21-13740B45	68 pF, ±5%, 50V
C206	21-13740B19	5.6 pF, ±5%, 50V
C207	21-13740B27	12 pF, ±5%, 50V
C208,209	21-13740B23	8.2 pF, ±5%, 50V
C210	21-13740B49	100 pF, ±5%, 50V
C211		not used
C212	21-13740B49	100 pF, ±5%, 50V

MXW-7584-O (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C213	21-13740B01	1 pF, ±5%, 50V
C121		not used
C215	21-13740B49	100 pF, ±5%, 50V
C216	21-13740B13	3.3 pF, ±5%, 50V
C218	21-13741B49	100 pF, ±5%, 50V
C219		not used
C220	21-13740B23	8.2 pF, ±5%, 50V
C221	21-13740B05	1.5 pF, ±5%, 50V
C222	21-13740B49	100 pF, ±5%, 50V
C223		not used
C224,225	21-13740B49	100 pF, ±5%, 50V
C228	21-13741B29	.0022 uF, ±5%, 50V
C229		not used
C230,231	21-13740B01	1 pF, ±5%, 50V
C233	21-13740B11	2.7 pF, ±5%, 50V
C234	21-13740B21	6.8 pF, ±5%, 50V
C235	21-13740B17	4.7 pF, ±5%, 50V
C236	21-13740B15	3.9 pF, ±5%, 50V
C237	21-13740B45	68 pF, ±5%, 50V
C238		not used
C239	21-13740B45	68 pF, ±5%, 50V
C240	21-13740B01	1 pF, ±5%, 50V
C241		not used
C242	21-13740B45	68 pF, ±5%, 50V
C243	21-13740B09	2.2 pF, ±5%, 50V
C245	21-13740B45	68 pF, ±5%, 50V
C246		not used
C247	21-13740B29	15 pF, ±5%, 50V
C248	21-13740B05	1.5 pF, ±5%, 50V
C249	21-13740B45	68 pF, ±5%, 50V
C250		not used
C251,252	21-13740B45	68 pF, ±5%, 50V
C253		not used
C256	21-13741B45	.01 uF, ±5%, 50V
C258	08-11051A07	.01 uF, ±5%, 63V
C259	21-13740B22	7.5 pF, ±5%, 50V
C260	21-13740B19	5.6 pF, ±5%, 50V
C263	21-13740B19	5.6 pF, ±5%, 50V
C266	21-13740B03	1.2 pF, ±5%, 50V
C267	21-13740B01	1 pF, ±5%, 50V
C268	21-13740B13	3.3 pF, ±5%, 50V
C269	21-13740B09	2.2 pF, ±5%, 50V
C276	21-13741B45	.01 uF, ±5%, 50V
C277,278	23-11048B19	47 uF, ±20%, 16V, electrolytic
C301	21-13741B45	.01 uF, ±5%, 50V
C302-313	21-13740B45	68 pF, ±5%, 50V
diode (see note)		
CR1	48-80236E16	Schottky
CR2	48-80154K02	Schottky
CR3	48-80939T01	Schottky
CR51	48-83654H01	silicon
CR101,102	48-83654H01	silicon
CR151,152	48-05129M21	varactor
CR153,154	48-83654H01	silicon
CR176	48-82256C11	zener
CR203	48-84534N02	varactor
CR205	48-84534N02	varactor
CR206	48-80154K02	Schottky
CR209	48-84534N02	varactor
CR211	48-84534N02	varactor
CR213	48-84534N02	varactor
CR214	48-80939T01	Schottky
filter		
FL51	91-80097D06	6 element, ceramic
FL52	91-80098D06	3 element, ceramic
connector receptacle		
J4,5	09-80135M01	2 pin coax
J6	09-80130M03	14 position socket
RF coil		
L1-7	24-80148M01	27 nH, 1.5 turns
L8,9	24-11030B04	1.5 turns, yellow
L51	24-11030B12	7.5 turns, yellow
L52	24-80063M13	1 uH
L53	24-80063M04	.18 uH
L54	24-80063M21	4.7 uH
L55	24-80164M04	5.2 turns, variable
L56	24-80164M01	1:6 ratio, variable
L57	24-80164M04	5.2 turns, variable
L58	24-80063M21	4.7 uH
L59	24-80164M03	4.3 turns, variable
L60	24-80063M14	1.2 uH
L61	25-80000E01	transformer
L101	24-80063M04	.18 uH
L102	24-11030B08	4.5 turns, brown
L151	24-80299D01	17.75 turns, orange
L152	24-80063M22	5.6 uH
L202	24-80148M01	27 nH, 1.5 turns
L203	24-80989T02	150 nH, ±20%
L204	24-11030B09	4.5 turns, brown
L205,206	24-80989T02	150 nH, ±20%
L207	24-80063M05	.22 uH
L209	24-11030B05	2.5 turns, green
L210	24-11030B08	4.5 turns, brown
L211	24-80063M05	.22 uH
L213	24-80148M01	27 nH, 1.5 turns
L214	24-80989T01	120 nH, ±20%
L215	24-11030B08	4.5 turns, brown
L216,217	24-80989T01	120 nH, ±20%

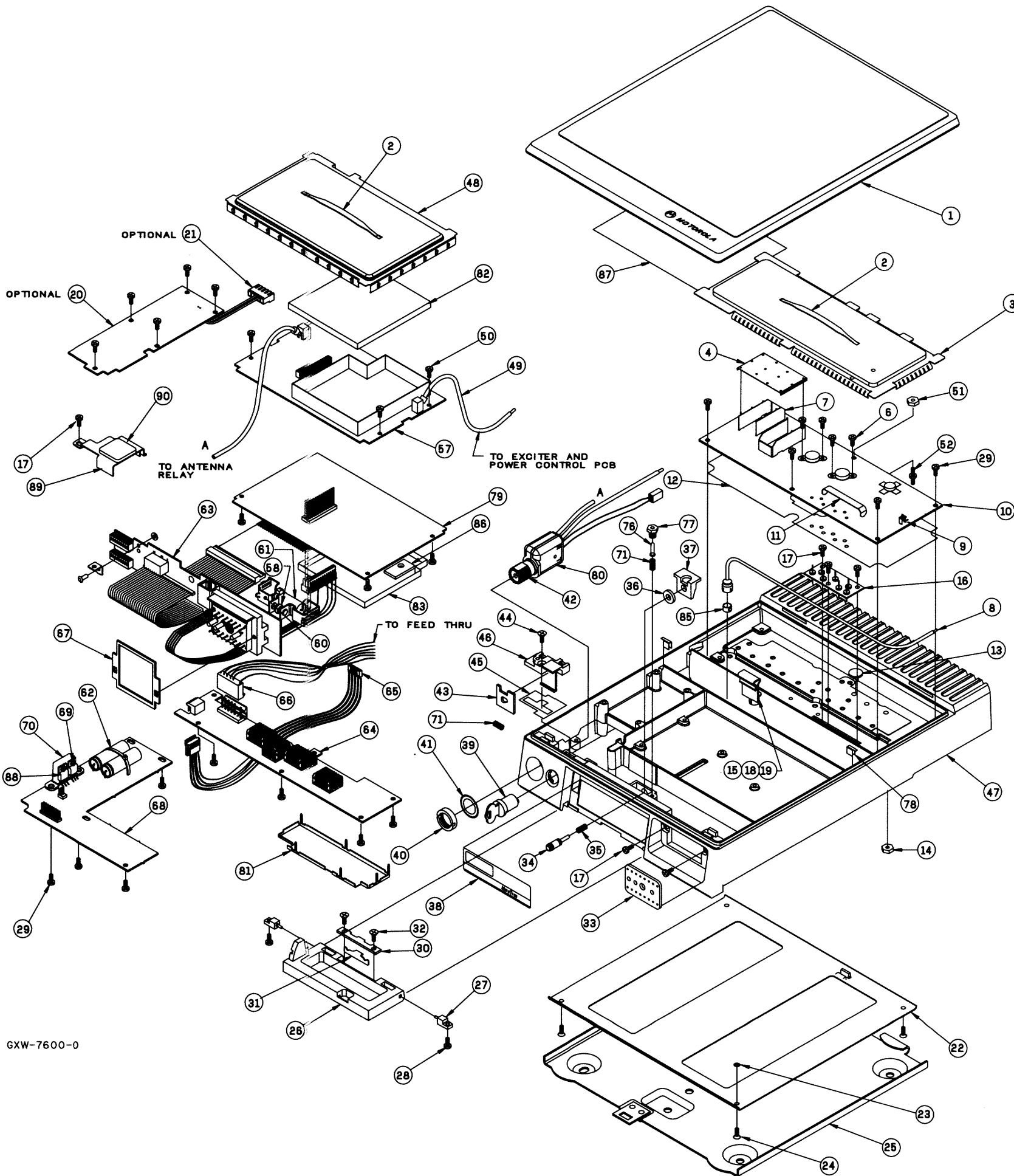
MXW-7584-O (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L218	24-80063M04	.18 uH
L220	24-11030B05	2.5 turns, green
L221	24-11030B08	4.5 turns, brown
L222	24-80063M04	.18 uH
transistor (see note)		
Q1	48-80182D44	NPN
Q2-4	48-00869643	PNP
Q51,52	48-00869839	N-channel
Q53	48-00869642	NPN
Q54	48-05128M16	PNP
Q101	48-00869643	PNP
Q102,103	48-80182D20	NPN
Q104	48-00869643	PNP
Q105,106	48-00869642	NPN
Q107	48-00869658	NPN
Q151	48-00869658	NPN
Q152	48-00869643	PNP
Q203	48-05128M66	N-channel
Q204,205	48-80950X01	NPN
Q206	48-05128M66	N-channel
Q207,208	48-80950X01	NPN
Q276	48-00869642	NPN
Q277-279	48-00869643	PNP
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1	06-11077A84	2.7k
R2	06-11077A62	330
R3	06-11077A60	270
R4	06-11077B01	12k
R5	06-11077B03	15k
R6	06-11077A90	4.7k
R7	06-11077A98	10k
R51	06-11077A44	56
R52	06-11077A54	150
R53	06-11077A98	10k
R54	06-11077A54	150
R56	06-11077B45	820k
R57	06-11077A72	820
R58	06-11077B23	100k
R59	06-11077B27	150k
R60	18-05500L08	22k, ±20%, potentiometer
R61	06-11077B19	68k
R62	06-11077B09	27k
R63	06-11077B21	82k
R64	06-11077B45	820k
R65	06-11077A98	10k
R102	06-11077A62	330
R103,104	06-11077A98	10k
R105	06-11077B11	33k
R106	06-11077A43	910
R107	06-11077A78	1.5k
R108,109	06-11077A26	10
R110	06-11077B03	15k
R111	06-11077A54	150
R112	06-11077A72	820
R113	06-11077A58	220
R114	06-11077A50	150
R115	06-11077A70	680
R116	06-11077A92	5.6k
R118	06-11077A70	680
R119,120	06-11077A88	3.9k
R121	06-11077A84	2.7k
R122	06-11077A88	3.9k
R123	06-11077A74	1k
R124	06-11077A78	1.5k
R125	06-11077A44	56
R126	06-11077A50	100
R127	06-11077A84	2.7k
R128	06-11077A72	820
R151	06-11077B15	47k
R152	06-11077B11	33k
R153	06-11077B15	47k
R154	06-11077A34	22
R155	06-11077A98	10k
R156	06-11077B03	15k
R157	06-11077A78	1.5k
R158,159	06-11077A74	1k
R161	06-11077A98	10k
R163	06-11077B17	56k
R164	18-05500L08	22k, ±20%, potentiometer
R165	06-11077B07	22k
R176	06-11077G26	22.6k, ±1%
R177	06-11077G18	18.7k, ±1%
R178	06-11077F91	10k, ±1%
R179	06-11077F91	10k, ±1%
R180	06-11077G52	42.2k, ±1%
R181	06-11077F91	10k, ±1%
R182	06-11077G28	23.7k, ±1%
R207,208	06-11077A44	56
R209	06-11077A38	33
R210	06-11077A98	10k
R211		not used
R212	06-11077A84	2.7k
R213	06-11077A72	820
R214	06-11077A50	100
R215	06-11077A84	2.7k
R216	06-11077A72	820
R217	06-11077A68	560
R218	06-11077A56	180
R219	06-11077A38	33

