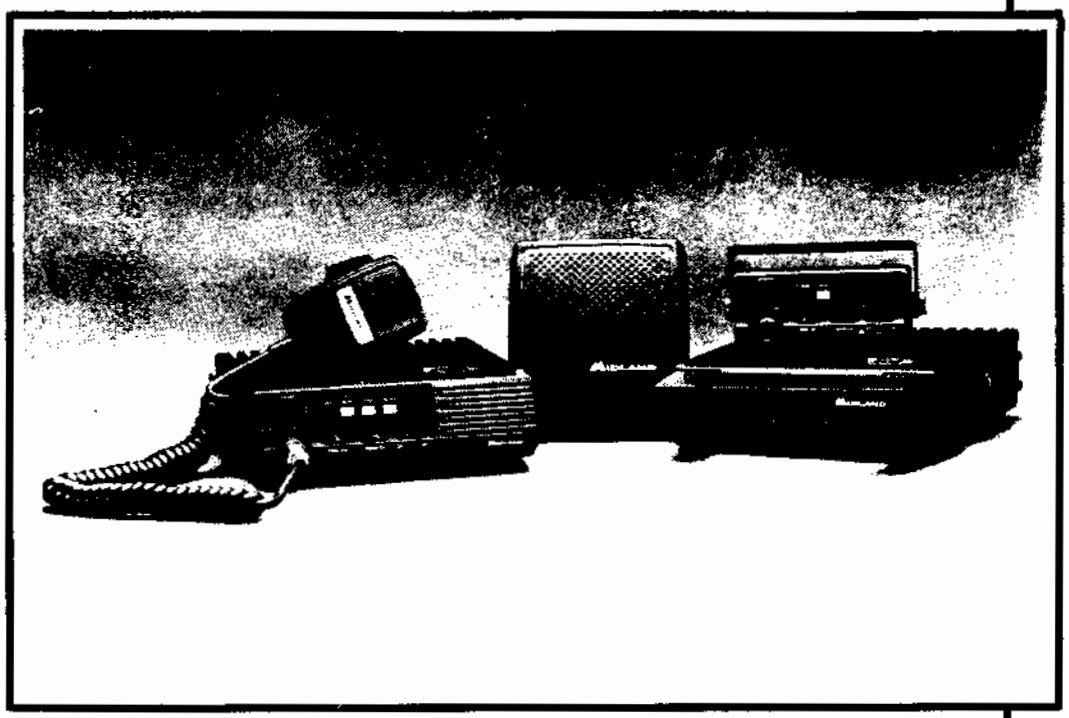
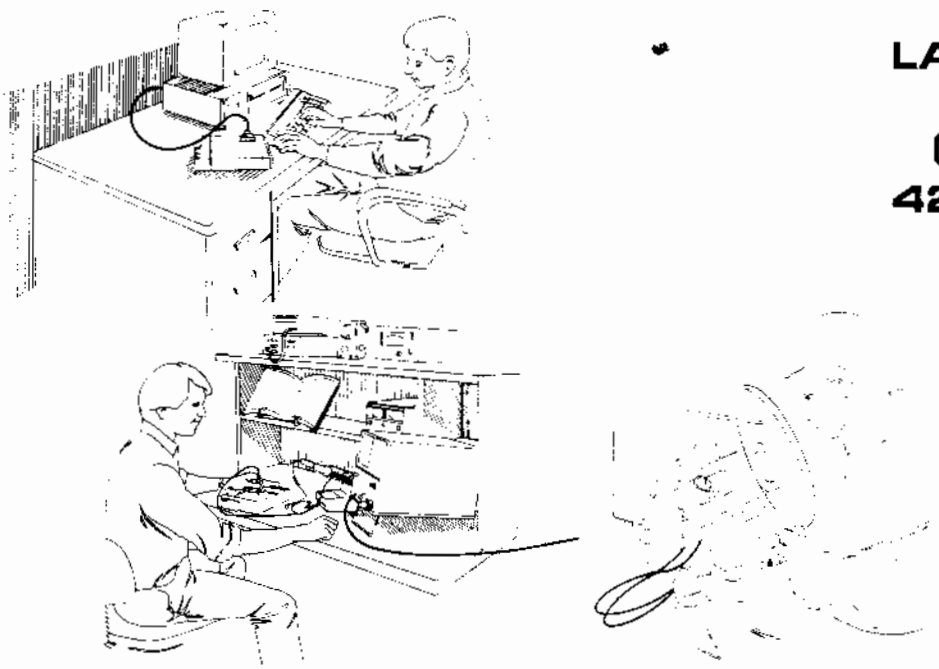
MIDLAND LMR
LAND MOBILE RADIO



SERVICE MANUAL
70-0351A/B/C AND 70-0355A/B/C

FM TWO-WAY
LAND MOBILE RADIO
VHF LOW BAND
(29.7 - 36 MHz/36 - 42 MHz/42 - 50 MHz)
60 WATT



MANUAL NO. 70-351355
09-0351/0355-SM-7/91-2M

This user's manual is designed to facilitate the set-up and service of the MIDLAND 70-0351/0355 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 production by model and serial number. Printed on YELLOW paper.
Manual Correction (MC)	For correcting literature errors not related to production changes. Printed on GREEN paper.
Technical Bulletin (TB)	For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Comments or suggestions concerning areas of manual improvement are welcome.

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SECTION 1

GENERAL INFORMATION

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DESCRIPTION

The 70-0351/0355 MIDLAND SYN-TECH XTR transceivers are programmable frequency-synthesized two-way FM mobile radios that operate in the low-band VHF frequency range. They are programmable for up to 22 channels, or up to 99 channels with plug-in option.

The 70-0351/0355 are designed to operate within one of three frequency ranges: 29.7—36 MHz (A-Band), 36—42 MHz (B-Band), or 42—50 MHz (C-Band). Transmit RF power is programmable for 2—60 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 70-0351), 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 70-0355). If the 70-0351 is purchased, the XTR is shipped with the Control Panel attached. If the 70-0355 is purchased, the XTR is shipped with a cable-interface board and handle assembly mounted in place of the Control Head on the transceiver, and a separate Control Head. The two units must be connected together with a multi-conductor 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: 29.7—36 MHz
B-Band: 36—42 MHZ
C-Band: 42—50 MHZ

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

CHANNEL SPACING: 20 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: 13.6 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 full rated audio): 1.0 A (approx.)
Transmit (full power): 10.0 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 Procedure 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 8.86 in (57 x 196 x 225 mm)
Trunk-mount: 2.25 x 7.75 x 9.65 in (57 x 196 x 245 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: 5.7 lb (2.6 kg)
Trunk-mount: 6.1 lb (2.8 kg)

TRANSMITTER

RF POWER OUTPUT (programmable): 2—60 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:
A-Band: 6.3 MHz
B-Band: 6 MHz
C-Band: 8 MHz

SPURIOUS & HARMONICS: −63 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:
A-Band: 6.3 MHz
B-Band: 6 MHz
C-Band: 8 MHz

ACCEPTABLE RADIO FREQ. DISPLACEMENT: ±2.0 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
70-2163	2nd IF Reverse Injection Kit
70-2963-1	MIL 810 C/D dust/rain/salt fog Kit (T/M Control Head only)
70-2963-2	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 2413A Interface Board)
70-2412A	Rolling Code Variable Split Band Scrambler (Requires 2413A Interface Board)
70-2413A	Interface Board
70-2415	2 Tone Sequential Decoder
70-2416	Private Squelch
70-2418	Burst Tone Encoder
70-2419	Reverse Burst Generator
70-2420A	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-K33-1)
70-2104A	DTMF Microphone with Up-Down Channel Switch and ANI w/ 6 Pin Jack Kit (70-K33-1)
70-2305B	Dynamic Base Station Microphone (w/70-K33-1)
70-2311	Telephone Handset (70-K37 required)
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 the 70-1489 PC Programming software.

• 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 13.6 V DC power to J415.
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 ±100 Hz of channel frequency using the programmer. Refer to the appropriate manual for details.
7. RF output power is adjustable through the 70-1080A programmer. Initiate transmit on any channel. Measure power of RF output at 50-Ω Antenna Conntector J501 and, if needed, adjust RF output power to obtain 60 W using the programmer. J402 is the interface connector between the transceiver and the programmer.

• Maximum Deviation

8. Select a channel with transmit frequency of 30 MHz for A-Band, 36 MHz for B-Band, or 42 MHz for C-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

1. Program the radio customer frequencies and select features using the MIDLAND 70-1080A SYN-TECH XTR/II Programmer and its instruction manual.
2. The 70-0351/0355 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 not require atypical equipment.
3. Install the radio into the vehicle (refer to Section 3 for instructions).

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.

Table 2 - 1 — Test Equipment Required

TEST INSTRUMENT	INSTRUMENT CAPABILITIES	USE
Regulated DC Power Supply	13.6 V DC, 15 A, adjustable voltage	Radio power source
RF Wattmeter	75 W, 29.7—50 MHz, 50 Ω circuit	Transmitter power measurements
RF Load Resistor	50 Ω @ 100 W	Antenna dummy load
Frequency Modulation Meter	29.7—50 MHz, peak-responding, ±5 kHz range	Modulation level measurements
Frequency Meter or Frequency counter	29.7—50 MHz, 1.0 ppm accuracy	Carrier frequency measurement
Audio Generator	1000 kHz sine wave, 0—4 V_{rms} output	Modulation level measurements
RF Signal Generator	29.7—50 MHz range 0.1—1 KμV 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 Ω, 20 W	Speaker load for all receiver measurements
AC Voltmeter	10 mV to 3 V_{rms}	Audio level adjustments
Oscilloscope	DC to 500 kHz bandwidth	DCS analysis
Digital Multimeter	0.1 to 20 V DC	Test point measurements and power supply setup
Programmer	MIDLAND 70-1080A (Version 15.1 firmware) or 70-1489 PC Programming software	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 13.6 V DC power to transceiver J415.

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 30.00 MHz for A-Band, 36.00 MHz for B-Band, or 42.00 MHz for C-Band.

2. Adjust Channel RX Tank L713 to obtain 1.5 V DC on CM701 pin 1.

3. Activate the transmit mode (using the Programmer). Adjust Channel TX Tank L733 to obtain 1.5 V DC on CM701-pin 1.

• Crystal Type Selection

4. Select the Test Mode of the Programmer, and choose Crystal Type as follows: 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 - 8) for complete alignment instructions.

• Reference Oscillator

5. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation and, if necessary, adjust L101 to bring the carrier frequency to within ±100 Hz of channel frequency.

60-WATT PA SECTION ALIGNMENT

1. Change the TX test to 30 MHz for A-Band, 36 MHz for B-Band, or 42 MHz for C-Band. Activate transmit mode.

2. Set RF output power to 60 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.

2. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of Mic Jack J301, then initiate transmit (if not using the programmer, ground J301 pin 4).

3. Measure total carrier deviation and, if needed, adjust modulation limiting to obtain ±5 kHz using the programmer.

• Microphone Gain

4. No alignment for microphone gain is required.

RECEIVER ALIGNMENT

1. Change the RX test frequency to 33.1 MHz for A-Band, 39.1 for B-Band, or 46.1 for C-Band.

• First Injection

2. No adjustment for first injection is required.

• Preselector Alignment

3. No adjustment for the preselector (L201, L202, L203, L204, L205, L206, L207, and L208) 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 enough modulated (by 1 kHz tone at ±3 kHz deviation) on-channel RF signal to maintain 12 to 15 dB SINAD. Adjust L245, L247, L803 and L804 for maximum SINAD, reducing the RF signal generator output as necessary to stay between 12 and 15 dB SINAD.

   NOTE: Do not adjust L801 or L802 unless appropriate test equipment is available for performing the "Noise Blanker Tuning" steps below. Normally, these coils are tuned for optimum sensitivity as are L803 and L804, then are retuned slightly for optimum noise blanker effectiveness. If the required test equipment is not availble, skip steps 6 through 14. If coils L801 or L802 were replaced, they may be tuned for best sensitivity after adjustment of L245, L247, L803 and L804. Noise blanker performance specifications , however, may not be met.

• Noise Blanker Tuning

This procedures requires the additional test equipment shown in **Table 2 - 2**.

6. Adjust the pulse generator to obtain a 10 nsec wide pulse, as shown in **Figure 2 - 2**. Set the pulse period controls to obtain 200 μsec between pulses (the pulse period is easier to observe on an oscilloscope if the pulse width is temporarily increased by about 10 times).

7. Temporarily disable the pulse generator.

8. Using coax cable of minimum convenient length, connect the pulse generator, the RF signal generator, and the radio to the two-way power divider.

9. Disable the noise blanker by placing SW801 to the OFF position.

10. Apply an on-channel signal to obtain 12 dB SINAD, then increase the RF generator output by 40 dB.

11. Enable the pulse generator to produce the 10 nsec pulses. Adjust pulse amplitude to return SINAD reading to 12 dB.

12. Switch SW801 to the ON position. The SINAD reading should improve.

13. Reduce the RF generator output until a 12 dB SINAD reading is obtained.

14. Using a non-metallic tool, slowly tune L801 (clockwise or counter-clockwise, as required) for best SINAD. The amount of L801 adjustment required should be slight,. Tune L802 in the same manner. Repeat this step. Noise blanker tuning is complete.

Table 2 - 2 — Noise Blanker Test Equipment

TEST INSTRUMENT	CAPABILITIES	SUGGESTED MODEL
Pulse Generator	Pulse Rate: 5000 pulses per second Pulse Width: Adjustable to 10 ns at 1/2 amplitude. Output: Continuously variable from 0.1 to 10 V peak into 50 Ω	Hewlett Packard 8012B or similar
Power Divider, 3 port:	50 Ω each port, 6 dB attenuation, DC to 50 MHz as defined in EIA Stardard RS-204C or RS-204D Appendix A.	Mini-Circuits model 2FRSC-2050 or similar

• **Tight Squelch**

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

16. **If filter FL801 has been removed from your radio:** Apply 0.4 μV of unmodulated on-channel RF signal to the 50-Ω antenna connector.

    For all other radios: Apply 1.5 μV of unmodulated on-channel RF signal to the 50-Ω antenna connector.

17. Adjust Squelch Range RV241 clockwise until squelch just opens (audio on).

CTCSS/DCS (If installed)

1. Enter DCS code +023, and adjust VR1 so that DCS deviation is at 0.75 ±0.1 kHz.

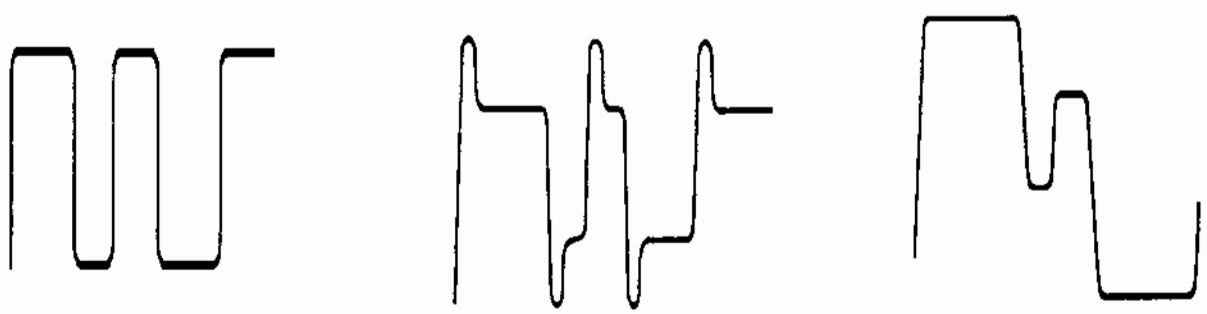
2. While observing recovered modulation on an oscilloscope, fine tune RV401 for a square DCS waveform as shown.

3. Readjust DCS deviation to 0.75 ±0.1 kHz.

4. Set frequency to CTCSS at 250.3 Hz. Adjust RV401 for 0.75 ±0.1 kHz

5. Repeat step 2.

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



CORRECT INCORRECT INCORRECT

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 volts 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.

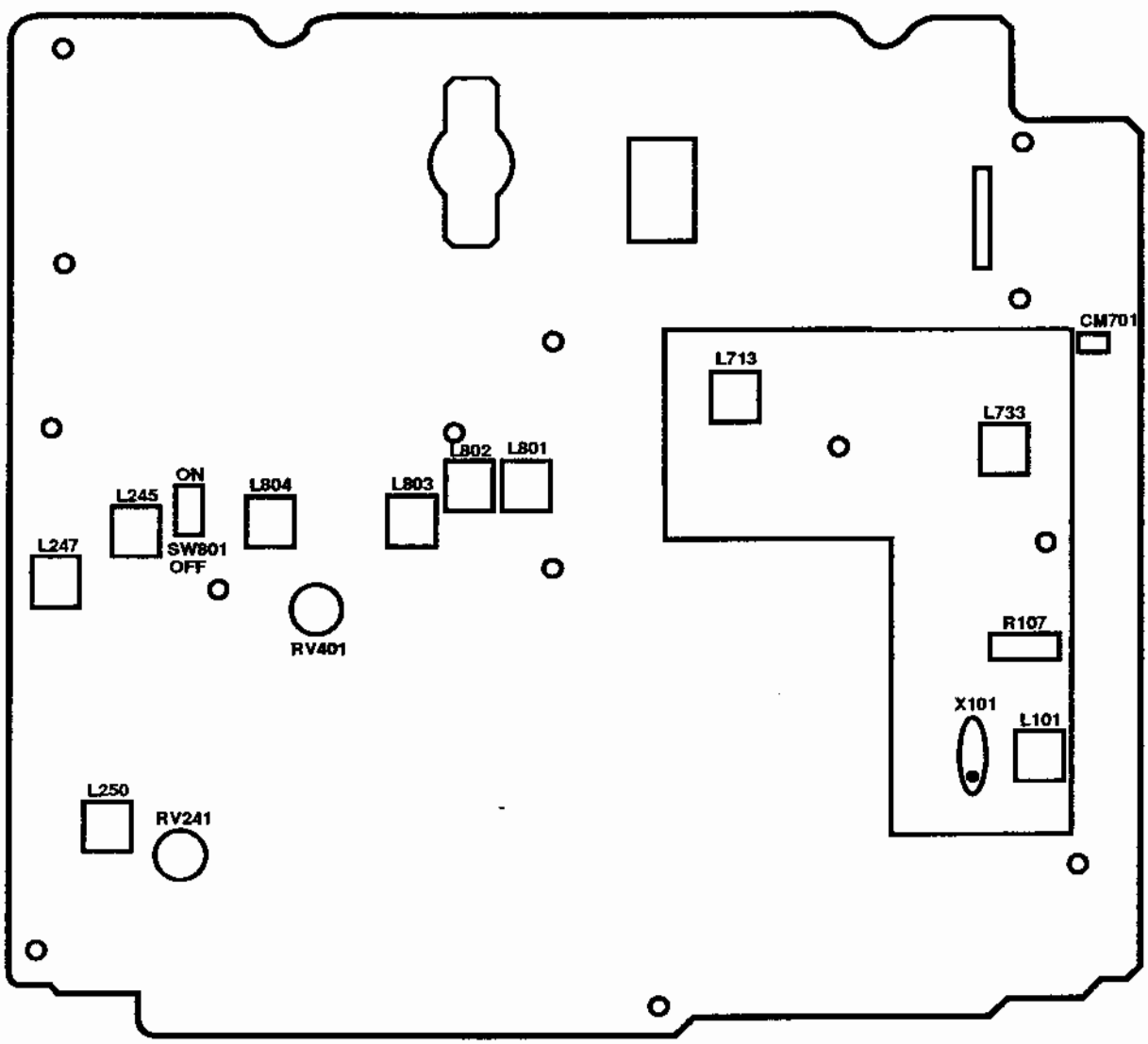


Figure 2 - 1 Adjustment Map — TR-053 Board

Table 2 - 3

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 - 2

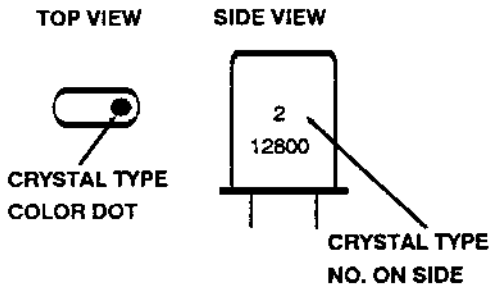
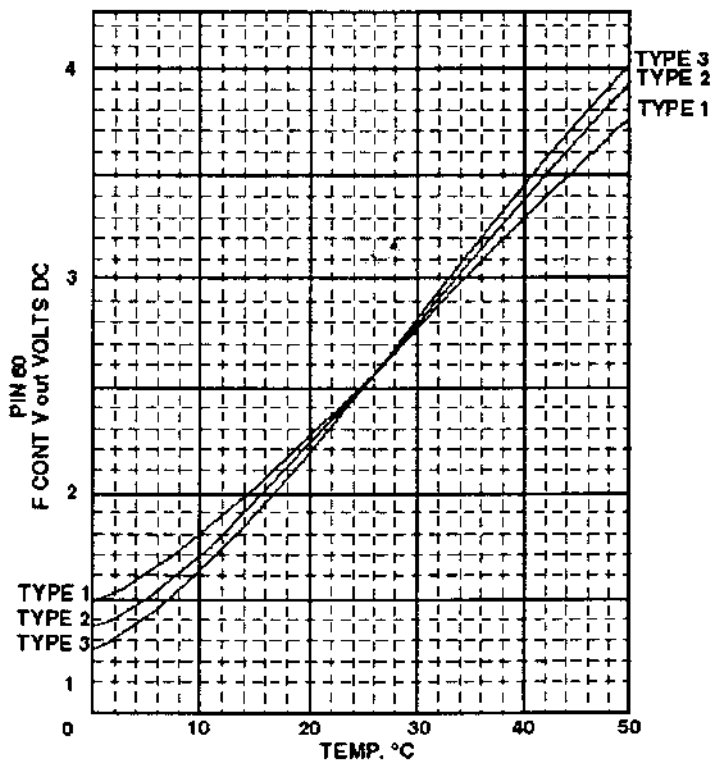


Table 2 - 4



NOTES

SECTION 3

INSTALLATION

NOTES

INSTALLATION

MOUNTING

• Under-dash

The 70-0351A/B/C 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 70-0355A/B/C 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 70-0355 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 a 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" 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/Accessory Cable is equipped with two unterminated 14 gauge wires two meters in length for connection to the vehicle electrical system. For Trunk-Mount units, the 70-2212B Power Cable is equipped with two unterminated 12 gauge wires six meters in length. These lengths will be sufficient for typical connection to a fuse block and chassis ground.

Connect the black wire to the negative (−) chassis ground of the vehicle. DO NOT ATTEMPT TO INSTALL THE TRANSCEIVER IN A POSITIVE GROUND VEHICLE. A large bolt that screws into the metallic vehicle body or chassis often provides an adequate ground if a lug is used to secure the wire to it.

Connect the red wire to the positive (+) side of the vehicle electrical system. This wire has its own in-line fuse for protection against wire penetration and transceiver defect. The connection can be made to the ignition hot so that the transceiver switches on with ignition, or it can be made to battery hot to enable the last-selected-channel of the transceiver (the transceiver must be turned off separately). Either connection is usually available in the vehicle fuse block if the red transceiver wire is terminated with an appropriate lug.

• Requirements

Both the 70-0351 and 70-0355 transceivers are designed to operate from a 12 V DC negative ground automotive electrical system. Current drain of at least 10 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/Accessory 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) is available for use with the CTCSS 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 9-pin male Molex connector and a fused, 2 m power cable assembly, P/N 70-2211B, mates to the power/accessory connector (J415) on the rear of the 70-0351. Extra pin positions are used for connection of optional devices not included with this assembly.

Optional devices can be connected to the Power/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 70-0355 has two 9-pin male Molex receptacles: J415 on the trunk unit; J324 on the Control Head. The trunk unit receptacle mates to the 70-2212B Power Cable assembly. The Power Cable includes an in-line fuse in its 6 m power leads and 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 pins 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 5½' cable is terminated with appropriate Molex pins for insertion into the trunk-mount Accessory Plug on the

Control Head or the under-dash Power/Accessory Plug. 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 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.

