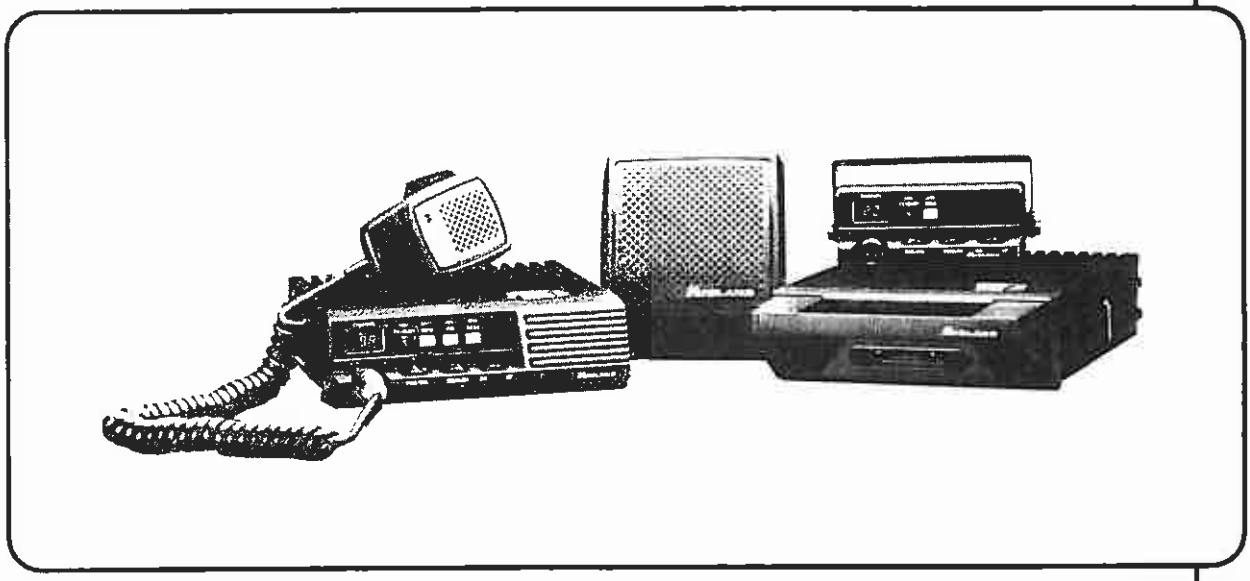
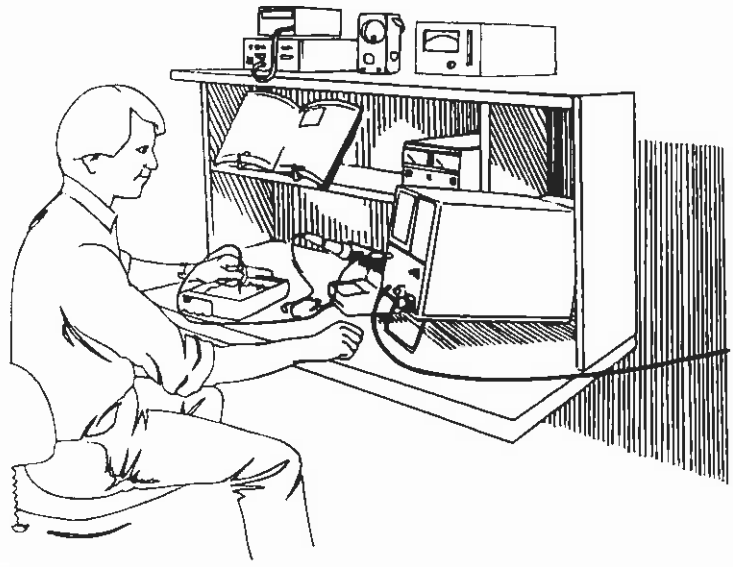
MIDLAND LMR
LAND MOBILE RADIO

SERVICE MANUAL



70-1395A/B AND 70-1495A/B

FM TWO-WAY
LAND MOBILE RADIO
VHF HIGH BAND
(136-162 MHz/148-174 MHz)
110 WATT



MANUAL NO.: 70-139149
09-1395/1495SM-7/93-2M

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This user's manual is designed to facilitate the set-up and service of the MIDLAND 70-1395/1495 SYN-TECH XTR mobile transceivers. As necessary, user's manual supplements will be published and distributed on the following forms:

Manual Addition (MA)	For supplemental information useful in product service or improvement. Printed on BLUE paper.
Change Notice (CN)	For details about changes made during product upgrades by model and serial number. Printed on YELLOW paper.
Manual Correction (MC)	For correcting literature errors not related to product upgrades. Printed on GREEN paper.
Technical Bulletin (TB)	For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Comments or suggestions concerning areas of manual improvement are welcome.

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SECTION 6 **DIAGRAMS**

SECTION 7 **PARTS**

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 70-1395/1495 MIDLAND SYN-TECH XTR transceivers are programmable frequency-synthesized two-way FM mobile radios that operate in the high-band VHF frequency range. They are programmable for up to 22 channels, or up 99 channel with plug-in option.

The 70-1395/1495 are designed to operate within either of two frequency ranges: 136–162 MHz (A-Band), or 148–174 MHz (B-Band). Transmit RF power is programmable for 2–110 watts.

There are two types of control head configurations for the SYN-TECH XTR. Either the entire radio can be mounted under the vehicle dashboard (model number 70-1395), or the bulk of the radio can be placed under a seat or in the trunk, with only the control panel mounted in the operator's reach (model number 70-1495). If the 70-1395 is purchased, the XTR is shipped with the Control Panel attached. If the 70-1495 is purchased, the XTR is shipped with a cable-interface board and handle assembly mounted in place of the Control Head, and a cable-interface board and a rear cover are added to the Control Head. The two units must be connected together with a multiconductor cable when installed.

SPECIFICATIONS

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

GENERAL

OPERATING FREQUENCY RANGE:
A-Band: 136–162 MHz
B-Band: 148–174 MHZ

COMMUNICATION SYSTEMS: Press-to-talk (1 or 2 frequency simplex)

CHANNEL SPACING: 30 kHz

CHANNEL STEPPING: 2.5 kHz

CHANNELS: 22 or 99 (optional)

REFERENCE OSCILLATOR: Microcomputer controlled

DUTY CYCLE: 1 minute TX, 4 minute RX

POWER SUPPLY: 13.4 V DC negative to ground

OPERATING VOLTAGE RANGE: 12.2 to 15.0 V

ABSOLUTE VOLTAGE RANGE: 10.9 to 16.3 V

CURRENT DRAIN:
Standby: 0.3 A (varies with options)
Receive at 10 W: 1.0 A (approx.)
Transmit: 25.0 A (approx.)

RF IMPEDANCE: 50 Ω unbalanced

OPERATION TEMPERATURE: −30° C to +60° C

RELATIVE HUMIDITY: 90% at 50° C ±2° C

SHOCK: MIL 810D 516.3 Prodedure I

VIBRATION: MIL 810C 514.2 Procedure VIII-V Category f
MIL 810D Method 514.3I-3.2.10

DIMENSIONS (H x W x D):
Dash-mount: 2.25 x 7.75 x 13.77 in (57 x 196 x 350 mm)
Trunk-mount: 2.25 x 7.75 x 13.77 in (57 x 196 x 350 mm)
Remote Control Head: 2.25 x 4.75 x 3.31 in (57 x 120 x 84 mm)
Speaker: 4.81 x 4.81 x 2.87 in (121 x 121 x 72 mm)

WEIGHT:
Dash-mount: 8.0 lb (3.62 kg)
Trunk-mount: 8.4 lb (3.82 kg)
Remote Control Head: 0.8 lb (0.36 kg)
Speaker: 1.38 lb (0.63 kg)

TRANSMITTER

RF POWER OUTPUT (programmable): 2−110 W, dual RF power levels

FREQUENCY STABILITY (−30° C to +60° C): ±0.0005% standard, ±0.0002%, optional

MODULATION (direct FM): 16K0F3E, 5 kHz maximum

FREQUENCY SEPARATION (at 110 W): 26 MHz

SPURIOUS & HARMONICS: −80 dB

FM HUM & NOISE: −50 dB

AUDIO RESPONSE: per EIA and DOC specifications

AUDIO DISTORTION (at 60% deviation): 3% or less at 1000 Hz

OUTPUT IMPEDANCE: 50 Ω

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RECEIVER

FREQUENCY STABILITY (−30° C to +60° C): ±0.0005% standard, ±0.0002% optional

SENSITIVITY (12 dB SINAD): 0.30 μV

SELECTIVITY (±30 kHz): −80 dB

FREQUENCY SEPARATION: 26 MHz

ACCEPTABLE RADIO FREQ. DISPLACEMENT: ±3.5 kHz minimum

SPURIOUS REJECTION: −80 dB

INTERMODULATION: −80 dB

SQUELCH SENSITIVITY: 0.18 μV maximum

AUDIO OUTPUT:
Int: 3 W at 3% distortion or less
Ext: 10 W at 3% distortion or less (into 3.2 Ω)
(Trunk-mount models measured at control head accessory connector with 4 meter maximum control cable. For longer control cables, measurement must be made at accessory connector on rear of radio.)

INPUT IMPEDANCE: 50 Ω

— All specifications subject to change without notice —

ACCESSORIES

OPTION KITS:

70-2180 . . . . . 99 Channel Option
70-2119 . . . . . 2 ppm Frequency Stability Kit
70-2120 . . . . . 2.5 ppm Frequency Stability Kit
70-2129 . . . . . 2nd IF Reverse Injection Kit
70-2963-1 . . . . . MIL 810 C/D dust/rain/salt fog Kit (T/M Control Head only)
70-2963-3 . . . . . MIL 810 C/D dust/rain/salt fog Kit (T/M Main Unit only)

SIGNALLING OPTIONS

70-2157	CTCSS/DCS Filter
70-2410	Digital Voice Storage/In Band Repeater (Requires 2413 Interface Board)
70-2412	Rolling Code Variable Split Band Scrambler (Requires 2413 Interface Board)
70-2413	Interface Board
70-2415	2 Tone Sequential Decoder
70-2416	Private Squelch
70-2417	2805 Hz Decoder
70-2418	Burst Tone Encoder
70-2419	Reverse Burst Generator
70-2420	DTMF Decoder

SPEAKERS AND MICROPHONES

70-2302	Weatherproof Microphone
70-2306	Microphone
70-2103A	DTMF Microphone with Up-Down Channel Switch w/6 Pin Jack Kit (70-K33)
70-2104A	DTMF Microphone with Up-Down Channel Switch and ANI w/ 6 Pin Jack Kit (70-K33)
70-2305B	Dynamic Base Station Microphone (w/70-K33)
70-2311	Telephone Handset
70-2195	CTCSS Microphone Hang-Up switch
70-2355	15 Watt Remote Speaker
70-2356	15 Watt Weatherproof Speaker
70-2365	15 Watt Horn Speaker
70-2325	Heavy Duty Amplified Condensor DTMF Microphone (w/ illuminated keypad)

MISCELLANEOUS

70-2249	Conversion Kit – Trunk Mount to Dash Mount
70-2250	Conversion Kit – Dash Mount to Trunk Mount
70-7070	Weatherproof Housing
70-2218	Ignition Relay Kit
70-2925	Memory Back up Kit (Short Term)
70-2926	Memory Back up Kit (Long Term)
70-2197	Electronic Noise Filter, 25 A

SECTION 2

PREPARATION

NOTES

PREINSTALLATION CHECK

NOTE: Alignment will require a programmer: either the 70-1080A Programmer (with Version 15.1 firmware or later), or 70-1489 PC Programming software. Refer to the appropriate programming manual for details.

- **Setup**

1. Remove the four securing screws on the 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 J501.
4. Connect 13.4 V DC power to J504.
5. Turn the radio on, 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 needed, set carrier frequency within ±150 Hz of channel frequency using the programmer. Refer to the appropriate manual for details.
7. RF output power is adjustable through the programmer. Initiate transmit on any channel. Measure power of RF output at 50-Ω Antenna Connector J501 and, if needed, adjust RF output power to obtain 110 W using the programmer. J402 is the interface connector between the transceiver and the programmer.

- **Maximum Deviation**

8. Select a channel with transmit frequency 136 MHz for A-Band, or 150 MHz for B-Band. If CTCSS or DCS is used, be sure the channel is programmed to send the same frequency.
9. Disconnect the hand microphone from its front panel receptacle J301. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of Mic Jack J301, then initiate transmit by grounding pin 4. Measure total carrier deviation. If it is not below ±5 kHz (including optional CTCSS/DCS signal), see MODULATOR ALIGNMENT on page 2 - 5.

START-UP

10. Program the radio customer frequencies and select features using the MIDLAND 70-1080A Programmer and its instruction manual.
11. The 70-1395/1495 Units are capable of operating across a wide band of channel frequencies; frequency selective circuits do not require realignment after the units are programmed with customer channel frequencies. After programming, only a general check of proper operation is needed. If any minor adjustments are necessary, refer to COMPLETE REALIGNMENT. These adjustments are of a general nature and do no require atypical equipment.
12. Install the radio into the vehicle. See Section 3.

CAUTION: Do not ground any speaker wires because they are all electrically hot (each wire is connected to a differential audio amplifier output).

NOTE: You must use the 70-1080A Programmer, the 70-1083 Jumper Plug, or 70-1489 PC Programming software to set Carrier Frequency, Maximum Deviation and RF Output Power.

COMPLETE REALIGNMENT

Complete realignment is only needed when a component that affects alignment has been replaced. RADIO REPROGRAMMING WITH TEST FREQUENCIES IS REQUIRED.

TEST EQUIPMENT REQUIRED

TEST INSTRUMENT	INSTRUMENT CAPABILITIES	USE
Regulated DC Power 13.4 V DC, 30 A	Radio power eource	
RF Wattmeter	200 W, 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, ±5 kHz range	Modulation level measurements
Frequency Meter or Frequency counter	136—174 MHz, 1.0 ppm accuracy	Carrier frequency measurement
RF Signal Generator	136—174 MHz range 0.1—1 KuV output, 3 kHz FM mod. with 1 kHz tone	All receiver measurements
Distortion Analyzer	1 kHz notch, 1% measuring range	Receiver performance test and IF alignment
Load Resistor (audio)	3.2 ohms, 20 W	Speaker load for all receiver measurements
AC Voltmeter	10 mV to 3 Vrms	Audio level adjustments
Oscilloscope	DC to 500 kHz bandwidth	DCS analysis
Digital Multimeter	0.1 to 20 V DC	Test point measurements
New SYN-TECH XTR Programmer	MIDLAND 70-1080A	Manual radio control

SET UP

1. Remove the four securing screws from 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 and a wattmeter to Antenna Connector J501.

4. Connect 13.4 V DC power to transceiver J504.

5. Connect a 3.2-Ω, 20-W resistor to pins 4 and 6 of the Accessory Plug. The jumper between pins 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 receive-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 J402. Upload the radio programming Data-Packet into the Programmer and initiate its Remote Control Mode. Refer to the appropriate manual for instructions.

SYNTHESIZER ALIGNMENT

- **VCO Resonance**

1. Select the Remote-Control Mode of the programmer and change the RX and TX test frequencies to 136.00 MHz for A-Band, or 150.00 MHz for B-Band.

2. Adjust Channel RX Tank L713 to obtain 1.5 V DC on CM701 pin 2.

3. Activate the transmit mode (using the Programmer). Adjust Channel TX Tank L733 to obtain 1.5 V DC on CM701-pin 2.

- **Crystal Type Selection**

4. Select the Test Mode of the Programmer, and choose Crystal Type as follows:

5. If X101 is marked "1", select Type 1; if X101 is marked "2", select Type 2; if X101 is marked "3", select Type 3. Refer to Crystal Alignment (page 2 - 9) for complete alignment instructions, if needed.

- **Reference Oscillator**

6. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation and, if necessary, adjust the carrier frequency to within ±150 Hz of channel frequency using the programmer.

110-WATT PA MODULE ALIGNMENT

1. Change the TX test to 160 MHz for A-Band, or 168 MHz for B-Band.

2. Activate transmit mode, then adjust CV503, CV504, and CV505 to obtain maximum RF power at Antenna Connector J501.

3. Set RF output power to 110 W at J501 using the programmer.

MODULATOR ALIGNMENT

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

- **Modulation Limiting**

1. Disconnect the hand microphone from its front panel receptacle J301. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of Mic Jack J301, then initiate transmit (if not using the 70-1080A Programmer ground P317 pin 4). Measure total carrier deviation and, if needed, adjust modulation limiting to obtain ±5 kHz using the programmer.

- **Microphone Gain**

2. No alignment for microphone gain is required.

- **CTCSS/DCS Modulation (if Installed)**

3. Enter DCS code +023, and adjust RV1 CTCSS/DCS so that deviation is at 750 Hz.

4. While observing recovered modulation on an oscilloscope, fine tune RV401 for a square DCS waveform as shown:

CORRECT INCORRECT INCORRECT

5. Readjust DCS deviation to 750 Hz.

6. Set frequency to CTCSS at 250.3 Hz. Adjust RV401 for 750 Hz deviation.

7. Set to DCS frequency. Fine tune RV401 for a square DCS waveform as shown.

8. Check CTCSS so that deviation is in 0.6 — 0.9 kHz range.

RECEIVER ALIGNMENT

1. Change the RX test frequency to 148.00 MHz for A-Band, or 162 for B-Band.

- **First Injection**

2. No adjustment for first injection is required.

- **Preselector Alignment**

3. No adjustment for the preselector (L201, L202, L203, L204, L205 and L206) is required.

- **Quadrature Detector**

4. Apply 1 mV of modulated (by 1 kHz tone at ±3 kHz deviation) on-channel RF signal to Antenna Jack J501. Adjust Detector L250 for maximum audio output.

- **First IF**

5. Apply 1 mV of modulated (by 1 kHz tone at ±3 kHz deviation) on-channel RF signal to maintain 12 to 15 dB SINAD. Adjust L245, L246, and L247.

- **Tight Squelch**

6. Set the front panel Squelch control to maximum (full clockwise). Set Squelch Range RV241 fully counter clockwise.

7. Apply 1 μV of unmodulated on-channel RF signal to the 50-Ω antenna connector. Adjust Squelch Range RV241 clockwise until squelch just opens (audio on).

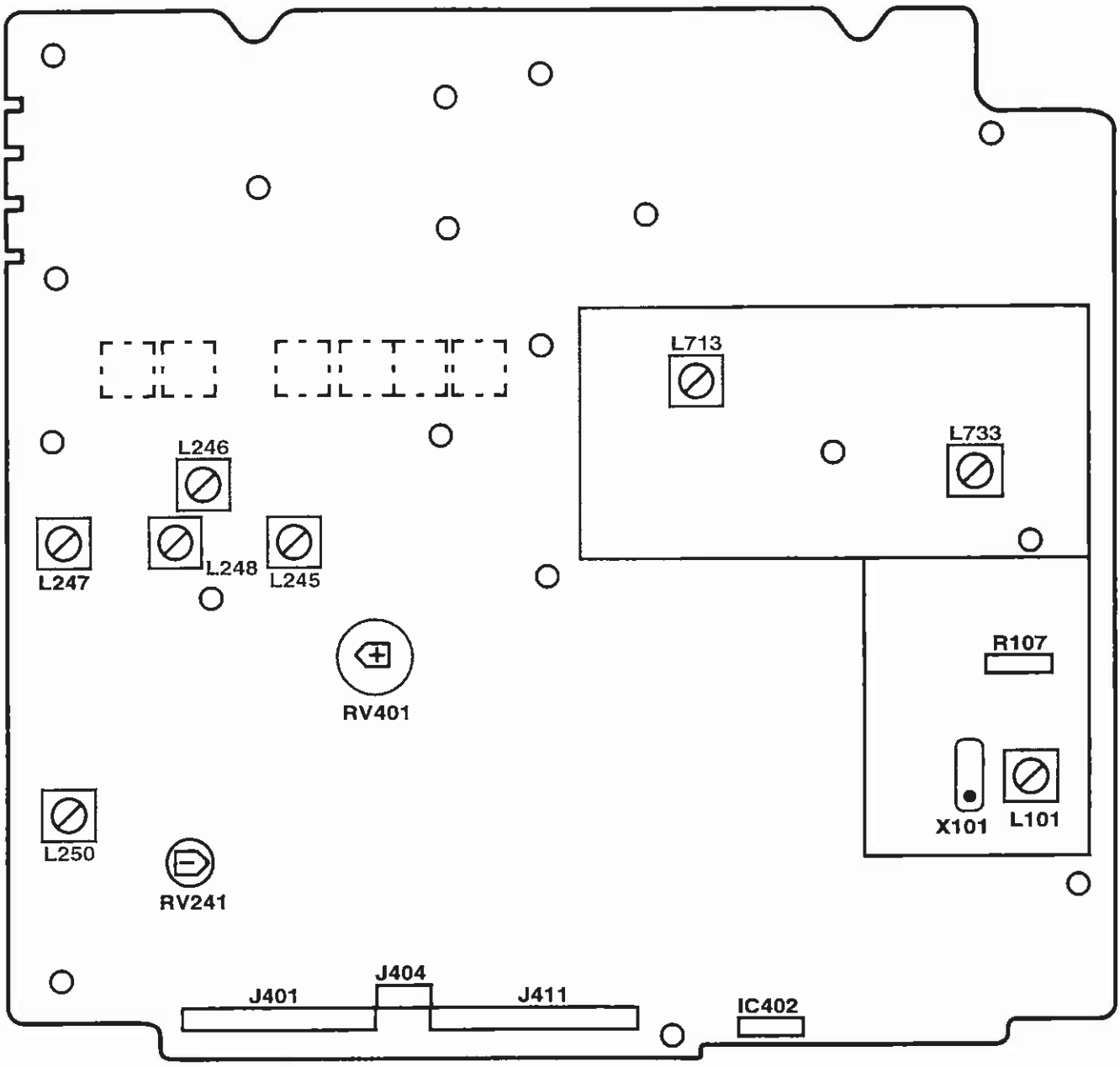

Figure 2 - 1 Adjustment Map — RF and Logic Board (TR-1517)

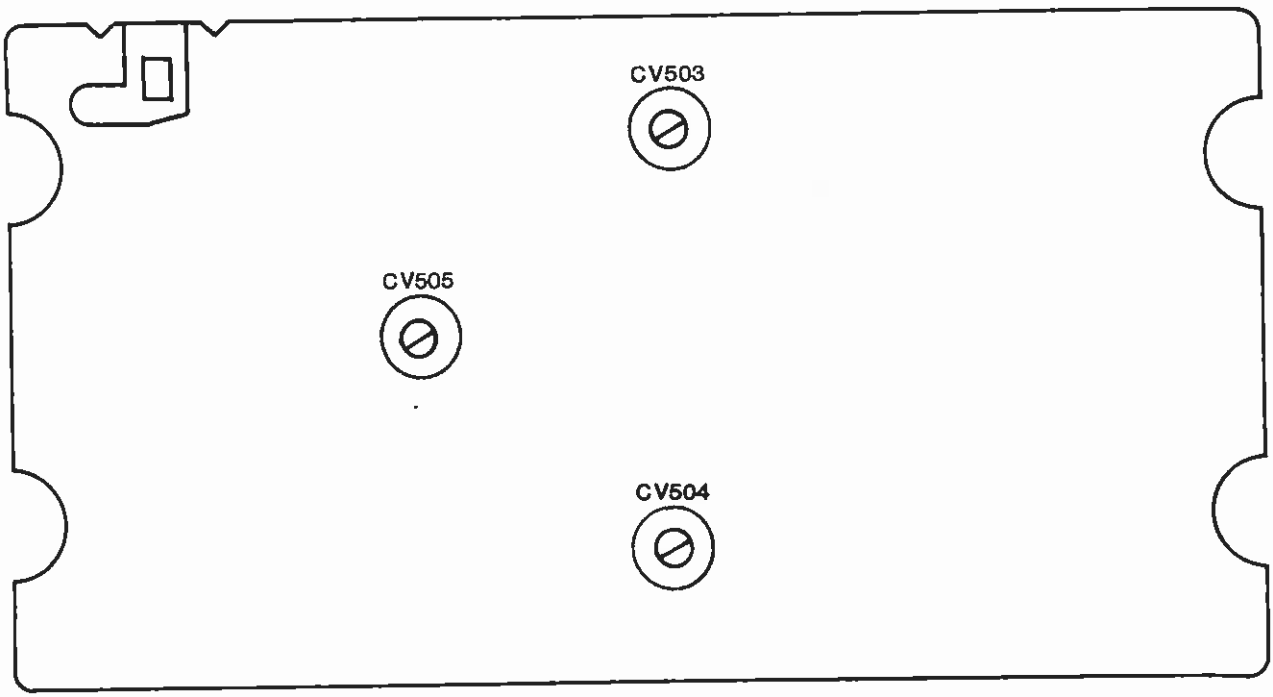

Figure 2 - 2 Adjustment Map — 110 W PA Board (PA-1554)

CRYSTAL ALIGNMENT

This alignment is required when a part in the reference oscillator circuit is replaced. This alignment is not needed during normal maintenance and radio alignment or programming.

When parts in the reference oscillator circuit are replaced, including the crystal, it is necessary to select the temperature compensation data of the microcomputer in accordance to the crystal markings. There are three types of crystals as (see **Table 2 - 3**). There are two ways to determine what type of crystal you have, either by the color of the dot on the top of the crystal or the type number on the side. See the example shown in **Figure 2 - 2**. See **Figure 2 - 1** for crystal location.

The procedure varies depending on what programmer is used. Proceed to the correct instructions for the programmer you are using.

- **70-1080A Programmer**

Refer to the 70-1080A Programmer's Manual for more information.

1. Connect the radio to power and test equipment as described under the alignment procedure section of the service manual.
2. Connect the 70-1080A programmer to the radio.
3. Upload the contents of the radio into the 70-1080A programmer.
4. Enter the test mode by pressing **CH**, **0**, then **ENT**.
5. Enter the correct RX (receive) and TX (transmit) test frequency for the radio. **NOTE:** The CTCSS and DCS does not need to be used for this test.
6. Press **GRP**, **4**, then **ENT**. "XTAL CHANGE OK ?" will be displayed.
7. Press **ENT**. "XTAL TYPE SELECT" will be displayed. Determine the type of crystal the radio has installed as shown in **Figures 1** and **2** and enter the correct type as shown in **Table 2 - 3**.
8. Press **ENT**. "DA CONTROL" will be displayed.
9. Press **3**, then **ENT**. "FO CONTROL" with a number (0 — 63) on the bottom line, representing the adjustment point of the reference oscillator frequency trim, will be displayed.
10. Measure the temperature of the body of R107 using a contact type thermometer. You must hold the thermometer on R107 for at least one minute before taking the temperature reading. R107 is located under the VCO shield (see **Figure 2 - 1**).
11. Using a digital voltmeter, measure the DC voltage on pin 60 of the microcomputer.
12. Find the measured temperature of R107 in **Table 2 - 4** and find the corresponding voltage for the type of crystal installed. Compare this voltage to that measured in step 11.
13. If the voltage does not match within 0.02 V DC, adjust it by using the **UP** or **DOWN** keys on the 70-1080A programmer until the DC voltage on pin 60 of the microcomputer is correct. Typical setting should be between 30 — 40.
14. When complete press **FNC**, then **OPT**. "DA DATA PROG END" will be displayed.
15. Initiate transmit and adjust L101 to within ±100 Hz of test frequency.
16. Return the radio to normal operation.

- **70-1489 Computer Based Programmer**

Refer to the 70-1489 Computer Based Programmer's Manual for more information.

1. Connect the radio to power and test equipment as described under the alignment procedure section of the service manual.
2. Connect the radio to the computer as described in the Computer Based Programmer's manual.

3. Upload the contents of the radio into the computer.

4. Enter the test mode of the program.

5. Select **RX-TX** in the TEST MODE and press **ENTER**.

6. Select **TX** in the RX-TX MODE and press **ENTER**.

7. Enter the correct RX (receive) and TX (transmit) test frequency for the radio. **NOTE:** The CTCSS/DCS tones/codes do not need to be used for this test. Do not leave the CHANNEL DATA FORM screen at this time.

8. Measure the temperature of the body of R107 using a contact type thermometer. You must hold the thermometer on R107 for at least one minute before taking the temperature reading. R107 is located under the VCO shield (see **Figure 2 - 1**) .

9. Determine the type of crystal the radio has installed as shown in **Figures 2 - 1** and **2 - 2**.

10. Using a digital voltmeter, measure the DC voltage on pin 60 of the microcomputer.

11. Find the measured temperature of R107 in **Table 2 - 4** and find the corresponding voltage for the type of crystal installed. Compare this voltage to that measured in step 10. If the voltage is within 0.02 V DC, then return the radio to normal operation. Otherwise:

12. Press **ESC** then **ENTER**.

13. Select **TX-CONTROL** in the TX MODE and press **ENTER**.

14. Use the **DOWN** arrow to select **CRYSTAL TYPE** and press **ENTER**. This will open the choice window.

15. Select the correct crystal type that the radio has and press **ENTER**.

16. Use the **UP** arrow to select the **REFERENCE FREQUENCY ADJUSTMENT**.

17. Using the **F5** — **F8** keys, adjust the voltage to within 0.02 V DC of the voltage determined in step 11. The typical setting of the **REFERENCE FREQUENCY ADJUSTMENT** should be between 30 — 40. Press **ENTER** after each entry of the **F5** — **F8**. After completion of the adjustment of the voltage on pin 60 of the microcomputer, press **ESC**.

18. Select **SAVE-TX** in the TX MODE and press **ENTER**.

19. Initiate transmit and adjust L101 to within ±100 Hz of test frequency.

20. Return the radio to normal operation.

Table 2 - 2

CRYSTAL TYPE	I	II	III
CRYSTAL TYPE COLOR OF DOT ON TOP	BLACK	BLUE	RED
CRYSTAL TYPE TYPE NO. ON SIDE	1	2	3
TYPE NO. TO ENTER IN PROG MODE	1	2	3

Figure 2 - 3

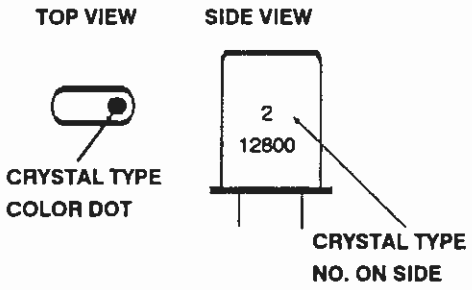

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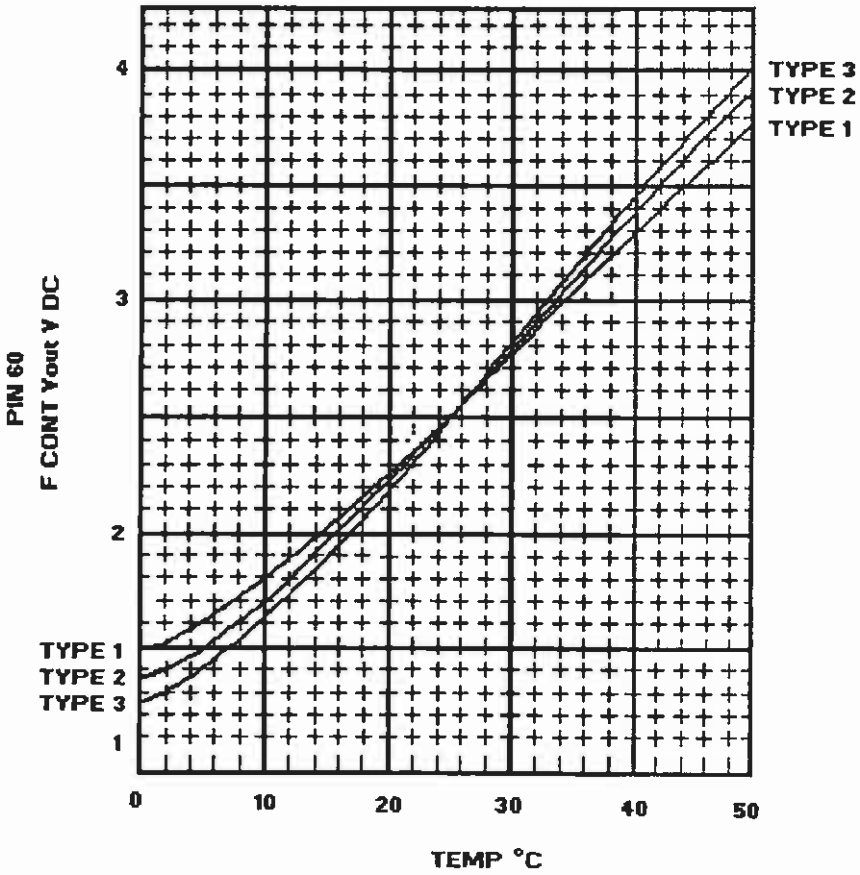
Table 2 - 3



NOTES

SECTION 3

INSTALLATION

NOTES

INSTALLATION

MOUNTING

• **Under-dash**

The 70-1395A/B mounting bracket slides into the transceiver siderails and provides a 3.25" x 7.75" flat surface across the transceiver top with holes for bolting to a flat surface in the vehicle. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided.

• **Trunk-Mount**

The operator controls for the 70-1495A/B transceiver are inside a compact control head for operator access, while the bulk of the transceiver is located in a separate remotely mounted unit. It does not have an internal speaker. Instead, a separate 3.2 Ω external speaker (included with the 70-1495 package) must be installed and connected to the Control Head.

The cable that interconnects the Control Head to the trunk unit is four meters long and flat for laying under carpeting. The cable must not lay near hot areas (above the catalytic converter, for example), or against sharp edges.

A trunk unit mounting tray is provided with each transceiver. The flat tray is 7.5" square and must be bolted to surface where the trunk unit will mount. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided. The 13" x 8" x 3" trunk unit then clips onto the tray.

A Control Head mounting bracket is provided with each transceiver. Its surface is 3/4" wide and 4" long with two screw holes 2" apart. 5/32" holes must be drilled in the mounting surface of the vehicle to accept the 3/8" screws and washers provided. The Control Head and Bracket assembly is 2 1/2 inches deep. At least 3/4 inch of additional depth is needed for the connectors that attach to the rear of the Control Head.

POWER

• **Connections**

For Under-Dash units, the Power Cable is equipped with two unterminated 10 gauge wires two meters in length for connection to the vehicle electrical system. For Trunk-Mount units, the Power Cable is equipped with two unterminated 10 gauge wires six meters in length. These lengths will be sufficient for direct connection to battery.

Connect the black wire to the negative (−) chassis ground of the vehicle. Because this radio draws such a large current (25 A), the black wire should be connected directly to the battery. **NOTE:** DO NOT ATTEMPT TO INSTALL THE TRANSCEIVER IN A POSITIVE GROUND VEHICLE.

Connect the red wire to the positive (+) side of the vehicle electrical system. Because of current requirements, connection to an existing fused circuit should be avoided to prevent overload of that fuse. This wire has its own in-line fuse for protection against wire penetration and transceiver defect. If you wish for the radio to turn on when ignition is engaged, you must install an ignition relay. The 70-2218 Ignition Relay Kit can be purchased for this purpose.

• **Requirements**

Both the 70-1395 and 70-1495 transceivers are designed to operate from a 12 V DC negative ground automotive electrical system. Current drain of at least 25 A should be expected. Inspection of the vehicle is recommended prior to installation. A low battery or other electrical system defects may degrade transceiver performance.

CAUTION: Check the voltage source before connecting the power cable. Too much voltage (above 16 V) can severely damage the transceiver.

Included with the trunk-mount transceiver is a 6 m power cable. The under-dash transceiver is shipped with a 2 m Power cable. Each cable includes fused power leads for connection to vehicle electrical system. Because the transceiver chassis is connected to the negative (−) lead, DO NOT INSTALL THE TRANSCEIVER IN A POSITIVE GROUND VEHICLE. If the transceiver is used as a base station, the external AC-line-to-DC power supply must be adequately regulated and have sufficient current capacity.

ANTENNA

The communications system component that can affect overall performance the most is the antenna. A good quality antenna designed to provide 50 Ω terminating impedance at appropriate transceiver frequencies is recommended. When adjusting the antenna, be sure to follow its manufacturer's instructions. A better quality SWR meter should be used to accurately measure minimum reflected energy.

