



MOTOROLA

Mobile Products Division

MaraTrac
VHF FM Two-Way Radio
150-174 MHz
75/100 Watts

NOTE: THIS MANUAL COVERS ONLY "AK" SUFFIX RADIOS;
SEE MANUAL 68P80102W94 FOR "BK" SUFFIX RADIOS.

THIS MANUAL HAS BEEN
DISCONTINUED

Instruction Manual
68P80102W18-A



MOTOROLA
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MARATRAC

VHF Band Radio System

75 Watts & 100 Watts, 150-174 MHz

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* ITEMS OMITTED DUE TO IRRELEVANCY

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.

Performance Specifications for Conventional VHF *MaraTrac* Radio

GENERAL

Channel Capability	8 Modes (A3 Model)	16 Modes (A2 Model)	99 Modes (A5 Model)
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 Field Maintenance Software.		
Environmental	Meets MIL-STD 810D environmental specifications for vibration, shock, rain, dust, and salt fog.		

Model	Frequency (MHz)	Minimum RF Power Output	Maximum Battery Current Drain			
			Off @ 13.8 V	Standby @ 13.8 V	Receiver @ 13.8 V	Transmit @ Rated Power
T73XTA7DA2-K	150-174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7DA3-K	150-174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7TA5-K	150-174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7TA7-K	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)	Handheld—2.3" H x 4.8" W x 1.5" L Basic—5.2" H x 3.7" W x 1.8" L Basic Plus—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

MXW-5201-A

CODE:

* = INDICATES BREAKDOWN IN SEPARATE CHART

MXW-5203-A

[illegible]

● = ONE ITEM SUPPLIED

[illegible]

MXW-5255-A

***MaraTrac* VHF Two-Way Radio Options Chart**

Option	Description	Kit Added	Kit Deleted
W544	3.0 dB Gain Antenna	TAD6170A	TAD611xA (x = 1,2,3, or 4)
B652	Wide Band Antenna	HAD4002A or HAD4003A	TAD611xA (x = 1,2,3, or 4)
B20	DTMF Microphone	HMN1022A	HMN1015A
B109	Handset	TLN4698A TMN6067A	HLN4024A HMN1015A
B239	Noise Cancelling Microphone	TMN6116A	HMN1015A
B70	Omit Antenna	—	TAD611xA (x = 1,2,3, or 4)
B90	Omit Accessories	—	Control Head Power Cable Fused Lead Hang-Up Box Microphone Speaker Antenna
B71	Omit Microphone	—	HMN1015A
B87	Omit Speaker	—	HSN4020A or HSN4021A
B161	Omit Main Radio Cable	—	Fused Power Cable Fused Red Lead Orange Cable
B206	Service Manual	6880102W18	
B730	75W Power set Option	—	—



1. Introduction

The *MaraTrac* 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 *MaraTrac* 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
- 10-watt audio
- Field programmable EEPROM

2.2 CONTROL HEADS

The following control heads are available with the *MaraTrac* radio:

(1) Basic "Clamshell" Control Head

The clamshell control head is available for use with either an 8 or 16 mode *MaraTrac* radio. This allows either 16 separate modes, or 8 modes and mode-programmable scan. An optional TalkAround switch is available for the control head.

(2) Handheld Control Head (HHCH)

A HHCH is available for the *MaraTrac* radio. This unit allows selection of up to 99 modes. Single priority scan is standard with either mode-programmable or operator-select scan lists.

(3) Advanced Control Head

An advanced control head is available for the *MaraTrac* 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

3.2.1 Microcomputer

The *MaraTrac* radio uses the Motorola 68HC11A8 Microcomputer operating in an expanded bus mode to perform all basic radio control functions. 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 lithium-battery backed-up RAM IC.

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 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 local oscillator. The mixer produces a 45.1 MHz first IF signal which is amplified before it passes through a 4-pole crystal filter. Another stage of amplification occurs before the RF signal passes into the receiver subsystem IC, where the 45.1 MHz signal is mixed with 44.645 MHz 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 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 *MaraTrac* 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 *MaraTrac* 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.

6.3 BASIC CONTROL HEAD SCAN

Activate and deactivate the Basic Control Head Scan by switching the rotary knob to the ON or OFF position. When activity is detected, the BUSY indicator lights solid to indicate the activity is from a non-priority mode, or flashes if the activity is from a priority mode. (A priority alert tone can be field programmed.) The basic control head model supports only a Mode-Slaved Scan list, meaning, the scan list is pre-programmed and requires a field programmer to modify it. The priority mode will always be equal to the selected mode. Also, there is no provision for operator review of the scan list.

6.4 HHCH AND ADVANCED SCAN

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.

6.5 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

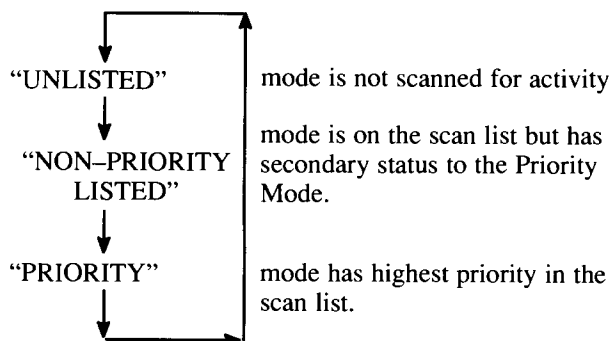
enunciate entry into the Scan configuration mode. Use the mode control to scroll to the desired mode. Press SEL to add the displayed mode to the list. Confirming the selection and defining the mode's "non-priority" status in the list, (1) on the handheld control head, the PRI indicator lights, or (2) 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, 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. The power level at J11V can be as high as 2 to 3 watts when controlled B+ is near 8 volts. The output drive from J11V is applied to the VHF 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 (Q803, Q804). Current to the finals is monitored from the voltage drop across R801. 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 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 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 achieve rated 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 power flow. 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. 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, and possibly damaging the final transistors. Shunt resistor R822, transistor Q805, and associated circuitry monitors the current drawn by driver Q802 and hence the drive to finals Q803 and Q804. As this current increases, the RF drive sense line voltage rises, causing 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 Q1702 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.

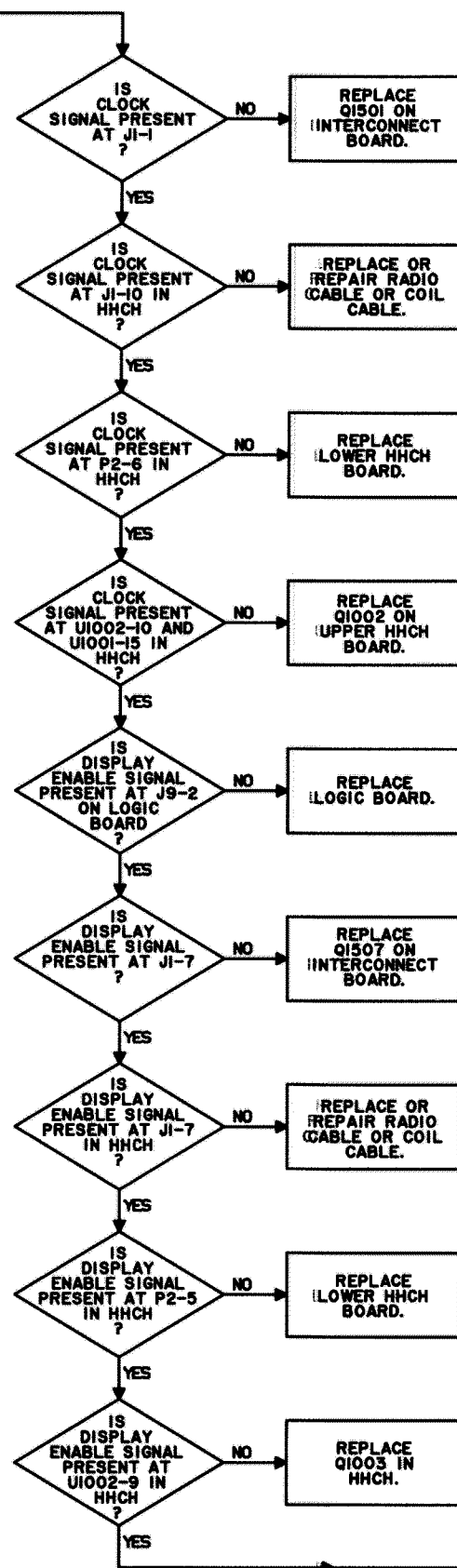
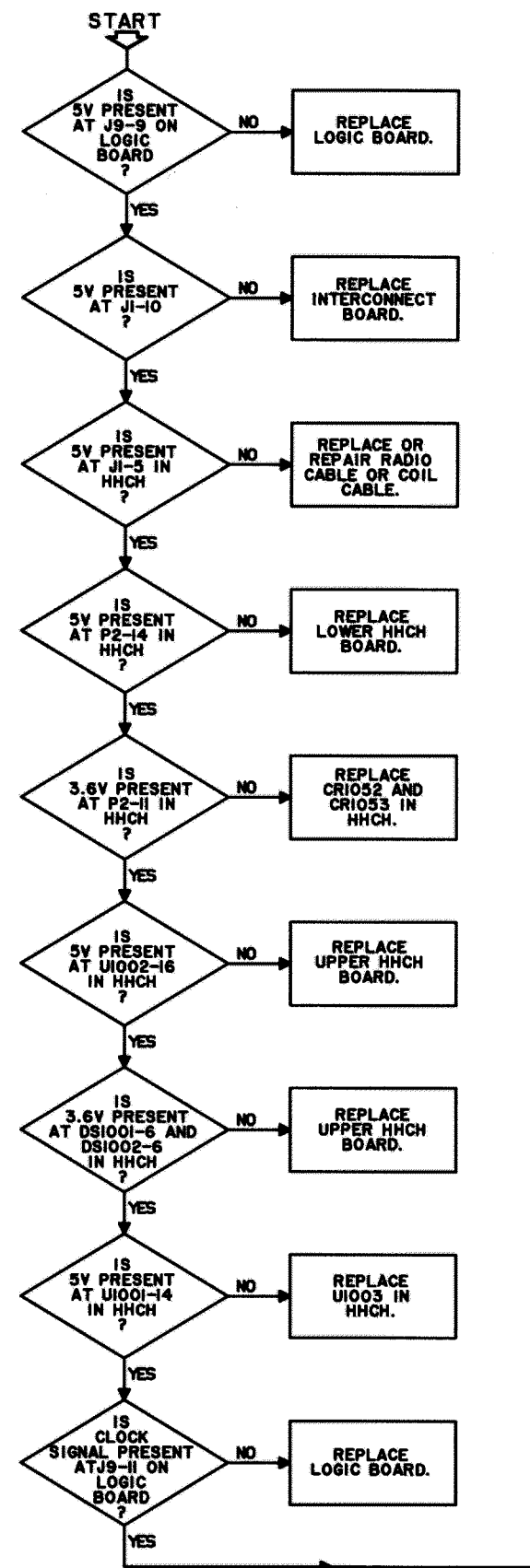
The serial data signal is logically ANDed with the DISPLAY ENABLE signal. Therefore, data out is always low unless DISPLAY ENABLE is high. The line labeled DATA OUT is used to send serial display data to the control head. Switch data is clocked from the control head and is received on the DATA IN line.

7.4 CONTROL HEAD

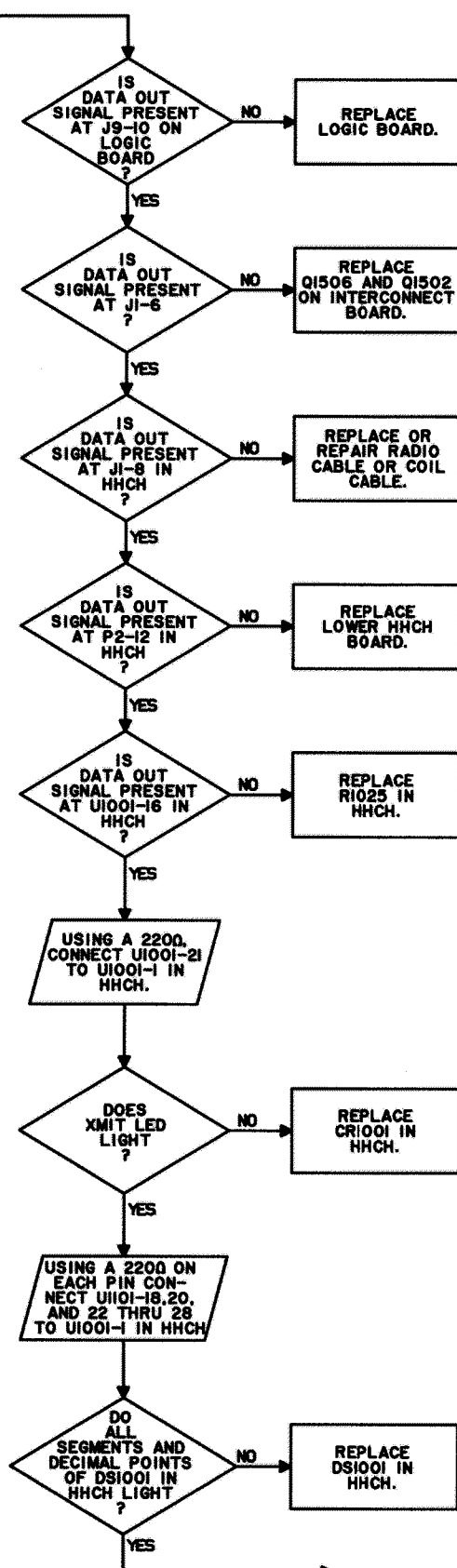
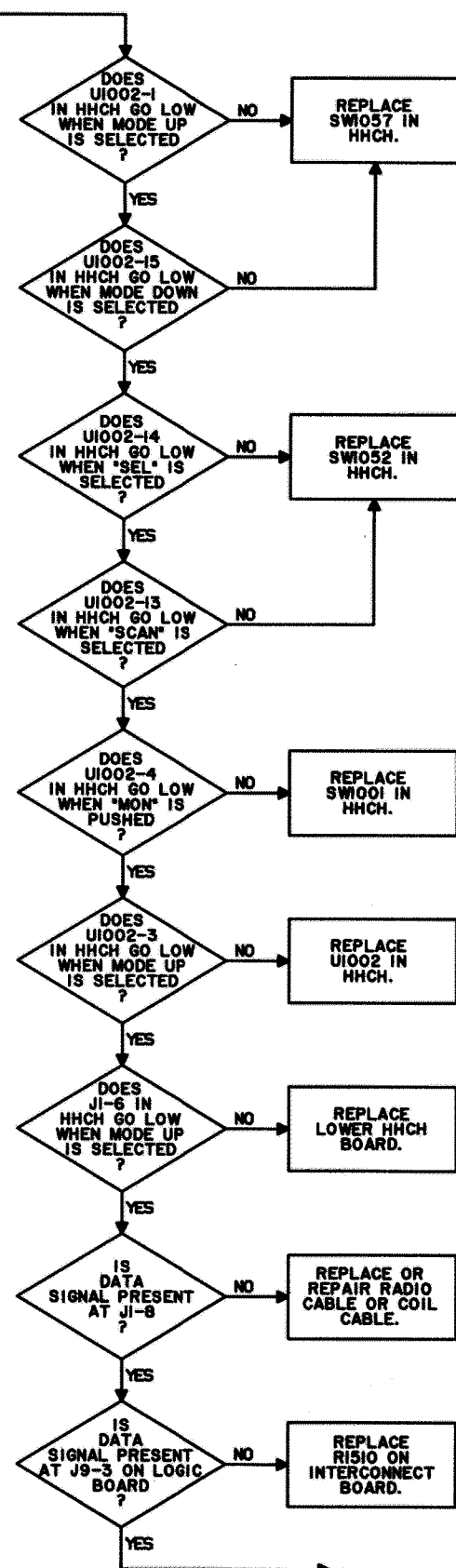
MaraTrac radios use three types of control heads. The basic model, a non-display control head, uses rotary knobs to control VOLUME, MODE, and ZONE or SCAN selections.

Mode selection is indicated by numbers (and zone letters, on some models) on the knob(s). The handheld model, a display-type control head, uses two seven-segment displays to indicate selected mode; it also contains the microphone circuitry. The advanced model, a display type control head, uses two seven segment displays to indicate selected mode.

All control heads use 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.

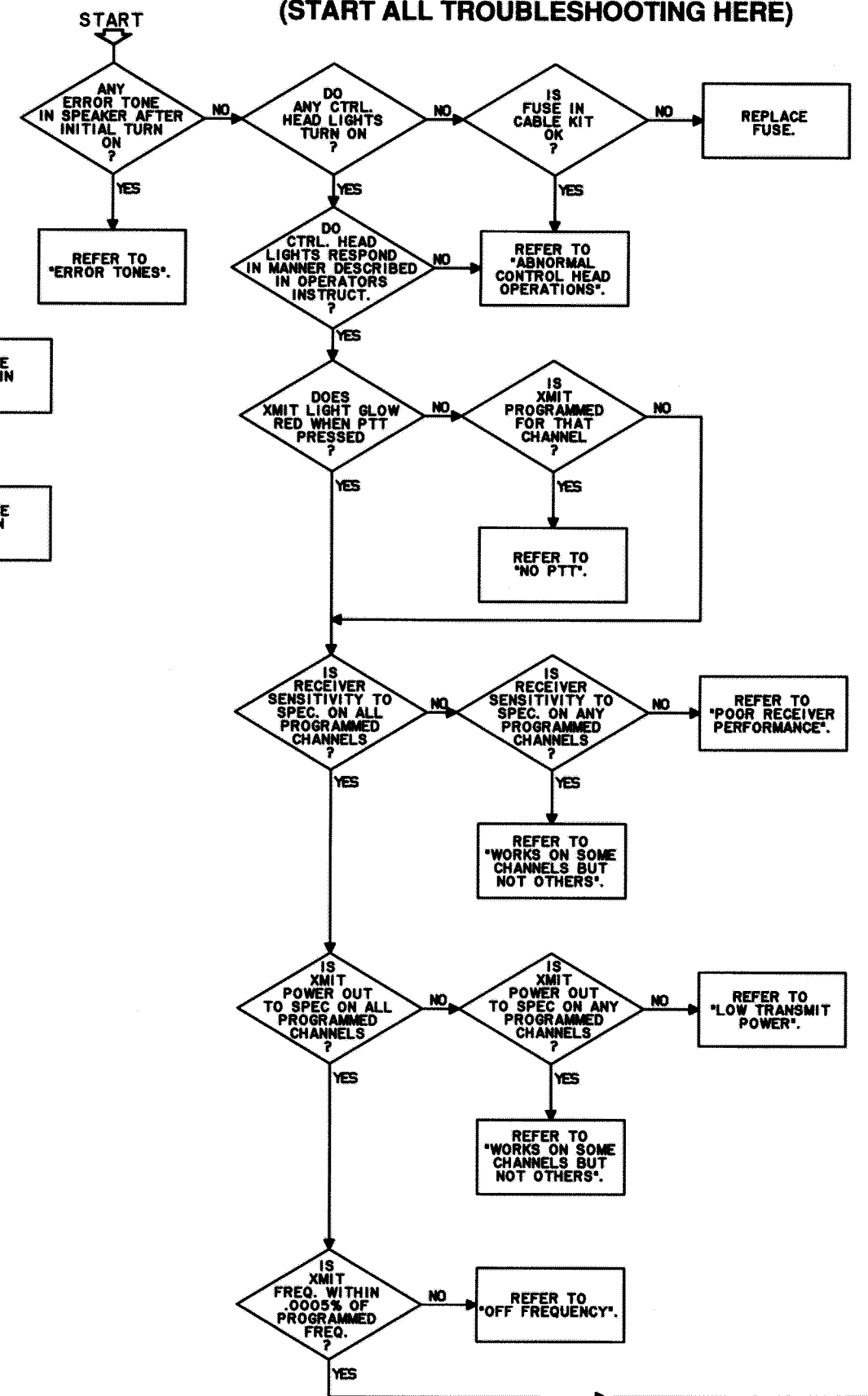


IMPROPER HHCH OPERATION



6XW-5206-0

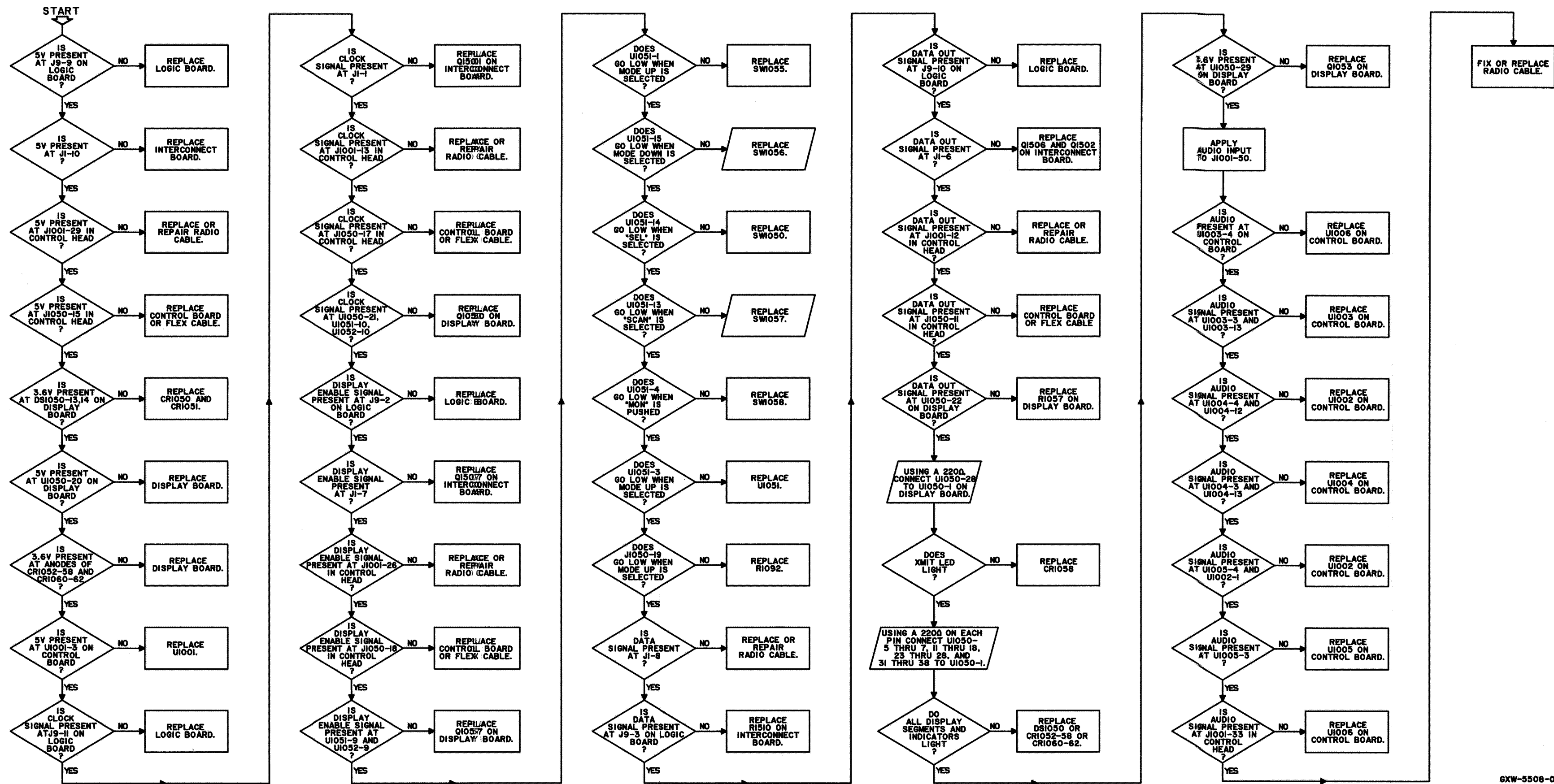
RADIO SYSTEM TROUBLESHOOTING CHART (START ALL TROUBLESHOOTING HERE)



NOTE
1. AUDIO SIGNAL FOR TRANSMIT
AUDIO TESTS SHOULD BE 1KHz
AT 800mV RMS.

