MIDLAND LMR
LAND MOBILE RADIO
SYNTECH™-II
SERVICE MANUAL

PART THREE (TX/RX UNIT)

70-0500CWB/0520CWB
VHF LOW-BAND 50/110 WATT

70-050052
09-050/052SM-7/90-2M

SYN-TECH II service information is published in three parts.

Part One contains general servicing and installation information that is common to the entire SYN-TECH II line.

Part Two contains technical data and drawings for the SYN-TECH II Control Heads. Two versions of this part exist: one for the the Deluxe Control head, and one for the Standard and Small-Remote Control Heads.

Part Three contains technical data and drawings for SYN-TECH II TX/RX Units.

This service manual is Part Three, and contains specific technical data and drawings for the 70-0500CWB/0520CWB SYN-TECH II TX/RX Units.

As necessary, user's manual supplements will be published and distributed on the following forms:

Manual Addition (MA) . . . . . For supplemental information useful in product service or improvement. Printed on BLUE paper.

Change Notice (CN) . . . . . For details about changes made during software upgrades by model and serial number. Printed on YELLOW paper.

Manual Correction (MC) . . . . . For correcting literature errors not related to software upgrades. Printed on GREEN paper.

Technical Bulletin (TB) . . . . . For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Comments or suggestions concerning areas of manual improvement are welcome.

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SECTION 1

GENERAL INFORMATION

NOTES

DESCRIPTION

The 70-0500CWB/0520CWB TX/RX Units are RF packages for the SYN-TECH II Low-Band VHF, FM mobile transceivers. The 70-0500CWB Unit is capable of producing 50 W RF output; the 70-0520CWB is capable of producing 110 W of RF output. The 70-0500CWB/0520CWB TX/RX Units operate any channel frequency 37 to 48 MHz band, automatically (without retuning).

Generally, the SYN-TECH II is comprised of two parts: a TX/RX Unit, which is the major portion of the radio; and a detachable Control Head. SYN-TECH II radios are compact and can be mounted under a vehicle dashboard; but, if available space is limited, the SYN-TECH II radio can be purchased with its control panel detached so that the bulk of the radio can be mounted under a seat or in trunk; thus, only the control panel need be mounted in the operator's reach. If an under-dash configuration is purchased, the TX/RX Unit is shipped with the Control Panel attached to it. The TX/RX Unit of the Trunk-Mount configuration has a cable-interface board and handle assembly mounted in place of the Control Head. A cable-interface board and rear cover are also added to the Control Head. The two units must be connected together with a multiconductor cable when installed.

The chassis of the SYN-TECH II TX/RX Unit is constructed of cast aluminum with sectional cavities that house three major printed circuit boards. The RF Board contains transmitter, receiver, and synthesizer circuitry and is located on the underside of the radio. The Logic Board contains the microcomputer and interface circuitry and is mounted on the top side of the radio. Another, unused, cavity is located on the radio topside to accommodate optional circuit boards. The third PC board is located inside the rear heat sink which comprises the PA Module. The PA Board is accessible by removal of the heat sink top cover.

SYN-TECH II MODELS

Model number 70-0500CWB/0520CWB identify TX/RX Units, which are SYN-TECH II subassemblies, not the entire transceiver.

MIDLAND models 70-050x, 70-055x, 70-052x, 70-056x are complete SYN-TECH II transceivers consisting of two major components: either the 70-0500CWB or 70-0520CWB TX/RX Unit and the Control Head (MIDLAND model number 70-0001, 70-0002, or 70-0007). Two of the Control Heads can be mounted directly onto the TX/RX Unit front, which completes the Under-Dash configuration that is identified by 70-050x and 70-0520x model numbers. The Trunk-Mount configuration separates the two components with a Control Cable, and is identified with 70-055x and 70-056x model numbers.

Model numbers of SYN-TECH II packages that contain the 70-0500CWB/0520CWB TX/RX Units are shown below:

MODEL NUMBER	MOUNTING	RF OUTPUT POWER	CONTROL HEAD	FREQUENCY BAND MHz	TX/RX UNIT
70-0501CWB	UD	50 WATTS	STANDARD	37–48 MHz	70-0500CWB
70-0521CWB	UD	110 WATTS	STANDARD	37–48 MHz	70-0520CWB
70-0502CWB	UD	50 WATTS	DELUXE	37–48 MHz	70-0500CWB
70-0522CWB	UD	110 WATTS	DELUXE	37–48 MHz	70-0520CWB
70-0551CWB	TM	50 WATTS	STANDARD	37–48 MHz	70-0500CWB
70-0561CWB	TM	110 WATTS	STANDARD	37–48 MHz	70-0520CWB
70-0552CWB	TM	50 WATTS	DELUXE	37–48 MHz	70-0500CWB
70-0562CWB	TM	110 WATTS	DELUXE	37–48 MHz	70-0520CWB
70-0557CWB	TM	50 WATTS	SMALL	37–48 MHz	70-0500CWB
70-0567CWB	TM	110 WATTS	SMALL	37–48 MHz	70-0520CWB

SPECIFICATIONS

Refer to EIA-152-C, EIA RS-204D, and DOC RSS-119, Issue 3 for standard of performance and method of measurement.

GENERAL

OPERATING VOLTAGE:	Nominal: 13.6 V DC, negative ground Range: 10.5 to 16 V DC
TEMPERATURE RANGE:	−30° C to +60° C
ANTENNA IMPEDANCE:	50 Ω, unbalanced
FREQUENCY CONTROL:	Phase-Lock-Loop synthesized
FREQUENCIES OF OPERATION:	37 to 48 MHz
CHANNEL CAPACITY:	Up to 320 transmit and 320 receive
CHANNEL SPREAD:	
Transmit:	11 MHz
Receive:	11 MHz
FREQUENCY TOLERANCE AND STABILITY:	5 ppm both TX and RX; 2.0 ppm optional
DUTY CYCLE:	Intermittent. 1 min TX, 4 min RX; (Per EIA RS-152B)
HIGH HUMIDITY:	95% at 50° C per EIA RS-152C, sec.13
VIBRATION STABILITY:	Per EIA RS-152C and applicable portions of MIL810C/D
SHOCK STABILITY:	Per EIA RS-152C and applicable portions of MIL810C/D
CURRENT DRAIN:	
Standby:	0.3 A DC (varies with options)
Receive (at rated audio):	2.00 A DC
Transmit (70-0500CWB):	10.0 A DC
Transmit (70-0520CWB):	10.0 A DC (55 W); 25.0 A DC (110 W)

DIMENSIONS (H x W x D):	
Under-Dash Radio:	57x185x300 mm (2.3"x 7.3"x 11.8")
Trunk-Mount TX/RX Unit only:	57x185x320 mm (2.3"x 7.3"x 12.6")
Standard Remote Control Head:	57x185x75 mm (2.3" x 7.3" x 3.0")
Small Remote Control Head:	57x120x75 mm (2.3" x 4.7" x 3.0")
Remote Speaker:	121x121x72mm (4.8" x 4.8" x 2.8")
WEIGHT:	
Under-Dash Radio:	3.1 kg (6.8 lbs)
Trunk-Mount TX/RX Unit only:	3.2 kg (7.0 lbs)
Standard Remote Control Head:	0.36 kg (0.8 lbs)
Small Remote Control Head:	0.23 kg (0.5 lbs)
Remote Speaker:	0.63 kg (1.38 lbs)

TRANSMITTER

CARRIER POWER OUTPUT:	
70-0500CWB:	50 W minimum, adjustable down to 25 W, and 1-10 W with Low-Power option
70-0520CWB:	110 W, adjustable down to 55 W
MODULATION SYSTEM:	16K0F3E, Direct FM
AUDIO FREQUENCY RESPONSE:	Per EIA and DOC specifications
AUDIO HARMONIC DISTORTION:	3% THD(1KHz tone at 3.0 kHz deviation, and 750 μs de-emphasis)
SYSTEM DEVIATION:	5 kHz maximum
MODULATION LIMITING:	Instantaneous peak clipping with low-pass audio filtering
HUM AND NOISE:	−50 dB
OCCUPIED BANDWIDTH:	Less than −60 dB of carrier power 30 kHz outside carrier frequency
TRANSMIT CARRIER ATTACK TIME:	20 ms max. for 50% rated power
CONDUCTED SPURIOUS EMISSIONS:	Less than 2.5 υW from 1 to 1000 MHz
MICROPHONE INPUT LEVEL:	−8 dBm 3 dB at 600 Ω
OUTPUT PROTECTION:	Shall withstand without damage 5 minutes of operation into a 20:1 load mismatch with any standing wave variance.
OUTPUT STABILITY:	Shall not exceed spurious emission limits herein while operating into a 5:1 load mismatch with full standing-wave variance.

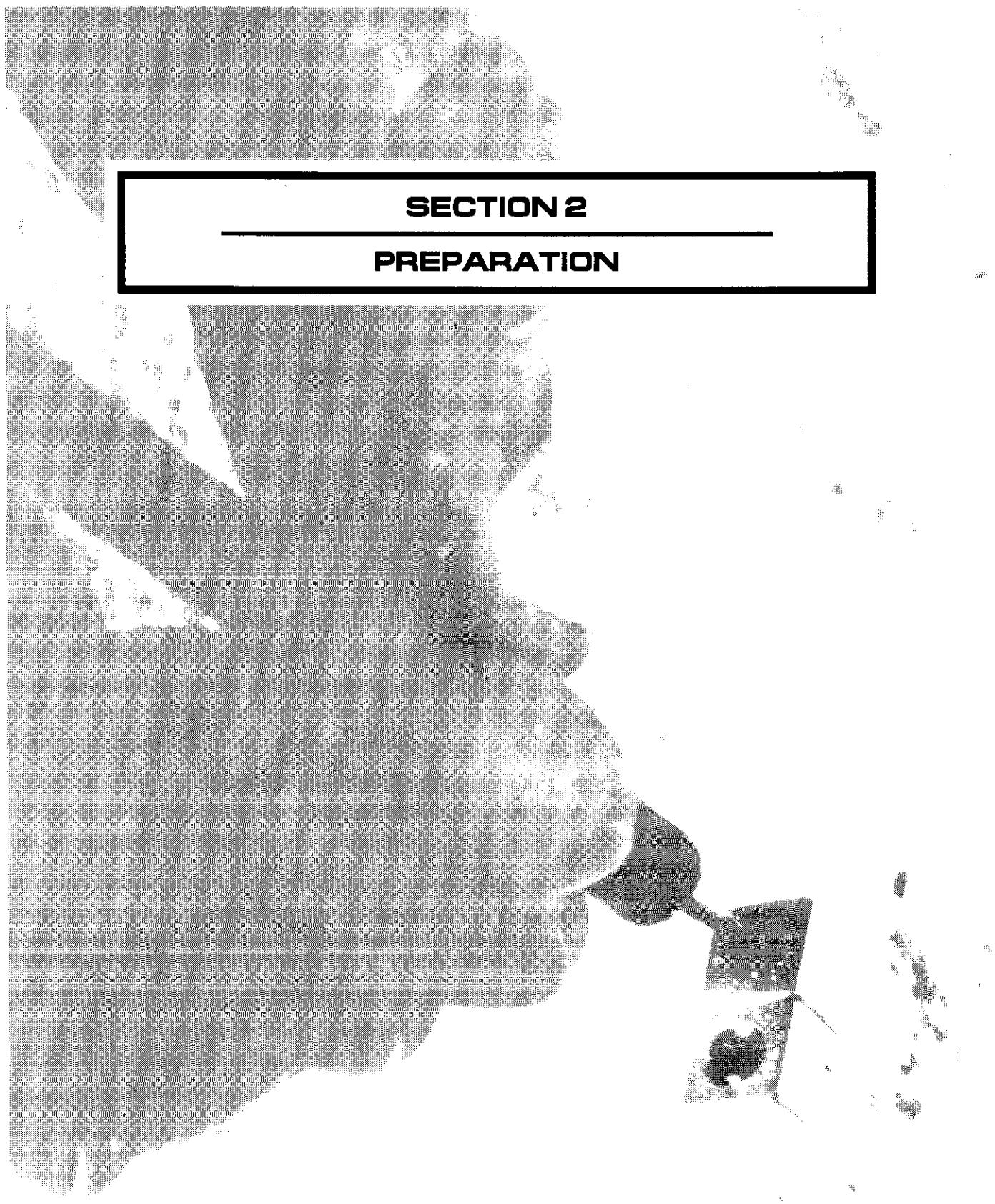
RECEIVER

SENSITIVITY:	
12 dB SINAD:	0.35 μV maximum
Threshold Squelch Break:	0.18 μV maximum or 6 dB SINAD
Tight Squelch Break:	0.8 to 1.2 μV
RECEIVER ATTACK TIME:	50 ms
RECEIVER SQUELCH CLOSING TIME:	100 ms
ACCEPTABLE RF DISPLACEMENT:	2.0 kHz minimum
ADJACENT CHANNEL REJECTION:	−90 dB at 30 KHz
SPURIOUS RESPONSE IMMUNITY:	−90 dB
INTERMODULATION IMMUNITY:	
standard:	−75 dB minimum
with 70-2991 Noise Blanker option:	−70 dB minimum
AUDIO POWER OUTPUT:	
Under-Dash Radio:	1.0 watt at 3% THD into its internal speaker, or 12 W 3% THD into a 4 Ω external speaker
Trunk-Mount Radio:	12 W at 3% THD into its 4 Ω external speaker
AUDIO FREQUENCY RESPONSE:	Per EIA and DOC specifications
HUM AND NOISE:	
Un-squelched:	−45 dB
Squelched:	−60 dB
CONDUCTED SPURIOUS EMISSIONS:	200 μV across 50 Ω (800 pW) from DC to 1 GHz
INTERMEDIATE FREQUENCIES:	10.7 MHz (1st) and 455 kHz (2nd)

—All specifications subject to change without notice—

SECTION 2

PREPARATION



NOTES

PROGRAMMING

NOTE: Data from a radio that has been programmed using the 70-1488 PC software can not be downloaded into a radio that has been programmed using the 70-1080/1080A programmer, and vice versa.

- **Programming by PC**

If the radio is to be programmed using the 70-1488 PC software versions 1.6 and later, a separate band has been allocated for "CWB" models.

- **70-1080/1080A Programming**

1. Turn on the 70-1080A programmer and enter the model number of one of the "C" band radios into the programmer.

2. Go to Manual Entry Mode on the programmer. Enter address 1894 (Hex) to change the data starting at this location.

3. At address 1894 (Hex) change the data from 06 (Hex) to 05 (Hex).

4. The programmer will continue to the next address location of 1895 (Hex). Enter the appropriate data for this address from the table below. Continue with the other addresses until all of the locations have been changed.

ADDRESS (Hex)	DATA FROM (Hex)	DATA TO (Hex)
1894	06	05
1895	68	A5
1896	Unchanged	
1897	B1	A8
1898	Unchanged	
1899	8F	86
189A	Unchanged	
189B	Unchanged	
189C	Unchanged	
189D	50	48
189E	Unchanged	
189F	42	37

NOTE: Do not hit **RST** on the programmer or the above data will be lost. Press the channel, group, options and print keys ONLY.

5. After all of the above locations have been changed, press **CH** and enter the frequencies. Then continue with the programming the group and options for the radio.

ALIGNMENT

The following alignment instructions are for the 70-0500CWB/0520CWB SYN-TECH II radio. Set the power supply to 13.6 V DC and connect the antenna to a 50 Ω high power load (at least 150 W).

RECEIVER AND TRANSMITTER VCO ADJUSTMENTS

1. Program the radio for the following frequencies:

	CH1	CH2	CH3
RX	37.00 MHz	42.00 MHz	48.00 MHz
TX	37.00 MHz	42.00 MHz	48.00 MHz

2. Select Channel 2 and in Receive mode adjust L702 for 6.0 V DC at CM118 pin 3.

3. At Channel 2, and in Transmit mode, adjust L722 for 6.0 V DC at CM118 pin 3.

4. Select Channel 3 and in Receive mode adjust L712 for 6.0 V DC at CM118 pin 3.

5. At Channel 3, and in Transmit mode, adjust L732 for 6.0 V DC at CM118 pin 3.

12.8 MHz REFERENCE OSCILLATOR FREQUENCY ADJUSTMENT

With the unit in transmit mode, adjust X101 for the correct frequency.

RF POWER ADJUSTMENT

70-0500CWB: Select Channel 2 and adjust RV502 for 25 to 50 W RF output power, then adjust RV501 for 1 to 10 W RF output power, if equipped.

70-0520CWB: Adjust RV501 for 110 W output power.

MODULATION LEVEL ADJUSTMENT

1. Select Channel 2, then apply an audio input modulation signal of 1000 Hz with 16 dB attenuation switched in at 1.5 Vp-p to the mic input. Adjust the output level from the audio signal source for 2.5 kHz deviation. Change the audio frequency to 2500 Hz and switch out the 16 dB attenuation.

2. In transmit mode, adjust RV104 for 4.50 kHz deviation.

NOTE: Use RV104 to adjust transmit modulation level above 42.00 MHz.

3. Select Channel 3, and in transmit mode adjust RV105 for 4.50 kHz deviation.

NOTE: Use RV105 to adjust transmit modulation level above 42.00 MHz.

4. Disconnect mic audio source and select CTCSS tone channel, then in transmit mode adjust RV102 for 500 Hz deviation.

5. Next select a DCS code channel and in transmit mode adjust RV101 for 500 Hz deviation.

6. Reconnect the mic audio source and check steps 4 and 5 so that maximum deviation is not over 5.00 kHz.

7. Change the modulation audio to 1 kHz audio at 310 mVrms, and in transmit mode adjust RV103 for 3.00 kHz deviation.

RECEIVER LOCAL OSCILLATOR ADJUSTMENT

Select Channel 1 and adjust L222 and L223 at CM118 pin 4 for maximum reading.

RECEIVER FRONT END AND IF ADJUSTMENT

1. Connect a signal generator set at 37.00 MHz to the radio.
2. Adjust L201, L202, L207, L208, and L209 for best SINAD level, or for maximum level at CM118 pin 5.
3. Adjust L221 and L261 for best SINAD at minimum audio distortion.
4. Check the receiver at Channels 1 and 3 for balanced sensitivity level. If not balanced, repeat steps 1 through 3.

QUADRATURE COIL ADJUSTMENT.

1. Adjust L262 for maximum audio output level.
2. Adjust volume control to maximum and then set RV401 to 8.20 Vrms at speaker.

TIGHT SQUELCH ADJUSTMENT

Adjust RV261 to the desired tight squelch sensitivity or to 1.5 μV.

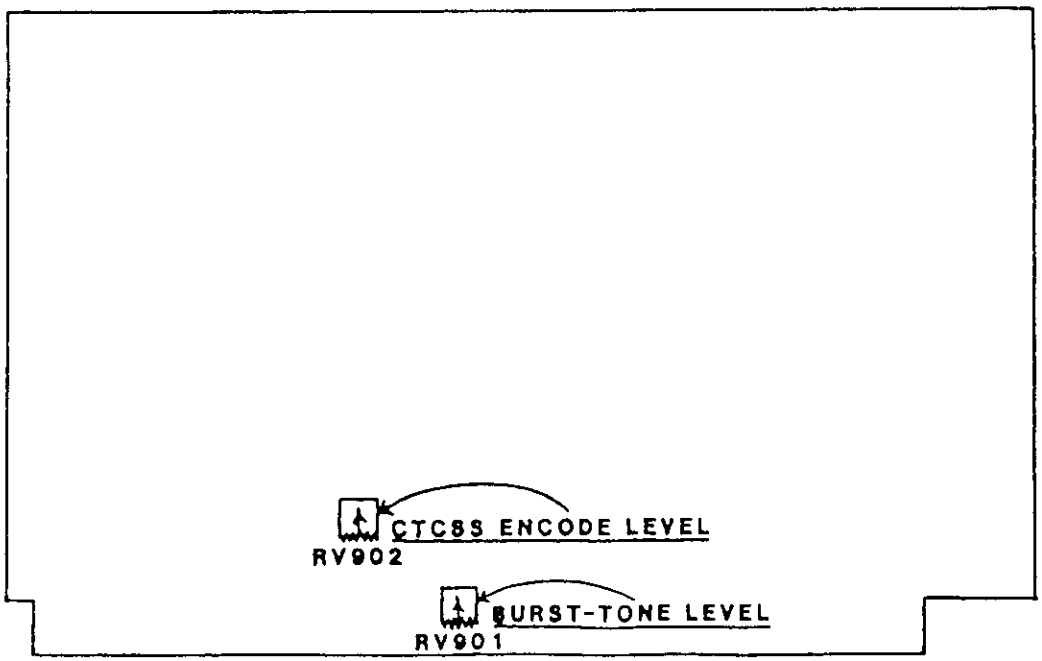


Figure 2 - 1 — Adjustment Map: Logic Board

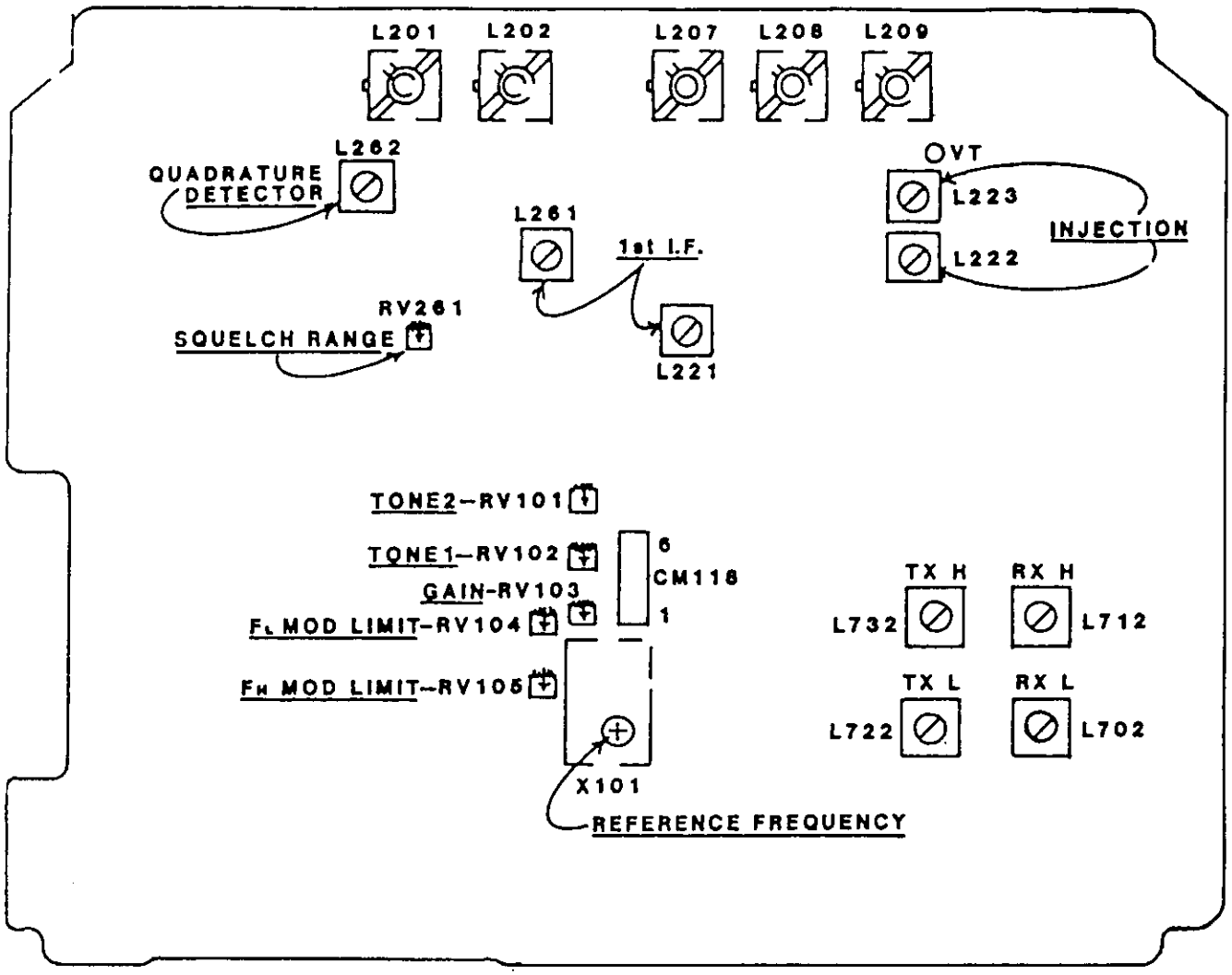


Figure 2 - 2 — Adjustment Map: RF Board

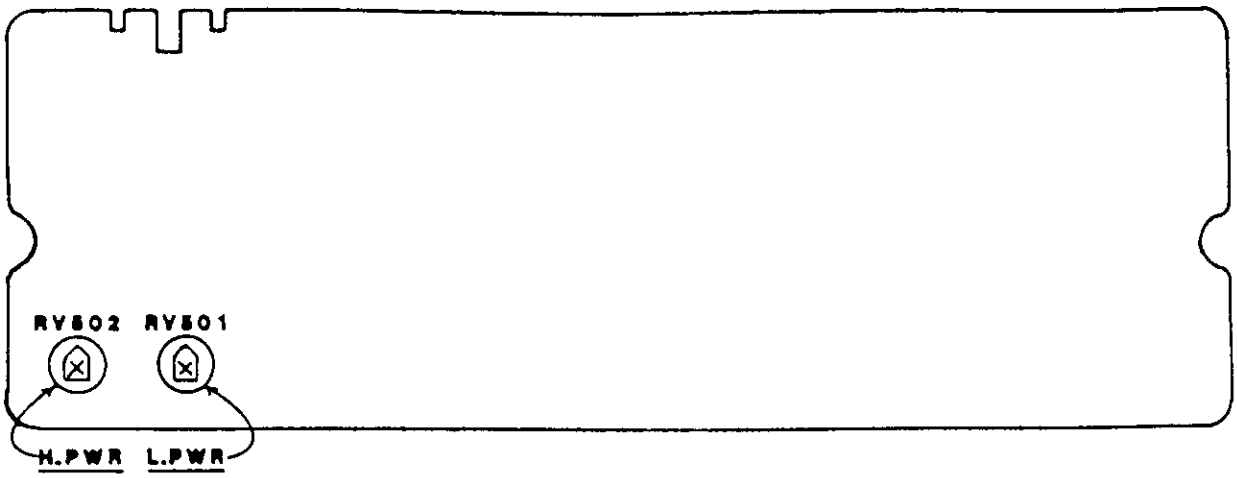


Figure 2 - 3 — Adjustment Map: 50-Watt PA Module (70-0500CWB only)

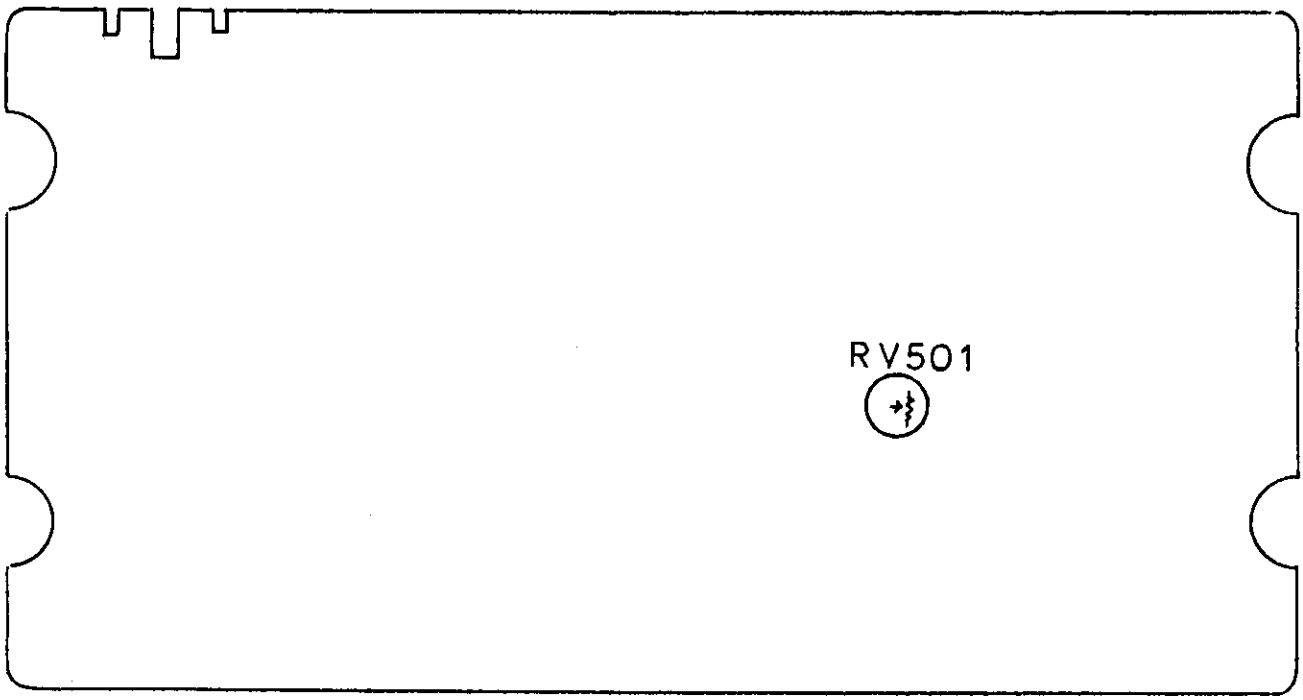


Figure 2 - 4 -- Adjustment Map: 110-Watt PA Module (70-0520CWB only)

SECTION 3

SERVICING

NOTES

METERING

The 70-0500CWB/0520CWB TX/RX Units contain a single block of metering pins for measurement of certain signals. This block, which is a 6-pin, ribbon-plug receptacle, is located on the RF Board next to the VCO cover and the synthesizer reference oscillator. It is labeled CM118.

PIN	SIGNAL FUNCTION	DETAILS
CM118-pin 1	Ground	
CM118-pin 2	REFERENCE OSCILLATOR ACTIVITY	A DC voltage that is produced by detection of IC102 reference-divider output that indicates existence of oscillator output. This metering voltage should be greater than 0.5 V.
CM118-pin 3 VCO STEERING	A DC voltage produced by the synthesizer	phase-lock loop that controls resonance of the TX and RX VCO's. This metering voltage should be between 2.0 and 8.0 V DC when the loop is in lock, and varies with selected-channel frequency.
CM118-pin 4	FIRST-INJECTION LEVEL	A DC voltage produced by detection of first Local-oscillator injection signal of the receiver, which is synthesized by the phase-lock loop. This metering voltage is used to optimize tuning of L222 and L223 and should be greater than 0.5 V.
CM118-pin 5	SIGNAL STRENGTH	A DC voltage produced by detection of the 60 kHz bandpass-amplifier output in the noise-squelch circuit, which varies with on-channel RF signal level. Detected voltage subtracts from 8 V bias; therefore, metering voltage swings positive with RF signal increase.
CM118-pin 6	Not used	

Minimum voltmeter impedance: 20,000 Ω.

Table 3 - 1: Metering Block

TROUBLESHOOTING CHARTS

The Troubleshooting Charts are located on pages 3 - 5 through 3 - 16. If you encounter a problem with your radio, these charts will help you locate the source of you problem, and tell you what steps to take to fix it.

Service Note: VCO Cover Reassembly

Certain attention to the VCO cover is required. The cover is a cast housing that is secured by six screws over the VCO circuitry in the RF Board. Located inside the cover is a rubber pad that applies pressure to the four VCO tuning coils, L702, L712, L722, and L732 (labeled RX- L, TX-L, RX-H, TX-H), to hold them solidly so they will not become microphonic.

When placing the VCO cover back onto the RF Board after repairs, its securing screws must be tightened in the pattern shown below to assure equal distribution of pressure on the tuning coils.

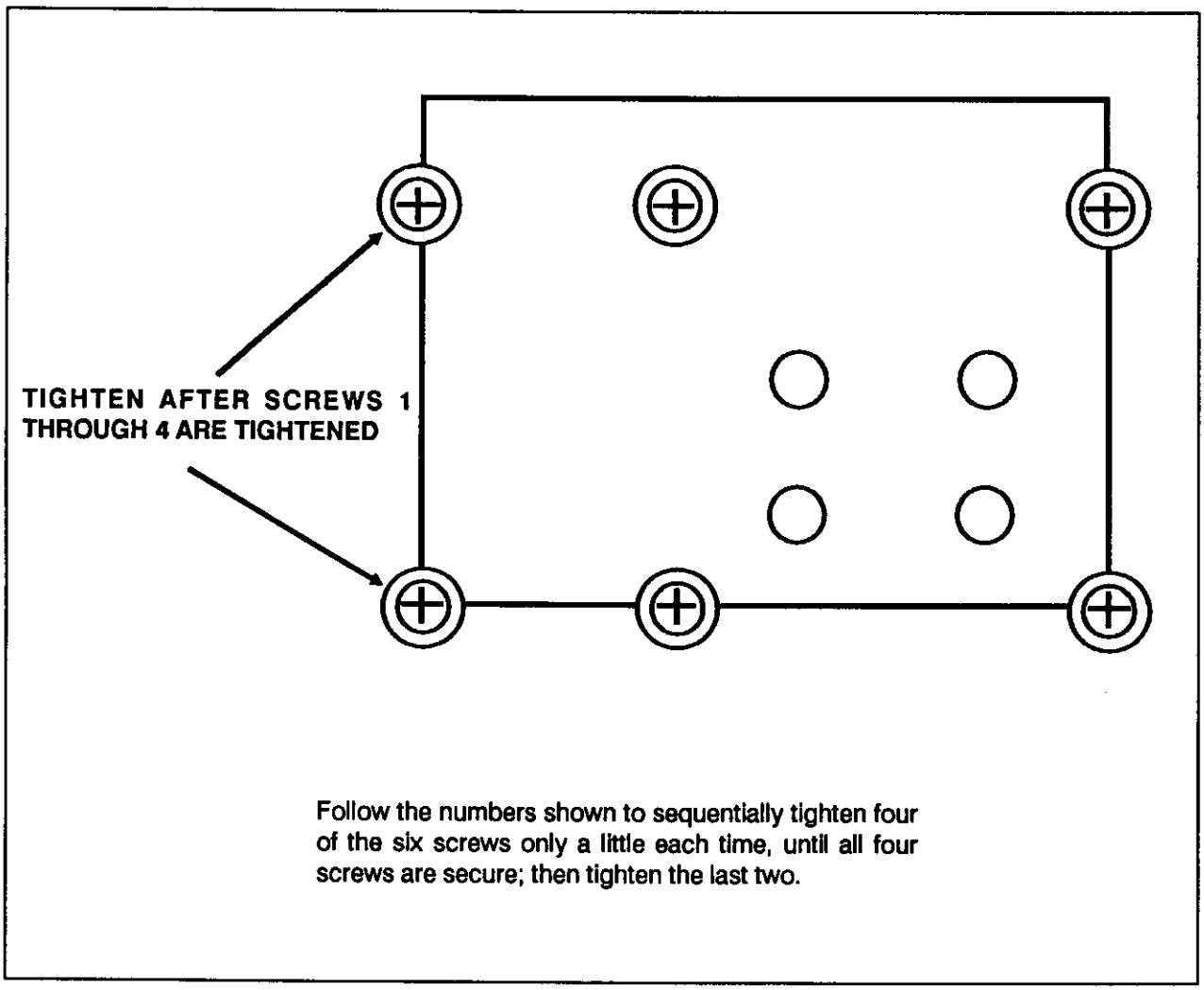
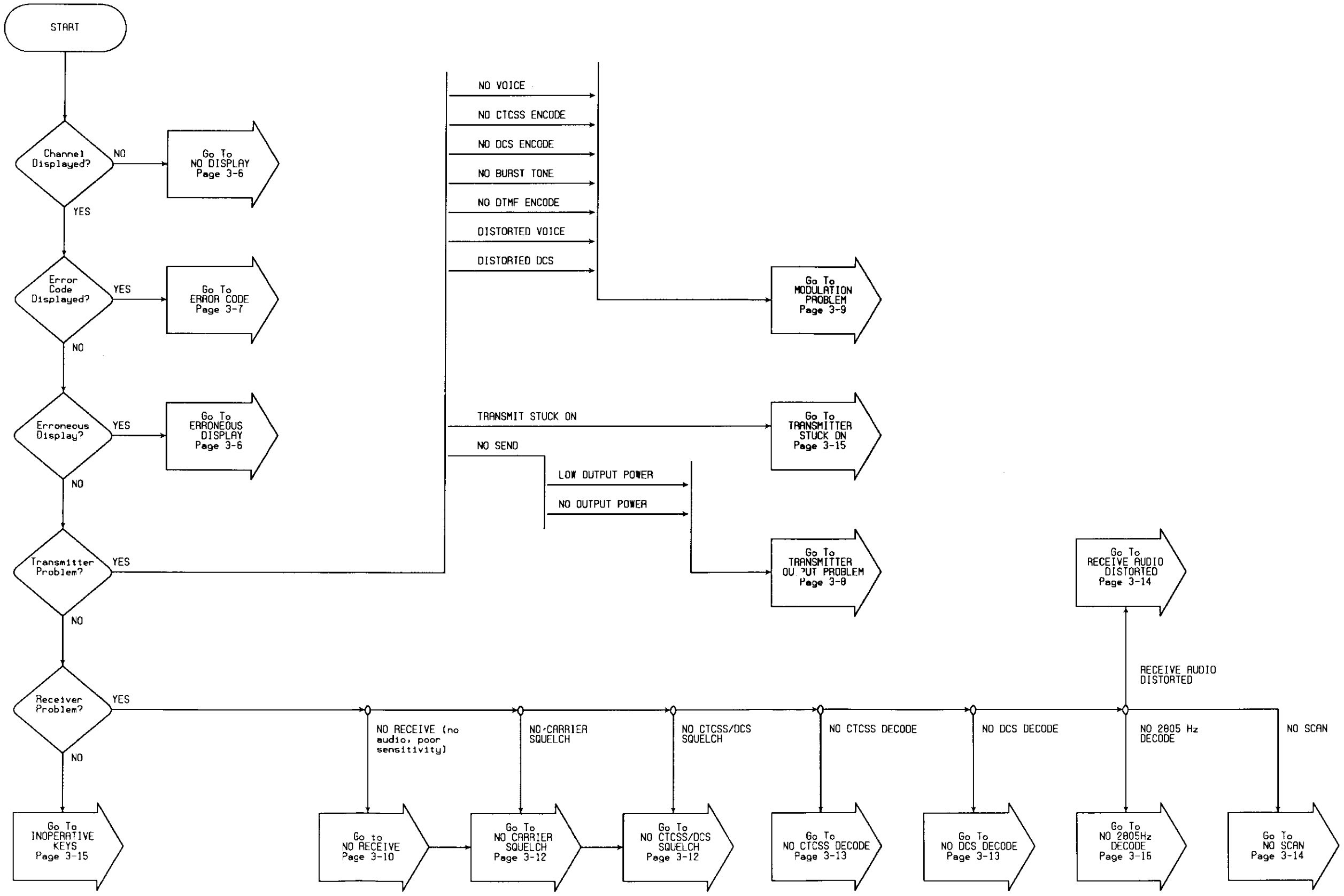
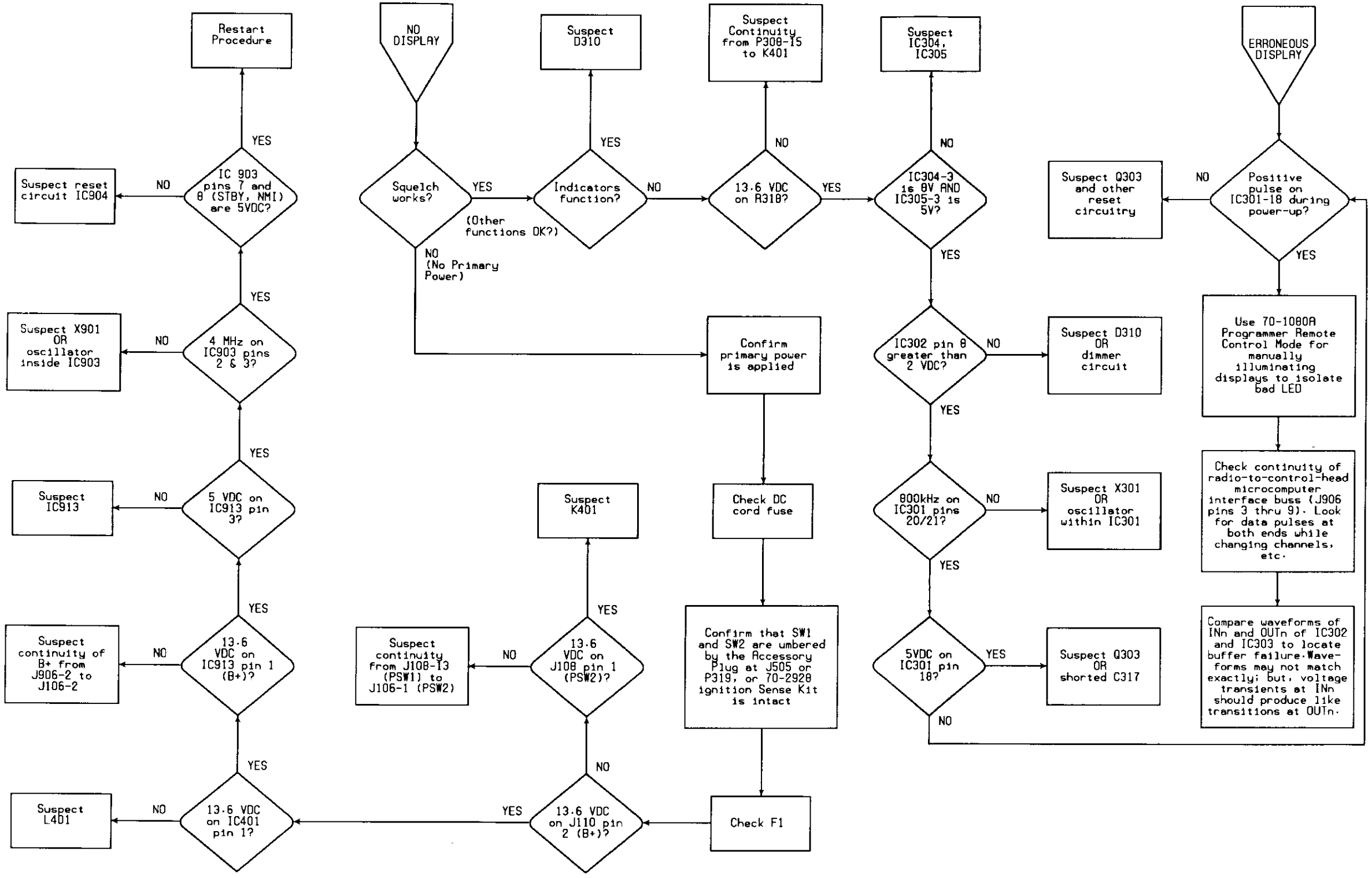


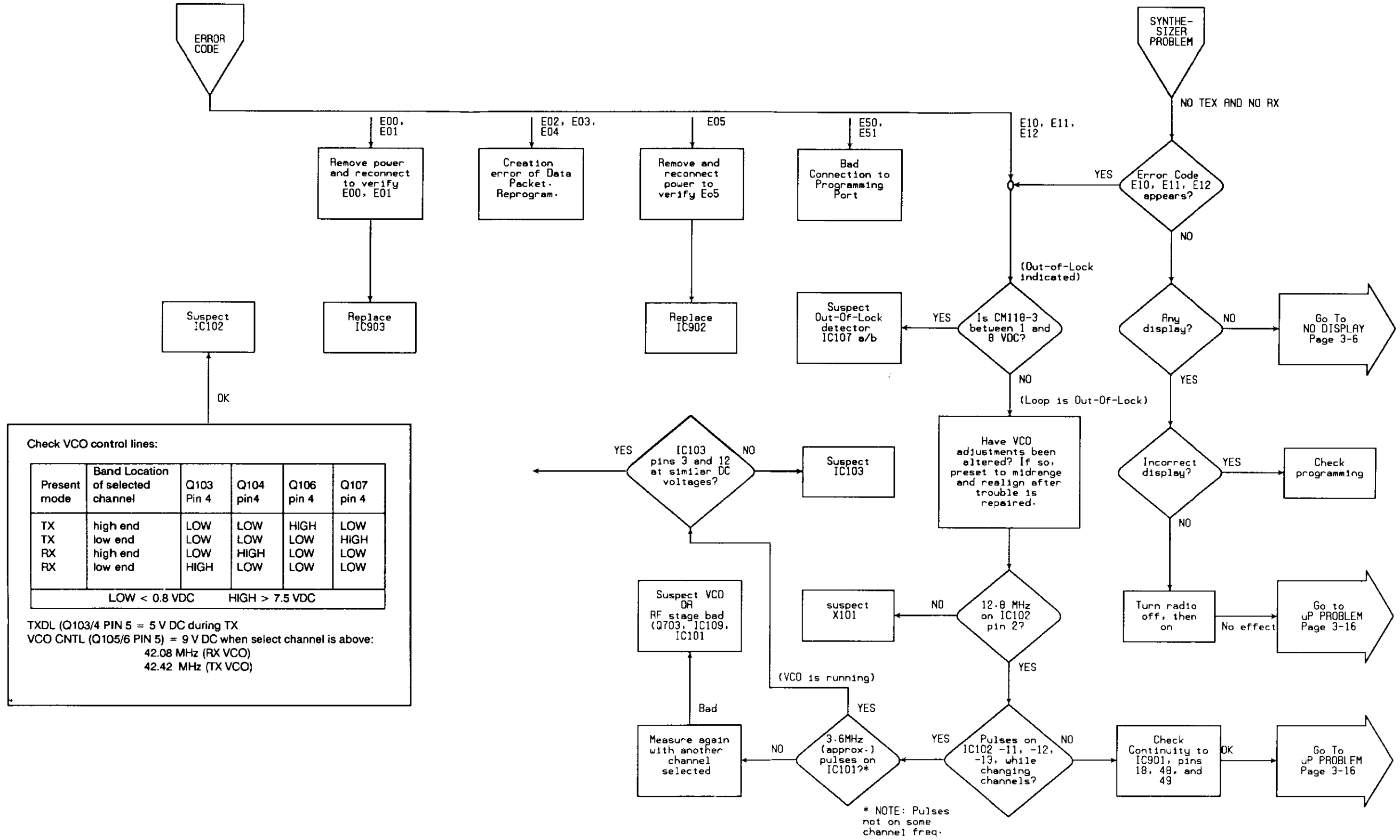
Figure 3 - 1 — Screw Tightening Pattern



Troubleshooting Chart 3 - 1 — Getting Started



Troubleshooting Chart 3 - 2 — Display Problem

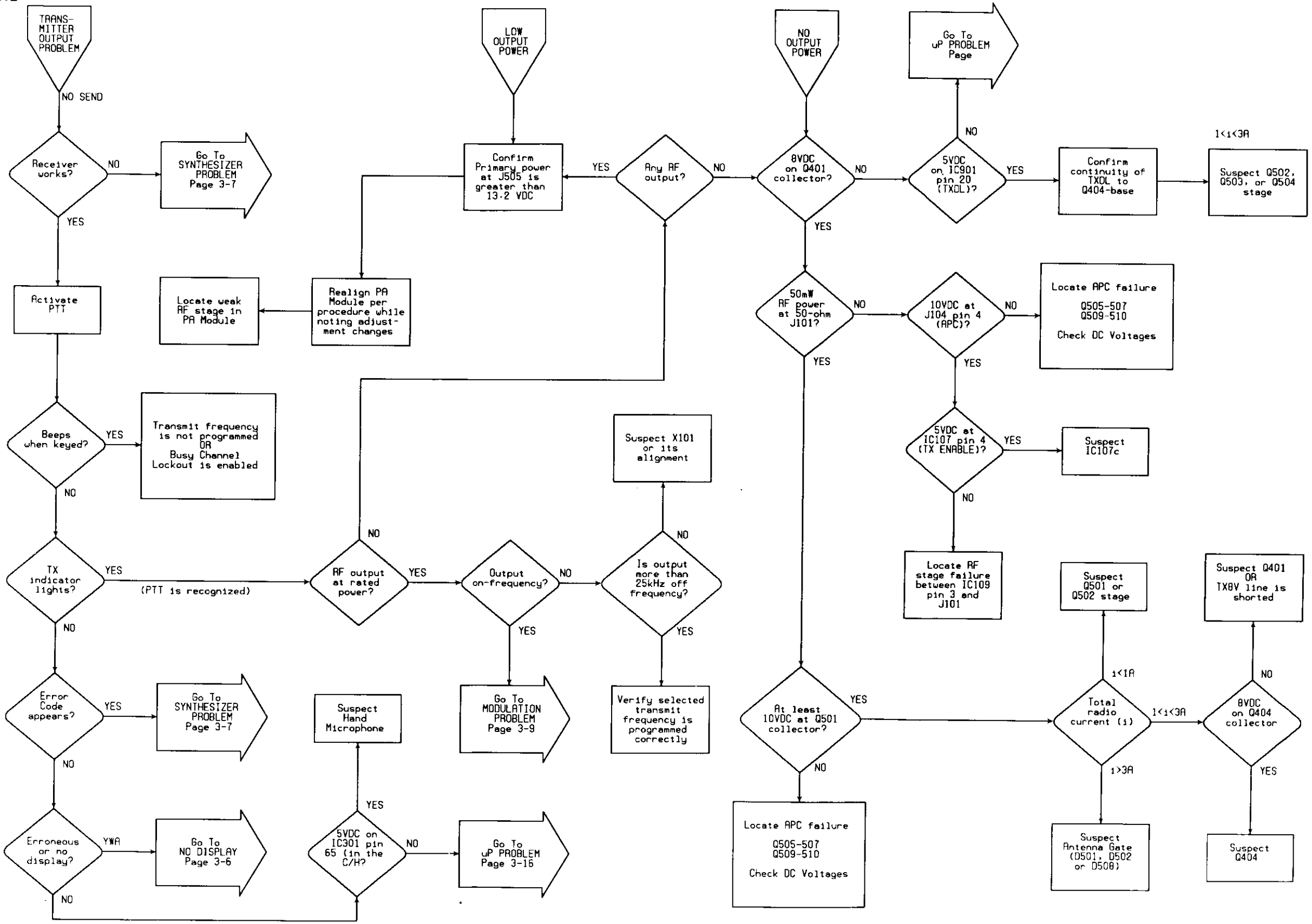


Check VCO control lines:

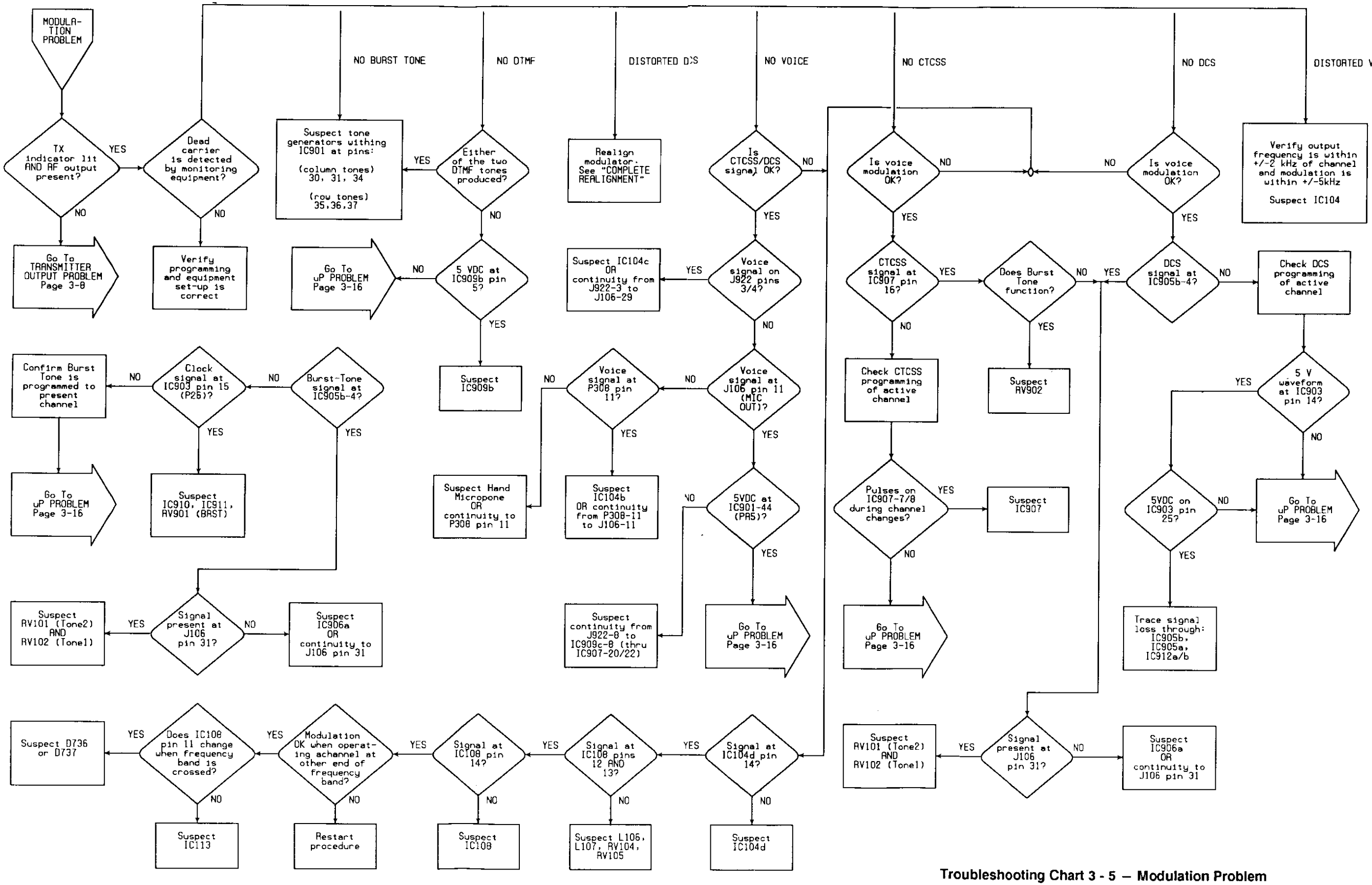
Present mode	Band Location of selected channel	Q103 Pin 4	Q104 pin4	Q106 pin 4	Q107 pin 4
TX	high end	LOW	LOW	HIGH	LOW
TX	low end	LOW	LOW	LOW	HIGH
RX	high end	LOW	HIGH	LOW	LOW
RX	low end	HIGH	LOW	LOW	LOW
LOW < 0.8 VDC HIGH > 7.5 VDC					

TXDL (Q103/4 PIN 5 = 5 V DC during TX
VCO CNTL (Q105/6 PIN 5) = 9 V DC when select channel is above:
42.08 MHz (RX VCO)
42.42 MHz (TX VCO)

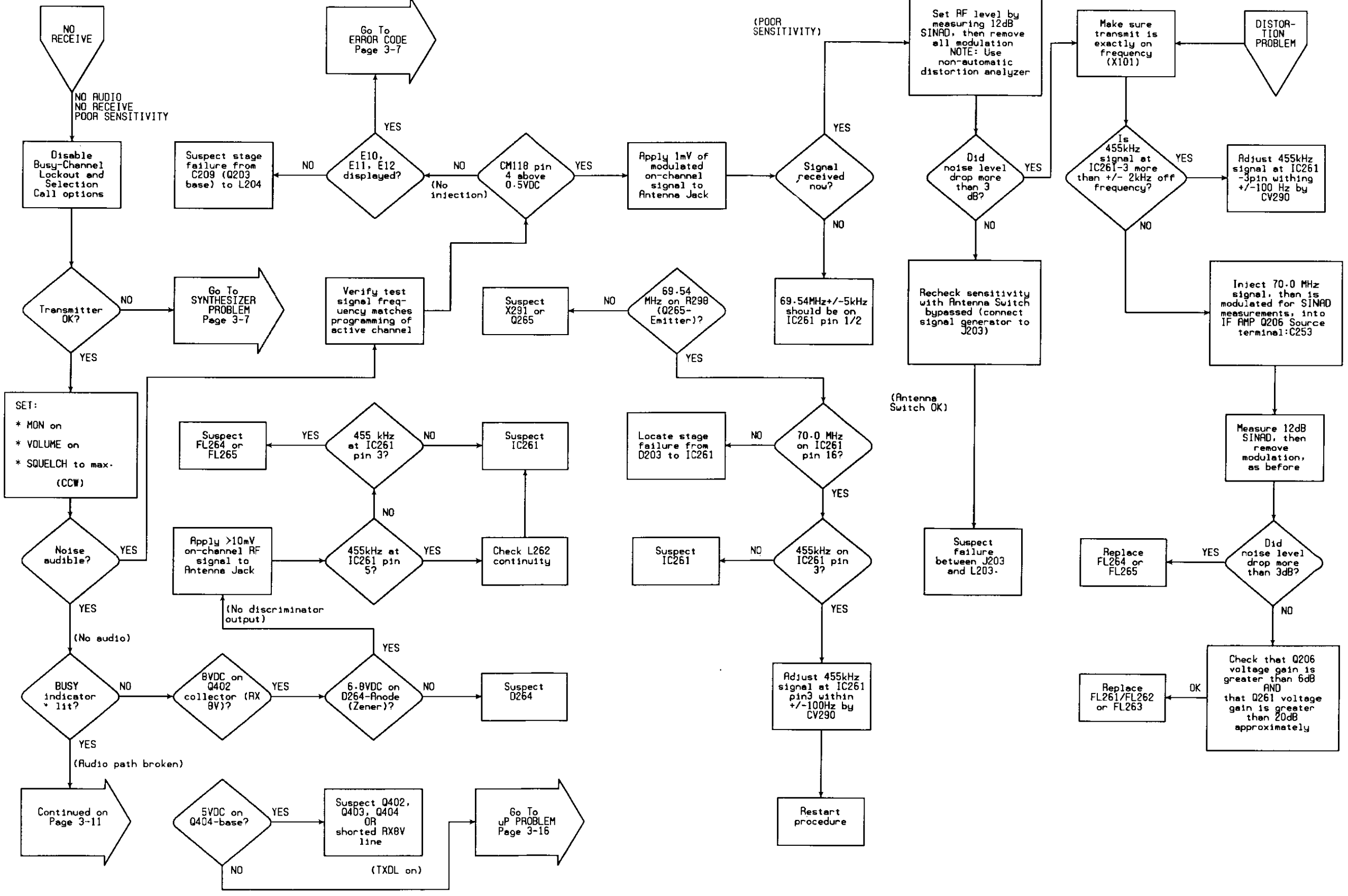
Troubleshooting Chart 3 - 3 — Error Codes & Synth Problem



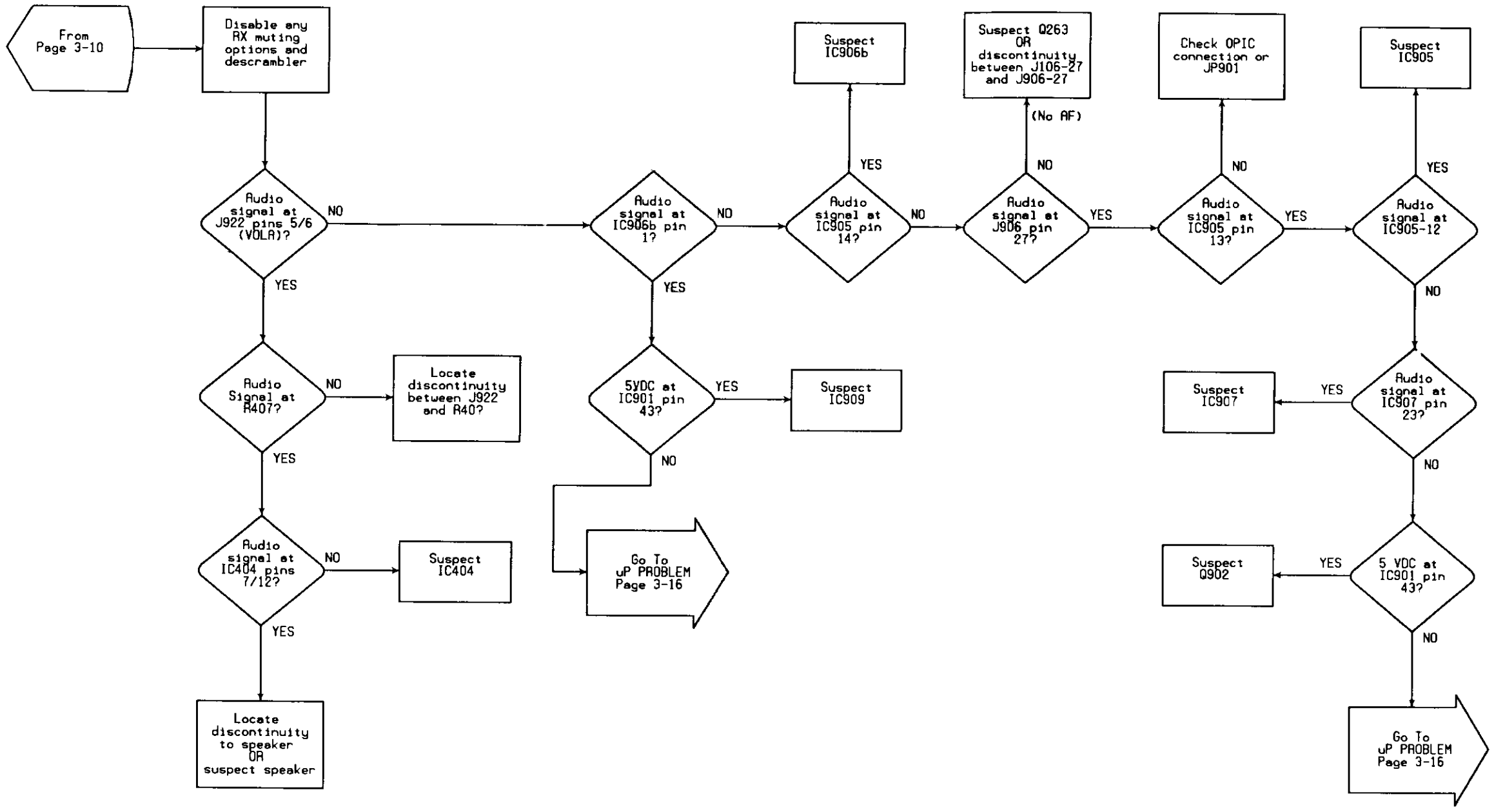
Troubleshooting Chart 3 - 4 — Transmitter & Power Output Problem



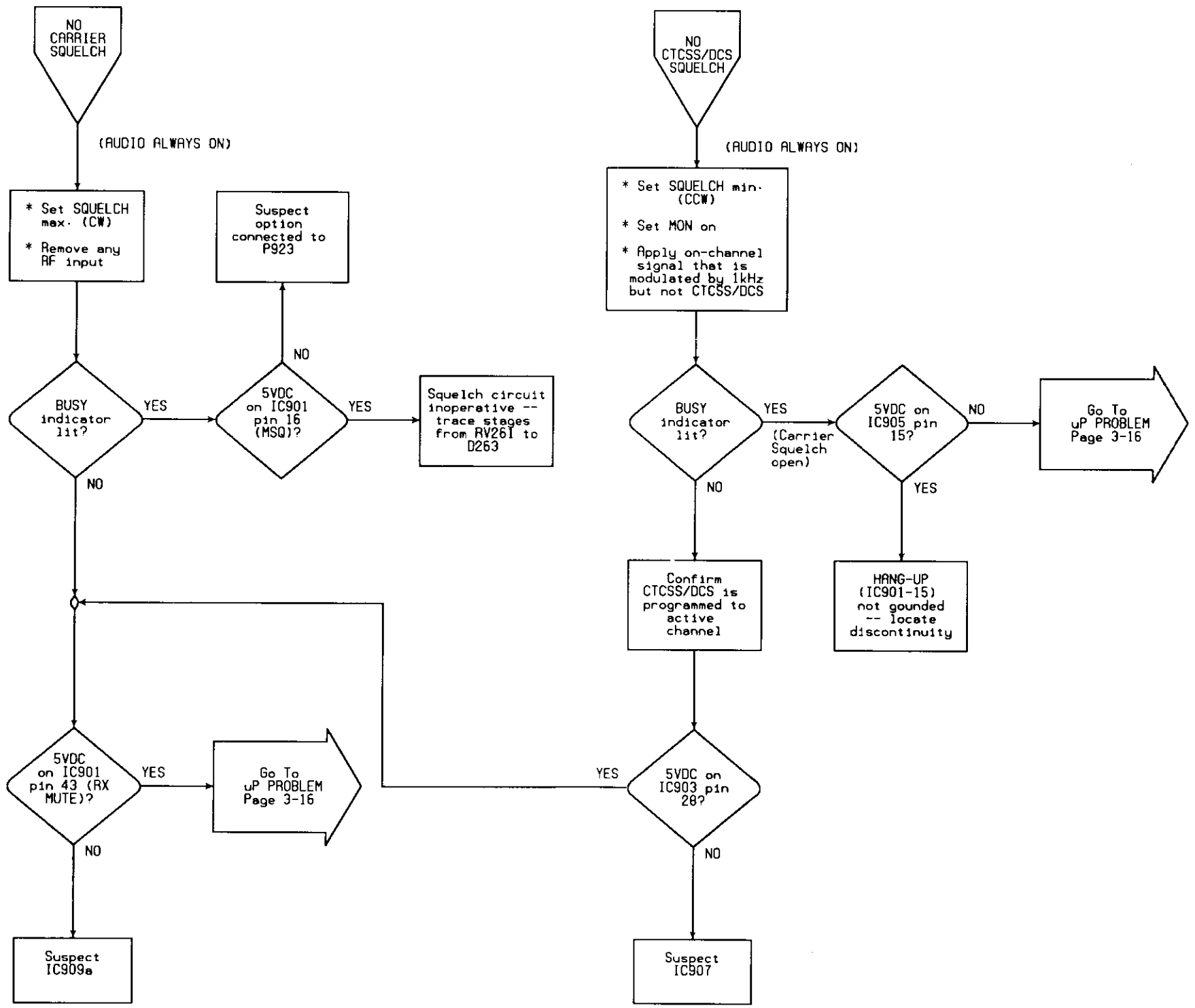
Troubleshooting Chart 3 - 5 — Modulation Problem



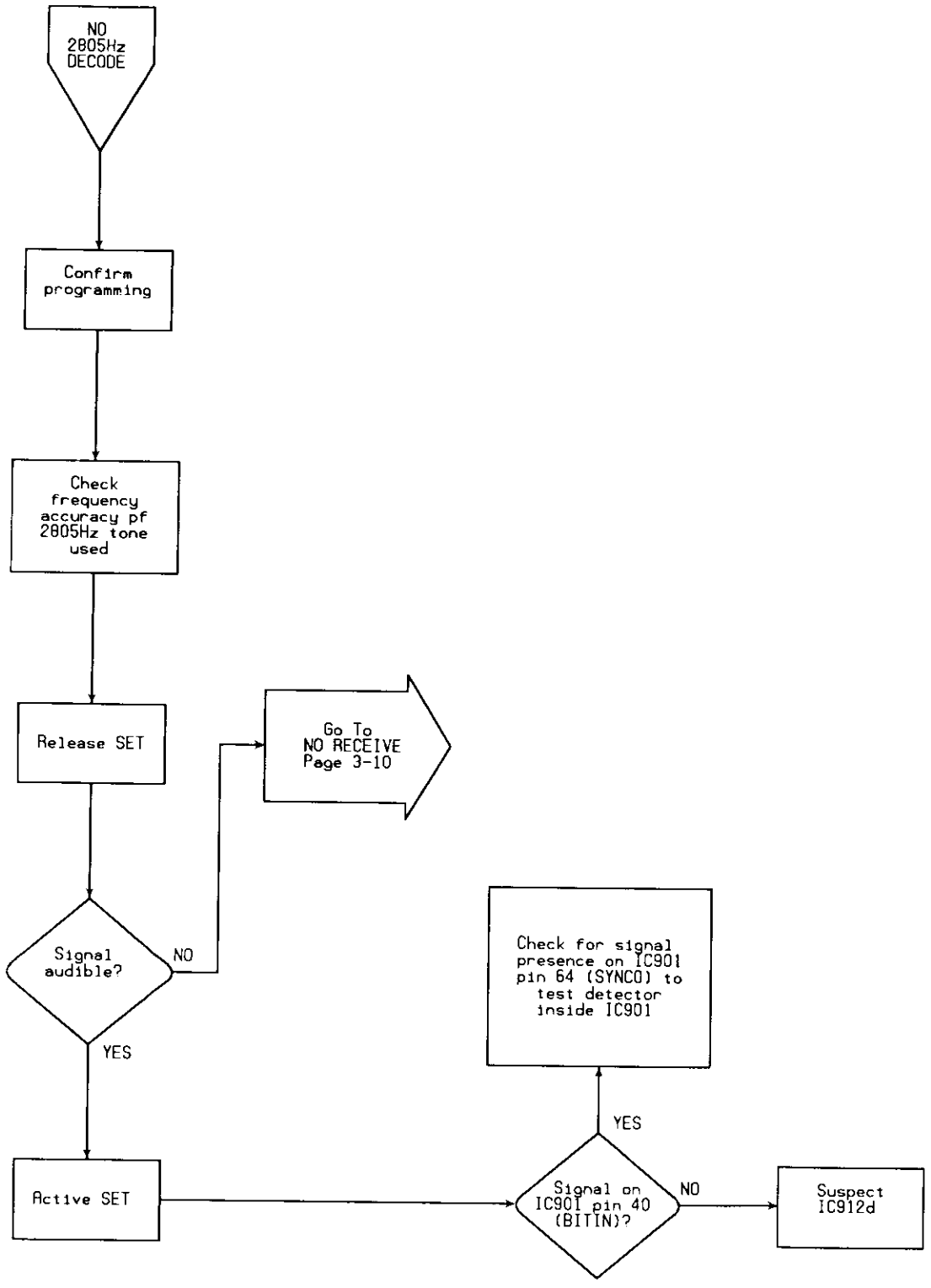
Troubleshooting Chart 3 - 6a — Receive and Distortion Problem



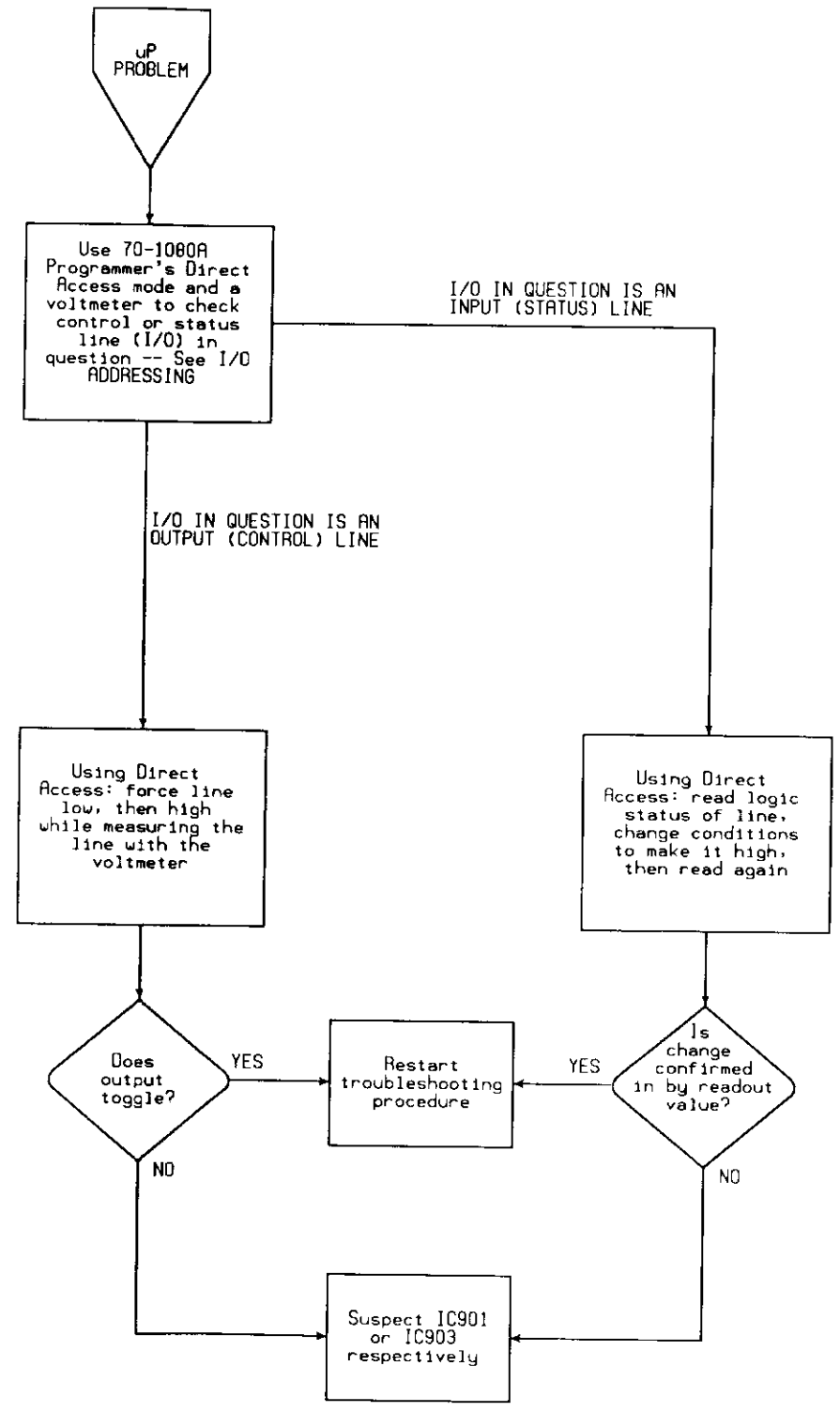
Troubleshooting Chart 3 - 6b – Receive and Distortion Problem (Continued)



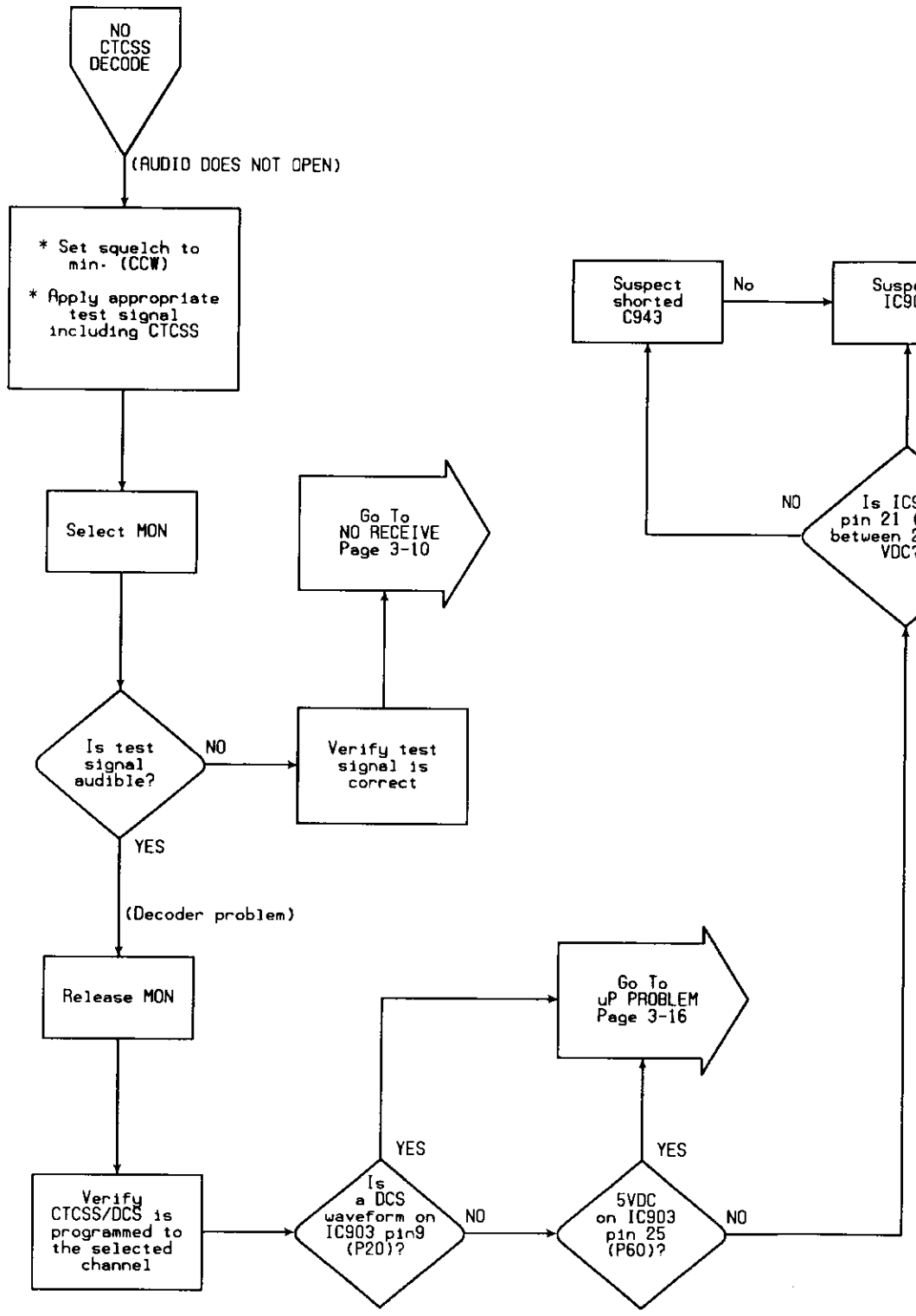
Troubleshooting Chart 3 - 7 — Squelch Problem



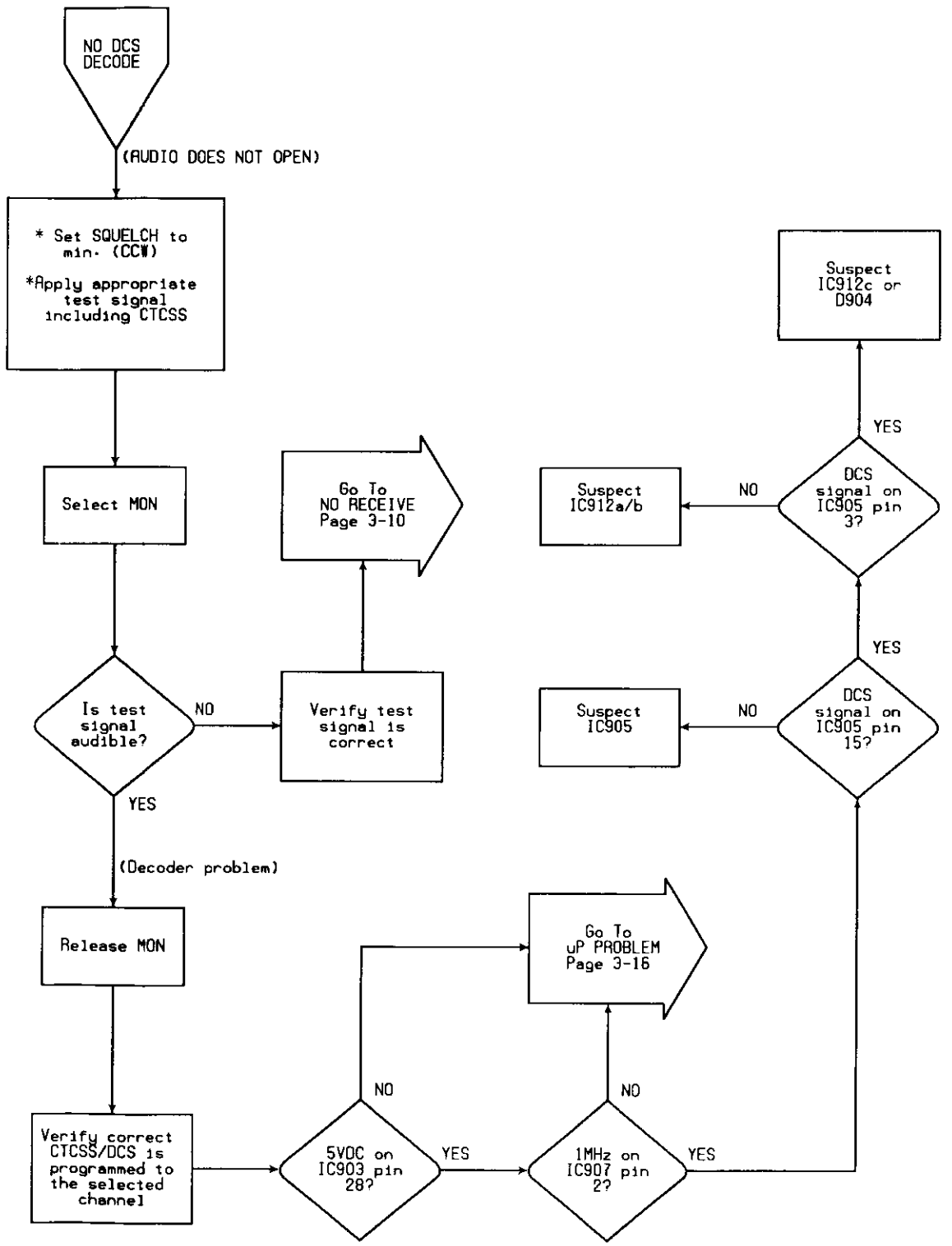
Troubleshooting Chart 3 - 14 — No 2805 Hz Decode



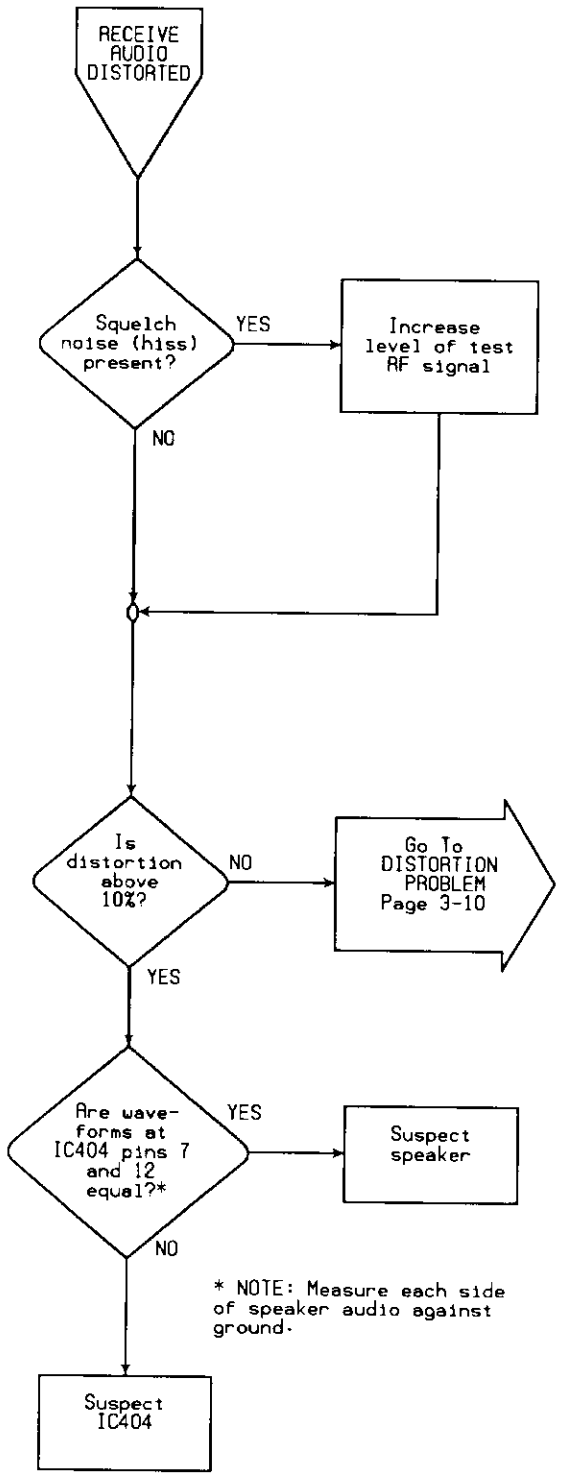
Troubleshooting Chart 3 - 15 — Microprocessor Problem



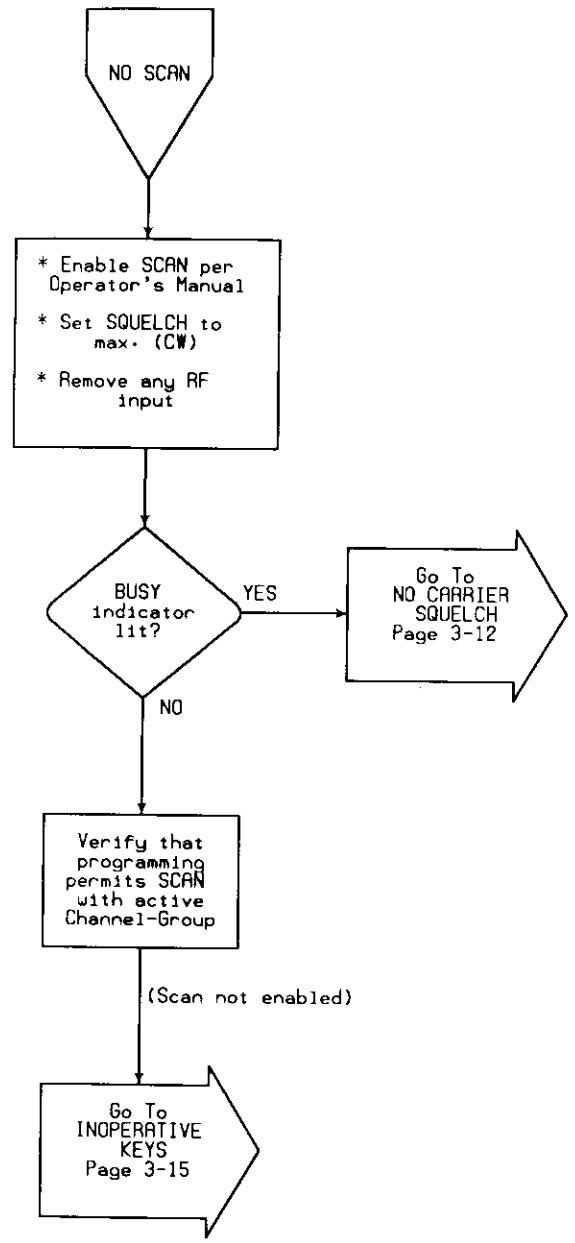
Troubleshooting Chart 3 - 8 — No CTCSS Decode



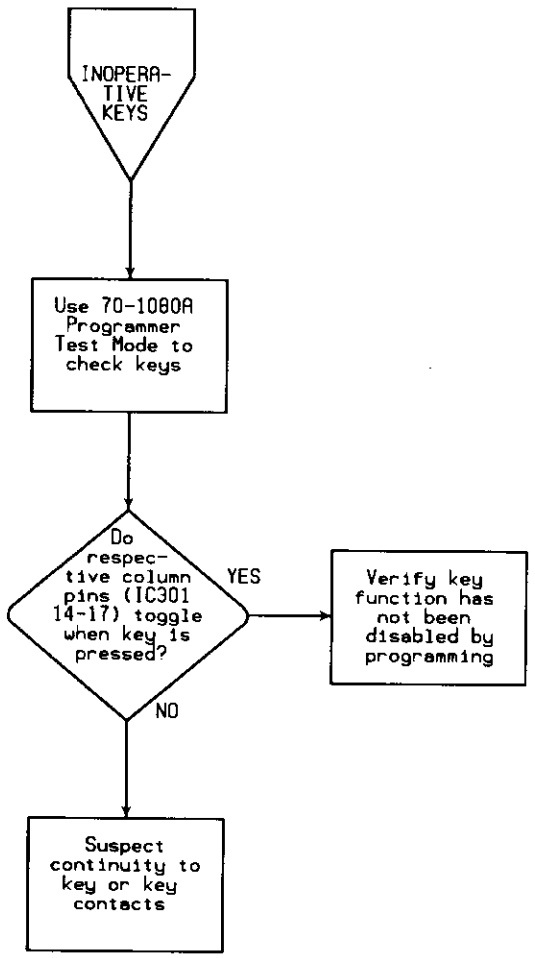
Troubleshooting Chart 3 - 9 — No DCS Decode



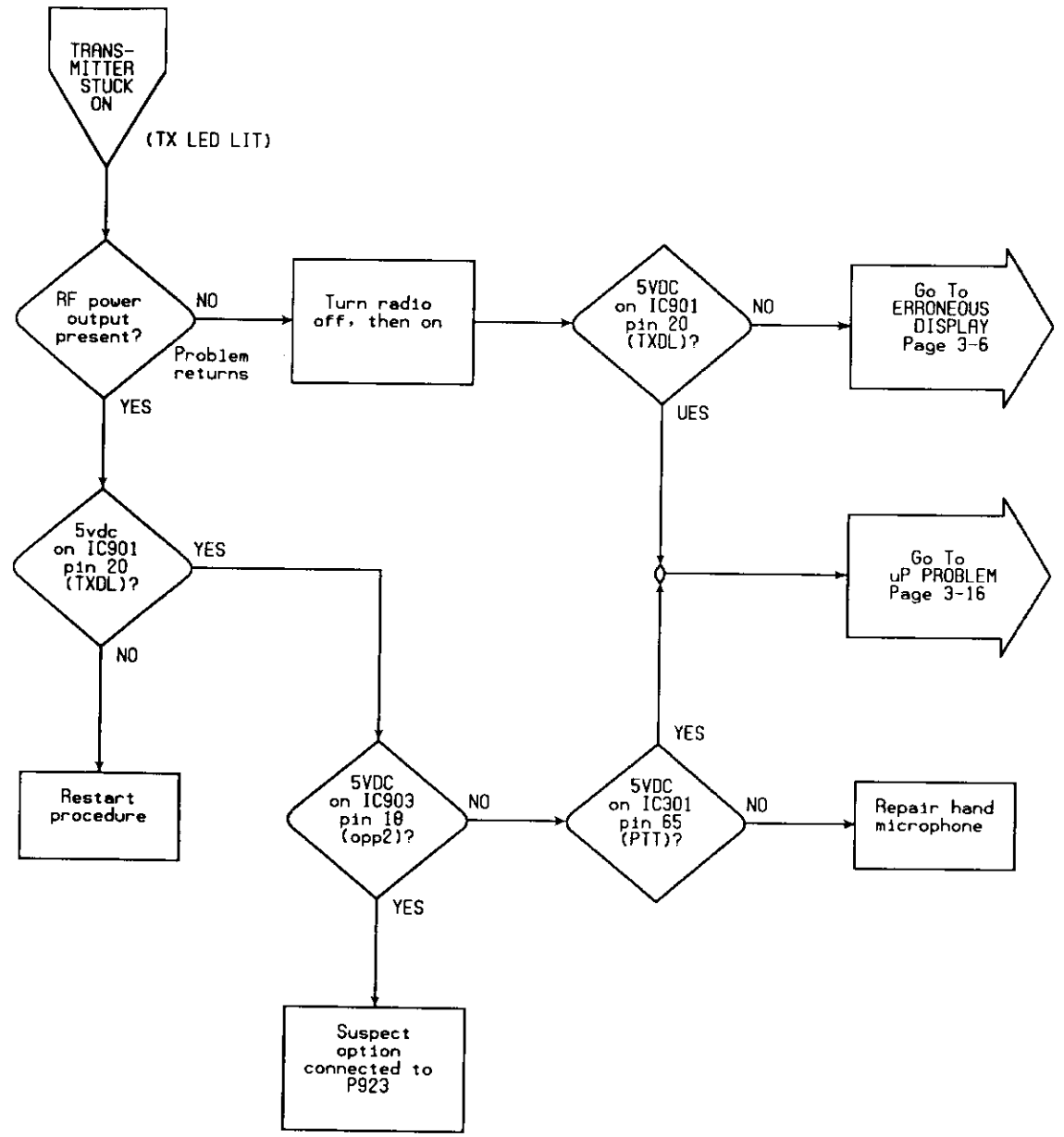
Troubleshooting Chart 3 - 10 — Receive Audio Distorted



Troubleshooting Chart 3 - 11 — No Scan



Troubleshooting Chart 3 - 12 — Inoperative Keys



Troubleshooting Chart 3 - 13 — Transmitter Stuck On

I/O ADDRESSING

Use I/O Addressing when troubleshooting process leads the failure to IC901 or IC903 ports.

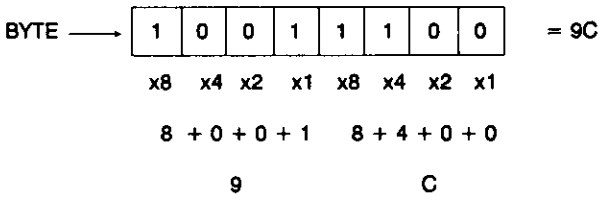
The 70-1080A SYN-TECH II Programmer is capable of manually controlling the microcomputer in the SYN-TECH II TX/RX Unit. This makes it possible to verify microcomputer input/output port operation by bypassing microcmputer software and switching output at will, or reading inputs. For example: if you set port PB2 to "1", IC901-20 should measure 5 V. If not, you can conclude that internal port circuitry within IC901 is defective and IC901 needs to be replaced.

A LITTLE BACKGOUND

The TX/RX Unit microcomputer, like most digital microcomputers, is comprised of a long column of data units. Each unit contains eight binary pieces of information (*bits*) In the form of electrical logic lows (approximately 0 V) and highs of (approximately 5 V), that represent zeros and ones. Each data unit, called a *byte*, has its own sequential numeric address in the column, so that it can be selected by the microprocessor. The entire column, with its addresses, is known as the *memory map*.

Byte locations in the column of bytes take different physical forms: some are read + write temporary storage locations (RAM); some are read-only locations filled with computer instructions (ROM); some are input ports where each bit is a radio status line, such as noise-squelch detector output (NSQ); some are output ports where each bit is applied to a radio control line, such as transmitter enable (TXDL). All these locations types are assembled using IC901, IC902, and IC903. Inside IC903 is a microprocessor that shuffles bytes from one location to another as dictated by the computer instructions in ROM. The microprocessor can also modify the byte on the way. Propelled by a 4 MHz clock, the processor's byte shuffling activity can produce useful results; like operating a two-way radio.