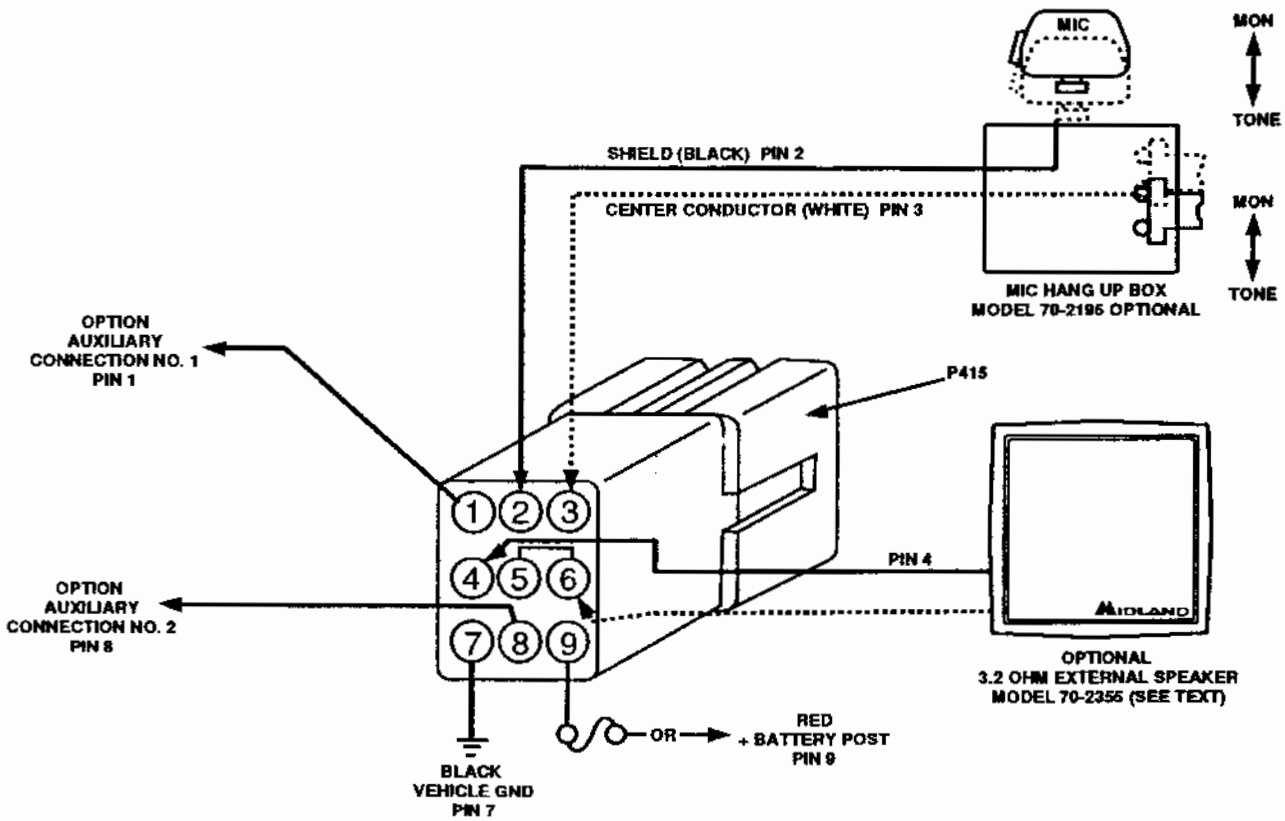


Figure 3 - 1 — Under-Dash Power/Accessory Plug

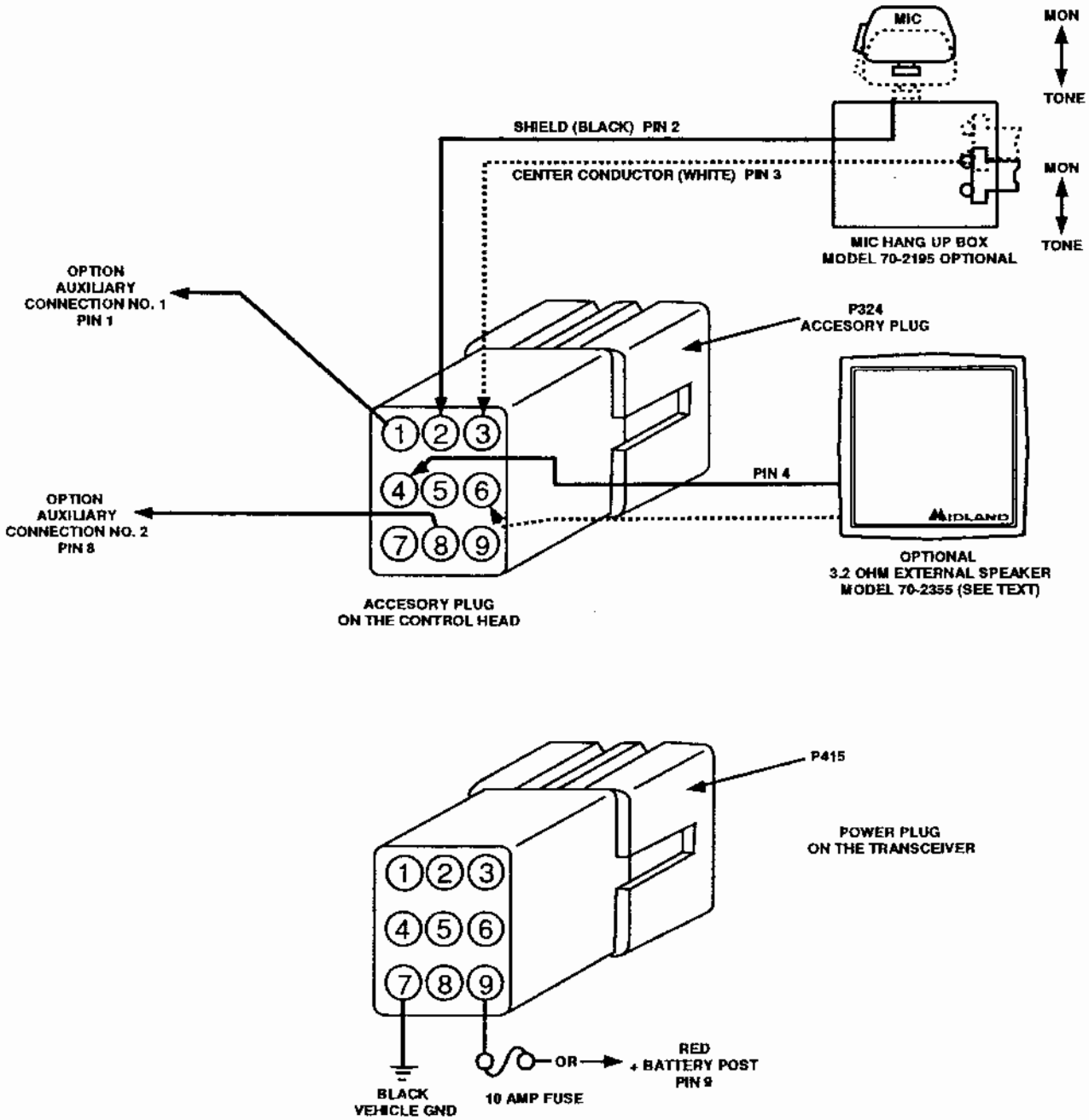


Figure 3 - 2 — Trunk-Mount Power and Accessory Plugs

SECTION 4

SERVICING

NOTES

REMOVING THE TR-053 BOARD

When servicing the XTR or adding option kits, you may need to remove the TR-053 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-053 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 PA Section and VCO/Reference Oscillator shield covers.
5. Loosen the nut on Antenna Jack J501.
6. Remove the eighteen screws securing the TR-053 Board (notice that two of the screws in the PA Section are longer than the rest).
7. Remove the three clips holding IC401, IC402, and IC406 to the front of the radio.
8. Lift the front part of the TR-053 Board up from the radio, and unclip Power Plug J415. Finish lifting the board out of the radio.

The TR-053 Board is now ready for servicing.

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

9. Insert J415 through its hole and reattach it to the radio.
10. Lower the board back into the radio (make sure all wires are on top). The plate on J501 goes on the outside of the radio.
11. Insert the two long screws into their proper positions in the PA Section (see **Figures 4-1a and 4-1b**). Then insert the sixteen remaining screws.
12. Tighten the eighteen screws. Do not overtighten.
13. Tighten the nut on J501. Check the solder connection on J501. Reflow solder if needed.
14. 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).
15. Replace the cover shields for the VCO/Reference Oscillator and PA Section. Make sure that you don't clamp the wires under the covers.
16. Replace the Control Head (or Nose-Piece for Trunk-Mount Units).
17. Replace the bottom cover.

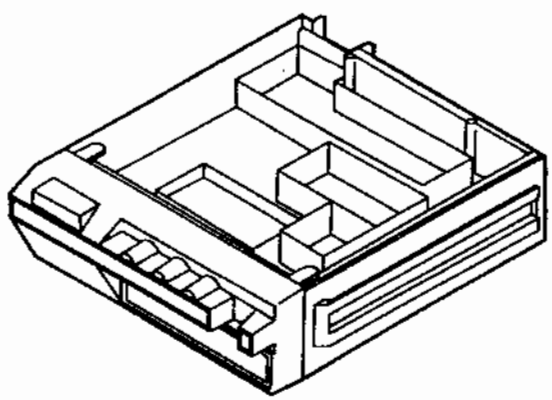


Figure 4 - 1a — SYN-TECH XTR Chassis and Control Head

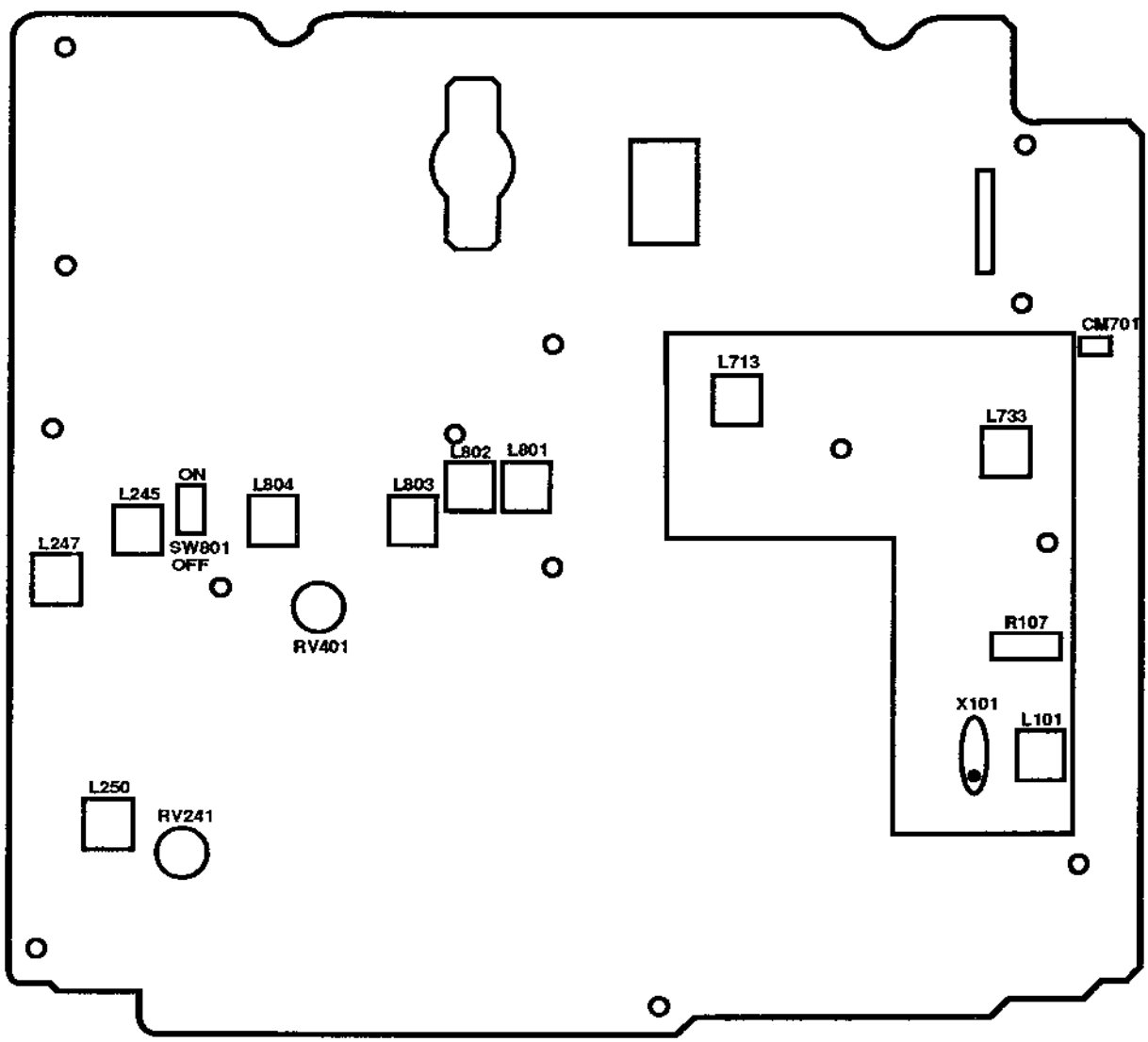
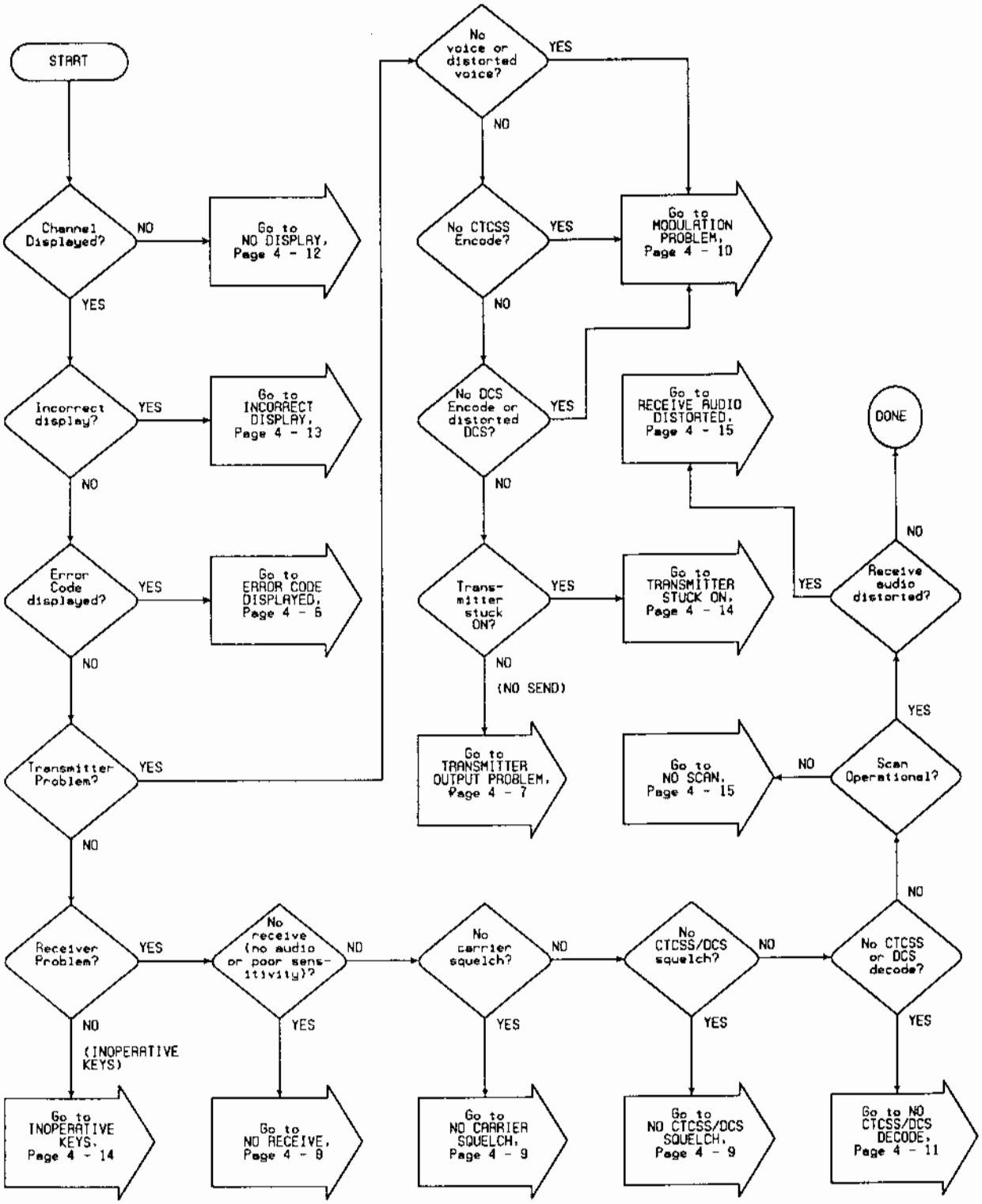
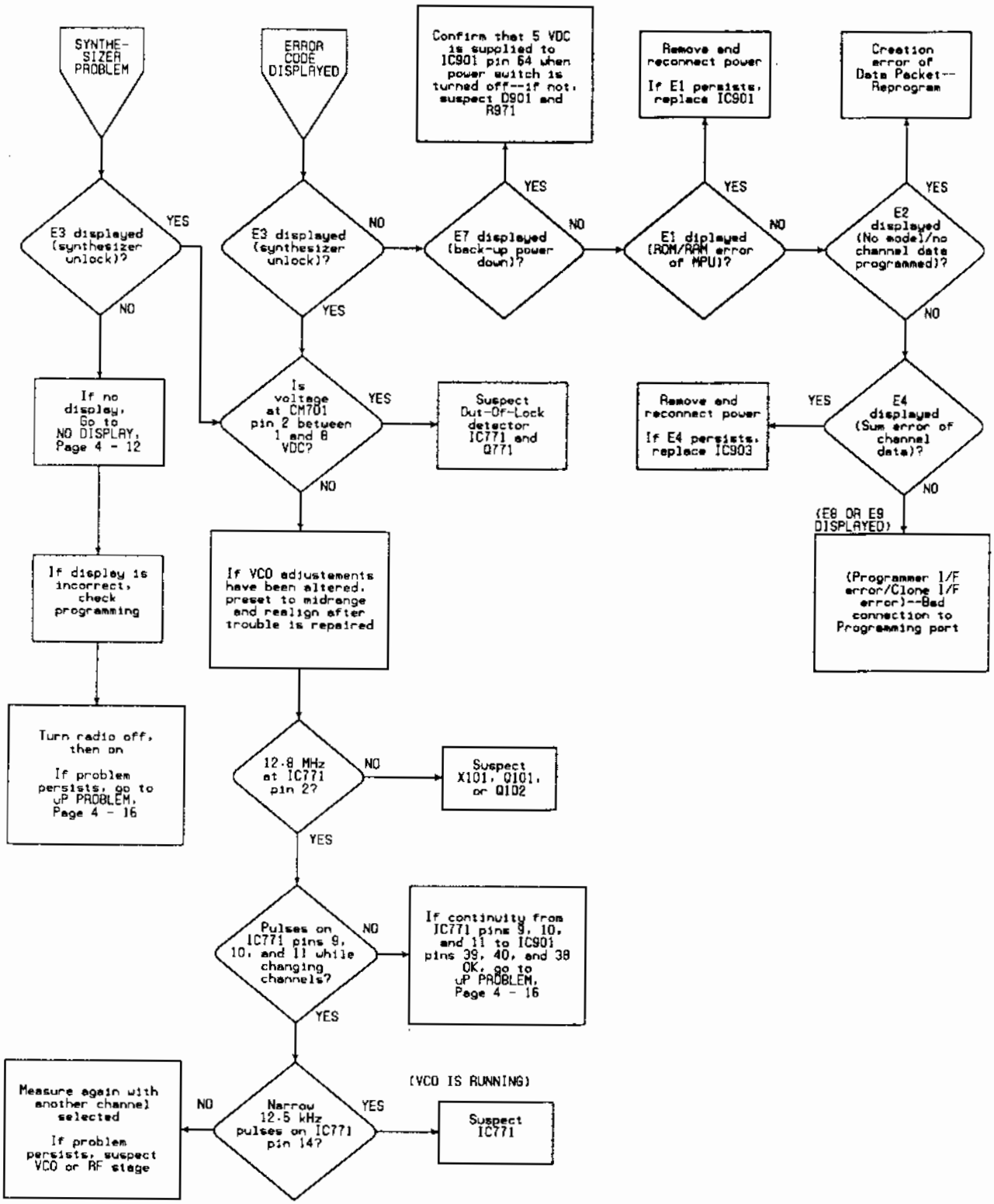