parts list

MaraTrac Low Band Radio Exploded View

MXW-7671-O



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	—	top cover assembly
2	55-84300B04	handle, nylon (2 used)
3	26-80070B01	shield, PA compartment
4	15-80205A02	cover, RF shield (HLB4115, Range 3)
5	—	not used
6	03-10911A11	machine screw, 3 x 0.5 x 8 (4 used)
7	26-80107P01	shield, RF (2 used) (HLB4115, Range 3)
8	01-80750T31	coaxial cable assembly
9	29-80014A01	clip, coaxial terminal
10	—	110W PA circuit board (Range 3)
11	17-80165C02	resistor, shunt (HLB4115, Range 3)
12	14-80143A03	insulator, PA
13	32-80084A02	gasket, stud device (2 used)
14	02-00119913	nut
15	26-80254A01	heatsink, LLA
16	—	feedthru plate assembly
17	03-10908A26	machine screw, 3.5 x 0.6 x 6 (6 used)
18	02-00007005	nut
19	26-80238N01	heatsink, TO5
20	—	option circuit board
21	30-80157N01	cable, 2 conductor
22	—	bottom cover assembly
23	04-80149A01	washer, captivating (4 used)
24	03-10913A29	machine screw, 3.5 x 0.6 x 13 (4 used)
25	—	mounting tray assembly
26	55-80002A01	handle
27	47-80176P01	pin, pivot (2 used)
28	03-10943R55	tapping screw 3 x 0.5 x 8 (2 used)
29	03-10943M16	tapping screw 3.5 x 0.6 x 10 (19 used)
30	64-80019A01	plate, backup
31	07-80113B01	bracket, latch
32	03-80001P01	screw, 3.5 x 0.6 x 6 (2 used)
33	32-80020C01	gasket, front cable connector
34	47-80027A01	pushbutton
35	41-80029A01	spring latch
36	32-80295C01	gasket
37	07-80030A01	bracket, latch
38	33-80028N03	nameplate, radio
39	55-80370A01	lock
40	02-80006A01	nut, spanner
41	04-00114522	lockwasher
42	32-80080A01	gasket, antenna connector
43	07-80016A01	bracket, lock slide
44	03-10936E14	tapping screw, B3.5 x 1.27 x 13
45	32-80000P01	gasket, lock support
46	07-80015A01	support, lock slide
47	27-80003P01	chassis
48	26-80092P01	shield, RF
49	30-80231N01	cable, coaxial
50	03-10943M10	tapping screw, 3.5 x 0.6 x 8 (12 used)
51	02-10971A63	nut, hex
52	43-80013B01	stand off
53-56	—	not used
57	—	RF circuit board (Range 3)
58	48-80153A01	diode, pellet
59	—	not used
60	26-80191P01	heatsink (2 used)
61	23-80167C03	capacitor, electrolytic
62	42-10217A14	strap, cable harness (2 used)
63	—	interconnect circuit board
64	—	exciter/power control circuit board
65	30-80159N01	cable, power control
66	30-80234N01	cable, feedthru
67	32-80074A02	gasket, cable plug
68	—	audio/squelch circuit board
69	03-10908A18	screw, 3 x 0.5 x 6 (2 used) (HLN5342)
70	26-80129P01	heatsink (HLN5342)
71	41-80022A01	lock, spring (2 used)
72-75	—	not used
76	46-80151A01	stud, cover release
77	43-80150A01	sleeve, cover release
78	42-80013A01	clip, coaxial (3 used)
79	—	logic circuit board
80	—	antenna relay assembly
81	26-80163N01	shield, solder side
82	15-80953T01	cover, VCO shield
83	15-80124M01	cover, logic shield
84	—	not used
85	42-84733F04	ring, compression
86	75-80202C01	pad, compression
87	54-80166K01	label
88	51-80065C03	IC audio (2 used) (HLN5342)
89	07-80126P01	bracket, relay
90	75-82200H01	pad
		non-referenced items
		30-10286A06 cable, 14 gage red
		30-10286A04 cable, 14 gage black

03/28/90

Low Band Radio Exploded View
PW-7678-O

3/30/90

Range 1 Parts List

HLB4099A RF Board, 29.7–36 MHz			MXW–6563–B		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION			
capacitor, chip, pF, ±5%, 50V (unless otherwise indicated)					
C1	21–13740B55	180			
C2	21–11032B15	0.22 uF, +80–20%			
C3	21–13740B66	510			
C4	21–13740B57	220			
C6	21–13740B38	36			
C7	21–13740B19	5.6, ±.25 pF			
C8	21–13740B55	180			
C9	21–13740B68	620			
C10	21–11032B15	0.22 uF, +80–20%			
C11	21–13740B55	180			
C12,13	21–11032B15	0.22 uF, +80–20%			
C14	—	not used			
C15	21–13740B46	75			
C17	21–13740B66	510			
C18	21–13740B61	330			
C19	—	not used			
C20	21–13740B71	820			
C21	21–13740B60	300			
C23	21–13740B69	680			
C24	21–13740B73	1000			
C25	21–13740B61	330			
C26–29	21–11032B15	0.22 uF, +80–20%			
C30	21–13740B69	680			
C31	21–13740B48	91			
C32	21–13740B63	390			
C33	—	not used			
C51	21–13740B52	130			
C52	21–13740B59	270			
C53–57	21–11032B15	0.22 uF, +80–20%			
C58	21–13740B68	620			
C59	21–13740B63	390			
C60	21–13740B26	11			
C61	21–13740B57	220			
C62	21–13740B17	4.7, ±.25 pF			
C63	21–13740B57	220			
C64	21–13740B19	5.6, ±.25 pF			
C65	21–13740B64	430			
C66	21–13740B65	470			
C67	21–13740B39	39			
C69	21–13740B18	5.1, ±.25 pF			
C71	21–13740B18	5.1, ±.25 pF			
C72	21–13740B37	33			
C73	21–11032B15	0.22 uF, +80–20%			
C74	21–13740B22	7.5, ±.5 pF			
C75	21–11032B15	0.22 uF, +80–20%			
C76	23–11013D13	10 uF, ±10%, 20V, tantalum			
C77	21–13740B37	33			
C78	21–13740B51	120			
C79–81	21–11032B15	0.22 uF, +80–20%			
C82	23–11013D13	10 uF, ±10%, 20V, tantalum			
C83	23–11048B13	10 uF, ±20%, 16V, electrolytic			
C84	21–11032B13	0.1 uF, +80–20%			
C85	23–11048B05	1 uF, ±20%, electrolytic			
C86,87	21–11032B15	0.22 uF, +80–20%			
C88	21–13741B29	0.0022 uF, ±10%			
C89	21–11032B15	0.22 uF, +80–20%			
C90	21–13741B29	0.0022 uF, ±10%			
C91–93	21–11032B15	0.22 uF, +80–20%			
C94	21–13740B05	1.5, ±.25 pF			
C95	21–11032B15	0.22 uF, +80–20%			
C96	21–13740B25	10, ±.5 pF			
C101	23–11048B13	10 uF, ±20%, 16V, electrolytic			
C102	08–11051A13	0.1 uF, 63V			
C103,104	21–13741B45	0.01 uF, ±10%			
C105	23–11048B13	10 uF, ±20%, 16V, electrolytic			
C106	21–13740B47	82			
C107,108	21–11032B13	0.1 uF, +80–20%			
C109	08–11051A13	0.1 uF, 63V			
C110	08–11044A33	1 uF			
C111	08–11051A08	0.015 uF, 63V			
C112	08–11051A05	0.0047 uF, 63V			
C113,114	21–13740B57	220			
C115	21–11032B13	0.1 uF, +80–20%			
C116,117	21–11032B15	0.22 uF, +80–20%			
C118	21–13740B33	22			
C119	21–11032B15	0.22 uF, +80–20%			
C122	23–11013D13	10 uF, ±10%, 20V, tantalum			
C123	21–13740B59	270			
C124	23–11013D13	10 uF, ±10%, 20V, tantalum			
C125	21–11032B13	0.1 uF, +80–20%			
C126	23–11013A56	47 uF, ±20%, 6V, tantalum			
C127	23–11048B13	10 uF, ±20%, 16V, electrolytic			
C128	23–11013A56	47 uF, ±20%, 6V, tantalum			
C151	21–13740B73	1000			
C152	21–13740B47	82			
C153	21–13740B25	10, ±.5 pF			
C154	21–13741B45	0.01 uF, ±10%			
C155,156	21–13740B55	180			
C157	21–13741B45	0.01 uF, ±10%			
C158	08–11051A15	0.22 uF, 63V			
C159	21–13740B29	15			
C160	21–13740B41	47			
C161	21–11032B15	0.22 uF, +80–20%			
C163	08–11051A15	0.22 uF, 63V			
C165	21–11032B15	0.22 uF, +80–20%			
C176	21–13740B73	1000			
C201	23–11048B13	10 uF, ±20%, 16V, electrolytic			
C205	21–13740B73	1000			
C206,207	21–13740B45	68			

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C208	21-13740B17	4.7, ±.25 pF
C211-213	21-11032B15	0.22 uF, +80-20%
C214,215	21-13740B43	56
C216	21-13740B13	3.3, ±.25 pF
C218-220	21-11032B15	0.22 uF, +80-20%
C221	21-13740B15	3.9, ±.25 pF
C223	21-13740B25	10, ±.5 pF
C224	21-13740B41	47
C225,226	21-11032B15	0.22 uF, +80-20%
C227	21-13740B41	47
C228	21-13740B73	1000
C229	21-13740B05	1.5, ±.25 pF
G230	21-13740B19	5.6, ±.25 pF
C231	21-13740B38	36
C233	21-13740B63	390
C234	21-13740B49	100
C235	21-13740B17	4.7, ±.25 pF
C238-240	21-11032B15	0.22 uF, +80-20%
C241,242	21-13740B47	82
C243	21-13740B13	3.3, ±.25 pF
C245-247	21-11032B15	0.22 uF, +80-20%
C248	21-13740B15	3.9, ±.25 pF
C250	21-13740B29	15
C251,252	21-11032B15	0.22 uF, +80-20%
C277,278	23-11048B19	47 uF, ±20%, 16V
C301	21-11032B15	0.22 uF, +80-20%
C311	21-11032B15	0.22 uF, +80-20%
C351	21-13740B37	33
C352-354	21-11032B15	0.22 uF, +80-20%
C355	21-13740B57	220
C356	21-13740B21	6.8, ±.5 pF
C357	21-13741B33	0.0033 uF, ±10%
C358	21-13740B58	240
C359	23-11013D13	10 uF, ±10%, 20V, tantalum
C360	21-11032B15	0.22 uF, +80-20%
C361	23-11013D13	10 uF, ±10%, 20V, tantalum
C362,363	21-11032B15	0.22 uF, +80-20%
C364	21-13740B57	220
C365	21-11032B15	0.22 uF, +80-20%
C366	21-13740B57	220
C367	21-13740B49	100
C368,369	21-11032B15	0.22 uF, +80-20%
C370	21-13741B37	0.0047 uF, ±10%
C371	21-13741B29	0.0022 uF, ±10%
C372	21-13740B52	130
C373	21-13740B72	910
C374	21-13740B25	10
C376,377	21-13740B29	15
C378	21-11032B15	0.22 uF, +80-20%
C379	23-11013D13	10 uF, ±10%, 20V, tantalum
C380,381	21-11032B15	0.22 uF, +80-20%
diode (see note)		
CR1	48-80236E16	quad Schottky, crossed
CR2	48-80154K03	dual Schottky, SOT
CR51	48-05129M76	silicon, SOT
CR101,102	48-05129M76	silicon, SOT
CR151,152	48-80006E10	silicon varactor, SOT
CR202	48-80991T01	silicon varactor, SOT
CR203	—	not used
CR204	48-80991T01	silicon varactor, SOT
CR205	—	not used
CR206	48-80154K03	dual Schottky, SOT
CR209	48-80006E10	silicon varactor, SOT
CR210-213	48-80991T01	silicon varactor, SOT
CR214	48-80154K03	dual Schottky, SOT
filters		
FL51	91-80097D05	455 kHz, 6E
FL52	91-80098D05	455 kHz, 4E
connector, receptacle		
J4,5	09-80135M01	coaxial (RX, TX)
J6	09-80130M02	14-pin socket (logic board)
coil		
L1-8	24-80148M21	9-1/2 turns (white)
L9	24-80063M04	0.18 uH
L51	24-80063M07	0.33 uH
L52,53	24-80063M19	3.3 uH
L54	24-80063M31	47 uH
L55-58	24-80164M01	tunable, 0.7 uH
L59,60	24-80063M23	6.8 uH
L61,62	24-80063M31	47 uH
L63	24-80063M24	8.2 uH
L64	25-80000E01	tunable, 455 kHz
L65,66	24-80063M31	47 uH
L101	24-80063M24	8.2 uH
L102	24-80063M11	0.68 uH
L151	24-80299D01	tunable, 17-3/4 turns
L152	24-80063M22	5.6 uH
L202	24-80931W26	tunable, 13-1/2 turns
L203	24-80063M23	6.8 uH
L204	24-80063M12	0.82 uH
L205-207	24-80063M23	6.8 uH
L209	24-80063M23	6.8 uH
L210	24-80063M13	1.0 uH
L211	24-80063M23	6.8 uH
L212	24-80063M07	0.33 uH
L213	24-80931W26	tunable, 13-1/2 turns
L214	24-80063M24	8.2 uH
L215	24-80063M12	0.82 uH