Hexadecimals are alphanumeric representations of half-bytes. Two hexadecimal numerals denote one byte, which contains eight bits. Each bit value (one or zero) can be determined from the hexadecimal designators as follows:



NOTE: Heaxidecimal uses 16 digits: A = 10, B = 11, C = 12, D = 13, E = 14, and F = 15.

HOW IT'S DONE

The 70-1080A Programmer is needed to manipulate SYN-TECH II I/O ports, and the Direct Access function of the Programmer Remote Control Mode is used for this. Under Direct Access Remote Control, normal TX/RX Unit microcomputer operation is frozen and data within any byte location can be read or written to.

See the 70-1080A Operator's Manual for instructions on how to connect the Programmer and initiate the Remote Control Mode, and how to operate the Direct Access function Because it is possible to permanently loose radio programming while using the Direct Access function, ALWAYS upload the radio Data Packet into the Programmer's memory BEFORE initiating the Remote Control Mode.

To troubleshoot an input port, address the port using Direct Access, and read its data byte (in hexadecimal) on the Programmer display. Depending on the byte value, the logic level on a specific status line can by determined mathematically. If the answer does not match voltmeter measurements, suspect defective port circuitry. To troubleshoot an output port, address the port again, and write a byte to it. The value of the byte determines which control lines will be logic high. Again, voltmeter measurement will locate any defect.

There are seven input and output ports that interface to the radio. Each port encompasses eight pinouts; some of which may not be used. When manipulating or reading a port, all eight pins are affected at once by one byte of information. Locate the input/output port you wish to access by noting its designator on the schematic. Locate the appropriate procedure in the following pages referring to **Table 3 - 2**.

Table 3 - 2 — IC Port Access Directory

RESETTING DIRECT ACCESS: If a problem arises while using Direct Access, a hard-reset is the best way out. A hard-reset is accomplished by removing all DC power (13.6 V DC) from the radio for at least 10 seconds, and turning the Programmer off, then on. If the radio is equipped with the 70-2925 Memory Back-up Kit (a large supercapacitor clamped and wired to the Logic Board), you must also momentarily short the black and red wires of the supercapacitor while the radio power is disconnected.

ACCESSING IC901 PORT-A (PAx) OUTPUTS

1. Using the Programmer's Direct Access mode, enter address 5000 (hex), then press **ENT**. "5000" will appear under the letters "ADS" and "00" will appear under the letters "DATA" in the Programmer display.

2. If you wish to output a logic high from a specific Port-A output, find the corresponding byte in the HIGH column of **Table 3 - 3**, then enter its two hexadecimal digits into the Programmer. Press **ENT**. A short beep will sound. If you wish to output a logic low instead, choose the corresponding byte in the LOW column to enter. The bytes in the chart are designed to switch only the selected line, and leave the rest unchanged.

   The selected control line should be at the selected logic voltage. If not, the output may be defective.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

Table 3 - 3 — IC901 Port-A Manipulation

PAX BIT	IN901 PIN NO.	FUNCTION	BYTE TO BE ENTERED FOR	
			HIGH	LOW
0	49	CHDT - RF Board data	81	80
1	48	DCLK - RF Board data clock	82	80
2	47	DCL - HI = C/H data direction: to C/H	84	80
3	46	P.A.CNTL - HI = pub. add. gate enable	88	80
4	45	P.A.SW - HI = public address relay on	90	80
5	44	TX MUTE - LO = mute micropone audio	A0	80
6	43	RX MUTE - LO = mute receive audio	C0	80
7	42	RX PATH - HI - RX audio bypass IC907	80	80

ACCESSING IC901 PORT-B (PBx) OUTPUTS

1. Using the Programmer's Direct Access mode, enter address 5002 (hex), then press **ENT**. "5002" appears under the letters "ADS" and "96" appears under the letters "DATA" in the Programmer display.

2. If you wish to output a logic high from a Port B output, find the appropriate byte in the HIGH column in **Table 3 - 4**, then enter its two hexadecimal digits into the Programmer. Press **ENT**. A short beep will sound. If you wish to output a logic low instead, choose the appropriate byte in the LOW column to enter. The bytes in the chart are designed to switch only the selected line, and leave the rest unchanged.

   The selected control line should be at the selected logic voltage. If not, the output may be defective.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

Table 3 - 4 — IC901 Port-B Manipulation

PAX BIT	IN901 PIN NO.	FUNCTION	BYTE TO BE ENTERED FOR	
			HIGH	LOW
0	18	DSTB1 - LO = latch RF Board data	63	62
1	19	LPS2W - LO = sppeed PLL lock time	63	61
2	20	TXDL1 - HI = transmitter circuits on	67	63
3	21	not used		
4	22	HORN SW - HI = horn switch on	73	63
5	23	DSTB2 - LO = latch opt. 2nd PII data	63	43
6	24	LPW1 - LO = sppeed 2nd PLL lock time	63	23
7	25	TXDL2 - HI = 2nd TX'er circuits on	E3	63

ACCESSING IC901 PORT-C (PCx) INPUTS

1. Set up the radio as follows. This assures that the bytes read from the port will be the same values shown in the chart below. If these items are not set as shown, you may need to do additional hexadecimal-to-binary conversion to determine the logic status of the port in question.

   - Set the SQUELCH control to maximum (clockwise).
   - Place a jumper between pins 2 and 3 of Accessory Jack J505 on the TX/RX Unit. If the radio is an under-dash configuration, either a jumper or a Hang-Up box (which must be closed) is already in place.
   - If the radio is a trunk-mount configuration, also remove the jumper between pins 2 and 3 of Accessory Jack J319 (or open the Hang-Up Box).
   - Disconnect the antenna so that no carrier is received.

2. Using the Programmer, enter address 5002 (hex), then press **ENT**. "5002" appears under the letters "ADS" and a two-character hexadecimal designator appears under the letters "DATA" in the Programmer display.

3. The DATA designator indicates the status of the logic voltages applied to the eight Port-C inputs. The hexadecimal value can be deciphered as shown in **Table 3 - 5**.

4. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

Table 3 - 5 — Reading IC901 Port-C

PAX BIT	IN901 PIN NO.	FUNCTION	BYTE TO BE ENTERED FOR	
			HIGH	LOW
0	9	HI = 2805 Hz tone is detected	97	96
1	10	not used		
2	11	not used		
3	13	THSW - HI = PA Module is overheated	9E	96
4	14	C/H HANGUP - HI = U/D or J319-3 is gnd	96	86
5	15	T/R HANUP - LO = J505-2 is gnd	B6	96
6	16	NSQ - HI = rcvr is quieted by carrier	D6	96
7	17	not used		

ACCESSING IC901 PORT-D (PDx) INPUTS/OUTPUTS

This entire port is used as a communications buss between the Control Head microcomputer and the TX/RX Unit microcomputer. Port-D lines serve as both inputs and outputs and manual manipulation is complicated. Troubleshooting by exchanging control heads is easier; therefore, I/O Port-D Manipulation instructions are not provided.

ACCESSING IC903 PORT-2 (P2x) INPUTS/OUTPUTS

Many of the lines from this port are used to communicate to the Programmer; therefore, manipulation of those lines is impossible and manipulation any Port-2 line is precarious — an incorrect entry may lockup the Programmer or radio. If lock-up occurs, a hard-reset is necessary.

- **Reading Port P20 (IC903-9, Recovered DCS input):**

1. Using the Programmer's Direct Access mode, enter address 0003 (hex), then press **ENT**. "0003" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

2. If the DATA value is odd, voltage on P20 was at a logic high while the port was read; if even, P20 was low. **NOTE:** Squelch noise applies random logic lows and highs to this port; therefore, if Port 20 is functioning correctly, odd and even values should by extracted at least once each during several readings of this port.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

- **Writing to Port P25 (IC903-14, DCS encode output):**

While the radio is under remote control, this line is programmed as an input and voltage on it will be the 2.5 V bias established by IC907 pin 21. Because other Port 2 lines are used to communicate to the Programmer, P25 cannot be set and held. You can only temporarily reprogram this line to be an output, in which case it will only apply a logic high; but, P25 will change back to an input as soon as you change Direct Access to another byte location.

1. Using the Programmer's Direct Access mode, enter address 0001, then press **ENT**. "0001" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

2. Enter F2 (hex), then press **ENT**. This will set P25 to logic high until you enter another address.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

- **Writing to Port P26 (IC903-15, Burst-Tone clock output):**

1. Using the Programmer's Direct Access mode, enter address 0003, then press **ENT**. "0003" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

2. If you wish to output a logic high from P26; enter 78 (hex), then press **ENT**. If you wish to output a logic low, enter 38 (hex), then press **ENT**.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

ACCESSING IC903 PORT-5 (P5x) OPP INPUTS/OUTPUTS

Each line of this port can be an input or an output, as determined by the value written to the direction register located at address 0020 (hex).

1. Disconnect any options that may be connected to P923.

2. Reprogram the Option Port Type parameter of the radio Data Packet for 0 (NONE), if necessary. You should already have the Data Packet stored in the Programmer, so simply change the Option parameter (see the 70-1080A Programmer Operator's Manual) to 0 and download the Data Packet back into the radio. Then initiate Remote Control Mode.

3. All Port 5 lines are unterminated; therefore, they should read logic low (0). To test an input, apply a logic high (5 V) to the I/O line in question using a 1,000-ohm resistor from P923 pin 2. Leave the others unterminated.

- **Input test**

4. Using the Programmer, enter address 0020 (hex), then press **ENT**. "0020" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

5. Enter 00, then press **ENT**. This sets all Port-5 lines to input mode.

6. Press **MNL**, then enter address 0015 (hex). Press **ENT**. "0015" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display. Refer to the table below to decode the status of the lines:

   If OPP1 (P50, IC903-17) is high, DATA will be "09"
   If OPP2 (P51, IC903-18) is high, DATA will be "0A"
   If OPP3 (P52, IC903-19) is high, DATA will be "0C"
   If OPP4 (P54, IC903-21) is high, DATA will be "18"
   If OPP5 (P55, IC903-22) is high, DATA will be "28"
   If OPP6 (P56, IC903-23) is high, DATA will be "48"
   If OPP7 (P57, IC903-24) is high, DATA will be "88"

- **Output test**

7. Press **MNL**, then enter this address: 0020 (hex). Press **ENT**. "0020" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

8. Enter F7 (hex), then press **ENT**. This sets all OPP lines to output mode, except P53 which must remain an input.

9. Press **MNL**, then enter address 0015 (hex). Press **ENT**. "0015" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

10. Enter the appropriate two-digit hexadecimal value to apply a logic high to the line under question, per the table below.

    To pull OPP1 (P50, IC903-17) high, enter "01"
    To pull OPP2 (P51, IC903-18) high, enter "02"
    To pull OPP3 (P52, IC903-19) high, enter "04"
    To pull OPP4 (P54, IC903-21) high, enter "10"
    To pull OPP5 (P55, IC903-22) high, enter "20"
    To pull OPP6 (P56, IC903-23) high, enter "40"
    To pull OPP7 (P57, IC903-24) high, enter "80"

11. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

ACCESSING IC903 PORT-6 (P6x) INPUTS/OUTPUTS

- **Inputs (P63 and P66):**

1. Using the Programmer, enter address 0017 (hex), then press **ENT**. "0017" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

2. Enter FA (hex), then press **ENT**. This establishes a reference. The next address (0018) will appear.

3. Press **UP ARROW**. Address 17 will return with a new DATA value. Refer to **Table 3 - 6** to interpret the logic level of P63 and P66.

Table 3 - 6 — Reading P63 and P66

If DATA is	voltage at P63 (IC903-28)	voltage at P66 (IC903-31)
FA	HIGH	HIGH
F2	LOW	HIGH
BA	HIGH	HIGH

- **Outputs (P60, P61, P62, P64, P65):**

1. Press **MNL**, then enter address 0017 (hex). Press **ENT**. "0017" appears under the letters "ADS" and a two-digit hexadecimal designator appears under the letters "DATA" in the Programmer display.

2. If you wish to output a logic high from a Port-A line, find the appropriate byte in the HIGH column of **Table 3 - 7**, and enter its two hexadecimal digits into the Programmer. Press **ENT**. A short beep will sound. If you wish to output a logic low instead, choose the appropriate byte in the LOW column to enter. The bytes in the table are designed to switch only the selected line, and leave the rest unchanged.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6 V power source for at least ten seconds. If the radio is equipped with the 70-2925 Memory Back-up Kit, short the terminals of the supercapacitor while radio power is disconnected.

Table 3 - 7 — IC901 Port-A Manipulation

PAX BIT	IN901 PIN NO.	FUNCTION	BYTE TO BE ENTERED FOR	
			HIGH	LOW
0	9	LO = Audio path switched for receive	FB	FA
1	10	HI = high beep level	FA	FB
2	11	HI = mute beeps	FE	FA
4	14	LO = latch CTCSS serial data on PA0	FA	EA
5	15	not used		

COMPONENT REPLACEMENT

STATIC POTENTIALS

Many of the transceiver components are susceptible to higher voltages whether they are in or out of a circuit. Avoid static or AC-line potentials when handling components and circuit boards. Prevent damage from electrically "hot" tips that carry AC-line or static potential by using a grounded soldering iron.

The only way to alleviate risk of component damage from static discharge is to make sure all of the objects that touch the circuitry during component replacement carry the same potential. Since the soldering iron is grounded, everything else must be grounded: the bench, the equipment being worked on, and you. There usually isn't a need to wire yourself to your bench unless you work on carpeting on dry-air days. Just touch bench ground when you sit down so that you and the grounded work area are at the same potential.

REPLACING CHIP CAPACITORS AND RESISTORS

This section describes the best way to remove a chip component and install a new one. Chip components do not have leads, just metallic film on end-surfaces to solder to. Often the surface is tinned with solder. Because the metallic film can be easily damaged by contamination and excessive heat, these components must be soldered very carefully. No chip component can be unsoldered, then resoldered without damage. Always discard a used component.

- **ITEMS REQUIRED:**
    - Grounded temperature-controlled soldering iron with a 1/32 inch flat-blade tip. The tip temperature must be maintained at approximately 600 degrees Fahrenheit.
    - 60/40 electronics-grade solder, 22 gauge or thinner, with rosin flux.
    - Tweezers or longnose pliers.
    - Thin desoldering-wick.
    - Isopropyl alcohol or Freon-TF for solvent.
    - Rosin solder-flux. DO NOT USE ACID FLUX.

- **PROCEDURE:**

1. Place the solder iron tip directly on the defective component to melt the glue under the component, then solder as shown in **Figure 3 - 2**. Remove the component with tweezers or longnose pliers. Discard the component.

CAUTION: Application of too much solder can create solder bridges between PC patterns under the soldered component and around the pad.

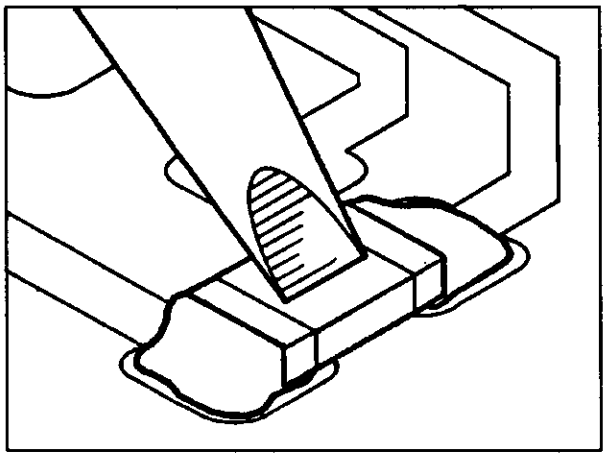


Figure 3 - 2

2. Completely remove old solder, old glue, and any other contaminants from the area with desoldering-wick and solvent.

3. Apply only enough fresh solder to coat the clean PC pad as shown in **Figure 3 - 3**.

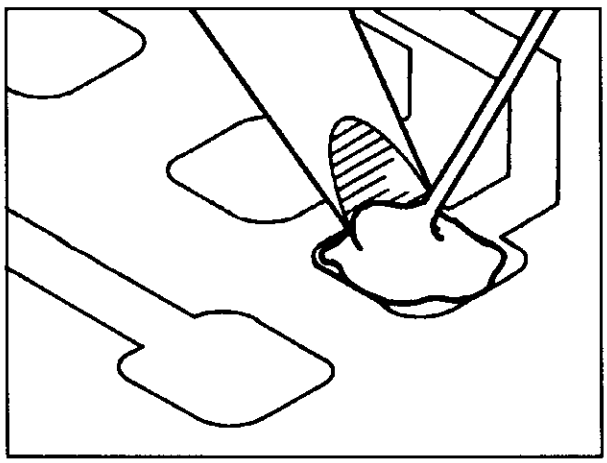


Figure 3 - 3

4. Place component and briefly heat the new solder and pad while holding the component with tweezers. Do not touch the new component with the iron. Only heated solder should touch the component to make a light "tack" bond to it. See **Figure 3 - 4.**

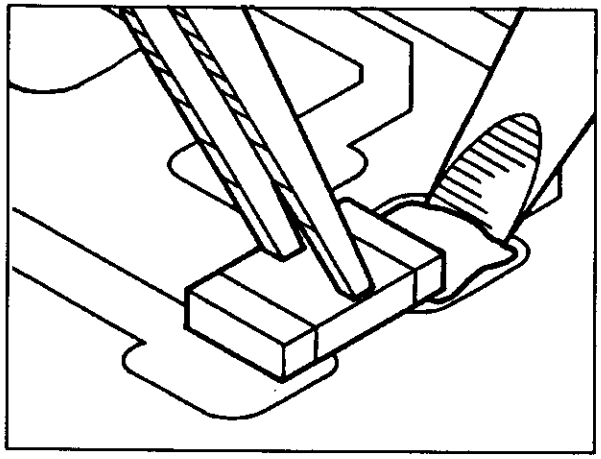


Figure 3 - 4

5. With one component end tacked to hold it, the other end can be soldered. Carefully apply heat to the PC pad while adding only enough fresh solder to produce a clean fillet as in **Figure 3 - 5** -- do not apply too much solder, otherwise it may flow underneath and short the pads together. Let the hot solder flow onto the component -- do not touch the component with the iron. Repeat to finish the other end of the component. Solder must adhere to all metallic end-surfaces on both ends as shown in **Figure 3 - 6.**

CAUTION: Avoid direct contact to the chip component with the iron tip. Too much heat and contamination will break down the metallic film on component ends resulting in loss of internal connection (a capacitor is comprised of several wafer plates that connect through the metallic end-surfaces). If satisfactory solder adhesion does not occur, the metallic end surface has been damaged and the chip component should be replaced again. More soldering will only damage the component further.

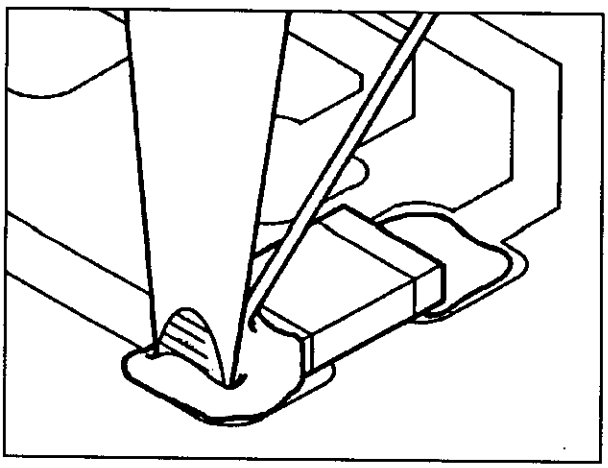


Figure 3 - 5

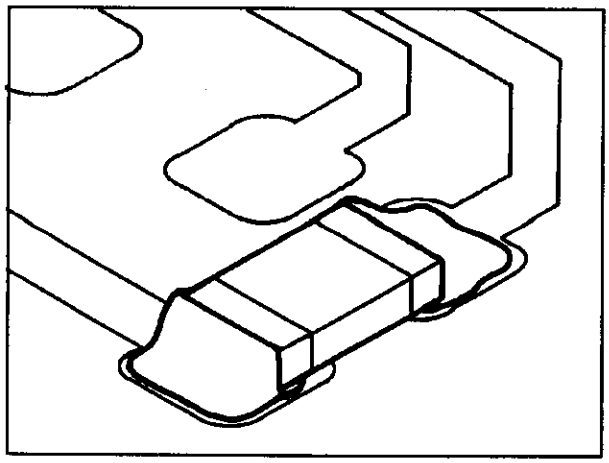


Figure 3 - 6

REPLACING COMPONENTS WITH FEED-THROUGH LEADS

Exercise extreme care when replacing components with leads that feed through a PC board. The copper plating on both sides of the printed circuit board and inside component lead holes easily separates and tears from the PC board when heated.

Use a solder suction tool or braided desoldering-wick to remove solder from component leads, one at a time. Solder must be removed carefully and thoroughly so that the IC can be pulled without resistance. After removing as much solder as possible, use a dental pick or straight-pin to break the leads loose from the inside of the cleaned-out hole. Cutting the defective components away from its leads first makes removing the leads and solder easier.

Before installing a new component, remove all solder from lead holes and make sure the device is oriented properly. Always inspect old part leads for any feed-through plating rings that may have been pulled out of holes. The plating may have completed a circuit. If so, make sure the corresponding lead of the new component is soldered to plating runners on both sides of PC board as shown below.

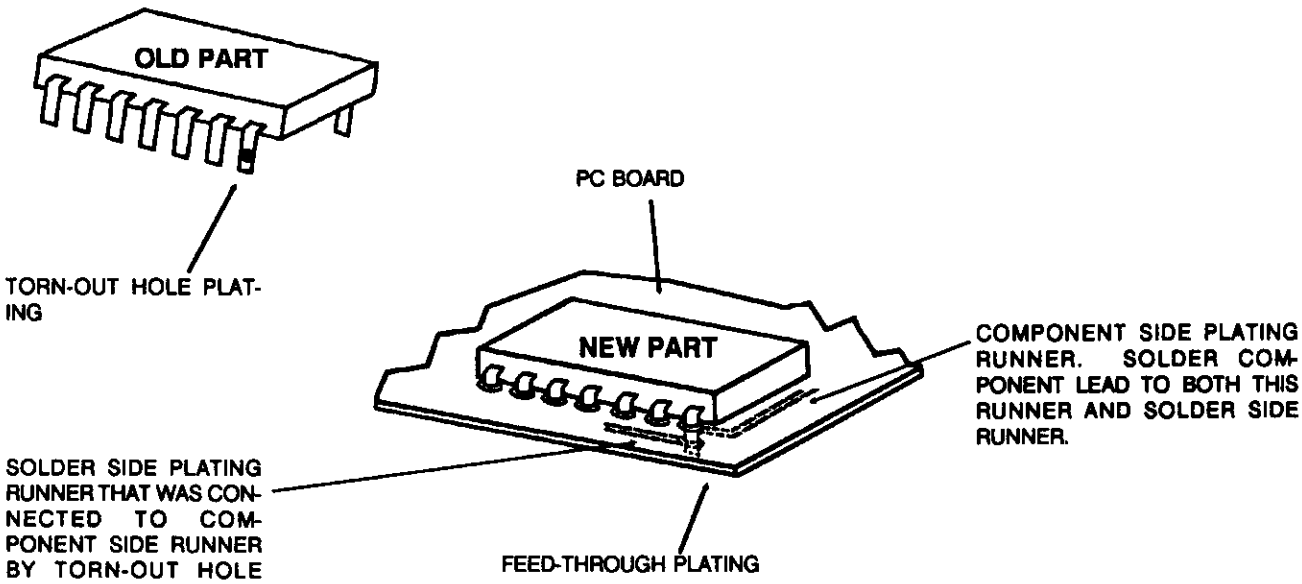


Figure 3 - 6

ELIMINATING RADIO INTERFERENCE

Occasionally, you must contend with interference from somewhere in the automobile. Interference problems are solved by understanding the interference and its path into the transceiver, locating its source logically, then eliminating it in the simplest way available.

Interference may be conducted into the transceiver directly, or induced into it, or both. Conducted interference passes through the DC power leads or the accessory wiring of the radio. Radiated interference, which can originate from anywhere in the vehicle, simply produces noise voltages on conductors inside the radio or its antenna. See **Figure 3 - 8.**

Conducted interference is simple noise voltage present in the vehicle electrical system. With many electrical devices turning on and off in a vehicle, current spikes produce voltage drops across wire resistances, causing voltage transients to appear throughout the electrical system. Connecting the radio power leads to this noisy electrical system applies the noise voltage directly to the radio. Most noise voltage is attenuated by power-line filters within the radio; but spikes that are severe enough may become audible.

While interference conducted through power leads affects only transceiver audio circuitry, induced interference often invades the receiver through the antenna by imitating receiver IF frequencies or channel frequencies. Induced interference occurs when an electromagnetic field penetrates the radio. If an electromagnetic field is strong enough, it can induce noise currents on the radio accessory and power wiring.

IDENTIFYING THE INTERFERENCE

The first step toward eliminating interference is to identify and characterize it. Listening to the noise can reveal a lot. For example: if the noise heard varies with engine speed, its source must relate to the engine, such as the alternator, ignition system, or tachometer.

Because you are dealing with frequency-modulated equipment, determining if the noise is at receiver-sensitive frequencies is easy. With all squelch circuits open, simply apply an unmodulated signal to the transceiver that is strong enough (10 mV at the Antenna Jack) to overcome any high frequency noise signal that could invade below. If noise remains, interference is at low frequencies that can enter only by proximity coupling to radio wiring or direct conduction.

Next, power the radio with an independent 12 V power source (such as another car battery). Isolate by moving wiring and/or the radio while listening for changes in the noise level. If the noise stopped when you connected the independent power source, noise voltages are conducting through on the positive circuit or the ground (see ELIMINATING CONDUCTED NOISE).

ELIMINATING CONDUCTED NOISE

If noise voltage is present on the power leads, there may be defective equipment in the vehicle electrical system that needs repair. An alternator with a bad diode has a large current ripple on its output, which produces a whine in the transceiver that varies in pitch with engine speed. Its current capacity is limited, but vehicle operation will not be noticeably impaired. Lights that dim during large current demands are a good sign of such a defect.

Another possible source of conducted interference is a fan motor in the same circuit to which the radio is connected. Because a fan also induces interference, confirm that noise is conducted into the radio (see IDENTIFYING THE INTERFERENCE). If the interference is conducted into the DC power leads of the radio, find a power connection point in the electrical system for the transceiver that is further from the fan circuit.

Noise voltages can also be added to the radio DC power input via the ground path. This is a condition where a high, noisy current shares the ground path of the radio equipment. For example:

Ground current of a fan motor finds its way to the vehicle battery through segments of metal body A-frame assemblies (see **Figure 3 - 9**). If the electri-

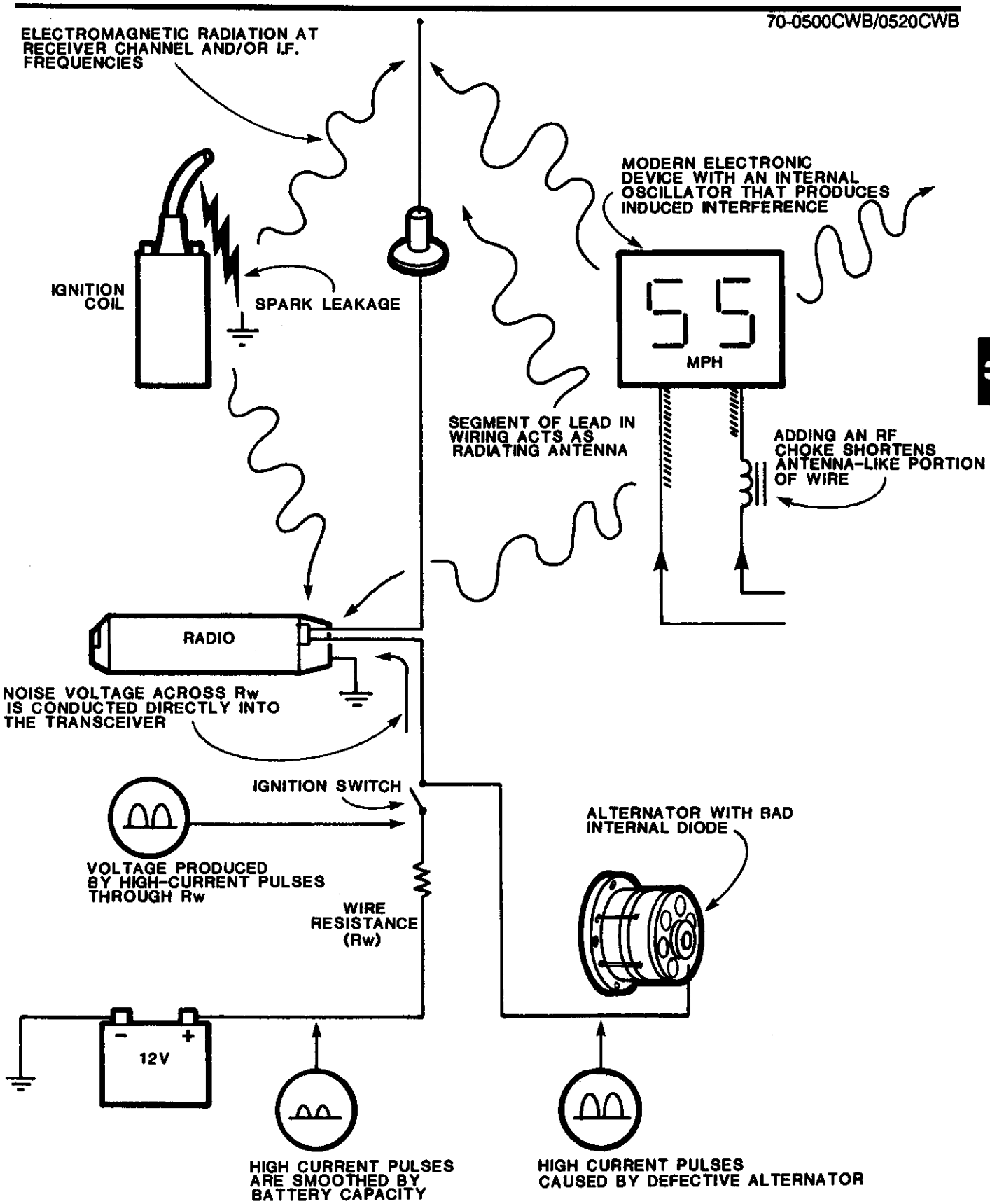


Figure 3 - 8 Interference Paths

cal bond between two parts is weak, and the radio ground current must also travel through this weak joint, a voltage drop induced across the joint by the fan current will appear at the radio power plug.

To avoid a noisy ground, connect radio ground closer to the vehicle battery.

ELIMINATING RADIATED INTERFERENCE

If DC power source substitution proves interference is not conducted into the power leads, two likely sources of radiated interference are sparks and high frequency oscillators. Modern vehicles use many electronic accessories and systems that may produce a hash or whine in the transceiver. Oscillators within these devices, which sometimes are poorly shielded, may radiate an electromagnetic field at frequencies many multiples of the oscillator frequency.

Again, listen to the noise to learn about its source. Unless the interfering automobile accessory is part of engine operation, the noise won't vary with engine speed. The interfering accessory can be isolated by temporarily removing power to it and checking for absence of noise.

Because the lead-in wires of an automobile device can become radiating antennas, induced interference is more often radiated from the automobile accessory wiring than the accessory itself. Such interference can by inductively coupled into nearby radio power and accessory wiring or radiated toward the antenna.

Check that the radio wiring does not run next to, nor parallel with, vehicle wiring. Move the wiring to identify and/or solve this problem.

If necessary, RF chokes can be connected in series with the "hot" lead-in wires of the interfering device, close to its housing to kill the antenna effect. Usually, "hot" wires can be identified if the noise volume changes with wire movement.

Radiated interference may also enter through the antenna. This can be verified by substituing the antenna and its cable with a 50 Ω RF dummy load and short cable. The dummy load is necessary to properly balance the receiver input and give comparable results. If the noise stops, interference was entering the antenna. The only way to solve this sort of interference problem is to eliminate radiation at the source with RF chokes as described above. Sometimes, positioning the antenna further from the interfering accessory may help.

ELIMINATING INTERFERENCE FROM SPARKS

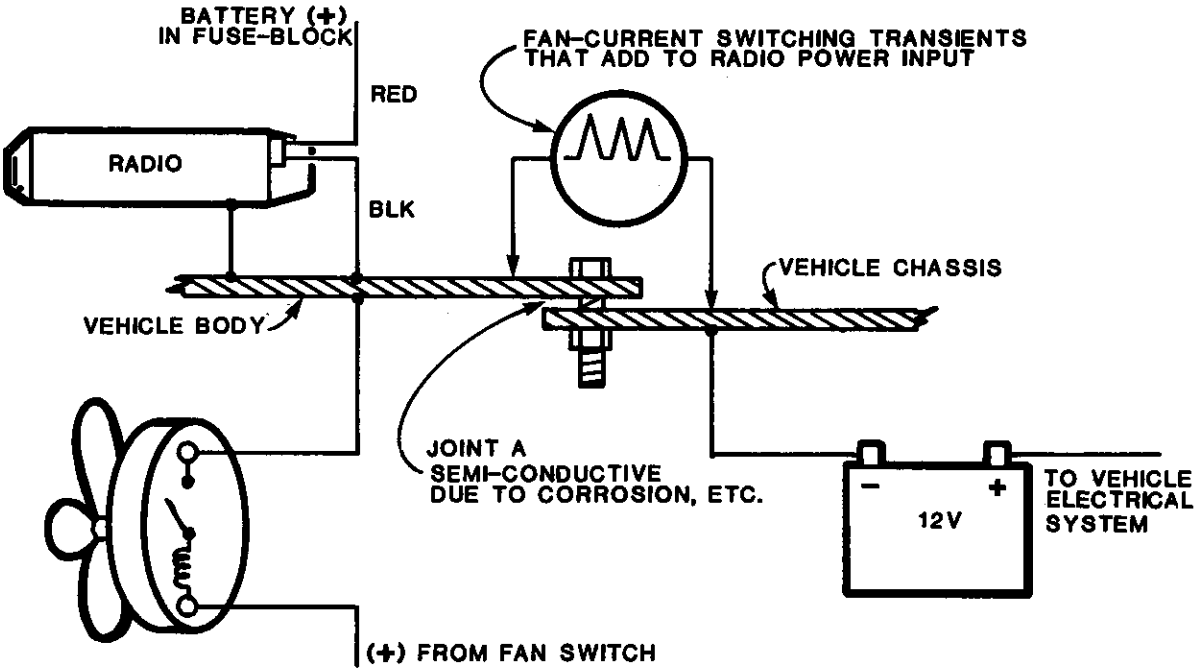
Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna. Therefore, the problem must be resolved at the source.

Modern vehicles use higher voltage ignition systems. As a result, electrical leakage occurs more easily through cracks and contaminants. If the interference produces a buzz while the engine is idling, and the buzz increases in pitch with engine speed, sparks are leaking to ground before distribution to the spark-plug wires. Check the ignition coil, its high voltage wire, and distributor cap for signs of arcing through cracks and burns or over dirt.

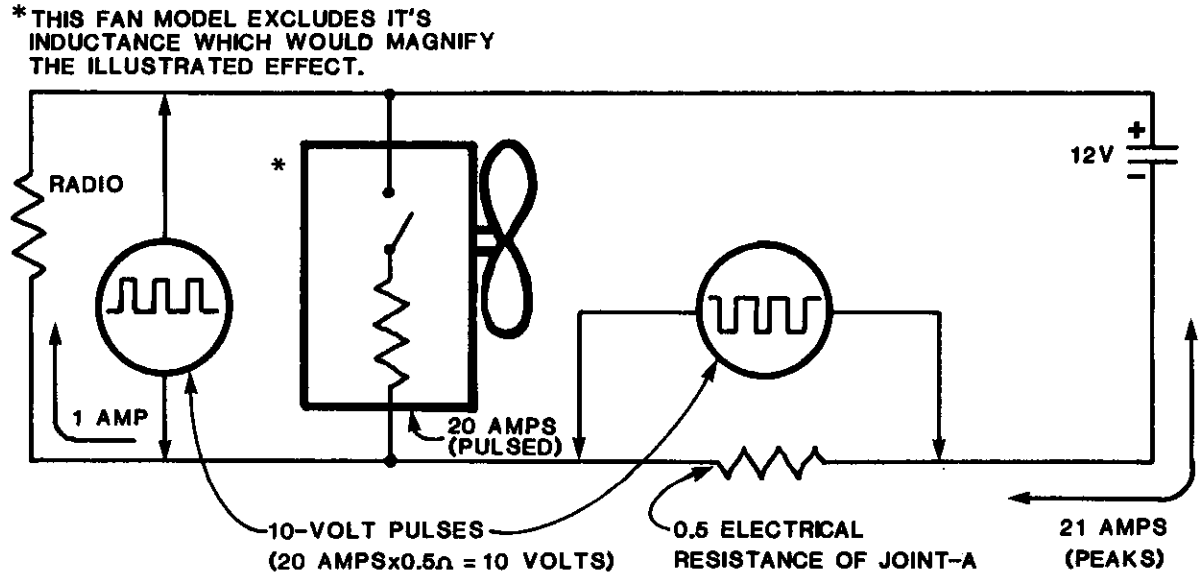
If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

Spark plug and ignition coil wires in modern vehicles are made with suppressive (resistive) conductors to reduce electromagnetic radiation. This may not be the case in older vehicles. Check with an ohmmeter.

Interference from sparks made by fan motor brushes produces a whine that varies with fan speed. Badly worn brushes or bearings cause excessive sparks, and you may need to replace them. A 0.1 μF coaxial capacitor can be connected to the positive lead as close to the motor as practical to reduce radiated interference. The capacitor body must connect securely to the grounded motor housing.



GROUND PATH



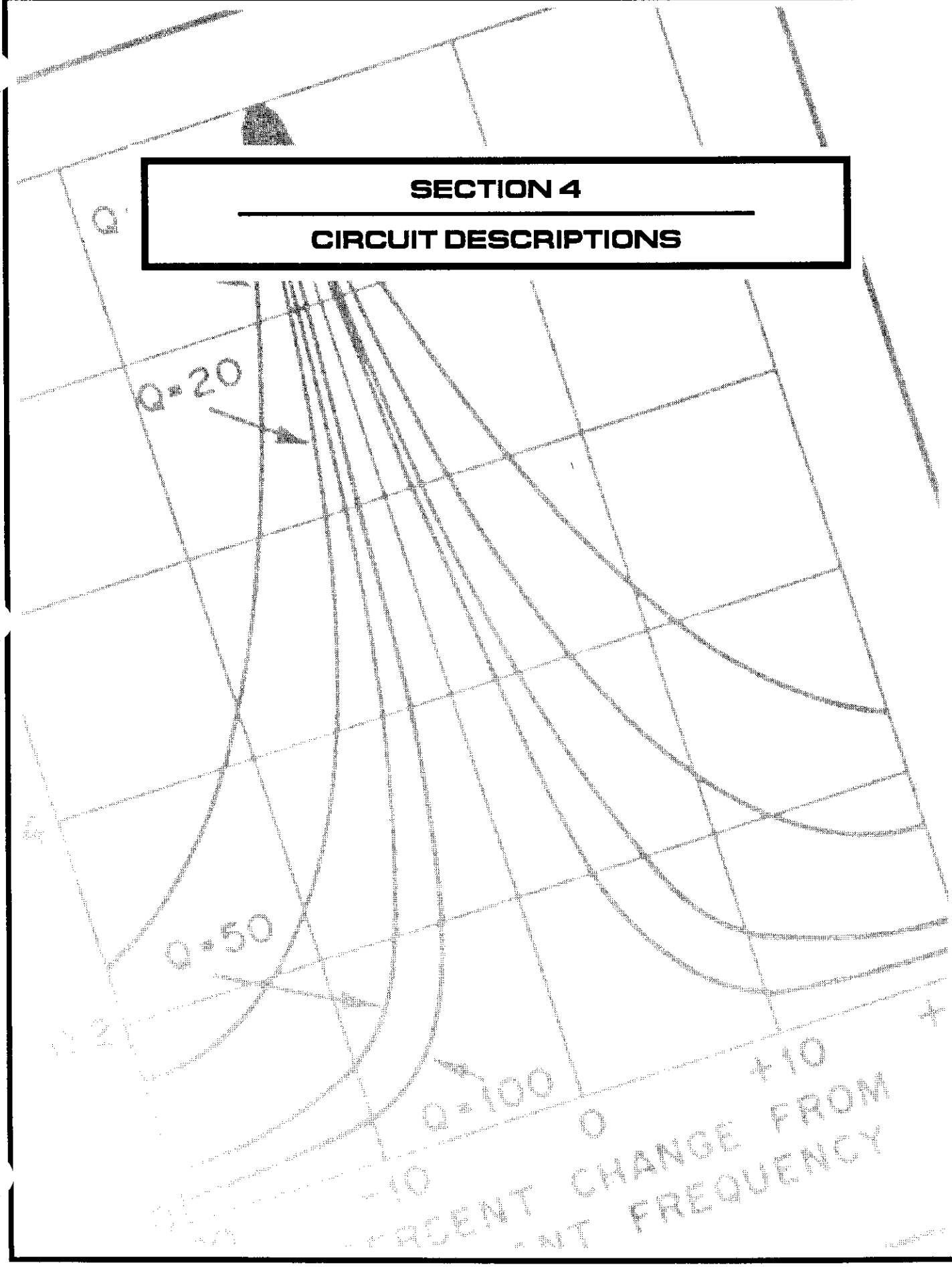
EQUIVALENT CIRCUIT

Figure 3 - 9 A Noisy Ground

NOTES

SECTION 4

CIRCUIT DESCRIPTIONS



NOTES

The SYN-TECH II radio unit is comprised of three major PC boards: the RF Board, which contains a frequency synthesizer, transmit modulator, receiver, and receive audio amplifier circuits; the PA Module, which contains the transmitter RF power amplifier; and The Logic Board, which contains a microcomputer and its peripheral interface circuits.

RF BOARD

SYNTHESIZER

Radio frequency signals for transmission and receiver injection are produced by voltage-controlled oscillators (VCO) in a phase-lock loop (PLL) configuration.

- **Voltage Controlled Oscillator**

In this radio, two VCO's are used: Q721 operates in transmit mode to generate transmit frequencies; Q701 operates in receive mode to generate receive injection frequencies. Each is buffered independently; by Q722 and Q702, respectively. Output of the activated buffer is amplified by Q703, then split to three parallel amplifiers: Q731, Q732, and Q733. During recieve mode, RF signal at receiver injection frequency (Fc + 10.7 MHz) is applied from Q731 to tuned LO amplifier Q204 in the receiver circuit. Q732 output serves as PLL feedback is applied to the loop dividers. RF signal from Q733 is amplified further by Q112, then delivered to the Power Amplifier Module.

The resonance of each VCO is adjusted by a DC steering voltage which is produced by the remainder of the phase-lock loop, and which appears at IC103. When the frequency of the VCO output drifts away from the desired value, the loop adjusts the steering voltage to compensate. Because of this tracking characteristic, VCO steering voltage is always greater with higher VCO output frequencies (unless the band split is crossed).

Because of circuit parameters, a single VCO tank cannot tune across the entire 11 MHz channel spread. Each of the two VCO's contains two electrically-tunable tank circuits: L702/L722 and L712/L732. Only one of the four tanks is switched in at a time and they are selected by the VCO CNT output of IC113 and TXDL from the Logic Board. The microcomputer sets VCO CNT to logic low when operating channel frequency is below a band-split point, and it sets TXDL to logic high during transmit mode. Q102-Q107 produce four tank-selecting voltages from VCO CNT and TXDL: VCO-TX-8V, VCO-TX-LO, VCO-RX-8V, VCO-RX-LO. Each tank-selecting voltage applies forward bias to a PIN diode (D706/ D726) that connects a respective inductance-capacitance network to oscillator Q701/Q721. Each network is independently calibrated by L702, L712, L722, or L732.

Resonance of each VCO tank is voltage-tuned by varactor diodes D702, D704, D712– D714, D722–D724, and D732–D734, respectively. Loop steering voltage applies reverse bias to all these varactor diodes simultaneously. As steering voltage increases, varactor diode capacitance decreases; thus, net capacitance in each tank decreases, which increases resonant frequency of the tanks.

- **Loop Dividers**

The amplitude of the VCO signal from Q732 is sufficient to feed prescaling frequency divider IC101, which applies an output pulse to IC102 pin 10 once every 64 or 65 input cycles. Additional frequency division is performed within IC102 to produce 2.5 kHz. Frequency division by IC101 is switched from 65 to 64 sometime between each of its output pulses and back to 65 at the start of each of those pulses. This provides vernier division of channel frequencies that do not divide evenly. 64/65 division is controlled by a programmable pulse counter in IC102 that applies control logic voltages to IC101 control input at pin 6.

X101 is a temperature-compensated crystal oscillator that produces a reference frequency of exactly 12.8 MHz. The reference frequency is divided by IC102 to produce 2.5 kHz that is compared to the down- counted 2.5 kHz sample of VCO output. Phase and/or frequency error between each 2.5 kHz signal produces current pulses that pass through IC102 pin 17. Depending on whether the phase difference of the comparator input is positive or negative, current pulses flow into or out of IC102, which charges or discharges C122 through loop filter

IC103. The DC voltage developed across C122 serves as VCO steering, which is first filtered within IC103 to limit loop response. Normally, the loop response is slowed enough by the active filter to block 2.5 kHz reference noise and prevent loop correction of voice modulation during transmit. Higher filter rolloff frequency is selected by the microcomputer system on the Logic Board when the radio changes channels or when it is keyed and unkeyed, by a logic low applied to pin 6. This increase in loop response hastens locking time.

A connection from an intermediate point in the phase/frequency comparator in IC102 is made at pin 12. When the loop is out of lock, the down-counted VCO sample is not in phase with the 2.5 kHz reference and low-going pulses appear here, which produce a logic low at pins 12 and 13 of IC107-a. This logic low is applied back to the microcomputer system as status input, plus it is inverted by IC107-c to switch on Q113. Q113 then clamps off bias to transmit RF preamplifier Q112 to prevent emission of erratic signals generated by the uncontrolled VCO.

- **Modulator**

Voice signals from the hand-microphone are applied to microphone amplifier IC104-b through Mic Gain adjustment RV103. Amplified microphone signals exit the RF Board and connect through optional circuitry that may be connected to the Logic Board. Voice signals return to IC104-c where frequency response is pre-emphasized. Signals are amplified further by IC104-d. Gain is such that stronger signals bring IC104-d output into clipping, which limits modulation. Harmonics above the 3 kHz modulation pass-band are removed by the 2.5 kHz pi-network comprised of L106/L107. Modulation signals are then adjusted by RV104/RV105 to so that modulation at limiting will produce transmitted carrier deviation of 5 kHz. F_L MOD LIMIT RV104 provides maximum deviation calibration when the operating channel is below the band-split frequency; F_H MOD LIMIT RV105 provides maximum deviation calibration when the operating channel is above the band-split.