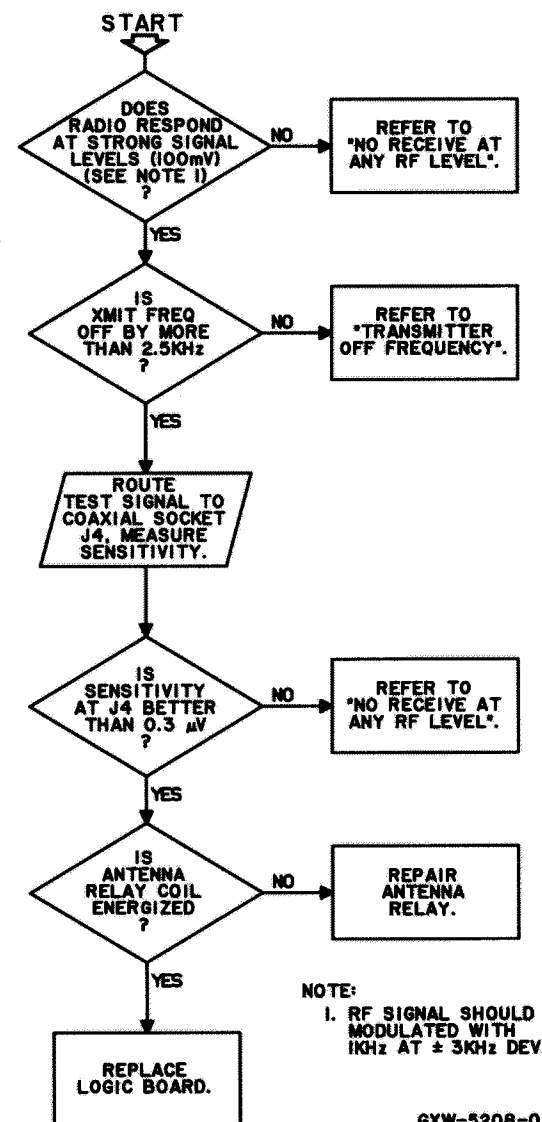
6XW-5204-0

IMPROPER ADVANCED CONTROL HEAD OPERATION



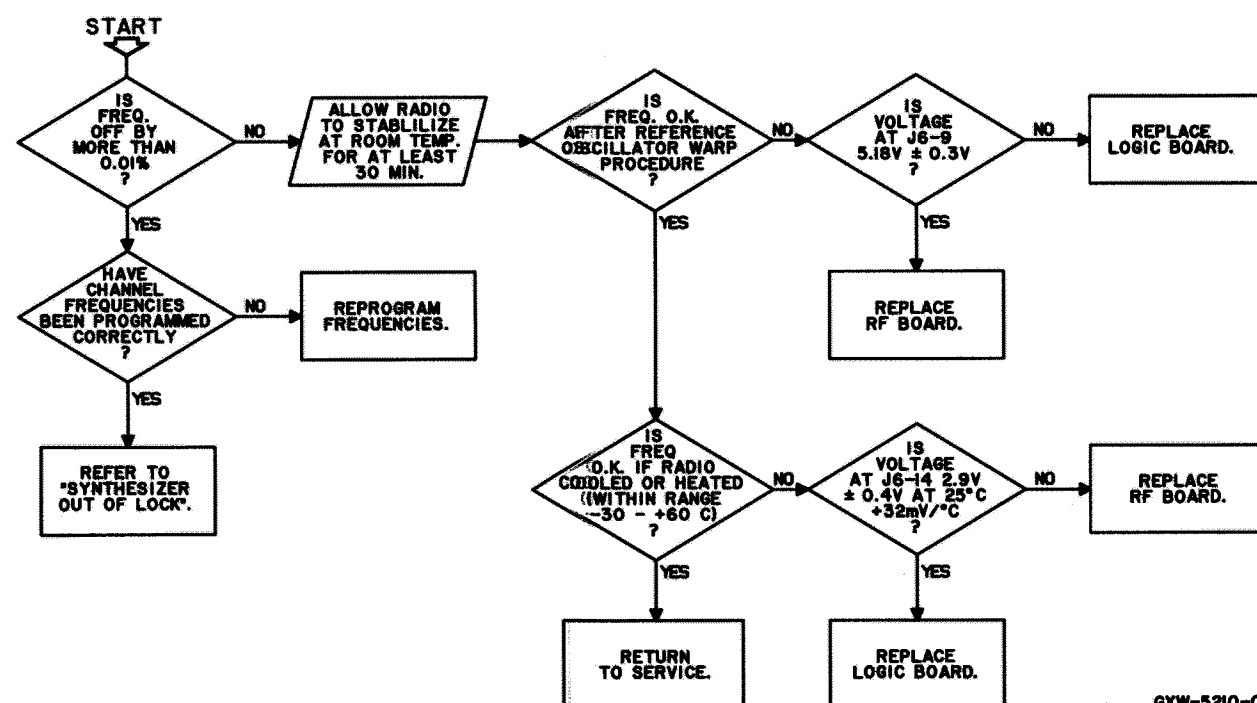
6XW-5508-0

POOR RECEIVER PERFORMANCE



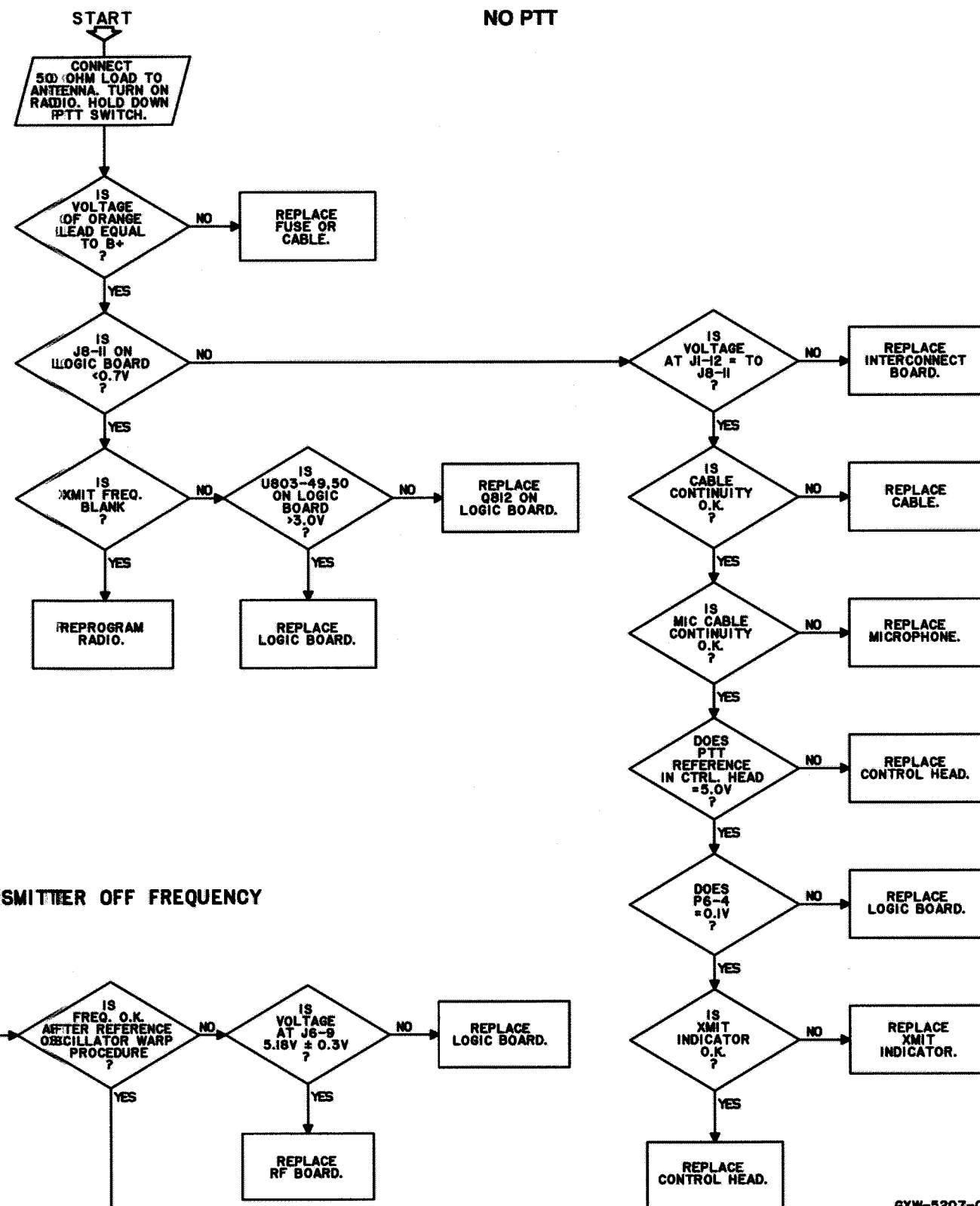
6XW-5208-0

TRANSMITTER OFF FREQUENCY



6XW-5210-0

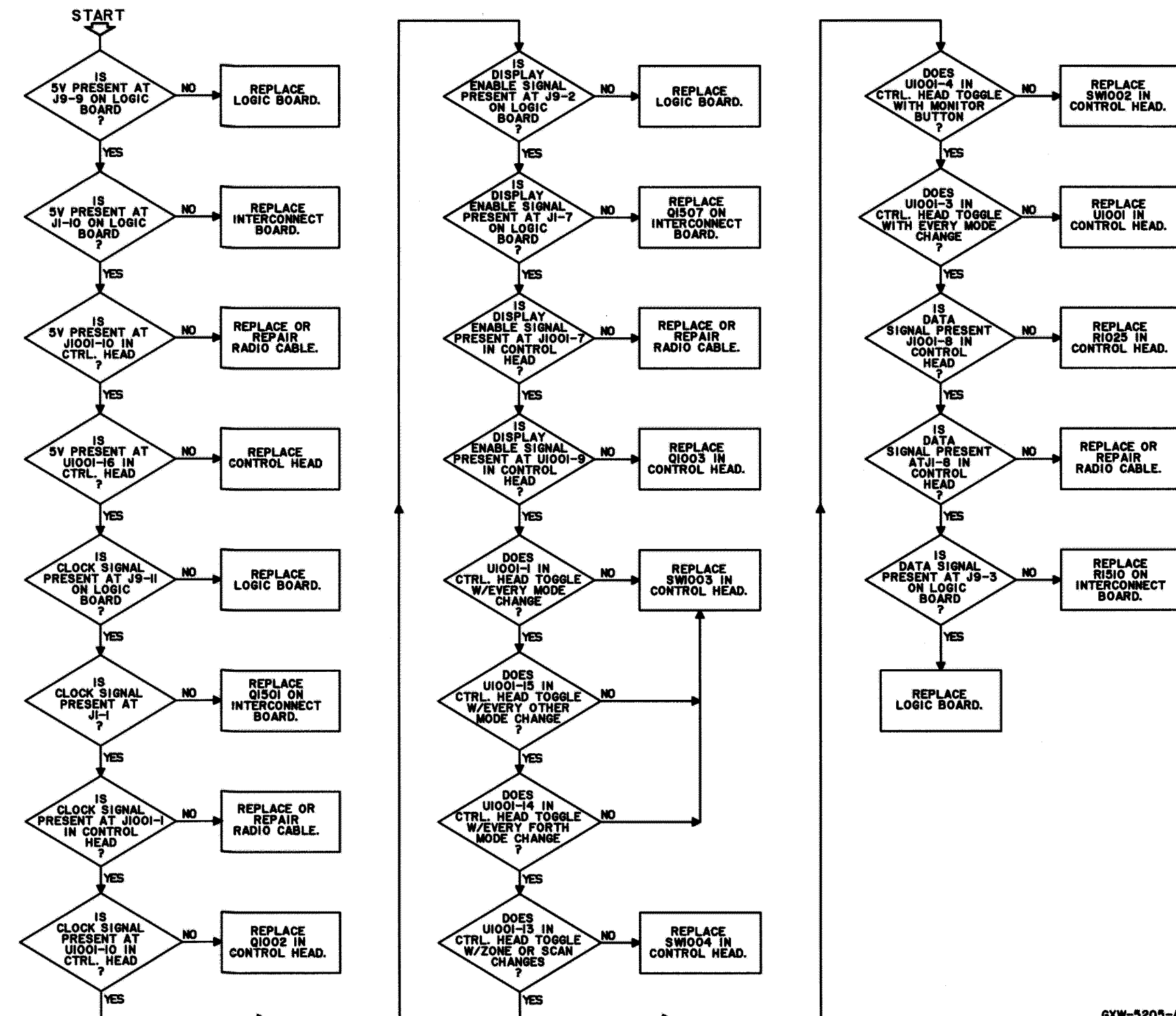
NO PTT



6XW-5207-0

ABNORMAL CONTROL HEAD OPERATION

BASIC CONTROL-SEE SEPARATE CHART FOR HHCH OR ADVANCED CONTROL HEAD



6XW-5205-A

LOW TRANSMIT POWER

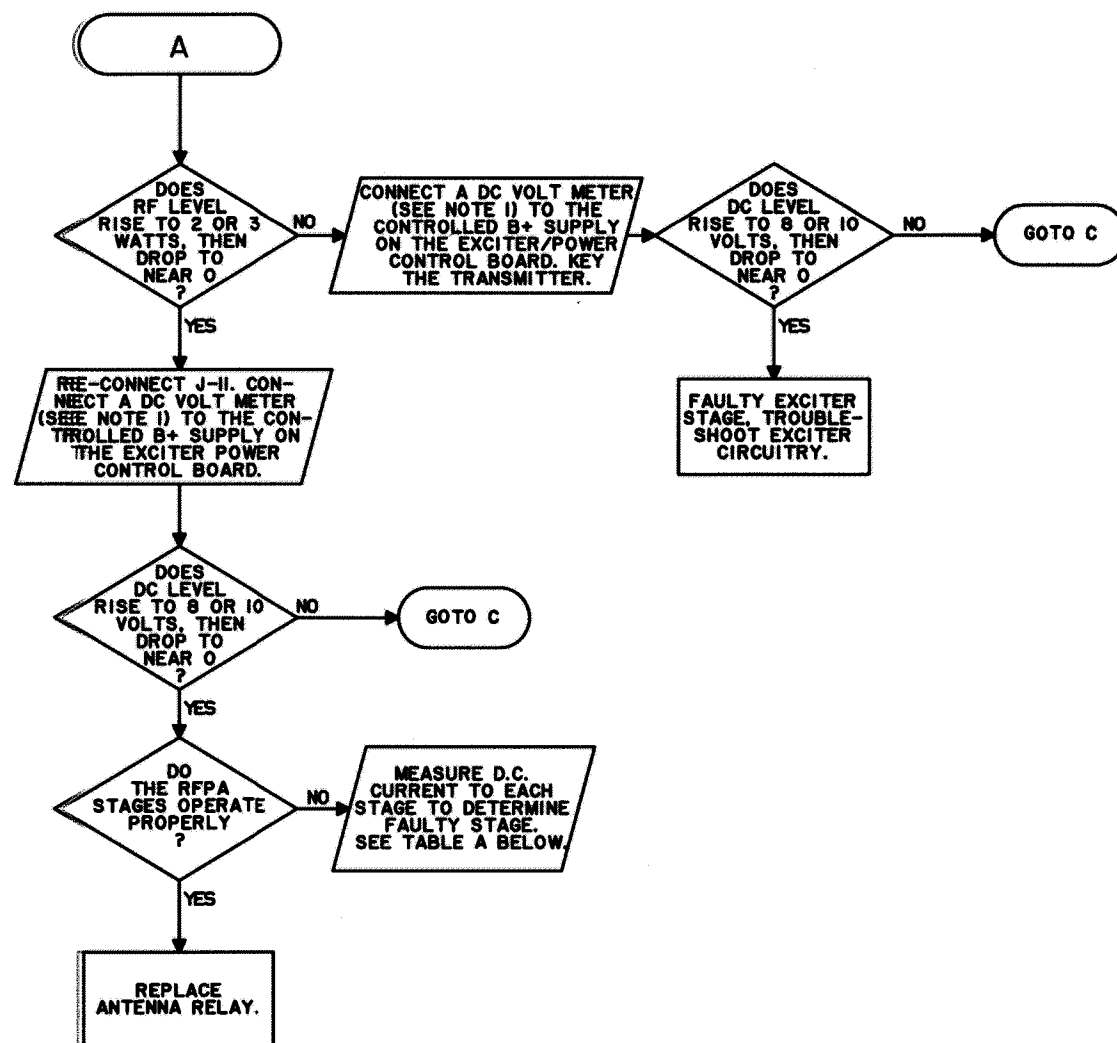
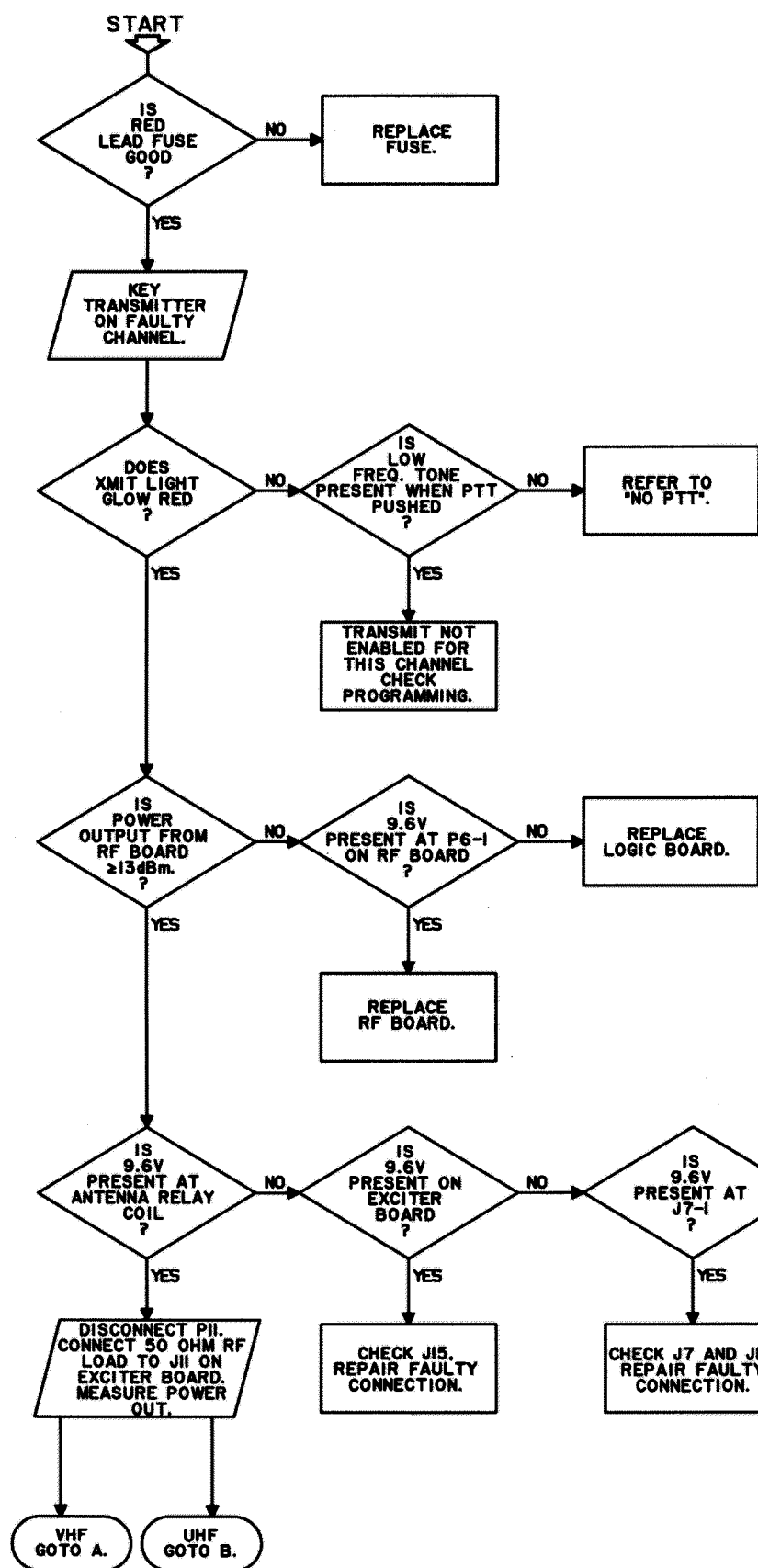
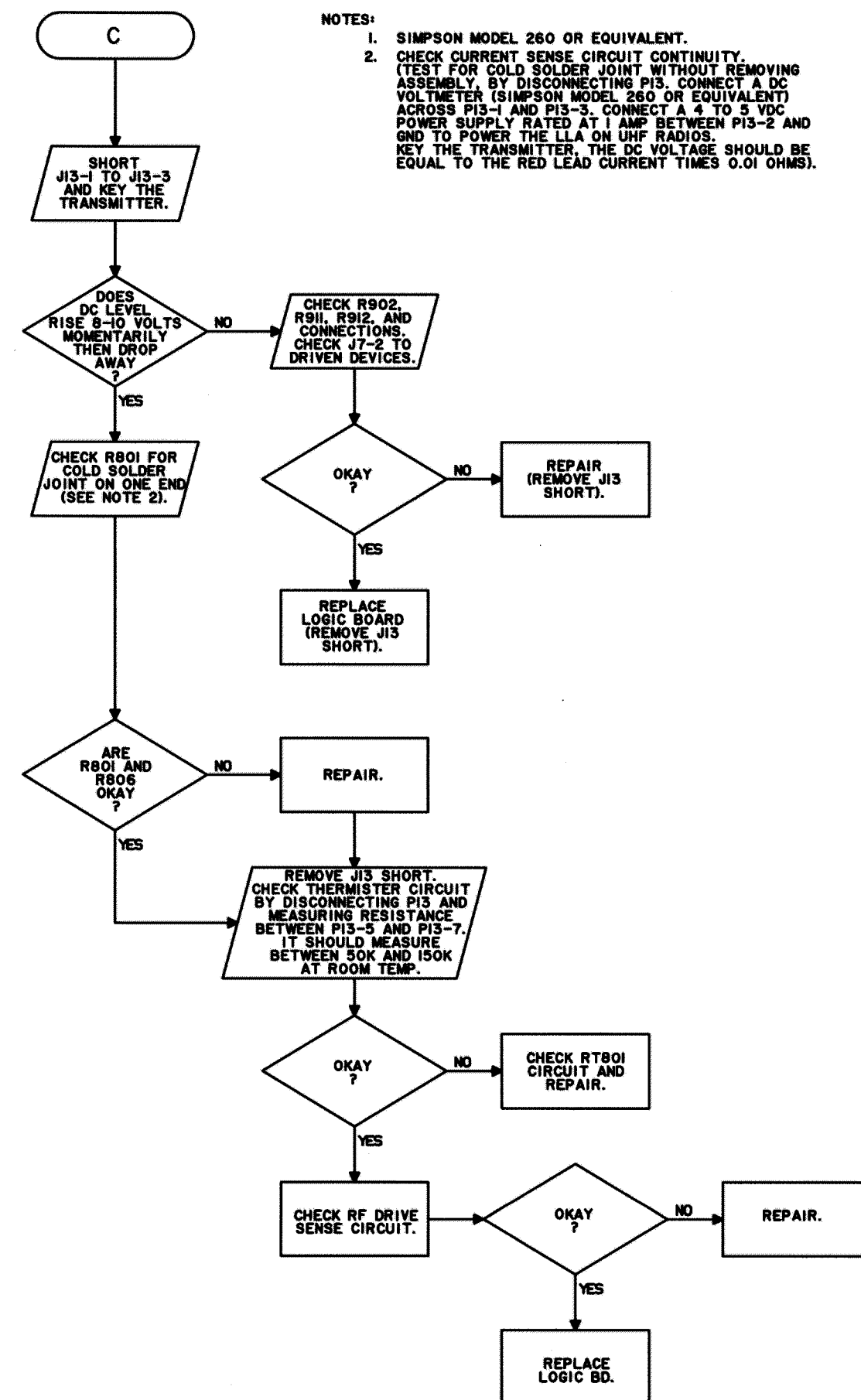
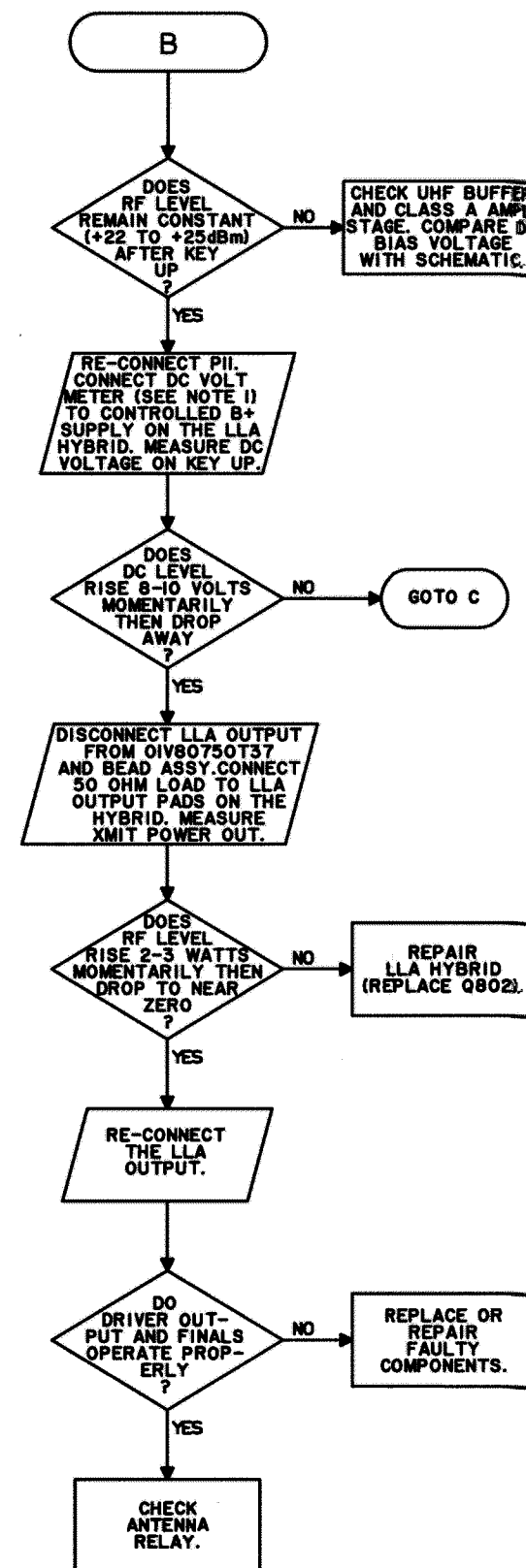


TABLE A
D.C. CURRENT DRAW - PA STAGES VHF

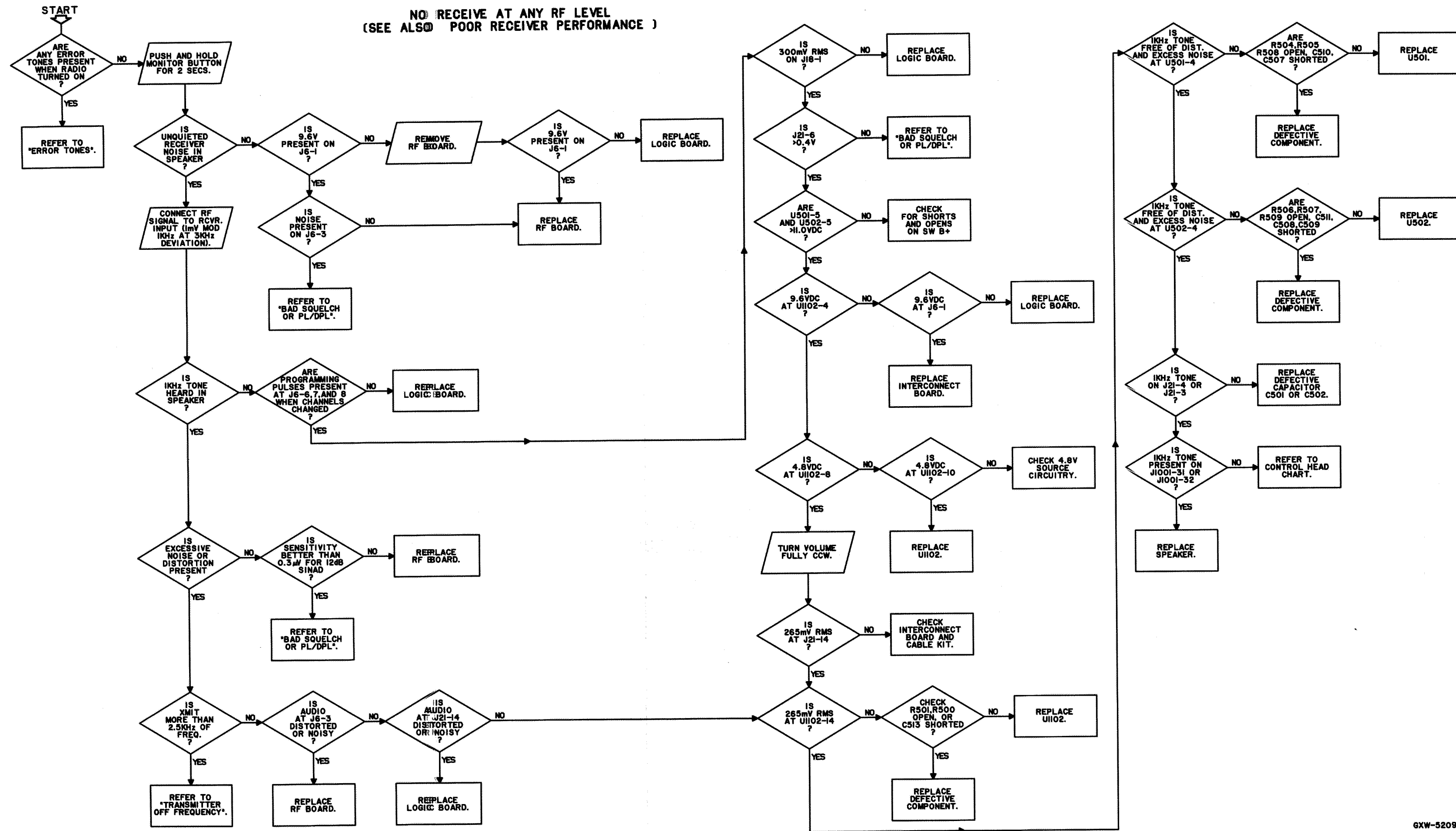
1. CURRENT MEASUREMENT MUST BE TAKEN BEFORE CONTROLLED B+ DROPS TO NEAR ZERO. IF THIS IS DIFFICULT, DISCONNECT PIN 4 OF J12 AND SUPPLY 6 VOLTS TO THE EXCITER BOARD AT PIN 4 J12.

2. LIFT ONE END OF COLLECTOR FEED CHOKE AND CONNECT SERIES AMMETER. COMPARE CURRENT DRAW OF STAGE TO VALUES IN THE TABLE WHILE TRANSMITTING.

STAGE	CONNECT AMMETER IN SERIES WITH	150MHZ	162MHZ	174MHZ
Q801	L803	1.8-2.3	1.2-1.6	1.0-1.4
Q802	L821	3.2-3.8	3.1-4.0	3.2-3.8
Q803, Q804	R801	18-22	18-22	18-22

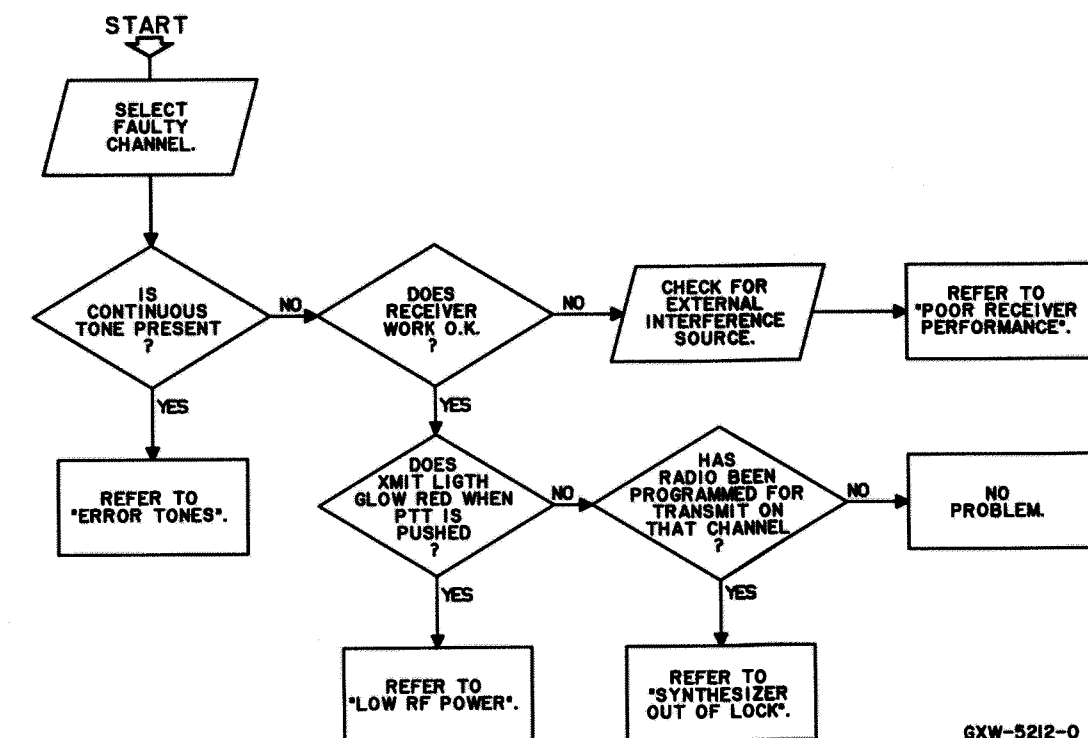


- NOTES:
1. SIMPSON MODEL 260 OR EQUIVALENT.
 2. CHECK CURRENT SENSE CIRCUIT CONTINUITY. (TEST FOR COLD SOLDER JOINT WITHOUT REMOVING ASSEMBLY, BY DISCONNECTING P13. CONNECT A DC VOLT METER (SIMPSON MODEL 260 OR EQUIVALENT) ACROSS P13-1 AND P13-3. CONNECT A 4 TO 5 VDC POWER SUPPLY RATED AT 1 AMP BETWEEN P13-2 AND GND TO POWER THE LLA ON UHF RADIOS. KEY THE TRANSMITTER. THE DC VOLTAGE SHOULD BE EQUAL TO THE RED LEAD CURRENT TIMES 0.01 OHMS).



GXW-5209-0

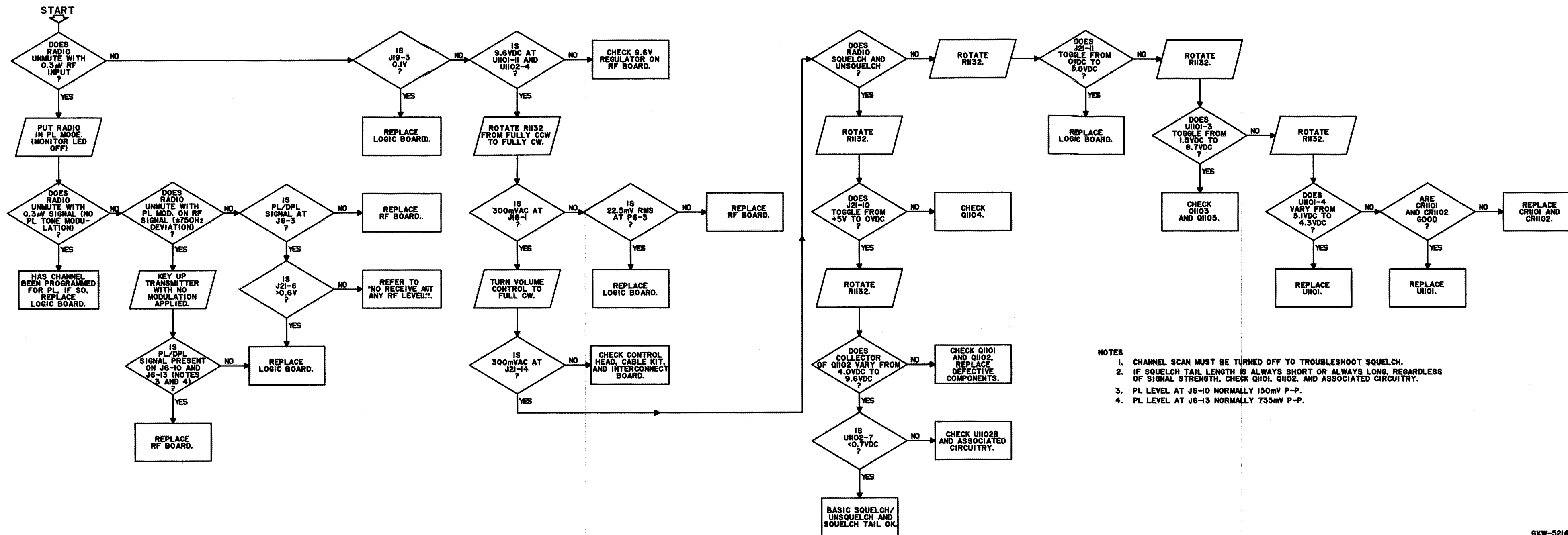
RADIO WORKS ON SOME CHANNELS BUT NOT OTHERS



GXW-5212-0

BAD SQUELCH OR PL/DPL

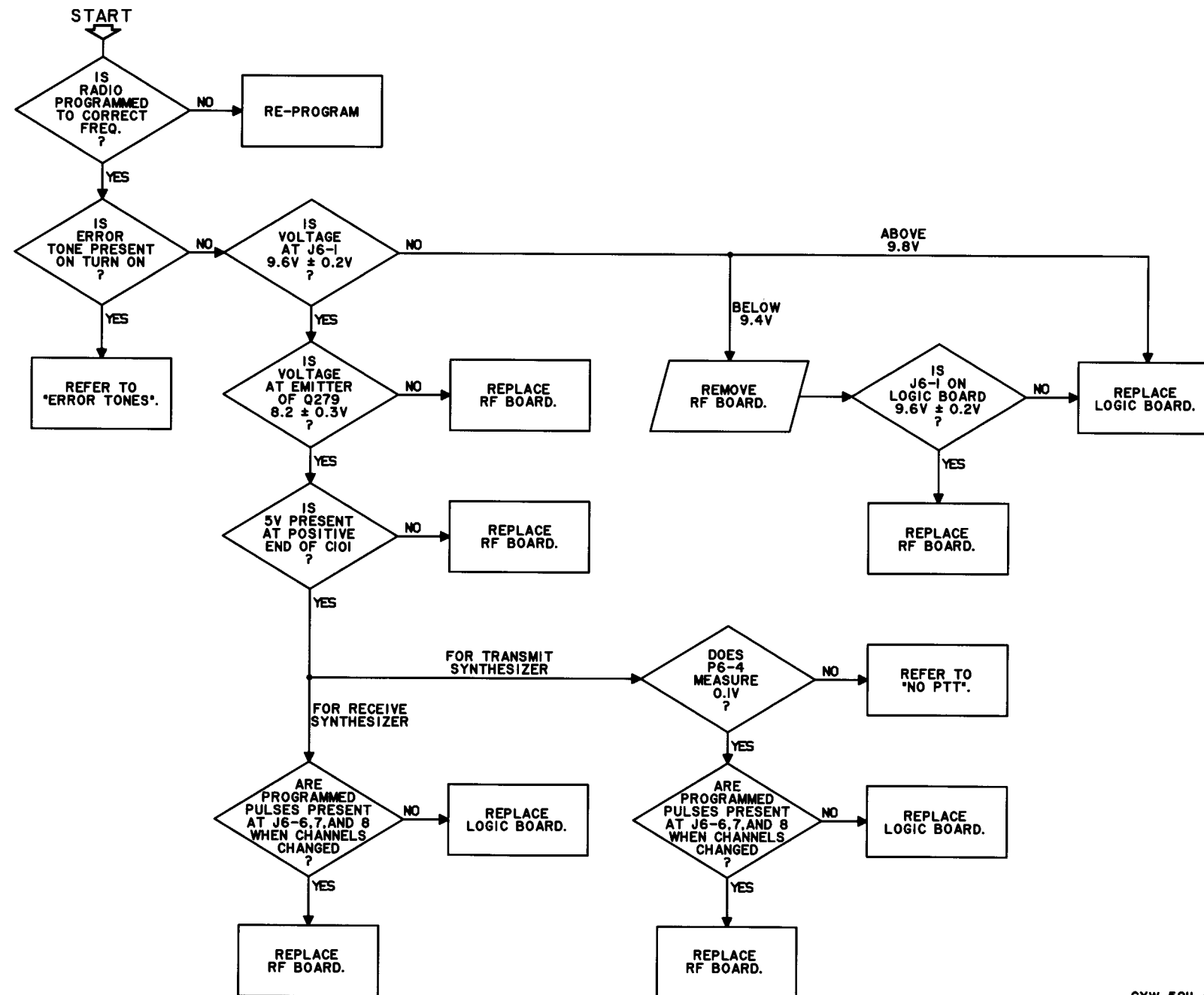
SEE NOTES 1 AND 2.