Range 3 Parts List

HLB4101A RF Board, 42–50 MHzMXW–6348–B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, chip, pF, ±5%, 50V (unless otherwise indicated)		
C1	21–13740B48	91
C2	21–13740B65	470
C3	21–13740B59	270
C4	21–13740B49	100
C6	21–13740B29	15
C8	21–13740B48	91
C9	21–13740B64	430
C10	21–13740B57	220
C11	21–13740B55	180
C12	21–13741B49	0.015 uF, ±10%
C13	21–13740B51	120
C14	21–13740B62	360
C15	21–13740B51	120
C17	21–13740B67	560
C18	21–13740B52	130
C20	21–13740B67	560
C21	21–13740B52	130
C23	21–13740B64	430
C24	21–13740B58	240
C25	21–13740B56	200
C26–29	21–13741B49	0.015 uF, ±10%
C30	21–13740B69	680
C31	21–13740B47	82
C32	21–13740B63	390
C51	21–13740B51	120
C52	21–13740B59	270
C53–57	21–11032B15	0.22 uF, +80–20%
C58	21–13740B68	620
C59	21–13740B63	390
C60	21–13740B26	11
C61	21–13740B57	220
C62	21–13740B17	4.7, ±25 pF
C63	21–13740B57	220
C64	21–13740B19	5.6, ±25 pF
C65	21–13740B64	430
C66	21–13740B65	470
C67	21–13740B39	39
C69	21–13740B18	5.1, ±25 pF
C71	21–13740B18	5.1, ±25 pF
C72	21–13740B37	33
C73	21–11032B15	0.22 uF, +80–20%
C74	21–13740B22	7.5, ±5 pF
C75	21–11032B15	0.22 uF, +80–20%
C76	23–11013D13	10 uF, ±10%, 20V, tantalum
C77	21–13740B37	33
C78	21–13740B51	120
C79–81	21–11032B15	0.22 uF, +80–20%
C82	23–11013D13	10 uF, ±10%, 20V, tantalum
C83	23–11048B13	10 uF, ±20%, 16V, electrolytic
C84	21–11032B13	0.1 uF, +80–20%
C85	23–11048B05	1 uF, ±20%, electrolytic
C86,87	21–11032B15	0.22 uF, +80–20%
C88	21–13741B29	0.0022 uF, ±10%
C89	21–11032B15	0.22 uF, +80–20%
C90	21–13741B29	0.0022 uF, ±10%
C91–93	21–11032B15	0.22 uF, +80–20%
C94	21–13740B05	1.5, ±25 pF
C95	21–11032B15	0.22 uF, +80–20%
C96	21–13740B25	10, ±5 pF
C101	23–11048B13	10 uF, ±20%, 16V, electrolytic
C102	08–11051A13	0.1 uF, 63V
C103,104	21–13741B45	0.01 uF, ±10%
C105	23–11048B13	10 uF, ±20%, 16V, electrolytic
C106	21–13740B29	15
C107,108	21–11032B13	0.1 uF, +80–20%
C109	08–11051A13	0.1 uF, 63V
C110	08–11044A33	1 uF
C111	08–11051A08	0.015 uF, 63V
C112	08–11051A05	0.0047 uF, 63V
C113,114	21–13740B57	220
C115	21–11032B13	0.1 uF, +80–20%
C116,117	21–11032B15	0.22 uF, +80–20%
C118	21–13740B27	12
C119	21–11032B15	0.22 uF, +80–20%
C122	23–11013D13	10 uF, ±10%, 20V, tantalum
C123	21–13740B59	270
C124	23–11013D13	10 uF, ±10%, 20V, tantalum
C125	21–11032B13	0.1 uF, +80–20%
C126	23–11013A56	47 uF, ±20%, 6V, tantalum
C127	23–11048B13	10 uF, ±20%, 16V, electrolytic
C128	23–11013A56	47 uF, ±20%, 6V, tantalum
C151	21–13740B73	1000
C152	21–13740B47	82
C153	21–13740B25	10, ±5 pF
C154	21–13741B45	0.01 uF, ±10%
C155,156	21–13740B55	180
C157	21–13741B45	0.01 uF, ±10%
C158	08–11051A15	0.22 uF, 63V
C159	21–13740B35	27
C160	21–13740B29	15
C161	21–11032B15	0.22 uF, +80–20%
C163	08–11051A15	0.22 uF, 63V
C165	21–11032B15	0.22 uF, +80–20%
C176	21–13740B73	1000
C201	23–11048B13	10 uF, ±20%, 16V, electrolytic
C205	21–13740B73	1000
C206	21–13740B37	33
C207	21–13740B27	12
C208	21–13740B17	4.7, ±25 pF
C211–213	21–11032B15	0.22 uF, +80–20%

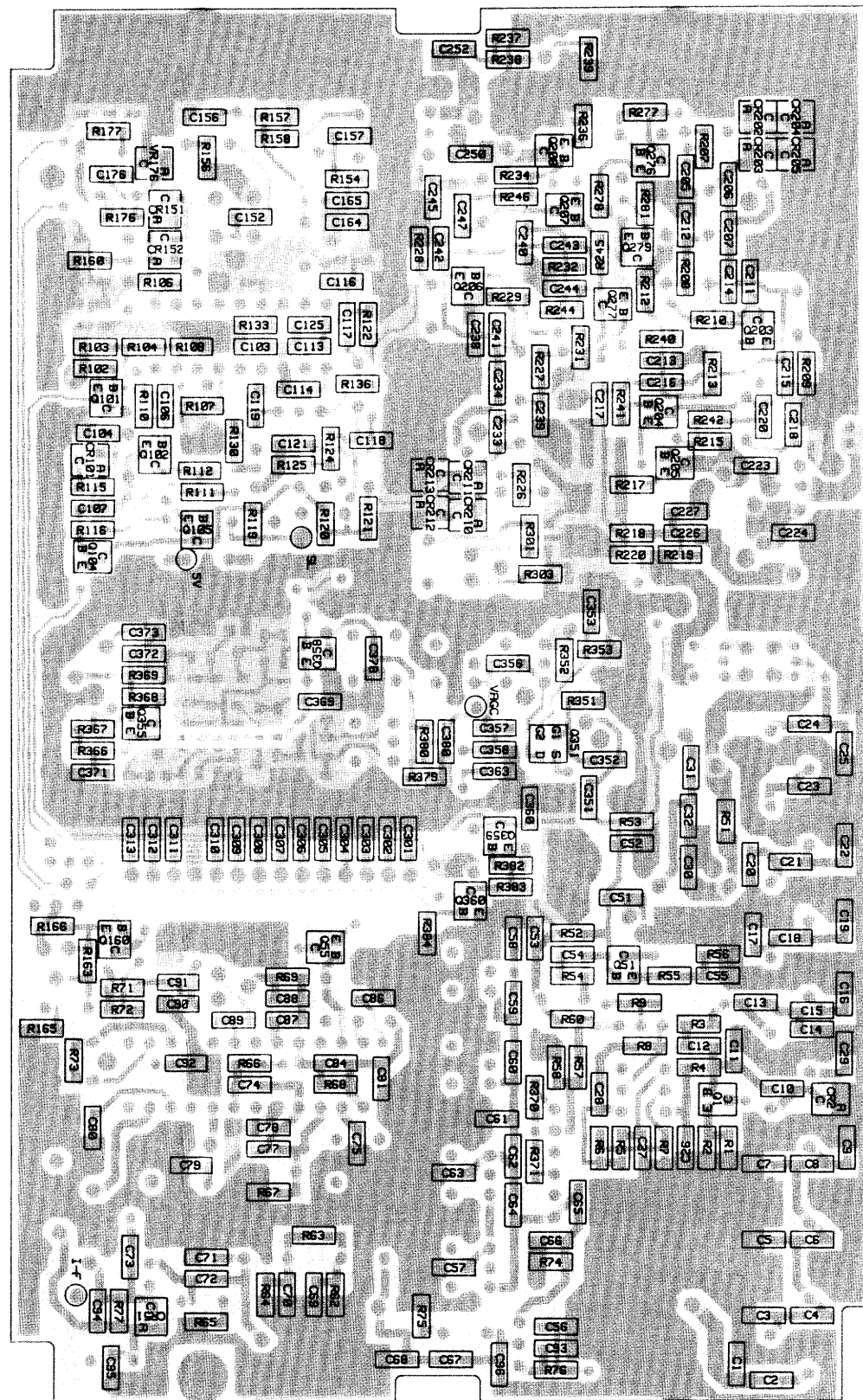
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C214,215	21–13740B27	12
C216	21–13740B13	3.3, ±25 pF
C218–220	21–11032B15	0.22 uF, +80–20%
C221	21–13740B15	3.9, ±25 pF
C223	21–13740B21	6.8, ±25 pF
C224	21–13740B39	39
C225,226	21–11032B15	0.22 uF, +80–20%
C227	21–13740B37	33
C228	21–13740B73	1000
C229	21–13740B05	1.5, ±25 pF
C230	21–13740B15	3.9, ±25 pF
C231	21–13740B38	36
C233	21–13740B49	100
C234	21–13740B34	24
C235	21–13740B17	4.7, ±25 pF
C238–240	21–11032B15	0.22 uF, +80–20%
C241,242	21–13740B31	18
C243	21–13740B13	3.3, ±25 pF
C245–247	21–11032B15	0.22 uF, +80–20%
C248	21–13740B15	3.9, ±25 pF
C250	21–13740B29	15
C251,252	21–11032B15	0.22 uF, +80–20%
C277,278	23–11048B19	47 uF, ±20%, 16V
C301	21–11032B15	0.22 uF, +80–20%
C311	21–11032B15	0.22 uF, +80–20%
C351	21–13740B37	33
C352–354	21–11032B15	0.22 uF, +80–20%
C355	21–13740B57	220
C356	21–13740B21	6.8, ±5 pF
C357	21–13741B33	0.0033 uF, ±10%
C358	21–13740B58	240
C359	23–11013D13	10 uF, ±10%, 20V, tantalum
C360	21–11032B15	0.22 uF, +80–20%
C361	23–11013D13	10 uF, ±10%, 20V, tantalum
C362,363	21–11032B15	0.22 uF, +80–20%
C364	21–13740B57	220
C365	21–11032B15	0.22 uF, +80–20%
C366	21–13740B57	220
C367	21–13740B49	100
C368,369	21–11032B15	0.22 uF, +80–20%
C370	21–13741B37	0.0047 uF, ±10%
C371	21–13741B29	0.0022 uF, ±10%
C372	21–13740B52	130
C373	21–13740B72	910
C374	21–13740B25	10
C376,377	21–13740B29	15
C378	21–11032B15	0.22 uF, +80–20%
C379	23–11013D13	10 uF, ±10%, 20V, tantalum
C380,381	21–11032B15	0.22 uF, +80–20%
diodes (see note)		
CR1	48–80236E16	quad Schottky, crossed
CR2	48–80154K03	dual Schottky, SOT
CR51	48–05129M76	silicon, SOT
CR101,102	48–05129M76	silicon, SOT
CR151,152	48–80006E10	silicon varactor, SOT
CR202–205	48–80006E10	silicon varactor, SOT
CR206	48–80154K03	dual Schottky, SOT
CR209–213	48–80006E10	silicon varactor, SOT
CR214	48–80154K03	dual Schottky, SOT
filters		
FL51	91–80097D05	455 kHz, 6E
FL52	91–80098D05	455 kHz, 4E
connector, receptacle		
J4	09–80135M01	coaxial (RX)
J5	09–80135M01	coaxial (TX)
J6	09–80130M02	14–pin socket (logic board)
coils		
L1–9	24–80148M22	9–1/2 turns (white)
L51	24–80063M07	0.33 uH
L52,53	24–80063M19	3.3 uH
L54	24–80063M31	47 uH
L55–58	24–80164M01	tunable, 0.7 uH
L59,60	24–80063M23	6.8 uH
L61,62	24–80063M31	47 uH
L63	24–80063M24	8.2 uH
L64	25–80000E01	tunable, 455 kHz
L65,66	24–80063M31	47 uH
L101	24–80063M23	6.8 uH
L102	24–80063M09	0.47 uH
L151	24–80299D01	tunable, 17–3/4 turns
L152	24–80063M22	5.6 uH
L202	24–80931W26	tunable, 13–1/2 turns
L203	24–80063M22	5.6 uH
L204	24–80063M12	0.82 uH
L205–207	24–80063M22	5.6 uH
L209	24–80063M22	5.6 uH
L210	24–80063M11	0.68 uH
L211	24–80063M22	5.6 uH
L212	24–80063M06	0.27 uH
L213	24–80931W26	tunable, 13–1/2 turns
L214	24–80063M23	6.8 uH
L215	24–80063M12	0.82 uH
L216–218	24–80063M23	6.8 uH
L220	24–80063M23	6.8 uH
L221	24–80063M09	0.47 uH
L222	24–80063M23	6.8 uH
L352,353	24–80164M01	tunable, 0.7 uH
L354–356	24–80063M31	47 uH
L357	24–80164M01	tunable, 0.7 uH
L358	24–80063M27	22 uH