MICROPHONE HANGER

The hand microphone included with the transceiver has a button on its backside to mate with its hang-up clip. The clip must be mounted with three screws in a location convenient to the operator. Three 1/2" screws and three 3/4" screws, each requiring a 5/64" hole, are also provided.

An optional microphone hanger (model 70-2195 for T/M radios, or 70-2195B for U/D radios) is available for use with the CTCSS/DCS option. This hang-up box may be installed in place of the microphone clip on both metallic or non-metallic surfaces.

POWER ACCESSORY PLUGS

- **Under-dash**

A 12-pin male Molex connector mates to the accessory connector (J415) on the rear of the 70-1395. Extra pin positions are used for connection of optional devices not included with this assembly.

Optional devices can be connected to the Accessory Plug by inserting Molex pins included with these devices into their respective vacant holes. See **Figure 3 - 1**. Option connections are shown in lighter shade.

- **Trunk-mount**

The 70-1495 has one 12-pin and one 9-pin male Molex receptacles—J415 on the trunk unit; J324 on the Control Head. The Accessory Plug includes a jumper between pins 5 and 6 that routes speaker audio to the control head.

The 9-pin Accessory Plug connects to the rear of the control head. The speaker has Molex pins that insert into this plug. Extra pin positions are present for connection of the optional 70-2195 switching hang-up box (not included with the standard transceiver) for use with CTCSS or CDCSS. Two more pin positions are provided for optional auxiliary connections. See **Figure 3 - 2**.

EXTERNAL SPEAKER

- **Under-dash (Model 70-2355)**

Normally, the transceiver internal speaker is connected to receive audio by the jumper to pins 5 and 6. If one of the MIDLAND external speakers is to be utilized, the jumper must be removed to disable the internal speaker and the two wires from the external speaker must connect to pin 4 and 6.

NOTE: If the 70-2355 15 W External Speaker is to be connected, its input cable center conductor (white) must be connected to pin 6, and the shield (black) to pin 4.

- **Trunk-mount**

The 70-2355 15 W speaker comes with the standard trunk-mount transceiver configuration. It connects to the Control Head Accessory Plug. Its 5 1/2' cable is terminated with appropriate Molex pins for insertion into the trunk-mount Accessory Plug on the

Control Head. The speaker housing and mounting bracket assembly is 5" x 5" x 3", and the mounting surface is 4 1/4" x 1 1/4", with four 3/32" screw slots.

HANG-UP BOX

If the CTCSS feature is included in the transceiver, the optional 70-2195 Microphone Hang-Up contact/switch-box is installed to unmute CTCSS/DCS squelch when the microphone is lifted. The center conductor of the shielded hang-up box cable connects to pin 3, the shield to pin 2.

AUXILIARY DEVICES

Pins 1 and 8 are available for auxiliary connections necessary with certain optional features. Wiring details for these are found in the literature for the option.

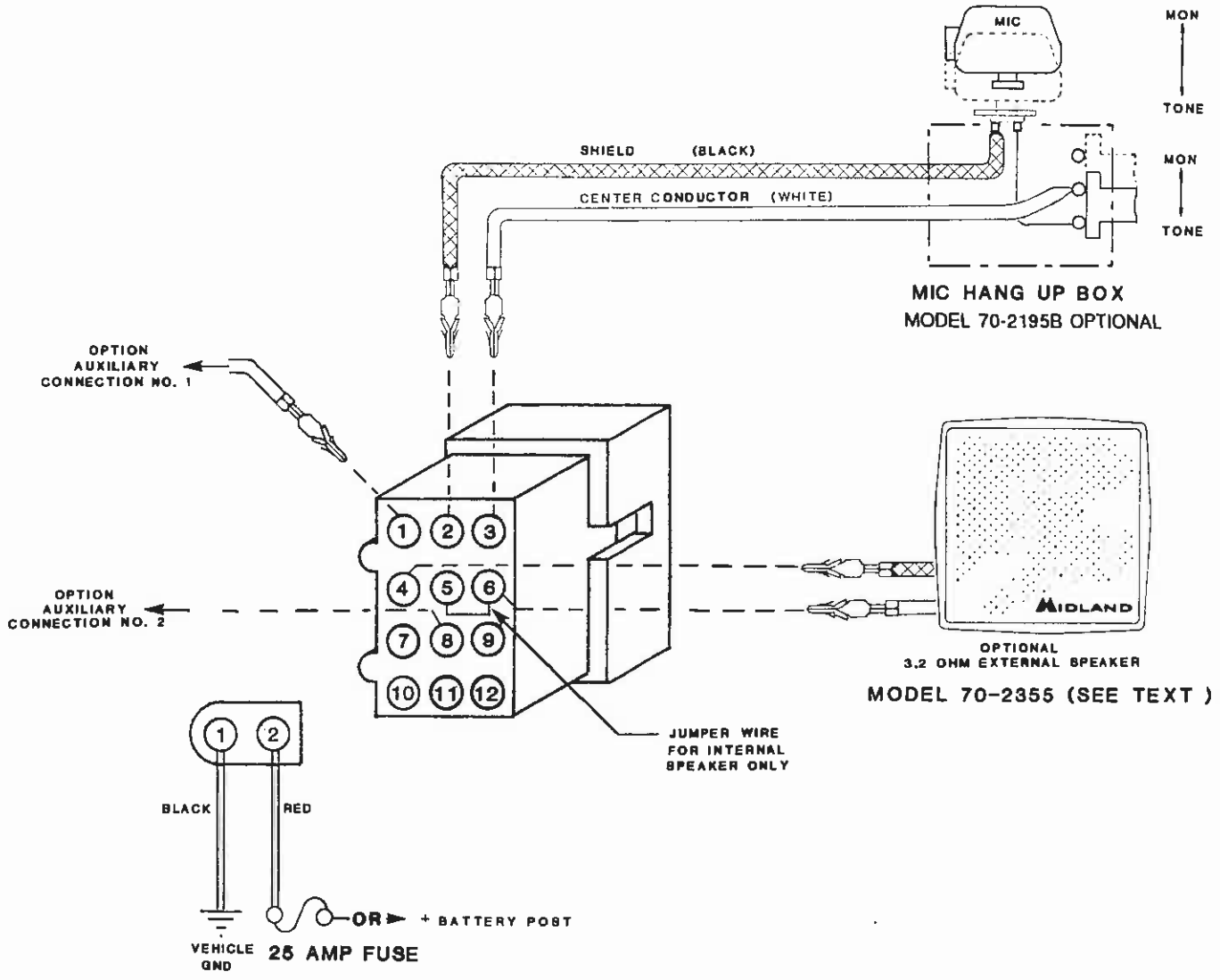


Figure 3 - 1 Under-Dash Power/Accessory Plug

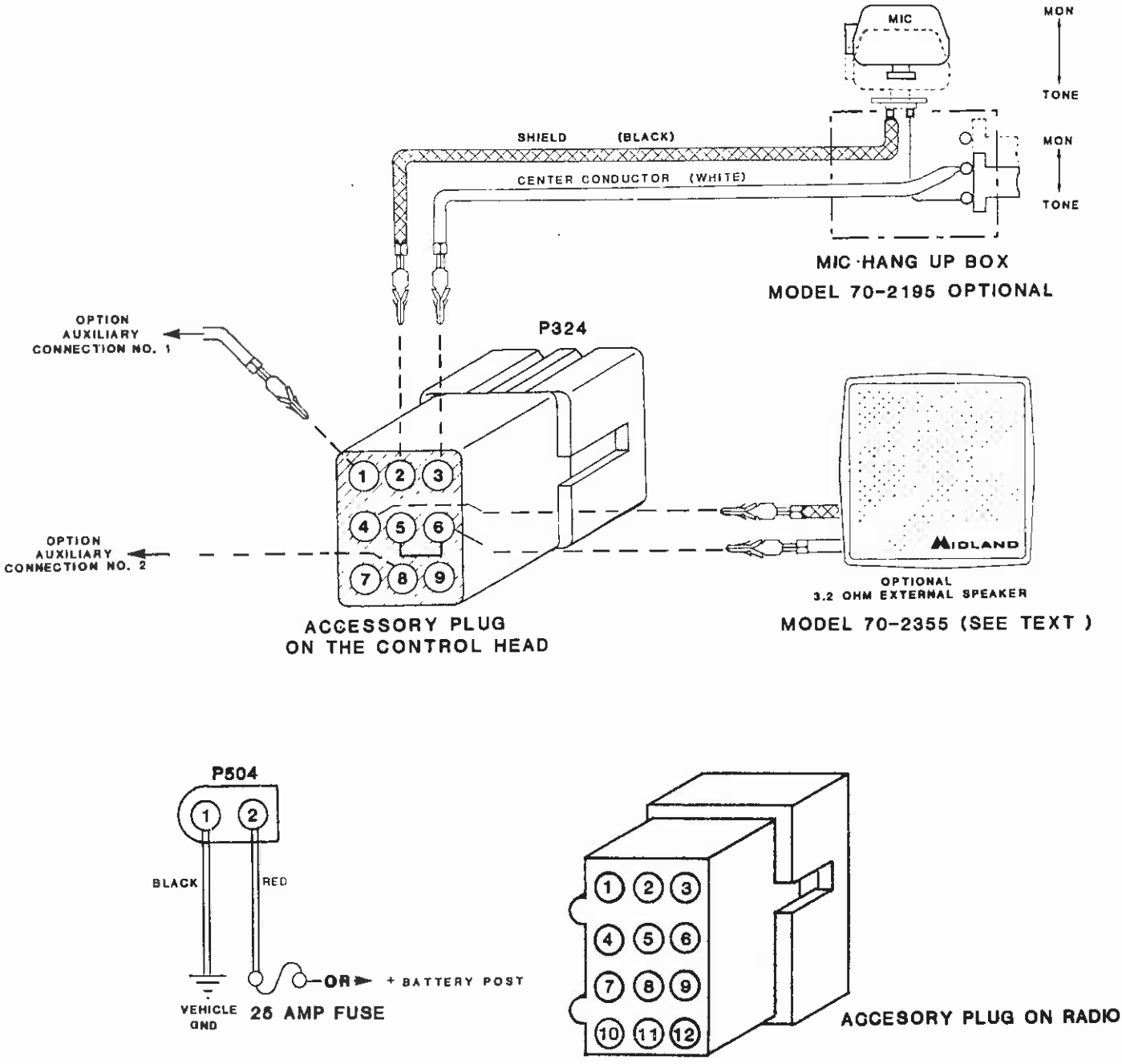


Figure 3 - 2 Trunk-Mount Power and Accessory Plugs

SECTION 4

SERVICING

NOTES

REMOVING THE TR-1517 BOARD

When servicing the XTR or adding option kits, you may need to remove the TR-1517 Board. To do so:

1. Unscrew and remove the bottom cover.
2. Unplug J401 and J411 (for Trunk-Mount units, unplug J414 as well).
3. Under-Dash Units: Insert a screwdriver in the slot located on the Control Head above J411 and IC402 of the TR-1517 Board (see **Figures 4 - 1a and 4 - 1b**). Pry up, then tilt the bottom part of the Control Head away from the radio chassis.

   Trunk-Mount Units: Remove the two screws securing the Nose-Piece (located in the handle), and pull it off.
4. Snap off the VCO/Reference Oscillator shield cover.
5. Remove the fifteen screws securing the TR-1517 Board.
6. Remove the three clips holding IC401, IC402, and IC406 to the front of the radio.
7. Lift the front part of the TR-1517 Board up from the radio. Tilt the board backwards.

The TR-1517 Board is now ready for servicing.

After servicing, reinstall the board by following the following steps:

1. Lower the board back into the radio (make sure all wires are on top).
2. Insert the fifteen screws, then tighten. Do not over-tighten.
3. Replace the clips for IC401, IC402 and IC406. Replace the connector plugs into J401 and J411 (for Trunk-Mount Units, also replace the brown connector plug into J414—notice that the white connector plug is not used).
4. Replace the cover shield for the VCO/Reference Oscillator. Make sure that you don't clamp the wires under the covers.
5. Replace the Control Head (or Nose-Piece for Trunk-Mount Units).
6. Replace the bottom cover.

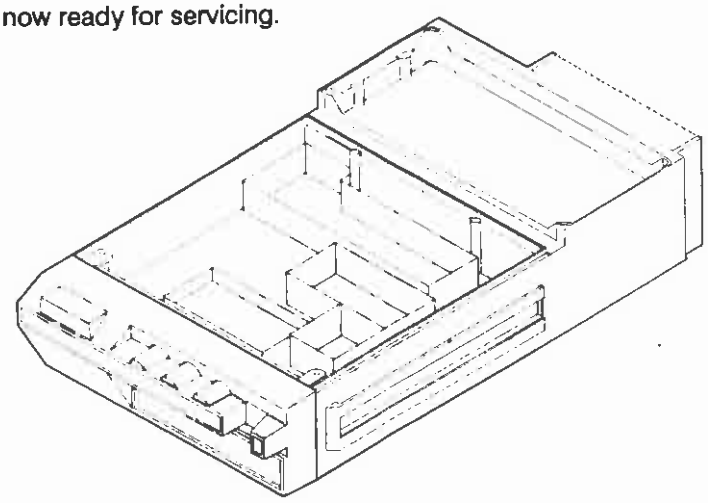


Figure 4 - 1a — SYN-TECH XTR Chassis and Control Head

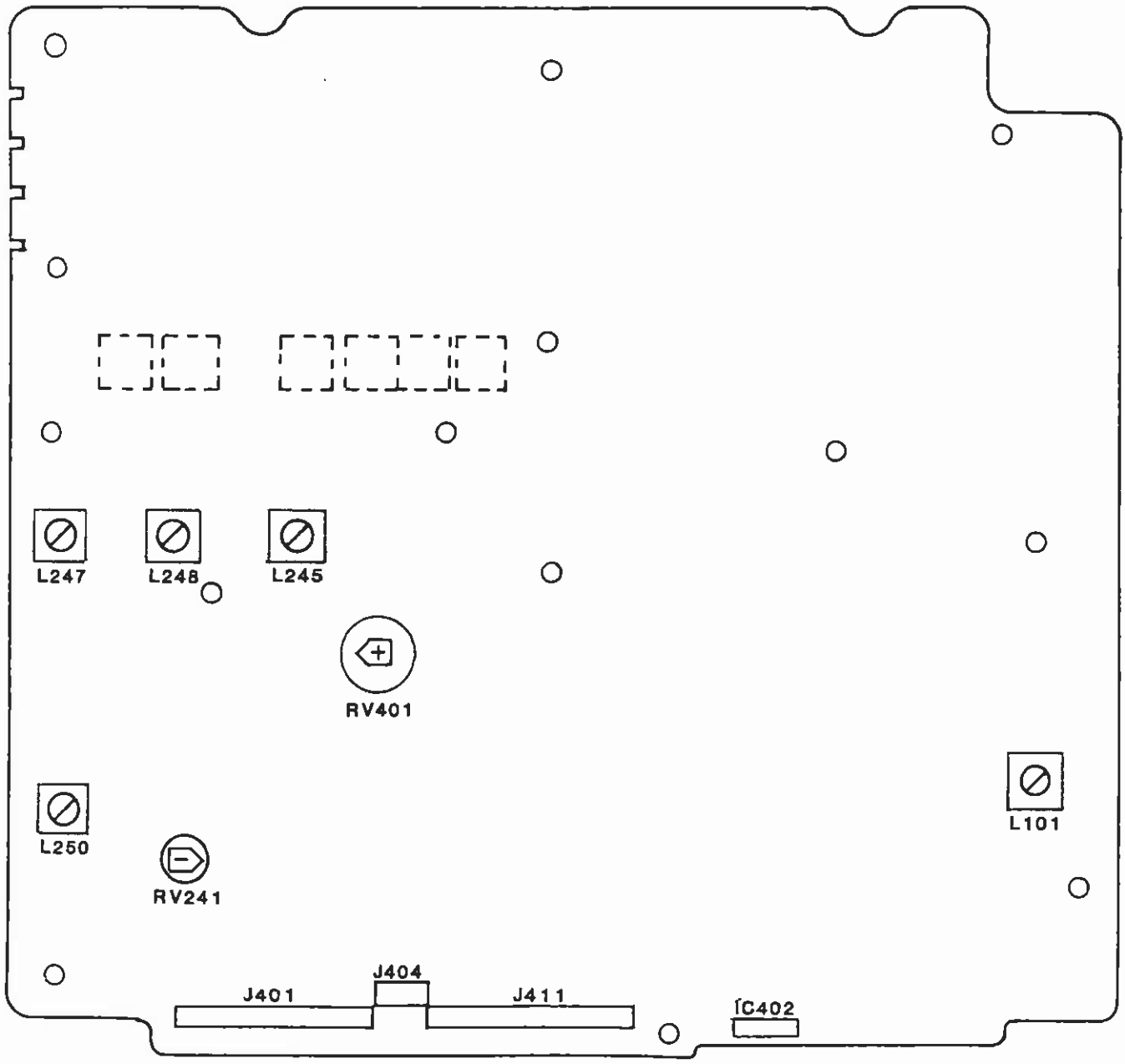


Figure 4 - 1b — TR-1517 Board

REMOVING THE PA-1554 BOARD

When servicing the XTR, you may need to remove the PA-1554 Board. To do so:

1. Unscrew and remove the bottom cover.
2. Remove the black screw on the back of the radio, near Antenna Jack J501 (see **Figure 4 - 2a**).
3. Disconnect J501 by first removing the two screws securing it to the radio, then desoldering it from the PC Board. Allow J501 to fall out of the radio.
4. Remove the seventeen screws from the PA-1554 Board (see **Figure 4 - 2b**). Note that seven of the screws are of medium length, seven are long, and the remaining three are short.
5. Lift the PA-1554 Board out of the radio.

The PA-1554 Board is now ready for servicing.

After servicing, reinstall the board by following the following steps:

1. Lower the board back into the radio.
2. Replace the seventeen screws.
3. Replace J501. First screw, then solder, it into place.
4. Replace the black screw on the back of the radio.
5. Replace the bottom cover.

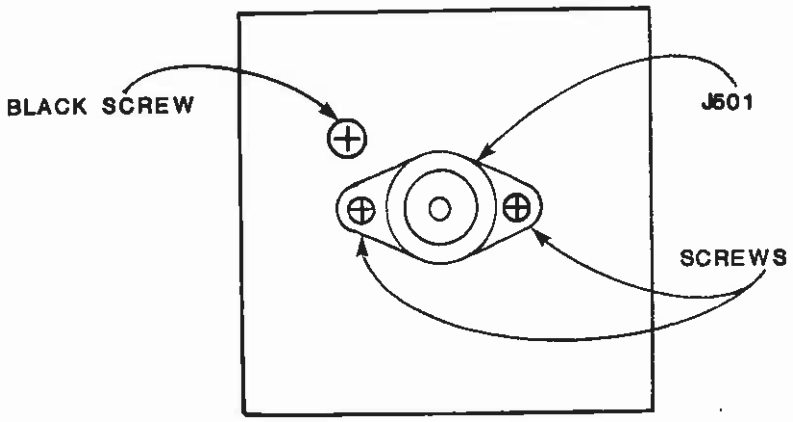
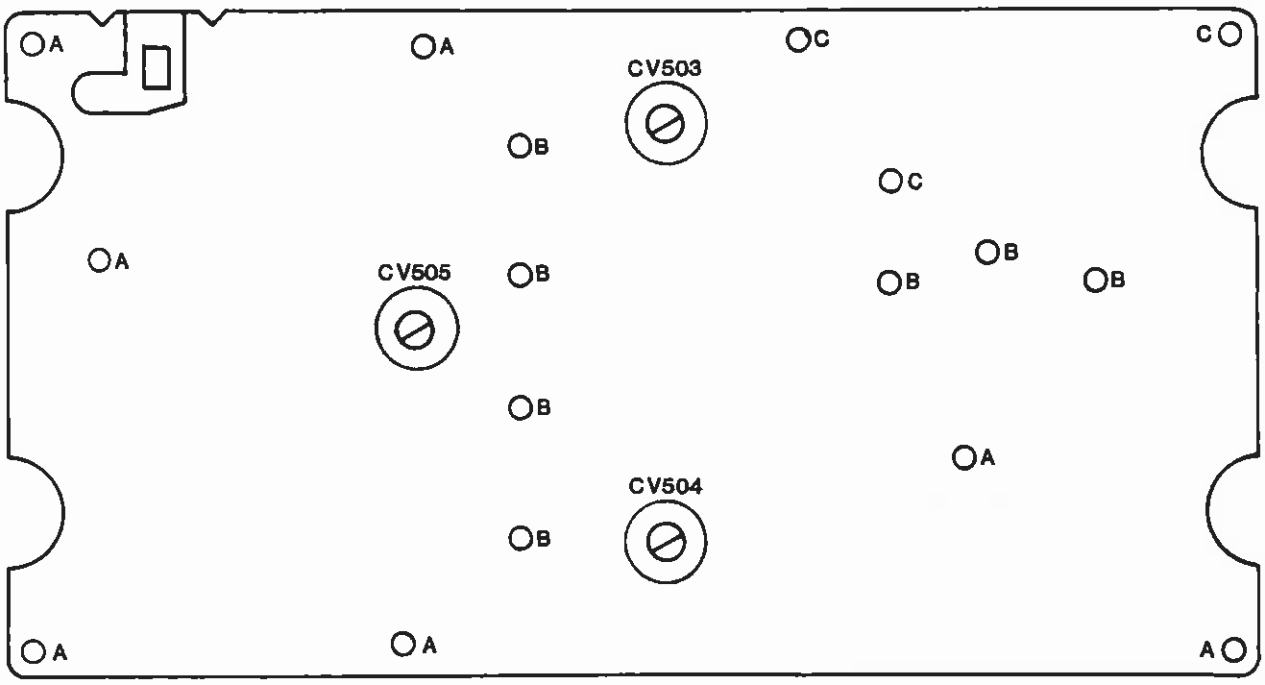


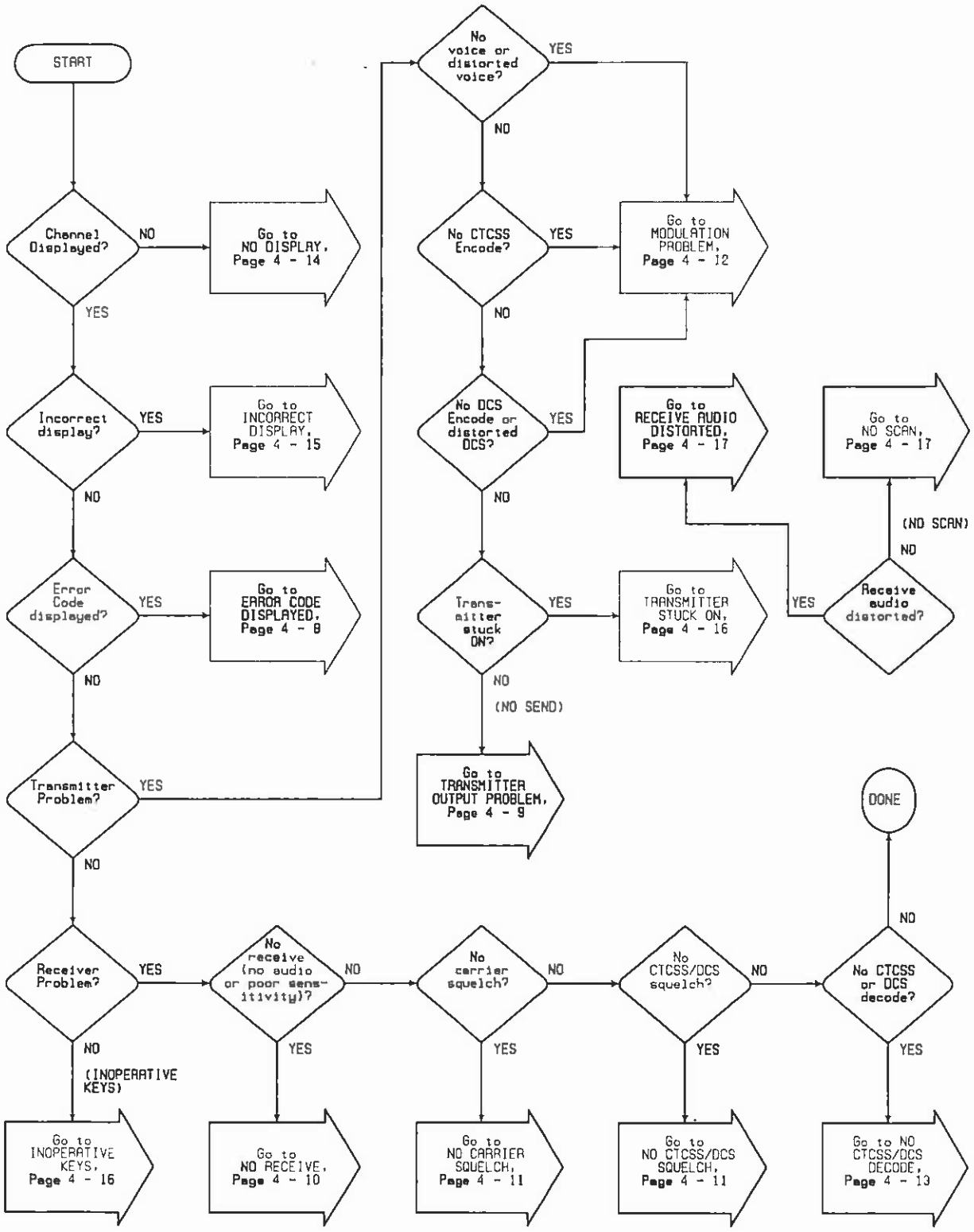
Figure 4 - 2a — Antenna Jack J501



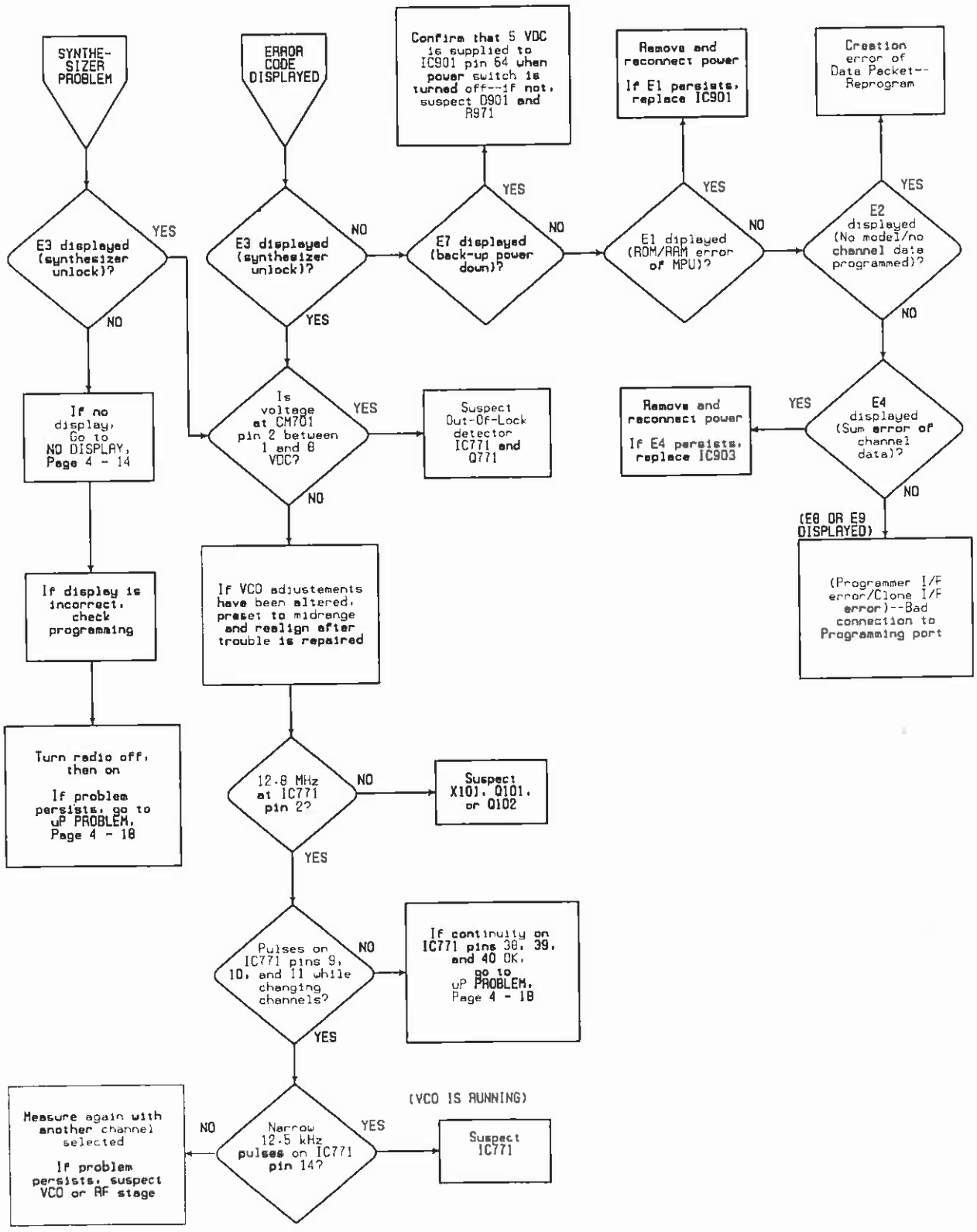
MEDIUM: A
LONG: B
SHORT: C

Figure 4 - 2b — PA-1554 Board

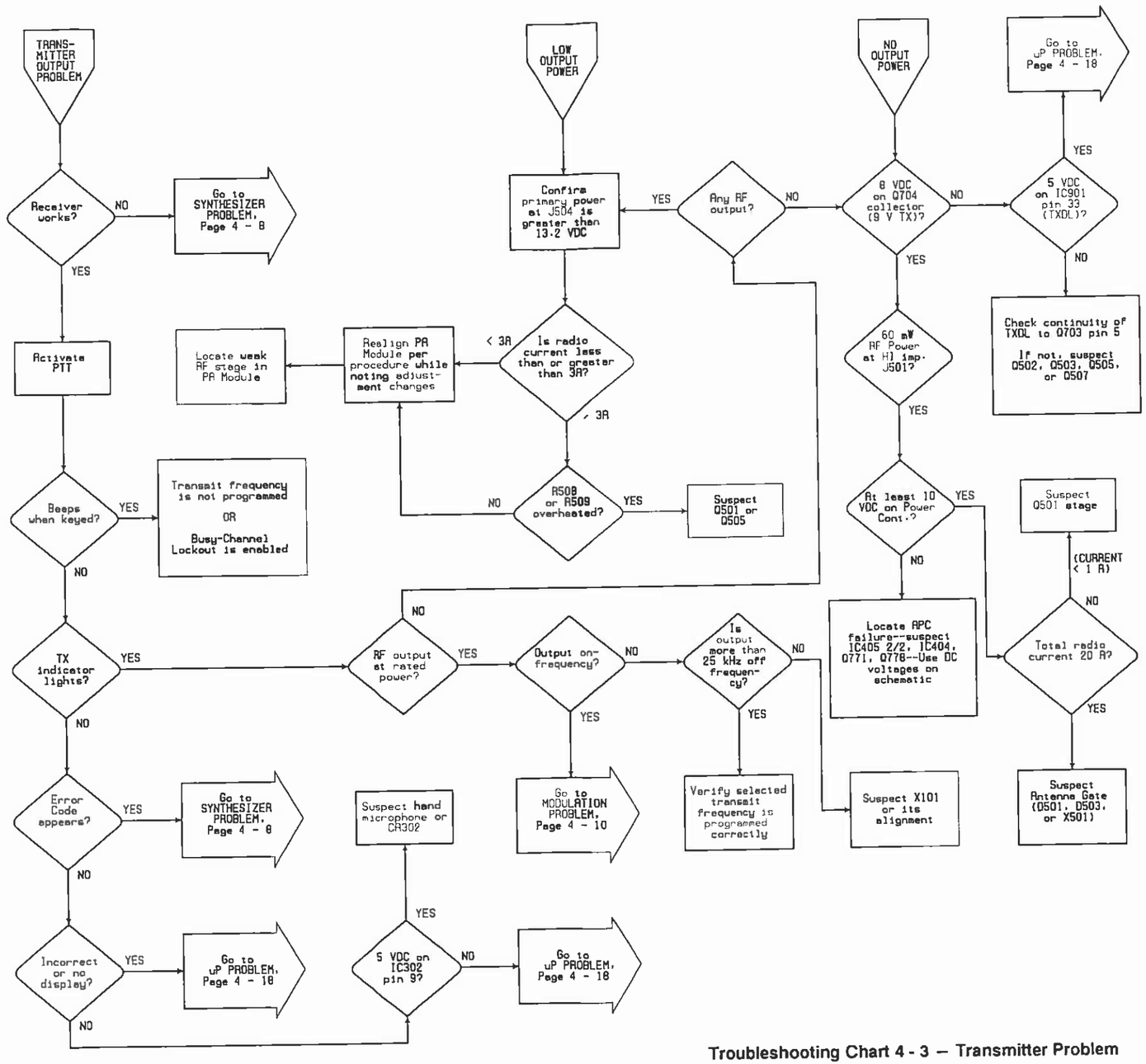
TROUBLESHOOTING CHARTS



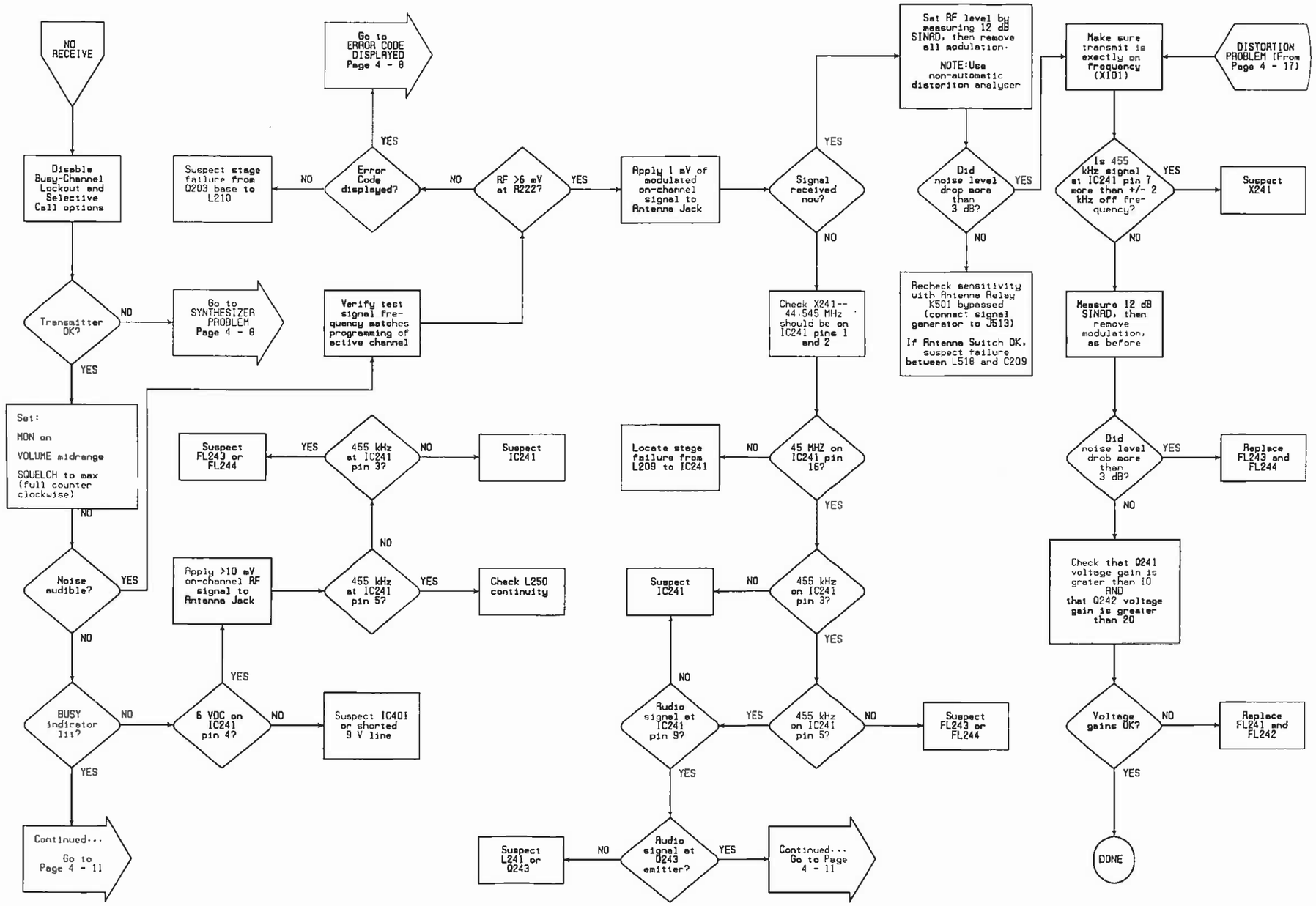
Troubleshooting Chart 4 - 1 — Getting Started