Figure 4 - 1b — TR-053 Board

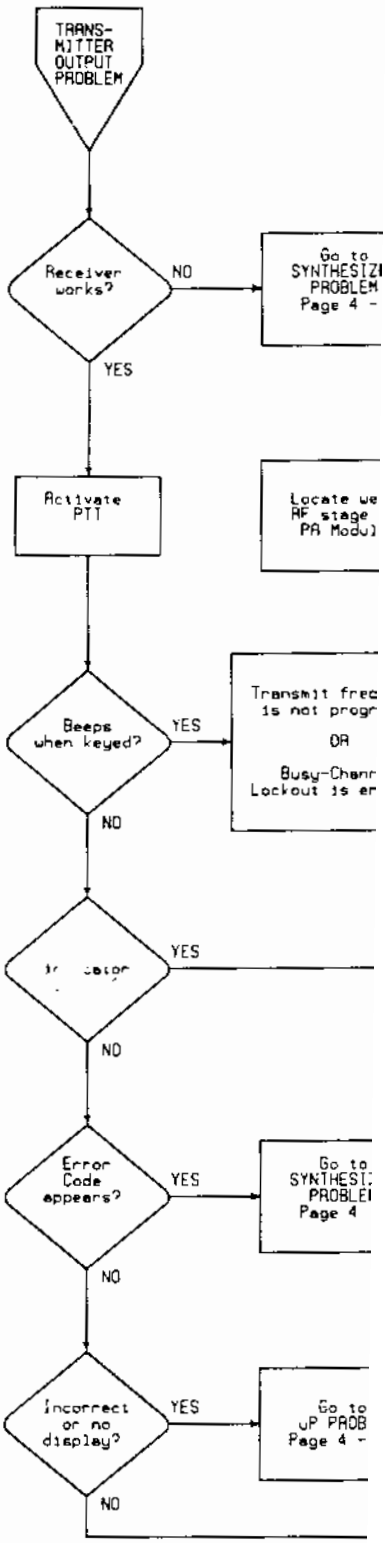
TROUBLESHOOTING CHARTS

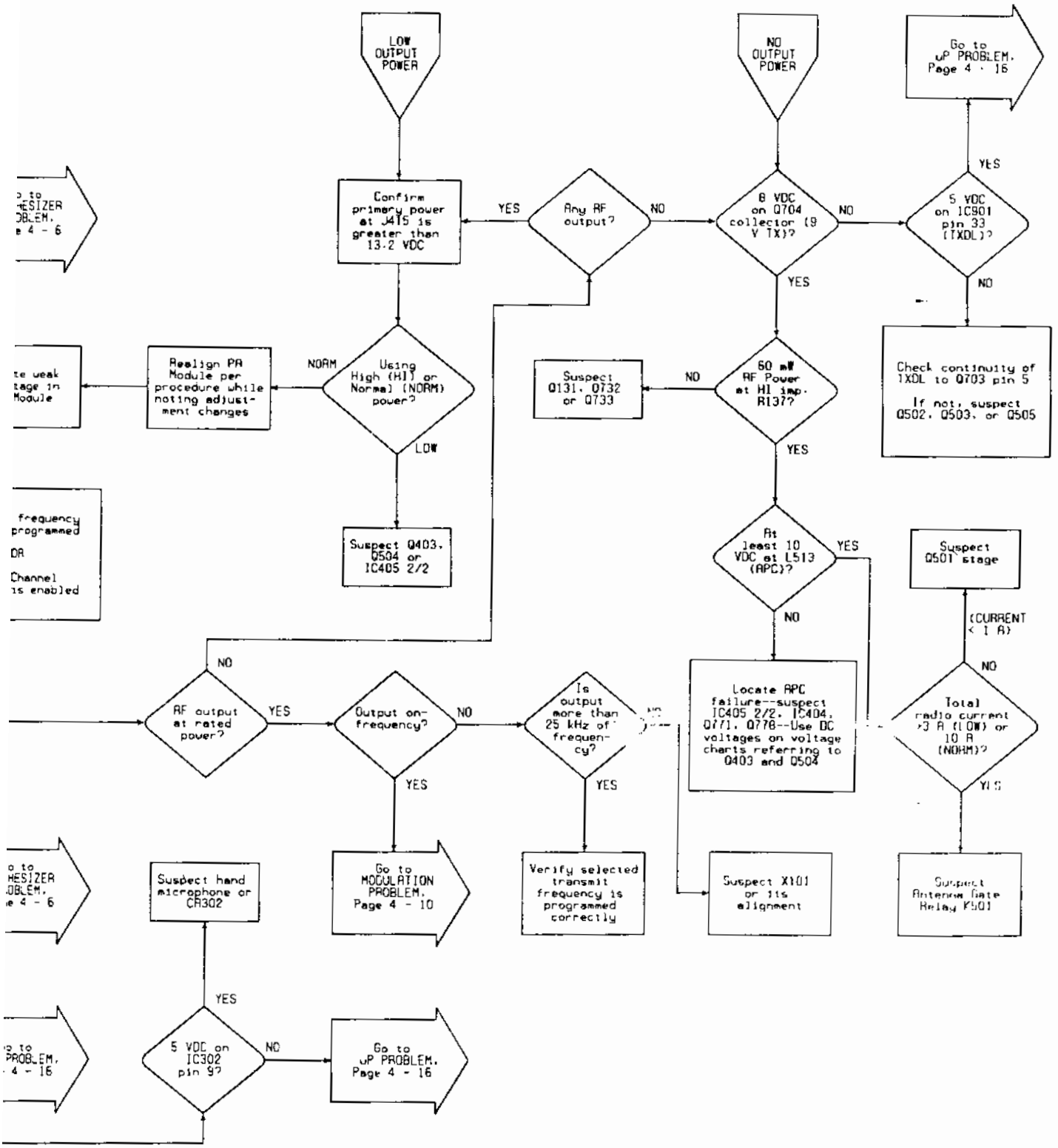


Troubleshooting Chart 4 - 1 — Getting Started

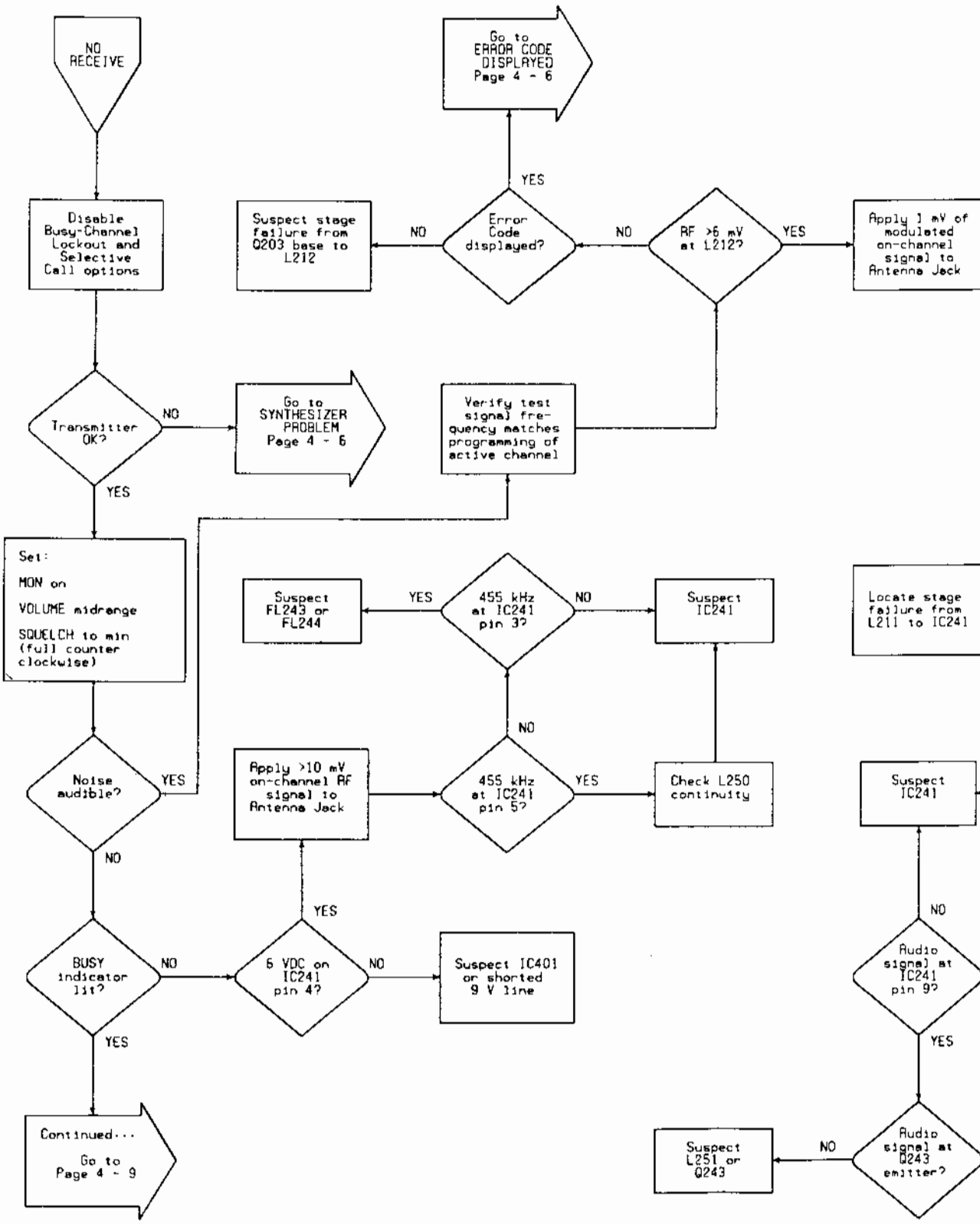


Troubleshooting Chart 4 - 2 — Synthesizer Problem/Error Code Displayed

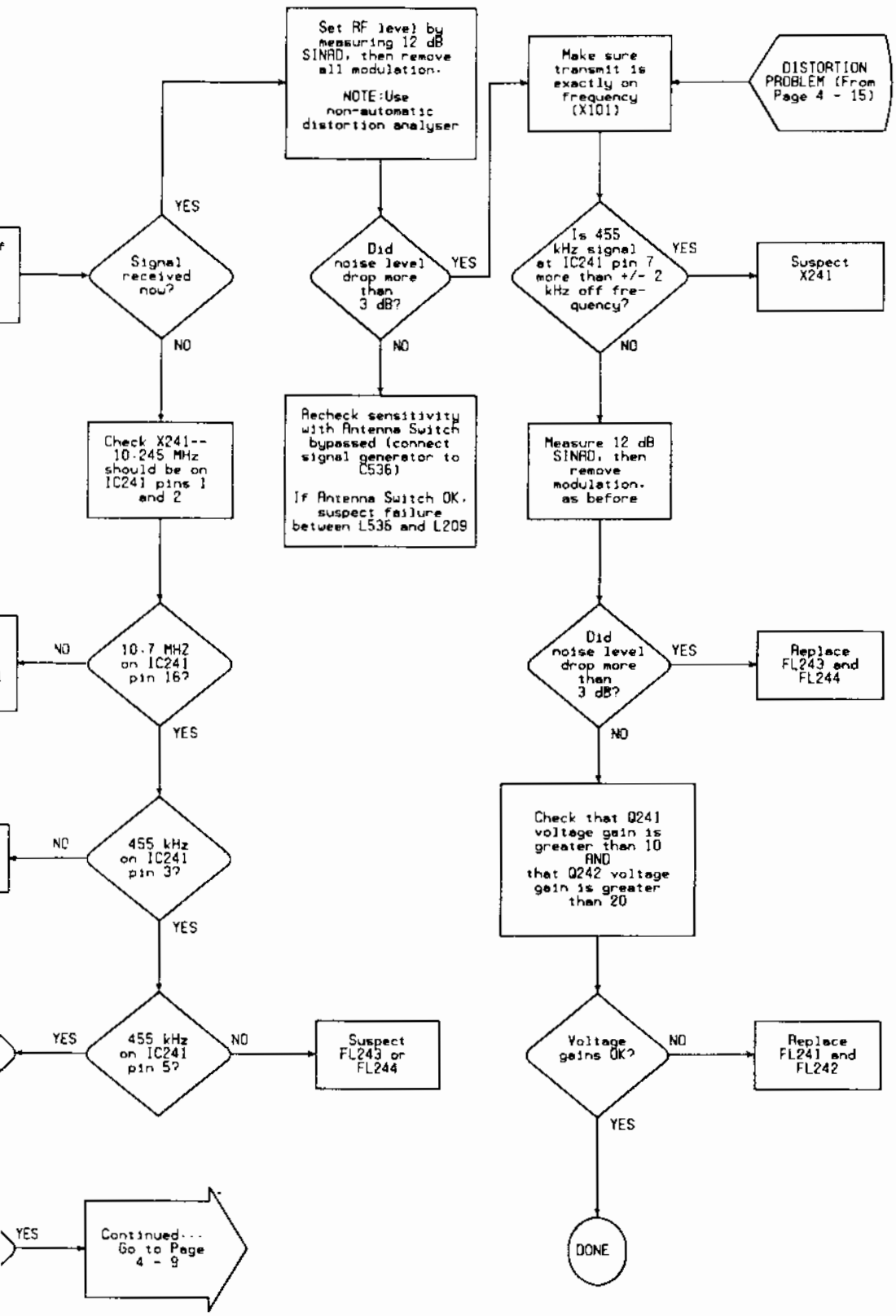

TRANS-
MITTER
OUTPUT
PROBLEM
Receiver
works?
NO
Go to
SYNTHESIZ
PROBLEM
Page 4 -
YES
Activate
PTT
Locate we
RF stage
PA Modu
Beeps
when keyed?
YES
Transmit freq
is not progr
OR
Busy-Chann
Lockout is en
NO
YES
NO
Error
Code
appears?
YES
Go to
SYNTHESI
PROBLE
Page 4
NO
Incorrect
or no
display?
YES
Go to
uP PROB
Page 4 -
NO

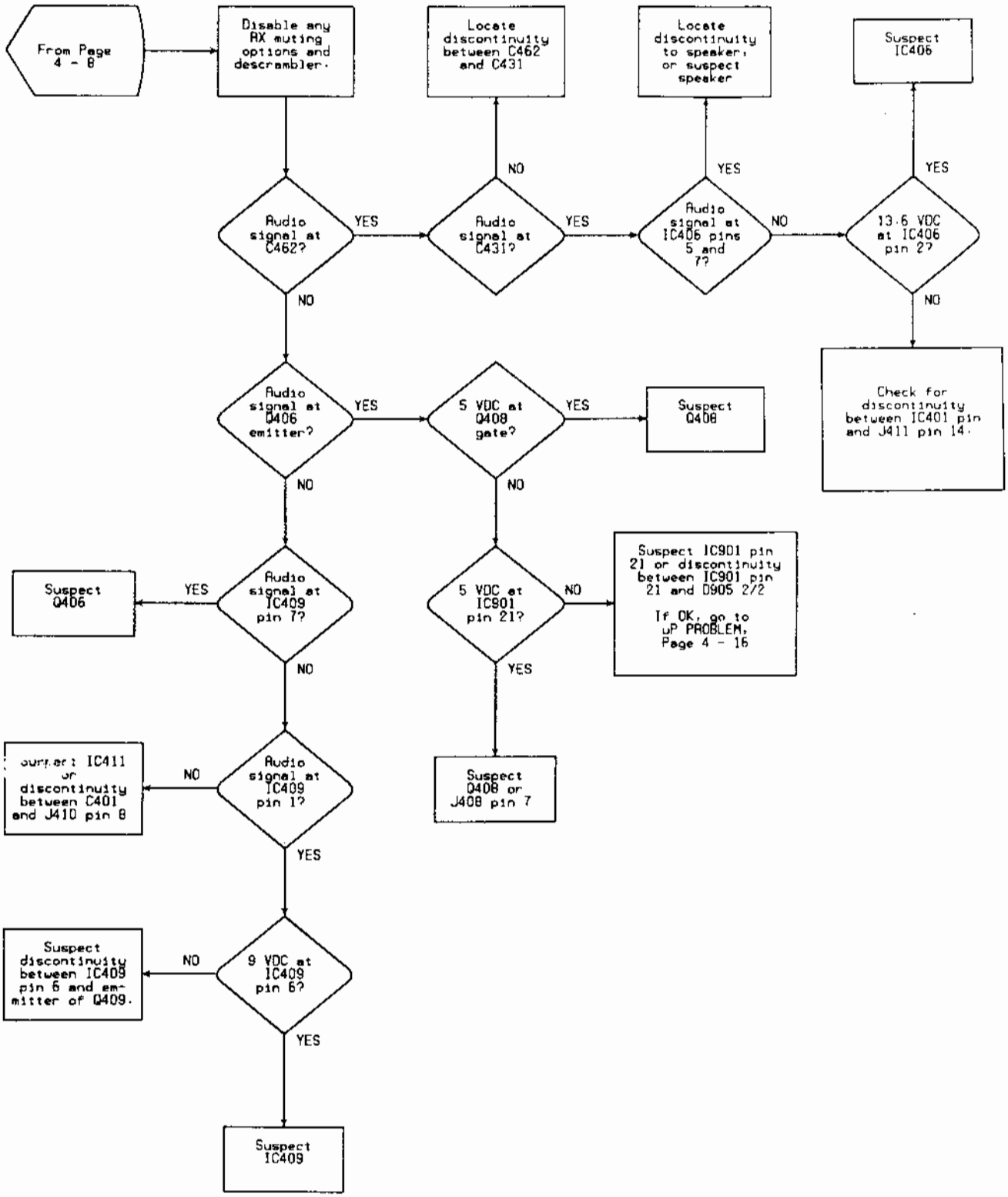


Troubleshooting Chart 4 - 3 — Transmitter Problem

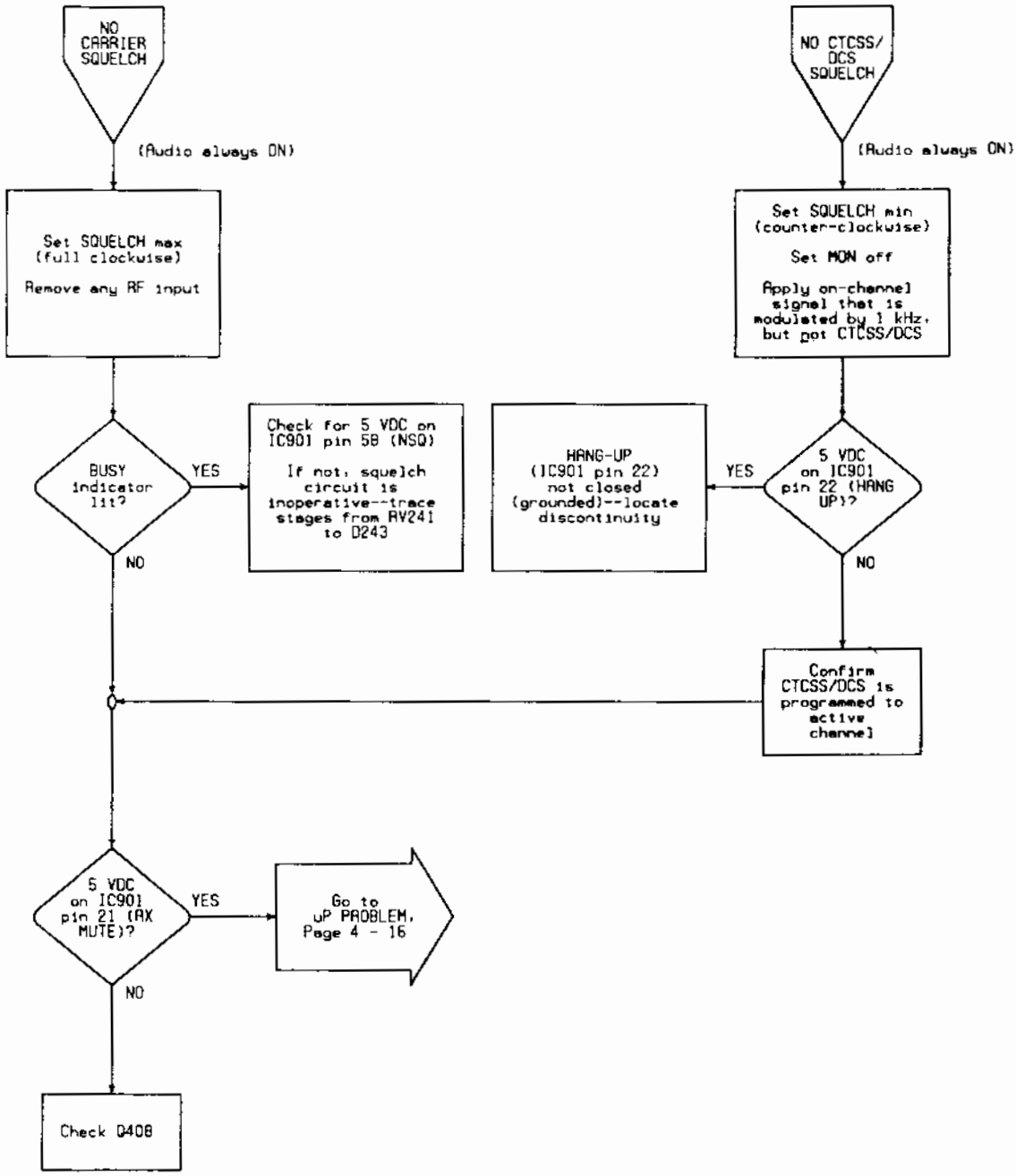


Troubleshooting Chart 4 - 4a — Receiver Problem

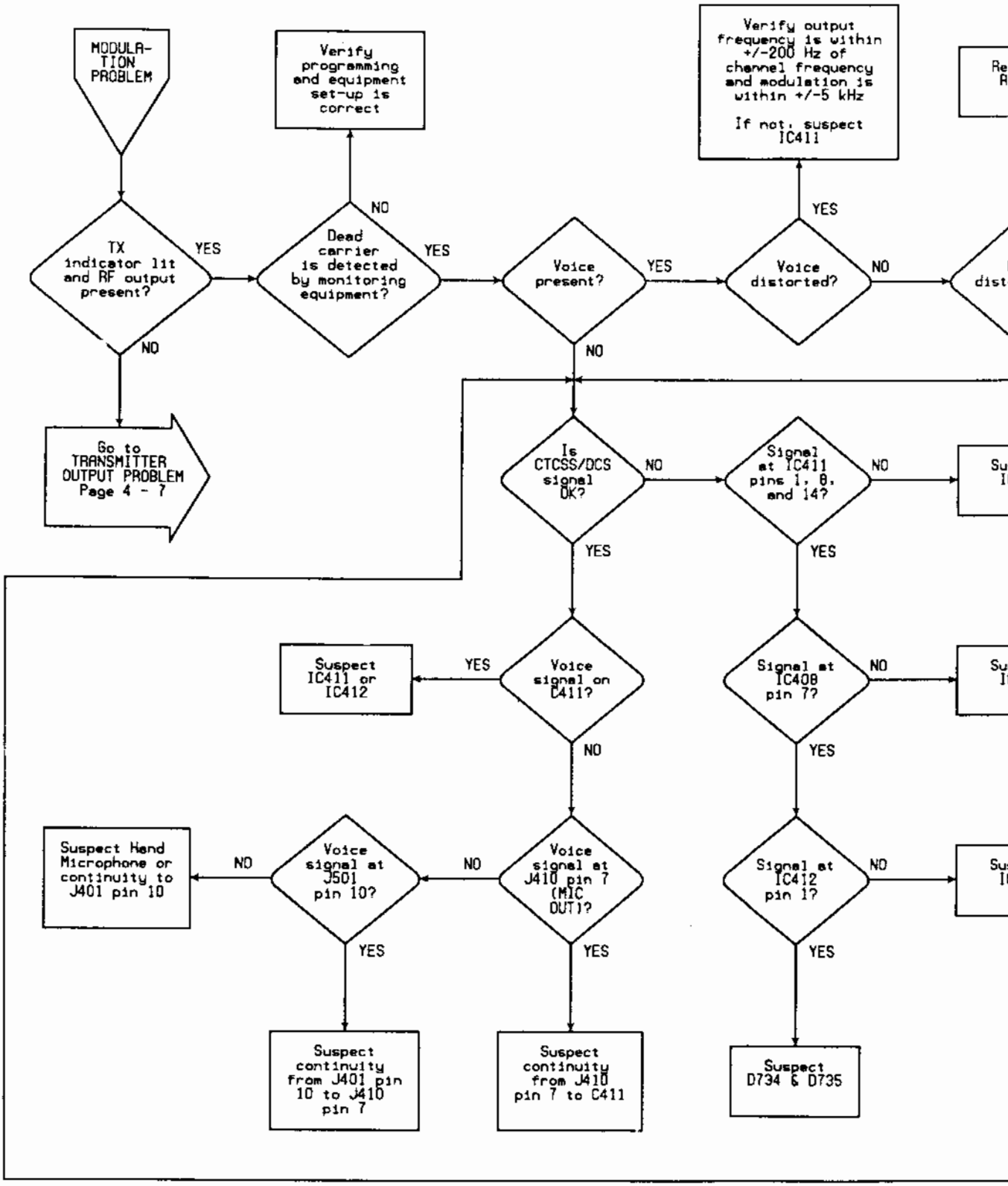

Set RF level by measuring 12 dB SINAD, then remove all modulation.
NOTE:Use non-automatic distortion analyser
Make sure transmit is exactly on frequency (X101)
DISTORTION PROBLEM (From Page 4 - 15)
YES
Signal received now?
Did noise level drop more than 3 dB?
YES
Is 455 kHz signal at IC241 pin 7 more than +/- 2 kHz off frequency?
YES
Suspect X241
NO
NO
NO
Recheck sensitivity with Antenna Switch bypassed (connect signal generator to C536)
If Antenna Switch OK, suspect failure between L536 and L209
Check X241--10.245 MHz should be on IC241 pins 1 and 2
Measure 12 dB SINAD, then remove modulation, as before
NO
10.7 MHZ on IC241 pin 16?
Did noise level drop more than 3 dB?
YES
Replace FL243 and FL244
YES
NO
Check that Q241 voltage gain is greater than 10 AND that Q242 voltage gain is greater than 20
NO
455 kHz on IC241 pin 3?
YES
YES
NO
455 kHz on IC241 pin 5?
Suspect FL243 or FL244
Voltage gains OK?
NO
Replace FL241 and FL242
YES
YES
Continued... Go to Page 4 - 9
DONE



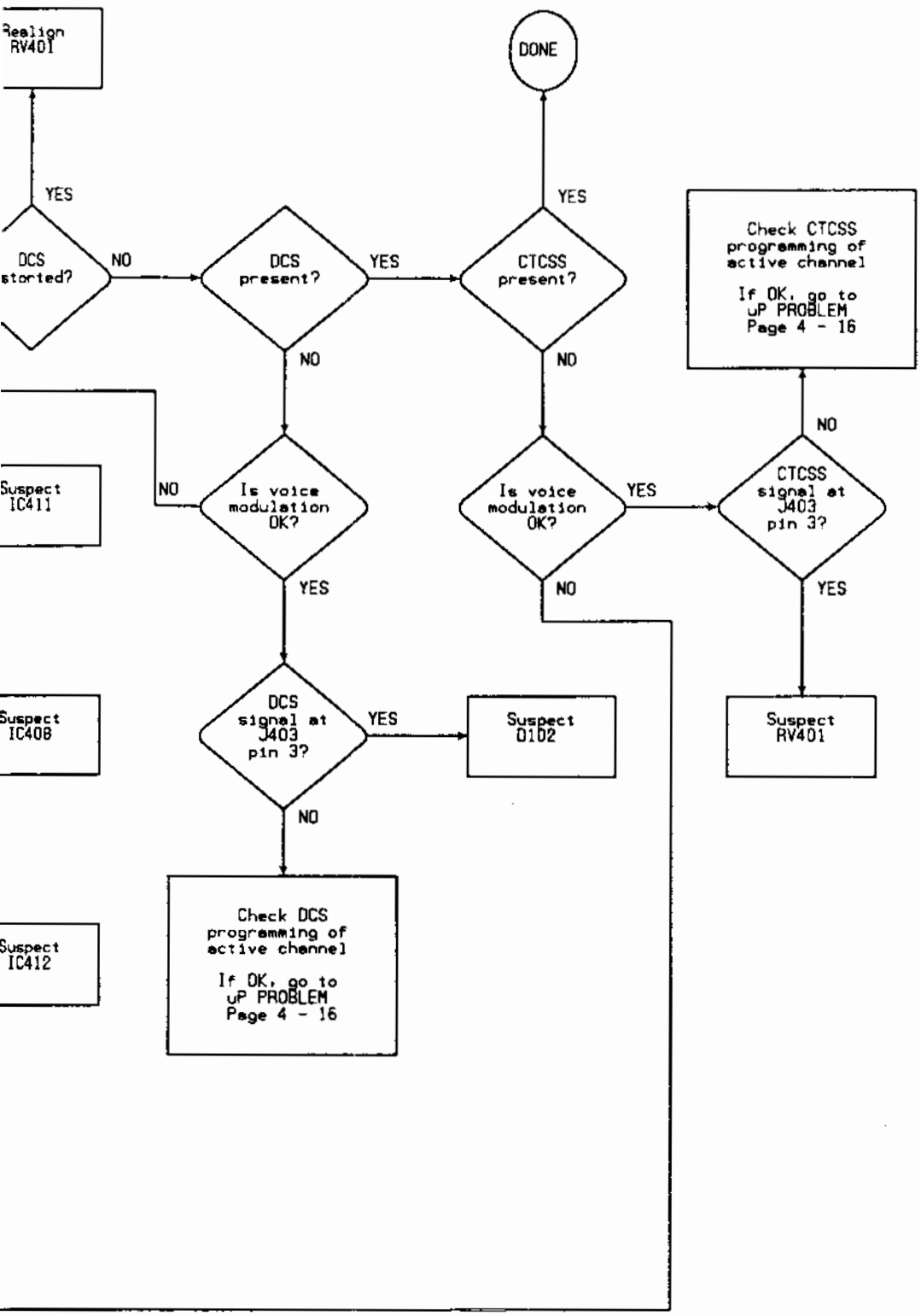
Troubleshooting Chart 4 - 4b — Receiver Problem (Continued)