MXW–6348–B (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
transistors (see note)		
Q1	48–80182D44	NPN
Q2–4	48–11043C06	PNP
Q51	48–80182D44	NPN
Q52–54	48–11043C12	FET
Q55	48–80214G02	NPN
Q56	48–11043C12	FET
Q101	48–05128M16	PNP
Q102,103	48–80214G02	NPN
Q104	48–05128M16	PNP
Q105	48–80214G02	NPN
Q107	48–80182D44	NPN
Q151	48–80182D44	NPN
Q152	48–05128M16	PNP
Q160	48–80214G02	NPN
Q203	48–80141L06	FET
Q204,205	48–80182D44	NPN
Q206	48–80141L06	FET
Q207,208	48–80182D44	NPN
Q276	48–80214G02	NPN
Q277–279	48–05128M16	PNP
Q351	48–80930W01	dual gate FET
Q352–354	48–80214G02	NPN
Q355	48–05128M16	PNP
Q356,357	48–80214G02	NPN
Q358,359	48–05128M16	PNP
Q360	48–80214G02	NPN
resistor, chip, ohm, ±5%, 1/8 watt (unless otherwise indicated)		
R1	06–11077A26	10
R2	06–11077A33	20
R3	06–11077A66	470
R4	06–11077A84	2.7k
R5	06–11077A46	68
R6	06–11077A86	3.3k
R7	06–11077B03	15k
R8	06–11077A90	4.7k
R9	06–11077A98	10k
R51	06–11077A43	51
R52,53	06–11077A86	3.3k
R54	06–11077A74	1k
R55	06–11077A30	15
R56	06–11077A46	68
R57	06–11077A86	3.3k
R58	06–11077A93	6.2k
R60	06–11077A50	100
R63	06–11077A26	10
R65	06–11077A54	150
R66	06–11077B45	820k
R68	06–11077B23	100k
R69	06–11077B27	150k
R70	18–05500L08	variable, 22k
R71	06–11077B11	33k
R72	06–11077B09	27k
R73	06–11077B21	82k
R74	06–11077A66	470
R75	06–11077A42	47
R76	06–11077A50	100
R77	06–11077A88	3.9k
R102	06–11077A62	330
R103,104	06–11077A98	10k
R105	06–11077B11	33k
R106	06–11077B15	47k
R107	06–11077A98	10k
R108	06–11077A90	4.7k
R109	06–11077A26	10
R110	06–11077B03	15k
R111	06–11077A70	680
R112	06–11077A84	2.7k
R113	06–11077A72	820
R114,115	06–11077A70	680
R116	06–11077A92	5.6k
R118	06–11077A70	680
R119	06–11077A86	3.3k
R120,121	06–11077A88	3.9k
R122	06–11077A43	51
R123	06–11077A34	22
R124	06–11077A86	3.3k
R125	06–11077A70	680
R126	06–11077A50	100
R127,128	06–11077B07	22k
R129	06–11077A94	6.8k
R130	06–11077A82	2.2k
R131	06–11077B11	33k
R132,133	06–11077A90	4.7k
R134,135	06–11077A74	1k
R136	06–11077A50	100
R151	06–11077B15	47k
R152	06–11077B11	33k
R153	06–11077B23	100k
R154	06–11077A34	22
R155	06–11077A98	10k
R156	06–11077B03	15k
R157	06–11077A78	1.5k
R158	06–11077A74	1k
R160,161	06–11077A98	10k
R163	06–11077A84	2.7k
R164	18–05500L08	variable, 22k
R165	06–11077B31	220k
R166	06–11077A74	1k
R176	06–11077G26	22.6k, ±1%
R177	06–11077G18	18.7k, ±1%

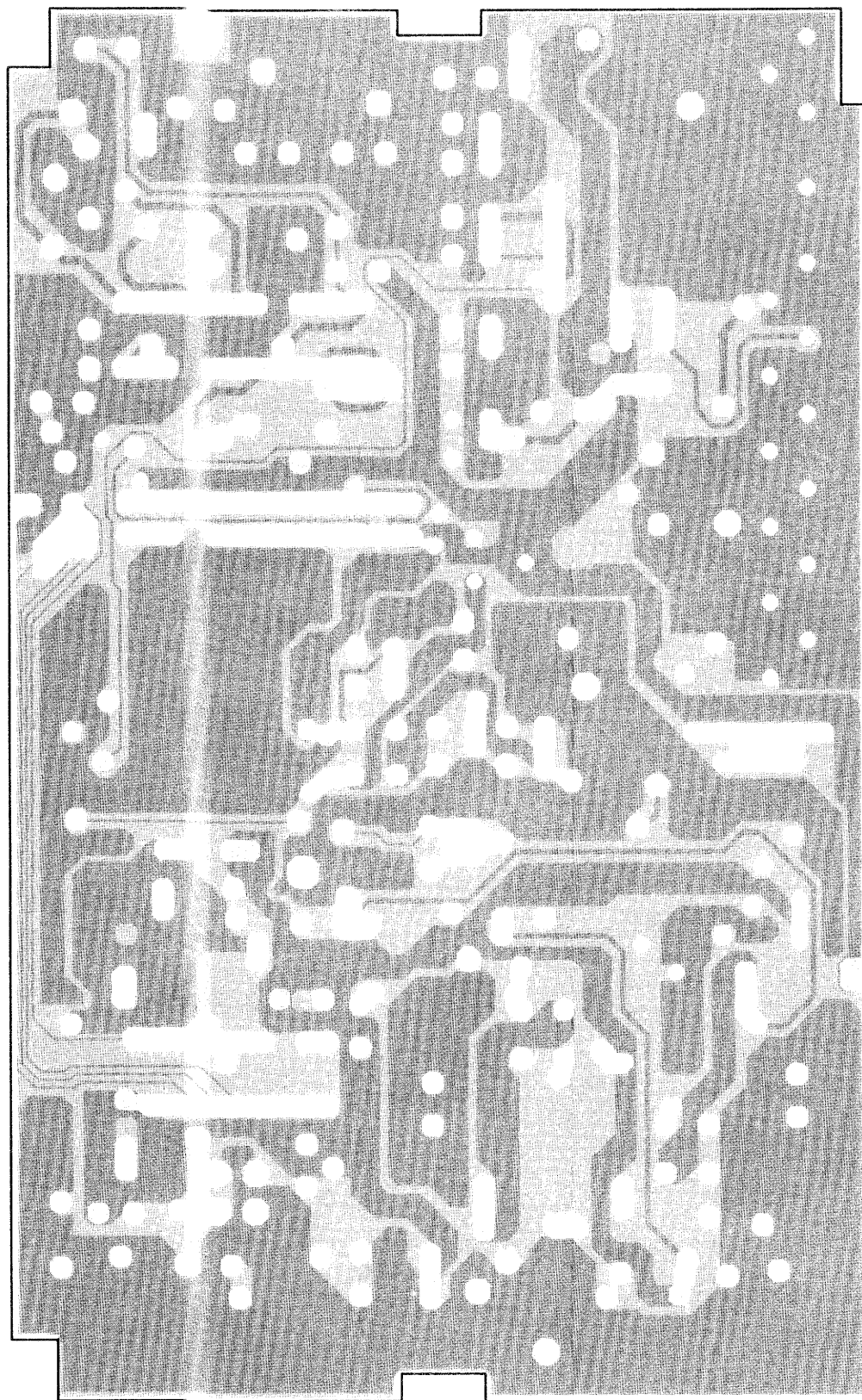
MXW–6348–B (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R178,179	06-11077F91	10.0k, ±1%
R180	06-11077G52	42.2k, ±1%
R181	06-11077F91	10.0k, ±1%
R182	06-11077G28	23.7k, ±1%
R207,208	06-11077A44	56
R209	06-11077A66	470
R210	06-11077A01	0
R211	06-11077A98	10k
R212,213	06-11077A76	1.2k
R214	06-11077A62	330
R215	06-11077A86	3.3k
R216	06-11077A70	680
R217	06-11077A34	22
R218	06-11077A66	470
R219	06-11077A28	12
R220	06-11077A66	470
R221	06-11077B23	100k
R222	06-11077B02	13k
R223	06-11077A94	6.8k
R224	06-11077B23	100k
R226,227	06-11077A44	56
R228	06-11077A66	470
R229	06-11077A01	0
R230	06-11077A98	10k
R231,232	06-11077A76	1.2k
R233	06-11077A62	330
R234	06-11077A86	3.3k
R235	06-11077A72	820
R236	06-11077A34	22
R237	06-11077A66	470
R238	06-11077A28	12
R239	06-11077A66	470
R240	06-11077A74	1k
R241,242	06-11077A50	100
R243	06-11077A54	150
R244	06-11077A74	1k
R245,246	06-11077A50	100
R247	06-11077A54	150
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301	06-11077A34	22
R302	18-05500L08	variable, 22k
R303	06-11077B01	12k
R351	06-11077B23	100k
R352	06-11077B09	27k
R353	06-11077A91	5.1k
R354	06-11077A43	51
R355	06-11077A78	1.5k
R356	06-11077A74	1k
R357	06-11077B44	750k
R358	06-11077B35	330k
R359	06-11077B27	150k
R360	06-11077A82	2.2k
R361	06-11077B08	24k
R362	06-11077A98	10k
R363	06-11077A74	1k
R364	06-11077A50	100
R365	06-11077A84	2.7k
R366,367	06-11077A74	1k
R368	06-11077A58	10k
R369	06-11077A82	220
R370,371	06-11077A89	2.2k
R372	06-11077A93	4.3k
R373	06-11077A76	6.2k
R374	06-11077A74	1.2k
R375	06-11077A74	1k
R376	06-11077A93	6.2k
R377	06-11077A76	1.2k
R378	06-11077A74	1k
R379-381	06-11077A98	10k
R382	06-11077A92	5.6k
R383	06-11077A98	10k
R384	06-11077A90	4.7k
R384	06-11077A98	10k
transformers		
T1,T2	25-80163M02	balun
integrated circuits (see note)		
U51	51-05479G05	receiver system
U101	51-80931V01	synthesizer
U103	51-84621K27	regulator, 5 volt
U176	51-80932W01	dual op-amp
U351	51-80929W01	MC1350
voltage regulator (see note)		
VR176	48-80140L15	zener, 10V
crystal (see note)		
Y51	91-80172D01	filter, 10.7 MHz
Y52	48-80908W01	10.245 MHz
Y151	48-80174D05	14.4 MHz
non-referenced items		
	14-05160A01	insulator, crystal (4 used)
	26-80097M01	shield, coil can (L151)
	26-80098M01	shield, coil can (10 used)
	26-80228L01	shield, can (J4, J5)
	26-80916V01	shield, VCO frame