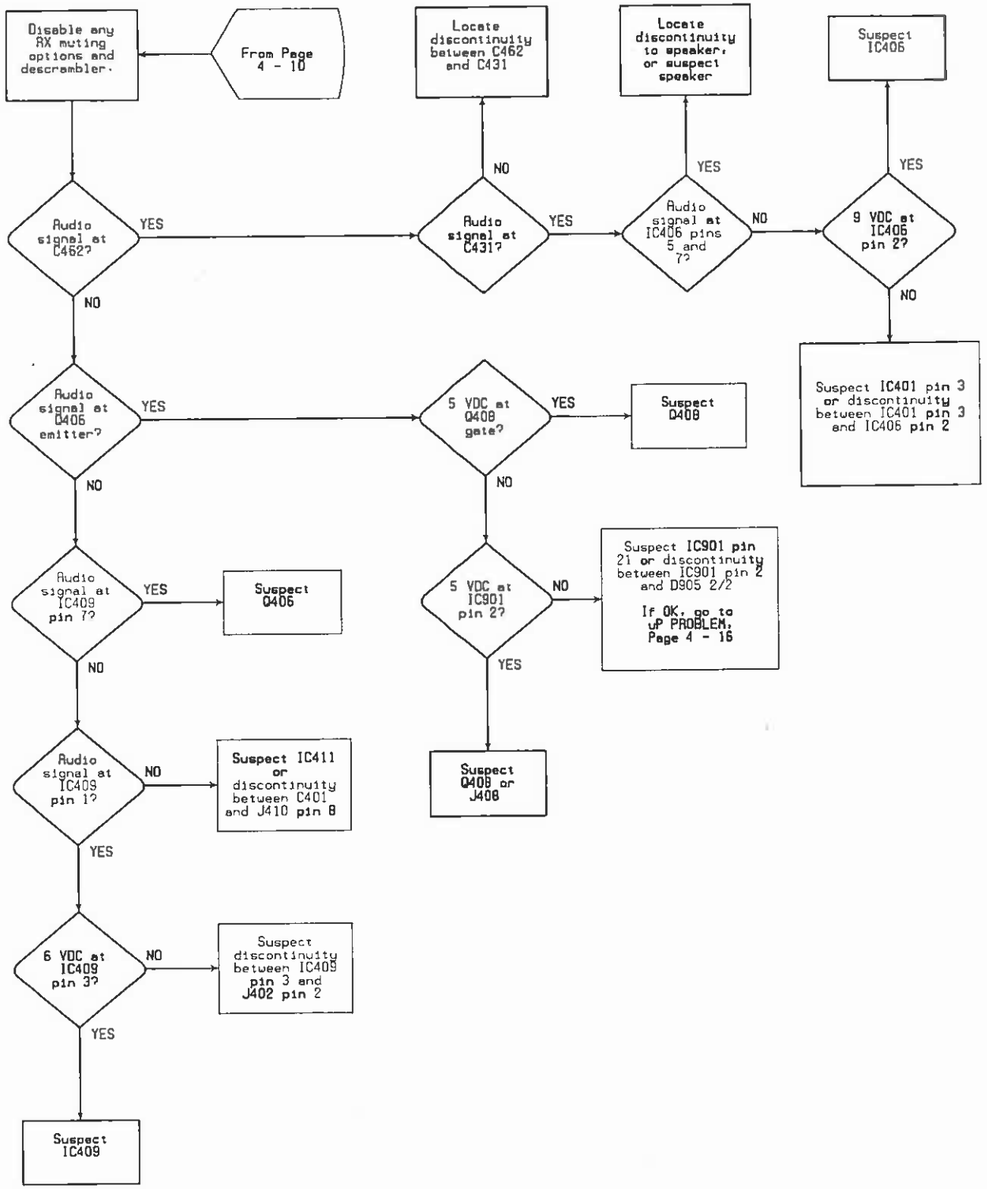
Troubleshooting Chart 4 - 2 — Synthesizer Problem/Error Code Displayed



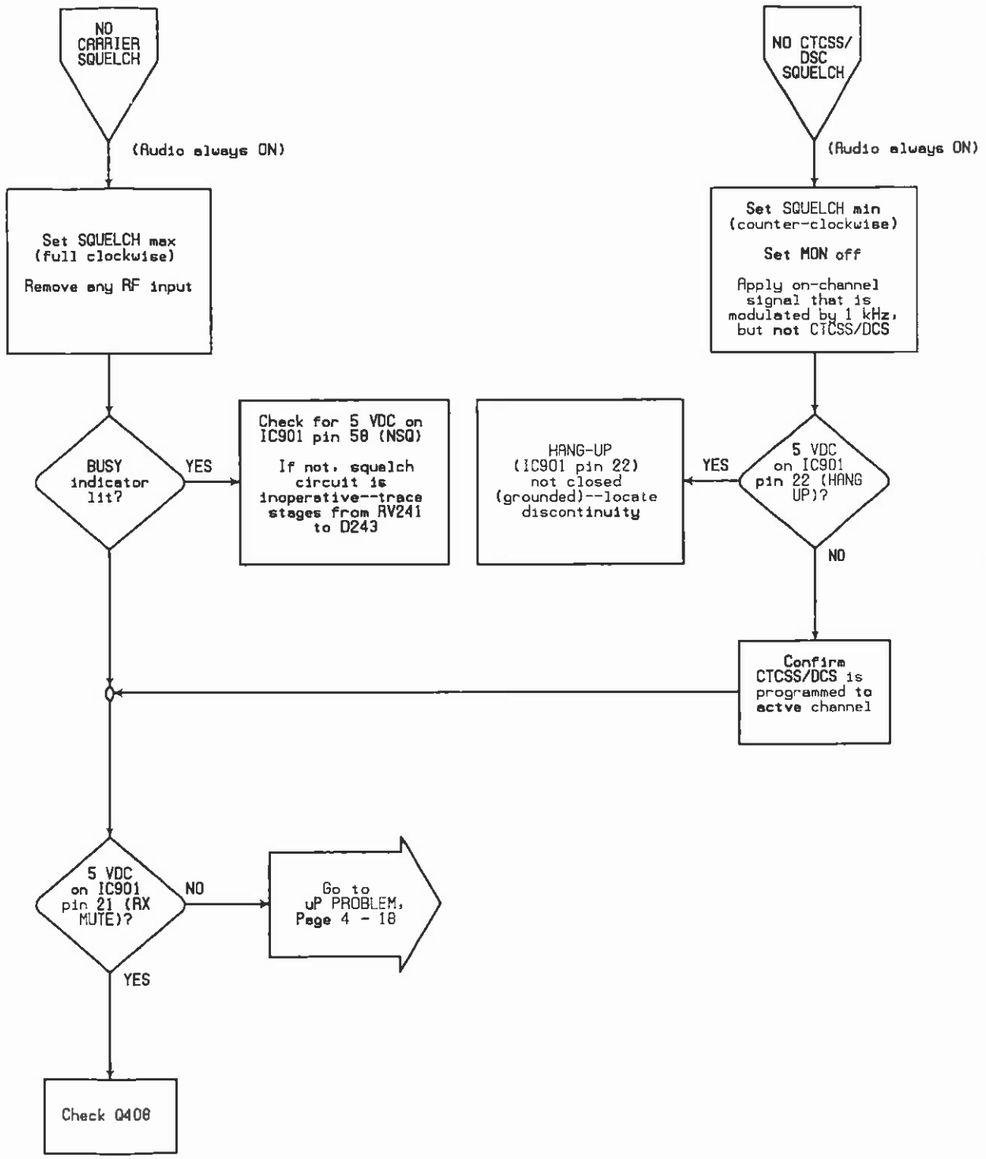
Troubleshooting Chart 4 - 3 — Transmitter Problem



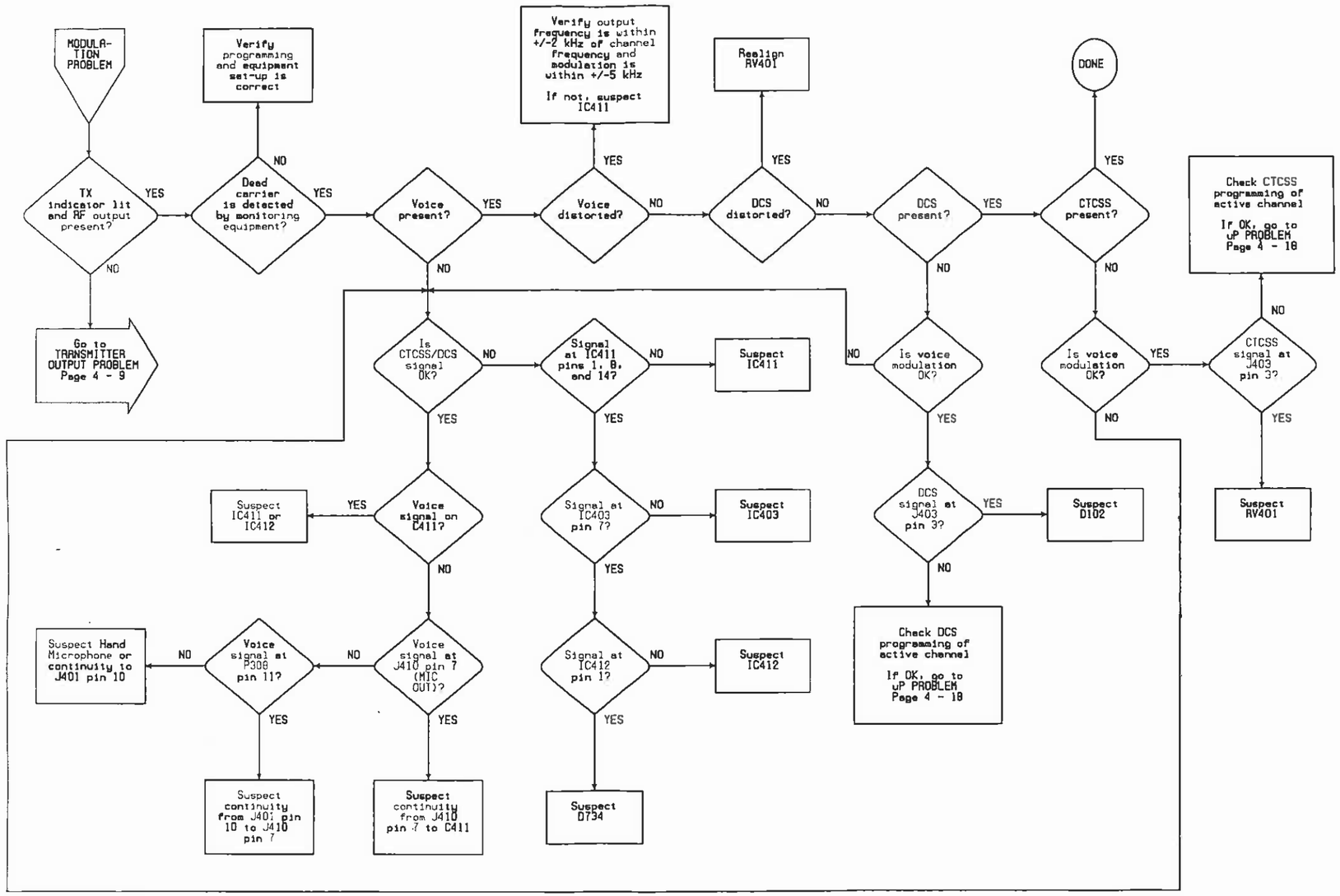
Troubleshooting Chart 4 - 4a — Receiver Problem



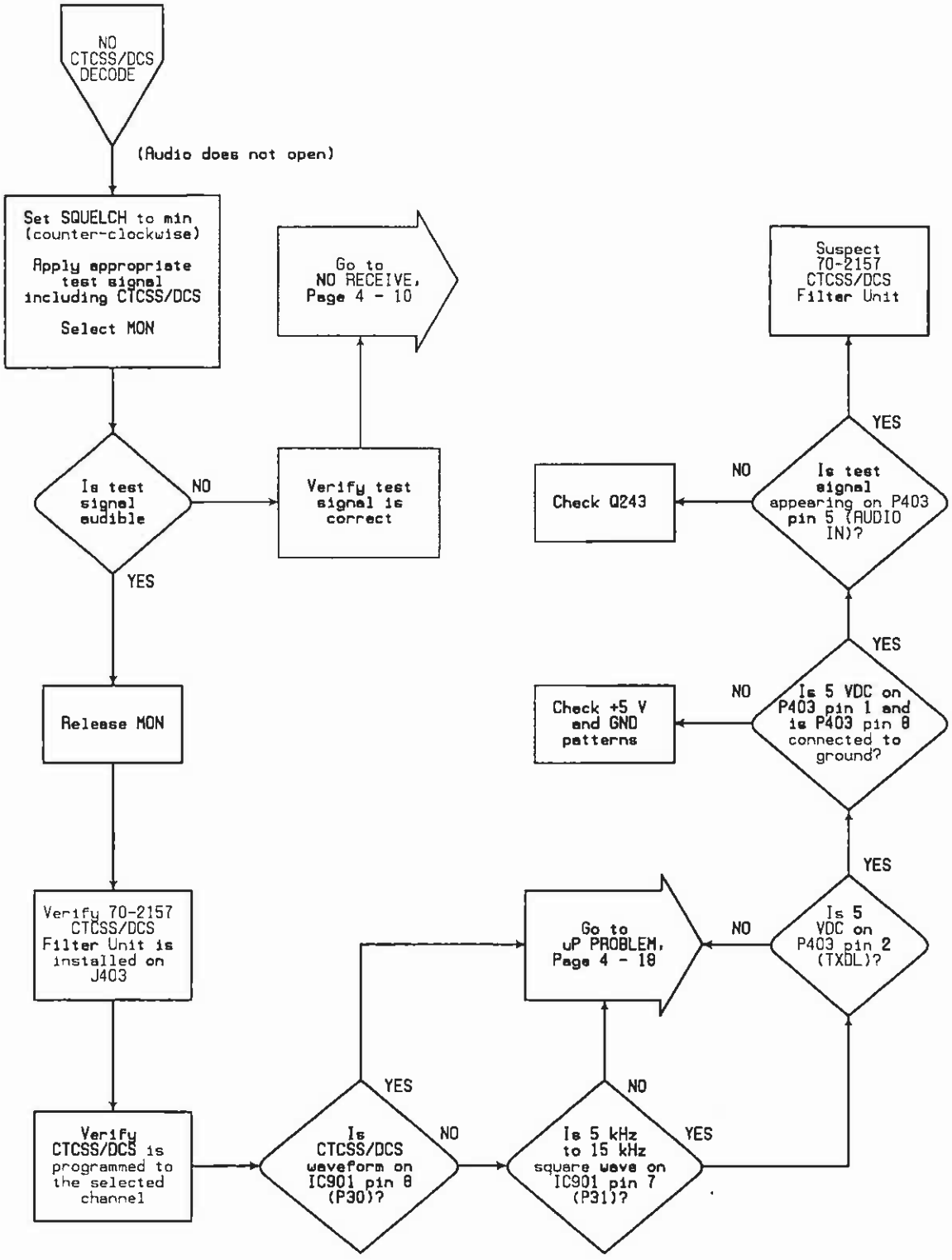
Troubleshooting Chart 4 - 4b — Receiver Problem (Continued)



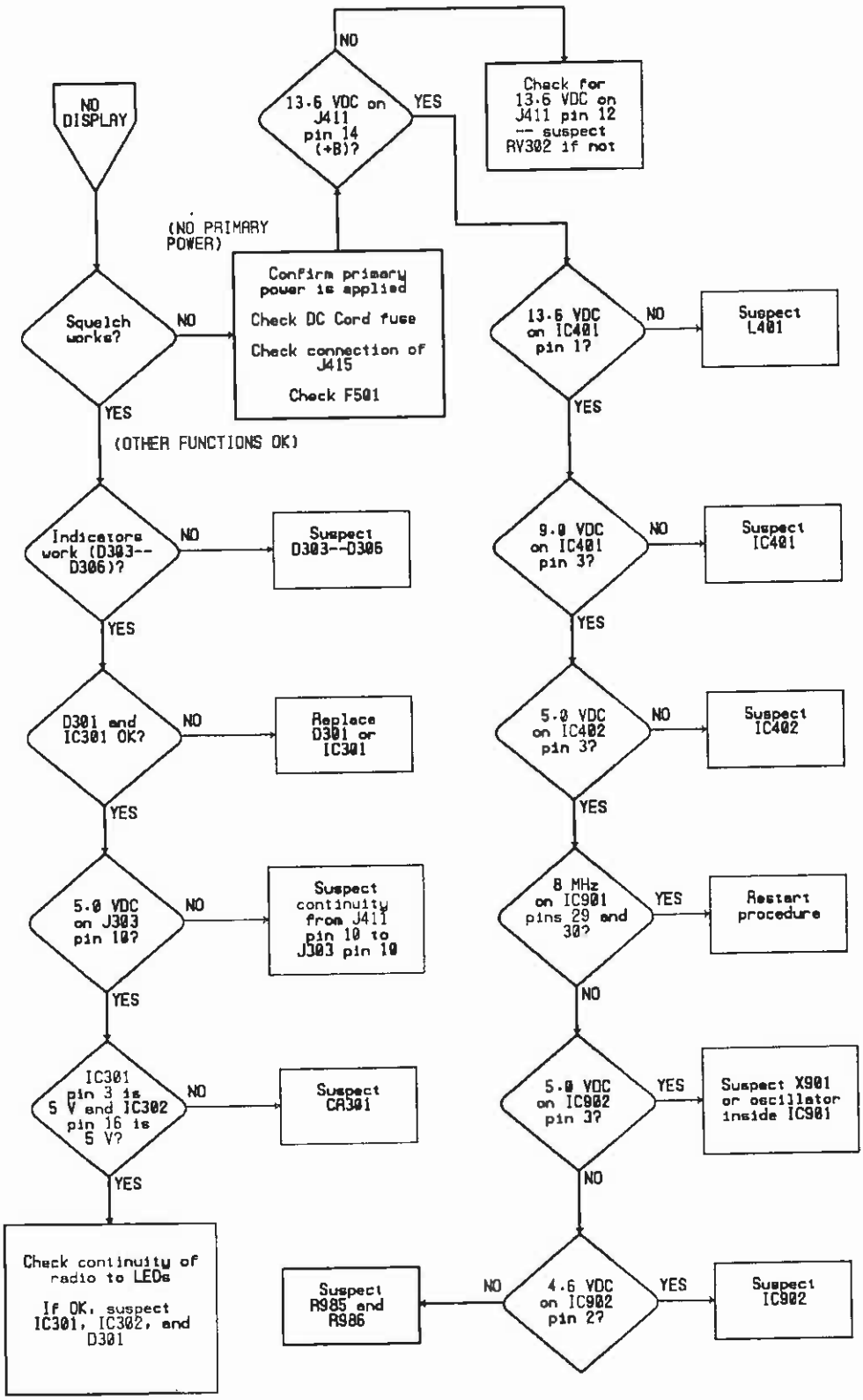
Troubleshooting Chart 4 - 5 — Squelch Problem



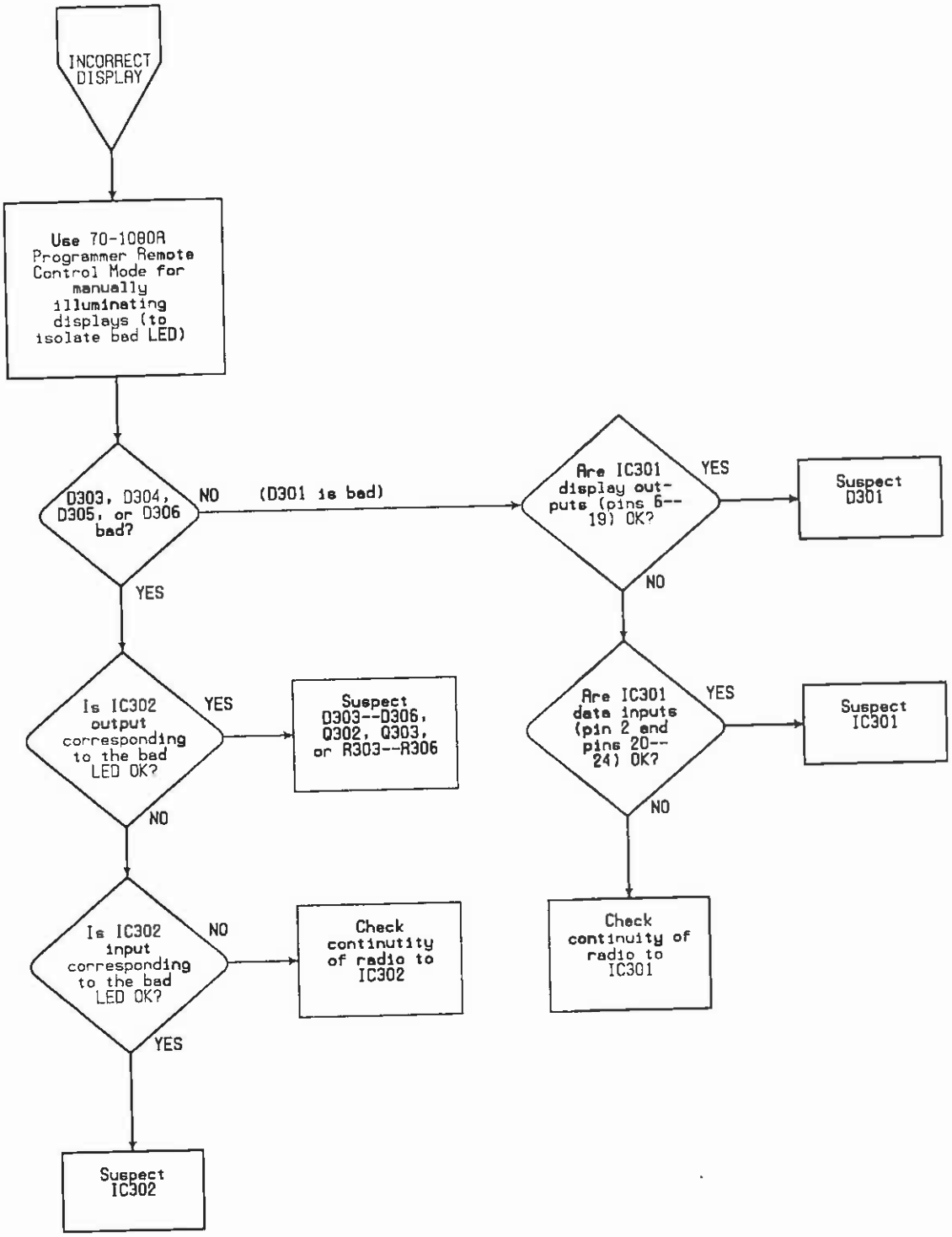
Troubleshooting Chart 4 - 6 — Modulation Problem



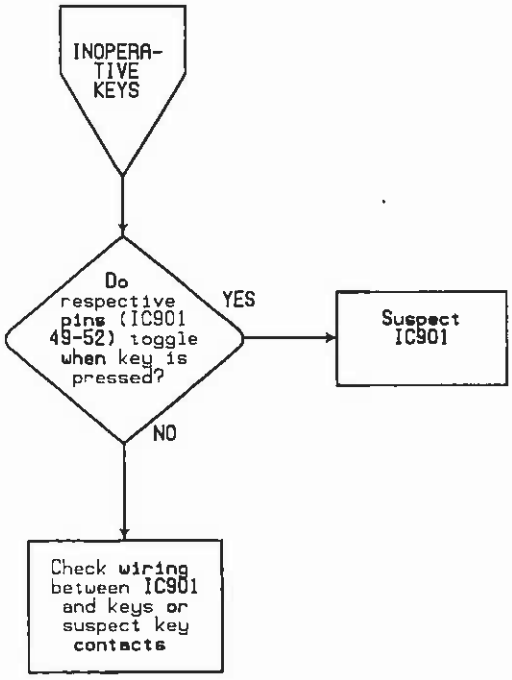
Troubleshooting Chart 4 - 7 — No CTCSS/DCS Decode



Troubleshooting Chart 4 - 8 — No Display

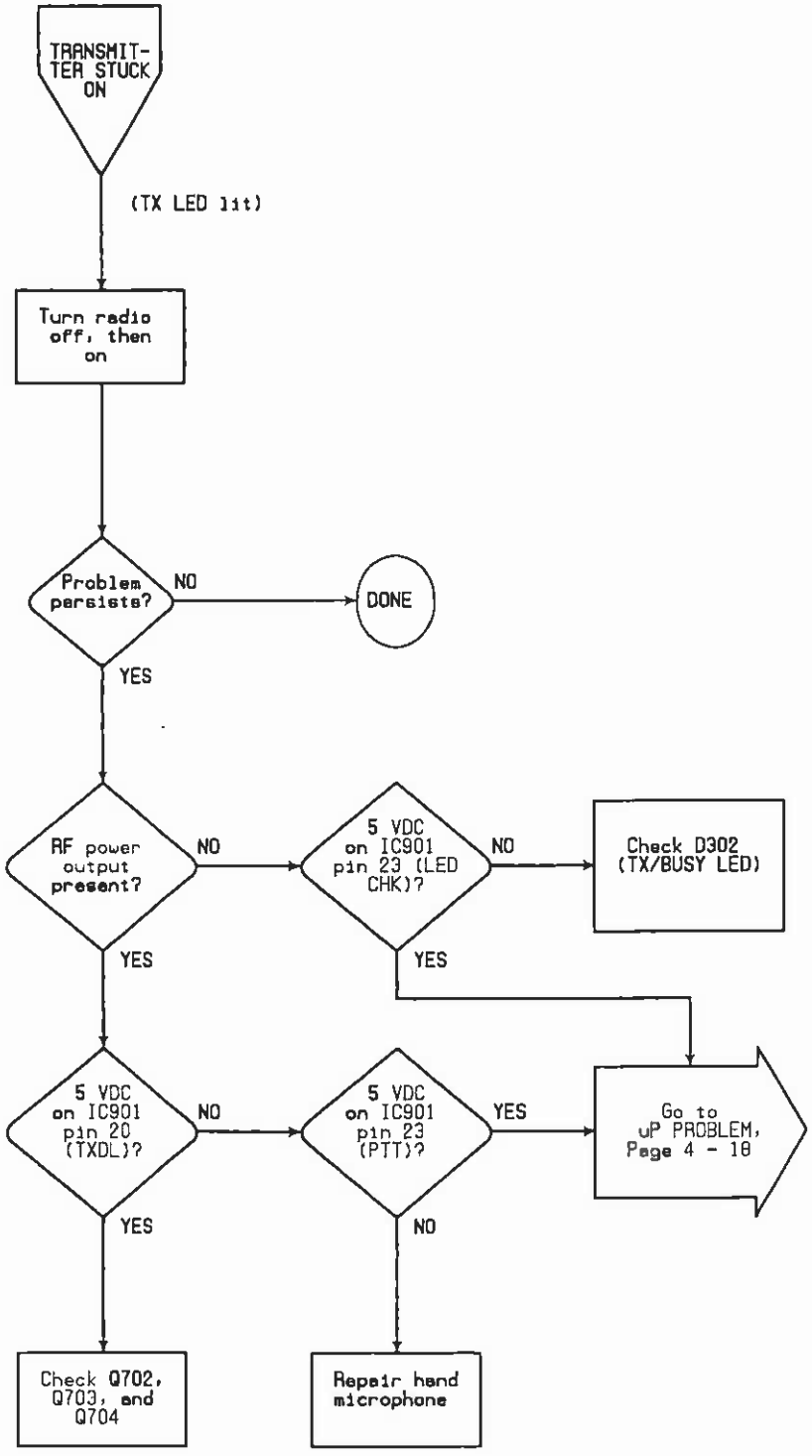


Troubleshooting Chart 4 - 9 — Incorrect Display

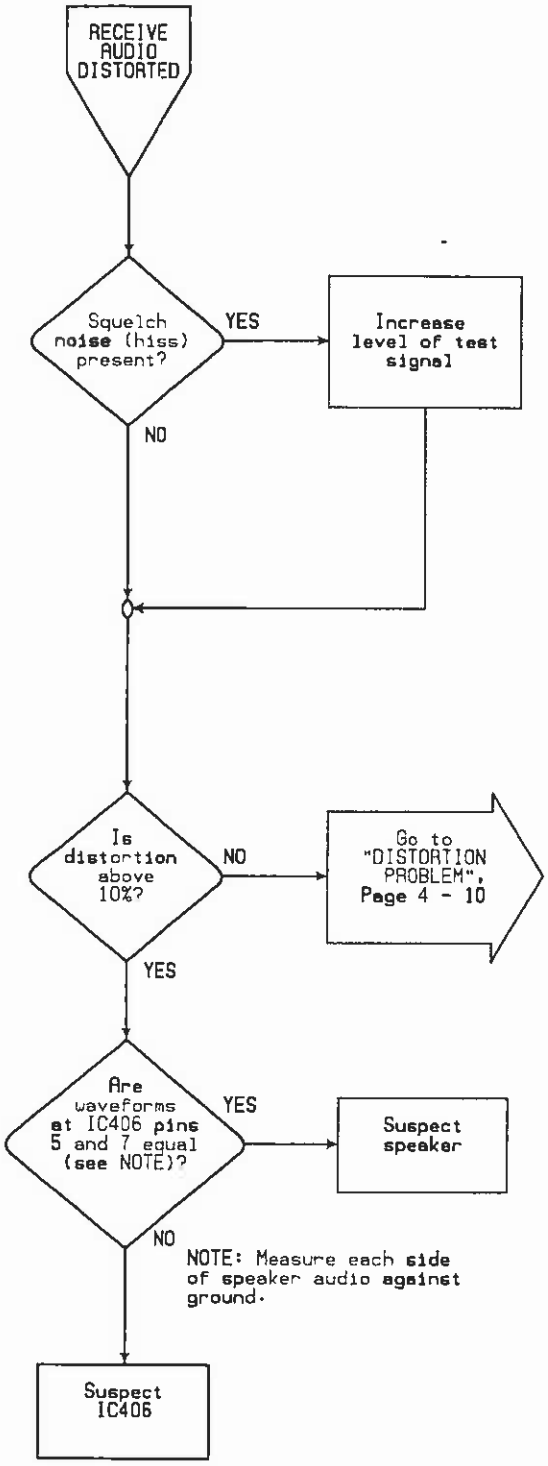


Troubleshooting Chart 4 - 10

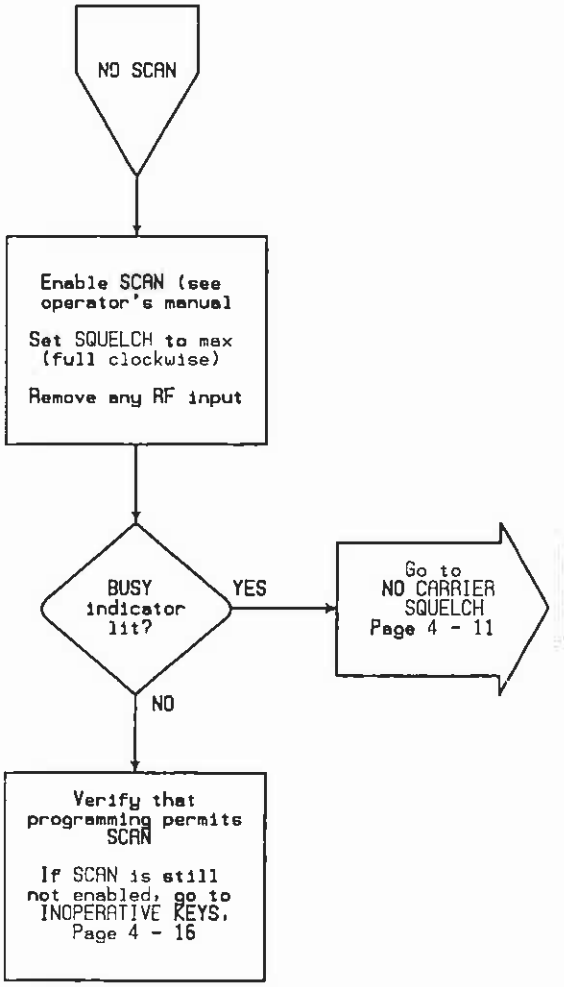
— Inoperative Keys



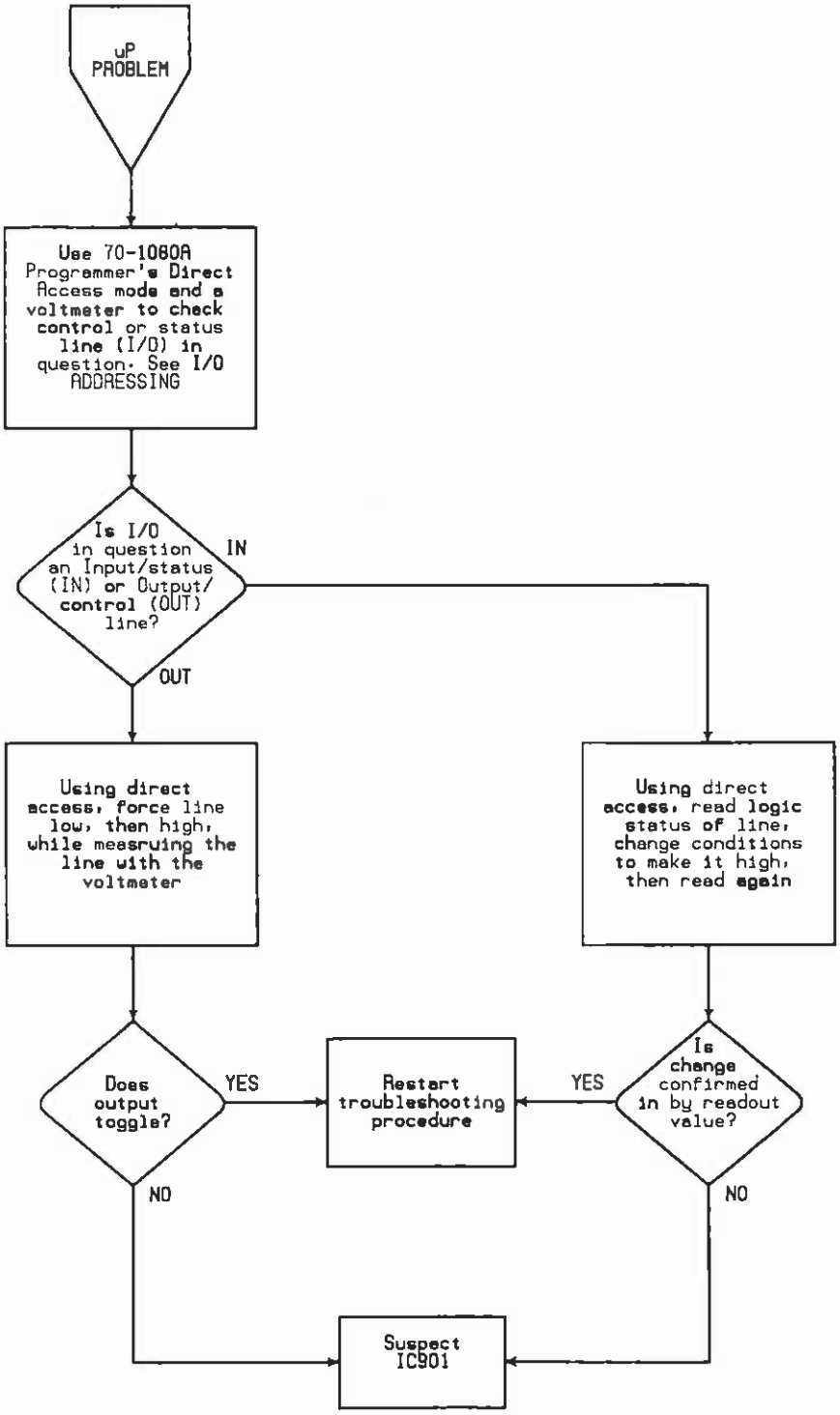
Troubleshooting Chart 4 - 11 — Transmitter Stuck On



Troubleshooting Chart 4 - 12 — Receive Audio Distorted



Troubleshooting Chart 4 - 13 — No Scan



Troubleshooting Chart 4 - 14 — Microprocessor Problem

COMPONENT REPLACEMENT

STATIC POTENTIALS

Many of the transceiver components are susceptible to higher voltages whether they are in or out of a circuit. Avoid static or AC-line potentials when handling components and circuit boards. Prevent damage from electrically "hot" tips that carry AC-line or static potential by using a grounded soldering iron. The only way to alleviate risk of component damage from static discharge is to make sure all of the objects that touch the circuitry during component replacement carry the same potential. Since the soldering iron is grounded, everything else must be grounded: the bench, the equipment being worked on,and you. There usually isn't a need to wire yourself to your bench unless you work on carpeting on dry-air days. Just touch bench ground when you sit down so that you and the grounded work area are at the same potential.