RV104/RV105-tap signals produce variations in reverse bias voltages across varactor diodes in the transmit VCO tank circuit. The varying capacitance of these diodes causes variations in resonance and output frequency, thus frequency modulation results.

Low frequency CTCSS tone and DCS code signals for transmission are produced on the Logic Board and applied to both IC104-a and RV102. Tone1 RV102 applies these signals to the modulator after the pre-emphasis portion. Because the lowest frequency that can modulate the VCO is much higher than the lowest DCS signal frequency (6 Hz), the DCS/CTCSS signals are also applied to the synthesizer reference oscillator (via IC104-a) where the 12.8 MHz reference is also frequency modulated. The reference-oscillator modulation port has a low-pass characteristic with rolloff determined by the loop filter response, while the VCO modulation port has a high-pass characteristic with rolloff determined by the same element; therefore, combined modulation through both ports can be flat if both ports are amplitude-balanced. Tone2 RV101 adjusts signal amplitude into the reference oscillator port, and it must be calibrated so that a low frequency signal (under 20 Hz) produces the same RF carrier deviation as would an equal amplitude, but higher frequency (over 200 Hz) signal. While Tone2 only adjusts modulation levels of lower frequency portion of DCS signals, Tone1 adjusts modulation levels of both higher frequency portions of DCS signals and CTCSS tones.

- **Transmit RF Preamplifier**

Synthesizer output at Q733 is modulated, on-channel RF signal that is ready for amplification and emission. Q112 is a preamplifier that feeds the coaxial cable that couples the RF signal to the PA Module.

RECEIVER

The entire receiver is located on the RF Board. It uses dual conversion and is electronically tuned.

- **Preselector**

Through PIN-diode gates in the PA Module, RF signals are routed to the receiver input at J203. Signals at image frequencies and frequencies far removed from the desired channel are rejected by a preselector comprised of five top-coupled, parallel tanks: L201, L202, L207, L208, and L209. To tune the preselector across the entire 11 MHz channel frequency spread, the capacitance of each tank is

varied by varactor diode pairs D201/D202, D203/D204, D206/D207, D208/D209, and D211/D212. All diodes are reverse biased by a DC voltage applied from a digital-to-analog converter comprised of IC113 and R147-R154. Depending on the frequency of the operating channel, the microcomputer system will switch one or more IC113 outputs to logic low; thus accumulatively sinking currents from R150 to ground. This computer-controlled voltage source varies bias of the varactor diodes to match the preselector tank resonance to the operating channel frequency. Q201 provides adequate gain to overcome preselector signal losses and maximize receiver sensitivity.

- **Injection**

First Local Oscillator signal (channel frequency plus 10.7 MHz) is synthesized by the phase-lock loop and applied to Q204. L222 and L223 reject extraneous synthesizer signals and couple the injection signal to the first mixer. A sample of the signal is extracted by C239 and converted to a DC voltage that appears at CM118 pin 4 as an injection-level metering point.

- **First Mixer**

To maximize intermodulation immunity, a balanced configuration is used for the first-mixer stage. L.O. injection is applied to L211-primary and preselector output is applied to its secondary center tap. FET devices Q202 and Q203, in complementary grounded-gate configuration, provide mixer gain and non-linearity. Q202 and Q203 drain terminals feed opposite primary windings of L219 and mixer output is taken from L219 secondary winding. Because L.O. injection is applied to the push-pull input of the mixer, some of this signal appears at mixer output; although, most is lost because L219 resonates at 10.7 MHz.

Signals from the preselector enter the balanced push-push input of the mixer, where they are split equally in both phase and amplitude. Those signals appear at the two primary sides of L219 in phase, where they cancel. Therefore, any signal originating from the antenna is cancelled and does not exit the mixer. Due to non-linearities in Q202 and Q203, sum and difference frequencies are produced from the L.O. injection and antenna signals. These products are not 180° out of phase; however, and they appear at mixer output.

If two undesired signals, that are 10.7 MHz apart, are strong enough to reach the mixer, their intermodulation by-products created in Q202 and Q203 will be 180° out of phase because both signals entered the balanced mixer input; thus, they will cancel in L219.

- **First I.F.**

Mixer output is applied to Q206, which drives L221. L221 tunes to match the input impedance of 10.7 MHz crystal filter FL261 that rejects signals outside the channel bandwidth. L261 matches FL261 to Q261 where the first I.F. signal is amplified at least 20 dB, then applied to second I.F. IC261.

- **Second I.F.**

IC261 contains all second I.F. circuitry, a quadrature demodulator, and threshold gate. X261 and circuitry in IC261 generate second L.O. injection of 10.245 MHz. A double-balanced mixer, that cancels both input signals internally, is used so that additional tuned circuits at its output are not needed. Mixer output signal of 455 kHz (IC261-3) is bandpass filtered further by FL262 and FL263, then super-amplified (100+ dB) by the second I.F. amplifier/limiter within IC261 (pin 5).

- **Demodulation**

The quadrature detector in IC261 is another double-balanced mixer to which limiter output is applied. Its second input is taken from 455 kHz tank L262 that is also fed with limiter output (IC261 pin 7). Frequency deviations from carrier center will cause phase difference between the two demodulator inputs, which produces output. Thus, preamplified recovered audio appears at demodulator output pin 9. C273, C274, and L263 attenuate signals above 100 kHz.

- **Audio**

Recovered audio from Q263 is routed to the Logic Board for gating, descrambling and/or squelch-code detection. Audio signal returns from the Front Panel Volume control through pin 15 of J110 and is ad-

justed by RV401 which sets maximum audio level. Power Amplifier IC404 amplifies the audio signal and drives the speaker. IC404 contains two amplifiers whose outputs are 180° out of phase and connected to respective sides of the speaker; therefore, both speaker terminals are "live". R199 is connected in series with the internal speaker to reduce maximum audio output in under-dash installations.

- **Squelch**

Audio signals at low-pass filter L263 are routed through Squelch Range RV261 that calibrates squelch-break level when the front panel Squelch control is maximum. Signals at RV261-tap feed a two-tank 60 kHz filter. The resulting 60 kHz signal is amplified by IC261 and Q262, then rectified by D263 to produce a DC voltage that varies inversely with received RF-carrier level. The front panel Squelch control sinks current from D263 so that the voltage can be adjusted. The DC voltage is input of a level detector within IC261, and detector output is an open collector that sinks voltages to logic low when on-channel receiver input is above the squelch threshold established by RV261 and RV301. Level detector output is applied through NSQ, the interconnect to microcomputer input port PC6, so that the microcomputer can take appropriate action.

70-0500CWB 50-WATT PA MODULE

The 50 W Power Amplifier (PA) Module is the rear portion of the 70-0500CWB TX/RX Unit. It contains RF circuitry that is accessible by removing its cover. RF signal routing between the receiver and the power amplifier is accomplished by a relay on the PA Module circuit board, which is energized by TX8V from the RF Board.

- **RF Power Amplifier**

A 50 Ω coaxial cable from the TX RF preamplifier connects to J501. C567, L514, and C570 match the base terminal of Q501 to the coax. RF impedance at Q501-collector is transformed to match the base terminal of driver Q502 by L501, C506, C507, and C571. Q502-collector is is matched to Q503-base, similarly. RF impedance at the collector of final-stage Q503 is transformed by inductors, capacitors, and PC stripline to 50 Ω circuit impedance at the antenna relay contacts. L510-L513, C521-C527, and C550-C555 comprise the harmonic filter that assures the transmitted signal is sinusoidal. R516 and R517 serve to drain static and other DC potentials from the antenna.

- **Automatic Power Control**

A torroidal transformer ahead of the harmonic filter D503 develops a small RF sample across its secondary windings. In conjunction with the RF sample coupled by C520, a DC voltage that increases with RF power travelling forward into the antenna is produced by D503. This power-level indicator is the inverting input of a differential amplifier comprised of Q506 and Q507. The non-inverting input is a DC voltage produced by the H.PWR adjustment RV502. Differential amplifier output drives Q504 which is a current source that feeds primary DC to the collector circuit of predriver Q501. The feedback loop, from the directional coupler to Q504, holds RF output power at a constant level that is determined by RV502.

If the radio is equipped with the Low Power Option, Q505 reduces the H.PWR set-point by connecting L.PWR adjustment RV501 in parallel with RV502 when a logic high is applied to J504-pin 5.

70-0520CWB 110-WATT PA MODULE

The 110-Watt Power Amplifier is the rear portion of the 70-0520CWB TX/RX Unit. It contains RF circuitry that is accessible by removing its cover.

- **RF Power Amplifier**

The TX RF preamplifier output is connected to 50 Ω coaxial cable at J501. A PC-Board stripline is used to couple class-B/C biased Q501 to class-C biased pre-driver Q502. Another PC stripline matches Q502-collector to driver class-C biased Q503. Transformer T1 split driver output feeds twin finals Q504 and Q505. Final-stage outputs are combined by Transformer T2. In transmit mode, K501 connects this RF signal to the harmonic filter consisting of L512-L514 that purifies the signal before emssion by the antenna connected to J502. R520 and R521 drain static and other DC potential from the antenna.

- **Antenna Relay**

Relay K501 is used to switch the high RF power output of Q504 and Q505 to the antenna in transmit mode. In receive mode, the normally closed contacts of K501 connect the antenna to the receiver input through J503. K501 is energized when Q509 is biased on by the TX 8V line from the RF Board. D505 absorbs magnetically induced back-voltage while the relay is de-energized.

- **Automatic Power Control**

Transformer T3, ahead of the harmonic filter, serves as a directional coupler. D502 rectifies a small RF sample that is developed across the transformer, producing a DC voltage that increases with RF power travelling forward into the antenna. This power-level sensing voltage is the inverting input of a differential amplifier comprised of Q507 and Q508. The non-inverting input is a DC voltage produced by PWR adjustment RV501. Differential amplifier output drives current source Q506, which feeds primary DC to the collector circuit of first pre-driver Q501. The feedback loop from transformer T3 to Q506 holds RF output power at the constant level determined by RV501.

LOGIC BOARD

The Logic Board is located on the top side of the TX/RX Unit and occupies only half of the topside area. The other half is available for mounting add-on options.

- **Microcomputer**

Radio operation is under control of a microcomputer system located on the Logic Board. This system is comprised of microcomputer IC903, 8K EEPROM IC902, and peripheral port IC901.

IC903 contains the CPU, ROM, RAM, input ports, and output ports. As determined by instructions in ROM; the CPU detects logic-level voltages on input ports, then changes logic voltages on appropriate output ports to perform the correct, predetermined action. All CPU activity is performed step-by-step in time with a clock of which frequency is fixed by crystal X901. Because of the high clock speed, microcomputer activity seems instantaneous.

EEPROM IC902 appears as additional RAM to the microcomputer, where the Data Packet of radio operating parameters is stored. IC901 contains addressable latches for expanding input and output ports, the DTMF tone generator, and the 2805 Hz tone detector.

Many input and output port connections route off of the Logic Board to interface with synthesizer, receiver, transmitter, and Control Head circuitry. Further details of input and output ports are found in following text and in the Pinout Charts of both major IC's on the Logic Board. Circuit description of the microcomputer itself, beyond port logic, is of little value for radio troubleshooting; therefore, such detail is not discussed in this manual.

- **System Clock**

A 4 MHz system clock is divided by four to produce a 1 MHz clock for the tone decoder/encoder within IC901, for the CTCSS encoder/decoder IC907, and for optional circuitry connected to P923. This clock appears at IC903-pin 64.

- **Serial-Data Peripherals**

Serial data output PA0, with its corresponding clock PA1 (IC901 pins 48 and 49), is used to program CTCSS encoder/decoder IC907, frequency synthesizer IC102 on the RF Board, RF controller IC113 on the RF Board, the OP IC, and an add-on option board connected to P923. The serial data selects CTCSS tone frequency, selects synthesizer division ratios, switches control lines, and controls optional circuitry. When serial data applied from PA0 is CTCSS tone-frequency information, the microcomputer pulses output-port P64 to instruct IC907 to latch and use that data. When data is for IC102 and/or IC113, microcomputer port PB0 is pulsed to force them to latch the data. Data to IC102 and IC113 is applied in two bursts: one burst programs two of three IC102 dividers, the second burst programs a third IC102 divider and IC113.

- **Control-Head Link**

A communications buss, at J906 pins 3 through 9, connects the radio microcomputer to the microcomputer in the Control Head. Push-button codes and display information are transferred through this buss as required.

- **Programming Port**

The microcomputer system is programmable through the Programming Port (J909); which is a bi-directional, asynchronous, 2400/31250 bps, serial communications port. The port connects directly to the microcomputer.

- **Option Interfaces**

Option plug P923 connects all necessary signals and logic functions to operate any of the four configuration types of add-on option boards (Sequential tone decoder, DTMF decoder, etc.). The functions of OPP1- OPP7 interconnects are programmable.

Eleven PC pads exist on the Logic Board to connect the OP IC, which is a voice-scrambler module. Jumpers JP901 and JP902 must be cut when this module is installed to route audio through it. Microcomputer control of the module is accomplished by serial data applied through pins 9 and 10, and by the OPP7 interconnect.

- **DC Power and Reset**

5 V DC power to all logic circuitry on the Logic Board, except IC903, is supplied from switched 13.6 volt interconnect at J906-pin 2 and is regulated by IC913. Microcomputer IC903 is powered by the 5 V drop across D902, which is sourced by the RF Board 9 V supply through J906-pin 33. R923 and R924 supply enough current to supply the microcomputer while it is running. When the radio is turned off, the microcomputer uses little current and its 5 V source input is maintained with low current from 47,000 Ω R410 on the RF Board from unswitched primary power. Because IC903 internal RAM is still powered, last selected channel information is not lost, unless primary power to the radio is disconnected. An optional super-capacitor can be installed in the radio, to R945, to hold DC voltage to RAM after radio primary power is removed.

When the radio is turned off, DC power throughout falls slowly as the filtering capacitors discharge. When switched 13.6 V line reaches 9 V, IC904 output at pin 3 switches high, which activates IC908-a, which activates IC903 /NMI input. The microcomputer then stores status data into RAM before all power is lost. When the 5 V source of the Logic Board drops to 4.2 V, IC904 pulls the microcomputer /RESET input low which stops the system. During power up, the microcomputer holds until its /HALT input is lifted, which occurs after primary power is above 9 V and all 5 V sources have stabilized.

AUDIO ROUTING

Most of the remaining circuitry on the Logic Board routes, detects, or produces audio signals. The following descriptions refer to the Audio Routing Schematic. Microcomputer control and input ports are denoted with oval labels on the schematic.

- **Transmit Audio Route**

Audio signal from the hand microphone is level calibrated by Mic Gain RV103 and pre-amplified on the RF Board. It is then routed through JP902 on the Logic Board, through audio gate IC909-c, and back to the modulator on the RF Board. IC909-c is controlled by the PA5 output port, which applies a logic low to mute voice signals during tone transmission. IC104-c on the RF Board amplifies and pre-emphasizes voice signals. IC104-d amplifies stronger signals into limiting and L106/L107 filters resultant signals and harmonics above 3 KHz. RV104 and RV105 calibrate limited signal before it frequency modulates the VCO so that the peak amplitude produces 5-KHz carrier deviation. RV104 is switched into the circuit when the active channel frequency is below or equal to the mid-band crossover frequency of 46.08 MHz. RV105 is switched in if channel frequency is above the crossover.

During transmit, CTCSS tones are produced by IC907 and level calibrated by RV902. The CTCSS signals are then amplified by IC906-a and routed to the RF Board. The signal is applied into the TONE input of the modulator where it is split: one side routes into the voice limiter for modulating the VCO; the other side is amplified by IC104a and used to frequency-modulate the phase-lock loop reference oscillator. RV101 and RV102 adjust gain of each route to balance frequency response so that the TONE modulator-input port is flat from below 10 Hz to above 2.5 KHz.

Transmitted DCS signals are also applied to the TONE interconnect. The DCS waveform, which is 134-bit-per-second serial data, is produced by the microcomputer and applied from output port P25. Output port P60 is at logic high in transmit mode, which lets the sharp-square DCS waveform pass into a low-pass filter consisting of IC912-a and IC912- b. The filter rounds the waveform by attenuating frequencies above 134 Hz. IC905-b gates the contoured signal to the input of TONE signal pre-amplifier IC906-a.

Burst-tone signals are produced by a stairstep generator comprised of IC910 and IC911. The microcomputer applies a square wave at eight times the burst-tone frequency from output port P26. For every cycle of tone, the three-bit binary value appearing at IC910-pins 3, 10, and 11 increments from zero to seven, then decrements back down to zero. Values of R939, R940, and R941 correspond to the binary weight of their respective IC910 outputs; thus, the charge on C922 varies with the binary value of those outputs, which produces a near sine wave at the desired burst-tone frequency. Burst-tone signal level is calibrated by BRST LVL RV901; then coupled to TONE signal pre-amplifier IC906-a by C974.

DTMF tone pairs are produced in the same manner by two more stairstep generators within IC901 that are clocked by the microcomputer (through internal connections) when DTMF tones are sent. One generator produces row tones and the other produces column tones; with outputs at RA, RB, RC, CA, CB, and CC (pins 30, 31, 34-37). Each set of generator outputs drive respective binary-weighted resistive adders: R925-R927 and R977-R979. Both adders share C973, which smooths the stairsteps. DTMF signal is routed two ways: 1) through R929 and R930 to the ALARM interconnect which connects to the speaker amplifier input; and 2) through audio gate IC909-b and C974 to TONE signal pre-amplifier IC906-a. Audio gate IC909-b passes the signal when the microcomputer sets SW port to logic high.

If the Public Address option is installed, the operator can press a front-panel push button to activate the feature. The microcomputer will activate analog gate IC909-d by applying a logic high to port PA3. Microphone audio will then be coupled to speaker amplifier IC404 input via C910 and the ALARM interconnect. The microcomputer will also apply a logic high to the PA SW2 input of the Relay Option Board at P125 of the RF Board, which switches speaker audio away from the radio speaker and to a public address speaker connected to corresponding sockets of the Accessory Jack.

- **Receive Audio Route**

Audio signal from the demodulator at IC261-pin 9 is contoured by the 100 kHz low-pass filter L263. The signal is then buffered by Q263, and sent to the Logic Board via the AF interconnection. Low-pass filtered signal is also routed through Squelch Range RV261, a two-tank 60 kHz filter, and amplifiers. The resulting signal, that is the 60 kHz portion of demodulator output, is then rectified by D263 to produce a DC voltage varies inversely with received RF-carrier level. The front panel Squelch adjusts this DC voltage and a level detector within IC261 uses it to produce a logic low when on-channel receiver input

is greater than squelch threshold. Squelch status logic is then applied to microcomputer port PC6.

For operation in 2805 Hz signaling systems, AF signal is applied to band-pass filter IC912-d. 2805 Hz dialing bursts from the filter are applied to IC901-pin 40 where they are detected by the microcomputer system.

AF signal from the RF Board is also applied to a low-pass filter comprised of IC912-a and IC912-b through analog gate IC905-a that passes the signal only during receive mode. IC912-a/IC912-b filter extracts voice signals above the DCS frequency range. DCS logic is then detected by a zero-crossing detector comprised of IC912-c and D904. IC912-c compares the difference between its input signal and a reference voltage produced by the charge on C944. C944 charge is an accumulation of the logic high bits of the DCS code and varies with the amplitude of the DCS signal; therefore, detector reference is self-adjusting. IC912-c output is applied to D904 to block small voltage changes. Recovered DCS signal is then applied to microcomputer port P20 for decoding.

CTCSS encoder/decoder IC907 contains a high-pass filter through which AF signal from the receiver is routed to strip away CTCSS and DCS signals so that they cannot be heard. AF signal is also applied to the TONE IN input of IC907 for decoding. Under control of the microcomputer through RX MUTE port PA6, Q902 passes AF signal when received voice signals are to be heard. Under certain conditions, a logic high from the microcomputer DIRECT port PA7 toggles audio gate IC905-c, which switches out the CTCSS/DCS stripping filter.

AF signal at IC905-c is amplified by IC906-b and again gated by IC909-a which is under control of RX MUTE port PA6. The signal returns to the RF Board via the VOL A interconnect; is attenuated by the front panel Volume control and the Max Volume adjustment; then applied to the input of speaker amplifier IC404.

Beep tones, which occur when a push button is pressed or the operator is alerted, are produced by the DTMF tone generator. When microcomputer BEEP LEVEL port P61 is logic low, it sinks audio signal through R931 to attenuate it if the sounding tone is programmed for Low Volume. When BEEP MUTE port P62 is high, Q901 sinks the signal entirely to mute it.

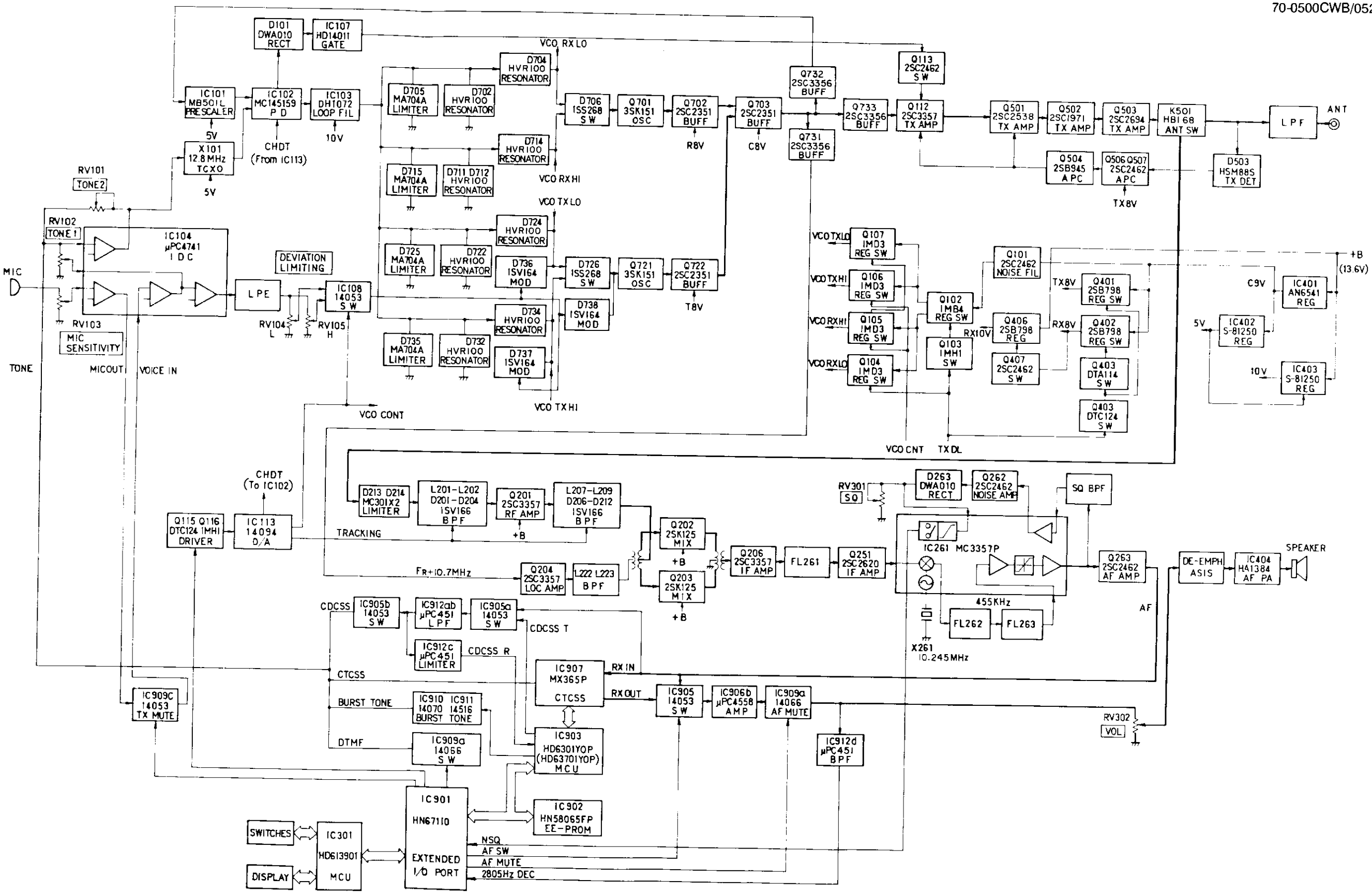
Speakers are driven by IC404, which contains dual audio power amplifiers in push-pull configuration. *EACH SIDE OF THE SPEAKER IS DRIVEN BY A LIVE AMPLIFIER OUTPUT.* Pin 7 supplies speaker signal to the SP1 and the PA1 terminals in Accessories Jack J305 that is located on the radio chassis. IC404 pin 7 also applies signal to the Control Head through J108 pin 6 to connect to the SP1 and PA1 terminals of its Accessory Jack J319 (in trunk-mount configurations). When the 70-0001 Standard Control Head is used, a jumper on J305 connects SP1 to the INT SP terminal to route the audio signal through 12 Ω attenuating resistor R199 and to the internal speaker of the Standard Control Head that is connected to J108 pins 2 and 3. IC404 pin 12 feeds the SP2 terminal of both Accessory Jacks J305 and J319, and the other side of the front-panel speaker in the Standard Control Head. PA2 terminal of J305 and J319 routes through the Relay Option Board at P124 where it is connected to IC404 pin 12 if the Public Address Option is installed and enabled.