- 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.

GXW-5214-0

SYNTHESIZER OUT OF LOCK



6XW-5211-0

BAD TRANSMIT MODULATION

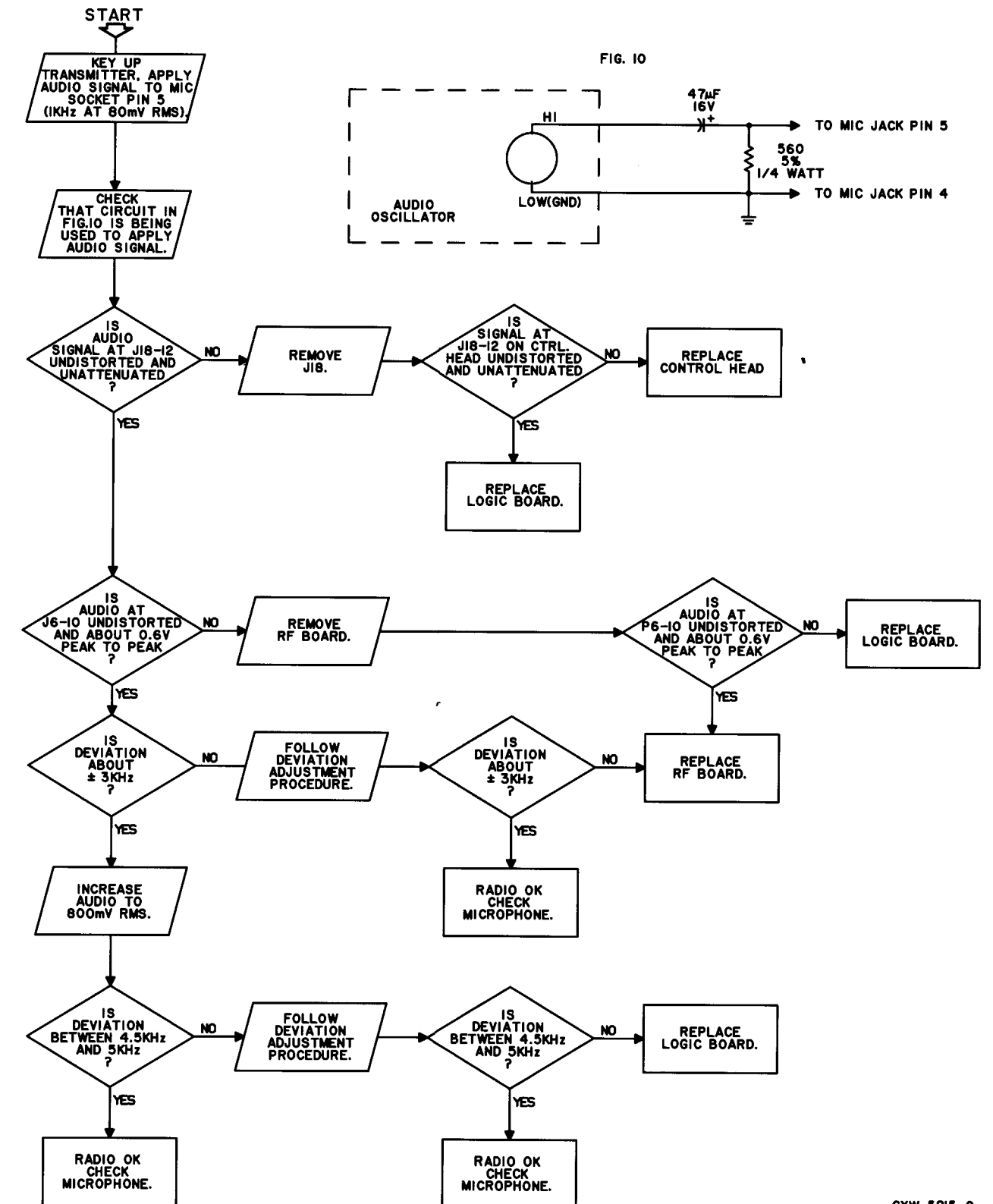
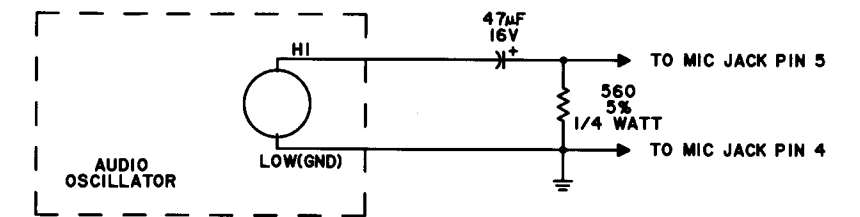
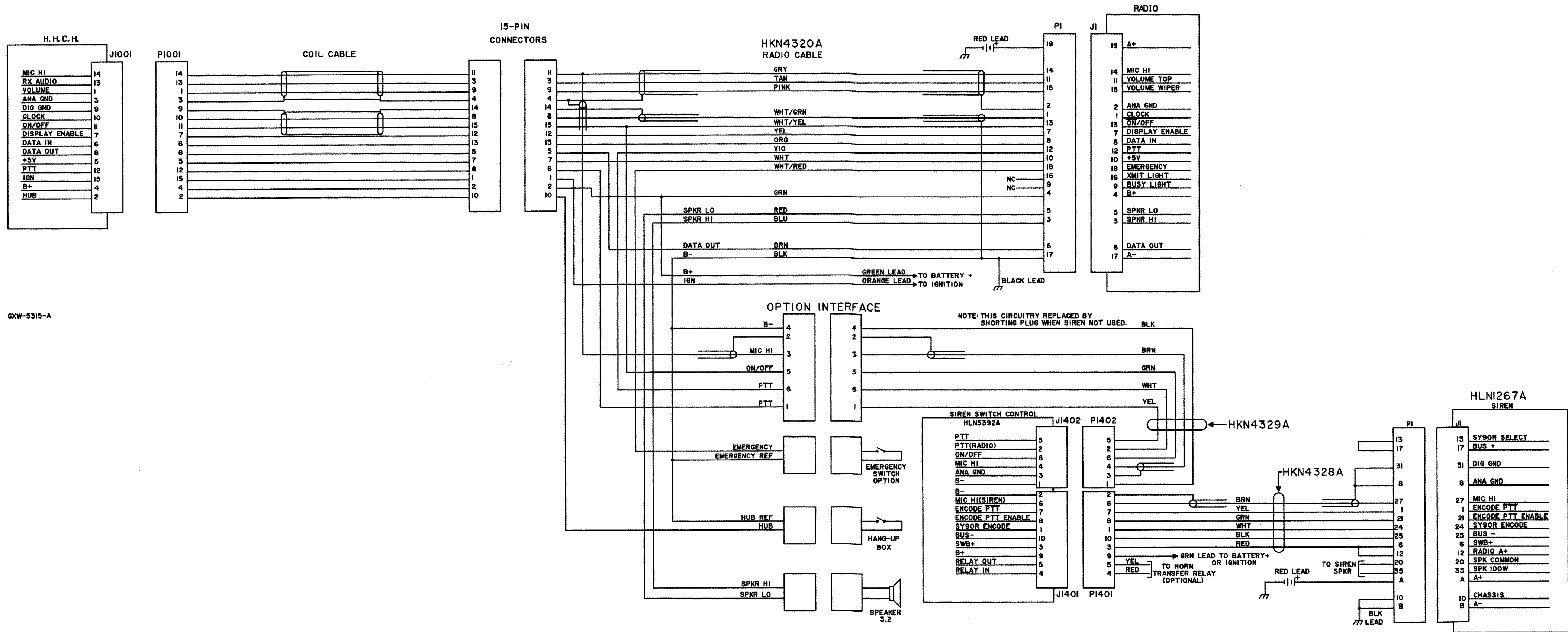


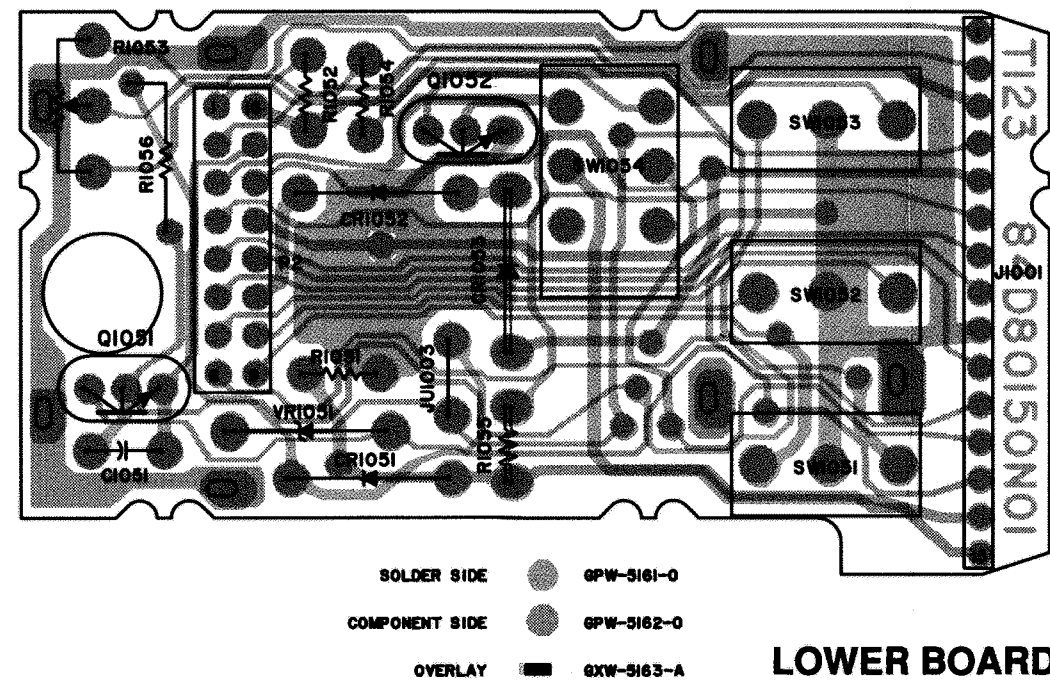
FIG. 10



6XW-5215-0



6XW-5315-A

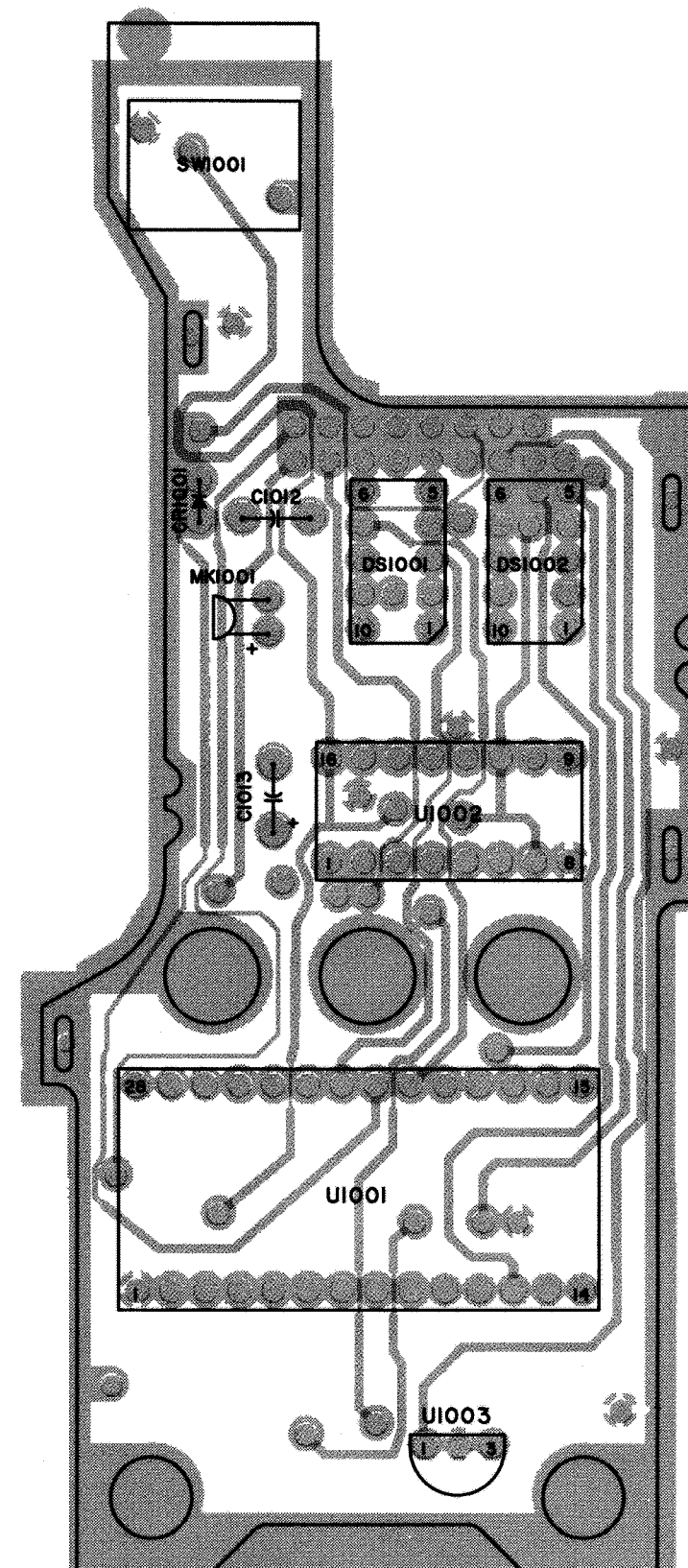


LOWER BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, μF $\pm 10\%$ 50V (unless otherwise stated)		
C1001-1007	21-11032A33	.100
C1008,1009	21-11032A09	.001
C1010	21-11032A33	.100
C1011	21-11032A09	.001
C1012	23-11054H08	10, 25V, tantalum
C1013	23-84538G03	.1, $\pm 20\%$, 35V, tantalum
C1014-1017	21-11032A09	.001
C1018,1019	21-11032A33	.100
C1051	08-11051A01	.001, $\pm 5\%$, 63V
diode (see note)		
CR1001	48-05504C01	LED
CR1051	48-11034A01	silicon
CR1052,1053	48-82466H18	silicon
indicator		
DS1001,1002	48-80187G05	LED, 7 segment
connector receptacle		
J1	28-80195N01	male, 15-pin right angle
J2	09-80196N01	male, 16-pin
MK1001	50-80258E04	mic cartridge
connector plug		
P2	28-80085E32	male, 16-pin
transistor (see note)		
Q1001-1003	48-80141L04	NPN
Q1051,1052	48-11043C07	NPN
jumper		
JU1003	0611009F23	0 ohm resistor
resistor, fixed, Ω $\pm 5\%$, 1/8 watt (unless otherwise stated)		
R1001-1010	06-11077A58	10k
R1011	06-11077A90	4.7k
R1012-1013	06-11077A98	10k
R1014	06-11077A90	4.7k
R1015,1016	06-11077A74	1k
R1017	06-11077A90	4.7k
R1018	06-11077A98	10k
R1019	06-11077A90	4.7k
R1020	06-11077A74	1k
R1021	06-11077A82	2.2k
R1022	06-11077A74	1k
R1023	06-11077B23	100k
R1024	08-11077A38	33
R1025	06-11077A74	1k
R1051	06-11009E73	10k
R1052	06-11009E11	27
R1054	06-11009E61	3.3k
R1055,1056	06-11009E73	10k
switch		
SW1001	40-80067H01	push button
SW1051,1052	40-80123H01	toggle
SW1053	40-80123H06	toggle
SW1054	40-80065E01	push button
integrated circuit (see note)		
U1001	51-80135C08	LED display driver
U1002	51-84887K36	shift register, 8 BIT static
U1003	51-84621K27	regulator, 5V
voltage regulator (see note)		
VR1001-1007	48-80140L06	5.1V zener
VR1008	48-80140L07	5.6V zener
VR1009,1011	48-80140L06	5.1V zener
VR1012	48-80140L17	12V zener
VR1051	48-11034A23	2.7V zener

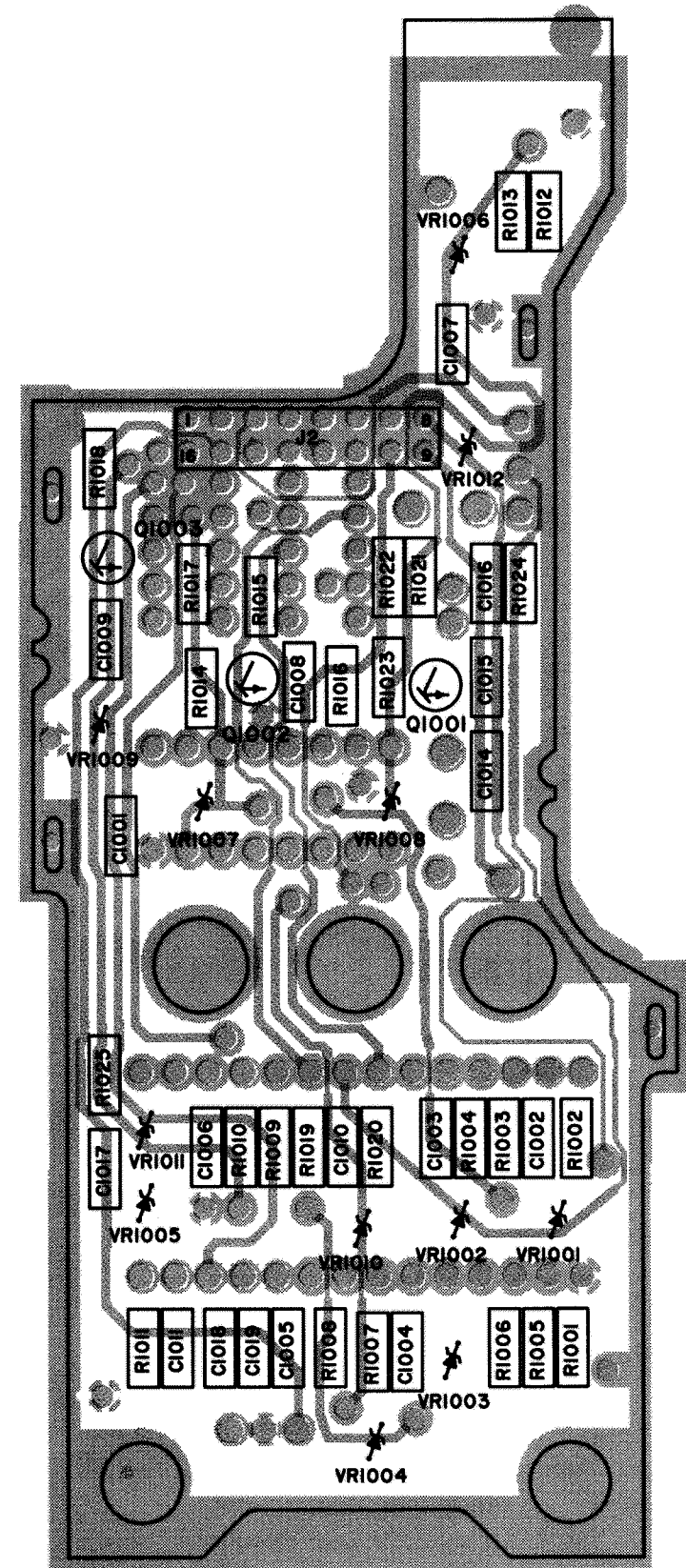
6/15/88

COMPONENT SIDE



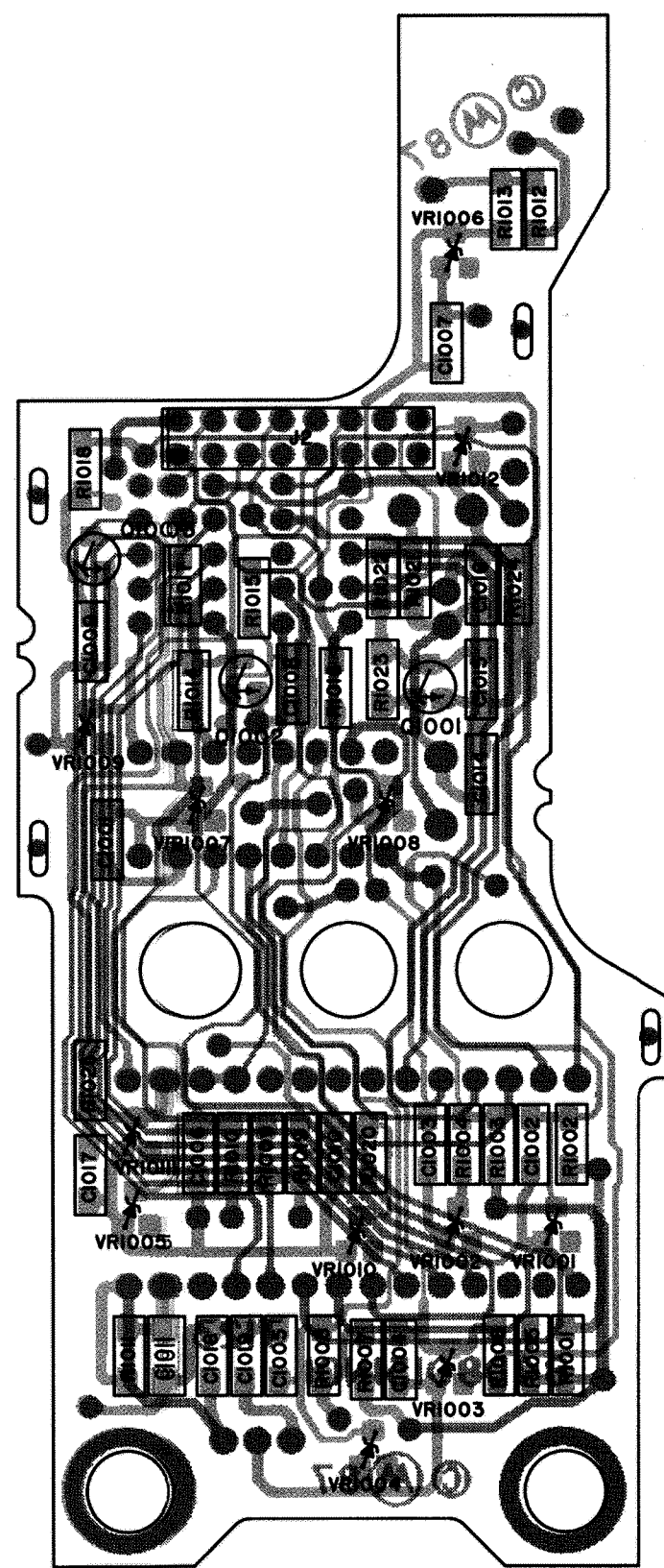
COMPONENT SIDE

UPPER BOARD



INNER TRACK - 1 GPW-5594-0
 INNER TRACK - GND GPW-5595-0
 OVERLAY GXW-5166W02-0

SOLDER SIDE



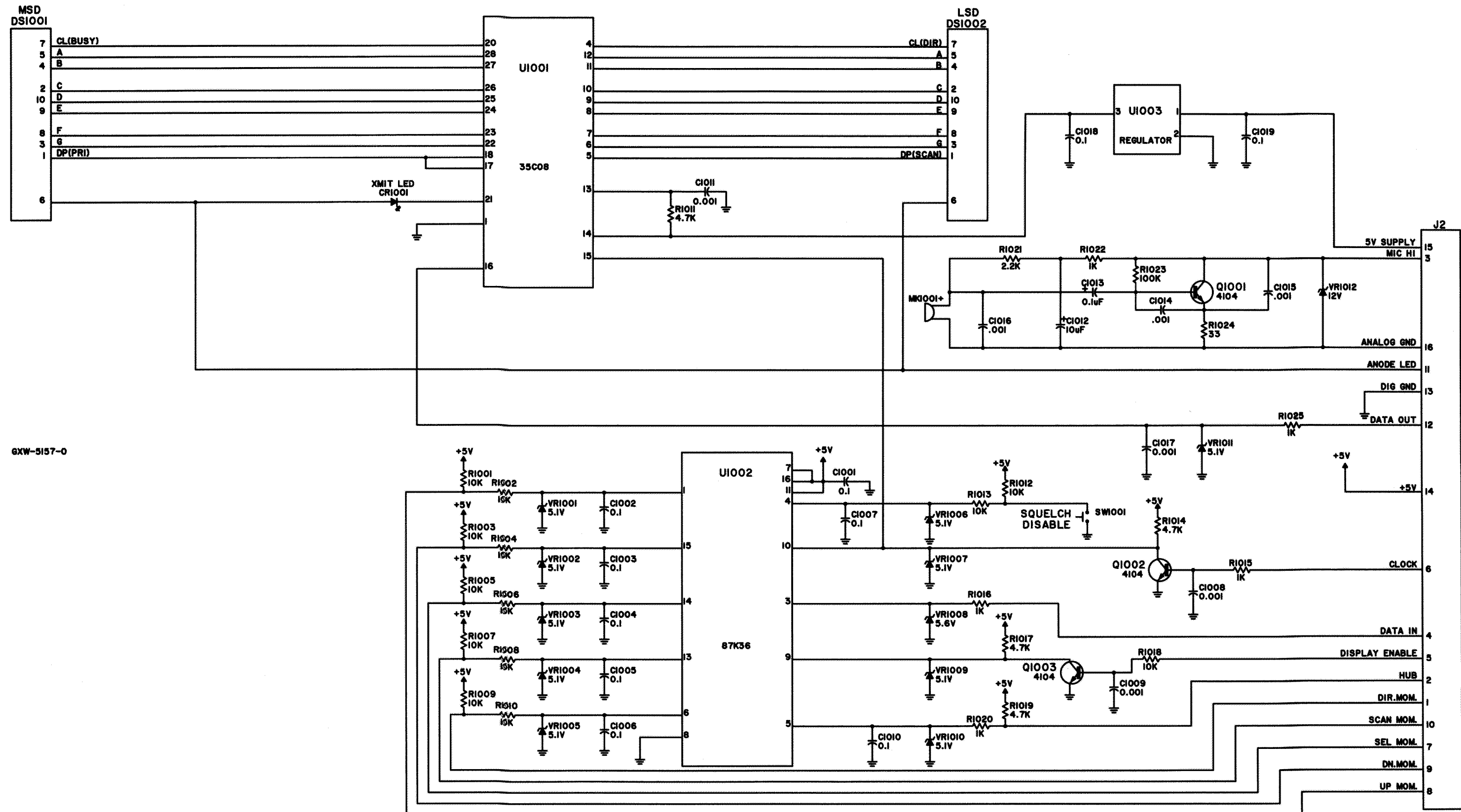
SOLDER SIDE GPW-5164-0
 COMPONENT SIDE GPW-5165-0
 OVERLAY GXW-5166W02-0

SOLDER SIDE

MSD
DS1001

7 CL(BUSY)
 5 A
 4 B
 2 C
 10 D
 9 E
 8 F
 3 G
 1 DP(PRI)
 6

6XW-5157-0



parts list

HCN4037A Basic Control Head w/Talkaround (16F)
HCN4038A Basic Control Head w/Scan & Talkaround (8F)
HCN4033A Basic Control Head w/Scan (8F)
HCN4034A Basic Control Head (16F)

MXW-5150-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF ±10% 50V (unless otherwise stated)		
C1003-1009	21-11032A33	.100
C1010	23-11019A20	10, ±20%, 25V electrolytic (8F only)
C1011	21-11032A33	.100
C1012,1013	21-11032A09	.001
C1014,1015	21-11032A33	.100

indicator
DS1001-1003 65-83376K01 incandescent lamp

connector receptacle
J104-106 09-80051B01 female, 2-contact, lamp socket
J1002 28-84324M01 male, 2-pin

jumper
JU1001-1003 06-11077A01 0 ohm

transistor (see note)
Q1001-1006 48-80141L04 NPN

resistor, fixed, Ω ±5%, 1/8 watt (unless otherwise stated)

R1002	06-11077A86	3.3k
R1003-1004	06-11077A98	10k
R1005	06-11077A90	4.7k
R1006	06-11077A74	1k
R1007,1008	06-11077A98	10k
R1009	06-11077A36	27
R1010	06-11077A90	4.7k
R1011-1020	06-11077A98	10k
R1021	06-11077A74	1k
R1022	06-11077A98	10k
R1023	06-11077A74	1k
R1024	06-11077A98	10k
R1025,1026	06-11077A74	1k
R1027	06-11077A90	4.7k
R1028	06-11077A98	10k
R1029	06-11077A60	270
R1030,1031	06-11077A98	10k

