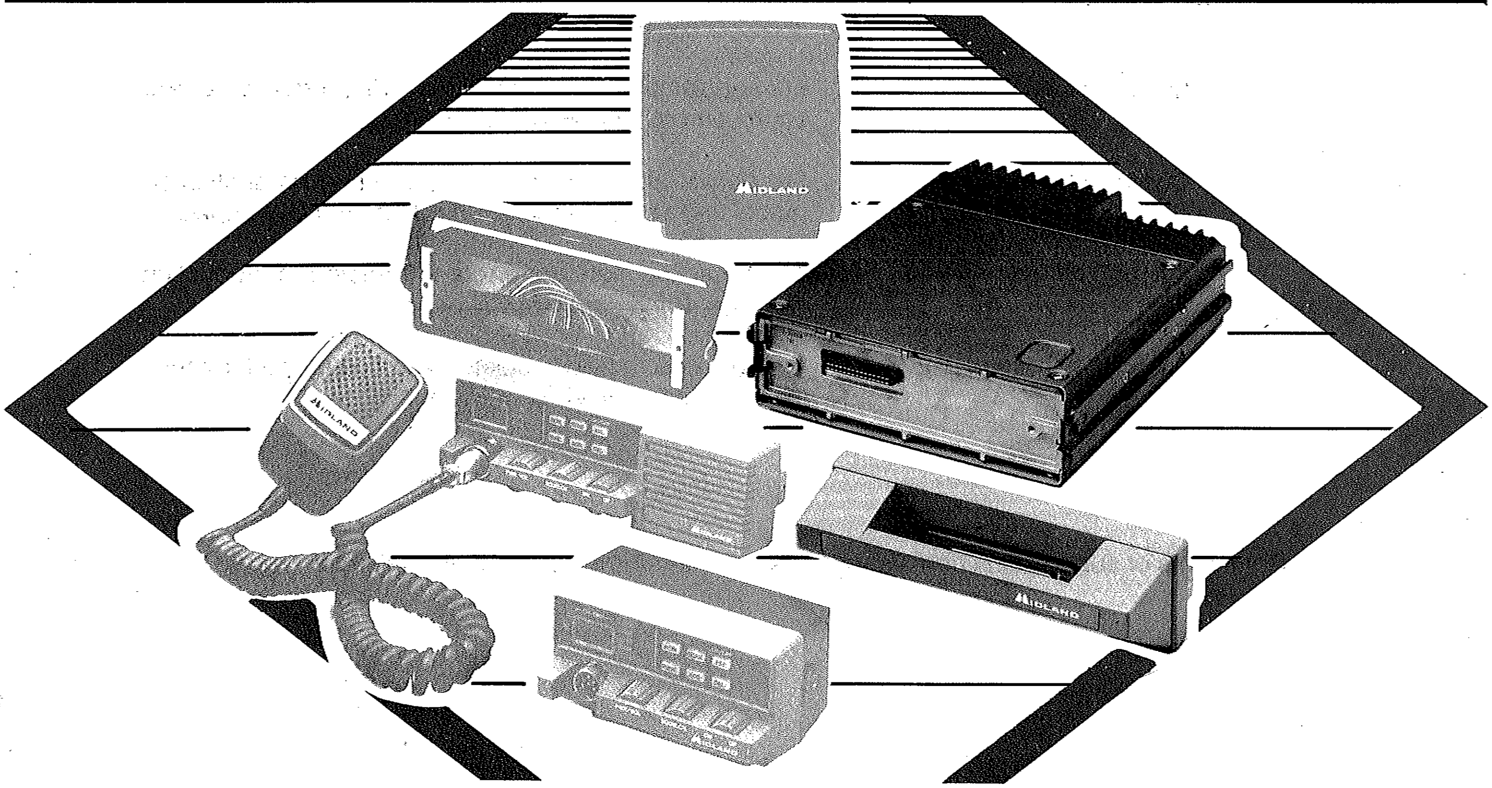
MIDLAND LMR
LAND MOBILE RADIO
SYN-TECH™-II
SERVICE MANUAL

PART THREE (TX/RX UNITS)



70-3400 AND 70-3800

HI-BAND VHF 40-WATT AND 110-WATT

MANUAL NO.: 70-340380
09-3400/3800-SM-2/93-2M

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

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 section exists: one for the Deluxe Control Head, and one for the Standard Control Head plus the Small-Remote Control Head.

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

This service-manual section is Part Three, and it contains specific technical data and drawings for the 70-3400 and 70-3800 SYN-TECH II TX/RX Units. As necessary, service 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 production by model and serial number. Printed on YELLOW paper.

Manual Correction (MC) . . . . . . For correcting literature errors not related to production changes. 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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ACRONYMS AND ABBREVIATIONS

Below is a list of common electrical acronyms and abbreviations used in this manual.

ANI	Automatic Number Identification
CTCSS	Continuous Tone-Controlled Squelch System
DCS (or CDCSS)	Continuous Digital-Controlled Squelch System
DTMF	Dual Tone Multi-Frequency
E^2PROM	Electrically Erasable Programmable Read Only Memory
MIL	Military Specification
RX	Receive
SINAD	The ratio in decibels of signal + noise + distortion to noise +distortion
TX	Transmit
VCO	Voltage Controlled Oscillator

SECTION 1

GENERAL INFORMATION

NOTES

DESCRIPTION

The 70-3400 and 70-3800 TX/RX Units are RF packages for the SYN- TECH II high-band VHF FM mobile transceivers. The 70-3400 Unit is capable of producing 40 W RF output (45 W optional), the 70-3800 produces 110 W RF output. A-Band radios operate from 136 MHz to 160 MHz; B-Band radios operate from 150 MHz to 174 MHz. The TX/RX Units operate any channel frequency within its respective 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 the trunk; 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.

If a trunk-mount configuration is purchased, the TX/RX Unit 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 multi-conductor 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.

APPLICABLE SYN-TECH II MODELS

Model numbers 70-3400 and 70-3800 identify a TX/RX Unit, which is a SYN-TECH II subassembly not the entire transceiver.

MIDLAND models 70-342x, 70-385x, 70-442x, and 70-485x SYN-TECH II transceivers consist of two major components: the TX/RX Unit (MIDLAND model number 70-3400 or 70-3800) and the Control Head (MIDLAND model number 70-0001, 70-0002, or 70-0007).

Model numbers of SYN-TECH II packages that contain the 70-3400 and 70- 3800 TX/RX Units are defined in **Table 1 - 1**.

MODEL NUMBER	MOUNTING*	RF OUTPUT POWER	CONTROL HEAD	FREQUENCY BAND (MHz)	TX/RX UNIT
70-3421A	UD	40 WATTS	STANDARD	136—160	70-3400A
70-3421B	UD	40 WATTS	STANDARD	150—174	70-3400B
70-3422A	UD	40 WATTS	DELUXE	136—160	70-3400A
70-3422B	UD	40 WATTS	DELUXE	150—174	70-3400B
70-4421A	TM	40 WATTS	STANDARD	136—160	70-3400A
70-4421B	TM	40 WATTS	STANDARD	150—174	70-3400B
70-4422A	TM	40 WATTS	DELUXE	136—160	70-3400A
70-4422B	TM	40 WATTS	DELUXE	150—174	70-3400B
70-4427A	TM	40 WATTS	SMALL REMOTE	136—160	70-3400A
70-4427B	TM	40 WATTS	SMALL REMOTE	150—174	70-3400B
70-3851A	UD	110 WATTS	STANDARD	136—160	70-3800A
70-3851B	UD	110 WATTS	STANDARD	150—174	70-3800B
70-3852A	UD	110 WATTS	DELUXE	136—160	70-3800A
70-3852B	UD	110 WATTS	DELUXE	150—174	70-3800B
70-4851A	TM	110 WATTS	STANDARD	136—160	70-3800A
70-4851B	TM	110 WATTS	STANDARD	150—174	70-3800B
70-4852A	TM	110 WATTS	DELUXE	136—160	70-3800A
70-4852B	TM	110 WATTS	DELUXE	150—174	70-3800B
70-4857A	TM	110 WATTS	SMALL REMOTE	136—160	70-3800A
70-4857B	TM	110 WATTS	SMALL REMOTE	150—174	70-3800B

*UD = Under-Dash TM = Trunk-Mount

SPECIFICATIONS

Refer to EIA-152-C, EIA/TIA-204-D, and DOC RSS-119, Issue 4 for standard of performance and method of measurement.

GENERAL

OPERATING VOLTAGE:
Nominal, 70-3400: 13.6 VDC, negative ground
Nominal, 70-3800: 13.4 VDC, negative ground
Range: 10.5 to 16 VDC

TEMPERATURE RANGE: –30C to +60C

ANTENNA IMPEDANCE: 50 Ω, unbalanced

FREQUENCY CONTROL: Phase-Lock-Loop synthesized

FREQUENCIES OF OPERATION:
A-Band: 136—160 MHz
B-Band: 150—174 MHz

CHANNEL CAPACITY: Up to 320 transmit and 320 receive

CHANNEL FREQUENCY SPREAD (without retuning):	
Transmit:	24 MHz
Receive:	24 MHz
FREQUENCY TOLERANCE AND STABILITY:	
Standard:	5.0 ppm both TX and RX
Optional:	2.0 ppm both TX and RX
DUTY CYCLE:	Intermittent. 1 min TX, 4 min RX (Per EIA 152-C)
HIGH HUMIDITY:	95% at 50C per EIA-152-C, sec.13
VIBRATION STABILITY:	Per EIA 152-C and applicable portions of MIL810C/D
SHOCK STABILITY:	Per EIA 152-C and applicable portions of MIL810C/D
CURRENT DRAIN:	
Standby:	0.5 A DC (varies with options)
Receive (at rated audio):	2.00 A DC
Transmit at 40 W (70-3400/4400):	9.0 A DC
Transmit at 110 W (70-3800/4800):	25.0 A DC
DIMENSIONS (H x W x D):	
Under-Dash:	
70-3421/3422 (40 W):	57 x 185 x 300 mm (2.3" x 7.3" x 11.8")
70-3821/3822 (110 W):	57 x 185 x 350 mm (2.3" x 7.3" x 13.8")
Trunk-Mount (TX/RX Unit only):	
70-4421/4422/4427 (40 W):	57 x 185 x 320 mm (2.3" x 7.3" x 12.6")
70-4821/4822/4827 (110 W):	57 x 185 x 370 mm (2.3" x 7.3" x 14.6")
Standard Remote Control Head:	57 x 185 x 75 mm (2.3" x 7.3" x 3.0")
Small Remote Control Head:	57 x 120 x 75 mm (2.3" x 4.7" x 3.0")
Remote Speaker:	121 x 121 x 72 mm (4.8" x 4.8" x 2.8")
WEIGHT:	
Under-Dash:	
70-3421/3422 (40 W):	3.1 kg (6.8 lbs)
70-3821/3822 (110 W):	3.8 kg (8.4 lbs)
Trunk-Mount (TX/RX Unit only):	
70-4421/4422/4427 (40 W)	3.2 kg (7.0 lbs)
70-4821/4822/4827 (110 W)	3.9 kg (8.5 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:	
70-34xx/44xx:	40 W minimum (45 W optional), adjustable down to 20 W, and 1—10 W with Low-Power option
70-48xx/48xx:	110 W minimum, adjustable down to 55 W
MODULATION SYSTEM:	16K0F3E, Direct FM
AUDIO FREQUENCY RESPONSE:	Per EIA and DOC specifications
AUDIO HARMONIC DISTORTION:	3% THD (1 kHz 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	55 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 μW 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:	3.0 kHz minimum
ADJACENT CHANNEL REJECTION:	90 dB at 30 kHz
SPURIOUS RESPONSE IMMUNITY	90 dB
INTERMODULATION IMMUNITY:	77 dB minimum (82 dB optional)
AUDIO POWER OUTPUT:	
Under-Dash Radio:	1.0 W 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 the 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:	21.4 MHz (1st) and 455 kHz (2nd)

— All specifications subject to change without notice —

NOTES

SECTION 2

PREPARATION

NOTES

The 70-3400 and 70-3800 SYN-TECH II TX/RX Units are capable of operating across a 24 MHz channel frequency spread. They do not require optimizing alignment, even when reprogrammed with new customer frequencies. Only general transmitter performance should be checked. COMPLETE REALIGNMENT MAY BE NECESSARY after a component that affects transceiver tuning has been replaced. Realignment requires transceiver operation on special frequencies; therefore, the transceiver must be reprogrammed specifically for alignment, the Remote-Control mode of the 70-1080A Programmer can be used, or the RX-TX Test Commands of the 70-1488 PC Programming software can be used.

PRE-INSTALLATION CHECK

- **Setup**

1. Remove the four screws securing the bottom cover and the cover itself.

2. If not already in place, connect the proper Control Head to the TX/RX Unit.

3. Connect a resistive, 50-Ω RF load (with a wattmeter) to Antenna Connector J502.

4. Connect 13.6 V DC power to J506.Connect [+] to pin 2 and [–] to pin 1.

5. Turn the radio on, turn Scan and Priority Sampling off, turn MON on, turn selective signaling options off.

- **Carrier Frequency**

6. Initiate transmit on any channel.Measure transmitted RF carrier frequency without modulation and, if necessary, adjust REFERENCE OSCILLATOR X101 for zero carrier frequency offset.

- **RF Output Power**

7. Deselect the Low Power option (if installed), then initiate transmit on any channel. Measure power of RF output at 50-Ω Antenna Connector J502 and, if necessary, adjust H.PWR as follows:

   70-3400: Adjust RV502 to obtain 40 W.

   70-3800: Adjust RV501 to obtain 110 W.

   RV501 and RV502 are located on the PA Module under the removable rubber cap.

   If the LOW Power option is in place (70-3400 only); select LOW power, and initiate transmit again. Measure RF output power and, if necessary, adjust L.PWR RV501 to obtain desired LOW-power level.

- **Maximum Deviation**

Two deviation limit adjustments exist: one for channels in the upper half of the frequency band, the other for the lower half.

8. Select a channel with transmit frequency in the lower half of the band (below 148.48 MHz for A-Band units, or below 162.56 MHz for B-Band). If CTCSS or DCS is used, be sure this channel also is programmed to send the same.

9. Disconnect the hand microphone from its front panel receptacle P317. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of MIC JACK P317, then initiate transmit by grounding pin 4. Measure total carrier deviation to assure it is below 5 kHz (including CTCSS/DCS signal).

10. Repeat step 9 with channels in the upper half of the frequency band (above 148.48 MHz for A-Band units, or above 162.56 MHz for B-Band units).

NOTE: If adjustments are needed, see MODULATOR ALIGNMENT on following page 2 - 6.

COMPLETE REALIGNMENT

The 70-3400 and 70-3800 TX/RX Units are capable of operating over a 24 MHz channel-frequency spread without retuning. The following procedure details entire transceiver realignment, and is needed only if a component that affects alignment has been replaced. RADIO RE-PROGRAMMING WITH TEST FREQUENCIES IS REQUIRED. Either the 70-1080A Programmer, or 70-1488 PC Programming Software can be used.

Table 2 - 1 — Test Equipment Required

TEST INSTRUMENT	CAPABILITIES	USE
Regulated DC Power Supply	13.8 VDC, 30 amps adjustable voltage	Radio power source
RF Wattmeter for 70-3400: for 70-3800:	 75 watts; 136—174 MHz ; 50-Ω circuit 150 watts; 136—174 MHz; 50-Ω circuit	Transmitter power measurements
RF Load Resistor	50 Ω; 200 W	Antenna dummy load
Frequency Modulation Meter	136—174 MHz; peak-responding, 5kHz range	Modulation level measurements
Frequency Meter or Frequency Counter	136—174 MHz; 1.0 ppm accuracy	Carrier frequency measurement
Audio Generator	1000 kHz sine-wave; 0-3 V_{rms} output	Modulation level measurements
RF Signal Generator	136—174 MHz range; 0.1—1KμV output; 3 kHz FM mod. with 1kHz tone	All receiver measurements
Distortion Analyzer	1 kHz notch; 1% measuring range	Receiver performance test and I.F. alignment
Load Resistor (audio)	4 Ω, 20 W	Speaker load for all receiver measurements
AC Voltmeter	10 mV to 3 V_{rms}	Audio level adjustments
Oscilloscope	DC to 500 kHz bandwidth	DCS alignment
Digital Multimeter	0.1 to 20 V DC	Test point measurements and power supply setup
SYN-TECH II Programmer	MIDLAND 70-1080A	Manual radio control

SETUP

1. Remove eight securing screws and the top and bottom covers. Loosen two securing screws and the PA Module cover.

2. If not already in place, connect the proper Control Head to the TX/RX Unit.

3. Connect a resistive, 50-Ω RF load and a wattmeter to Antenna Connector J502.

4. Connect 13.6 volts DC power to transceiver J506. Connect [+] to pin 2 and [-] to pin 1.

5. Connect a 4-Ω, 20-watt resistor to pins 4 and 6 of the Accessory Plug. The jumper between pin 5 and 6 must be temporarily disconnected to make this connection. The resistor serves as a constant load to replace the speaker's inconsistencies.

CAUTION: Both speaker terminals are LIVE! Never ground either one. Connect grounded receiver-audio measuring equipment to **only one side** of the speaker, and chassis ground. Normally, voltage measurements will be half of true values.

6. Turn the radio on, set the VOLUME control to a mid-position, and set the SQUELCH control fully counterclockwise.

7. Connect the programmer to Programming Port J909. Upload the radio programming Data-Packet into the programmer and initiate its Remote Control Mode. Refer to appropriate Operator's Manual for instructions.

SYNTHESIZER ALIGNMENT

- **VCO Resonance**

1. Select the Remote-Control Mode of the Programmer and enter the following test frequencies:

	A-Band	B-Band
RX Frequency:	136.00 MHz	150.00 MHz
TX Frequency:	136.00 MHz	150.00 MHz

2. Adjust LOW-CHANNEL RX TANK L702 (labeled "RX L") to obtain 2.5 V DC on CM118 pin 3 (VCO STEERING).

3. Activate the transmit mode (using the Programmer). Adjust LOW-CHANNEL TX TANK L722 (labeled "TX L") to obtain 2.0 V DC on CM118 pin 3.

4. Change the test frequencies to:

	A-Band	B-Band
RX Frequency:	148.20 MHz	162.30 MHz
TX Frequency:	148.50 MHz	162.60 MHz

5. Adjust HIGH-CHANNEL RX TANK L712 (labeled "RX H") to obtain 2.5 V DC on CM118 pin 3.

6. Activate transmit, then adjust HIGH-CHANNEL TX TANK L732 (labeled "TX H") to obtain 2.0 V DC on CM118 pin 3.

- **Reference Oscillator**

7. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation and, if necessary, adjust REFERENCE OSCILLATOR X101 for zero carrier frequency offset (within 100 Hz of channel frequency if using a frequency counter).

40-WATT PA MODULE (70-3400 TX/RX Units only)

1. Change the TX test frequency to 160.00 MHz, for A-Band units, or 174.00 MHz for B-Band units.

2. Deselect the LOW Power option (if installed) and set H.PWR RV502 to maximum (full clockwise).

3. Activate transmit mode, then adjust CV501 and CV504 to obtain maximum RF power at Antenna Connector J502.

4. Adjust RV502 to obtain 40 W power at J502. If the LOW Power option is in place, select LOW power, and initiate transmit again. Measure RF output power and adjust L.PWR RV501 to obtain desired LOW-power level.

110-WATT PA MODULE (70-3800 TX/RX Units only)

1. Change the TX test frequency to 160.00 MHz for A-Band units, or 168.00 MHz for B-Band units.

2. Set PWR RV501 to maximum (full clockwise).

3. Set CV503 and CV504 to maximum capacitance (plates fully meshed).

4. Initiate transmit, then adjust CV505 to obtain maximum RF power at Antenna Connector J502.

5. If output power is less than 135 W, fine-tune CV504 to obtain maximum power; otherwise, skip this step.

6. Change the TX test frequency to 143.00 MHz for A-Band units, or 151.00 MHz for B-Band units.

7. Initiate transmit and adjust PWR RV501 to obtain 110 W power at J502. RV501 is located on the PA Module under a removable rubber cap.

MODULATOR ALIGNMENT

Always perform Modulator Alignment in its entirety; the following adjustments are interactive.

- **Modulation Limiting**

Two deviation limit adjustments exist: one for channels in the upper half of the frequency band, the other for the lower half.

1. Change the TX test frequency to 148.00 MHz for A-Band units, or 162.00 MHz for B-Band units.

2. Clear CTCSS or DCS encode.

3. Disconnect the hand microphone from its front panel receptacle P317. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of MIC JACK P317, then initiate transmit (if not using the 70-1080A Programmer, ground P317-pin 4). Measure total carrier deviation and, if needed, adjust F_L MOD LIMIT RV104 to obtain ±4.2 kHz.

4. Change the TX test frequency to 160.00 MHz for A-Band units, or 174.00 MHz for B-Band units.

5. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of MIC JACK P317, then initiate transmit. Measure total carrier deviation and, if needed, adjust F_H MOD LIMIT RV105 to obtain ±4.2 kHz.

- **VCO Modulation Port**

6. Set CTCSS RV902 (accessed from the radio topside) to mid-range and set TONE2 RV101 (on the bottom side) near minimum.

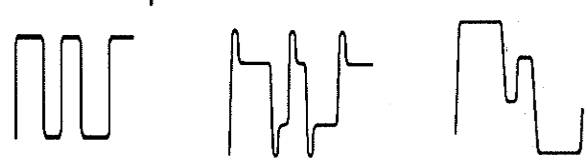
7. Change the TX test frequency to 154.10 MHz for A-Band units, or 168.15 MHz for B-Band units.

8. Remove external modulation signals, enter the DCS code +023, then initiate transmit.

9. Observe the modulation level of the distorted recovered waveform and adjust TONE1 RV102 to obtain ±700 Hz deviation at the peaks.

- **Reference-Oscillator Modulating Port**

10. While observing recovered modulation on an oscilloscope, adjust TONE2 RV101 to obtain a square DCS waveform as shown below. If modulation level exceeds ±700 Hz deviation, reduce TONE1 RV102 slightly, then repeat this step.



CORRECT | INCORRECT | INCORRECT

WARNING: Use equipment with DC coupling to avoid distortion of the DCS waveform that contains frequencies as low as 6 Hz.

NOTE: Observe the DCS waveform at pin 31 of J106 with an oscilloscope for a better example. The recovered DCS waveform above should be similar to it.

11. Change the TX test frequency to 148.00 MHz for A-Band units, or 162.00 MHz for B-Band units.

12. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of MIC JACK P317, then inititate transmit. Make sure total carrier deviation (1kHz tone plus DCS modulation) does not exceed ±5.0 kHz. If it must be turned down, adjust F_L MOD LIMIT RV104.

13. Change the TX test frequency to 160.00 MHz for A-Band units, or 174.00 MHz for B-Band units.

14. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of MIC JACK P317, then inititate transmit. Make sure total carrier deviation (1kHz tone plus DCS modulation) does not exceed ±5.0 kHz. If it must be turned down, adjust F_H MOD LIMIT RV105.

- **Microphone Gain**

15. Change the TX test frequency to 154.10 MHz for A-Band units, or 168.15 MHz for B-Band units.

16. Clear DCS encode.

17. Apply 310 mV_{rms} of 1000 Hz sine-wave signal to pin 1 of MIC JACK P317; then initiate transmit. Measure carrier deviation and, if needed, adjust MIC GAIN RV103 to obtain 3 kHz.

- **CTCSS Level**

18. Enter the 100.0 Hz CTCSS tone and initiate transmit. Adjust CTCSS RV902 to obtain CTCSS modulation of ±700 Hz deviation). RV902 is located on the radio topside of the Logic Board.

- **Burst-Tone Level**

19. Clear the CTCSS tone and enter the highest Burst-Tone frequency used. Initiate transmit, then adjust BRST RV901 for 3 kHz deviation. RV901 is located on the radio topside of the Logic Board. If more than one Burst Tone is used, adjust as necessary to keep modulation level of all tones between ±2.0 kHz and ±3.5 kHz deviation.

RECEIVER ALIGNMENT

1. Change the RX test frequency to 148.20 MHz for A-Band units, or 162.30 MHz for B-Band units.

- **First Injection**

2. Adjust L222 and L223 to obtain maximum DC voltage on Injection Metering Point CM118 pin 4.

- **Preselector Alignment**

3. Apply sufficient unmodulated, on-channel RF signal to 50-Ω antenna connector J502 to obtain approximately 20 dB quieting. Adjust L201, L202, L207, L208, and L209 for maximum quieting indication (peak positive voltage) at CM118 pin 5. Readjust input signal, as necessary, to maintain 20 to 30 dB quieting while aligning.

- **Quadrature Detector**

4. Apply 1 mV of modulated (by 1 kHz tone at 3 kHz deviation) on-channel RF signal to Antenna Connector J502. Adjust DETECTOR L262 for maximum audio output.

- **First I.F.**

5. Apply enough modulated (by 1 kHz tone at 3 kHz deviation) on-channel carrier to maintain 12 to 15 dB SINAD. Adjust L221 and L261 for best SINAD.

6. Apply 1 mV modulated (by 1 kHz tone at 3 kHz deviation) on- channel carrier. Readjust L221 and L261 for minimum receive audio distortion. **NOTE:** If a distortion analyzer is not available, this step may be deleted although distortion specifications may not be met.

- **Tight Squelch**

7. Set the front panel SQUELCH control to maximum (full clockwise). Set SQUELCH RANGE RV261 fully counterclockwise.

8. Apply 1.5 μV of unmodulated on-channel RF signal to the 50-Ω antenna connector. Adjust SQUELCH RANGE RV261 clockwise just until squelch opens (audio on).

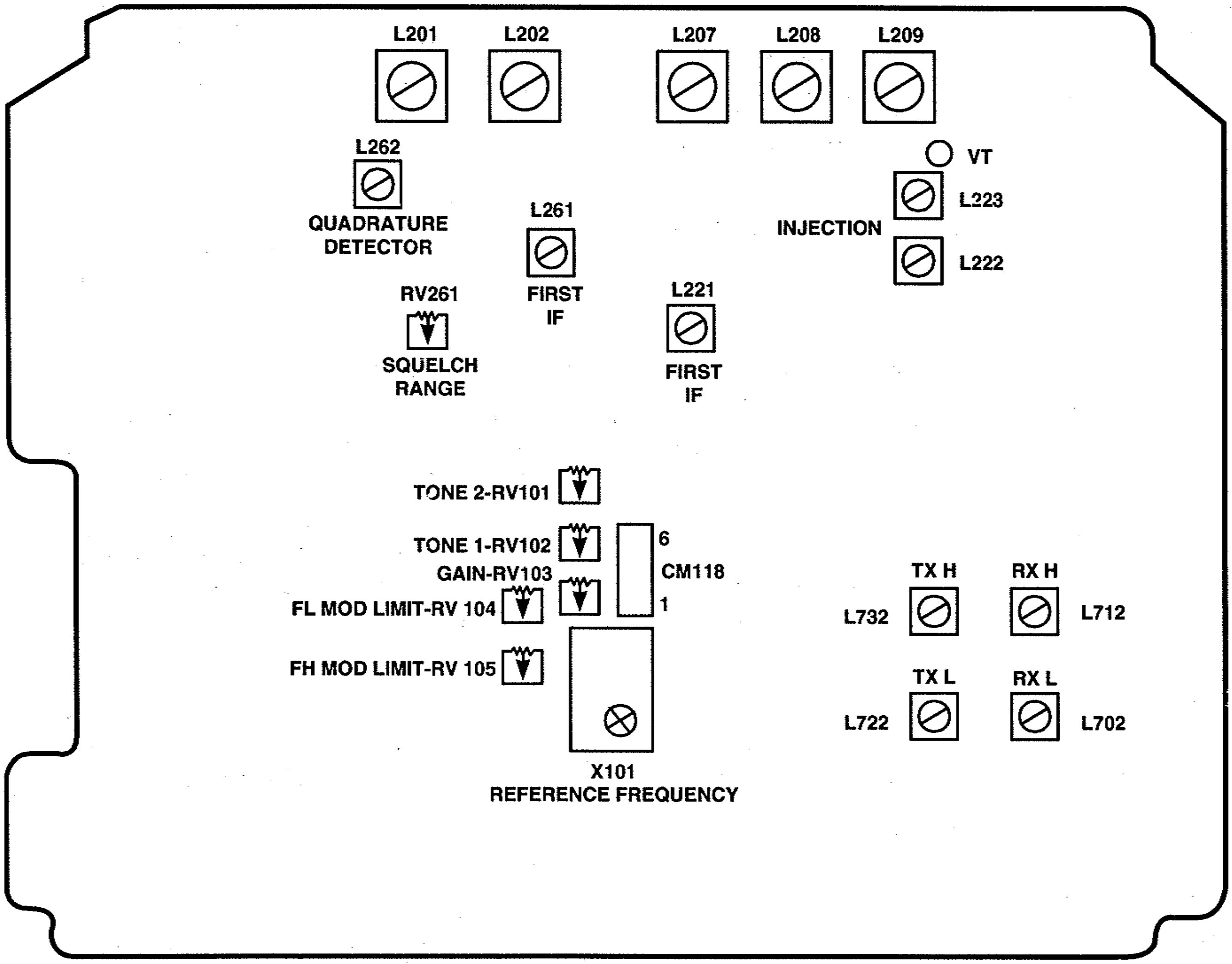


Figure 2 - 1 — Adjustment Map, RF Board

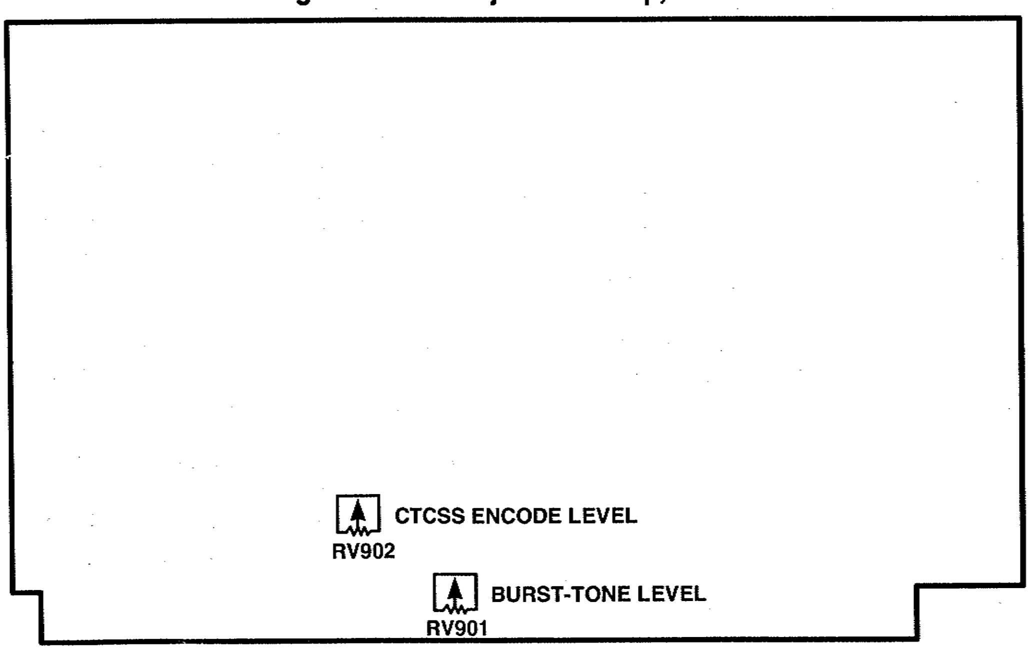


Figure 2 - 2 — Adjustment Map, Logic Board

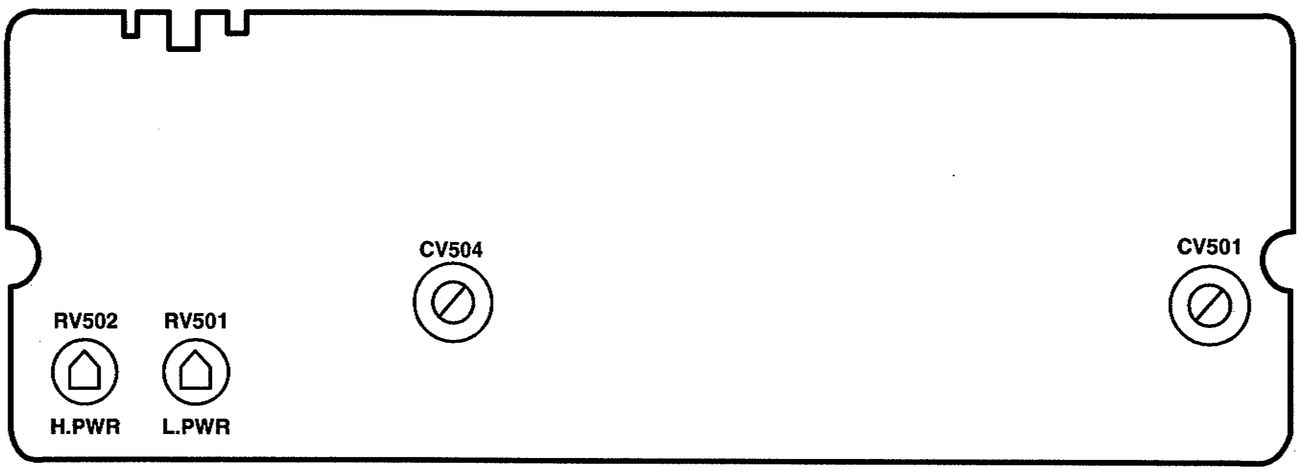


Figure 2 - 3 — Adjustment Map, 40 W PA Module

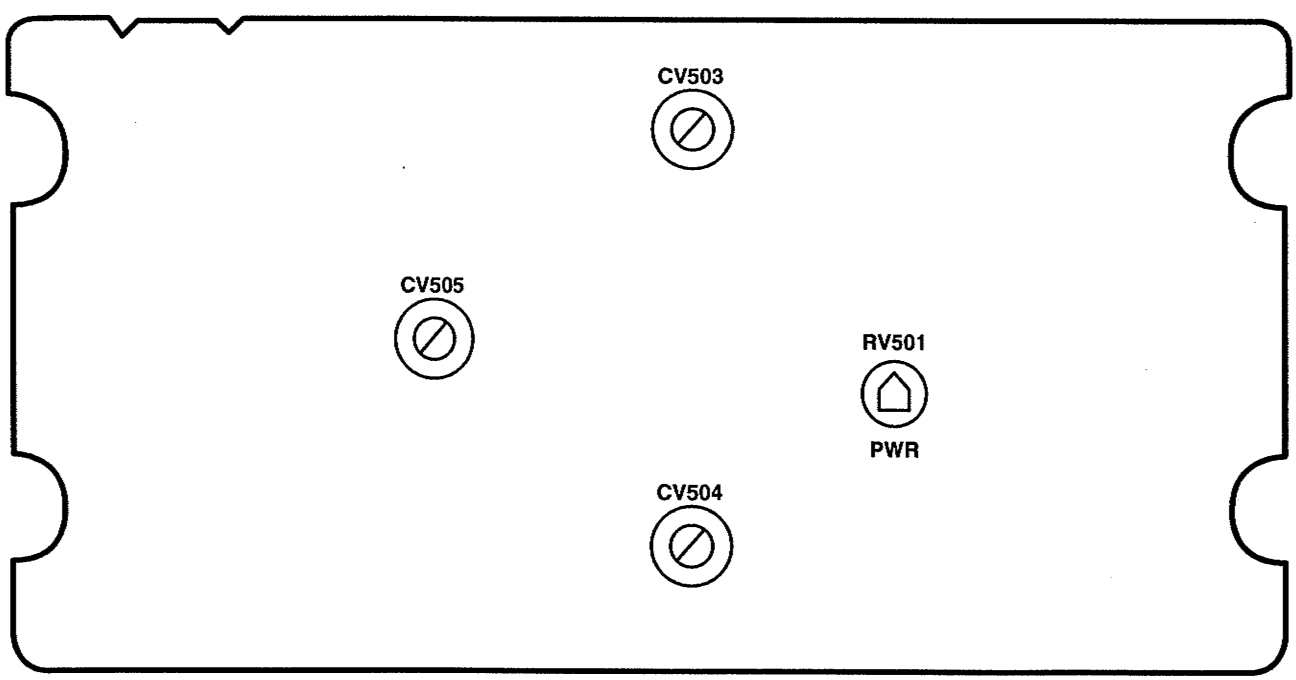


Figure 2 - 4 — Adjustment Map, 110 W PA Module

NOTES

SECTION 3

SERVICING

3

NOTES

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; they have 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" 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 equivalent 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 - 1**. 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.

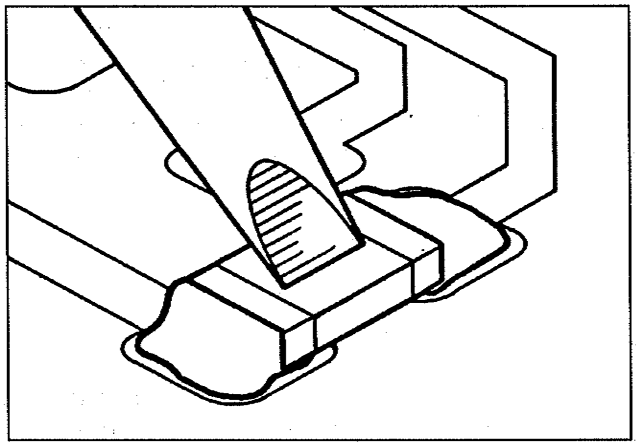


Figure 3 - 1

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 - 2.**

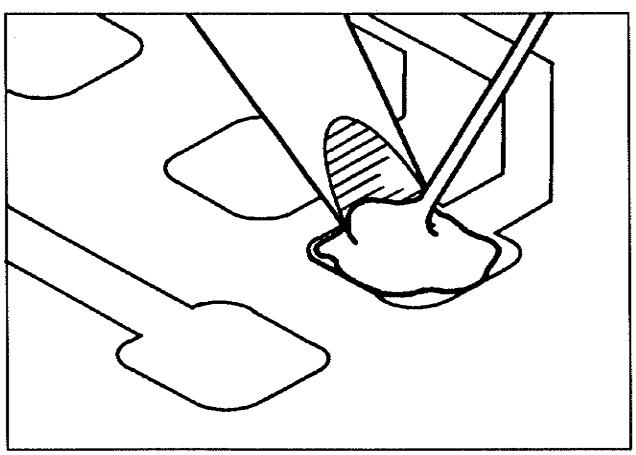


Figure 3 - 2

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 - 3.**

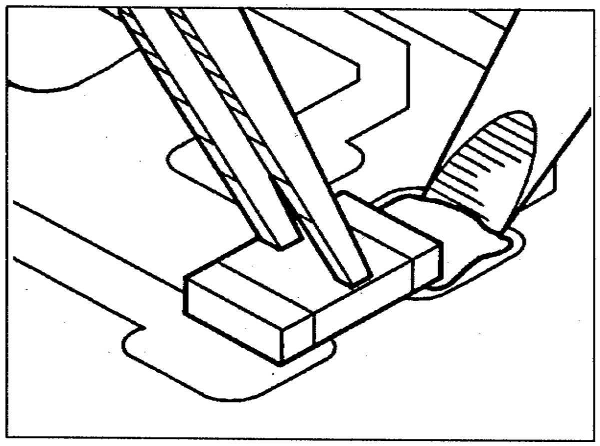


Figure 3 - 3

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 - 4** — 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 - 5.**

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.

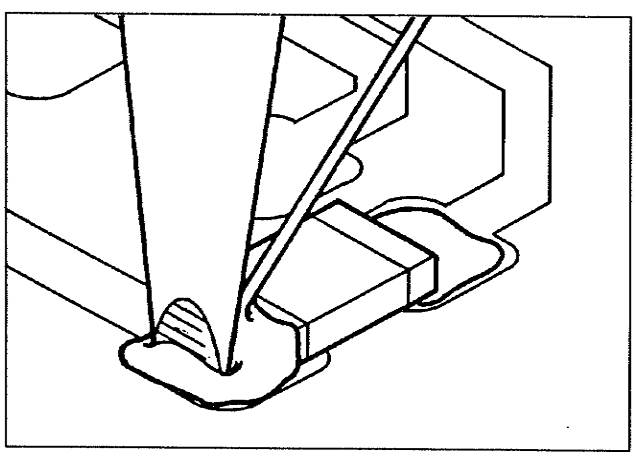


Figure 3 - 4

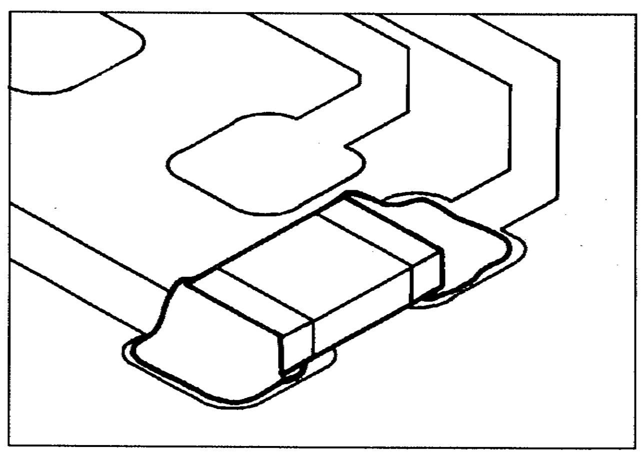


Figure 3 - 5

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.

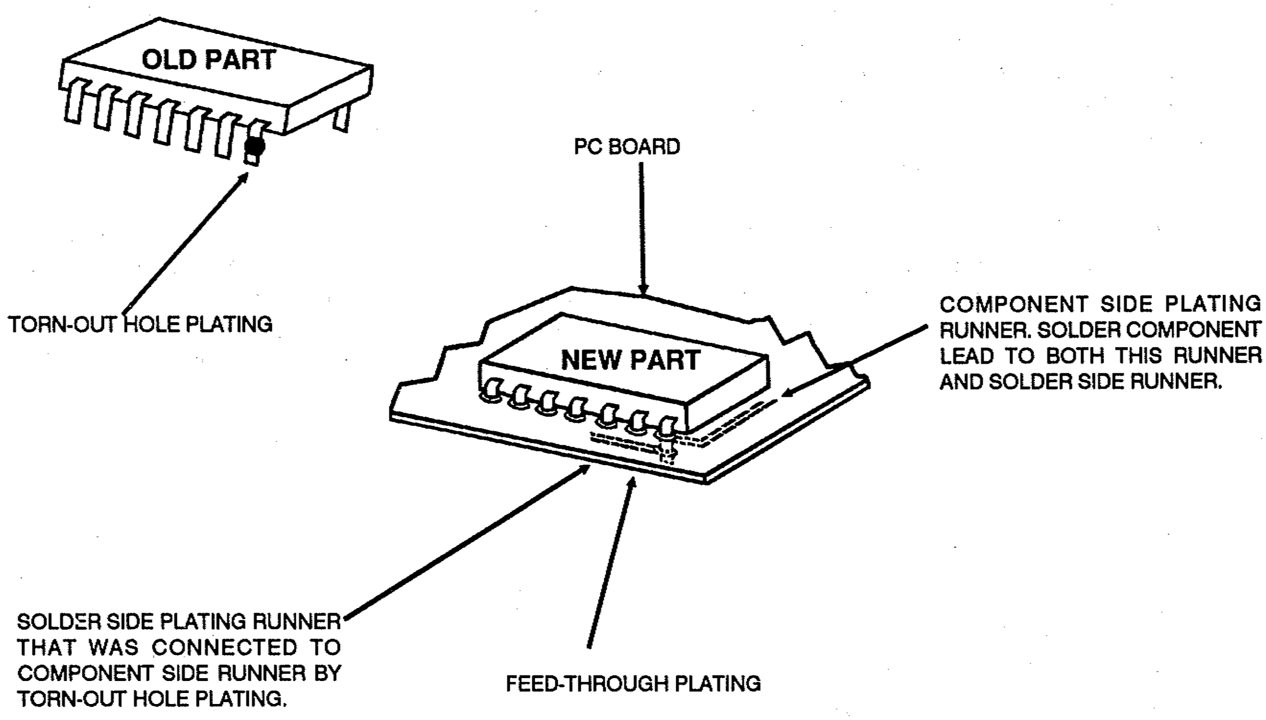


Figure 3 - 6

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 - 7**.

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 - 8**). If the electrical 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.

3

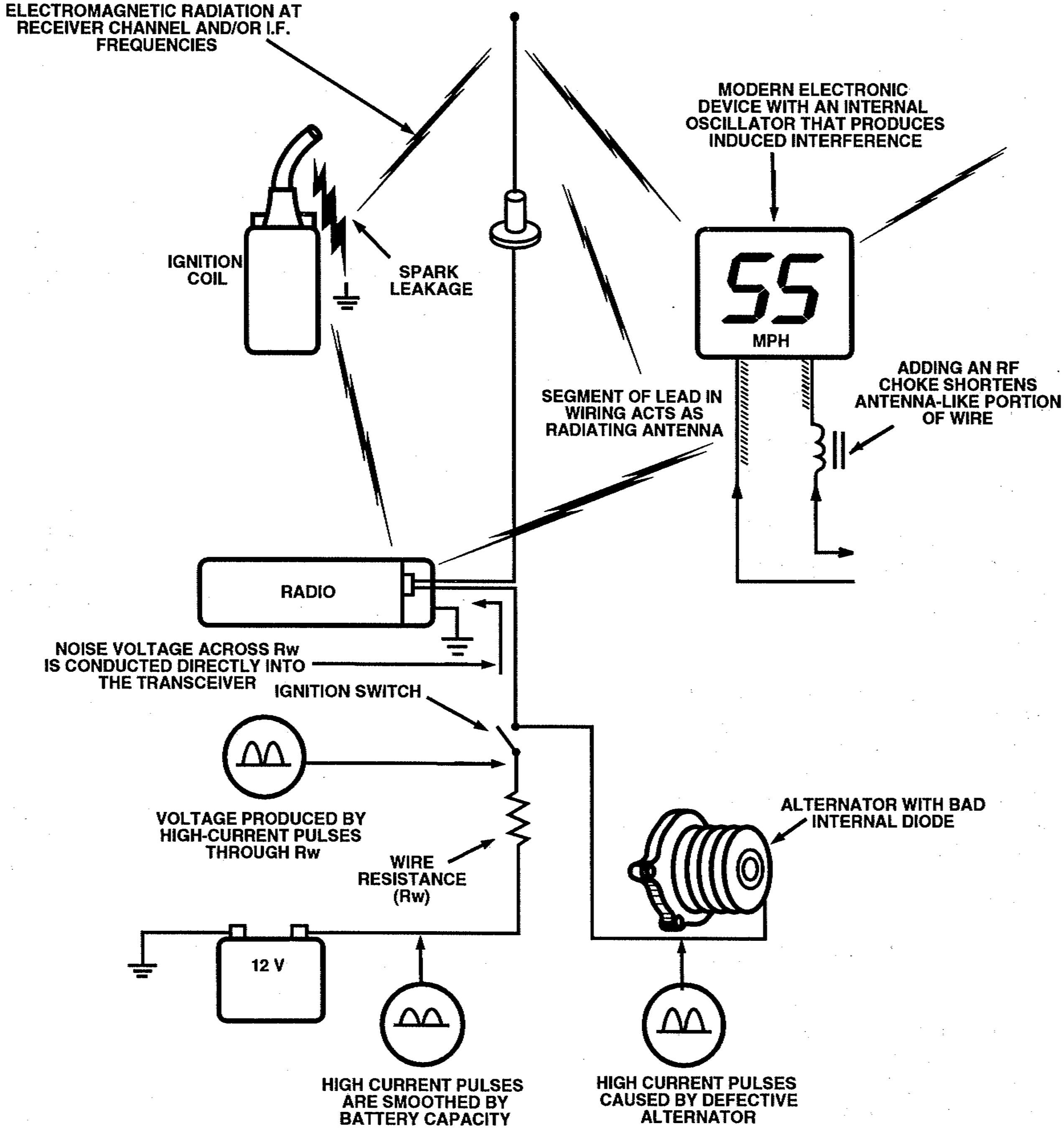


Figure 3 - 7 — Interference Paths

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 substituting 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

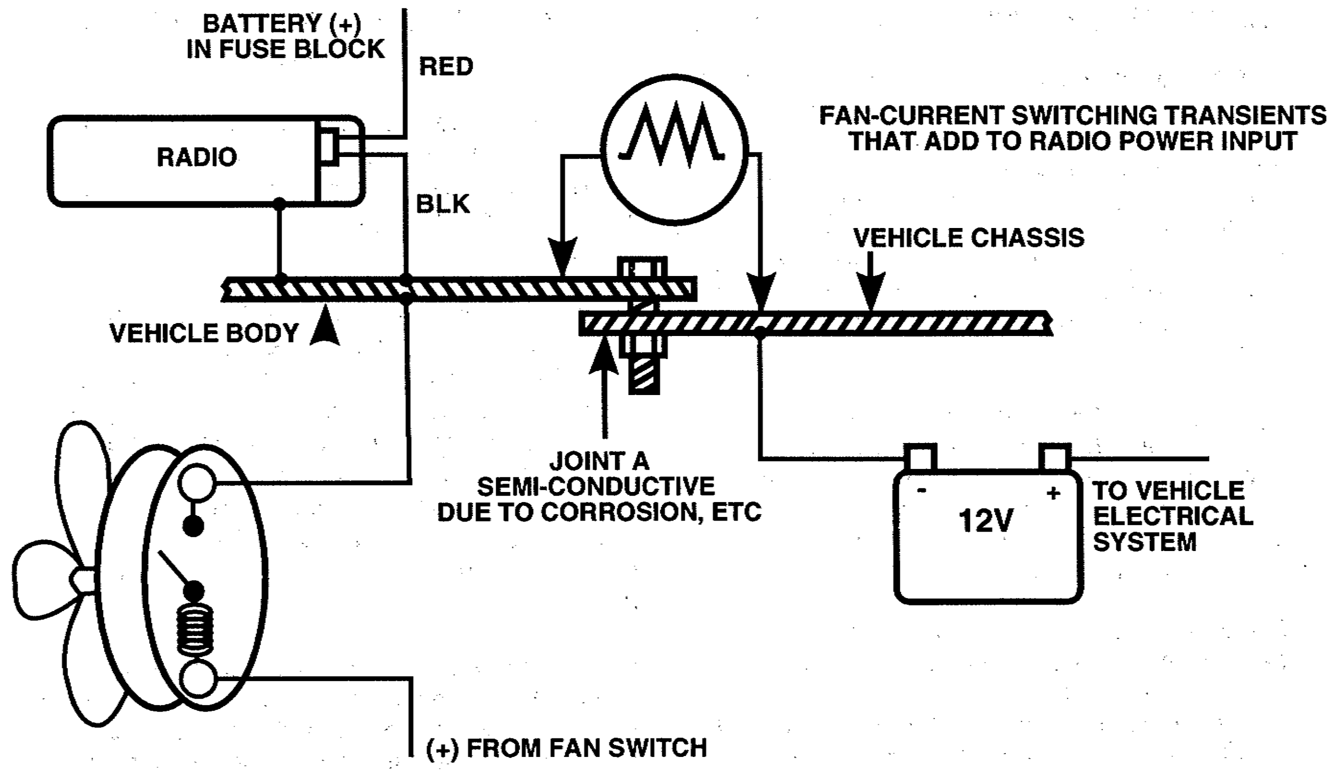
Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna. Therefore, the problem must be resolved at the source.