REPLACING CHIP CAPACITORS AND RESISTORS

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

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

- **Procedure:**

1. Place the solder iron tip directly on the defective component to melt the glue under the component, then solder as shown in **Figure 4 - 3**. 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.

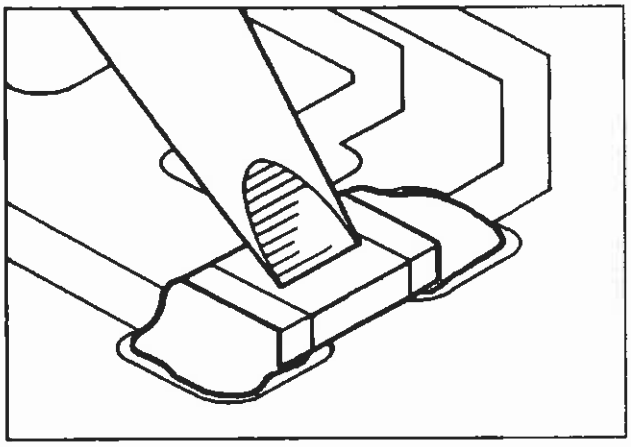


Figure 4 - 3

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 4 - 4.**

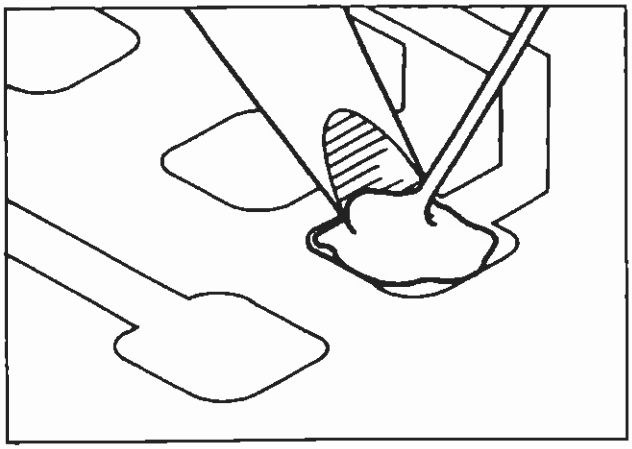


Figure 4 - 4

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 4 - 5.**

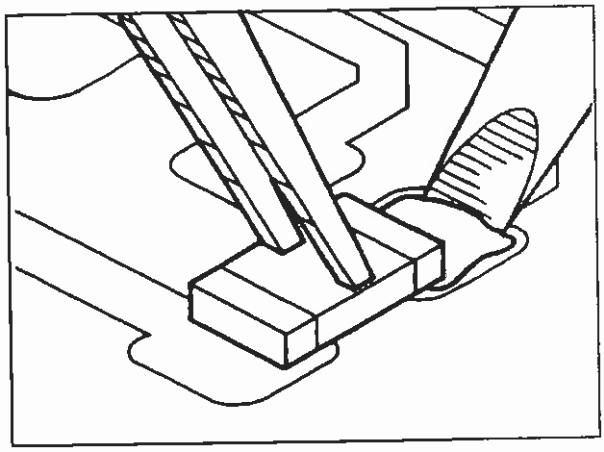


Figure 4 - 5

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 4 - 6**—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 4 - 7.**

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.

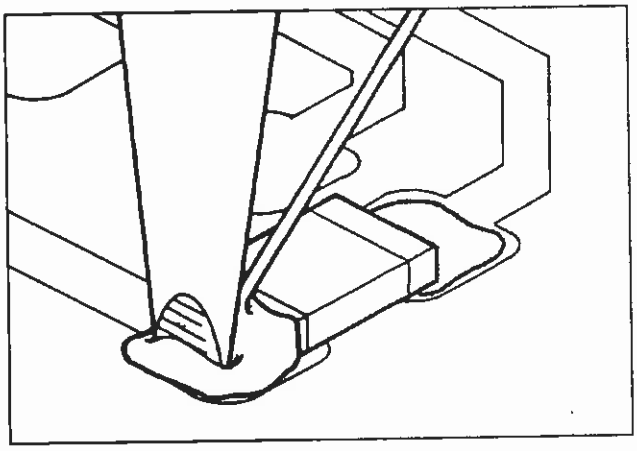


Figure 4 - 6

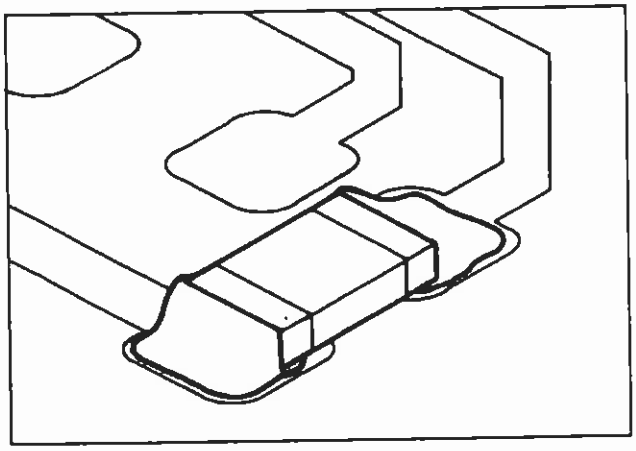


Figure 4 - 7

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.

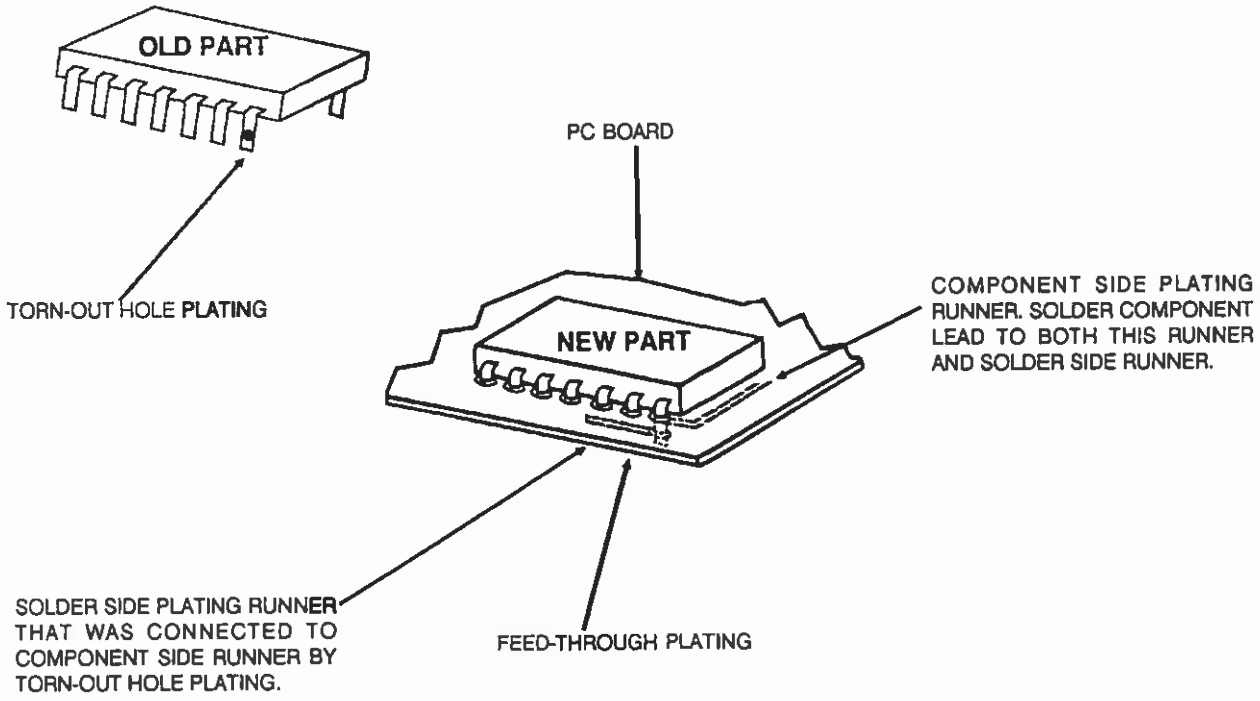


Figure 4 - 8

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 4 - 9**.

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 4 - 10**). If the electri-

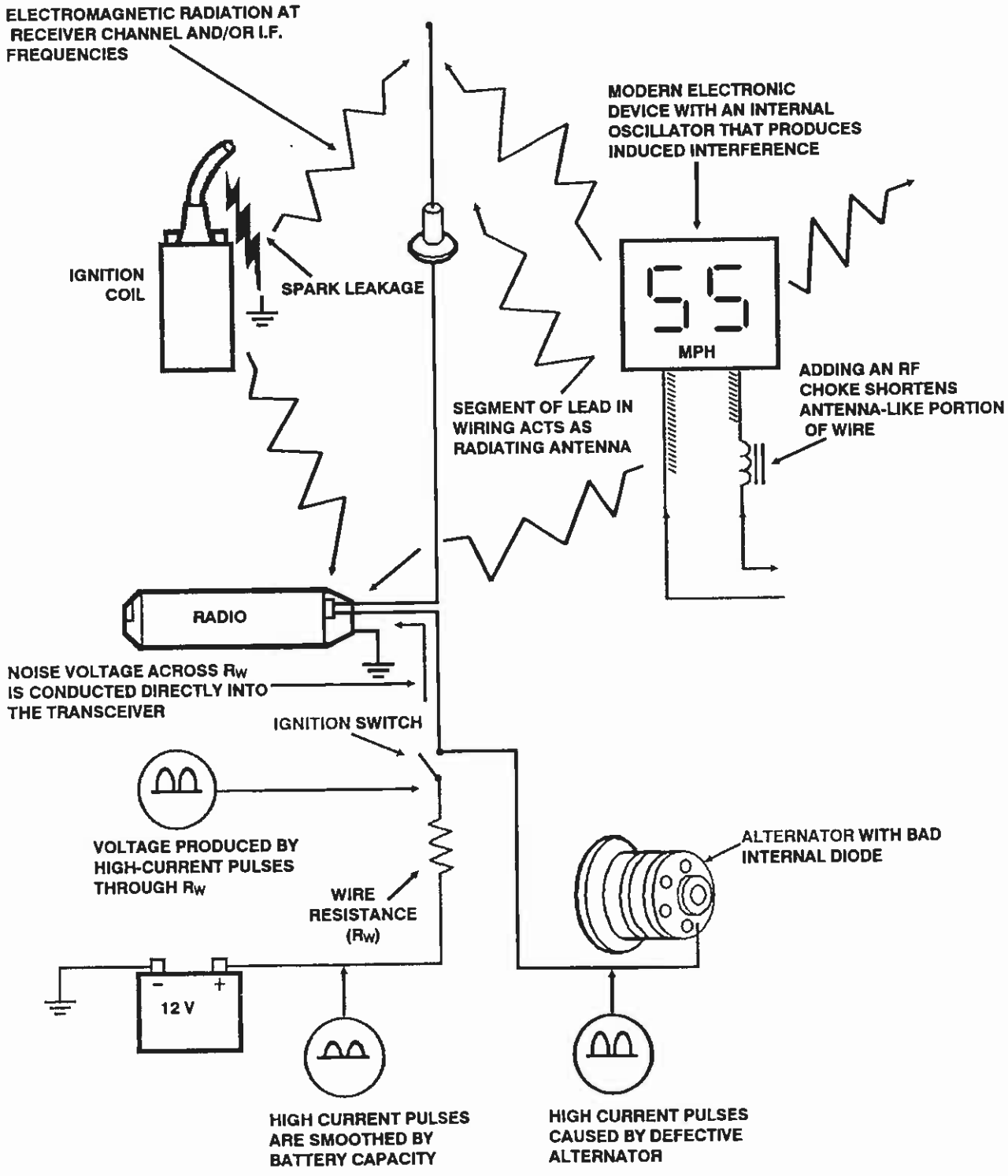


Figure 4 - 9 — Interference Paths

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

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

ELIMINATING RADIATED INTERFERENCE

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

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

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

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

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

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

ELIMINATING INTERFERENCE FROM SPARKS

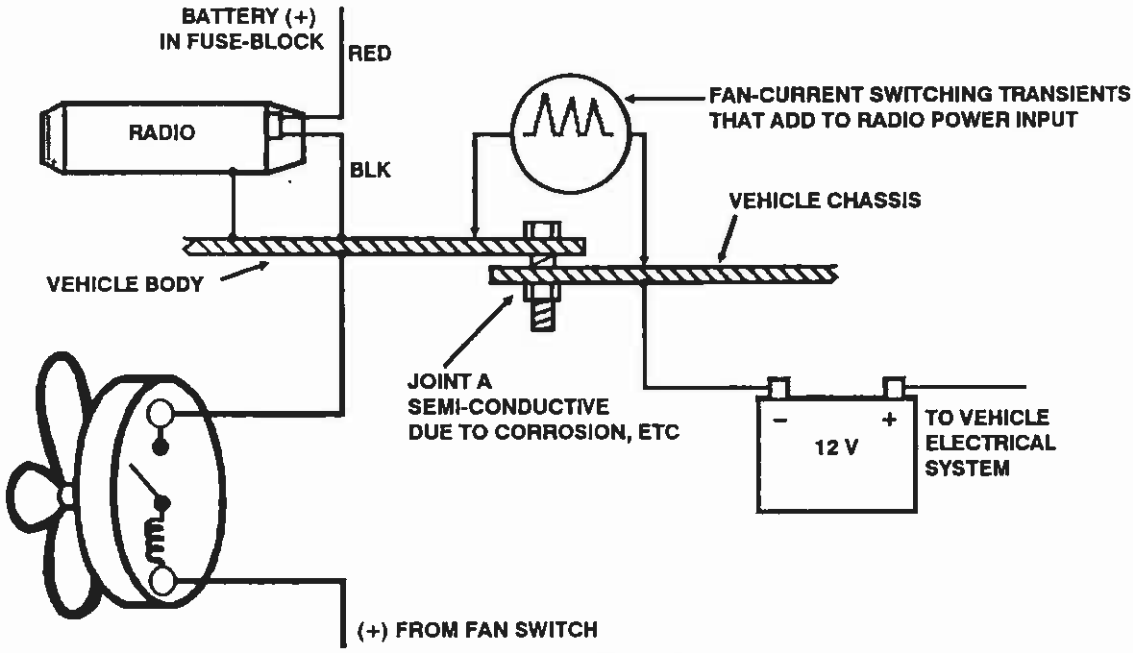
Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna. Therefore, the problem must be resolved at the source.

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

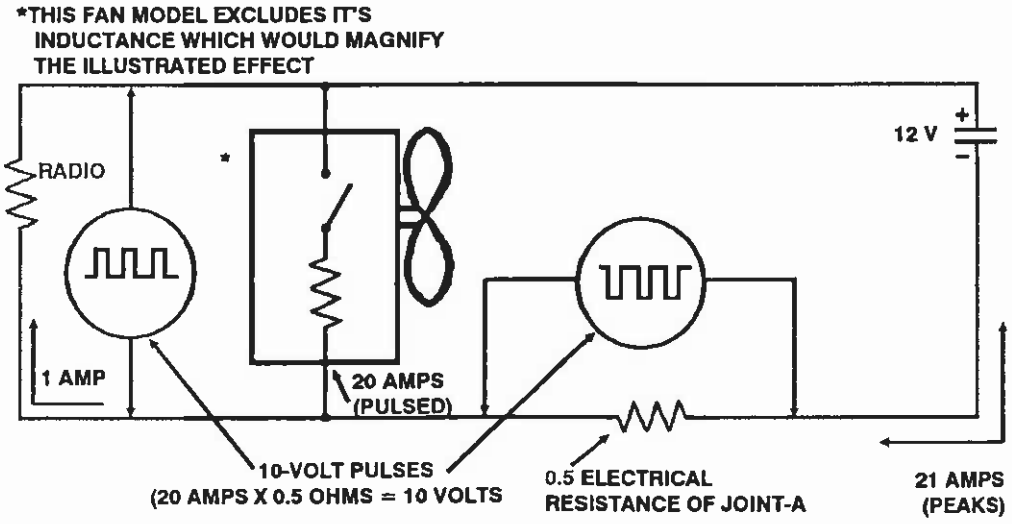
If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

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

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



GROUND PATH



EQUIVALENT CIRCUIT

Figure 4 - 10 — A Noisy Ground

DC VOLTAGE CHARTS

Table 4 - 1 — Transistors

NAME	MODE	BASE	COLLECTOR	EMITTER
Q1	RX	0.7	0.0	0.0
	TX	0.0	5.0	0.0
Q2	RX	0.0-0.7	0.0-5.0	0.0
Q101	RX/TX	3.1	4.8	2.6
Q102	RX/TX	3.2	4.7	2.6
Q131	TX	0.9	7.6	0.7
Q201	RX	0.9	7.2	0.1
Q203	RX	0.7	6.2	0.5
Q243	RX	3.1	9.1	2.2
Q244	RX	2.4	4.3	1.7
Q301	RX/TX	4.4	3.4	5.0
Q501	TX	0.3	4.0—12.5	0.0
Q502	TX	0.0	11.0	0.0
Q503	TX	0.0	12.5	0.0
Q504	TX	12.5	5.4	13.6
Q505	TX	0.0	12.5	0.0
Q507	TX	0.0	12.5	0.0
Q510	TX	0.7	0.6	0.0
Q701	RX/TX	9.0	9.1	8.2
Q712	RX	1.6	7.0	0.9
Q732	TX	1.0	7.6	0.4
Q733	RX/TX	1.8	8.3	1.3
Q734	TX	1.8	8.2	1.3
Q773	RX/TX	0.0	—	0.0
Q774	RX/TX	9.0	—	9.0
Q775	RX/TX	9.0	9.0	9.0
Q776	RX/TX	0.0	0.0	0.0

Table 4 - 2 — Transistor Packs

NAME	MODE	PIN NO. 1	2	3	4	5	6
Q302	RX	0.0	5.0	0.0	0.0	5.0	0.0
Q303	RX	0.0	5.0	0.0	0.0	5.0	0.0
Q401	RX/TX	0.1	0.7	7.6	0.0	0.0	0.0
Q403	RX/TX	13.1	9.1	6.4	0.0	0.0—5.0	0.0—4.3
Q702	RX	7.6	0.0	0.0	0.0	0.0	8.2
	TX	7.6	0.0	7.5	7.5	8.0	8.2
Q703	RX	0.0	0.0	0.0	9.0	4.6	0.0
	TX	2.9	2.9	0.0	0.0	0.2	0.0
Q771	RX/TX	4.6	4.6	4.6	4.6	4.6	0.0
Q772	RX/TX	0.0	4.6	4.4	9.0	4.6	0.0
Q778	RX/TX	4.6	4.6	0.0	0.0	0.0	0.0

Table 4 - 3 — Integrated Circuits, 8 Pins or Less

NAME	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC401	RX/TX	13.5	0.0	9.1	—	—	—	—	—
IC402	RX/TX	13.5	0.0	5.0	—	—	—	—	—
IC406	RX	6.5	6.5	6.4	0.0	6.0	13.5	6.5	—
IC408	TX	4.0	0.0	8.3	0.0	1.3	9.1	3.6	—
IC409	RX	4.0	0.0	—	0.0	1.3	9.1	3.6	—
IC412	TX	2.3	0.0	2.5	5.0	—	—	—	—
IC902	RX/TX	4.9	4.9	0.0	—	—	—	—	—
IC903	RX/TX	0.0	0.0	0.0	8.2	—	1.2	9.1	3.6

Table 4 - 4 — FET's

NAME	MODE	GATE 1	GATE 2	DRAIN	SOURCE
Q241	RX	0.0	—	9.0	2.2
Q242	RX	0.0	—	9.0	0.52
Q408	UNSQ	4.7	—	5.0	5.0
	SQ	0.0	—	5.0	5.0
Q711	RX	3.4	4.7	7.8	3.0
Q731	TX	3.4	4.7	7.8	3.0

Table 4 - 5 —Integrated Circuits, 13 to 16 Pins

NAME	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC1	RX/TX	—	—	—	2.3	2.3	2.3	2.3	2.2
IC2	TX	—	—	—	—	5.0	0.0	0.0	2.3
	RX	—	—	—	—	0.0	5.0	0.0	2.3
IC50	RX/TX	1.7	1.7	1.7	5.0	1.7	1.7	1.7	1.7
IC241	UNSQ	6.7	6.6	6.6	6.8	6.4	6.4	6.4	6.8
	SQ	6.7	6.0	6.6	6.8	6.4	6.4	6.4	6.8
IC301	RX/TX	0.0	—	5.0	—	—	—	—	—
IC302	RX/TX	—	—	—	—	—	—	—	0.0
IC404	RX/TX	4.7	8.5	9.1	0.0	0.1	4.8	0.0	0.0
IC411	RX/TX	4.7	4.7	4.7	9.0	4.7	4.7	4.7	4.7
IC771	RX/TX	2.3	2.3	4.7	4.7	4.6	0.0	4.7	3.2
IC772	RX/TX	0.7	0.7	0.7	0.7	9.0	9.0	0.0	0.7

NAME	MODE	PIN NO. 9	10	11	12	13	14	15	16
IC1	RX/TX	—	0.0	—	0.0	2.3	—	—	—
IC2	TX	2.3	2.3	2.3	5.0	0.0	5.0	—	—
	RX	2.3	2.3	0.0	5.0	5.0	—	—	
IC50	RX/TX	1.7	1.7	0.0	1.7	1.7	—	—	—
IC241	UNSQ	2.8	0.7	0.8	3.0	0.0	3.0	0.0	1.8
	SQ	2.8	0.7	0.8	3.1	6.3	4.7	0.0	1.8
IC301	RX/TX	—	—	—	—	—	—	—	—
IC302	RX/TX	—	—	—	—	—	—	—	5.0
IC404	RX/RX	8.5	9.1	0.0	0.2	0.0	9.0	—	—
IC411	RX/TX	4.7	4.7	0.0	4.7	4.7	4.7	—	—
IC771	RX/TX	0.0	4.8	0.1	—	—	—	4.6	3.5
IC772	RX/TX	0.7	0.7	0.7	9.0	9.0	9.1	—	—

TRANSCEIVER ERROR CODES

When the Syn-Tech XTR radio is turned on, it performs a self-test that reports success by illuminating all displays and indicators momentarily. If a problem occurs, the radio will beep and an error code will appear in the channel display. Please note that multiple error codes will be displayed in sequence when the radio is turned on if multiple problems exist. In many cases, the error display can be cleared by pressing any button, but will re-occur at the next unit power-up.

CODE	MEANING
E1	Microcomputer error — ROM/RAM
E2	No Model/No Channel Data Programmed
E3	Synthesizer Unlock
E4	Sum error of channel data
E7*	Power disconnected — previous front panel control conditions were lost
E8	Programming I/F error
E9	Clone I/F error

*Note that E7 is the normal power-up display when the power has been disconnected for some period of time. When E7 is displayed, it simply means that the last selected channel number and front panel switch configuration (SCAN on or off, etc.) has been lost. All basic radio data (channel frequencies, etc.) is written in non-volatile memory and cannot be changed or lost without reprogramming.

SECTION 5

CIRCUIT DESCRIPTION

NOTES

The SYN-TECH XTR 70-1395/1495 High Power radio unit is made up of three major sections on two PC boards. The RF Section and the Logic Section are located on one board (TR-1517), and the PA Section is located on another (PA-1554).

RF SECTION

The RF Section consists of a frequency synthesizer, a transmit modulator, a receiver, and receive audio amplifier circuits

SYNTHESIZER

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

• Voltage Controlled Oscillator

In this radio, two VCO's are used – Q731 operates in transmit mode to generate transmit frequencies: Q711 operates in receive mode to generate receive injection frequencies. Each is buffered independently: by Q732 and Q712 respectively. Outputs of the buffers are amplified by Q131 and Q203 respectively. RF signal at receiver injection frequency (Fc + 45.0 MHz) is applied from the LO amplifier Q203 in the receiver circuit. RF signal from Q131 is amplified further by the PA portion.

When the frequency of the VCO output drifts away from the desired value, the loop adjusts the steering voltage to compensate.

A single VCO tank can tune across the entire 26 MHz channel spread. Only one of the two tanks is switched in at a time and it is selected by TXDL from the Logic portion. The microcomputer sets TXDL to logic low during transmit mode.

Resonance of each VCO tank is voltage-tuned by varactor diodes D711 and D731 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 Q734 collector for TX and Q733 collector for RX is sufficient to feed prescaling frequency divider involved in IC771, which applies an output pulse to once every 64 or 65 input cycles. Additional frequency division is also performed within IC771 to produce 2.5 kHz.

X101 is a temperature-compensated crystal oscillator that produces a reference frequency of exactly 12.8 MHz. The reference frequency is divided by IC771 to produce 2.5 kHz that is compared to the down-counted 2.5 kHz sample of VCO output.

Normally the loop response is slowed enough by lag-lead 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 portion when the radio changes channels or it is keyed and unkeyed, by a logic low applied to the base of Q772. This increase is loop response speeds locking time.

A connection from an intermediate point in the phase/frequency comparator in IC771 is made at pin 7. 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 pin 7. This logic low is applied to Q778 through Q771 to switch Q403-2/2 and Q504. Q504 then clamps off bias to transmit PA preamplifier Q501 to prevent emission of erratic signals generated by the uncontrolled VCO.

• Modulator

Voice signals from the hand-microphone are applied to the active filter composed of IC411, where frequency response is pre-emphasized and splatter filtered. Gain is such that the stronger signals bring

IC411 output into clipping, which limits modulation. Harmonics above the 3 kHz modulation pass-band are removed by the 2.5 kHz pi-network in IC411. Modulation signals are then adjusted by IC408 and IC404 so that modulation at limiting will produce transmitted carrier deviation of ±5 kHz. Output of processed voice signals at IC411-pin 14 is fed to the gain control IC408, where the control voltage is fed from the D/A converter IC404 controlled by the command via the 70-1080A programmer.

RECEIVER

- **Preselector**

Through K501 Relay in the PA, RF signals are routed to the receiver input. Signals at image frequencies and frequencies far removed from the desired channel are rejected by a preselector comprised of six top-coupled, parallel tanks: L201, L202, L203, L204, L205, and L206. No tuning of these tanks is required for the entire 26 MHz channel frequency spread. Q201 provides adequate gain to overcome preselector signal losses and maximize receiver sensitivity.

- **Injection**

First Local Oscillator signal (channel frequency plus 45.0 MHz) is synthesized by the phase-lock loop and applied to Q203. A low-pass filter is provided at output of Q203, which rejects extraneous synthesized signals. No alignment for the first local oscillator signal is required.

- **First Mixer**

To maximize intermodulation immunity, a balanced configuration is utilized for the first-mixer stage. High injection is applied to L209-primary and preselector output is applied to L210-primary tap operated at the 45 MHz first IF frequency which is output from the secondary center tap of L209. Diode double balanced mixer using quad-diode D202 is employed.

- **First IF**

Mixer output is applied to Q241, which drives L224. L224 tunes to match the input impedance of 45 MHz monolithic crystal filter FL241 and FL242 that rejects signals outside the channel bandwidth. L247 matches FL261 to Q242 where the first IF signal is amplified at least 20 dB, then applied to second IF IC241.

- **Second IF**

IC241 contains all second IF circuitry, a quadrature demodulator, and threshold gate. X241 and circuitry in IC241 generate second LO injection of 45.545 MHz. A double-balanced mixer, that cancels both input signals internally is used so that additional tuned circuits at its output are not needed. Mixer output signal of 455 kHz (IC241 pin 3) is bandpass filtered further by FL243 and FL244 then super-amplified (100+ dB) by the second IF amplifier/limiter within IC241 (pin 5).

- **Demodulation**

The quadrature detector in IC241 is another double-balanced mixer to which limiter output is applied. Its second input is taken from 455 kHz tank L250 that is also fed with limiter output (IC241 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. C264, C265 and L251 attenuate signals above 100 kHz.

- **Audio**

Recovered audio from Q244 is routed to the gain control IC409 and applied to the active filter IC411. The amplification level is controlled by the gain control IC409, where the control voltage is fed via the external volume on the control unit. Output of the gain controller IC409 is applied to the Audio amplifier IC406. Power Amplifier IC406 Amplifies the audio signal and drives the speaker.

- **Squelch**

Audio signals at low-pass filter L251 are routed through Squelch Range RV that calibrates squelch-break level when the front panel SQUELCH control is maximum. Signals at RV241-top feed a two tank 60 kHz filter. The resulting 60 kHz signal is amplified by IC241 and Q244, then rectified by D243 to produce a DC voltage that varies inversely with received RF carrier level. The front panel Squelch

received RF carrier level. The front panel Squelch control sinks current from D243 so that the voltage can be adjusted. The DC voltage is input of a level detector within IC241 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 RV241. Level detector output is applied through NSQ the interconnect to microcomputer input port P41 so that the microcomputer can take appropriate action.

110-WATT PA

• RF Power Amplifier

A RF output of Q131 of TX/RX PC board is fed to the base of Q501 terminal through the coax-cable CA511. RF impedance at the collector of Q501 is transformed by PC board stripline to the base terminal of driver Q502. The collector of Q502 is transformed to the base of Q503, and the collector of Q503 is transformed to the base of Q505 and the base of Q507. RF impedance at the collector of final-stage Q505 and Q507 is again transformed by PC stripline and fine tuned by CV503. CV504 and CV505 match circuit impedance at RF-gate K501. L515—L518 and C584—C588 make up the harmonic filter. R521 and R522 serve to drain static and other DC potentials from the antenna.

• Antenna Gate

In receive mode, Relay K501 is switched to the J502-J503 route. The RF signal path from final amplifier Q505 and Q507 is then severed, and the impedance matching to J503 routes signals from the antenna to the receiver input through 50 Ω coax at J501.

In transmit mode, Relay K501 is switched off J503's route. The receiver port network is detuned such that it appears as a high impedance to the antenna, and K501 couples final amplifier output to the antenna at J501.

• Automatic Power Control

A PC stripline ahead of the harmonic filter and 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 the comparator IC405 pin 2 through the jump wire. The reference voltage applied to the comparator IC405 pin 3 is fed from the D/A convertor IC404 pin 4, of which command in controlled by the microcomputer via the 70-1080A programmer in alignment mode.

Output of the comparator IC404 is applied to Q504 via Q404, which is a current source that feeds primary DC to the collector circuits of the predriver Q501.

The feedback loop, from the directional coupler to Q504 via the comparator input IC405 pin 2 holds RF output power at the constant level determined by the reference voltage of IC405 pin 3 which is initially adjusted using the programmer.

LOGIC

• Microcomputer

Radio operation is under control of a microcomputer system located on the Logic Board. This system is comprised of microcomputer IC901, 2K EEPROM IC903 and peripheral port IC901. 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.

• DC Power and Reset

5-V DC power to all logic circuitry in Logic portion is supplied from switched 13.6 V and is regulated by IC402. Microcomputer IC901 is powered by the 5-V drop across D903 which is sourced by IC401 9-V regulator supply through J411 pin 14.