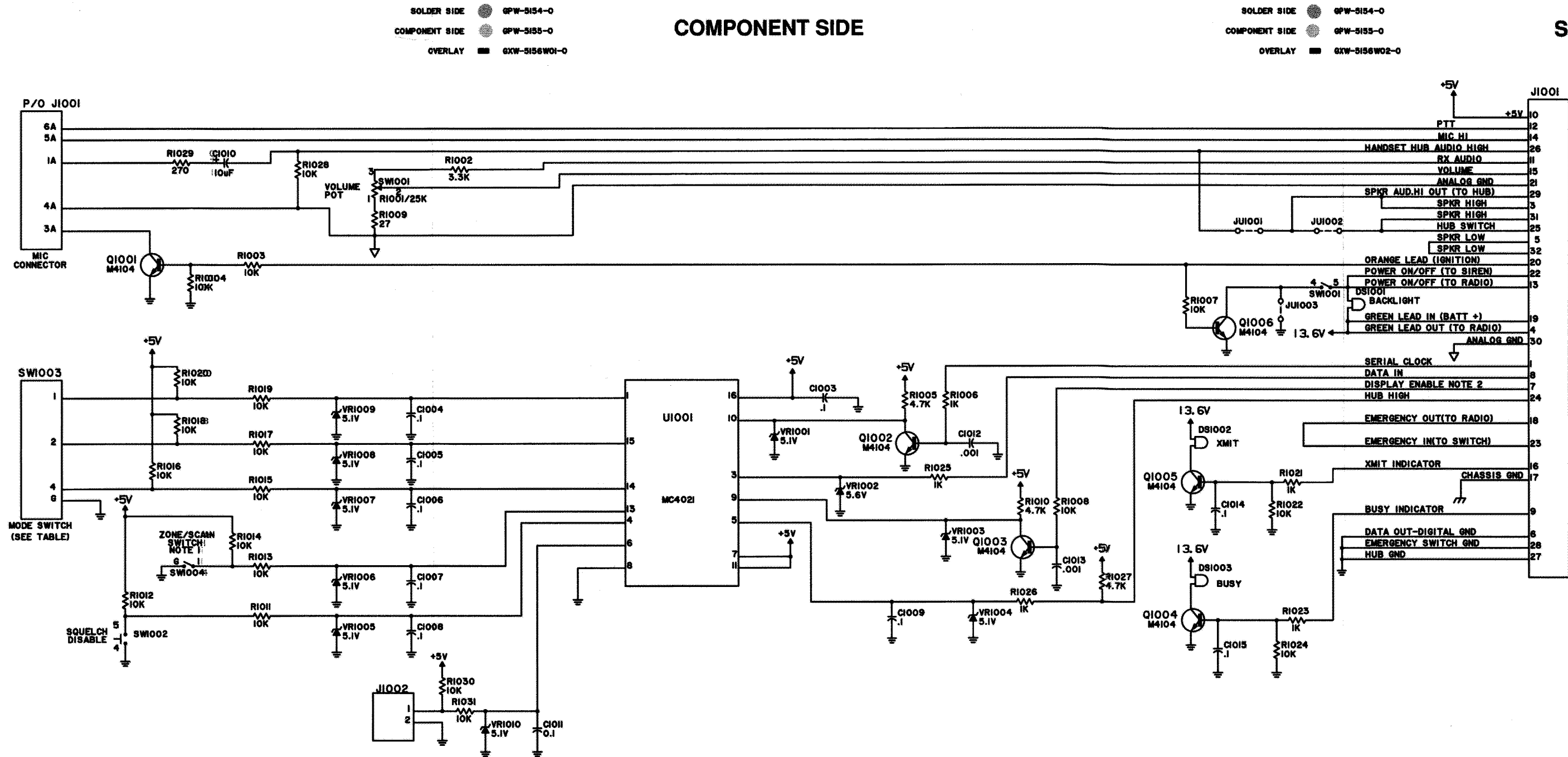
switch
SW1001 18-80126A03 potentiometer, 25k, ±30%, .16W
SW1002 40-80127A03 push button
SW1003 40-80166N01 rotary 8 position
SW1004 40-80166N02 rotary 2 position

integrated circuit (see note)
U1001 51-84887K36 8 bit shift register

voltage regulator (see note)
VR1001 48-80140L06 1.5V zener
VR1002 48-80140L07 5.6V zener
VR1003-1010 48-80140L06 5.1V zener

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

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Schematic, Circuit Board Diagram, and Parts List for
HCN4033A, HCN4034A, HCN4037A, HCN4038A for
Control Head (Clam Shell)

PW-5271-A

(Sheet 1 of 2)

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GKW-5149-0

BASIC CONTROL HEAD

IGNITION	20
B+	19
MIC HI	14
RX AUDIO	11
VOLUME	15
ANALOG GND	21
N.C.	2
CLOCK	1

+5V	10
PTT	12
DATA IN	8
XMIT LIGHT	16
ON/OFF	13
EMERGENCY	18
DISPLAY ENABLE	7
BUSY LIGHT	9
B+	4
SPKR HI	3
SPKR LO	5
DATA OUT-DIG GND	6
CHASSIS	17

ON/OFF	22
ANALOG GND	30

HUB REF	27
HUB	24

EMERGENCY REF	28
EMERGENCY	23
SPKR LO	32
SPKR HI	31
SPKR AUDIO HI	29
HUB SWITCH	25
HANDSET AUDIO	26

PTT	6A
PTT REF	3A
AUDIO	1A
GND	4A
MIC HI	5A

J1001

PI001

20 ORANGE LEAD → TO IGNITION
19 GREEN LEAD → TO BATTERY +

14	BLK/YEL	14
11	BLK/BRN	11
15	BLK/GRN	15
21		
2		2
1	BRN	1
10	BLK	10
12	BLK/RED	12
8	GRY	8
16	BLK/BLU	16
13	BLK/ORG	13
18	BLK/GRY	18
7	VIO	7
9	WHT	9
4	YEL	4
3	ORG	3
5	GRN	5
6	BLU	6
17	BLK/VIO	17

22
30 } → TO SIREN
27
24 }
28
23 }
32
31 } → TO SPEAKER
29
25 } → HANDSET HUB
26

6A
3A
1A } → MICROPHONE
4A
5A

PI

RED LEAD 19

BLACK LEAD

RADIO

19	A+
14	MIC HI
11	VOLUME TOP
15	VOLUME WIPER
2	ANALOG GND
1	CLOCK
10	+5V
12	PTT
8	DATA IN
16	XMIT LIGHT
13	ON/OFF
18	EMERGENCY
7	DISPLAY ENABLE
9	BUSY LIGHT
4	B+
3	SPKR HI
5	SPKR LO
6	DATA OUT
17	A-

J1

GXW-5151-A

parts list

HLN5406A Advanced Control Head, 99F (Control Board) MXW-5584-O

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	21-11031A47	220 pF
C1012	08-11051A17	0.47, 63V
C1013,1014	21-11032A09	.001
C1015-1021	21-11032A21	0.01, ±10%
C1022	21-11032A09	.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
connector receptacle		
J1001	28-80228J01	connector, 50 position
jumper		
JU1001	06-11077A01	0-ohm resistor
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
R1002,1003	06-11077A90	4.7k
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	06-11077A90	4.7k
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	06-11077A90	4.7k
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

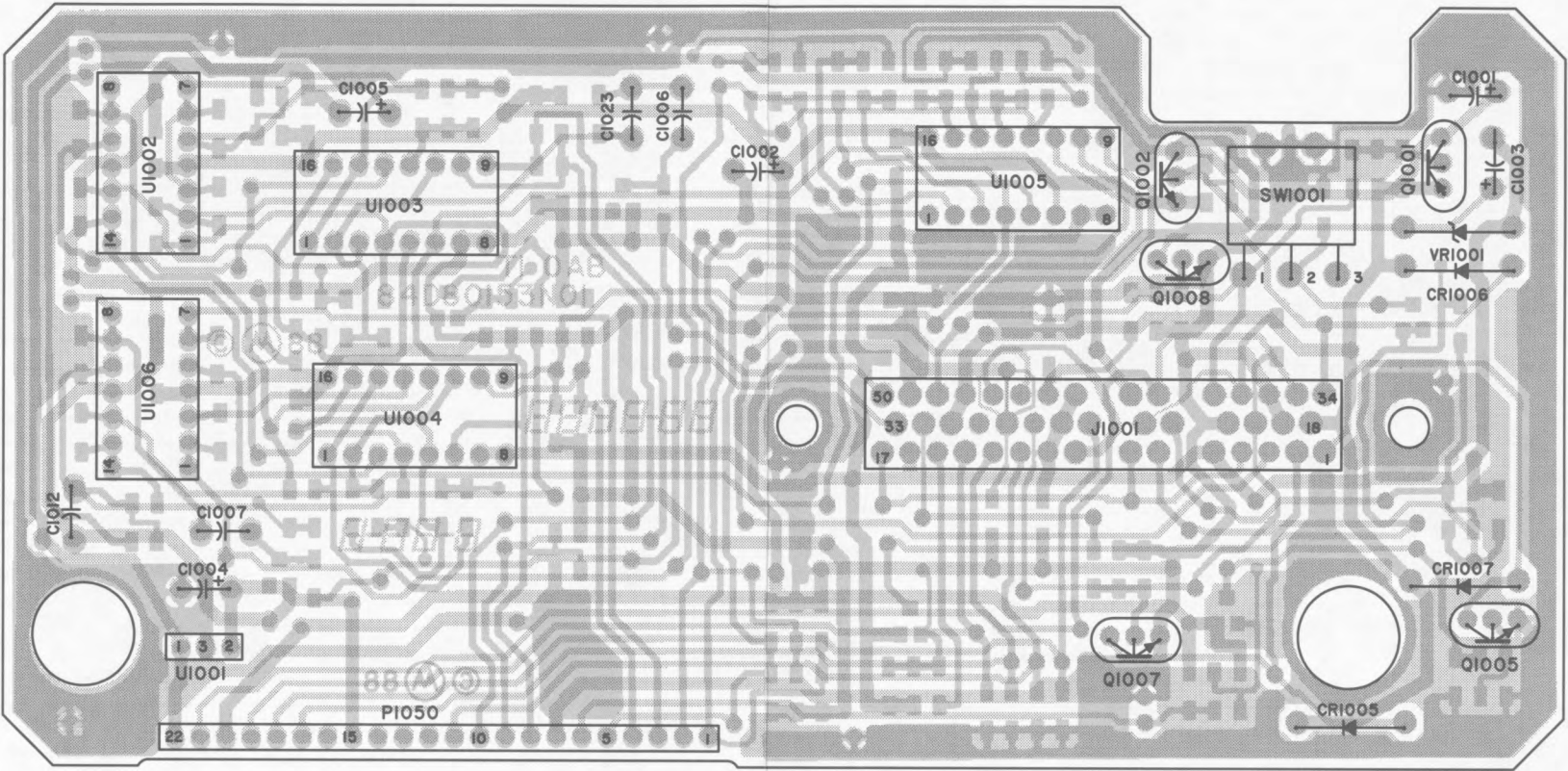
6/15/88
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematics, Circuit Boards Diagrams, and Parts List for Advanced Control Head

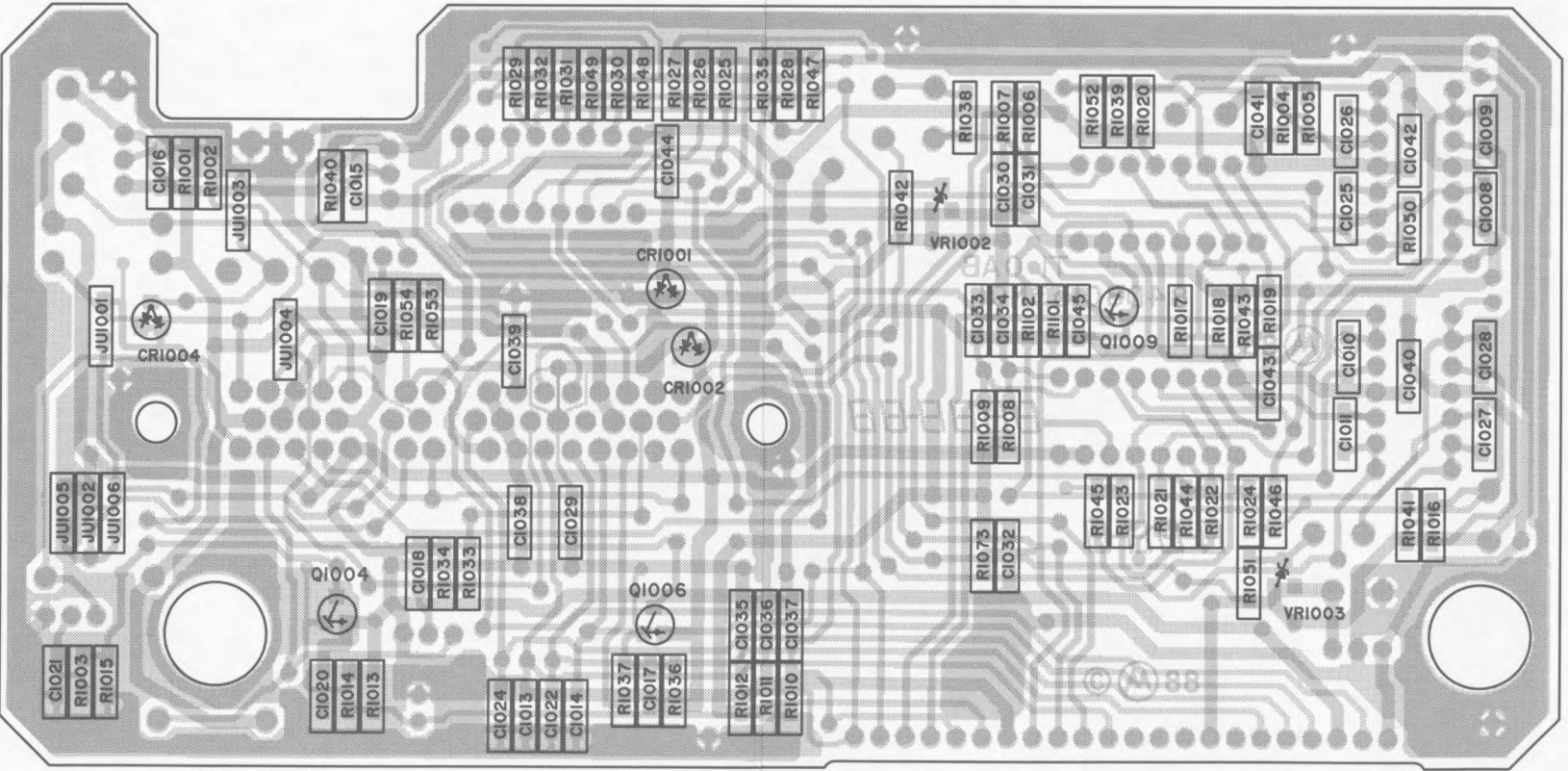
PW-5583-O

(Sheet 1 of 4)

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COMPONENT SIDE



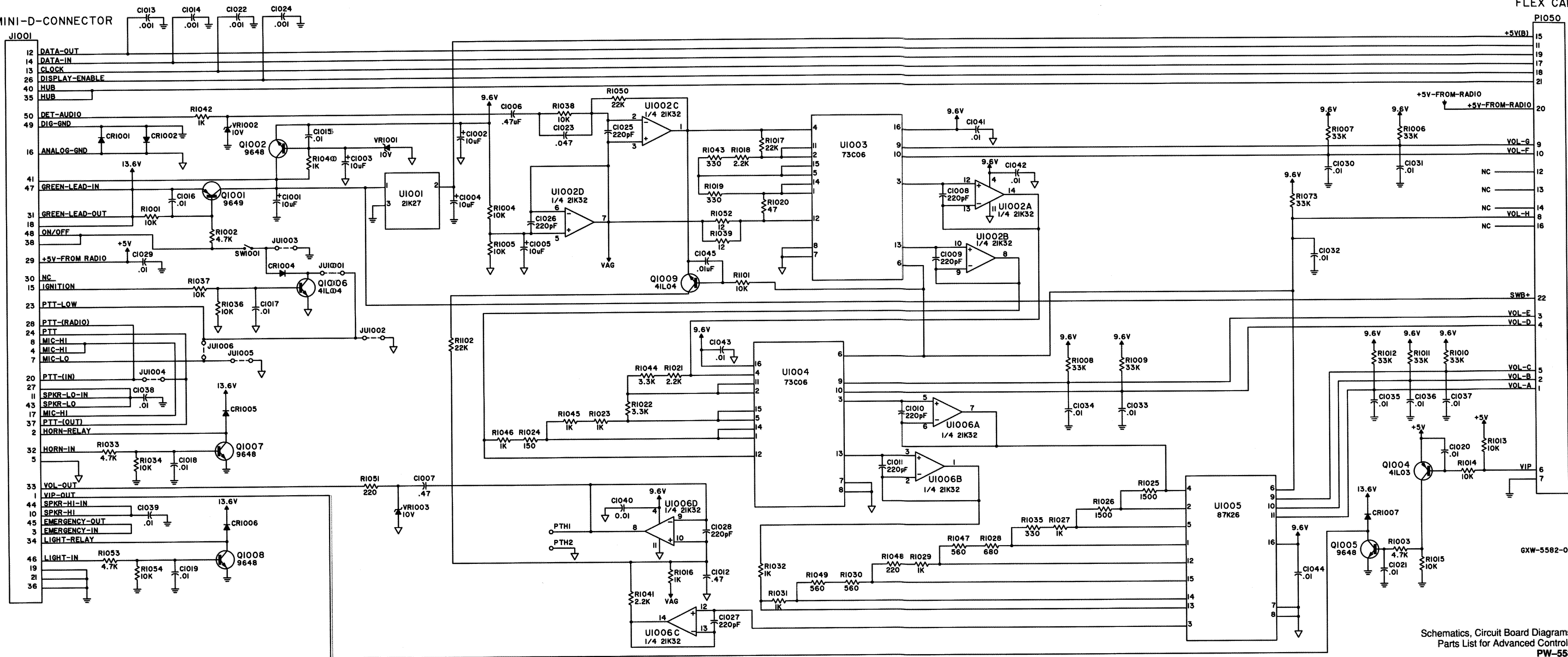
SOLDER SIDE

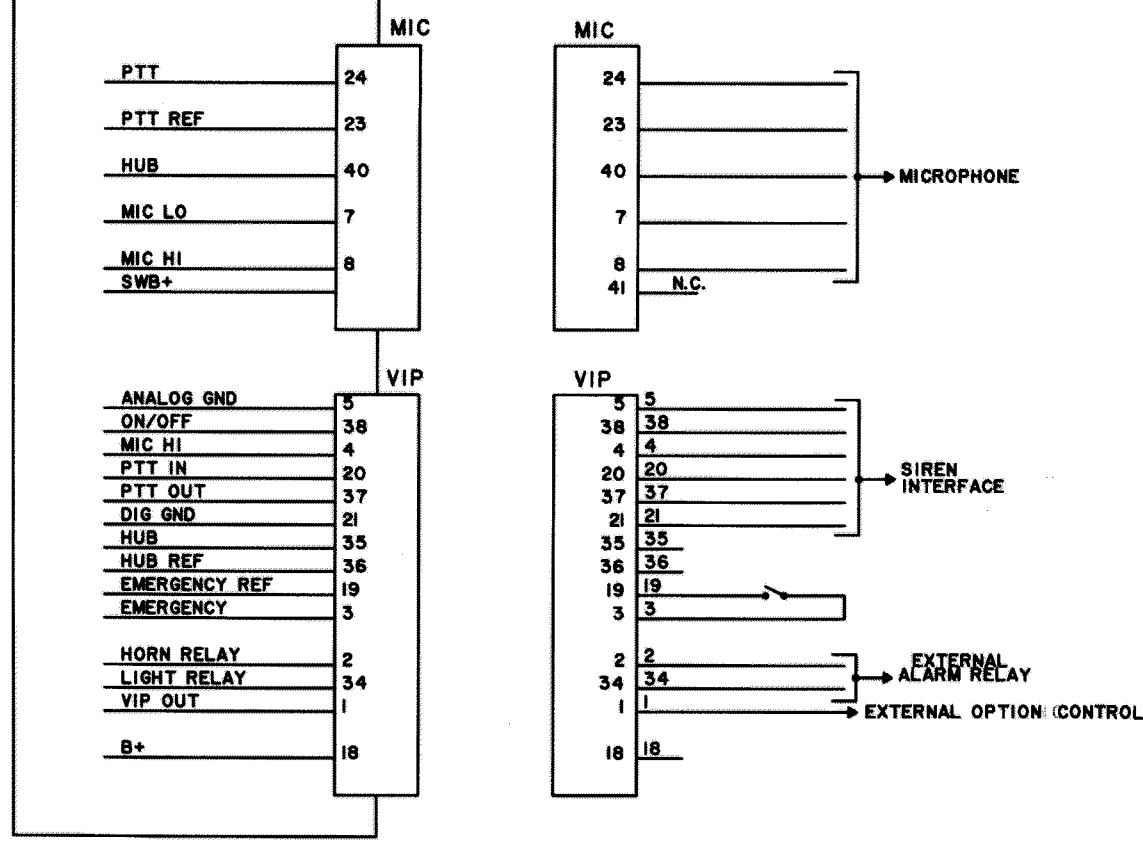
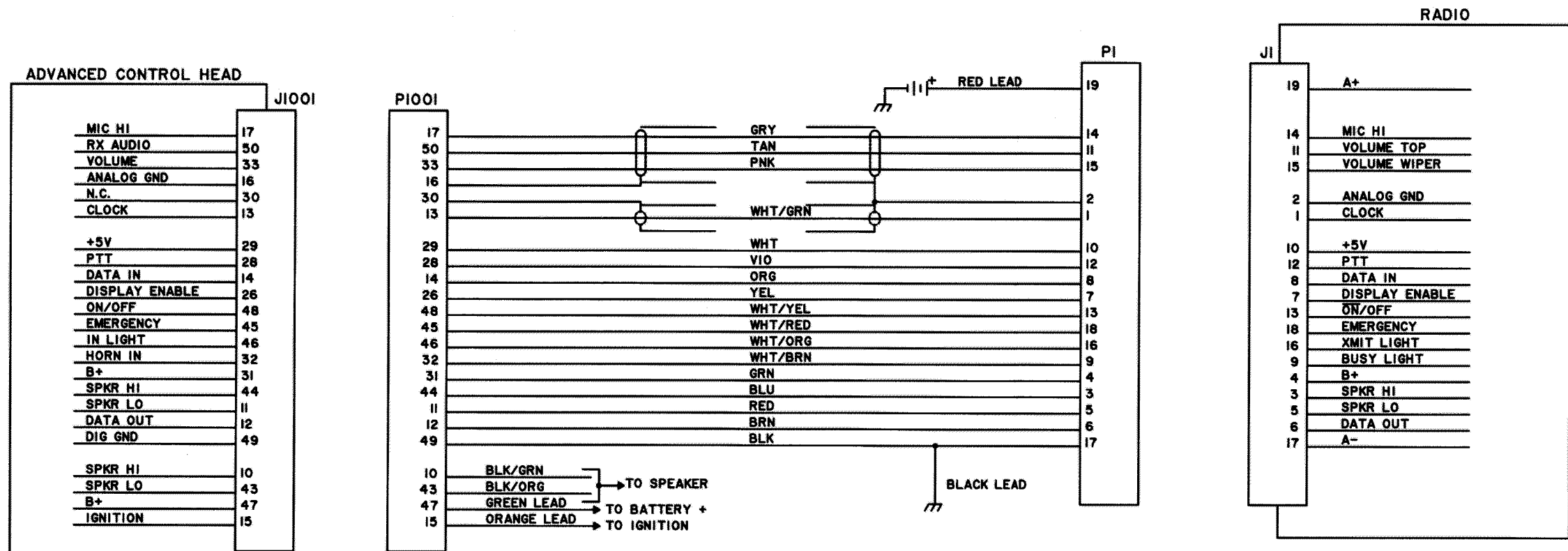
JUMPER CONFIGURATION	
JUMPER	FUNCTION
JU1001	CONNECTS PTT LOW TO IGNITION SENSE WHICH PREVENTS TRANSMITTING WHEN IGNITION IS OFF.
JU1002	CONNECTS PTT LOW TO ANALOG GROUND TO ALLOW TRANSMITTING REGARDLESS OF IGNITION SENSE.
JU1003	CONNECTS ON/OFF SWITCH TO DIGITAL GROUND ALLOWING RECEIVER OPERATION REGARDLESS 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.

MINI-D-CONNECTOR

FLEX CABLE

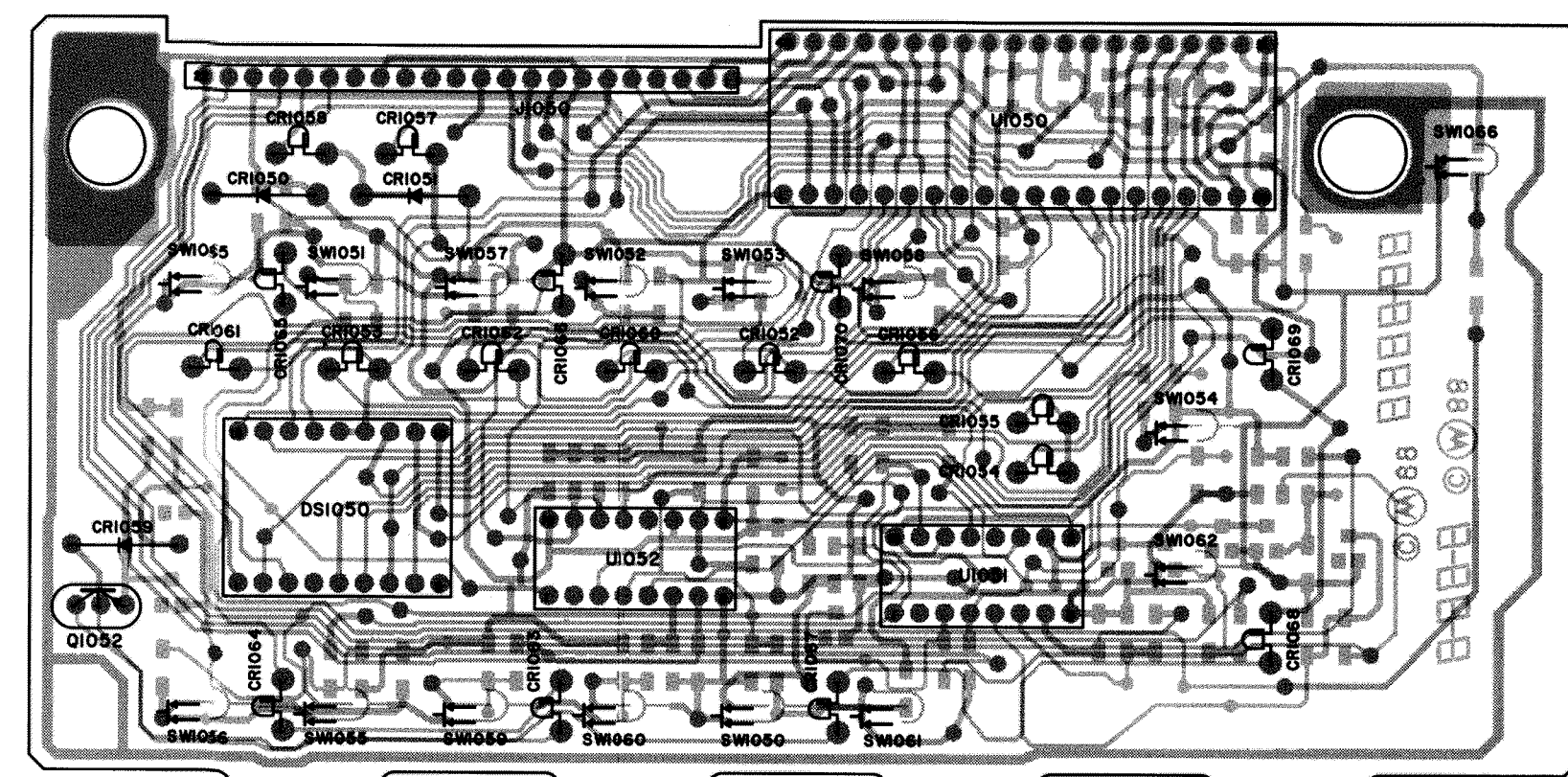




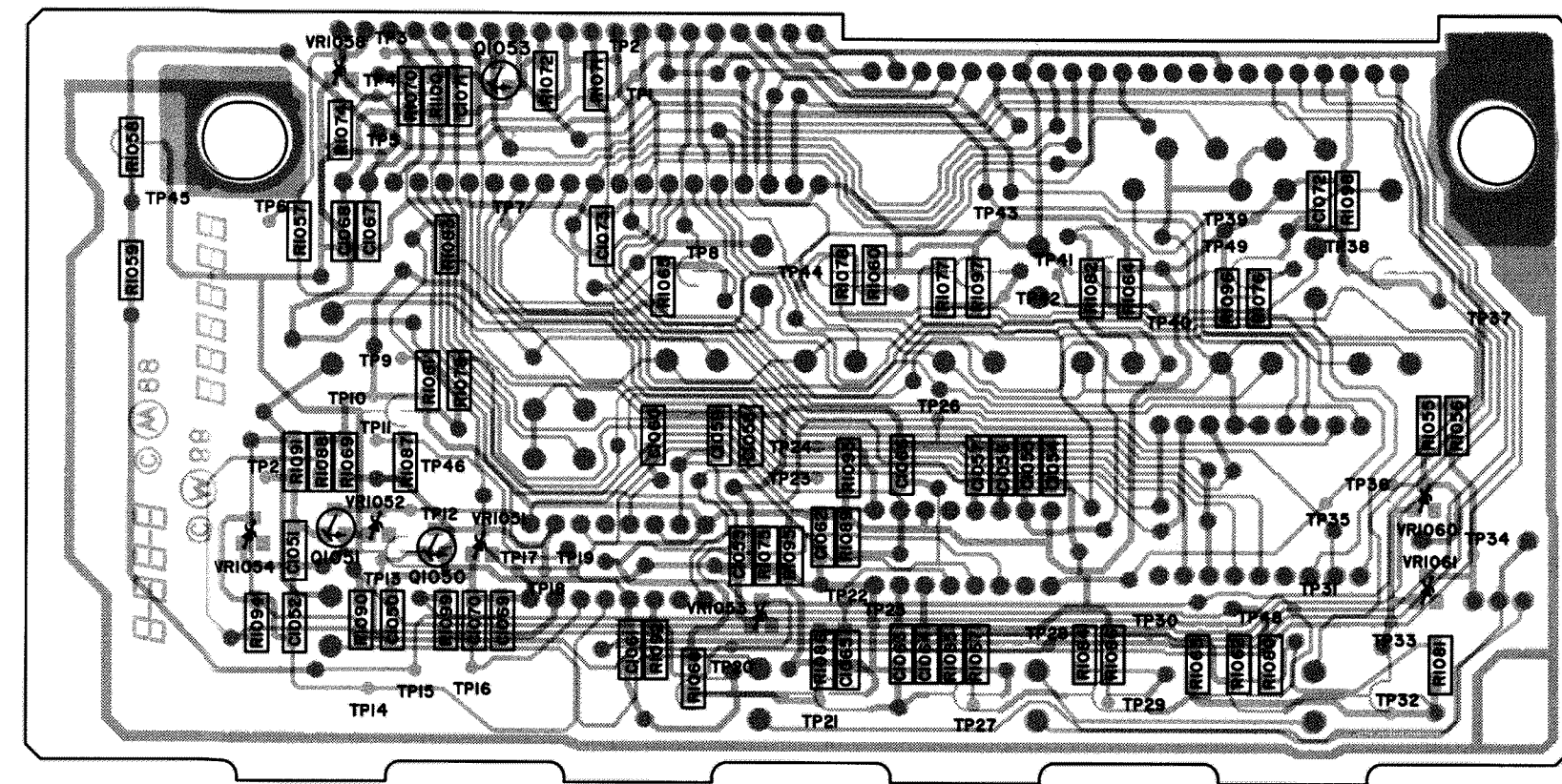
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, $\pm 10\%$, 50V (unless otherwise stated)		
C1050,1051	21-11032A09	0.001
C1052-1070	21-11032A33	0.1
C1071-1073	21-11032A21	0.01
diode (see note)		
CR1050,1051	48-82465H18	rectifier, silicon
CR1052,1053	48-80246K01	LED, red
CR1054	48-80246K02	LED, yellow
CR1055,1056	48-80246K01	LED, red
CR1057	48-80246K02	LED, yellow
CR1058	48-80246K01	LED, red
CR1059	48-80236C08	rectifier, silicon
CR1060-1062	48-80246K01	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
VR1060,1061	48-80140L17	zener, 12V