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.

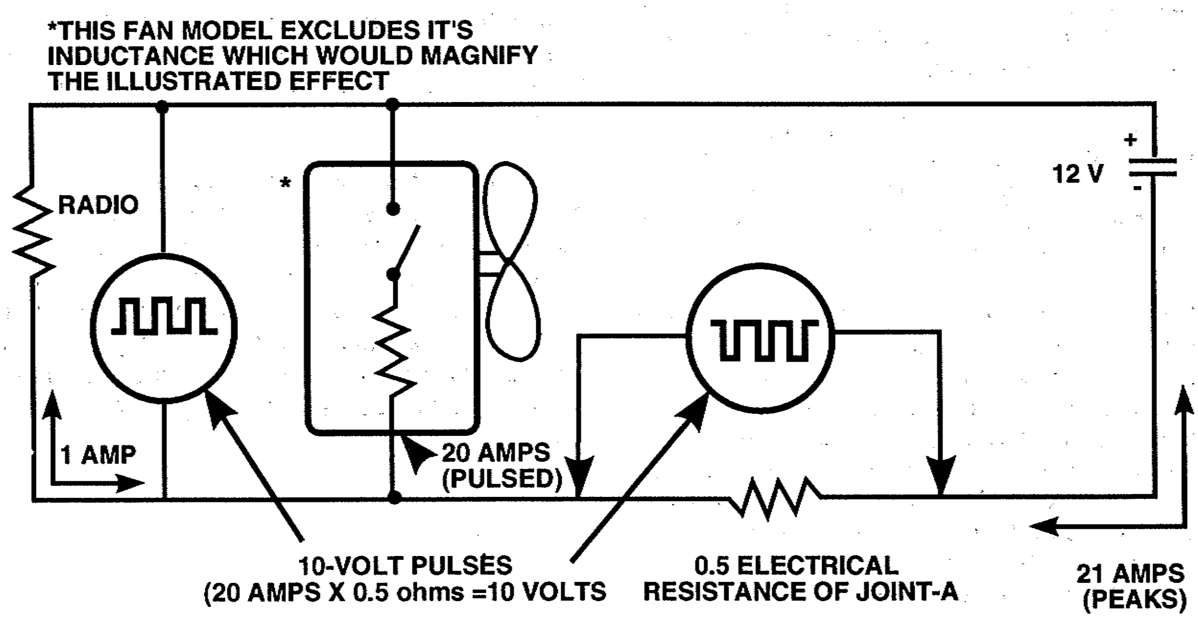
If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

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 - 8 — A Noisy Ground

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. Follow the numbers shown to sequentially tighten four of the six screws only a little each time, until all four screws are secure; then, tighten the last two.

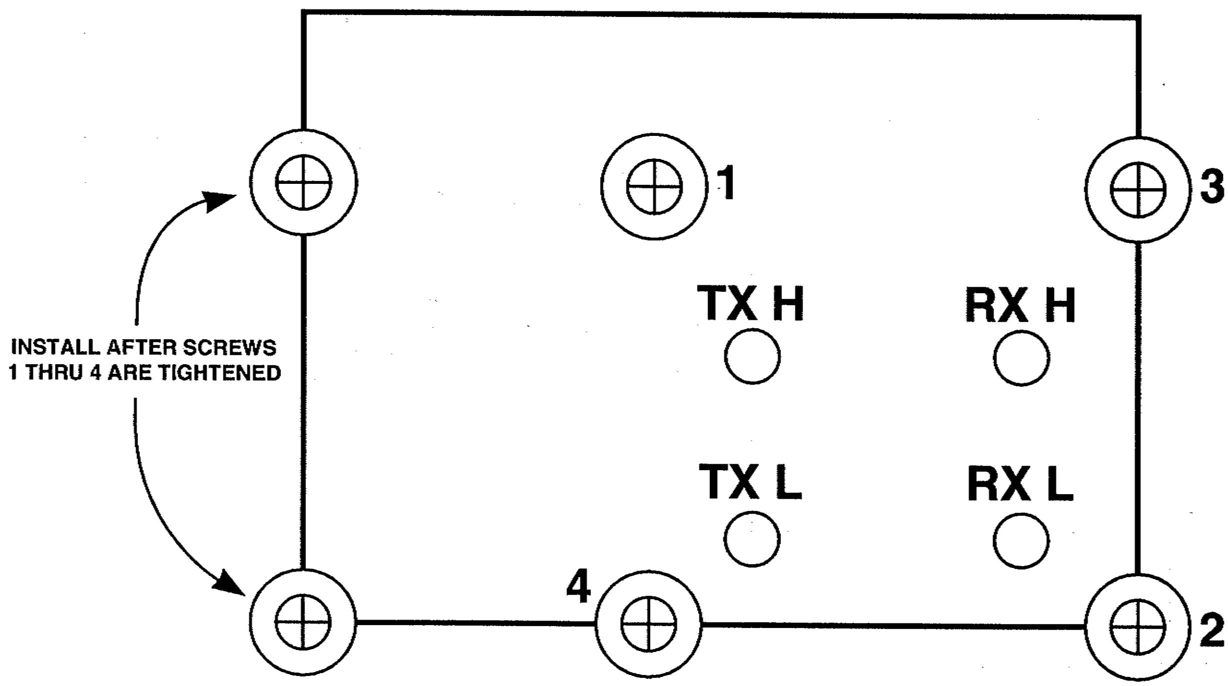


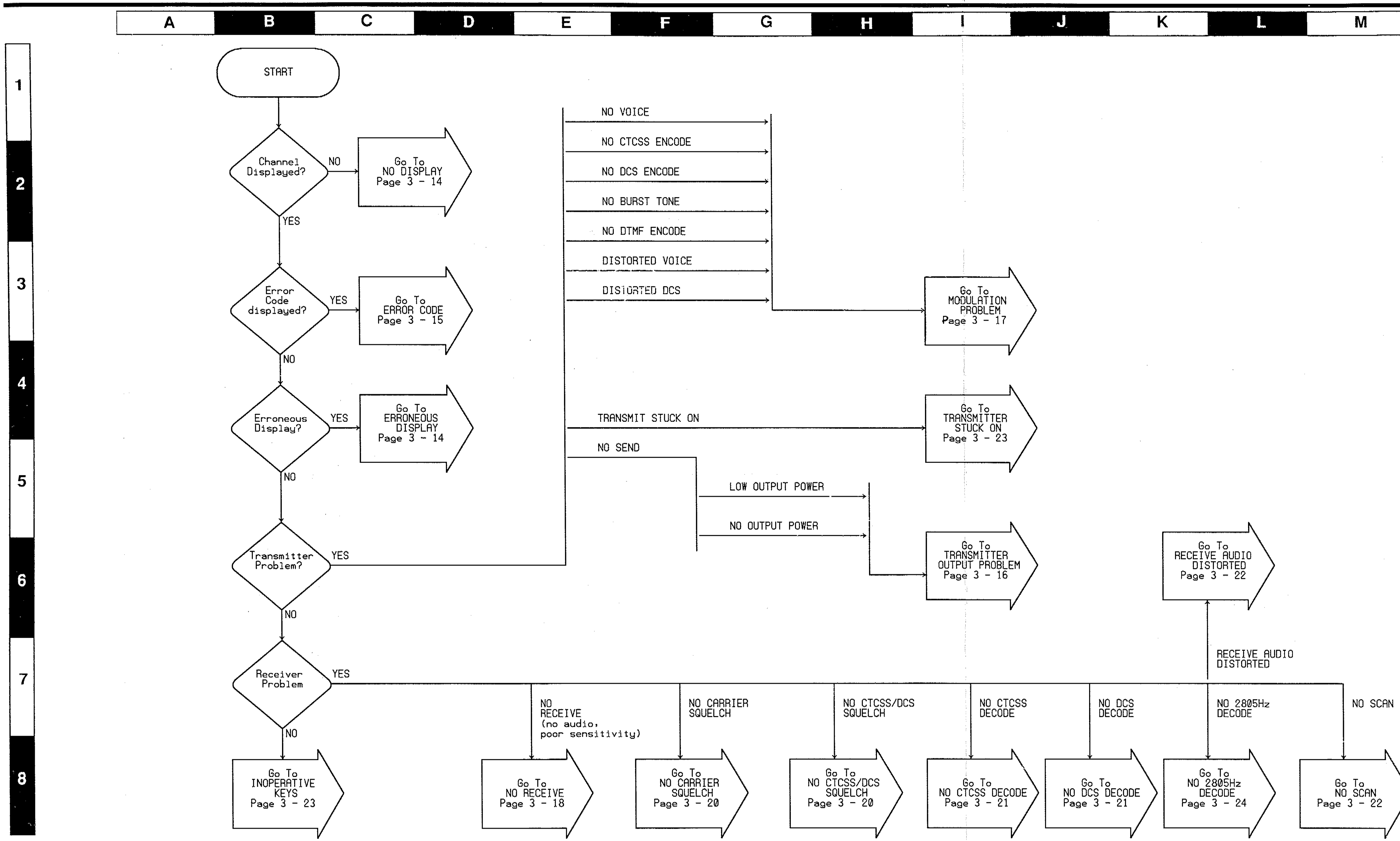
Figure 3 - 9 — Screw Tightening Pattern

METERING

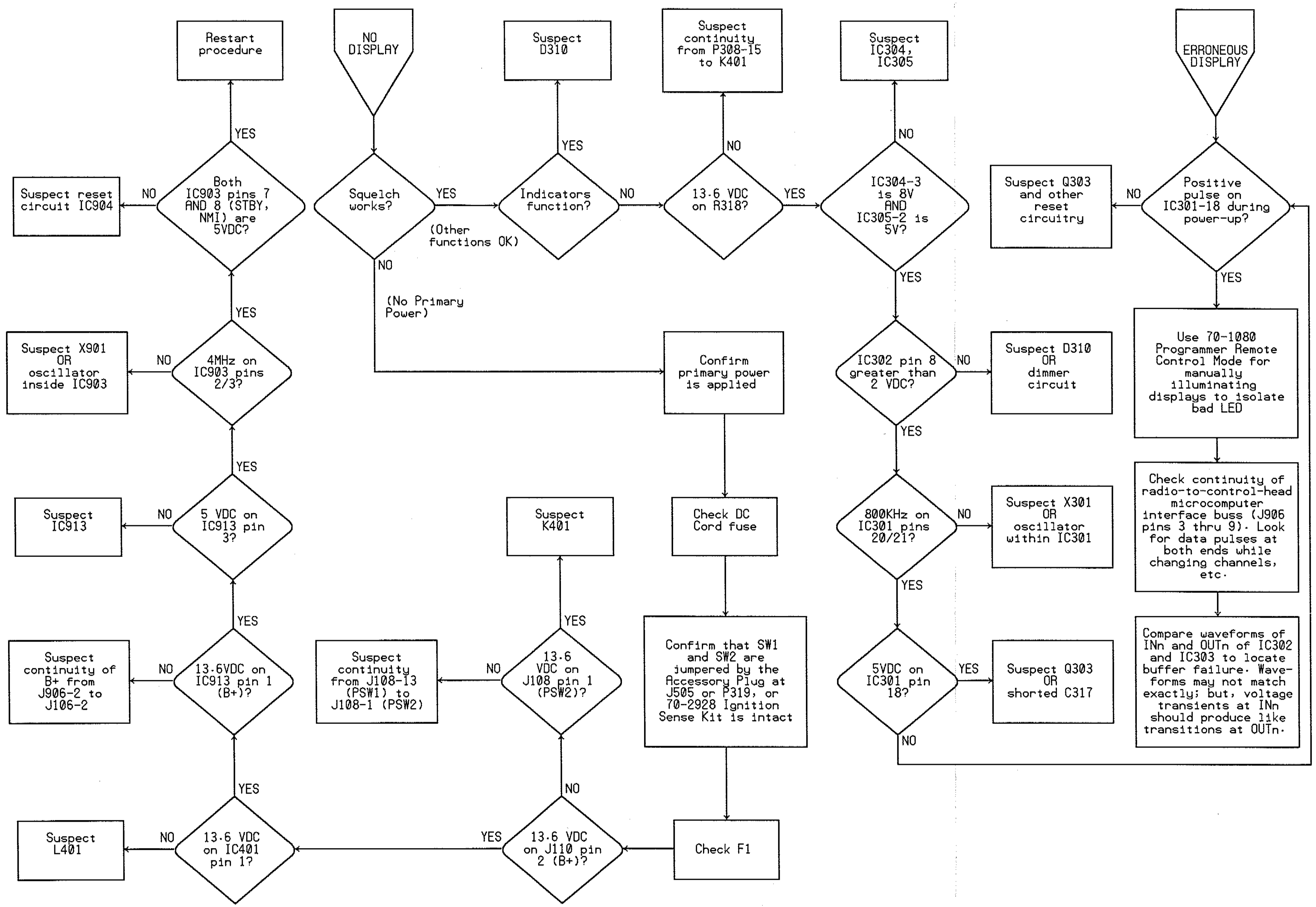
The 70-3400 and the 70-3800 TX/RX Units contain a single block of metering pins for measurement of certain signals. This block, CM118, is a 6-pin, ribbon-plug receptacle. It is located on the RF Board next to the VCO cover and the synthesizer reference oscillator. Refer to **Table 3 - 1.**

PIN	NAME	MEASUREMENT
1	Ground	
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.
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. 5 and 8. 0 V DC when the loop is in lock, and varies with selected-channel frequency.
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.
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.
6	Not used	

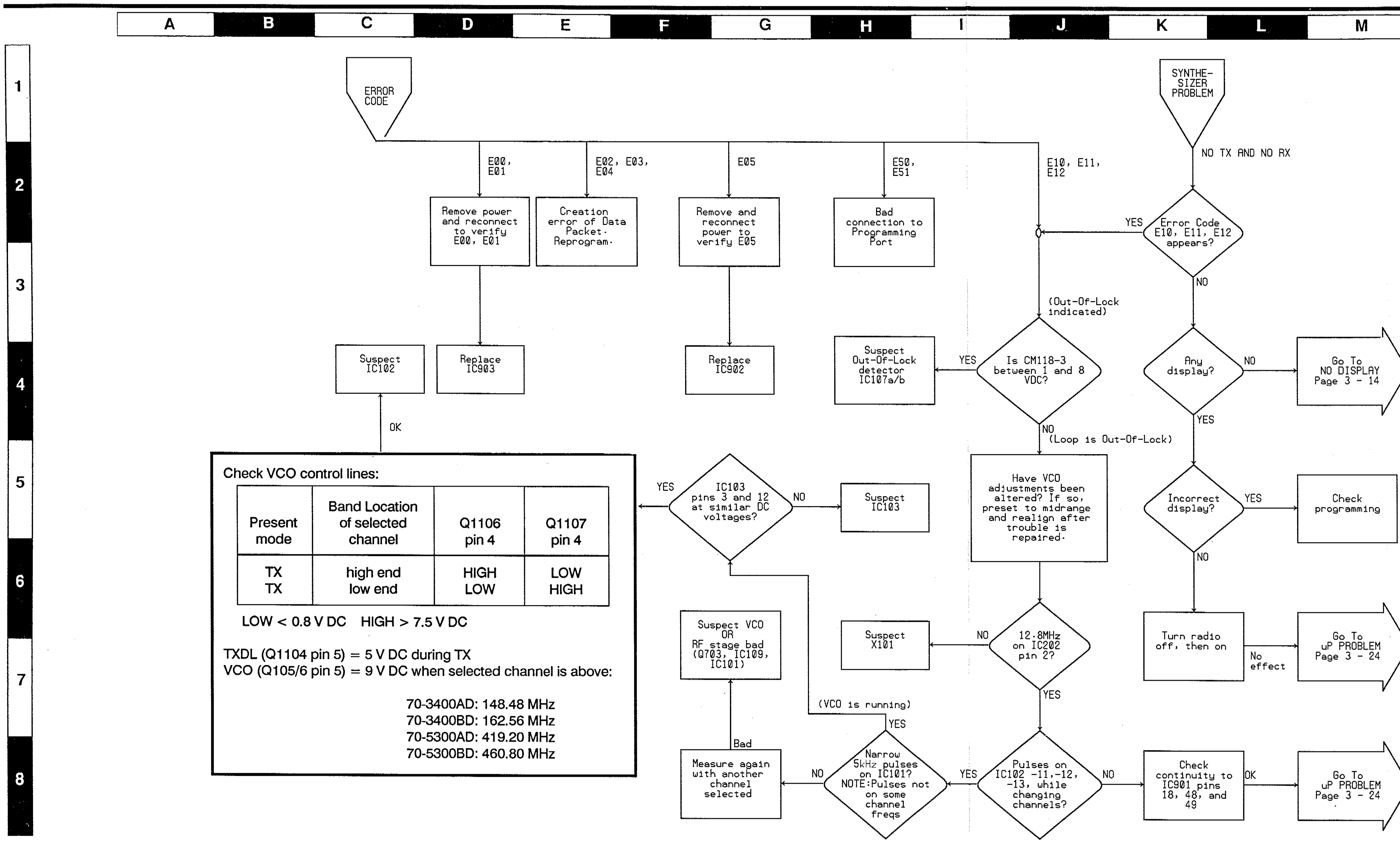
NOTE: Minimum voltmeter input impedance: 20,000 Ω



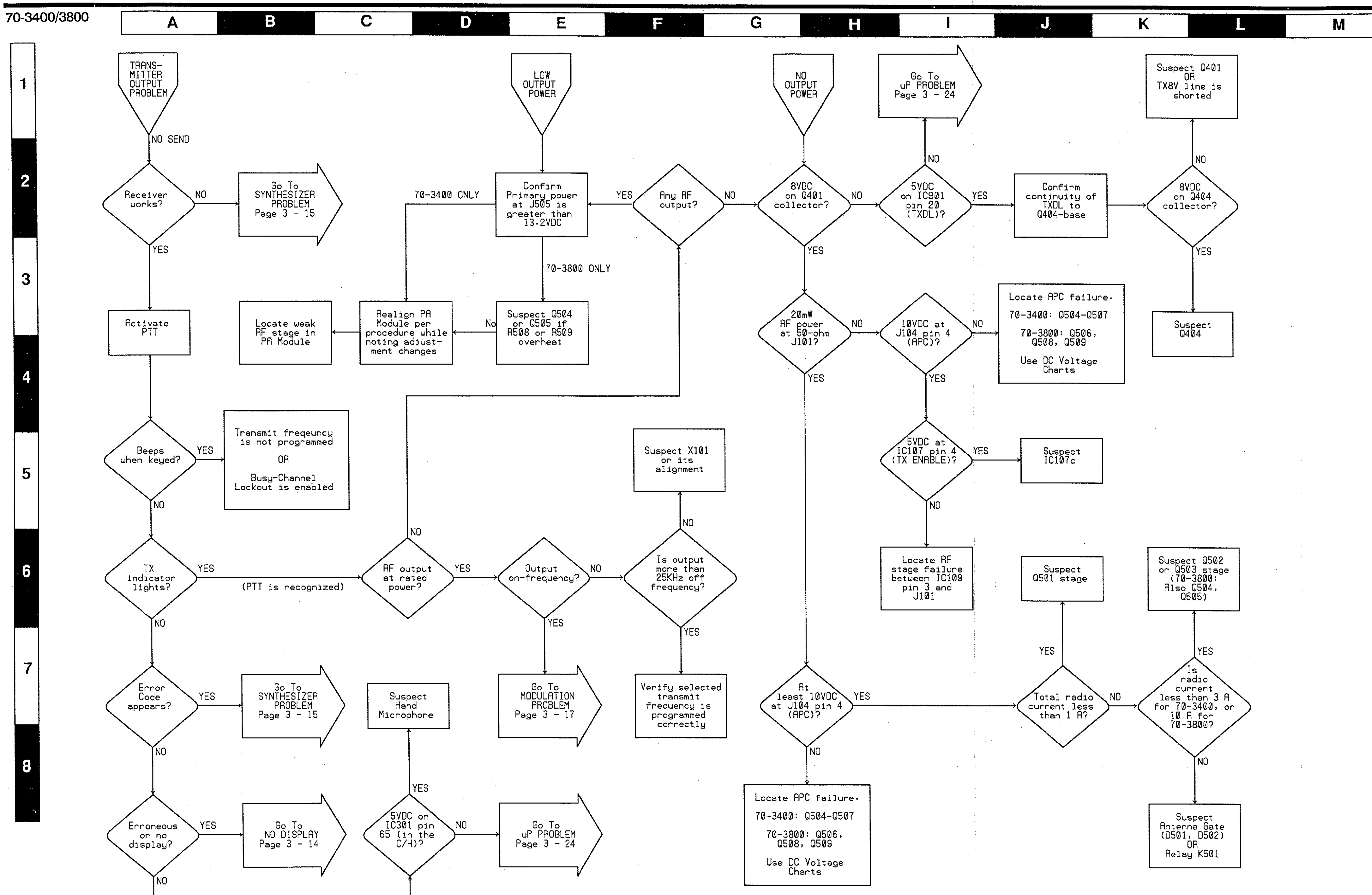
Troubleshooting Chart 3 - 1 — Getting Started



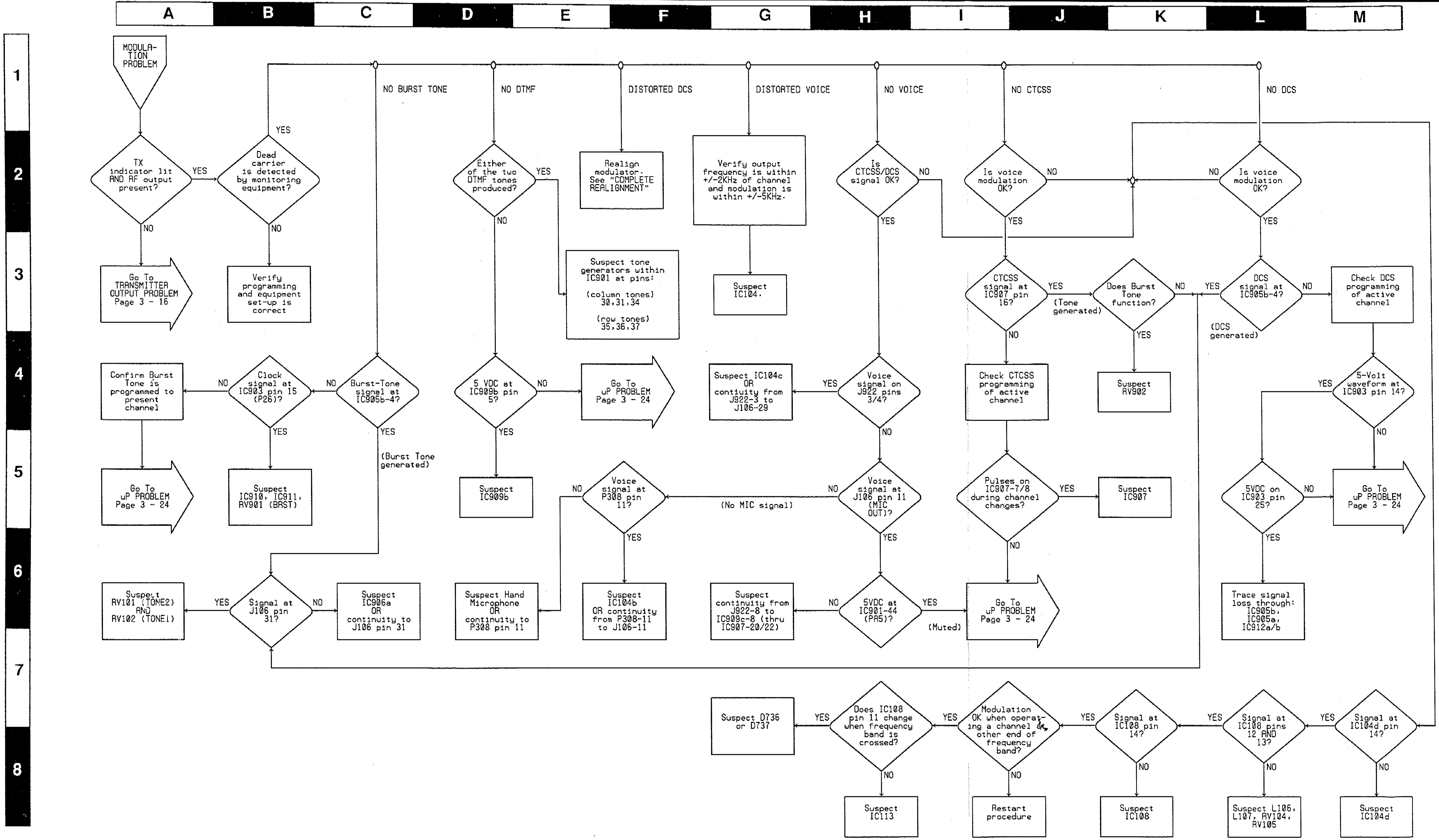
Troubleshooting Chart 3 - 2 — Display Problem



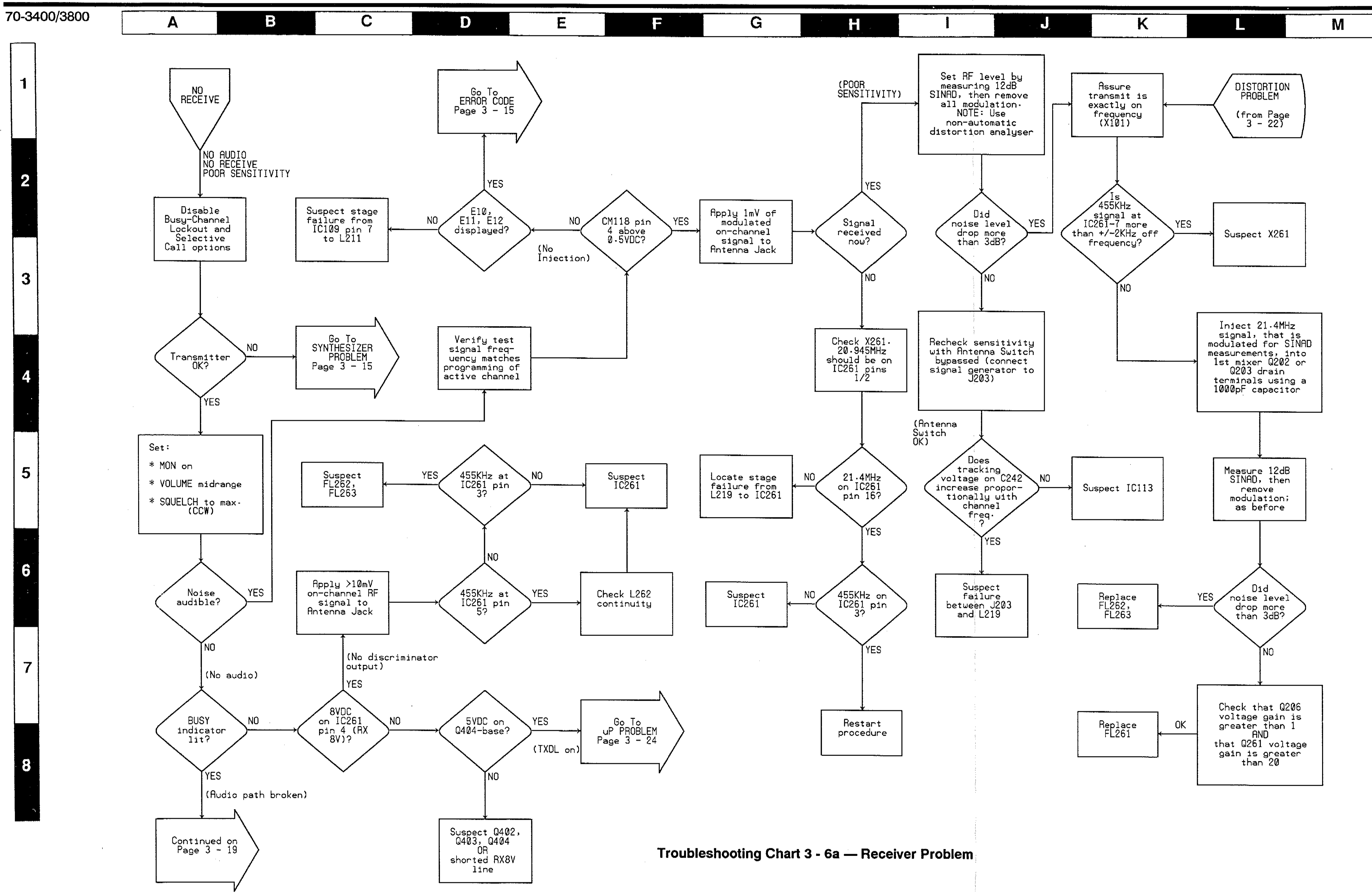
Troubleshooting Chart 3 - 3 — Error Code/Synthesizer Problem



Troubleshooting Chart 3 - 4 — Transmitter Problem



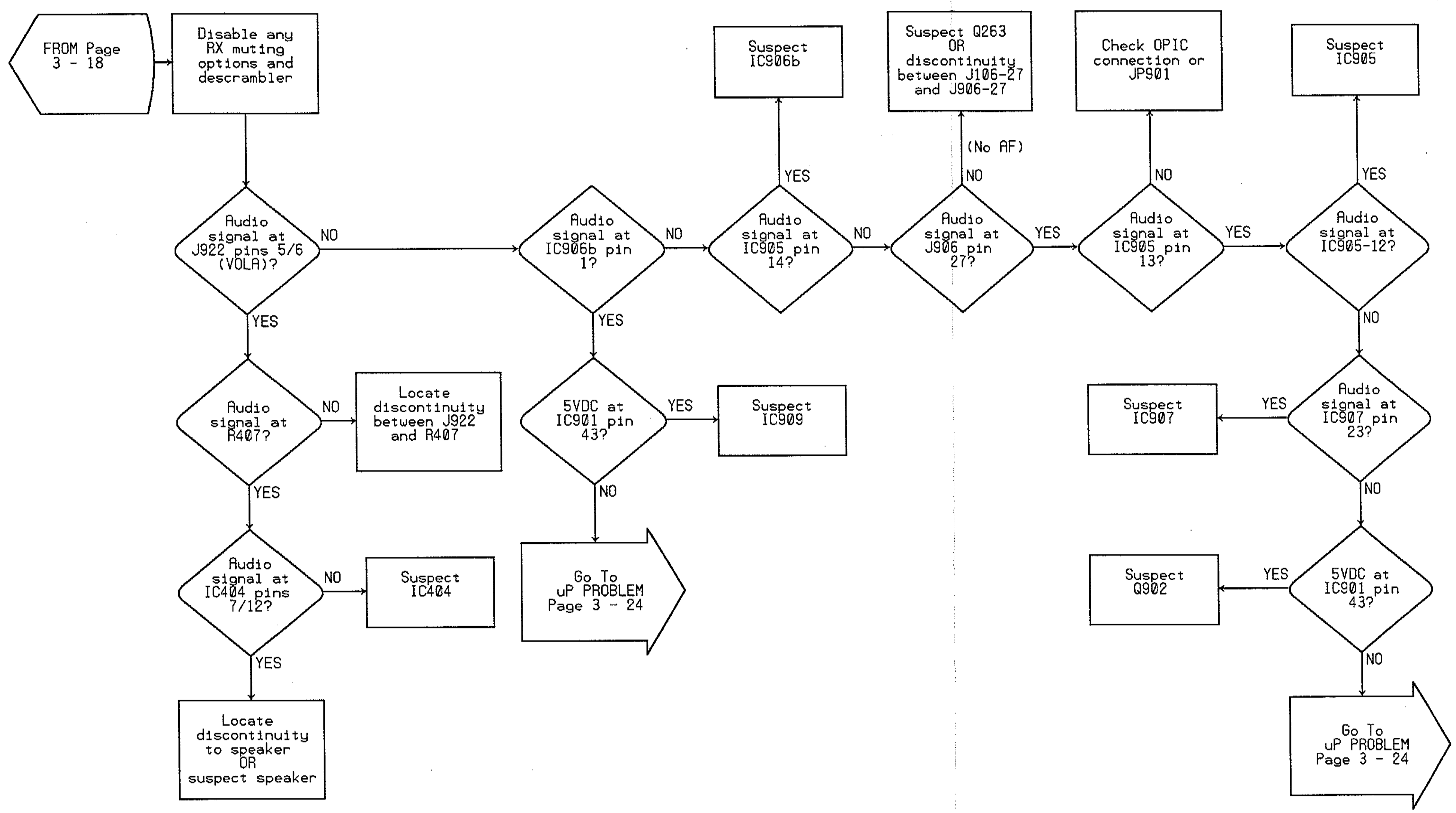
Troubleshooting Chart 3 - 5 — Modulation Problem



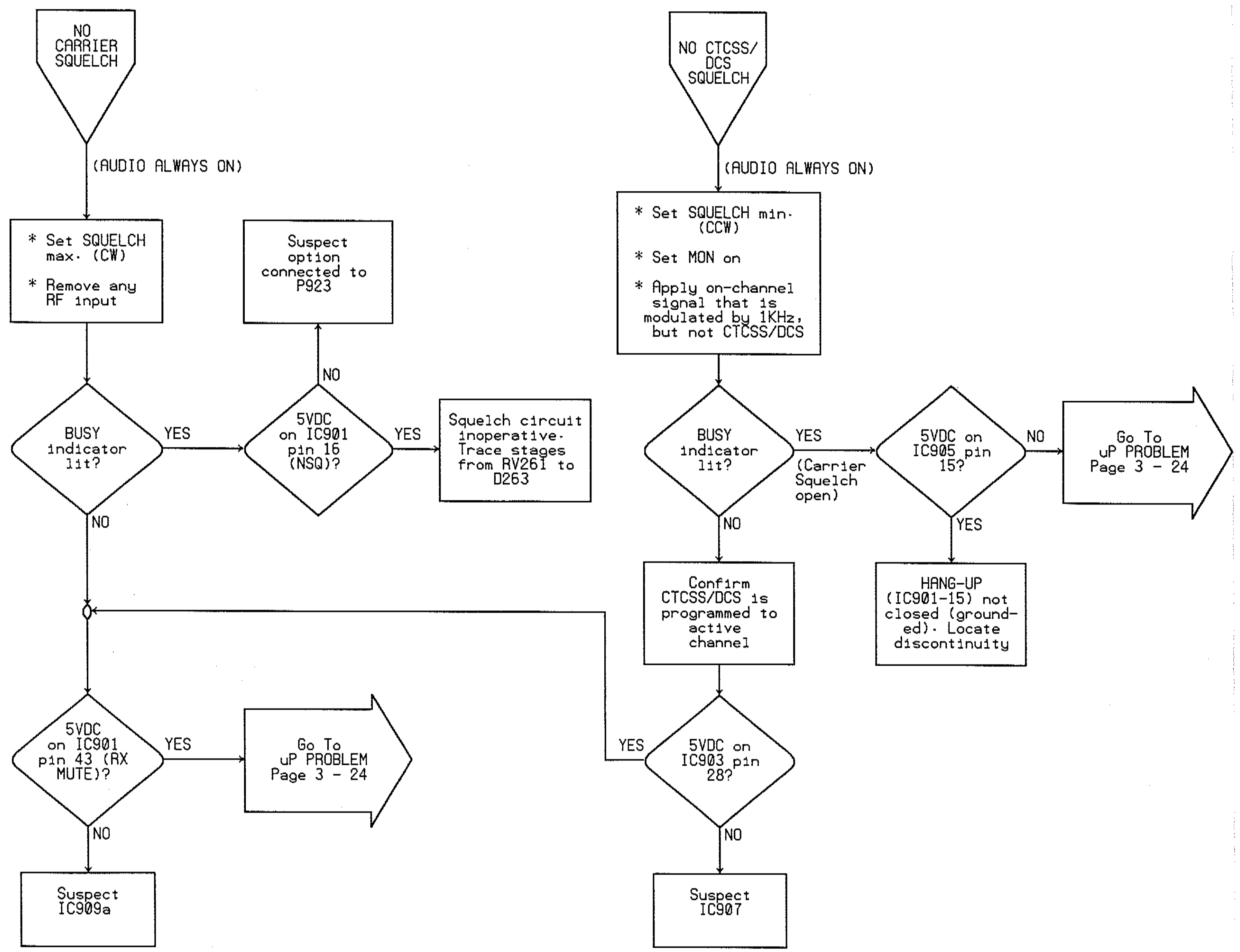
Troubleshooting Chart 3 - 6a — Receiver Problem

A B C D E F G H I J K L M

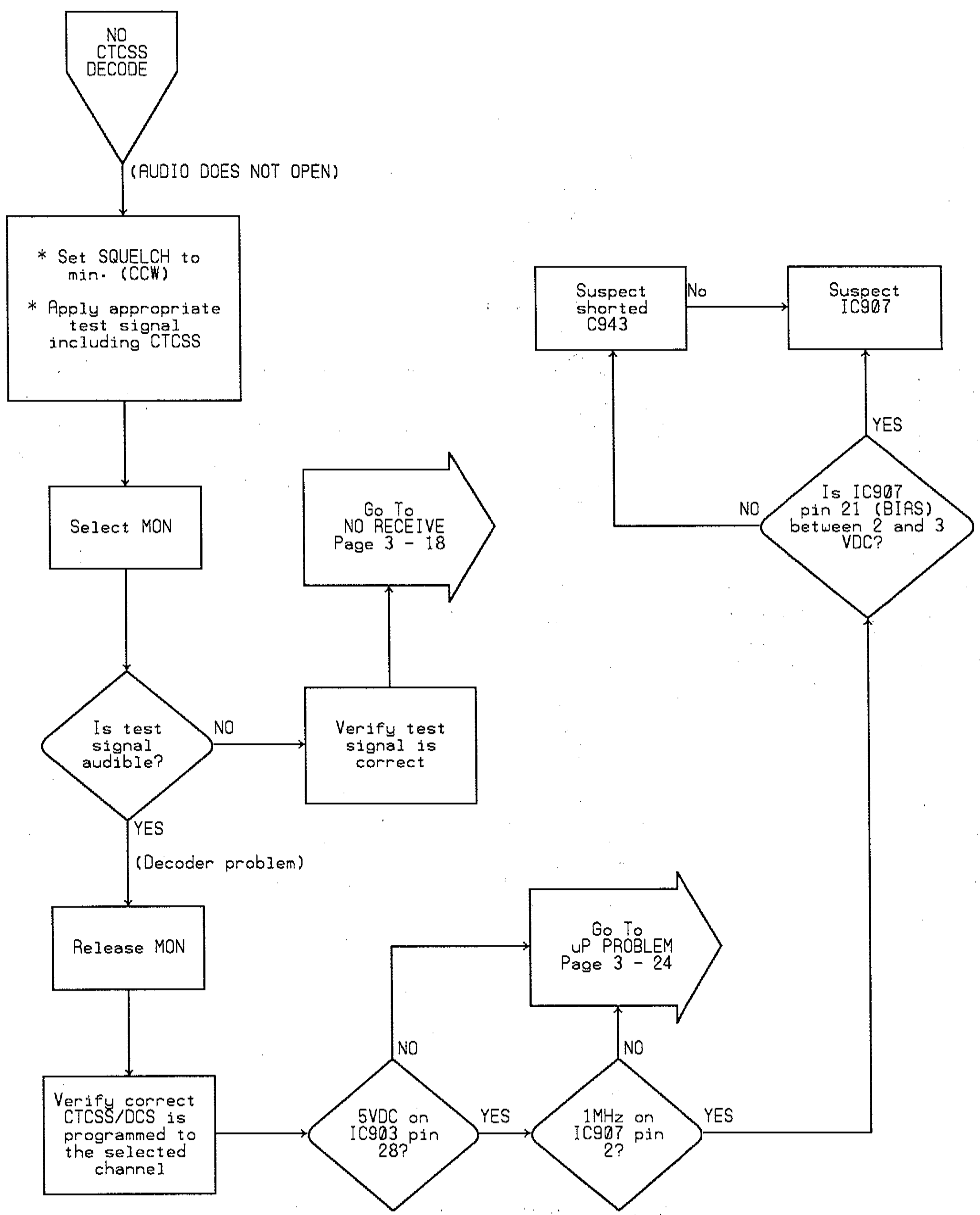
1 2 3 4 5 6 7 8



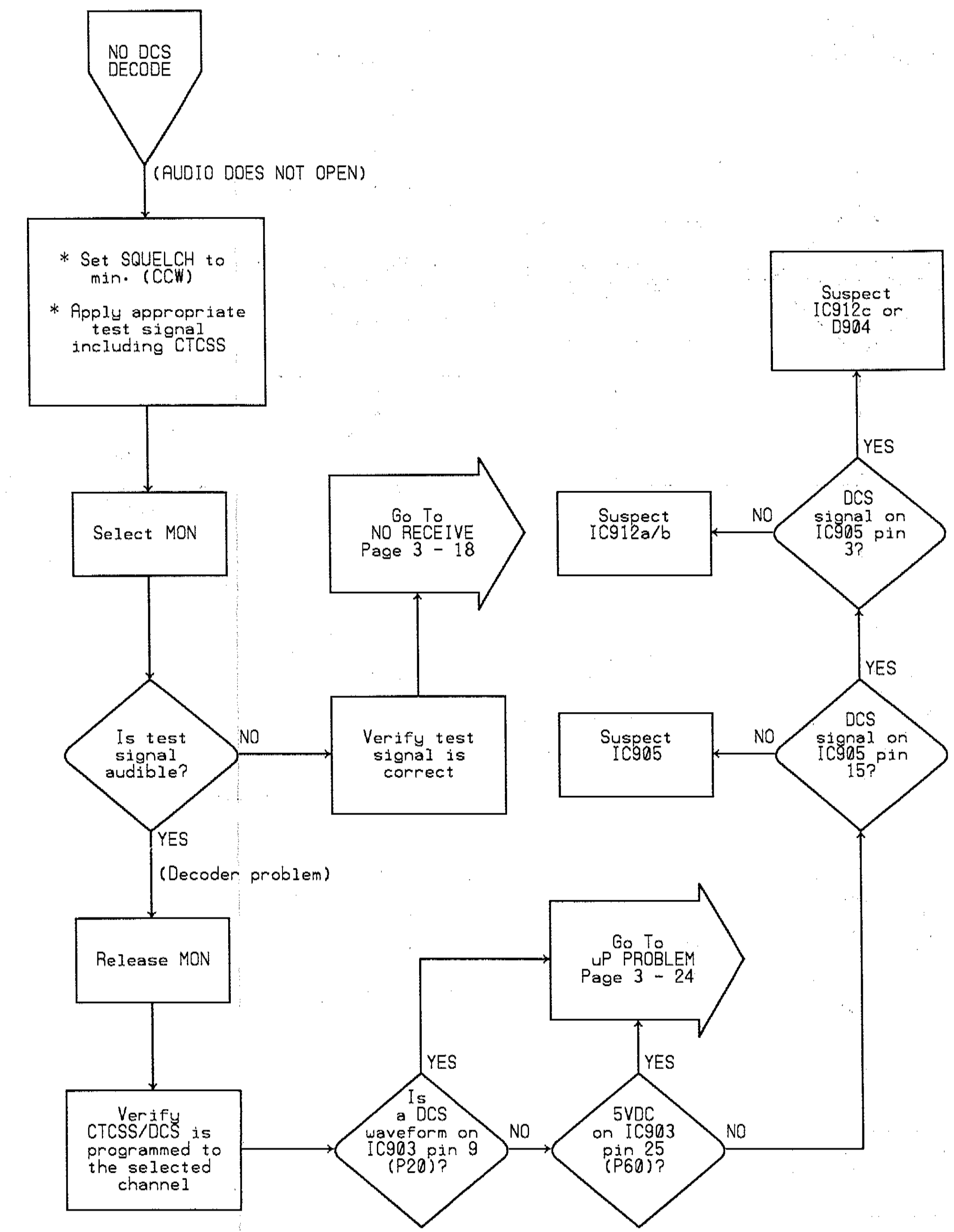
Troubleshooting Chart 3 - 6b — Receiver Problem (Continued)



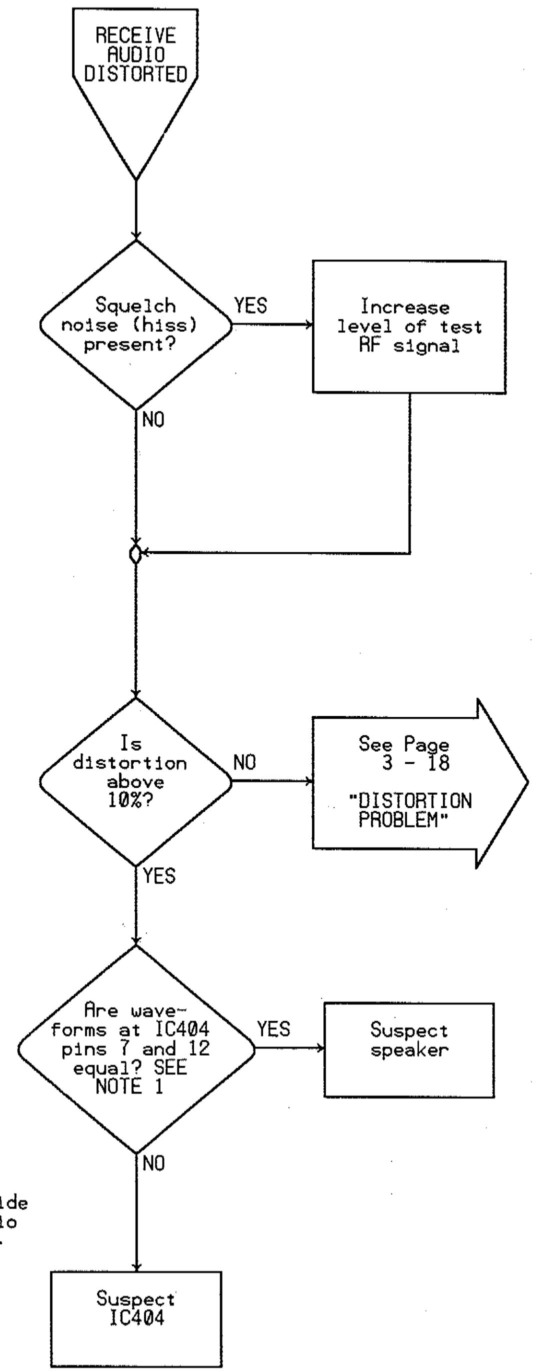
Troubleshooting Chart 3 - 7 — Squelch Problem



Troubleshooting Chart 3 - 8 — No CTCSS Decode



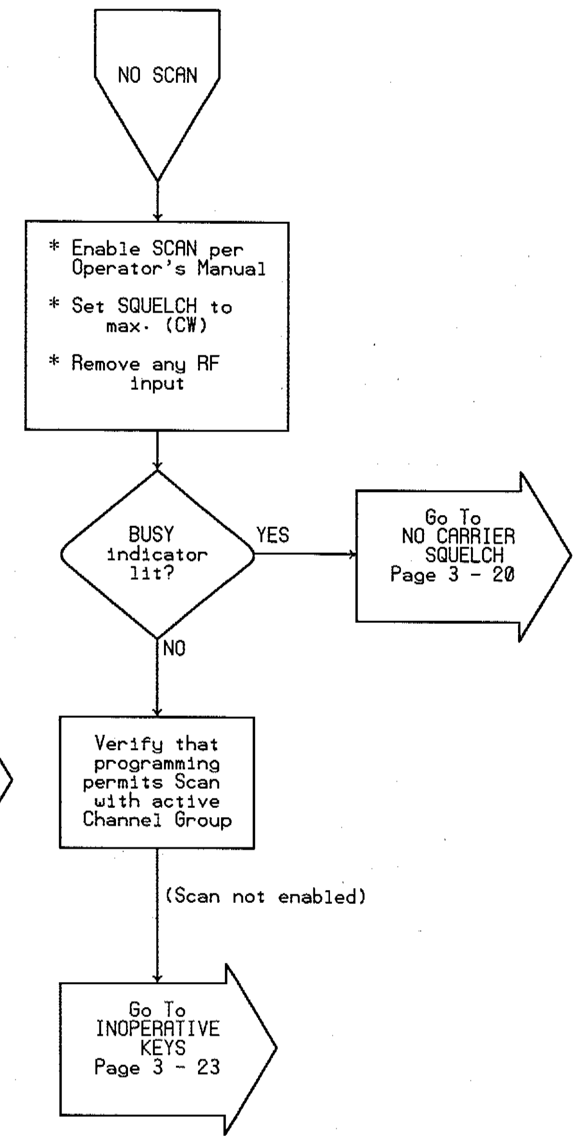
Troubleshooting Chart 3 - 9 — No DCS Decode

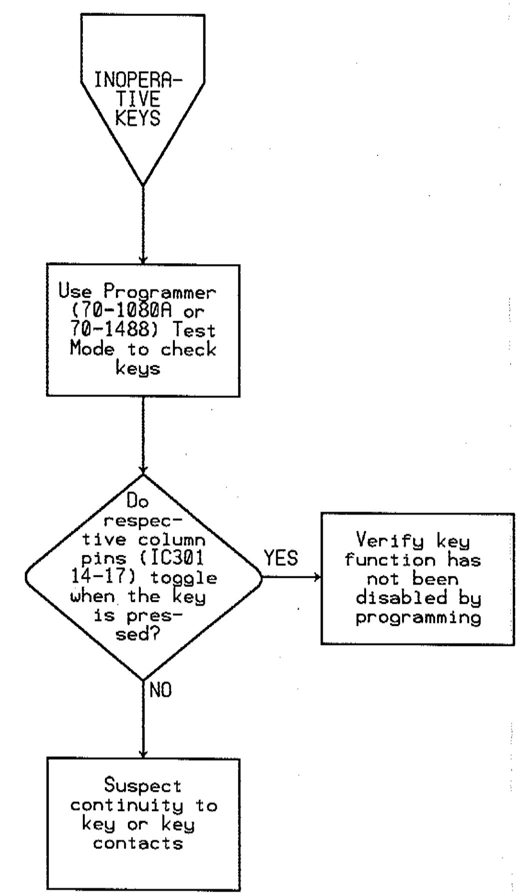


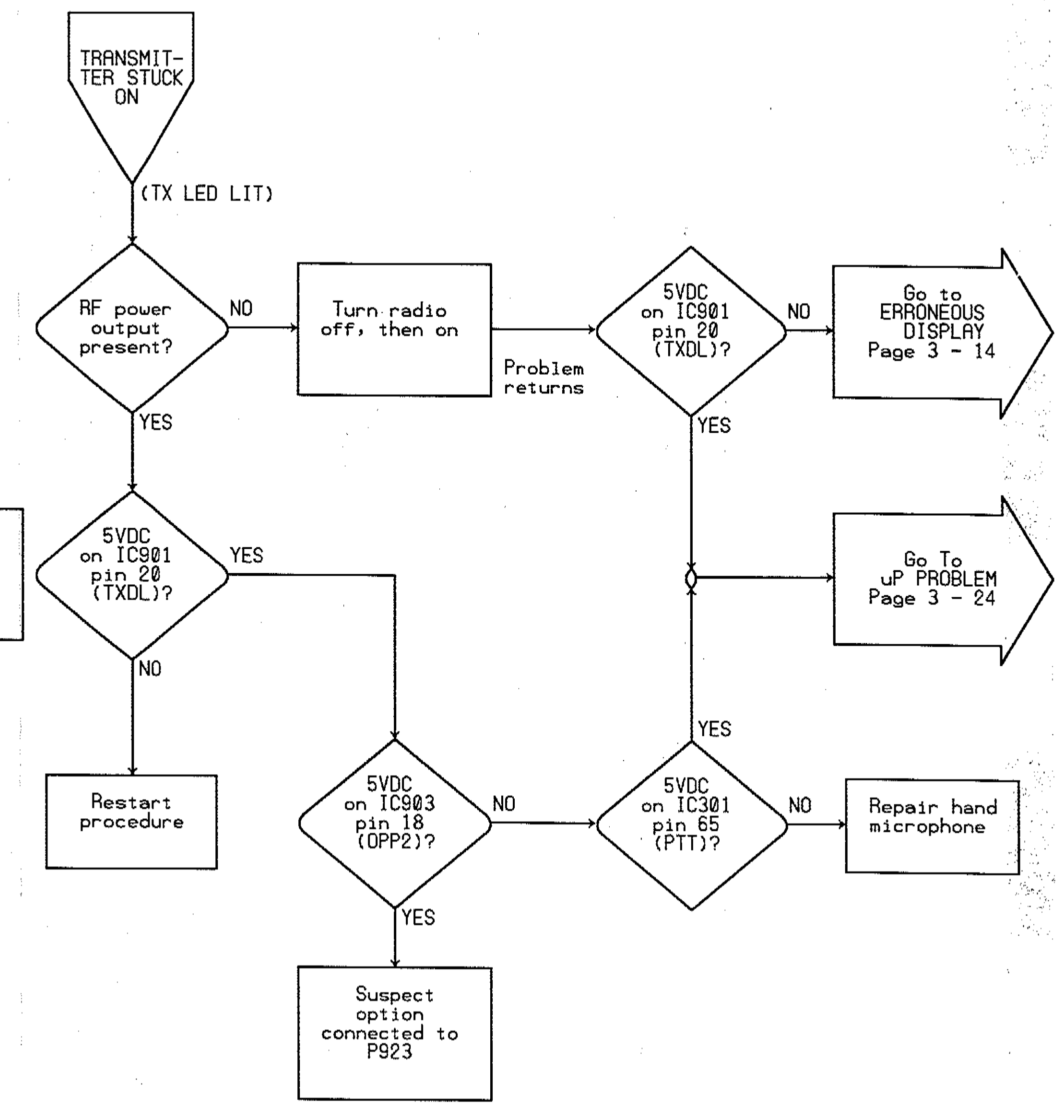
NOTE 1:

Measure each side of speaker audio against ground.