Table 5-1—IC901 PINOUTS

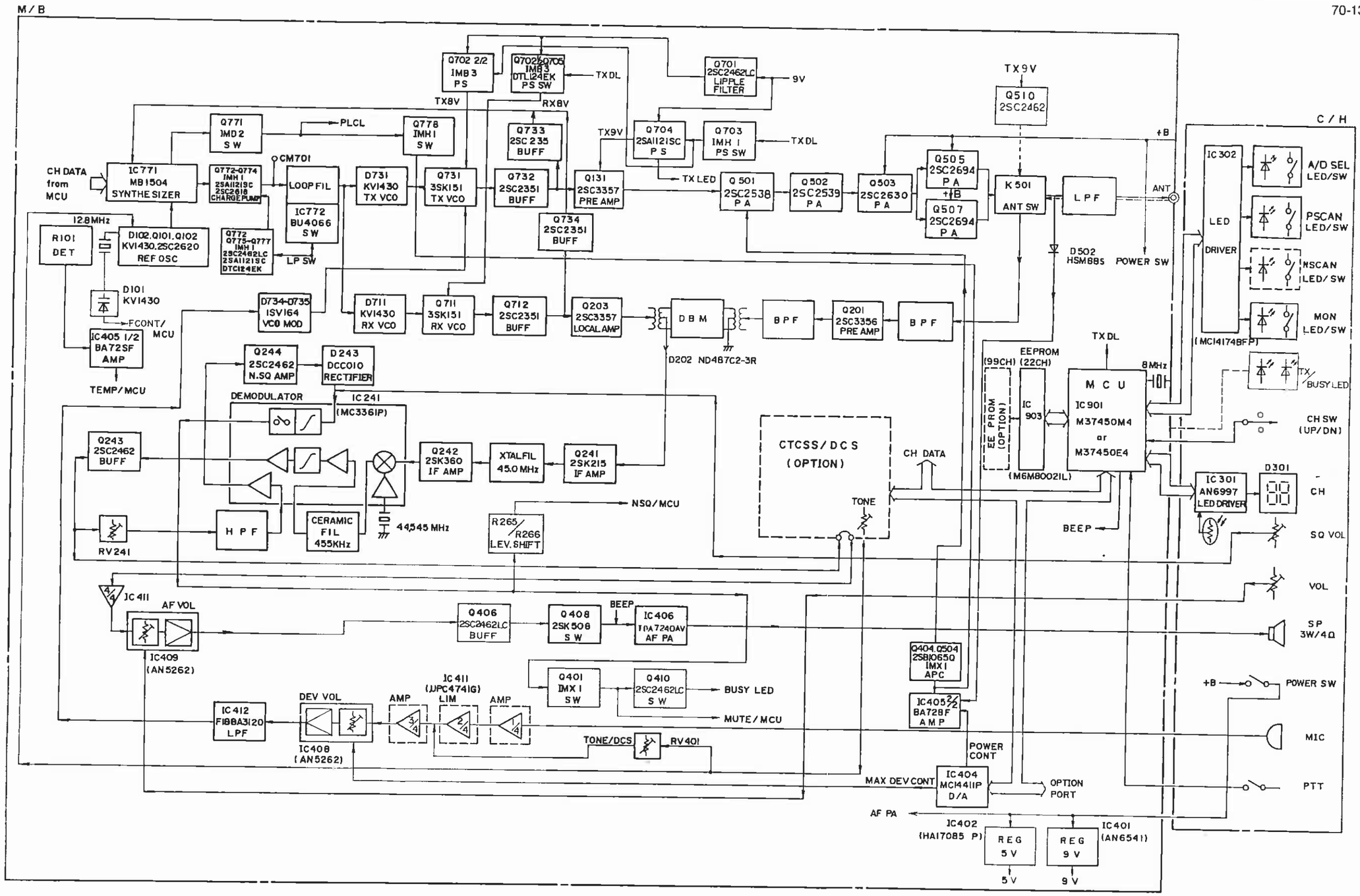
Pin No.	Pin Name	I/O Flow	Function Label	Logic & Function
1	P37	I	PC RTS	Programmer Interface
2	P36	O	PC CTS	Programmer Interface
3	P35	O	PC RD	Programmer Interface
4	P34	I	PC SD	Programmer Interface
5	P33	I	PC CD	Programmer Interface
6	P32	O	BEEP OUT	Beep Tone Output
7	P31	O	SGNCLK	Clock Output for CTCSS/CDCSS
8	P30	I/O	SG IO	Signal I/O for CTCSS/CDCSS
9	P57	O	LEDCHK	LED Check Output
10	P56	O	LEDAUX	not used
11	P55	O	LED STB	Parallel-Data Strobe for Indicators
12	P54	O	DSP STB	Parallel Data Strobe for Displays
13	P53	O	DSP3	Display/LED Data
14	P52	O	DSP2	Display/LED Data
15	P51	O	DSP1	Display/LED Data
16	P50	O	DSP0	Display/LED Data
17	P67	O	AUXOUT	Aux Switch Output (Low = ON)
18	P66	I	TASW	Talk-around Switch Input (Low = ON)
19	P65	O	SCRB STB	Serial Data Strobe for Voice Scrambler
20	P64	O	AUX STB	Serial Data Strobe for AUX
21	P63	O	MUTE	Low = MUTE
22	P62	I	HANGUP	Low = HANG UP
23	P61	I	PTT	Low = TX
24	P60	I	VLINT	Low = LOW VOLTAGE
25	R/W	O	—	not used
26	SYNC.	O	—	not used
27	$\overline{CNV_{SS}}$	I	—	GND
28	$\overline{RESET}$	I	—	Low = MICROCOMPUTER RESET
29	X_{IN}	I	—	Crystal Oscillator, 8 MHZ
30	X_{OUT}	O	—	Crystal Oscillator, 8 MHz
31	0	O	—	not used
32	V_{SS}	I	—	GND
33	P27	O	TXDL	Low = TX ACTIVATE
34	P26	O	DA STB	Serial Data Strobe for D/A Converter
35	P25	O	VCOSW	VCO Switch Signal Output
36	P24	O	LPSW	Loop Switch Signal Output
37	P23	I/O	PLCL	Synth Unlock (Low = UNLOCK)
38	P22	O	DSTB	Serial Data Strobe for Synthesizer
39	P21	O	DCLK	Clock for Serial Data
40	P20	O	CHDT	Serial Data Output
41	P17	I/O	—	not used
42	P16	I/O	ECS4	Chip Select for EEPROM 4
43	P15	I/O	ECS3	Chip Select for EEPROM 3
44	P14	I/O	ECS2	Chip Select for EEPROM 2
45	P13	I/O	ESC1	Chip Select for EEPROM 1
46	P12	O	ECLK	Clock for EEPROM
47	P11	O	EDI	Data Input Into EEPROM
48	P10	I	ED0	Data Output from EEPROM
49	P07	I	AUXSW/CH0	AUX Switch (Low = ACTIVE)/CHNL NO, INPUT
50	P06	I	MONSW/CH1	Monitor Switch (Low = ACTIVE)/CHNL NO. INPUT
51	P05	I	PRISW/CH2	PRI Switch (Low = ACTIVE)/CHNL NO. INPUT
52	P04	I	SCNSW/CH3	SCAN Switch (Low = ACTIVE)/CHNL NO. INPUT
53	P03	I	DEPWRSW/CH4	DE-POWER Switch (Low = ACTIVE)/CHNL NO. INPUT
54	P02	I	—/CH5	not used/CHNL NO. INPUT
55	P01	I	DNSW/CH6	DOWN Switch (Low = ACTIVE)/CHNL NO. INPUT
56	P00	I	UPSW/CH7	UP Switch (Low = ACTIVE)/CHNL NO. INPUT
57	P42	I	VLTIN	not used
58	P41	I	NSQIN	NSQ Status Input (High = RECEIVE)
59	P40	I	TMPRTR	Thermal Sensor Input
60	DA2	O	REFCNT	Reference Frequency Control Output
61	DA1	O	—	not used
62	VREF	I	—	Reference Voltage Input to Convert A/D
63	AVSS	I	—	GND
64	VCC	I	—	+5 V

SECTION 6

DIAGRAMS

NOTES

70-1395/1495


M/B
C/H
Q702 2/2 IMB3 PS
Q702 Q705 IMB3 DTL124EK PS SW
TXDL
Q701 2SC2462LC RIPPLE FILTER
9V
TX8V
RX8V
TX9V
Q704 2SA1213SC P S
Q703 IMH1 PS SW
TXDL
TX LED
Q771 IMD2 SW
PLCL
Q778 IMH1 SW
Q733 2SC 235 BUFF
CM701
CH DATA from MCU
IC771 MB1504 SYNTHESIZER
Q772-Q774 IMH1 2SA1213C 2SC2618 CHARGE PUMP
LOOP FIL
IC772 BU4066 SW
D731 KV1430 TX VCO
Q731 3SK151 TX VCO
Q732 2SC2351 BUFF
Q131 2SC3357 PRE AMP
Q734 2SC2351 BUFF
Q501 2SC2538 P A
Q502 2SC2539 P A
Q503 2SC2630 P A
Q505 2SC2694 P A
Q507 2SC2694 P A
+B
TX9V
Q510 2SC2462
K501 ANT SW
L P F
ANT
D502 HSM88S
POWER SW
12.8MHz
R101 DET
D102,Q101,Q102 KV1430,2SC2620 REF OSC
Q772 Q775-Q777 IMH1 2SC2462LC 2SA1213C DTC124EK
LP SW
D101 KV1430
FCONT/ MCU
IC405 1/2 BA72SF AMP
TEMP/MCU
D734-D735 ISV164 VCO MOD
D711 KV1430 RX VCO
Q711 3SK151 RX VCO
Q712 2SC2351 BUFF
Q203 2SC3357 LOCAL AMP
D B M
D202 ND487C2-3R
B P F
Q201 2SC3356 PRE AMP
B P F
Q244 2SC2462 N.SQ AMP
D243 DCC010 RECTIFIER
DEMODULATOR
IC241 (MC3361P)
Q243 2SC2462 BUFF
Q242 2SK360 IF AMP
XTAL FIL 45.0 MHz
Q241 2SK215 IF AMP
44.545 MHz
CERAMIC FIL 455KHz
H P F
RV241
NSQ/MCU
R265/R266 LEV. SHIFT
CTCSS/DCS (OPTION)
CH DATA
TONE
BEEP
TXDL
EEPROM (99CH) (22CH)
EE PROM (OPTION)
IC 903
(M6M8002IL)
M C U
IC 901
M37450M4 or M37450E4
8MHz
IC 302
LED DRIVER
(MCI4174BFP)
A/D SEL LED/SW
PSCAN LED/SW
NSCAN LED/SW
MON LED/SW
TX/BUSY LED
CH SW (UP/DN)
IC 301 AN6997 LED DRIVER
D301
CH
SQ VOL
VOL
SP 3W/4Ω
+B
POWER SW
MIC
PTT
IC411 AF VOL
IC409 (AN5262)
Q406 2SC2462LC BUFF
Q408 2SK508 S W
BEEP
IC406 TDA7240AV AF PA
Q401 IMX1 S W
Q410 2SC2462LC S W
BUSY LED
MUTE/MCU
IC411 (UPC4741G)
DEV VOL
AMP
LIM
AMP
IC412 FI88A3120 LPF
IC408 (AN5262)
TONE/DCS
RV401
Q404,Q504 2SB1065Q IMX1 APC
IC405 2/2 BA728F AMP
POWER CONT
MAX DEV CONT
IC404 MCI4411P D/A
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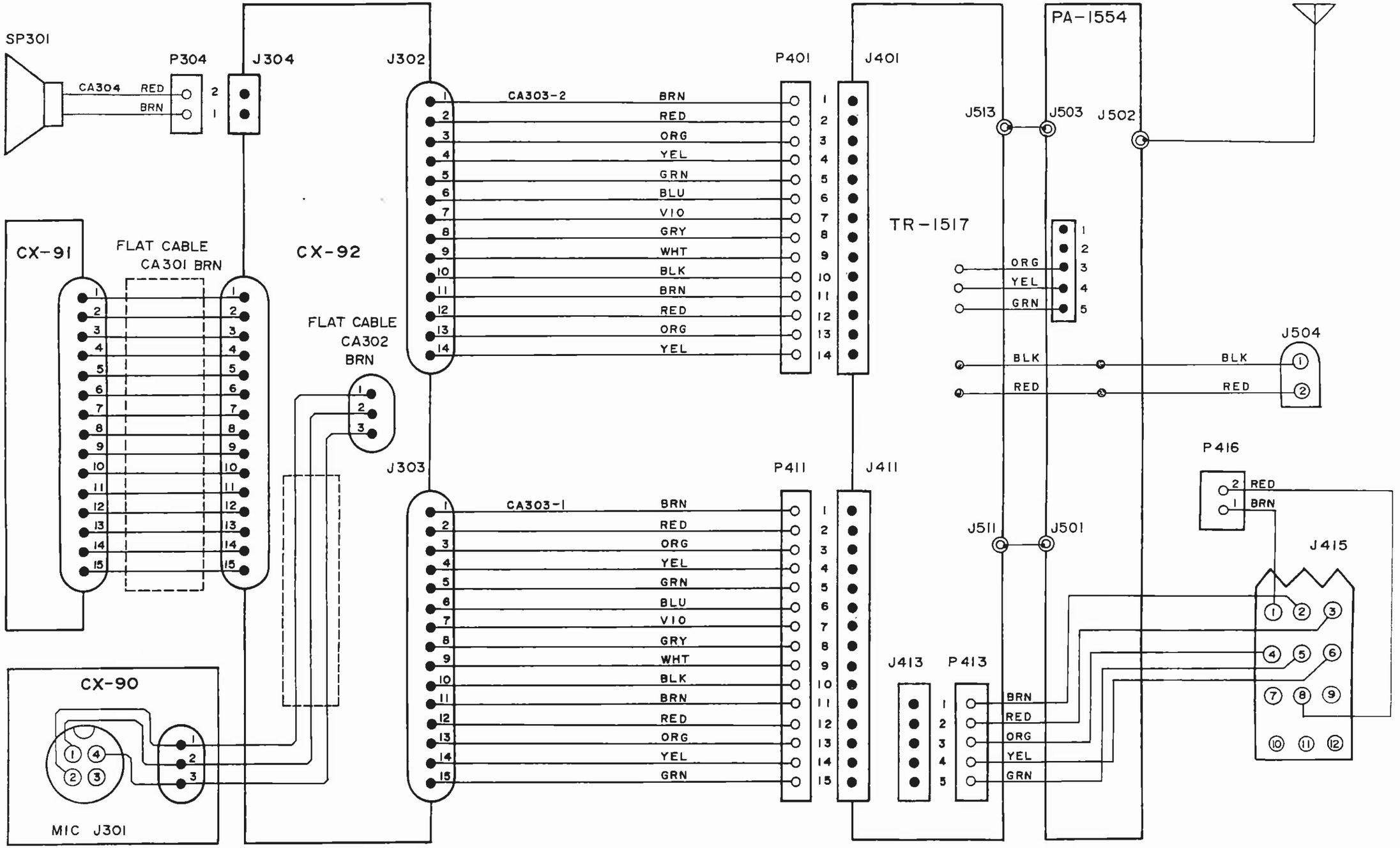
AF PA
IC402 (HA17085 P)
IC401 (AN6541)
REG 5V
REG 9V
5V
9V

70-1395/1495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CX-91
FLAT CABLE
CA301 BRN
CX-92
FLAT CABLE
CA302
BRN
J303
CA303-1
P411
J411
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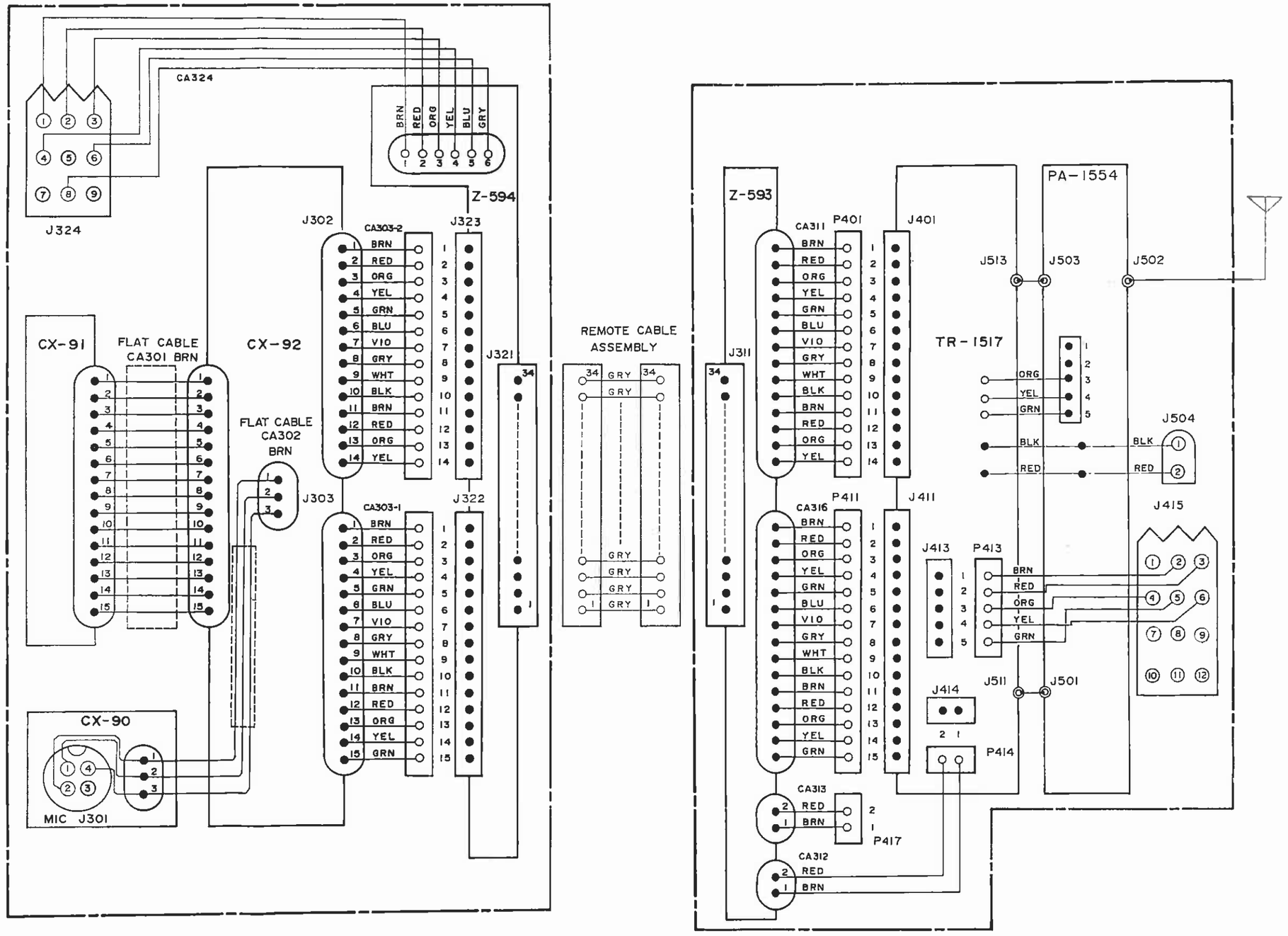
CX-90
MIC J301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J324
BRN RED ORG YEL BLU GRY
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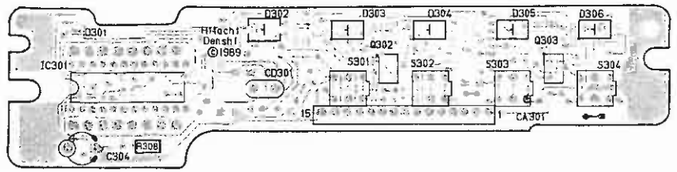
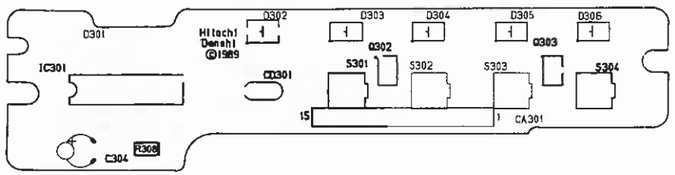
J302
CA303-2
J323
CX-91
FLAT CABLE
CA301 BRN
CX-92
FLAT CABLE
CA302
BRN
J303
J321
J322
CA303-1
BRN RED ORG YEL GRN BLU VIO GRY WHT BLK BRN RED ORG YEL GRN
REMOTE CABLE
ASSEMBLY
GRY
CX-90
MIC J301
Z-593
J311
CA311
P401
J401
PA-1554
J513
J503
J502
TR-1517
ORG YEL GRN
BLK RED
J504
J415
P411
J411
CA316
J413
P413
J414
P414
J511
J501
CA313
RED BRN
P417
CA312
RED BRN

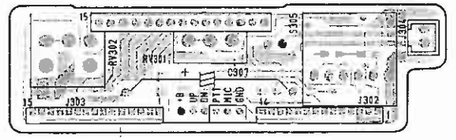
CX-90 LAYOUT TOP VIEW

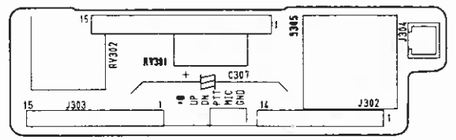
CX-91 LAYOUT TOP VIEW



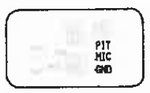


CX-92 LAYOUT TOP VIEW

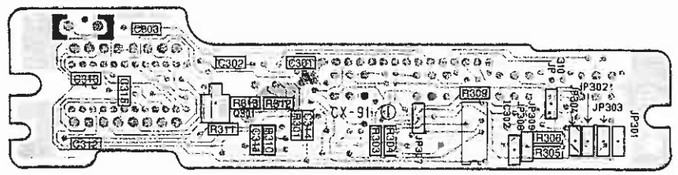


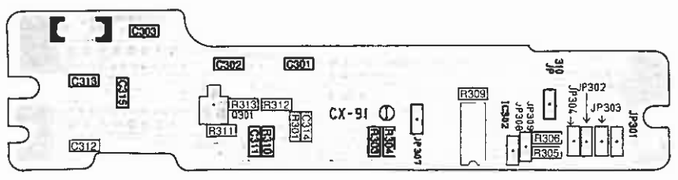


CX-90 LAYOUT BOTTOM VIEW

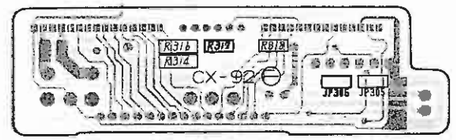


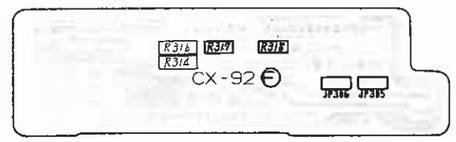
CX-91 LAYOUT BOTTOM VIEW





CX-92 LAYOUT BOTTOM VIEW



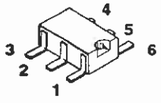


BLUE VISIBLE PLATING

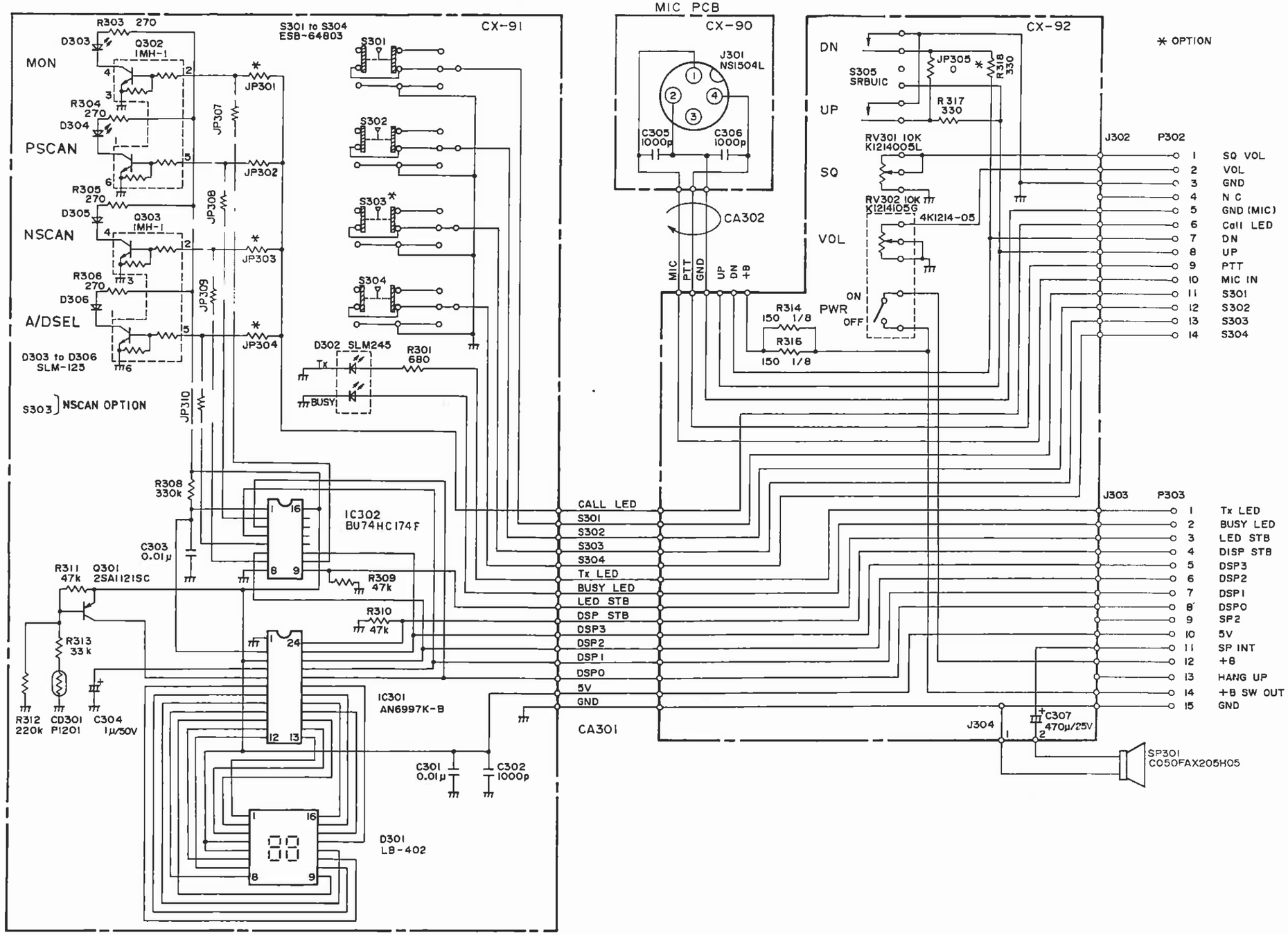
RED UNDERSIDE PLATING

70-1395/1495

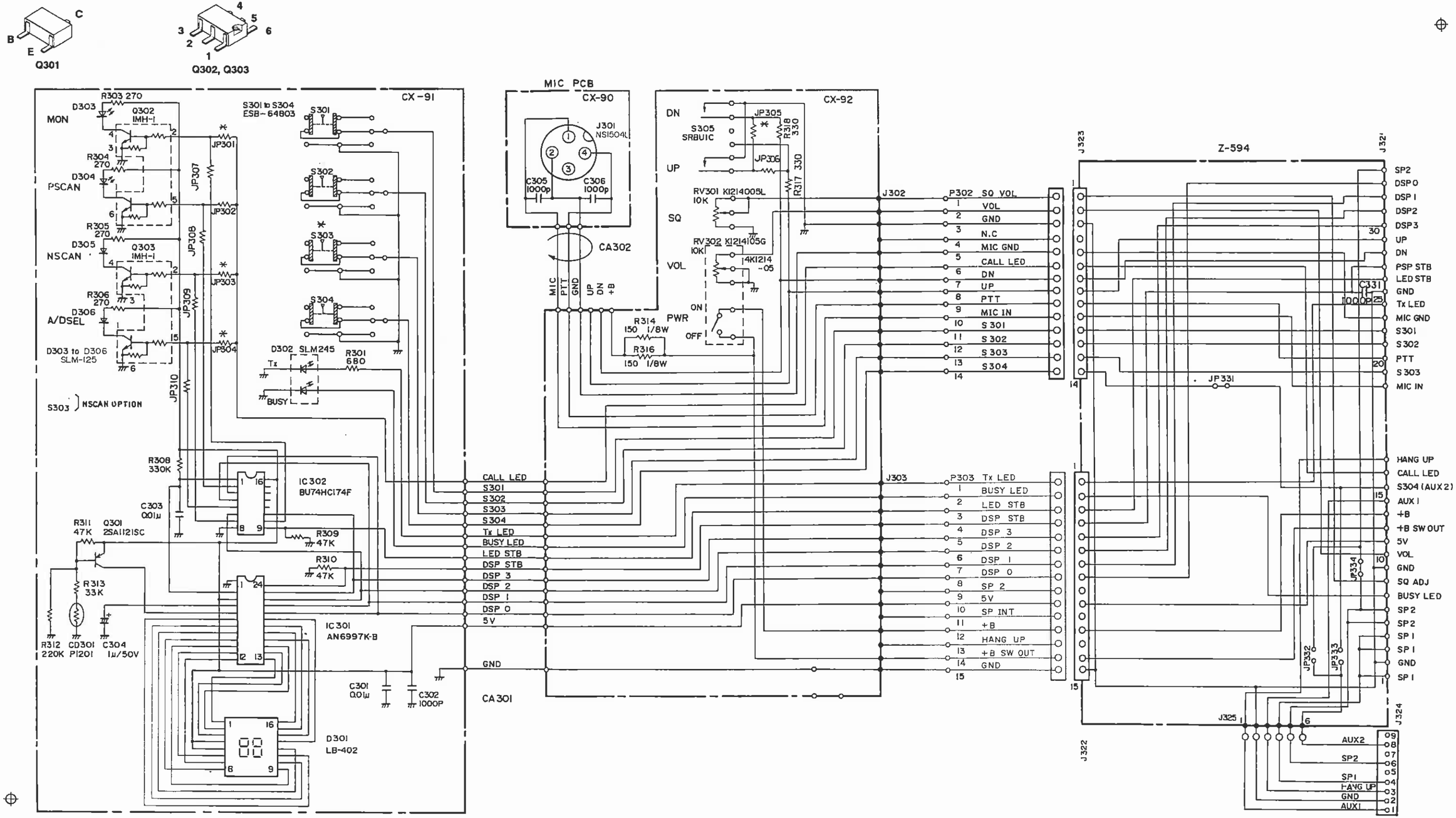
Q301



Q302, Q303

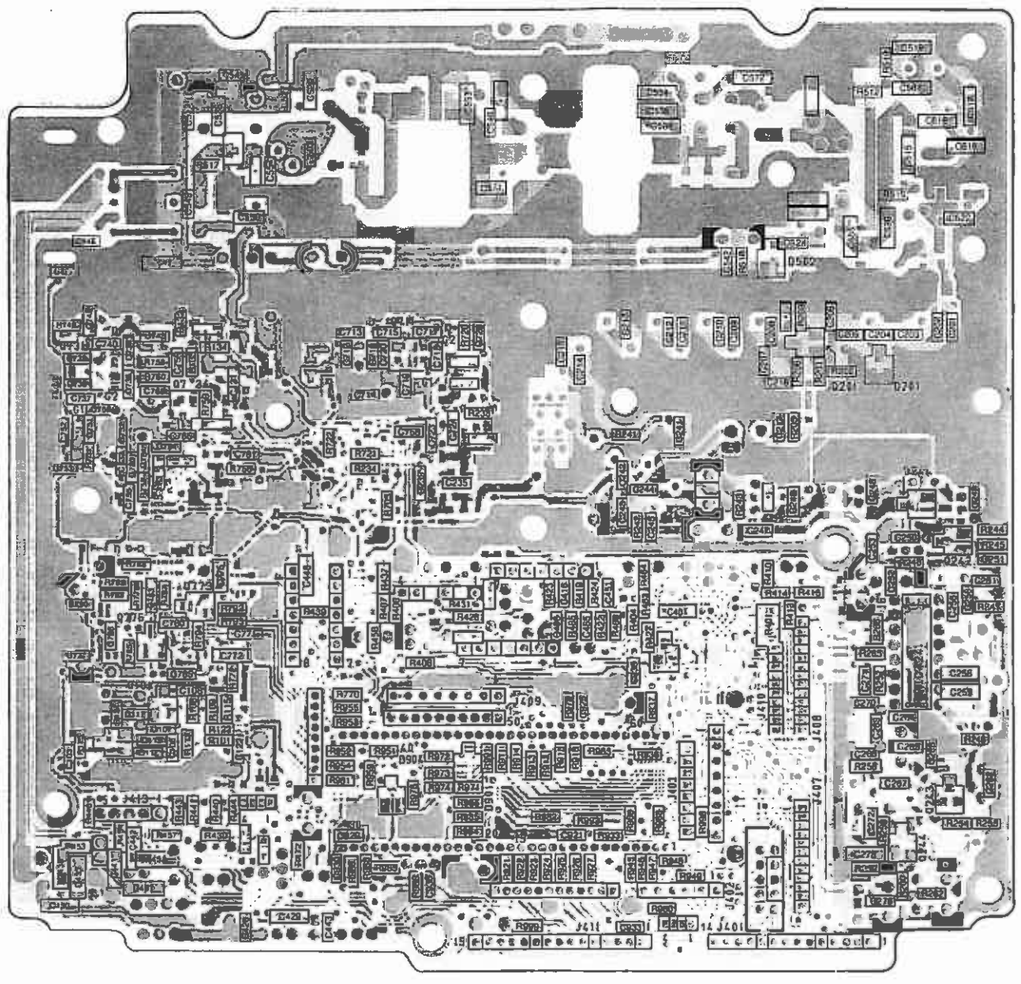


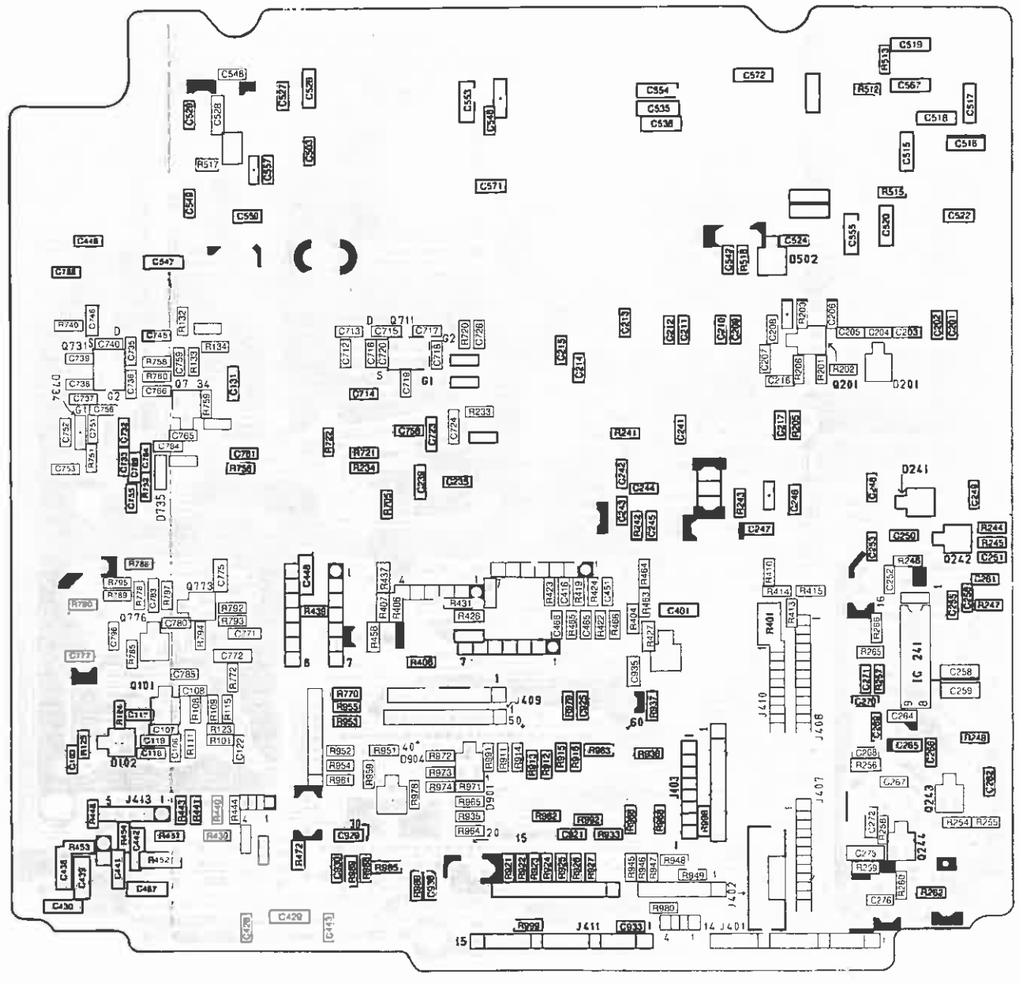
70-1395/1495


Q301
Q302, Q303
CX-91
MON
PSCAN
NSCAN
A/DSEL
D303 to D306 SLM-125
S303 NSCAN OPTION
S301 to S304 ESB-64803
D302 SLM245
Tx
BUSY
R301 680
IC302 BU74HC174F
IC301 AN6997K-B
D301 LB-402
Q301 2SA1121SC
CD301 P1201
C304 1µ/50V
C303 0.01µ
C301 0.01µ
C302 1000P
CA301
CA302
MIC PCB
CX-90
J301 NSI504L
C305 1000p
C306 1000p
MIC
PTT
GND
UP
DN
+B
CX-92
S305 SRBUIC
RV301 K12140051
RV302 K12141056
4K1214-05
PWR
R314 150 1/8W
R316 150 1/8W
J302
P302 SQ VOL
VOL
GND
N.C
MIC GND
CALL LED
DN
UP
PTT
MIC IN
S301
S302
S303
S304
J303
P303 Tx LED
BUSY LED
LED STB
DSP STB
DSP 3
DSP 2
DSP 1
DSP 0
SP 2
5V
SP INT
+B
HANG UP
+B SW OUT
GND
Z-594
J323
J321
J322
J324
J325
JP331
JP332
JP333
JP334
C331 1000P
SP2
DSP0
DSP1
DSP2
DSP3
UP
DN
PSP STB
LED STB
GND
Tx LED
MIC GND
S301
S302
PTT
S303
MIC IN
HANG UP
CALL LED
S304 (AUX2)
AUX1
+B
+B SW OUT
5V
VOL
GND
SQ ADJ
BUSY LED
SP2
SP2
SP1
SP1
GND
SP1
AUX2
SP2
SP1
HANG UP
GND
AUX1