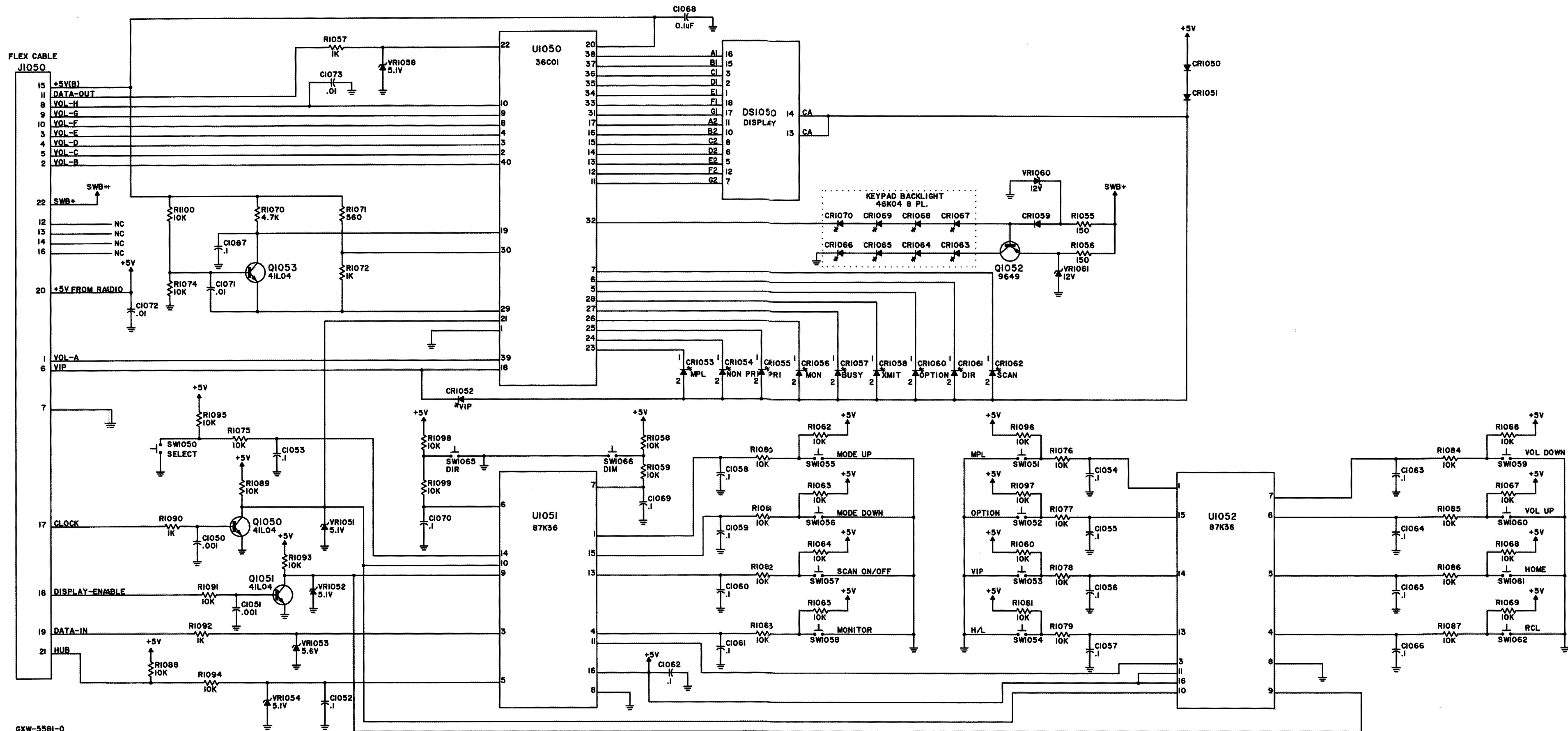
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

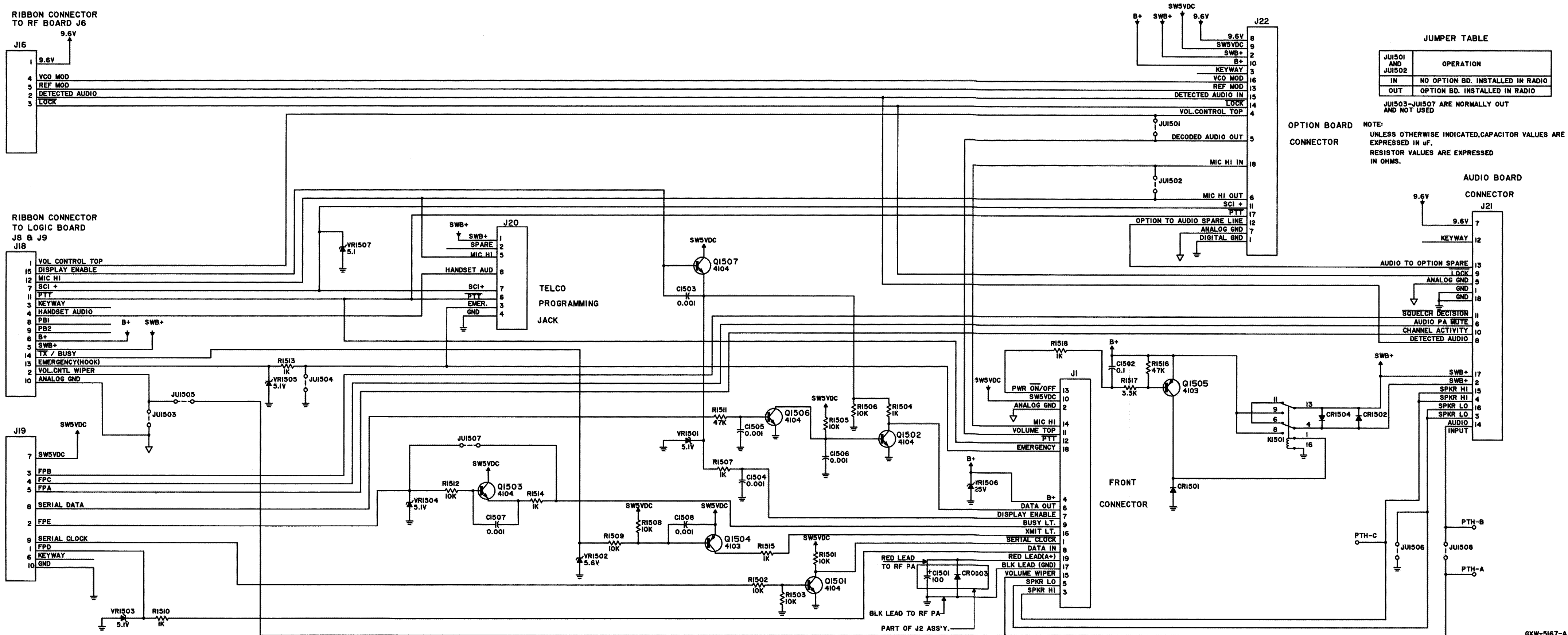


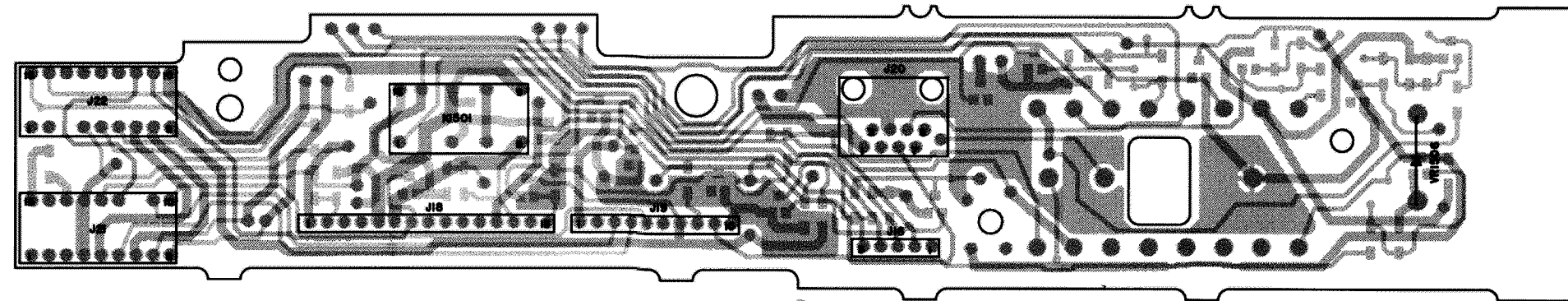
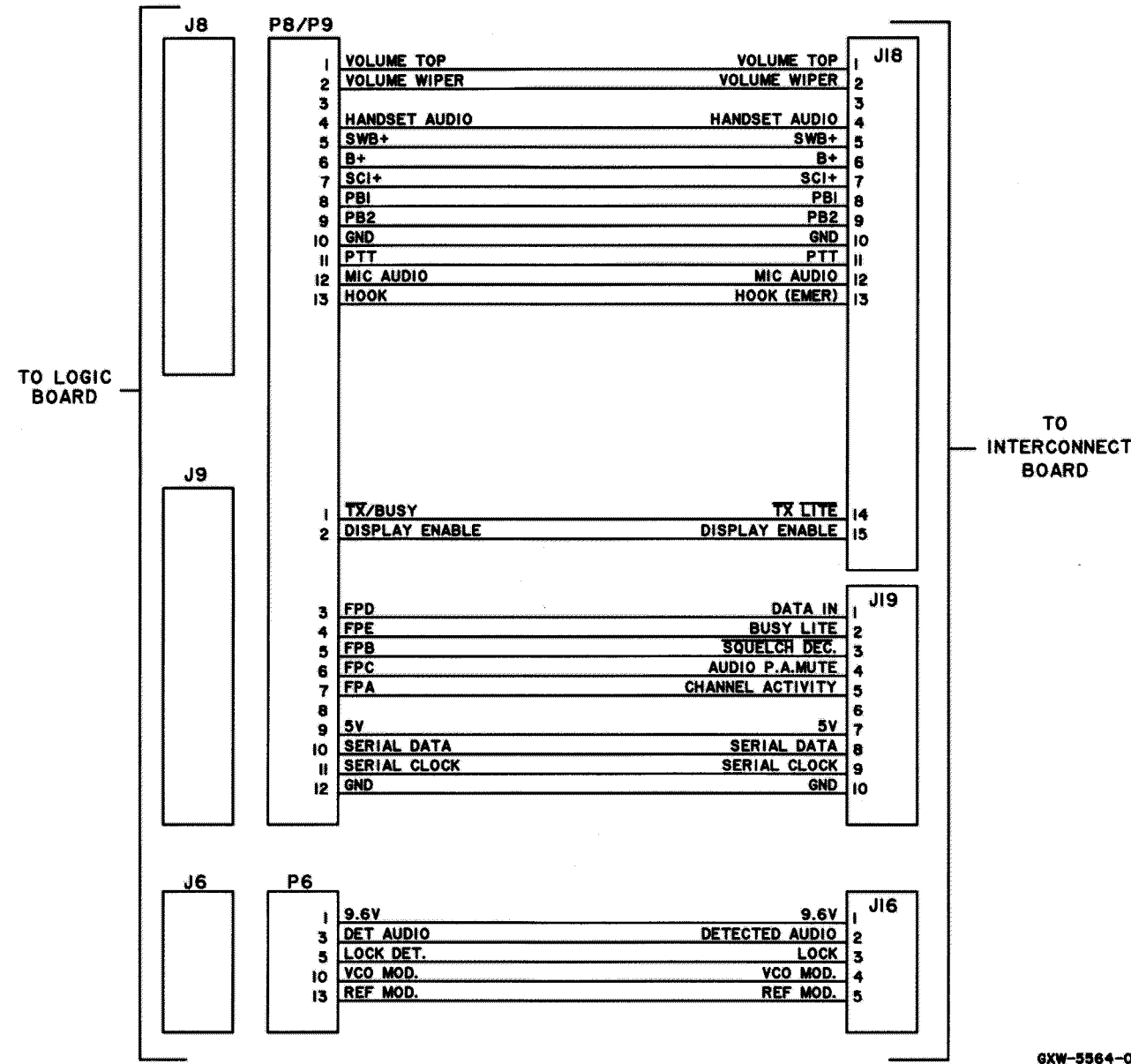
COMPONENT SIDE



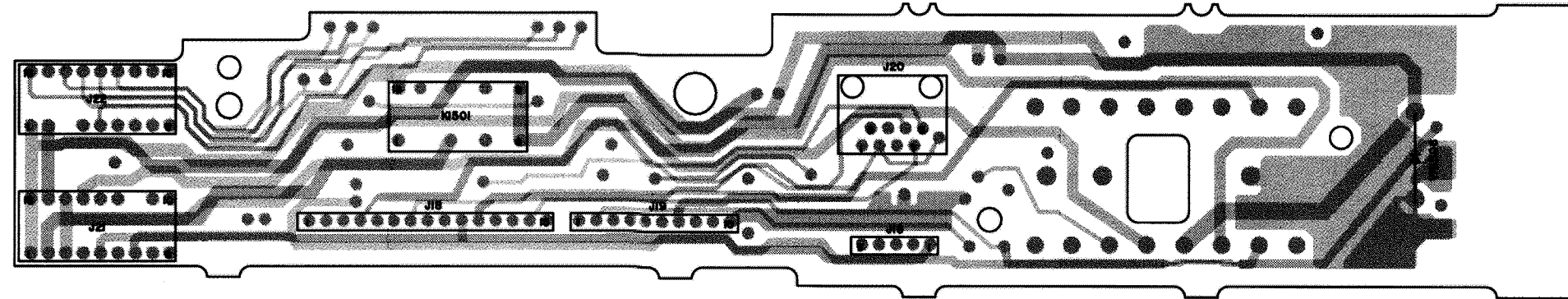
SOLDER SIDE



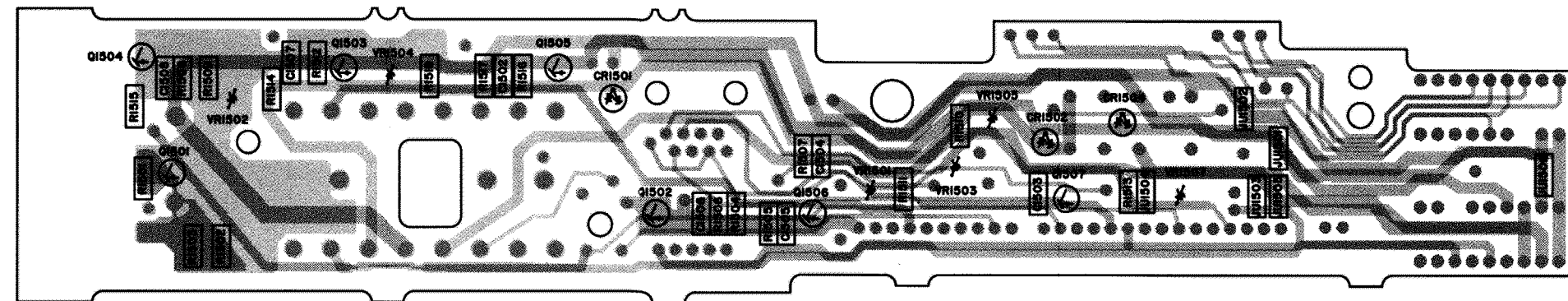




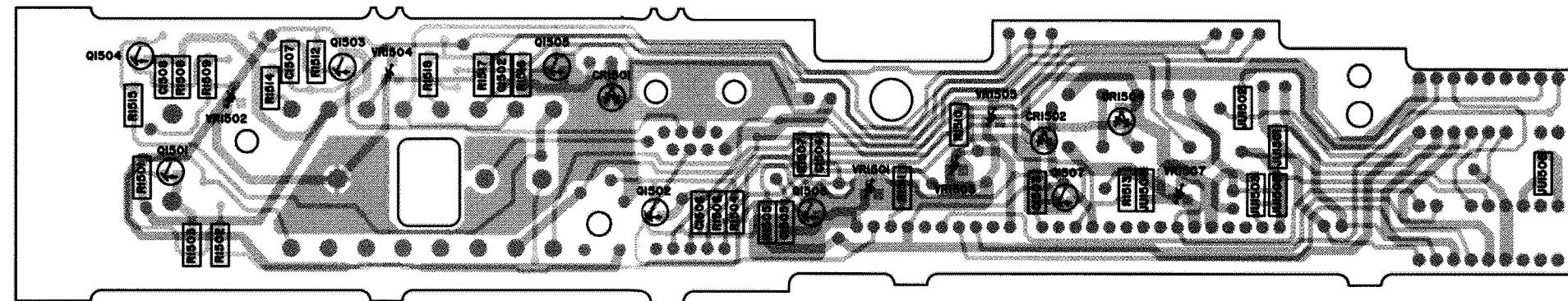
COMPONENT SIDE



COMPONENT SIDE I



SOLDER SIDE I



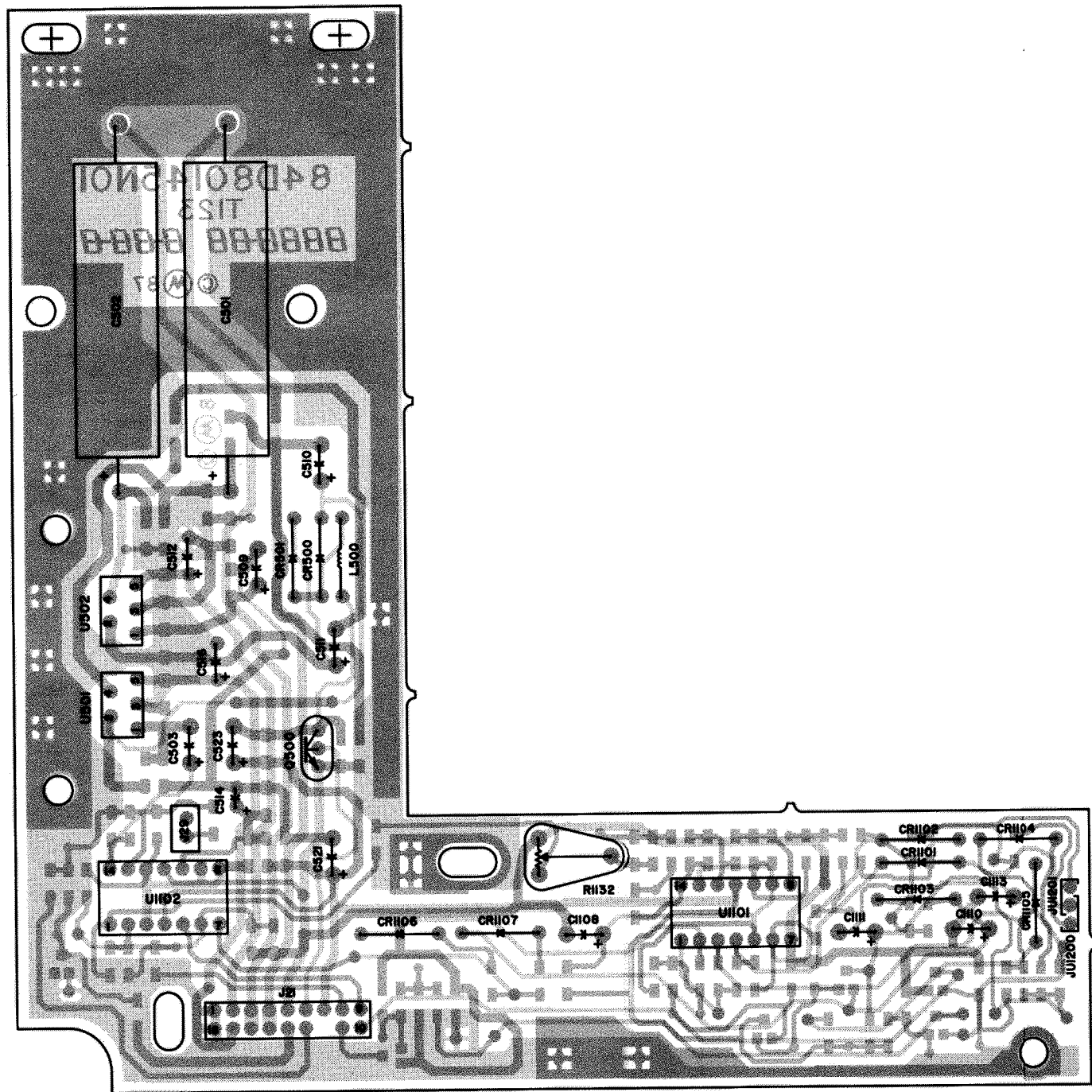
SOLDER SIDE

parts list

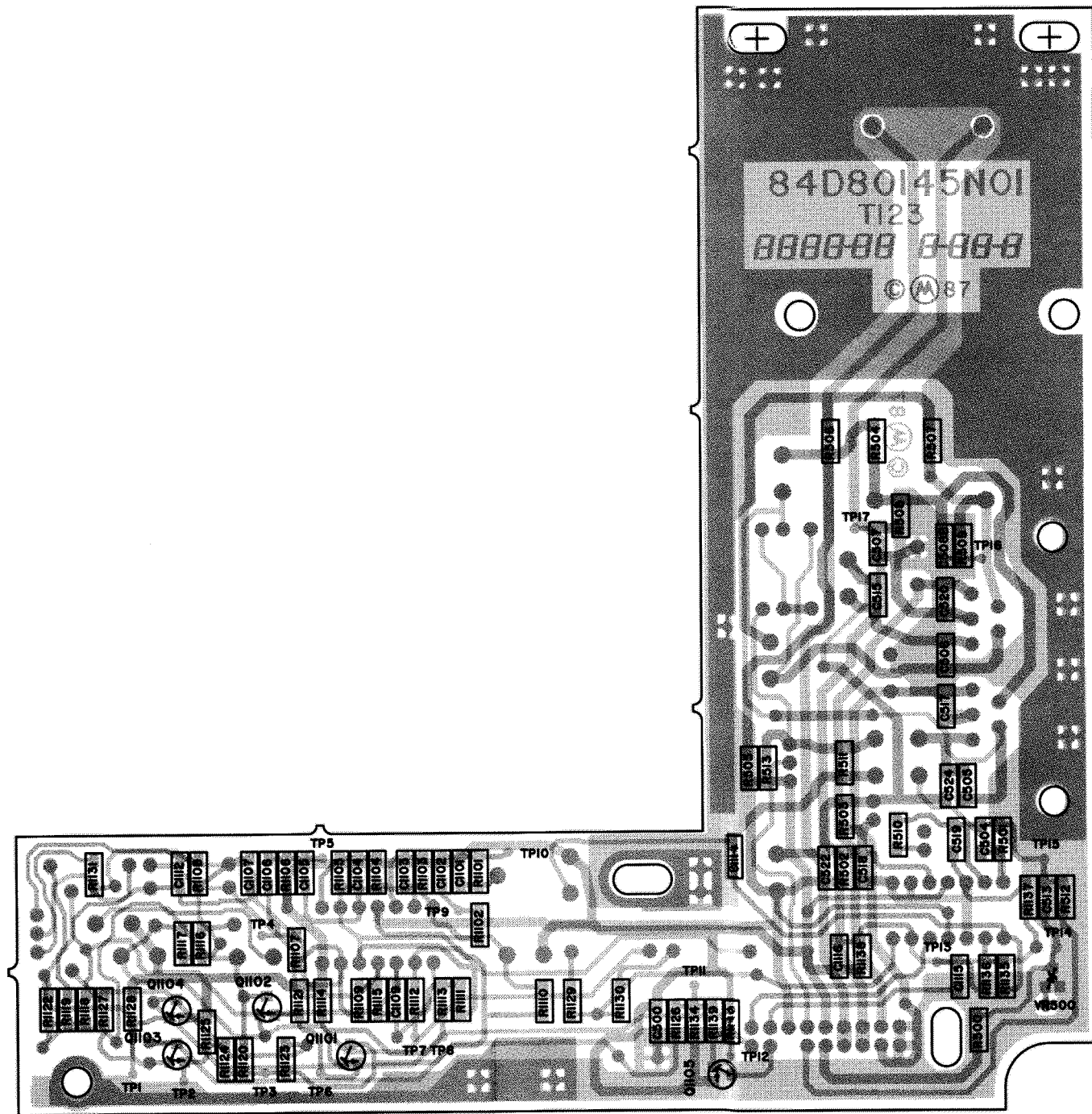
HLN5343A Interconnect Board MXW-5168-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, $\mu F \pm 10\%$ 50V (unless otherwise stated)		
C11-26	21-84874K01	470 pF, $\pm 20\%$, 250V
C28-29	21-84874K01	470 pF, $\pm 20\%$, 250V
C1501	23-80167C03	1, $\pm 20\%$, 25V electrolytic
C1502	21-11032A33	.100
C1503-1508	21-11032A09	.001
diode (see note)		
CR0003	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
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, $\Omega \pm 5\%$, 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)		
VR1501	48-80140L06	zener 5.1V
VR1502	48-80140L07	zener 5.6V
VR1503-1505	48-80140L06	zener 5.1V
VR1506	48-80236E07	zener 28V
VR1507	48-80140L06	zener 5.1V
mechanical parts		
26-80275A01		heat sink diode (left)
26-80274A01		heat sink diode (right)
64-80264A01		cable plug
03-10904A02		machine screw (2-used)

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



COMPONENT SIDE



SOLDER SIDE

parts list

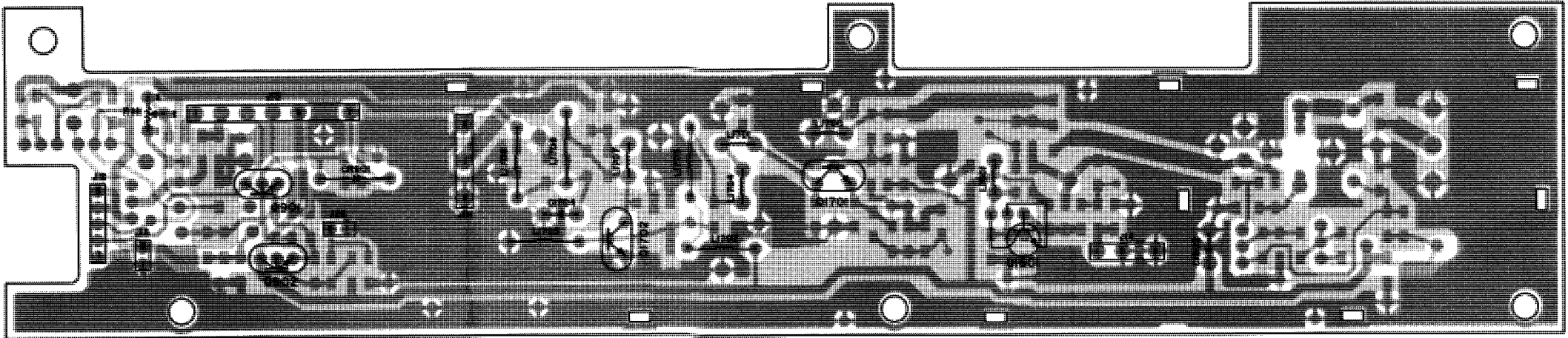
HLN5342A Audio Squelch Board MXW-5152-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, $\mu F \pm 10\%$ 50V (unless otherwise stated)		
C500	21-11032A21	.01
C501,502	23-80167C02	1000, 25V, electrolytic
C503	08-11051A09	.022, $\pm 5\%$, 63V
C504	21-11032A09	.001
C505,506	21-11031A47	220 pF, $\pm 5\%$, 50V
C507,508	21-11032A33	.100
C509	08-11051A17	.47, $\pm 5\%$, 63V
C510,511	23-11054G10	15, $\pm 20\%$, 25V tantalum
C513	21-11032A27	.033
C514	23-11054L06	1.0 tantalum
C515	21-11031A39	100, pF $\pm 5\%$
C516	23-84665F06	220, $-10\%+150\%$, 25V electrolytic
C517	21-11032A09	.001
C518,519	21-11031A39	100 pF $\pm 5\%$
C520	21-11032A09	.001
C521	23-11048C11	10, $\pm 20\%$, 35V, electrolytic
C522	21-11032A21	.01
C523	23-11048C11	10, $\pm 20\%$, 35V, electrolytic
C524	21-11031A29	39 pF, $\pm 5\%$
C1101	21-11032A09	.001
C1102	21-11032A33	.100
C1103	21-11031A47	220 pF, $\pm 5\%$
C1104	21-11031A37	82 pF, $\pm 5\%$
C1105	21-11032A21	.01
C1106	21-11032A13	.0022
C1107	21-11031A47	220 pF, $\pm 5\%$
C1108	23-11054H08	10, 25V, tantalum
C1109	21-11032A21	.01
C1110	23-11054L06	1.0, tantalum
C1111	23-11054M01	2.2, 35V tantalum
C1112	21-11032A09	.001
C1113	23-11054N02	1.5, 35V tantalum
C1114	21-11032A25	.022
C1115	21-11032A27	.033
C1116	21-11032A21	.01
diode (see note)		
CR500,501	48-11034A01	silicon
CR1101-1107	48-11034A01	silicon
connector receptacle		
JU1200	28-84318M07	male, 3-pin
JU1201	09-80080L01	female, 2-contact
J21	28-80085E31	male, 12-pin
J29	28-84324M01	male, 2-pin
coil, rf		
L500	24-82723H36	.41 μH
transistor (see note)		
Q500	48-11043C05	NPN
Q1101,1102	48-80141L02	NPN
Q1103	48-80141L01	PNP
Q1104,1105	48-80141L02	NPN

HLN5342A Audio Squelch Board MXW-5152-A (2)