SECTION 5

DIAGRAMS

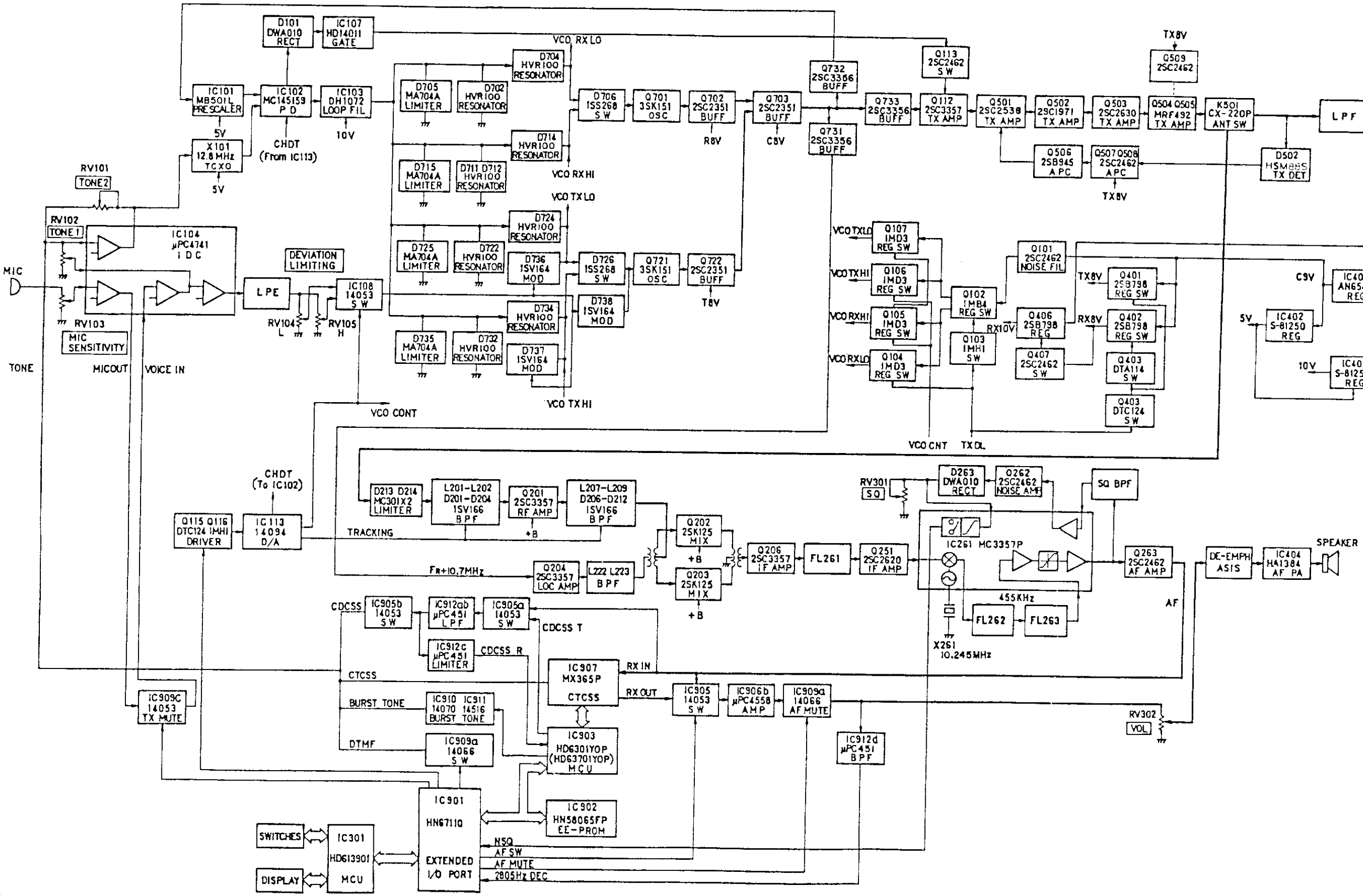
NOTES

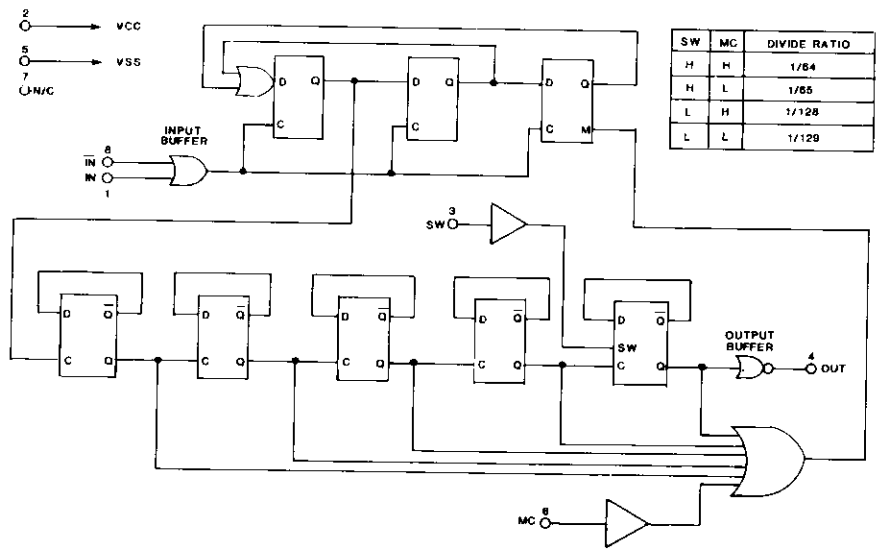
70-0500CWB/0520CWB



70-0520CWB BLOCK DIAGRAM

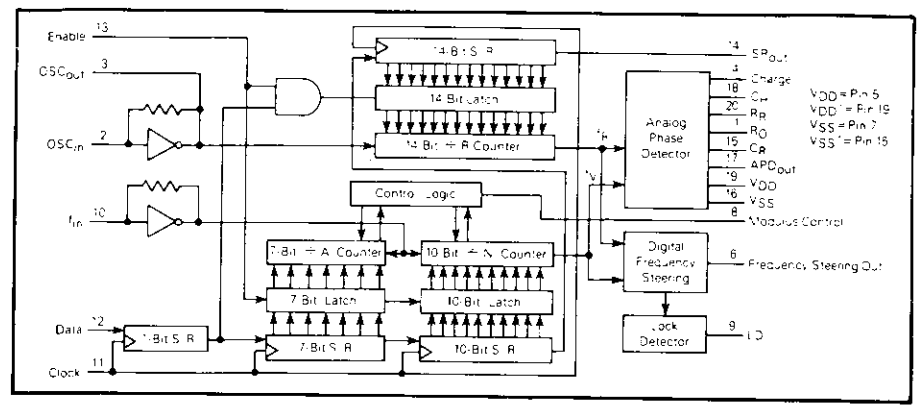
70-0500CWB/0520CWB



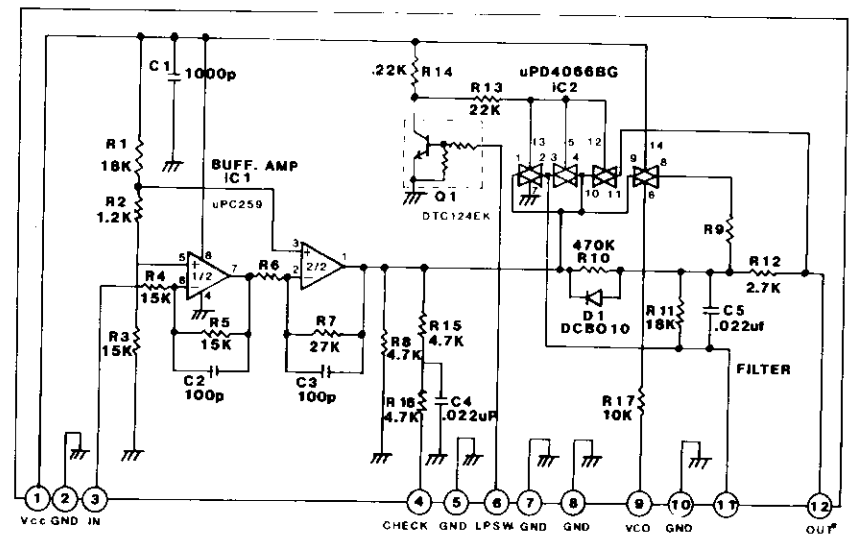


SW	MC	DIVIDE RATIO
H	H	1/64
H	L	1/65
L	H	1/128
L	L	1/129

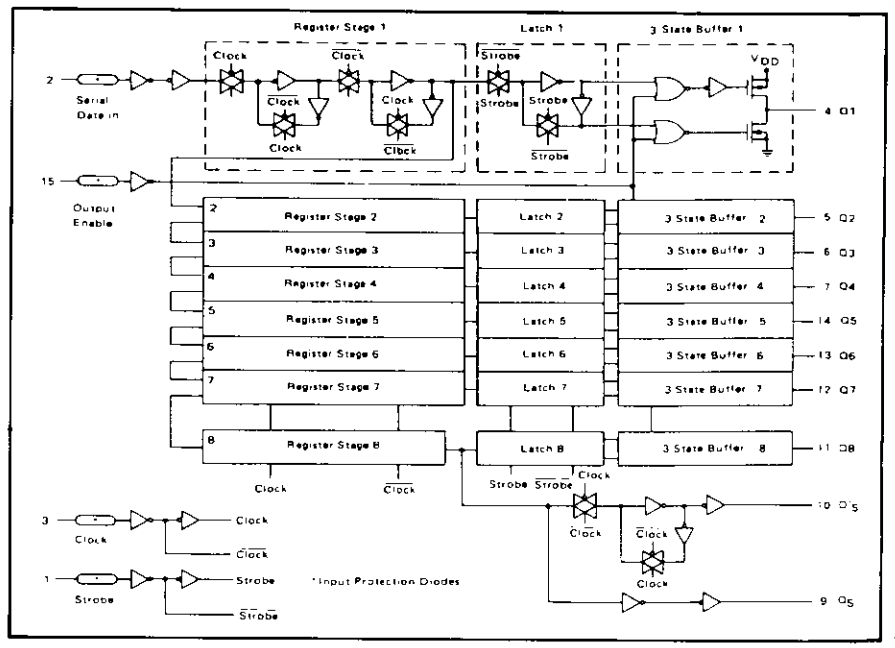
IC101 MB501L MODULUS PRESCALER



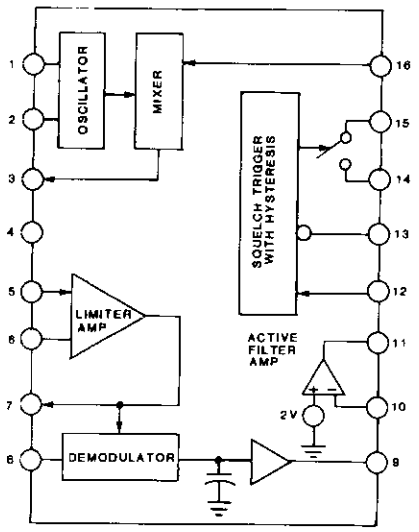
IC102 MC145159-FN1 PHASE-LOCK LOOP



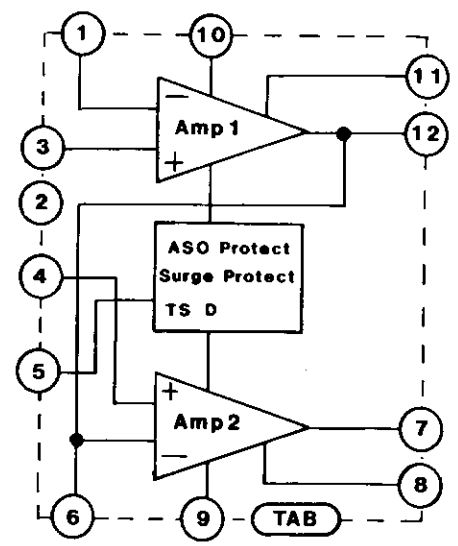
IC103 DH-1072A LOOP FILTER



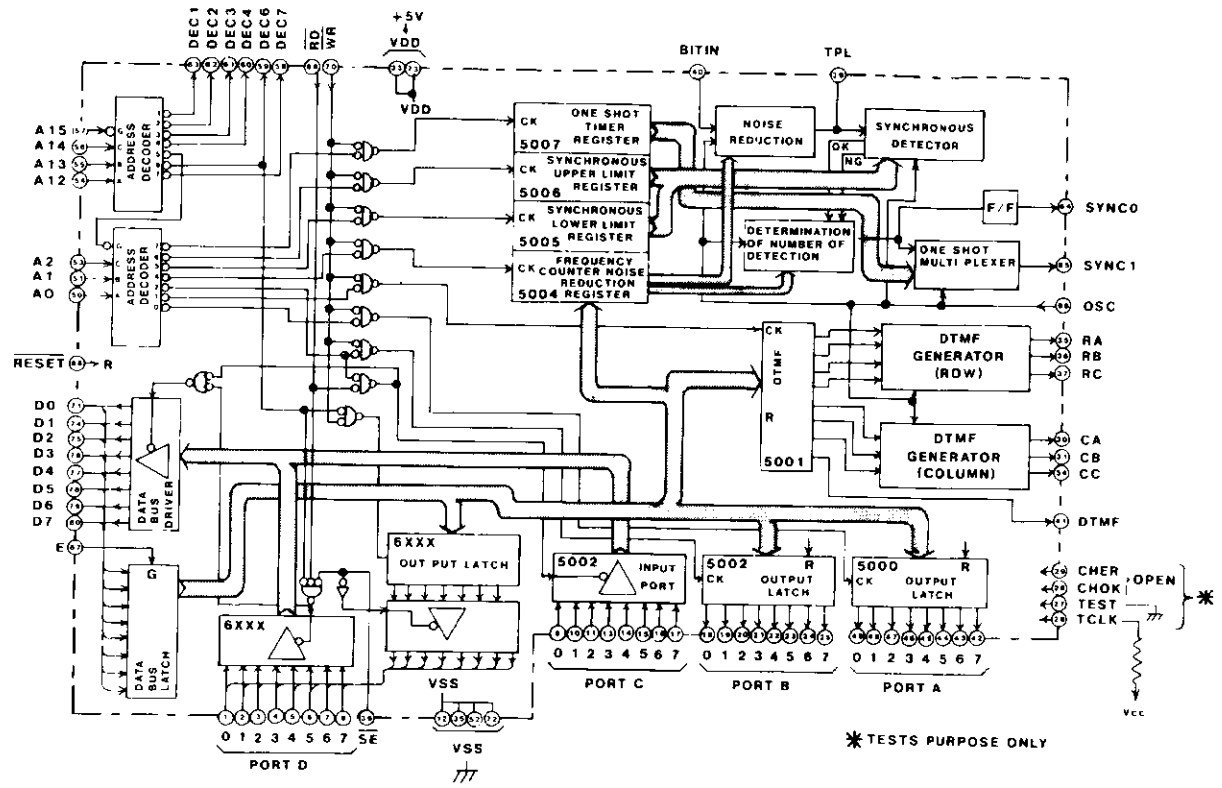
IC113 MC14094B 8-BIT SHIFT REGISTER



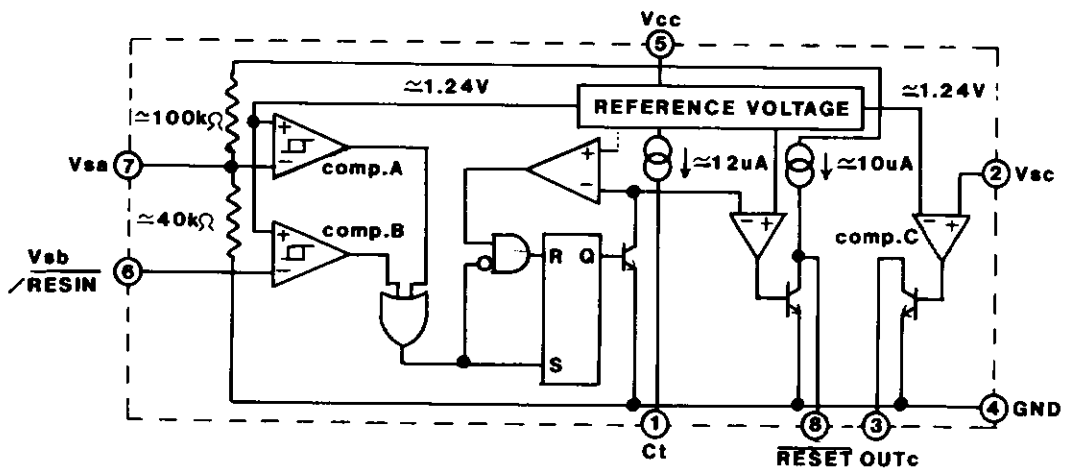
IC261 MC3357P 2ND IF



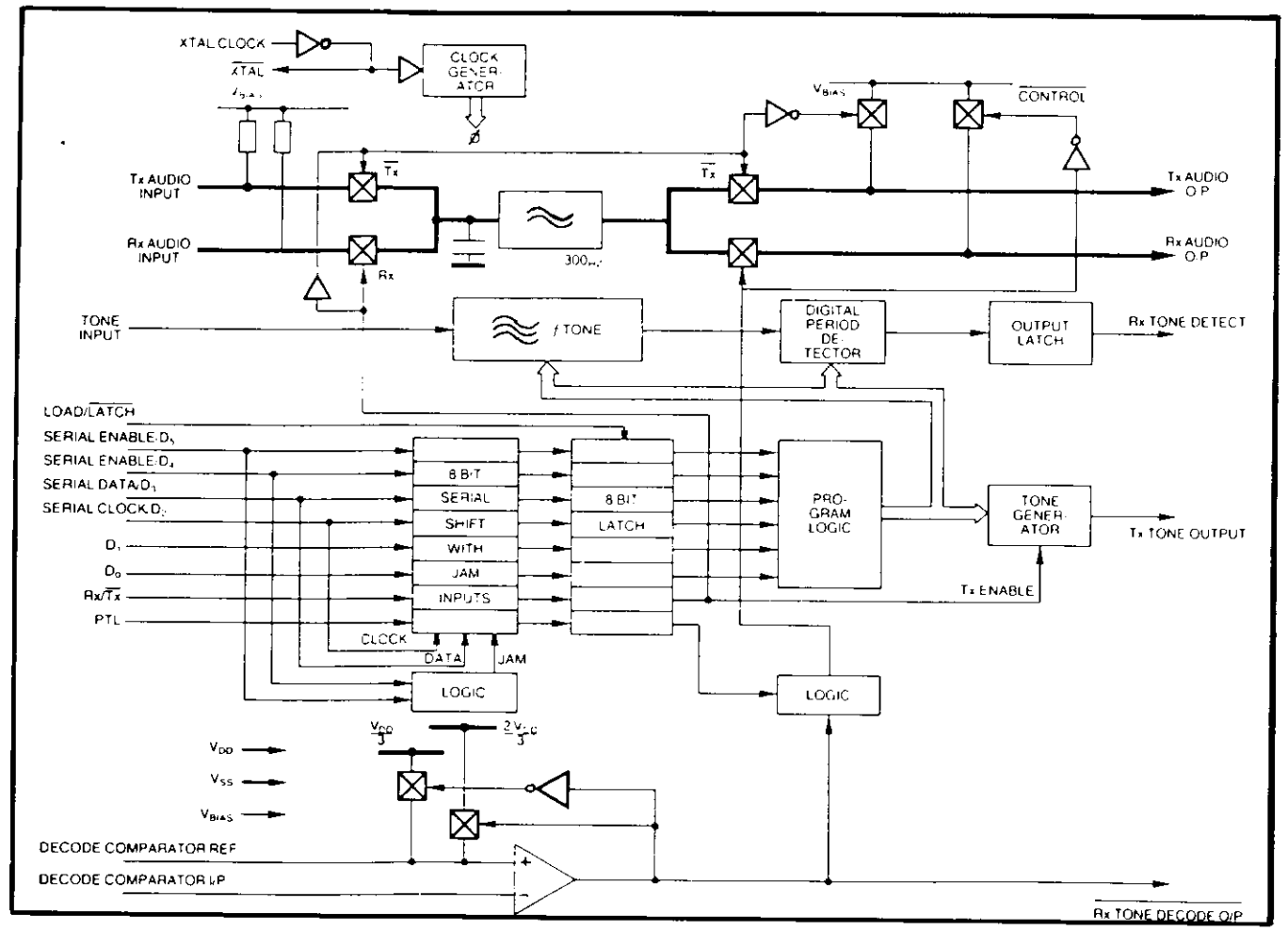
IC404 HA1384 AUDIO POWER AMPLIFIER



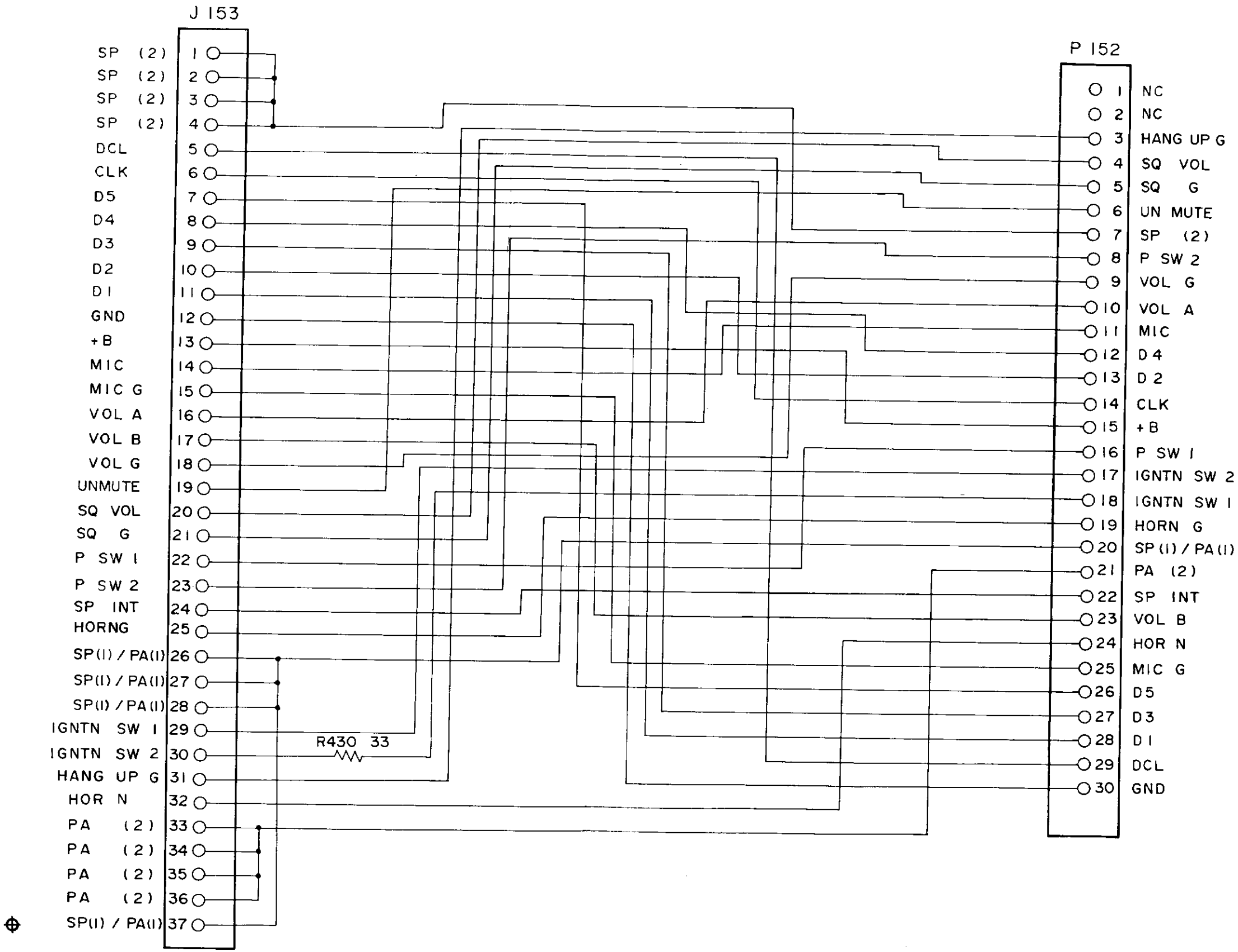
IC901 HN671106U PERIPHERAL LSIC

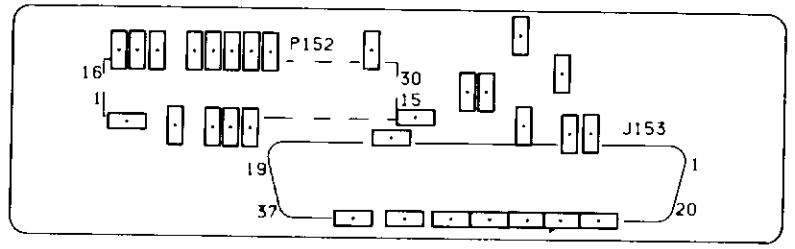


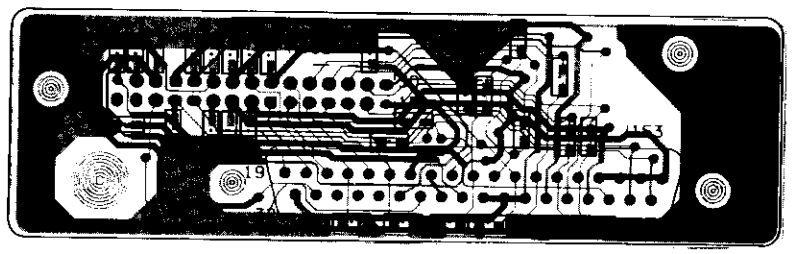
IC904 MB3771 RESET CONTROLLER



IC907 MX365P CTCSS ENCODER/DECODER

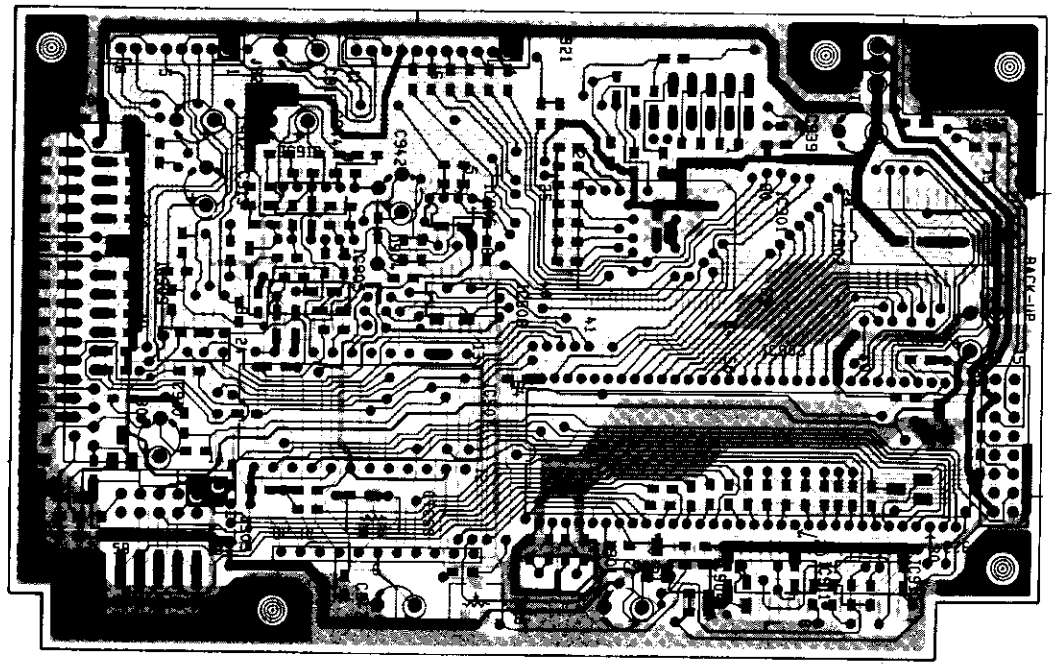

J 153
SP (2) 1
SP (2) 2
SP (2) 3
SP (2) 4
DCL 5
CLK 6
D5 7
D4 8
D3 9
D2 10
D1 11
GND 12
+B 13
MIC 14
MIC G 15
VOL A 16
VOL B 17
VOL G 18
UNMUTE 19
SQ VOL 20
SQ G 21
P SW 1 22
P SW 2 23
SP INT 24
HORNG 25
SP(1) / PA(1) 26
SP(1) / PA(1) 27
SP(1) / PA(1) 28
IGNTN SW 1 29
IGNTN SW 2 30
HANG UP G 31
HOR N 32
PA (2) 33
PA (2) 34
PA (2) 35
PA (2) 36
SP(1) / PA(1) 37
R430 33
P 152
1 NC
2 NC
3 HANG UP G
4 SQ VOL
5 SQ G
6 UN MUTE
7 SP (2)
8 P SW 2
9 VOL G
10 VOL A
11 MIC
12 D 4
13 D 2
14 CLK
15 +B
16 P SW 1
17 IGNTN SW 2
18 IGNTN SW 1
19 HORN G
20 SP (1) / PA (1)
21 PA (2)
22 SP INT
23 VOL B
24 HOR N
25 MIC G
26 D5
27 D3
28 D1
29 DCL
30 GND


P152
J153
16
1
30
15
19
37
1
20

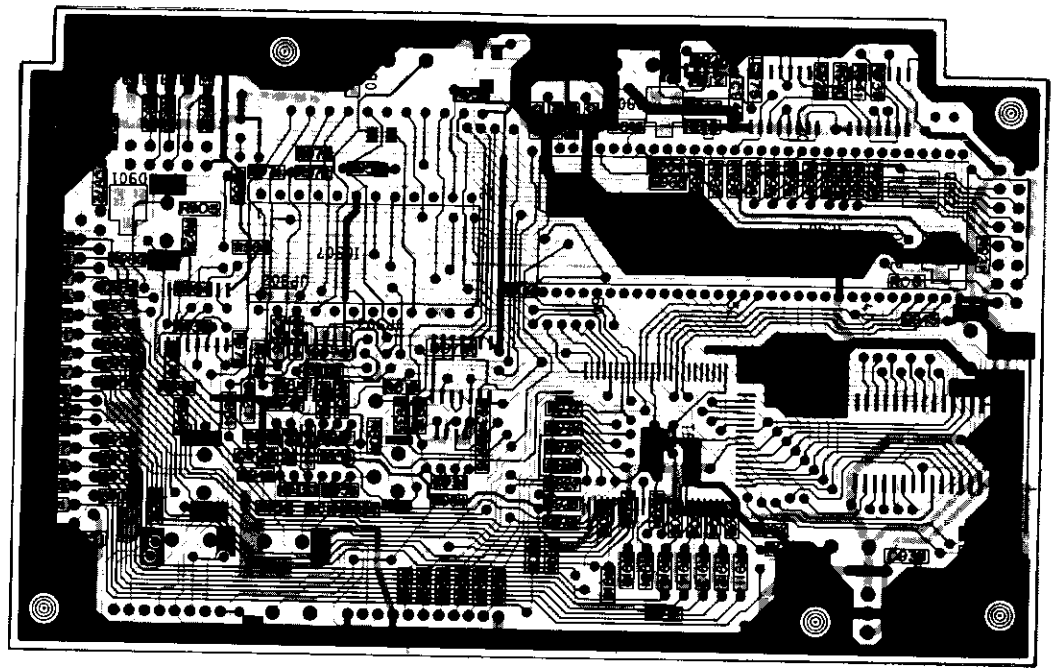


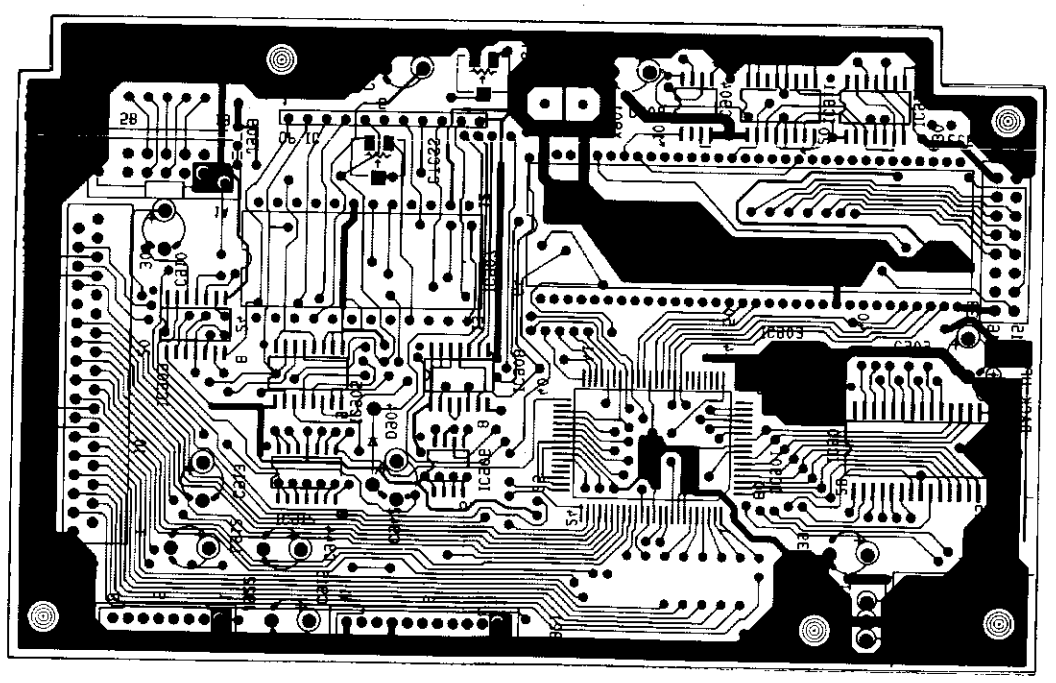

VISIBLE PLATING
UNDERSIDE PLATING

TOP VIEW



BOTTOM VIEW





VISIBLE PLATING

UNDERSIDE PLATING

70-050)CWB/0520CWB

CX-55 / CX-55-I ⚠

J906: GND, +B, DCL, CLK, DI, D2, D3, D4, D5, UNMUTE, MIC, MIC G, VÖL A, VÖL G, TH SW, HANG UP, NSQ, DSTB I, LP SW I, TXDL I, INTRX, HORN SW, PA SW, CHDT, DCLK, PLCL I, AF, AFG, VOICE, VOICEG, TONE, ALARM, C9V, 13.6V

J922: MIC IN, MIC OUT, VOLA OUT, VOLA IN, VOICE OUT, VOICE IN, TONE OUT, TONE IN

J921: +B, CHDT, DCLK, DSTB 2, LP SW 2, TX DL 2, PLCL 2, GND, VOICE, TONE, VOICE G

IC901 HN671106U

IC902 HN58C65FP

IC903 HD6301Y0P (OR HD6370IY0P)

IC904 MB3771

IC905 14053B

IC906 µPC4558G (OR EQ)

IC907 MX365P

IC908 74HC10

IC909 14066B

IC910 14070B

IC911 14516B

IC912 µPC451G (OR EQ)

IC913 7805

4.9 BEEP MUTED
0.0 UNMUTED

CTCSS

J909: 5V IN, 5V OUT, CTS, RTS, SD, RD, CD, GND

P923: GND, 5V, DET, OPP 1, OPP 2, OPP 3, OPP 4, OPP 5, OPP 6, OPP 7, CLK, SER, NC, +B, 1MHz, BACK UP

OP IC

Q901

IC913

D901, D902, D903

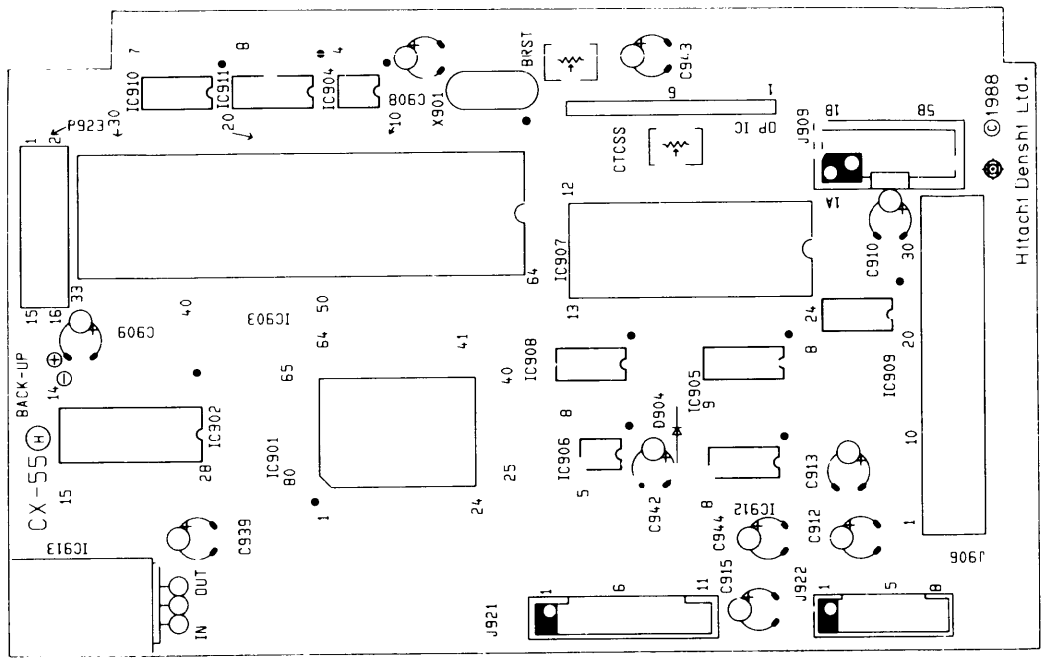
⚠ ※: CX-55 220P
CX-55-I 1000P

UNLESS OTHERWISE NOTED RESISTORS: 1/16W

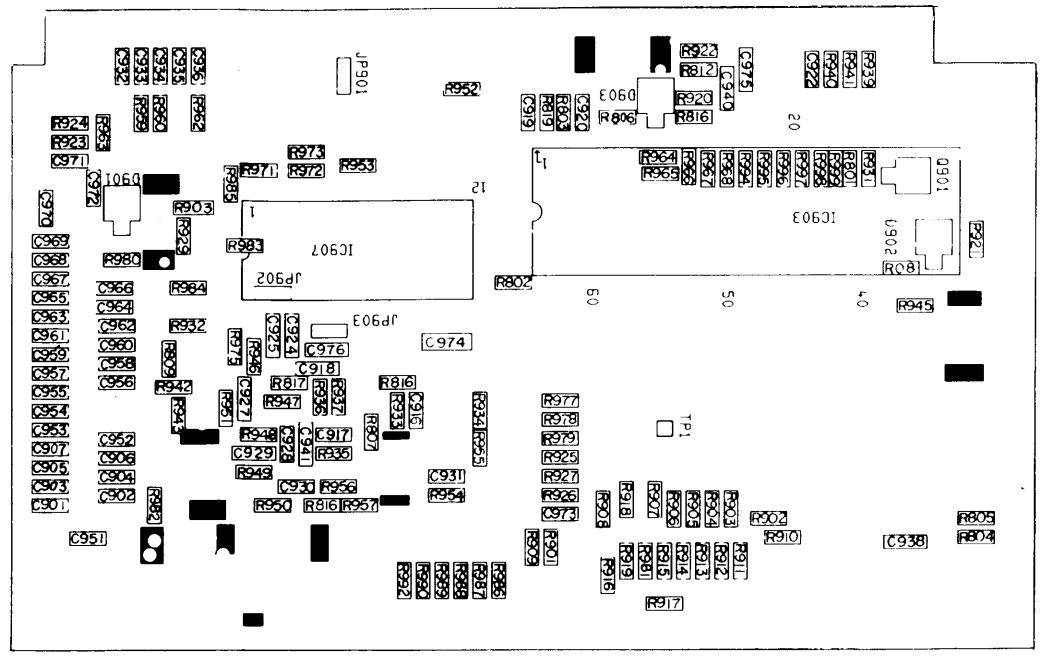
CX-55 LOGIC BOARD COMPONENT LAYOUT

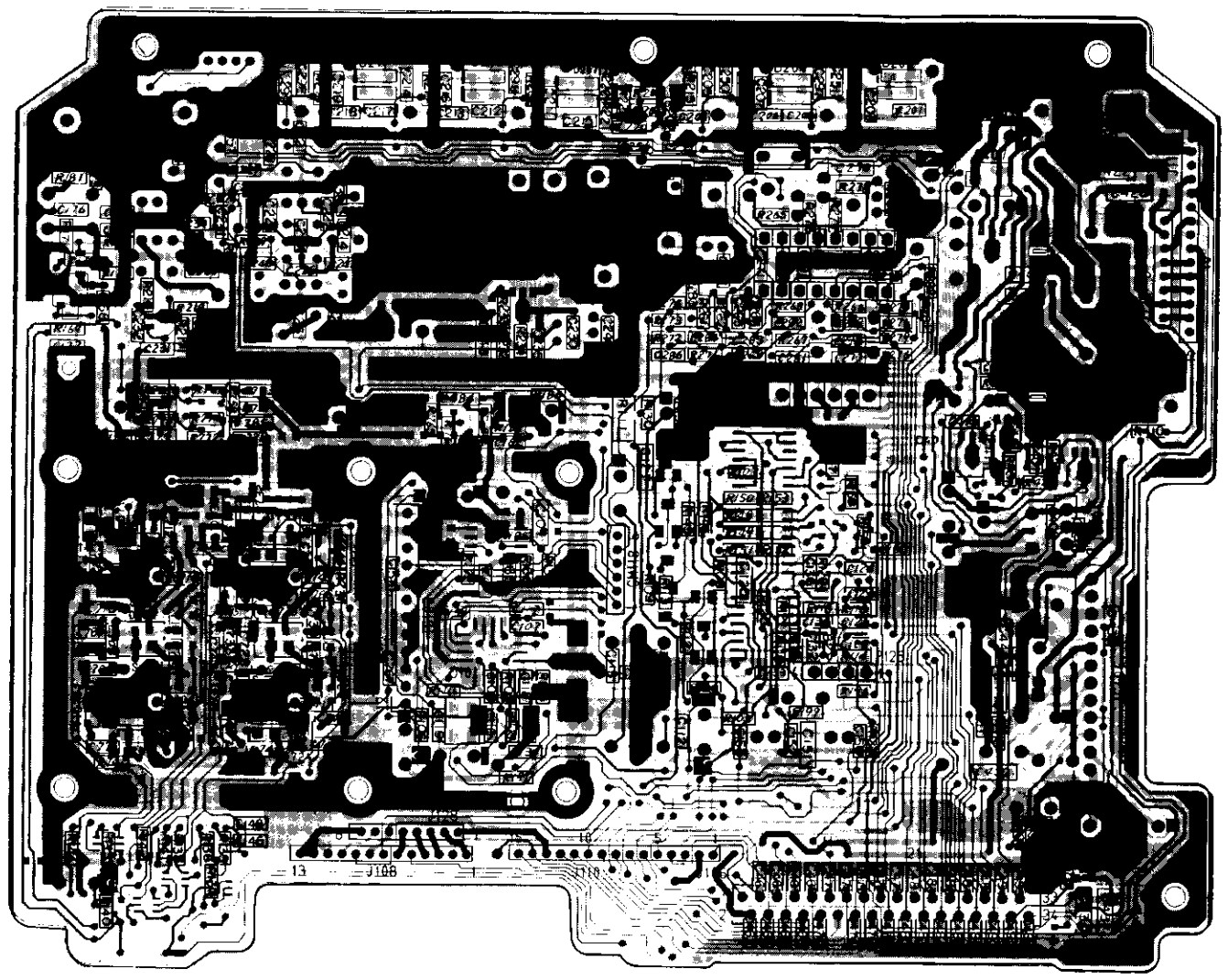
70-0500CWB/0520CWB

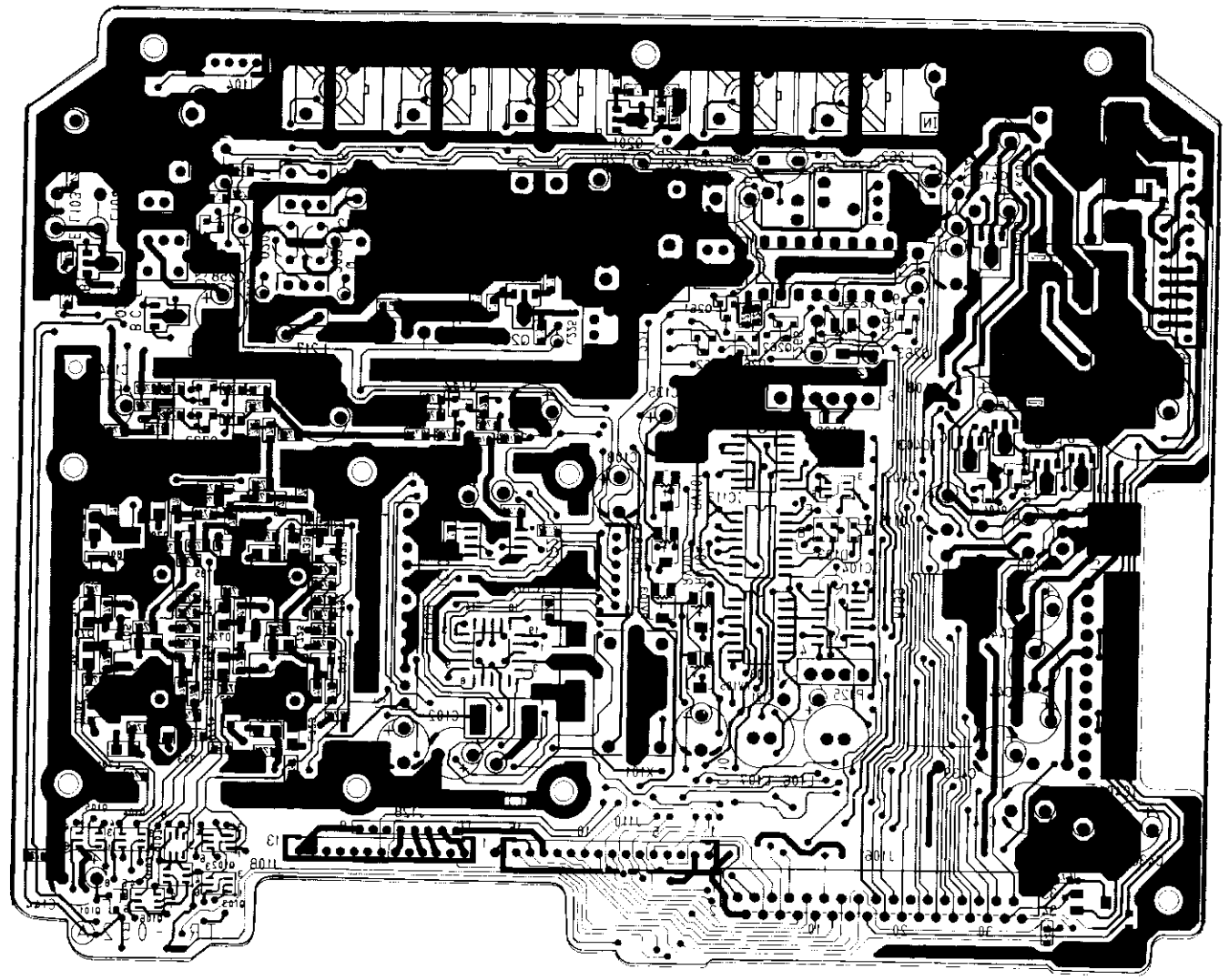
TOP VIEW



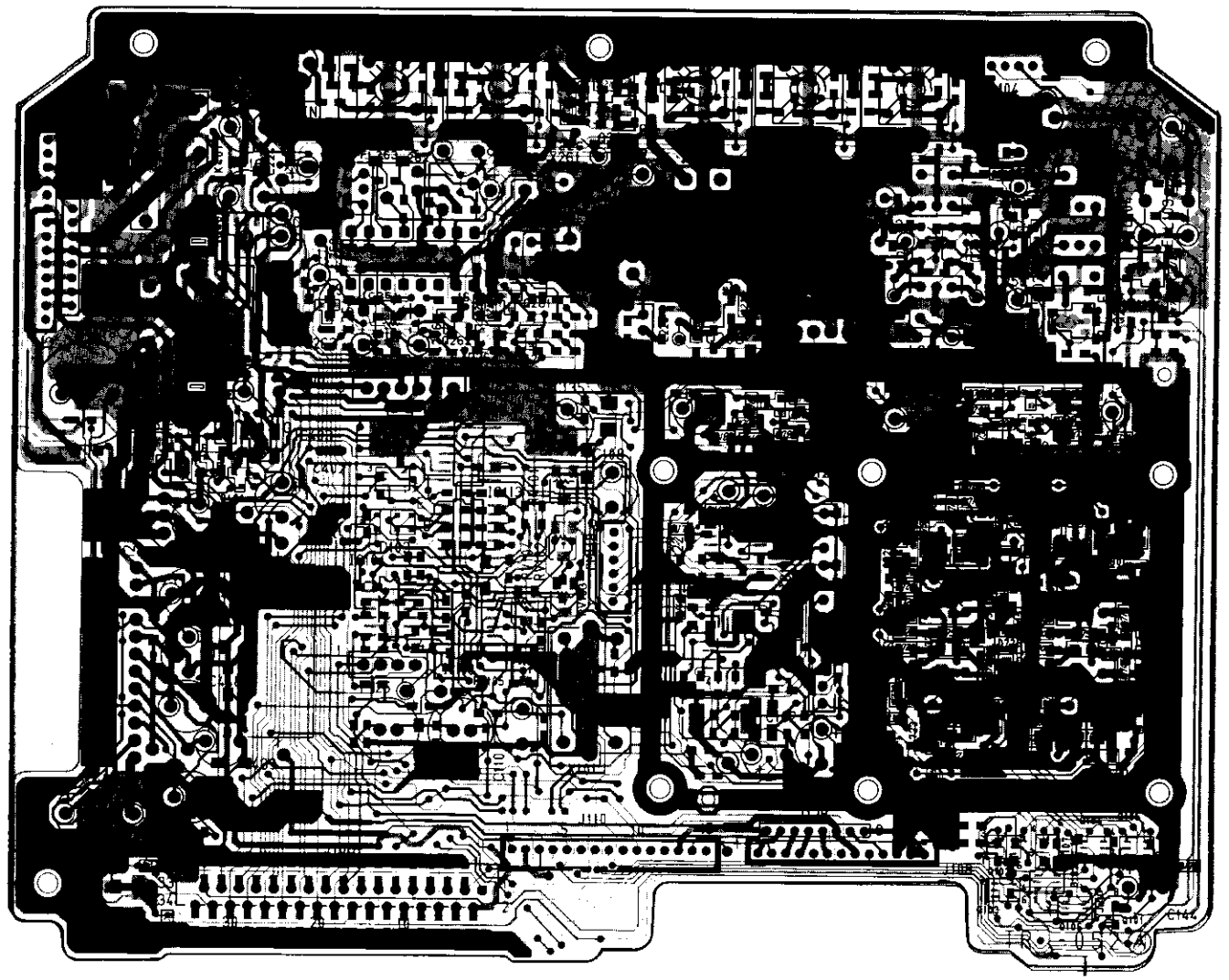
BOTTOM VIEW

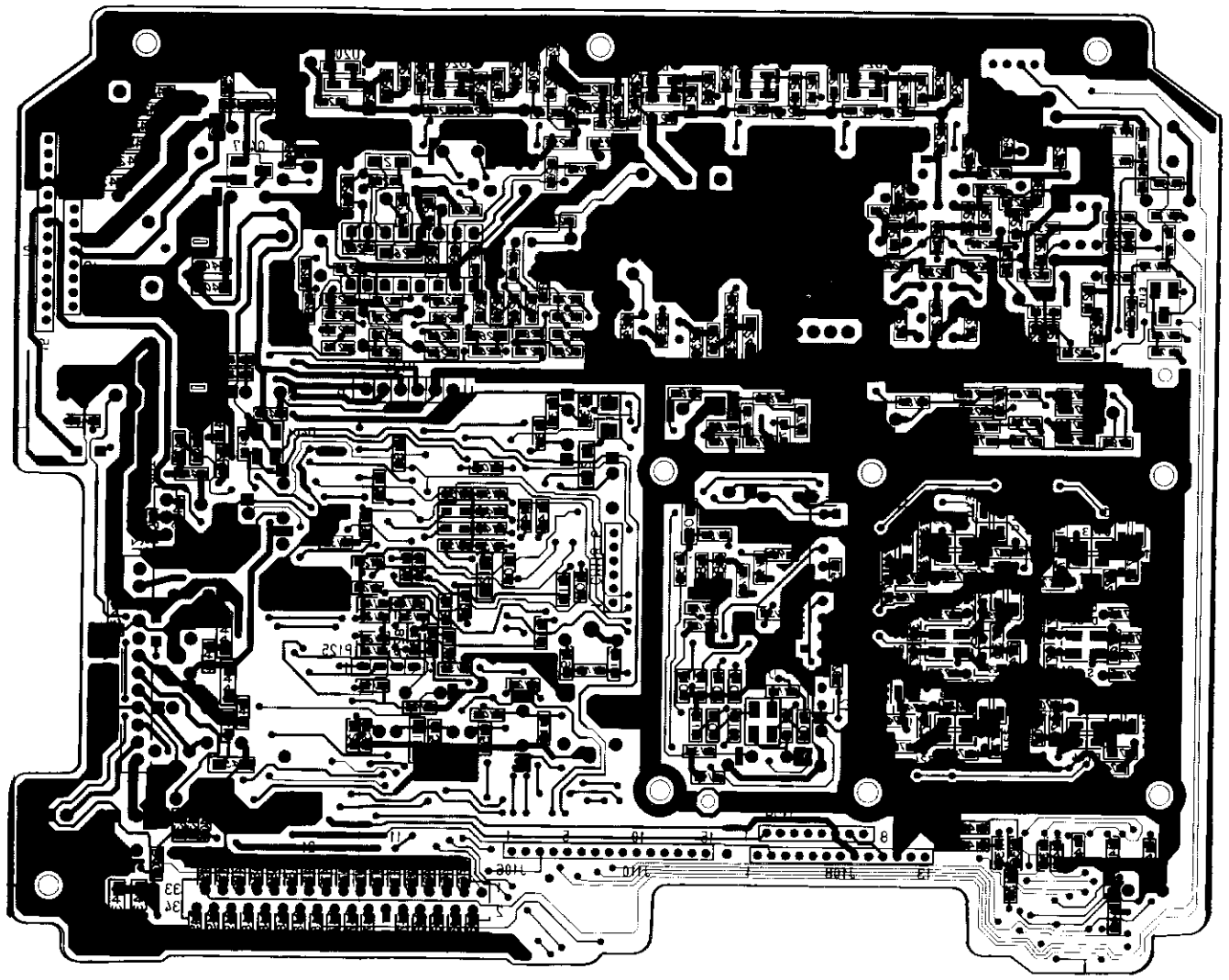






BLUE VISIBLE PLATING
UNDERSIDE PLATING





VISIBLE PLATING

UNDERSIDE PLATING

70-0500CWB/0520CWB

TR-052

THE NOMINAL RF POWER OF THE EXCITER (Q112) IS APPROX. 28.75mw AT J101.

Q101, Q113, Q115, Q261, Q262, Q403, Q404, Q407, Q702, Q703, Q722, Q731, Q732, Q733

Q102, Q103, Q104, Q105, Q106, Q107, Q116

Q112, Q201, Q204, Q206, Q406

D502

Q202, Q203

D102

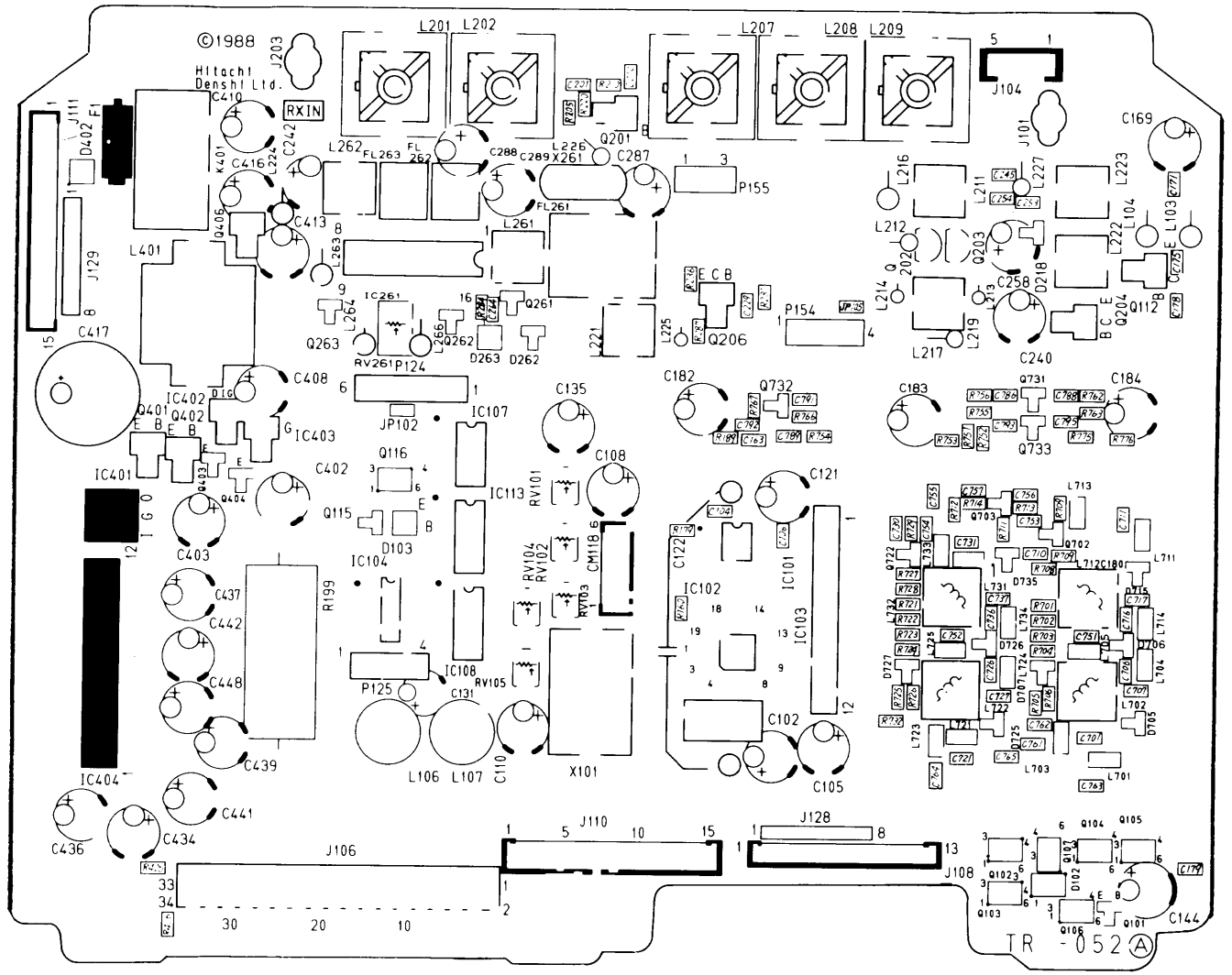
D705, D706, D707, D715, D725, D726, D727, D735