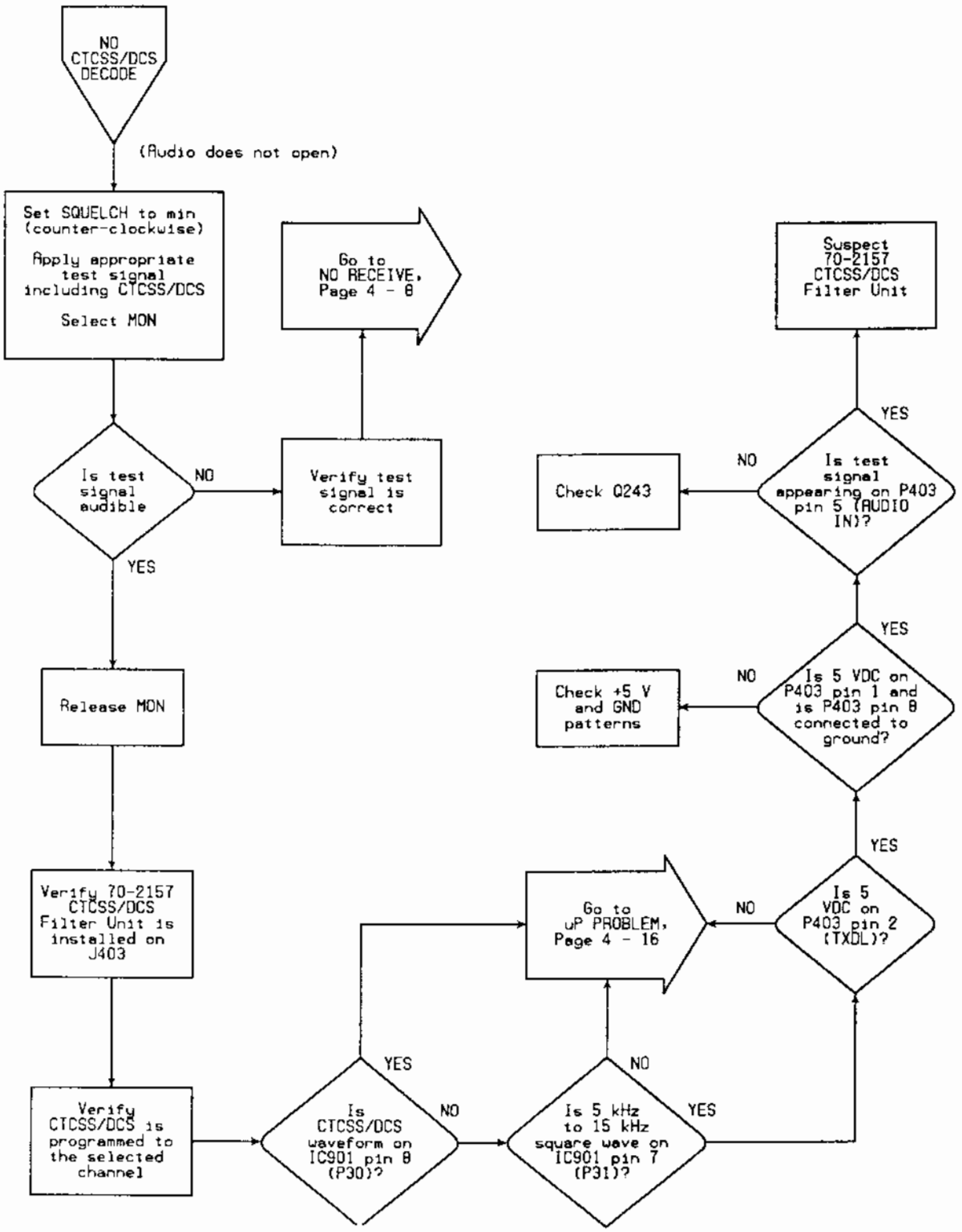


Troubleshooting Chart 4 - 5 — Squelch Problem

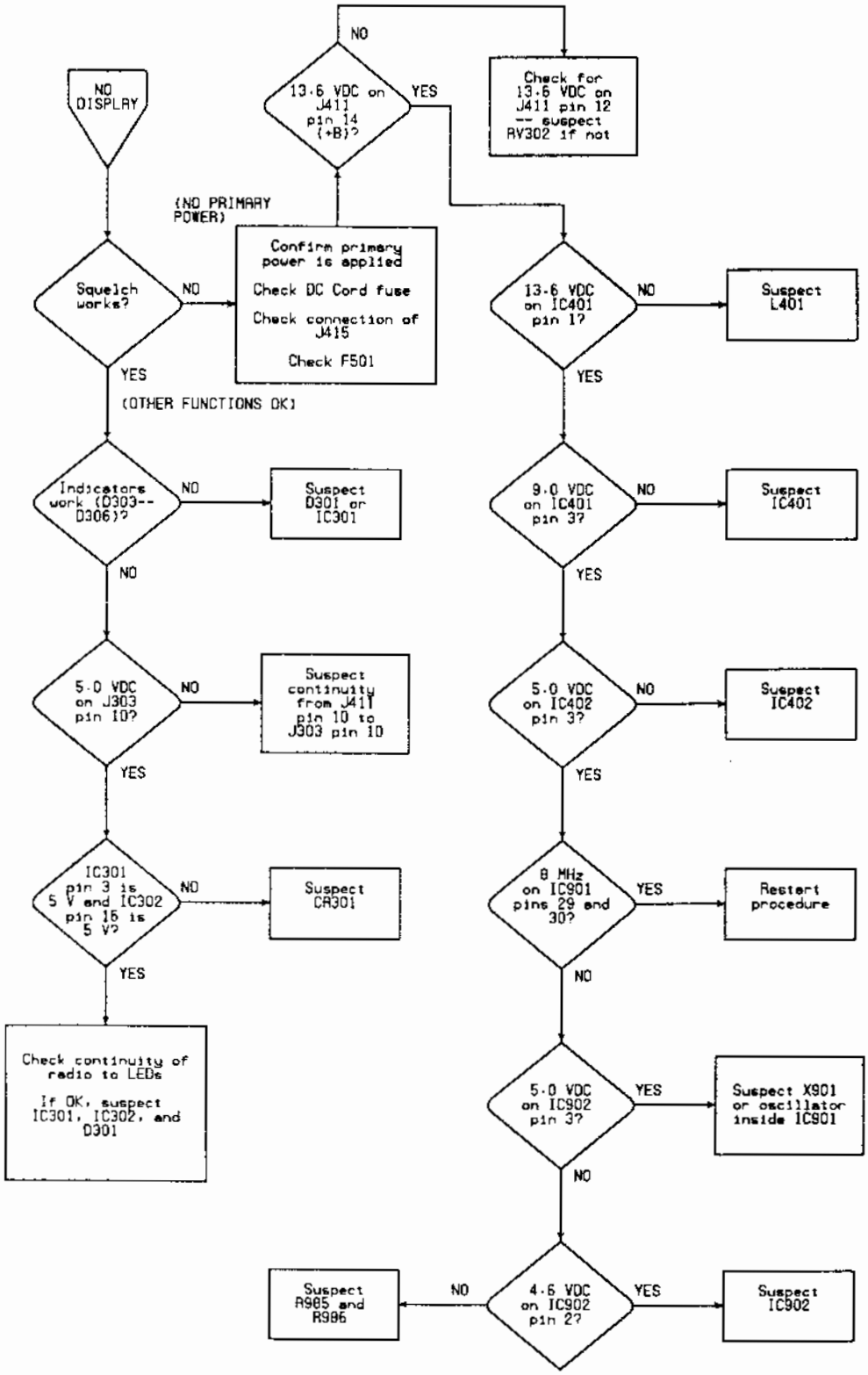


Troubleshooting Chart 4 - 6 — Modulation Problem

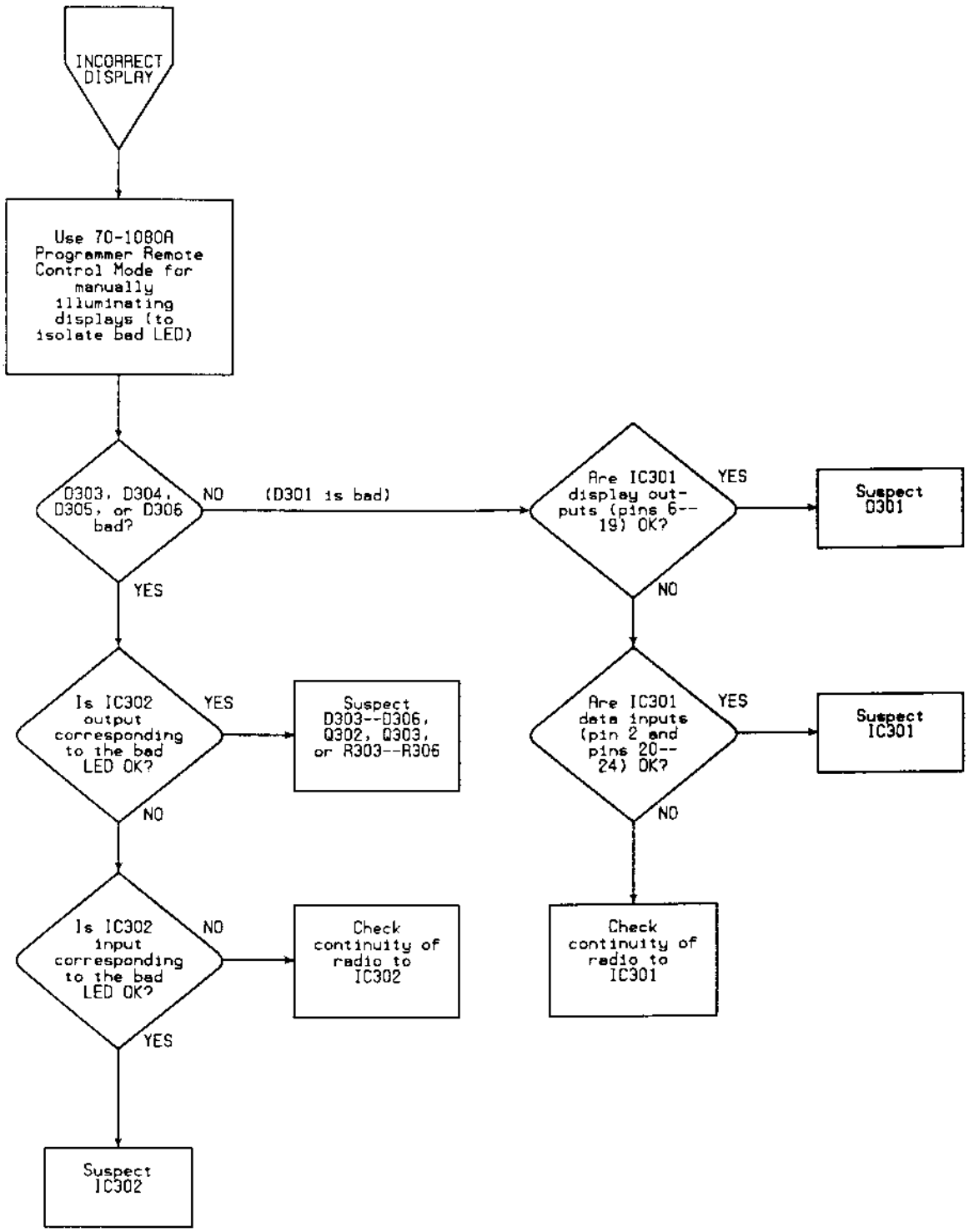

Realign RV401
YES
DCS started?
NO
DCS present?
YES
CTCSS present?
YES
DONE
Check CTCSS programming of active channel
If OK, go to uP PROBLEM Page 4 - 16
NO
NO
NO
Suspect IC411
NO
Is voice modulation OK?
Is voice modulation OK?
YES
CTCSS signal at J403 pin 3?
YES
NO
YES
Suspect IC408
DCS signal at J403 pin 3?
YES
Suspect D102
Suspect RV401
NO
Suspect IC412
Check DCS programming of active channel
If OK, go to uP PROBLEM Page 4 - 16



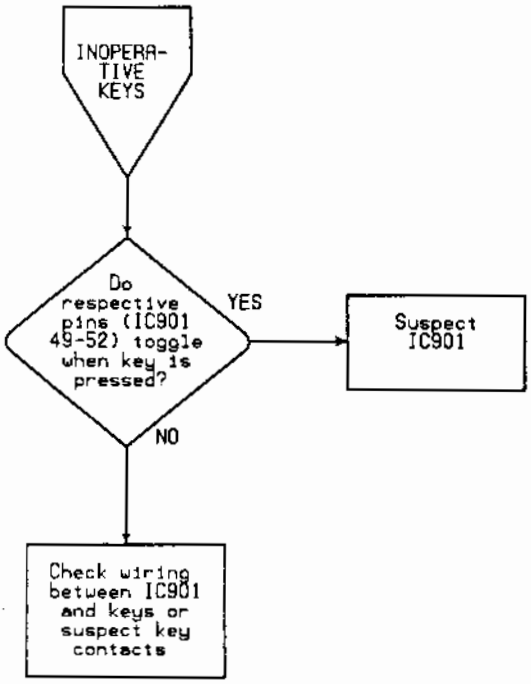
Troubleshooting Chart 4 - 7 — No CTCSS/DCS Decode



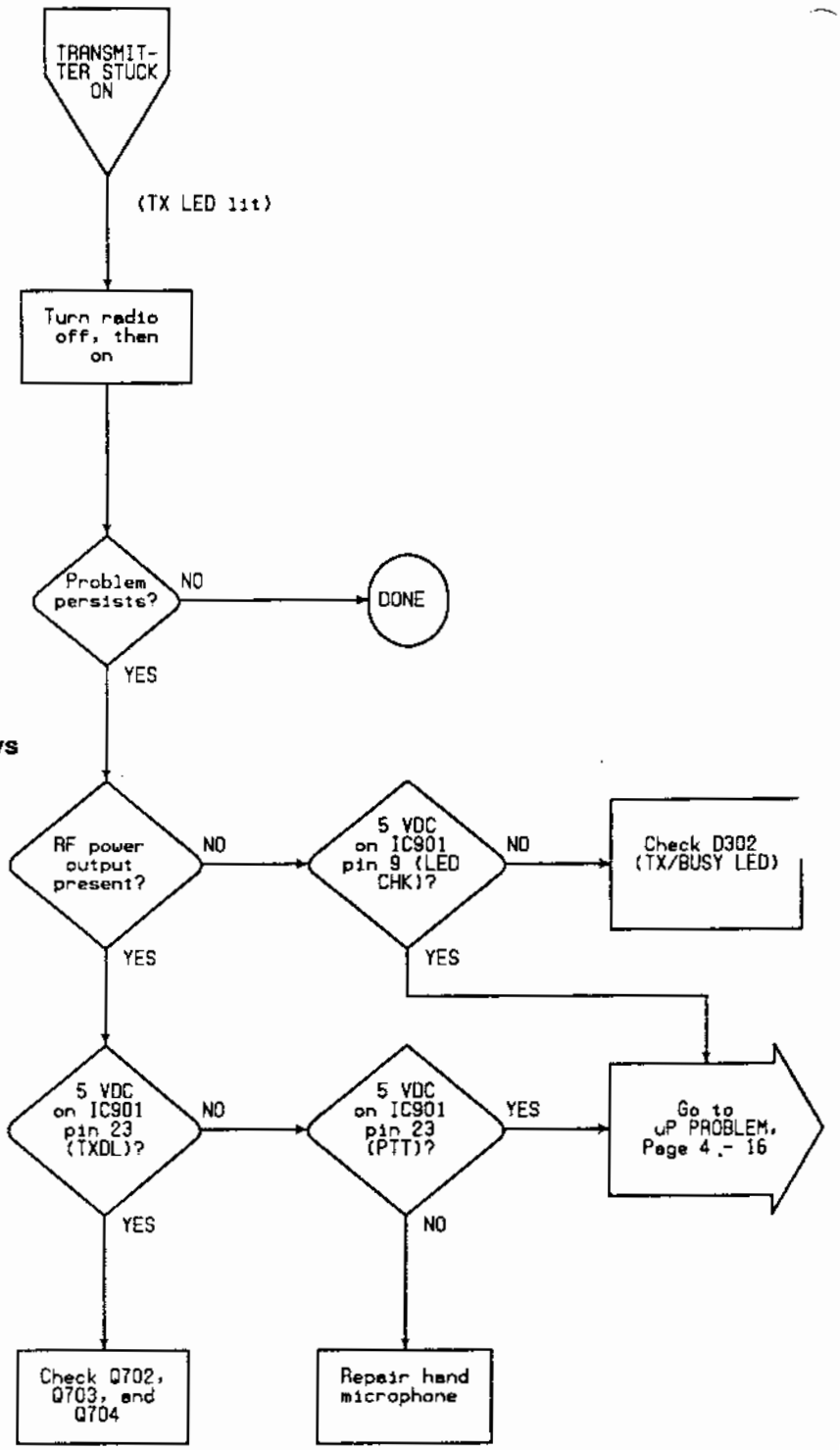
Troubleshooting Chart 4 - 8 — No Display



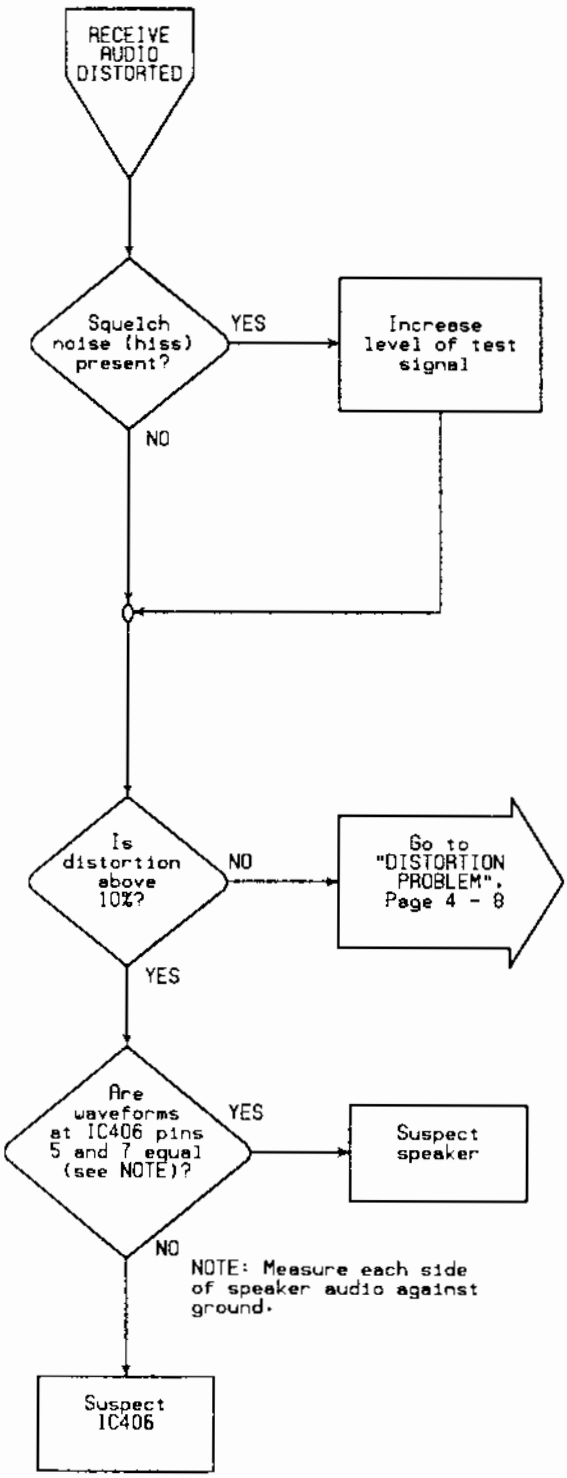
Troubleshooting Chart 4 - 9 — Incorrect Display



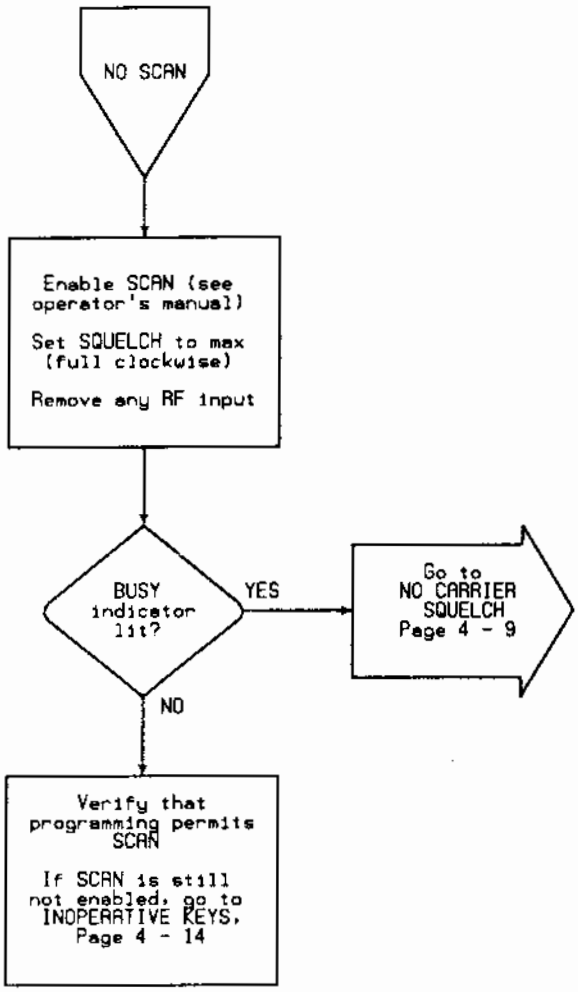
Troubleshooting Chart 4 - 10 — Inoperative Keys



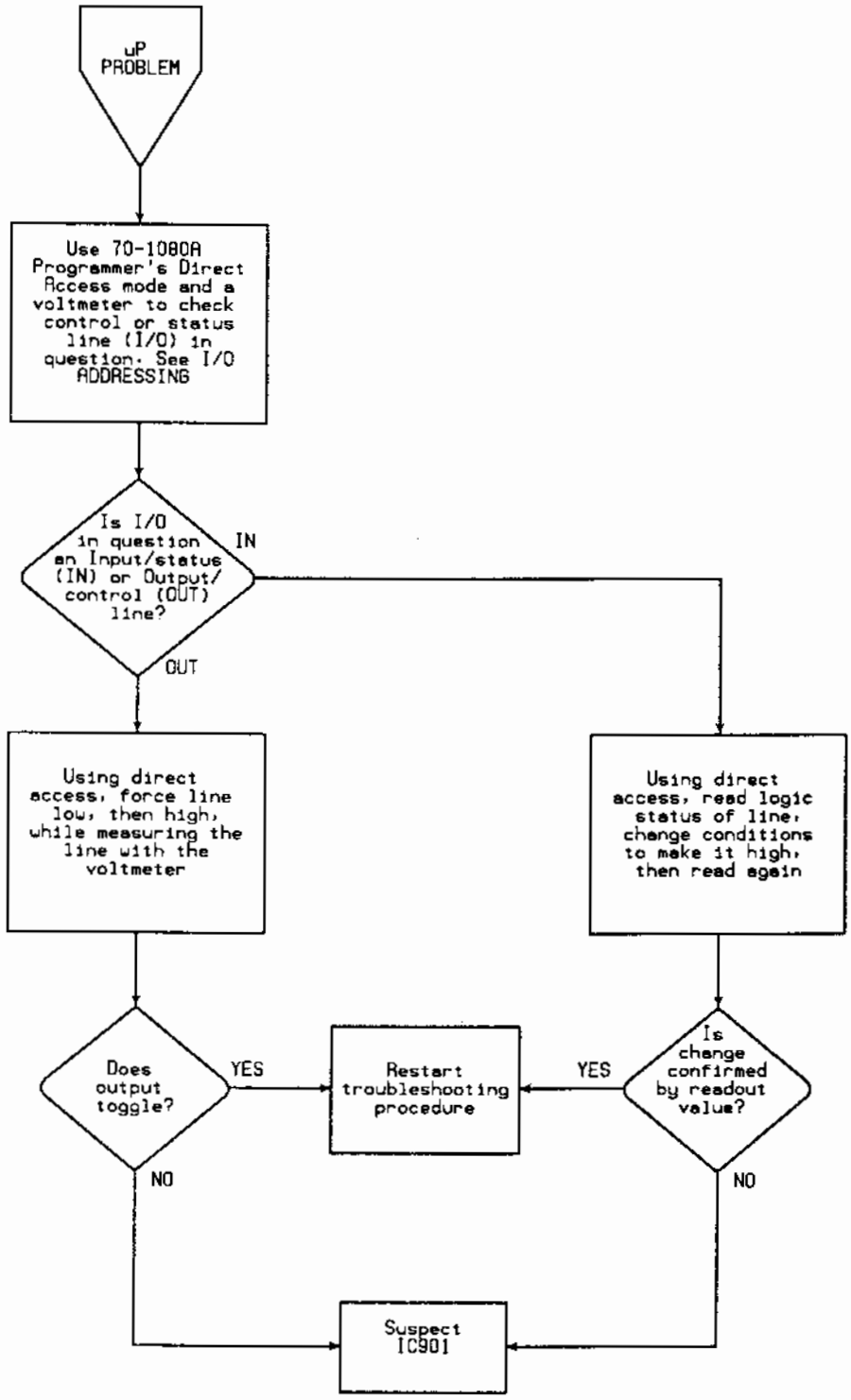
Troubleshooting Chart 4 - 11 — Transmitter Stuck On



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 - 2**. Remove the component with tweezers or longnose pliers. Discard the component.