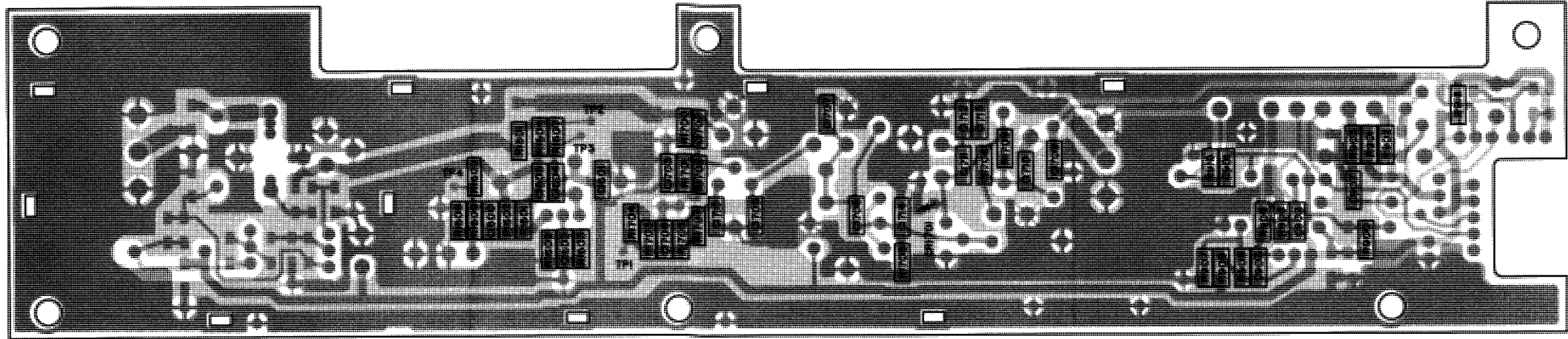
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
resistor, fixed, $\Omega \pm 5\%$, 1/8 watt (unless otherwise stated)		
R500-503	06-11077A99	10k
R504	06-11077A67	510
R505,506	06-11077A34	22
R507	06-11077A74	1k
R508,509	06-11077A02	1.0
R510	06-11077B23	100k
R511	06-11077A94	6.8k
R512	06-11077B23	100k
R513	06-11077A94	6.8k
R1101	06-11077B15	47k
R1102	06-11077A86	3.3k
R1103	06-11077B11	33k
R1104	06-11077A91	5.1k
R1105	06-11077B23	100k
R1106	06-11077A58	220
R1107	06-11077A78	1.5k
R1108	06-11077B15	47k
R1109	06-11077B31	220k
R1110	06-11077A86	3.3k
R1111	06-11077A58	220
R1112	06-11077A98	10k
R1113	06-11077A58	220
R1114	06-11077A86	3.3k
R1115	06-11077A98	10k
R1116	06-11077A94	6.8k
R1117	06-11077B27	150k
R1118	06-11077B27	150k
R1119	06-11077B01	12k
R1120	06-11077A98	10k
R1121	06-11077A70	680
R1122	06-11077B31	220k
R1123	06-11077B45	820k
R1124	06-11077A78	1.5k
R1125	06-11077A84	2.7k
R1126	06-11077B03	15k
R1127	06-11077A94	6.8k
R1128	06-11077A74	1k
R1129	06-11077B11	33k
R1130	06-11077B19	68k
R1131	06-11077B13	39k
R1132	18-84944C03	10k, $\pm 20\%$, .10W, potentiometer
R1134	06-11077B15	47k
R1135	06-11077B23	100k
R1136	06-11077A98	10k
R1137	06-11077B03	15k
R1138	06-11077A94	6.8k
R1139	06-11077B09	27k
R1140	06-11077A98	10k
integrated circuit (see note)		
U501,502	51-80065C03	audio PA
U1101	51-80067C04	quad operational amp
U1102	51-84621K32	quad operational amp
voltage regulator (see note)		
VR500	48-80140L15	zener, 10V

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



SOLDER SIDE ● 6PW-53H-0
COMPONENT SIDE ● 6PW-53I2-0
OVERLAY ■ 6XW-5282W01-A

COMPONENT SIDE



SOLDER SIDE ● 6PW-53H-0
COMPONENT SIDE ● 6PW-53I2-0
OVERLAY ■ 6XW-5282W02-A

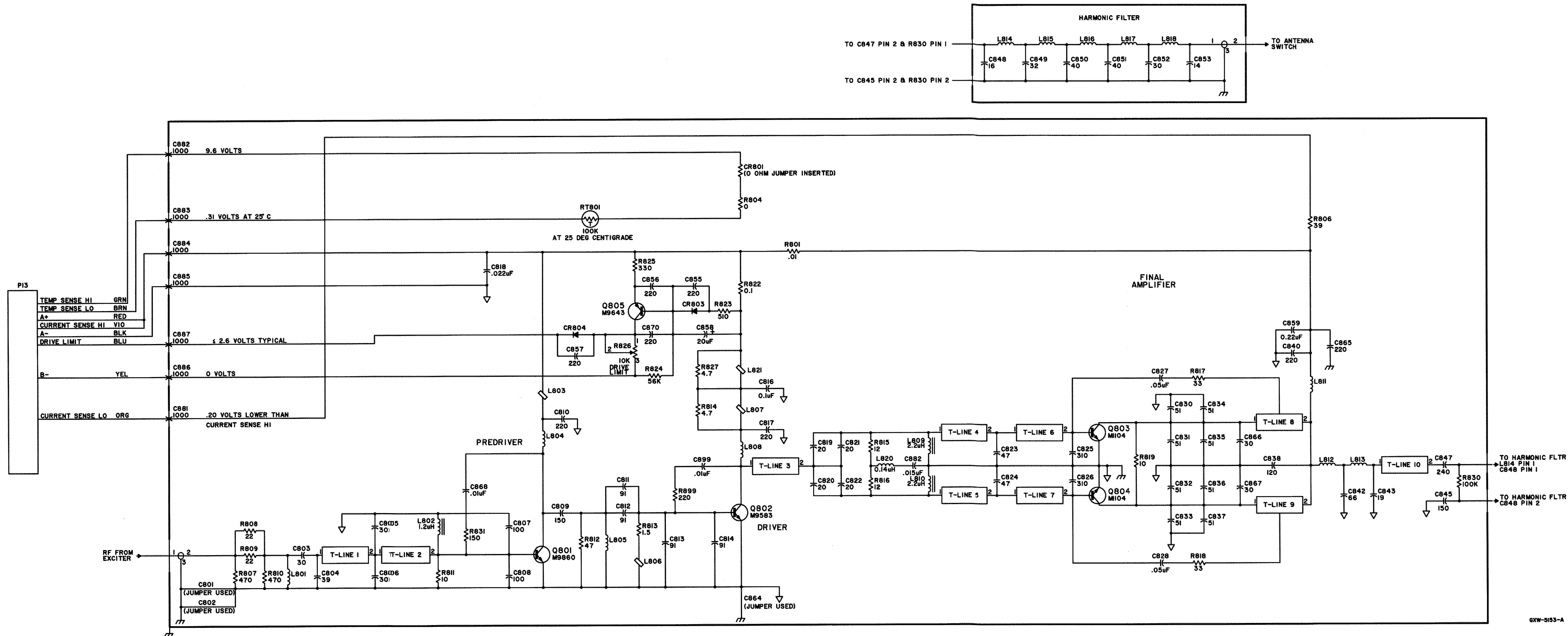
SOLDER SIDE

parts list

HLD4335A Exciter/Power Control Board MXW-5173-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed uF, ±10%, 50v (unless otherwise stated)		
C901	21-11032A21	.01
C1600,1601	21-11032A21	.01
C1602	23-11054M01	2.2, 35V, tantalum
C1603	21-11032A21	.01
C1604	21-11031A19	15 pF, ±5%
C1606	21-11032A21	.01
C1702,1703	21-11032A21	.01
C1704	23-11054M01	2.2, 35V, tantalum
C1705	21-11031A12	7.5 pF, ±5 pF
C1706	21-11032A21	.01
C1707	21-11031A29	39 pF, ±5%
C1708-1710	21-11032A21	.01
C1711	21-11031A13	8.2 pF, ±5 pF
C1712	21-11031A25	27 pF, ±5%
C1713	21-11032A21	.01
C1714	21-11031A39	100 pF, ±5%
diode (see note)		
CR901	48-11034A01	silicon
connector receptacle		
J11V	09-80001F01	female, 1-contact
J12	28-80164N01	5-pin
J13	28-80071H01	male, 7-pin
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	1.2 uH
L1705	24-80293D02	ferrite bead
L1706	24-11030D06	86.6 nH
L1707	24-11030B05	19.6 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, Ω ±5%, 1/8 watt (unless otherwise stated)		
R900	06-11077A01	0 ohm jumper
R902	06-11077A34	22
R903	06-11077A01	0 ohm 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
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	06-11077A36	27
R1705	06-11077A28	12
R1706	06-11077A68	560
R1707	06-11077A28	12

2/10/88
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.



Schematic, Circuit Board Diagram, and
 Parts List for VHF Power Amplifier
PW-5276-A
 (Sheet 1 of 2)
 6/15/88

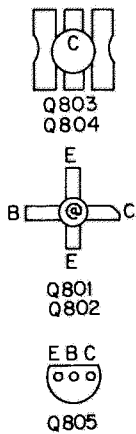
6XW-5153-A

parts list

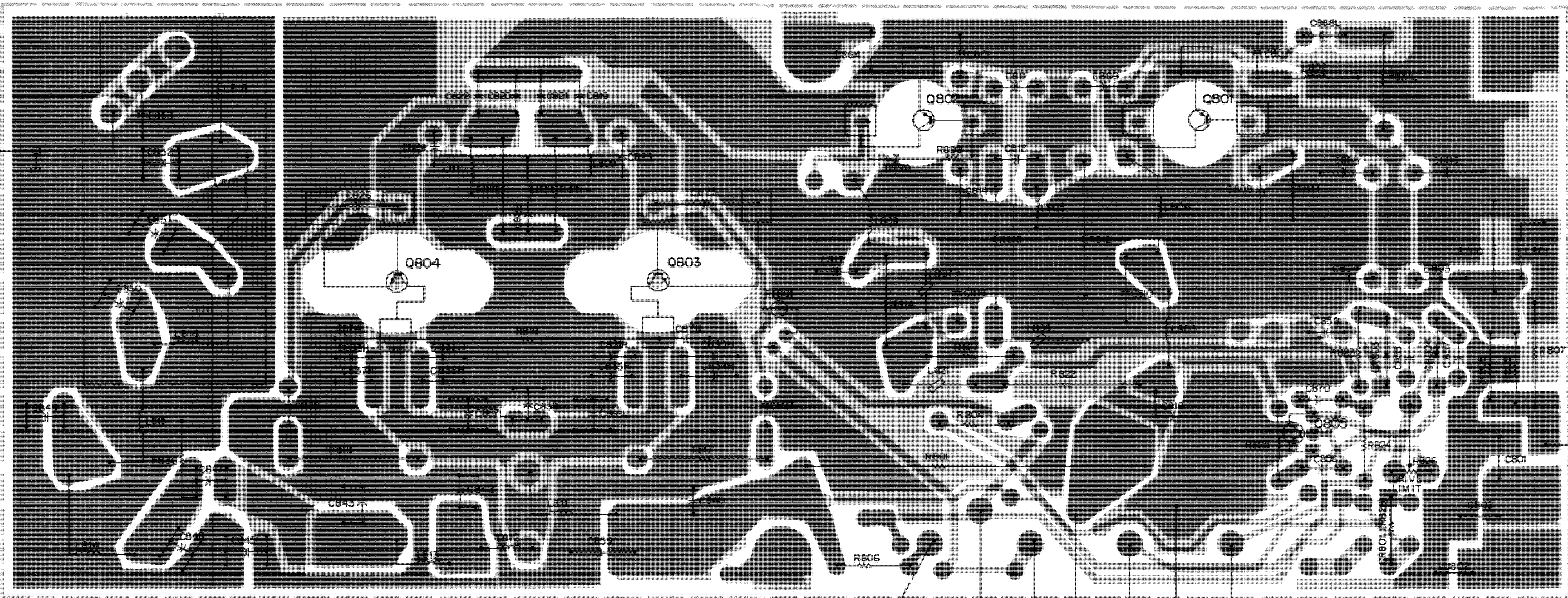
HLD4337B PA Board, 75/100W MXW-5216-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF ±5% 500V (unless otherwise stated)		
C801	—	(jumper used)
C802	—	(jumper used)
C803	21-83406D77	30
C804	21-84493B59	39
C805,806	21-83406D77	30
C807,808	21-84493B65	100
C809	21-84493B66	150
C810	21-83596E10	220, ±20%
C811,814	21-84493B64	91
C816	08-82096J18	.1, ±10%, 250V
C817	21-83596E10	220, ±20%
C818	08-82096J08	.022, ±10%, 250V
C819-822	21-82610C13	20, 200V
C823,824	21-84493B56	47pF
C827,828	21-82372C10	.05 uF, +80-20%, 25V
C830-837	21-82610C07	51, 200V
C838	21-84395B04	120, 250V
C840	21-83596E10	220
C842	21-84395B48	66, 250V
C843	21-84395B41	19, 350V
C845	21-84395B46	150, 250V
C847	21-84395B35	240, ±10%, 350V
C848	21-84395B51	16, 250V
C849	21-84395B28	32, 350V
C850,851	21-84395B36	40, 350V
C852	21-84395B39	30, 350V
C853	21-84395B30	14, 350V
C855-857	21-83596E10	220, ±20%
C858	23-84538G04	15 uF, ±20%, 20V, tantalum
C859	08-82096J20	22, ±10%, 250V
C864	—	(jumper used)
C866,867	21-84395B39	30, 350V
C868	21-83596E21	.01uF 200
C870	21-83596E10	220, ±20%
C882	08-11051A08	.015
C899	08-11051A07	.01uF, 5%, 63V
diode (see note)		
CR801	—	(see R828)
CR803,804	48-82466H13	silicon
coil, RF		
L801	24-83884G01	50 uH
L802	24-82729H27	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
L807	24-80036A02	ferrite bead, 1/2 turn
L808	24-80277A14	airwound, 1.5 turns
L809,810	24-82549D48	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
L815-818	24-80277A11	airwound, 6.5 turns
L820	24-82729H41	.14 uH
L821	24-80036A02	ferrite bead, 1/2 turn
transistor (see note)		
Q801	48-Q0869860	NPN; type M9860
Q802	48-Q0889583	NPN; type M9583
Q803,804	48-84411L04	NPN; type M1104
Q805	48-11043C06	silicon
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, ±5%, 1/4 watt (unless otherwise stated)		
R801	17-80165C02	shunt
R804	06-11009D23	0 ohm jumper
R806	06-11009C15	39
R807	06-11045A41	470, 1/2W
R808,809	06-11009C09	22
R810	06-11045A41	470, 1/2W
R811	06-11045A01	10, ±5%, 1/2W
R812	06-11086C27	47, 2W
R813	17-82036G07	1.5, ±10%, 2W
R814	06-11045B26	4.7, 1/2W
R815,816	06-11045A03	12, ±5%, 1/2W
R817,818	17-82036G11	33, ±10%, 2W
R819	06-11086C11	10, ±5%, 2W
R822	17-82291B24	1.3W (wirewound)
R823	06-11009C42	510
R824	06-11009C91	56k
R825	06-11009C37	330
R826	18-80087E08	10k potentiometer
R827	06-11045B26	4.7, 1/2W
R828	06-11009D23	0 ohm jumper (in place of CR801)
R830	06-11009C97	100k
R831	06-11045A29	150, 1/2W
R899	06-11045A33	220, 1/2W
mechanical parts		
07-80078A01	bracket, thermistor mount	
26-80070B01	PA shield	
26-80052B01	filter shield	
29-80014A01	coax clip (2-used)	
75-80054F01	pad	

TRANSISTOR BASE DETAILS



TO ANTENNA SWITCH



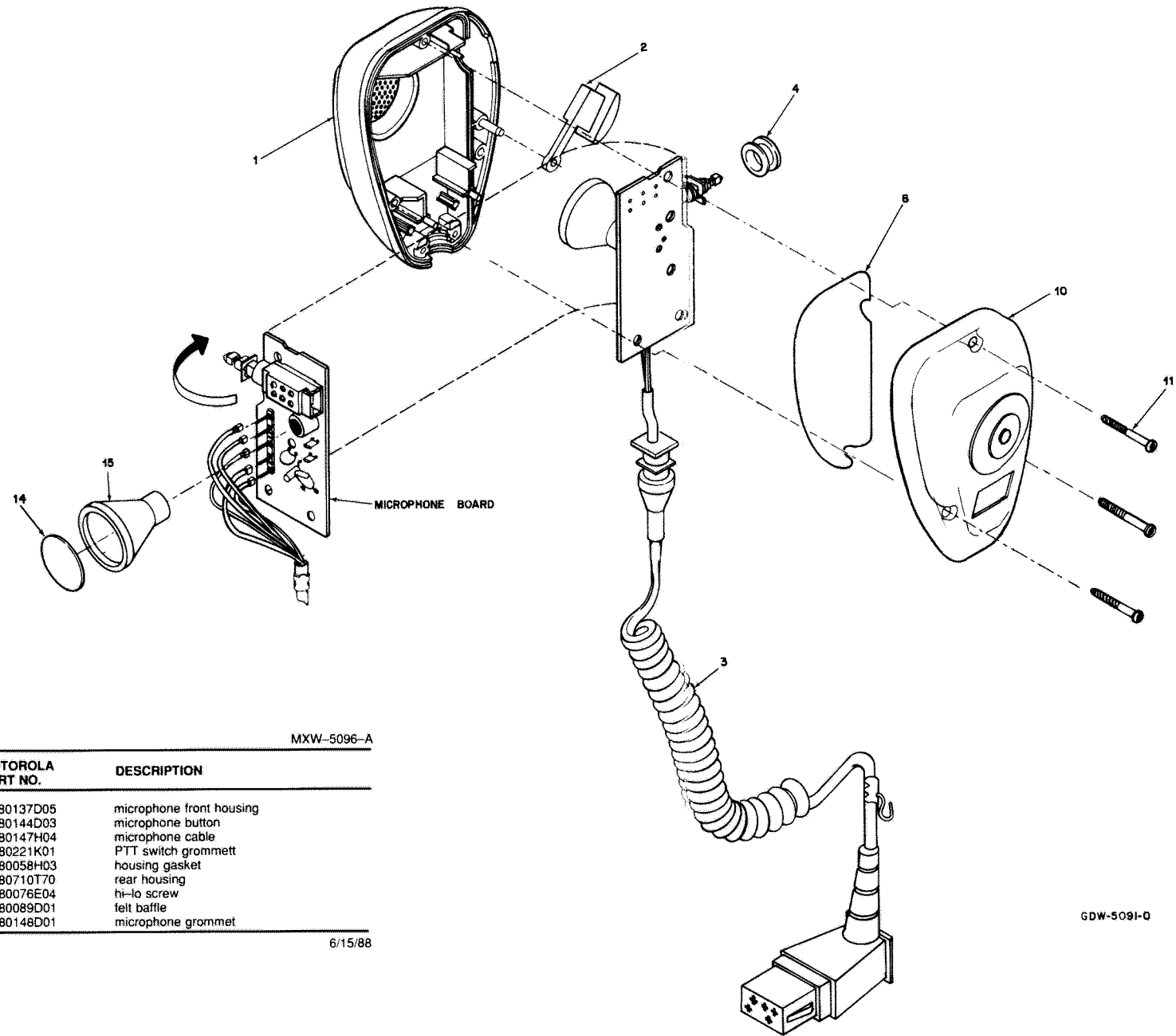
SHOWN FROM COMPONENT SIDE

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

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

Schematic, Circuit Board Diagrams, and Parts Lists for VHF Power Amplifier
PW-5276-A
(Sheet 2 of 2)
6/15/88

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



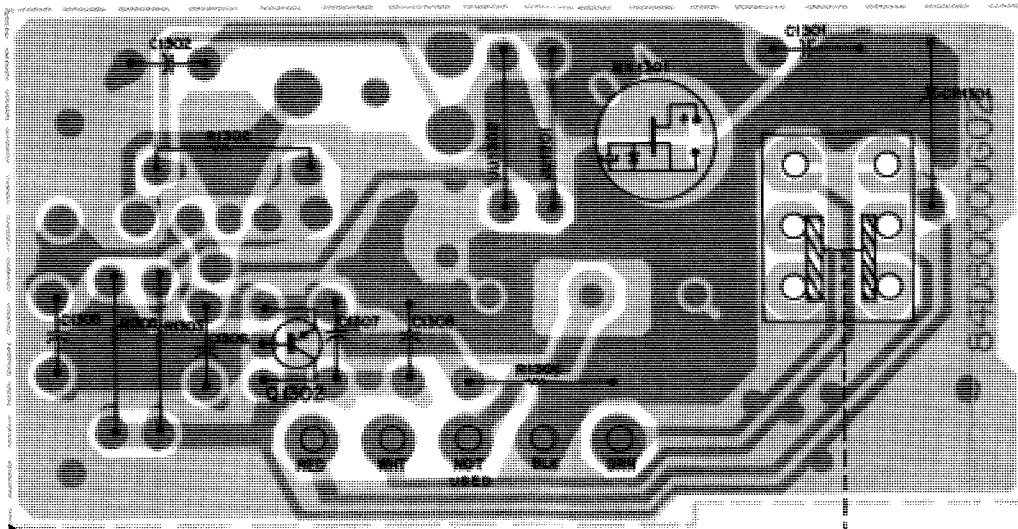
parts list

Microphone Hardware MXW-5096-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15-80137D05	microphone front housing
2	38-80144D03	microphone button
3	30-80147H04	microphone cable
4	05-80221K01	PTT switch grommet
8	32-80058H03	housing gasket
10	01-80710T70	rear housing
11	03-80076E04	hi-lo screw
14	35-80089D01	felt baffle
15	05-80148D01	microphone grommet

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BASIC CONTROL HEAD MICROPHONE



SHOWN FROM SOLDER SIDE

COMPONENT SIDE @ GBW-3447-A
SOLDER SIDE @ GBW-3448-A
OVERLAY - GBW-3449-A

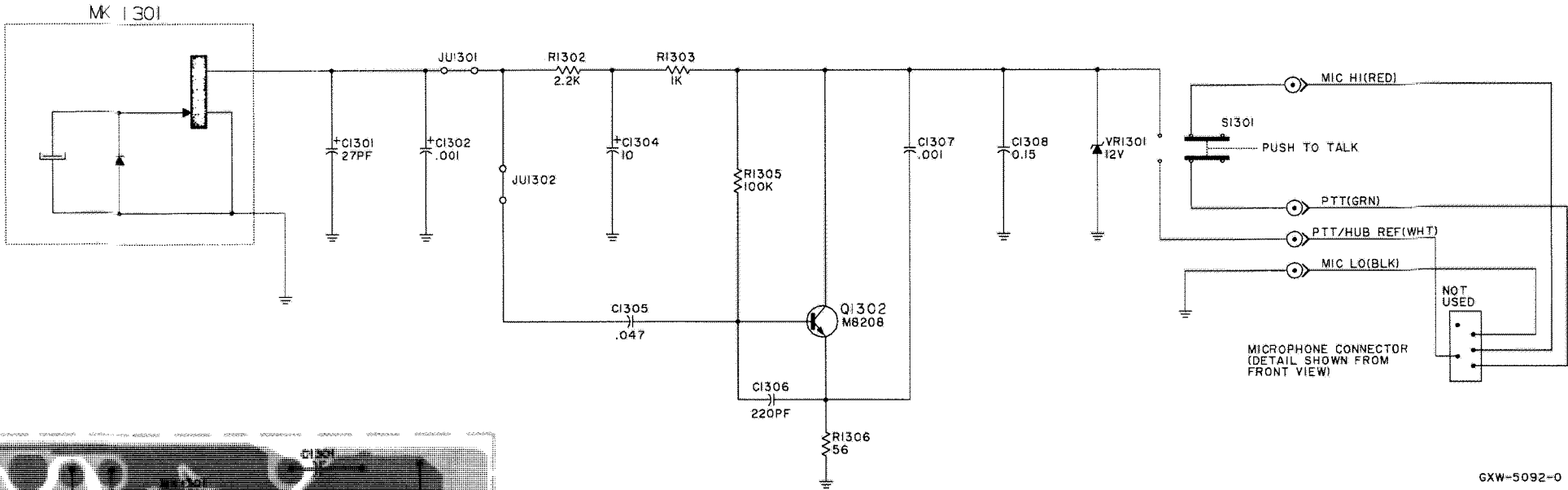
parts list

HLN4384B Microphone Circuit Board MXW-2051-C

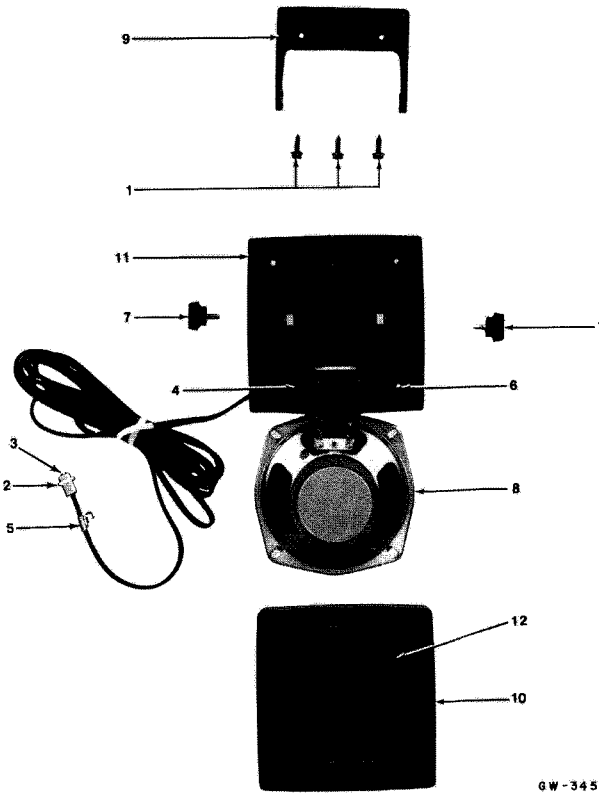
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed uF, ±5%, 50V (unless otherwise stated)		
C1301	21-11038H35	24 pF
C1302	21-11039B13	.001 ±10%
C1304	23-11019A20	10 ±20% 25V, electrolytic
C1305	08-11017A14	.047
C1306	21-11038P50	220 pF
C1307	21-11039B13	.001 ±10%
C1308	08-11051A14	.15 63V
diode (see note)		
CR1301	48082256C25	12V zener ±5% 400mW
connector receptacle		
JU1301,1302	06-11009B23	0 ohm jumper
microphone		
MK1301	50-80258E04	electret cartridge
transistor (see note)		
Q1302	48-80182D08	NPN
resistor, fixed ohm, ±5%, 1/4 watt (unless otherwise stated)		
R1302	06-11009C57	2.2k
R1303	06-11009C49	1k
R1305	06-11009C97	100k
R1306	06-11009C19	56
switch		
S1301	40-80652E02	momentary switch
mechanical part		
	14-80652E01	switch insulator

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

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BASIC CONTROL HEAD MICROPHONE SCHEMATIC



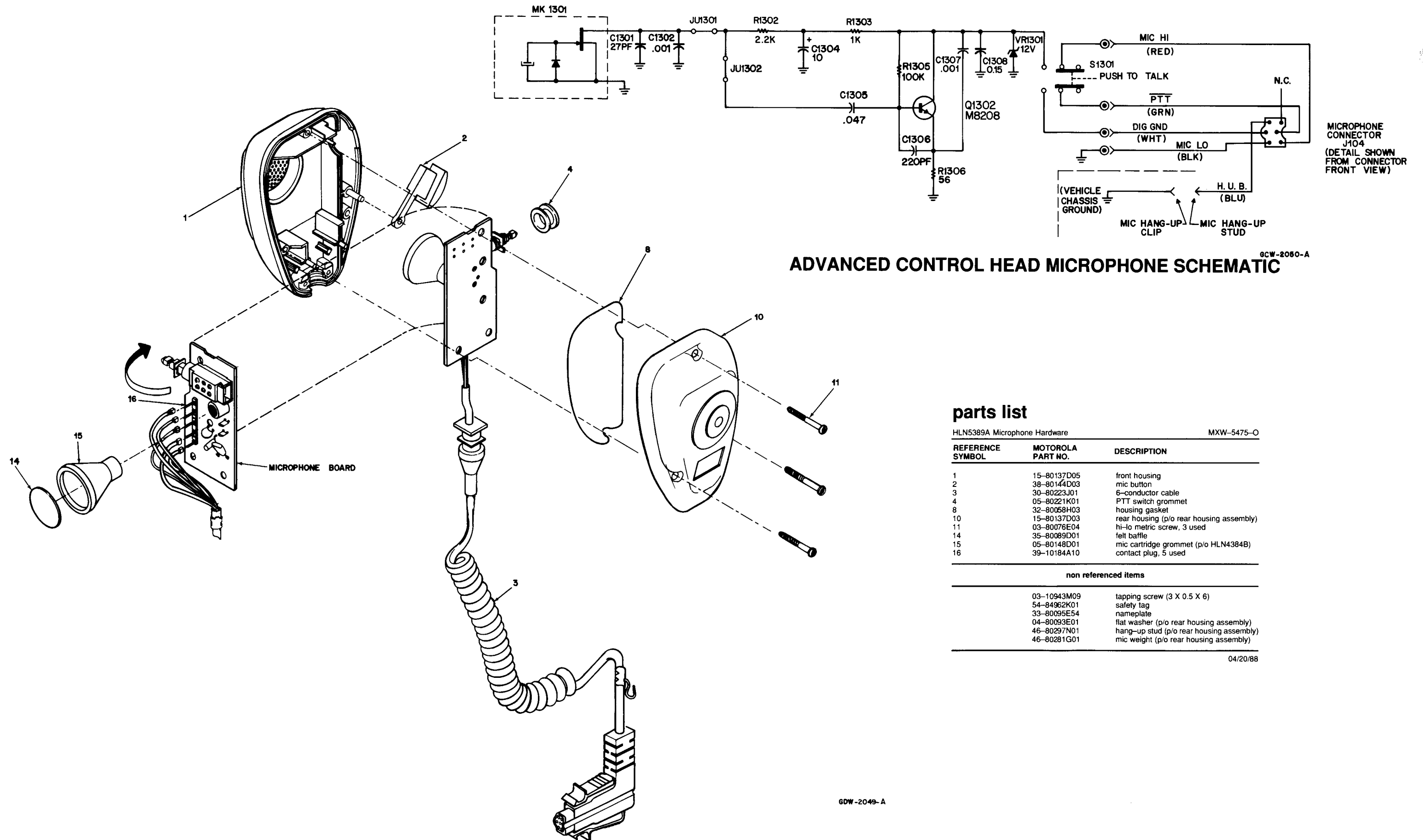
GW-3459-A

parts list

HSN4020A External Speaker
HSN4021A External Speaker MXW-5223-A

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	03-00136756	tapping screw, 10-16 x 5/8 (3 used)
2	15-10183A18	connector housing, 2- contact
3	39-10164A45	contact
4	42-92018H05	cable retainer
5	42-840E1A03	wire clamp
6	03-00140001	tapping screw 6-19 x 7/8 (4-used)
7	03-84244C01	wing screw (2 used)
8	50-8006C01	speaker, 5", 30W
9	07-802C0E02	trunnion bracket
10	13-82671M08	bezel
11	15-84981B09	cover
12	32-80155A01	gasket