Troubleshooting Chart 3 - 10 — Receive Audio Distorted

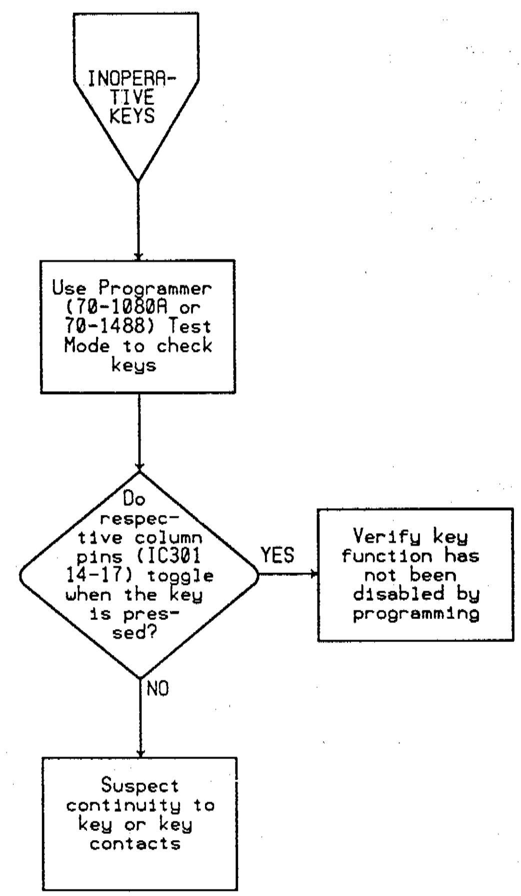




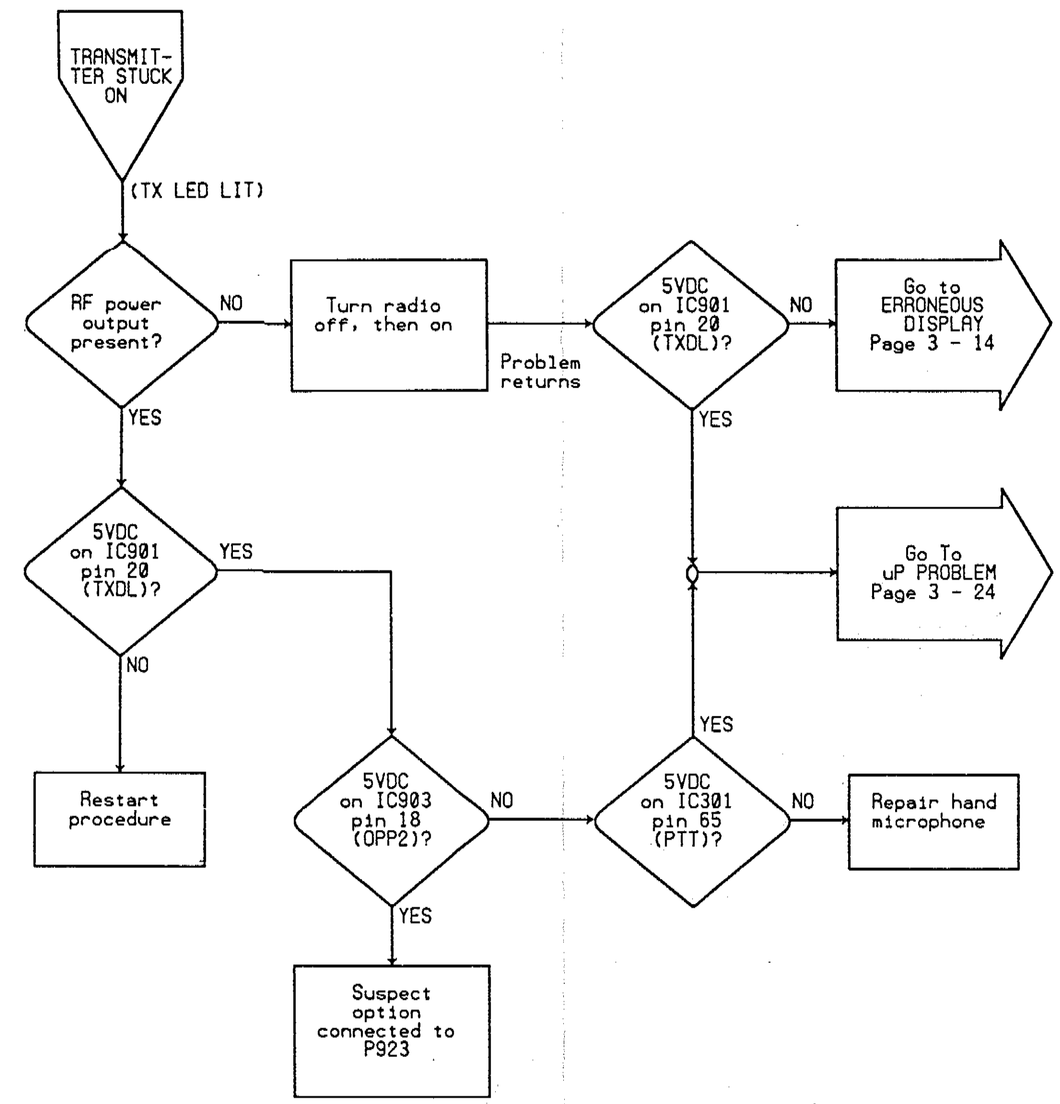


Troubleshooting Chart 3 - 11 — No Scan

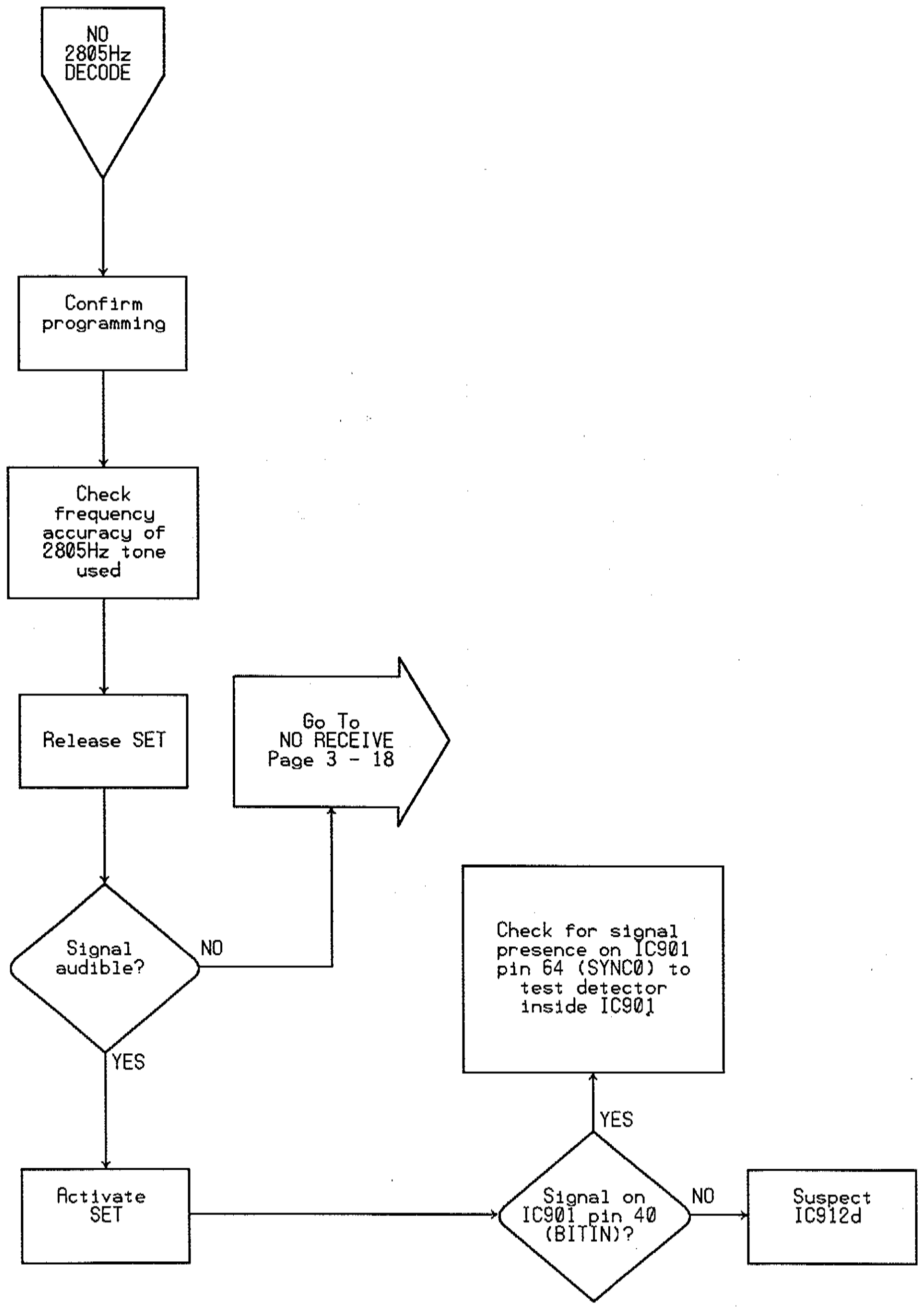
A	B	C	D	E	F	G	H	I	J	K	L	M



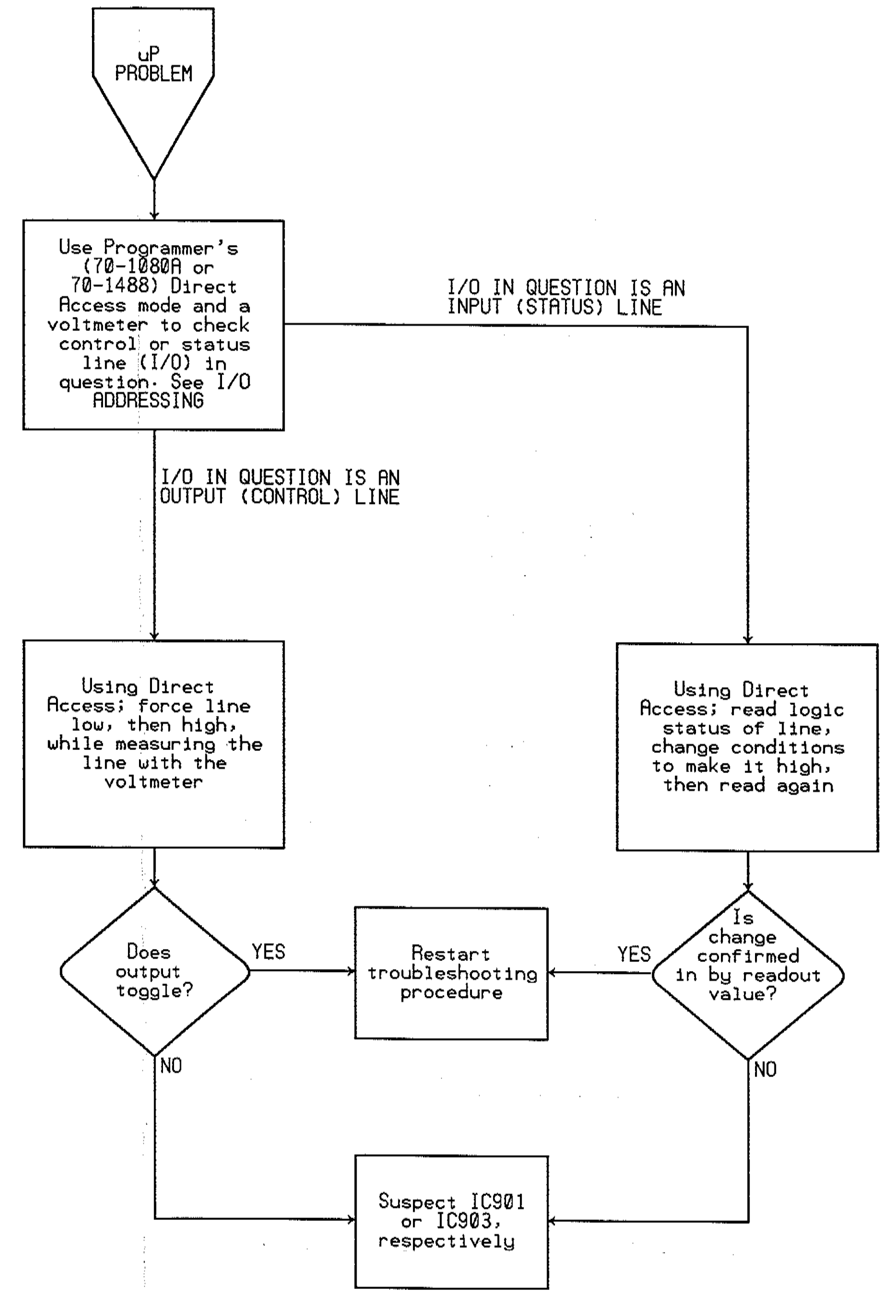
Troubleshooting Chart 3 - 12 — Inoperative Keys



Troubleshooting Chart 3 - 13 — Transmitter Stuck On



Troubleshooting Chart 3 - 14 — No 2805Hz Decode



Troubleshooting Chart 3 - 15 — Microprocessor Problem

I/O ADDRESSING

Please refer to the Troubleshooting Flow Charts, first. Due to the complications and confusions that can evolve when manipulating the microcomputer, only use I/O Addressing when troubleshooting process leads the failure to IC901 or IC903 ports.

Either the 70-1080A Programmer or 70-1488 PC Programming software is capable of manually controlling the microcomputer in the SYN-TECH II TX/RX Unit. This feature provides a valuable service tool; because, it is possible to verify microcomputer input/output port operation by bypassing microcomputer software and switching outputs 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 ones and zeros that represent electrical logic lows of nearly 0 V and logic highs of approximately 5 V, respectively. 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.

BYTE	1	0	0	1	1	1	0	0 = 9C
	x8	x4	x2	x1	x8	x4	x2	x1
	8 + 0 + 0 + 1				8 + 4 + 0 + 0			
	9				C			

DIRECT ACCESS

Either the 70-1080A Programmer or 70-1488 PC Programming software is needed to manipulate SYN-TECH II I/O ports and the Direct Access function of the Programmer Remote Control Mode is used. 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.

Refer to the appropriate 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 lose radio programming while using the Direct Access function, ALWAYS upload the radio Data Packet into the Programmers memory BEFORE initiating the Remote Control Mode.

To troubleshoot an input port, the port is addressed using Direct Access, and its data byte (in hexadecimal) is read 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, defective port circuitry is suspect. To troubleshoot an output port, the port is again addressed, then a byte is written to it. The value of the byte determines which control lines will be logic high. Again, voltmeter measurement locates a 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. Procedures herein detail specific I/O port access. Please follow these procedures to assure correct results.

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 capacitor 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.

- **IC901 — PORT A (PAx), Outputs Only**

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

2. If you wish to output a logic high from a specific Port-A line, find the corresponding byte in the HIGH column of **Table 3 - 1**, 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 corresponding byte in the LOW column to enter. The bytes in the chart are designed to switch the selected line, only; 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 - 1 — IC901 Port A

PAx BIT	IC901 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 microphone audio	A0	80
6	43	RX MUTE - LO= mute receive audio	C0	80
7	42	RX PATH - HI= RX audio bypass IC907	80	00

- **IC901 — PORT B (PBx), Outputs Only**

1. Using the Programmer's Direct Access mode, enter this 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 A line, find the appropriate byte in the HIGH column of the chart below, 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 of **Table 3 - 2**, to enter. The bytes in the chart are designed to switch the selected line, only; 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 - 2 — IC901 Port B

PBx BIT	IC901 PIN NO.	FUNCTION	BYTE TO BE ENTERED FOR HIGH	LOW
0	18	DSTB1 - LO= latch RF Board data	63	62
1	19	LPSW1 - LO= speed 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 is on	73	63
5	23	DSTB2 - LO= latch opt. 2nd PLL data	63	43
6	24	LPSW2 - LO= speed 2nd PLL lock time	63	23
7	25	TXDL2 - HI= 2nd TX'er circuits on	E3	63

- **IC901 — PORT C (PCx), Inputs Only**

1. Set up the radio as follows. This assures that the bytes read from the port will be the same values shown in **Table 3 - 3**. 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.

   a. Set the SQUELCH control to maximum (clockwise).

   b. 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 (70-342x or 70-385x), either a jumper or a Hang-Up box (which must be closed) is already in place.

   c. 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).

   d. Disconnect the antenna so that no carrier is received.

2. Using the Programmer, enter this 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 follows:

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 - 3 — IC901 Port C

PCx BIT	IC901 PIN NO.	FUNCTION	BYTE VALUE IF PCx IS 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 HANGUP - LO= J505-3 is grounded	B6	96
6	16	NSQ - HI= rcvr is quieted by carrier	D6	96
7	17	not used		

- **IC901 — PORT D (PDx), Inputs and Outputs**

This entire port is used as a communications buss between the Control Head microcomputer and the TX/RX Unit microcomputer. Manual control of these lines is complicated and troubleshooting by exchanging control heads is easier. Therefore, I/O-Port-D Manipulation instructions are not provided.

- **IC903 — PORT 2 (P2x), Input/Output**

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. A hard-reset would then be required.

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

1. Using the Programmer's Direct Access mode, enter this 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 when 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):

1. 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 as 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.

2. Using the Programmer's Direct Access mode, enter this 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.

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

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.

Writing to Port P26
(IC903-15, Burst-Tone Clock Output):

1. Using the Programmer's Direct Access mode, enter this 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, then press **ENT**. If you wish to output a logic low, enter 38, 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.

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 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 will be unterminated; therefore, they will read as logic low (0). To test an input, it is necessary to apply a logic high (5 V) to the I/O line in question using a 1,000-Ω resistor from P923 pin 2. Leave the others unterminated.

Input Test:

4. Using the Programmer, enter this address: 0020, 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 this 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
"	OPP2 (P51, IC903-18)	"	0A
"	OPP3 (P52, IC903-19)	"	0C
"	OPP4 (P54, IC903-21)	"	18
"	OPP5 (P55, IC903-22)	"	28
"	OPP6 (P56, IC903-23)	"	48
"	OPP7 (P57, IC903-24)	"	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, then press **ENT**. This sets all OPP lines to output mode (P53 of IC903 **must** remain an input).

9. Press **MNL**, then enter this 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
"	OPP2 (P51, IC903-18)	"	02
"	OPP3 (P52, IC903-19)	"	04
"	OPP4 (P54, IC903-21)	"	10
"	OPP5 (P55, IC903-22)	"	20
"	OPP6 (P56, IC903-23)	"	40
"	OPP7 (P57, IC903-24)	"	80

11. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6-Volt 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.

• IC903 — PORT 6 (P6x), Inputs and Outputs

Inputs (P63 and P66):

1. Using the Programmer, enter this address: 0017, 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, then press **ENT**. This establishes a reference. The next address (18) will appear.

3. Press **UP ARROW**, then **DOWN ARROW**. Address 17 will return with a new DATA value.

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

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

1. Press **MNL**, then enter this 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 - 4**, 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 chart are designed to switch the selected line, only; and leave the rest unchanged.

3. When finished, disconnect the Programmer and turn it off. Disconnect the radio from its 13.6-Volt 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

			BYTE TO BE ENTERED FOR	
BIT	**IC901 PIN NO.**	**FUNCTION**	**HIGH**	**LOW**
0	9	LO= Audio path switched for receive	FB	FA
1	10	HI= high beep level	FA	F8
2	11	HI= mute beeps	FE	FA
4	14	LO= latch CTCSS serial data on PA0	FA	EA
5	15	not used	— —	— —

DC VOLTAGE CHARTS

LOGIC BOARD

Table 3 - 5 — Integrated Circuits

PIN NO.	IC904 MB3771	IC905 14053B	IC906 uPC4558G	IC907 MX365P	IC909 14066B	IC912 uPC4519	IC913 7805
1	1.7	2.5	2.5	5.0	2.5	2.6	13.6
2	1.8	2.6	2.5	2.5	2.5	2.6	0.0
3	0.0	2.6	2.5	2.5	——	2.6	5.0
4	0.0	2.5	0.0	0.0	——	5.0	
5	5.0	2.5	2.5	5.0	——	2.6	
6	5.0	0.0	2.5	0.0	——	2.6	
7	1.5	0.0	2.5	——	0.0	2.6	
8	5.0	0.0	5.0	——	2.5	2.6	
9		——		4.9	2.5	2.6	
10		——		4.9	2.5	2.6	
11		——		0.0	2.5	0.0	
12		2.5		3.2	——	2.6	
13		2.5		——	——	2.6	
14		2.5		——	5.0	2.6	
15		2.6		——			
16		5.0		2.5			
17			4.9				
18			4.9				
19			2.5				
20			2.5				
21			2.5				
22			2.1				
23			2.3				
24			2.3				

40-WATT PA MODULE

Table 3 - 6 — TRANSISTORS

SYMBOL	TYPE	BASE	COLL	EMIT	FUNCTION
Q501	2SC1971	0. 85	5. 2	0. 0	Pre-Driver
Q502	2SC2539	–0. 16	5. 0	0. 0	Driver
Q503	2SC2694	–0. 38	8. 4	0. 0	Final
Q504	2SC945Q	12. 7	5. 5	12. 0	Current Regulator
Q505	2SC2462	0. 0	8. 5	0. 0	LO Power Clamp
Q506	2SC2462	6. 1	12. 7	5. 4	Differential Amp.
Q507	2SC2462	7. 5	8. 7	6. 8	Differential Amp.

110-WATT PA MODULE

Table 3 - 7 — Transistors

SYMBOL	TYPE	BASE	COLL	EMIT	FUNCTION
Q501	2SC2538	0. 3	——	0. 0	Pre-Driver
Q502	2SC2539	0. 0	11. 0	0. 0	Driver
Q503	2SC2630	0. 0	12. 5	0. 0	Driver
Q504	2SC2694	0. 0	12. 5	0. 0	Final
Q505	2SC2694	0. 0	12. 5	0. 0	Final
Q506	2SB945Q	——	——	12. 5	Current Regulator
Q508	2SC2462	2. 0	9. 0	1. 4	Differential Amp.
Q509	2SC2462	2. 0	——	1. 4	Differential Amp.
Q510	2SC2462	0. 7	0. 6	0. 0	Relay Driver

RF BOARD

Table 3 - 8 — Transistors

SYMBOL	TYPE	MODE	BASE	COLL	EMIT	FUNCTION
Q101	2SC2462LC			8. 9	9. 0	8.1
Q112	2SC3357	TX	3. 8		3. 0	TX Preamp
Q113	2SC2462LC	TX	0. 0	4. 0	0. 0	Switch
Q115	DTC124EK		0. 0	8. 5	0. 0	Buss Driver
Q201	2SC3357	RX	1. 1	10. 4	0. 4	RF Amplifier
Q204	2SC3357	RX	5. 7	12. 2	4. 9	Injection Amp
Q206	2SC3357	RX	1. 5	7. 5	0. 7	1st IF Amp
Q261	2SC2620QB	RX	0. 7	3. 3	0. 0	1st IF Amp
Q262	2SC2462LC	RX	2. 3	4. 1	1. 9	60 kHz Amp
Q401	2SB798	RX	9. 1	0. 0	9. 1	Switch
		TX	8. 5	9. 1	9. 1	
Q402	2SB798	RX	8. 5	9. 1	9. 1	Switch
		TX	9. 1	0. 0	9. 1	
Q403	DTA114YK	RX	9. 1	8. 5	9. 1	Switch
		TX	0. 0	9. 1	9. 1	
Q404	DTC124EK	RX	0. 0	9. 1	0. 0	Switch
		TX	5. 0	0. 3	0. 0	
Q406	2SB798	RX	12. 5	13. 0	13. 2	Regulator
		TX	13. 1	0. 0	13. 6	
Q407	2SC2462	RX	9. 1	12. 5	8. 5	Switch
		TX	0. 0	13. 1	0. 0	
Q702	2SC2351	RX	2. 4	7. 9	1. 7	Buffer Amp
Q703	2SC2351		2. 6	7. 0	2. 2	Buffer Amp.
Q722	2SC2351	TX	2. 5	8. 0	1. 9	Buffer Amp.

Table 3 - 9 — F. E. T. 's

SYMBOL	TYPE	MODE	GATE 1	GATE 2	SOURCE	DRAIN	FUNCTION
Q202	2SK125	RX	0. 0		13. 1	2. 4	First Mixer
Q203	2SK125	RX	0. 0		13. 1	2. 4	First Mixer
Q701	3SK151	RX	3. 8	4. 7	6. 9	3. 3	RX VCO
Q721	3SK151	TX	3. 7	4. 6	7. 0	3. 2	TX VCO

Table 3 - 10 — Transistor Packs

SYMBOL	TYPE	MODE	PIN NUMBER					
			1	2	3	4	5	6
Q102	IMB4	RX HI	0.0	7.9	0.0	7.4	0.0	0.6
		RX LO	7.7	0.6	0.0	0.0	0.0	7.9
		TX HI	0.0	0.0	7.9	7.7	0.6	0.0
		TX LO	7.7	0.0	0.6	0.0	8.0	0.0
Q103	IMH1	RX HI	2.9	2.9	0.0	0.0	0.0	0.0
		RX LO	2.9	2.9	0.0	0.0	0.0	0.0
		TX HI	0.0	0.0	0.0	8.0	5.0	0.0
		TX LO	0.0	0.0	0.0	8.0	5.0	0.0
Q104	IMD3	RX HI	7.8	7.8	7.9	0.0	0.0	0.0
		RX LO	8.0	0.6	7.9	7.8	0.0	0.0
		TX HI	0.0	0.0	0.0	0.0	5.0	0.0
		TX LO	0.0	0.0	0.0	0.0	5.0	0.0
Q105	IMD3	RX HI	0.0	0.0	7.9	7.8	9.8	0.0
		RX LO	3.0	7.9	7.9	0.0	0.0	0.0
		TX HI	0.0	0.0	0.0	0.0	9.8	0.0
		TX LO	3.0	0.0	0.0	0.0	0.0	0.0
Q106	IMD3	RX HI	0.0	0.0	0.0	0.0	9.8	0.0
		RX LO	7.6	0.0	0.0	0.0	0.0	0.0
		TX HI	0.0	0.6	8.0	7.8	9.8	0.0
		TX LO	7.7	7.9	8.0	0.0	0.0	0.0
Q107	IMD3	RX HI	7.7	0.0	0.0	0.0	0.0	0.0
		RX LO	0.0	0.0	0.0	0.0	3.0	0.0
		TX HI	7.6	7.9	7.9	0.0	0.0	0.0
		TX LO	0.0	0.6	8.0	7.8	3.0	0.0
Q116	IMH1	RX/TX	9.1	0.0	0.0	8.5	0.0	0.0

Table 3 - 11 — Analog Integrated Circuits

	IC261 MB3357P		IC103 DH1072	IC104 uPC458G	IC109 DH-1071		IC111 DH-1071		IC404 HA1384
PIN NO.	SQ	UNSQ		TX	RX	TX	RX	TX	
1	9.0	9.0	10.0	4.9	8.7	8.7	8.7	8.7	1.6
2	8.4	8.4	0.0	4.9	0.0	0.0	0.0	0.0	3.6
3	9.1	9.1	——	4.9	0.0	0.0	0.0	0.0	0.0
4	9.1	9.1	——	9.1	0.0	0.0	0.0	0.0	0.0
5	1.0	1.0	0.0	4.9	0.0	0.0	0.0	0.0	1.4
6	1.0	1.0	5.0	4.9	0.0	0.0	0.0	0.0	1.5
7	1.0	1.0	0.0	4.9	0.0	0.0	0.0	0.0	6.9
8	9.1	9.1	0.0	4.9	8.8	0.0	0.0	8.9	13.0
9	4.1	4.1	0.0	4.8	——	——	——	——	0.0
10	1.9	1.9	0.0	4.9	——	——	——	——	13.6
11	1.9	1.9	——	0.0	——	——	——	——	13.0
12	0.8	0.2	——	4.5	——	——	——	——	6.9
13	0.0	8.4	——	5.0	——	——	——	——	——
14	1.0	0.0	——	5.0	——	——	——	——	——
15	0.0	0.0	——	——	——	——	——	——	——
16	1.9	1.9	——	——	——	——	——	——	——

3

NOTES

SECTION 4

CIRCUIT DESCRIPTIONS

4

NOTES

RF BOARD

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

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 Q701 operates in transmit mode to generate transmit frequencies; Q721 operates in receive mode to generate receive injection frequencies. Each is buffered independently; by Q702 and Q722, respectively. Outputs of the buffers are amplified by Q703 and stage-gain hybrids IC109 and IC111. RF signal at receiver injection frequency (F_C–21.4 MHz) is applied from the intermediate output of IC109 (pin 7) to tuned LO amplifier Q204 in the receiver circuit. Intermediate RF output of IC111 is applied to the PLL dividers. RF signal from the last output of IC111 is amplified further by the PA 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 the entire 24 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 D701—D704, D711—D714, D721—D724, and D731—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 IC111 pin 3 is sufficient to feed prescaling frequency divider IC101, which applies an output pulse to IC102 pin 10 once every 128 or 129 input cycles. Additional frequency division is performed within IC102 to produce 2.5 kHz. Frequency division by IC101 is switched from 129 to 128 sometime between each of its output pulses and back to 129 during the start of each of those pulses. This provides vernier division of channel frequencies that do not divide evenly. 128/129 division is controlled by a programmable pulse counter in IC102 that applies control logic voltages to IC101 control input at pin 1.

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 inputs 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 applied through an active filter 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 active filter rolloff frequency is selected by the microcomputer system on the Logic Board when the radio changes channels or it is keyed and unkeyed, by a logic low applied to pin 6. This increase in loop response speeds 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 perfectly 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 IC111 pin 7 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. DC source current to the collector of Q112 is regulated by the Automatic Power Control (APC) circuitry on the PA Module.

RECEIVER

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

- **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 24 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, respectively. 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 minus 21.4 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 utilized 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 is designed to operate at the 21.4 MHz first IF frequency.

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 21.4 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 IF**

Mixer output is applied to Q206, which drives L221. L221 tunes to match the input impedance of 21.4 MHz crystal filter FL261 that rejects signals outside the channel bandwidth. L261 matches FL261 to Q261 where the first IF signal is amplified at least 20 dB, then applied to second IF IC261.

- **Second I.F.**

IC261 contains all second IF circuitry, a quadrature demodulator, and threshold gate. X261 and circuitry in IC261 generate second L.O. injection of 20.945 MHz. A double-balanced mixer, which 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 IF.

- **Demodulation**

The quadrature detector in IC261 is another double-balanced mixer to which limiter output is applied. Its second input is taken from 455kHz 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 adjusted 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; 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 to 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 inter-connect to microcomputer input port PC6 so that the microcomputer can take appropriate action.

40-WATT PA MODULE

The 40-Watt Power Amplifier (PA) Module is the rear portion of the TX/RX Unit. It contains RF circuitry that is accessible by removing its cover.

• **RF Power Amplifier**

A 50-Ω coaxial cable from the TX RF preamplifier connects to J501. A PC-board stripline is utilized to match Q501-base terminal to the coax and CV501 fine-tunes this match by balancing reactances. RF impedance at the collector Q501 is transformed by PC-board stripline to the base terminal of driver Q502, and the collector of Q502 is transformed to the base of Q503, similarly. RF impedance at the collector of final-stage Q503 is again transformed by PC stripline and fine tuned by CV504 to match circuit impedance at RF-gate D501. L511—L514 and C545—C549 comprise the harmonic filter. R512 and R513 serve to drain static and other DC potentials from the antenna.

• **Antenna Gate**

In receive mode, PIN-diodes D501 and D502 are unbiased. The RF-signal path from final-amplifier Q503 is then severed, and the impedance matching network consisting of L515, C532, and C533 routes signals from the antenna to the receiver input through 50-Ω coax at J503.

In transmit mode, D501 and D502 are biased on. The receiver port network (L515, etc.) is detuned such that it appears as a high impedance to the antenna, and D501 couples final amplifier output to the antenna at J502.

• **Automatic Power Control**

A PC stripline ahead of the harmonic filter, plus a thin PC runner adjacent to it, serve as a directional coupler. D503 rectifies a small RF sample that is developed across the thin runner; thus producing a DC voltage that increases with RF power travelling forward into the antenna. This power-level sensing voltage is 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 circuits of both predriver Q501 and preamplifier Q112. The feedback loop, from the directional coupler to Q504, holds RF output power at the constant level 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. Q508 is also biased on to increase the sensitivity of the differential amplifier.

110-WATT PA MODULE

The 110-W Power Amplifier (PA) Module is the rear portion of the TX/RX Unit. It contains RF circuitry that is accessible by removing its cover.

- **RF Power Amplifier**

TX RF Preamplifier output is connected to 50-Ω J501. C501 and L501 transform the 50-Ω circuit to Q501 input impedance. A PC stripline is used to couple class-B/C biased Q501 to class-C biased pre-driver Q502. Another PC stripline matches Q502-collector circuit to driver Q503, which is also class-C biased. PC striplines split driver output to feed twin finals Q504 and Q505. Each feeder is tuned by CV503 and CV504, respectively. Final-stage outputs are combined by PC-stripline transformers, and the junction is tuned by CV505 to maximize the match to Antenna Relay K501. In transmit mode, K501 connects this RF signal to the harmonic filter consisting of L515—L518 that purifies the signal before emission by the antenna connected to J502. R521 and R522 drain static and other DC potentials from the antenna.

If the twin finals are not in balance (due to component failure or CV503/CV504 misadjustment), RF voltages at the base terminals of the finals will be unequal; and the voltage difference across R508 will be enough to overheat the resistor. The same occurs with R509 across the final-stage collectors.

- **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 Q510 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**

A PC stripline ahead of the harmonic filter, plus a thin PC runner adjacent to it, serve as a directional coupler. D502 rectifies a small RF sample that is developed across the thin runner; thus producing a DC voltage that increases with RF power travelling forward into the antenna. This power-level sensing voltage is inverting input of a differential amplifier comprised of Q508 and Q509. The non-inverting input is a DC voltage produced by PWR adjustment RV501. Differential amplifier output drives Q506 which is a current source that feeds primary DC to the collector circuits of both first pre-driver Q501 and pre-amplifier Q112. The feedback loop, from the directional coupler 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.

- **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 bus, 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-volt 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 labeled ovals 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 148.48 MHz for A-Band, or 162.56 MHz for B-Band. 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 that 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.

PINOUT CHARTS

Table 4 - 1a — IC901 HN671106U (Custom Peripheral LSIC)

PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
1	PD0	BOTH	CLK	LOW = C/H data present on port
2	PD1	BOTH	D1	C/H-to-T/R Unit communications bus
3	PD2	BOTH	D2	C/H-to-T/R Unit communications bus
4	PD3	BOTH	D3	C/H-to-T/R Unit communications bus
5	PD4	BOTH	D4	C/H-to-T/R Unit communications bus
6	PD5	BOTH	D5	C/H-to-T/R Unit communications bus
7	PD6			not used
8	PD7			not used
9	PC0	INP		HIGH = 2805Hz tone detected
10	PC1	INP		not used
11	PC2	INP		not used
12	Vss			ground
13	PC3	INP	TH SW	Temp. switch status. HIGH = TX off
14	PC4	INP	C/H HGUP	HI = U/D config. or J319-3 is ground
15	PC5	INP	T/R HGUP	LOW= J505-3 is grounded
16	PC6	INP	NSQ STAT	HIGH= noise-squelch detects carrier
17	PC7	INP		not used
18	PB0	OUT	DSTB1	RF Brd. data strobe. LOW=latch data
19	PB1	OUT	LPSW1	LOW= speed PLL loop response
20	PB2	OUT	TXDL1	HIGH = Activate transmit
21	PB3	OUT	INTRX	not used
22	PB4	OUT	HORN SW	HIGH = Horn switch is on
23	PB5	OUT	DSTB2	Optnl synth. serial data strobe
24	PB6	OUT	LPSW2	LOW= switch optnl synth loop filter
25	PB7	OUT	TXDL2	Optnl synth. TX control HIGH = TX
26	TCLK	INP		Mfr. test point not used
27	TEST	INP		Mfr. test point not used
28	CHOK	BOTH		Mfr. test point not used
29	CHER	BOTH		Mfr. test point not used
30	CA	OUT		Square wave at DTMF tone-1 freq.
31	CB			DTMF tone-1 frequency 2
32	Vss			ground
33	Vdd			+5 Volts
34	CC	OUT		DTMF tone-1 frequency 4
35	RA	OUT		Square wave at DTMF tone-2 freq.
36	RB	OUT		DTMF tone-2 frequency 2
37	RC	OUT		DTMF tone-2 frequency 4
38	SE	INP		Port-D direction control
39	TPL	OUT		not used

Table 4 - 1b — IC901 HN671106U (Custom Peripheral LSIC Continued)

PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
40	BITIN	INP		2805 Hz input for detection
41	SW	OUT		HIGH = DTMF transmit
42	PA7	OUT		RX audio path control. HIGH=direct
43	PA6	OUT		LOW = mute receive audio
44	PA5	OUT	TX MUTE	LOW = mute transmit voice audio
45	PA4	OUT	PA SW	HIGH = Public Address optn enabled
46	PA3	OUT	PA	CNTL HIGH = Audio rerouted for Pub. Add.
47	PA2	OUT	DCL	C/H data bus directn. HIGH=to C/H
48	PA1	OUT	DCLK	Clock for serial data at PA0
49	PA0	OUT	CHDT	Serial control data to RF Board
50	A0	INP		Address bus
51	A1	INP		Address bus
52	Vss			ground
53	A2	INP		Address bus
54	A12	INP		Address bus
55	A13	INP		Address bus
56	A14	INP		Address bus
57	A15	INP		Address bus
58	/DEC7	OUT		not used
59	/DEC6	OUT		not used
60	/DEC4	OUT		not used
61	/DEC3	OUT		not used
62	/DEC2	OUT		not used
63	/DEC1	OUT		not used
64	SYNC0	OUT		2805Hz detector out. HIGH= present
65	SYNC1	OUT		not used
66	OSC	INP		Tone generator and detector clock
67	E	INP		Data-bus latch clock
68	/R	INP		LOW = system reset
69	/RD	INP		LOW = Read data from microcomputer
70	/WR	INP		LOW = Write data to microcomputer
71	D0	BOTH		Data bus
72	Vss			ground
73	Vdd			+5 Volts
74	D1	BOTH		Data bus
75	D2	BOTH		Data bus
76	D3	BOTH		Data bus
77	D4	BOTH		Data bus
78	D5	BOTH		Data bus
79	D6	BOTH		Data bus
80	D7	BOTH		Data bus

Table 4 - 2a — IC903 HD6301YOP (Radio Microcomputer)

PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
1	Vss			Ground
2	XTAL	NP		Crystal oscillator, 4 MHz
3	XTAL	INP		Crystal oscillator, 4 MHz
4	MP0	INP		not used
5	MP1	INP		not used
6	/RES	INP		LOW = Microcomputer reset
7	/STBY	INP		LOW = Microcomputer standby mode
8	/NM	INP		LOW GOING = Interrupt: store status
9	P20	INP		DCS signal in (for decoding)
10	P21	OUT	CTS	p/o Std. serial port to Programmer
11	P22	INP	RTS	p/o Std. serial port to Programmer
12	P23	INP	SD	p/o Std. serial port to Programmer
13	P24	OUT	RD	p/o Std. serial port to Programmer
14	P25	OUT		DCS signal output (for transmission)
15	P26	OUT		Burst-Tone clock (tone freq. x 8)
16	P27	OUT	CD	p/o Std. serial port to Programmer
17	P50	BOTH	OPP1	Programmable option port
18	P51	BOTH	OPP2	Programmable option port
19	P52	BOTH	OPP3	Programmable option port
20	/HALT	INP		LOW = Microcomputer HALT
21	P54	BOTH	OPP4	Programmable option port
22	P55	BOTH	OPP5	Programmable option port
23	P56	BOTH	OPP6	Programmable option port
24	P57	BOTH	OPP7	Programmable option port
25	P60	OUT		Signal-path switch. LOW=RX
26	P61	OUT		HIGH = High beep level
27	P62	OUT		HIGH = Mute beeps
28	P63	INP		LOW = CTCSS Tone detected
29	P64	OUT		LO= latch CTCSS data sent on PA0
30	P65			not used
31	P66	INP	PLCL1	LOW = RF Synthesizer is unlocked
32	P67	INP	PLCL2	LOW = Optional synthesizer unlocked
33	Vcc	INP		5 Volts DC
34	A15	OUT		Address Bus, MSB
35	A14	OUT		Address Bus
36	A13	OUT		Address Bus
37	A12	OUT		Address Bus
38	A11	OUT		Address Bus
39	A10	OUT		Address Bus
40	A9	OUT		Address Bus
41	A8	OUT		Address Bus

Table 4 - 2b — IC903 HD6301YOP (Radio Microcomputer Continued)

PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
42	GND			
43	A7	OUT		Address Bus
44	A6	OUT		Address Bus
45	A5	OUT		Address Bus
46	A4	OUT		Address Bus
47	A3	OUT		Address Bus
48	A2	OUT		Address Bus
49	A1	OUT		Address Bus
50	A0	OUT		Address Bus, LSB
51	D7	BOTH		Data Bus, MSB
52	D6	BOTH		Data Bus
53	D5	BOTH		Data Bus
54	D4	BOTH		Data Bus
55	D3	BOTH		Data Bus
56	D2	BOTH		Data Bus
57	D1	BOTH		Data Bus
58	D0	BOTH		Data Bus, LSB
59	BA	OUT		not used
60	/LIR	OUT		not used
61	R/W	OUT		not used
62	/WR	OUT		LOW = Writing data
63	/RD	OUT		LOW = Reading data
64	E	OUT		1 MHz clock

OPTION CONNECTOR P923

P923 is a receptacle for connecting various add-on options. The RF Board serial port and seven I/O lines from the microcomputer are routed here to interface to options. There are four sets of functions of these I/O lines, and each set can be selected by programming. Page 20 of 70-1080A Programmer Operator's Manual describes Programming the Option Port Type parameter; and, which configuration Type used depends on which option is connected. One of four Types are available and a function-description chart for each is provided below. If "NONE" is programmed, OPP1 through OPP7 do not function.