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

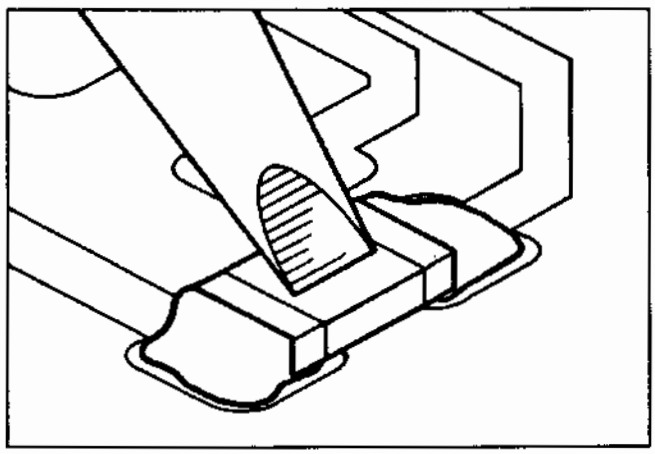


Figure 4 - 2

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

3. Apply only enough fresh solder to coat the clean PC pad as shown in **Figure 4 - 3.**

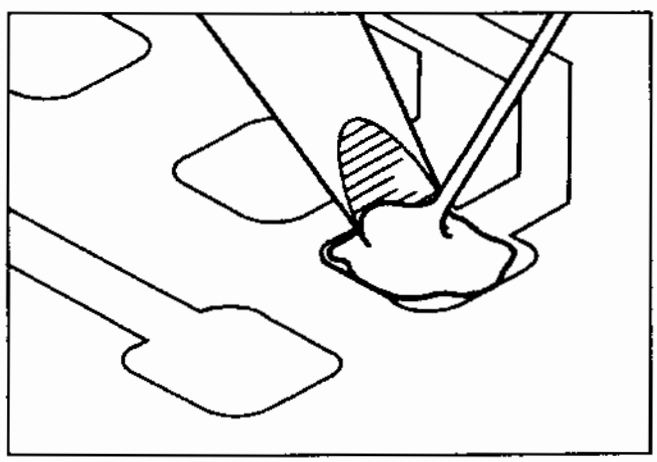


Figure 4 - 3

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

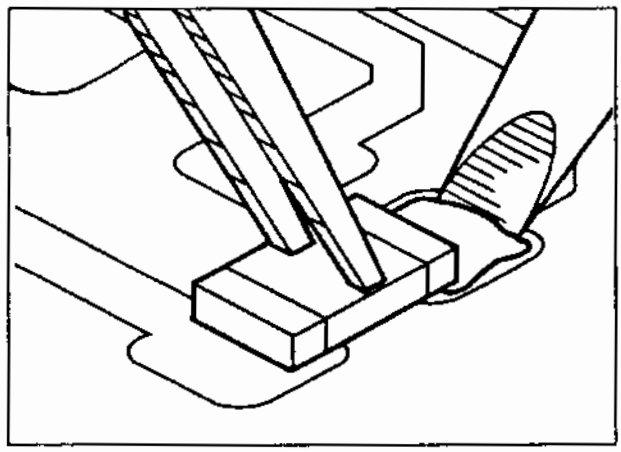


Figure 4 - 4

5. With one component end tacked to hold it, the other end can be soldered. Carefully apply heat to the PC pad while adding only enough fresh solder to produce a clean fillet as in **Figure 4 - 5**—do not apply too much solder, otherwise it may flow underneath and short the pads together. Let the hot solder flow onto the component—do not touch the component with the iron. Repeat to finish the other end of the component. Solder must adhere to all metallic end-surfaces on both ends as shown in **Figure 4 - 6.**

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

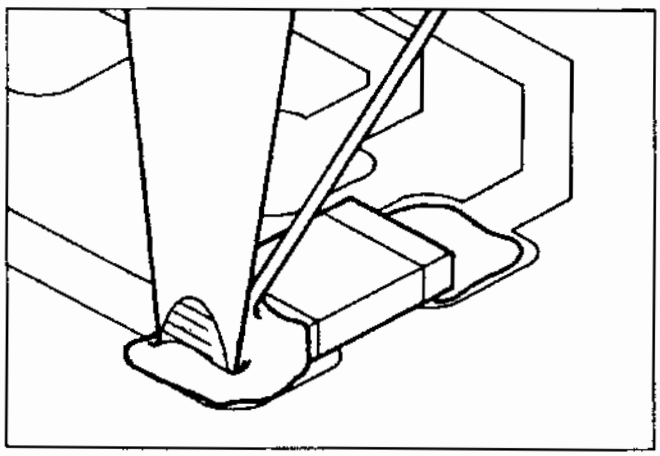


Figure 4 - 5

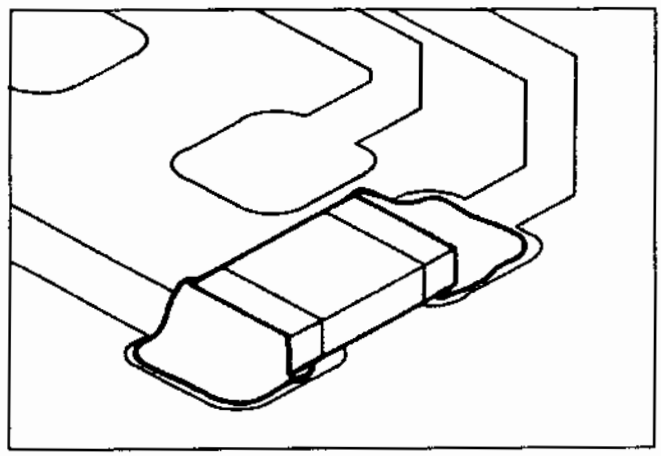


Figure 4 - 6

REPLACING COMPONENTS WITH FEED-THROUGH LEADS

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

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

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

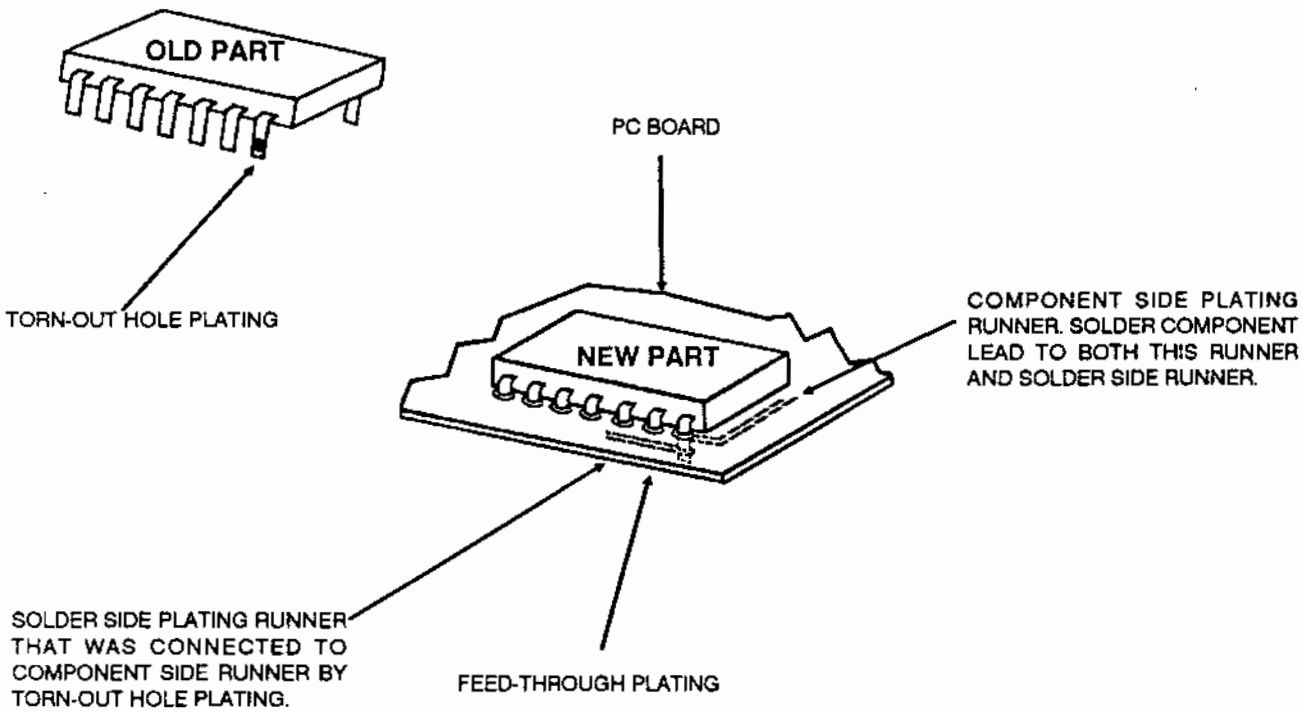


Figure 4 - 7

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 - 8.**

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

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

IDENTIFYING THE INTERFERENCE

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

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

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

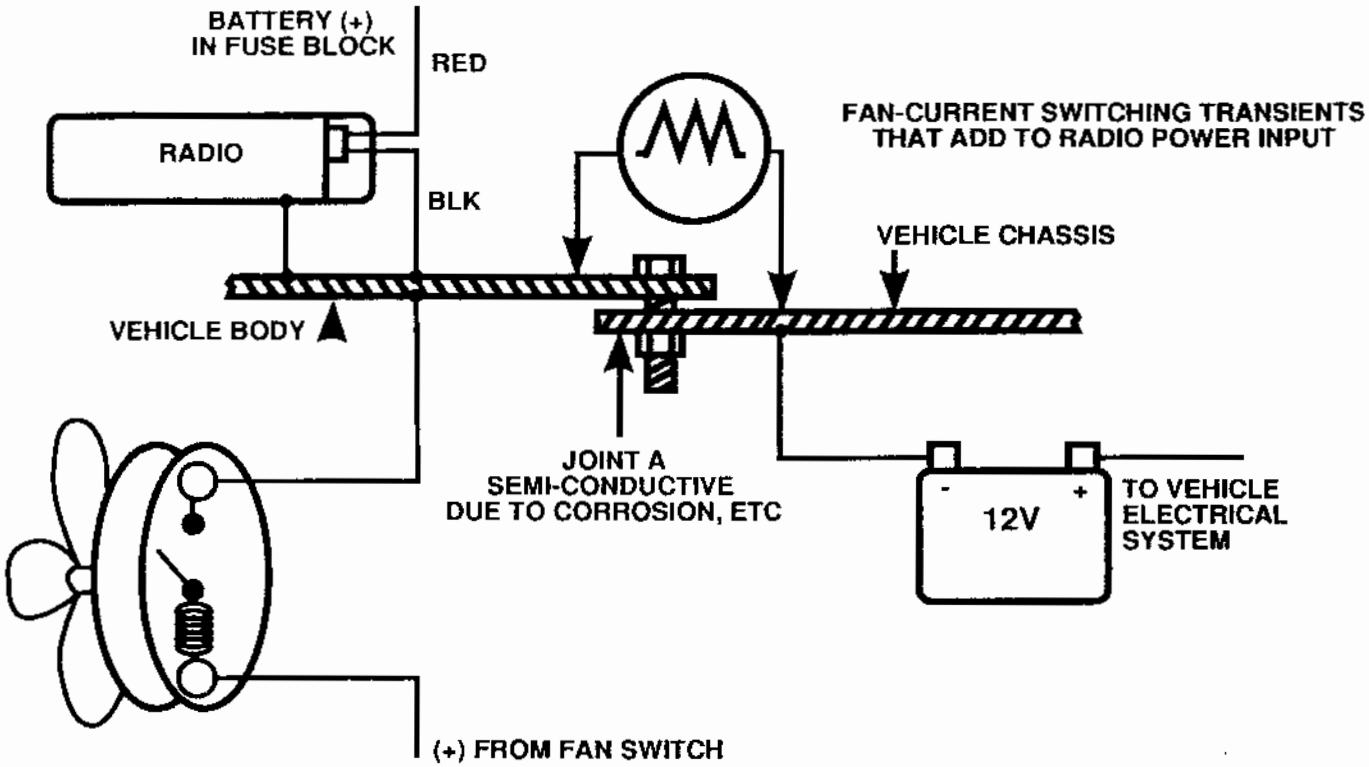
ELIMINATING CONDUCTED NOISE

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

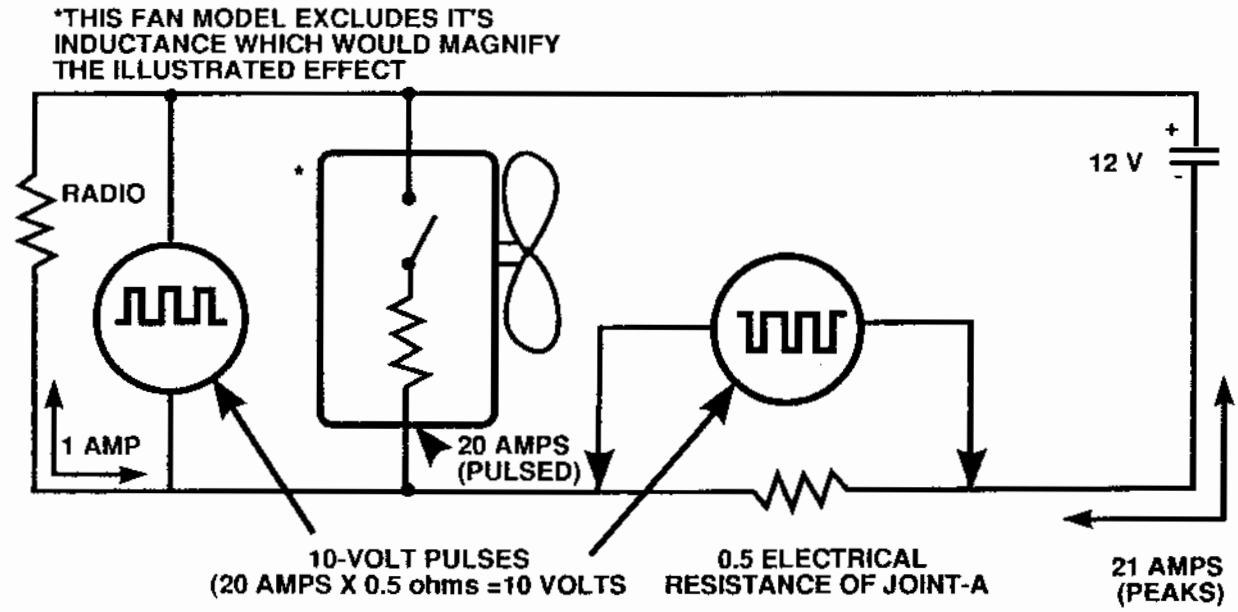
Another possible source of conducted interference is a fan motor in the same circuit to which the radio is connected. Because a fan also induces interference, confirm that noise is conducted into the radio (see IDENTIFYING THE INTERFERENCE). If the interference is conducted into the DC power leads of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

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

Ground current of a fan motor finds its way to the vehicle battery through segments of metal body A-frame assemblies (see **Figure 4 - 9**). If the elec-



GROUND PATH



EQUIVALENT CIRCUIT

Figure 4 - 8 — Interference Paths

trical 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.

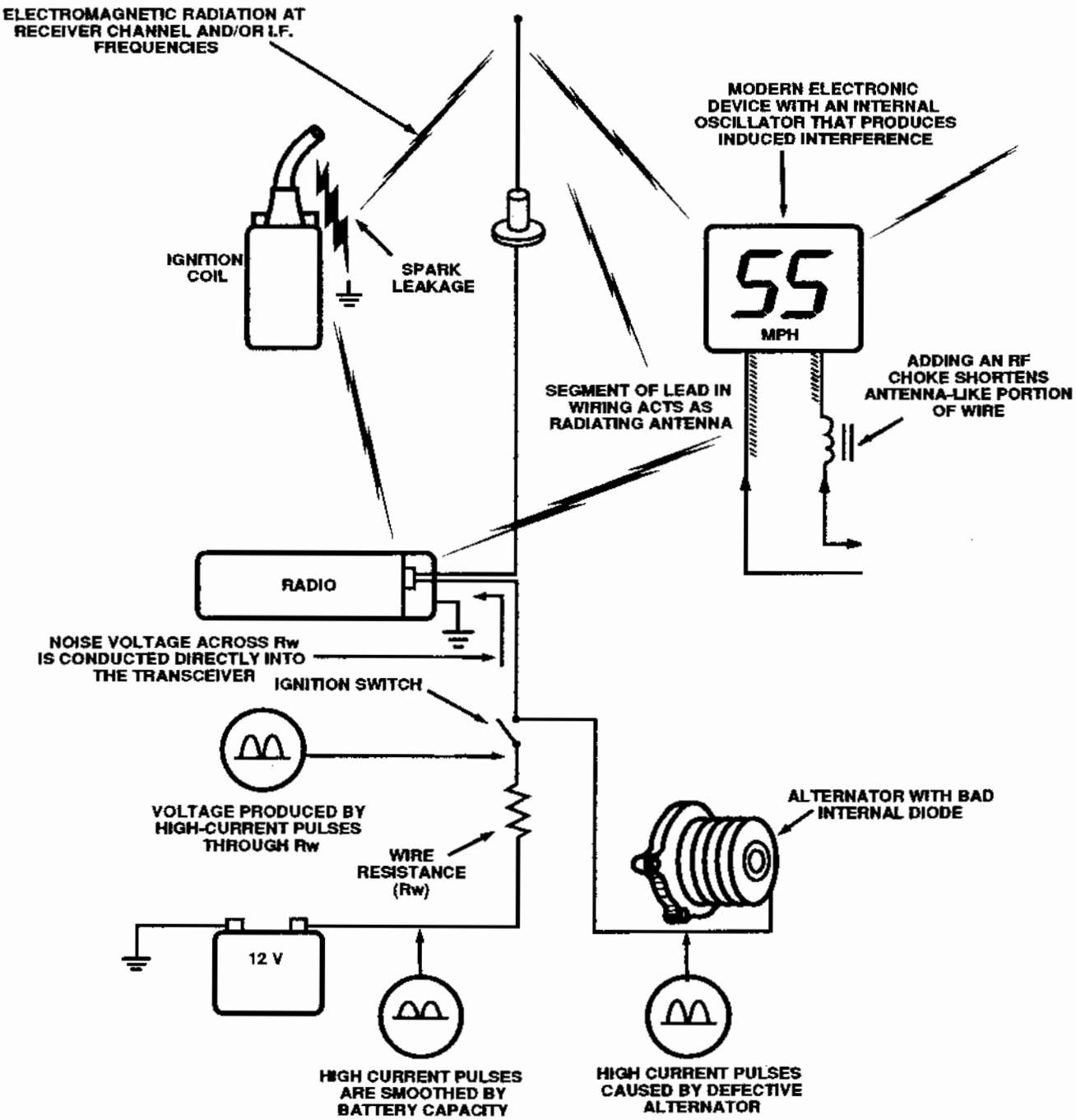


Figure 4 - 9 — A Noisy Ground

DC VOLTAGE CHARTS

Table 4 - 1 — Transistors

NAME	MODE	BASE	COLLECTOR	EMITTER
Q1	RX TX	0.7 0.0	0.0 5.0	0.0 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
Q103	RX/TX	2.1	4.6	1.4
Q131	TX	0.9	7.6	0.7
Q201	RX	1.0	8.5	0.3
Q203	RX	0.7	6.2	0.5
Q241	RX	3.3	7.8	2.6
Q243	RX	3.1	9.1	2.2
Q244	RX	2.4	4.0	1.8
Q301	RX/TX	4.4	3.4	5.0
Q406	RX	3.6	5.0	0.0
Q409	RX/TX	8.8	8.8	8.2
Q410	RX	5.0	5.0	1.0
Q501	TX	0.8	0.0—12.2	0.0
Q502	TX	0.0	13.4	0.0
Q503	TX	0.0	13.4	0.0
Q504	TX	12.5	5.4	13.6
Q701	RX/TX	9.0	9.1	8.2
Q704	TX	8.3	8.2	9.0
Q705	RX TX	4.2 0.2	0.3 8.0	0.0 0.0
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
Q804	RX	0.7	0.3	0.1
Q805	RX	4.7	0.1	5.3
Q806	RX	8.6	0.1	5.3
Q807	RX	0.0	8.6	0.0
Q808	RX	8.6	0.0	8.1
Q809	RX	8.4	8.4	8.9
Q810	RX	8.4	5.4	8.9
Q811	RX	5.4	8.9	4.7

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	5.0	0.0—4.3
Q702	RX TX	7.6 7.6	0.0 0.0	0.0 7.5	0.0 7.5	0.0 8.0	8.2 8.2
Q703	RX TX	0.0 2.9	0.0 2.9	0.0 0.0	9.0 0.0	4.6 0.2	0.0 0.0
Q771	RX/TX	4.6	4.6	4.6	4.6	4.6	0.0
Q772	RX/TX	0.0	4.6	4.6	9.0	4.6	0.0
Q778	RX/TX	4.6	4.6	0.0	0.0	0.0	0.0

Table 4 - 3 — FET's

NAME	MODE	GATE 1	GATE 2	DRAIN	SOURCE
Q242	RX	0.0	—	9.0	0.52
Q408	SQ OPEN SQ CLOSED	4.7 0.0	— —	5.0 5.0	5.0 5.0
Q711	RX	3.4	4.7	7.8	3.0
Q731	TX	3.4	4.7	7.8	3.0
Q801	RX	3.7	—	3.7	3.7
Q802	RX	3.7	—	3.7	3.7
Q803	RX	3.7	6.7	8.9	3.5

Table 4 - 4 — 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	—	—	—	—	—
IC405	RX/TX	0.9	2.8	2.8	0.0	4.1	4.1	3.3	9.0
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	—	—	—	—
IC801	RX	8.9	8.9	0.0	2.83	4.5	2.8	0.0	8.9
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 - 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	SQ OPEN	6.7	6.6	6.6	6.8	6.4	6.4	6.4	6.8
	SQ CLOSED	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	2.3	0.0	5.0	5.0	—	—
IC50	RX/TX	1.7	1.7	0.0	1.7	1.7	—	—	—
IC241	SQ OPEN	2.8	0.7	0.8	3.0	0.0	3.0	0.0	1.8
	SQ CLOSED	2.8	0.7	0.8	3.1	6.3	4.7	0.0	1.8
IC301	RX/TX	—	—	—	—	—	—	—	5.0
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	—	—

NOTES

SECTION 5

CIRCUIT DESCRIPTIONS

NOTES

The SYN-TECH XTR TX/RX unit is made up of three major sections: the RF Section, the PA Section, and the Logic Section.

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 oscillators (VCO's) 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 + 10.7 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 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 a 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 in 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 Q403-1/2 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 IC411, where frequency response is pre-emphasized and splatter filtered. Gain is such that stronger signals bring the 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 70-1080A programmer.

RECEIVER

• Preselector

Through the TX and RX relay, 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 eight top-coupled, parallel tanks: L201, L202, L203, L204, L205, L206, L207 and L208. No tuning of these tanks is required for the entire channel frequency spread (6.3 MHz for A Band, 6 MHz for B Band, and 8 MHz for C Band). Q201 provides adequate gain to overcome preselector signal losses and maximize receiver sensitivity.

• Injection

First Local Oscillator signal (Fc + 10.7 MHz) is synthesized by the phase-lock loop and applied to Q203. A low-pass filter is provided at the output of Q203, and this rejects extraneous synthesized signals.

• First Mixer

To maximize intermodulation immunity, a balanced configuration is used for the first-mixer stage. High injection is applied to L212-primary and preselector output is applied to its secondary center tap. Diode double balanced mixer using quad-diode D202 is employed. High injection is applied to the push-pull input of the mixer. Some of this signal appears at mixer output, but most is lost because L211 is designed to be operated at the 10.7 MHz First IF frequency.

• First IF

Mixer output is applied to Q241, which drives L245. L245 tunes to match the input impedance of 10.7 MHz crystal filter FL241 and FL242, which reject signals outside the channel bandwidth. L247 matches FL242 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 generates a second LO injection of 10.245 MHz. A double-balanced mixer, that cancels both input signals internally, is used so that additional tuned circuits at its output are not needed. Mixer output signal of 455 kHz (IC241 pin 3) is bandpass filtered further by FL243 and FL244, then superamplified (100+ dB) by the second IF amplifier/limiter within IC241 (at 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. Limiter output (IC241 pin 7) is also fed to L250. 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 Q243 is routed to the gain control IC409 and applied to the active filter IC411. The amplification level is controlled by the gain 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 RV241, which calibrates squelch-break level when the front panel SQUELCH control is maximum. Signals at RV241 top feed a two-tank 50 kHz filter. The resulting 50 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 control sinks current from D243 so that the voltage can be adjusted. The DC voltage is input to 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.

• Noise Blanker

Noise generated at the output of Q241 is amplified at Q803 and then sent to IC801. IC801 controls gain of pin 8 output through Q809 to Q811 (rectifier/amplifier circuit) and fed-back to pin 5. Output of IC801 pin 1 is rectified at Q804 and given to Q805 and Q806 (one-shot multi-vibrator), which generates a blanking pulse. Q801 and Q802 switch "IF" signal on and off by blanking pulse amplified at Q807 and Q808.

60-WATT PA SECTION

• RF Power Amplifier

A PC-board stripline is used to match the Q501 base terminal to the coax. RF impedance at the collector of Q501 is transformed by PC-board stripline to the base terminal of drive Q502 and the collector of Q502 is transformed to the base of Q503. Similarly, RF impedance at the collector of final-stage Q503 is transformed by PC stripline and T1 to match the impedance at RF-gate K501. L510—L512 and C561—C568 comprise 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 C544 route. The RF signal path from final amplifier Q503 is then severed.

In transmit mode, Relay K501 is switched off the C544 route. The receiver port network is detuned so that is appears as a high impedance to the antenna, and K501 switches final amplifier output to the antenna at J501.