D103, D105, D104, D263, D401, D402

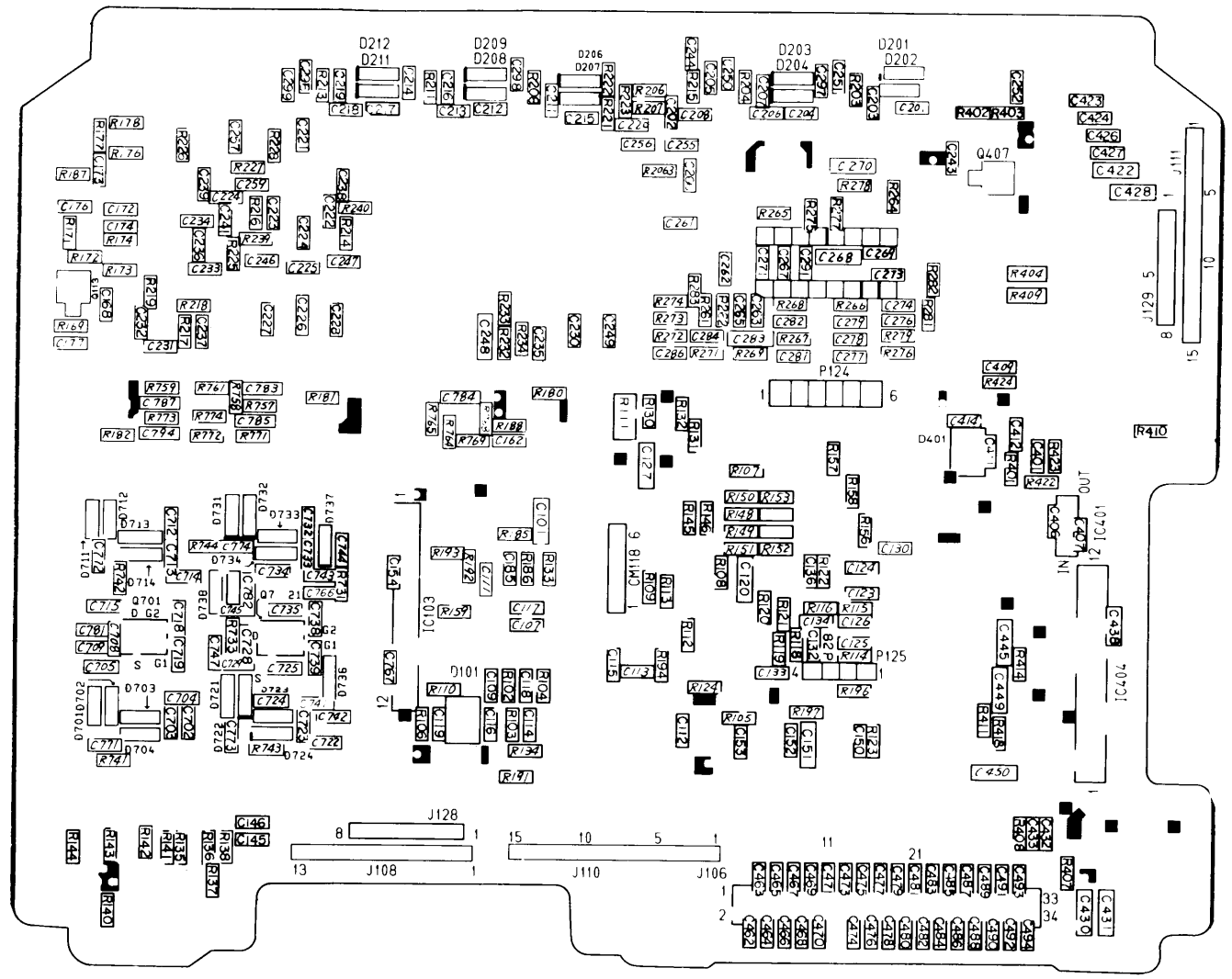
IC402, IC403

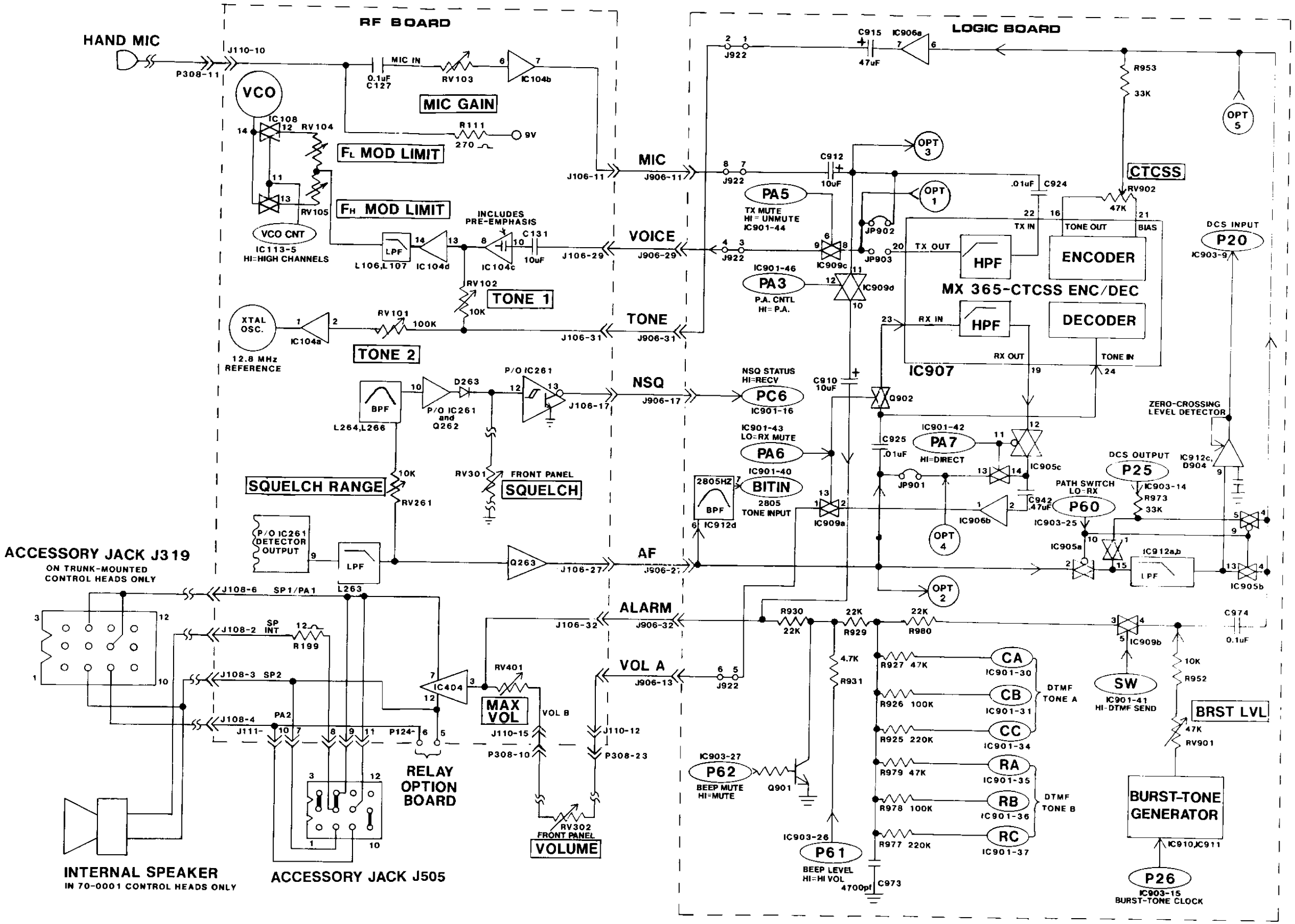
IC401

TOP VIEW

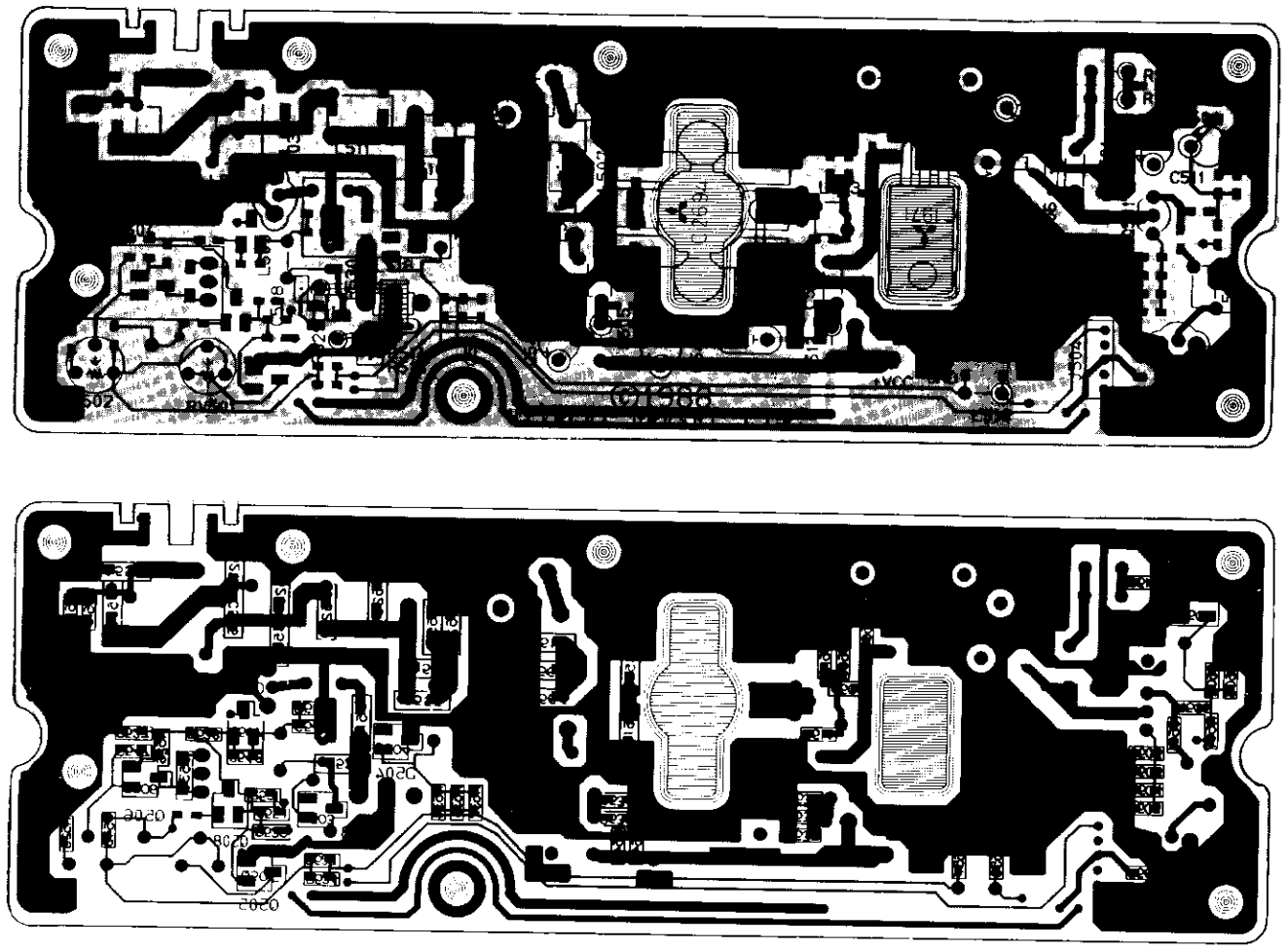


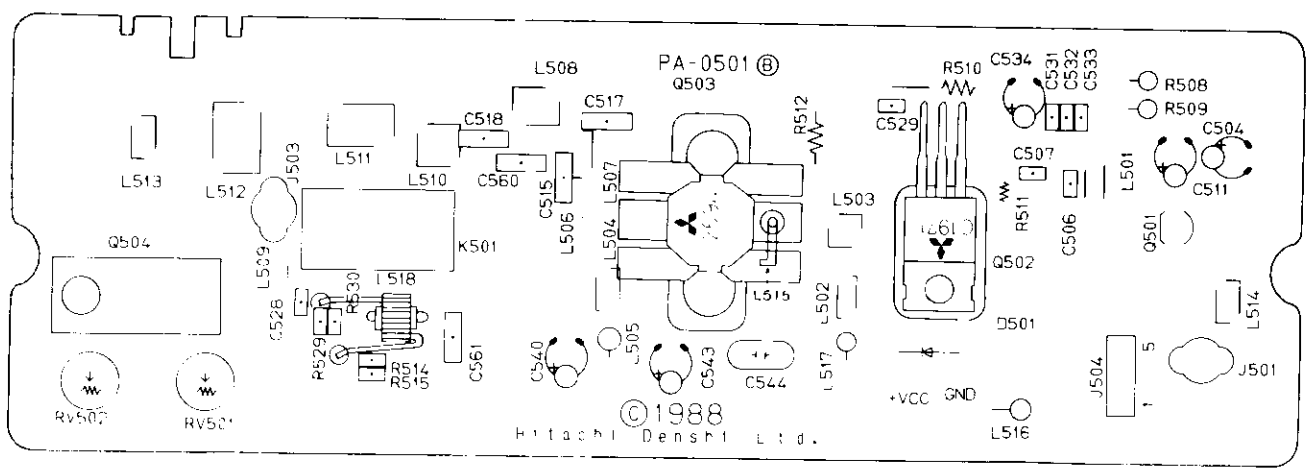
BOTTOM VIEW



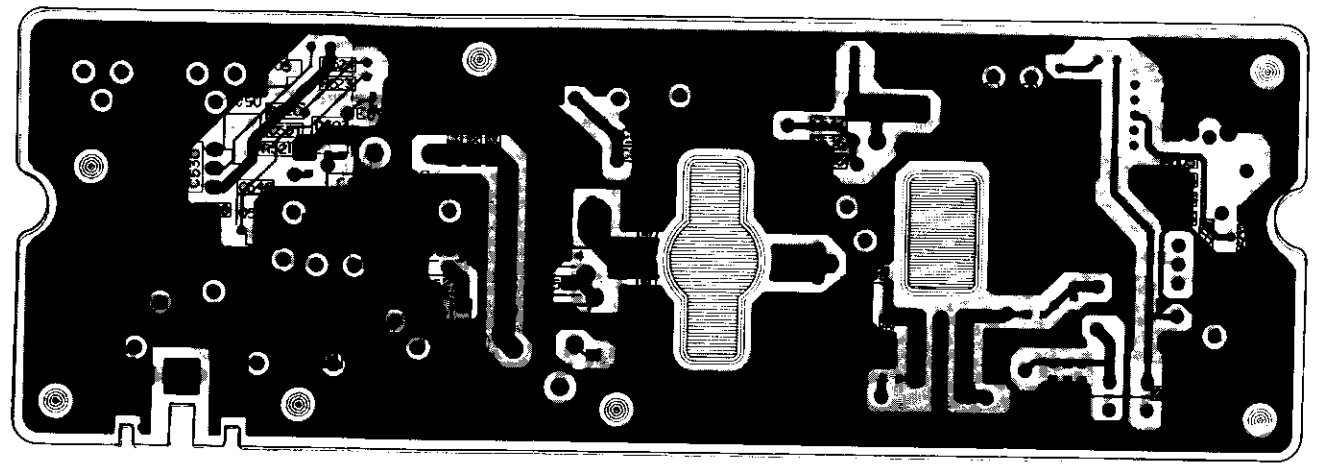

RF BOARD
LOGIC BOARD
HAND MIC
J110-10
P308-11
VCO
IC108
RV104
RV105
VCO CNT
IC113-5
HI=HIGH CHANNELS
MIC IN
0.1uF C127
RV103
IC104b
MIC GAIN
R111
270
9V
FL MOD LIMIT
FH MOD LIMIT
INCLUDES PRE-EMPHASIS
C131
10uF
IC104c
LPF
L106,L107
IC104d
RV102
10K
TONE 1
XTAL OSC.
12.8 MHz REFERENCE
IC104a
RV101
100K
TONE 2
P/O IC261
D263
BPF
L264,L266
P/O IC261 and Q262
10K
RV261
SQUELCH RANGE
RV301
FRONT PANEL
SQUELCH
P/O IC261 DETECTOR OUTPUT
LPF
Q263
J106-27
J906-27
AF
MIC
J106-11
J906-11
VOICE
J106-29
J906-29
TONE
J106-31
J906-31
NSQ
J106-17
J906-17
ALARM
J106-32
J906-32
VOL A
J906-13
J922
C915
47uF
IC906a
R953
33K
OPT 5
OPT 3
C912
10uF
PA5
TX MUTE HI=UNMUTE
IC901-44
OPT 1
.01uF C924
RV902
47K
CTCSS
JP902
JP903
TX OUT
TX IN
TONE OUT
BIAS
HPF
ENCODER
MX 365-CTCSS ENC/DEC
DCS INPUT
P20
IC903-9
IC909c
IC909d
IC901-46
PA3
P.A. CNTL HI=P.A.
RX IN
RX OUT
HPF
DECODER
TONE IN
IC907
NSQ STATUS HI=RECV
PC6
IC901-16
C910
10uF
Q902
ZERO-CROSSING LEVEL DETECTOR
IC912c, D904
IC901-43
LO=RX MUTE
PA6
IC901-42
PA7
HI=DIRECT
C925
.01uF
IC905c
JP901
DCS OUTPUT
P25
IC903-14
R973
33K
PATH SWITCH LO-RX
P60
IC903-25
IC905a
IC912a,b
LPF
IC905b
IC901-40
BITIN
2805 TONE INPUT
2805HZ
BPF
IC912d
IC909a
IC906b
C942
.47uF
OPT 4
OPT 2
R930
22K
R929
22K
R980
22K
4.7K
R931
C974
0.1uF
IC909b
SW
IC901-41
HI=DTMF SEND
10K
R952
BRST LVL
47K
RV901
BURST-TONE GENERATOR
IC910,IC911
P26
IC903-15
BURST-TONE CLOCK
CA
IC901-30
CB
IC901-31
CC
IC901-34
DTMF TONE A
RA
IC901-35
RB
IC901-36
RC
IC901-37
DTMF TONE B
R927 47K
R926 100K
R925 220K
R979 47K
R978 100K
R977 220K
IC903-27
P62
BEEP MUTE HI=MUTE
Q901
IC903-26
P61
BEEP LEVEL HI=HI VOL
4700pf
C973
ACCESSORY JACK J319
ON TRUNK-MOUNTED CONTROL HEADS ONLY
J108-6 SP1/PA1
J108-2 SP INT
J108-3 SP2
J108-4 PA2
J111-
L263
R199
IC404
RV401
MAX VOL
VOL B
J110-15
P308-10
J110-12
P308-23
RELAY OPTION BOARD
RV302
FRONT PANEL
VOLUME
INTERNAL SPEAKER
IN 70-0001 CONTROL HEADS ONLY
ACCESSORY JACK J505

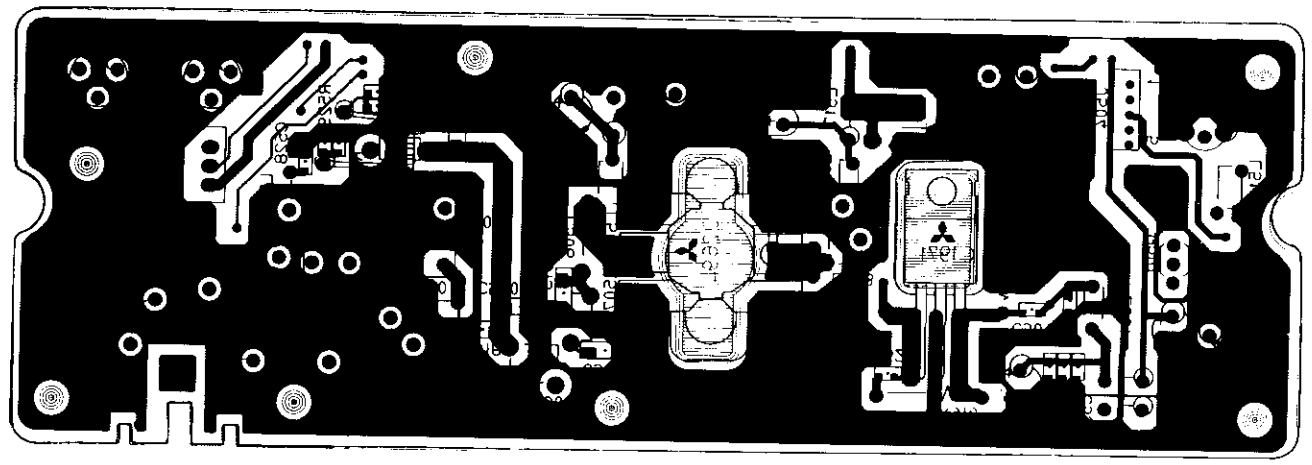
TOP VIEW

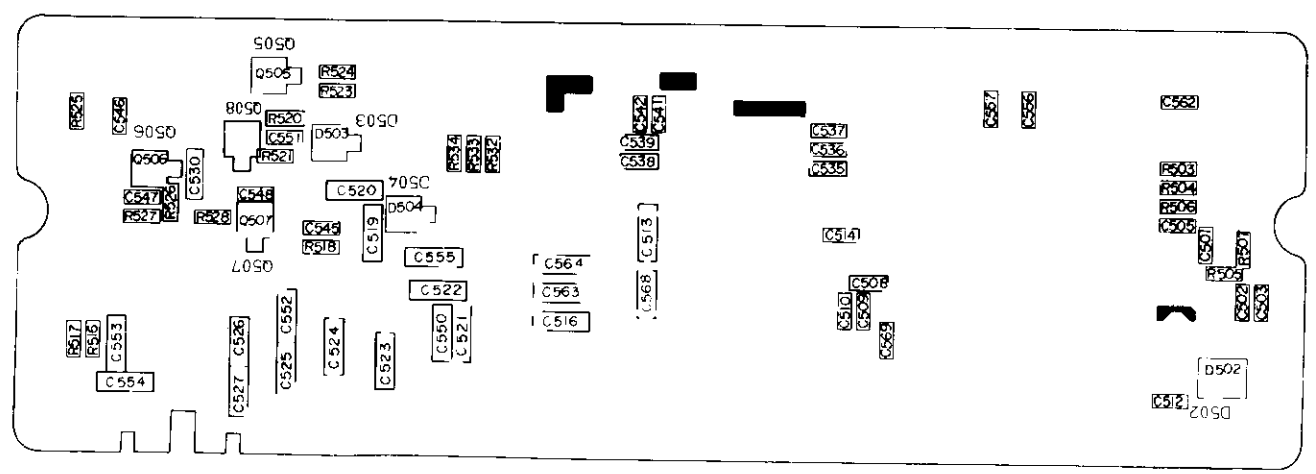




BOTTOM VIEW



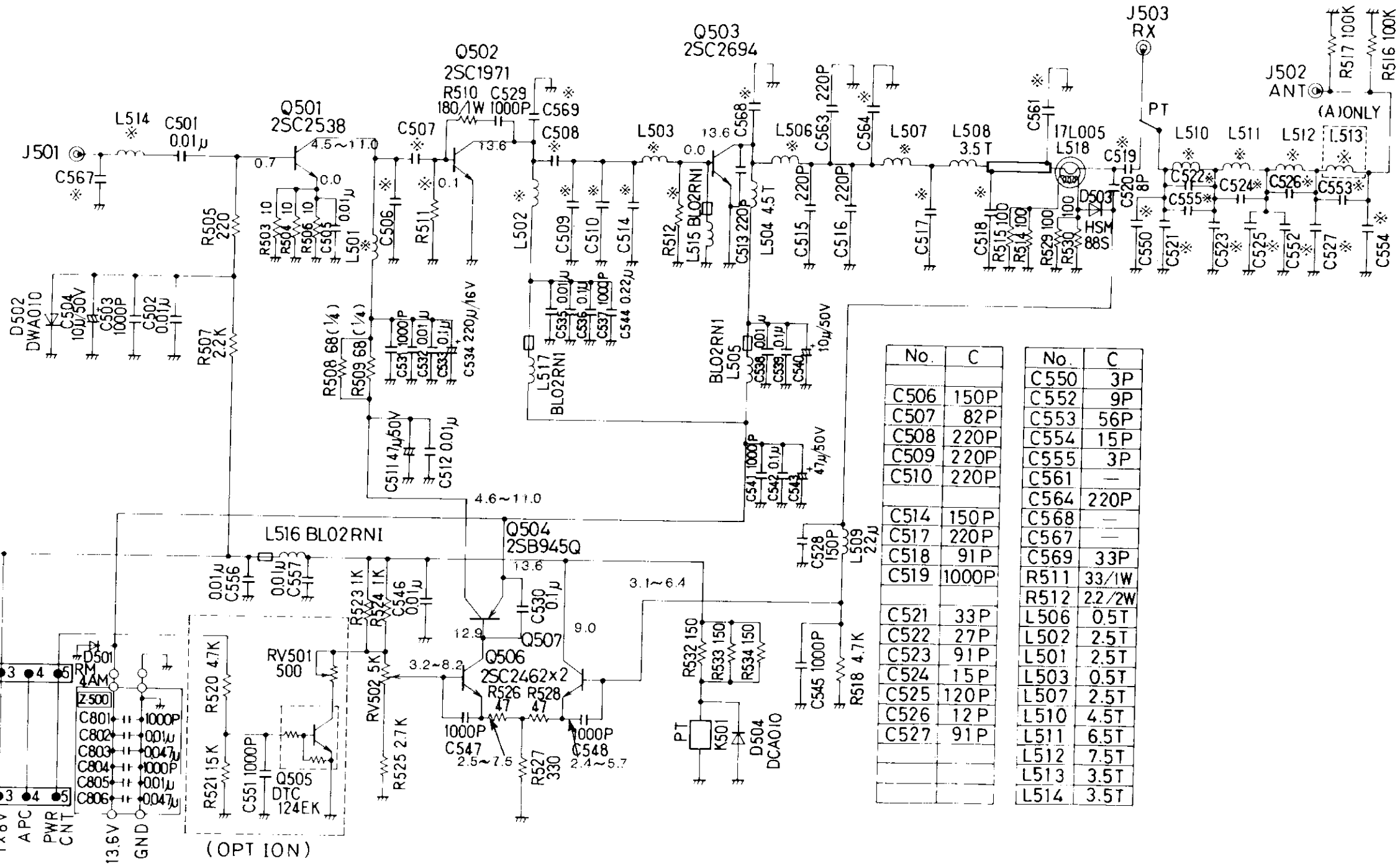




VISIBLE PLATING

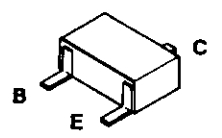
UNDERSIDE PLATING

70-0500CWB/0520CWB

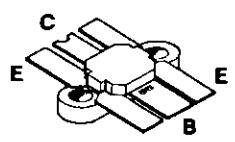


No.	C
C506	150P
C507	82P
C508	220P
C509	220P
C510	220P
C514	150P
C517	220P
C518	91P
C519	1000P
C521	33P
C522	27P
C523	91P
C524	15P
C525	120P
C526	12P
C527	91P

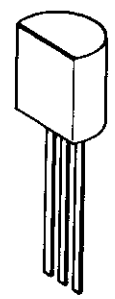
No.	C
C550	3P
C552	9P
C553	56P
C554	15P
C555	3P
C561	—
C564	220P
C568	—
C567	—
C569	33P
R511	33/1W
R512	2.2/2W
L506	0.5T
L502	2.5T
L501	2.5T
L503	0.5T
L507	2.5T
L510	4.5T
L511	6.5T
L512	7.5T
L513	3.5T
L514	3.5T



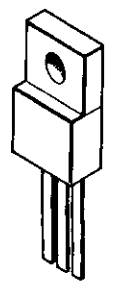
Q505, Q506, Q507



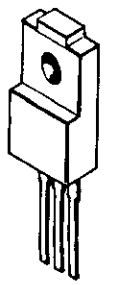
Q503



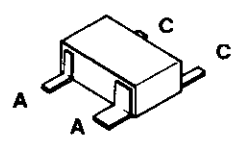
Q501



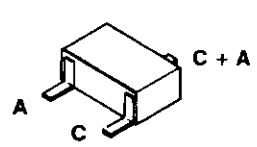
Q502



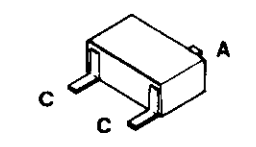
Q504



D502

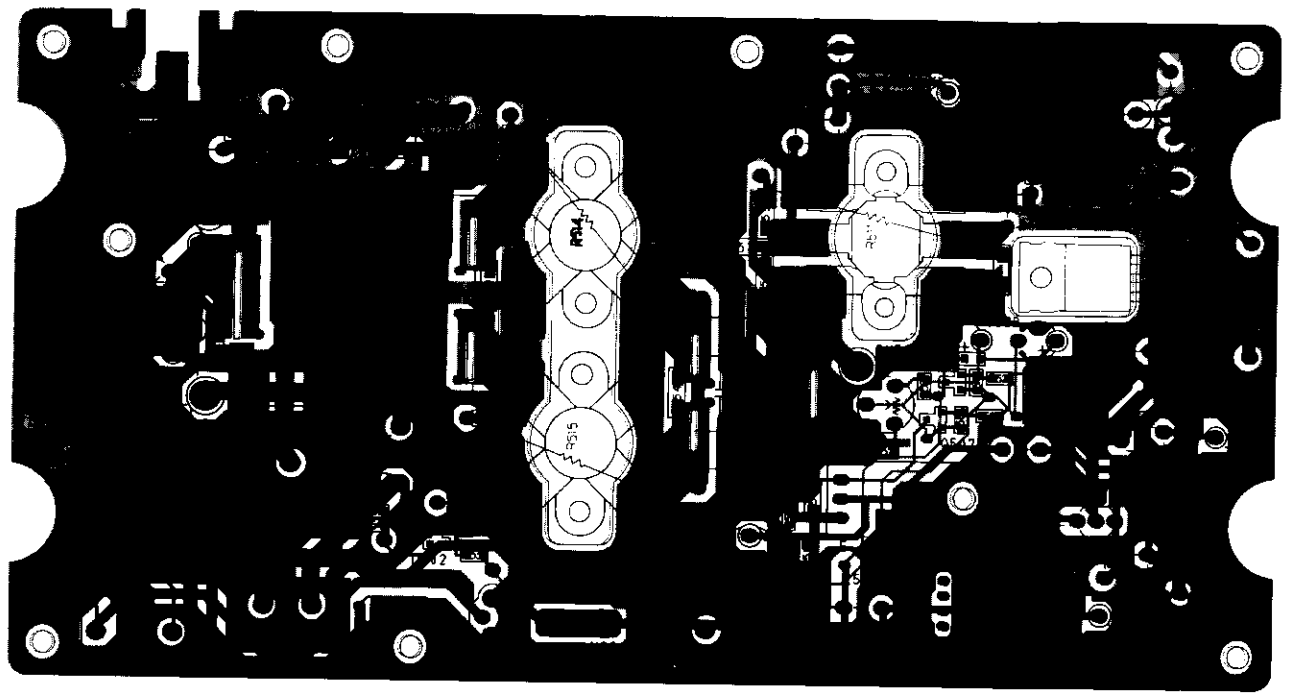


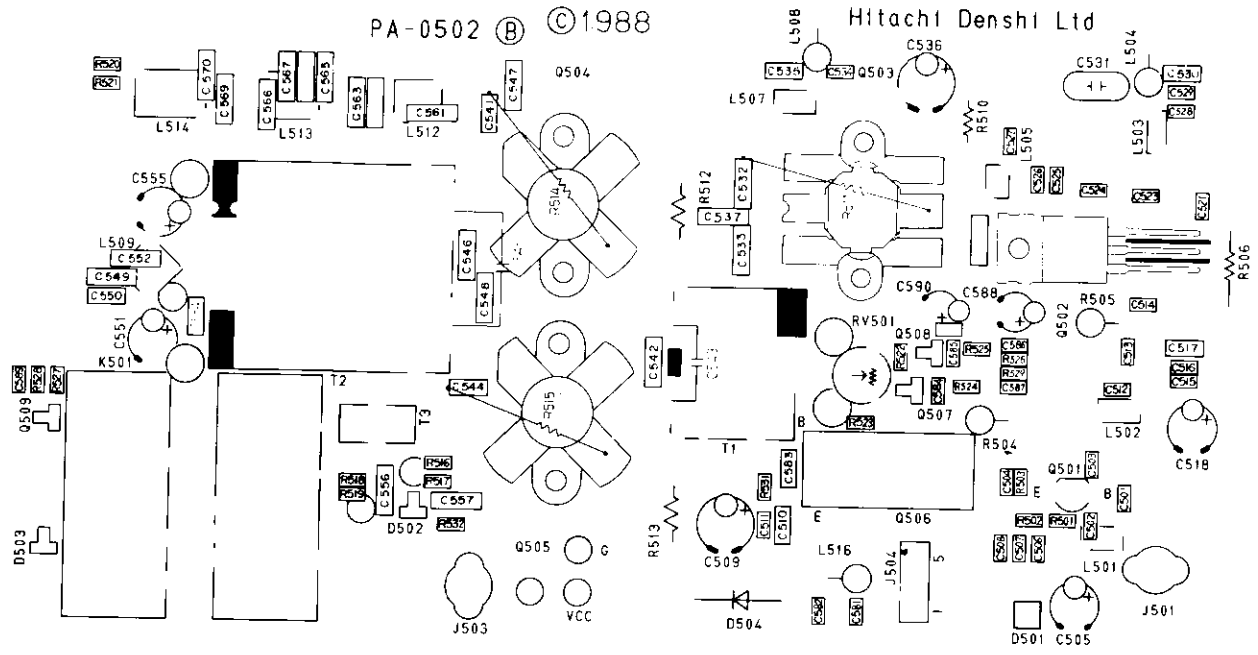
D503



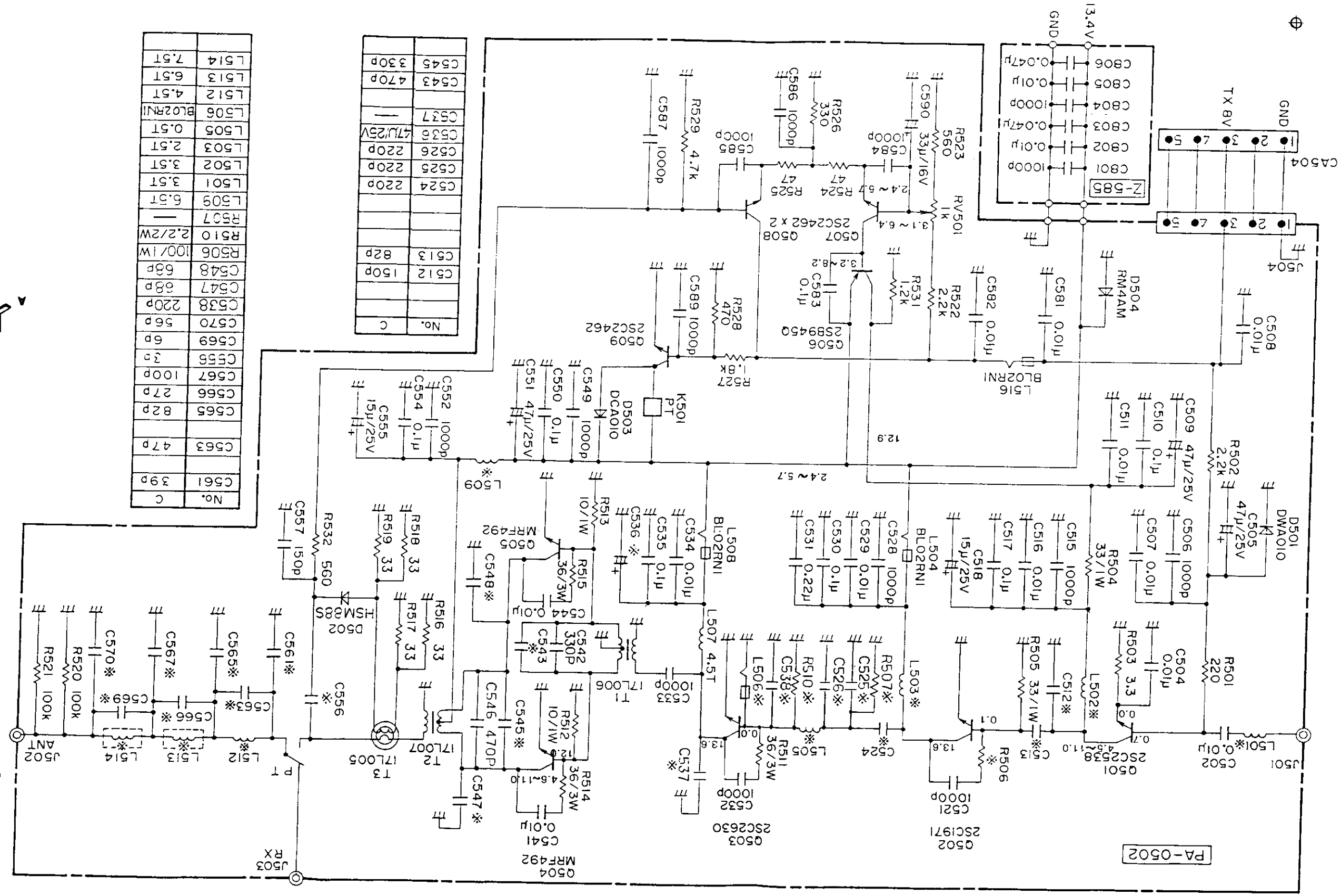
D504

TOP VIEW



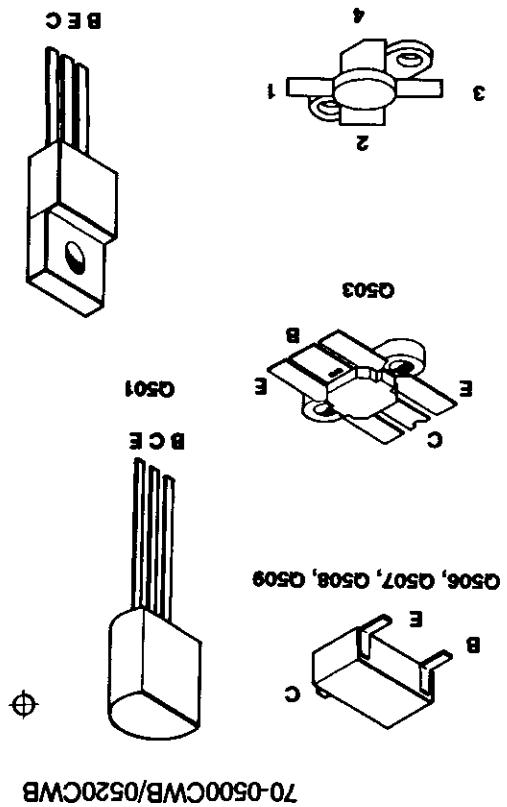


VISIBLE PLATING
UNDERSIDE PLATING



No.	C
C545	330p
C543	470p
C537	—
C535	47U/25V
C526	220p
C525	220p
C524	220p
C513	82p
C512	150p
No.	C

L514	7.5T
L513	6.5T
L512	4.5T
L506	BL02RNI
L505	0.5T
L503	2.5T
L502	3.5T
L501	3.5T
L509	6.5T
R507	—
R510	2.2/2W
R506	100/1W
C548	68p
C547	68p
C538	220p
C570	56p
C569	6p
C556	※
C555	※
C567	100p
C566	27p
C565	82p
C563	47p
C561	39p
No.	C

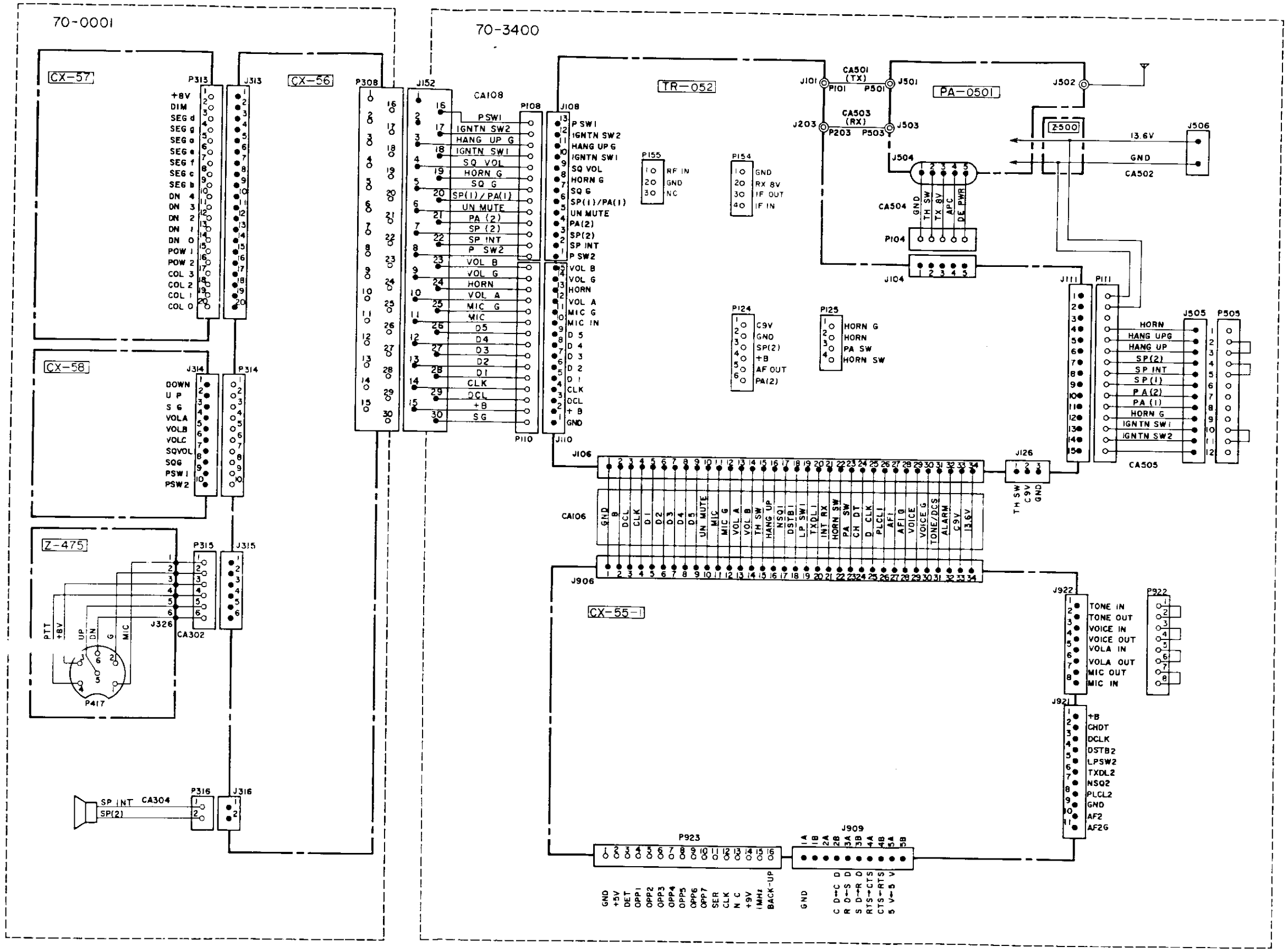


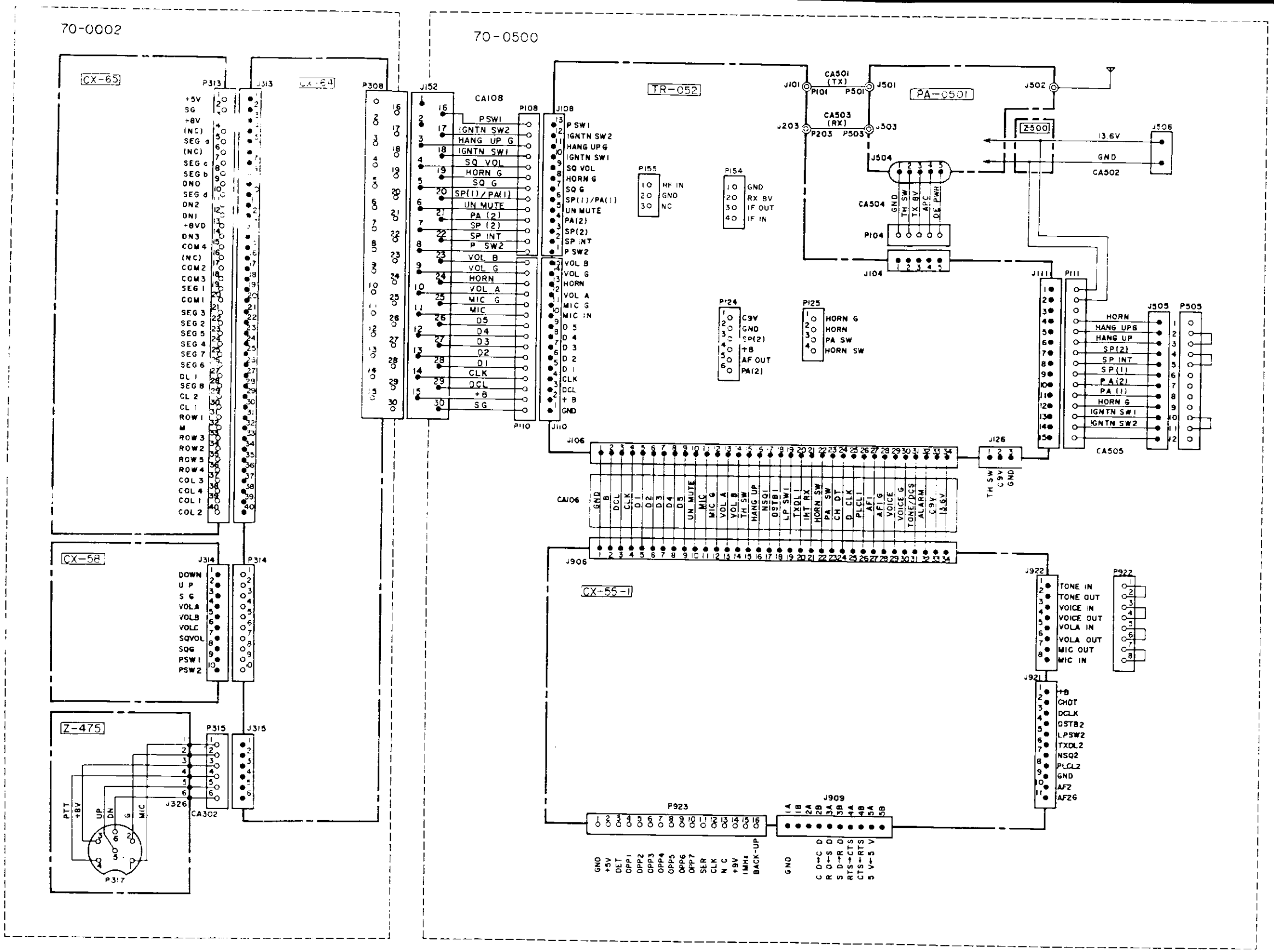
70-0500CWB/0520CWB

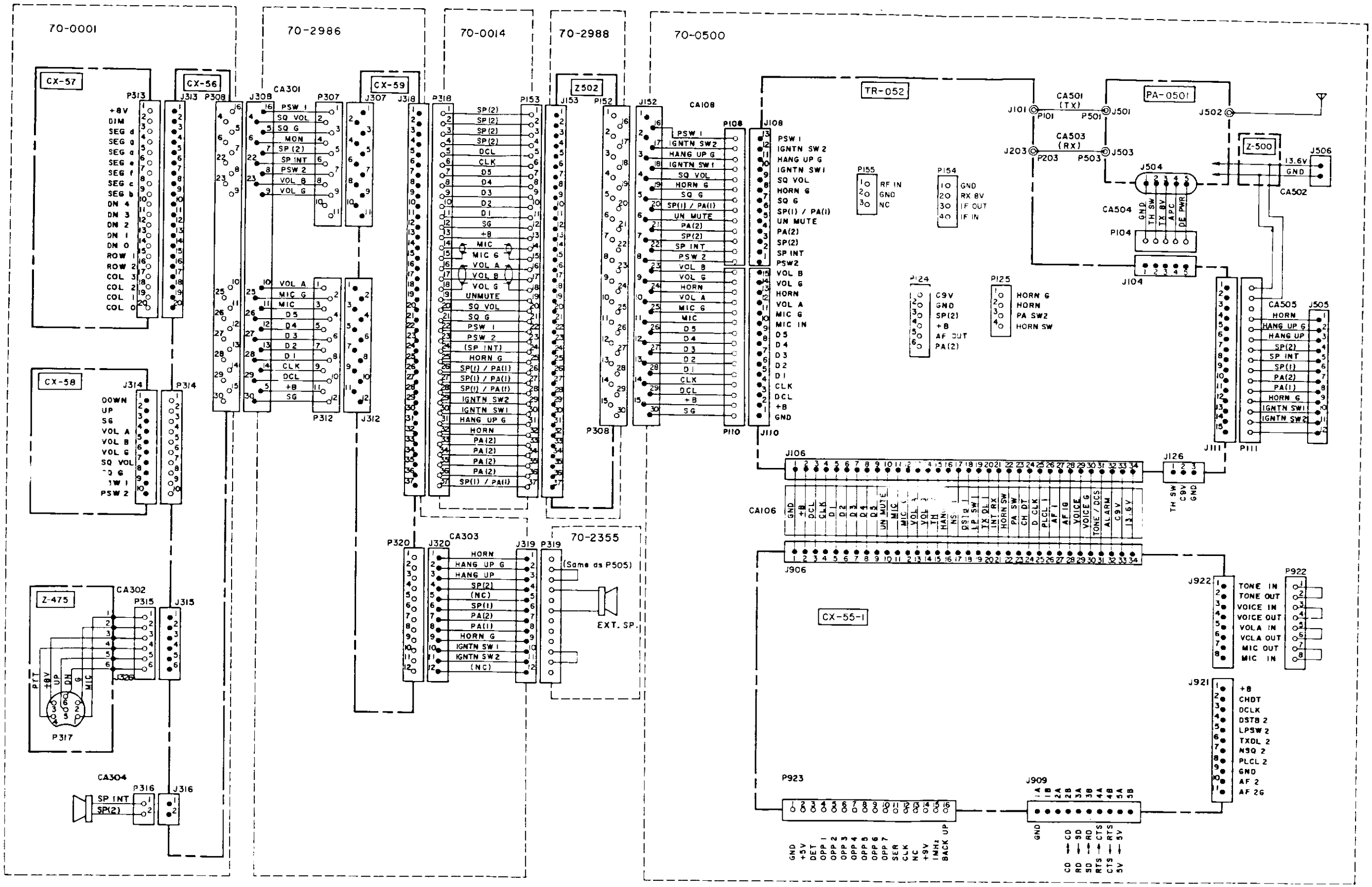
PA-0502 POWER AMPLIFIER SCHEMATIC (70-0520CWB)

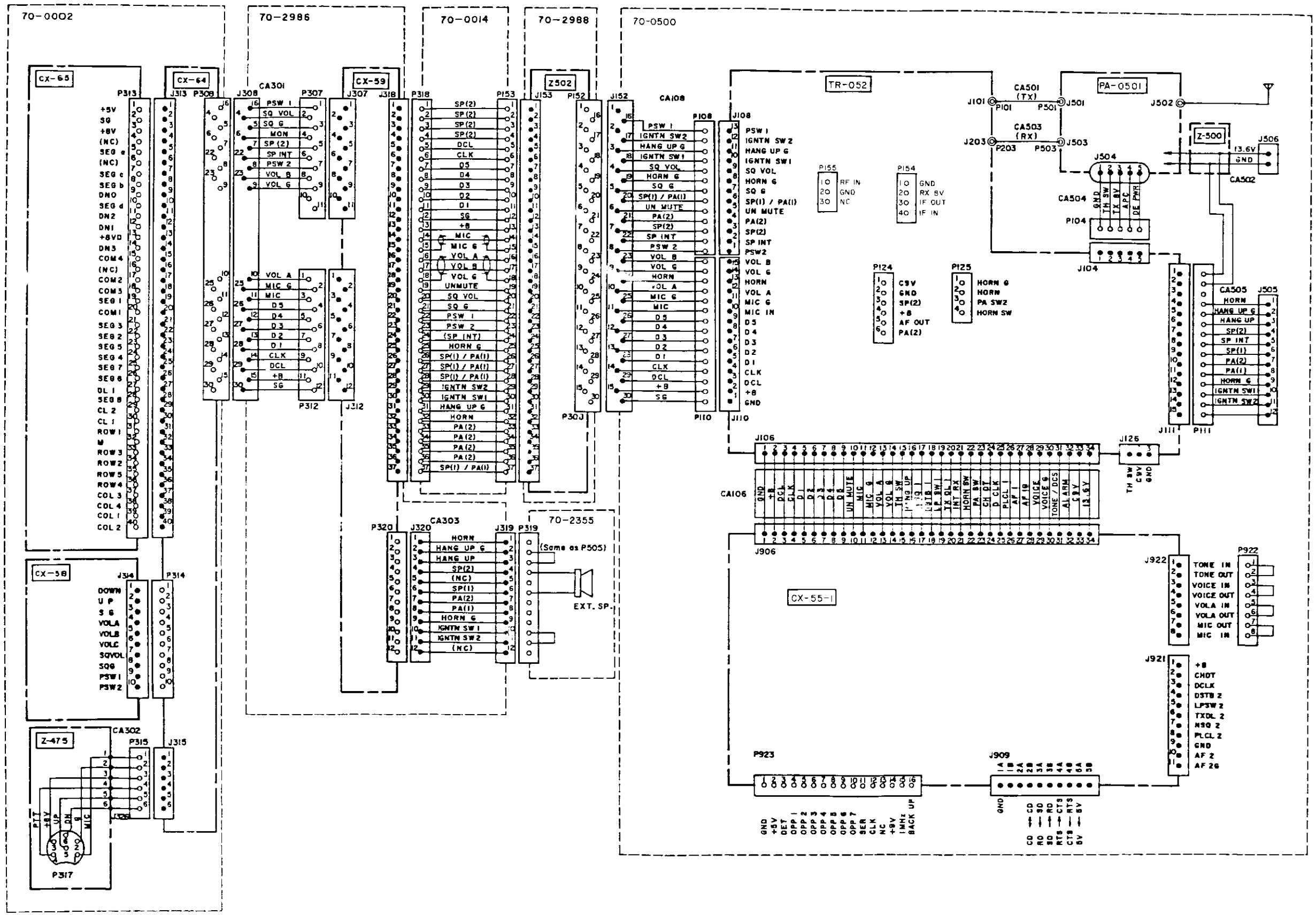
70-0501CWB/0521CWB WIRING DIAGRAM

70-0500CWB/0520CWB



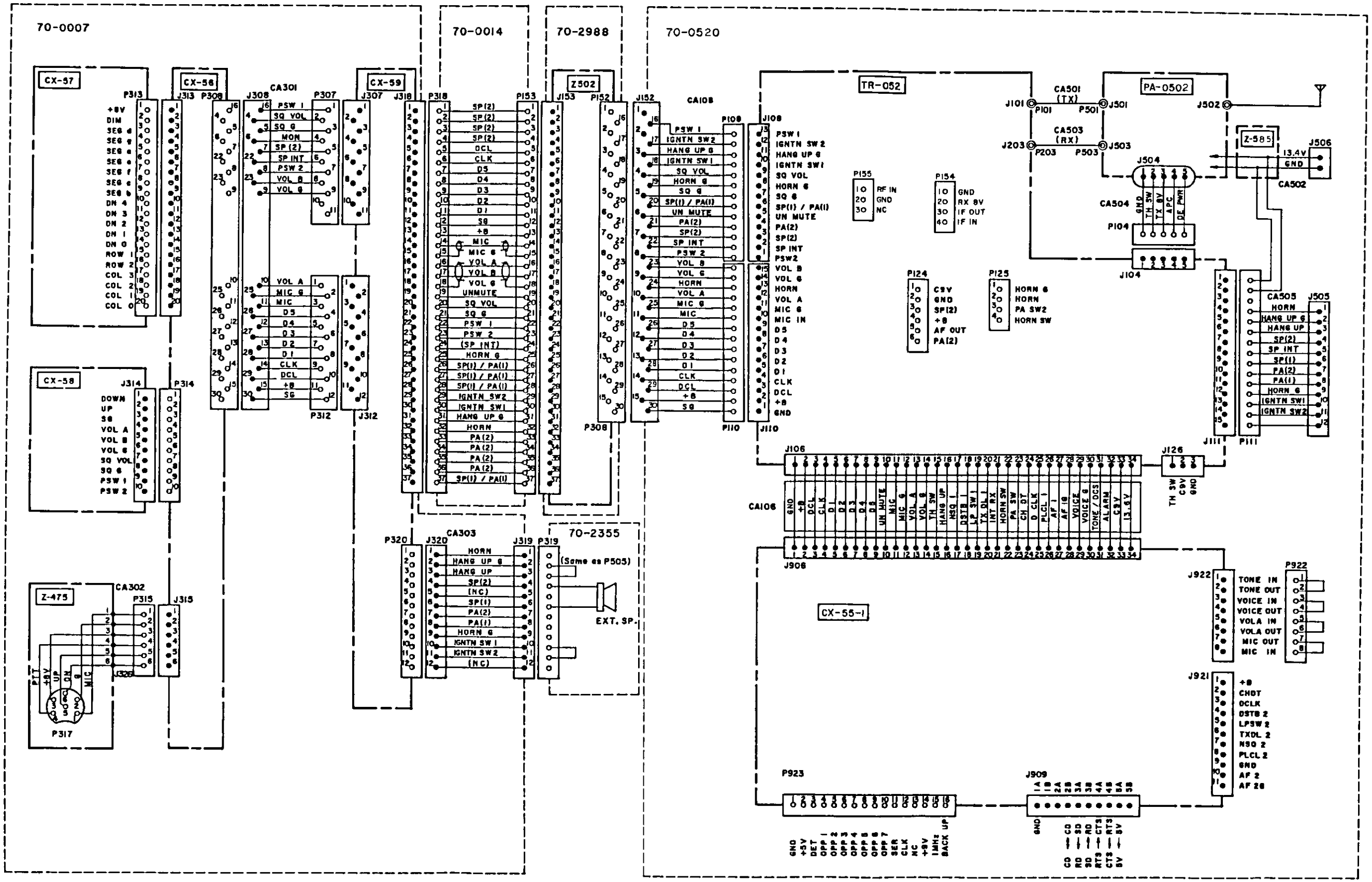

70-0002
CX-65
P313
J313
CX-24
P308
J308
+5V
5G
+8V
(NC)
SEG a
(NC)
SEG c
SEG b
DN0
SEG d
DN2
DN1
+8VD
DN3
COM4
(NC)
COM2
COM3
SEG 1
COM1
SEG 3
SEG 2
SEG 5
SEG 4
SEG 7
SEG 6
DL 1
SEG 8
CL 2
CL 1
ROW1
M
ROW 3
ROW 2
ROW 5
ROW 4
COL 3
COL 4
COL 1
COL 2
CX-58
J314
P314
DOWN
U P
S G
VOLA
VOLB
VOLC
SQVOL
SQG
PSW1
PSW2
Z-475
P315
J315
J326
CA302
PTT
+8V
UP
DN
MIC
P317
70-0500
J152
CA108
P108
J108
J110
PSW1
IGNTN SW2
HANG UP G
IGNTN SW1
SQ VOL
HORN G
SQ G
SP(1)/PA(1)
UN MUTE
PA (2)
SP (2)
SP INT
P SW2
VOL B
VOL G
HORN
VOL A
MIC G
MIC
D5
D4
D3
D2
D1
CLK
DCL
+B
SG
TR-052
P155
RF IN
GND
NC
P154
GND
RX 8V
IF OUT
IF IN
P124
C9V
GND
SP(2)
+8
AF OUT
PA(2)
P125
HORN G
HORN
PA SW
HORN SW
J101
P101
CA501 (TX)
P501
J501
PA-0501
J203
P203
CA503 (RX)
P503
J503
J502
2500
J506
13.6V
GND
CA502
J504
CA504
GND
TH SW
TX 8V
APC
DE PWR
P104
J104
J111
P111
J505
P505
HORN
HANG UP6
HANG UP
SP(2)
SP INT
SP(1)
PA(2)
PA(1)
HORN G
IGNTN SW1
IGNTN SW2
CA505
J106
J126
TH SW
C9V
GND
CA106
GND
+B
DCL
CLK
D1
D2
D3
D4
D5
UN MUTE
MIC
MIC G
VOL A
VOL B
TH SW
HANG UP
NSQ1
DSTB1
LPSW1
TXDL1
INT RX
HORN SW
PA SW
CH DT
D CLK
PLCL1
AF1
AF1 G
VOICE
VOICE G
TONE/DCS
ALARM
C9V
13.6V
J906
CX-55-1
J922
P922
TONE IN
TONE OUT
VOICE IN
VOICE OUT
VOLA IN
VOLA OUT
MIC OUT
MIC IN
J921
+B
CHDT
DCLK
DSTB2
LPSW2
TXDL2
NSQ2
PLCL2
GND
AF2
AF2G
P923
J909
GND
+5V
DET
OPP1
OPP2
OPP3
OPP4
OPP5
OPP6
OPP7
SLR
CLK
N C
+9V
IMH1
BACK-UP
GND
C D→C D
R D→S D
S D→R D
RTS→CTS
CTS→RTS
5 V→5 V