OPTION PORT TYPE 1

PIN	NAME	FLOW	FUNCTION
4	OPP1	INPUT	LOW = valid code decoded
5	OPP2	INPUT	LOW = transmit request (PTT)
6	OPP3	OUTPUT	HIGH = Auxiliary push button is on
7	OPP4	OUTPUT	HIGH = carrier received (noise squelch)
8	OPP5	OUTPUT	LOW = transmit mode
9	OPP6	OUTPUT	HIGH = CTCSS/DCS decoded
10	OPP7	OUTPUT	HIGH = latch Option Data sent on P923-12
11	CLK	OUTPUT	HIGH = data bit is on P923-12 (data clock)
12	SER	OUTPUT	serial port data line for Option Data

OPTION PORT TYPE 2

PIN	NAME	FLOW	FUNCTION
4	OPP1	OUTPUT	LOW = DTMF code compares true PLUS carrier is present (noise squelch) PLUS transpond Burst-Tone is complete.
5	OPP2	INPUT	LOW = transmit request (PTT)
6	OPP3	INPUT	received-DTMF-data serial port
7	OPP4	INPUT	LOW = valid data string is on OPP3
8	OPP5	OUTPUT	LOW = transmit mode
9	OPP6	OUTPUT	HIGH = bit request for OPP3 data
10	OPP7	OUTPUT	HIGH = latch Option Data sent on P923-12
11	CLK	OUTPUT	HIGH = data bit is on P923-12
12	SER	OUTPUT	serial port data line for Option Data

OPTION PORT TYPE 3

PIN	NAME	FLOW	FUNCTION
4	OPP1	INPUT	LOW = valid code decoded
5	OPP2	INPUT	LOW = transmit request (PTT)
6	OPP3	INPUT	channel-number serial data
7	OPP4	INPUT	HIGH PULSE = request to send data on OPP3
8	OPP5	OUTPUT	LOW = transmit mode
9	OPP6	OUTPUT	HIGH = bit request for OPP3 data
10	OPP7	OUTPUT	HIGH = latch Option Data sent on P923-12
11	CLK	OUTPUT	HIGH = data bit is on P923-12
12	SER	OUTPUT	serial port data line for Option Data

OPTION PORT TYPE 4

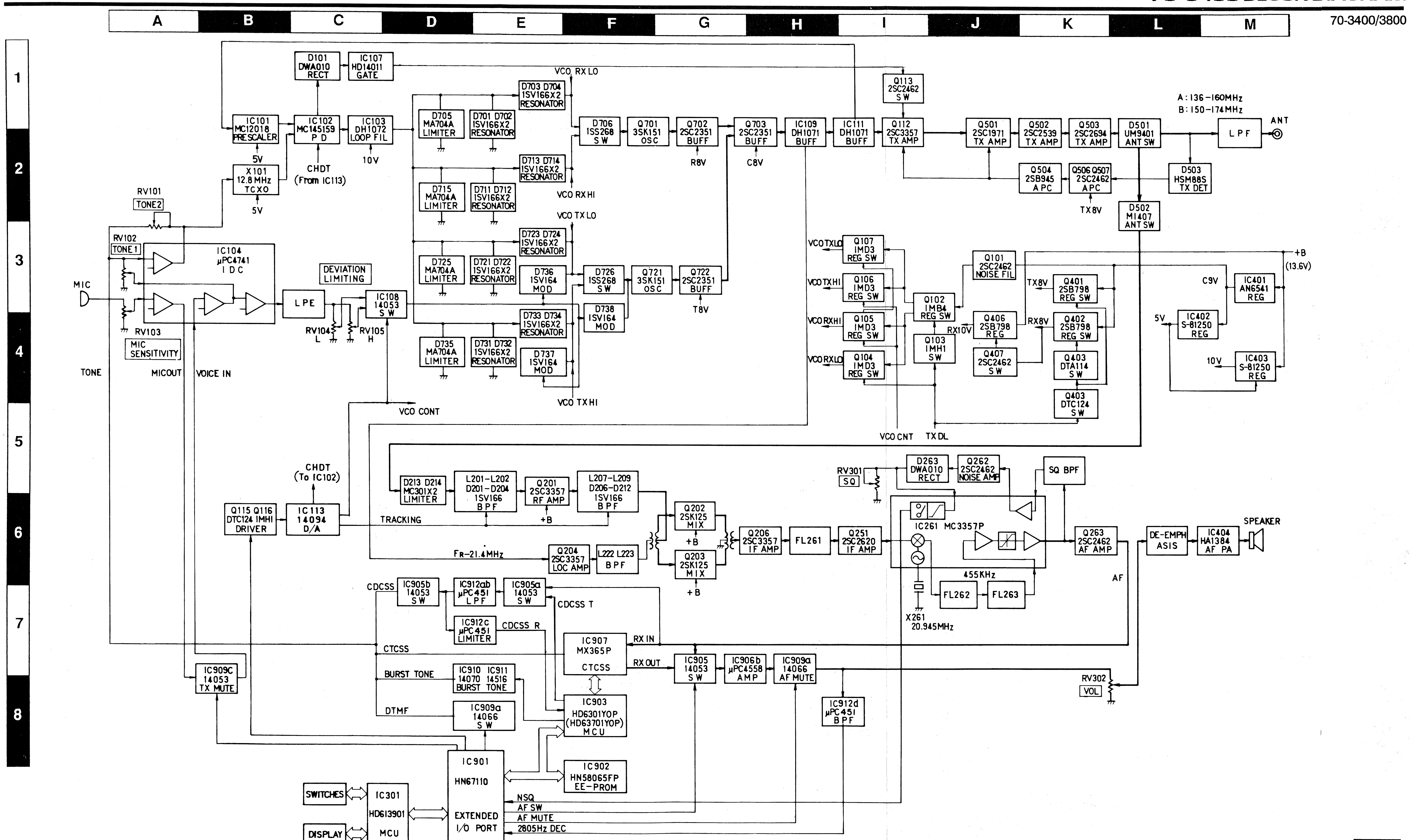
PIN	NAME	FLOW	FUNCTION
4	OPP1	INPUT	LOW = data ready on OPP2-OPP5
5	OPP2	INPUT	received DTMF parallel data, bit 0
6	OPP3	INPUT	received DTMF parallel data, bit 1
7	OPP4	INPUT	received DTMF parallel data, bit 2
8	OPP5	INPUT	received DTMF parallel data, bit 3
9	OPP6	OUTPUT	LOW = DTMF code compares true PLUS carrier is present (noise squelch) PLUS transpond Burst-Tone is complete.
10	OPP7	OUTPUT	HIGH = latch Option Data sent on P923-12
11	CLK	OUTPUT	HIGH = data bit is on P923-12
12	SER	OUTPUT	serial port data line for Option Data

SECTION 5

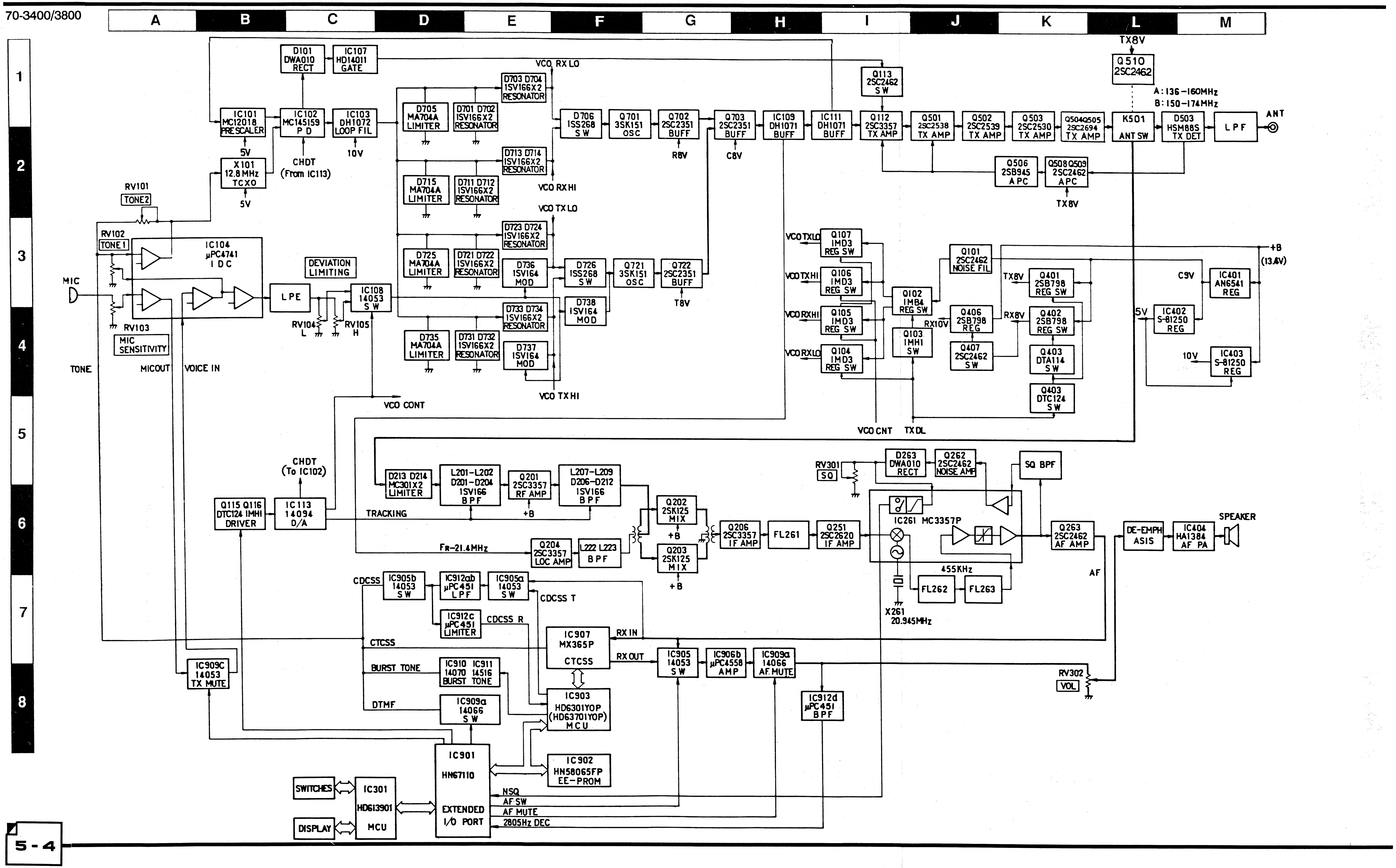
DIAGRAMS

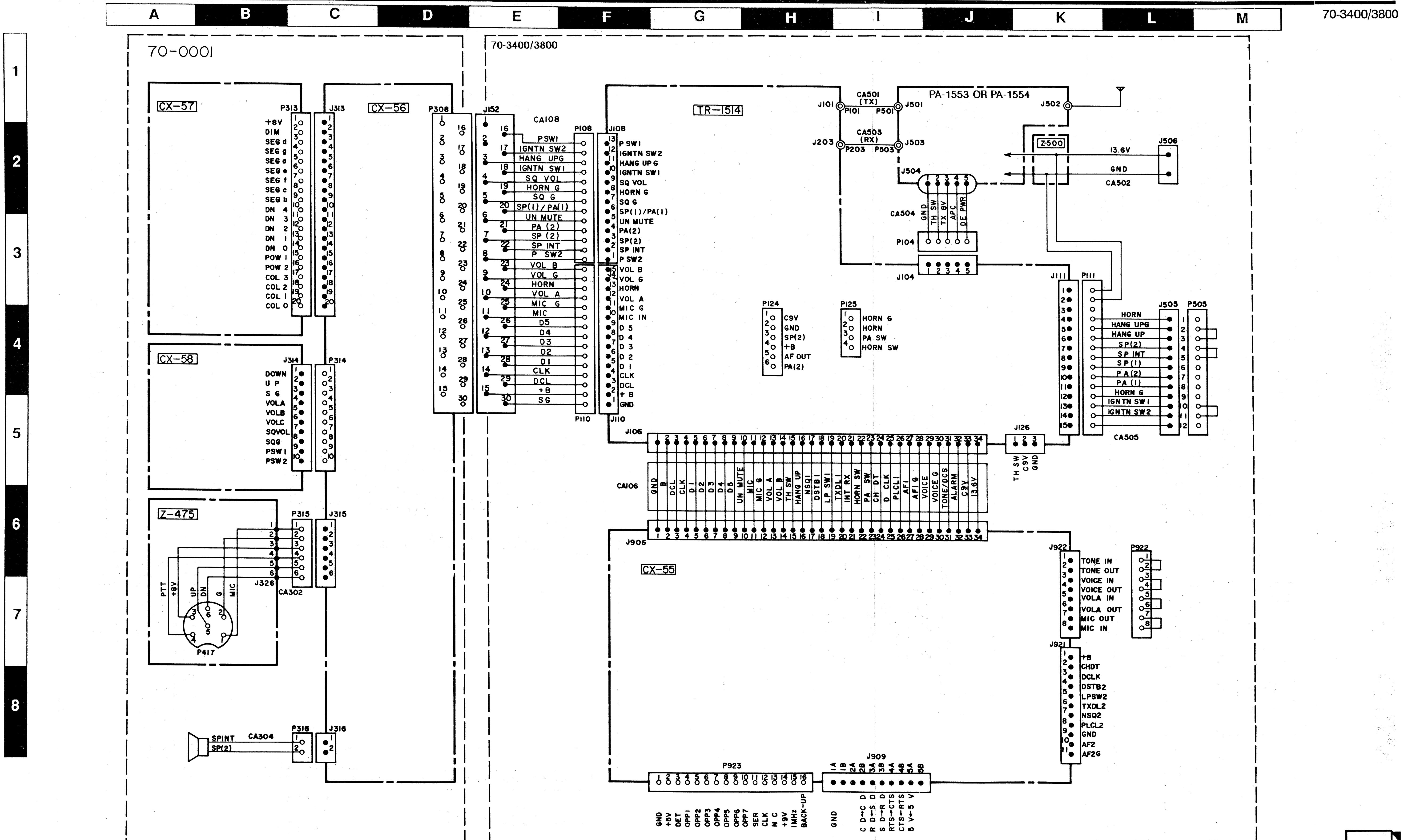
5

NOTES


A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
8
D101 DWA010 RECT
IC107 HD14011 GATE
VCO RX LO
D703 D704 1SV166X2 RESONATOR
Q113 2SC2462 SW
IC101 MC12018 PRESCALER
IC102 MC145159 PD
IC103 DH1072 LOOP FIL
D705 MA704A LIMITER
D701 D702 1SV166X2 RESONATOR
D706 1SS268 SW
Q701 3SK151 OSC
Q702 2SC2351 BUFF
Q703 2SC2351 BUFF
IC109 DH1071 BUFF
IC111 DH1071 BUFF
Q112 2SC3357 TX AMP
Q501 2SC1971 TX AMP
Q502 2SC2539 TX AMP
Q503 2SC2694 TX AMP
D501 UM9401 ANT SW
LPF
ANT
A : 136–160MHz
B : 150–174MHz
5V
10V
CHDT (From IC113)
R8V
C8V
X101 12.8MHz TCXO
D713 D714 1SV166X2 RESONATOR
D715 MA704A LIMITER
D711 D712 1SV166X2 RESONATOR
VCO RX HI
Q504 2SB945 APC
Q506 Q507 2SC2462 APC
D503 HSM88S TX DET
TX8V
D502 M1407 ANT SW
RV101 TONE2
VCO TX LO
D723 D724 1SV166X2 RESONATOR
RV102 TONE1
IC104 μPC4741 IDC
DEVIATION LIMITING
D725 MA704A LIMITER
D721 D722 1SV166X2 RESONATOR
D736 1SV164 MOD
D726 1SS268 SW
Q721 3SK151 OSC
Q722 2SC2351 BUFF
VCO TXLO
Q107 IMD3 REG SW
Q101 2SC2462 NOISE FIL
+B (13.6V)
MIC
LPE
IC108 14053 SW
T8V
VCO TXHI
Q106 IMD3 REG SW
TX8V
Q401 2SB798 REG SW
C9V
IC401 AN6541 REG
D733 D734 1SV166X2 RESONATOR
D738 1SV164 MOD
Q102 IMB4 REG SW
VCO RXHI
Q105 IMD3 REG SW
Q406 2SB798 REG
RX8V
Q402 2SB798 REG SW
5V
IC402 S-81250 REG
RV103
RV104 L
RV105 H
RX10V
MIC SENSITIVITY
D735 MA704A LIMITER
D731 D732 1SV166X2 RESONATOR
D737 1SV164 MOD
Q103 IMH1 SW
VCO RXLO
Q104 IMD3 REG SW
Q407 2SC2462 SW
Q403 DTA114 SW
10V
IC403 S-81250 REG
TONE
MICOUT
VOICE IN
VCO TX HI
Q403 DTC124 SW
VCO CONT
VCO CNT
TX DL
D263 DWA010 RECT
Q262 2SC2462 NOISE AMP
SQ BPF
CHDT (To IC102)
RV301 SQ
D213 D214 MC301X2 LIMITER
L201–L202 D201–D204 1SV166 BPF
Q201 2SC3357 RF AMP
L207–L209 D206–D212 1SV166 BPF
Q202 2SK125 MIX
Q115 Q116 DTC124 IMH1 DRIVER
IC113 14094 D/A
TRACKING
+B
+B
IC261 MC3357P
Q206 2SC3357 IF AMP
FL261
Q251 2SC2620 IF AMP
Q263 2SC2462 AF AMP
DE-EMPHASIS
IC404 HA1384 AF PA
SPEAKER
FR–21.4MHz
Q204 2SC3357 LOC AMP
L222 L223 BPF
Q203 2SK125 MIX
455KHz
CDCSS
IC905b 14053 SW
IC912ab μPC451 LPF
IC905a 14053 SW
+B
FL262
FL263
AF
CDCSS T
X261 20.945MHz
IC912c μPC451 LIMITER
CDCSS R
IC907 MX365P CTCSS
RX IN
CTCSS
RX OUT
IC905 14053 SW
IC906b μPC4558 AMP
IC909a 14066 AF MUTE
IC909C 14053 TX MUTE
BURST TONE
IC910 IC911 14070 14516 BURST TONE
RV302 VOL
IC903 HD6301YOP (HD63701YOP) MCU
IC912d μPC451 BPF
DTMF
IC909a 14066 SW
IC901 HN67110 EXTENDED I/O PORT
IC902 HN58065FP EE-PROM
SWITCHES
IC301 HD613901 MCU
DISPLAY
NSQ
AF SW
AF MUTE
2805Hz DEC

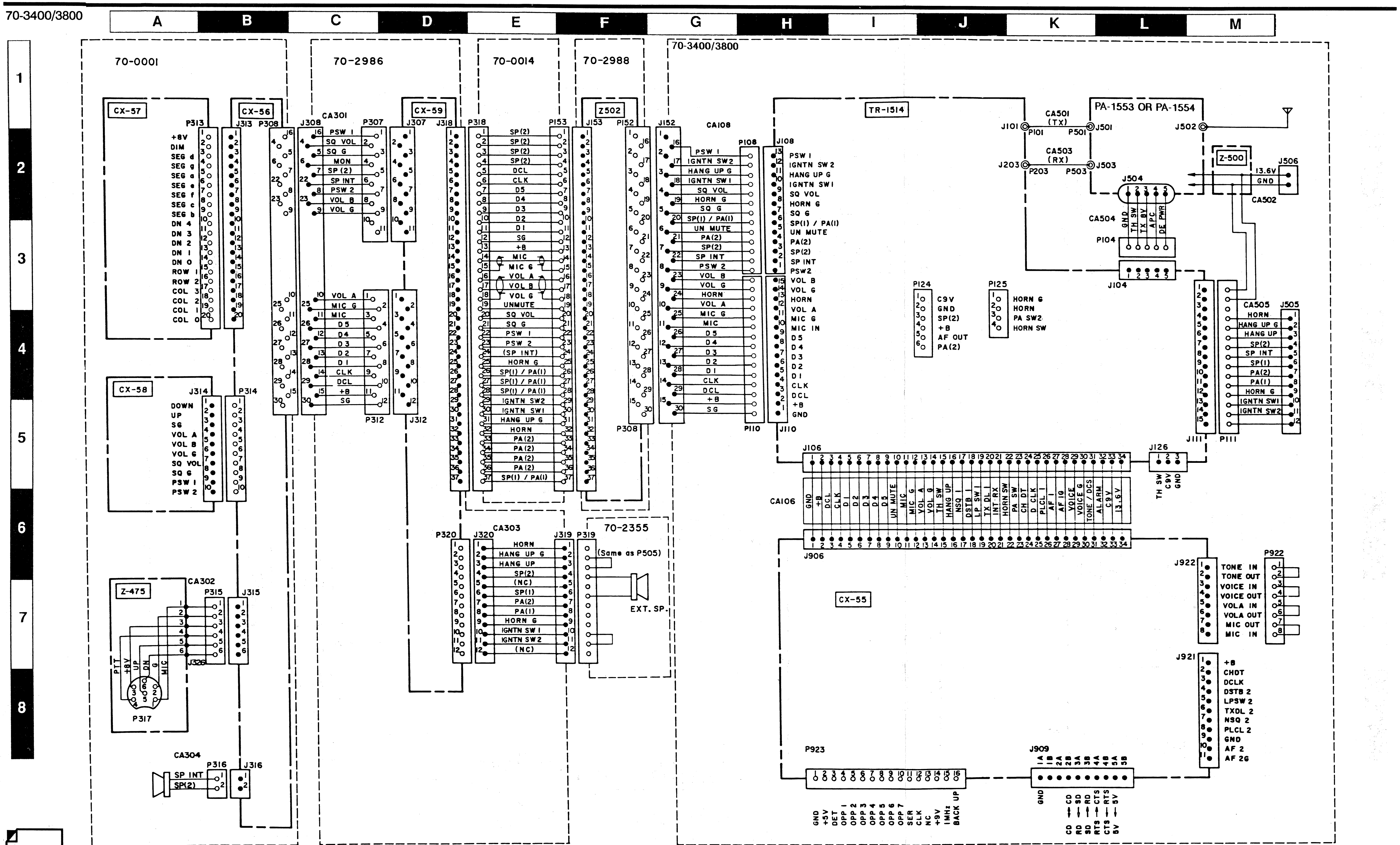
70-3400/3800

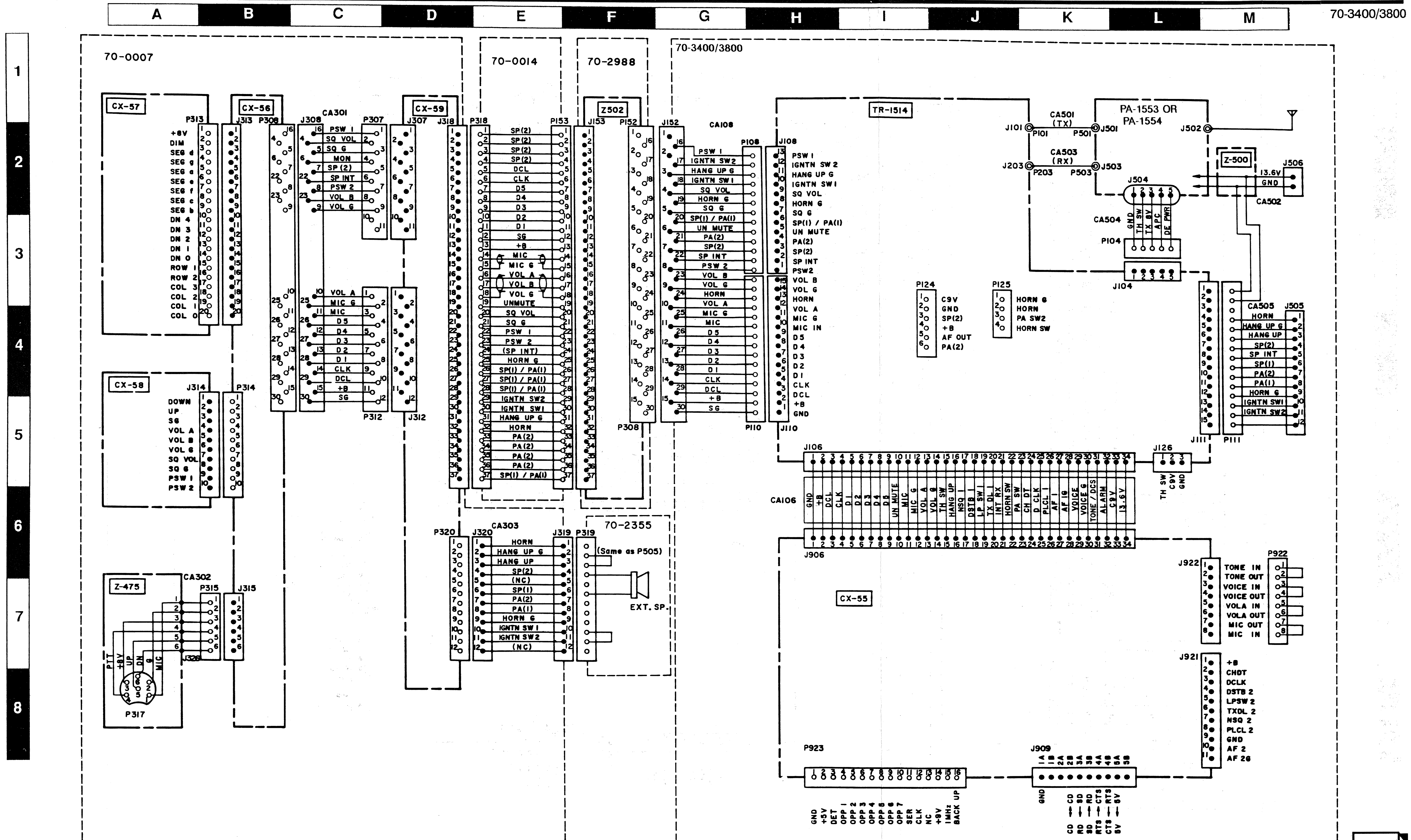

A B C D E F G H I J K L M
1 2 3 4 5 6 7 8
MIC
TONE
MICOUT
VOICE IN
RV101 TONE2
RV102 TONE1
RV103 MIC SENSITIVITY
IC104 μPC4741 IDC
LPE
DEVIATION LIMITING
RV104 L
RV105 H
IC108 14053 SW
IC101 MC12018 PRESCALER
IC102 MC145159 PD
IC103 DH1072 LOOP FIL
D101 DWA010 RECT
IC107 HD14011 GATE
X101 12.8MHz TCXO
CHDT (From IC113)
VCO RX LO
VCO RX HI
VCO TX LO
VCO TX HI
VCO CONT
D703 D704 1SV166X2 RESONATOR
D705 MA704A LIMITER
D701 D702 1SV166X2 RESONATOR
D713 D714 1SV166X2 RESONATOR
D715 MA704A LIMITER
D711 D712 1SV166X2 RESONATOR
D723 D724 1SV166X2 RESONATOR
D725 MA704A LIMITER
D721 D722 1SV166X2 RESONATOR
D736 1SV164 MOD
D733 D734 1SV166X2 RESONATOR
D735 MA704A LIMITER
D731 D732 1SV166X2 RESONATOR
D737 1SV164 MOD
D706 1SS268 SW
Q701 3SK151 OSC
Q702 2SC2351 BUFF
D726 1SS268 SW
Q721 3SK151 OSC
Q722 2SC2351 BUFF
D738 1SV164 MOD
R8V C8V T8V
Q703 2SC2351 BUFF
IC109 DH1071 BUFF
IC111 DH1071 BUFF
Q113 2SC2462 SW
Q112 2SC3357 TX AMP
Q501 2SC2538 TX AMP
Q502 2SC2539 TX AMP
Q503 2SC2530 TX AMP
Q504Q505 2SC2694 TX AMP
Q510 2SC2462
TX8V
A: 136-160MHz
B: 150-174MHz
K501 ANT SW
D503 HSM88S TX DET
LPF
ANT
Q506 2SB945 APC
Q508Q509 2SC2462 APC
VCO TXLO
VCO TXHI
VCO RXHI
VCO RXLO
Q107 IMD3 REG SW
Q106 IMD3 REG SW
Q105 IMD3 REG SW
Q104 IMD3 REG SW
Q102 IMB4 REG SW
Q103 IMH1 SW
RX10V
Q101 2SC2462 NOISE FIL
Q406 2SB798 REG
Q407 2SC2462 SW
Q401 2SB798 REG SW
Q402 2SB798 REG SW
Q403 DTA114 SW
Q403 DTC124 SW
RX8V
+B (13.8V)
C9V
IC401 AN6541 REG
5V
IC402 S-81250 REG
10V
IC403 S-81250 REG
VCO CNT
TXDL
CHDT (To IC102)
Q115 Q116 DTC124 IMH1 DRIVER
IC113 14094 D/A
TRACKING
D213 D214 MC301X2 LIMITER
L201-L202 D201-D204 1SV166 BPF
Q201 2SC3357 RF AMP
L207-L209 D206-D212 1SV166 BPF
Q202 2SK125 MIX
Q203 2SK125 MIX
FR-21.4MHz
Q204 2SC3357 LOC AMP
L222 L223 BPF
Q206 2SC3357 IF AMP
FL261
Q251 2SC2620 IF AMP
RV301 SQ
D263 DWA010 RECT
Q262 2SC2462 NOISE AMP
SQ BPF
IC261 MC3357P
455KHz
FL262
FL263
X261 20.945MHz
Q263 2SC2462 AF AMP
AF
DE-EMPHASIS
IC404 HA1384 AF PA
SPEAKER
RV302 VOL
CDCSS
IC905b 14053 SW
IC912ab μPC451 LPF
IC905a 14053 SW
CDCSS T
IC912c μPC451 LIMITER
CDCSS R
IC907 MX365P CTCSS
RX IN
RX OUT
CTCSS
BURST TONE
IC910 IC911 14070 14516 BURST TONE
DTMF
IC909a 14066 SW
IC909C 14053 TX MUTE
IC903 HD6301YOP (HD63701YOP) MCU
IC902 HN58065FP EE-PROM
IC905 14053 SW
IC906b μPC4558 AMP
IC909a 14066 AF MUTE
IC912d μPC451 BPF
IC901 HN67110 EXTENDED I/O PORT
NSQ
AF SW
AF MUTE
2805Hz DEC
SWITCHES
DISPLAY
IC301 HD613901 MCU



70-0001
CX-57
CX-56
CX-58
Z-475
P417
70-3400/3800
TR-1514
PA-1553 OR PA-1554
Z-500
CX-55
CA108
CA106
CA501 (TX)
CA503 (RX)
CA504
CA502
CA505
CA302
CA304
13.6V
GND
SPINT
SP(2)

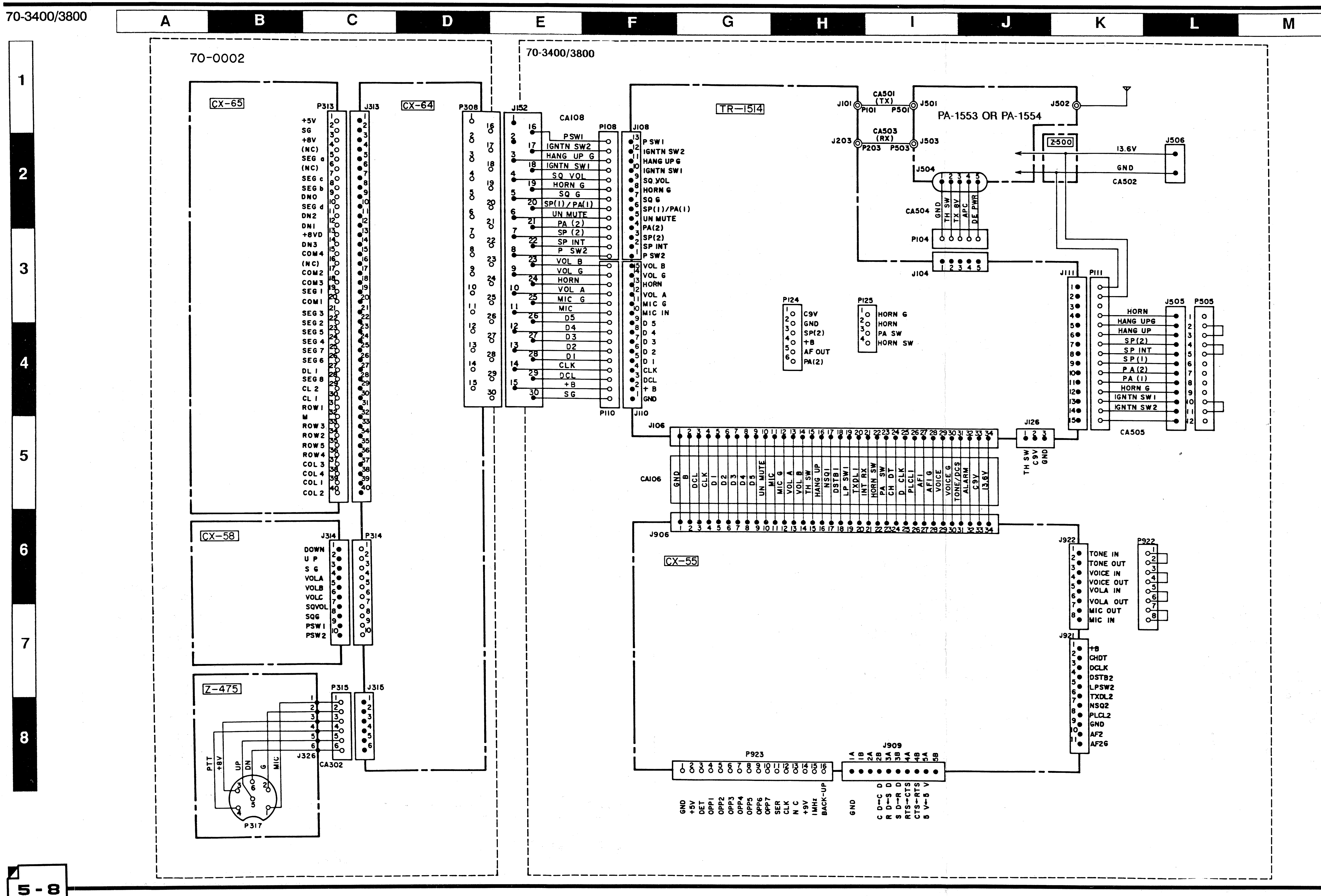
70-4421/4851 WIRING DIAGRAM

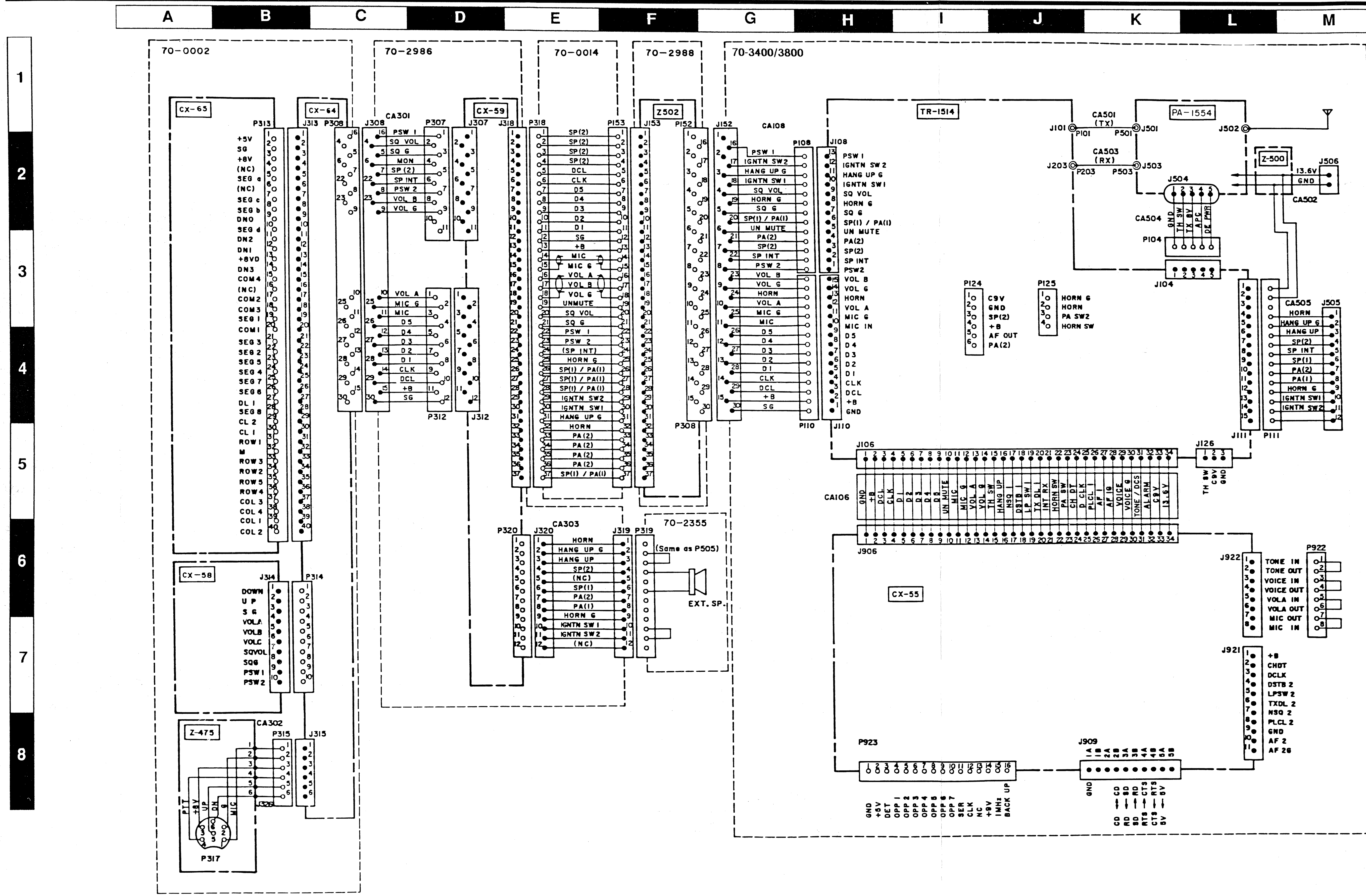




70-0007
CX-57
CX-56
CX-58
Z-475
CX-59
70-0014
70-2988
Z502
70-3400/3800
TR-1514
CX-55
70-2355
EXT. SP.
PA-1553 OR PA-1554
Z-500

70-3400/3800


A B C D E F G H I J K L M
1 2 3 4 5 6 7 8
70-0002
CX-65
CX-64
CX-58
Z-475
70-3400/3800
TR-1514
PA-1553 OR PA-1554
Z-500
CX-55
P313
J313
P308
J152
CA108
P108
J108
P110
J110
J314
P314
P315
J315
J326
CA302
P317
CA501 (TX)
CA503 (RX)
J101
P101
P501
J501
J502
J203
P203
P503
J503
J504
CA504
P104
J104
J506
13.6V
GND
CA502
J111
P111
J505
P505
CA505
P124
P125
J106
CA106
J906
J126
J922
P922
J921
P923
J909
+5V
SG
+8V
(NC)
SEG a
SEG c
SEG b
DNO
SEG d
DN2
DN1
+8VD
DN3
COM4
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
ROW3
ROW2
ROW5
ROW4
COL 3
COL 4
COL 1
COL 2
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
MIC IN
DOWN
UP
S G
VOLA
VOLB
VOLC
SQVOL
SQG
PSW1
PSW2
PTT
+8V
UP
DN
G
MIC
GND
TH SW
TX 8V
APC
DE PWR
C9V
GND
SP(2)
+B
AF OUT
PA(2)
HORN G
HORN
PA SW
HORN SW
HANG UPG
HANG UP
SP(2)
SP INT
SP(1)
PA(2)
PA (1)
HORN G
IGNTN SW1
IGNTN SW2
TH SW
C9V
GND
GND
B
DCL
CLK
D1
D2
D3
D4
D5
UN MUTE
MIC
MIC G
VOL A
VOL B
TH SW
HANG UP
NSQ1
DSTB1
LP SW1
TXDL1
INT RX
HORN SW
PA SW
CH DT
D CLK
PLCL1
AF1
AF1 G
VOICE
VOICE G
TONE/DCS
ALARM
C9V
13.6V
TONE IN
TONE OUT
VOICE IN
VOICE OUT
VOLA IN
VOLA OUT
MIC OUT
MIC IN
+B
CHDT
DCLK
DSTB2
LPSW2
TXDL2
NSQ2
PLCL2
GND
AF2
AF2G
GND
+5V
DET
OPP1
OPP2
OPP3
OPP4
OPP5
OPP6
OPP7
SER
CLK
N C
+9V
1MHz
BACK-UP
GND
C D→C D
R D→S D
S D→R D
RTS→CTS
CTS→RTS
B V→5 V
1A 1B 2A 2B 3A 3B 4A 4B 5A 5B

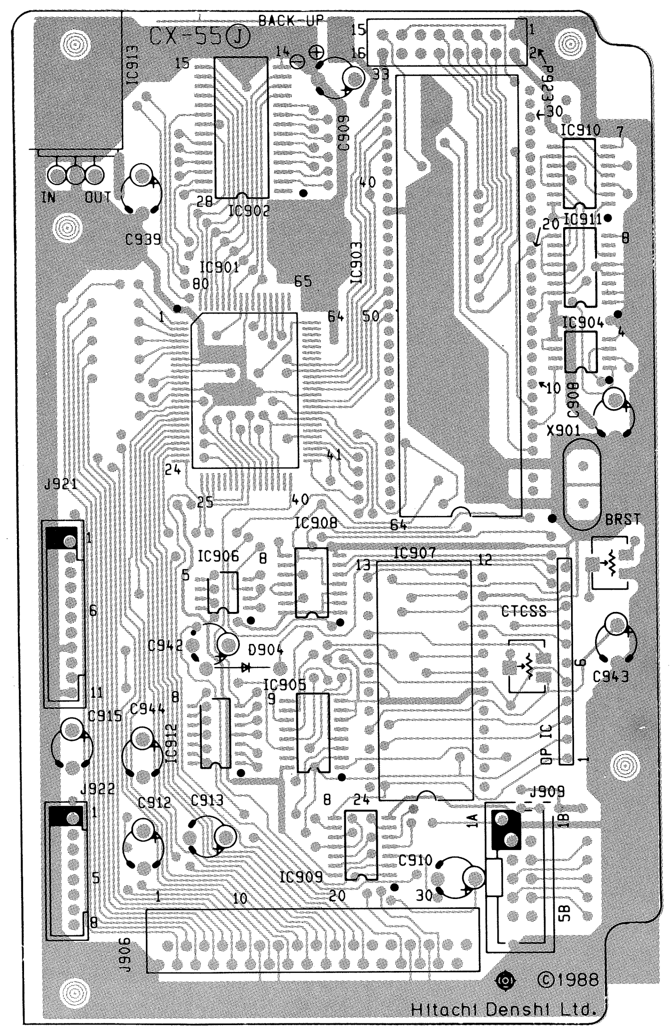

70-0002
CX-65
CX-64
CX-58
Z-475
CA302
P317
70-2986
CA301
CX-59
CA303
70-0014
70-2988
Z502
70-2355
(Same as P505)
EXT. SP.
70-3400/3800
CA108
TR-1514
CA501 (TX)
CA503 (RX)
PA-1554
Z-500
CA502
CA504
CA505
CA106
CX-55