• Automatic Power Control

T1, ahead of the harmonic filter, serves as a directional coupler. D503 rectifies a small RF sample that is developed across the thin runner, producing a DC voltage that increases with RF power traveling forward into the antenna. This power-level sensing voltage is the inverting input of the comparator IC405 pin 6. The reference voltage applied to the comparator IC405 pin 5 is fed from the D/A convertor IC404 pin 4, which is controlled by the microcomputer via the 70-1080A Programmer (in alignment mode).

Output of the comparator IC405 is applied to Q504 via Q403, 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 6 holds RF output power at the constant level determined by the reference voltage of IC405 pin 5, which is initially adjusted using the programmer.

5

LOGIC SECTION

DC POWER AND RESET

5 V DC power to all logic circuitry in the 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.

MICROCOMPUTER

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

All CPU activity is performed step-by-step in time with a clock. The frequency of the clock is fixed by crystal X901. Because of the high clock speed, microcomputer activity seems instantaneous.

• Display and Switches

Rotating S305 (UP) or (DN) applies a momentary logic low to pin 56 or 55 of IC901, respectively. IC901 interprets this request as a channel change up or down and outputs the appropriate BCD display data from pin 13—pin 16 (DSP3—DSP0), which is applied to the BCD-to-Seven Segment Display driver, IC301. The channel display data is latched into IC301 by the DSP STB from pin 12 of IC901. Once latched, the appropriate channel is diplayed on the channel display, D301.

Pressing S301 (MON) applies a momentary logic low to pin 50 of IC901. IC901 responds by putting CTCSS/DCS decode (if installed) in the monitor state and outputs a logic high from pin 13 (DSP3) which is latched in IC302 by the LED STB sent from pin 11. The logic high is inverted by Q302-2/2 to light the MON LED, D303.

Pressing optional switch S302 (PSCAN) applies a momentary logic low to pin 51 of IC901. IC901 places the radio in the PSCAN mode and indicates this by outputting a logic high from pin 16 (DSP0) which is latched into IC302 by the LED STB sent from pin 11. The logic high is inverted by Q302-1/2 to light the optional PSCAN LED, D304.

Before going into the PSCAN mode, pressing S304 (ADD/DEL) applies a momentary logic low to pin 49 of IC901. IC901 outputs to the ADD/DEL LED (D306), causing it to begin flashing, allowing the user to check the PSCAN list.

During transmit, TX 9V is present at the anode of D701, which applies a positive voltage to the anode of the TX LED, turning it on. When a signal is received, Q410 is turned on, which allows a positive voltage to be applied to the anode of the BUSY LED via D401-3/3.

• CTCSS/DCS Encode/Decode

IC901 controls CTCSS/DCS encode and decode. If the optional 70-2157 CTCSS board has been installed, during receive mode the receive audio signal is high-pass filtered at IC50 (on the 70-2157 board) to remove the CTCSS/DCS tones/codes. The CTCSS/DCS square wave is input through the Signal I/O line, pin 8 of IC901. IC901 determines if the CTCSS/DCS signal received is a valid tone/code. If it is valid, the output at pin 21 (MUTE) will go to logic high, which opens radio squelch.

In TX mode, pin 8 of IC901 will output the programmed CTCSS/DCS tone/code to the 70-2157 board, if installed. TXDL goes low, turning off Q1, which turns on IC2-2/4 and IC2-4/4, allowing the tone/code on the Signal I/O line to pass through IC1. IC1 is a programmable filter that "cleans up" CTCSS/DCS tones/codes. The generated tone is applied to Level Adjust RV1, and from there to Balance Control RV401 via C6. The signal is then sent to IC411-3/4, where it is mixed with the mic audio, and also to D102 in the reference oscillator.

• RX and TX Switching

In receive mode, TXDL (pin 33 of IC901) is at logic high. This turns Q705 on, which causes Q702-1/2 to turn on. This applies RX8V to the VCO. Also, when TXDL is high, Q703-1/2 turns on, and Q703-2/2 turns off. This turns Q702-2/2 and Q704 off, which turns TX8V and TX9V off.

In transmit mode, TXDL is at logic low. This turns Q703-1/2 off, which turns Q703-2/2 on. This turns Q702-2/2 and Q704 on, which turn TX8V and TX9V on. Also, when TXDL is low, this turns Q705 off, which causes Q702-1/2 to turn off. This turns RX8V off, and TX8V and TX9V on.

• Data Control

When the radio is turned on, the contents of EEPROM IC903 are serially clocked into IC901 so that it can set up receiver frequency, scan operation, transmit/receive hold timer, busy-channel lock-out timer, time-out-timer and reference oscillator frequency control.

When a channel is changed, or when PTT is pressed, the contents of EEPROM IC903 are sent to IC901. IC901 then uses this data to send the appropriate information for the channel selected to IC771, CTCSS/DCS circuitry, display circuitry, and any signalling options.

• Reference Oscillator Frequency Control

The resistance of thermistor R107 varies with temperature. This resistance change is converted to a voltage by IC405. Output of IC405 is sent to IC901 pin 59 (TEMP). IC901 compares this data internally with the preset crystal type and programmed offset, and outputs a compensating voltage from pin 60 (F CONT). This voltage is sent to varactor diode D101 to stabilize the frequency of the reference oscillator.

• Transmit Output Power Control

Power level data is sent from IC901 pin 40 (DATA) to IC404 (the D/A converter) and outputs a reference voltage from pin 4 as described under "Automatic Power Control" on page 5 - 5.

• Modulation Level Control

Modulation level data is sent from IC901 pin 40 (DATA) to IC404 (the D/A converter) and outputs a reference voltage from pin 2, which adjust the gain of IC408. This controls the modulation level as described under "Modulator", page 5 - 3.

Table 5-1—IC901 PINOUTS

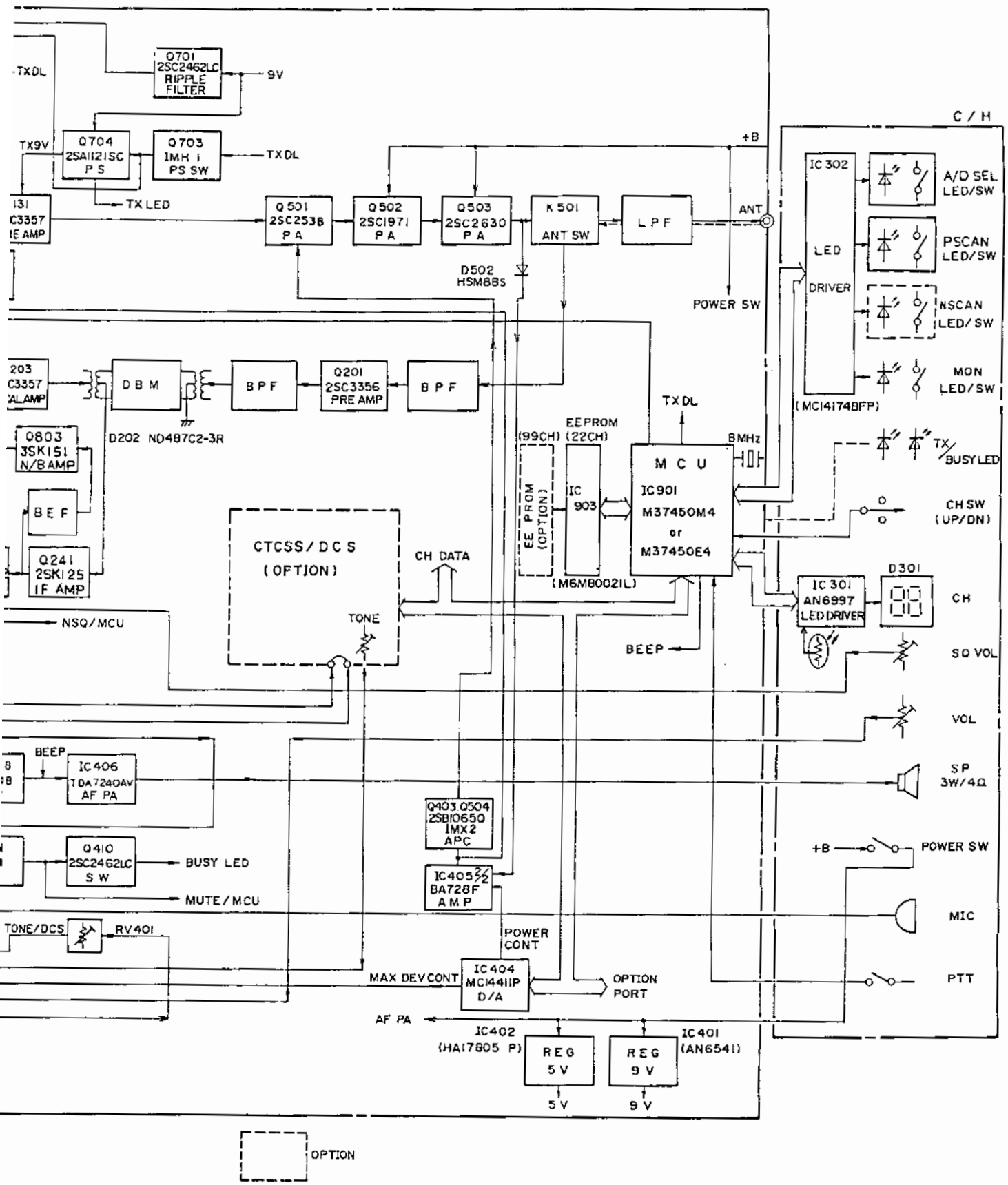
Pin No.	Pin Name	I/O Flow	Function Label	Logic & Function
1	P37	I	PC RTS	Programmer Interface
2	P36	O	PC CTS	Programmer Interface
3	P35	O	PC RD	Programmer Interface
4	P34	I	PC SD	Programmer Interface
5	P33	I	PC CD	Programmer Interface
6	P32	O	BEEP OUT	Beep Tone Output
7	P31	O	SGNCLK	Clock Output for 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	Paralled-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	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

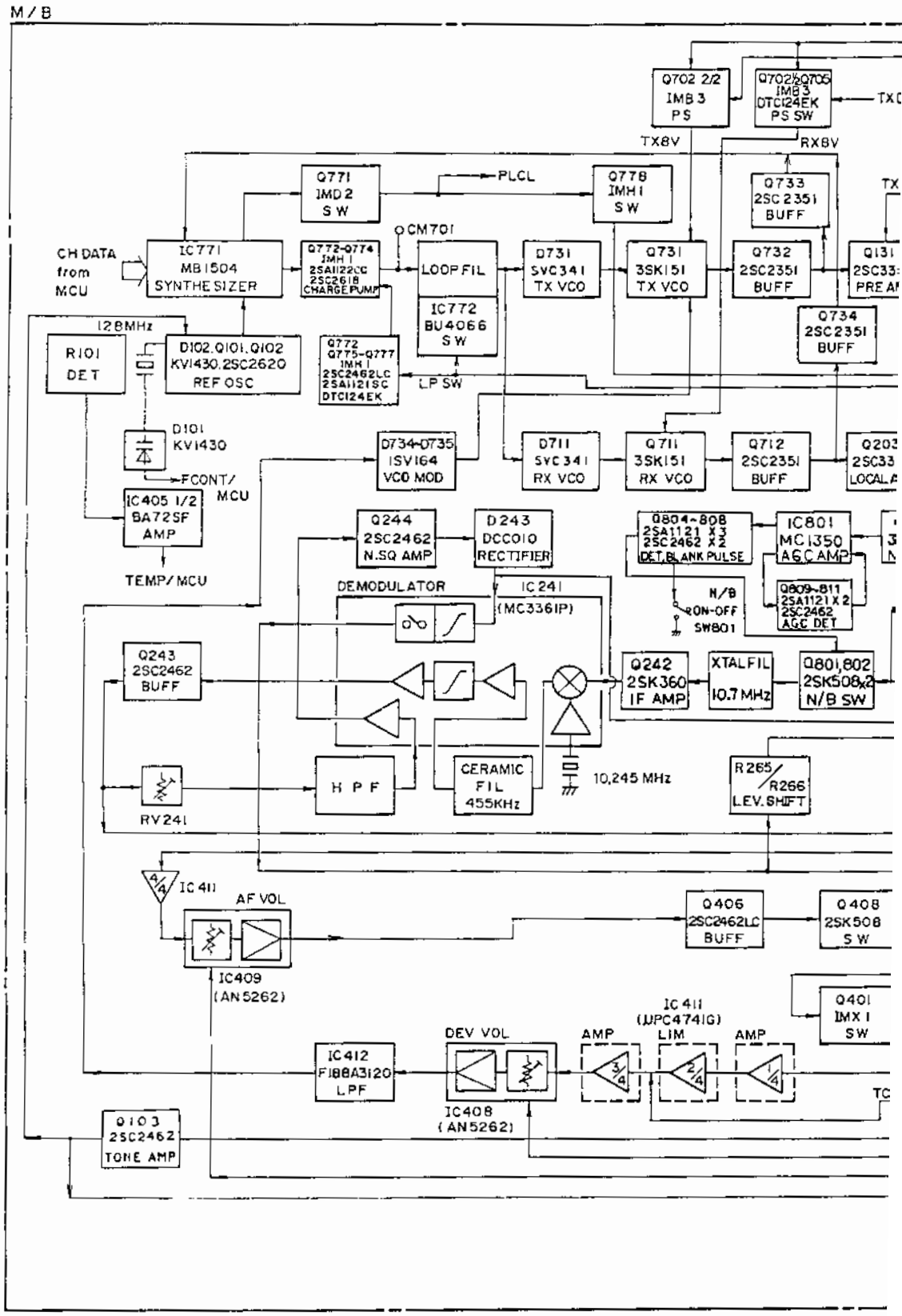
NOTES

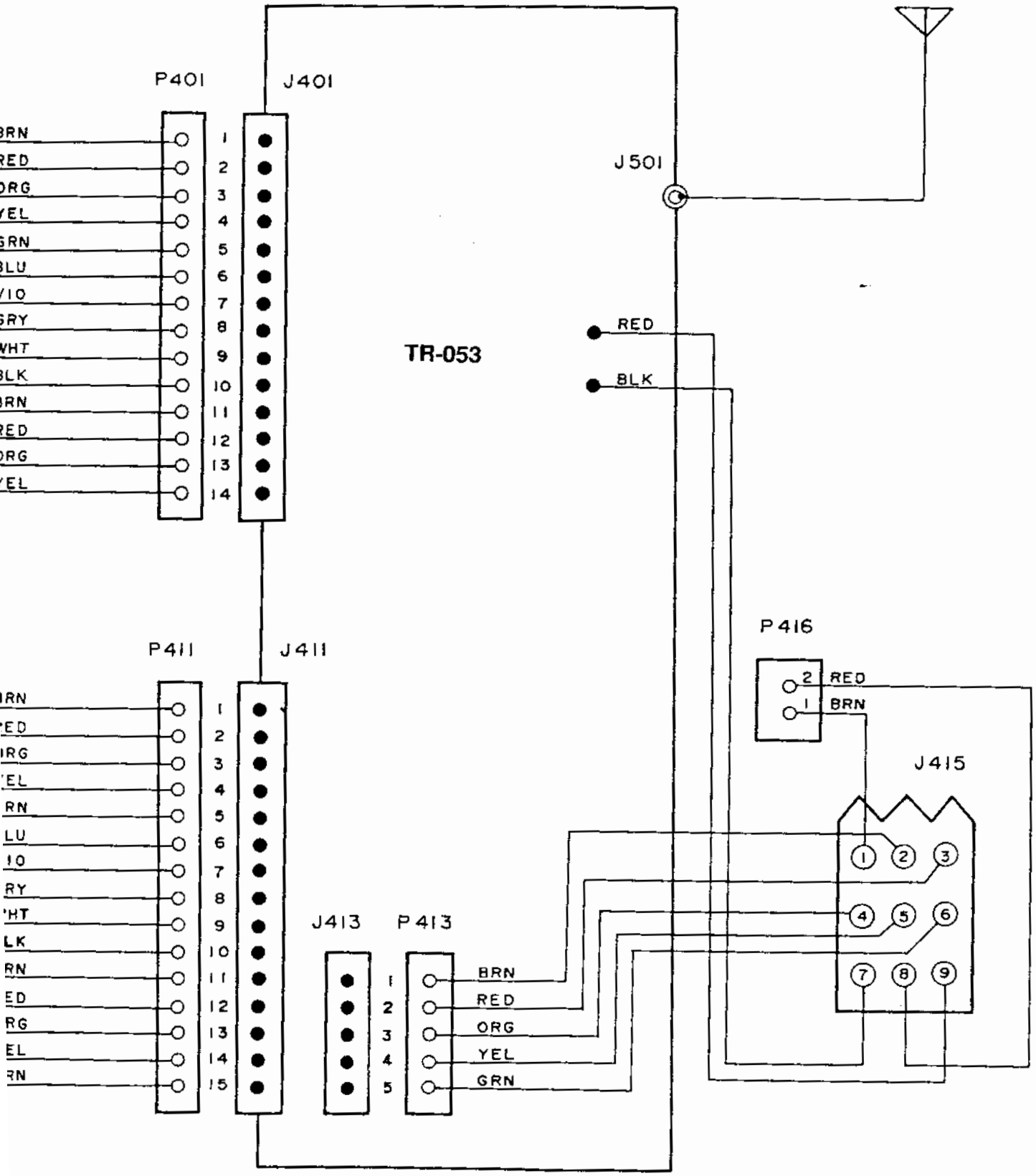
SECTION 6

DIAGRAMS

NOTES

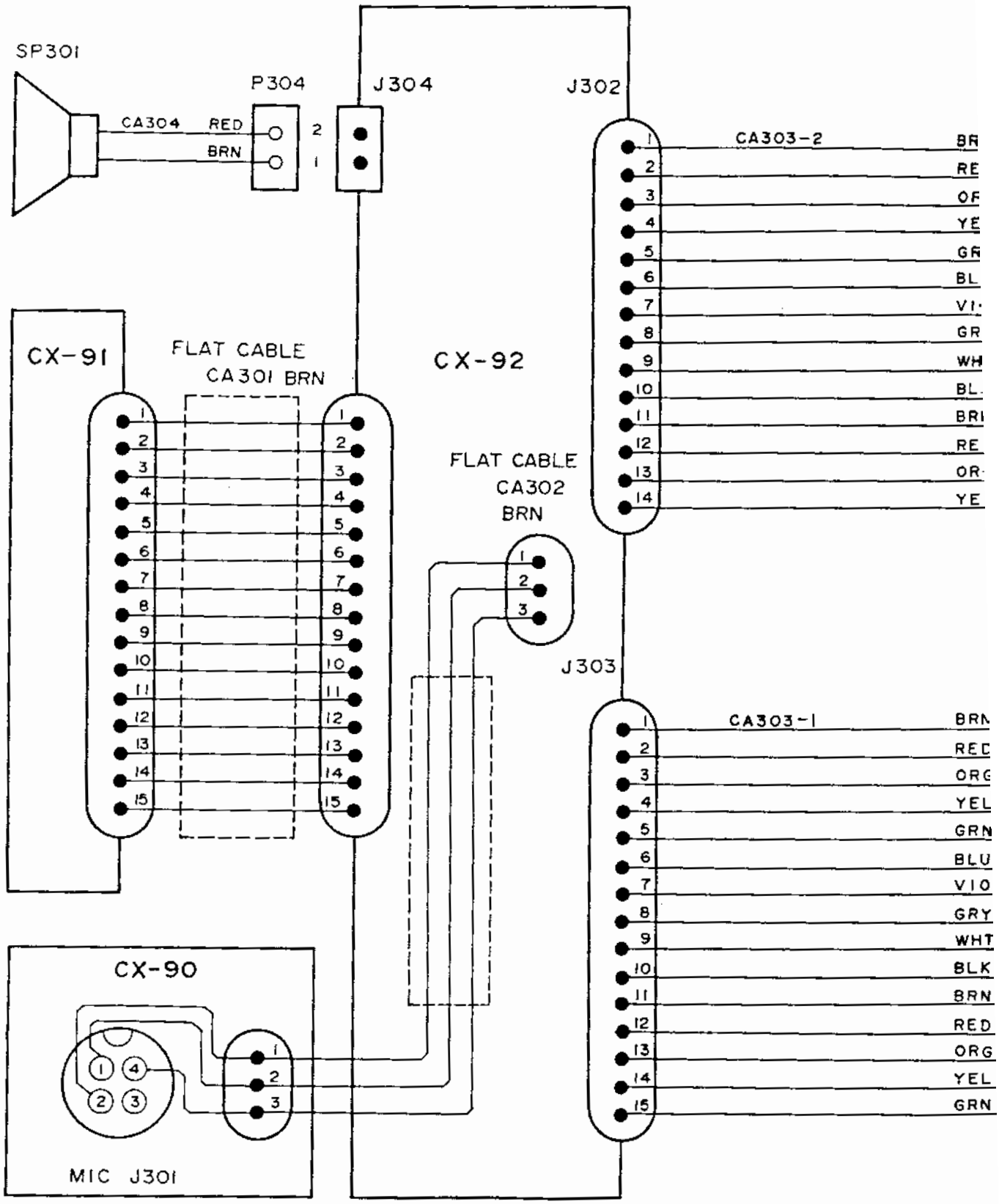

TXDL
Q701 2SC2462LC RIPPLE FILTER
9V
TX9V
Q704 2SA1121SC P S
Q703 IMH 1 PS SW
TXDL
TX LED
Q501 2SC2538 P A
Q502 2SC1971 P A
Q503 2SC2630 P A
K501 ANT SW
L P F
ANT
+B
C / H
IC302
LED DRIVER
A/D SEL LED/SW
PSCAN LED/SW
NSCAN LED/SW
MON LED/SW
(MC14174BFP)
D502 HSM88S
POWER SW
D B M
D202 ND487C2-3R
B P F
Q201 2SC3356 PRE AMP
B P F
Q803 3SK151 N/B AMP
B E F
Q241 2SK125 IF AMP
NSQ/MCU
CTCSS/DCS (OPTION)
TONE
CH DATA
EEPROM (99CH) (22CH)
EE PROM (OPTION)
IC 903
(M6M80021L)
M C U
IC901
M37450M4 or M37450E4
8MHz
TXDL
TX/BUSY LED
CH SW (UP/DN)
IC 301 AN6997 LED DRIVER
D301
CH
BEEP
SQ VOL
VOL
SP 3W/4Ω
IC406 TDA7240AV AF PA
Q410 2SC2462LC S W
BUSY LED
MUTE/MCU
Q403,Q504 2SB1065Q IMX2 APC
IC405 BA728F AMP
+B
POWER SW
MIC
PTT
TONE/DCS
RV401
POWER CONT
IC404 MC144111P D/A
MAX DEVCONT
OPTION PORT
AF PA
IC402 (HA17805 P)
IC401 (AN6541)
REG 5V
REG 9V
5V
9V
OPTION