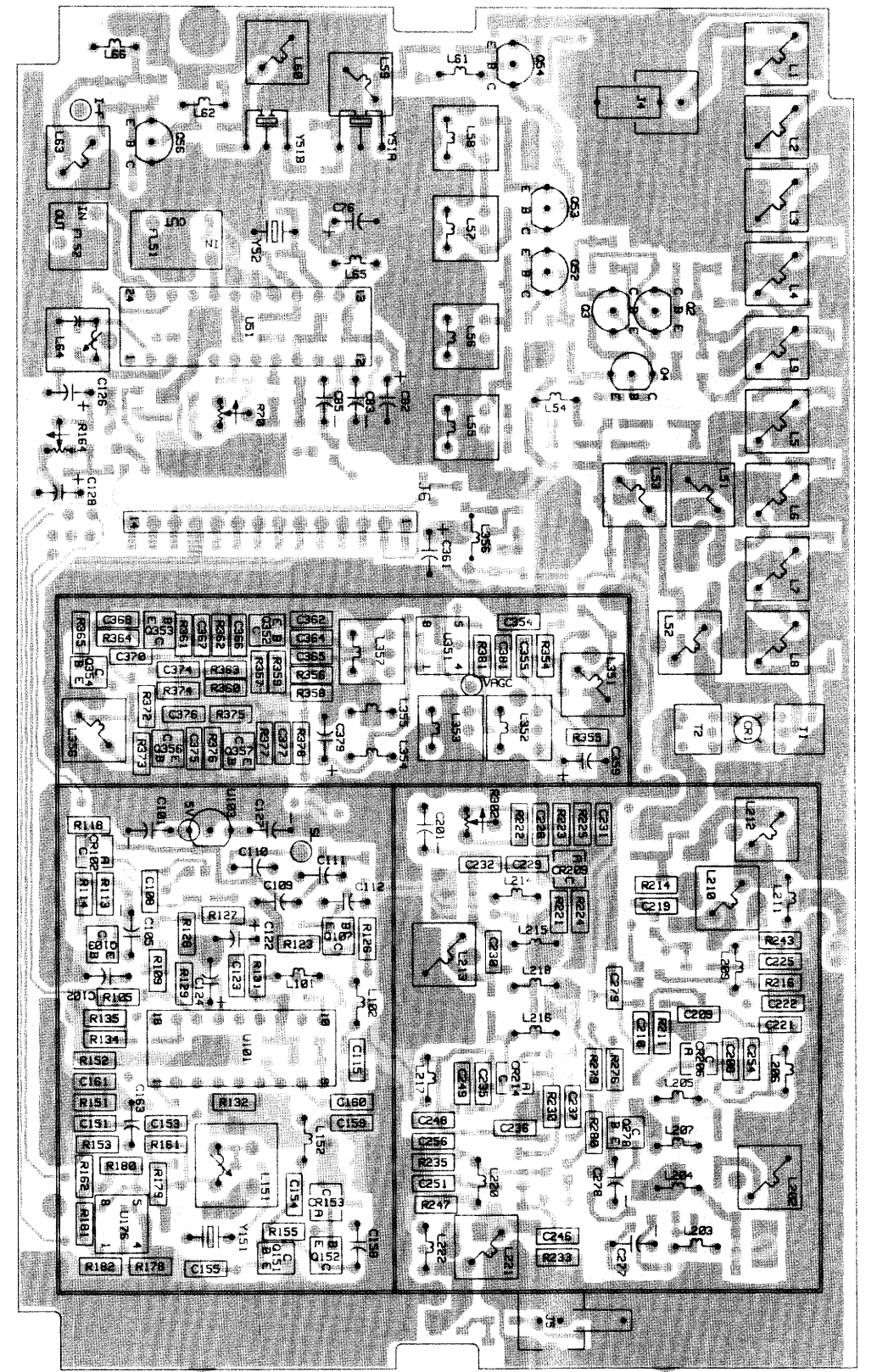
SOLDER SIDE + GBW-6349-O
 COMPONENT SIDE - GBW-6350-O
 OVERLAY - GBW-6351-O

SOLDER SIDE VIEW



SOLDER INNER LAYER GCW-6389-O
 COMPONENT INNER LAYER GCW-6390-O

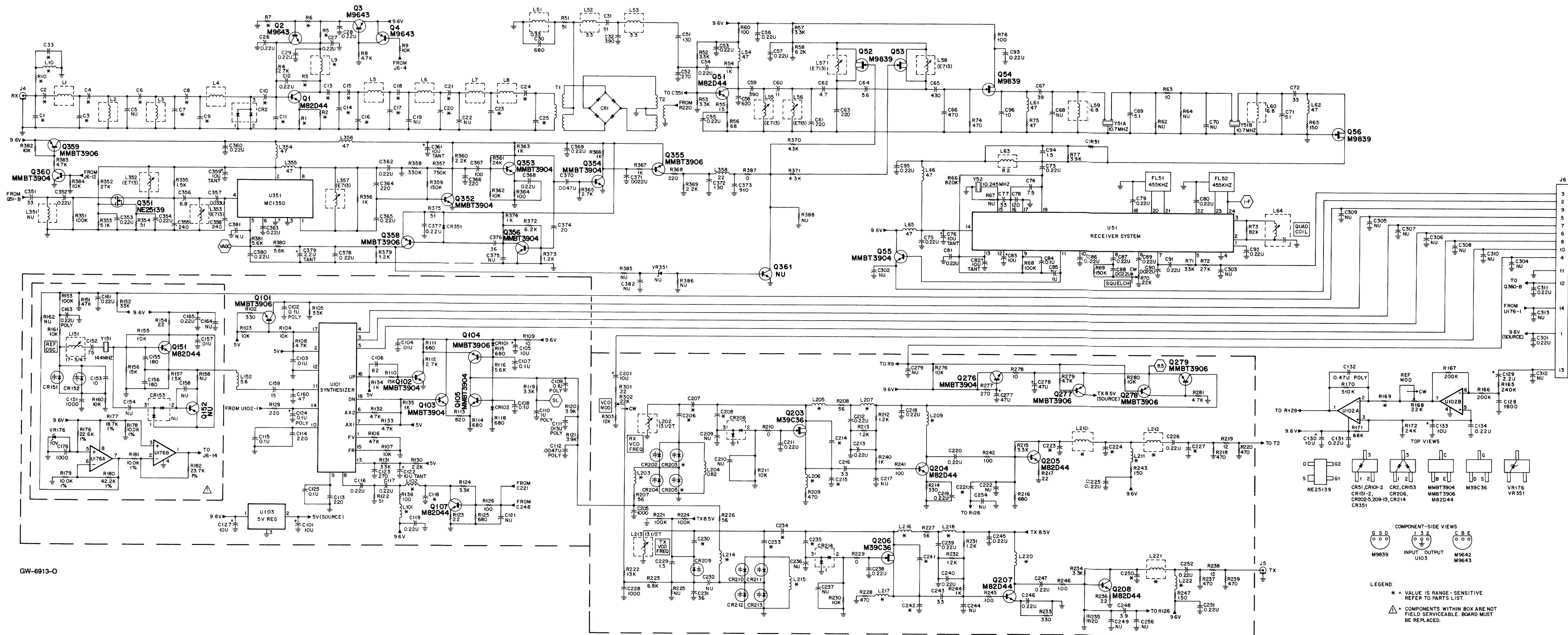
INNER LAYERS



SOLDER SIDE + GBW-6349-O
 COMPONENT SIDE - GBW-6350-O
 OVERLAY - GBW-6391-O

COMPONENT SIDE VIEW

Schematic, Circuit Board Diagrams, and
 Parts Lists for m400 Low Band
 Ranges 1 and 3 RF Board
 (Sheet 4 of 4)



Range 2 Parts List

HLB4100A RF Board, 36–42 MHz

MXW–6910–O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, chip, pF, ±5%, 50V (unless otherwise indicated)		
C1	21–13740B53	150
C2	21–13740B74	1200
C3	21–13740B63	390
C4	21–13740B53	150
C6	21–13740B36	30
C8	21–13740B52	130
C9	21–13740B65	470
C10	21–13740B73	1000
C11	21–13740B54	160
C12,13	21–11032B15	0.22 uF, +80–20%
C15	21–11032B15	0.22 uF, +80–20%
C16	21–13740B51	120
C17	21–13740B66	510
C18	21–13740B55	180
C20	21–13740B66	510
C21	21–13740B56	200
C23	21–13740B65	470
C24	21–13740B61	330
C25	21–13740B60	300
C26–29	21–11032B15	0.22 uF, +80–20%
C30	21–13740B69	680
C31	21–13740B48	91
C32	21–13740B63	390
C51	21–13740B52	130
C52	21–13740B59	270
C53–57	21–11032B15	0.22 uF, +80–20%
C58	21–13740B68	620
C59	21–13740B63	390
C60	21–13740B26	11
C61	21–13740B57	220
C62	21–13740B17	4.7, ±.25 pF
C63	21–13740B57	220
C64	21–13740B19	5.6, ±.25 pF
C65	21–13740B64	430
C66	21–13740B65	470
C67	21–13740B39	39
C69	21–13740B18	5.1, ±.25 pF
C71	21–13740B18	5.1, ±.25 pF
C72	21–13740B37	33
C73	21–11032B15	0.22 uF, +80–20%
C74	21–13740B22	7.5, ±.5 pF
C75	21–11032B15	0.22 uF, +80–20%
C76	23–11013D13	10 uF, ±10%, 20V, tantalum
C77	21–13740B37	33
C78	21–13740B51	120
C79–81	21–11032B15	0.22 uF, +80–20%
C82	23–11013D13	10 uF, ±10%, 20V, tantalum
C83	23–11048B13	10 uF, ±20%, 16V, electrolytic
C84	21–13741B69	0.1 uF, ±10%
C85	23–11048B05	1 uF, ±20%, electrolytic
C86,87	21–11032B15	0.22 uF, +80–20%
C88	21–13741B29	0.0022 uF, ±10%
C89	21–11032B15	0.22 uF, +80–20%
C90	21–13741B29	0.0022 uF, ±10%
C91–93	21–11032B15	0.22 uF, +80–20%
C94	21–13740B05	1.5, ±.25 pF
C95	21–11032B15	0.22 uF, +80–20%
C96	21–13740B25	10, ±.5 pF
C101	23–11048B13	10 uF, ±20%, 16V, electrolytic
C102	08–11051A13	0.1 uF, 63V
C103,104	21–13741B45	0.01 uF, ±10%
C105	23–11048B13	10 uF, ±20%, 16V, electrolytic
C106	21–13740B47	82
C107,108	21–13741B69	0.1 uF, ±10%
C109	08–11051A13	0.1 uF, 63V
C110	08–11044A33	1 uF
C111	08–11051A08	0.015 uF, 63V
C112	08–11051A05	0.0047 uF, 63V
C113,114	21–13740B57	220
C115	21–13741B69	0.1 uF, ±10%
C116,117	21–11032B15	0.22 uF, +80–20%
C118	21–13740B29	15
C119	21–11032B15	0.22 uF, +80–20%
C122	23–11013D13	10 uF, ±10%, 20V, tantalum
C123	21–13740B59	270
C124	08–11051A13	0.1 uF, 63V
C125	21–13741B69	0.1 uF, ±10%
C127	23–11048B13	10 uF, ±20%, 16V, electrolytic
C128	21–13740B78	1800
C129	23–11048B06	2.2 uF, ±20%, electrolytic
C130	23–11048B13	10 uF, ±20%, 16V, electrolytic
C131	21–11032B15	0.22 uF, +80–20%
C132	08–11051A17	0.47 uF, 63V
C133	23–11048B13	10 uF, ±20%, 16V, electrolytic
C134	21–11032B15	0.22 uF, +80–20%
C151	21–13740B73	1000
C152	21–13740B46	75
C153	21–13740B25	10, ±.5 pF
C155,156	21–13740B55	180
C157	21–13741B45	0.01 uF, ±10%
C159	21–13740B29	15
C160	21–13740B41	47
C161	21–11032B15	0.22 uF, +80–20%
C163	08–11051A15	0.22 uF, 63V
C165	21–11032B15	0.22 uF, +80–20%
C176	21–13740B73	1000
C201	23–11048B13	10 uF, ±20%, 16V, electrolytic
C205	21–13740B73	1000
C206	21–13740B38	36

MXW–6910–O (2)

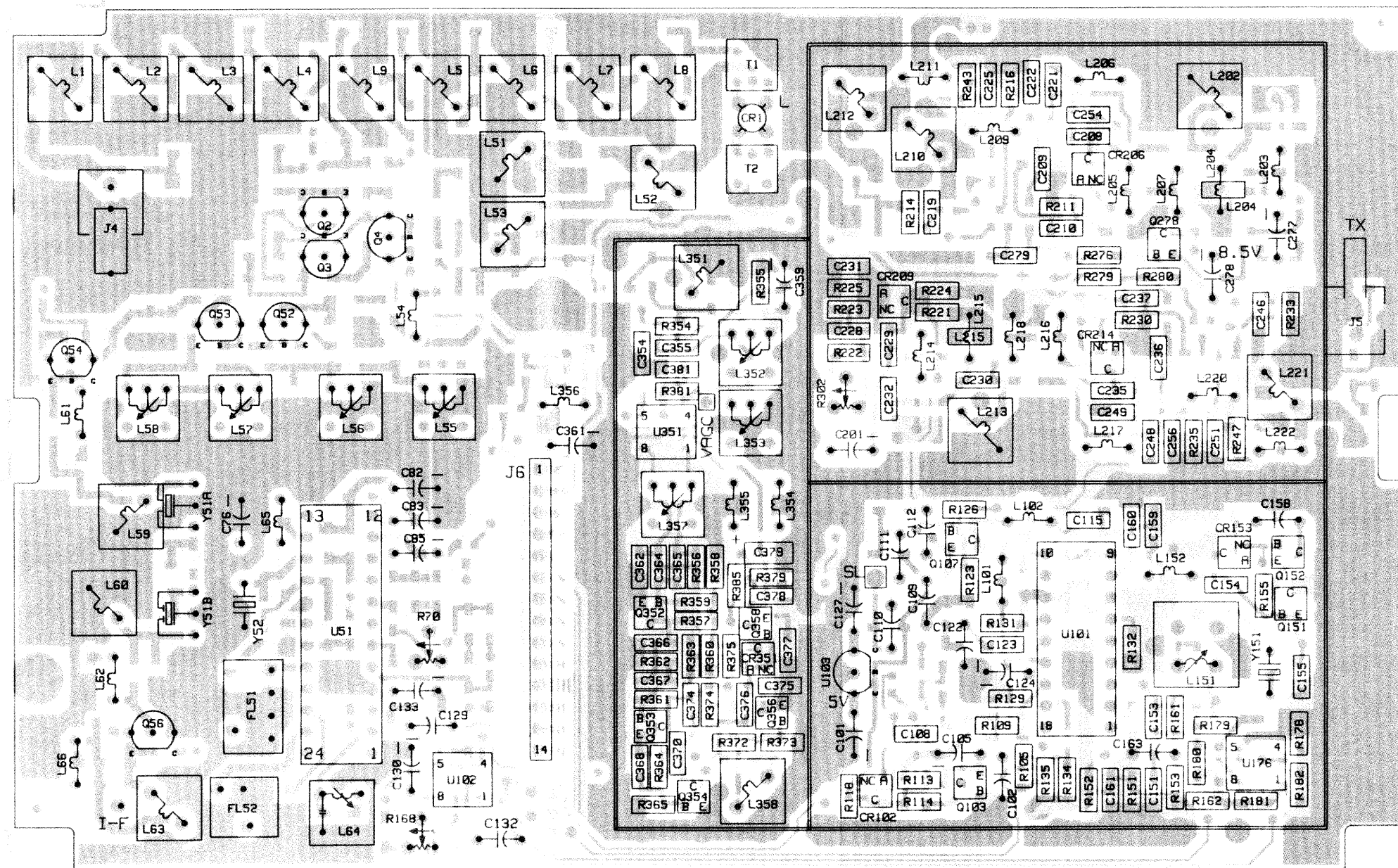
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C207	21–13740B35	27
C208	21–13740B17	4.7, ±.25 pF
C211–213	21–11032B15	0.22 uF, +80–20%
C214,215	21–13740B35	27
C216	21–13740B13	3.3, ±.25 pF
C218–220	21–11032B15	0.22 uF, +80–20%
C221	21–13740B09	2.2, ±.25 pF
C223	21–13740B23	8.2, ±.5 pF
C224	21–13740B39	39
C225,226	21–11032B15	0.22 uF, +80–20%
C227	21–13740B37	33
C228	21–13740B73	1000
C229	21–13740B05	1.5, ±.25 pF
C230	21–13740B17	4.7, ±.25 pF
C231	21–13740B38	36
C233	21–13740B49	100
C234	21–13740B38	36
C235	21–13740B17	4.7, ±.25 pF
C238–240	21–11032B15	0.22 uF, +80–20%
C241,242	21–13740B31	18
C243	21–13740B13	3.3, ±.25 pF
C245–247	21–11032B15	0.22 uF, +80–20%
C248	21–13740B15	3.9, ±.25 pF
C250	21–13740B31	18
C251,252	21–11032B15	0.22 uF, +80–20%
C277,278	23–11048B19	47 uF, ±20%, 16V
C301	21–11032B15	0.22 uF, +80–20%
C311	21–13740B37	33
C351	21–11032B15	0.22 uF, +80–20%
C352–354	21–13740B58	240
C355	21–13740B21	6.8, ±.5 pF
C356	21–13741B33	0.0033 uF, ±10%
C357	21–13740B58	240
C358	21–1013D13	10 uF, ±10%, 20V, tantalum
C359	21–11032B15	0.22 uF, +80–20%
C360	23–11013D13	10 uF, ±10%, 20V, tantalum
C361	21–11032B15	0.22 uF, +80–20%
C362,363	21–13740B57	220
C364	21–11032B15	0.22 uF, +80–20%
C365	21–13740B57	220
C366	21–13740B49	100
C367	21–11032B15	0.22 uF, +80–20%
C368,369	21–13741B37	0.0047 uF, ±10%
C370	21–13741B29	0.0022 uF, ±10%
C371	21–13740B52	130
C372	21–13740B72	910
C373	21–13740B32	20
C374	21–13740B38	36
C376	21–11032B15	0.22 uF, +80–20%
C377,C378	23–11049A09	2.2 uF, ±10%, 20V, tantalum
C379	23–11049A09	2.2 uF, ±10%, 20V, tantalum
C380	21–11032B15	0.22 uF, +80–20%
diode (see note)		
CR1	48–80236E16	quad Schottky, crossed
CR2	48–80154K03	dual Schottky, SOT
CR51	48–05129M76	silicon, SOT
CR101,102	48–05129M76	silicon, SOT
CR151,152	48–80006E10	silicon varactor, SOT
CR202–205	48–80006E10	silicon varactor, SOT
CR206	48–80154K03	dual Schottky, SOT
CR209	48–80006E10	silicon varactor, SOT
CR210–213	48–80991T01	silicon varactor, SOT
CR214	48–80154K03	dual Schottky, SOT
CR351	48–80939T01	barrier Schottky
filters		
FLS1	91–80097D05	455 kHz, 6E
FLS2	91–80098D05	455 kHz, 4E
connector, receptacle		
J4,5	09–80135M01	coaxial (RX, TX)
J6	09–80130M03	14–pin socket (logic board)
coil		
L1–8	24–80148M21	9–1/2 turns (white)
L9	24–80063M31	47 uH
L51	24–80063M07	0.33 uH
L52,53	24–80063M19	3.3 uH
L54	24–80063M31	47 uH
L55–58	24–80164M01	tunable, 0.7 uH
L59,60	24–80063M23	6.8 uH
L61,62	24–80063M31	47 uH
L63	24–80063M24	8.2 uH
L64	25–80000E01	tunable, 455 kHz
L65,66	24–80063M31	47 uH
L101	24–80063M24	8.2 uH
L102	24–80063M10	0.56 uH
L151	24–80299D01	tunable, 17–3/4 turns
L152	24–80063M22	5.6 uH
L202	24–80931W26	tunable, 13–1/2 turns
L203	24–80063M23	6.8 uH
L204	24–80063M12	0.82 uH
L205–207	24–80063M23	6.8 uH
L209	24–80063M23	6.8 uH
L210	24–80063M12	0.82 uH
L211	24–80063M23	6.8 uH
L212	24–80063M06	0.27 uH
L213	24–80931W26	tunable, 13–1/2 turns
L214	24–80063M24	8.2 uH
L215	24–80063M12	0.82 uH
L216–218	24–80063M24	8.2 uH