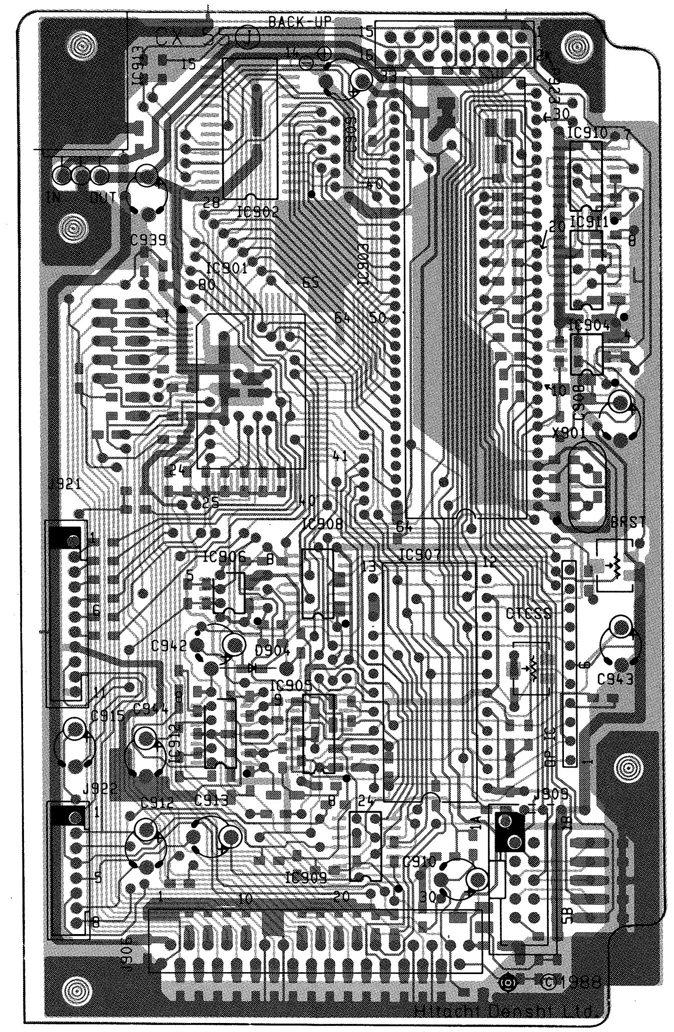
70-3400/3800

A	B	C	D	E	F	G	H	I	J	K	L	M

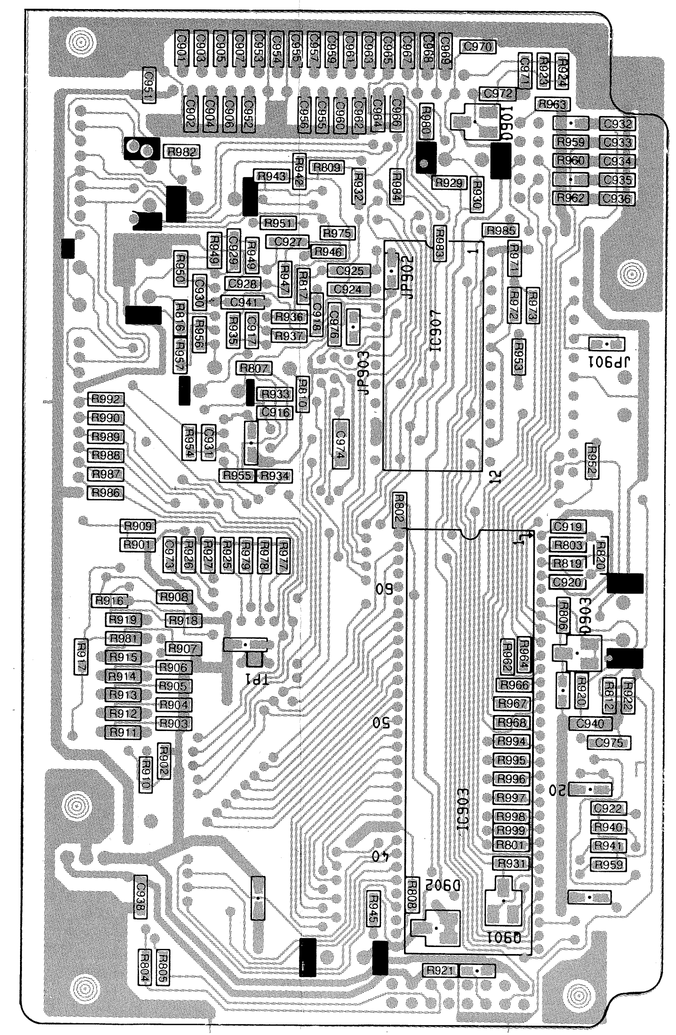
1 2 3 4 5 6 7 8

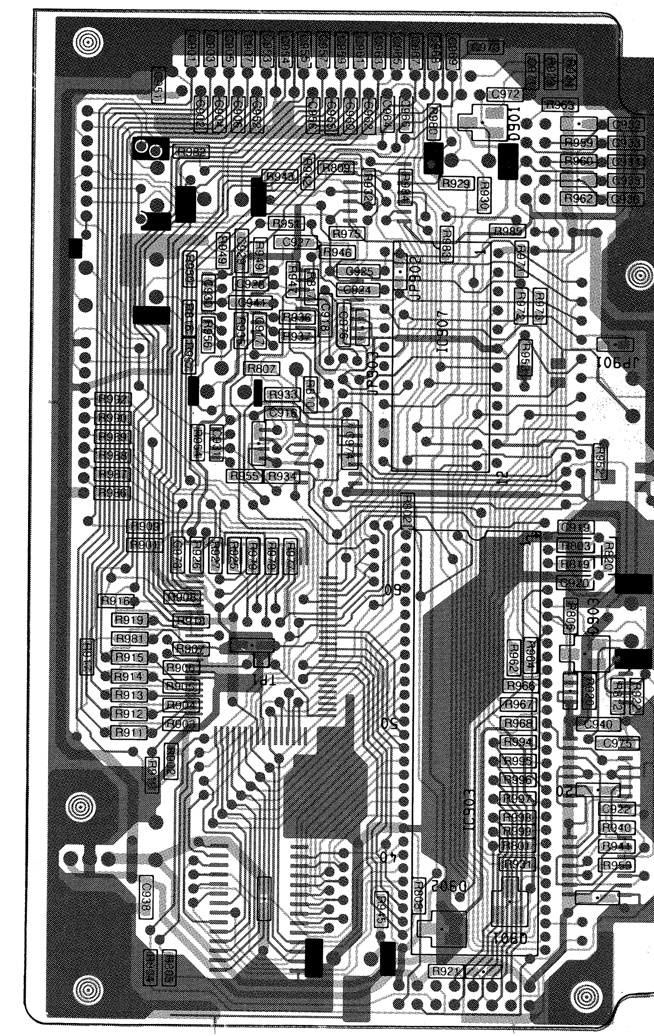
TOP VIEW





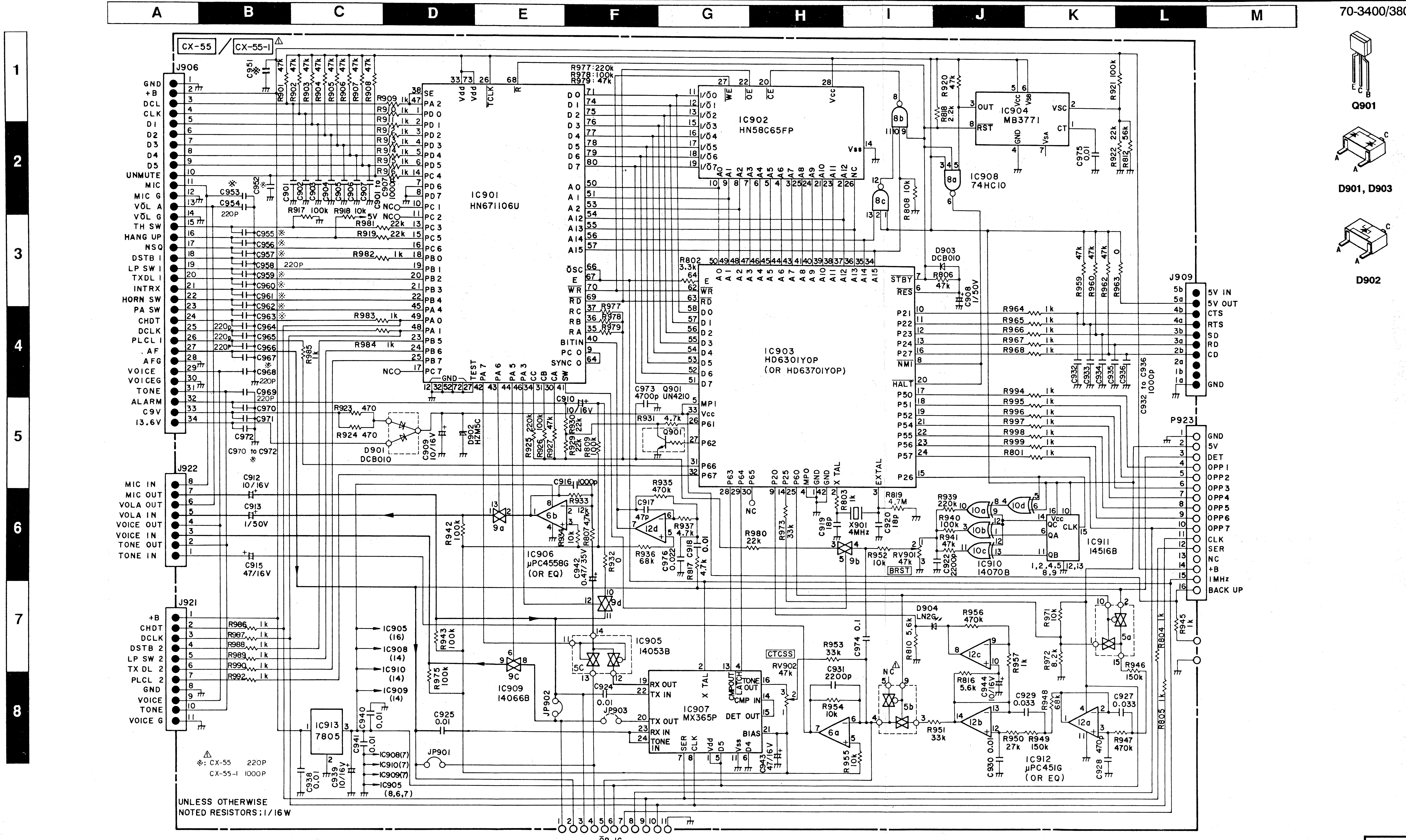
BOTTOM VIEW

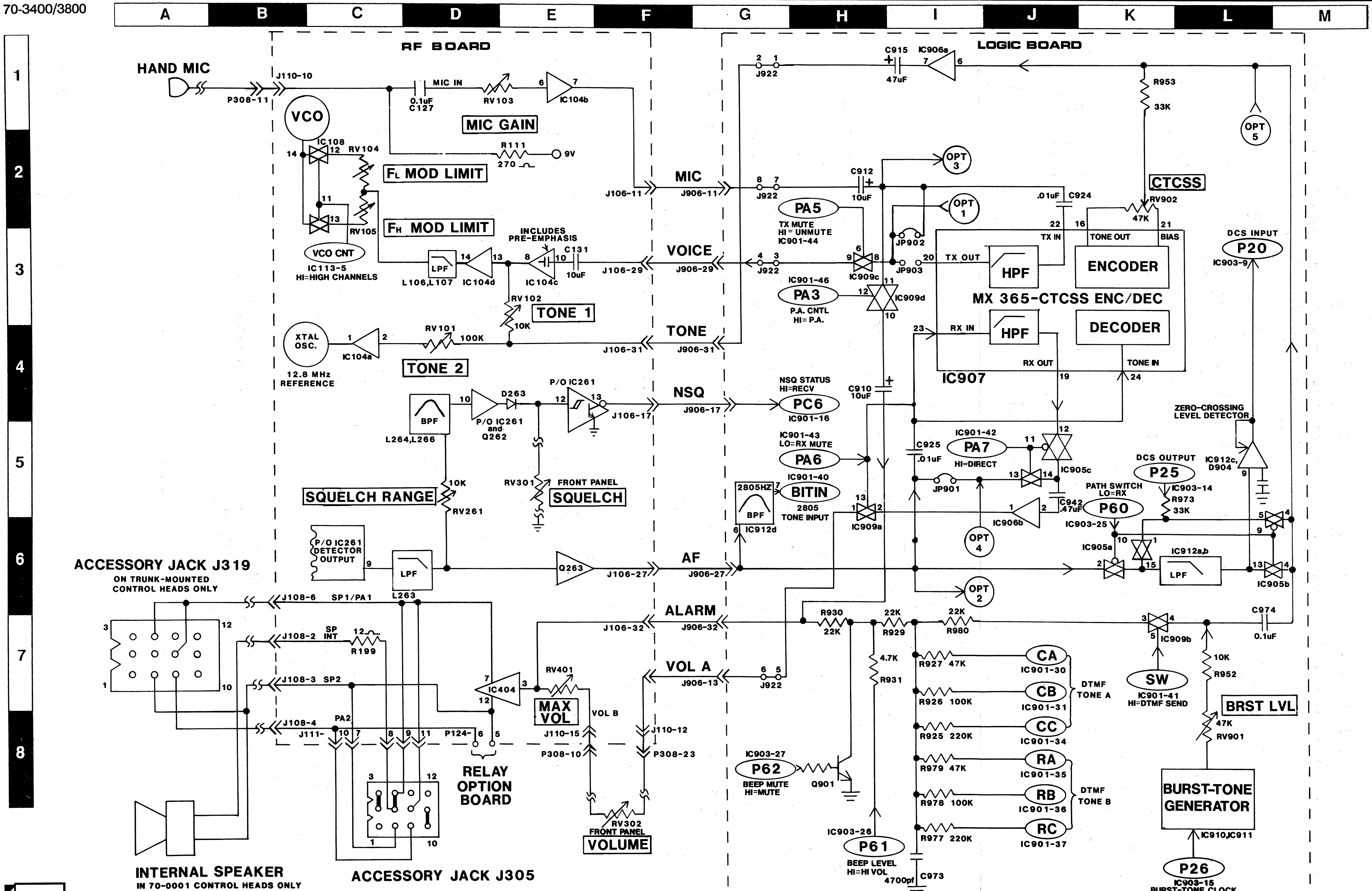




BLUE VISIBLE PLATING

RED UNDERSIDE PLATING

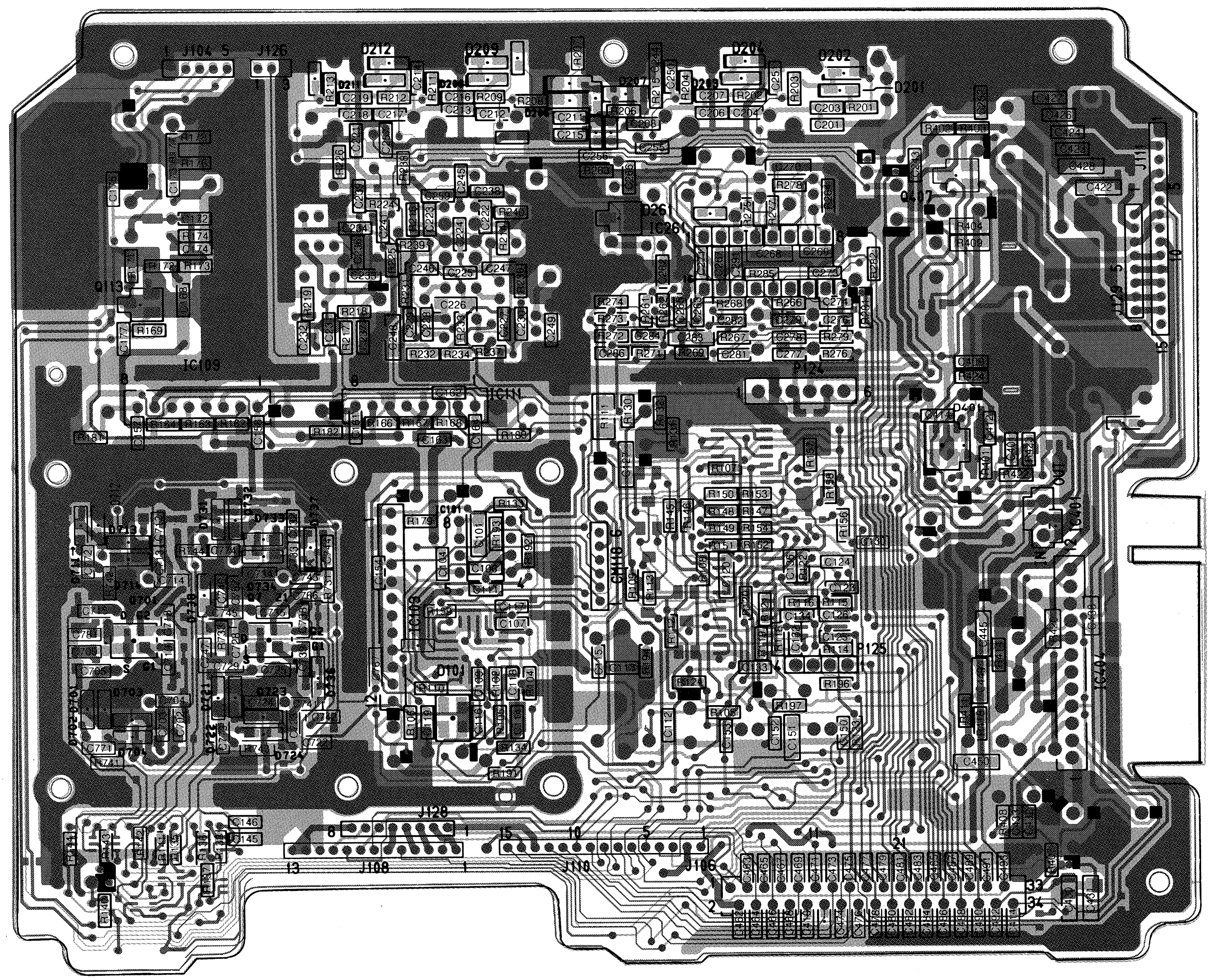

CX-55 / CX-55-I
J906
IC901
HN671106U
IC902
HN58C65FP
IC903
HD6301Y0P
(OR HD63701Y0P)
IC904
MB3771
IC908
74HC10
J909
P923
J922
J921
IC906
μPC4558G
(OR EQ)
IC905
14053B
IC909
14066B
IC907
MX365P
IC910
14070B
IC911
14516B
IC912
μPC451G
(OR EQ)
IC913
7805
X901
4MHz
D901
DCB010
D902
HZM5C
D903
DCB010
D904
LN2G
OP IC
※: CX-55 220P
CX-55-I 1000P
UNLESS OTHERWISE
NOTED RESISTORS; 1/16W
Q901
D901, D903
D902

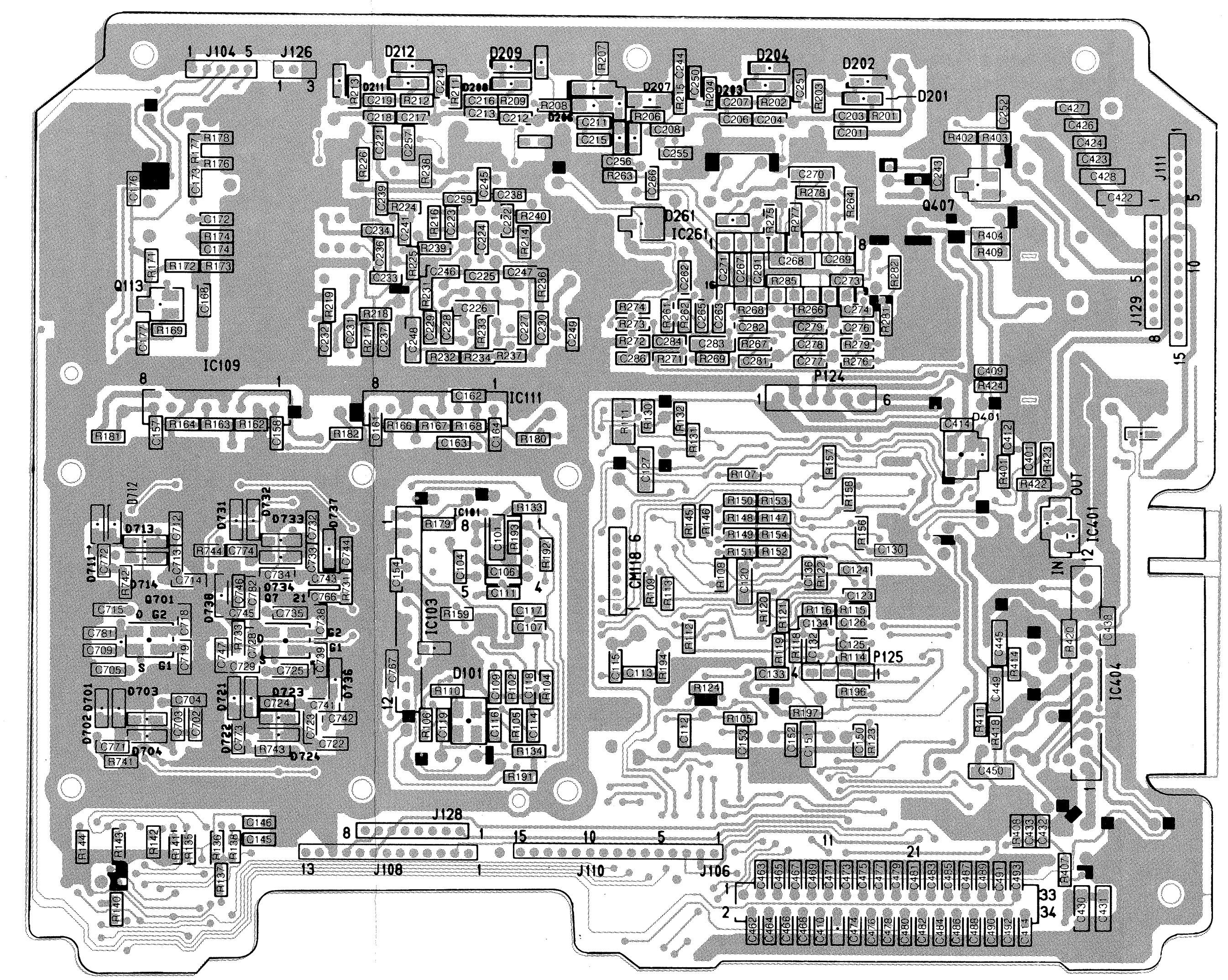


A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
8
RF BOARD
LOGIC BOARD
HAND MIC
P308-11
J110-10
VCO
IC108
RV104
14
12
11
13
RV105
VCO CNT
IC113-5
HI=HIGH CHANNELS
MIC IN
0.1uF
C127
RV103
IC104b
MIC GAIN
R111
270
9V
FL MOD LIMIT
FH MOD LIMIT
INCLUDES PRE-EMPHASIS
C131
10uF
LPF
L106,L107
IC104d
IC104c
RV102
TONE 1
10K
XTAL OSC.
12.8 MHz REFERENCE
IC104a
RV101
100K
TONE 2
BPF
L264,L266
D263
P/O IC261 and Q262
P/O IC261
SQUELCH RANGE
10K
RV261
RV301
FRONT PANEL
SQUELCH
P/O IC261 DETECTOR OUTPUT
LPF
L263
Q263
ACCESSORY JACK J319
ON TRUNK-MOUNTED CONTROL HEADS ONLY
J108-6
SP1/PA1
J108-2
SP INT
R199
J108-3
SP2
J108-4
PA2
J111-
P124-
IC404
RV401
MAX VOL
VOL B
J110-15
P308-10
J110-12
P308-23
RV302
FRONT PANEL
VOLUME
RELAY OPTION BOARD
INTERNAL SPEAKER
IN 70-0001 CONTROL HEADS ONLY
ACCESSORY JACK J305
MIC
J106-11
J906-11
VOICE
J106-29
J906-29
TONE
J106-31
J906-31
NSQ
J106-17
J906-17
AF
J106-27
J906-27
ALARM
J106-32
J906-32
VOL A
J906-13
J922
C915
47uF
IC906a
R953
33K
OPT 5
OPT 3
C912
10uF
OPT 1
PA5
TX MUTE
HI = UNMUTE
IC901-44
JP902
JP903
IC909c
IC901-46
PA3
P.A. CNTL
HI= P.A.
IC909d
CTCSS
RV902
47K
.01uF
C924
TX IN
TONE OUT
BIAS
TX OUT
HPF
ENCODER
MX 365-CTCSS ENC/DEC
RX IN
HPF
DECODER
RX OUT
TONE IN
IC907
DCS INPUT
P20
IC903-9
C910
10uF
NSQ STATUS
HI=RECV
PC6
IC901-16
IC901-43
LO=RX MUTE
PA6
C925
.01uF
IC901-42
PA7
HI=DIRECT
IC905c
JP901
C942
.47uF
ZERO-CROSSING LEVEL DETECTOR
IC912c, D904
DCS OUTPUT
P25
IC903-14
R973
33K
PATH SWITCH
LO=RX
P60
IC903-25
2805HZ
BPF
IC912d
IC901-40
BITIN
2805 TONE INPUT
IC909a
IC906b
OPT 4
IC905a
IC912a,b
LPF
IC905b
OPT 2
R930
22K
22K
R929
22K
R980
C974
0.1uF
IC909b
SW
IC901-41
HI=DTMF SEND
10K
R952
BRST LVL
47K
RV901
4.7K
R931
R927 47K
CA
IC901-30
R926 100K
CB
IC901-31
R925 220K
CC
IC901-34
DTMF TONE A
R979 47K
RA
IC901-35
R978 100K
RB
IC901-36
R977 220K
RC
IC901-37
DTMF TONE B
IC903-27
P62
BEEP MUTE
HI=MUTE
Q901
IC903-26
P61
BEEP LEVEL
HI=HI VOL
4700pf
C973
BURST-TONE GENERATOR
IC910,IC911
P26
IC903-15
BURST-TONE CLOCK

A	B	C	D	E	F	G	H	I	J	K	L	M

1 2 3 4 5 6 7 8

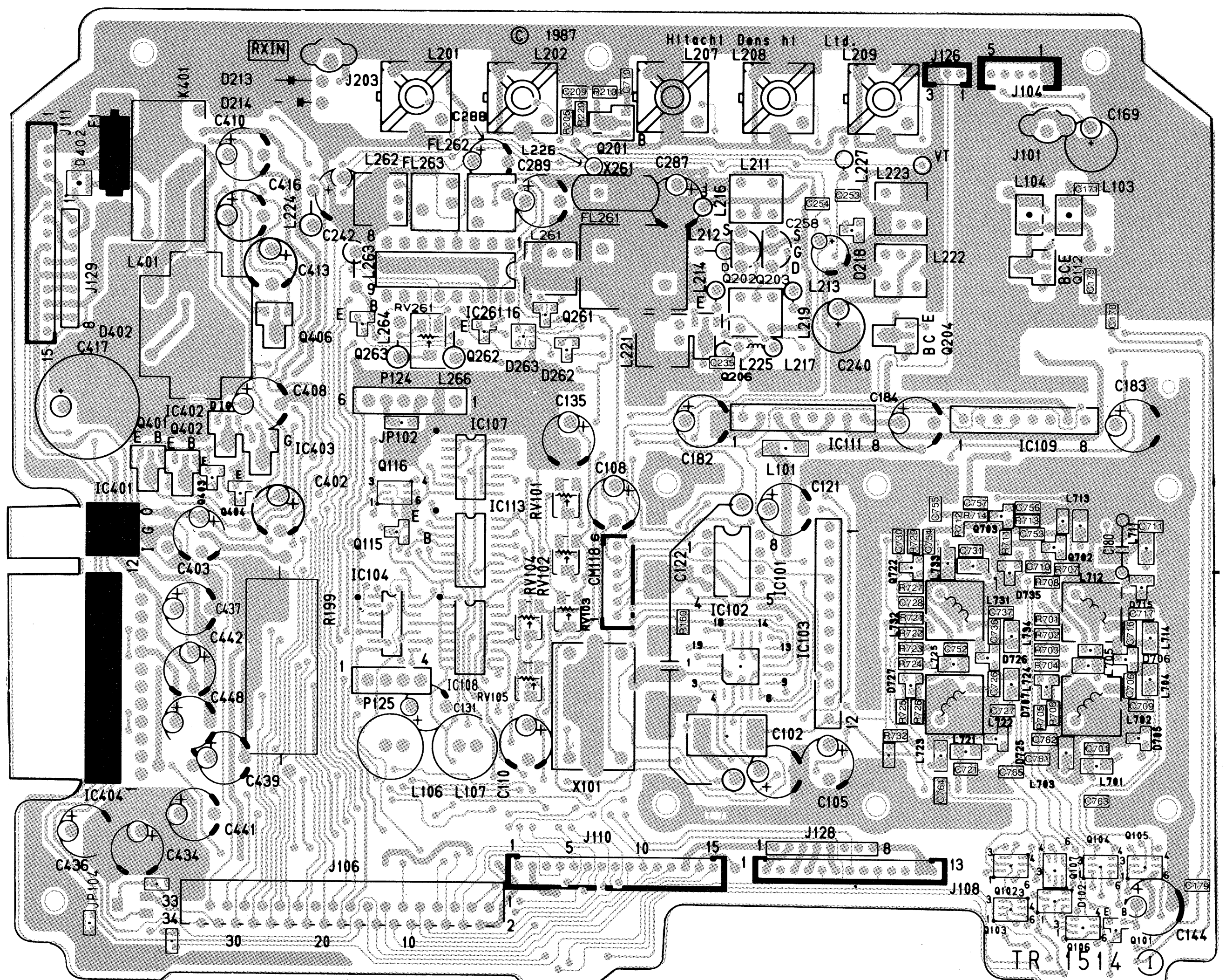


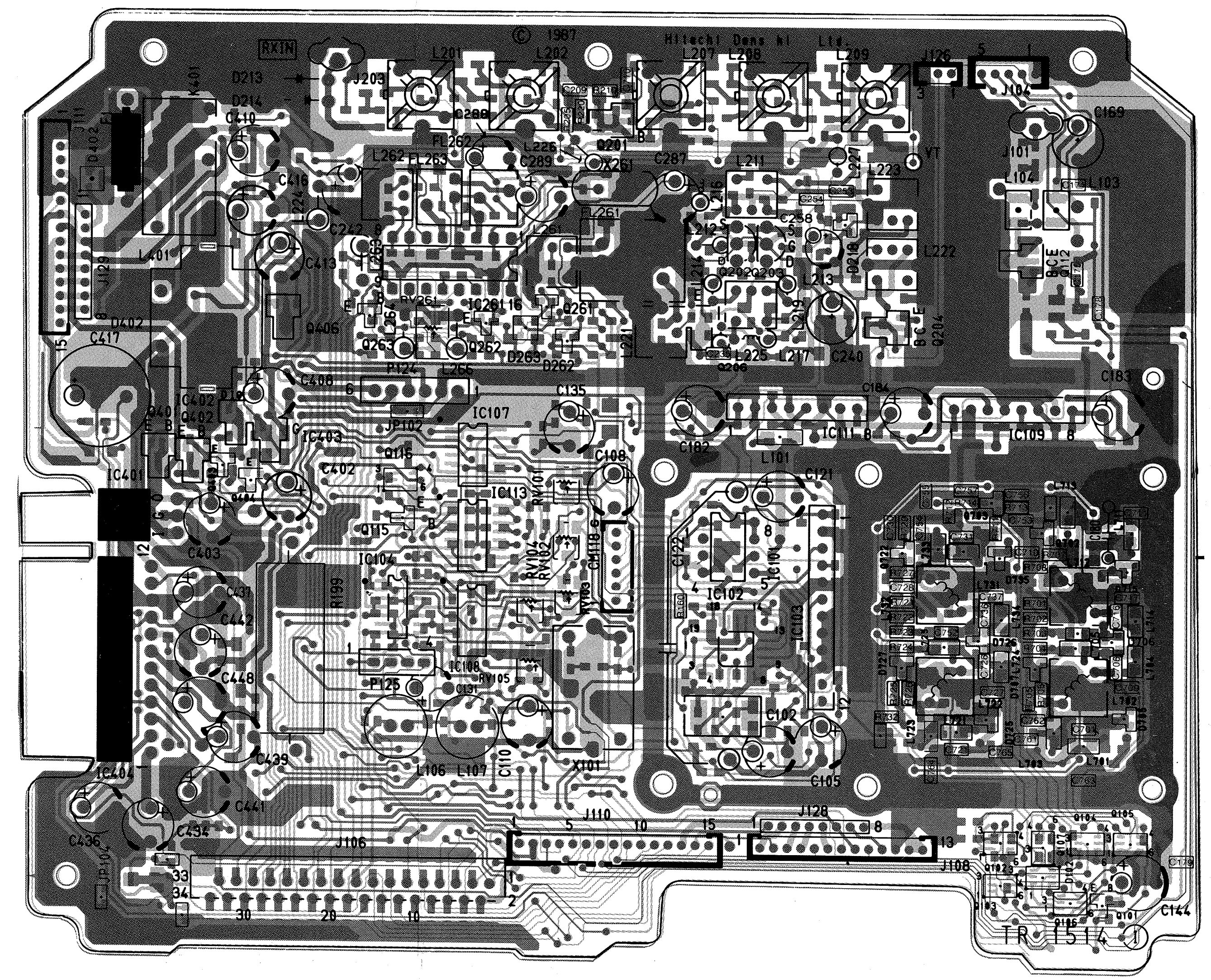


BLUE VISIBLE PLATING
RED UNDERSIDE PLATING

70-3400/3800

A	B	C	D	E	F	G	H	I	J	K	L	M

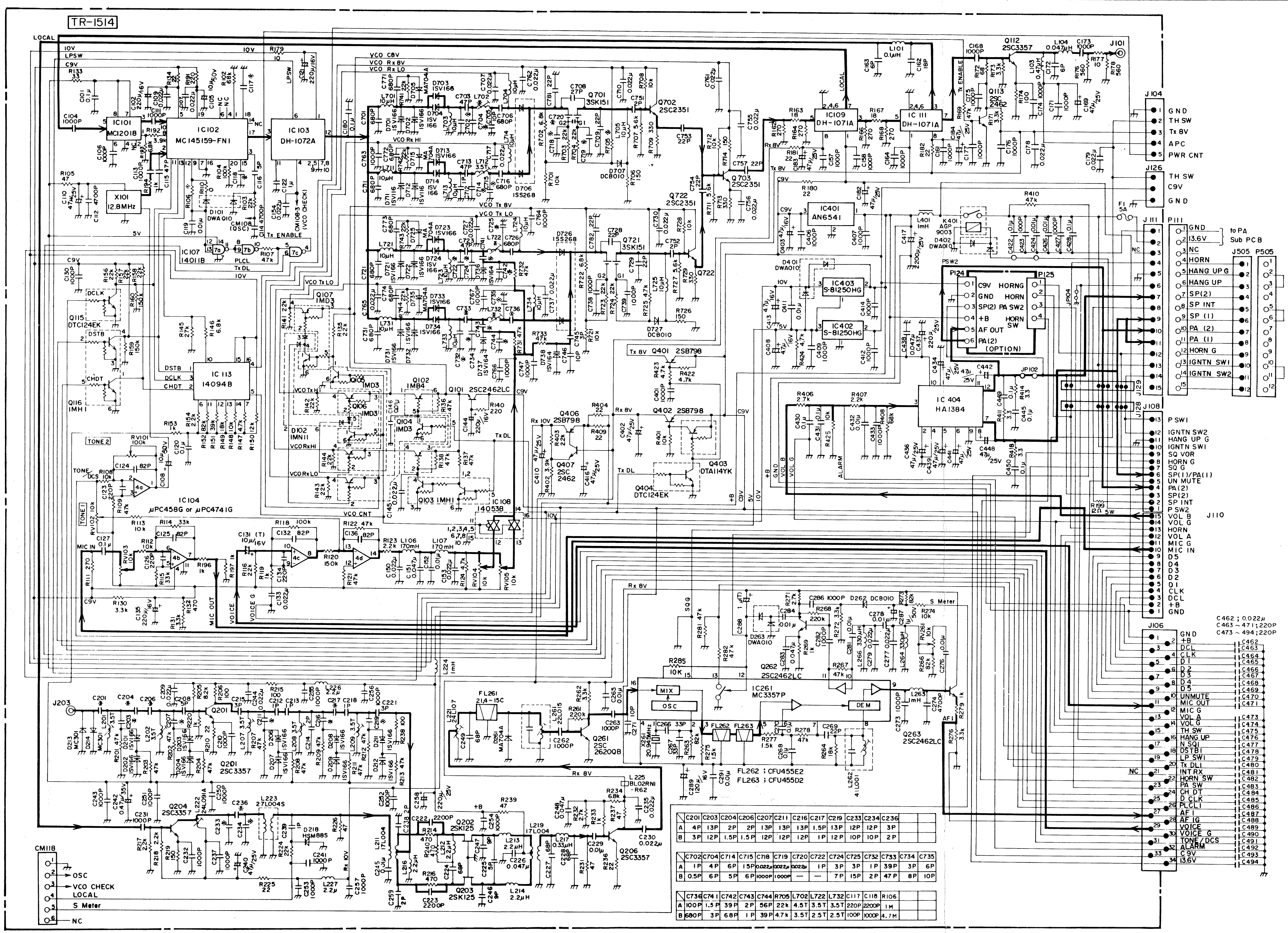




BLUE VISIBLE PLATING

RED UNDERSIDE PLATING

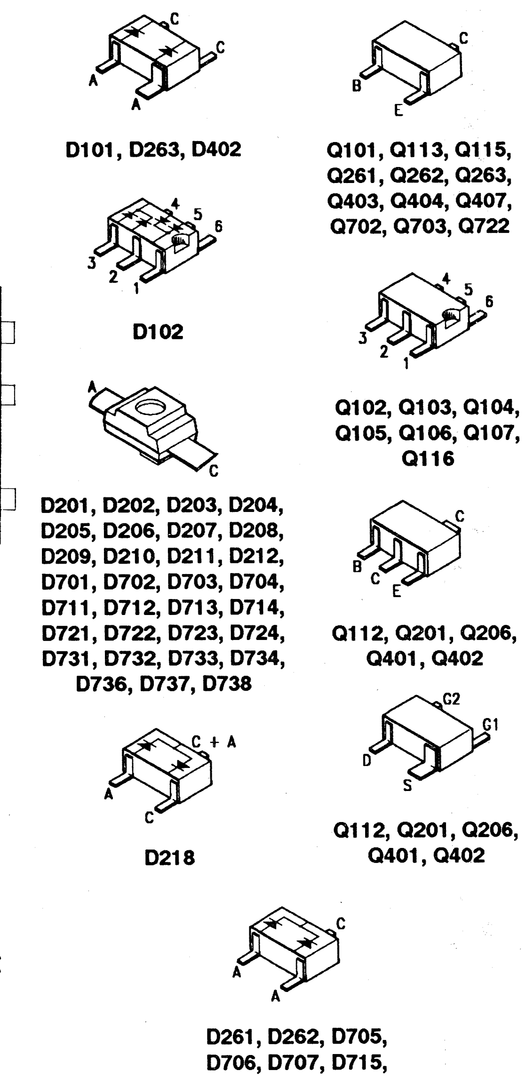
A	B	C	D	E	F	G	H	I	J	K	L	M



	C201	C203	C204	C206	C207	C211	C216	C217	C219	C233	C234	C236		
A	4P	13P	2P	2P	13P	13P	13P	1.5P	13P	12P	12P	3P		
B	3P	12P	1.5P	1.5P	12P	12P	12P	1P	12P	10P	10P	2P		

	C702	C704	C714	C715	C718	C719	C720	C722	C724	C725	C732	C733	C734	C735
A	1P	4P	6P	15P	0.022μ	0.022μ	0.022μ	1P	3P	3P	1P	39P	3P	6P
B	0.5P	6P	5P	6P	1000P	1000P	—	—	7P	15P	2P	47P	8P	10P

	C736	C741	C742	C743	C744	R705	L702	L722	L732	C117	C118	R106		
A	100P	1.5P	39P	2P	56P	22k	4.5T	3.5T	3.5T	220P	2200P	1M		
B	680P	3P	68P	1P	39P	4.7k	3.5T	2.5T	2.5T	100P	1000P	4.7M		



D101, D263, D402

Q101, Q113, Q115, Q261, Q262, Q263, Q403, Q404, Q407, Q702, Q703, Q722

D102

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

D201, D202, D203, D204, D205, D206, D207, D208, D209, D210, D211, D212, D701, D702, D703, D704, D711, D712, D713, D714, D721, D722, D723, D724, D731, D732, D733, D734, D736, D737, D738

Q112, Q201, Q206, Q401, Q402

D218

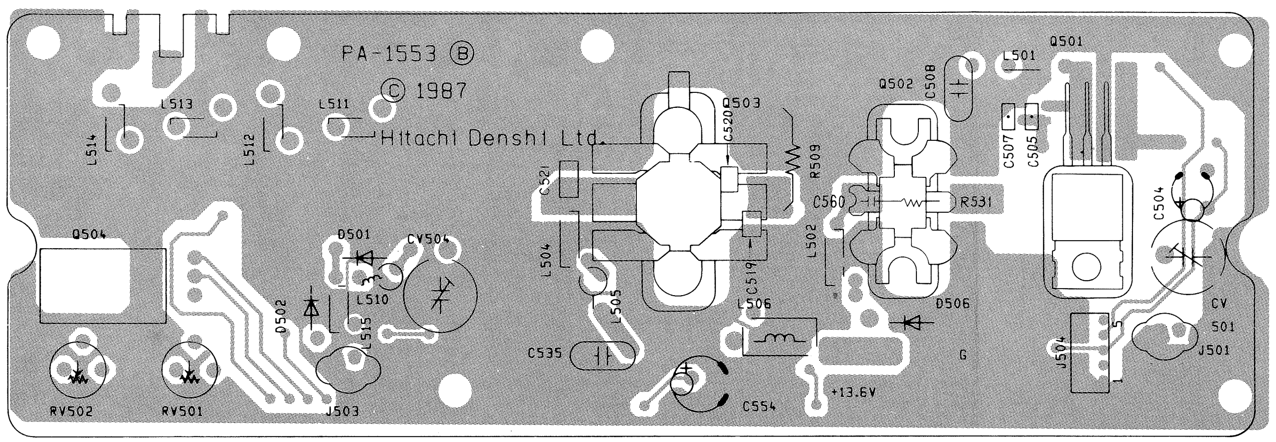
Q112, Q201, Q206, Q401, Q402

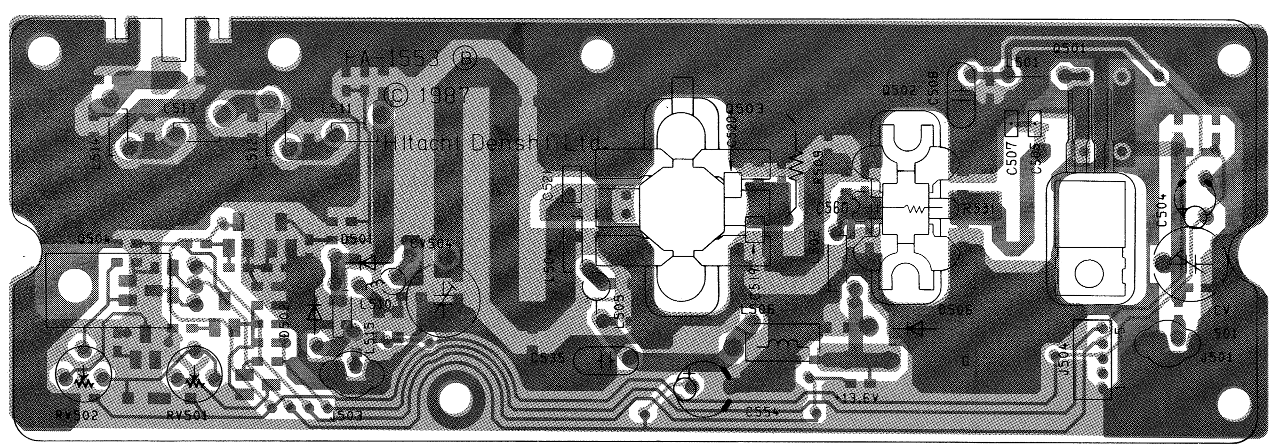
D261, D262, D705, D706, D707, D715, D725, D726, D727, D735

A B C D E F G H I J K L M

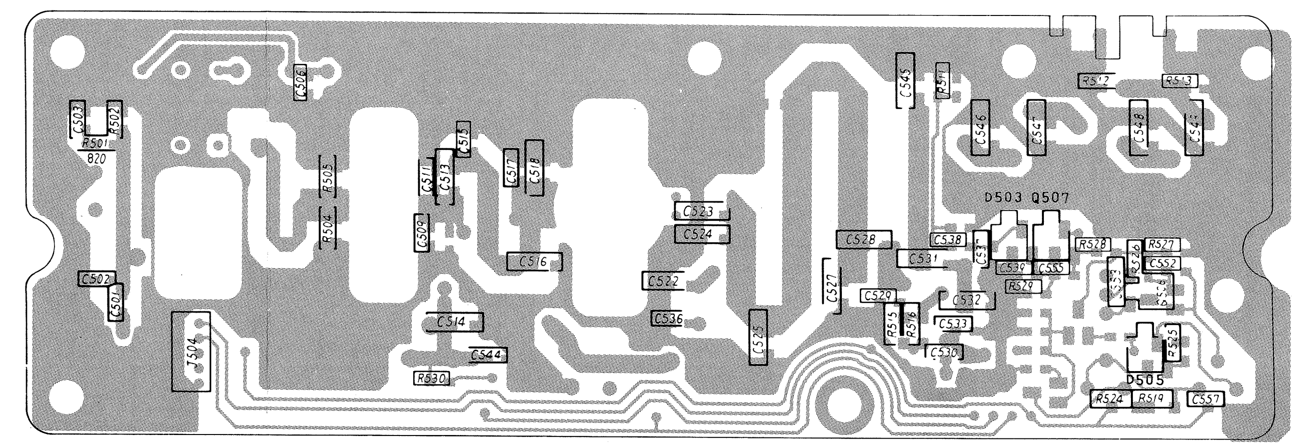
1 2 3 4 5 6 7 8

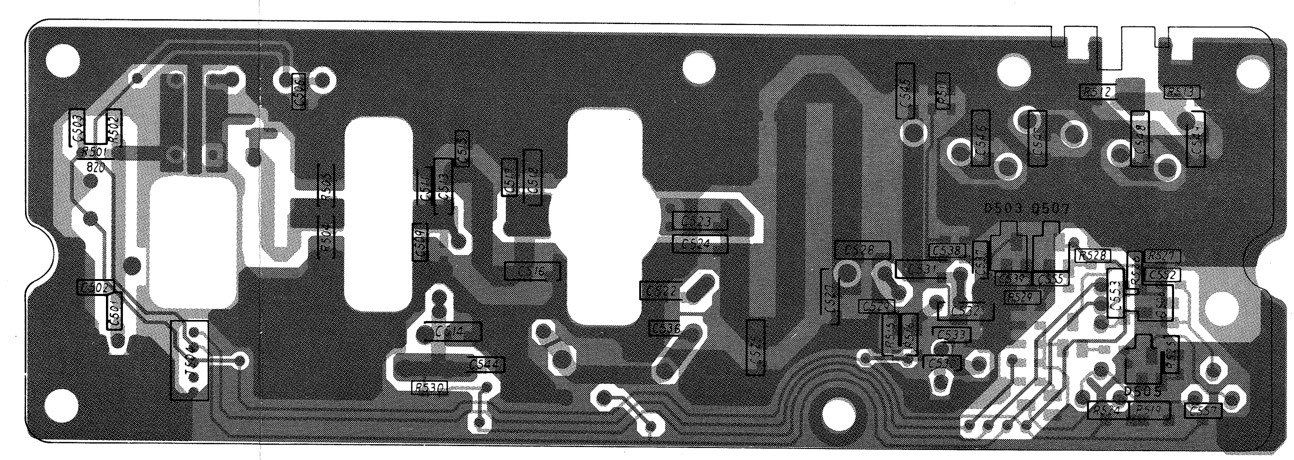
TOP VIEW





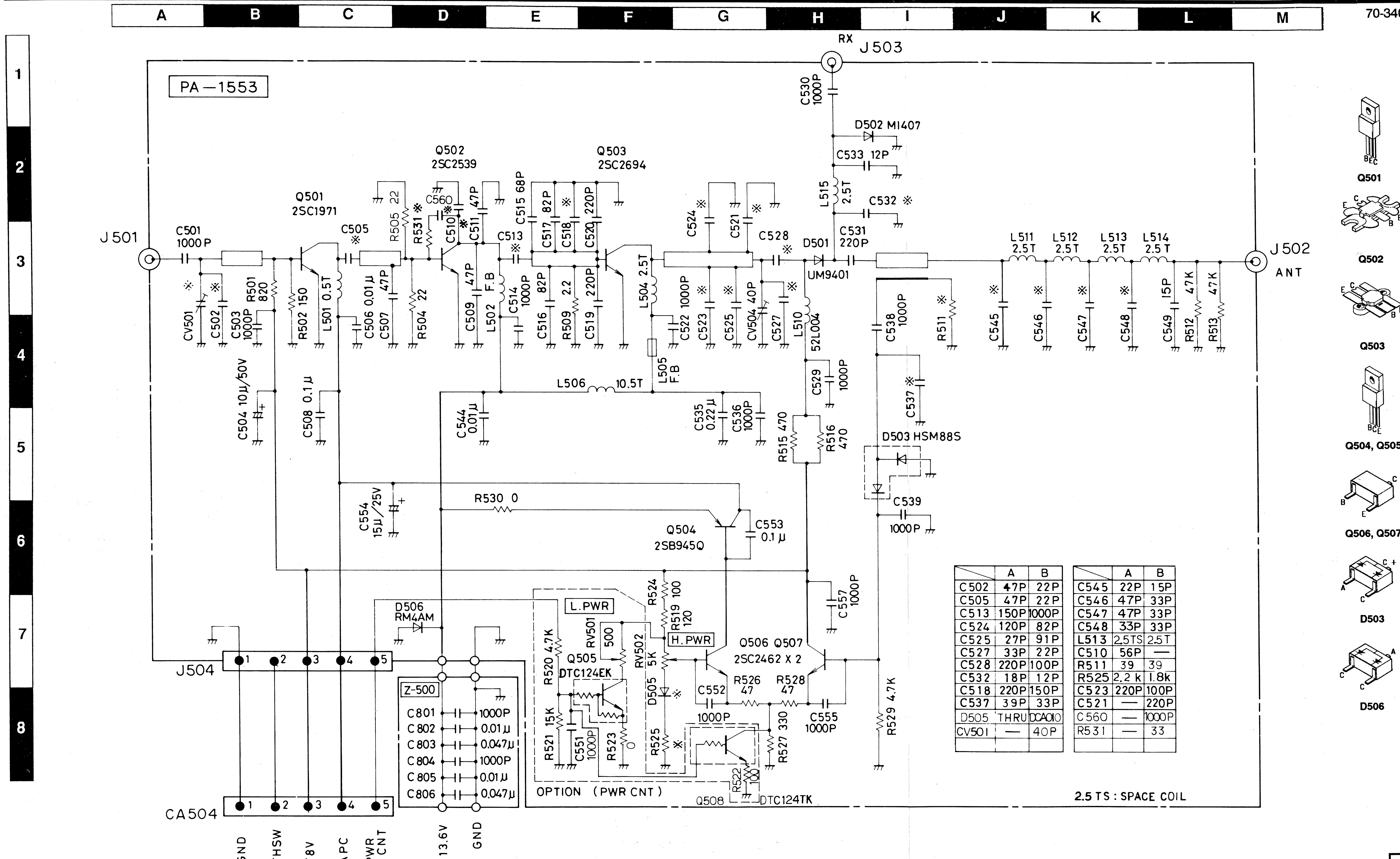
BOTTOM VIEW





BLUE VISIBLE PLATING

RED UNDERSIDE PLATING

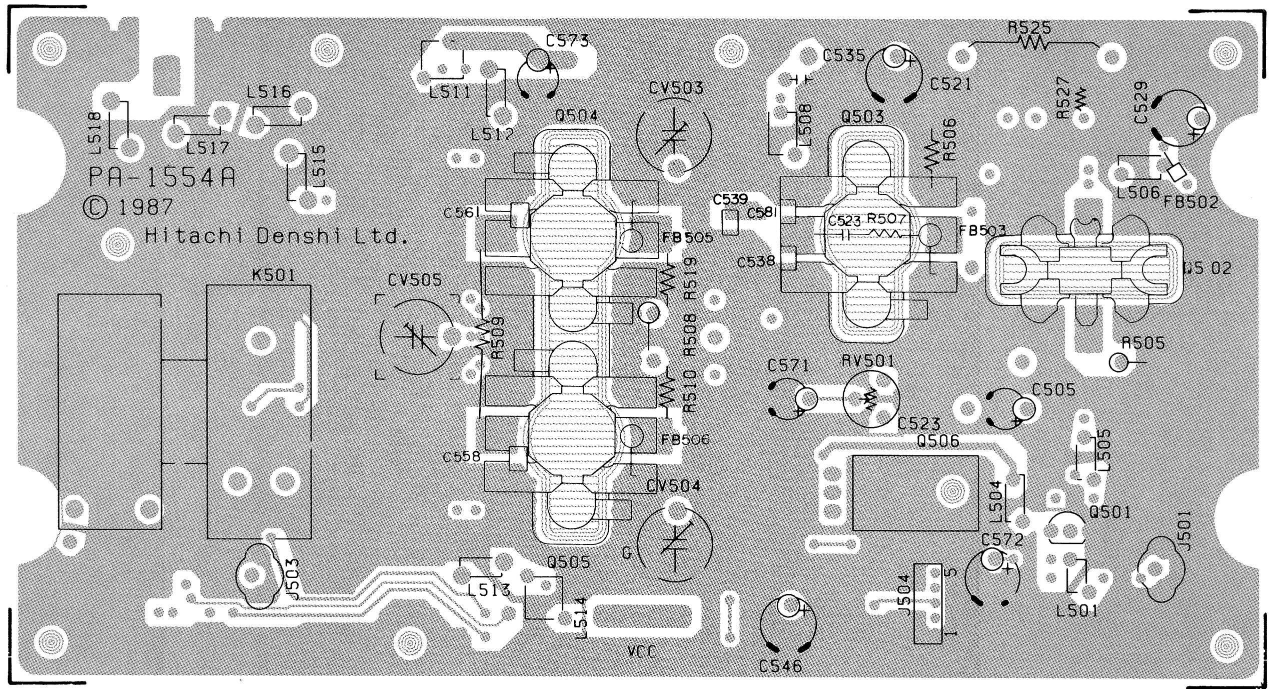


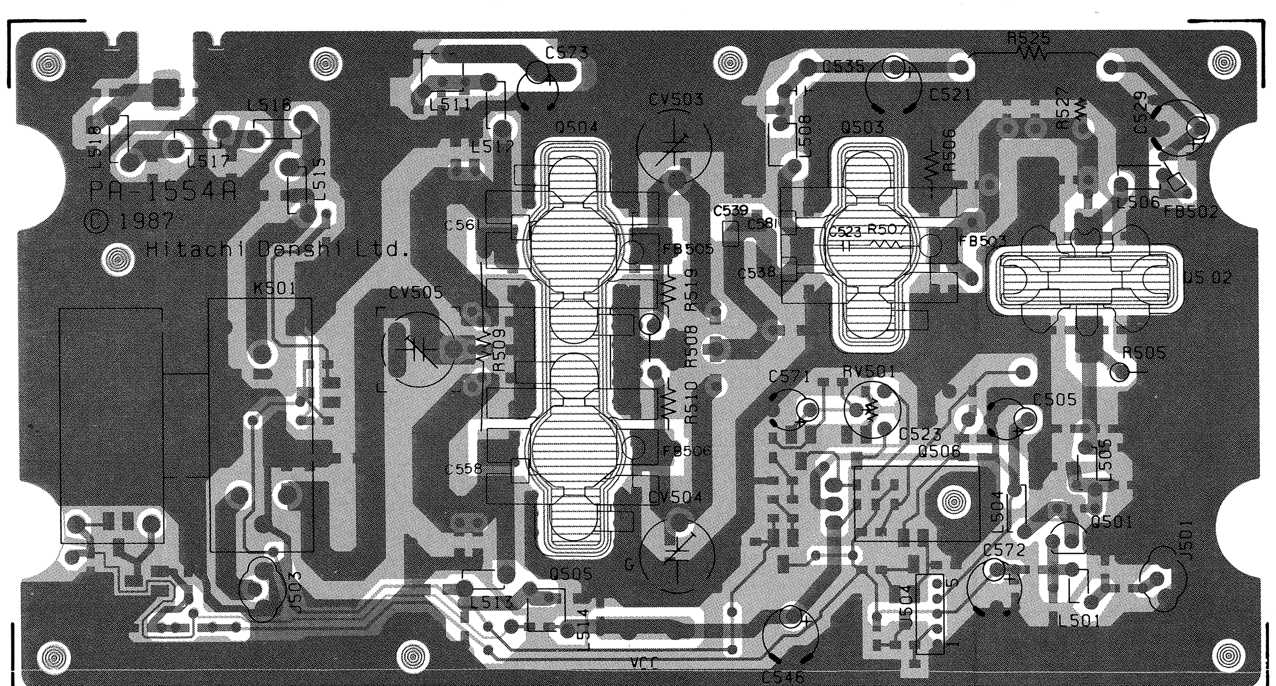
	A	B
C502	47P	22P
C505	47P	22P
C513	150P	1000P
C524	120P	82P
C525	27P	91P
C527	33P	22P
C528	220P	100P
C532	18P	12P
C518	220P	150P
C537	39P	33P
D505	THRU	DCA010
CV501	—	40P