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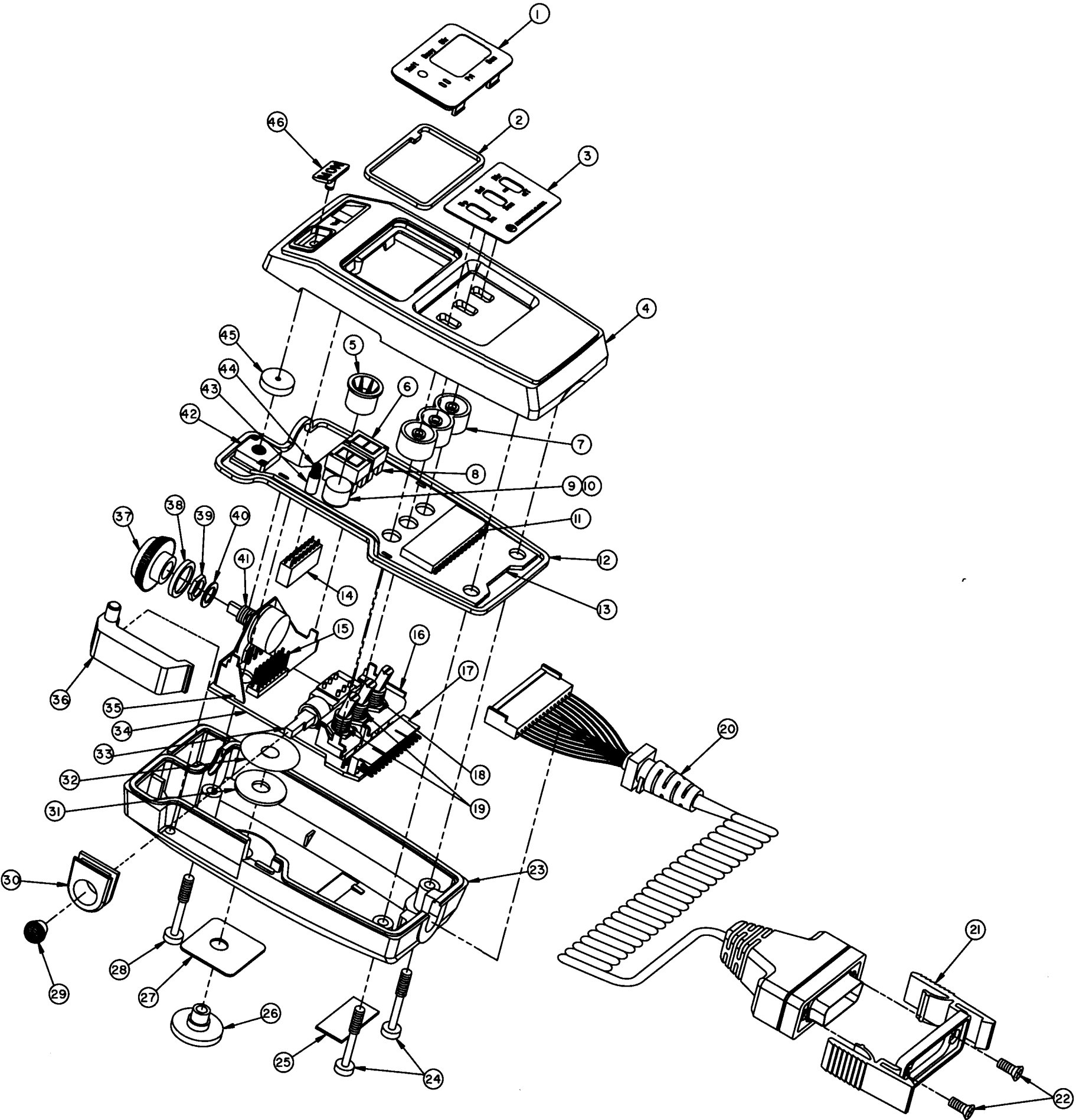
ADVANCED CONTROL HEAD MICROPHONE

parts list

Handheld Control Head Exploded View MXW-5227-A

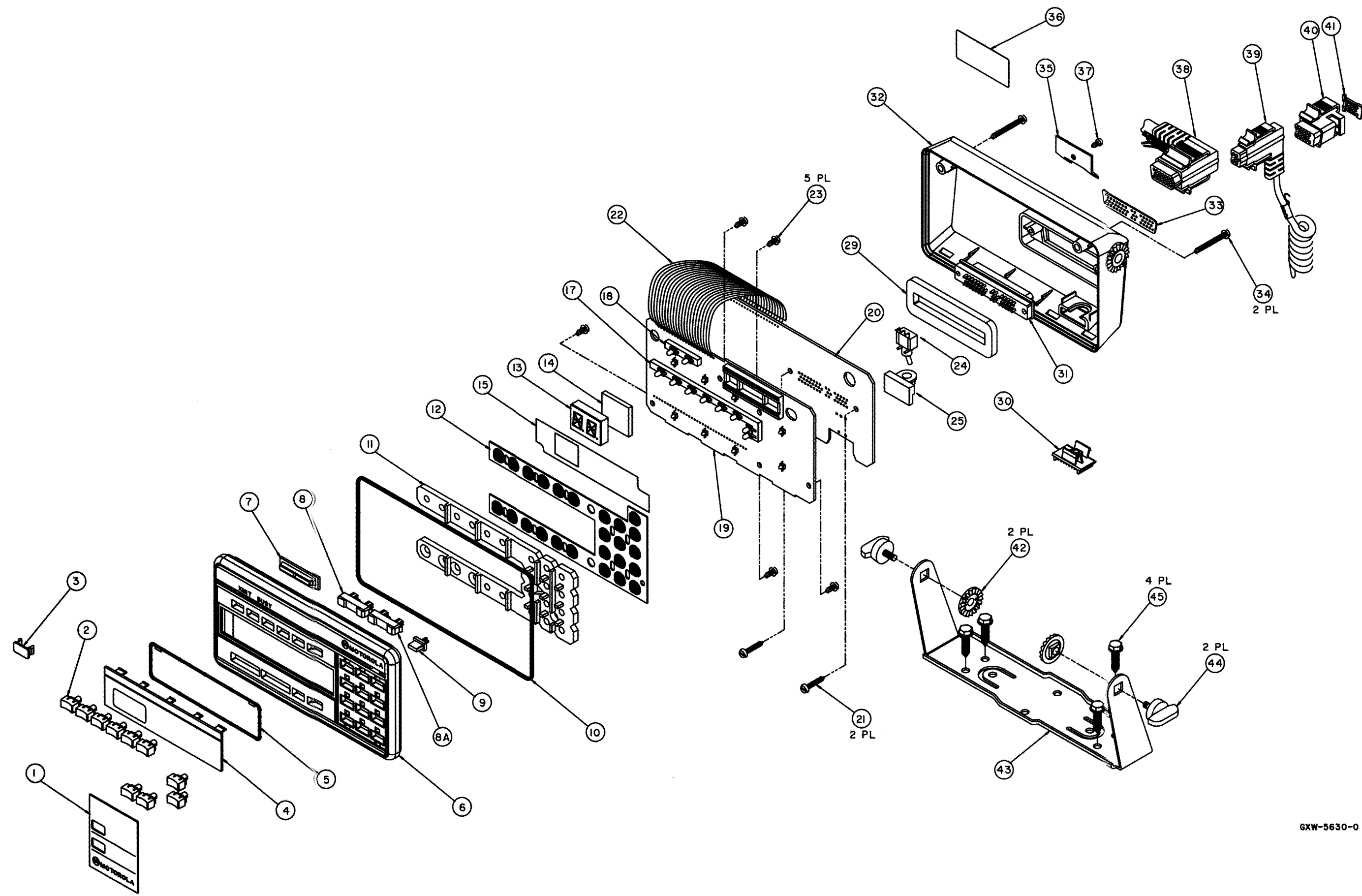
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	61-80052H07	lens
2	32-80059H01	gasket, lens
3	13-80020H09	escutcheon (for talkaround)
3	13-80020H10	escutcheon (for non-talkaround)
4	15-80047H02	housing, front
5	32-80061H01	seal, microphone
6	48-80187G05	diode, common anode
7	32-80063H01	seal, switch
8	09-80197N01	receptacle, LED
9	50-80258E04	electret, microphone cartridge
10	14-80065H01	insulator, microphone
11	51-80135C08	IC display, driver MM5480
12	32-80058H02	gasket, housing
13	01-80749T73	circuit board, upper
14	09-80196N01	receptacle, vertical
15	28-80085E32	connector, male header
16	07-80050H01	bracket, switch
17	28-80195N01	plug, right angle
18	40-80123H06	switch, toggle
19	40-80123H01	switch, toggle
20	30-80227N01	cable, coiled
21	42-80253N01	clip, coiled cord
22	03-00140287	screw
23	15-80048H02	housing, back
24	03-80076E02	screw, metric, hi-lo
25	33-80025H21	nameplate, HHCH
26	05-00855939	rivet
27	04-80072H01	washer
28	03-80076E06	screw, metric, hi-lo
29	38-80066H01	cap, PTT switch
30	32-80060H01	seal, PTT
31	04-00139386	washer, flat
32	14-80258N01	insulator, microphone
33	40-80065E01	switch, momentary PTT
34	01-80749T68	circuit board, lower
35	07-80002J01	bracket, potentiometer
36	38-80055H01	button, PTT
37	36-80053H01	knob
38	42-84591A03	o-ring
39	02-80188H01	nut, hex, machine
40	04-00124629	washer, flat
41	18-80095D07	resistor, variable, squelch
42	40-80067H01	switch, momentary
43	43-80064H01	spacer, LED
44	48-05504C01	LED
45	32-80062H01	seal, button
46	38-80054H02	squelch button
47	32-80291N01	gasket retainer

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HANDHELD CONTROL HEAD

ADVANCED CONTROL HEAD

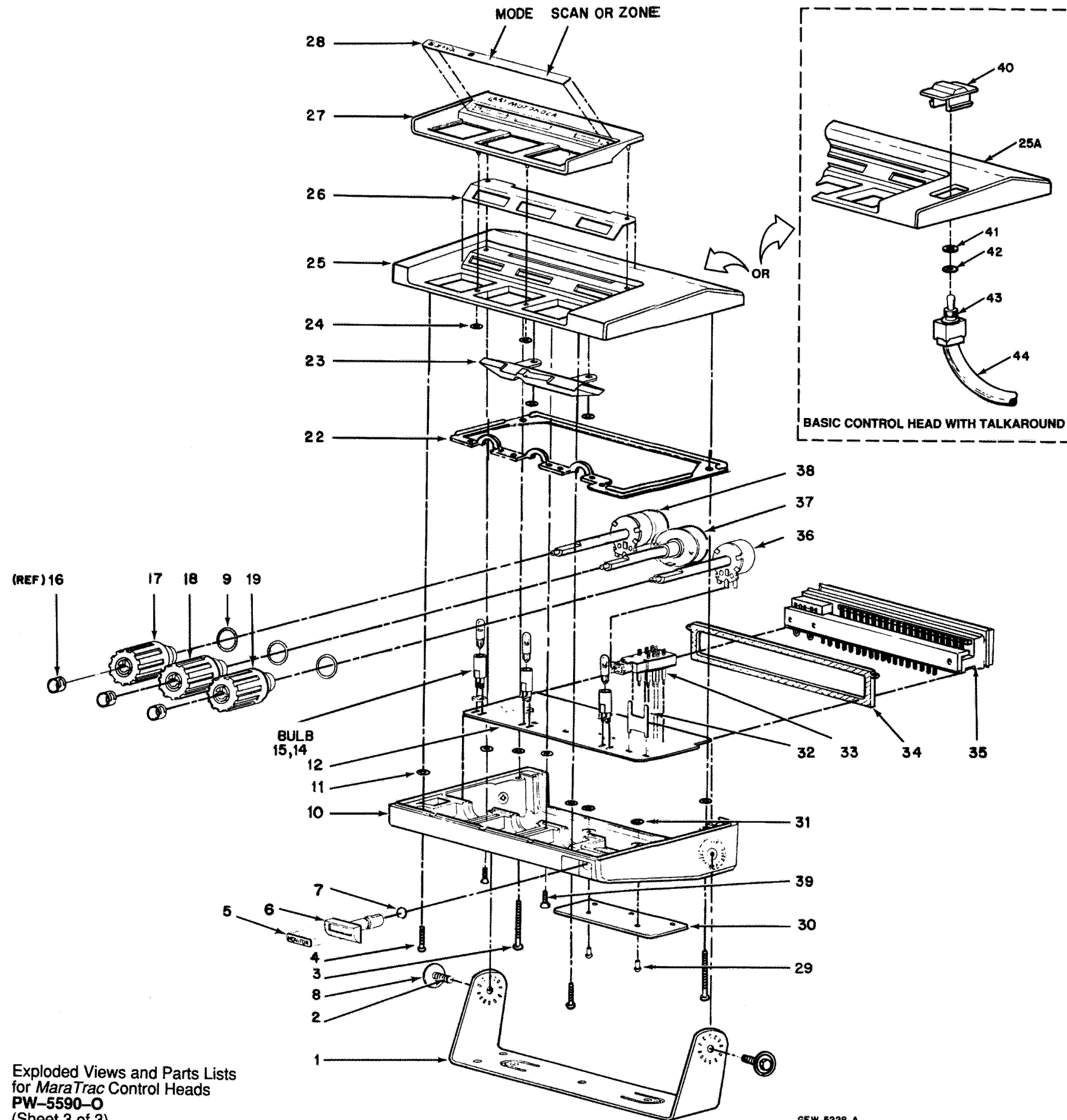


6XW-5630-0

parts list

Advanced Control Head Hardware		MXW-5585-0
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	13-80087J04	escutcheon
2	38-80043M02	pushbutton, MPL
2	38-80043M03	pushbutton, SCAN
2	38-80043M14	pushbutton, RCL
2	38-80043M18	pushbutton, SEL
2	38-80043M19	pushbutton, HOME
2	38-80043M39	pushbutton, HOME
3	38-80253K02	plug
4	61-80095J03	lens, vacuum fluorescent
5	32-80057K02	gasket, lens
6	15-80088J04	housing, front
7	61-80097J01	lens, LED
8	38-80091J03	rocker button, MODE
8A	38-80091J04	rocker button, VOL
9	38-80092J01	pushbutton, DIM
10	32-80180J02	gasket, housing
11	61-80185J02	light pipe, keypad
12	75-80098J01	keypad
13	—	LED display (see Control Heads display board)
14	75-80184J01	shock pad
15	14-80240N01	insulator
16	—	(not used)
17	43-80011L01	spacer, LED, 8-position
18	43-80012L01	spacer, LED, 2-position
19	—	display circuit board (see Control Heads)
20	—	control circuit board (see Control Heads)
21	03-10945A14	screw, tapping, M3.12 x 1.27 x 16
22	30-80034K01	flex cable
23	03-10945A11	screw, tapping, M3.12 x 1.27 x 8
24	—	toggle switch (see Control Heads control board)
25	32-80178J01	gasket, ON/OFF switch
26-28	—	(not used)
29	32-80179J01	gasket, D-connector
30	38-80126J01	O-connector (see Control Heads control board)
31	—	housing, rear
32	15-80088J02	gasket, connector face
33	03-10908A33	screw, machine, M3.5 x 0.6 x 30
34	07-84323C01	bracket, strain relief
35	33-80178M03	nameplate
36	03-10908A18	screw, machine, M3 x 0.5 x 6
37	30-80184N02	radio cable
38	—	microphone cable (see Accessories Section)
39	15-80221K01	VIP connector
40	32-80275K01	gasket, VIP connector
41	43-80127J01	spacer, trunnion
42	07-80263L01	bracket, trunnion
43	03-80160E01	screw, wing, M5.0 x .8 x 10
44	03-00136756	screw, tapping, 10-16 x 5/8
45	—	—

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parts list

Basic Control Head Mechanical Parts

MXW-5229-A

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	07-80101A01	bracket, trunnion
2	03-00135726	screw, trunnion (2 used)
3	03-10908A33	screw, machine (M3.5x0.6x30)(2 used)
4	03-10908A29	screw, machine housing (2 used)
5	33-80117A01	nameplate "MONITOR"
6	36-80102A01	pushbutton
7	42-10128A22	"O" ring
8	04-00135784	washer, trunnion 2-used
9	42-10128A23	"O" ring (3-used)
10	15-80109A01	housing, bottom
11	04-80149A01	washer, caprice (6-used)
12	84-80148N01	printed circuit board
14	09-80051B01	light socket (3-used)
15	65-80284N01	light bulb (3-used)
16	42-10082A14	retainer, knob (3-used) (for Ref. vendor installed)
17	36-80107A01	knob, volume squelch
18	36-80107A05	knob, mode
19	36-80107A06	knob, zone
		or
	36-80107A07	knob, scan
22	32-80203B01	gasket, housing
23	61-80119A01	lens
24	42-10113A31	retainer ring (6-used)
25	15-80108A01	housing, top (for non-talkaround)
25A	15-80221N01	housing, top (talkaround)
26	32-80140B03	gasket, bezel
27	13-80114A04	bezel, bezel
28	33-80116A09	nameplate (overlay) (8-mode)
		or
29	33-80116A10	nameplate (16-mode)
	05-00132475	rivet (2-used)
30	07-80100A02	bracket, strain relief
31	04-00007555	washer, flat (2-used)
32	07-80159A01	bracket, switch
33	40-80127A03	switch, pushbutton
34	32-80038C01	gasket, connector
35	01-80749T24	connector assembly
36	40-80166N02	switch, rotary 2-P
37	40-80166N01	switch, rotary 8-P
38	18-80126A03	potentiometer, rotary
39	03-10913A29	screw, machine (2-used)(M3.5x0.6x1x3)
	03-00136756	screw, tapping, 10-16 x 5/8" (3-used) (for trunnion mounting)
40	38-80202N01	repeat/direct button
41	02-82653D01	nut, spanner
42	15-80201N01	switch, housing (p/o 25A)
43	32-05082E20	o-ring
44	40-05680K03	toggle switch
45	01-80749T20	cable, talkaround

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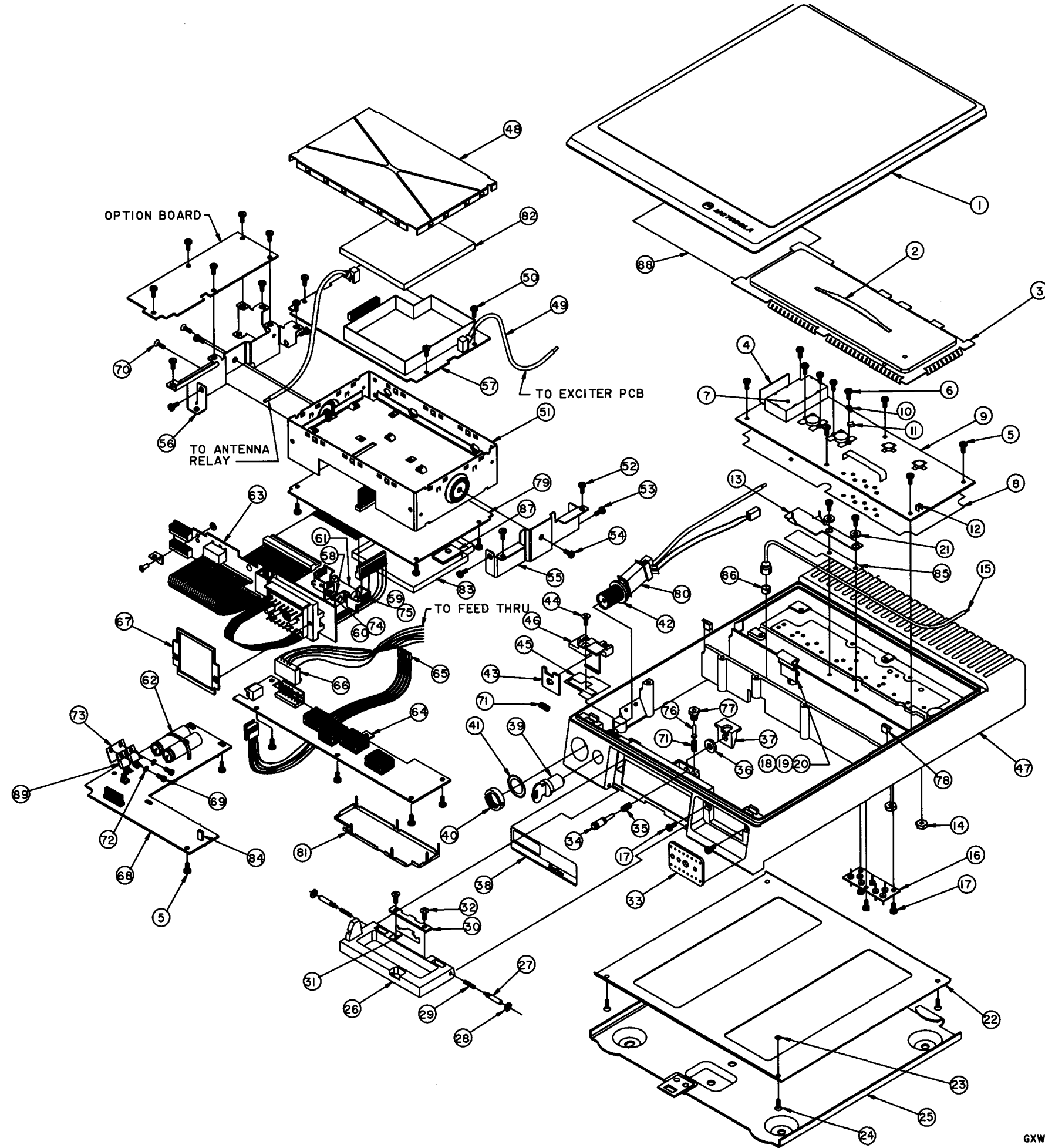
parts list

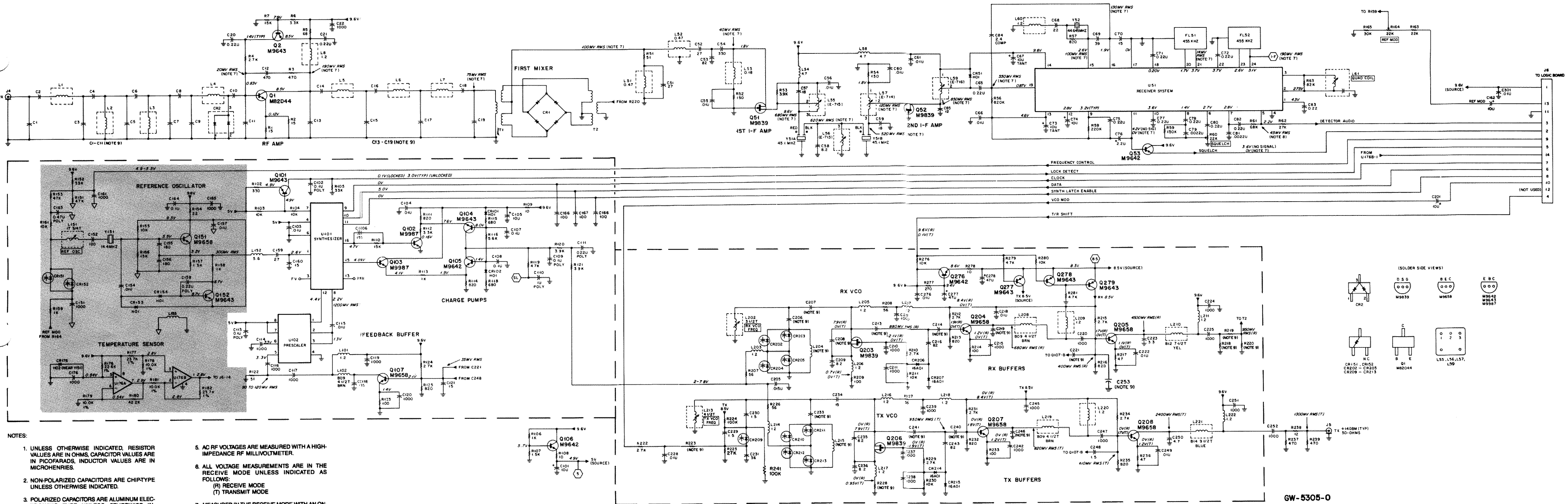
MaraTrac VHF Radio Exploded View

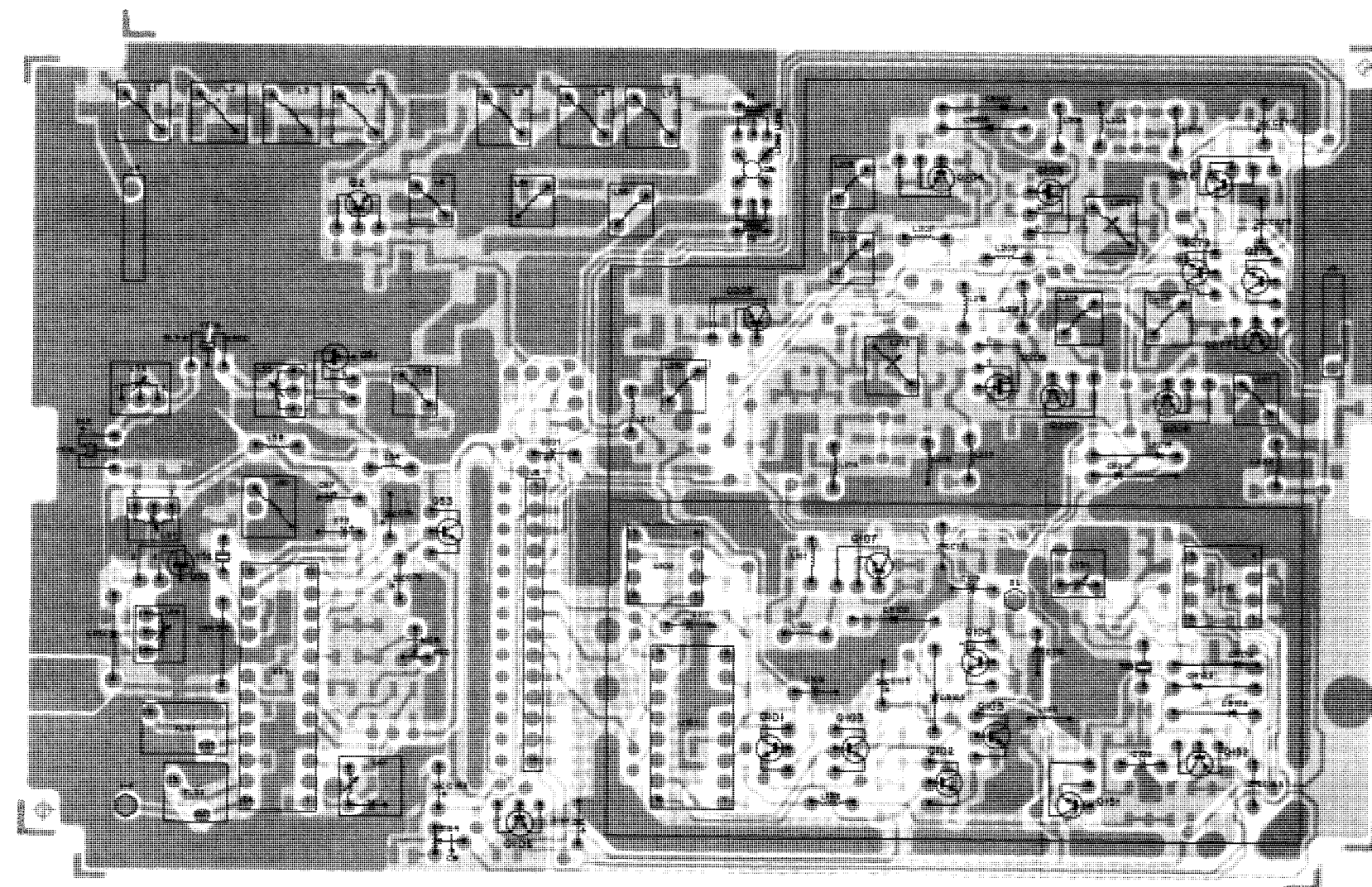
MXW-5604-O

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	HHN4032A	top cover
2	55-84300B04	handle, nylon
3	26-80070B01	shield, PA compartment
4	26-80019C01	heat sink, harmonic filter
5	03-10943M15	screw, 3.5 x 0.6 x 8 (20 used)
6	03-10911A11	screw, 3 x 0.5 x 8 (4 used)
7	15-80053B01	cover shield
8	14-80143A04	insulator, PA
9	HLD4337B	100W PA PCB assembly
10	07-80078A01	bracket, thermistor mounting
11	75-80054F01	pad, compression (HLD4337B)
12	29-80014A01	clip coax (HLD4337B) (2 used)
13	26-80205C01	heat sink
14	02-00119913	nut 8-32 x 1 1/32 x 1/8 hex (2 used)
15	01-80750T31	coax cable assembly
16	HLN4046A	pre-amp feedthru plate assembly
17	03-10908A26	screw, 3.5 x 0.6 x 6 (6 used)
18	02-00007005	nut 6-32 x 1/4 x 3/32 hex
19	26-80254A01	heatsink LL AMP
20	26-80238N01	heatsink T05
21	04-80207C01	washer shoulder
22	HLN4033A	bottom cover assembly
23	04-80149A01	washer, captivating (4 used)
24	03-10913A29	screw, 3.5 x 0.6 x 13 (4 used)
25	HLN4034C	mounting tray assembly
26	55-80002A01	handle
27	47-80021A01	pin, pivot (2 used)
28	04-80017F01	washer, pivot (2 used)
29	41-80175A01	spring (2 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, cable connector front
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, 5/8"
42	32-80080A01	gasket, antenna connector
43	07-80016A01	bracket, lock slide
44	03-10936E14	screw, B 3.5 x 1.27 x 13
45	32-80000P01	gasket, lock support
46	07-80015A01	support, lock slide
47	15-80162N02	housing
48	26-80038M01	shield, chassis, RF side
49	30-80231N01	cable, coax
50	03-10943M09	screw, 3 x 0.5 x 6 (12 used)
51	27-80128L02	chassis
52	03-10943M17	screw, 3.5 x 0.6 x 13 (4 used)
53	03-10908A35	screw, 4 x 0.7 x 8 (4 used)
54	03-10908B08	screw, 5 x 0.8 x 10 (2 used)
55	07-80142N01	bracket, transceiver, side
56	07-80141N01	bracket, transceiver, inner
57	HLD4322A	RF circuit board
58	48-80153A01	diode, pellet
59	26-80274A01	heatsink, diode, right
60	26-80275A01	heatsink, diode, left
61	23-80167C03	capacitor, electrolytic
62	42-10217A26	strap, cable harness (4 used)
63	HLN5343A	interconnect circuit board
64	HLE4335A	exciter, power control circuit board
65	30-80159N01	cable, power control board
66	30-80234N01	cable, power control board
67	32-80074A02	gasket, cable plug
68	HLN5342A	audio/squelch board
69	03-10908A18	screw, 3 x 0.5 x 6 (2 used)
70	03-10943R04	screw, 2.5 x 0.45 x 8 (2 used)
71	41-80022A01	spring, lock (2 used)
72	04-84180C01	washer, shoulder (2 used)
73	14-80075D01	insulator, TO220
74	30-10286A06	cable, 14 gage, red
75	30-10286A04	cable, 14 gage, black
76	46-80151A01	stud, cover release
77	43-80150A01	sleeve, cover release
78	42-80013A01	clip, coax (3 used)
79	HLN5402A	logic board
80	HLN5344A	antenna relay
81	26-80163N01	shield, solder side
82	15-80953T01	cover, VCO shield
83	15-80124M01	cover, logic shield
84	09-80080L01	jumper, 2-position
85	14-80206C01	insulator
86	42-84733F01	ring, compression
87	75-80202C01	pad, compression
88	54-80166K01	label
89	51-80065C03	IC audio (2 used)