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

1 2 3 4 5 6 7 8





BLUE VISIBLE PLATING

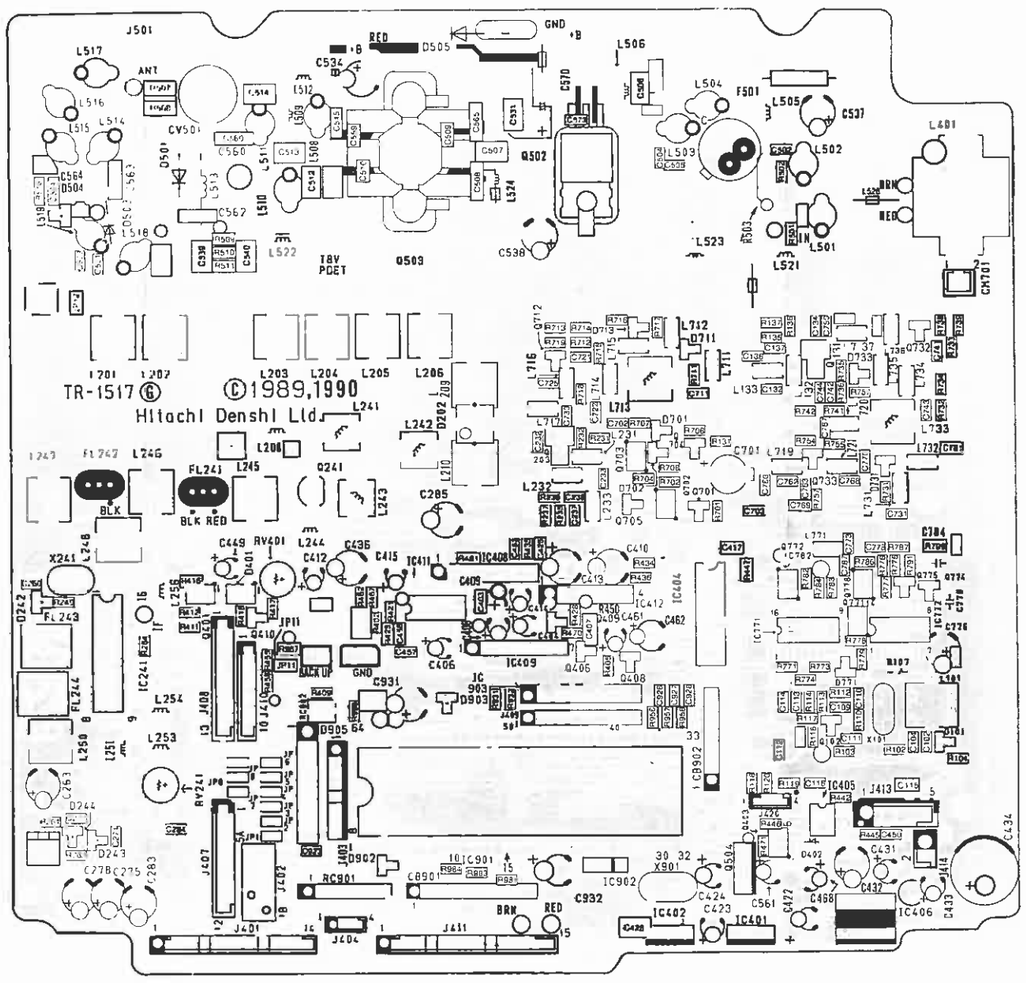
RED UNDERSIDE PLATING

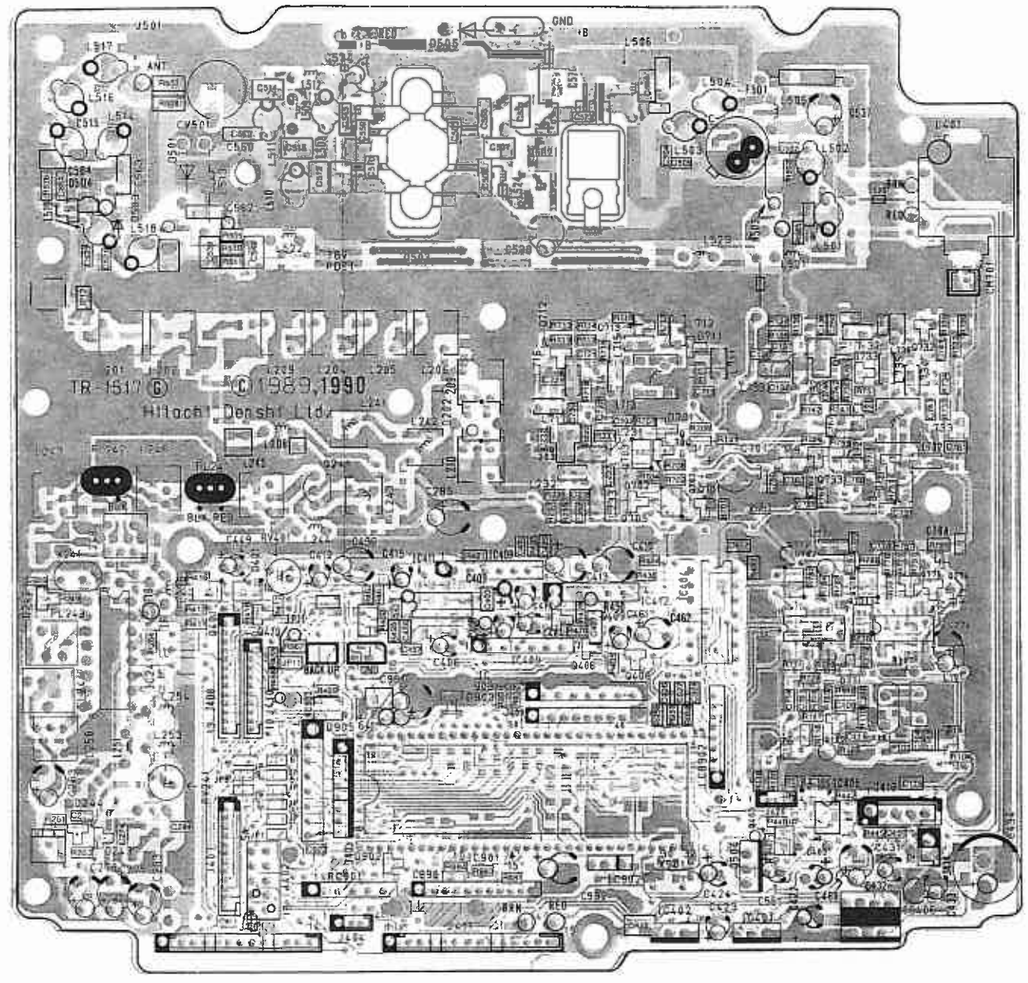
TR-1517 LAYOUT--TOP VIEW

70-1395/1495

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

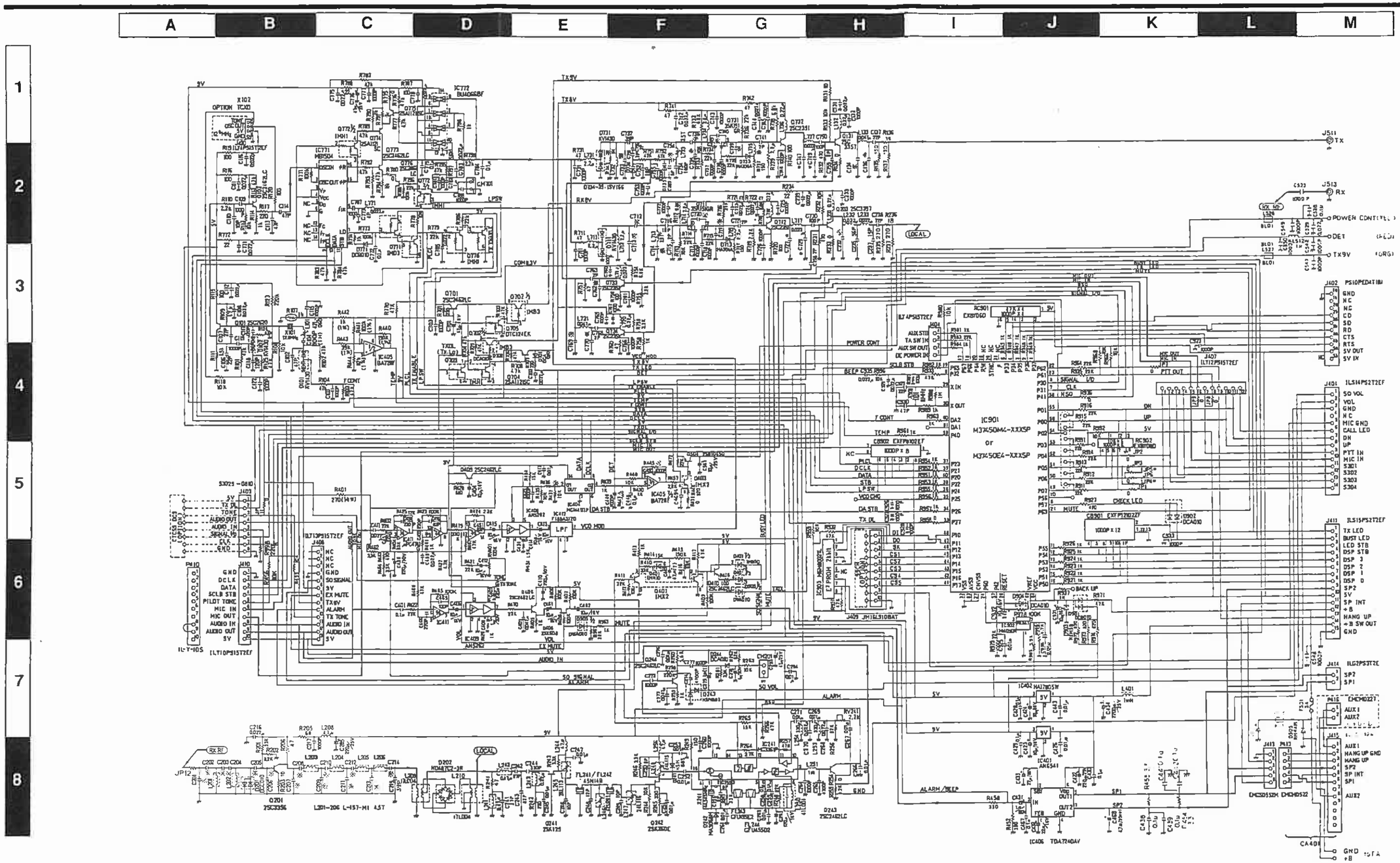
1 2 3 4 5 6 7 8





BLUE VISIBLE PLATING

RED UNDERSIDE PLATING


A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
8
IC901
M37450M4-XXXSP
or
M37450E4-XXXSP
IC405 BA728F
IC406 TDA7240AV
IC403 HA17805W
IC401 AN6541
IC411 AN5262
IC409 AN5262
IC772 BU4066BF
IC771 M65854
IC772 TA8164AF70
Q201 2SC3356
Q241 2SK125
Q242 2SK302E
Q243 2SC2412LC
D202 MD4817C2-39
D241 FL261/FL247
D242 1SV214
D243 1SV211
L201-206 L-457-M1 4.5T
L210 1T1.0DIA
L241 0.22μH CM453022
L243 0.22μH CM453022
L401 1mH
X102 OPTION TCXO
J511 Tx
J513 Rx
J402 PS10PEDAT1BU
J401 ILS14PS2T2EF
J411 ILS15PS2T2EF
J414 ILG2PS3T2E
J407 ILT12PS4S72EF
J408 ILT10PS15T2EF
J410 ILY-10S
CA401
POWER CONT
DET
TX9V
LOCAL
ALARM
ALARM/BEEP
SQ SIGNAL
SQ VOL
AUDIO IN
EX MUTE
MUTE
VCO MOD
LPF
BUSY LED
Rx RF
GND
+B

TR-1517 TRANSISTOR PINOUTS

TR-1517 DIODE PINOUTS

70-1395/1495

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

1

2

3

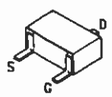
4

5

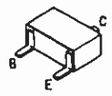
6

7

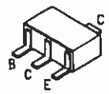
8



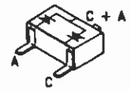
Q242



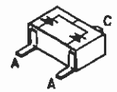
Q101, Q102, Q201, Q243, Q244, Q406, Q409, Q410, Q701, Q704, Q705, Q712, Q732, Q733, Q734, Q773, Q774, Q775, Q776



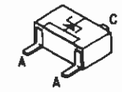
Q131, Q203



D201, D243

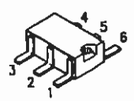


D101, D102, D711, D713, D731, D904

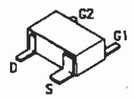


D903

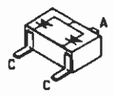
Q241



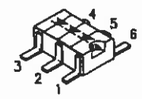
Q401, Q403, Q703, Q703, Q771, Q772, Q778



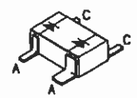
Q711, Q731



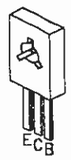
D241, D244, D701, D702



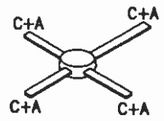
D401



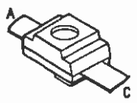
D905



Q504

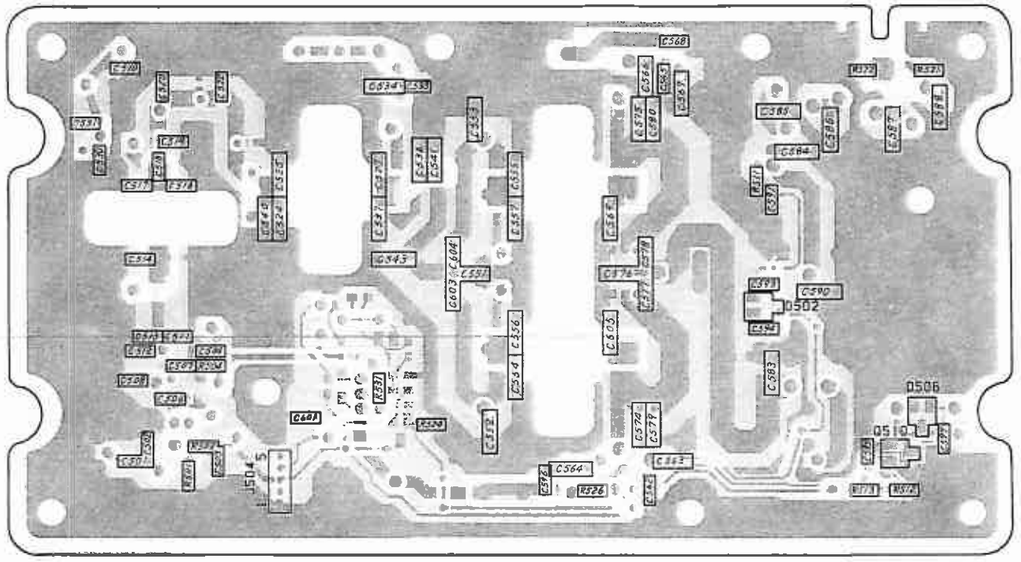


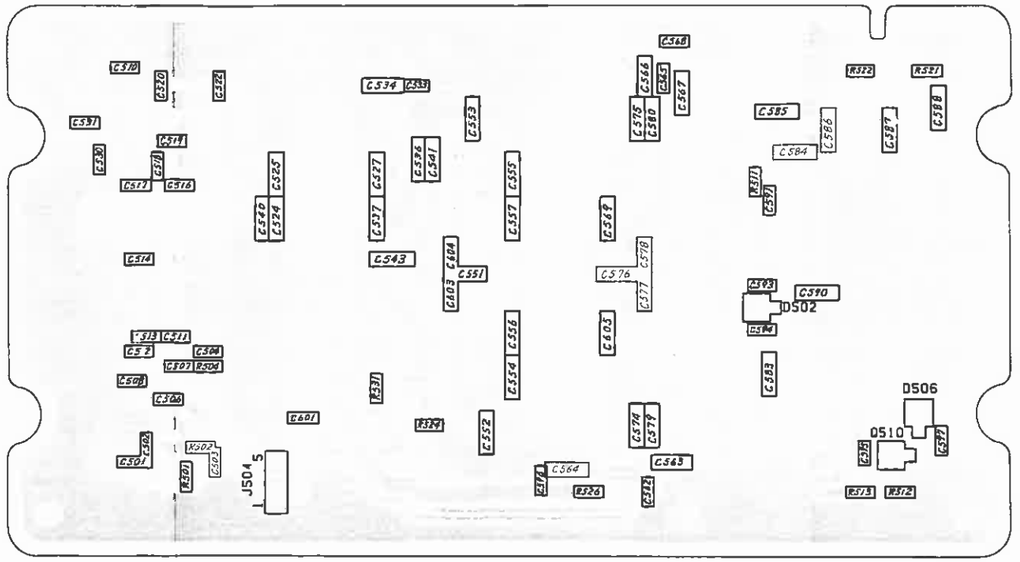
D202



D734, D735

70-1395/1495





BLUE VISIBLE PLATING

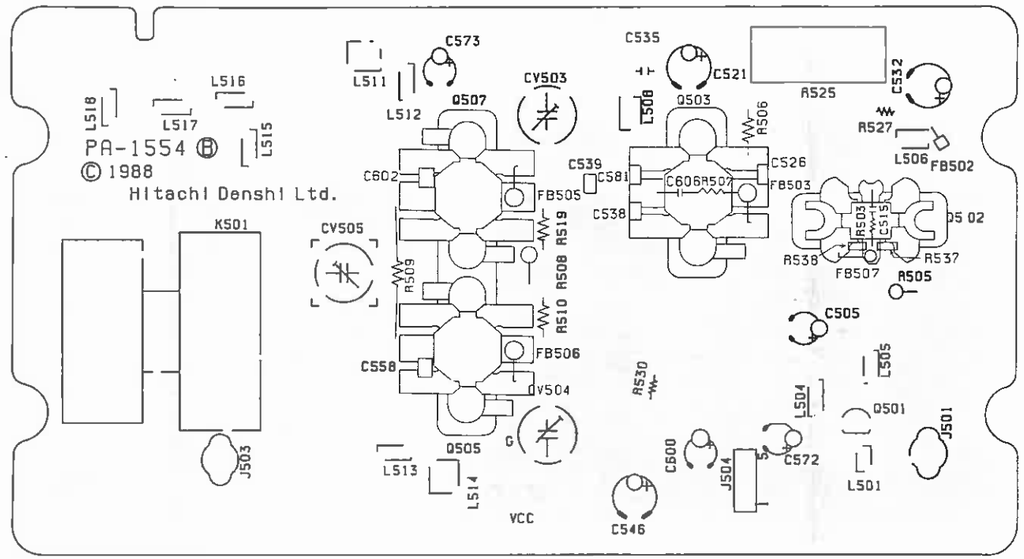
RED UNDERSIDE PLATING

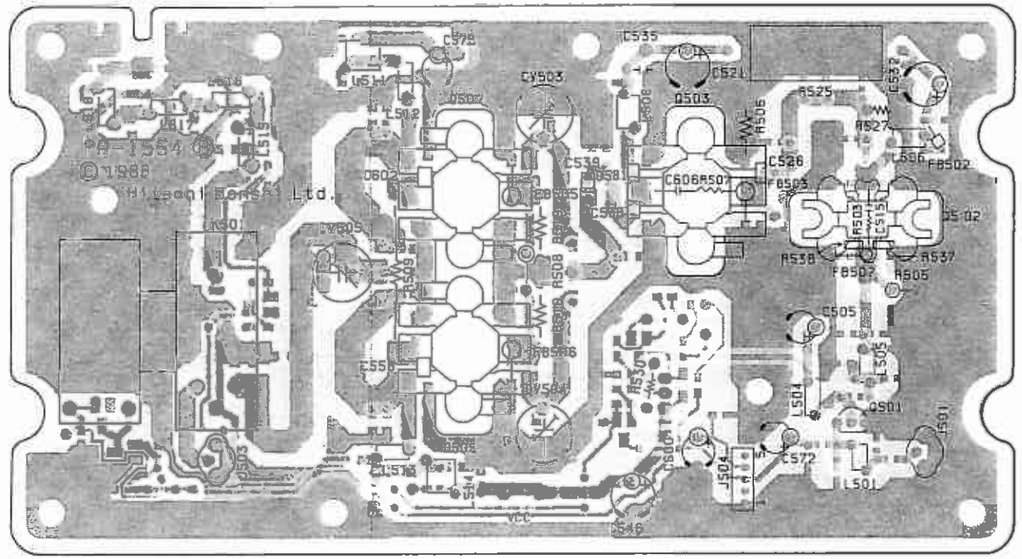
PA-1554 LAYOUT -- TOP VIEW

70-1395/1495

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

1 2 3 4 5 6 7 8

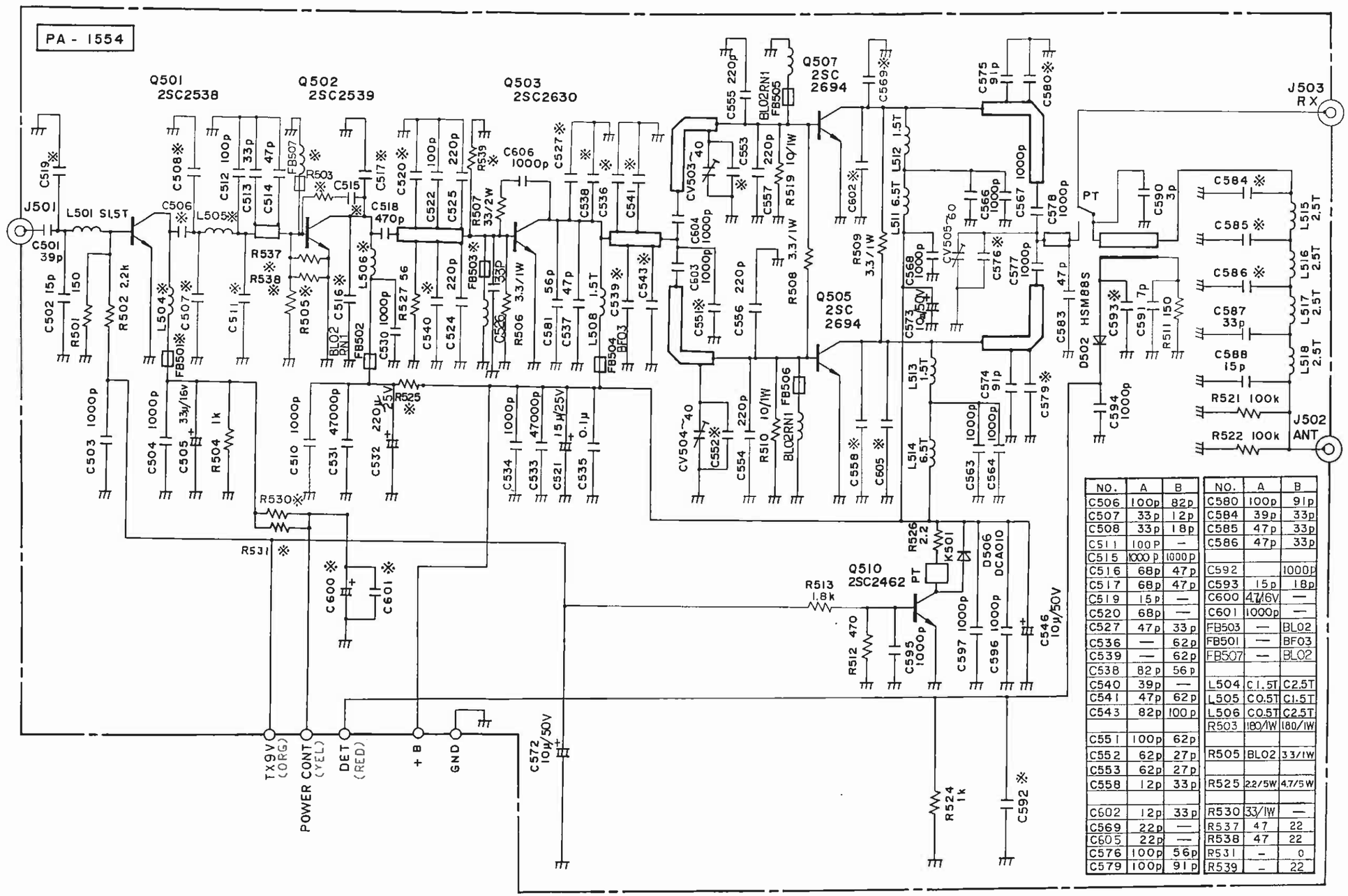




BLUE VISIBLE PLATING

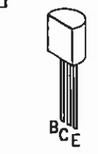
RED UNDERSIDE PLATING

70-1395/1495



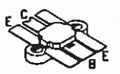
NO.	A	B
C506	100p	82p
C507	33p	12p
C508	33p	18p
C511	100P	—
C515	1000 p	1000p
C516	68p	47p
C517	68p	47p
C519	15p	—
C520	68p	—
C527	47p	33p
C536	—	62p
C539	—	62p
C538	82p	56p
C540	39p	—
C541	47p	62p
C543	82p	100p
C551	100p	62p
C552	62p	27p
C553	62p	27p
C558	12p	33p
C602	12p	33p
C569	22p	—
C605	22p	—
C576	100p	56p
C579	100p	91p

NO.	A	B
C580	100p	91p
C584	39p	33p
C585	47p	33p
C586	47p	33p
C592		1000p
C593	15p	18p
C600	47/6V	—
C601	1000p	—
FB503	—	BL02
FB501	—	BF03
FB507	—	BL02
L504	C1.5T	C2.5T
L505	C0.5T	C1.5T
L506	C0.5T	C2.5T
R503	180/1W	180/1W
R505	BL02	33/1W
R525	2.2/5W	4.7/5W
R530	33/1W	—
R537	47	22
R538	47	22
R531	—	0
R539	—	22

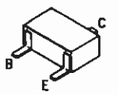


Q501

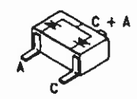
Q502



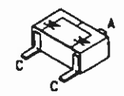
Q503, Q505, Q507



Q510



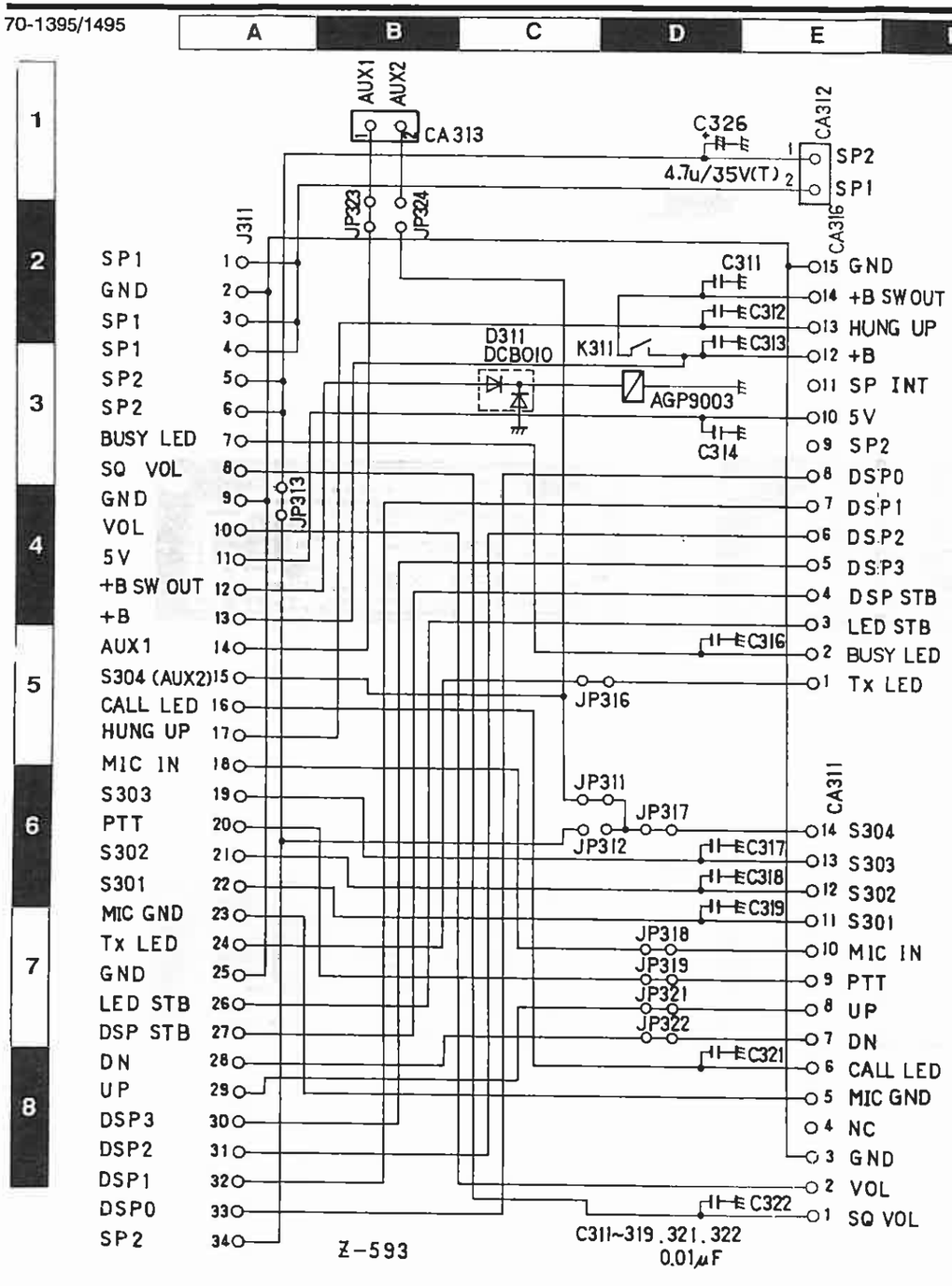
D502



D506

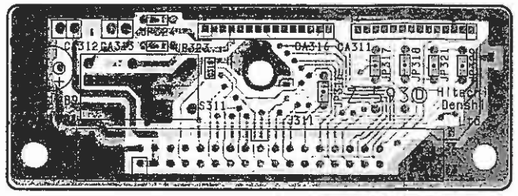
Z-593 INTERFACE SCHEMATIC DIAGRAM

70-1395/1495

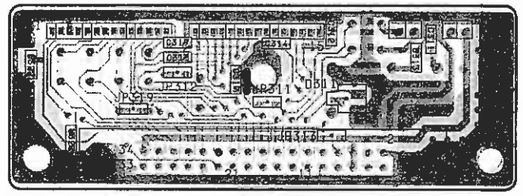


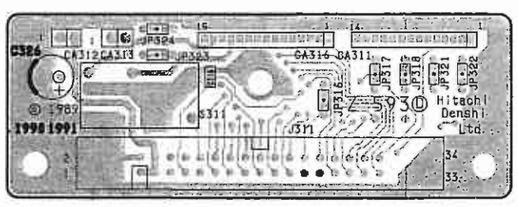
Z-593 LAYOUT

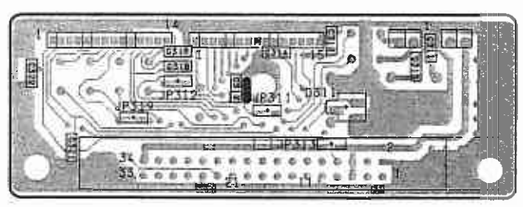
TOP VIEW



BOTTOM VIEW



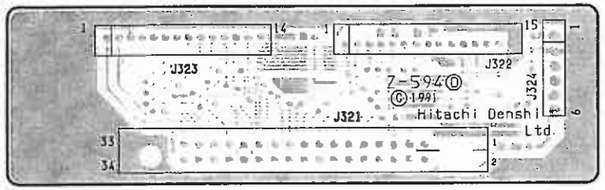




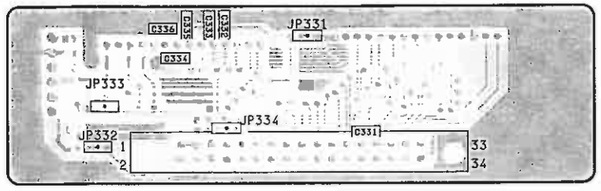
BLUE VISIBLE PLATING

RED UNDERSIDE PLATING

TOP VIEW



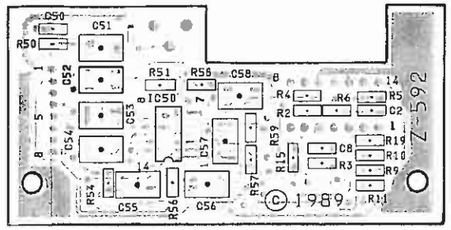
BOTTOM VIEW



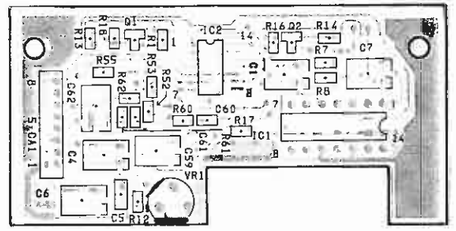
BLUE VISIBLE PLATING

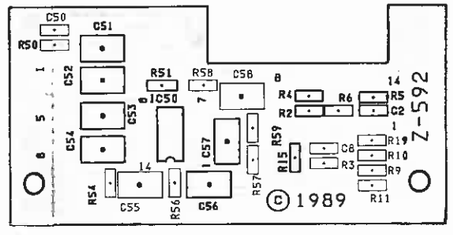
RED UNDERSIDE PLATING

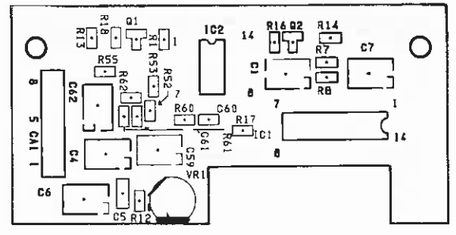
TOP VIEW



BOTTOM VIEW





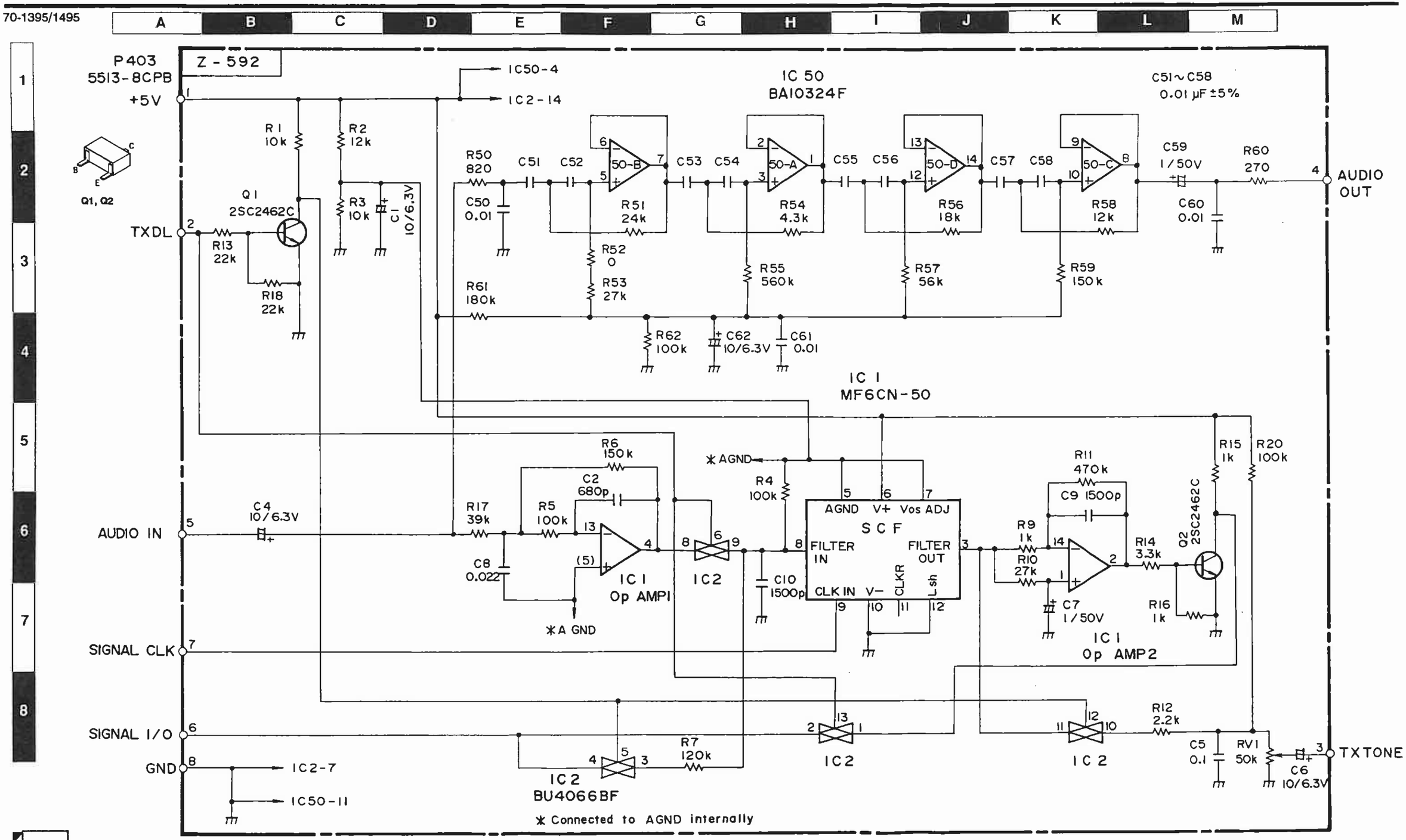


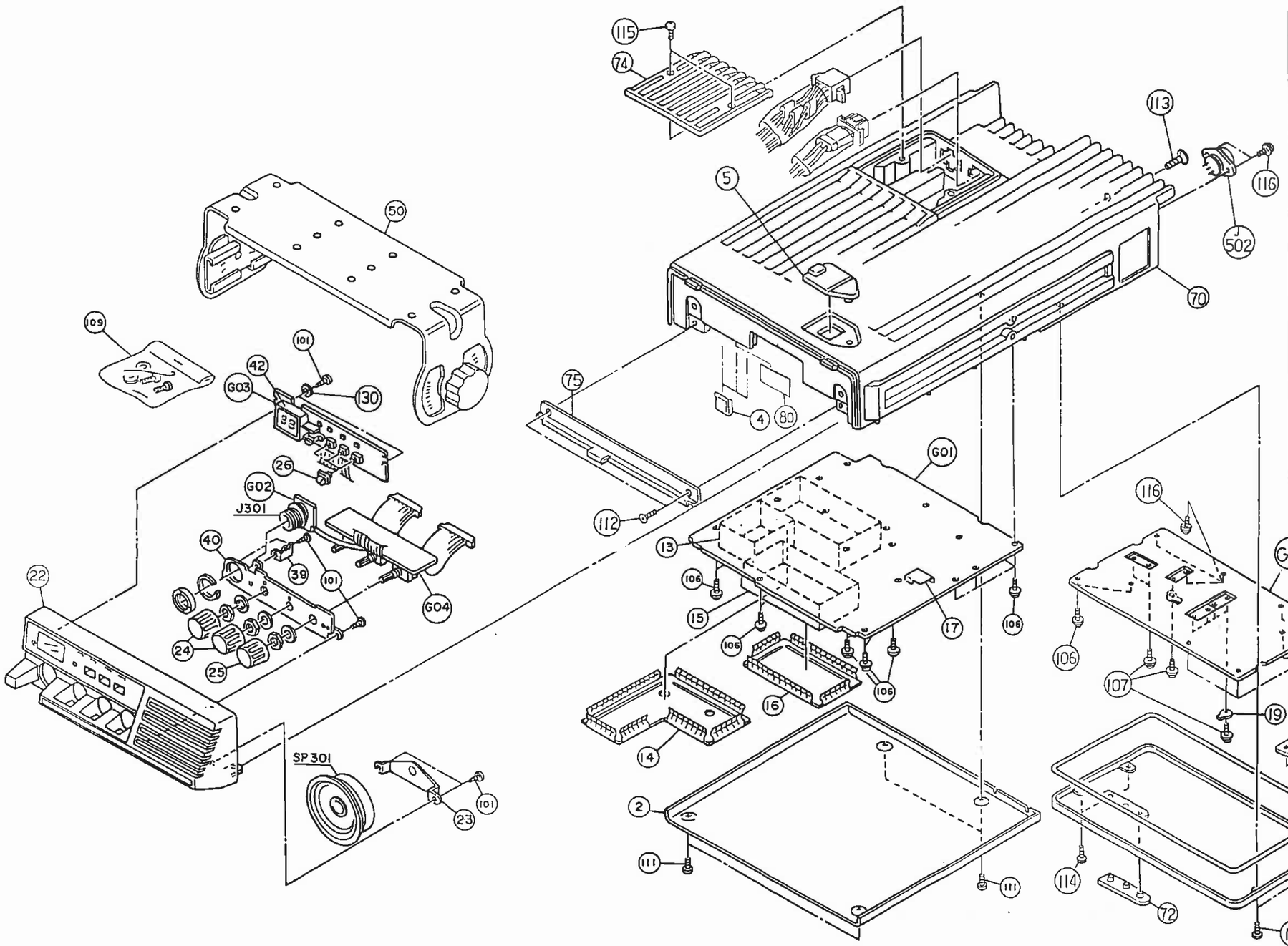
BLUE VISIBLE PLATING

RED UNDERSIDE PLATING

Z-592 (CTCSS) SCHEMATIC DIAGRAM

70-1395/1495





REF NO.	DESCRIPTION	PART NO.
2	COVER	70-010301
4	CLIP	70-150126
5	PROGRAMMER PORT PACKING	70-157358
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
17	IF SHIELD	70-089349
18	GROUND LUG	70-150181
22	FRONT COVER ASSY	70-010289
23	SPEAKER BRACKET	70-158324
24	VOLUME KNOB	70-011086
25	VOLUME KNOB	70-011087
26	SWITCH BUTTON	70-011085
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158326
42	LED SPACER	70-150133
50	BRACKET ASSY	70-158327
70	CHASSIS	70-010300
71	PA COVER (H)	70-010302
72	PA PACKING	70-157398
73	SHIELD TUBE	70-157399
74	CONNECTOR COVER	70-010304
75	LOCK PLATE	70-010303
76	PCB HEAT SINK	70-089359
101	SCREW PLAX PAN HD M3 x 10	70-150138
106	SEMS M3 x 10	70-150180
107	SEMS M3 x 12	70-150151
109	FIXED SCREW	70-151850
111	SCREW BIND HD M3 x 8	70-150146
112	SCREW FLAT HD M3 x 8	70-150177
113	SCREW FLAT HD M3 x 10	70-150178
114	SCREW BIND HD M3 x 12	70-151839
115	SCREW BIND HD M3 x 10	70-150171
116	SEMS M3 x 8	70-150179
G01	TRX, LOGIC PCB	TR-1517
G02	MIC CONNECTOR PCB	CX-90
G03	DISPLAY PCB	CX-91
G04	OPERATE PCB	CX-92
G07	PA PCB	PA-1554