70-0001
70-2986
70-0014
70-2988
70-0500
CX-57
CX-56
CX-59
CX-58
Z-475
Z502
Z-500
TR-052
PA-0501
CX-55-1
70-2355
CA301
CA108
CA501 (TX)
CA503 (RX)
CA504
CA505
CA506
CA302
CA303
CA304
CA502
P313
J313
P308
J308
P307
J307
J318
P318
P153
J153
P152
J152
P108
J108
P110
J110
P155
P154
P124
P125
J101
P101
P501
J501
J502
J203
P203
P503
J503
J504
P104
J104
J506
J111
P111
J505
J106
J126
P906
J906
P315
J315
P317
P316
J316
P320
J320
J319
P319
P312
J312
P314
J314
J922
P922
J921
P923
J909
EXT. SP.
(Same as P505)
13.6V
GND
RF IN
RX 8V
IF OUT
IF IN
C9V
SP(2)
AF OUT
PA(2)
HORN G
HORN
PA SW2
HORN SW
TONE IN
TONE OUT
VOICE IN
VOICE OUT
VOLA IN
VCLA OUT
MIC OUT
MIC IN
CHDT
DCLK
DSTB 2
LPSW 2
TXDL 2
NSQ 2
PLCL 2
AF 2
AF 2G

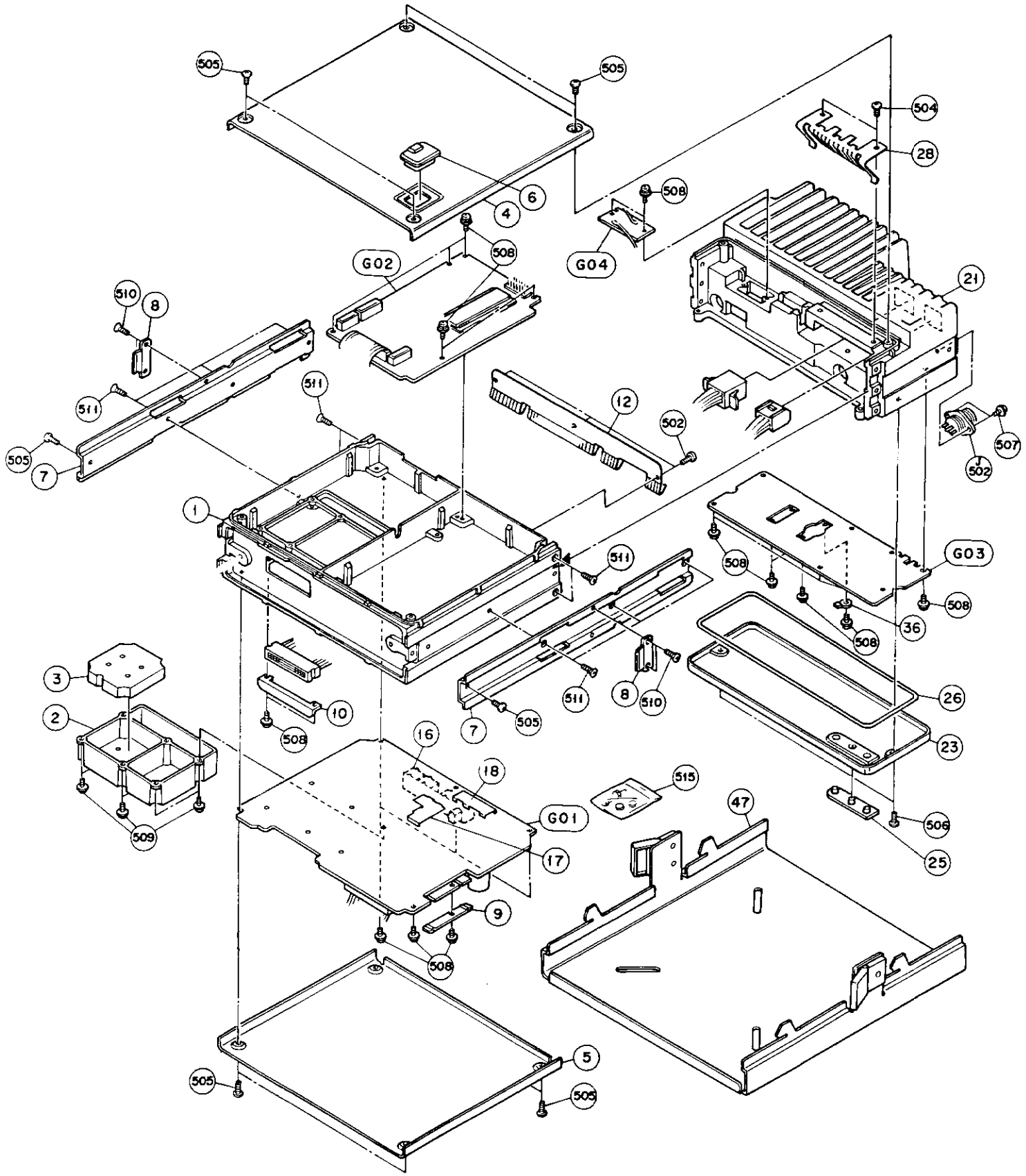

70-0002
70-2986
70-0014
70-2988
70-0500
CX-65
CX-64
CX-59
CX-58
Z-475
Z502
TR-052
PA-0501
Z-500
CX-55-1
70-2355
CA301
CA303
CA108
CA106
CA501 (TX)
CA503 (RX)
CA502
CA504
CA505
CA302
P313
P314
P315
P317
P307
P308
P312
P318
P153
P152
P30J
P110
P108
P155
P154
P124
P125
P104
P111
P320
P319
J313
J308
J307
J318
J153
J152
J310
J106
J125
J906
J909
J923
J922
J921
J922
J101
J501
J203
J503
J504
J506
J505
J104
J111
P101
P501
P203
P503
P922
SP(2)
SP(1)
PA(2)
PA(1)
MIC
MIC G
VOL A
VOL B
VOL G
UNMUTE
SQ VOL
SQ G
PSW 1
PSW 2
HORN G
HORN
HANG UP G
HANG UP
IGNTN SW1
IGNTN SW2
(SP INT)
(NC)
EXT. SP.
(Same as P505)
RF IN
GND
NC
RX 8V
IF OUT
IF IN
C9V
AF OUT
HORN SW
PA SW2
TONE IN
TONE OUT
VOICE IN
VOICE OUT
VOLA IN
VOLA OUT
MIC OUT
MIC IN
CHDT
DCLK
DSTB 2
LPSW 2
TXDL 2
N90 2
PLCL 2
AF 2
AF 26
13.6V
TH SW
TX 8V
APC
DE PWR

70-0557CWB/0567CWB WIRING DIAGRAM

70-0500CWB/0520CWB



70-0500CWB/0520CWB

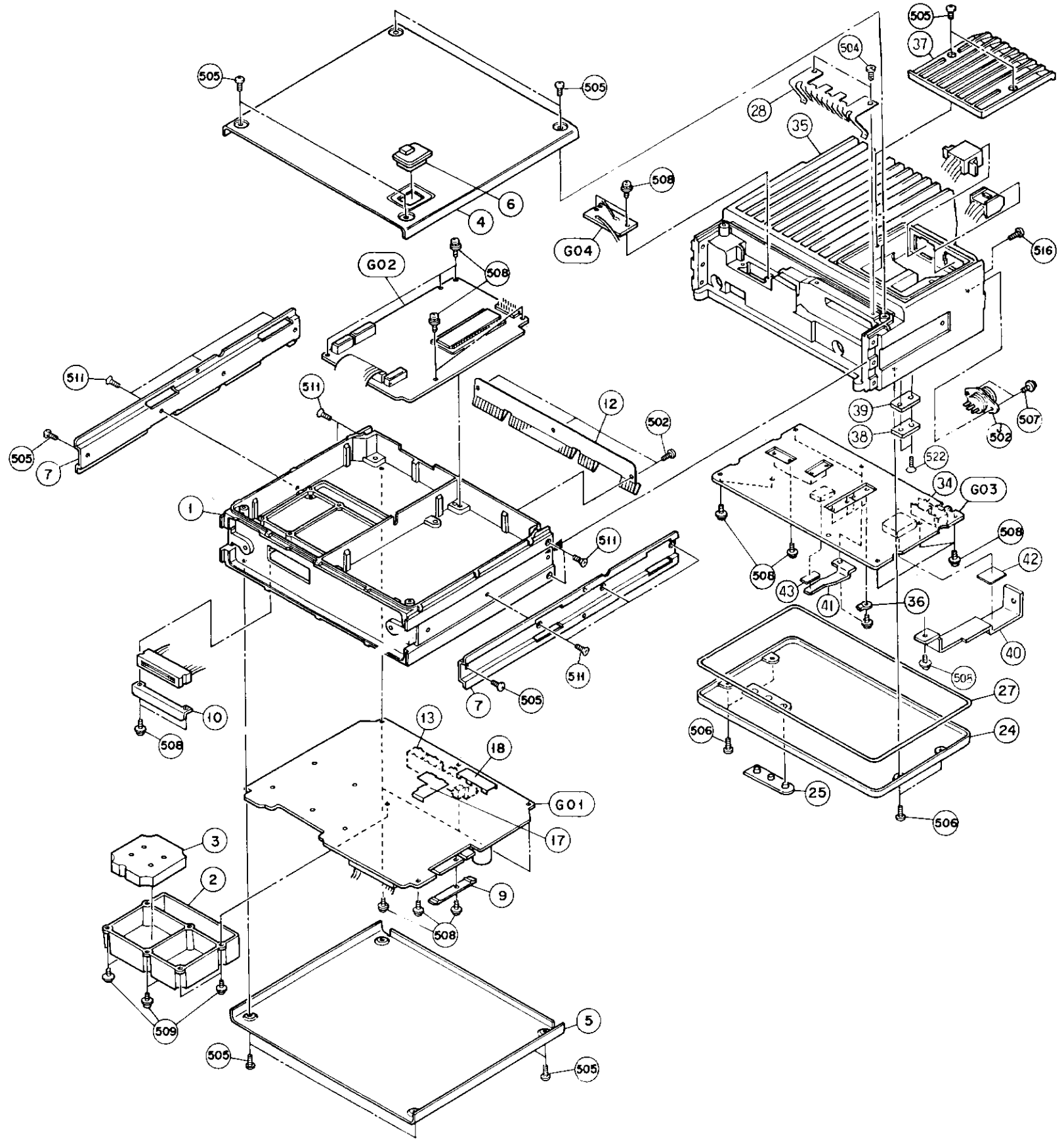


REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-015043
2	VCO CASE	70-157292
3	RUBBER PAD	70-157307
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PROGRAMMER PORT COVER	70-010192
7	SIDE RAIL	70-010193
8	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152085
17	IF PATTERN SHIELD	70-088308
18	RF SHIELD	70-088309
21	HEAT SINK	70-088307
23	PA COVER	70-010194
25	PA PACKING	70-157270
26	GROUND BRAID	70-034354
28	SP GROUND SPRING	70-152084
36	GROUND LUG	70-151910
502	SCREW BIND HD M3 x 6	70-151616
504	SCREW BIND HD M3 x 8	70-151356
505	SCREW BIND HD M3 x 8	70-151409
506	SCREW BIND HD M3 x 12	70-151839
507	SCREW SEMS HD M3 x 8	70-151899
508	SCREW SEMS M3 x 10	70-151905
509	SCREW M3 x 12	70-151841
511	SCREW FLAT HD M3 x 4	70-151804
G01	TX/RX BOARD	TR-052
G02	LOGIC BOARD	CX-55
G03	HIGH POWER PA	PA-0502
G04	POWER SUPPLY	Z-585

70-0520CWB TX/RX EXPLODED VIEW

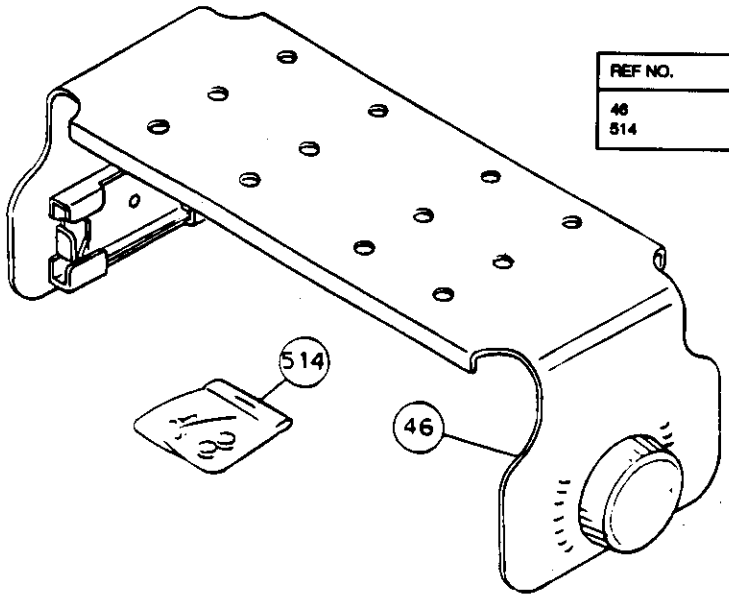
70-0500CWB/0520CWB

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-015043
2	VCO CASE	70-010184
3	RUBBER PAD	70-157307
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PROGRAMMER PORT COVER	70-010192
7	SIDE RAIL	70-010193
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
13	GROUND SPRING	70-152107
17	IF PATTERN SHIELD	70-089308
18	RF SHIELD	70-089309
24	PA COVER	70-010187
25	PA PACKING	70-157270
27	SHIELD TUBE	70-034330
28	SP GROUND SPRING	70-152094
34	LPF SHIELD	70-089363
35	PA HEAT SINK (H)	70-089360
37	CONNECTOR COVER	70-010188
38	SPACER	70-150186
39	SPACER	70-150187
40	HEAT SINK PLATE	70-089361
41	HEAT SINK PLATE (2)	70-089362
42	SHEET	70-157406
43	SHEET	70-157407
502	SCREW BIND HD M3 x 6	70-151616
504	SCREW BIND HD M3 x 8	70-151356
505	SCREW BIND HD M3 x 8	70-151972
506	SCREW BIND HD M3 x 12	70-151839
507	SCREW SEMS HD M3 x 8	70-151899
508	SCREW SEMS M3 x 10	70-151905
509	SCREW SEMS M3 x 12	70-151955
511	SCREW FLAT HD M3 x 4	70-151804
513	SCREW TAP PAN M3 x 8	70-151975
516	SCREW BIND HD M3 x 10	70-151413
522	SCREW FLAT HD M3 x 10	70-150188
G01	TX/RX BOARD	TR-052
G02	LOGIC BOARD	CX-55
G03	HIGH POWER PA	PA-0502
G04	POWER SUPPLY	Z-585



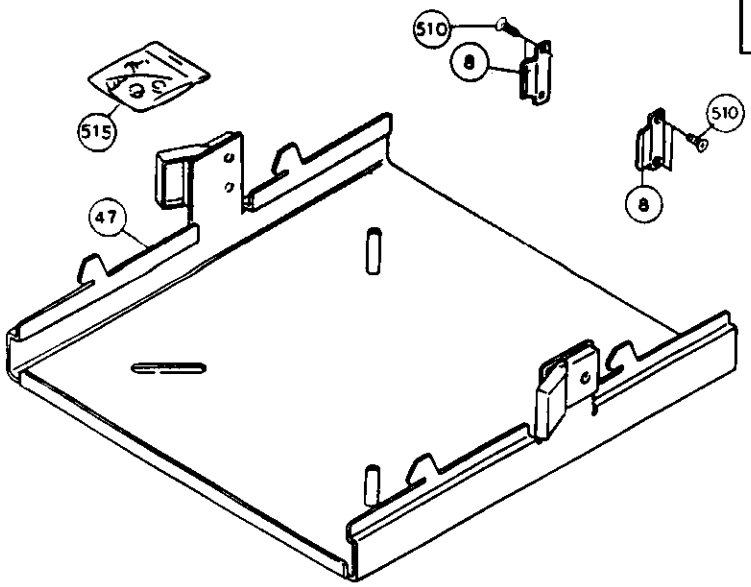
70-2985 UNDER-DASH BRACKET EXPLODED VIEW

70-0500CWB/0520CWB



REF NO.	DESCRIPTION	PART NO.
46	UD BRACKET	70-158255
514	HARDWARE BAG	70-000012

70-2987 TRUNK-MOUNT BRACKET EXPLODED VIEW

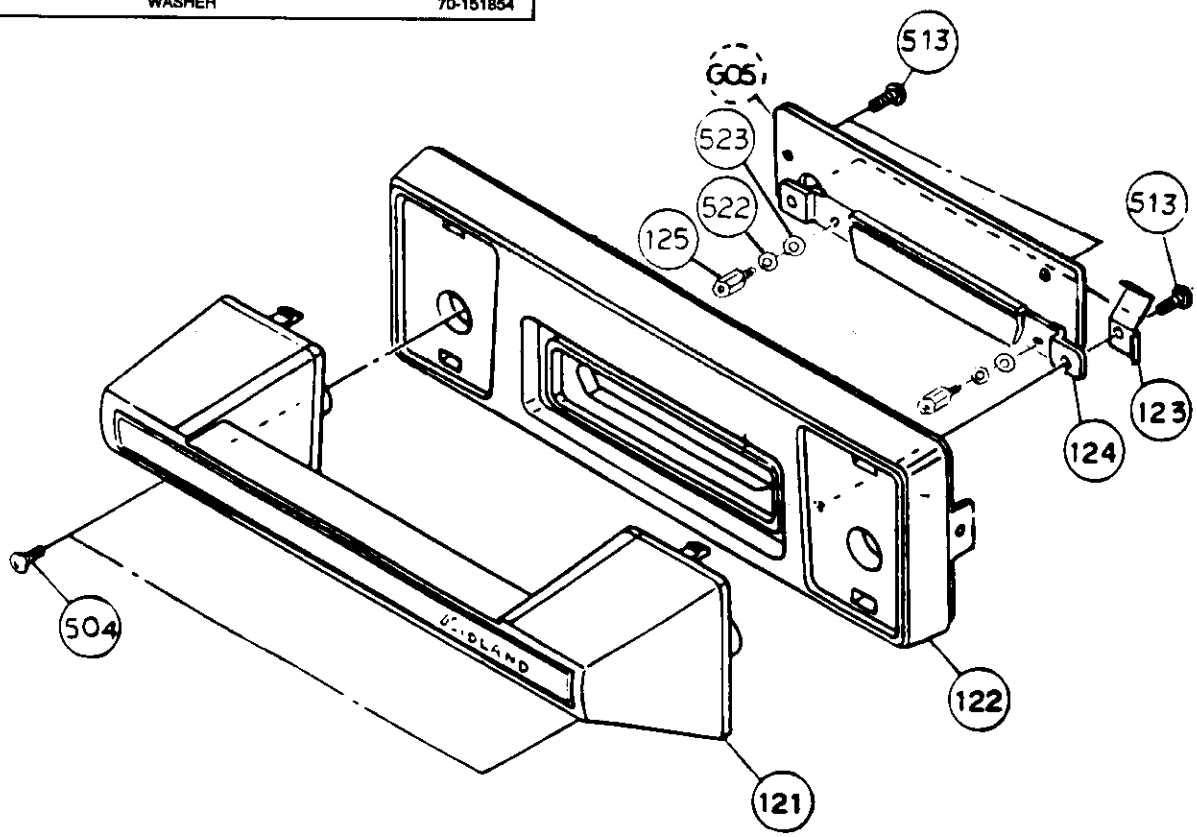


REF NO.	DESCRIPTION	PART NO.
8	CLIP	70-156252
47	TM BRACKET	70-156256
510	SCREW M3 x 4	70-151840
515	HARDWARE BAG	70-000013

70-2988 TRUNK-MOUNT NOSE-PIECE EXPLODED VIEW

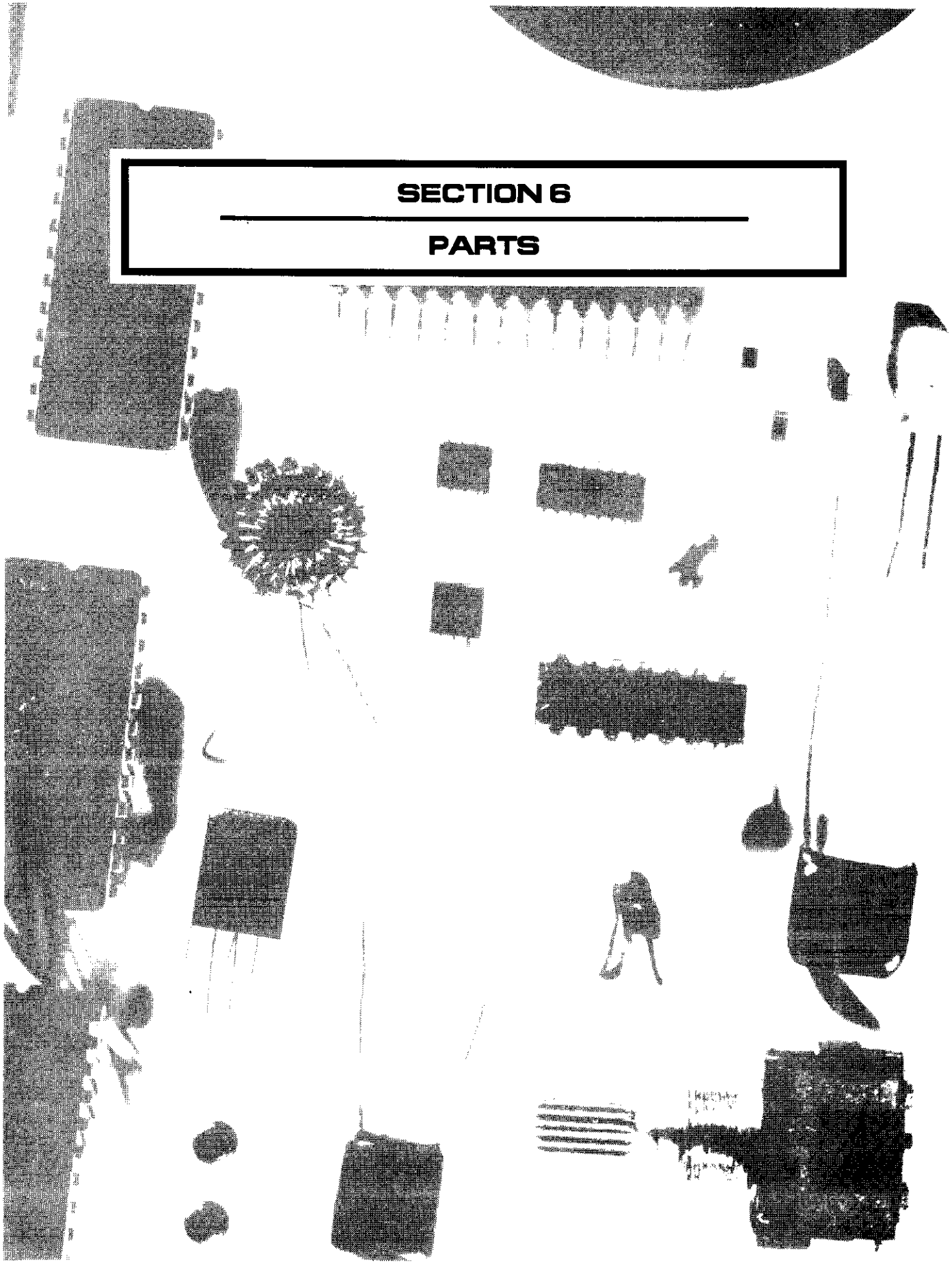
70-0500CWB/0520CWB

REF NO.	DESCRIPTION	PART NO.
121	HANDLE	70-158259
122	HANDLE BASE	70-158260
123	GROUND PLATE	70-151849
124	BRACKET	70-158261
125	HEX STUD	70-151852
504	SCREW M3 x 8	70-151356
513	SCREW M3 x 8	70-151843
522	WASHER	70-151853
523	WASHER	70-151854



SECTION 6

PARTS



NOTES

MECHANICAL PARTS

REF NO.	DESCRIPTION	PART NO.
	70-0500CWB TX/RX UNIT	
1	CHASSIS	70-015043
2	VCO CASE	70-157292
3	RUBBER PAD	70-157307
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PROGRAMMER PORT COVER	70-010192
7	SIDE RAIL	70-010193
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
17	IF PATTERN SHIELD	70-089308
18	RF SHIELD	70-089309
21	HEAT SINK	70-089307
23	PA COVER	70-010194
25	PA PACKING	70-157270
26	GROUND BRAID	70-034354
28	SP GROUND SPRING	70-152094
36	GROUND LUG	70-151910
502	SCREW BIND HD M3 x 6	70-151816
504	SCREW BIND HD M3 x 8	70-151356
505	SCREW BIND HD M3 x 8	70-151409
506	SCREW BIND HD M3 x 12	70-151839
507	SCREW SEMS HD M3 x 8	70-151889
508	SCREW SEMS M3 x 10	70-151905
509	SCREW M3 x 12	70-151841
511	SCREW FLAT HD M3 x 4	70-151804
G01	TX/RX BOARD	TR-052
G02	LOGIC BOARD	CX-55
G03	HIGH POWER PA	PA-0502
G04	POWER SUPPLY	Z-585
	70-0520CWB TX/RX UNIT	
1	CHASSIS	70-015043
2	VCO CASE	70-010184
3	RUBBER PAD	70-157307
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PROGRAMMER PORT COVER	70-010192
7	SIDE RAIL	70-010193
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
13	GROUND SPRING	70-152107
17	IF PATTERN SHIELD	70-089308
18	RF SHIELD	70-089309
24	PA COVER	70-010187
25	PA PACKING	70-157270
27	SHIELD TUBE	70-034330
28	SP GROUND SPRING	70-152094
34	LPF SHIELD	70-089363

REF NO.	DESCRIPTION	PART NO.
	70-0520CWB TX/RX UNIT (CONTINUED)	
35	PA HEAT SINK (H)	70-089360
37	CONNECTOR COVER	70-010188
38	SPACER	70-150186
39	SPACER	70-150187
40	HEAT SINK PLATE	70-089361
41	HEAT SINK PLATE (2)	70-089362
42	SHEET	70-157406
43	SHEET	70-157407
502	SCREW BIND HD M3 x 6	70-151816
504	SCREW BIND HD M3 x 8	70-151356
505	SCREW BIND HD M3 x 8	70-151972
506	SCREW BIND HD M3 x 12	70-151839
507	SCREW SEMS HD M3 x 8	70-151889
508	SCREW SEMS M3 x 10	70-151905
509	SCREW SEMS M3 x 12	70-151955
511	SCREW FLAT HD M3 x 4	70-151804
513	SCREW TAP PAN M3 x 8	70-151975
516	SCREW BIND HD M3 x 10	70-151413
522	SCREW FLAT HD M3 x 10	70-150188
G01	TX/RX BOARD	TR-052
G02	LOGIC BOARD	CX-55
G03	HIGH POWER PA	PA-0502
G04	POWER SUPPLY	Z-585
	70-2985 UNDER-DASH BRACKET	
46	UD BRACKET	70-158255
514	HARDWARE BAG	70-000012
	70-2987 TRUNK-MOUNT BRACKET	
8	CLIP	70-158252
47	TM BRACKET	70-158256
510	SCREW M3 x 4	70-151840
515	HARDWARE BAG	70-000013
	70-2988 TRUNK-MOUNT NOSE PIECE	
121	HANDLE	70-158259
122	HANDLE BASE	70-158260
123	GROUND PLATE	70-151849
124	BRACKET	70-158261
125	HEX STUD	70-151852
504	SCREW M3 x 8	70-151356
513	SCREW M3 x 8	70-151843
522	WASHER	70-151853
523	WASHER	70-151854

TR-052 RF BOARD

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C101	0.1 uF, 50 V, CER	70-138249
C102	220 uF, 16 V, AL, ELYC	70-135164
C104	1000 pF, 50 V, CER	70-135170
C105	10 uF, 50 V, AL, ELYC	70-135142
C106	1000 pF, 50 V, CER	70-138170
C107	0.022 uF, 25 V, CER	70-138162
C108	10 uF, 50 V, AL, ELYC	70-135142
C109	0.022 uF, 25 V, CER	70-138162
C110	47 uF, 25 V, AL, ELYC	70-135144
C111	1000 pF, 50 V, CER	70-138170
C112	4700 pF, 50 V, CER	70-138163
C113	1000 pF, 50 V, CER	70-138170
C114	4700 pF, 50 V, CER	70-138163
C115	47 pF, 50 V, CER	70-138185
C116	5 pF, 50 V, CER	70-138166
C117	220 pF, 50 V, CER	70-138176
C118	2200 pF, 50 V, CER	70-138235
C119	0.01 uF, 50 V, CER	70-138168
C120	0.1 uF, 50 V, CER	70-138249
C121	220 uF, 16 V, AL, ELYC	70-135147
C122	1 uF, 100 V, PLAS	70-137081
C123	220 pF, 50 V, CER	70-138178
C124	82 pF, 50 V, CER	70-138250
C125	82 pF, 50 V, CER	70-138250
C126	220 pF, 50 V, CER	70-138178
C127	0.1 uF, 50 V, CER	70-138249
C130	1000 pF, 50 V, CER	70-138170
C131	10 uF, 50 V, AL, ELYC	70-135142
C132	82 pF, 50 V, CER	70-138250
C133	0.022 uF, 25 V, CER	70-138162
C134	220 pF, 50 V, CER	70-138178
C135	220 uF, 16 V, AL, ELYC	70-135164
C136	82 pF, 50 V, CER	70-138250
C144	220 uF, 16 V, AL, ELYC	70-135164
C145	0.01 uF, 50 V, CER	70-138168
C146	0.01 uF, 50 V, CER	70-138168
C150	0.022 uF, 25 V, CER	70-138162
C151	0.047 uF, 50 V, CER	70-131298
C152	0.01 uF, 50 V, CER	70-138168
C153	0.022 uF, 25 V, CER	70-138162
C154	0.022 uF, 25 V, CER	70-138162
C162	39 pF, 50 V, CER	70-138233
C163	39 pF, 50 V, CER	70-138233
C168	1000 pF, 50 V, CER	70-138170
C169	47 uF, 25 V, AL, ELYC	70-135144
C171	0.01 uF, 50 V, CER	70-138168
C172	47 pF, 50 V, CER	70-138185
C173	1000 pF, 50 V, CER	70-138170
C174	1000 pF, 50 V, CER	70-138170
C175	0.01 uF, 50 V, CER	70-138168
C176	0.01 uF, 50 V, CER	70-138168
C177	1000 pF, 50 V, CER	70-138170
C178	0.022 uF, 25 V, CER	70-138162
C179	0.022 uF, 25 V, CER	70-138162
C180	47 uF, 100 V, PLAS	70-138144
C182	47 uF, 25 V, AL, ELYC	70-135144
C183	47 uF, 25 V, AL, ELYC	70-135144
C184	47 uF, 25 V, AL, ELYC	70-135144
C201	10 pF, 50 V, CER	70-138186
C202	0.01 uF, 50 V, CER	70-138168
C203	68 pF, 50 V, CER	70-138229
C204	9 pF, 50 V, CER	70-138208
C205	3 pF, 50 V, CER	70-138164
C206	3 pF, 50 V, CER	70-138164
C207	68 pF, 50 V, CER	70-138229
C208	8 pF, 50 V, CER	70-138203
C209	0.022 uF, 50 V, CER	70-138162
C210	0.01 uF, 50 V, CER	70-138168
C211	68 pF, 50 V, CER	70-138229
C212	6 pF, 50 V, CER	70-138208
C213	3 pF, 50 V, CER	70-138164
C214	10 pF, 50 V, CER	70-138187
C215	10 pF, 50 V, CER	70-138187
C216	68 pF, 50 V, CER	70-138229
C217	6 pF, 50 V, CER	70-138208
C218	3 uF, 50 V, AL, ELYC	70-135164
C219	68 pF, 50 V, CER	70-138229

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C220	0.01 uF, 50 V, CER	70-138168
C221	10 pF, 50 V, CER	70-138255
C222	0.022 uF, 25 V, CER	70-138162
C223	0.022 uF, 25 V, CER	70-138162
C224	100 pF, 50 V, CER	70-138175
C225	10 pF, 50 V, CER	70-138255
C226	0.047 uF, 50 V, CER	70-131298
C227	470 pF, 50 V, CER	70-138252
C228	470 pF, 50 V, CER	70-138252
C229	0.01 uF, 50 V, CER	70-138168
C230	10 pF, 25 V, CER	70-138255
C231	0.01 uF, 50 V, CER	70-138168
C232	0.01 uF, 50 V, CER	70-138168
C233	18 pF, 50 V, CER	70-138206
C234	18 pF, 50 V, CER	70-138206
C235	0.022 uF, 25 V, CER	70-138162
C236	4 pF, 50 V, CER	70-138179
C237	0.01 uF, 50 V, CER	70-138168
C238	2 pF, 50 V, CER	70-138189
C239	1 pF, 50 V, CER	70-138174
C240	47 uF, 25 V, CER	70-135144
C241	1000 pF, 50 V, CER	70-138304
C242	0.47 uF, 35 V, TA, ELYC	70-135094
C243	1000 pF, 50 V, CER	70-138170
C244	0.022 uF, 25 V, CER	70-138162
C245	0.01 uF, 50 V, CER	70-138168
C246	18 pF, 50 V, CER	70-138206
C247	18 pF, 50 V, CER	70-138206
C248	0.047 uF, 50 V, CER	70-131298
C249	82 pF, 50 V, CER	70-138250
C250	0.01 uF, 50 V, CER	70-138168
C251	0.01 uF, 50 V, CER	70-138168
C252	0.01 uF, 50 V, CER	70-138168
C253	0.01 uF, 50 V, CER	70-138168
C254	0.01 uF, 50 V, CER	70-138168
C255	0.01 uF, 50 V, CER	70-138168
C256	0.01 uF, 50 V, CER	70-138168
C257	0.01 uF, 50 V, CER	70-138168
C258	5 pF, 25 V, AL, ELYC	70-138166
C259	2 pF, 50 V, CER	70-138189
C261	82 pF, 50 V, CER	70-138250
C262	1000 pF, 50 V, CER	70-138170
C263	1000 pF, 50 V, CER	70-138170
C264	0.01 uF, 50 V, CER	70-138168
C265	0.01 uF, 50 V, CER	70-138168
C266	47 pF, 50 V, CER	70-138185
C267	100 pF, 50 V, CER	70-138175
C268	0.1 uF, 50 V, CER	70-138249
C269	22 pF, 50 V, CER	70-138171
C270	0.1 uF, 50 V, CER	70-138249
C271	22 pF, 50 V, CER	70-138171
C273	1000 pF, 50 V, CER	70-138170
C274	4700 pF, 50 V, CER	70-138163
C276	0.01 uF, 50 V, CER	70-138168
C277	6800 pF, 50 V, CER	70-138173
C278	2200 pF, 50 V, CER	70-138235
C279	6800 pF, 50 V, CER	70-138173
C281	4700 pF, 50 V, CER	70-138163
C282	1000 pF, 50 V, CER	70-138170
C283	0.047 uF, 50 V, CER	70-131047
C284	0.01 uF, 50 V, CER	70-138168
C286	1000 pF, 50 V, CER	70-138170
C287	1 uF, 35 V, TANT	70-138087
C288	0.47 uF, 35 V, AL, ELYC	70-135094
C289	120 uF, 16 V, AL, ELYC	70-135167
C291	0.01 uF, 50 V, CER	70-138168
C296	0.01 uF, 50 V, CER	70-138168
C401	1000 pF, 50 V, CER	70-138170
C402	47 uF, 25 V, AL, ELYC	70-138144
C403	4.7 uF, 16 V, AL, ELYC	70-138172
C406	1000 pF, 50 V, CER	70-138170
C407	1000 pF, 50 V, CER	70-138170
C408	4.7 uF, 16 V, AL, ELYC	70-138172
C409	1000 pF, 50 V, CER	70-138170
C410	47 uF, 25 V, AL, ELYC	70-135144
C411	0.01 uF, 50 V, CER	70-138168
C412	1000 pF, 50 V, CER	70-138170

TR-052 RF BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C413	4.7 uF, 16 V, AL, ELYC	70-136172
C414	1000 pF, 50 V, CER	70-136170
C416	47 uF, 25 V, AL, ELYC	70-135144
C417	2 pF, 50 V, CER	70-136169
C422	0.1 uF, 50 V, CER	70-136249
C423	1000 pF, 50 V, CER	70-136170
C424	0.01 uF, 50 V, CER	70-136168
C426	0.01 uF, 50 V, CER	70-136168
C427	1000 pF, 50 V, CER	70-136170
C428	0.1 uF, 50 V, CER	70-136249
C430	0.1 uF, 50 V, CER	70-136249
C431	0.1 uF, 50 V, CER	70-136249
C432	0.01 uF, 50 V, CER	70-136168
C433	1000 pF, 50 V, CER	70-136170
C434	47 uF, 25 V, AL, ELYC	70-135144
C436	47 uF, 25 V, AL, ELYC	70-135144
C437	220 uF, 25 V, AL, ELYC	70-135083
C438	0.047 uF, 50 V, CER	70-131298
C439	47 uF, 25 V, AL, ELYC	70-135144
C441	47 uF, 25 V, AL, ELYC	70-135144
C442	47 uF, 25 V, AL, ELYC	70-135144
C445	0.1 uF, 50 V, CER	70-136249
C448	47 uF, 50 V, AL, ELYC	70-135144
C449	0.1 uF, 50 V, CER	70-136249
C450	0.1 uF, 50 V, CER	70-136249
C462	2200 pF, 50 V, CER	70-136235
C463	2200 pF, 50 V, CER	70-136235
C464	2200 pF, 50 V, CER	70-136235
C465	2200 pF, 50 V, CER	70-136235
C466	2200 pF, 50 V, CER	70-136235
C467	2200 pF, 50 V, CER	70-136235
C468	2200 pF, 50 V, CER	70-136235
C469	2200 pF, 50 V, CER	70-136235
C470	2200 pF, 50 V, CER	70-136235
C471	2200 pF, 50 V, CER	70-136235
C473	2200 pF, 50 V, CER	70-136235
C474	2200 pF, 50 V, CER	70-136235
C475	2200 pF, 50 V, CER	70-136235
C476	2200 pF, 50 V, CER	70-136235
C477	2200 pF, 50 V, CER	70-136235
C478	220 pF, 50 V, CER	70-136176
C479	2200 pF, 50 V, CER	70-136235
C480	2200 pF, 50 V, CER	70-136235
C481	2200 pF, 50 V, CER	70-136235
C482	2200 pF, 50 V, CER	70-136235
C483	2200 pF, 50 V, CER	70-136235
C484	220 pF, 50 V, CER	70-136176
C485	220 pF, 50 V, CER	70-136176
C486	220 pF, 50 V, CER	70-136176
C487	2200 pF, 50 V, CER	70-136235
C488	2200 pF, 50 V, CER	70-136235
C489	2200 pF, 50 V, CER	70-136235
C490	2200 pF, 50 V, CER	70-136235
C491	2200 pF, 50 V, CER	70-136235
C492	2200 pF, 50 V, CER	70-136235
C493	2200 pF, 50 V, CER	70-136235
C494	2200 pF, 50 V, CER	70-136235
C701	3300 pF, 50 V, CER	70-136217
C702	39 pF, 50 V, CER	70-136233
C703	220 pF, 50 V, CER	70-136176
C704	33 pF, 50 V, CER	70-136188
C705	68 pF, 50 V, CER	70-136229
C706	470 pF, 50 V, CER	70-136252
C707	0.022 uF, 25 V, CER	70-136162
C708	100 pF, 50 V, CER	70-136175
C709	100 pF, 50 V, CER	70-136175
C710	0.022 uF, 50 V, CER	70-136162
C711	3300 pF, 50 V, CER	70-136217
C712	39 pF, 50 V, CER	70-136233
C713	220 pF, 50 V, CER	70-136176
C714	47 pF, 50 V, CER	70-136185
C715	100 pF, 50 V, CER	70-136175
C716	470 pF, 50 V, CER	70-136252
C717	0.022 uF, 25 V, CER	70-136162
C718	1000 pF, 50 V, CER	70-136170
C719	1000 pF, 50 V, CER	70-136170
C721	3300 pF, 50 V, CER	70-136217

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C722	33 pF, 50 V, CER	70-136188
C723	220 pF, 50 V, CER	70-136176
C724	27 pF, 50 V, CER	70-136185
C725	68 pF, 50 V, CER	70-136229
C726	470 pF, 50 V, CER	70-136252
C727	0.022 uF, 25 V, CER	70-136162
C728	100 pF, 50 V, CER	70-136175
C729	100 pF, 50 V, CER	70-136175
C730	0.022 uF, 25 V, CER	70-136162
C731	3300 pF, 50 V, CER	70-136217
C732	33 pF, 50 V, CER	70-136188
C733	220 pF, 50 V, CER	70-136176
C734	33 pF, 50 V, CER	70-136188
C735	68 pF, 50 V, CER	70-136229
C736	470 pF, 50 V, CER	70-136252
C737	0.022 uF, 25 V, CER	70-136162
C738	1000 pF, 50 V, CER	70-136170
C739	1000 pF, 50 V, CER	70-136170
C741	2 pF, 50 V, CER	70-136169
C742	5 pF, 50 V, CER	70-136166
C743	2 pF, 50 V, CER	70-136169
C744	5 pF, 50 V, CER	70-136166
C745	10 pF, 50 V, CER	70-136167
C747	2200 pF, 50 V, CER	70-136235
C751	5 pF, 50 V, CER	70-136166
C752	5 pF, 50 V, CER	70-136166
C753	22 pF, 50 V, CER	70-136171
C754	22 pF, 50 V, CER	70-136171
C755	0.022 uF, 25 V, CER	70-136162
C756	0.022 uF, 25 V, CER	70-136162
C757	22 pF, 50 V, CER	70-136171
C761	0.022 uF, 25 V, CER	70-136162
C762	0.022 uF, 25 V, CER	70-136162
C763	1000 pF, 50 V, CER	70-136170
C764	1000 pF, 50 V, CER	70-136170
C765	0.022 uF, 25 V, CER	70-136162
C766	1000 pF, 50 V, CER	70-136170
C767	1000 pF, 50 V, CER	70-136170
C771	470 pF, 50 V, CER	70-136252
C772	470 pF, 50 V, CER	70-136252
C773	470 pF, 50 V, CER	70-136252
C774	470 pF, 50 V, CER	70-136252
C781	22 pF, 50 V, CER	70-136171
C782	22 pF, 50 V, CER	70-136171
C783	0.01 uF, 50 V, CER	70-136168
C784	0.01 uF, 50 V, CER	70-136168
C785	0.01 uF, 50 V, CER	70-136168
C786	100 pF, 50 V, CER	70-136175
C787	0.01 uF, 50 V, CER	70-136168
C788	100 pF, 50 V, CER	70-136175
C789	100 pF, 50 V, CER	70-136175
C791	0.01 uF, 50 V, CER	70-136168
C792	100 pF, 50 V, CER	70-136175
C793	100 pF, 50 V, CER	70-136175
C794	0.01 uF, 50 V, CER	70-136168
C795	100 pF, 50 V, CER	70-136175
	DIODES	
D101	DWA010	70-085246
D102	1MN11	70-085257
D103	DWA010	70-085246
D201	1SV166	70-085159
D202	1SV166	70-085159
D203	1SV166	70-085159
D204	1SV166	70-085159
D206	1SV166	70-085159
D207	1SV166	70-085159
D208	1SV166	70-085159
D209	1SV166	70-085159
D211	1SV166	70-085159
D212	1SV166	70-085159
D213	MC301	70-085077
D214	MC301	70-085077
D218	HSM885	70-085154
D262	DCB010	70-085245