MXW–6910–O (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L220	24–80063M24	8.2 uH
L221	24–80063M10	0.56 uH
L222	24–80063M24	8.2 uH
L352,353	24–80164M01	tunable, 0.7 uH
L354–356	24–80063M31	47 uH
L357	24–80164M01	tunable, 0.7 uH
L358	24–80063M27	22 uH
transistor (see note)		
Q1	48–80182D44	NPN
Q2–4	48–11043C06	PNP
Q51	48–80182D44	NPN
Q52–54	48–11043C12	FET
Q55	48–80214G02	NPN
Q56	48–11043C12	FET
Q101	48–05128M16	PNP
Q102,103	48–80214G02	NPN
Q104	48–05128M16	PNP
Q105	48–80214G02	NPN
Q107	48–80182D44	NPN
Q151	48–80182D44	NPN
Q203	48–80141L06	FET
Q204,205	48–80182D44	NPN
Q206	48–80141L06	FET
Q207,208	48–80182D44	NPN
Q276	48–80214G02	NPN
Q277–279	48–05128M16	PNP
Q351	48–80930W01	dual gate FET
Q352–354	48–80214G02	NPN
Q355	48–05128M16	PNP
Q356,357	48–80214G02	NPN
Q358,359	48–05128M16	PNP
Q360	48–80214G02	NPN
resistor, chip, ohm, ±5%, 1/8 watt (unless otherwise indicated)		
R2	06–11077A29	13
R3	06–11077A68	560
R4	06–11077A84	2.7k
R5	06–11077A56	180
R6	06–11077A98	10k
R7	06–11077A94	6.8k
R8	06–11077A90	4.7k
R9	06–11077A98	10k
R51	06–11077A43	51
R52,53	06–11077A86	3.3k
R54	06–11077A74	1k
R55	06–11077A30	15
R56	06–11077A46	68
R57	06–11077A86	3.3k
R58	06–11077A93	6.2k
R60	06–11077A50	100
R63	06–11077A26	10
R65	06–11077A54	150
R66	06–11077B45	820k
R68	06–11077B23	100k
R69	06–11077B27	150k
R70	18–05500L08	variable, 22k
R71	06–11077B11	33k
R72	06–11077B09	27k
R73	06–11077B21	82k
R74	06–11077A66	470
R75	06–11077A42	47
R76	06–11077A50	100
R77	06–11077A88	3.9k
R102	06–11077A62	330
R103,104	06–11077A98	10k
R105	06–11077B11	33k
R106	06–11077B15	47k
R107	06–11077A98	10k
R108	06–11077A90	4.7k
R109	06–11077A26	10
R110	06–11077B03	15k
R111	06–11077A70	680
R112	06–11077A84	2.7k
R113	06–11077A72	820
R114,115	06–11077A70	680
R116	06–11077A92	5.6k
R118	06–11077A70	680
R119	06–11077A86	3.3k
R120,121	06–11077A88	3.9k
R122	06–11077A43	51
R123	06–11077A34	22
R124	06–11077A86	3.3k
R125	06–11077A70	680
R126	06–11077A50	100
R129	06–11077A58	220
R130	06–11077A82	2.2k
R131	06–11077B11	33k
R132,133	06–11077A90	4.7k
R134,135	06–11077A74	1k
R136	06–11077A50	100
R151	06–11077B15	47k
R152	06–11077B11	33k
R153	06–11077B23	100k
R154	06–11077A34	22
R155	06–11077A98	10k
R156	06–11077B03	15k
R157	06–11077A78	1.5k
R160,161	06–11077A98	10k
R164	18–05500L08	variable, 22k
R165	06–11077B32	240k

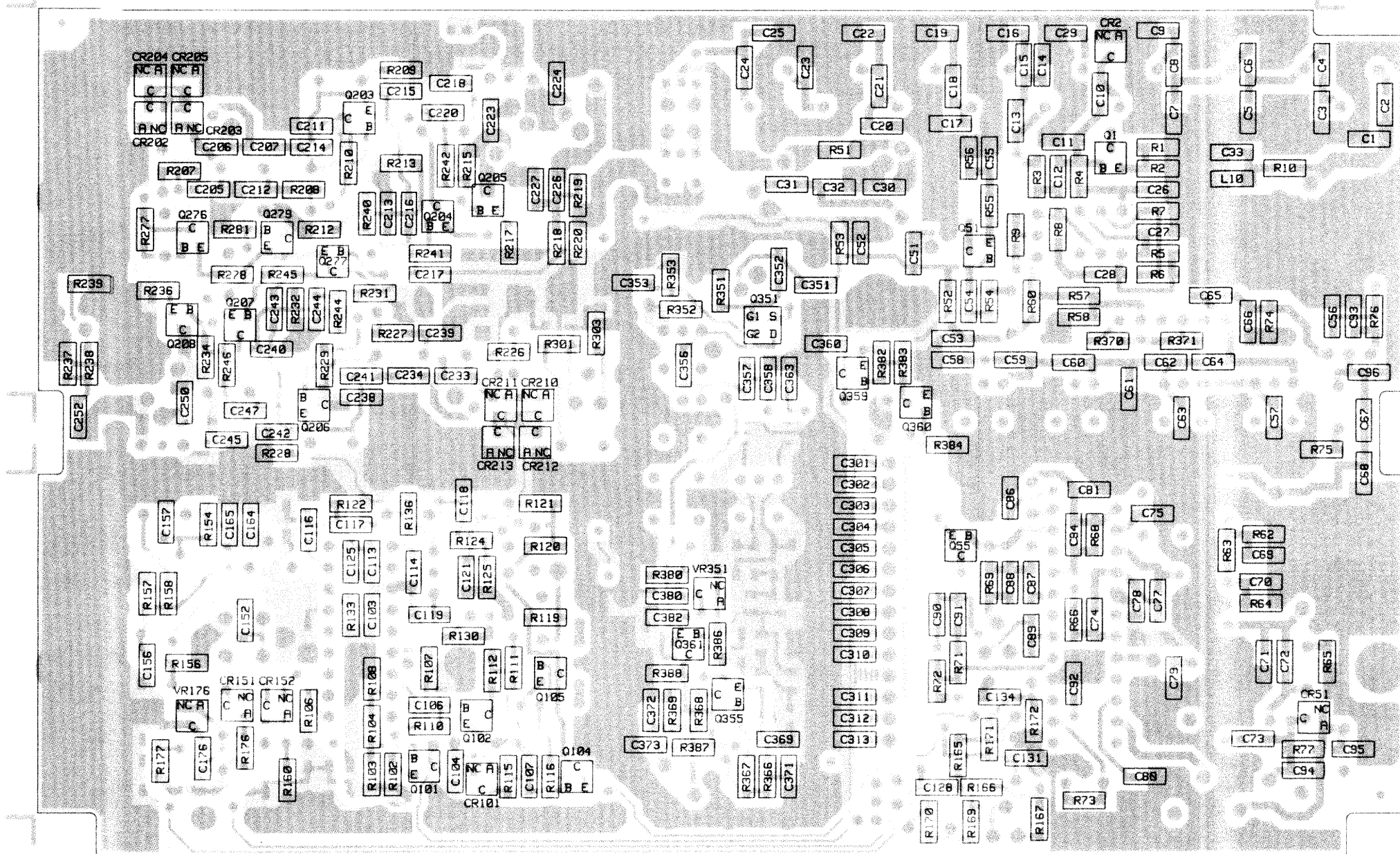
MXW–6910–O (4)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R166	06-11077B30	200k
R167	06-11077B30	200k
R168	18-05500L08	variable, 22k
R169	06-11077B17	56k
R170	06-11077B40	510k
R171	06-11077B19	68k
R172	06-11077B08	24k
R176	06-11077G26	22.6k, ±1%
R177	06-11077G18	18.7k, ±1%
R178,179	06-11077F91	10.0k, ±1%
R180	06-11077G52	42.2k, ±1%
R181	06-11077F91	10.0k, ±1%
R182	06-11077G28	23.7k, ±1%
R207,208	06-11077A44	56
R209	06-11077A66	470
R210	06-11077A01	0
R211	06-11077A98	10k
R212,213	06-11077A76	1.2k
R214	06-11077A62	330
R215	06-11077A86	3.3k
R216	06-11077A70	680
R217	06-11077A34	22
R218	06-11077A66	470
R219	06-11077A28	12
R220	06-11077A66	470
R221	06-11077B23	100k
R222	06-11077B02	13k
R223	06-11077A94	6.8k
R224	06-11077B23	100k
R226,227	06-11077A44	56
R228	06-11077A66	470
R229	06-11077A01	0
R230	06-11077A98	10k
R231,232	06-11077A76	1.2k
R233	06-11077A62	330
R234	06-11077A86	3.3k
R235	06-11077A72	820
R236	06-11077A34	22
R237	06-11077A66	470
R238	06-11077A28	12
R239	06-11077A66	470
R240	06-11077A74	1k
R241,242	06-11077A50	100
R243	06-11077A54	150
R244	06-11077A74	1k
R245,246	06-11077A50	100
R247	06-11077A54	150
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301	06-11077A34	22
R302	18-05500L08	variable, 22k
R303	06-11077B01	12k
R351	06-11077B23	100k
R352	06-11077B09	27k
R353	06-11077A91	5.1k
R354	06-11077A43	51
R355	06-11077A78	1.5k
R356	06-11077A74	1k
R357	06-11077B44	750k
R358	06-11077B35	330k
R359	06-11077B27	150k
R360	06-11077A82	2.2k
R361	06-11077B08	24k
R362	06-11077A98	10k
R363	06-11077A74	1k
R364	06-11077A50	100
R365	06-11077A84	2.7k
R366,367	06-11077A74	1k
R368	06-11077A58	220
R369	06-11077A82	2.2k
R370,371	06-11077A89	4.3k
R372	06-11077A93	6.2k
R373	06-11077A76	1.2k
R374	06-11077A74	1k
R375	06-11077A43	51
R379	06-11077A76	1.2k
R380,R381	06-11077A92	5.6k
R382	06-11077A98	10k
R383	06-11077A90	4.7k
R384	06-11077A98	10k
R387	06-11077A01	0
transformer		
T1,T2	25-80163M02	balun
integrated circuit (see note)		
U51	51-05479G05	receiver system
U101	51-80931V01	synthesizer
U102	51-80056M04	dual op-amp
U103	51-84621K27	regulator, 5 volt
U176	51-80932W01	dual op-amp
U351	51-80929W01	MC1350
voltage regulator (see note)		
VR176	48-80140L15	zener, 10V