	A	B
C545	22P	15P
C546	47P	33P
C547	47P	33P
C548	33P	33P
L513	2.5TS	2.5T
C510	56P	—
R511	39	39
R525	2.2 k	1.8k
C523	220P	100P
C521	—	220P
C560	—	1000P
R531	—	33

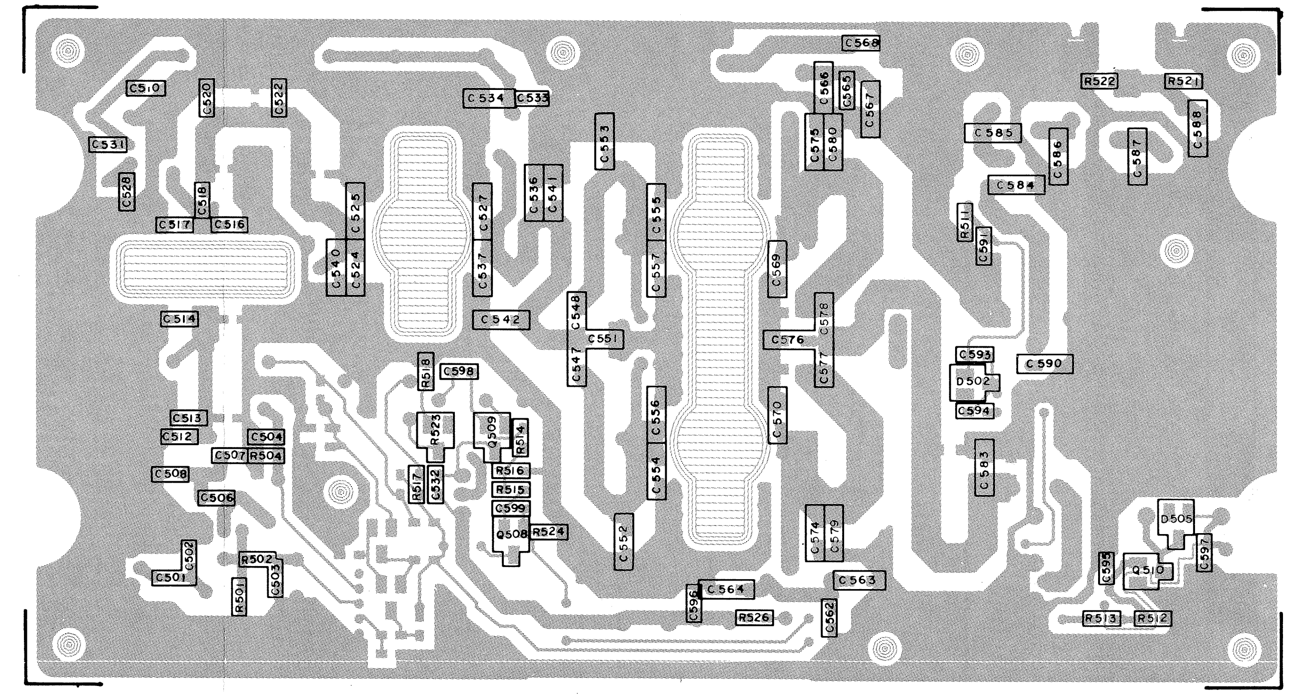
A	B	C	D	E	F	G	H	I	J	K	L	M

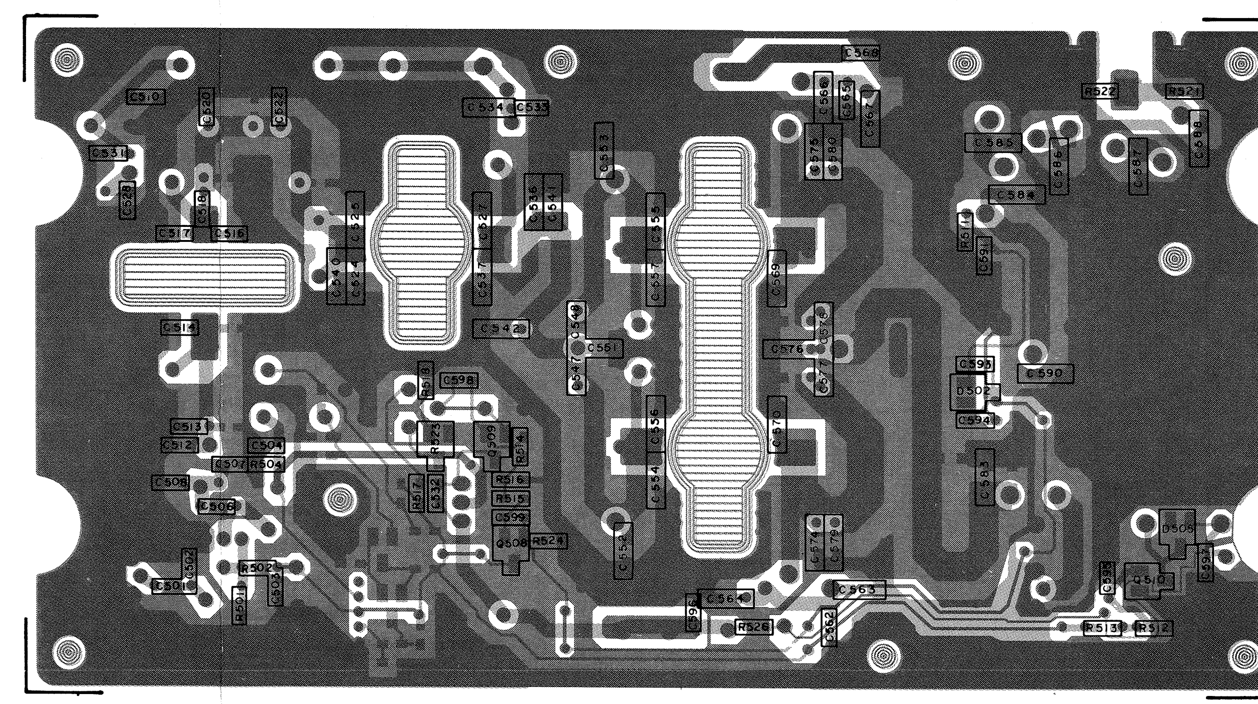
TOP VIEW





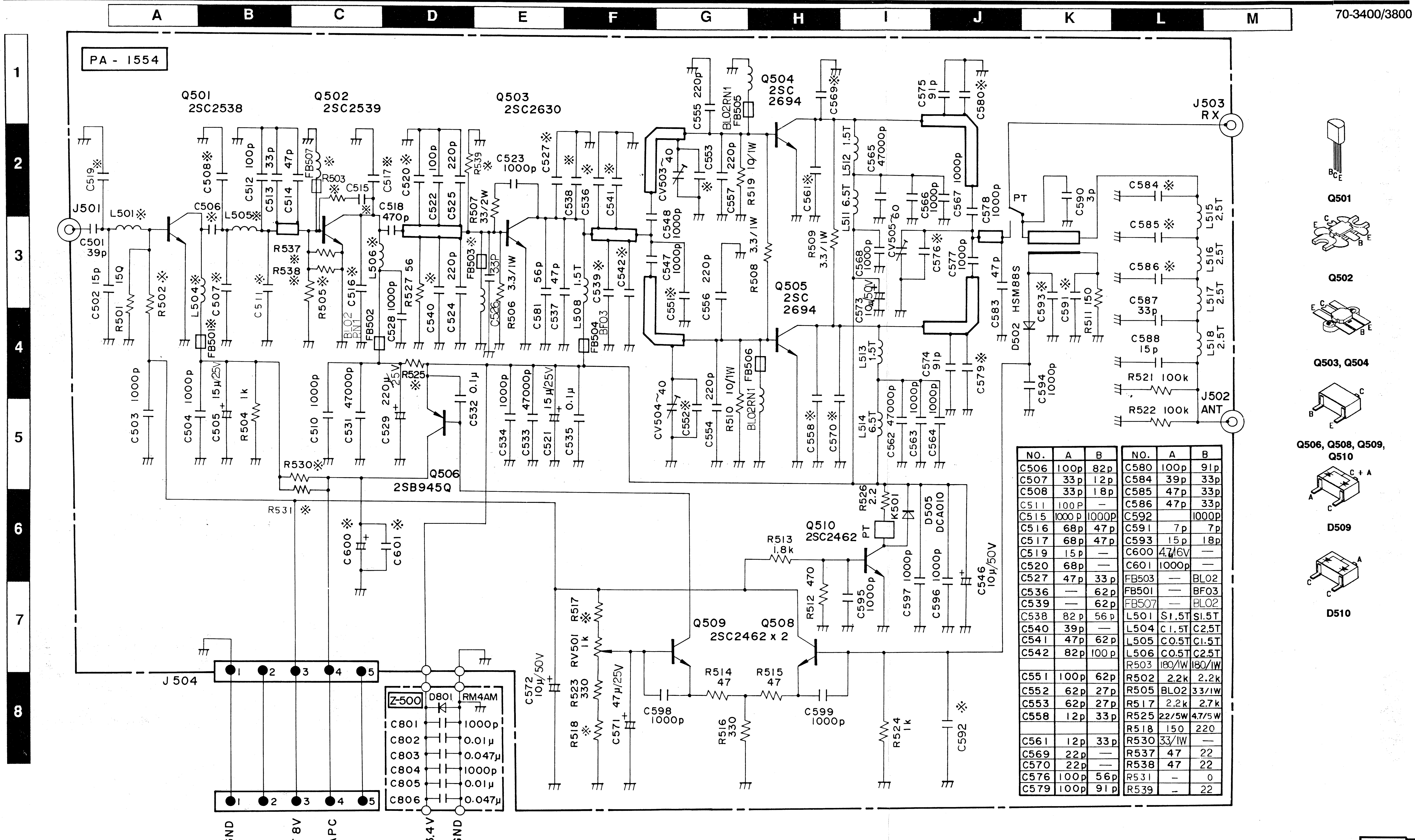
BOTTOM VIEW





BLUE VISIBLE PLATING

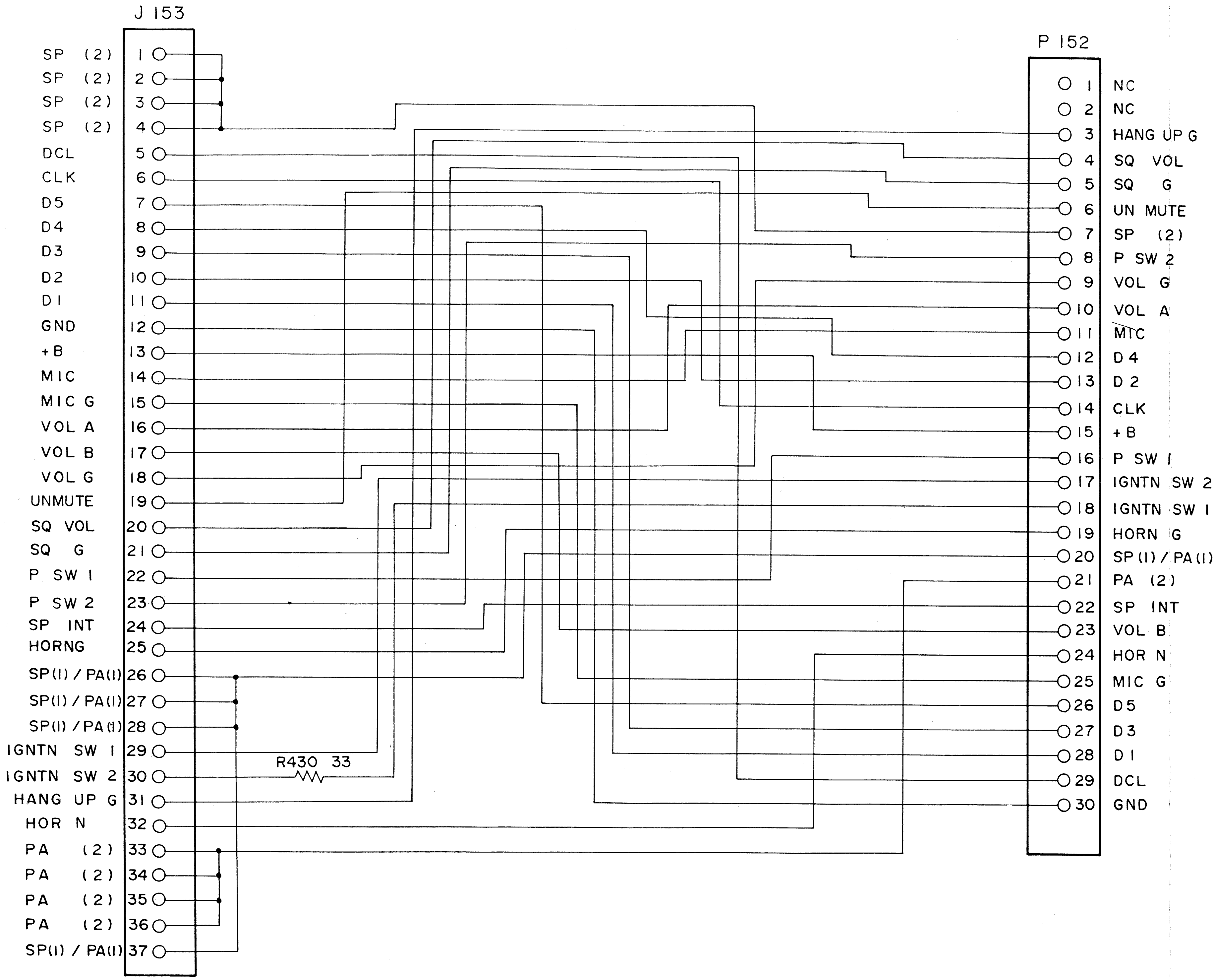
RED UNDERSIDE PLATING



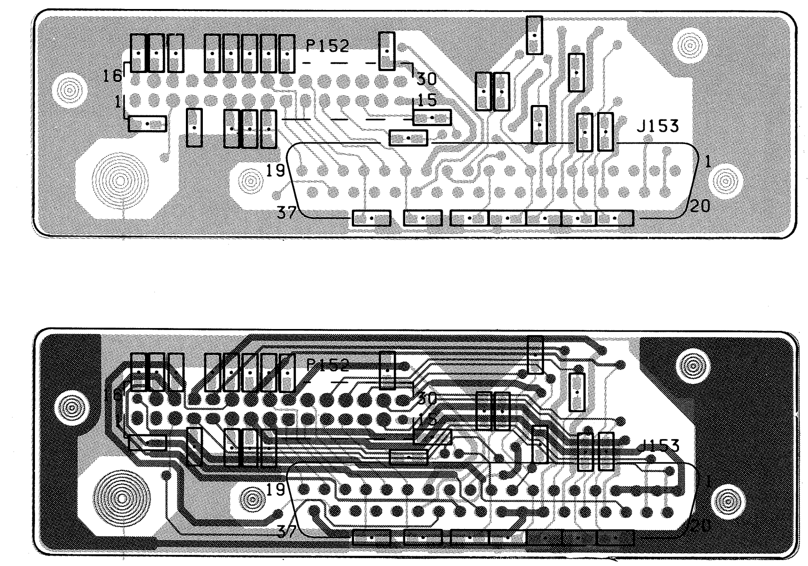
NO.	A	B
C506	100p	82p
C507	33p	12p
C508	33p	18p
C511	100P	—
C515	1000p	1000p
C516	68p	47p
C517	68p	47p
C519	15p	—
C520	68p	—
C527	47p	33p
C536	—	62p
C539	—	62p
C538	82p	56p
C540	39p	—
C541	47p	62p
C542	82p	100p
C551	100p	62p
C552	62p	27p
C553	62p	27p
C558	12p	33p
C561	12p	33p
C569	22p	—
C570	22p	—
C576	100p	56p
C579	100p	91p

NO.	A	B
C580	100p	91p
C584	39p	33p
C585	47p	33p
C586	47p	33p
C592		1000p
C591	7p	7p
C593	15p	18p
C600	47µ/16V	—
C601	1000p	—
FB503	—	BL02
FB501	—	BF03
FB507	—	BL02
L501	S1.5T	S1.5T
L504	C1.5T	C2.5T
L505	C0.5T	C1.5T
L506	C0.5T	C2.5T
R503	180/1W	180/1W
R502	2.2k	2.2k
R505	BL02	33/1W
R517	2.2k	2.7k
R525	2.2/5W	4.7/5W
R518	150	220
R530	33/1W	—
R537	47	22
R538	47	22
R531	–	0
R539	–	22

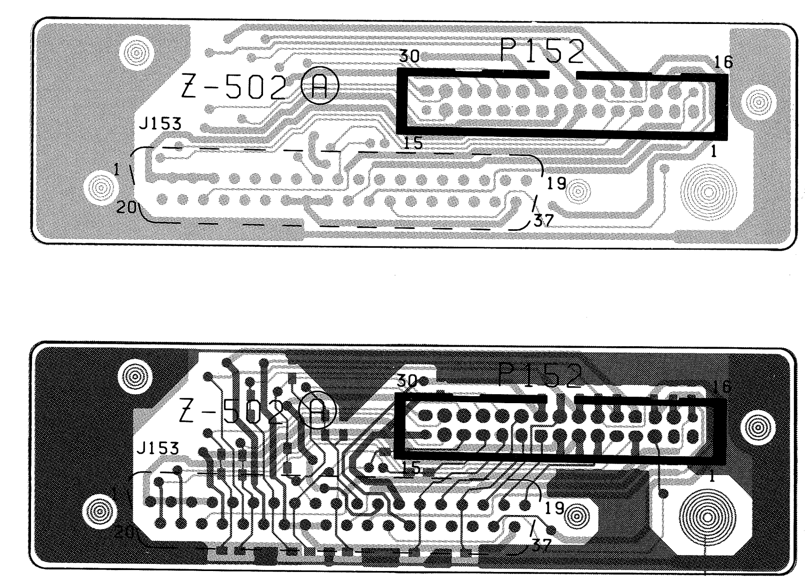
A	B	C	D	E	F	G	H	I	J	K	L	M



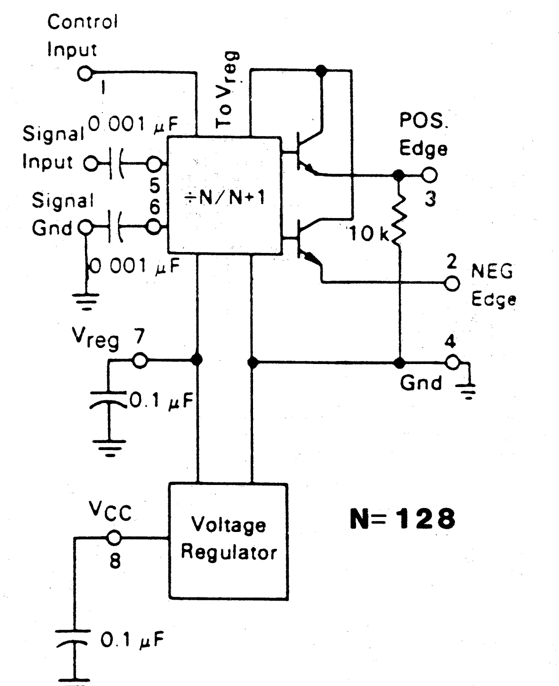
TOP VIEW



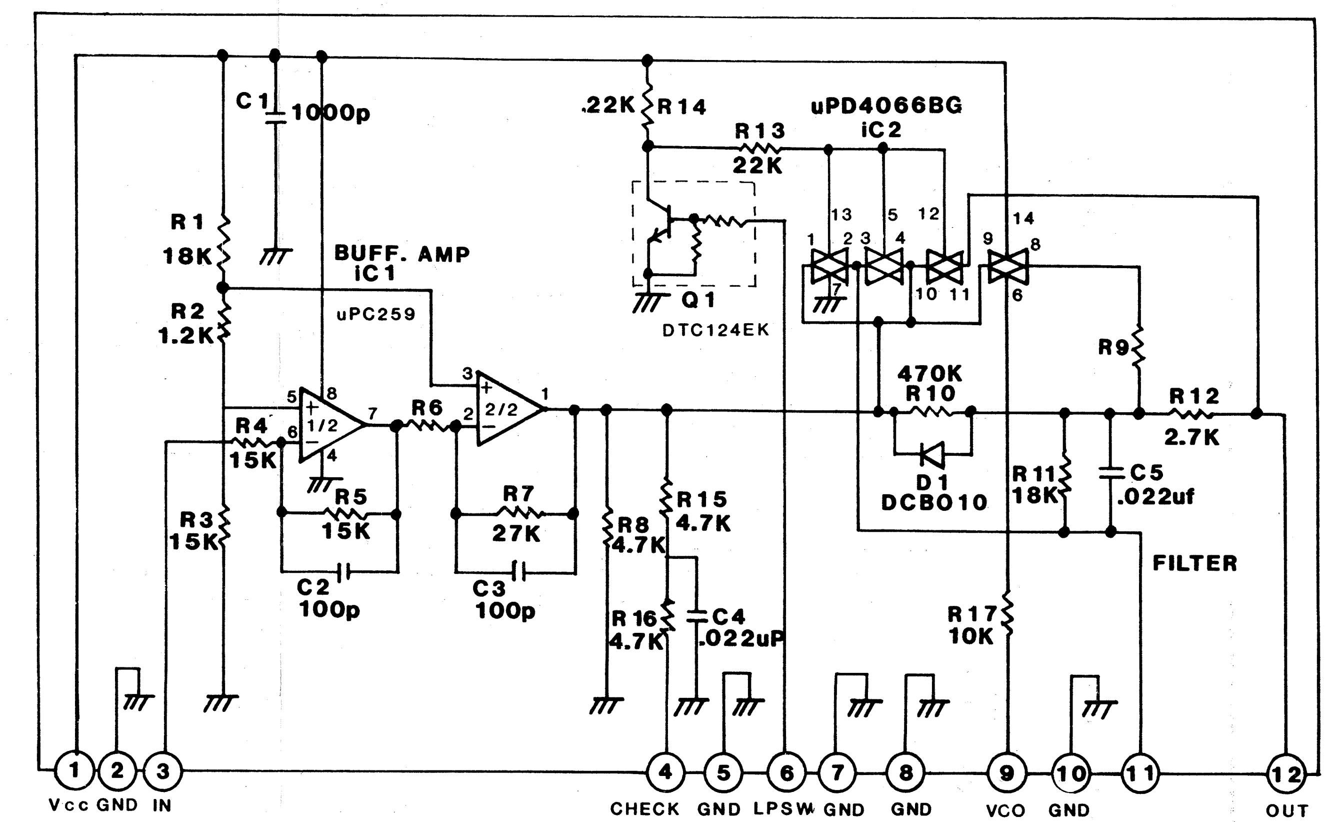
BOTTOM VIEW



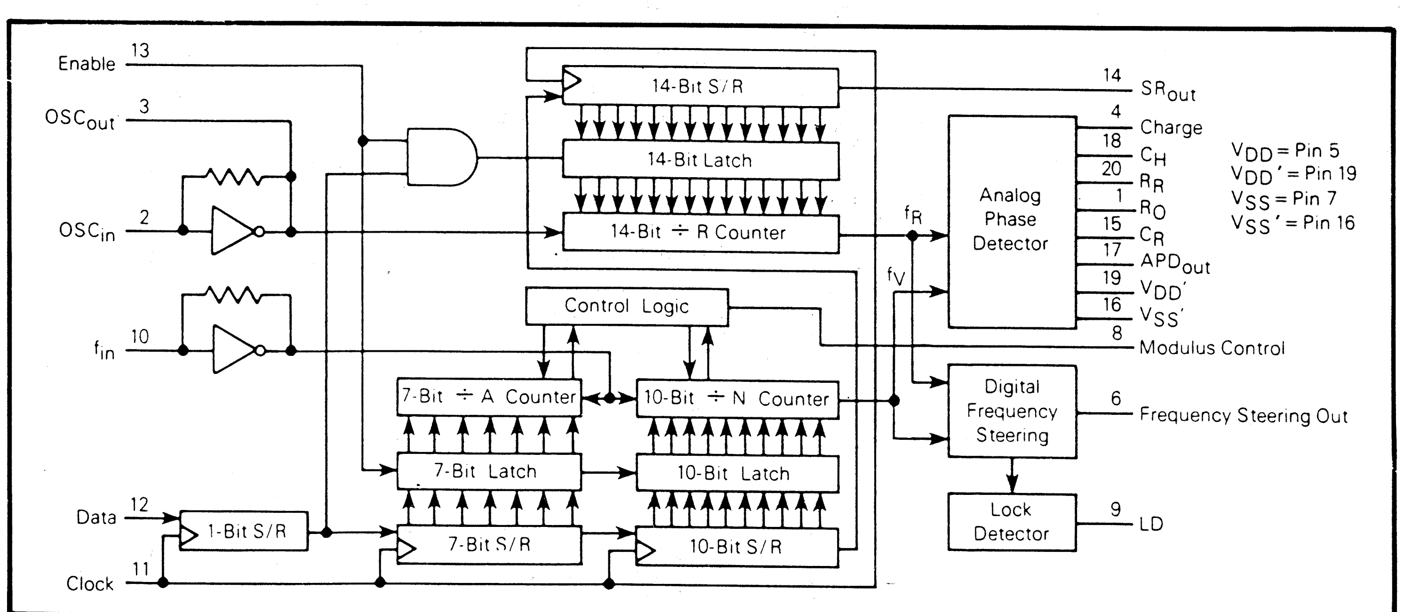
BLUE VISIBLE PLATING
RED UNDERSIDE PLATING



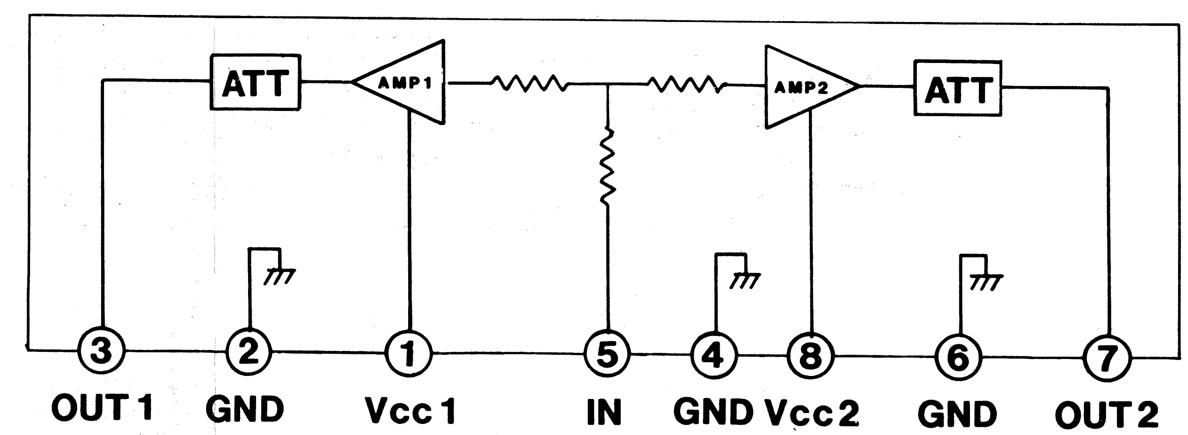
IC101–MC12018 MODULUS PRESCALER



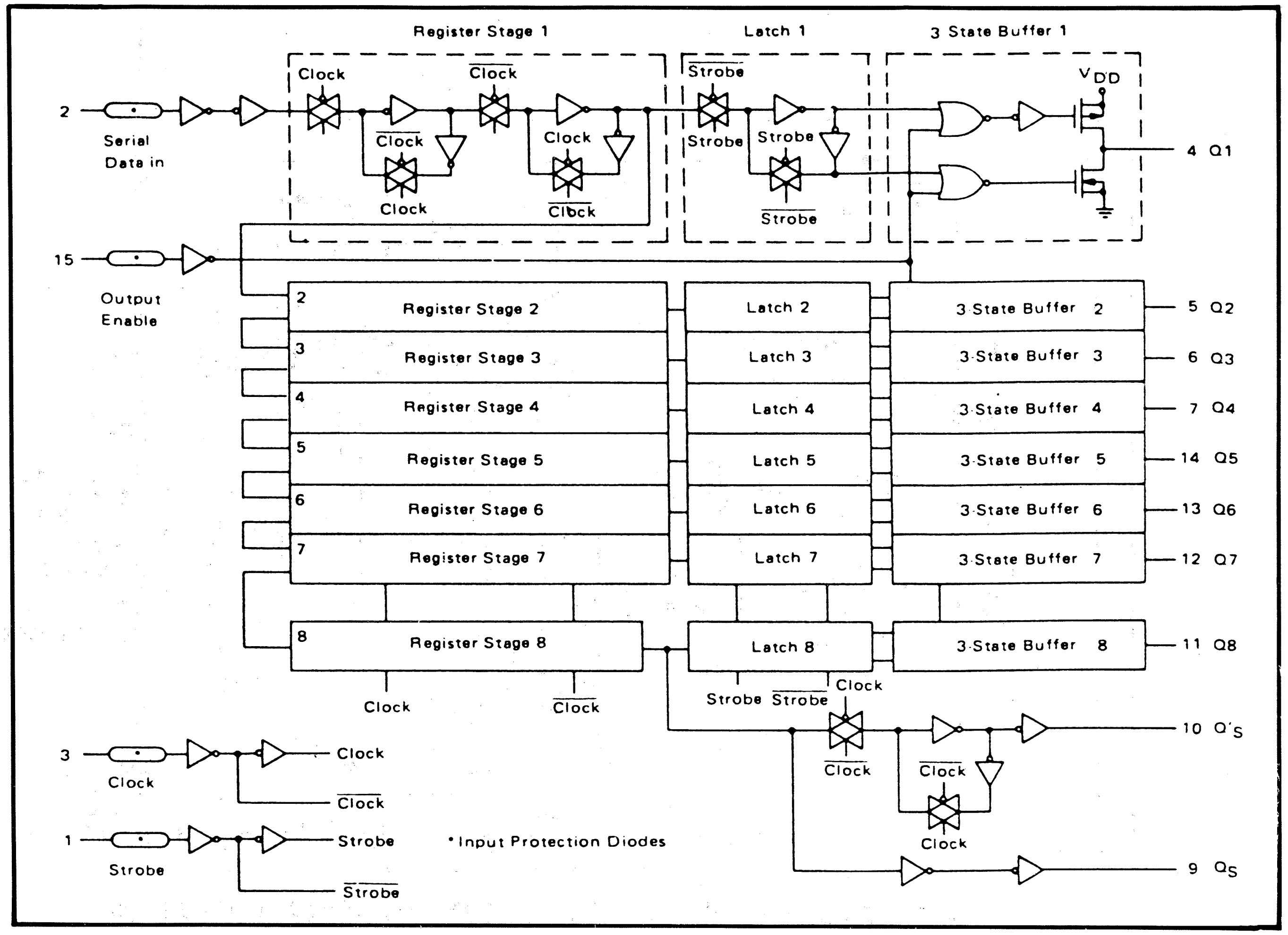
IC103 — DH-1072A LOOP FILTER



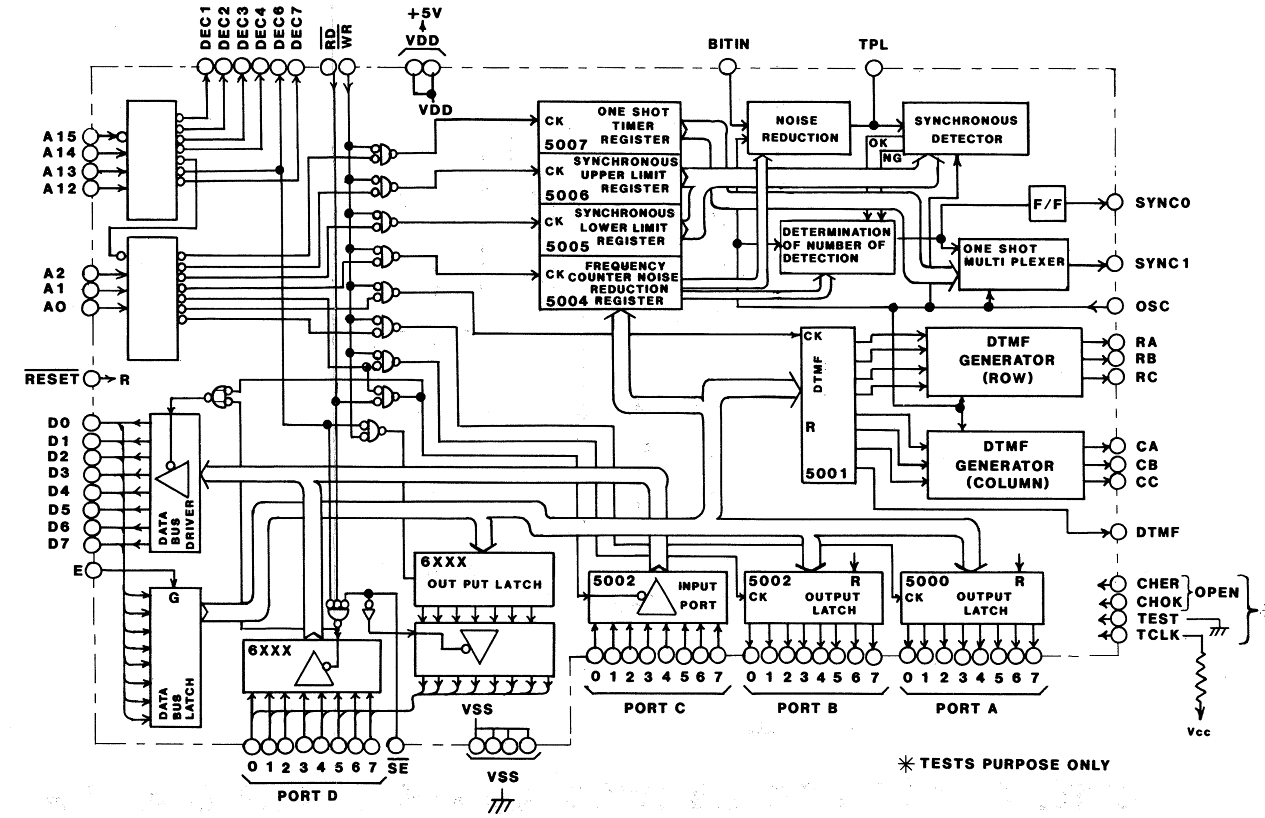
IC102 — MC145159-FN1 PHASE-LOCK LOOP



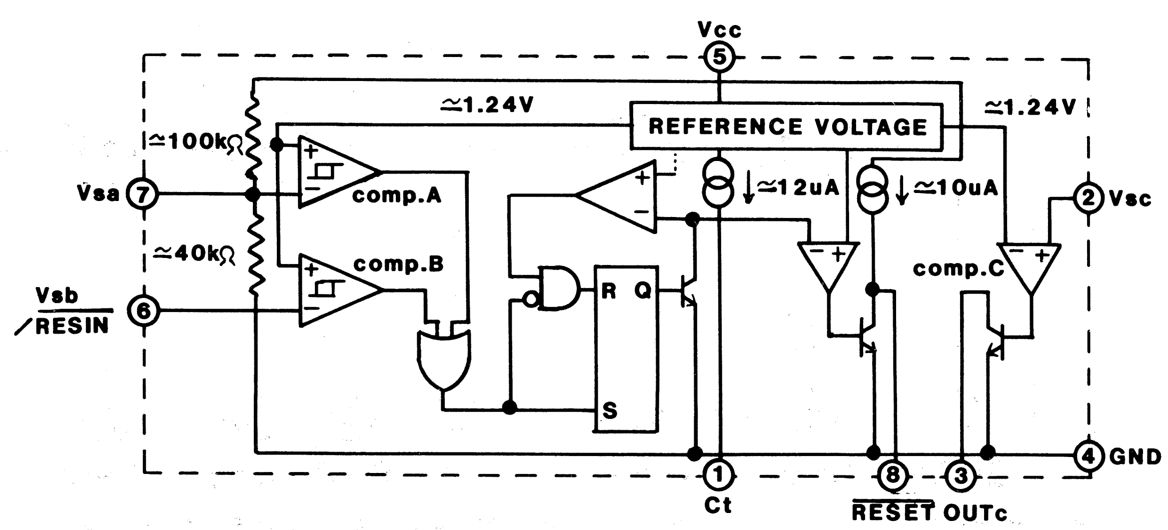
IC109/IC111 — DH-1071A DUAL RF AMPLIFIER



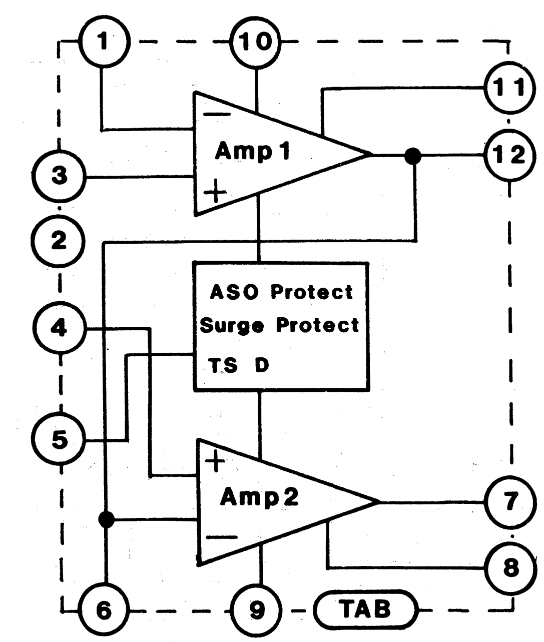
IC113 — MC14094B 8-BIT SHIFT REGISTER



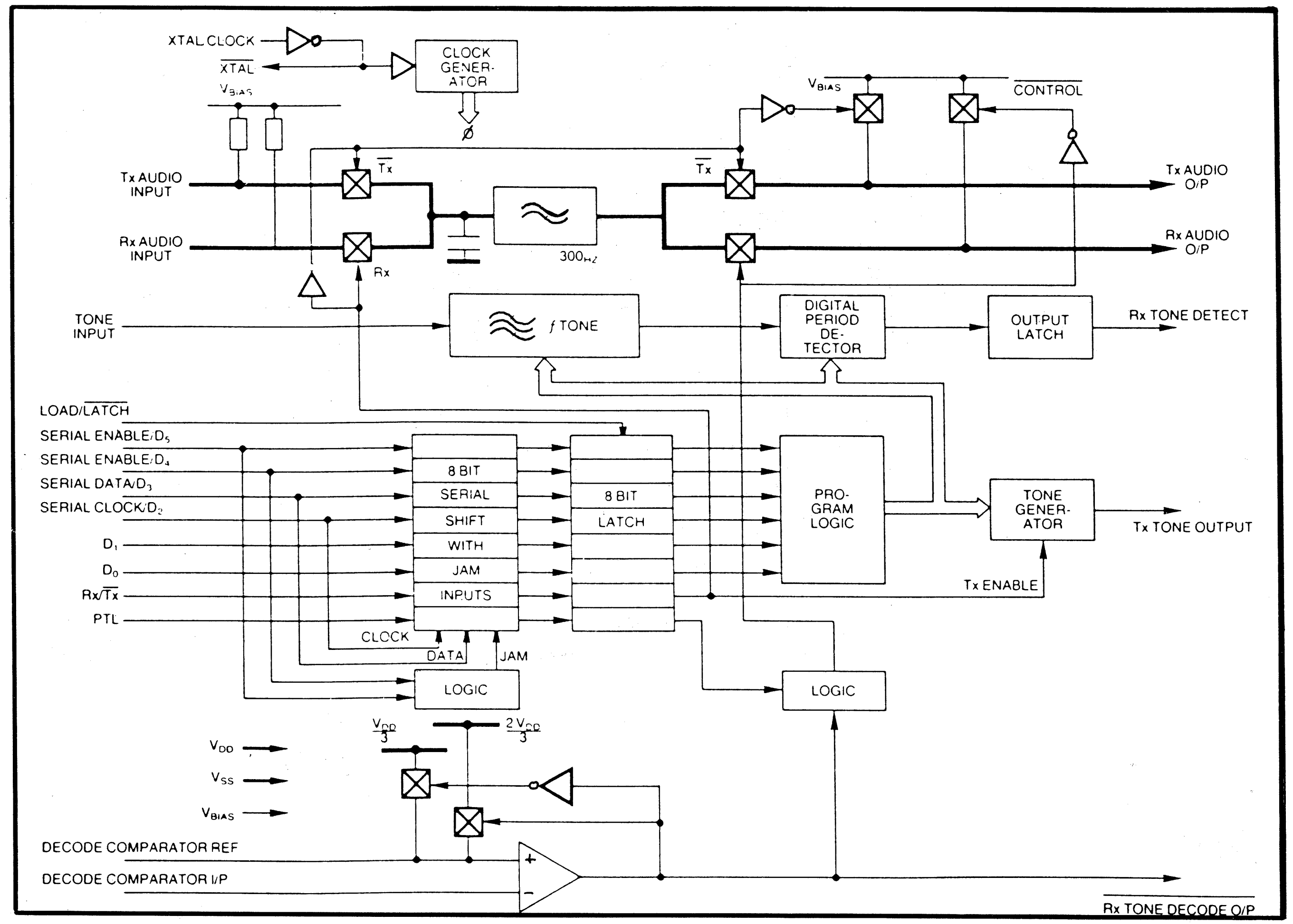
IC901 — HN671106U PERIPHERAL LSIC



IC904 — MB3771 RESET CONTROLLER

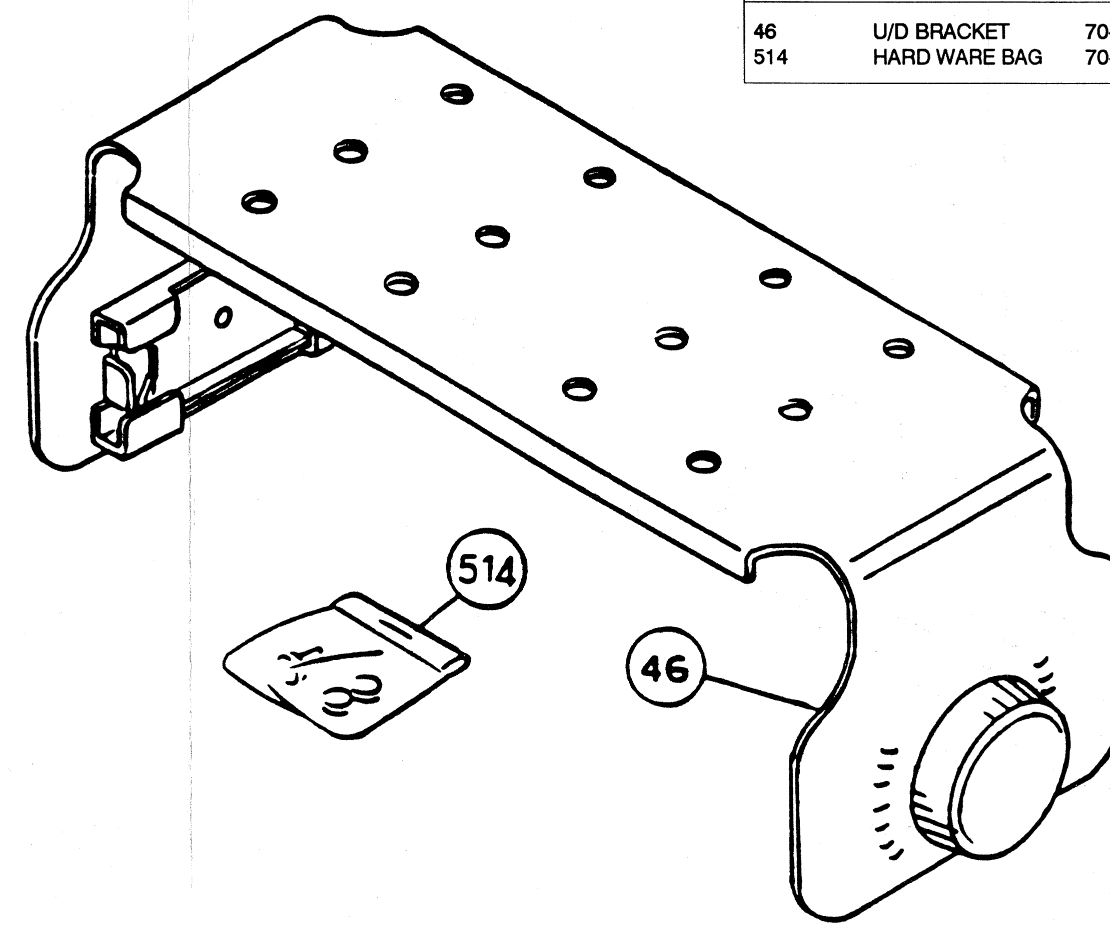


IC404 — HA1384 AUDIO POWER AMPLIFIER

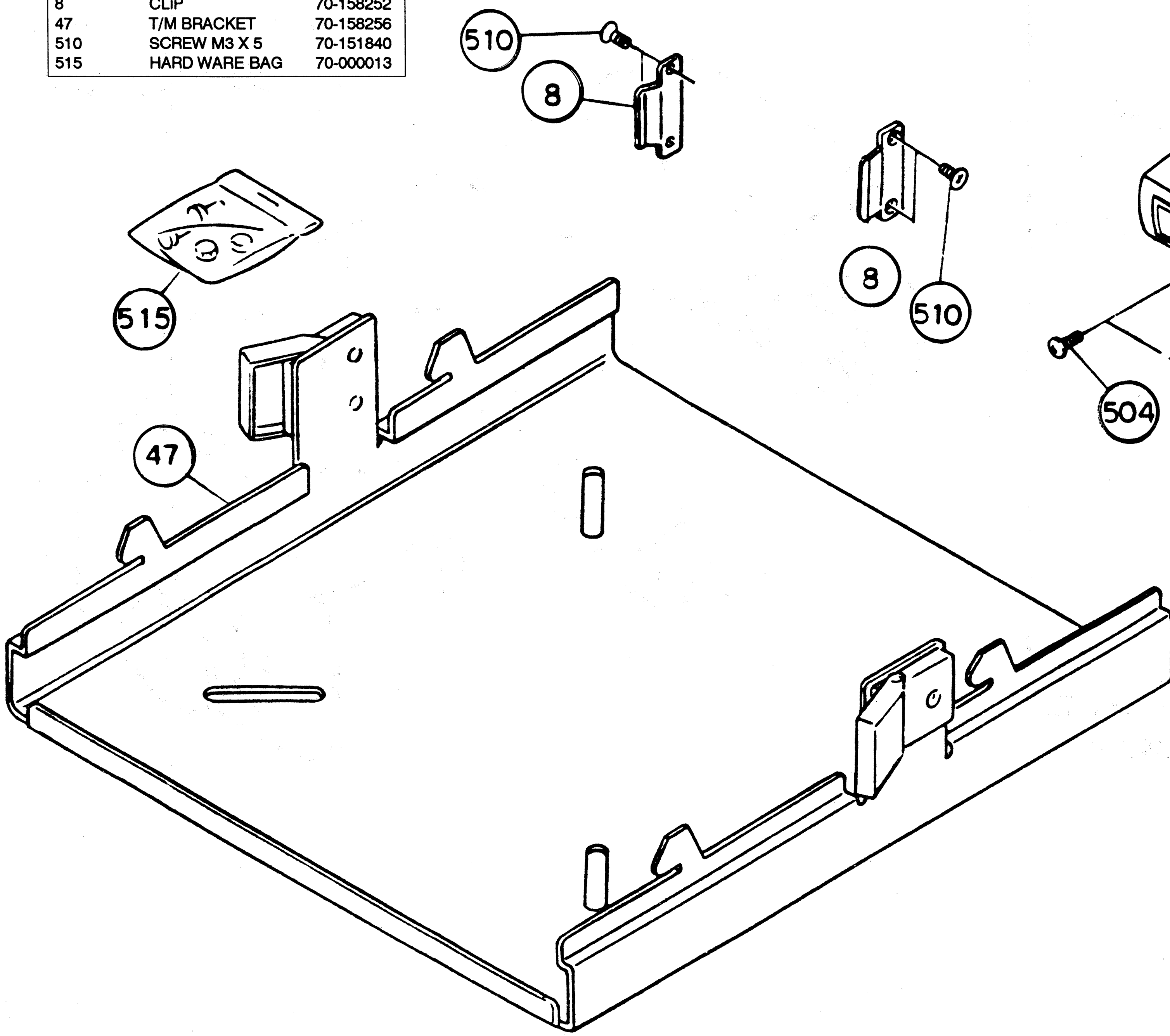


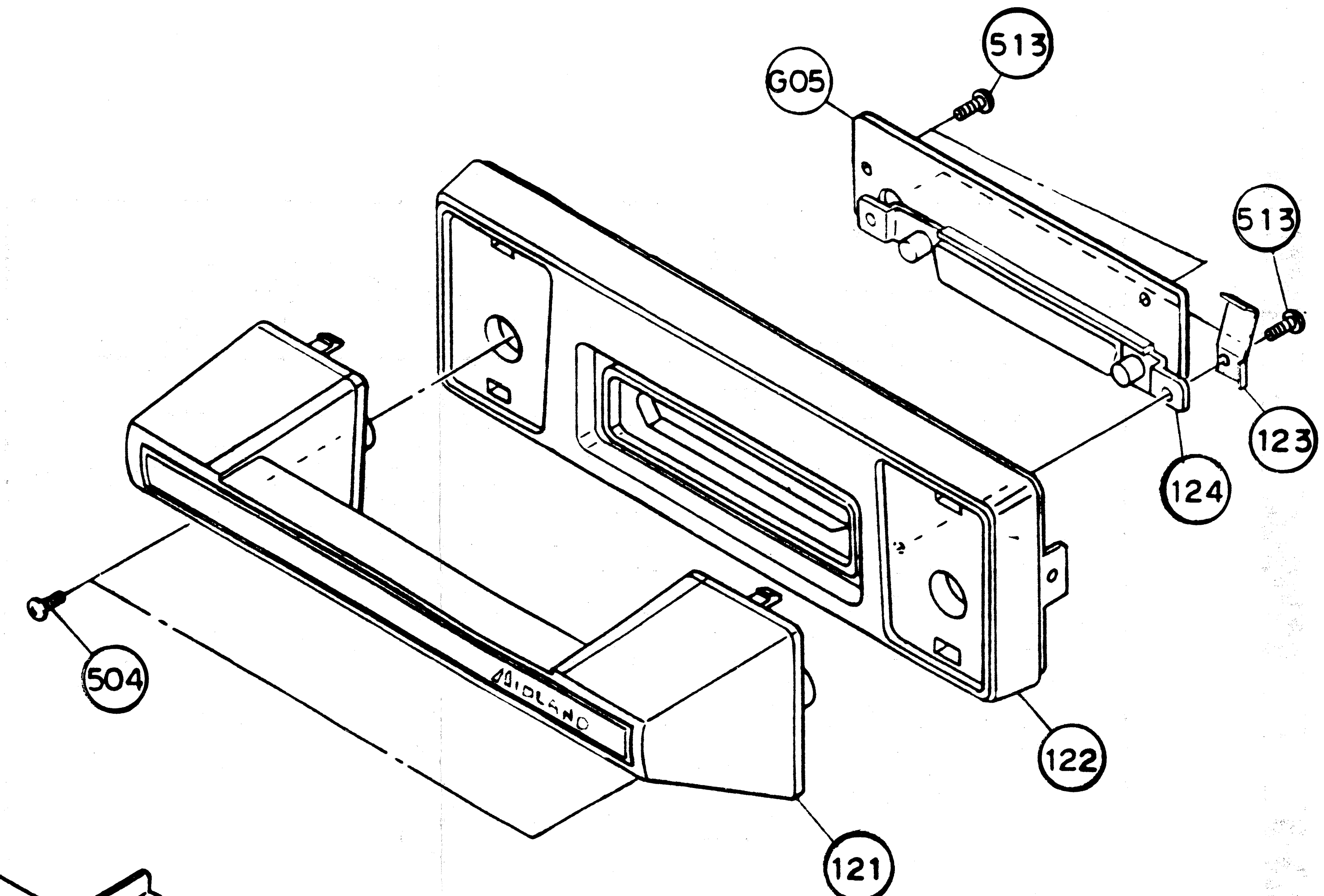
IC907 — MX365P CTCSS ENCODER/DECODER

REF NO.	DESCRIPTION	PART NO.
46	U/D BRACKET	70-158255
514	HARD WARE BAG	70-000012



REF NO.	DESCRIPTION	PART NO.
8	CLIP	70-158252
47	T/M BRACKET	70-158256
510	SCREW M3 X 5	70-151840
515	HARD WARE BAG	70-000013