TRUNK-MOUNT EXPLODED VIEW

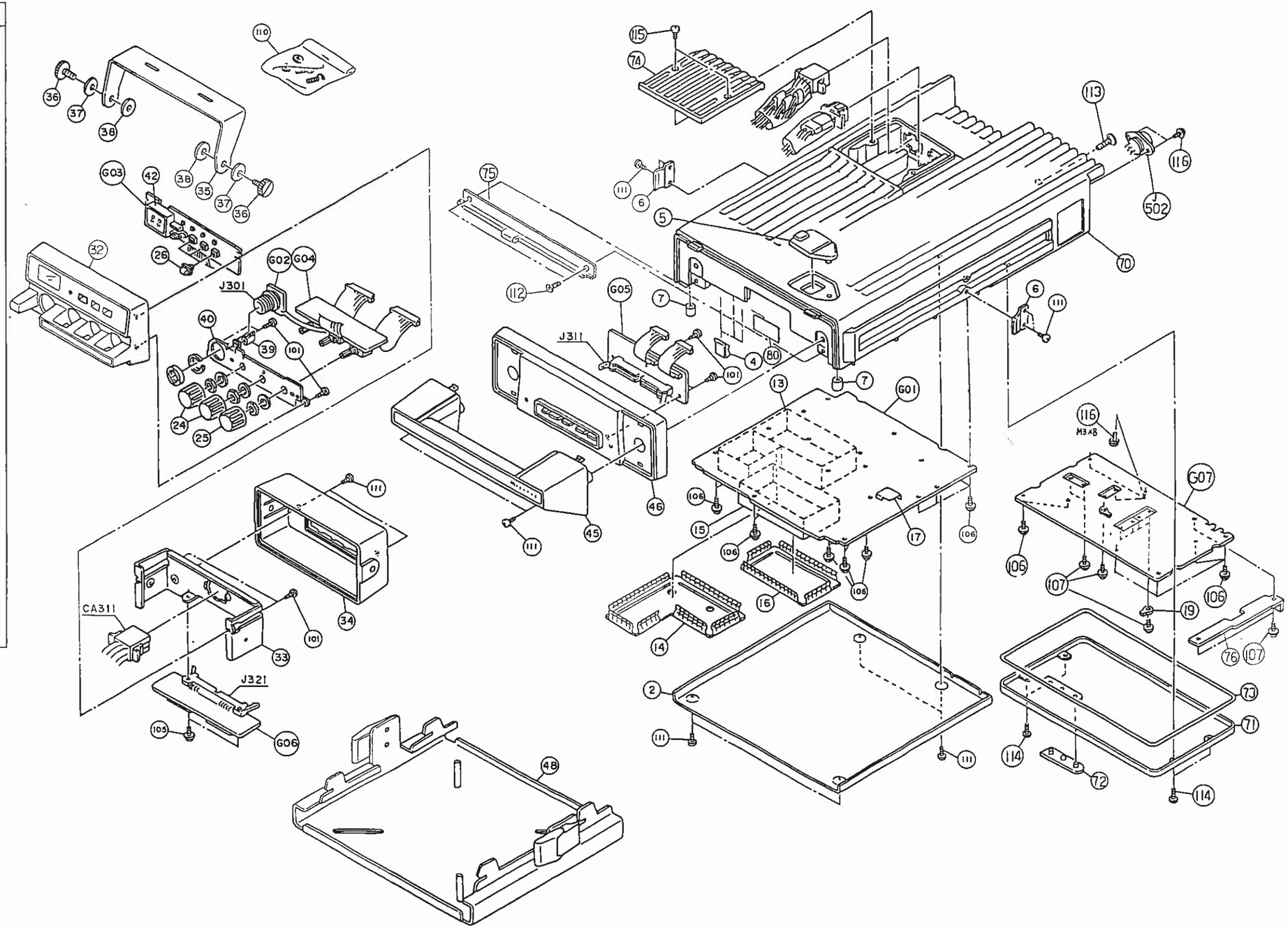
70-1395/1495

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

REF NO.	DESCRIPTION	PART NO.
2	COVER	70-010301
4	CLIP	70-150126
5	PROGRAMMER PORT PACKING	70-157358
6	BRACKET	70-158323
7	CAP	70-150127
13	VCO SHIELD CASE	70-088341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-088343
16	LOG SHIELD COVER	70-089344
17	IF SHIELD	70-089349
19	GROUND LUG	70-150161
22	FRONT COVER ASSY	70-010289
24	VOLUME KNOB	70-011088
25	VOLUME KNOB	70-011087
26	SWITCH BUTTON	70-011085
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-156328
42	LED SPACER	70-150133
45	HANDLE	70-158325
46	HANDLE BASE	70-150132
48	BRACKET ASSY	70-158326
70	CHASSIS	70-010300
71	PA COVER (H)	70-010302
72	PA PACKING	70-157396
73	SHIELD TUBE	70-157399
74	CONNECTOR COVER	70-010304
75	LOCK PLATE	70-010303
76	PCB HEAT SINK	70-089359
101	SCREW PLAX PAN HD M3 x 10	70-150138
106	SEMS M3 x 10	70-150180
107	SEMS M3 x 12	70-150151
110	FIXED SCREW	70-151974
111	SCREW BIND HD M3 x 6	70-150146
112	SCREW FLAT HD M3 x 8	70-150177
113	SCREW FLAT HD M3 x 10	70-150178
114	SCREW BIND HD M3 x 12	70-151639
115	SCREW BIND HD M3 x 10	70-150171
116	SEMS M3 x 8	70-150179
G01	TRX, LOGIC PCB	TR-1517
G02	MIC CONNECTOR PCB	CX-90
G03	DISPLAY PCB	CX-91
G04	OPERATE PCB	CX-92
G05	ADAPTOR (HANDLE) PCB	Z-593
G07	PA PCB	PA-1554

SMALL REMOTE CONTROL HEADS ONLY:

32	CONT CASE ASSY	70-010290
33	CONT CHASSIS	70-010287
34	CONT COVER	70-010288
35	CONT BRACKET	70-158329
36	COIN SCREW	70-150130
37	WASHER	70-151383
38	WASHER	70-150135
105	SCREW SEMS PAN HD M2 x 14	70-150191
G08	ADAPTOR	Z-594



SECTION 7

PARTS

NOTES

MECHANICAL PARTS

U/D = UNDER-DASH
T/M = TRUNK-MOUNT

REF NO.	DESCRIPTION	PART NO.
2	COVER	70-010301
4	CLIP	70-150126
5	PROGRAMMER PORT PACKING	70-157358
6	T/M BRACKET	70-158323
7	T/M CAP	70-150127
12	PA SHIELD COVER	70-089417
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089403
17	IF SHIELD	70-089349
19	GROUND LUG	70-150181
22	FRONT COVER ASSY	70-010289
23	U/D SPEAKER BRACKET	70-158324
24	VOLUME KNOB	70-110066
25	VOLUME KNOB	70-110067
26	SWITCH BUTTON	70-110065
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158328
42	LED SPACER	70-150133
45	T/M HANDLE	70-158325
46	T/M HANDLE BASE	70-150132
48	T/M BRACKET ASSY	70-158326
50	U/D BRACKET ASSY	70-158327
61	INSULATOR	70-157697
70	CHASSIS	70-010388
71	PA COVER (H)	70-010302
72	PA PACKING	70-157398
73	SHIELD TUBE	70-157399
74	CONNECTOR COVER	70-010304
75	LOCK PLATE	70-010303
76	PCB HEAT SINK	70-089359
80	SPACER	70-150435
88	PA SHIELD	70-089418
101	SCREW PLAX PAN HD M3 x 10	70-150138
106	SEMS M3 x 10	70-150180
107	SEMS M3 x 12	70-150151
109	FIXED SCREW (U/D ONLY)	70-151850
110	FIXED SCREW (T/M ONLY)	70-151874
111	SCREW BIND HD M3 x 8	70-150146
112	SCREW FLAT HD M3 x 8	70-150436
113	SCREW FLAT HD M3 x 10	70-150178
114	SCREW BIND HD M3 x 12	70-151839
115	SCREW BIND HD M3 x 10	70-150171
116	SEMS M3 x 8	70-150179
G01	TRX, LOGIC PCB	TR-1517
G02	MIC CONNECTOR PCB	CX-90
G03	DISPLAY PCB	CX-91
G04	OPERATE PCB	CX-92
G05	T/M ADAPTOR (HANDLE) PCB	Z-593
G07	PA PCB	PA-1554
SMALL REMOTE CONTROL HEADS ONLY:		
32	CONT CASE ASSY	70-010290
33	CONT CHASSIS	70-010287
34	CONT COVER	70-010288
35	CONT BRACKET	70-158329
36	COIN SCREW	70-150130
37	WASHER	70-151383
38	WASHER	70-150135
105	SCREW SEMS PAN HD M2 x 14	70-150191
G06	T/M ADAPTOR	Z-594

TR-1517 BOARD

70-1395/1495 TR-1517 Assembly, A-Band, USE "A"
70-1395/1495 TR-1517 Assembly, B-Band, USE "B"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C102	47 pF, 50 V, CER	70-138344
C103	1000 pF, 50 V, CER	70-138170
C104	100 pF, 50 V, CER	70-138345
C106	22 pF, 50 V, CER	70-138171
C107	27 pF, 50 V, CER	70-138165
C108	0.022 uF, 25 V, CER	70-138162
C109	1000 pF, 50 V, CER	70-138170
C110	10 pF, 50 V, CER	70-138167
C111	0.022 uF, 25 V, CER	70-138162
C112	0.022 uF, 50 V, CER	70-138162
C113	47 pF, 50 V, CER	70-138344
C114	47 pF, 50 V, CER	70-138344
C115	1000 pF, 50 V, CER	70-138170
C116	0.022 uF, 25 V, CER	70-138162
C117	120 pF, 50 V, CER	70-138303
C118	120 pF, 50 V, CER	70-138303
C119	1000 pF, 50 V, CER	70-138170
C122	1000 pF, 50 V, CER	70-138170
C131	0.022 uF, 25 V, CER	70-138162
C132	1000 pF, 50 V, CER	70-138170
C134 A	33 pF, 50 V, CER	70-138188
C134 B	27 pF, 50 V, CER	70-138165
C136	22 pF, 50 V, CER	70-138171
C137	22 pF, 50 V, CER	70-138171
C201 A	27 pF, 50 V, CER	70-138165
C201 B	33 pF, 50 V, CER	70-138188
C202 A	27 pF, 50 V, CER	70-138165
C202 B	22 pF, 50 V, CER	70-138171
C203 A	8 pF, 50 V, CER	70-138203
C203 B	8 pF, 50 V, CER	70-138210
C204 A	8 pF, 50 V, CER	70-138203
C204 B	8 pF, 50 V, CER	70-138210
C205 A	33 pF, 50 V, CER	70-138188
C205 B	39 pF, 50 V, CER	70-138233
C206 B	10 pF, 50 V, CER	70-138330
C208 A	15 pF, 50 V, CER	70-138205
C207 B	27 pF, 50 V, CER	70-138165
C207 A	39 pF, 50 V, CER	70-138233
C208 A	39 pF, 50 V, CER	70-138233
C208 B	33 pF, 50 V, CER	70-138188
C209 A	100 pF, 50 V, CER	70-138175
C209 B	82 pF, 50 V, CER	70-138250
C210 A	27 pF, 50 V, CER	70-138165
C210 B	22 pF, 50 V, CER	70-138171
C211 A	120 pF, 50 V, CER	70-138303
C211 B	100 pF, 50 V, CER	70-138175
C212 A	27 pF, 50 V, CER	70-138165
C212 B	22 pF, 50 V, CER	70-138171
C213 A	100 pF, 50 V, CER	70-138175
C213 B	82 pF, 50 V, CER	70-138250
C214 A	39 pF, 50 V, CER	70-138233
C214 B	27 pF, 50 V, CER	70-138165
C215	39 pF, 50 V, CER	70-138233
C216	0.022 UF, 25 V, CER	70-138162
C217	1000 pF, 50 V, CER	70-138170
C231	1000 pF, 50 V, CER	70-138170
C232 A	27 pF, 50 V, CER	70-138165
C232 B	33 pF, 50 V, CER	70-138188
C233	1000 pF, 50 V, CER	70-138170
C235	56 pF, 50 V, CER	70-138254
C237	15 pF, 50 V, CER	70-138205
C238	22 pF, 50 V, CER	70-138171
C239	0.022 uF, 25 V, CER	70-138162
C241	27 pF, 50 V, CER	70-138165
C242	27 pF, 50 V, CER	70-138165
C243	82 pF, 50 V, CER	70-138250
C244	330 pF, 50 V, CER	70-138228
C245	0.01 uF, 50 V, CER	70-138270
C246	10 pF, 50 V, CER	70-138346
C247	0.01 uF, 50 V, CER	70-138270
C248	12 pF, 50 V, CER	70-138347
C249	10 pF, 50 V, CER	70-138346
C250	8 pF, 50 V, CER	70-138203
C251	0.01 uF, 50 V, CER	70-138270

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C252	0.01 uF, 50 V, CER	70-138270
C253	0.01 uF, 50 V, CER	70-138270
C255	8 pF, 50 V, CER	70-138203
C256	6 pF, 50 V, CER	70-138210
C258	0.1 uF, 50 V, CER	70-138327
C259	0.1 uF, 50 V, CER	70-138327
C260	100 pF, 50 V, CER	70-138170
C261	0.02 uF, 50 V, CER	70-138270
C262	0.01 uF, 50 V, CER	70-138270
C263	120 uF, 16 V, AL, ELYC	70-135187
C264	1000 pF, 50 V, CER	70-138170
C265	4700 pF, 50 V, CER	70-138183
C266	0.01 uF, 50 V, CER	70-138270
C267	0.01 uF, 50 V, CER	70-138270
C268	0.022 uF, 25 V, CER	70-138162
C269	0.01 uF, 50 V, CER	70-138270
C270	0.022 uF, 25 V, CER	70-138162
C271	0.01 pF, 50 V, CER	70-138270
C272	1000 pF, 50 V, CER	70-138170
C273	0.047 pF, 50 V, CER	70-131298
C274	4700 pF, 50 V, CER	70-138183
C275	1.0 uF, 35 V, TA, ELYC	70-136087
C276	0.01 uF, 50 V, CER	70-138270
C277	1000 pF, 50 V, CER	70-138170
C278	1 uF, 50 V, AL, ELYC	70-135147
C283	47 uF, 25 V, AL, ELYC	70-135144
C284	0.01 uF, 50 V, CER	70-138270
C285	220 uF, 25 V, AL, ELYC	70-131300
C401	0.1 uF, 25 V, CER	70-138327
C403	220 pF, 50 V, CER	70-138178
C404	10 uF, 16 V, AL, ELYC	70-138191
C406	10 uF, 16 V, AL, ELYC	70-138191
C407	0.047 uF, 50 V, CER	70-131298
C408	1 uF, 50 V, AL, ELYC	70-138194
C409	220 uF, 16 V, AL, ELYC	70-135164
C410	220 uF, 16 V, AL, ELYC	70-135217
C411	0.022 uF, 50 V, CER	70-132033
C412	10 uF, 16 V, AL, ELYC	70-138191
C413	10 uF, 16 V, AL, ELYC	70-138191
C414	10 uF, 16 V, AL, ELYC	70-138191
C415	10 uF, 16 V, AL, ELYC	70-138191
C416	82 pF, 50 V, CER	70-138250
C417	0.01 uF, 50 V, CER	70-138270
C422	220 uF, 25 V, AL, ELYC	70-135166
C423	10 uF, 16 V, AL, ELYC	70-138191
C424	10 uF, 16 V, AL, ELYC	70-138191
C425	1000 pF, 50 V, CER	70-138170
C426	0.01 uF, 50 V, CER	70-138270
C428	0.1 uF, 25 V, CER	70-138327
C429	0.1 uF, 25 V, CER	70-138327
C430	0.1 uF, 25 V, CER	70-138327
C431	1 uF, 50 V, AL, ELYC	70-138194
C432	22 uF, 16 V, AL, ELYC	70-135220
C433	22 uF, 16 V, AL, ELYC	70-135220
C434	2200 uF, 25 V, AL, ELYC	70-135235
C436	220 uF, 10 V, AL, ELYC	70-135217
C438	0.1 uF, 50 V, CER	70-138444
C439	0.1 uF, 50 V, CER	70-138444
C443	0.01 uF, 50 V, CER	70-138270
C446	1000 pF, 50 V, CER	70-138170
C448	0.1 uF, 25 V, CER	70-138327
C449	4.7 uF, 16 V, TA, ELYC	70-138101
C450	1000 pF, 50 V, CER	70-138170
C451	82 pF, 50 V, CER	70-138250
C452	0.022 uF, 25 V, CER	70-138162
C457	220 pF, 50 V, CER	70-138178
C458	220 pF, 50 V, CER	70-138178
C461	10 uF, 16 V, AL, ELYC	70-138191
C462	10 uF, 16 V, AL, ELYC	70-138191
C465	100 pF, 50 V, CER	70-138175
C466	220 pF, 50 V, CER	70-138178
C467	0.1 uF, 25 V, CER	70-138327
C468	4.7 uF, 35 V, TA, ELYC	70-136088
C523	1000 pF, 50 V, CER	70-138170

TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C528	0.1 uF, 25 V, CER	70-138327
C529	0.022 uF, 25 V, CER	70-138162
C542	1000 pF, 50 V, CER	70-138170
C547	1000 pF, 50 V, CER	70-136073
C548	1000 pF, 50 V, CER	70-138170
C549	1000 pF, 50 V, CER	70-138170
C550	1000 pF, 50 V, CER	70-138170
C561	10 uF, 25 V, AL, ELYC	70-135173
C570	2200 pF, 25 V, CER	70-135235
C701	47 uF, 16 V, AL, ELYC	70-135219
C702	0.022 uF, 25 V, CER	70-138162
C703	1000 pF, 50 V, CER	70-138170
C711	1000 pF, 50 V, CER	70-138170
C712 A	27 pF, 50 V, CER	70-138185
C712 B	22 pF, 50 V, CER	70-138171
C713 A	4 pF, 50 V, CER	70-138179
C713 B	8 pF, 50 V, CER	70-138210
C714 A	2200 pF, 50 V, CER	70-138195
C714 B	1000 pF, 50 V, CER	70-138170
C715	2 pF, 50 V, CER	70-138169
C716	15 pF, 50 V, CER	70-138205
C717	1000 pF, 50 V, CER	70-138170
C718	1000 pF, 50 V, CER	70-138170
C719 A	15 pF, 50 V, CER	70-138205
C719 B	10 pF, 50 V, CER	70-138187
C720 A	15 pF, 50 V, CER	70-138205
C720 B	10 pF, 50 V, CER	70-138187
C721	2 pF, 50 V, CER	70-138169
C722	1000 pF, 50 V, CER	70-138170
C723	0.022 uF, 25 V, CER	70-138162
C724	0.022 uF, 25 V, CER	70-138162
C725	1000 pF, 50 V, CER	70-138170
C726	1000 pF, 50 V, CER	70-138170
C727	10 pF, 50 V, CER	70-138187
C729	22 pF, 50 V, CER	70-138171
C730	100 pF, 50 V, CER	70-138175
C731	1000 pF, 50 V, CER	70-138167
C732	39 pF, 50 V, CER	70-138233
C733 A	1 pF, 50 V, CER	70-138174
C733 B	4 pF, 50 V, CER	70-138179
C734	180 pF, 50 V, CER	70-138230
C735 A	4 pF, 50 V, CER	70-138179
C735 B	2 pF, 50 V, CER	70-138169
C736 A	15 pF, 50 V, CER	70-138205
C736 B	22 pF, 50 V, CER	70-138171
C737	1000 pF, 50 V, CER	70-138170
C738	1000 pF, 50 V, CER	70-138170
C739 A	15 pF, 50 V, CER	70-138205
C739 B	10 pF, 50 V, CER	70-138330
C740 A	15 pF, 50 V, CER	70-138205
C740 B	10 pF, 50 V, CER	70-138187
C741	2 pF, 50 V, CER	70-138169
C742	0.022 uF, 25 V, CER	70-138162
C743	1000 pF, 50 V, CER	70-138170
C744	0.022 uF, 35 V, CER	70-138162
C745	1000 pF, 50 V, CER	70-138170
C746	1000 pF, 50 V, CER	70-138170
C747	6 pF, 50 V, CER	70-138210
C748	22 pF, 50 V, CER	70-138171
C750	100 pF, 50 V, CER	70-138175
C751	3 pF, 50 V, CER	70-138184
C752	18 pF, 50 V, CER	70-138206
C753	1000 pF, 50 V, CER	70-138170
C754 A	20 pF, 50 V, CER	70-138401
C754 B	18 pF, 50 V, CER	70-138206
C755	1000 pF, 50 V, CER	70-138170
C756	3 pF, 50 V, CER	70-138184
C758	2 pF, 50 V, CER	70-138175
C759	2 pF, 50 V, CER	70-138175
C760	1000 pF, 50 V, CER	70-138170
C761	1000 pF, 50 V, CER	70-138170
C762 A	4 pF, 50 V, CER	70-138179
C762 B	2 pF, 50 V, CER	70-138175
C763	4 pF, 50 V, CER	70-138179
C765	1000 pF, 50 V, CER	70-138170
C766	1000 pF, 50 V, CER	70-138170
C767	1000 pF, 50 V, CER	70-138170
C768	2 pF, 50 V, CER	70-138169
C769 A	39 pF, 50 V, CER	70-138233

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C769 B	27 pF, 50 V, CER	70-138185
C770 A	4 pF, 50 V, CER	70-138179
C770 B	3 pF, 50 V, CER	70-138184
C771	0.022 uF, 25 V, CER	70-138162
C772	0.1 uF, 25 V, CER	70-138327
C773	4 pF, 50 V, CER	70-138179
C775	0.022 uF, 25 V, CER	70-138162
C776	47 uF, 25 V, AL, ELYC	70-135144
C777	1000 pF, 50 V, CER	70-138170
C778	0.022 uF, 25 V, CER	70-138162
C779	0.1 uF, 50 V, PLAS	70-138189
C781	1000 pF, 50 V, CER	70-138170
C782	1 uF, 63 V, FILM	70-137101
C783	0.022 uF, 25 V, CER	70-138162
C784	0.1 uF, 50 V, PLAS	70-138189
C785	0.022 uF, 25 V, CER	70-138162
C787	1000 pF, 50 V, CER	70-138170
C788	1000 pF, 50 V, CER	70-138170
C789 A	10 pF, 50 V, CER	70-138187
C789 B	5 pF, 50 V, CER	70-138186
C921	0.022 uF, 50 V, CER	70-138162
C923	1000 pF, 50 V, CER	70-138170
C925	0.01 uF, 50 V, CER	70-138270
C926	1000 pF, 50 V, CER	70-138170
C927	1000 pF, 50 V, CER	70-138170
C928	1000 pF, 50 V, CER	70-138170
C929	22 pF, 50 V, CER	70-138171
C930	47 pF, 50 V, CER	70-138344
C931	10 uF, 16 V, AL, ELYC	70-138191
C932	10 uF, 16 V, AL, ELYC	70-138191
C933	1000 pF, 50 V, CER	70-138170
C935	0.022 uF, 50 V, CER	70-138162
C936	0.01 uF, 50 V, CER	70-138270
	DIODES	
D101	KV1430TR01-34 (F3)	70-085312
D102	KV1430TR01-34 (F3)	70-085312
D201	DCC010-TA	70-085313
D202	ND487C2-3R	70-085228
D241	DCA010-TA	70-085250
D242	MA3068-M TW	70-085273
D243	HSM88S	70-085154
D244	DCA010-TA	70-085250
D401	IMN10	70-085314
D505	RM4AM	70-085157
D701	DCA010-TA	70-085250
D702	DCA010-TA	70-085250
D711	KV1430TR01-34 (F3)	70-085312
D713	MA704A	70-085247
D731	KV1430TR01-34 (F3)	70-085312
D733	MA704A	70-085247
D734	1SV168	70-085159
D735	1SV168	70-085159
D771	DCB010-TA	70-085245
D901	DCB010-TA	70-085245
D902	DCA010	70-085250
D903	HZM5B	70-085253
D904	DCA010	70-085250
D905	DWA010-TF	70-085248
	FILTERS	
FL241	45N14BA 45.000 MHz	70-179091
FL242	45N14BA 45.000 MHz	70-179091
FL243	CFU455E2	70-179019
FL244	CFU455D2	70-179018
	INTEGRATED CIRCUITS	
IC241	MC3361P	70-076454
IC401	uPC2409HF	70-076778
IC402	HA17805W	70-076567
IC404	MC144111P	70-076568
IC405	BA728F	70-076569
IC406	TDA7240AV	70-076570
IC408	AN5262	70-076571

TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	INTEGRATED CIRCUITS (CONTINUED)	
IC409	AN5262	70-076571
IC411	BA14741AF	70-076628
IC412	F188A3120	70-076208
IC771	MB1504-TF (SOP)	70-076572
IC772	BU4066BF-T1	70-076573
IC801	M37451M4-406SP	70-076831
IC802	MN1280R	70-076575
IC803	M6M80021L	70-076576
	JACKS	
J401	IL-S-14P-S2T2-EF	70-159558
J402	PS-10PE-D4T1-B1	70-159428
J403	53029-0810	70-159559
J404	IL-Y-4P-S15T2-EF	70-159560
J407	IL-Y-12P-S15T2-EF	70-159561
J408	IL-Y-13P-S15T2-EF	70-159562
J409	JMI6LS-10BAT	70-159563
J410	IL-Y-10P-S15T2-EF	70-159564
J411	IL-S-15P-S2T2-EF	70-159425
J413	EMCS0552M	70-159093
J414	IL-G-2P-S3T2-EF	70-159565
J415	8-PIN CABLE ASSEMBLY	70-034742
J420	IL-Y-4P-S15T2-EF	70-159560
J511	JACK A	70-159510
J513	JACK V	70-159069
	JUMPERS	
JP1	0 OHM, 1/10 W, MET	70-144106
JP2	0 OHM, 1/10 W, MET	70-144106
JP3	0 OHM, 1/10 W, MET	70-144106
JP6	0 OHM, 1/10 W, MET	70-144106
JP7	0 OHM, 1/10 W, MET	70-144106
JP8	0 OHM, 1/10 W, MET	70-144106
JP9	0 OHM, 1/10 W, MET	70-144106
JP11	0 OHM, 1/10 W, MET	70-144106
JP12	0 OHM, 1/10 W, MET	70-144106
	COILS	
L101	42L-060	70-090482
L132	LQN2AR22K	70-090483
L133	LQN2A47NM	70-090484
L201	L-1S7-M1 4.5T	70-090485
L202	L-1S7-M1 4.5T	70-090485
L203	L-1S7-M1 4.5T	70-090485
L204	L-1S7-M1 4.5T	70-090485
L205	L-1S7-M1 4.5T	70-090485
L206	L-1S7-M1 4.5T	70-090485
L208	ELESN4R7KA	70-090486
L209	17L004	70-090114
L210	17L004	70-090114
L231	LQN2AR22K	70-090483
L232	LQN2A22NM	70-090412
L233	LQN2A22NM	70-090412
L241	ELESNR47MA	70-090488
L242	ELESNR47MA	70-090488
L243	ELESNR22MA	70-090489
L244	ELESN4R7KA	70-090486
L245	24L113	70-090470
L246	42L061	70-090471
L247	24L116	70-090472
L248	24L115	70-090473
L249	TLE0205	70-090486
L250	41L001	70-090423
L251	ELESN102KA	70-090474
L252	TLE0205	70-090486
L253	ELESN331KA	70-090476
L255	TLE0205	70-090486
L256	ELESN4R7KA	70-090486
L401	1.0 MH	70-178057
L402	TLE0205	70-090486
L521	ELESN 1R0	70-090480
L525	TLB0021	70-090560
L526	BL01RN-A62	70-090482
L527	BL01RN-A62	70-090482
L528	BL01RN-A62	70-090482

REF NO.	DESCRIPTION	PART NO.
	COILS (CONTINUED)	
L530	TLB0021	70-090560
L701	IL-S-2P-S2T2-EF	70-159399
L711	LQH3N242M02M00=100	70-090477
L712	LQH3N242M02M00=100	70-090477
L713 A	L=157=M1 2.5 T(VSF)	70-090534
L713 B	L=157=M1 2.5 T	70-090501
L714	LQH3N242M02M00=100	70-090477
L715	LQH3N242M02M00=100	70-090477
L716	LQN2AR22K	70-090483
L717	LQN2A22NM	70-090412
L719	LQN2A22NM	70-090412
L720	LQN2A22NM R22K	70-090483
L721	LQN2A47NM	70-090484
L731	LQH3N242M02M00=100	70-090477
L732	LQH3N242M02M00=100	70-090477
L733 A	L=157=M1 3.5 T(VSF)	70-090523
L733 B	L=157=M1 3.5 T	70-090522
L734	LQH3N242M02M00=100	70-090477
L735 A	LQN2AR22K	70-090483
L735 B	LQH3N242M02M00=100	70-090477
L736	LQN2A22K	70-090483
L737	LQN2A22NM	70-090412
L771	LQN2A22NM	70-090412
	TRANSISTORS	
Q101	2SC2620B-TR (QB)	70-080181
Q102	2SC2462C-TR (LC)	70-080288
Q131	2SC3357-T2	70-080298
Q201	2SC3356 T2	70-080192
Q203	2SC3357 T2	70-080298
Q241	2SK125	70-080089
Q242	2SK380E	70-080362
Q243	2SC2462C-TR	70-080288
Q244	2SC2462C-TR	70-080288
Q401	IMX2-T108 (X2)	70-080363
Q403	IMX2-T108 (X2)	70-080363
Q406	2SC2462	70-080288
Q408	2SK508	70-080181
Q409	2SC2462	70-080288
Q410	2SC2462	70-080288
Q504	2SB1065Q	70-080357
Q701	2SC2462C-TR (LC)	70-080288
Q702	IMB3-T110 (B3)	70-080364
Q703	IMH1-T1	70-080296
Q704	2SA1121SC	70-080339
Q705	DTC124EK	70-080300
Q711	3SK151GR-TE85L	70-080303
Q712	2SC2351-T2B R3	70-080218
Q731	3SK151GR-TE85L	70-080303
Q732	2SC2351-T2V R3	70-080218
Q733	2SC2351-T2V R3	70-080218
Q734	2SC2351-T2V R3	70-080218
Q771	IMD3-T1	70-080297
Q772	IMH1-T1	70-080296
Q773	2SC2462LC	70-080288
Q774	2SA1121C-TR	70-080159
Q775	2SA1121C-TR	70-080159
Q776	2SC2462LC	70-080288
Q778	IMH1	70-080296
	RESISTORS	
R101	47 kOHM, 1/10 W, MET	70-145145
R102	47 kOHM, 1/10 W, MET	70-145145
R103	47 kOHM, 1/10 W, MET	70-145145
R104	47 kOHM, 1/10 W, MET	70-145145
R107	1 kOHM, 1/4 W, MET	70-144268
R108	10 kOHM, 1/10 W, MET	70-144120
R109	4.7 kOHM, 1/10 W, MET	70-144123
R110	2.2 kOHM, 1/10 W, MET	70-144113
R111	1.5 kOHM, 1/10 W, MET	70-145133
R112	10 kOHM, 1/10 W, MET	70-144120
R113	4.7 kOHM, 1/10 W, MET	70-144123
R114	1 kOHM, 1/10 W, MET	70-144125
R115	100 OHM, 1/10 W, MET	70-145146
R116	100 OHM, 1/10 W, MET	70-145146
R117	220 OHM, 1/10 W, MET	70-144194

TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R116	10 kOHM, 1/10 W, MET	70-144120
R119	100 kOHM, 1/10 W, MET	70-145148
R120	100 kOHM, 1/10 W, MET	70-145148
R123	220 kOHM, 1/10 W, MET	70-145131
R124	47 kOHM, 1/10 W, MET	70-145145
R125	47 kOHM, 1/10 W, MET	70-145145
R131	10 OHM, 1/10 W, MET	70-144115
R132	470 OHM, 1/10 W, MET	70-144152
R133	10 kOHM, 1/10 W, MET	70-144120
R134	0 OHM, 1/10 W, MET	70-144106
R135	150 OHM, 1/10 W, MET	70-140321
R136	39 OHM, 1/10 W, MET	70-144124
R137	150 OHM, 1/10 W, MET	70-140321
R201	33 kOHM, 1/10 W, MET	70-144112
R202	8.2 kOHM, 1/10 W, MET	70-140305
R203	10 OHM, 1/10 W, MET	70-144115
R205	68 OHM, 1/10 W, MET	70-144114
R206	47 OHM, 1/10 W, MET	70-145130
R231	470 OHM, 1/10 W, MET	70-144130
R232	10 KOHM, 1/10 W, MET	70-144120
R233	0 OHM, 1/10 W, MET	70-144106
R234	22 OHM, 1/10 W, MET	70-144160
R235	270 OHM, 1/10 W, MET	70-144116
R236	18 OHM, 1/10 W, MET	70-144171
R237	270 OHM, 1/10 W, MET	70-144116
R241	47 OHM, 1/10 W, MET	70-145130
R242	220 OHM, 1/10 W, MET	70-144194
R243	3.3 kOHM, 1/10 W, MET	70-144118
R244	10 kOHM, 1/10 W, MET	70-144120
R245	330 OHM, 1/10 W, MET	70-144164
R246	3.9 kOHM, 1/10 W, MET	70-144132
R247	33 kOHM, 1/10 W, MET	70-144112
R248	22 kOHM, 1/10 W, MET	70-144121
R249	150 OHM, 1/10 W, MET	70-140321
R254	0 OHM, 1/10 W, MET	70-144106
R255	1.2 kOHM, 1/10 W, MET	70-144167
R256	82 kOHM, 1/10 W, MET	70-144173
R257	47 kOHM, 1/10 W, MET	70-145145
R258	220 kOHM, 1/10 W, MET	70-144131
R259	1 kOHM, 1/10 W, MET	70-144125
R260	5.6 kOHM, 1/10 W, MET	70-144168
R261	3.3 kOHM, 1/10 W, MET	70-144118
R262	82 kOHM, 1/10 W, MET	70-144173
R263	10 kOHM, 1/10 W, MET	70-144120
R264	27 kOHM, 1/10 W, MET	70-144163
R265	15 kOHM, 1/10 W, MET	70-144122
R266	47 kOHM, 1/10 W, MET	70-145145
R401	270 OHM, 1/4 W, MET	70-144193
R402	22 kOHM, 1/10 W, MET	70-144121
R404	33 kOHM, 1/10 W, MET	70-144112
R405	1 kOHM, 1/10 W, MET	70-144125
R406	100 kOHM, 1/10 W, MET	70-145128
R407	100 kOHM, 1/10 W, MET	70-145128
R408	100 kOHM, 1/10 W, MET	70-145128
R409	100 kOHM, 1/10 W, MET	70-145128
R410	33 kOHM, 1/10 W, MET	70-144112
R411	22 kOHM, 1/10 W, MET	70-144121
R412	10 kOHM, 1/10 W, MET	70-144120
R413	1 kOHM, 1/10 W, MET	70-144125
R414	15 kOHM, 1/10 W, MET	70-144122
R415	150 kOHM, 1/10 W, MET	70-144129
R416	68 kOHM, 1/10 W, MET	70-144119
R417	4.7 kOHM, 1/10 W, MET	70-144123
R418	100 kOHM, 1/10 W, MET	70-145146
R419	330 kOHM, 1/10 W, MET	70-140318
R421	22 kOHM, 1/10 W, MET	70-144121
R422	22 kOHM, 1/10 W, MET	70-144121
R423	100 kOHM, 1/10 W, MET	70-145128
R424	56 kOHM, 1/10 W, MET	70-144169
R425	12 kOHM, 1/10 W, MET	70-144111
R426	1 kOHM, 1/10 W, MET	70-144125
R427	4.7 kOHM, 1/10 W, MET	70-144123
R428	680 OHM, 1/10 W, MET	70-144157
R430	1 kOHM, 1/10 W, MET	70-144125
R431	1.5 kOHM, 1/10 W, MET	70-144134
R434	15 kOHM, 1/10 W, MET	70-144122
R435	10 kOHM, 1/10 W, MET	70-144120
R436 A	18 kOHM, 1/10 W, MET	70-144195
R436 B	22 kOHM, 1/10 W, MET	70-144121

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R437	10 kOHM, 1/10 W, MET	70-144120
R439	1 kOHM, 1/10 W, MET	70-144125
R440	150 kOHM, 1/10 W, MET	70-144287
R441	100 kOHM, 1/10 W, MET	70-144288
R442	1 kOHM, 1/10 W, MET	70-144289
R443	39 kOHM, 1/10 W, MET	70-144290
R444	82 kOHM, 1/10 W, MET	70-144291
R445	100 kOHM, 1/10 W, MET	70-145128
R446	2.2 kOHM, 1/10 W, MET	70-144113
R447	4.7 kOHM, 1/10 W, MET	70-144123
R448	10 kOHM, 1/10 W, MET	70-144120
R452	330 OHM, 1/10 W, MET	70-144164
R454	10 OHM, 1/10 W, MET	70-144115
R455	10 kOHM, 1/10 W, MET	70-144120
R456	10 kOHM, 1/10 W, MET	70-144120
R457	2.2 kOHM, 1/10 W, MET	70-144163
R458	330 OHM, 1/10 W, MET	70-144164
R461	1 kOHM, 1/10 W, MET	70-144125
R462	3.3 kOHM, 1/10 W, MET	70-144118
R463	560 kOHM, 1/10 W, MET	70-144130
R464	2.7 kOHM, 1/10 W, MET	70-144159
R465	100 kOHM, 1/10 W, MET	70-145128
R466	47 kOHM, 1/10 W, MET	70-145145
R467	47 kOHM, 1/10 W, MET	70-145145
R470	22 kOHM, 1/10 W, MET	70-144121
R471	0 OHM, 1/10 W, MET	70-144106
R472	22 kOHM, 1/10 W, MET	70-144121
R701	220 OHM, 1/10 W, MET	70-144194
R702	47 kOHM, 1/10 W, MET	70-145145
R704	47 kOHM, 1/10 W, MET	70-145145
R705	47 kOHM, 1/10 W, MET	70-145145
R706	47 kOHM, 1/10 W, MET	70-145145
R707	220 OHM, 1/10 W, MET	70-144194
R708	47 kOHM, 1/10 W, MET	70-144123
R711	47 OHM, 1/10 W, MET	70-145130
R712	1.8 kOHM, 1/10 W, MET	70-144158
R713	10 kOHM, 1/10 W, MET	70-144120
R714	22 kOHM, 1/10 W, MET	70-144121
R715	22 kOHM, 1/10 W, MET	70-144121
R716	22 kOHM, 1/10 W, MET	70-144121
R717	150 OHM, 1/10 W, MET	70-140321
R718	6.8 kOHM, 1/10 W, MET	70-145139
R719	2.2 kOHM, 1/10 W, MET	70-144113
R720	100 OHM, 1/10 W, MET	70-145148
R721	47 OHM, 1/10 W, MET	70-145130
R722	47 OHM, 1/10 W, MET	70-145130
R731	47 OHM, 1/10 W, MET	70-145130
R732	6.8 kOHM, 1/10 W, MET	70-145139
R733	10 kOHM, 1/10 W, MET	70-144120
R734	22 kOHM, 1/10 W, MET	70-144121
R735	22 kOHM, 1/10 W, MET	70-144121
R736 A	1 kOHM, 1/10 W, MET	70-144125
R736 B	22 kOHM, 1/10 W, MET	70-144121
R737	150 OHM, 1/10 W, MET	70-140321
R738	6.8 kOHM, 1/10 W, MET	70-145139
R739	2.2 kOHM, 1/10 W, MET	70-144113
R740	100 OHM, 1/10 W, MET	70-145148
R741	47 OHM, 1/10 W, MET	70-145130
R742	47 OHM, 1/10 W, MET	70-145130
R751	47 kOHM, 1/10 W, MET	70-145145
R752	47 kOHM, 1/10 W, MET	70-145145
R754	6.8 kOHM, 1/10 W, MET	70-145139
R755	2.2 kOHM, 1/10 W, MET	70-144113
R756	100 OHM, 1/10 W, MET	70-145148
R757	47 OHM, 1/10 W, MET	70-144113
R758	1 kOHM, 1/10 W, MET	70-144125
R759	3.3 kOHM, 1/10 W, MET	70-144118
R760	47 OHM,.1/10 W, MET	70-145130
R770	47 kOHM, 2 W, MET	70-141210
R771	100 kOHM, 1/10 W, MET	70-145128
R772	22 OHM, 1/10 W, MET	70-144160
R773	100 kOHM, 1/10 W, MET	70-145128
R774	1 kOHM, 1/10 W, MET	70-144125
R775	0 OHM, 1/10 W, MET	70-144106
R776	47 kOHM, 1/10 W, MET	70-145145
R777	4.7 kOHM, 1/10 W, MET	70-144123
R778	100 kOHM, 1/10 W, MET	70-144128
R779	22 kOHM, 1/10 W, MET	70-144121
R780	0 OHM, 1/10 W, MET	70-144106

TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R782	4.7 kOHM, 1/10 W, MET	70-144123
R783	47 kOHM, 1/10 W, MET	70-145145
R784	47 kOHM, 1/10 W, MET	70-145145
R785	100 kOHM, 1/10 W, MET	70-145128
R786	22 kOHM, 1/10 W, MET	70-144121
R787	100 OHM, 1/10 W, MET	70-145148
R788	22 OHM, 1/10 W, MET	70-144160
R789	4.7 kOHM, 1/10 W, MET	70-144123
R790	1 kOHM, 1/10 W, MET	70-144125
R791 A	2.2 kOHM, 1/10 W, MET	70-144113
R791 B	1.5 kOHM, 1/10 W, MET	70-144134
R792	4.7 kOHM, 1/10 W, MET	70-144123
R793	47 kOHM, 1/10 W, MET	70-145126
R794 A	1 kOHM, 1/10 W, MET	70-144125
R794 B	1.5 kOHM, 1/10 W, MET	70-144134
R795	47 kOHM, 1/10 W, MET	70-144145
R796	22 kOHM, 1/10 W, MET	70-144121
R797	5.6 kOHM, 1/10 W, MET	70-144168
R798	1 kOHM, 1/10 W, MET	70-144125
R799	2.7 kOHM, 1/10 W, MET	70-144159
R911	22 kOHM, 1/10 W, MET	70-144121
R912	22 kOHM, 1/10 W, MET	70-144121
R913	22 kOHM, 1/10 W, MET	70-144121
R914	22 kOHM, 1/10 W, MET	70-144121
R915	22 kOHM, 1/10 W, MET	70-144121
R916	22 kOHM, 1/10 W, MET	70-144121
R921	1 kOHM, 1/10 W, MET	70-144125
R922	1 kOHM, 1/10 W, MET	70-144125
R923	1 kOHM, 1/10 W, MET	70-144125
R924	1 kOHM, 1/10 W, MET	70-144125
R925	1 kOHM, 1/10 W, MET	70-144125
R926	1 kOHM, 1/10 W, MET	70-144125
R927	470 OHM, 1/10 W, MET	70-144152
R931	47 kOHM, 1/10 W, MET	70-145145
R932	47 kOHM, 1/10 W, MET	70-145145
R933	47 kOHM, 1/10 W, MET	70-145145
R935	22 kOHM, 1/10 W, MET	70-144121
R936	0 OHM, 1/10 W, MET	70-144106
R937	1 kOHM, 1/10 W, MET	70-144125
R945	1 kOHM, 1/10 W, MET	70-144125
R946	1 kOHM, 1/10 W, MET	70-144125
R947	1 kOHM, 1/10 W, MET	70-144125
R948	1 kOHM, 1/10 W, MET	70-144125
R949	1 kOHM, 1/10 W, MET	70-144125
R951	1 kOHM, 1/10 W, MET	70-144125
R952	1 kOHM, 1/10 W, MET	70-144125
R953	1 kOHM, 1/10 W, MET	70-144125
R954	1 kOHM, 1/10 W, MET	70-144125
R955	1 kOHM, 1/10 W, MET	70-144125
R956	1 kOHM, 1/10 W, MET	70-144125
R957	1 kOHM, 1/10 W, MET	70-144125
R958	0 OHM, 1/10 W, MET	70-144106
R959	10 kOHM, 1/10 W, MET	70-144120
R961	1 kOHM, 1/10 W, MET	70-144125

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R963	1 kOHM, 1/10 W, MET	70-144125
R964	22 kOHM, 1/10 W, MET	70-144121
R965	1 kOHM, 1/10 W, MET	70-144125
R966	10 kOHM, 1/10 W, MET	70-144120
R967	22 kOHM, 1/10 W, MET	70-144121
R968	10 kOHM, 1/10 W, MET	70-144120
R970	1 kOHM, 1/10 W, MET	70-144125
R971	2.2 kOHM, 1/10 W, MET	70-145113
R972	820 OHM, 1/10 W, MET	70-144165
R973	820 OHM, 1/10 W, MET	70-144165
R974	820 OHM, 1/10 W, MET	70-144165
R975 B	100 kOHM, 1/10 W, MET	70-145128
R978	100 kOHM, 1/10 W, MET	70-145128
R979	22 kOHM, 1/10 W, MET	70-144121
R980	10 kOHM, 1/10 W, MET	70-144120
R981	1 kOHM, 1/10 W, MET	70-144125
R982	1 kOHM, 1/10 W, MET	70-144125
R983	22 kOHM, 1/10 W, MET	70-144121
R984	1 kOHM, 1/10 W, MET	70-144125
R985	3.9 kOHM, 1/10 W, MET	70-145132
R986	4.7 kOHM, 1/10 W, MET	70-144123
R988	1 MOHM, 1/10 W, MET	70-144155
R989	1 kOHM, 1/10 W, MET	70-144125
R991	22 kOHM, 1/10 W, MET	70-144121
R992	10 kOHM, 1/10 W, MET	70-144120
R996	10 kOHM, 1/10 W, MET	70-144120
R997	100 kOHM, 1/10 W, MET	70-145128
R998	220 kOHM, 1/10 W, MET	70-147328
	VARIABLE RESISTORS	
RV241	RH062KCJ3 (2.2K)	70-184109
RV401	100K	70-184110
	MISCELLANEOUS	
	INSULATION PLATE	70-157357
	SHIELD CASE	70-089339
CA511	8: CABLE ASSEMBLY	70-034060
CA513	9" CABLE ASSEMBLY	70-034121
CB901	EXF P12 102ZF	70-086058
CB902	EXF P8 102ZF	70-086059
CM201	IL-S-2P-S2T2-EF	70-159398
CM701	IL-S-2P-S2T2-EF	70-159398
F501	FUSE, 5A	70-204062
RC901	EXBY 06D (47K, 1000p)	70-086060
RC902	EXBY 06 (10K, 1000p)	70-086061
X101	CRYSTAL, HC-431u 12.8 MHz	70-128097
X241	UM-1 44.545 MHz	70-128098
X901	XTAL, AT-51, 8.000 MHz	70-128099

PA-1554 BOARD

70-1395/1495 PA-1554 Assembly, A-Band — USE "A"
70-1395/1495 PA-1554 Assembly, B-Band — USE "B"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C501	39 pF, 50 V, CER	70-138233
C502	15 pF, 50 V, CER	70-138205
C503	1000 pF, 50 V, CER	70-138170
C504	1000 pF, 50 V, CER	70-138170
C506	33 uF, 16 V, AL, ELYC	70-135366
C506 A	100 pF, 50 V, CER	70-138175
C506 B	82 pF, 50 V, CER	70-138250
C507 A	33 pF, 50 V, CER	70-138188
C507 B	12 pF, 50 V, CER	70-138209
C508 A	33 pF, 50 V, CER	70-138188
C508 B	18 pF, 50 V, CER	70-138208
C510	1000 pF, 50 V, CER	70-138170
C511	100 pF, 50 V, CER	70-138175
C512	100 pF, 50 V, CER	70-138175
C513	33 pF, 50 V, CER	70-138188
C514	47 pF, 50 V, CER	70-138185
C515 A	1000 pF, 50 V, CER	70-132042
C515 B	1000 pF, CER	70-131397
C516 A	68 pF, 50 V, CER	70-138228
C516 B	47 pF, 50 V, CER	70-138185
C517 A	68 pF, 50 V, CER	70-138228
C517 B	47 pF, 50 V, CER	70-138185
C518	470 pF, 100 V, CER	70-138238
C519 A	15 pF, 50 V, CER	70-138205
C520 A	68 pF, 50 V, CER	70-138229
C521	15 uF, 25 V, AL, ELYC	70-135154
C522	100 pF, 50 V, CER	70-138175
C524	220 pF, 100 V, MICA	70-138112
C525	220 pF, 100 V, MICA	70-138112
C526	33 pF, 500 V, MICA	70-138083
C527 A	47 pF, 500 V, MICA	70-138114
C527 B	33 pF, 500 V, MICA	70-138083
C530	1000 pF, 50 V, CER	70-138170
C531	0.047 uF, 50 V, CER	70-138256
C532	220 uF, 25 V, AL, ELYC	70-131300
C533	0.047 uF, 50 V, CER	70-138256
C534	1000 pF, 50 V, CER	70-131222
C535	0.10 uF, 50 V, PLAS	70-138169
C536 B	62 pF, 500 V, MICA	70-138121
C537	47 pF, 500 V, MICA	70-138114
C538 A	82 pF, 500 V, MICA	70-138109
C538 B	56 pF, 500 V, MICA	70-138117
C539 B	62 pF, 500 V, MICA	70-138121
C540 A	39 pF, 100 V, MICA	70-138099
C541 A	47 pF, 100 V, MICA	70-138114
C541 B	62 pF, 500 V, MICA	70-138121
C543 A	82 pF, 100 V, MICA	70-138109
C543 B	10 pF, 500 V, MICA	70-023351
C546	10 uF, 50 V, AL, ELYC	70-135059
C551 A	100 pF, 100 V, MICA	70-138115
C551 B	62 pF, 500 V, MICA	70-138121
C552 A	62 pF, 500 V, MICA	70-138121
C552 B	27 pF, 500 V, MICA	70-138082
C553 A	62 pF, 500 V, MICA	70-138121
C553 B	27 pF, 500 V, MICA	70-138082
C554	220 pF, 100 V, MICA	70-138112
C555	220 pF, 100 V, MICA	70-138112
C556	220 pF, 100 V, MICA	70-138112
C557	220 pF, 100 V, MICA	70-138112
C558	33 pF, 500 V, MICA	70-138083
C563	1000 pF, 50 V, CER	70-131222
C564	1000 pF, 50 V, CER	70-136073
C566	1000 pF, 50 V, CER	70-131222
C567	1000 pF, 50 V, CER	70-136073
C568	1000 pF, 50 V, CER	70-138170
C569 A	22 pF, 100 V, MICA	70-138107
C572	10 pF, 50 V, MICA	70-135059
C573	10 pF, 50 V, MICA	70-135059
C574	91 pF, 500 V, MICA	70-138110
C575	91 pF, 500 V, MICA	70-138110
C576 A	100 pF, 500 V, MICA	70-138115
C576 B	56 pF, 500 V, MICA	70-138117
C577	1000 pF, 50 V, CER	70-131222
C578	1000 pF, 50 V, CER	70-131222

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C579 A	100 pF, 100 V, MICA	70-138115
C579 B	91 pF, 500 V, MICA	70-138110
C580 A	100 pF, 100 V, MICA	70-138115
C580 B	91 pF, 500 V, MICA	70-138110
C581	56 pF, 500 V, MICA	70-138117
C583	47 pF, 500 V, MICA	70-138114
C584 A	39 pF, 500 V, MICA	70-138099
C584 B	33 pF, 500 V, MICA	70-138083
C585 A	47 pF, 500 V, MICA	70-138114
C585 B	33 pF, 500 V, MICA	70-138083
C586 A	47 pF, 500 V, MICA	70-138114
C586 B	33 pF, 500 V, MICA	70-138083
C587	33 pF, 500 V, MICA	70-138083
C588	15 pF, 500 V, MICA	70-138080
C590	3 pF, 500 V, MICA	70-138126
C591	7 pF, 50 V, CER	70-138181
C592	1000 pF, 50 V, CER	70-138170
C593 A	15 pF, 50 V, CER	70-138205
C593 B	18 pF, 50 V, CER	70-138206
C594	1000 pF, 50 V, CER	70-138170
C595	1000 pF, 50 V, CER	70-138170
C596	1000 pF, 50 V, CER	70-138170
C597	1000 pF, 50 V, CER	70-138170
C600 A	4.7 uF, 16 V, AL, ELYC	70-138172
C601 A	1000 pF, 50 V, CER	70-138170
C602	33 pF, 50 V, CER	70-138134
C603	1000 pF, 50 V, CER	70-131222
C604	1000 pF, 50 V, CER	70-131222
C605 A	22 pF, 500 V, MICA	70-138107
C606	1000 pF, 50 V, CER	70-132042
	VARIABLE CAPACITORS	
CV503	2222-808-32409 (40 pF)	70-123024
CV504	2222-808-32409 (40 pF)	70-123024
CV505	2222-809-08003	70-123031
	DIODES	
D502	HSM88S	70-085154
D508	DCA010	70-085250
	FERRITE BEADS	
FB501 B	BF03-3.5 x 5 x 1.3	70-178088
FB502	BL02RN1-R62	70-090122
FB503 B	BL02RN1-R62	70-090122
FB504	BF03-3.5 x 5 x 1.3	70-178088
FB505	BL02RN1-R62	70-090122
FB506	BL02RN1-R62	70-090122
FB507 B	BL02RN1-R62	70-090122
	JACKS	
J501	JACK V	70-159089
J502	MR-DS2504E-01	70-159427
J503	JACK V	70-159089
	COILS	
L501	Z0.8C5D 1.5T	70-090097
L504 A	Z0.8C5D 1.5T	70-090097
L504 B	Z0.8C5D 2.5T	70-090098
L505 A	Z0.8C5D 0.5T	70-090180
L505 B	Z0.8C5D 1.5T	70-090097
L506 A	Z0.8C5D 0.5T	70-090180
L506 B	Z0.8C5D 2.5T	70-090098
L508	Z0.8C5D 1.5T	70-090097
L511	Z0.8C5D 6.5T	70-090131

PA-1554 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	COILS (CONTINUED)	
L512	Z1.2C5D 1.5T	70-090133
L513	Z1.2C5D 1.5T	70-090133
L514	Z0.8C5D 6.5T	70-090131
L515	Z1.2C5D 2.5T	70-090102
L516	Z1.2C5D 2.5T	70-090102
L517	Z1.2C5D 2.5T	70-090102
L518	Z1.2C5D 2.5T	70-090102
	TRANSISTORS	
Q501	2SC2538	70-080108
Q502	2SC2539	70-080090
Q503	2SC2630	70-080091
Q505	2SC2694	70-080133
Q507	2SC2694	70-080133
Q510	2SC2462LC	70-080160
	RESISTORS	
R501	150 OHM, 1/10 W, MET	70-140321
R502	2.2 kOHM, 1/10 W, MET	70-144113
R503	180 OHM, 1/10 W, MET	70-144221
R504	1.0 kOHM, 1/10 W, MET	70-144125
R505 A	COIL, BL02RN1-R62	70-090326
R505 B	33 OHM, 1/10 W, MET	70-142028

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R506	3.3 OHM, 1/10 W, MET	70-144048
R507	33 OHM, 2 W, MET	70-145143
R508	3.3 OHM, 1 W, MET	70-144048
R509	3.3 OHM, 1 W, MET	70-144048
R510	10 OHM, 2 W, MET	70-144082
R511	150 OHM, 1/10 W, MET	70-140321
R512	470 OHM, 1/10 W, MET	70-144156
R513	1.8 kOHM, 1/10 W, MET	70-144154
R519	10 OHM, 2 W, MET	70-145131
R521	100 OHM, 1/10 W, MET	70-145128
R522	100 OHM, 1/10 W, MET	70-145128
R524	1 kOHM, 1/10 W, MET	70-144125
R525 A	2.2 OHM, 2 W, MET	70-145050
R525 B	4.7 OHM, 2 W, MET	70-144043
R526	2.2 OHM, 2 W, MET	70-144202
R527	56 OHM, 2 W, CARBON	70-141217
R530 A	33 OHM, 1 W, MET	70-142028
R537 A	47 OHM, 1/10 W, MET	70-144006
R537 B	22 OHM, 1/10 W, MET	70-144074
R538 A	47 OHM, 1/10 W, MET	70-144006
R539 B	22 OHM, 1/8 W, MET	70-144074
R539 B	22 OHM, 1/8 W, MET	70-144074
	MISCELLANEOUS	
	CORE, Q5B RID 7.5 x 7 x 13	70-178075
	CABLE 1-350345-0	70-034319

Z-593 TRUNK-MOUNT ADAPTOR

70-1395/1495 A BAND USE "A"
70-1395/1495 B BAND USE "B"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C311	0.01 uF, 50 V, CER	70-138270
C312	0.01 uF, 50 V, CER	70-138270
C313	0.01 uF, 50 V, CER	70-138270
C314	0.01 uF, 50 V, CER	70-138270
C316	0.01 uF, 50 V, CER	70-138270
C317	0.01 uF, 50 V, CER	70-138270
C318	0.01 uF, 50 V, CER	70-138270
C319	0.01 uF, 50 V, CER	70-138270
C321	0.01 uF, 50 V, CER	70-138270
C322	0.01 uF, 50 V, CER	70-138270
C326	4.7 uF, 50 V, CER	70-138068
	CABLE ASSEMBLIES	
CA311	IL-YB-14P-IL-S-14S	70-034627
CA312	IL-3-2P-IL-G-2S	70-034626
CA313	ILJ2P-EMCHUM0201W	70-034625
CA316	IL-YE-15P-IL-S-15S	70-034598
	DIODES	
D311	DCB010	70-085323

REF NO.	DESCRIPTION	PART NO.
	CONNECTORS	
J311	D3431	70-159582
	JUMPERS	
JP311	0 OHM, 1/10 W, MET	70-144106
JP312	0 OHM, 1/10 W, MET	70-144106
JP313	0 OHM, 1/10 W, MET	70-144106
JP316	0 OHM, 1/10 W, MET	70-144106
JP317	0 OHM, 1/10 W, MET	70-144106
JP318	0 OHM, 1/10 W, MET	70-144106
JP319	0 OHM, 1/10 W, MET	70-144106
JP321	0 OHM, 1/10 W, MET	70-144106
JP322	0 OHM, 1/10 W, MET	70-144106
JP323	0 OHM, 1/10 W, MET	70-144106
JP324	0 OHM, 1/10 W, MET	70-144106
	SWITCHES	
K311	RELAY AGP9003	70-105022

CONTROL HEAD

70-1395/1495 A BAND USE "A"
70-1395/1495 B BAND USE "B"

REF NO.	DESCRIPTION	PART NO.
	CABLE ASSEMBLIES	
CA301	SMV 2d 15x21	70-034820
CA302	SMV 2d 3x83	70-034821
CA303-1	ILYB-15P-ILS 15S	70-034822
CA303-2	ILYB-14P-ILS 14S	70-034823
CA304	ILG 2S-5307	70-034824
	CX-90 BOARD	
	CAPACITORS	
C305	1000 pF, 50 V, CER	70-138170
C306	1000 pF, 50 V, CER	70-138170
	JACKS	
J301	NS1504L	70-159100
	CX-91 BOARD	
	CAPACITORS	
C301	0.01 uF, 50 V, CER	70-138270
C302	1000 pF, 50 V, CER	70-138170
C303	0.01 uF, 50 V, CER	70-138270
C304	1 uF, 50 V, AL ELYC	70-138194
	DIODES	
D301	LED LB 402	70-202066
D302	SLM-245 LMW TE84L	70-085316
D303	SLM-125MT TE84L	70-085317
D304	SLM-125MT TE84L	70-085317
D305	SLM-125MT TE84L	70-085317
D306	SLM-125MT TE84L	70-085317
	INTEGRATED CIRCUITS	
IC301	AN6997K	70-076577
IC302	BU74HC174F-T1	70-076578
	TRANSISTORS	
Q301	2SA1121C-TR	70-080339
Q302	IMH1-T1	70-080296
Q303	IMH1-T1	70-080296
	RESISTORS	
R301	680 OHM, 1/10 W, MET	70-144157
R303	270 OHM, 1/10 W, MET	70-144116
R304	270 OHM, 1/10 W, MET	70-144116
R305	270 OHM, 1/10 W, MET	70-144116
R306	270 OHM, 1/10 W, MET	70-144116
R308	330 kOHM, 1/10 W, MET	70-140318
R309	47 kOHM, 1/10 W, MET	70-145145
R310	47 kOHM, 1/10 W, MET	70-145145
R311	47 kOHM, 1/10 W, MET	70-145145
R312	220 kOHM, 1/10 W, MET	70-144131
R313	33 kOHM, 1/10 W, MET	70-144112
	JUMPERS	
JP301	0 OHM, 1/10 W, MET	70-144106
JP302	0 OHM, 1/10 W, MET	70-144106
JP303	0 OHM, 1/10 W, MET	70-144106
JP304	0 OHM, 1/10 W, MET	70-144106
JP306	0 OHM, 1/10 W, MET	70-144106
JP307	0 OHM, 1/10 W, MET	70-144106
JP308	0 OHM, 1/10 W, MET	70-144106
JP309	0 OHM, 1/10 W, MET	70-144106
JP310	0 OHM, 1/10 W, MET	70-144106

REF NO.	DESCRIPTION	PART NO.
	CX-91 BOARD (CONTINUED)	
	SWITCHES	
S301	ESB-64803	70-183080
S302	ESB-64803	70-183080
S303	ESB-64803	70-183080
S304	ESB-64803	70-183080
	MISCELLANEOUS	
CD301	PHOTO SENSOR P1201	70-085054
	CX-92 BOARD	
	CAPACITORS	
C307 (UD)	470 uF, 25 V, AL, ELYC	70-135237
	RESISTORS	
R314	150 OHM, 1/8 W, MET	70-144011
R316	150 OHM, 1/8 W, MET	70-144011
R317	330 OHM, 1/8 W, MET	70-144184
R318	330 OHM, 1/8 W, MET	70-144184
	VARIABLE RESISTORS	
RV301	K1214005L (10KB)	70-160025
RV302	K1214105G (10KB)	70-160026
	SWITCHES	
S305	SRBU1C L-15MM	70-183094
	JACKS	
J304	IL-G-2P-S3T2-EF	70-159565
	MISCELLANEOUS	
SP301 UD	SPEAKER	70-060033
	Z-594	
	CAPACITORS	
C331 TM	1000 pF, 50 V, CER	70-138255
	CABLE ASSEMBLIES	
CA324 TM	1292R L=120	70-034830
	JACKS	
J321 TM	D3431	70-159593
J322 TM	IL-S-15P-S2T2-EF	70-159425
J323 TM	IL-S-14P-S2T2-EF	70-159558
J324 TM		
J325 TM		
	JUMPERS	
JP331 TM	0 OHM, 1/10 W, MET	70-144105
JP332 TM	0 OHM, 1/10 W, MET	70-144105
JP333 TM	0 OHM, 1/10 W, MET	70-144105
JP334 TM	0 OHM, 1/10 W, MET	70-144105

70-2157 CTCSS FILTER BOARD

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C1	6.8 uF, 10 V, AL, ELYC	70-135256
C2	680 pF, 50 V, CER	70-138252
C4	6.8 uF, 10 V, AL, ELYC	70-135256
C5	0.1 uF, 25 V, CER	70-138327
C6	6.8 uF, 10 V, AL, ELYC	70-135256
C7	1 uF, 50 V, CER	70-135257
C8	0.022 uF, 25 V, CER	70-138182
C9	1500 pF, 50 V, CER	70-138204
C10	1500 pF, 50 V, CER	70-138204
C50	0.01 uF, 50 V, CER	70-138270
C51	0.01 uF, 25 V, PLAS	70-137102
C52	0.01 uF, 25 V, PLAS	70-137102
C53	0.01 uF, 25 V, PLAS	70-137102
C54	0.01 uF, 25 V, PLAS	70-137102
C55	0.01 uF, 25 V, PLAS	70-137102
C56	0.01 uF, 25 V, PLAS	70-137102
C57	0.01 uF, 25 V, PLAS	70-137102
C58	0.01 uF, 25 V, PLAS	70-137102
C59	1 uF, 50 V, AL, ELYC	70-135257
C60	0.01 uF, 50 V, CER	70-138270
C61	0.01 uF, 50 V, CER	70-138270
C62	6.8 uF, 10 V, AL, ELYC	70-135256
	INTEGRATED CIRCUITS	
IC1	MF6CWM-50-14W	70-076811
IC2	BU4066BF	70-076573
IC50	BA10324F	70-076812
	TRANSISTORS	
Q1	2SC2462C	70-080288
Q2	2SC2462C	70-080288
	RESISTORS	
R1	10 kOHM, 1/10 W, MET	70-144120
R2	12 kOHM, 1/10 W, MET	70-144111
R3	10 kOHM, 1/10 W, MET	70-144120
R4	100 kOHM, 1/10 W, MET	70-145128
R5	100 kOHM, 1/10 W, MET	70-145128
R6	150 kOHM, 1/10 W, MET	70-144129
R7	120 kOHM, 1/10 W, MET	70-144310
R9	1 kOHM, 1/10 W, MET	70-144125
R10	27 kOHM, 1/10 W, MET	70-144163
R11	470 kOHM, 1/10 W, MET	70-144199
R12	2.2 kOHM, 1/10 W, MET	70-144113
R13	22 kOHM, 1/10 W, MET	70-144121
R14	3.3 kOHM, 1/10 W, MET	70-144118
R15	1 kOHM, 1/10 W, MET	70-144125
R16	1 kOHM, 1/10 W, MET	70-144125
R17	39 kOHM, 1/10 W, MET	70-144196
R18	22 kOHM, 1/10 W, MET	70-144121
R20	100 kOHM, 1/10 W, MET	70-145128
R50	820 OHM, 1/10 W, MET	70-144165
R51	24 kOHM, 1/10 W, MET	70-144306
R52	0 OHM, 1/10 W, MET	70-144105
R53	27 kOHM, 1/10 W, MET	70-144163
R54	4.3 kOHM, 1/10 W, MET	70-144307
R55	560 kOHM, 1/10 W, MET	70-144308
R56	18 kOHM, 1/10 W, MET	70-144185
R57	56 kOHM, 1/10 W, MET	70-144169
R58	12 kOHM, 1/10 W, MET	70-144111
R59	150 kOHM, 1/10 W, MET	70-144129
R60	270 OHM, 1/10 W, MET	70-144116
R61	180 kOHM, 1/10 W, MET	70-144309
R62	100 kOHM, 1/10 W, MET	70-145128
	VARIABLE RESISTORS	
RV1	50 kOHM	70-164158
	MISCELLANEOUS	
	SCREW BIND HD M26 x 8	70-150169
P403	CONNECTOR 5513-8CPB	70-156567

REPLACEMENT PARTS ORDERING

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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