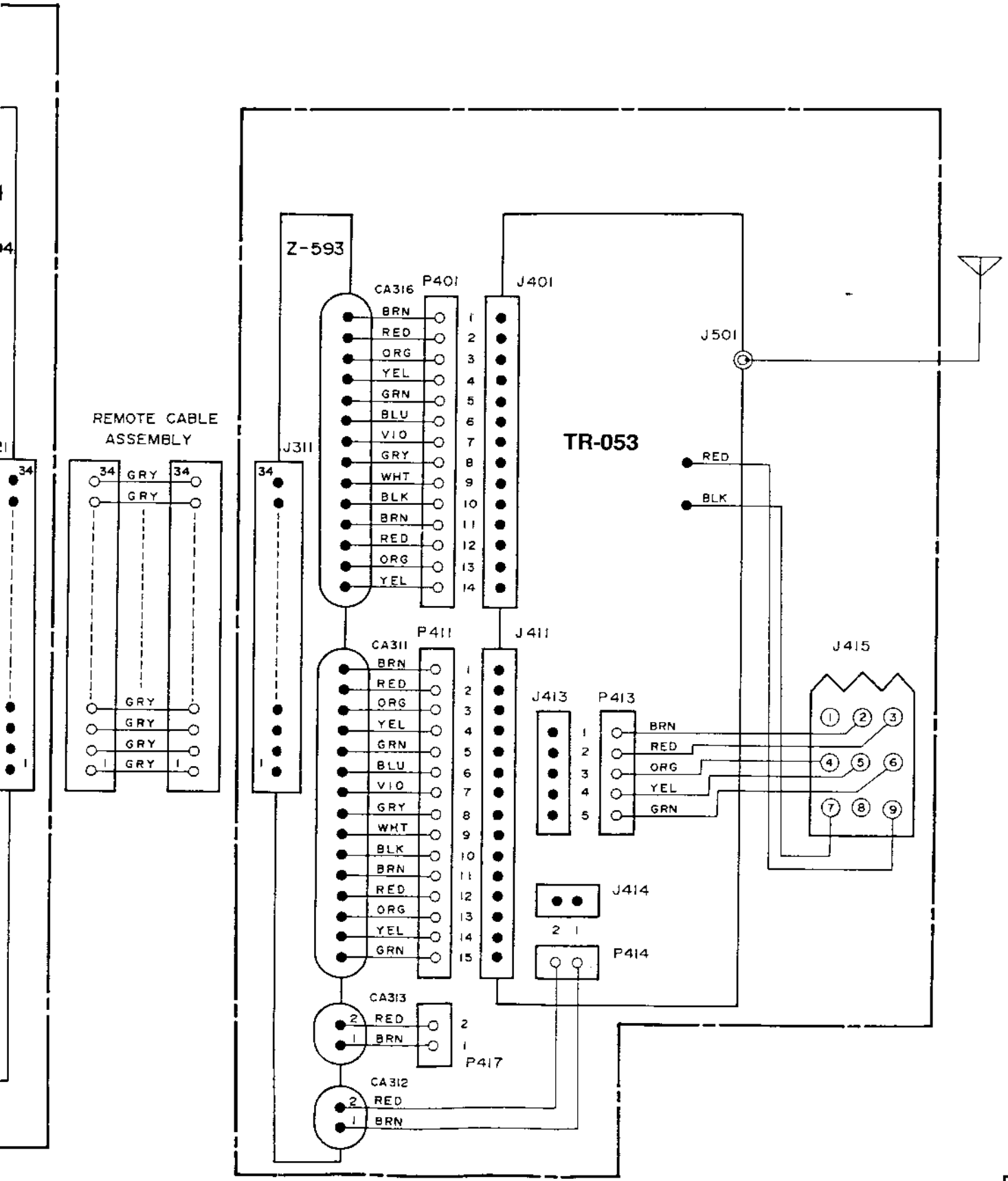

M/B
Q702 2/2 IMB 3 PS
Q702,Q705 IMB 3 DTC124EK PS SW
TX8V
RX8V
Q771 IMD 2 SW
PLCL
Q778 IMH 1 SW
Q733 2SC2351 BUFF
CH DATA from MCU
IC771 MB1504 SYNTHESIZER
Q772-Q774 IMH 1 2SA1122GC 2SC2618 CHARGE PUMP
OCM701
LOOP FIL
IC772 BU4066 SW
D731 SVC341 TX VCO
Q731 3SK151 TX VCO
Q732 2SC2351 BUFF
Q734 2SC2351 BUFF
12.8MHz
R101 DET
D102,Q101,Q102 KVI430,2SC2620 REF OSC
Q772 Q775-Q777 IMH 1 2SC2462LC 2SA1121SC DTC124EK
LP SW
D101 KVI430
FCONT/ MCU
IC405 1/2 BA72SF AMP
TEMP/MCU
D734-D735 1SV164 VCO MOD
D711 SVC341 RX VCO
Q711 3SK151 RX VCO
Q712 2SC2351 BUFF
Q244 2SC2462 N.SQ AMP
D243 DCC010 RECTIFIER
Q804~808 2SA1121 X3 2SC2462 X2 DET,BLANK PULSE
IC801 MC1350 AGC AMP
DEMODULATOR
IC241 (MC3361P)
N/B ON-OFF SW801
Q809~811 2SA1121 X2 2SC2462 AGC DET
Q243 2SC2462 BUFF
Q242 2SK360 IF AMP
XTAL FIL 10.7 MHz
Q801,802 2SK508 X2 N/B SW
H P F
CERAMIC FIL 455KHz
10.245 MHz
R265 / R266 LEV. SHIFT
RV241
IC411
AF VOL
IC409 (AN5262)
Q406 2SC2462LC BUFF
Q408 2SK508 S W
Q401 IMX 1 SW
IC411 (UPC4741G)
DEV VOL
AMP
LIM
AMP
IC412 F1B8A3120 LPF
IC408 (AN5262)
Q103 2SC2462 TONE AMP

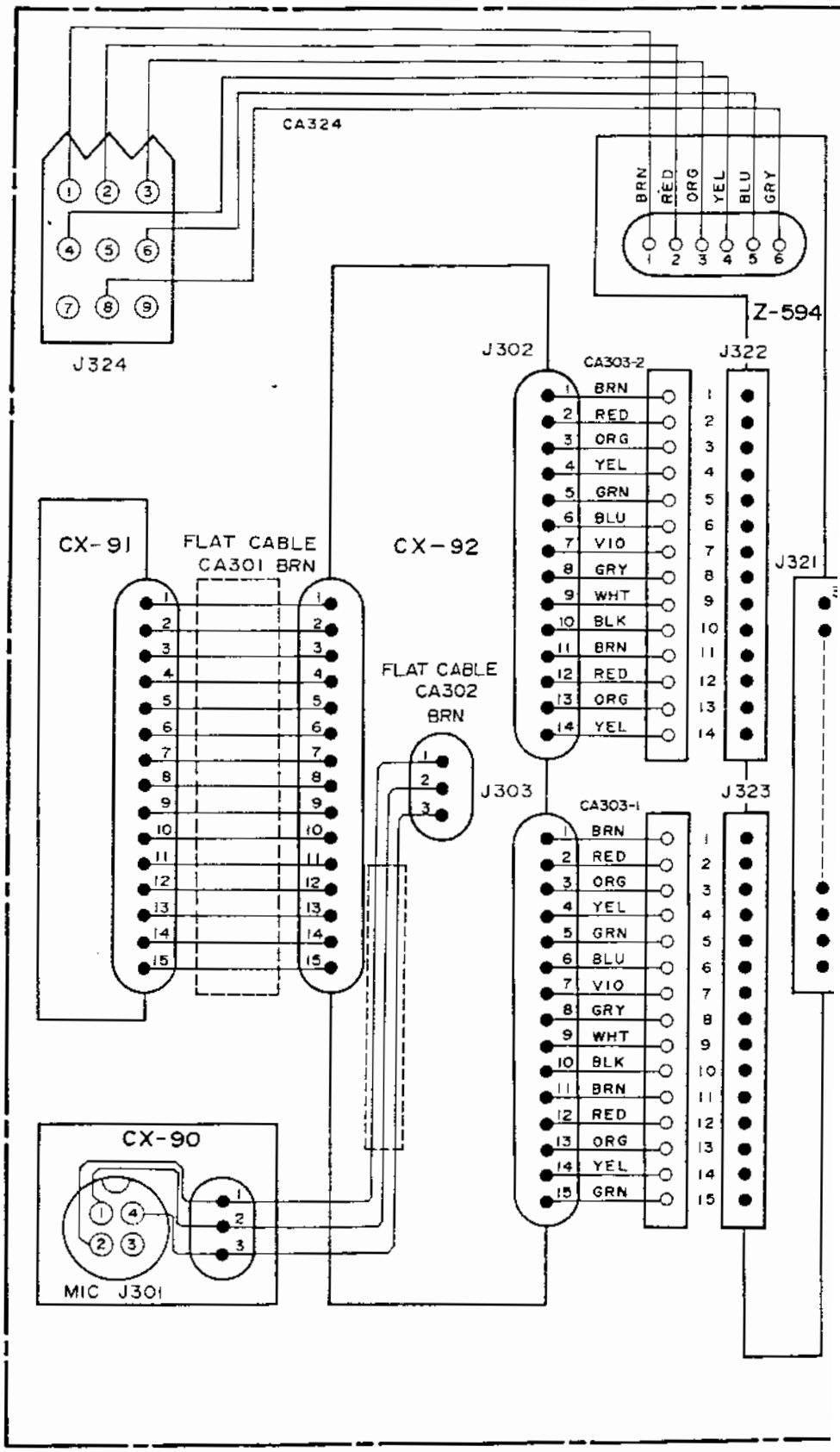

P401
J401
J501
TR-053
RED
BLK
P411
J411
P416
2 RED
1 BRN
J415
J413
P413
BRN
RED
ORG
YEL
GRN

UNDER-DASH WIRING DIAGRAM

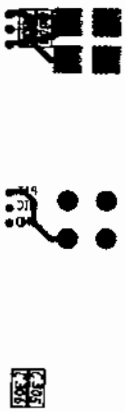
70-0351/0355




Z-593
CA316
P401
J401
BRN
RED
ORG
YEL
GRN
BLU
VIO
GRY
WHT
BLK
J501
REMOTE CABLE ASSEMBLY
J311
TR-053
RED
BLK
P411
J411
CA311
J415
J413
P413
J414
P414
CA313
P417
CA312

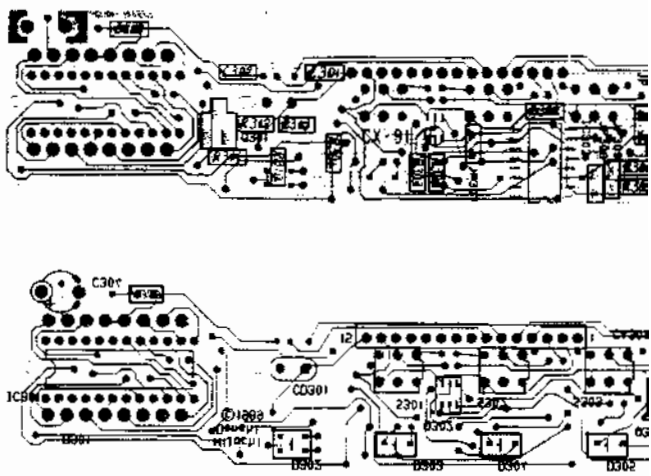

CA324
J324
BRN
RED
ORG
YEL
BLU
GRY
Z-594
J302
J322
CA303-2
CX-91
FLAT CABLE
CA301 BRN
CX-92
J321
FLAT CABLE
CA302
BRN
J303
J323
CA303-1
CX-90
MIC J301

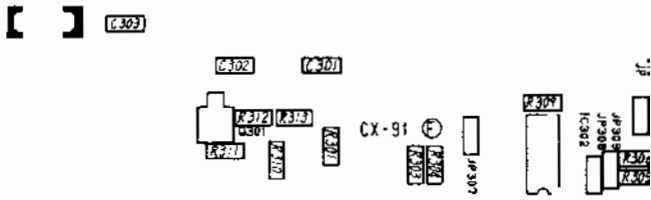
CX-90 LAYOUT BOTTOM VIEW



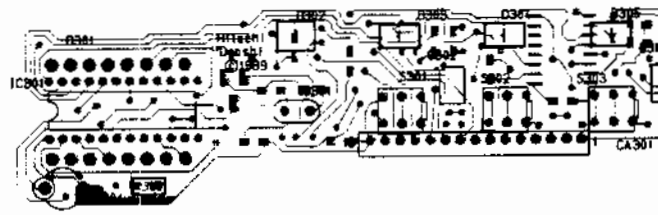
CX-90 LAYOUT TOP VIEW

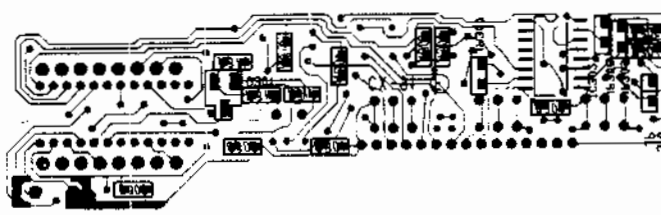
CX-91 LAYOUT BOTTOM VIEW

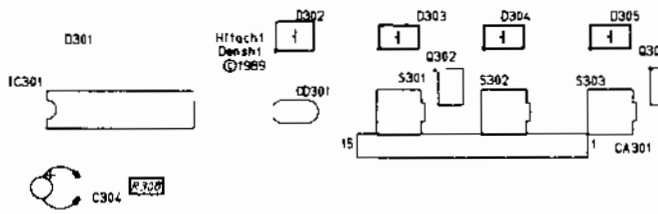




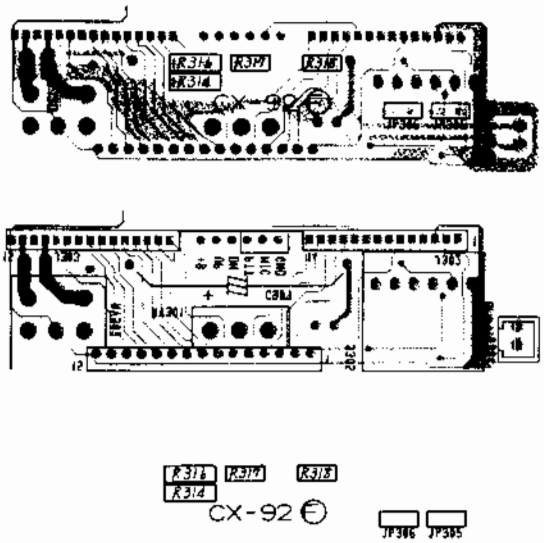
CX-91 LAYOUT TOP VIEW



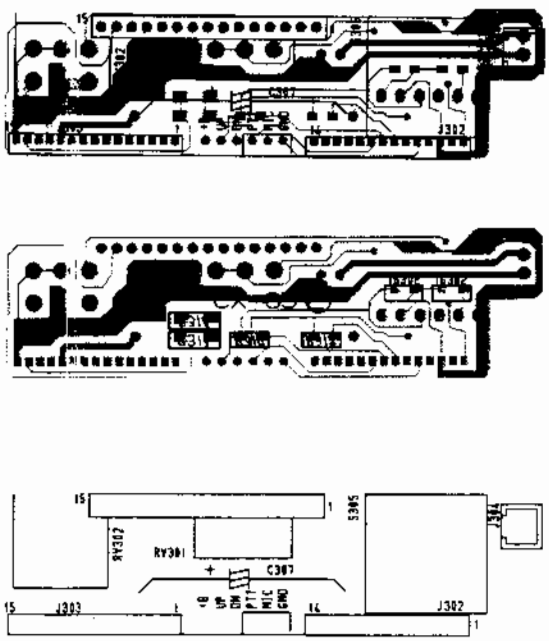




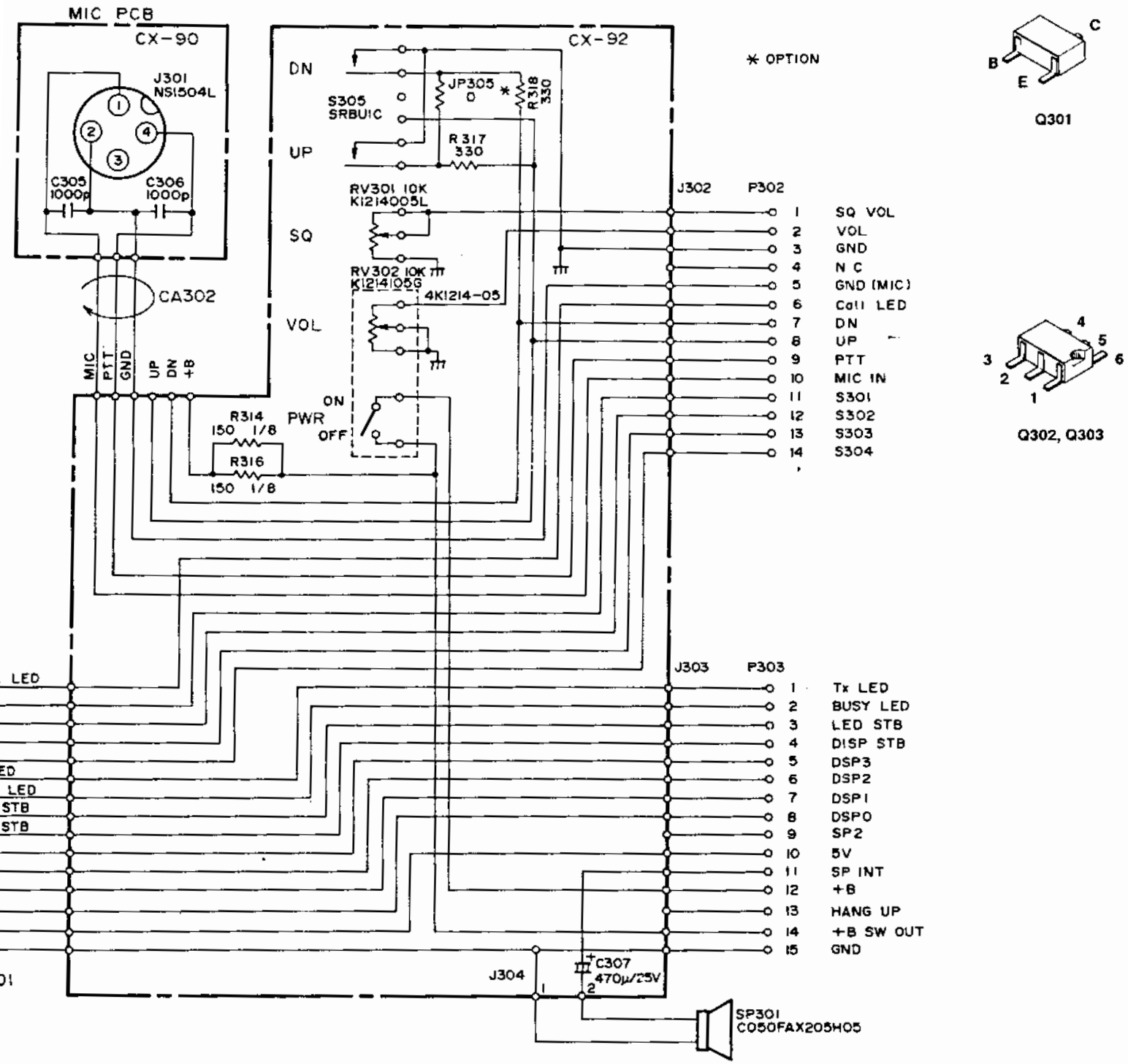
CX-92 LAYOUT BOTTOM VIEW

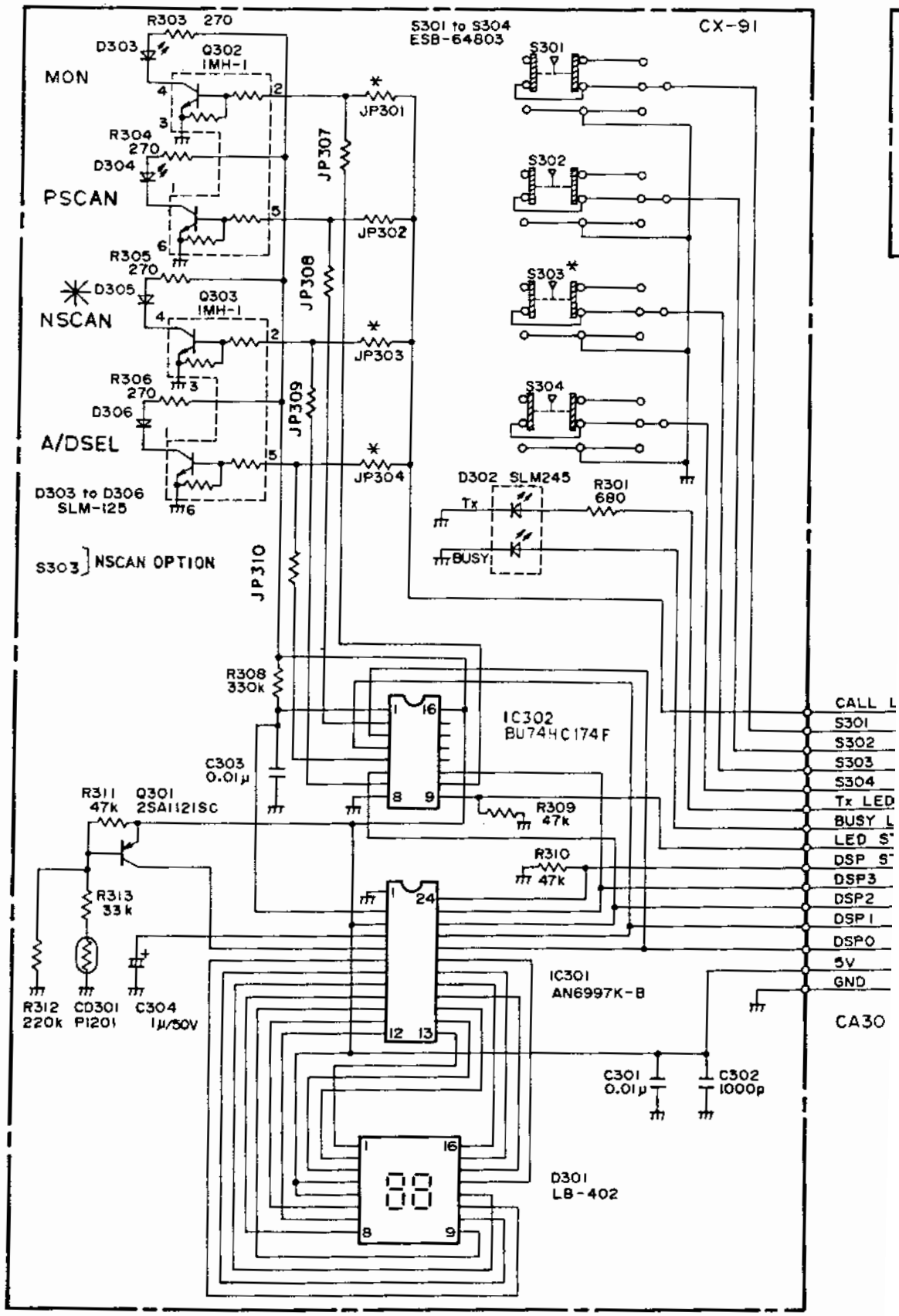


CX-92 LAYOUT TOP VIEW



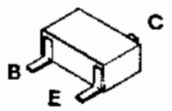
70-0351/0355


MIC PCB
CX-90
J301
NS1504L
C305
1000p
C306
1000p
CA302
MIC
PTT
GND
UP
DN
+B
CX-92
DN
UP
SQ
VOL
S305
SRBUIC
JP305
0
*
R318
330
R317
330
RV301 10K
K1214005L
RV302 10K
K1214105G
4K1214-05
ON
PWR
OFF
R314
150 1/8
R316
150 1/8
* OPTION
J302
P302
1 SQ VOL
2 VOL
3 GND
4 N C
5 GND (MIC)
6 Call LED
7 DN
8 UP
9 PTT
10 MIC IN
11 S301
12 S302
13 S303
14 S304
J303
P303
1 Tx LED
2 BUSY LED
3 LED STB
4 DISP STB
5 DSP3
6 DSP2
7 DSP1
8 DSP0
9 SP2
10 5V
11 SP INT
12 +B
13 HANG UP
14 +B SW OUT
15 GND
J304
C307
470µ/25V
SP301
C050FAX205H05
C
B
E
Q301
4
5
3
6
2
1
Q302, Q303

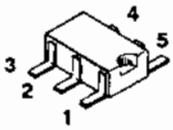

CX-91
S301 to S304
ESB-64803
R303 270
D303
Q302
IMH-1
MON
R304
270
D304
PSCAN
R305
270
D305
Q303
IMH-1
NSCAN
R306
270
D306
A/DSEL
D303 to D306
SLM-125
S303 NSCAN OPTION
JP301
JP302
JP303
JP304
JP307
JP308
JP309
JP310
S301
S302
S303
S304
D302 SLM245
Tx
BUSY
R301
680
R308
330k
IC302
BU74HC174F
C303
0.01µ
R311
47k
Q301
2SA1121SC
R309
47k
R310
47k
R313
33k
R312
220k
CD301
P1201
C304
1µ/50V
IC301
AN6997K-B
C301
0.01µ
C302
1000p
D301
LB-402
CALL L
S301
S302
S303
S304
Tx LED
BUSY L
LED S
DSP S
DSP3
DSP2
DSP1
DSP0
5V
GND
CA30