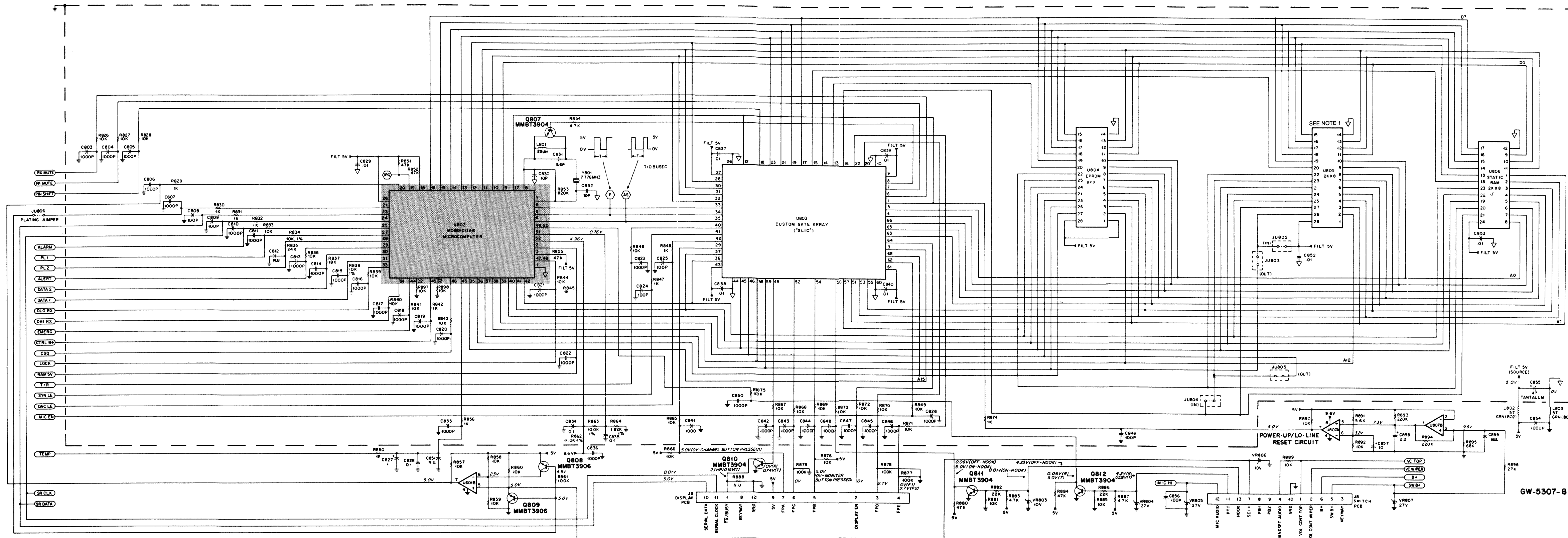
COMPONENT SIDE

COMPONENT SIDE
SOLDER SIDE
OVERLAY



SOLDER SIDE

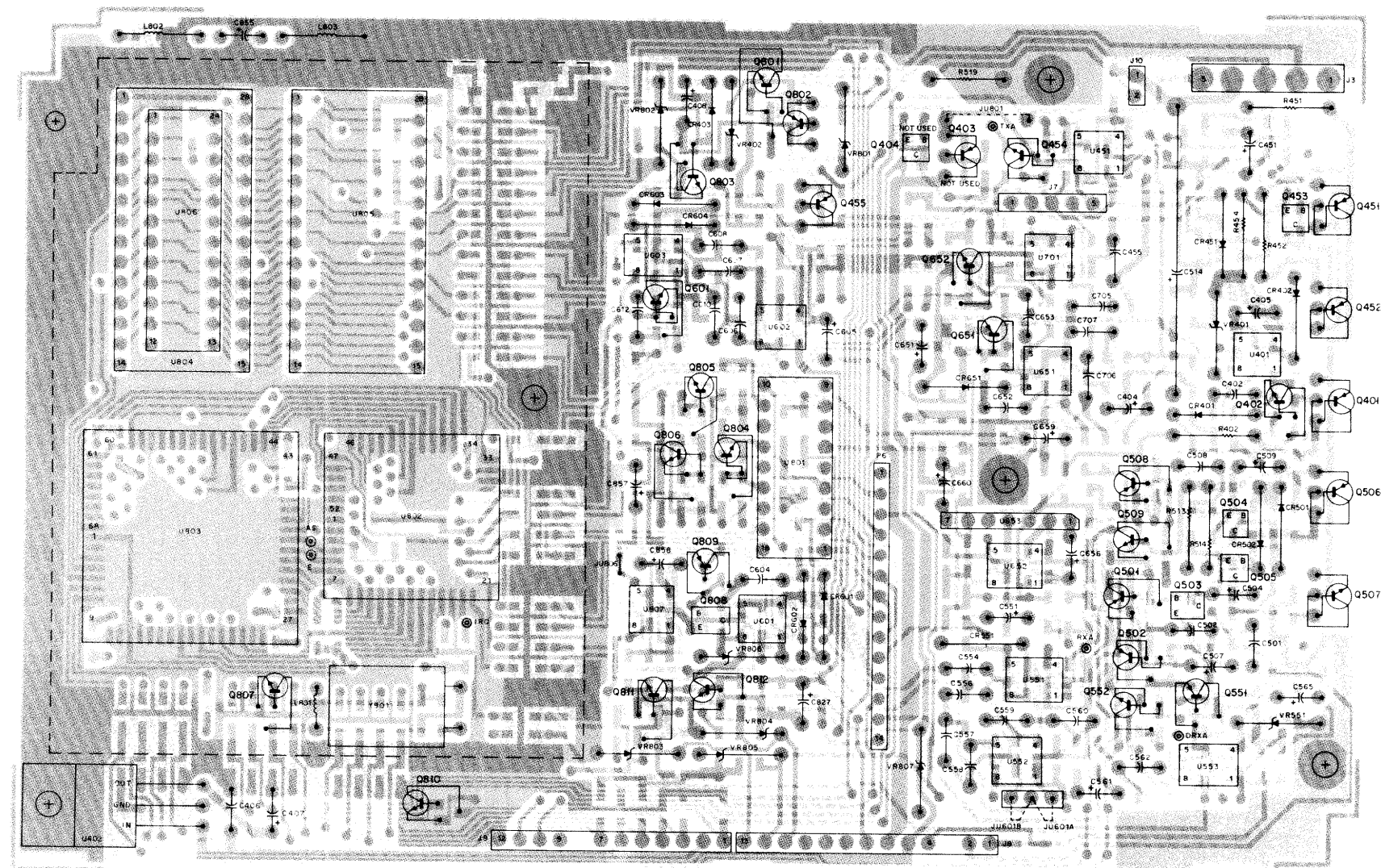
COMPONENT SIDE
SOLDER SIDE
OVERLAY



IMPORTANT
COMPONENTS WITHIN SHADED AREA ARE NOT FIELD-SERVICEABLE. IF SERVICING IS REQUIRED, THE ENTIRE BOARD MUST BE REPLACED.

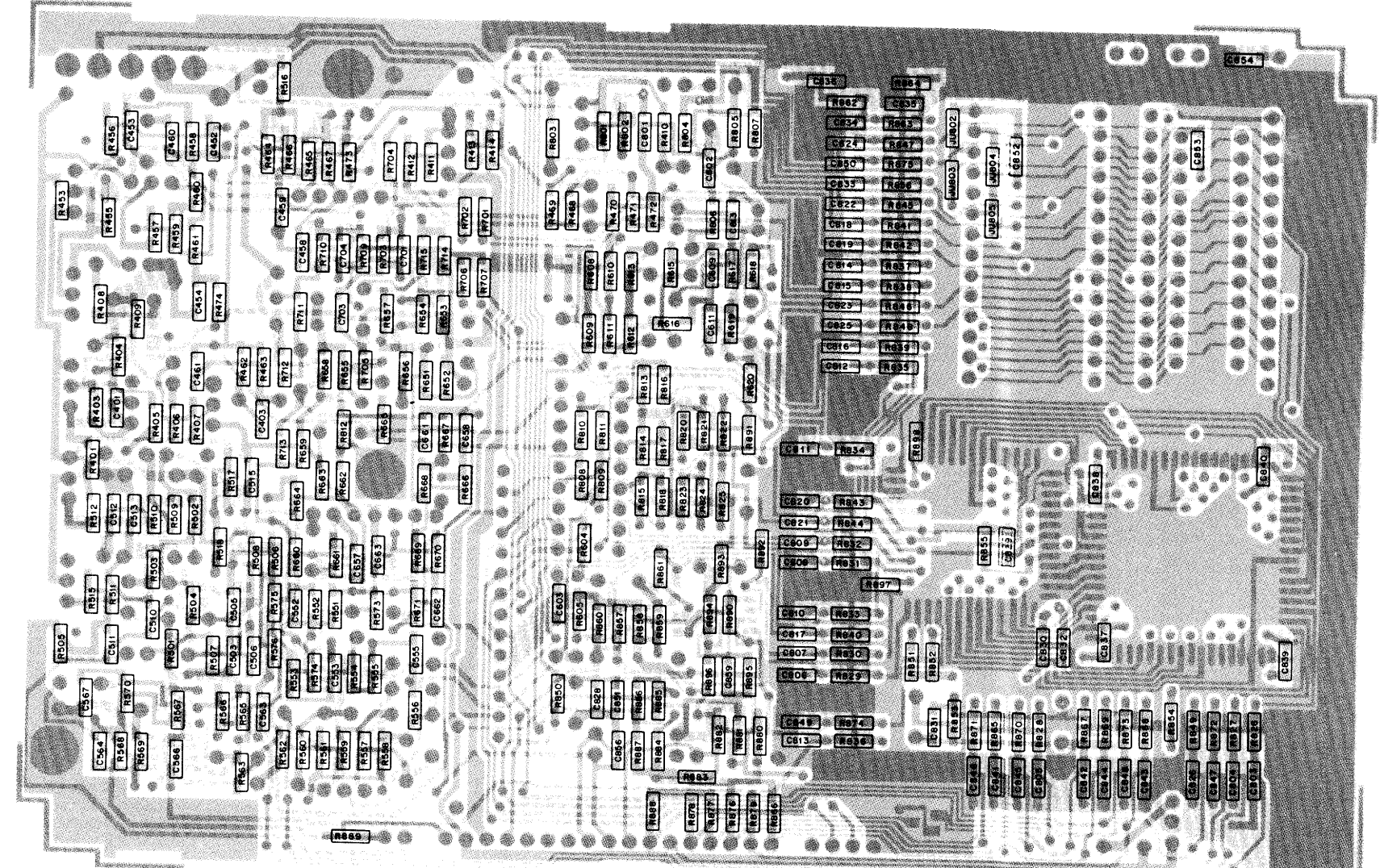
NOTE 1: EARLY MODEL USE 2KX8 NOVDRAM, LATE MODELS USE 2KX8 EEPROM.