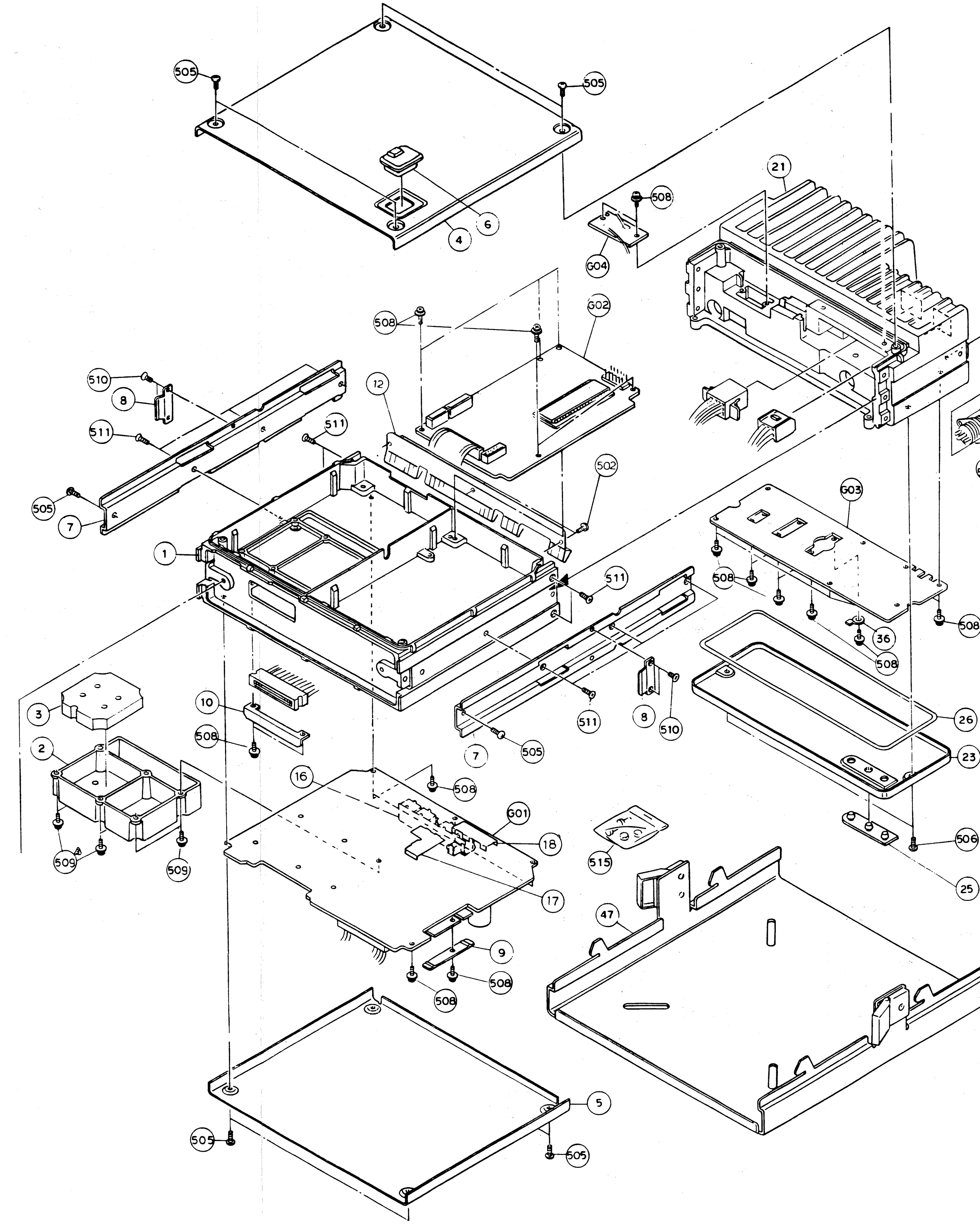




REF NO.	DESCRIPTION	PART NO.
121	HANDLE	70-158259
122	HANDLE BASE	70-158260
123	GROUND PLATE	70-151849
124	BRACKET	70-158261
125	HEX STUD	70-151852
504	SCREW M3 X 8	70-151356
513	SCREW M3 X 8	70-151843
522	WASHER	70-151853
523	WASHER	70-151854

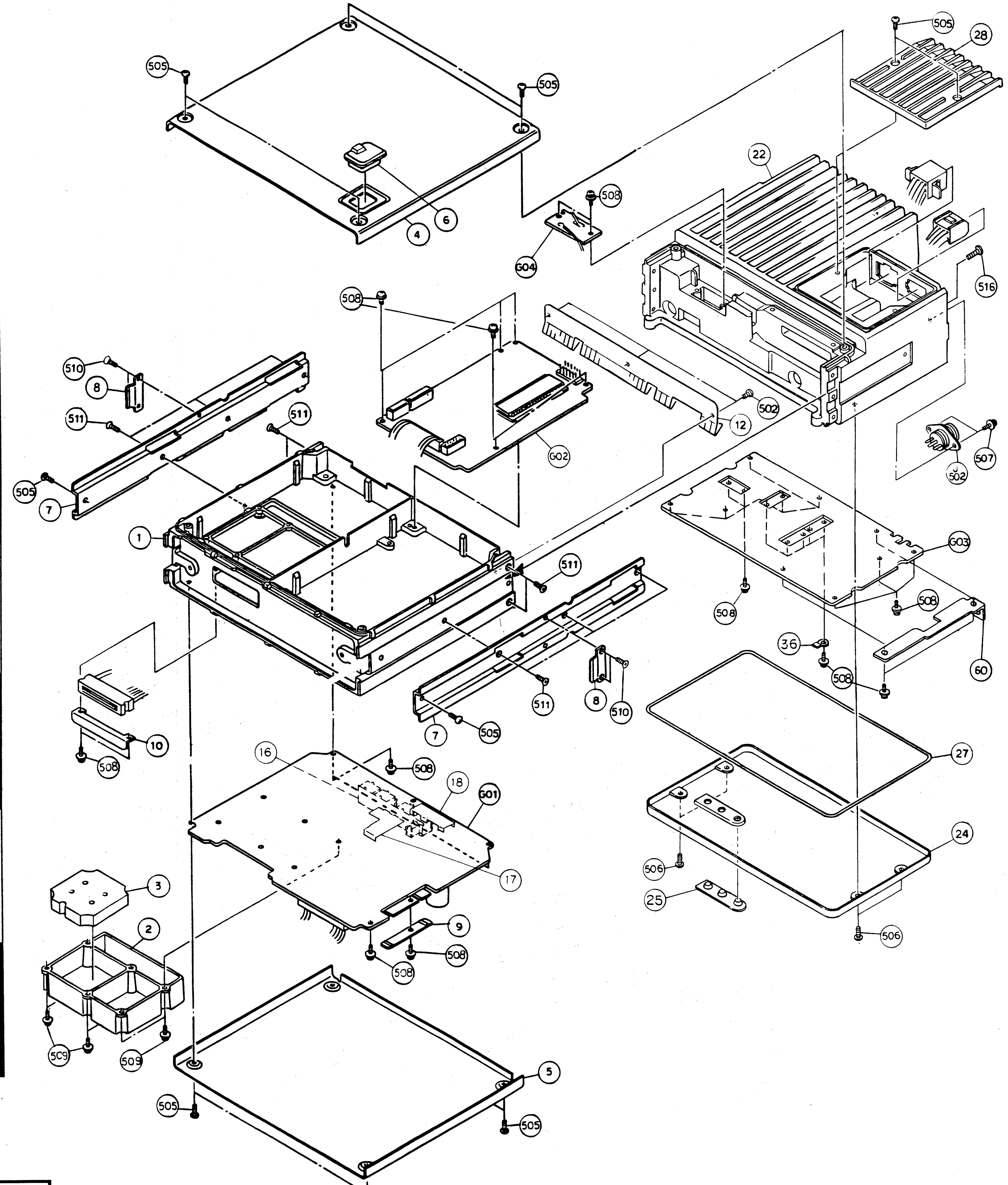
A = A-Band Only 40 = 40 W PA
B = B-Band Only 110 = 110 W PA

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-015043
2	VCO CASE	70-010189
3	RUBBER COVER	70-157271
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PORT COVER	70-010192
7	SIDE RAIL	70-010193
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
16	GROUND SPRING	70-152097
17	IF SHIELD	70-089308
18	RF SHIELD	70-089309
21	PA HEATSINK	70-089307
23	PA COVER	70-010194
25	PA INSULATOR	70-010270
26	GROUND CABLE	70-034329
36	GROUND LUG	70-151271
46	U/D BRACKET	70-158255
502	SCREW M3 X6	70-151616
504	SCREW M3 X 2	70-151356
505	SCREW M3 X 8	70-151409
506	SCREW M3 X 12	70-151839
507	SCREW M3 X 8	70-151810
508	SCREW M3 X 10	70-151273
509	SCREW M3 X 12	70-151841
511	SCREW M3 X 10	70-151804
514	HARDWARE BAG	70-000012
G01 A	RF PCB TR 1514A	70-075312
G01 B	RF PCB TR 1514B	70-075374
G02	CX-55	70-075375
G03 A 40	PA-1553A	70-075313
G03 B 40	PA-1553B	70-075326
G03 A 110	PA-1553A	70-075314
G03 B 110	PA-1553B	70-075327
G04	DC FEED THRU Z-500 (INCLUDED IN PA-1553)	
G05	NOSE PIECE CONNECTOR BOARD Z-502	70-075321



70-3800 EXPLODED VIEW

70-3400/3800



A = A-Band Only   40 = 40 W PA
B = B-Band Only   110 = 110 W PA

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-015043
2	VCO CASE	70-010189
3	RUBBER COVER	70-157271
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PORT COVER	70-010192
7	SIDE RAIL	70-010193
8	BRACKET	70-158252
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
16	GROUND SPRING	70-152097
17	IF SHIELD	70-089308
18	RF SHIELD	70-089309
21	PA HEATSINK	70-089307
24	PA COVER	70-010187
25	PA INSULATOR	70-010271
27	GROUND CABLE	70-034330
28	CONNECTOR COVER	70-010188
36	GROUND LUG	70-151271
57	T/M BRACKET	70-158256
121	HANDLE	70-158259
122	HANDLE BASE	70-158260
123	GROUND PLATE	70-151849
124	BRACKET	70-158261
125	HEX STUD	70-151852
502	SCREW M3 X6	70-151616
504	SCREW M3 X 2	70-151356
505	SCREW M3 X 8	70-151409
506	SCREW M3 X 12	70-151839
507	SCREW M3 X 8	70-151810
508	SCREW M3 X 10	70-151273
509	SCREW M3 X 12	70-151841
510	SCREW M3 X 4	70-151840
511	SCREW M3 X 10	70-151804
513	SCREW M3 X 8	70-151843
522	WASHER	70-151853
523	WASHER	70-151854
515	HARDWARE BAG	70-000013
516	SCREW M3 X 10	70-151413
G01 A	RF PCB TR 1514A	70-075312
G01 B	RF PCB TR 1514B	70-075374
G02	CX-55	70-075375
G03 A 40	PA-1553A	70-075313
G03 B 40	PA-1553B	70-075326
G03 A 110	PA-1553A	70-075314
G03 B 110	PA-1553B	70-075327
G04	DC FEED THRU Z-500 (INCLUDED IN PA-1553)	
G05	NOSE PIECE CONNECTOR BOARD Z-502	70-075321

SECTION 6

PARTS

6

NOTES

MECHANICAL PARTS

A = A-Band Only | 40 = 40 W PA Only | UD = Under-Dash Only
B = B-Band Only | 110 = 110 W PA Only | TM = Trunk-Mount Only

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-015043
2	VCO CASE	70-010189
3	RUBBER COVER	70-157271
4	TOP COVER	70-010190
5	BOTTOM COVER	70-010191
6	PORT COVER	70-010192
7	SIDE RAIL	70-010193
8 TM	BRACKET	70-158252
9	IC BRACKET	70-158253
10	CONNECTOR BRACKET	70-158254
12	GROUND SPRING	70-152095
16	GROUND SPRING	70-152097
17	IF SHIELD	70-089308
18	RF SHIELD	70-089309
21	PA HEATSINK	70-089307
23 UD	PA COVER	70-010194
24 TM	PA COVER	70-010187
25 UD	PA INSULATOR	70-010270
25 TM	PA INSULATOR	70-010271
26 UD	GROUND CABLE	70-034329
27 TM	GROUND CABLE	70-034330
28 TM	CONNECTOR COVER	70-010188
36	GROUND LUG	70-151271
46 UD	U/D BRACKET	70-158255
57 TM	T/M BRACKET	70-158256
121 TM	HANDLE	70-158259
122 TM	HANDLE BASE	70-158260
123 TM	GROUND PLATE	70-151849
124 TM	BRACKET	70-158261
125 TM	HEX STUD	70-151852
502	SCREW M3 X6	70-151616
504	SCREW M3 X 2	70-151356
505	SCREW M3 X 8	70-151409
506	SCREW M3 X 12	70-151839
507	SCREW M3 X 8	70-151810
508	SCREW M3 X 10	70-151273
509	SCREW M3 X 12	70-151841
510 TM	SCREW M3 X 4	70-151840
511	SCREW M3 X 10	70-151804
513 TM	SCREW M3 X 8	70-151843
522 TM	WASHER	70-151853
523 TM	WASHER	70-151854
514 UD	HARDWARE BAG	70-000012
515 TM	HARDWARE BAG	70-000013
516 TM	SCREW M3 X 10	70-151413
G01 A	RF PCB TR 1514A	70-075312
G01 B	RF PCB TR 1514B	70-075374
G02	CX-55	70-075375
G03 A 40	PA-1553A	70-075313
G03 B 40	PA-1553B	70-075326
G03 A 110	PA-1553A	70-075314
G03 B 110	PA-1553B	70-075327
G04	DC FEED THRU Z-500 (INCLUDED IN PA-1553)	
G05	NOSE PIECE CONNECTOR BOARD Z-502	70-075321

TR-1514 RF BOARD

A = A-Band Only T = Topside
B = B-Band Only U = Underside

REF NO.	LOC	DESCRIPTION	PART NO.
		CONNECTORS	
CM116		METER JACK	70-159252
J101		COAX JACK	70-159089
J104		5 PIN JACK	70-159424
J106		34 PIN JACK	70-159422
J108		13 PIN JACK	70-159421
J110		15 PIN JACK	70-159423
J111		15 PIN JACK	70-159425
J203		COAX JACK	70-159089
P124		6 PIN PLUG	70-159426
P125		4 PIN PLUG	70-159196
P126		3 PIN JACK	70-159254
		CABLE ASSEMBLIES	
CA106		34 COND. CABLE	70-034316
CA108		CONNECTOR WIRE	70-034372
CA141		8 PIN CABLE	70-034317
		INTEGRATED CIRCUITS	
IC101	T	MC12018P	70-076460
IC102	T	MC145159FN1	70-076461
IC103	T	DH1072A	70-076462
IC104	T	uPC4741G	70-076463
IC107	T	HD14011BFP	70-076464
IC108	T	HDMC14053BFP	70-076465
IC109	T	DH 1071A	70-076466
IC111	T	DH 1071A	70-076466
IC113	T	MC14094BF	70-076467
IC261	T	MC3357P	70-076138
IC401	T	AN6541	70-076468
IC402	T	S-81250HG	70-076390
IC403	T	S-81250HG	70-076390
IC404	T	HA1384	70-076469
		TRANSISTORS	
Q101	T	2SC2462LC	70-080160
Q102	T	IMB4	70-080295
Q103	T	IMH1	70-080296
Q104	T	IMD3	70-080297
Q105	T	IMD3	70-080297
Q106	T	IMD3	70-080297
Q107	T	IMD3	70-080297
Q112	T	2SC3357	70-080298
Q113	U	2SC2462LC	70-080160
Q115	T	DTC124EK	70-080274
Q116	T	IMH1	70-080296
Q201	T	2SC3357	70-080298
Q202	T	2SK125	70-080089
Q203	T	2SK125	70-080089
Q204	T	2SC3357	70-080298
Q206	T	2SC3357	70-080298
Q261	T	2SC2620QB	70-080161
Q262	T	2SC2462LC	70-080160
Q263	T	2SC2462LC	70-080160
Q401	T	2SB798	70-080164
Q402	T	2SB798	70-080164
Q403	T	DTA114YK	70-080301
Q404	T	DTC124EK	70-080274
Q406	T	2SB798DK	70-080302
Q407	U	2SC2462LC	70-080160
Q701	U	3SK151GR	70-080303
Q702	T	2SC2351	70-080218
Q703	T	2SC2351	70-080218
Q721	U	3SK151GR	70-080303
Q722	T	2SC2351	70-080218

REF NO.	LOC	DESCRIPTION	PART NO.
		FILTERS	
FL261	T	21.4—15	70-179072
FL262	T	CFU455E2	70-179019
FL263	T	CFU455D2	70-179071
		CRYSTALS	
X101	T	12.8 MHz	70-128080
X261	T	20.945 MHz	70-128081
		CONTROLS	
RV101	T	TONE 2, 100K	70-164093
RV102	T	TONE 1, 10 K	70-164094
RV103	T	MIC SENSITIVITY, 10 K	70-164094
RV104	T	DEVIATION LO CH	70-164094
RV105	T	DEVIATION HI CH	70-164094
RV261	T	SQUELCH RANGE	70-164094
		DIODES	
D101	U	DWA010	70-085246
D102	T	IMN11	70-085257
D201	U	1SV166	70-085159
D202	U	1SV166	70-085159
D203	U	1SV166	70-085159
D204	U	1SV166	70-085159
D205	U	1SV166	70-085159
D206	U	1SV166	70-085159
D207	U	1SV166	70-085159
D208	U	1SV166	70-085159
D209	U	1SV166	70-085159
D210	U	1SV166	70-085159
D211	U	1SV166	70-085159
D212	U	1SV166	70-085159
D213	U	MC301	70-085077
D214	U	MC301	70-085077
D218	U	HSM88S	70-085154
D261	U	MA704A	70-085247
D262	T	DCB010	70-085245
D263	T	DWA010	70-085246
D402	T	DWA010	70-085246
D701	U	1SV166	70-085159
D702	U	1SV166	70-085159
D703	U	1SV166	70-085159
D704	U	1SV166	70-085159
D705	T	MA704A	70-085247
D706	T	1SS268	70-085248
D707	T	DCB010	70-085245
D711	U	1SV166	70-085159
D712	U	1SV166	70-085159
D713	U	1SV166	70-085159
D714	U	1SV166	70-085159
D715	T	MA704A	70-085247
D721	U	1SV166	70-085159
D722	U	1SV166	70-085159
D723	U	1SV166	70-085159
D724	U	1SV166	70-085159
D725	T	MA704A	70-085247
D726	T	1SS268	70-085248
D727	T	DCB010'	70-085245
D731	U	1SV166	70-085159
D732	U	1SV166	70-085159
D733	U	1SV166	70-085159
D734	U	1SV166	70-085159
D735	T	MA704A	70-085247
D736	U	1SV164	70-085249
D737	U	1SV164	70-085249
D738	U	1SV164	70-085249

TR-1514 RF BOARD (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		COILS	
L101	T	MLF3216DR10KL	70-090316
L103	T	ELEY R47	70-090401
L104	T	Z0.8C8045T	70-090163
L106	T	FS1012S-174K	70-178055
L107	T	FS1012S-174K	70-178055
L201	T	3.5T	70-090239
L202	T	3.5T	70-090239
L207	T	3.5T	70-090239
L208	T	3.5T	70-090239
L209	T	3.5T	70-090239
L211	T	17L004	70-090114
L212	T	ELE-Y 2R2	70-090261
L213	T	52L007	70-090319
L214	T	52L007	70-090319
L216	T	ELE-Y 2R2MA	70-090121
L217	T	ELE-Y R33	70-090400
L219	T	17L004	70-090114
L221	T	24L107	70-090322
L222	T	24L091A	70-090323
L223	T	27L004SA	70-090191
L224	T	ELE-Y102KA	70-090125
L225	T	BLO2RN1-R62	70-090291
L226	T	ELE-Y 2R2MA	70-090121
L227	T	ELE-Y 2R2MA	70-090121
L261	T	22L015	70-090240
L262	T	22L004	70-090112
L263	T	ELE-Y102KA	70-090125
L264	T	ELE-Y331KA	70-090124
L266	T	ELE-Y331KA	70-090124
L401	T	COIL 1 MH	70-178057
L701	T	MLF3216E100M-L	70-090324
L702	T	MC122 4.5T	70-090237
L703	T	MLF3216E100M-L	70-090324
L704	T	MLF3216E100M-L	70-090324
L705	T	MLF3216E100M-L	70-090324
L711	T	MLF3216E100M-L	70-090324
L713	T	MLF3216E100M-L	70-090324
L714	T	MLF3216E100M-L	70-090324
L721	T	MLF3216E100M-L	70-090324
L722 A	T	MC122 3.5T	70-090235
L722 B	T	MC122 2.5T	70-090315
L723	T	MLF3216E100M-L	70-090324
L724	T	MLF3216E100M-L	70-090324
L725	T	MLF3216E100M-L	70-090324
L731	T	MLF3216E100M-L	70-090324
L732 A	T	MC122 3.5T	70-090235
L732 B	T	MC122 2.5T	70-090315
L732	T	MLF3216E100M-L	70-090324
L733	T	MLF3216E100M-L	70-090324
L734	T	MLF3216E100M-L	70-090324
		CAPACITORS	
C101	U	0.1 uF, 50 V, CERAMIC	70-138249
C102	T	220 uF, 16 V, AL ELECT	70-135164
C104	U	1000 pF, 50 V, CERAMIC	70-138170
C105	T	10 uF, 50 V, AL ELECT	70-135420
C106	U	1000 pF, 50 V, CERAMIC	70-138170
C107	U	22000 pF, 50 V, CERAMIC	70-138162
C108	T	10 uF, 50 V, AL ELECT	70-135142
C109	U	22000 pF, 50 V, CERAMIC	70-138162
C111	U	1000 pF, 50 V, CERAMIC	70-138170
C112	U	4700 pF, 50 V, CERAMIC	70-138163
C113	U	1000 pF, 50 V, CERAMIC	70-138170
C114	U	4700 pF, 50 V, CERAMIC	70-138163
C115	U	47 pF, 50 V, CERAMIC	70-138185
C116	U	5 pF, 50 V, CERAMIC	70-138166
C117	U	220 pF, 50 V, CERAMIC	70-138176
C118	U	2200 pF, 50 V, CERAMIC	70-138235
C119	U	10000 pF, 50 V, CERAMIC	70-138168
C120	U	0.1 uF, 50 V, CERAMIC	70-138249
C121	T	220 uF, 16 V, AL ELECT	70-137065
C122	T	1 uF, 200 V, PLASTIC	70-137081
C123	U	220 pF, 50 V, CERAMIC	70-138176
C124	U	82 pF, 50 V, CERAMIC	70-138250
C125	U	82 pF, 50 V, CERAMIC	70-138250
C126	U	220 pF, 50 V, CERAMIC	70-138176
C127	U	0.1 uF, 50 V, CERAMIC	70-138249

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C130	U	1000 pF, 50 V, CERAMIC	70-138170
C131	T	10 uF, 50 V, TANT ELECT	70-135142
C132	U	82 pF, 50 V, CERAMIC	70-138250
C133	U	22000 pF, 50 V, CERAMIC	70-138162
C134	U	220 pF, 50 V, CERAMIC	70-138176
C136	U	82 pF, 50 V, CERAMIC	70-138250
C145	T	22000 pF, 50 V, PLASTIC	70-137082
C146	T	0.01 uF, 50 V, CERAMIC	70-138270
C150	U	22000 pF, 50 V, CERAMIC	70-138162
C151	U	0.047 uF, 50 V, CERAMIC	70-131298
C152	U	10000 pF, 50 V, CERAMIC	70-138168
C153	U	22000 pF, 50 V, CERAMIC	70-138162
C154	U	22000 pF, 50 V, CERAMIC	70-138162
C157	U	1000 pF, 50 V, CERAMIC	70-138170
C158	U	1000 pF, 50 V, CERAMIC	70-138170
C161	U	1000 pF, 50 V, CERAMIC	70-138170
C162	U	18 pF, 50 V, CERAMIC	70-138206
C163	U	6 pF, 50 V, CERAMIC	70-138210
C164	U	1000 pF, 50 V, CERAMIC	70-138170
C168	U	1000 pF, 50 V, CERAMIC	70-138170
C169	T	47 uF, 25 V, AL ELECT	70-135144
C171	U	1000 pF, 50 V, CERAMIC	70-138170
C172	U	6 pF, 50 V, CERAMIC	70-138210
C173	U	1000 pF, 50 V, CERAMIC	70-138170
C174	U	1000 pF, 50 V, CERAMIC	70-138170
C175	U	1000 pF, 50 V, CERAMIC	70-138170
C176	U	1000 pF, 50 V, CERAMIC	70-138170
C177	U	1000 pF, 50 V, CERAMIC	70-138170
C178	T	2200 pF, 25 V, CERAMIC	70-138162
C179	T	2200 pF, 25 V, CERAMIC	70-138162
C180	T	0.1 uF, 100 V, PLASTIC	70-137083
C182	T	47 uF, 25 V, AL ELECT	70-135144
C183	T	47 uF, 25 V, AL ELECT	70-135144
C184	T	47 uF, 25 V, AL ELECT	70-135144
C201 A	U	4 pF, 50 V, CERAMIC	70-138179
C201 B	U	3 pF, 50 V, CERAMIC	70-138164
C203 B	U	12 pF, 50 V, CERAMIC	70-138209
C203 A	U	13 pF, 50 V, CERAMIC	70-138183
C204 B	U	1.5 pF, 50 V, CERAMIC	70-138180
C204 A	U	2 pF, 50 V, CERAMIC	70-138169
C206 A	U	2 pF, 50 V, CERAMIC	70-138169
C206 B	U	1.5 pF, 50 V, CERAMIC	70-138180
C207 B	U	12 pF, 50 V, CERAMIC	70-138209
C207 A	U	13 pF, 50 V, CERAMIC	70-138183
C208	U	5 pF, 50 V, CERAMIC	70-138166
C209	U	22000 pF, 50 V, CERAMIC	70-138162
C209	T	2200 pF, 25 V, CERAMIC	70-138162
C210	U	1000 pF, 50 V, CERAMIC	70-138170
C210	T	1000 pF, 50 V, CERAMIC	70-138170
C211 A	U	13 pF, 50 V, CERAMIC	70-138183
C211 B	U	12 pF, 50 V, CERAMIC	70-138209
C212	U	1 pF, 50 V, CERAMIC	70-138174
C213	U	1 pF, 50 V, CERAMIC	70-138174
C214	U	2 pF, 50 V, CERAMIC	70-138169
C215	U	3 pF, 50 V, CERAMIC	70-138164
C216 A	U	13 pF, 50 V, CERAMIC	70-138183
C216 B	U	12 pF, 50 V, CERAMIC	70-138209
C217 B	U	1 pF, 50 V, CERAMIC	70-138174
C217 A	U	1.5 pF, 50 V, CERAMIC	70-138180
C218	U	1 pF, 50 V, CERAMIC	70-138174
C219 A	U	13 pF, 50 V, CERAMIC	70-138183
C219 B	U	12 pF, 50 V, CERAMIC	70-138209
C221	U	3 pF, 50 V, CERAMIC	70-138164
C222	U	2200 pF, 50 V, CERAMIC	70-138235
C223	U	2200 pF, 50 V, CERAMIC	70-138235
C224	U	68 pF, 50 V, CERAMIC	70-138229
C225	U	5 pF, 50 V, CERAMIC	70-138166
C226	U	0.047 uF, 50 V, CERAMIC	70-131298
C227	U	68 pF, 50 V, CERAMIC	70-138229
C228	U	68 pF, 50 V, CERAMIC	70-138229
C229	U	10000 pF, 50 V, CERAMIC	70-138168
C230	U	22000 pF, 50 V, CERAMIC	70-138162
C231	U	1000 pF, 50 V, CERAMIC	70-138170
C232	U	1000 pF, 50 V, CERAMIC	70-138170
C233 B	U	10 pF, 50 V, CERAMIC	70-138187
C233 A	U	12 pF, 50 V, CERAMIC	70-138209
C234 A	U	12 pF, 50 V, CERAMIC	70-138209
C234 B	U	10 pF, 50 V, CERAMIC	70-138187

TR-1514 RF BOARD (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C235	T	2200 pF, 25 V, CERAMIC	70-138162
C235	U	22000 pF, 50 V, CERAMIC	70-138162
C236 B	U	2 pF, 50 V, CERAMIC	70-138169
C236 A	U	12 pF, 50 V, CERAMIC	70-138164
C237	U	1000 pF, 50 V, CERAMIC	70-138170
C238	T	2 pF, 50 V, CERAMIC	70-138169
C239	U	1 pF, 50 V, CERAMIC	70-138174
C240	T	47 uF, 25 V, AL ELECT	70-135144
C241	U	1000 pF, 50 V, CERAMIC	70-138170
C242	T	0.47 uF, 35 V, TANT ELECT	70-135094
C243	U	1000 pF, 50 V, CERAMIC	70-138170
C244	U	22000 pF, 50 V, CERAMIC	70-138162
C245	U	10000 pF, 50 V, CERAMIC	70-138168
C246	U	9 pF, 50 V, CERAMIC	70-138186
C247	U	9 pF, 50 V, CERAMIC	70-138186
C248	U	0.047 uF, 50 V, CERAMIC	70-131298
C249	U	68 pF, 50 V, CERAMIC	70-138229
C250	U	1000 pF, 50 V, CERAMIC	70-138170
C251	U	1000 pF, 50 V, CERAMIC	70-138170
C252	U	1000 pF, 50 V, CERAMIC	70-138170
C253	T	1000 pF, 50 V, CERAMIC	70-138170
C254	T	1000 pF, 50 V, CERAMIC	70-138170
C255	U	1000 pF, 50 V, CERAMIC	70-138170
C256	U	1000 pF, 50 V, CERAMIC	70-138170
C257	U	1000 pF, 50 V, CERAMIC	70-138170
C258	T	220 uF, 25 V, AL ELECT	70-135166
C259	T	2 pF, 50 V, CERAMIC	70-138169
C262	U	1000 pF, 50 V, CERAMIC	70-138170
C263	U	1000 pF, 50 V, CERAMIC	70-138170
C265	U	10000 pF, 50 V, CERAMIC	70-138168
C266	U	33 pF, 50 V, CERAMIC	70-138188
C267	U	33 pF, 50 V, CERAMIC	70-138188
C268	U	0.1 uF, 50 V, CERAMIC	70-138249
C269	U	22 pF, 50 V, CERAMIC	70-138171
C270	U	0.1 uF, 50 V, CERAMIC	70-138249
C273	U	1000 pF, 50 V, CERAMIC	70-138170
C274	U	4700 pF, 50 V, CERAMIC	70-138163
C276	U	10000 pF, 50 V, CERAMIC	70-138168
C277	U	22000 pF, 50 V, CERAMIC	70-138162
C278	U	10000 pF, 50 V, CERAMIC	70-138168
C279	U	22000 pF, 50 V, CERAMIC	70-138162
C281	U	10000 pF, 50 V, CERAMIC	70-138168
C282	U	1000 pF, 50 V, CERAMIC	70-138170
C283	U	0.047 uF, 50 V, CERAMIC	70-131298
C284	U	10000 pF, 50 V, CERAMIC	70-138168
C286	U	1000 pF, 50 V, CERAMIC	70-138151
C287	T	1 uF, 50 V, AL ELECT	70-135147
C288	T	0.047 uF, 35 V, TANT ELECT	70-138133
C289	T	120 uF, 16 V, AL ELECT	70-135167
C291	U	10000 pF, 50 V, CERAMIC	70-138168
C401	U	1000 pF, 50 V, CERAMIC	70-138170
C402	T	47 uF, 25 V, AL ELECT	70-135144
C403	T	4.7 uF, 16 V, AL ELECT	70-135172
C406	U	1000 pF, 50 V, CERAMIC	70-138170
C407	U	1000 pF, 50 V, CERAMIC	70-138170
C408	T	4.7 uF, 16 V, AL ELECT	70-135172
C409	U	1000 pF, 50 V, CERAMIC	70-138170
C410	T	47 uF, 25 V, AL ELECT	70-135144
C411	U	10000 pF, 50 V, CERAMIC	70-138168
C412	U	1000 pF, 50 V, CERAMIC	70-138170
C413	T	4.7 uF, 16 V, AL ELECT	70-135172
C414	U	1000 pF, 50 V, CERAMIC	70-138170
C416	T	47 uF, 25 V, AL ELECT	70-135144
C417	T	2200 uF, 25 V, AL ELECT	70-135169
C422	U	0.1 uF, 50 V, CERAMIC	70-138249
C426	U	10000 pF, 50 V, CERAMIC	70-138168
C427	U	1000 pF, 50 V, CERAMIC	70-138170
C428	U	0.1 uF, 50 V, CERAMIC	70-138249
C430	U	0.1 uF, 50 V, CERAMIC	70-138249
C432	U	10000 pF, 50 V, CERAMIC	70-138168
C433	U	1000 pF, 50 V, CERAMIC	70-138170
C434	T	47 uF, 25 V, AL ELECT	70-135168
C436	T	47 uF, 25 V, AL ELECT	70-135144
C437	T	220 uF, 25 V, AL ELECT	70-135170
C438	U	0.047 uF, 50 V, CERAMIC	70-131298
C423	U	1000 pF, 50 V, CERAMIC	70-138170
C424	U	10000 pF, 50 V, CERAMIC	70-138168
C438	U	0.047 uF, 50 V, CERAMIC	70-131298

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C439	T	47 uF, 25 V, AL ELECT	70-135168
C441	T	47 uF, 25 V, AL ELECT	70-135144
C442	T	47 uF, 25 V, AL ELECT	70-135144
C445	U	0.1 uF, 50 V, CERAMIC	70-138249
C448	T	47 uF, 25 V, AL ELECT	70-135144
C449	U	0.1 uF, 50 V, CERAMIC	70-138249
C450	T	0.1 uF, 50 V, CERAMIC	70-138249
C452	T	2.2 uF, 50 V, AL ELECT	70-135171
C462	U	22000 pF, 50 V, CERAMIC	70-138162
C463	U	220 pF, 50 V, CERAMIC	70-138176
C464	U	220 pF, 50 V, CERAMIC	70-138176
C465	U	220 pF, 50 V, CERAMIC	70-138176
C466	U	220 pF, 50 V, CERAMIC	70-138176
C467	U	220 pF, 50 V, CERAMIC	70-138176
C468	U	220 pF, 50 V, CERAMIC	70-138176
C469	U	220 pF, 50 V, CERAMIC	70-138176
C470	U	220 pF, 50 V, CERAMIC	70-138176
C471	U	220 pF, 50 V, CERAMIC	70-138176
C473	T	220 pF, 50 V, CERAMIC	70-138176
C474	T	220 pF, 50 V, CERAMIC	70-138176
C475	T	220 pF, 50 V, CERAMIC	70-138176
C476	T	220 pF, 50 V, CERAMIC	70-138176
C477	T	220 pF, 50 V, CERAMIC	70-138176
C478	T	220 pF, 50 V, CERAMIC	70-138176
C479	T	220 pF, 50 V, CERAMIC	70-138176
C480	T	220 pF, 50 V, CERAMIC	70-138176
C481	T	220 pF, 50 V, CERAMIC	70-138176
C482	T	220 pF, 50 V, CERAMIC	70-138176
C483	T	220 pF, 50 V, CERAMIC	70-138176
C484	T	220 pF, 50 V, CERAMIC	70-138176
C485	T	220 pF, 50 V, CERAMIC	70-138176
C486	T	220 pF, 50 V, CERAMIC	70-138176
C487	T	220 pF, 50 V, CERAMIC	70-138176
C488	T	220 pF, 50 V, CERAMIC	70-138176
C489	T	220 pF, 50 V, CERAMIC	70-138176
C490	T	220 pF, 50 V, CERAMIC	70-138176
C491	T	220 pF, 50 V, CERAMIC	70-138176
C492	T	220 pF, 50 V, CERAMIC	70-138176
C493	T	220 pF, 50 V, CERAMIC	70-138176
C494	T	220 pF, 50 V, CERAMIC	70-138176
C701	T	680 pF, 50 V, CERAMIC	70-138252
C702 B	U	0.5 pF, 50 V, CERAMIC	70-138182
C702 A	U	1 pF, 50 V, CERAMIC	70-138174
C703	U	47 pF, 50 V, CERAMIC	70-138185
C704 B	U	6 pF, 50 V, CERAMIC	70-138210
C704 A	U	4 pF, 50 V, CERAMIC	70-138179
C705	U	10 pF, 50 V, CERAMIC	70-138187
C706	T	680 pF, 50 V, CERAMIC	70-138252
C707	T	2200 pF, 25 V, CERAMIC	70-138162
C708	U	27 pF, 50 V, CERAMIC	70-138165
C709	U	22 pF, 50 V, CERAMIC	70-138171
C710	T	2200 pF, 25 V, CERAMIC	70-138162
C711	T	680 pF, 50 V, CERAMIC	70-138252
C712	U	1 pF, 50 V, CERAMIC	70-138174
C713	U	47 pF, 50 V, CERAMIC	70-138185
C714 B	U	5 pF, 50 V, CERAMIC	70-138166
C714 A	U	6 pF, 50 V, CERAMIC	70-138210
C715 B	U	6 pF, 50 V, CERAMIC	70-138210
C715 A	U	15 pF, 50 V, CERAMIC	70-138205
C716	T	680 pF, 50 V, CERAMIC	70-138252
C717	T	2200 pF, 25 V, CERAMIC	70-138162
C718 B	U	1000 pF, 50 V, CERAMIC	70-138170
C718 A	U	0.022 pF, 50 V, CERAMIC	70-138162
C719 B	U	1000 pF, 50 V, CERAMIC	70-138170
C719 A	U	0.022 pF, 50 V, CERAMIC	70-138162
C720	U	22000 pF, 50 V, CERAMIC	70-138162
C721	T	680 pF, 50 V, CERAMIC	70-138252
C722	U	1 pF, 50 V, CERAMIC	70-138174
C723	U	47 pF, 50 V, CERAMIC	70-138185
C724 A	U	3 pF, 50 V, CERAMIC	70-138164
C724 B	U	7 pF, 50 V, CERAMIC	70-138181
C725 B	U	15 pF, 50 V, CERAMIC	70-138205
C725 A	U	3 pF, 50 V, CERAMIC	70-138164
C726	U	680 pF, 50 V, CERAMIC	70-138252
C726	T	680 pF, 50 V, CERAMIC	70-138252
C727	T	2200 pF, 25 V, CERAMIC	70-138162
C728	U	22 pF, 50 V, CERAMIC	70-138171