TR-052 RF BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	DIODES (CONTINUED)	
D263	DWA010	70-085246
D264	MA157	70-085098
D401	DWA010	70-085246
D402	DWA010	70-085246
D702	HVR-100	70-085268
D704	HVR-100	70-085268
D705	MA704A	70-085247
D706	1SS268	70-085248
D707	DCB010	70-085245
D712	HVR-100	70-085268
D714	HVR-100	70-085268
D715	MA704A	70-085247
D722	HVR-100	70-085268
D724	HVR-100	70-085268
D725	MA704A	70-085247
D726	1SS268	70-085248
D727	DCB010	70-085245
D732	HVR-100	70-085268
D734	HVR-100	70-085268
D735	MA704A	70-085247
D736	1SV164	70-085249
D737	1SV164	70-085249
D738	1SV164	70-085249
	INTEGRATED CIRCUITS	
IC101	MB501L	70-076505
IC102	MC145159FNI	70-076461
IC103	DH1072A	70-076462
IC104	uPC4741G	70-076463
IC107	HD14011BFP/MC14011BFP	70-076506
IC108	HD14053BFP/MC14053BFP	70-076465
IC113	MC1409BFR	70-076467
IC261	MC3357P	70-076138
IC401	AN6541	70-076468
IC402	S-8120HG	70-076390
IC403	S-8120HG	70-076390
IC404	HA1384	70-076469
	COILS & CAVITIES	
L103	ELE-Y 1R0 KA	70-090307
L104	ELE-Y R22 MA	70-090374
L106	HS10125-174K	70-178055
L107	HS10125-174K	70-178055
L201	COIL, 7.5T	70-090157
L202	COIL, 7.5T	70-090157
L207	COIL, 7.5T	70-090157
L208	COIL, 7.5T	70-090157
L209	COIL, 7.5T	70-090157
L211	17L004	70-090114
L212	ELE-Y 2R2MA	70-090261
L213	52L045	70-090373
L214	52L045	70-090373
L216	ELE-Y 2R2 MA	70-090261
L217	ELE-Y 1R0 KA	70-090307
L219	ELE-Y 2R2 MA	70-090114
L221	24L108	70-090375
L222	24L109	70-090376
L223	27L0055	70-090220
L224	ELE-Y 102KA	70-090169
L225	BLO2RNI-R82	70-090122
L226	ELE-Y2R2 MA	70-090261
L227	ELE-Y 2R2 MA	70-090261
L261	24L110	70-090377
L262	41l001	70-090423
L263	ELE-Y 102KA	70-090169
L264	ELE-Y 331KA	70-090170
L266	ELE-Y 331KA	70-090170
L401	1.0mH	70-178057
L701	MLF321611E100M	70-090324
L702	MC134 5.5T	70-090384
L703	MLF321611E100M	70-090324
L704	MLF321611E100M	70-090324
L705	MLF321611E100M	70-090324
L711	MLF321611E100M	70-090324

REF NO.	DESCRIPTION	PART NO.
	COILS AND CAVITIES (CONTINUED)	
L712	MC134 4.5T	70-090379
L713	MLF321611E100M	70-090324
L714	MLF321611E100M	70-090324
L721	MLF321611E100M	70-090324
L722	MC134 7.5T	70-090380
L723	MLF321611E100M	70-090324
L724	MLF321611E100M	70-090324
L725	MLF321611E100M	70-090324
L731	MLF321611E100M	70-090324
L732	MC134 6.5T	70-090385
L733	MLF321611E100M	70-090324
L734	MLF321611E100M	70-090324
	TRANSISTORS	
Q101	2SC2462LC	70-080160
Q102	1MB4	70-080295
Q103	1MHI	70-080296
Q104	1MD3	70-080297
Q105	1MD3	70-080297
Q106	1MD3	70-080297
Q107	1MD3	70-080297
Q112	2SC3357	70-080298
Q113	2SC2462LC	70-080160
Q115	DTC124EKT	70-080300
Q116	1MHI	70-080296
Q201	2SC3357	70-080298
Q202	2SK125	70-080089
Q203	2SK125	70-080089
Q204	2SC3357	70-080298
Q206	2SC3357	70-080298
Q261	2SC2620QB	70-080161
Q262	2SC2462LC	70-080160
Q263	2SC2462LC	70-080160
Q401	2SB798	70-080164
Q402	2SB798	70-080164
Q403	DTA114YK	70-080301
Q404	DTC124EK	70-080300
Q406	2SB798	70-080164
Q407	2SC2462LC	70-080160
Q701	3SK151GR	70-080303
Q702	2SC2351	70-080218
Q703	2SC2351	70-080218
Q721	3SK151	70-080303
Q722	2SC3356	70-080322
Q731	2SC3356	70-080322
Q732	2SC3356	70-080322
Q733	2SC3356	70-080322
	RESISTORS	
R102	68 kOHM, 1/10 W, MET	70-144119
R103	22 kOHM, 1/10 W, MET	70-144121
R104	100 kOHM, 1/10 W, MET	70-145128
R105	47 OHM, 1/10 W, MET	70-145130
R106	1 MOHM, 1/10 W, MET	70-145127
R107	47 kOHM, 1/10 W, MET	70-145145
R108	10 kOHM, 1/10 W, MET	70-144120
R109	47 kOHM, 1/10 W, MET	70-145145
R110	0 OHM, 1/10 W, MET	70-144106
R111	270 OHM, 1/4 W, MET	70-144193
R112	10 kOHM, 1/10 W, MET	70-144120
R113	10 kOHM, 1/10 W, MET	70-144120
R114	33 kOHM, 1/10 W, MET	70-144112
R115	33 kOHM, 1/10 W, MET	70-144112
R116	22 kOHM, 1/10 W, MET	70-144121
R118	100 kOHM, 1/10 W, MET	70-145128
R119	1 kOHM, 1/10 W, MET	70-144125
R120	150 kOHM, 1/10 W, MET	70-144129
R121	47 kOHM, 1/10 W, MET	70-145145
R122	47 kOHM, 1/10 W, MET	70-145145
R123	2.2 kOHM, 1/10 W, MET	70-144113
R124	4.7 kOHM, 1/10 W, MET	70-144123
R130	3.3 kOHM, 1/10 W, MET	70-144118
R131	3.3 kOHM, 1/10 W, MET	70-144118
R132	470 OHM, 1/10 W, MET	70-144130

TR-052 RF BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R133	33 OHM, 1/10 W, MET	70-140320
R134	22 OHM, 1/10 W, MET	70-140160
R135	47 kOHM, 1/10 W, MET	70-145145
R136	47 kOHM, 1/10 W, MET	70-145145
R137	47 kOHM, 1/10 W, MET	70-145145
R138	47 kOHM, 1/10 W, MET	70-145145
R140	220 OHM, 1/10 W, MET	70-144194
R141	22 kOHM, 1/10 W, MET	70-144121
R142	22 kOHM, 1/10 W, MET	70-144121
R143	22 kOHM, 1/10 W, MET	70-144121
R144	22 kOHM, 1/10 W, MET	70-144121
R145	27 kOHM, 1/10 W, MET	70-144163
R146	6.8 kOHM, 1/10 W, MET	70-145139
R147	6.8 kOHM, 1/10 W, MET	70-145139
R148	10 kOHM, 1/10 W, MET	70-144120
R149	18 kOHM, 1/10 W, MET	70-144195
R150	39 kOHM, 1/10 W, MET	70-145099
R151	33 kOHM, 1/10 W, MET	70-145115
R153	1 kOHM, 1/10 W, MET	70-144125
R154	1.5 kOHM, 1/10 W, MET	70-145112
R156	22 kOHM, 1/10 W, MET	70-144121
R157	22 kOHM, 1/10 W, MET	70-144121
R158	22 kOHM, 1/10 W, MET	70-144121
R159	150 kOHM, 1/10 W, MET	70-144129
R160	150 kOHM, 1/10 W, MET	70-144129
R169	47 kOHM, 1/10 W, MET	70-145145
R171	3.3 kOHM, 1/10 W, MET	70-144118
R172	100 OHM, 1/10 W, MET	70-145146
R173	3.3 kOHM, 1/10 W, MET	70-144118
R174	100 OHM, 1/10 W, MET	70-144146
R176	220 OHM, 1/10 W, MET	70-144194
R177	22 OHM, 1/10 W, MET	70-140160
R178	220 OHM, 1/10 W, MET	70-144194
R179	10 OHM, 1/10 W, MET	70-144115
R180	22 OHM, 1/10 W, MET	70-144160
R181	22 OHM, 1/10 W, MET	70-144160
R182	22 OHM, 1/10 W, MET	70-144160
R185	22 OHM, 1/10 W, MET	70-140160
R186	2.2 kOHM, 1/10 W, MET	70-144113
R187	22 OHM, 1/10 W, MET	70-144160
R188	100 OHM, 1/10 W, MET	70-145146
R189	100 OHM, 1/10 W, MET	70-145146
R191	220 OHM, 1/10 W, MET	70-144194
R192	6.8 kOHM, 1/10 W, MET	70-145158
R193	6.8 kOHM, 1/10 W, MET	70-144158
R194	1 kOHM, 1/10 W, MET	70-144125
R196	1 kOHM, 1/10 W, MET	70-144125
R197	1 kOHM, 1/10 W, MET	70-144125
R199	12 OHM, 5 W, WIRE WOUND	70-144197
R203	47 kOHM, 1/10 W, MET	70-145145
R204	47 kOHM, 1/10 W, MET	70-145145
R205	68 kOHM, 1/10 W, MET	70-144119
R206	47 OHM, 1/10 W, MET	70-145130
R207	470 kOHM, 1/10 W, MET	70-144156
R208	47 kOHM, 1/10 W, MET	70-145145
R210	22 OHM, 1/10 W, MET	70-144160
R211	47 kOHM, 1/10 W, MET	70-145145
R213	47 kOHM, 1/10 W, MET	70-145145
R214	470 OHM, 1/10 W, MET	70-144156
R215	100 OHM, 1/10 W, MET	70-145146
R216	470 OHM, 1/10 W, MET	70-144156
R217	2.2 kOHM, 1/10 W, MET	70-144113
R218	2.2 kOHM, 1/10 W, MET	70-144113
R219	150 OHM, 1/10 W, MET	70-140321
R220	1 kOHM, 1/10 W, MET	70-144125
R221	10 kOHM, 1/10 W, MET	70-144115
R222	470 OHM, 1/10 W, MET	70-144130
R223	470 OHM, 1/10 W, MET	70-144130
R224	22 kOHM, 1/10 W, MET	70-144121
R225	22 OHM, 1/10 W, MET	70-140320
R226	470 OHM, 1/10 W, MET	70-144156
R227	12 OHM, 1/10 W, MET	70-144127
R228	470 OHM, 1/10 W, MET	70-144156
R231	470 OHM, 1/10 W, MET	70-145130
R232	2.7 kOHM, 1/10 W, MET	70-144159
R233	1 kOHM, 1/10 W, MET	70-144125
R234	1 kOHM, 1/10 W, MET	70-144125

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R236	22 OHM, 1/10 W, MET	70-144160
R237	470 OHM, 1/10 W, MET	70-145130
R239	470 OHM, 1/10 W, MET	70-145130
R240	470 OHM, 1/10 W, MET	70-144156
R261	33 kOHM, 1/10 W, MET	70-144112
R262	330 OHM, 1/10 W, MET	70-144164
R263	82 kOHM, 1/10 W, MET	70-144173
R264	18 kOHM, 1/10 W, MET	70-144195
R265	0 OHM, 1/10 W, MET	70-144108
R266	82 kOHM, 1/10 W, MET	70-144173
R267	47 kOHM, 1/10 W, MET	70-145145
R268	220 kOHM, 1/10 W, MET	70-144131
R269	1 kOHM, 1/10 W, MET	70-144125
R271	2.7 kOHM, 1/10 W, MET	70-144159
R272	3.3 kOHM, 1/10 W, MET	70-144118
R273	82 kOHM, 1/10 W, MET	70-144173
R274	10 kOHM, 1/10 W, MET	70-144120
R275	2.2 kOHM, 1/10 W, MET	70-144113
R276	3.3 kOHM, 1/10 W, MET	70-144118
R277	2.2 kOHM, 1/10 W, MET	70-144113
R278	47 kOHM, 1/10 W, MET	70-145145
R279	1 kOHM, 1/10 W, MET	70-144125
R281	47 kOHM, 1/10 W, MET	70-145145
R282	47 kOHM, 1/10 W, MET	70-145145
R283	4.7 kOHM, 1/10 W, MET	70-144123
R284	220 OHM, 1/10 W, MET	70-144194
R285	47 kOHM, 1/4 W, MET	70-141210
R401	10 kOHM, 1/10 W, MET	70-144120
R402	3.9 kOHM, 1/10 W, MET	70-145132
R403	2.2 kOHM, 1/10 W, MET	70-144413
R404	22 OHM, 1/10 W, MET	70-144160
R406	2.7 kOHM, 1/10 W, MET	70-144159
R407	2.2 kOHM, 1/10 W, MET	70-144113
R408	68 kOHM, 1/10 W, MET	70-144119
R409	22 OHM, 1/10 W, MET	70-144160
R410	47 kOHM, 1/10 W, MET	70-145145
R411	3.3 OHM, 1/10 W, MET	70-144198
R414	3.3 OHM, 1/10 W, MET	70-144198
R418	3.3 OHM, 1/10 W, MET	70-144198
R422	4.7 kOHM, 1/10 W, MET	70-144123
R423	4.7 kOHM, 1/10 W, MET	70-144123
R424	4.7 kOHM, 1/10 W, MET	70-144123
R425	10 kOHM, 1/10 W, MET	70-144120
R701	10 kOHM, 1/10 W, MET	70-144120
R702	6.8 kOHM, 1/10 W, MET	70-144158
R703	22 kOHM, 1/10 W, MET	70-144121
R704	22 kOHM, 1/10 W, MET	70-144121
R705	4.7 kOHM, 1/10 W, MET	70-144123
R706	150 OHM, 1/10 W, MET	70-140321
R707	5.6 kOHM, 1/10 W, MET	70-144168
R708	10 kOHM, 1/10 W, MET	70-144120
R709	330 OHM, 1/10 W, MET	70-144164
R711	5.6 kOHM, 1/10 W, MET	70-144168
R712	10 kOHM, 1/10 W, MET	70-144120
R713	330 OHM, 1/10 W, MET	70-144164
R714	150 OHM, 1/10 W, MET	70-140321
R721	10 kOHM, 1/10 W, MET	70-144120
R722	6.8 kOHM, 1/10 W, MET	70-144158
R723	22 kOHM, 1/10 W, MET	70-144121
R724	22 kOHM, 1/10 W, MET	70-144121
R725	4.7 kOHM, 1/10 W, MET	70-144123
R726	150 OHM, 1/10 W, MET	70-140321
R727	5.6 kOHM, 1/10 W, MET	70-144168
R728	10 kOHM, 1/10 W, MET	70-144120
R729	470 OHM, 1/10 W, MET	70-144130
R731	47 kOHM, 1/10 W, MET	70-145145
R732	47 kOHM, 1/10 W, MET	70-145145
R733	47 kOHM, 1/10 W, MET	70-145145
R741	22 kOHM, 1/10 W, MET	70-144121
R742	22 kOHM, 1/10 W, MET	70-144121
R743	22 kOHM, 1/10 W, MET	70-144121
R744	22 kOHM, 1/10 W, MET	70-144121
R751	10 OHM, 1/10 W, MET	70-144115
R752	150 OHM, 1/10 W, MET	70-140321
R753	27 OHM, 1/10 W, MET	70-144219
R754	18 OHM, 1/10 W, MET	70-144171
R755	18 OHM, 1/10 W, MET	70-144171

TR-052 RF BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R756	18 OHM, 1/10 W, MET	70-144171
R757	4.7 kOHM, 1/10 W, MET	70-144123
R758	6.8 kOHM, 1/10 W, MET	70-144158
R759	270 OHM, 1/10 W, MET	70-144116
R761	330 OHM, 1/10 W, MET	70-144164
R762	15 OHM, 1/10 W, MET	70-144162
R763	100 OHM, 1/10 W, MET	70-145146
R764	4.7 kOHM, 1/10 W, MET	70-144123
R765	6.8 kOHM, 1/10 W, MET	70-144158
R766	270 OHM, 1/10 W, MET	70-144116
R767	330 OHM, 1/10 W, MET	70-144164
R768	15 OHM, 1/10 W, MET	70-144162
R769	100 OHM, 1/10 W, MET	70-145146
R771	4.7 kOHM, 1/10 W, MET	70-144123
R772	6.8 kOHM, 1/10 W, MET	70-144158
R773	270 OHM, 1/10 W, MET	70-144116
R774	330 OHM, 1/10 W, MET	70-144164
R775	15 OHM, 1/10 W, MET	70-144162
R776	100 OHM, 1/10 W, MET	70-145146
	VARIABLE RESISTORS	
RV103	RH04AYA, 14 W, (10 KB)	70-164094
RV104	RH04AYA, 14 W, (10 KB)	70-164094
RV105	RH04AYA, 14 W, (10 KB)	70-164094
RV261	RH04AYA, 14 W, (10 KB)	70-164094

REF NO.	DESCRIPTION	PART NO.
	CONNECTORS	
CM118	IL-S-6P-S2T2-EF	70-159252
J101	JACKV	70-159089
J104	IL-S-5P-S2T2-EF	70-159424
J106	HLEM34S-1	70-159422
J108	DF3-13P-2 DSA	70-159421
J110	DF3-15P-S2T2-EF	70-159423
J111	IL-S-15P-S2T2-EF	70-159425
J203	JACK V	70-159089
P124	3022-06B	70-159426
P125	3022-04B	70-159196
	FILTERS	
FL261	10.7 - 15C	70-179024
FL262	CFU - 455 G2	70-179077
FL263	CFU - 455 F2	70-179078
	MISCELLANEOUS	
CA106	JOINER	70-034371
CA108	CABLE ASSY	70-034312
CA141	CABLE ASSY	70-034373
F1	FUSE-SSFR 5A	70-204062
JP102	ZERO OHM, 1/10 W, MET	70-144106
JP105	ZERO OHM, 1/10 W, MET	70-144106
K401	AGP9003	70-105022
X101 T	XTAL-12.8 MHz +/-5ppm	70-128080
X261	XTAL-89.545 MHz	70-128025

PA-501 POWER AMPLIFIER (70-0500CWB)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C501	0.01 uF, 50 V, CER	70-138168
C502	0.01 uF, 50 V, CER	70-138168
C503	1000 pF, 50 V, CER	70-138170
C504	10 uF, 50 V, AL, ELYC	70-135059
C505	0.01 uF, 50 V, CER	70-138168
C506	150 pF, 50 V, CER	70-138231
C507	220 pF, 50 V, CER	70-138176
C509	220 pF, 50 V, CER	70-138176
C510	220 pF, 50 V, CER	70-138176
C511	47 uF, 50 V, AL, ELYC	70-135178
C512	0.01 uF, 50 V, CER	70-138168
C513	220 pF, 100 V, MICA	70-138112
C514	150 pF, 50 V, CER	70-138231
C515	220 pF, 100 V, MICA	70-138112
C516	220 pF, 100 V, MICA	70-138112
C517	220 pF, 100 V, CER	70-138261
C518	91 pF, 500 V, CER	70-138307
C519	1000 pF, 100 V, CER	70-138239
C520	8 pF, 500 V, MICA	70-138118
C521	33 pF, 500 V, CER	70-138268
C522	22 pF, 500 V, CER	70-138263
C523	91 pF, 500 V, CER	70-138307
C524	12 pF, 500 V, CER	70-138266
C525	120 pF, 500 V, CER	70-138306
C526	9 pF, 500 V, CER	70-138313
C527	91 pF, 500 V, CER	70-138307
C528	150 pF, 50 V, CER	70-138231
C529	1000 pF, 50 V, CER	70-138170
C530	0.1 uF, 50 V, CER	70-138249
C531	1000 pF, 50 V, CER	70-138170
C532	0.01 uF, 50 V, CER	70-138168
C533	0.1 uf, 25 V, CER	70-138236
C534	15 uF, 25 V, AL, ELYC	70-135154
C535	0.01 uF, 50 V, CER	70-138168
C536	0.1 uf, 25 V, CER	70-138236
C537	1000 pF, 50 V, CER	70-138170
C538	0.01 uF, 50 V, CER	70-138168
C539	0.1 uf, 25 V, CER	70-138236
C540	10 uF, 50 V, AL, ELYC	70-135059
C541	1000 pF, 50 V, CER	70-138170
C542	0.1 uf, 25 V, CER	70-138236
C543	47 uF, 50 V, AL, ELYC	70-135178
C544	0.22 uF, 50 V, PLAS	70-138160
C545	1000 pF, 50 V, CER	70-138170
C546	0.01 uF, 50 V, CER	70-138168
C547	1000 pF, 50 V, CER	70-138170
C548	1000 pF, 50 V, CER	70-138170
C550	3 pF, 500V, CER	70-138311
C552	36 pF, 500V, CER	70-138315
C553	56 pF, 500V, CER	70-138285
C554	15 pF, 500 V, CER	70-138267
C556	0.01 uF, 50 V, CER	70-138168
C557	0.01 uF, 50 V, CER	70-138168
C562	0.01 uF, 50 V, CER	70-138168
C563	220 pF, 100 V, MICA	70-138112
C564	220 pF, 100 V, MICA	70-138112
	DIODES	
D501	RM4AM LF-JB	70-085269
D502	DWA010	70-085246
D503	HSM885	70-085454
D504	DCA010	70-085250
	JACKS	
J501	JACK V	70-159089
J502	ANTENNA JACK	70-159259
J503	JACK V	70-159089

REF NO.	DESCRIPTION	PART NO.
	CABLE ASSEMBLIES	
CA501	COAX, TX	70-034198
CA502	J506 & 2 WIRES	70-034319
CA504	IL-T-5P-IL-S-5S	70-034320
CA506	J502-P111	70-034321
	TRANSISTORS	
Q501	2SC2538	70-080108
Q502	2SC1971	70-080054
Q503	2SC2884	70-080133
Q504	2SB945Q/P	70-080214
Q506	2SC2482LC	70-080160
Q507	2SC2482LC	70-080160
	COILS AND CONDUCTORS	
L501	Z0.8C5D 2.5T	70-090098
L502	Z0.8C5D 2.5T	70-090098
L503	Z0.8C3D 0.5T	70-090164
L504	Z0.8C5D 4.5T	70-090129
L505	BLO2RN1-R82	70-090122
L506	Z1.2C5D 0.5T	70-090424
L507	Z1.2C5D 3.5T	70-090102
L508	Z1.0C5D 4.5T	70-090212
L509	2R2MA, CHOKE	70-090261
L510	Z1.0C5D 5.0T	70-090422
L511	Z1.0C5D 6.5T	70-090214
L512	Z1.0C5D 7.5T	70-090215
L513	Z1.0C5D 6.5T	70-090388
L514	Z0.8C5D 3.5T	70-090389
L515	BLO2RN1-R82	70-090122
L516	BLO2RN1-R82	70-090122
L517	BLO2RN1-R82	70-090122
L518	17I005, XFMR	70-090399
	RESISTORS	
R503	10 OHM, 0.1 W, MET	70-144115
R504	10 OHM, 0.1 W, MET	70-144115
R505	220 OHM, 0.1 W, MET	70-144194
R506	10 OHM, 0.1 W, MET	70-144115
R507	2.2 kOHM, 0.1 W, MET	70-144113
R508	68 OHM, 1/4 W, CARBON	70-144220
R509	68 OHM, 1/4 W, CARBON	70-144220
R510	180 OHM, 1 W, MET	70-144221
R511	33 OHM, 1 W, MET	70-142028
R512	2.2 OHM, 2 W, MET	70-144200
R514	100 OHM, 0.1 W, MET	70-145146
R515	100 OHM, 0.1 W, MET	70-145146
R516	100 kOHM, 0.1 W, MET	70-145128
R517	100 kOHM, 0.1 W, MET	70-145128
R518	4.7 kOHM, 0.1 W, MET	70-144123
R519	100 kOHM, 0.1 W, MET	70-145128
R520	100 kOHM, 0.1 W, MET	70-145128
R523	1 kOHM, 0.1 W, MET	70-144125
R524	1 kOHM, 0.1 W, MET	70-144125
R525	2.7 kOHM, 0.1 W, MET	70-144159
R526	47 OHM, 0.1 W, MET	70-145130
R527	330 OHM, 0.1 W, MET	70-144164
R528	47 OHM, 0.1 W, MET	70-145130
R532	150 OHM, 0.1 W, MET	70-140321
R533	150 OHM, 0.1 W, MET	70-140321
R534	150 OHM, 0.1 W, MET	70-140321
	VARIABLE RESISTORS	
RV502	5K, MET	70-164066
	MISCELLANEOUS	
K501	HBI-DC6V RELAY	70-105010

PA-502 POWER AMPLIFIER (70-0520CWB)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C502	0.01 uF, 50 V, CER	70-138270
C504	0.01 uF, 50 V, CER	70-138270
C505	47 uF, 25 V AL, ELYC	70-135055
C506	1000 uF, 50 V, CER	70-138170
C507	0.01 uF, 50 V, CER	70-138270
C508	0.01 uF, 50 V, CER	70-138270
C509	47 uF, 25 V AL, ELYC	70-135055
C510	0.1 uF, 50 V, CER	70-138249
C511	0.01 uF, 50 V, CER	70-138270
C512	150 pF, 50 V, CER	70-138231
C513	82 pF, 50 V, CER	70-138250
C515	1000 uF, 50 V, CER	70-138170
C516	0.01 uF, 50 V, CER	70-138270
C517	0.1 uF, 50 V, CER	70-138249
C518	15 uF, 25 V, AL, ELYC	70-135154
C521	1000 pF, 50 V, CER	70-138170
C522	47 pF, 50 V, CER	70-131200
C524	220 pF, 50 V, CER	70-138176
C525	220 pF, 50 V, CER	70-138176
C526	220 pF, 50 V, CER	70-138176
C528	1000 pF, 50 V, CER	70-138170
C529	0.01 uF, 50 V, CER	70-138270
C530	0.1 uF, 50 V, CER	70-138249
C531	0.22 uF, 50 V, PLAS	70-138160
C532	1000 uF, 100 V, CER	70-138239
C533	1000 uF, 100 V, CER	70-138239
C534	0.01 uF, 50 V, CER	70-138270
C535	0.1 uF, 50 V, CER	70-138249
C536	47 uF, 25 V, AL, ELYC	70-135055
C538	220 pF, 100 V, CER	70-138261
C541	0.01 uF, 50 V, CER	70-131297
C542	330 pF, 100 V, CER	70-138320
C543	470 pF, 300 V, MICA	70-137104
C544	0.01 uF, 50 V, CER	70-131297
C545	330 pF, 300 V, MICA	70-137105
C546	470 pF, 100 V, CER	70-138238
C547	68 pF, 500 V, MICA	70-138141
C548	68 pF, 500 V, MICA	70-138141
C549	1000 pF, 100 V, CER	70-138239
C550	0.1 uf, 50 V, CER	70-138249
C551	47 uF, 25 V, AL, ELYC	70-135055
C552	1000 pF, 100 V, CER	70-138239
C554	0.1 uf, 50 V, CER	70-138249
C555	15 uF, 25 V, AL, ELYC	70-135154
C556	3 pF, 500 V, CER	70-138311
C557	150 pF, 100 V, CER	70-138258
C561	C39 pF, 500 V, CER	70-138286
C563	33 pF, 500 V, MICA	70-138098
C565	82 pF, 500 V, CER	70-138259
C566	27 pF, 500 V, CER	70-138305
C567	100 pF, 500 V, CER	70-138264
C569	9 pF, 500 V, MICA	70-138127
C570	56 pF, 500 V, CER	70-138285
C581	0.01 uF, 50 V, CER	70-138270
C582	0.01 uF, 50 V, CER	70-138270
C583	0.1 uF, 50 V, CER	70-138249
C584	1000 pF, 50 V, CER	70-138170
C585	1000 pF, 50 V, CER	70-138170
C586	1000 pF, 50 V, CER	70-138170
C587	1000 pF, 50 V, CER	70-138170
C589	1000 pF, 50 V, CER	70-138170
C590	33 uF, 16 V, TA, ELYC	70-135261
	DIODES	
D501	DWA010	70-085246
D502	HSM88S	70-085154
D503	DCA010	70-085250
D504	RM4AM LF-JB	70-085269
	JACKS	
J501	JACK V	70-159089
J502	MR-DS2505-01	70-159427
J503	JACK V	70-159089
	VARIABLE RESISTORS	
RV501	EVN-39C00YB 13 (1K)	70-164040

REF NO.	DESCRIPTION	PART NO.
	CABLE ASSEMBLIES	
CA501	L = 100	70-034325
CA502	1-350345-0 (A = 200)	70-034332
CA503	L = 100	70-034325
CA504	IL-T-5P-IL-S-5S	70-034320
CA505	1825-12R-15S (A = 185)	70-034333
	TRANSISTORS	
Q501	2SC2538	70-080108
Q502	2SC1971	70-080054
Q503	2SC2630	70-080091
Q504	MRF492	70-085342
Q505	MRF492	70-085342
Q506	2SB945Q/P	70-080214
Q507	2SC2462LC	70-080160
Q508	2SC2462LC	70-080160
Q509	2SC2462LC	70-080160
	COILS AND CONDUCTORS	
L501	Z0.8C5D 3.5T	70-090099
L502	Z0.8C5D 3.5T	70-090099
L503	Z0.8C5D 2.5 T	70-090098
L504	BL02RN1-R82	70-090122
L505	Z0.8C3D 1.5T	70-090155
L506	BLO2RN1-R82	70-090022
L507	Z0.8C5D 4.5T	70-090129
L508	BLO2RN1-R82	70-090122
L509	Z0.8C5D 6.5T	70-090131
L512	Z1.0C5D 5.5T	70-090213
L513	Z1.0C5D 6.5T	70-090214
L514	Z1.0C5D 7.5T	70-090215
L516	BLO2RN1-R82	70-090122
L517	BLO2RN1-R82	70-090122
T1	17L006	70-090524
T2	17L007	70-090525
T3	17L005	70-090399
	RESISTORS	
R501	220 OHM, 1/10 W, MET	70-144194
R502	2.2 kOHM, 1/10 W, MET	70-144113
R503	3.3 OHM, 1/10 W, MET	70-144198
R504	33 OHM, 1 W, MET	70-142028
R505	33 OHM, 1 W, MET	70-142028
R504	33 OHM, 1 W, MET	70-142028
R505	33 OHM, 1 W, MET	70-142028
R506	100 OHM, 1 W, MET	70-144299
R510	2.2 OHM, 2 W, MET	70-144200
R511	36 OHM, 3 W, MET	70-144314
R512	10 OHM, 1 W, MET	70-144082
R513	10 OHM, 1 W, MET	70-144082
R514	36 OHM, 3 W, MET	70-144314
R515	36 OHM, 3 W, MET	70-144314
R516	33 OHM, 1/10 W, MET	70-144320
R517	33 OHM, 1/10 W, MET	70-144320
R518	33 OHM, 1/10 W, MET	70-144320
R519	33 OHM, 1/10 W, MET	70-144320
R520	100 kOHM, 1/10 W, MET	70-144128
R521	100 kOHM, 1/10 W, MET	70-144128
R522	2.2 kOHM, 1/10 W, MET	70-144113
R523	560 OHM, 1/10 W, MET	70-144130
R524	47 OHM, 1/10 W, MET	70-145130
R525	47 OHM, 1/10 W, MET	70-145130
R526	330 OHM, 1/10 W, MET	70-144164
R527	1.8 kOHM, 1/10 W, MET	70-144154
R528	470 OHM, 1/10 W, MET	70-146107
R529	4.7 kOHM, 1/10 W, MET	70-144123
R531	1.2 kOHM, 1/10 W, MET	70-144167
R532	560 OHM, 1/10 W, MET	70-144130
	MISCELLANEOUS	
K501	RELAY CX-220P	70-105014

CX-55 LOGIC BOARD

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C901	1000 pF, 50 V, CER	70-138170
C902	1000 pF, 50 V, CER	70-138170
C903	1000 pF, 50 V, CER	70-138170
C904	1000 pF, 50 V, CER	70-138170
C905	1000 pF, 50 V, CER	70-138170
C906	1000 pF, 50 V, CER	70-138170
C907	1000 pF, 50 V, CER	70-138170
C908	1 uF, 50 V, AL, ELYC	70-135172
C909	10 uF, 16 V, AL, ELYC	70-135163
C912	10 uF, 16 V, AL, ELYC	70-135163
C910	10 uF, 16 V, AL, ELYC	70-135163
C913	1 uF, 50 V, AL, ELYC	70-135172
C915	47 uF, 16 V, AL, ELYC	70-135140
C916	1000 pF, 50 V, CER	70-138170
C917	47 pF, 50 V, CER	70-138185
C918	0.01 uF, 50 V, CER	70-138168
C919	18 pF, 50 V CER	70-138206
C920	18 pF, 50 V CER	70-138206
C922	2200 pF, 50 V, CER	70-138235
C924	0.01 uF, 50 V, CER	70-138168
C925	0.01 uF, 50 V, CER	70-138168
C927	0.033 uF, 50 V, CER	70-138257
C928	2200 pF, 50 V, CER	70-138195
C929	0.033 uF, 50 V, CER	70-138257
C930	0.01 uF, 50 V, CER	70-138168
C931	2200 pF, 50 V, CER	70-138235
C932	1000 pF, 50 V, CER	70-138170
C933	1000 pF, 50 V, CER	70-138170
C934	1000 pF, 50 V, CER	70-138170
C935	1000 pF, 50 V, CER	70-138170
C936	1000 pF, 50 V, CER	70-138170
C938	0.01 uF, 50 V, CER	70-138168
C939	10 uF, 25 V, AL ELYC	70-135173
C940	0.01 uF, 50 V, CER	70-138168
C941	0.01 uF, 50 V, CER	70-138168
C942	0.47 uF, 35 V, TA, ELYC	70-138214
C943	47 uF, 16 V, CER	70-138140
C944	10 uF, 16 V, CER	70-135173
C951	1000 pF, 50 V, CER	70-138170
C952	1000 pF, 50 V, CER	70-138170
C953	1000 pF, 50 V, CER	70-138170
C954	220 pF, 50 V, CER	70-138176
C955	1000 pF, 50 V, CER	70-138170
C956	1000 pF, 50 V, CER	70-138170
C957	1000 pF, 50 V, CER	70-138170
C958	220 pF, 50 V, CER	70-138176
C959	1000 pF, 50 V, CER	70-138170
C960	1000 pF, 50 V, CER	70-138170
C962	1000 pF, 50 V, CER	70-138170
C962	1000 pF, 50 V, CER	70-138170
C963	1000 pF, 50 V, CER	70-138170
C964	220 pF, 50 V, CER	70-138176
C965	220 pF, 50 V, CER	70-138176
C966	220 pF, 50 V, CER	70-138176
C967	1000 pF, 50 V, CER	70-138170
C968	220 pF, 50 V, CER	70-138176
C969	1000 pF, 50 V, CER	70-138170
C970	1000 pF, 50 V, CER	70-138170
C971	1000 pF, 50 V, CER	70-138170
C972	1000 pF, 50 V, CER	70-138170
C973	4700 pF, 50 V, CER	70-138204
C974	0.1 uF, 50 V, CER	70-138236
C975	0.01 uF, 50 V, CER	70-138168
C976	0.022 pF, 50 V, PLASTIC	70-137082
	DIODES	
D901	DCB010-TA	70-085245
D902	HZM5C-TR	70-085251
D903	DCB010-TA	70-085245
D904	LN2G	70-085252

REF NO.	DESCRIPTION	PART NO.
	INTEGRATED CIRCUITS	
IC901	HN671106U	70-076470
IC902	HN58C8FP-25	70-076471
IC903	HD6301Y0E55	70-076509
IC904	MB3771FPT	70-076473
IC905	HD/MC74HC10FP	70-076474
IC906	uPC4558G	70-076475
IC907	MX365P	70-076476
IC908	HD/MC74HC10FP	70-076477
IC909	HD/MC14066BFP	70-076478
IC910	HD/MC14070BFP-TR	70-076479
IC911	HD/MC14516BFP-TR	70-076480
IC912	uPC 451G2	70-076481
IC913	HA17805P	70-076482
	JACKS	
J906	HLEM34S-1	70-159422
J907	PS-10PE-D4T1-B1	70-159428
J921	IL-S-11P-S2T2-EF	70-159429
J922	IL-S-8P-S2T2-EF	70-159253
	PLUGS	
P922	IL-S-8S-S2C2-S	70-034324
P923	OS-16PE-D4T1-PN1	70-159430
	TRASNSISTORS	
Q901	UN4210	70-060304
	RESISTORS	
R801	1.0 kOHM, 1/10 W, MET	70-144128
R802	3.3 kOHM, 1/10 W, MET	70-144144
R803	1.0 kOHM, 1/10 W, MET	70-144128
R804	1.0 kOHM, 1/10 W, MET	70-144128
R805	1.0 kOHM, 1/10 W, MET	70-144128
R806	47 kOHM, 1/10 W, MET	70-145145
R807	4.7 kOHM, 1/10 W, MET	70-144123
R808	10 kOHM, 1/4 W, MET	70-141212
R809	100 kOHM, 1/4 W, MET	70-141213
R810	5.6 kOHM, 1/4 W, MET	70-141214
R812	56 kOHM, 1/10 W, MET	70-144169
R816	5.6 kOHM, 1/4 W, MET	70-141214
R817	4.7 kOHM, 1/10 W, MET	70-144123
R818	2.2 kOHM, 1/10 W, MET	70-144113
R819	4.7 kOHM, 1/10 W, MET	70-144192
R901	47 kOHM, 1/10 W, MET	70-145145
R902	47 kOHM, 1/10 W, MET	70-145145
R903	47 kOHM, 1/10 W, MET	70-145145
R904	47 kOHM, 1/10 W, MET	70-145145
R905	47 kOHM, 1/10 W, MET	70-145145
R906	47 kOHM, 1/10 W, MET	70-145145
R907	47 kOHM, 1/10 W, MET	70-145145
R908	47 kOHM, 1/10 W, MET	70-145145
R910	1.0 kOHM, 1/10 W, MET	70-144128
R911	1.0 kOHM, 1/10 W, MET	70-144128
R912	1.0 kOHM, 1/10 W, MET	70-144128
R913	1.0 kOHM, 1/10 W, MET	70-144128
R914	1.0 kOHM, 1/10 W, MET	70-144128
R915	1.0 kOHM, 1/10 W, MET	70-144128
R916	1.0 kOHM, 1/10 W, MET	70-144128
R917	100 kOHM, 1/10 W, MET	70-145128
R918	10 kOHM, 1/10 W, MET	70-144120
R919	22 kOHM, 1/10 W, MET	70-144121
R920	47 kOHM, 1/10 W, MET	70-145145
R921	100 kOHM, 1/10 W, MET	70-145128
R922	22 kOHM, 1/10 W, MET	70-144121

CX-55 LOGIC BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R923	470 OHM, 1/10 W, MET	70-144156
R924	470 OHM, 1/10 W, MET	70-144156
R925	220 kOHM, 1/10 W, MET	70-144131
R926	100 kOHM, 1/10 W, MET	70-145128
R927	47 kOHM, 1/10 W, MET	70-145145
R929	22 kOHM, 1/10 W, MET	70-144121
R930	22 kOHM, 1/10 W, MET	70-144121
R931	4.7 kOHM, 1/10 W, MET	70-144123
R932	0 OHM, 1/10 W, MET	70-144106
R933	12 kOHM, 1/10 W, MET	70-144111
R934	10 kOHM, 1/10 W, MET	70-144120
R935	470 kOHM, 1/10 W, MET	70-144199
R936	68 kOHM, 1/10 W, MET	70-144119
R937	4.7 kOHM, 1/10 W, MET	70-144123
R939	220 kOHM, 1/10 W, MET	70-144131
R940	1.0 kOHM, 1/10 W, MET	70-144128
R941	47 kOHM, 1/10 W, MET	70-145145
R942	100 kOHM, 1/10 W, MET	70-145128
R943	100 kOHM, 1/10 W, MET	70-145128
R945	1.0 kOHM, 1/10 W, MET	70-144128
R946	150 kOHM, 1/10 W, MET	70-144129
R947	470 kOHM, 1/10 W, MET	70-144199
R948	68 kOHM, 1/10 W, MET	70-144119
R949	150 kOHM, 1/10 W, MET	70-144129
R950	27 kOHM, 1/10 W, MET	70-144163
R951	33 kOHM, 1/10 W, MET	70-144112
R952	10 kOHM, 1/10 W, MFT	70-144120
R953	33 kOHM, 1/10 W, MET	70-144112
R954	10 kOHM, 1/10 W, MET	70-144120
R955	10 kOHM, 1/10 W, MET	70-144120
R956	470 kOHM, 1/10 W, MET	70-144199
R957	1.0 kOHM, 1/10 W, MET	70-144128
R959	47 kOHM, 1/10 W, MET	70-145145
R960	47 kOHM, 1/10 W, MET	70-145145
R962	47 kOHM, 1/10 W, MET	70-145145
R963	0 OHM, 1/10 W, MET	70-144106
R964	1 kOHM, 1/10 W, MET	70-144125
R965	1 kOHM, 1/10 W, MET	70-144125
R966	1 kOHM, 1/10 W, MET	70-144125
R967	1 kOHM, 1/10 W, MET	70-144125

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R968	1 kOHM, 1/10 W, MET	70-144125
R971	10 kOHM, 1/10 W, MET	70-144120
R972	8.2 kOHM, 1/10 W, MET	70-140305
R973	33 kOHM, 1/10 W, MET	70-144112
R975	100 kOHM, 1/10 W, MET	70-145128
R977	220 kOHM, 1/10 W, MET	70-144131
R978	100 kOHM, 1/10 W, MET	70-145128
R979	47 kOHM, 1/10 W, MET	70-145145
R980	22 kOHM, 1/10 W, MET	70-144121
R981	22 kOHM, 1/10 W, MET	70-144121
R982	1 kOHM, 1/10 W, MET	70-144125
R983	1 kOHM, 1/10 W, MET	70-144125
R984	1 kOHM, 1/10 W, MET	70-144125
R985	1 kOHM, 1/10 W, MET	70-144125
R986	1 kOHM, 1/10 W, MET	70-144125
R987	1 kOHM, 1/10 W, MET	70-144125
R988	1.0 kOHM, 1/10 W, MET	70-144128
R989	1.0 kOHM, 1/10 W, MET	70-144128
R990	1.0 kOHM, 1/10 W, MET	70-144128
R992	1.0 kOHM, 1/10 W, MET	70-144128
R994	1.0 kOHM, 1/10 W, MET	70-144128
R995	1.0 kOHM, 1/10 W, MET	70-144128
R996	1.0 kOHM, 1/10 W, MET	70-144128
R997	1.0 kOHM, 1/10 W, MET	70-144128
R998	1.0 kOHM, 1/10 W, MET	70-144128
R999	1.0 kOHM, 1/10 W, MET	70-144128
	VARIABLE RESISTORS	
RV901	47 kOHM	70-164095
RV902	47 kOHM	70-164095
	MISCELLANEOUS	
JP901	0 OHM, 1/10 W, MET	70-144106
JP902	0 OHM, 1/10 W, MET	70-144106
X901	CRYSTAL, 4.000 MHz, AT-51	70-128078

To speed delivery and avoid errors, always include the following information when ordering replacement parts:

1. Best identification of the parts.
   - A. MIDLAND part number, or
   - B. Model and Serial numbers of equipment in which the part is used, with
   - C. Part description, and
   - D. Schematic reference designator, and,
   - E. If necessary, return the old part as sample.
2. Specify quantity desired of each part.
3. Ship-to address (and billing address if different).

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THE NOMINAL RF POWER OF THE EXCITER (Q112) IS APPROX. 28.75mw AT J101.

Q731-Q733: 2SC3356

TR-052 SCHEMATIC DIAGRAM

TR-052

LOCAL

10V

LPSW

C9V

IC101 MB501L

IC102 MC145159-FN1

IC103 DH-1072A

X101 12.8MHz

IC104 μPC4741G

IC107 14011B

IC113 14094B

IC108 14053B

Q101 2SC2462LC

Q102 IMB4

Q103 IMH1

Q104 IMD3

Q105 IMD3

Q106 IMD3

Q107 IMD3

Q115 DTC124EK

Q116 IMH1

Q201 2SC3357

Q202 2SK125

Q203 2SK125

Q204 2SC3357

Q406 2SB798

Q407 2SC 2462

Q701 3SK151

Q702 2SC2351

Q721 3SK151

D102 IMN11

D218 HSM88S

D702 HVR100

D704 HVR100

D706 ISS268

D707 DCB010

D712 HVR100

D714 HVR100

D722 HVR100

D724 HVR100

D726 ISS268

D727 DCB010

D732 HVR100

D734 HVR100

D738 ISV164

D101 DWA010

CM118 (OSC)

CM118-3 (VCO CHECK)

Tx ENABLE

PLCL

TxDL

VCO TxLO

VCO TxHI

VCO RxHI

VCO RxLO

VCO CNT

VCO TxV

VCO RxV 7.9 RX 0.0 TX

VCO RxLO 7.8 RX LOW CHNLS

VCO RxHI 7.9 RX HIGH CHNLS

7.8 TX LOW CHNLS

7.9 TX 0.0 RX

5.0 TX 0.0 RX

13.0 RX

12.5 RX

13.2RXR

Rx 10V

Tx DL

TONE2

TONE1

TONE DET

DSTB

DCLK

CHDT

MIC IN

MIC OUT

VOICE

VOICE G

J203

P154

P155

JP105

FL261 10.7-15C

CM118

1 OSC

2 VCO CHECK

3 LOCAL

4 S Meter

5 NC