Schematics, Circuit Board Diagrams, and Parts List for Logic Board



COMPONENT SIDE GW-5299-0
 SOLDER SIDE GW-5298-0
 OVERLAY GW-5300-A

SHOWN FROM COMPONENT SIDE



COMPONENT SIDE GW-5302-0
 SOLDER SIDE GW-5301-0
 OVERLAY GW-5303-0

SHOWN FROM SOLDER SIDE

parts list

HLN5402A Logic Board

MXW-5310-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 50V (unless otherwise indicated)		
C401	21-13741B45	0.01 uF, ±10%
C402	08-11051A09	0.022 uF, 63V
C403	21-13741B45	0.01 uF, ±10%
C404	23-11048B19	47 uF, ±20%, 16V, electrolytic
C405	23-11048B13	10 uF, ±20%, 16V, electrolytic
C406	23-11048A17	33 uF, ±20%, 16V, electrolytic
C407	23-11013A56	47 uF, ±20%, 6V, tantalum
C408	23-11048B19	47 uF, ±20%, 16V, electrolytic
C451	23-11048B19	47 uF, ±20%, 16V, electrolytic
C452	21-13741B45	0.01 uF, ±10%
C453	21-13741B69	0.1 uF, ±80-20%
C454	21-13741B45	0.01 uF, ±10%
C455	08-11051A15	0.22 uF, 63V
C458,459	21-13740B36	30
C460,461	21-13741B45	0.01 uF, ±10%
C501,502	08-11051A13	0.1 uF, 63V
C503	21-13740B49	100
C504	23-11048B13	10 uF, ±20%, 16V, electrolytic
C505,506	21-13740B49	100
C507	23-11013D13	10 uF, ±10%, 20V, tantalum
C508	08-11051A15	0.22 uF, 63V
C509	23-11048B13	10 uF, ±20%, 16V, electrolytic
C510	21-13740B61	330
C511-513	21-13740B49	100
C514	23-02308M01	1000 uF, ±20%, 16V, electrolytic
C515	21-13740B49	100
C551	23-11048A17	33 uF, ±20%, 16V, electrolytic
C552	21-13740B33	22
C553	21-13740B73	1000
C554	08-11051A03	0.0022 uF, 63V
C555	21-13740B53	150
C556-558	08-11051A12	0.068 uF, 63V
C559,560	08-11051A13	0.1 uF, 63V
C561	23-11048B05	1 uF, ±20%, electrolytic
C562	08-11051A09	0.022 uF, 63V
C563,564	21-13740B49	100
C565	23-11048B13	10 uF, ±20%, 16V, electrolytic
C566,567	21-13741B45	0.01 uF, ±10%
C604	23-11048B05	1 uF, ±20%, electrolytic
C606	08-11044A22	0.039 uF, 63V
C607	08-11051A13	0.1 uF, 63V
C608	08-11051A05	0.0047 uF, 63V
C609	21-13740B55	180
C610	08-11051A15	0.22 uF, 63V
C611	21-13740B46	75
C612	23-11048B19	47 uF, ±20%, 16V, electrolytic
C651	23-11048B19	47 uF, ±20%, 16V, electrolytic
C652	08-11051A06	0.0068 uF, 63V
C653	08-11051A15	0.22 uF, 63V
C656	23-11048B13	10 uF, ±20%, 16V, electrolytic
C657	21-13741B69	0.1 uF, ±80-20%
C658	21-13741B45	0.01 uF, ±10%
C659	23-11013A56	47 uF, ±20%, 6V, tantalum
C660	23-11048B13	10 uF, ±20%, 16V, electrolytic
C661	21-13740B76	1500
C662	21-13741B39	0.0056
C663	21-13740B49	100
C701	21-13740B78	1800
C703	21-13741B69	0.1 uF, ±80-20%
C704	21-13740B49	100
C705	08-11051A09	0.022 uF, 63V
C706	08-11051A13	0.1 uF, 63V
C707	08-11051A01	0.001 uF, 63V
C801,802	21-13740B49	100
C803-807	21-13740B73	1000
C808,809	21-13740B49	100
C810,811	21-13740B73	1000
C813-823	21-13740B73	1000
C824,825	21-13740B49	100
C826	21-13740B73	1000
C827	23-11048B05	1 uF, ±20%, electrolytic
C828	21-13741B69	0.1 uF, ±80-20%
C829	21-13741B45	0.01 uF, ±10%
C830	21-13740B25	10, ±5 pF
C831	21-11031F10	5.6, ±5 pF
C832	21-13740B25	10, ±5 pF
C833	21-13740B73	1000
C834,835	21-13741B69	0.1 uF, ±80-20%
C836	21-13740B73	1000
C837-840	21-13741B45	0.01 uF, ±10%
C841-848	21-13740B73	1000
C849	21-13740B49	100
C850	21-13740B73	1000
C852,853	21-13741B45	0.01 uF, ±10%
C854	21-13740B73	1000
C855	23-11054A09	47 uF, ±20%, 6V, tantalum
C856	21-13740B49	100
C857	23-11048B13	10 uF, ±20%, 16V, electrolytic
C858	08-11051A15	0.22 uF, 63V
C868	21-13740B49	100
diode (see note)		
CR401	48-83654H01	silicon
CR402	48-83654H02	silicon
CR403	48-83654H01	silicon
CR451	48-83654H01	silicon
CR501,502	48-83654H02	silicon
CR551	06-11009B23	jumper resistor
CR603	48-83654H01	silicon

MXW-5310-D (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR604	48-83654H01	silicon
CR651	48-83654H01	silicon
connector, receptacle		
J3	28-80129M01	5-pin, accessories
J7	28-80128M01	5-pin, RF power amplifier
J8	28-80126M01	23-pin
J10	28-80128M02	2-pin, internal speaker jumper
J601	09-84181L01	2-pin push-on
J801	06-11009B23	0-ohm resistor
J802	06-11024B23	0-ohm resistor
J804	06-11024B23	0-ohm resistor
coil		
L801	24-82723H35	23 uH
L802,803	24-83961B02	5 turns, green
connector, plug		
P6	28-80127M02	14-pin, RF board
PE01	28-80250B02	3-pin, for JU601
transistor (see note)		
Q401	48-00869619	PNP
Q402	48-80214G02	NPN
Q451,452	48-00869619	PNP
Q453,454	48-80214G02	NPN
Q455	48-11043C10	PNP
Q501,502	48-05128M16	PNP
Q503,504	48-80214G02	NPN
Q505	48-05128M16	PNP
Q506	48-00869619	PNP
Q507	48-00869618	NPN
Q508	48-05128M16	PNP
Q509	48-80214G02	NPN
Q551	48-05128M16	PNP
Q552	48-80214G02	NPN
Q601	48-80214G02	NPN
Q651	48-05128M16	PNP
Q652	48-80214G02	NPN
Q801	48-80214G02	NPN
Q802	48-11043C10	PNP
Q803-807	48-80214G02	NPN
Q808,809	48-05128M16	PNP
Q810-812	48-80214G02	NPN
resistor, fixed, ohm, +5%, 1/8 watt (unless otherwise specified)		
R401	06-11077A70	680
R402	06-02369M31	330, 0.6W, metal film
R403	06-11077A70	680
R404	06-11077F18	1.74k, ±1%
R405	06-11077F28	2.21k, ±1%
R406	06-11077A98	10k
R407	06-11077A76	1.2k
R408,409	06-11077A98	10k
R410	06-11077A80	1.8k
R451,452	06-02369M01	1, 0.6W, metal film
R453	06-11077A70	680
R454	06-02369M31	330, 0.6W, metal film
R455	06-11077A70	680
R456	06-11077A82	2.2k
R457	06-11077A76	1.2k
R458,459	06-11077A90	4.7k
R460	06-11077B01	12k
R461	06-11077A70	680
R462	06-11077B29	180k
R463	06-11077B25	120k
R464,465	06-11077G88	100k, ±1%
R466,467	06-11077F91	10k, ±1%
R468	06-11077A60	270
R469	06-11077A74	1k
R470	06-11077A98	10k
R471	06-11077B07	22k
R472	06-11077A92	5.6k
R473	06-11077B09	27k
R474	06-11077A98	10k
R501	06-11077A84	2.7k
R502,503	06-11077B07	22k
R504	06-11077A98	10k
R505	06-11077A86	3.3k
R506	06-11077A78	1.5k
R507	06-11077A66	470
R508	06-11077A98	10k
R509,510	06-11077A72	820
R511	06-11077B07	22k
R512	06-11077A46	68
R513,514	06-11009B23	2.7, 1/4W, carbon
R515	06-11077A46	68
R516	06-11077A66	470
R517,518	06-11077A98	10k
R519	06-80185M01	1, 2W, metal plate
R551	06-11077B01	12k
R552	06-11077B37	390k
R553	06-11077B19	68k
R554-555	06-11077B18	62k
R556	06-11077F53	4.02k, ±1%
R557	06-11077F20	1.82k, ±1%
R558	06-11077G41	32.4k, ±1%
R559	06-11077G88	100k, ±1%
R560	06-11077E77	665, ±1%
R561	06-11077G91	107k, ±1%
R562	06-11077B11	33k
R563	06-11077B15	47k

MXW-5310-D (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R565	06-11077A98	10k
R566	06-11077A96	8.2k
R567	06-11077A86	3.3k
R568	06-11077A98	10k
R569	06-11077A42	47
R570	06-11077B17	56k
R573	06-11077B09	27k
R574	06-11077A01	0
R604	06-11077A98	10k
R605	06-11077A74	1k
R609	06-11077B11	33k
R610	06-11077B07	22k
R611,612	06-11077G42	33.2k, ±1%
R613	06-11077G45	35.7k, ±1%
R615	06-11024J15	187k, ±1%
R616	06-11077G48	38.3k, ±1%
R617	06-11077A82	2.2k
R618	06-11077B23	100k
R619,620	06-11077A98	10k
R651	06-11077A68	560
R652	06-11077A50	100
R653,654	06-11077A98	10k
R655	06-11077A90	4.7k
R656	06-11077B39	470k
R657	06-11077B42	620k
R658	06-11077H65	619k
R659	06-11077A82	2.2k
R660	06-11077B19	68k
R661	06-11077B03	15k
R662	06-11077B17	56k
R663	06-11077B18	62k
R664	06-11077B07	22k
R665	06-11077A84	2.7k
R666,667	06-11077B23	100k
R668-670	06-11077B18	62k
R671	06-11077A50	100
R701	06-11077G88	100k, ±1%
R702	06-11077H13	178k
R703	06-11077G31	25.5k
R705	06-11077H13	178k
R706	06-11077G88	100k, ±1%
R707	06-11024J26	243k, ±1%
R709	06-11077B10	30k
R710-712	06-11077G68	61.9k, ±1%
R713	06-11077A86	3.3k
R714	06-11077B16	51k
R715	06-11077B05	18k
R801	06-11077A78	1.5k
R802	06-11077A84	2.7k
R803	06-11077A98	10k
R804	06-11077A90	4.7k
R805,806	06-11077A98	10k
R807	06-11077B15	47k
R808,809	06-11077A90	4.7k
R810,811	06-11077B17	56k
R812-815	06-11077A90	4.7k
R816-818	06-11077B23	100k
R820,821	06-11077A98	10k
R822	06-11077B15	47k
R823,824	06-11077A98	10k
R825	06-11077B15	47k
R826-828	06-11077A98	10k
R829-832	06-11077A74	1k
R833	06-11077A98	10k
R834	06-11077F91	10k, ±1%
R835	06-11077B08	24k
R836	06-11077A98	10k
R837	06-11077B05	18k
R838	06-11077F91	10k, ±1%
R839-841	06-11077A98	10k
R842	06-11077A74	1k
R843,844	06-11077A98	10k
R845	06-11077A74	1k
R846	06-11077A98	10k
R847,848	06-11077A74	1k
R849	06-11077A98	10k
R850	06-11077A74	1k
R851,852	06-11077B15	47k
R853	06-11077B45	820k
R854	06-11077A90	4.7k
R855	06-11077B15	47k
R856	06-11077A74	1k
R857-860	06-11077A98	10k
R861	06-11077B23	100k
R862	06-11077F95	11k, ±1%
R863	06-11077F91	10k, ±1%
R864	06-11077F20	1.82k, ±1%
R865-873	06-11077A98	10k
R874	06-11077A74	1k
R875,876	06-11077A98	10k
R877-879	06-11077B23	100k
R880	06-11077B15	47k
R881	06-11077A98	10k
R882	06-11077B07	22k
R883	06-11077A90	4.7k
R884	06-11077B15	47k
R885	06-11077A98	10k
R886	06-11077B07	22k
R887	06-11077A90	4.7k
R889,890	06-11077A98	10k

MXW-5310-D (4)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R891	06-11077A92	5.6k
R892	06-11077A98	10k
R893,894	06-11077B31	220k
R895	06-11077B19	68k
R896	06-11077B09	27k
R897,898	06-11077A98	10k
Integrated circuit (see note)		
U401	51-80056M04	dual op-amp
U402	51-80068C06	regulator
U451	51-80056M04	dual op-amp
U551-553	51-80056M04	dual op-amp
U601	51-80056M01	dual comparator
U602,603	51-80056M04	dual op-amp
U651,652	51-80056M04	dual op-amp
U653	51-80059M01	voltage-controlled attenuator
U701	51-80056M04	dual op-amp
U801	51-80135C10	D/A converter
U802	51-80960T01	microcomputer
U803	51-82862N09	logic array
U804	51-99003D02	EPROM 8KX8
U805	51-80057M01	NOVRAM, 2KX8, early models
U805	51-80901W01	EEPROM, 2KX8, late models
U806	51-80914V01	static RAM, 2KX8
U807	51-80056M01	dual comparator
voltage regulators (see note)		
VR401	48-83461E40	zener, 5.1V
VR402	48-82256C15	zener, 5.1V
VR501	48-82256C11	zener, 10V
VR801	48-82256C20	zener, 27V
VR802,803	48-82256C11	zener, 10V
VR804,805	48-82256C20	zener, 27V
VR806	48-82256C11	zener, 10V
VR807	48-82256C20	zener, 27V
crystal (see note)		
Y151	48-80173D09	7.776 MHz
non-referenced items		
03-10943M04	screw, M2.5 X 8 (5 used)	
04-00001718	washer (4 used)	
07-80925T01	bracket, heat sink	
09-82071K09	14-pin socket (2 used)	
14-80145M01	insulator, accessory	
14-82369E13	insulator, accessory connector	
14-83820M05	insulator, head conductive	
15-80076M01	plastic housing	
26-80123M01	shield frame, high speed logic	
26-80125L02	heat sink, audio/regulator	
42-80940T01	ring, retaining	