TR-1514 RF BOARD (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C729	U	22 pF, 50 V, CERAMIC	70-138171
C730	T	2200 pF, 25 V, CERAMIC	70-138162
C731	T	680 pF, 50 V, CERAMIC	70-138252
C732 B	U	2 pF, 50 V, CERAMIC	70-138169
C732 A	U	1 pF, 50 V, CERAMIC	70-138174
C733 A	U	39 pF, 50 V, CERAMIC	70-138233
C733 B	U	39 pF, 50 V, CERAMIC	70-138185
C734 A	U	3 pF, 50 V, CERAMIC	70-138164
C734 B	U	8 pF, 50 V, CERAMIC	70-138203
C735 A	U	6 pF, 50 V, CERAMIC	70-138210
C735 B	U	10 pF, 50 V, CERAMIC	70-138187
C736 B	T	680 pF, 50 V, CERAMIC	70-138252
C736 A	T	100 pF, 50 V, CERAMIC	70-138175
C737	T	2200 pF, 25 V, CERAMIC	70-138162
C738	U	1000 pF, 50 V, CERAMIC	70-138170
C739	U	1000 pF, 50 V, CERAMIC	70-138170
C741 A	U	1.5 pF, 50 V, CERAMIC	70-138180
C741 B	U	3 pF, 50 V, CERAMIC	70-138164
C742 B	U	68 pF, 50 V, CERAMIC	70-138229
C742 A	U	39 pF, 50 V, CERAMIC	70-138233
C743 B	U	1 pF, 50 V, CERAMIC	70-138174
C743 A	U	2 pF, 50 V, CERAMIC	70-138169
C744 A	U	56 pF, 50 V, CERAMIC	70-138254
C744 B	U	39 pF, 50 V, CERAMIC	70-138233
C745	U	3 pF, 50 V, CERAMIC	70-138164
C746	U	10 pF, 50 V, CERAMIC	70-138187
C747	U	1000 pF, 50 V, CERAMIC	70-138170
C751	T	2 pF, 50 V, CERAMIC	70-138175
C752	T	2 pF, 50 V, CERAMIC	70-138175
C753	T	22 pF, 50 V, CERAMIC	70-138171
C754	T	22 pF, 50 V, CERAMIC	70-138171
C755	T	2200 pF, 25 V, CERAMIC	70-138162
C756	T	2200 pF, 25 V, CERAMIC	70-138162
C757	T	22 pF, 50 V, CERAMIC	70-138171
C761	T	2200 pF, 25 V, CERAMIC	70-138162
C762	T	2200 pF, 25 V, CERAMIC	70-138162
C763	T	1000 pF, 50 V, CERAMIC	70-138170
C764	T	1000 pF, 50 V, CERAMIC	70-138170
C765	T	2200 pF, 25 V, CERAMIC	70-138162
C766	U	1000 pF, 50 V, CERAMIC	70-138170
C767	U	1000 pF, 50 V, CERAMIC	70-138170
C771	U	680 pF, 50 V, CERAMIC	70-138252
C772	U	680 pF, 50 V, CERAMIC	70-138252
C773	U	680 pF, 50 V, CERAMIC	70-138252
C774	U	680 pF, 50 V, CERAMIC	70-138252
C781	U	22 pF, 50 V, CERAMIC	70-138171
C782	U	22 pF, 50 V, CERAMIC	70-138171
		RESISTORS	
R102	U	68 kOHM, 1/10 W, METAL	70-144119
R103	U	22 kOHM, 1/10 W, METAL	70-144121
R104	U	100 kOHM, 1/10 W, METAL	70-145128
R105	U	47 OHM, 1/10 W, METAL	70-145130
R106	U	1 MOHM, 1/10 W, METAL	70-144155
R107	U	47 kOHM, 1/10 W, METAL	70-145145
R108	U	10 kOHM, 1/10 W, METAL	70-144120
R109	U	47 kOHM, 1/10 W, METAL	70-145145
R110	U	0 OHM, 1/10 W, METAL	70-144106
R111	U	270 OHM, 1/4 W, METAL	70-144193
R112	U	10 kOHM, 1/10 W, METAL	70-144120
R113	U	10 kOHM, 1/10 W, METAL	70-144120
R114	U	33 kOHM, 1/10 W, METAL	70-144112
R115	U	33 kOHM, 1/10 W, METAL	70-144112
R116	U	22 kOHM, 1/10 W, METAL	70-144121
R118	U	100 kOHM, 1/10 W, METAL	70-145128
R119	U	1 kOHM, 1/10 W, METAL	70-144128
R120	U	150 kOHM, 1/10 W, METAL	70-144129
R121	U	47 kOHM, 1/10 W, METAL	70-145145
R122	U	47 kOHM, 1/10 W, METAL	70-145145
R123	U	2.2 kOHM, 1/10 W, METAL	70-144113
R124	U	4.7 kOHM, 1/10 W, METAL	70-144123
R130	U	3.3 kOHM, 1/10 W, METAL	70-144118
R131	U	3.3 kOHM, 1/10 W, METAL	70-144118
R132	U	470 OHM, 1/10 W, METAL	70-144156
R133	U	33 OHM, 1/10 W, METAL	70-140320
R134	U	22 OHM, 1/10 W, METAL	70-144160
R135	U	22 kOHM, 1/10 W, METAL	70-144121
		RESISTORS (Continued)	
R136	U	47 kOHM, 1/10 W, METAL	70-145145
R137	U	47 kOHM, 1/10 W, METAL	70-145145
R138	U	47 kOHM, 1/10 W, METAL	70-145145
R140	U	220 OHM, 1/10 W, METAL	70-144131
R141	U	22 kOHM, 1/10 W, METAL	70-144121
R142	U	22 kOHM, 1/10 W, METAL	70-144121
R143	U	22 kOHM, 1/10 W, METAL	70-144121
R144	U	22 kOHM, 1/10 W, METAL	70-144121
R145	U	27 kOHM, 1/10 W, METAL	70-144163
R146	U	6.8 kOHM, 1/10 W, METAL	70-144158
R147	U	4.7 kOHM, 1/10 W, METAL	70-144123
R148	U	10 kOHM, 1/10 W, METAL	70-144120
R149	U	18 kOHM, 1/10 W, METAL	70-144195
R150	U	12 kOHM, 1/10 W, METAL	70-144111
R151	U	39 kOHM, 1/10 W, METAL	70-144196
R152	U	82 kOHM, 1/10 W, METAL	70-144173
R153	U	1 kOHM, 1/10 W, METAL	70-144128
R154	U	2.2 kOHM, 1/10 W, METAL	70-144113
R156	U	22 kOHM, 1/10 W, METAL	70-144121
R157	U	22 kOHM, 1/10 W, METAL	70-144121
R158	U	22 kOHM, 1/10 W, METAL	70-144121
R159	T	150 kOHM, 1/10 W, METAL	70-144129
R159	U	4.7 kOHM, 1/10 W, METAL	70-144123
R162	U	270 OHM, 1/10 W, METAL	70-144116
R163	U	18 OHM, 1/10 W, METAL	70-144171
R164	U	270 OHM, 1/10 W, METAL	70-144116
R166	U	270 OHM, 1/10 W, METAL	70-144116
R167	U	18 OHM, 1/10 W, METAL	70-144171
R168	U	270 OHM, 1/10 W, METAL	70-144116
R169	U	47 kOHM, 1/10 W, METAL	70-145145
R171	U	3.3 kOHM, 1/10 W, METAL	70-144144
R172	U	68 OHM, 1/10 W, METAL	70-144114
R173	U	3.3 kOHM, 1/10 W, METAL	70-144144
R174	U	100 OHM, 1/10 W, METAL	70-144146
R176	U	560 OHM, 1/10 W, METAL	70-144130
R177	U	10 OHM, 1/10 W, METAL	70-144115
R178	U	560 OHM, 1/10 W, METAL	70-144130
R179	U	10 OHM, 1/10 W, METAL	70-144115
R180	U	22 OHM, 1/10 W, METAL	70-144160
R181	U	22 OHM, 1/10 W, METAL	70-144160
R182	U	22 OHM, 1/10 W, METAL	70-144160
R184	U	470 OHM, 1/10 W, METAL	70-144156
R185	U	100 kOHM, 1/10 W, METAL	70-145128
R191	U	220 OHM, 1/10 W, METAL	70-144131
R192	U	3.9 kOHM, 1/10 W, METAL	70-144132
R193	U	6.8 kOHM, 1/10 W, METAL	70-144158
R194	U	1 kOHM, 1/10 W, METAL	70-144128
R196	U	1 kOHM, 1/10 W, METAL	70-144128
R197	U	1 kOHM, 1/10 W, METAL	70-144128
R199	U	12 OHM, 5 W, METAL	70-144197
R201	U	47 kOHM, 1/10 W, METAL	70-145145
R202	U	47 kOHM, 1/10 W, METAL	70-145145
R203	U	47 kOHM, 1/10 W, METAL	70-145145
R204	U	47 kOHM, 1/10 W, METAL	70-145145
R205	T	8.2 kOHM, 1/10 W, METAL	70-144305
R215	U	100 OHM, 1/10 W, METAL	70-144146
R216	U	470 OHM, 1/10 W, METAL	70-144156
R217	U	2.2 kOHM, 1/10 W, METAL	70-144113
R218	U	2.2 kOHM, 1/10 W, METAL	70-144113
R219	U	150 OHM, 1/10 W, METAL	70-144321
R220	T	1 kOHM, 1/10 W, METAL	70-144125
R224	U	22 kOHM, 1/10 W, METAL	70-144121
R225	U	22 OHM, 1/10 W, METAL	70-144160
R226	U	47 OHM, 1/10 W, METAL	70-145130
R231	U	47 OHM, 1/10 W, METAL	70-145130
R232	U	2.7 kOHM, 1/10 W, METAL	70-144159
R233	U	1 kOHM, 1/10 W, METAL	70-144128
R234	U	6.8 kOHM, 1/10 W, METAL	70-144158
R236	U	22 OHM, 1/10 W, METAL	70-144160
R237	U	47 OHM, 1/10 W, METAL	70-145130
R206	U	100 OHM, 1/10 W, METAL	70-144146
R207	U	47 kOHM, 1/10 W, METAL	70-145145
R208	U	47 kOHM, 1/10 W, METAL	70-145145
R209	U	47 kOHM, 1/10 W, METAL	70-145145
R210	T	22 OHM, 1/10 W, METAL	70-144160
R210	U	22 OHM, 1/10 W, METAL	70-144160
R211	U	47 kOHM, 1/10 W, METAL	70-145145
R212	U	47 kOHM, 1/10 W, METAL	70-145145

TR-1514 RF BOARD (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		RESISTORS (Continued)	
R213	U	47 kOHM, 1/10 W, METAL	70-145145
R214	U	470 OHM, 1/10 W, METAL	70-144156
R238	U	100 OHM, 1/10 W, METAL	70-144148
R239	U	47 OHM, 1/10 W, METAL	70-145130
R240	U	470 OHM, 1/10 W, METAL	70-145152
R261	U	220 OHM, 1/10 W, METAL	70-144131
R262	U	3.3 kOHM, 1/10 W, METAL	70-144118
R263	U	82 kOHM, 1/10 W, METAL	70-144173
R264	U	18 kOHM, 1/10 W, METAL	70-144195
R265	U	0 OHM, 1/10 W, METAL	70-144106
R266	U	82 kOHM, 1/10 W, METAL	70-144173
R267	U	47 kOHM, 1/10 W, METAL	70-145145
R268	U	220 kOHM, 1/10 W, METAL	70-144131
R269	U	1 kOHM, 1/10 W, METAL	70-144128
R271	U	2.7 kOHM, 1/10 W, METAL	70-144159
R272	U	3.3 kOHM, 1/10 W, METAL	70-144118
R273	U	82 kOHM, 1/10 W, METAL	70-144173
R274	U	10 kOHM, 1/10 W, METAL	70-144120
R275	U	1.5 kOHM, 1/10 W, METAL	70-144134
R276	U	3.3 kOHM, 1/10 W, METAL	70-144118
R277	U	1.5 kOHM, 1/10 W, METAL	70-144134
R278	U	47 kOHM, 1/10 W, METAL	70-145145
R279	U	1 kOHM, 1/10 W, METAL	70-144128
R281	U	47 kOHM, 1/10 W, METAL	70-145145
R282	U	47 kOHM, 1/10 W, METAL	70-145145
R330	T	330 OHM, 1/10 W, METAL	70-144164
R401	U	10 kOHM, 1/10 W, METAL	70-144120
R402	U	3.9 kOHM, 1/10 W, METAL	70-144132
R403	U	2.2 kOHM, 1/10 W, METAL	70-144113
R404	U	22 OHM, 1/8 W, METAL	70-144074
R406	T	2.7 kOHM, 1/10 W, METAL	70-144159
R407	U	2.2 kOHM, 1/10 W, METAL	70-144113
R408	U	68 kOHM, 1/10 W, METAL	70-144119
R409	U	22 OHM, 1/8 W, METAL	70-144074
R410	U	47 kOHM, 1/10 W, METAL	70-145145
R411	U	2.3 OHM, 1/8 W, METAL	70-144198
R414	U	2.3 OHM, 1/8 W, METAL	70-144198
R418	U	2.3 OHM, 1/8 W, METAL	70-144198
R420	U	1 kOHM, 1/10 W, METAL	70-144128

REF NO.	LOC	DESCRIPTION	PART NO.
		RESISTORS (Continued)	
R422	U	4.7 kOHM, 1/10 W, METAL	70-144123
R423	U	4.7 kOHM, 1/10 W, METAL	70-144123
R424	U	4.7 kOHM, 1/10 W, METAL	70-144123
R425	U	10 kOHM, 1/10 W, METAL	70-144120
R701	T	10 kOHM, 1/10 W, METAL	70-144120
R702	T	6.8 kOHM, 1/10 W, METAL	70-144158
R703	T	22 kOHM, 1/10 W, METAL	70-144121
R704	T	22 kOHM, 1/10 W, METAL	70-144121
R705	T	4.7 kOHM, 1/10 W, METAL	70-144123
R705	T	22 kOHM, 1/10 W, METAL	70-144121
R706	T	150 OHM, 1/10 W, METAL	70-144321
R707	T	5.6 kOHM, 1/10 W, METAL	70-144168
R708	T	10 kOHM, 1/10 W, METAL	70-144120
R711	T	5.6 kOHM, 1/10 W, METAL	70-144168
R712	T	10 kOHM, 1/10 W, METAL	70-144120
R713	T	330 OHM, 1/10 W, METAL	70-144164
R714	T	150 OHM, 1/10 W, METAL	70-144321
R721	T	10 kOHM, 1/10 W, METAL	70-144120
R722	T	6.8 kOHM, 1/10 W, METAL	70-144158
R723	T	22 kOHM, 1/10 W, METAL	70-144121
R724	T	22 kOHM, 1/10 W, METAL	70-144121
R725	T	4.7 kOHM, 1/10 W, METAL	70-144123
R726	T	150 OHM, 1/10 W, METAL	70-144321
R727	T	5.6 kOHM, 1/10 W, METAL	70-144168
R728	T	10 kOHM, 1/10 W, METAL	70-144120
R729	T	330 OHM, 1/10 W, METAL	70-144164
R731	U	47 kOHM, 1/10 W, METAL	70-145145
R732	T	47 kOHM, 1/10 W, METAL	70-144145
R733	U	47 kOHM, 1/10 W, METAL	70-145145
R741	U	22 kOHM, 1/10 W, METAL	70-144121
R742	U	22 kOHM, 1/10 W, METAL	70-144121
R743	U	22 kOHM, 1/10 W, METAL	70-144121
R744	U	22 kOHM, 1/10 W, METAL	70-144121
		MISCELLANEOUS	
JP102	U	0 OHM, 1/10 W, METAL	70-144106
K401		RELAY AGP9003	70-105022
F1		FUSE 5A	70-204062

CX-55 LOGIC BOARD

REF NO.	LOC	DESCRIPTION	PART NO.
		CONNECTORS	
J906		34 PIN JACK	70-159422
J909		PROGRAM JACK	70-159428
J921		11 PIN JACK	70-159429
J922		8 PIN JACK	70-159253
P923		16 PIN PLUG	70-159430
P922		8 PIN PLUG	70-034324
		INTEGRATED CIRCUITS	
IC901	T	HN671106U	70-076470
IC902	T	HN58C65FP-25	70-076471
IC903	T	HD63701YOPJ	70-076509
IC904	T	MB3771FPT	70-076473
IC905	T	HD/MC14053BFPTR	70-076474
IC906 A	T	uPC4558G	70-076475
IC906 B	T	BA228F	70-076569
IC907	T	MX365P	70-076476
IC908	T	HD/MC74HC1OFPTR	70-076477
IC909	T	HD/MC14066BFPTR	70-076478
IC910	T	HD/MC14070BRPTR	70-076479
IC911	T	HD/MC14516BFPTR	70-076480
IC912	T	uPC451G2	70-076481
IC913	T	HA17805P	70-076482
		TRANSISTORS	
Q901	U	UN4210	70-080304
		CONTROLS	
RV901		BRST ADJ 47K	70-164095
RV901		CTCSS ADJ 47K	70-164095

REF NO.	LOC	DESCRIPTION	PART NO.
		DIODES	
D901	U	DCB010	70-085245
D902	U	HZM5C-TR	70-085251
D903	U	DCB010	70-085245
D904	U	LN2G	70-085252
		CAPACITORS	
C901	U	1000 pF, 50 V, CERAMIC	70-138170
C902	U	1000 pF, 50 V, CERAMIC	70-138170
C903	U	1000 pF, 50 V, CERAMIC	70-138170
C904	U	1000 pF, 50 V, CERAMIC	70-138170
C905	U	1000 pF, 50 V, CERAMIC	70-138170
C906	U	1000 pF, 50 V, CERAMIC	70-138170
C907	U	1000 pF, 50 V, CERAMIC	70-138170
C908	T	1 uF, 50 V, ELECT	70-135172
C909	T	10 uF, 16 V, ELECT	70-135163
C910	T	10 uF, 16 V, ELECT	70-135163
C912	T	10 uF, 16 V, ELECT	70-135163
C913	T	1 uF, 50 V, ELECT	70-135172
C915	T	47 uF, 16 V, ELECT	70-135140
C916	U	1000 pF, 50 V, CERAMIC	70-138170
C917	U	47 pF, 50 V, CERAMIC	70-138185
C918	U	10000 pF, 50 V, CERAMIC	70-138168
C919	U	18 pF, 50 V, CERAMIC	70-138206
C920	U	18 pF, 50 V, CERAMIC	70-138206
C922	U	2200 pF, 50 V, CERAMIC	70-138235
C924	U	10000 pF, 50 V, CERAMIC	70-138168
C925	U	10000 pF, 50 V, CERAMIC	70-138168
C927	U	33000 pF, 50 V, CERAMIC	70-138257
C928	U	470 pF, 50 V, CERAMIC	70-138195
C929	U	33000 pF, 50 V, CERAMIC	70-138257

CX-55 LOGIC BOARD (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C930	U	10000 pF, 50 V, CERAMIC	70-138168
C931	U	2200 pF, 50 V, CERAMIC	70-138235
C932	U	10000 pF, 50 V, CERAMIC	70-138168
C933	U	10000 pF, 50 V, CERAMIC	70-138168
C934	U	10000 pF, 50 V, CERAMIC	70-138168
C935	U	10000 pF, 50 V, CERAMIC	70-138168
C936	U	10000 pF, 50 V, CERAMIC	70-138168
C938	U	10000 pF, 50 V, CERAMIC	70-138168
C939	T	10 uF, 16 V, ELECT	70-135163
C940	U	10000 pF, 50 V, CERAMIC	70-138168
C941	U	10000 pF, 50 V, CERAMIC	70-138168
C942	T	0.47 uF, 35 V, TANT	70-138214
C943	T	47 uF, 16 V, ELECT	70-135140
C944	T	10 uF, 16 V, ELECT	70-135163
C951	U	220 pF, 50 V, CERAMIC	70-138176
C952	U	220 pF, 50 V, CERAMIC	70-138176
C953	U	220 pF, 50 V, CERAMIC	70-138176
C954	U	220 pF, 50 V, CERAMIC	70-138176
C955	U	220 pF, 50 V, CERAMIC	70-138176
C956	U	220 pF, 50 V, CERAMIC	70-138176
C957	U	220 pF, 50 V, CERAMIC	70-138176
C958	U	220 pF, 50 V, CERAMIC	70-138176
C959	U	220 pF, 50 V, CERAMIC	70-138176
C960	U	220 pF, 50 V, CERAMIC	70-138176
C961	U	220 pF, 50 V, CERAMIC	70-138176
C962	U	220 pF, 50 V, CERAMIC	70-138176
C963	U	220 pF, 50 V, CERAMIC	70-138176
C964	U	220 pF, 50 V, CERAMIC	70-138176
C965	U	220 pF, 50 V, CERAMIC	70-138176
C966	U	220 pF, 50 V, CERAMIC	70-138176
C967	U	220 pF, 50 V, CERAMIC	70-138176
C968	U	220 pF, 50 V, CERAMIC	70-138176
C969	U	220 pF, 50 V, CERAMIC	70-138176
C970	U	220 pF, 50 V, CERAMIC	70-138176
C971	U	220 pF, 50 V, CERAMIC	70-138176
C972	U	220 pF, 50 V, CERAMIC	70-138176
C973	U	4700 pF, 60 V, CERAMIC	70-138204
C974	U	0.1 uF, 50 V, CERAMIC	70-138236
C975	U	10000 pF, 50 V, CERAMIC	70-138168
C976	U	0.022 pF, 50 V, PLASTIC	70-137082
		RESISTORS	
R801	U	1 kOHM, 1/10 W, METAL	70-144128
R802	U	3.3 kOHM, 1/10 W, METAL	70-144144
R803	U	1 kOHM, 1/10 W, METAL	70-144128
R804	U	1 kOHM, 1/10 W, METAL	70-144128
R805	U	1 kOHM, 1/10 W, METAL	70-144128
R806	U	47 kOHM, 1/10 W, METAL	70-145145
R807	U	4.7 kOHM, 1/10 W, METAL	70-144123
R808	U	10 kOHM, 1/4 W, CARBON	70-141212
R809	U	100 kOHM, 1/4 W, CARBON	70-141213
R810	T	5.6 kOHM, 1/4 W, CARBON	70-141214
R811	U	5.6 kOHM, 1/4 W, CARBON	70-141214
R812	U	56 kOHM, 1/10 W, METAL	70-144169
R816	U	5.6 kOHM, 1/4 W, CARBON	70-141214
R817	U	4.7 kOHM, 1/10 W, METAL	70-144123
R818	T	2.2 kOHM, 1/10 W, METAL	70-144107
R819	T	47 MOHM, 1/10 W, METAL	70-144192
R901	U	47 kOHM, 1/10 W, METAL	70-145145
R902	U	47 kOHM, 1/10 W, METAL	70-145145
R903	U	47 kOHM, 1/10 W, METAL	70-145145
R904	U	47 kOHM, 1/10 W, METAL	70-145145
R905	U	47 kOHM, 1/10 W, METAL	70-145145
R906	U	47 kOHM, 1/10 W, METAL	70-145145
R907	U	47 kOHM, 1/10 W, METAL	70-145145
R908	U	47 kOHM, 1/10 W, METAL	70-145145
R909	U	1 kOHM, 1/10 W, METAL	70-144128
R910	U	1 kOHM, 1/10 W, METAL	70-144128
R911	U	1 kOHM, 1/10 W, METAL	70-144128
R912	U	1 kOHM, 1/10 W, METAL	70-144128
R913	U	1 kOHM, 1/10 W, METAL	70-144128
R914	U	1 kOHM, 1/10 W, METAL	70-144128
R915	U	1 kOHM, 1/10 W, METAL	70-144128
R916	U	1 kOHM, 1/10 W, METAL	70-144128
R917	U	100 kOHM, 1/10 W, METAL	70-145128
R918	U	10 kOHM, 1/10 W, METAL	70-144120

REF NO.	LOC	DESCRIPTION	PART NO.
		RESISTORS (Continued)	
R919	U	22 kOHM, 1/10 W, METAL	70-144121
R920	U	47 kOHM, 1/10 W, METAL	70-145145
R921	U	100 kOHM, 1/10 W, METAL	70-145128
R922	U	22 kOHM, 1/10 W, METAL	70-144121
R923	U	470 OHM, 1/10 W, METAL	70-144156
R924	U	470 OHM, 1/10 W, METAL	70-144156
R925	U	220 kOHM, 1/10 W, METAL	70-144131
R926	U	100 kOHM, 1/10 W, METAL	70-145128
R927	U	47 kOHM, 1/10 W, METAL	70-145145
R929	U	22 kOHM, 1/10 W, METAL	70-144121
R930	U	22 kOHM, 1/10 W, METAL	70-144121
R931	U	4.7 kOHM, 1/10 W, METAL	70-144123
R932	U	0 OHM, 1/10 W, METAL	70-144106
R933	U	12 kOHM, 1/10 W, METAL	70-144111
R934	U	10 kOHM, 1/10 W, METAL	70-144120
R935	U	470 kOHM, 1/10 W, METAL	70-144199
R936	U	68 kOHM, 1/10 W, METAL	70-144119
R937	U	4.7 kOHM, 1/10 W, METAL	70-144123
R939	U	220 kOHM, 1/10 W, METAL	70-144131
R940	U	100 kOHM, 1/10 W, METAL	70-145128
R941	U	47 kOHM, 1/10 W, METAL	70-145145
R942	U	100 kOHM, 1/10 W, METAL	70-145128
R943	U	100 kOHM, 1/10 W, METAL	70-145128
R945	U	1 kOHM, 1/10 W, METAL	70-144128
R946	U	150 kOHM, 1/10 W, METAL	70-144129
R947	U	470 kOHM, 1/10 W, METAL	70-144199
R948	U	68 kOHM, 1/10 W, METAL	70-144119
R949	U	150 kOHM, 1/10 W, METAL	70-144129
R951	U	33 kOHM, 1/10 W, METAL	70-144112
R952	U	10 kOHM, 1/10 W, METAL	70-144120
R953	U	33 kOHM, 1/10 W, METAL	70-144112
R954	U	10 kOHM, 1/10 W, METAL	70-144120
R955	U	10 kOHM, 1/10 W, METAL	70-144120
R956	U	470 kOHM, 1/10 W, METAL	70-144199
R957	U	1 kOHM, 1/10 W, METAL	70-144128
R959	U	47 kOHM, 1/10 W, METAL	70-145145
R960	U	47 kOHM, 1/10 W, METAL	70-145145
R962	U	47 kOHM, 1/10 W, METAL	70-145145
R963	U	0 OHM, 1/10 W, METAL	70-144106
R964	U	1 kOHM, 1/10 W, METAL	70-144128
R965	U	1 kOHM, 1/10 W, METAL	70-144128
R966	U	1 kOHM, 1/10 W, METAL	70-144128
R967	U	1 kOHM, 1/10 W, METAL	70-144128
R968	U	1 kOHM, 1/10 W, METAL	70-144128
R971	U	10 kOHM, 1/10 W, METAL	70-144120
R972	U	8.2 kOHM, 1/10 W, METAL	70-144305
R973	U	33 kOHM, 1/10 W, METAL	70-144112
R975	U	100 kOHM, 1/10 W, METAL	70-145128
R977	U	220 kOHM, 1/10 W, METAL	70-144131
R978	U	100 kOHM, 1/10 W, METAL	70-145128
R979	U	47 kOHM, 1/10 W, METAL	70-145145
R980	U	22 kOHM, 1/10 W, METAL	70-144121
R981	U	22 kOHM, 1/10 W, METAL	70-144121
R982	U	1 kOHM, 1/10 W, METAL	70-144128
R983	U	1 kOHM, 1/10 W, METAL	70-144128
R984	U	1 kOHM, 1/10 W, METAL	70-144128
R985	U	1 kOHM, 1/10 W, METAL	70-144128
R986	U	1 kOHM, 1/10 W, METAL	70-144128
R987	U	1 kOHM, 1/10 W, METAL	70-144128
R988	U	1 kOHM, 1/10 W, METAL	70-144128
R989	U	1 kOHM, 1/10 W, METAL	70-144128
R990	U	1 kOHM, 1/10 W, METAL	70-144128
R992	U	1 kOHM, 1/10 W, METAL	70-144128
R994	U	1 kOHM, 1/10 W, METAL	70-144128
R995	U	1 kOHM, 1/10 W, METAL	70-144128
R996	U	1 kOHM, 1/10 W, METAL	70-144128
R997	U	1 kOHM, 1/10 W, METAL	70-144128
R998	U	1 kOHM, 1/10 W, METAL	70-144128
R999	U	1 kOHM, 1/10 W, METAL	70-144128
		MISCELLANEOUS	
JP901	U	0 OHM, 1/10 W, METAL	70-144106
JP902	U	0 OHM, 1/10 W, METAL	70-144106
X901	T	CRYSTAL	70-128078
Z323	T	SUB-PC BOARD	70-070302

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PA-1553 40 WATT PA MODULE

REF NO.	LOC	DESCRIPTION	PART NO.
		CONNECTORS	
J501		INPUT JACK	70-159089
J502		ANTENNA JACK	70-159427
J503		RECEIVE JACK	70-159089
P505		ACCESSORY PLUG	70-034322
		CABLES	
CA501		TX COAX	70-034325
CA502		J506 ASSEMBLY	70-034319
CA503		RX COAX	70-034325
CA504		P104 ASSEMBLY	70-034320
CA505		J505 ASSEMBLY	70-034321
		TRANSISTORS	
Q501	T	2SC1971	70-080305
Q502	T	2SC2539	70-080090
Q503	T	2SC2694	70-080133
Q504	T	2SC26945	70-080338
Q505	T	2SC26945	70-080338
Q506	U	2SC2462LC	70-080160
Q507	U	2SC2462LC	70-080160
		COILS	
L501	T	Z0.8C5D 0.5T	70-090325
L502	T	BL02RN1-R62	70-090122
L504	T	Z0.8C5D 2.5T	70-090098
L505	T	BL02RN1-R62	70-090122
L506	T	Z0.8C5D 0.5T	70-090160
L510	T	42L004	70-090127
L511	T	Z1.2C5D 2.5T	70-090102
L512	T	Z1.2C5D 2.5T	70-090102
L513	T	Z1.2C5D 2.5T	70-090102
L514	T	Z1.2C5D 2.5T	70-090102
L515	T	Z0.8C5D 2.5T	70-090098
L517	T	Z0.8C5D 2.5T	70-090098
		DIODES	
D501	T	UM9401	70-085056
D502	T	MI407	70-085047
D503	U	HSM885	70-085154
D505	U	DCA010	70-085250
D506	T	RM4AM	70-085157
		TRIMMER CAPACITORS	
CV501	T	40 pF	70-123024
CV504	T	40 pF	70-123024
		CONTROLS	
RV502	T	HI PWR ADJUSTMENT	70-164096
		CAPACITORS	
C501	U	1000 pF, 50 V, CERAMIC	70-138170
C502 A	U	47 pF, 50 V, CERAMIC	70-138185
C502 B	U	22 pF, 50 V, CERAMIC	70-138171
C503	U	1000 pF, 50 V, CERAMIC	70-138170
C504	T	10 uF, 50 V, ELECT	70-135174
C505 B	T	22 pF, 50 V, CERAMIC	70-138171
C505 A	T	47 pF, 50 V, CERAMIC	70-138185
C506	U	0.01 u pF, 50 V, CERAMIC	70-138168
C507	T	47 pF, 50 V, CERAMIC	70-138185
C508	T	0.1 uF, 50 V, PLASTIC	70-137084
C509	U	47 pF, 50 V, CERAMIC	70-138185
C510	U	56 pF, 50 V, CERAMIC	70-138254
C511	U	47 pF, 50 V, CERAMIC	70-138185
C513 B	U	1000 pF, 100 V, CERAMIC	70-138239
C513 A	U	150 pF, 50 V, CERAMIC	70-138258
C514	U	1000 pF, 100 V, CERAMIC	70-138239
C515	U	68 pF, 50 V, CERAMIC	70-138229
C516	U	82 pF, 500 V, CERAMIC	70-138259
		CAPACITORS	
C517	U	82 pF, 50 V, CERAMIC	70-138260
C518 A	U	220 pF, 100 V, CERAMIC	70-138261
C518 B	U	150 pF, 100 V, CERAMIC	70-138258
C519	T	220 pF, 100 V, CERAMIC	70-138261
C520	T	220 pF, 100 V, CERAMIC	70-138261
C521 B	T	220 pF, 100 V, MICA	70-138112
C522	U	1000 pF, 100 V, CERAMIC	70-138239
C523 A	U	220 pF, 100 V, MICA	70-138112
C523 B	U	100 pF, 100 V, MICA	70-138115
C524 A	U	120 pF, 100 V, MICA	70-138109
C524 B	U	82 pF, 100 V, MICA	70-138250
C525 B	U	91 pF, 100 V, MICA	70-138110
C525 A	U	120 pF, 100 V, MICA	70-138116
C527 A	U	33 pF, 500 V, CERAMIC	70-138262
C527 B	U	22 pF, 500 V, CERAMIC	70-138263
C528 A	U	220 pF, 500 V, CERAMIC	70-138261
C528 B	U	100 pF, 500 V, CERAMIC	70-138264
C529	U	1000 pF, 50 V, CERAMIC	70-138170
C530	U	1000 pF, 50 V, CERAMIC	70-138170
C531	U	220 pF, 100 V, CERAMIC	70-138261
C532 B	U	12 pF, 500 V, CERAMIC	70-138266
C532 A	U	18 pF, 500 V, CERAMIC	70-138265
C533	U	12 pF, 50 V, CERAMIC	70-138209
C535	T	0.22 uF, 50 V, PLASTIC	70-138160
C536	U	1000 pF, 50 V, CERAMIC	70-138170
C537 A	U	39 pF, 50 V, CERAMIC	70-138233
C537 B	U	33 pF, 50 V, CERAMIC	70-138188
C538	U	1000 pF, 50 V, CERAMIC	70-138170
C539	U	1000 pF, 50 V, CERAMIC	70-138170
C544	U	0.01 u pF, 50 V, CERAMIC	70-138168
C545 B	U	15 pF, 500 V, CERAMIC	70-138267
C545 A	U	22 pF, 500 V, CERAMIC	70-138263
C546 B	U	33 pF, 500 V, CERAMIC	70-138262
C546 A	U	47 pF, 500 V, CERAMIC	70-138268
C547 A	U	47 pF, 500 V, CERAMIC	70-138268
C547 B	U	33 pF, 500 V, CERAMIC	70-138262
C548	U	33 pF, 500 V, CERAMIC	70-138262
C549	U	15 pF, 500 V, CERAMIC	70-138267
C552	U	0.1 uF, 50 V, CERAMIC	70-138249
C552	U	1000 pF, 50 V, CERAMIC	70-138170
C554	T	15 uF, 25 V, ELECT	70-135154
C555	U	1000 pF, 50 V, CERAMIC	70-138170
C557	U	1000 pF, 50 V, CERAMIC	70-138170
C560 B	T	1000 pF, 50 V, CERAMIC	70-132042
C801	U	1000 pF, 50 V, CERAMIC	70-138170
C802	U	0.01 u pF, 50 V, CERAMIC	70-138168
C803	U	0.047 uF, 50 V, CERAMIC	70-138256
C804	U	1000 pF, 50 V, CERAMIC	70-138170
C805	U	0.01 u pF, 50 V, CERAMIC	70-138168
C806	U	0.047 uF, 50 V, CERAMIC	70-138256
		RESISTORS	
R501	U	820 OHM, 1/10 W, METAL	70-144165
R502	U	150 OHM, 1/10 W, METAL	70-140321
R504	U	22 OHM, 1/8 W, METAL	70-144074
R505	U	22 OHM, 1/8 W, METAL	70-144074
R509	T	2.2 OHM, 1/8 W, METAL	70-144200
R511 A	U	39 OHM, 1/10 W, METAL	70-144125
R511 B	U	47 OHM, 1/10 W, METAL	70-145130
R512	U	47 kOHM, 1/10 W, METAL	70-145145
R513	U	47 kOHM, 1/10 W, METAL	70-145145
R515	U	470 OHM, 1/10 W, METAL	70-144015
R516	U	470 OHM, 1/10 W, METAL	70-144015
R519	U	120 OHM, 1/8 W, METAL	70-144010
R524	U	100 OHM, 1/10 W, METAL	70-144009
R525 A	U	2.2 kOHM, 1/10 W, METAL	70-144229
R525 B	U	1.8 kOHM, 1/10 W, METAL	70-144154
R526	U	47 OHM, 1/10 W, METAL	70-145130
R527	U	330 OHM, 1/10 W, METAL	70-144164
R528	U	47 OHM, 1/10 W, METAL	70-145130
R529	U	4.7 kOHM, 1/10 W, METAL	70-144199
R530	U	0 OHM, 1/10 W, METAL	70-144106
R531	T	33 OHM, 1 W, METAL	70-144201

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REF NO.	LOC	DESCRIPTION	PART NO.
		CONNECTORS	
J501		INPUT JACK	70-159089
J502		ANTENNA JACK	70-159427
J503		RECEIVE JACK	70-159089
P505		ACCESSORY PLUG	70-034333
		CABLES	
CA501		TX COAX	70-034198
CA502		J501 ASSEMBLY	70-034332
CA503		RX COAX	70-034198
CA504		P104 ASSEMBLY	70-034320
CA505		J505 ASSEMBLY	70-034321
		TRANSISTORS	
Q501	T	2SC2538	70-080108
Q502	T	2SC2539	70-080090
Q503	T	2SC2630	70-080091
Q504	T	2SC2694	70-080133
Q506	T	2SB945Q	70-080214
Q508	U	2SC2462	70-080160
Q509	U	2SC2462	70-080160
Q510	U	2SC2462	70-080160
		DIODES	
D502	U	HSM88S	70-085154
D505 B	U	DCA010	70-085250
		COILS	
L501	T	Z0.8C5D 1.5T	70-090097
L504	T	Z0.8C5D 1.5T	70-090097
L508	T	Z0.8C5D 1.5T	70-090097
L505 A	T	Z0.8C5D 0.5T	70-090160
L505 B	T	Z0.8C5D 1.5T	70-090097
L506 A	T	Z0.8C5D 0.5T	70-090160
L506 B	T	Z0.8C5D 2.5T	70-090098
L511	T	Z0.8C5D 6.5T	70-090131
L514	T	Z0.8C5D 6.5T	70-090131
L512	T	Z1.2C5D 1.5T	70-090133
L513	T	Z1.2C5D 1.5T	70-090133
L515	T	Z1.2C5D 2.5T	70-090102
L516	T	Z1.2C5D 2.5T	70-090102
L517	T	Z1.2C5D 2.5T	70-090102
L518	T	Z1.2C5D 2.5T	70-090102
		CONTROLS	
RV501	T	POWER ADJUSTMENT	70-164040
		VARIABLE CAPACITORS	
CV503	T	40 uF	70-123024
CV504	T	40 uF	70-123024
CV505	T	222-809-08003	70-123031
		CAPACITORS	
C501 B	U	39 pF, 50 V, CERAMIC	70-138233
C502	U	15 pF, 50 V, CERAMIC	70-138205
C503	U	1000 pF, 50 V, CERAMIC	70-138255
C504	U	1000 pF, 50 V, CERAMIC	70-138255
C505	T	15 uF, 25 V, ELECT	70-135154
C506 B	U	82 pF, 50 V, CERAMIC	70-138250
C506 A	U	100 pF, 50 V, CERAMIC	70-138175
C507 A	U	33 pF, 50 V, CERAMIC	70-138188
C507 B	U	12 pF, 50 V, CERAMIC	70-138209
C508 A	U	33 pF, 50 V, CERAMIC	70-138188
C508 B	U	18 pF, 50 V, CERAMIC	70-138206
C510	U	1000 pF, 50 V, CERAMIC	70-138255
C511	U	100 pF, 50 V, CERAMIC	70-138175
C512 B	U	100 pF, 50 V, CERAMIC	70-138175
C513	U	33 pF, 50 V, CERAMIC	70-138188
C514	U	47 pF, 50 V, CERAMIC	70-138185
C515 A	U	5 pF, 50 V, CERAMIC	70-138205
C515 B	U	1000 pF, 50 V, CERAMIC	70-132042
C516 A	U	68 pF, 50 V, CERAMIC	70-138229

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C516 B	U	47 pF, 50 V, CERAMIC	70-138185
C517 A	U	68 pF, 50 V, CERAMIC	70-138229
C517 B	U	47 pF, 50 V, CERAMIC	70-138185
C518	U	470 pF, 50 V, CERAMIC	70-138238
C519 A	U	1000 pF, 50 V, CERAMIC	70-138170
C520	U	68 pF, 50 V, CERAMIC	70-138229
C521 B	T	15 uF, 25 V, ELECT	70-135154
C521 A	T	100 uF, 25 V, ELECT	70-135050
C522	U	100 pF, 50 V, CERAMIC	70-138175
C523	T	1000 pF, 50 V, CERAMIC	70-132042
C524	T	220 pF, 100 V, MICA	70-138112
C525	T	220 pF, 100 V, MICA	70-138112
C526	T	33 pF, 500 V, MICA	70-138098
C527 B	T	33 pF, 500 V, MICA	70-138098
C527 A	T	47 pF, 500 V, MICA	70-138109
C528	T	1000 pF, 50 V, CERAMIC	70-132042
C529	T	220 uF, 25 V, ELECT	70-131030
C531	U	0.047 uF, 50 V, CERAMIC	70-138256
C532 A	U	1000 pF, 50 V, CERAMIC	70-138170
C532 B	U	0.1 uF, 50 V, CERAMIC	70-138249
C533	U	0.047 uF, 50 V, CERAMIC	70-138256
C534	U	1000 pF, 50 V, CERAMIC	70-131222
C535	T	0.1 uF, 50 V, PLASTIC	70-138189
C536 B	U	62 pF, 500 V, MICA	70-138121
C537 B	U	47 pF, 500 V, MICA	70-138114
C538 A	T	82 pF, 500 V, MICA	70-138109
C538 B	T	56 pF, 500 V, MICA	70-138117
C539	T	62 pF, 500 V, MICA	70-138121
C540 A	U	39 pF, 100 V, MICA	70-138112
C541 B	U	62 pF, 500 V, MICA	70-138121
C541 A	U	47 pF, 100 V, MICA	70-138114
C542 A	U	82 pF, 100 V, MICA	70-138109
C542 B	U	100 pF, 100 V, MICA	70-138115
C543 A	U	47 pF, 50 V,CERA MIC	70-138283
C546	T	10 uF, 50 V, ELECT	70-135059
C547	U	1000 pF, 50 V, CERAMIC	70-131222
C548	U	1000 pF, 50 V, CERAMIC	70-131222
C551 A	U	100 pF, 100 V, MICA	70-138115
C551 B	U	62 pF, 500 V, MICA	70-138121
C552 B	U	27 pF, 500 V, MICA	70-138097
C552 A	U	62 pF, 500 V, MICA	70-138121
C554	U	220 pF, 100 V, MICA	70-138073
C555	U	220 pF, 100 V, MICA	70-138073
C556	U	220 pF, 100 V, MICA	70-138112
C557	U	220 pF, 100 V, MICA	70-138112
C558 A	T	12 pF, 500 V, MICA	70-138094
C558 B	T	33 pF, 500 V, MICA	70-138083
C561 A	T	12 pF, 500 V, MICA	70-138094
C561 B	T	33 pF, 500 V, MICA	70-138083
C562 A	U	0.047 uF, 50 V, CERAMIC	70-138256
C562 B	U	4700 PF, 50 V, CERAMIC	70-132034
C563	U	1000 pF, 50 V, CERAMIC	70-131222
C564	U	1000 pF, 50 V, CERAMIC	70-136073
C565 A	U	0.047 uF, 50 V, CERAMIC	70-138256
C565 B	U	4700 PF, 50 V, CERAMIC	70-132034
C566	U	1000 pF, 50 V, CERAMIC	70-131222
C567	U	1000 pF, 50 V, CERAMIC	70-136073
C568	U	1000 pF, 50 V, CERAMIC	70-138170
C569 A	U	22 pF, 100 V, MICA	70-138107
C570 A	U	22 pF, 100 V, MICA	70-138107
C571	T	47 uF, 25 V, ELECT	70-135055
C574	U	91 pF, 500 V, MICA	70-138110
C575	U	91 pF, 500 V, MICA	70-138110
C575	U	22 pF, 100 V, MICA	70-138107
C576 B	U	56 pF, 500 V, MICA	70-138117
C576 A	U	100 pF, 500 V, MICA	70-138115
C577	U	1000 pF, 50 V, CERAMIC	70-131222
C578	U	1000 pF, 50 V, CERAMIC	70-131222
C579 B	U	91 pF, 500 V, MICA	70-138110
C579 A	U	100 pF, 100 V, MICA	70-138115
C580 A	U	100 pF, 100 V, MICA	70-138115
C580 B	U	91 pF, 500 V, MICA	70-138110
C581	T	56 pF, 500 V, MICA	70-138117
C581	U	33 pF, 500 V, MICA	70-138083
C583	U	47 pF, 500 V, MICA	70-138114
C584 A	U	22 pF, 500 V, MICA	70-138084
C584 B	U	27 pF, 500 V, MICA	70-138083
C585 B	U	33 pF, 500 V, MICA	70-138083

PA-1554 110 WATT PA MODULE (Continued)

REF NO.	LOC	DESCRIPTION	PART NO.
		CAPACITORS (Continued)	
C585 A	U	56 pF, 500 V, MICA	70-138107
C586 A	U	56 pF, 500 V, MICA	70-138107
C586 B	U	33 pF, 500 V, MICA	70-138083
C588	U	15 pF, 500 V, MICA	70-138080
C590 B	U	3 pF, 500 V, MICA	70-138126
C591	U	7 pF, 50 V, CERAMIC	70-138181
C592	U	1000 pF, 50 V, CERAMIC	70-138170
C593 B	U	18 pF, 50 V, CERAMIC	70-138206
C593 A	U	27 pF, 50 V, CERAMIC	70-138165
		CONNECTORS	
C594	U	1000 pF, 50 V, CERAMIC	70-138170
C595	U	1000 pF, 50 V, CERAMIC	70-138170
C596	U	1000 pF, 50 V, CERAMIC	70-138170
C597	U	1000 pF, 50 V, CERAMIC	70-138170
C598	U	1000 pF, 50 V, CERAMIC	70-138170
C599	U	1000 pF, 50 V, CERAMIC	70-138170
C600 A	T	4.7 uF, 16 V, ELECT	70-138172
C601 A	U	1000 pF, 50 V, CERAMIC	70-138170
C801	U	1000 pF, 50 V, CERAMIC	70-138170
C802	U	0.01 uF, 50 V, CERAMIC	70-138168
C803	U	0.047 uF, 50 V, CERAMIC	70-138256
C804	U	1000 pF, 50 V, CERAMIC	70-138170
C805	U	0.01 uF, 50 V, CERAMIC	70-138168
C806	U	0.047 uF, 50 V, CERAMIC	70-138256
		FERRITE BEADS	
FB501 B	U	FERRITE BEAD	70-178088
FB502	U	FERRITE BEAD	70-178089
FB503	U	FERRITE BEAD	70-178089
FB505	U	FERRITE BEAD	70-178089
FB506	U	FERRITE BEAD	70-178089
FB504	U	FERRITE BEAD	70-178088
FB507 A	U	FERRITE BEAD	70-178089

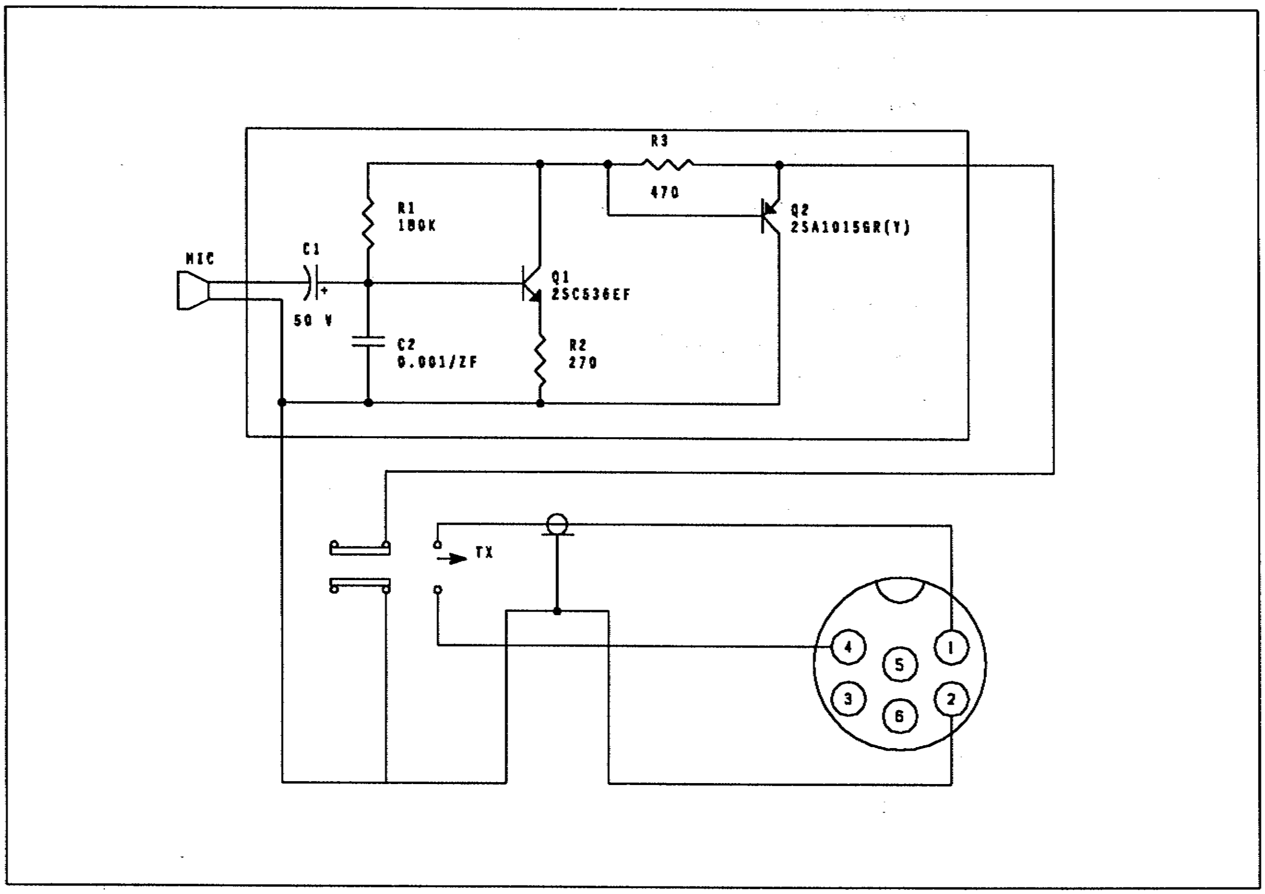
REF NO.	LOC	DESCRIPTION	PART NO.
		RESISTORS	
R501	U	150 OHM, 1/10 W, METAL	70-140321
R502	U	2.2 kOHM, 1/10 W, METAL	70-144113
R503	R	180 OHM, 1/10 W, METAL	70-144221
R504	U	1 kOHM, 1/10 W, METAL	70-144125
R505 A	U	COIL BL0ZRN1-R62	70-090326
R505 B	U	3.3 OHM, 1 W, METAL	70-142028
R506	U	3.3 OHM, 1 W, METAL	70-144048
R508	U	3.3 OHM, 1 W, METAL	70-144048
R509	U	3.3 OHM, 1 W, METAL	70-144048
R507	U	3.3 OHM, 2 W, METAL	70-145143
R510 B	U	10 OHM, 2 W, METAL	70-144082
R512	U	470 OHM, 1/10 W, METAL	70-144156
R513	U	1.8 kOHM, 1/10 W, METAL	70-144154
R514	U	47 OHM, 1/10 W, METAL	70-145130
R515	U	47 OHM, 1/10 W, METAL	70-145130
R516	U	330 OHM, 1/10 W, METAL	70-144164
R517 A	U	2.2 kOHM, 1/10 W, METAL	70-144113
R517 B	U	2.7 kOHM, 1/10 W, METAL	70-144159
R518 A	U	150 OHM, 1/10 W, METAL	70-140321
R518 B	U	100 OHM, 1/10 W, METAL	70-145131
R519 B	U	10 OHM, 2 W, METAL	70-145131
R521	U	100 kOHM, 1/10 W, METAL	70-145128
R522	U	100 kOHM, 1/10 W, METAL	70-145128
R523	U	300 OHM, 1/10 W, METAL	70-144164
R525 A	U	2.2 OHM, 2 W, METAL	70-145050
R525 B	U	4.7 OHM, 5 W, METAL	70-144197
R526	U	2.2 kOHM, 1/10 W, METAL	70-144202
R527 B	U	56 OHM, 1/10 W, METAL	70-141217
R530 A	U	33 OHM, 1 W, METAL	70-142028
R531	U	0 OHM, 1/10 W, METAL	70-144106
R537 A	U	0 OHM, 1/10 W, METAL	70-144106
R538 B	T	22 OHM, 1/10 W, METAL	70-144074
R538 A	U	47 OHM, 1/10 W, METAL	70-144006
R538 B	T	22 OHM, 1/10 W, METAL	70-144074
R539	T	22 OHM, 1/10 W, METAL	70-144074

Z-502 NOSE PIECE CONNECTOR BOARD

REF NO.	DESCRIPTION	PART NO.
	CONNECTORS	
P152	30 PIN PLUG	70-159431
J153	CONTROL CABLE JACK	70-159432
	RESISTORS	
R430	33 OHM, 1 W	70-142028

70-2326 MICROPHONE

DESCRIPTION	PART NO.
LMR DYNAMIC MIC	70-038013
ELEMENT, DYNAIMC	70-038004
P/T SWITCH	70-183004
PCB W COMP	70-075014
PCB W/0 COMP	70-070008
2SA1015	70-080025
2SC536	70-080026
ELECT CAP, 10 uF, 50 WV	70-135002
CERAMIC CAP (102)	70-132005
RESISTOR 270 OHM, 1/4 W	70-141010
RESISTOR, 470 OHM, 1/4 W	70-141016
RESISTOR, 180 kOHM, 1/4 W	70-141037
PLUG MIC 6 PIN	70-159164



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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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