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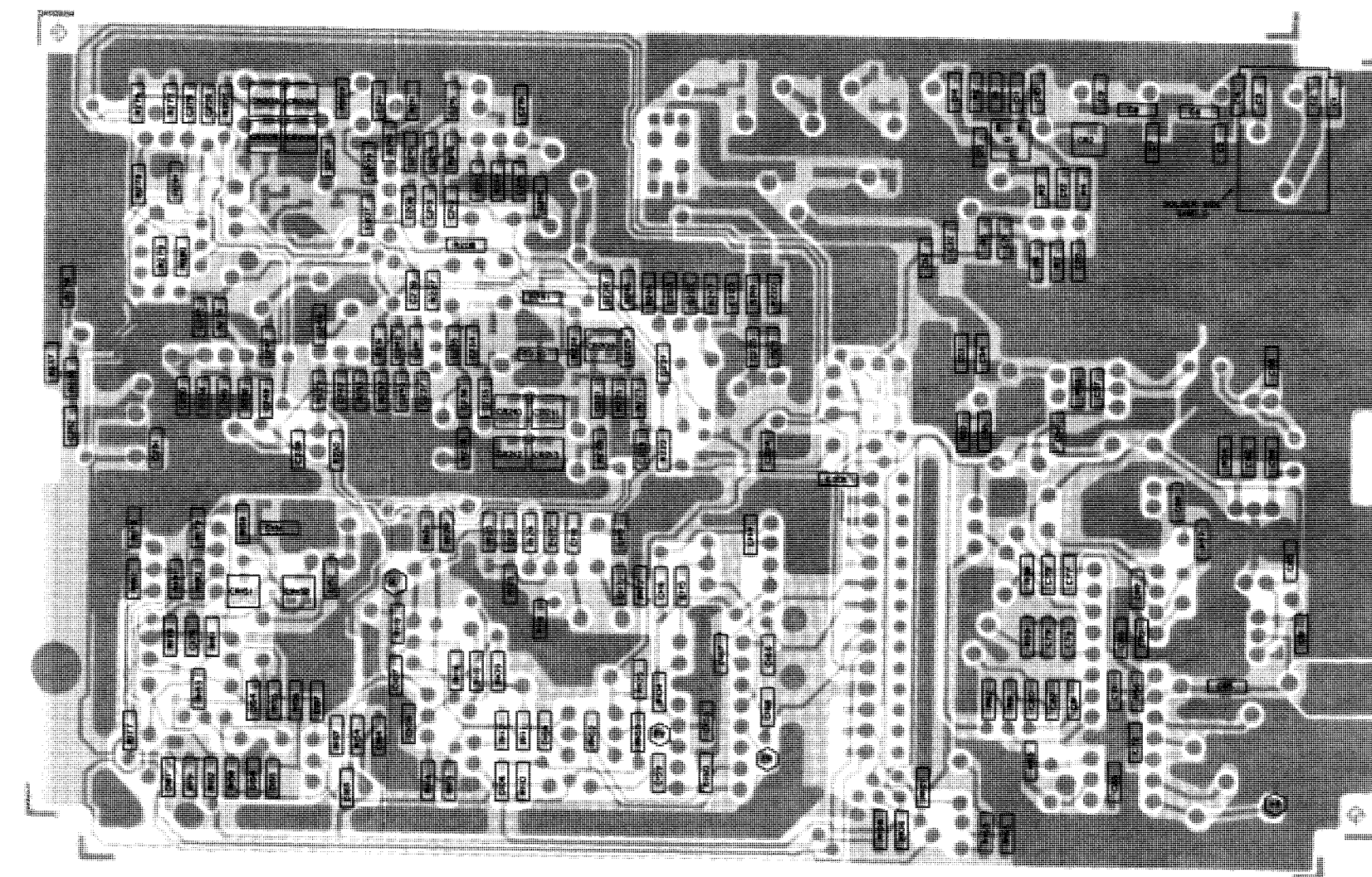






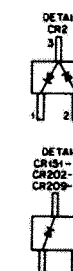
SHOWN FROM COMPONENT SIDE

COMPONENT SIDE GW-5287-0
 SOLDER SIDE GW-5286-0
 OVERLAY GW-5288-0



SHOWN FROM SOLDER SIDE

COMPONENT SIDE GW-5290-0
 SOLDER SIDE GW-5289-0
 OVERLAY GW-5291-0



HLD4321A RF Board, 136-162 MHz (L)
HLD4322A RF Board, 146-174 MHz (H) MXW - 5308-O

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated

C1(L)	21-11031A26	30 pF
C1(H)	21-11031A25	27 pF
C2(L)	21-11031A33	56 pF
C2(H)	21-11031A29	39 pF
C3(L)	21-11031A34	62 pF
C3(H)	21-11031A33	56 pF
C4(L)	21-11031A21	18 pF
C4(H)	21-11031A19	15 pF
C5(L)	21-11031A04	1.8 +/--.25 pF
C5(H)	21-11031A03	1.5 +/--.25 pF
C6(L)	21-11031A07	3.3 +/--.25 pF
C6(H)	21-11031A06	2.7 +/--.25 pF
C7(L)	21-11031A04	1.8 +/--.25 pF
C7(H)	21-11031A03	1.5 +/--.25 pF
C8(L)	21-11031A21	18 pF
C8(H)	21-11031A19	15 pF
C9(L)	21-11031A34	62 pF
C9(H)	21-11031A33	56 pF
C10(L)	21-11031A31	47 pF
C10(H)	21-11031A29	39 pF
C11(L)	21-11031A15	10 +/--.5 pF
C11(H)	21-11031A09	4.7 +/--.25 pF
C12	21-11031A55	470 pF
C13(L)	21-11031A21	18 pF
C13(H)	21-11031A14	9.1 +/--.5 pF
C14(L)	21-11031A39	100 pF
C14(H)	21-11031A53	390 pF
C15(L)	21-11031A37	82 pF
C15(H)	21-11031A36	75 pF
C16(L)	21-11031A26	30 pF
C16(H)	21-11031A24	24 pF
C17(L)	21-11031A37	82 pF
C17(H)	21-11031A36	75 pF
C18(L)	21-11031A28	36 pF
C18(H)	21-11031A25	27 pF
C19(L)	21-11031A30	43 pF
C19(H)	21-11031A29	39 pF
C20	21-11032B15	.22 uF +80/-20%
C21	21-11032B15	.22 uF +80/-20%
C22	21-11031A61	1000 pF
C51	21-11031A25	27 pF
C52	21-11031A25	27 pF
C53	21-11031A37	82 pF
C54	21-11031A51	330 pF
C55	21-11032A21	.01 uF 10%
C56	21-11032A21	.01 uF 10%
C57	21-11031A21	18 pF
C58	21-11031A13	8.2 +/--.5 pF
C59	21-11031A21	18 pF
C60	21-11032A21	.01 uF 10%
C61	21-11032A21	.01 uF 10%
C65	21-11032B15	.22 uF +80/-20%
C66	21-11032A21	.01 uF 10%
C67	23-11013D13	tantalum 10 uF 10% 20V
C68	21-11031A23	22 pF
C69	21-11031A29	39 pF
C70	21-11031A19	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-11013D13	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-11032B15	.22 uF +80/-20%
C76	23-11048B06	lytic 2.2 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-11032A13	.0022 uF 10%
C80	21-11032B15	.22 uF +80/-20%
C81	21-11032A13	.0022 uF 10%
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%

C84	21-82450B14	composition 2.4 pF 500V
C85	21-11031A17	12 pF
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-11032A21	.01 uF 10%
C104	21-11032A21	.01 uF 10%
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-11031A19	15 pF
C107	21-11032B13	.1 uF +80/-20%
C108	21-11032B13	.1 uF +80/-20%
C109	08-11051A13	poly .1 uF 63V
C110	08-11044A33	poly 1 uF
C111	08-11051A09	poly .022 uF 63V
C113	08-11051A13	poly .1 uF 63V
C114	21-11031A61	1000 pF
C115	21-11032A21	.01 uF 10%
C116	21-11031A61	1000 pF
C117	21-11031A61	1000 pF
C118	21-11031A19	15 pF
C119	21-11031A61	1000 pF
C120	21-11031A61	1000 pF
C121	21-11031A19	15 pF
C151	21-11031A61	1000 pF
C152	21-11031A41	120 pF
C154	21-11032A21	.01 uF 10%
C155	21-11031A45	180 pF
C156	21-11031A45	180 pF
C157	21-11032A21	.01 uF 10%
C158	08-11051A15	poly .22 uF 63V
C159	21-11031A25	27 pF
C160	21-11031A19	15 pF
C161	21-11031A61	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164	21-11032B13	.1 uF +80/-20%
C165	21-11031A61	1000 pF
C166	21-11031A39	100 pF
C167	21-11031A39	100 pF
C168	21-11031A39	100 pF
C176	21-11031A61	1000 pF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-11032A23	.015 uF 10%
C206(L)	21-11031A22	20 pF
C206(H)	21-11031A17	12 pF
C207(L)	21-11031A15	10 +/--.5 pF
C207(H)	21-11031A19	15 pF
C208(L)	21-11031A13	8.2 +/--.5 pF
C208(H)	21-11031A17	12 pF
C209	21-11031A13	8.2 +/--.5 pF
C210	21-11031A61	1000 pF
C211	21-11031A61	1000 pF
C212	21-11031A61	1000 pF
C213(L)	21-11031A09	4.7 +/--.25 pF
C213(H)	21-11031A10	5.6 +/--.5 pF
C214(L)	21-11031A05	2.2 +/--.25 pF
C214(H)	21-11031A07	3.3 +/--.25 pF
C215	21-11031A61	1000 pF
C216	21-11031A37	82 pF
C218	21-11032A21	.01 uF 10%
C219(L)		not used
C219(H)	21-11031A07	3.3 +/--.25 pF
C220	21-11031A61	1000 pF
C221(L)	21-11031A05	2.2 +/--.25 pF
C221(H)	21-11031A03	1.5 +/--.25 pF
C222	21-11032A21	.01 uF 10%
C223	21-11031A07	3.3 +/--.25 pF
C224	21-11031A61	1000 pF
C225	21-11031A61	1000 pF
C228	21-11032A21	.01 uF 10%
C229	21-11031A03	1.5 +/--.25 pF
C230	21-11031A03	1.5 +/--.25 pF
C231	21-11031A28	36 pF
C233(L)	21-11031A28	36 pF
C233(H)	21-11031A27	33 pF
C234	21-11031A19	15 pF
C235	21-11031A13	8.2 +/--.5 pF
C236	21-11031A13	8.2 +/--.5 pF
C237	21-11031A61	1000 pF

composition 2.4 pF 500V

C238	21-11031A61	1000 pF
C239	21-11031A61	1000 pF
C240(L)	21-11031A05	2.2 +/--.25 pF
C240(H)	21-11031A07	3.3 +/--.25 pF
C241(L)	21-11031A09	4.7 +/--.25 pF
C241(H)	21-11031A10	5.6 +/--.25 pF
C242	21-11031A61	1000 pF
C243	21-11031A37	82 pF
C245	21-11031A61	1000 pF
C246(L)		not used
C246(H)	21-11031A07	3.3 +/--.25 pF
C247	21-11031A61	1000 pF
C248	21-11031A03	1.5 +/--.25 pF
C249	21-11032A21	.01 uF 10%
C250	21-11031A09	4.7 +/--.25 pF
C251	21-11031A61	1000 pF
C252	21-11031A61	1000 pF
C253(L)		not used
C253(H)	21-11031A19	15 pF
C276	21-11032A21	.01 uF 10%
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C301	21-11032A21	.01 uF 10%

Diodes (see note)

CR1	48-80236E16	quad Schottky ring
CR2	48-80154K03	dual Schottky SOT
CR51	48-83654H01	silicon
CR101	48-83654H01	silicon
CR102	48-83654H01	silicon
CR151	48-82190H54	silicon varactor SOT
CR152	48-82190H54	silicon varactor SOT
CR153	48-83654H01	silicon
CR154	48-83654H01	silicon
CR176	48-83654H02	silicon
CR202	48-82190H54	silicon varactor SOT
CR203	48-82190H54	silicon varactor SOT
CR204	48-82190H54	silicon varactor SOT
CR205	48-82190H54	silicon varactor SOT
CR206	48-84616A01	silicon hot carrier
CR207	48-84616A01	silicon hot carrier
CR209	48-82190H54	silicon varactor SOT
CR210	48-82190H54	silicon varactor SOT
CR211	48-82190H54	silicon varactor SOT
CR212	48-82190H54	silicon varactor SOT
CR213	48-82190H54	silicon varactor SOT
CR214	48-84616A01	silicon hot carrier
CR215	48-84616A01	silicon hot carrier

Filters

FL51	91-80097D06	455 kHz, 6D
FL52	91-80098D06	455 kHz, 4D

Connectors, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M02	14-pin socket (logic board)

Coils

L1	24-80148M06	4-1/2 turns YEL
L2	24-80148M06	4-1/2 turns YEL
L3	24-80148M06	4-1/2 turns YEL
L4	24-80148M06	4-1/2 turns YEL
L5	24-80148M06	4-1/2 turns YEL
L6	24-80148M06	4-1/2 turns YEL
L7	24-80148M06	4-1/2 turns YEL
L8	24-80063M14	1.2 uH
L51	24-80063M09	.47 uH
L52	24-80063M09	.47 uH
L53	24-80063M04	.18 uH
L54	24-80063M21	4.7 uH
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714

L58	24-80063M21	4.7 uH
L59	24-80164M03	tunable .7 uH E716
L60	24-80063M14	1.2 uH
L61	25-80000E01	tunable 455 kHz with cap
L101	24-80063M14	1.2 uH
L102	24-11030B09	4-1/2 turns BRN
L151	24-80299D01	tunable 17-3/4 turns
L152	24-80063M22	5.6 uH
L153	30-10286A72	sleeved jumper
L202	24-80148M05	tunable 3-1/2 turns
L203	24-80063M14	1.2 uH
L204(L)	24-11030B11	6-1/2 turns ORG
L204(H)	24-11030B08	4-1/2 turns BRN
L205	24-80063M14	1.2 uH
L206	24-80063M14	1.2 uH
L207	24-80063M14	1.2 uH
L208	24-11030B09	4-1/2 turns BRN
L209	24-80063M14	1.2 uH
L210	24-11030B12	7-1/2 turns YEL
L211	24-80063M14	1.2 uH
L213	24-80148M08	tunable 4-1/2 turns
L214	24-80063M14	1.2 uH
L215(L)	24-11030B14	9-1/2 turns BLU
L215(H)	24-11030B12	7-1/2 turns YEL
L216	24-80063M14	1.2 uH
L217	24-80063M14	1.2 uH
L218	24-80063M14	1.2 uH
L219	24-11030B09	4-1/2 turns BRN
L220	24-80063M14	1.2 uH
L221	24-11030B14	9-1/2 turns BLU
L222	24-80063M14	1.2 uH

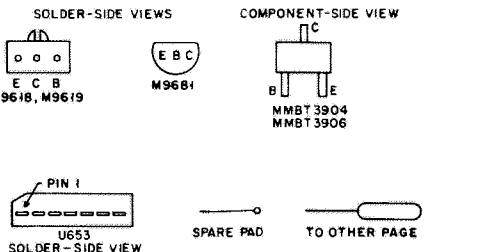
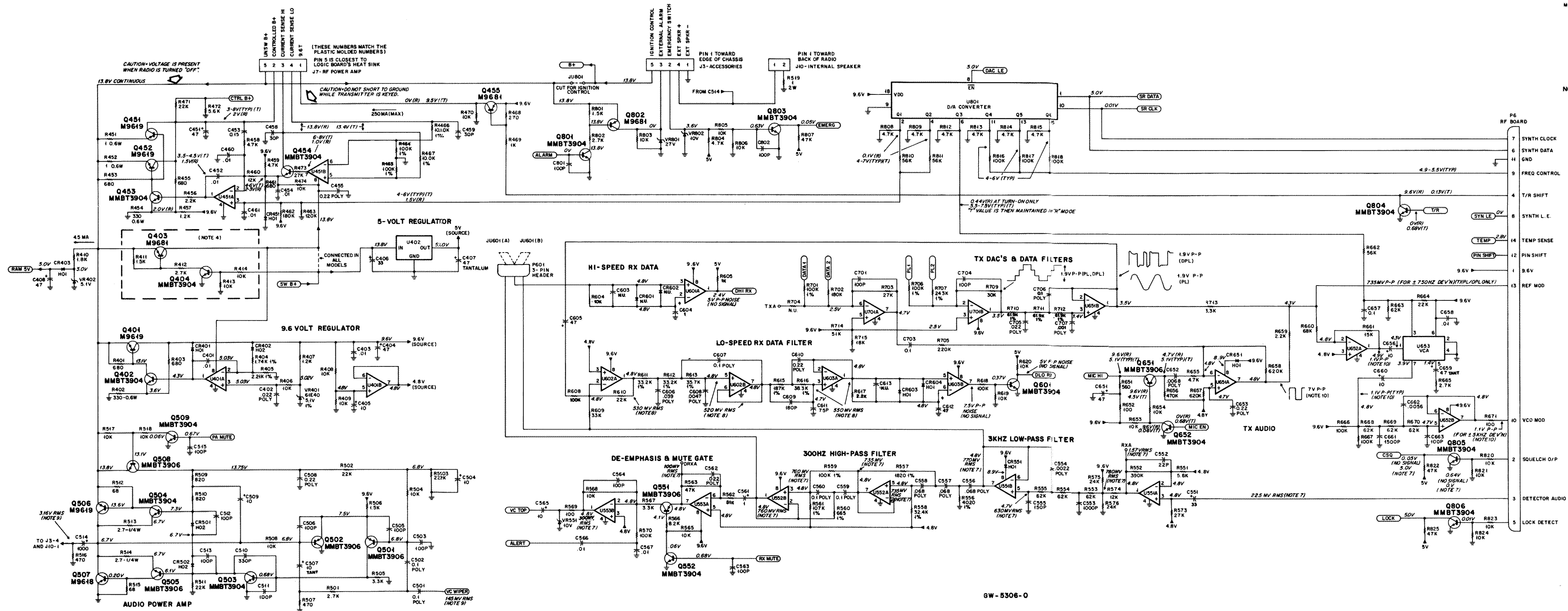
Transistors (see note)

Q1	48-80182D44	NPN; type M82D44
Q2	48-00869643	PNP; type M9643
Q51	48-00869839	field effect; type M9839
Q52	48-00869839	field effect; type M9839
Q53	48-00869642	NPN; type M9642
Q101	48-00869643	PNP; type M9643
Q102	48-00869987	NPN; type M9987
Q103	48-00869987	NPN; type M9987
Q104	48-00869643	PNP; type M9643
Q105	48-00869642	NPN; type M9642
Q106	48-00869642	NPN; type M9642
Q107	48-00869658	NPN; type M9658
Q151	48-00869658	NPN; type M9658
Q152	48-00869643	PNP; type M9643
Q203	48-00869839	field effect; type M9839
Q204	48-00869658	NPN; type M9658
Q205	48-00869658	NPN; type M9658
Q206	48-00869839	field effect; type M9839
Q207	48-00869658	NPN; type M9658
Q208	48-00869658	NPN; type M9658
Q276	48-00869642	NPN; type M9642
Q277	48-00869643	PNP; type M9643
Q278	48-00869643	PNP; type M9643
Q279	48-00869643	PNP; type M9643

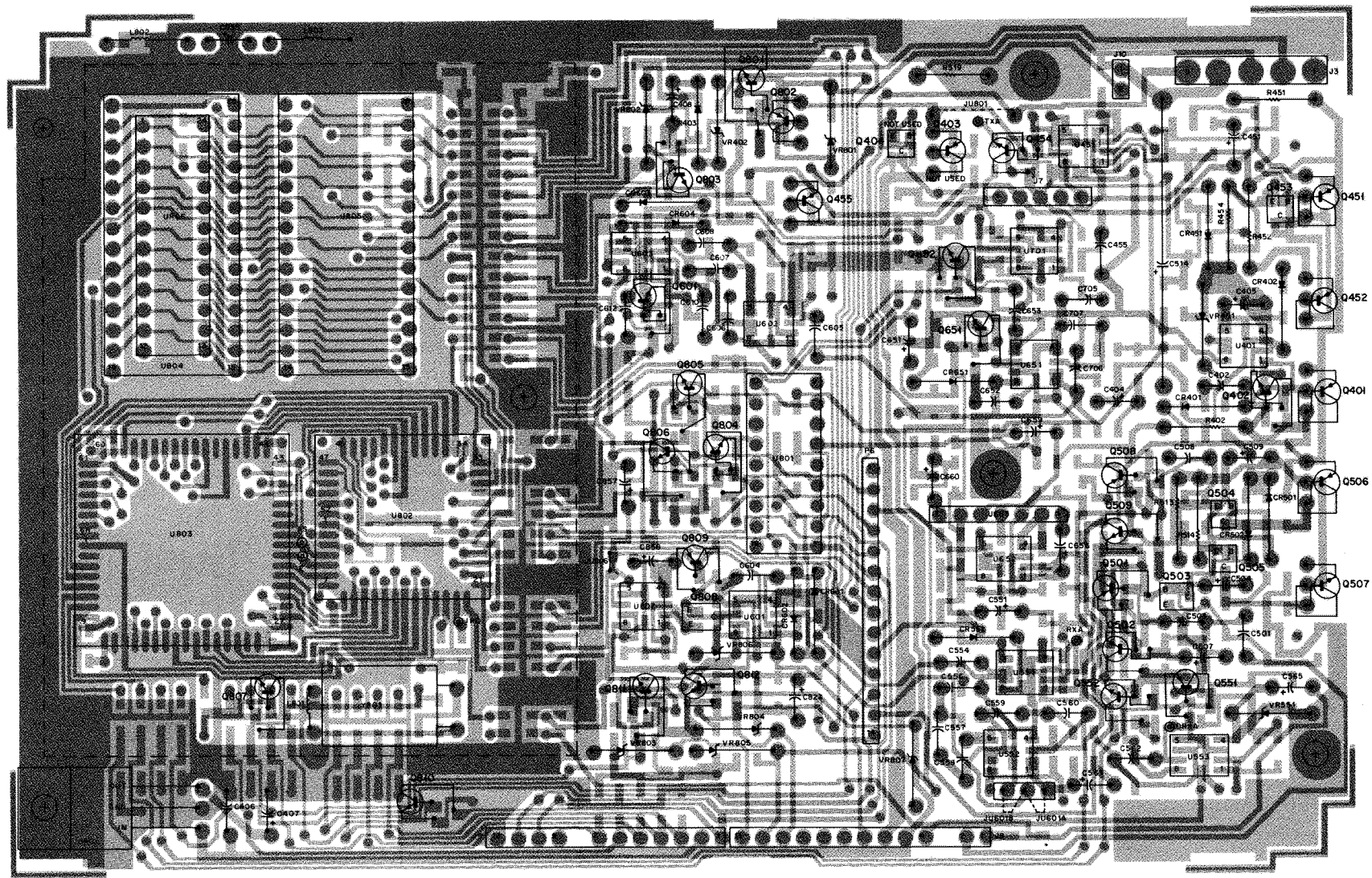
Resistors, chip, 5%, 1/8 watt, unless otherwise indicated

R1	06-11024A05	15
R2	06-11024A05	15
R3	06-11024A41	470
R4	06-11024A59	2.7k
R5	06-11024A21	68
R6	06-11024A61	3.3k
R7	06-11024A77	15k
R51	06-11024A18	51
R52	06-11024A29	150
R53	06-11024A63	3.9k
R54	06-11024A29	150
R56	06-11024B20	820k
R57	06-11024A47	820
R58	06-11024B06	220k
R59	06-11024B02	150k
R60	18-05500L08	variable 22k
R61	06-11024A93	68k

R62	06-11024A83	27k
R63	06-11024A95	82k
R102	06-11024A37	330
R103	06-11024A73	10k
R104	06-11024A73	10k
R105	06-11024A85	33k
R106	06-11024A49	1k
R107	06-11024A53	1.5k
R108	06-11024A01	10
R109	06-11024A01	10
R110	06-11024A77	15k
R111	06-11024A47	820
R112	06-11024A61	3.3k
R113	06-11024A49	1k
R114	06-11024A47	820
R115	06-11024A45	680
R116	06-11024A67	5.6k
R118	06-11024A45	680
R119	06-11024A65	4.7k
R120	06-11024A63	3.9k
R121	06-11024A63	3.9k
R122	06-11024A18	51
R123	06-11024A25	100
R124	06-11024A59	2.7k
R125	06-11024A47	820
R151	06-11024A89	47k
R152	06-11024A85	33k
R153	06-11024A89	47k
R154	06-11024A09	22
R155	06-11024A73	10k
R156	06-11024A77	15k
R157	06-11024A53	1.5k
R158	06-11024A49	1k
R159	06-11024A49	1k
R161	06-11024A73	10k
R163	06-11024A81	22k
R164	18-05500L08	variable 22k
R165	06-11024A84	30k
R176	06-11024H26	22.6k 1%
R177	06-11024H28	23.7k 1%
R178	06-11024G91	10.0k 1%
R179	06-11024G91	10.0k 1%
R180	06-11024H52	42.2k 1%
R181	06-11024G91	10.0k 1%
R182	06-11024H28	23.7k 1%
R207	06-11024A19	56
R208	06-11024A19	56
R209	06-11024A25	100
R210	06-11024A59	2.7k
R211	06-11024A73	10k
R212	06-11024A59	2.7k
R213	06-11024A47	820
R214	06-11024A25	100
R215	06-11024A59	2.7k
R216	06-11024A47	820
R217	06-11024A17	47
R218	06-11024A25	100
R219	06-11024A21	68
R220	06-11024A25	100
R222	06-11024A59	2.7k
R223(L)	06-11024A73	10k
R223(H)	06-11024A75	12k
R224	06-11024A97	100k
R225	06-11024A83	27k
R226	06-11024A19	56
R227	06-11024A19	56
R228(L)	06-11024A29	150
R228(H)	06-11024A25	100
R229	06-11024A59	2.7k
R230	06-11024A73	10k
R231	06-11024A59	2.7k
R232	06-11024A47	820
R233	06-11024A25	100
R234	06-11024A59	2.7k
R235	06-11024A47	820
R236	06-11024A17	47
R237	06-11024A41	470
R238	06-11024A03	12

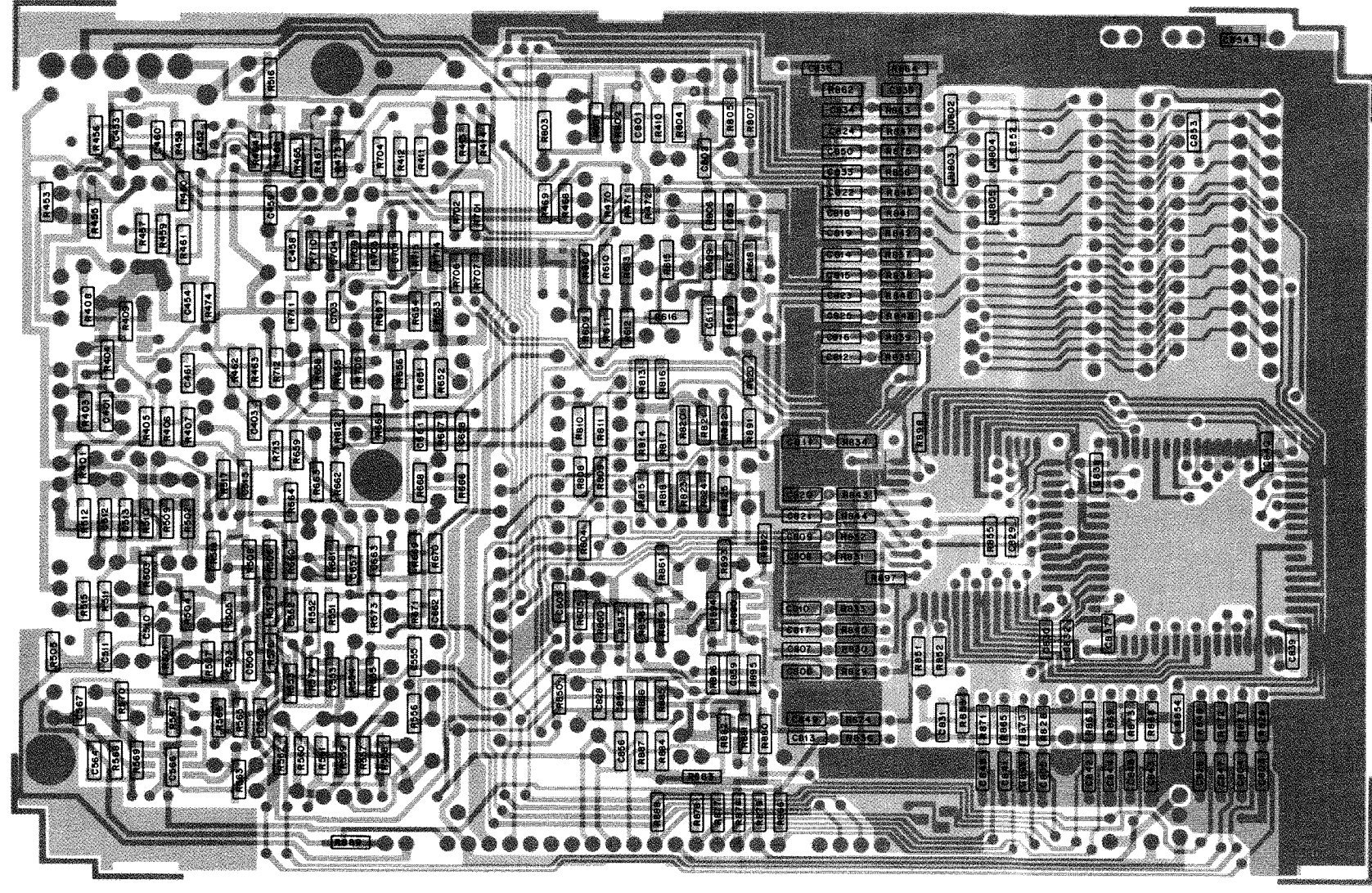


- NOTES:
- UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
 - NON-POLARIZED CAPACITORS ARE CHIRTYPE UNLESS OTHERWISE INDICATED.
 - POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC TYPE UNLESS OTHERWISE INDICATED.
 - NOT USED.
 - DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 - ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 1 KHZ AT 3 KHZ DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
 - SAME AS NOTE 7 EXCEPT MODULATING FREQUENCY IS 100 HZ.
 - SAME AS NOTE 7 EXCEPT WITH VOLUME CONTROL ADJUSTED FOR 5 WATTS (3.18 VOLTS RMS ACROSS 2 OHM LOAD).
 - MEASURED IN THE TRANSMIT MODE WITH 1 KHZ, 800 MV RMS SIGNAL APPLIED TO MICROPHONE INPUT FROM 600 OHM SOURCE.



COMPONENT SIDE ● GW-5299-0
 SOLDER SIDE ● GW-5298-0
 OVERLAY — GW-5300-0

SHOWN FROM COMPONENT SIDE



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

SHOWN FROM SOLDER SIDE