TRUNK-MOUNT CONTROL HEAD SCHEMATIC

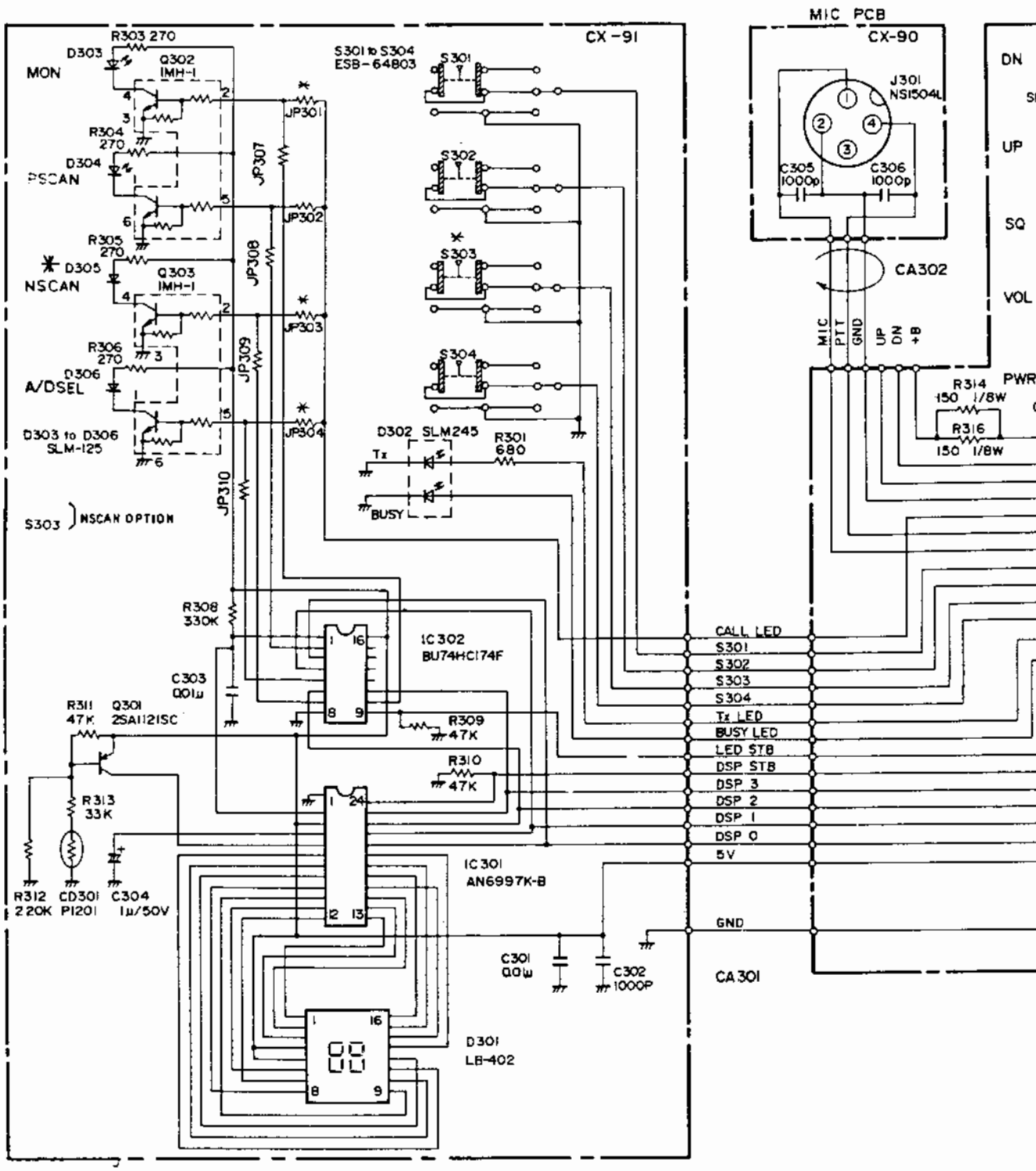
70-0351/0355

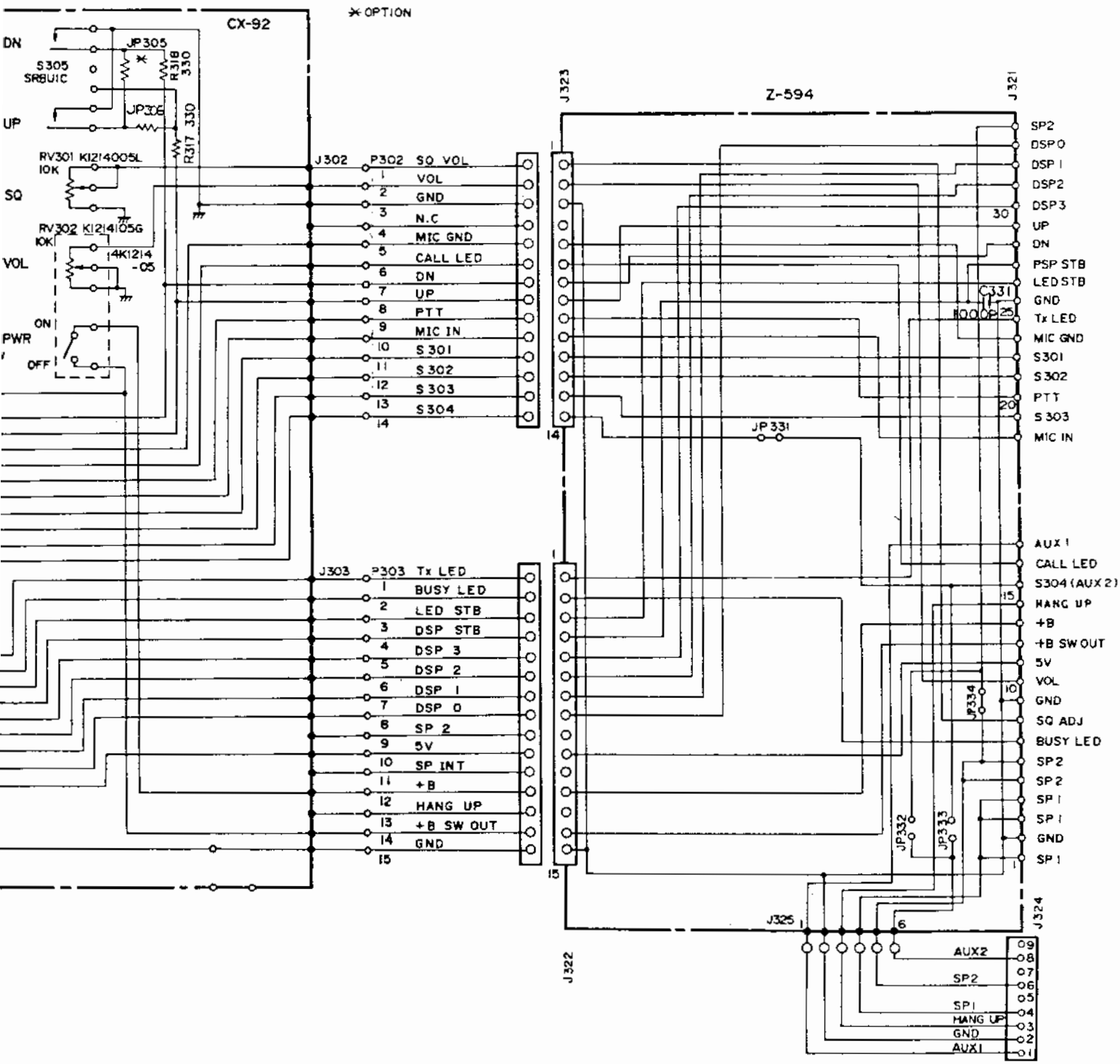


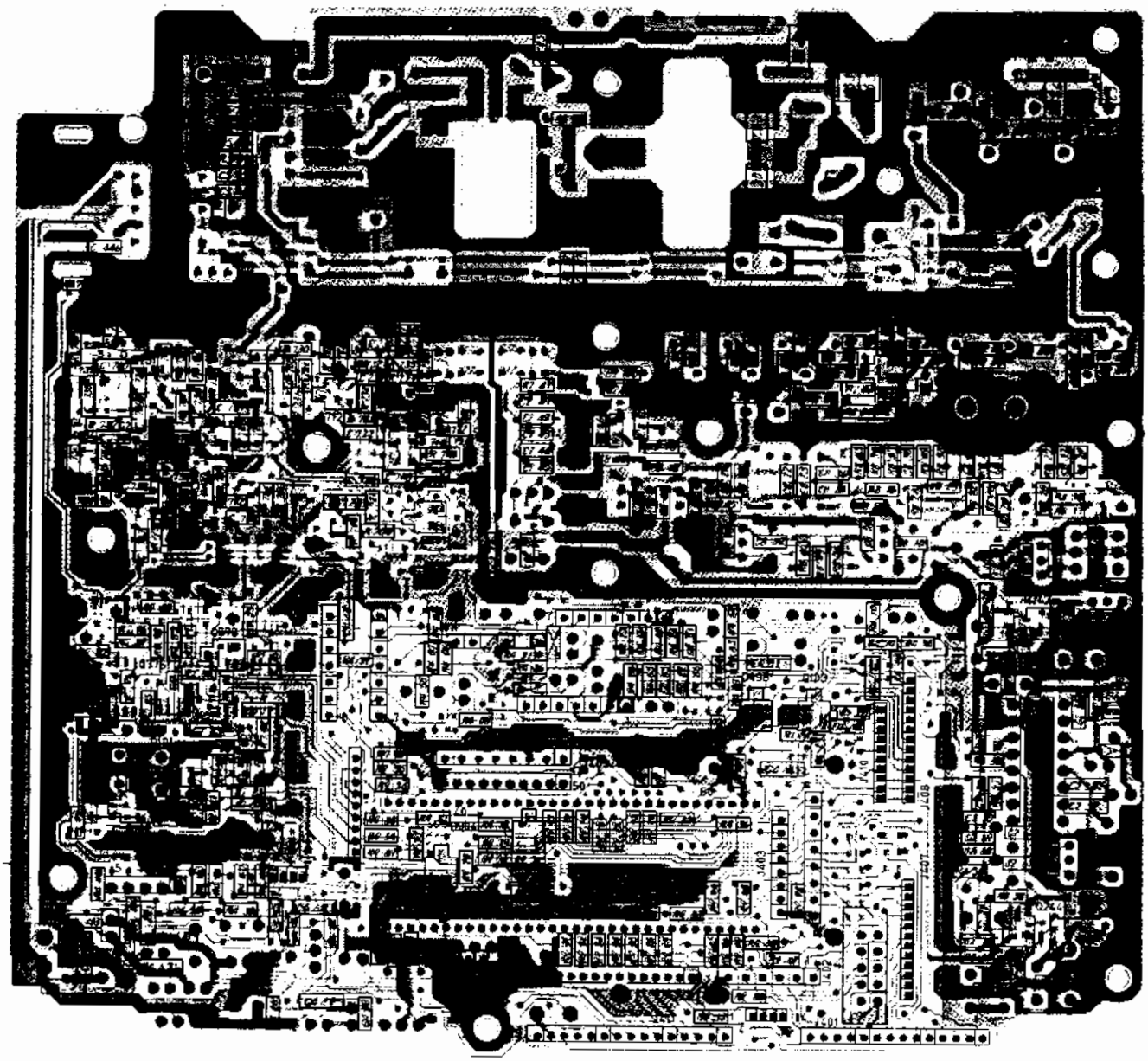
Q301



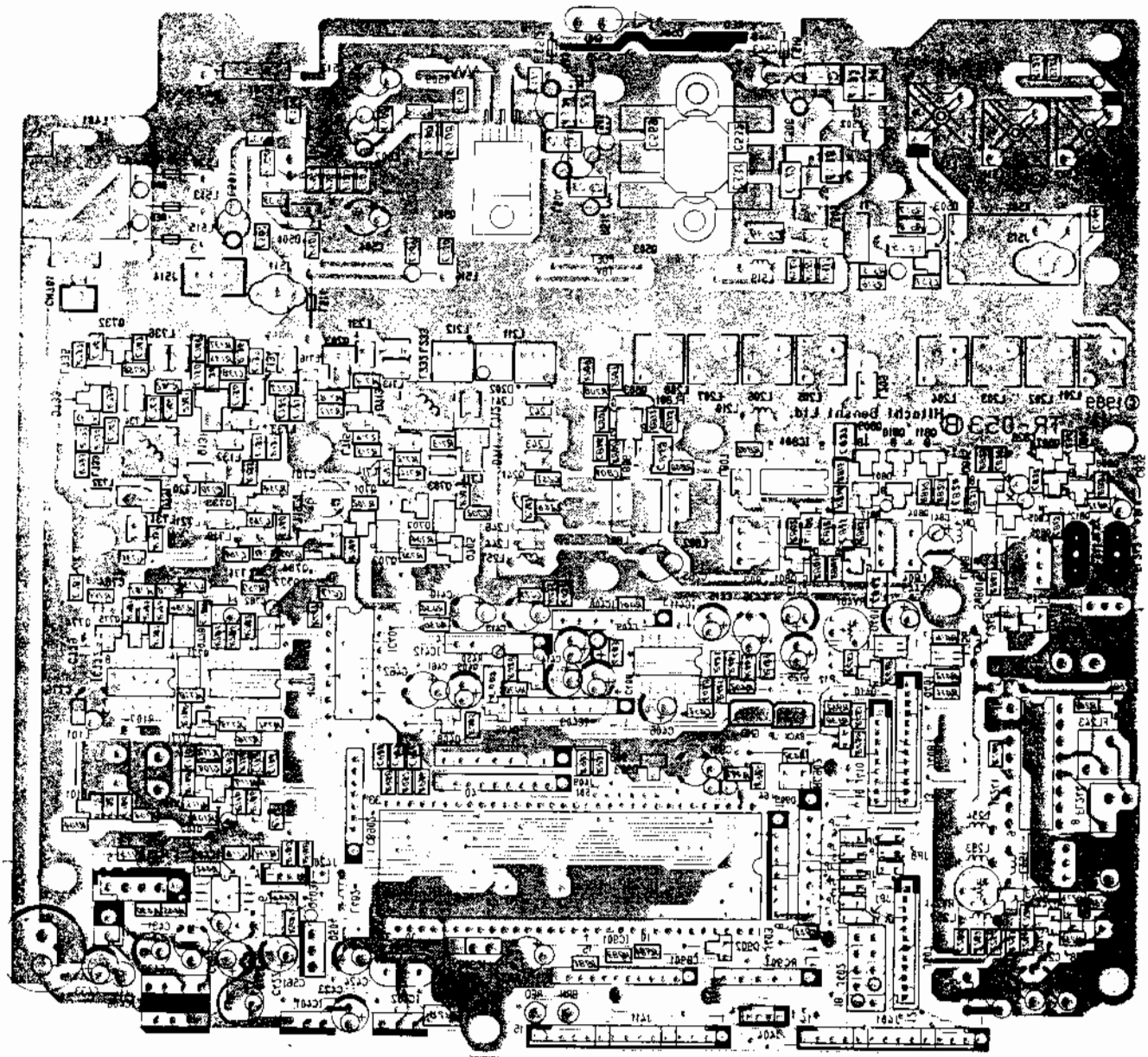
Q302, Q303




CX-92
* OPTION
Z-594
DN
UP
SQ
VOL
PWR
ON
OFF
S305
SRBU1C
JP305
JP306
R318 330
R317 330
RV301 K12140051 10K
RV302 K12141051 10K
4K1214 -05
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
J323
J321
SP2
DSP0
DSP1
DSP2
DSP3
UP
DN
PSP STB
LED STB
GND
Tx LED
MIC GND
S301
S302
PTT
S303
MIC IN
C331 1000P
JP331
AUX1
CALL LED
S304 (AUX2)
HANG UP
+B
+B SW OUT
5V
VOL
GND
SQ ADJ
BUSY LED
SP2
SP2
SP1
SP1
GND
SP1
JP332
JP333
JP334
J322
J325
J324
AUX2
SP2
SP1
HANG UP
GND
AUX1

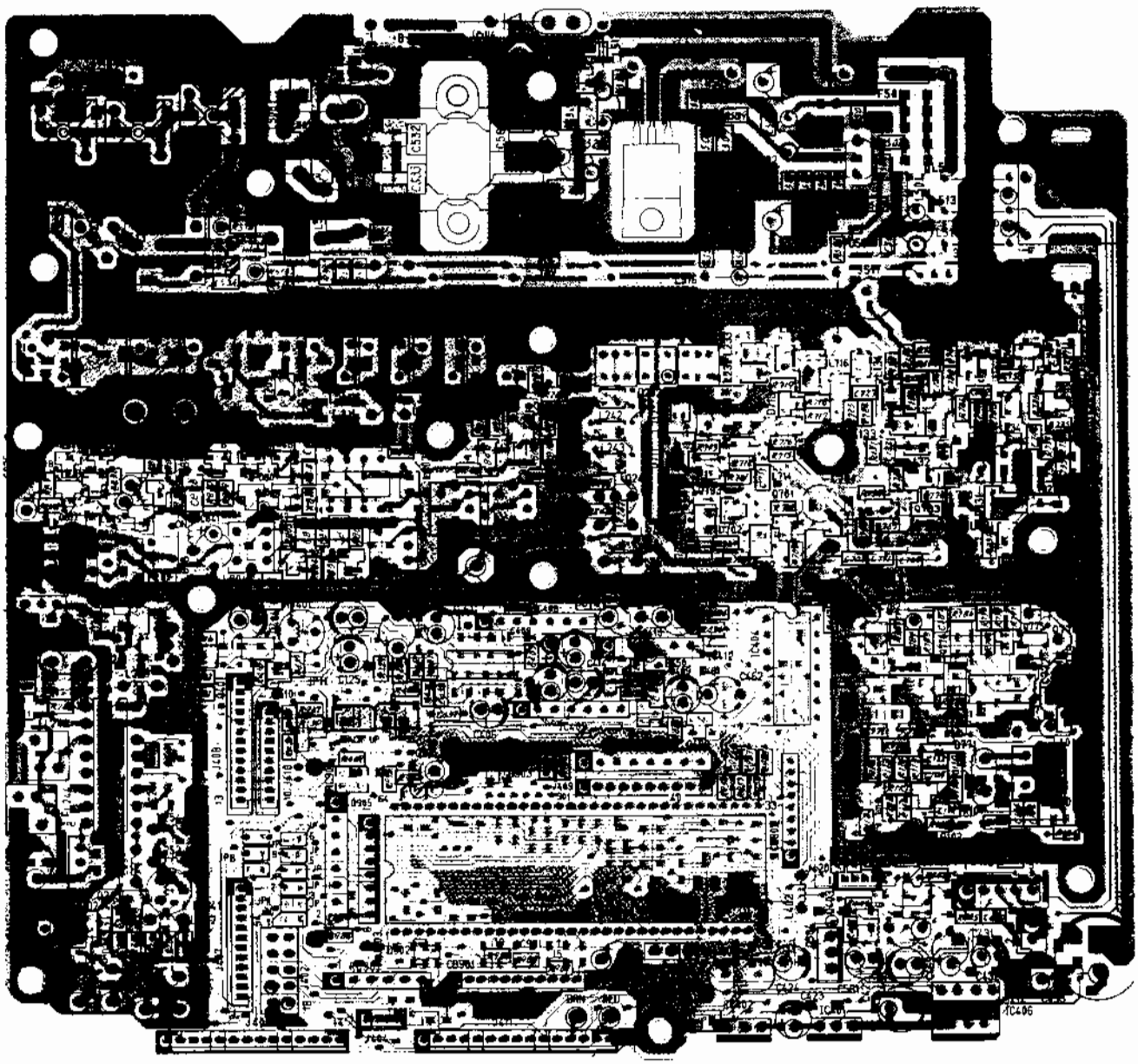


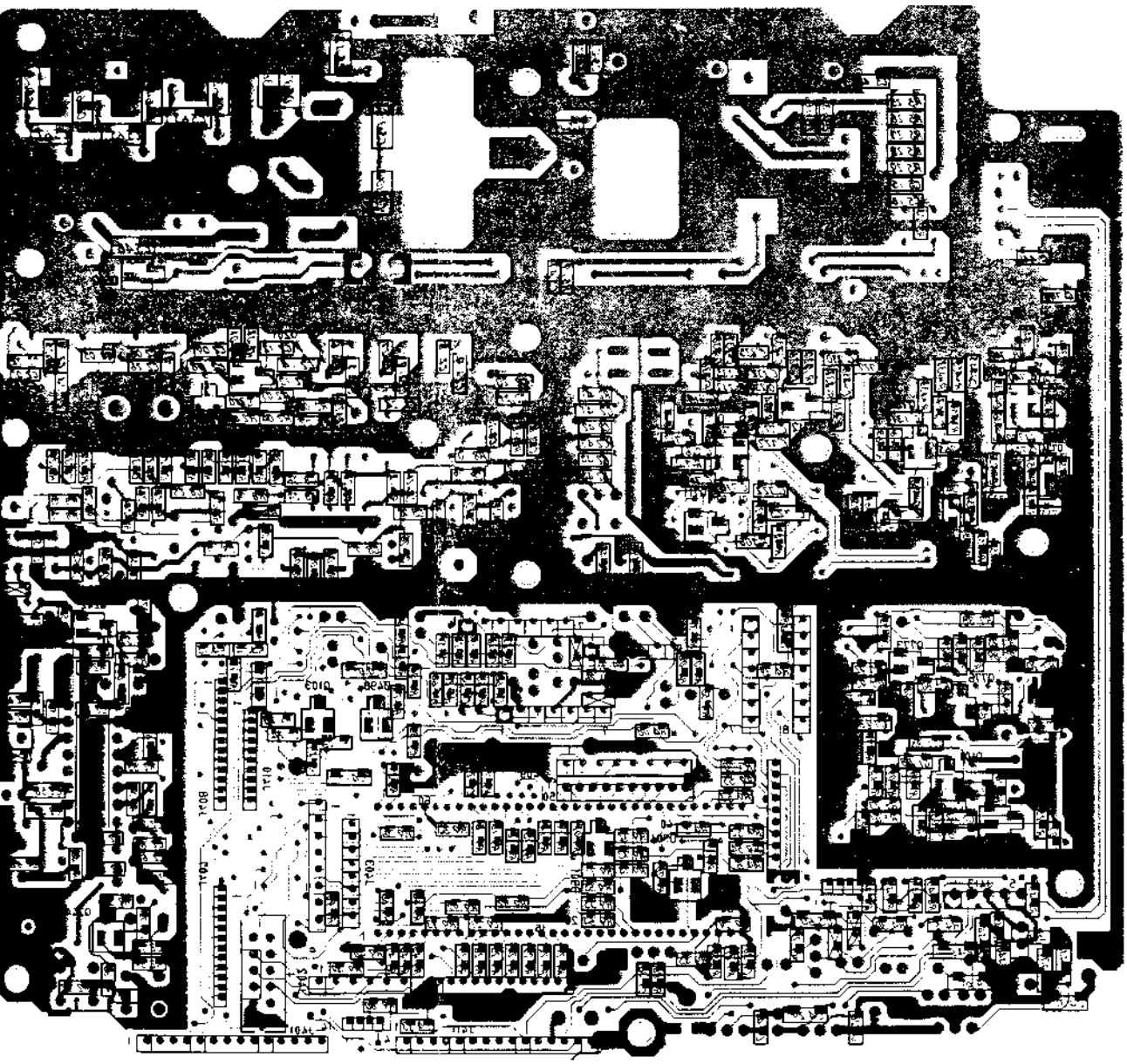

VISIBLE PLATING
UNDERSIDE PLATING

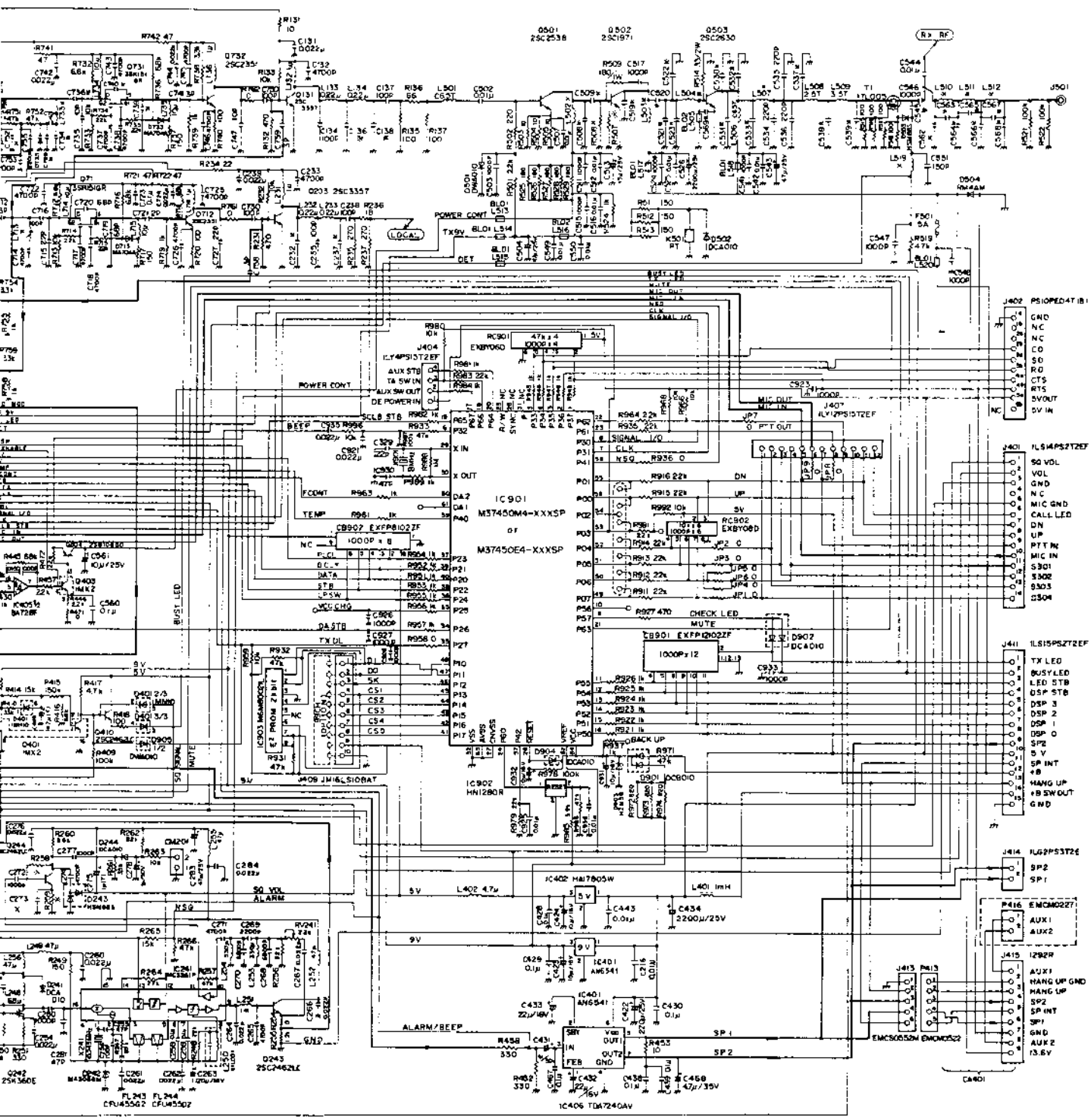


TR-053 LAYOUT--TOP VIEW

70-0351/0355







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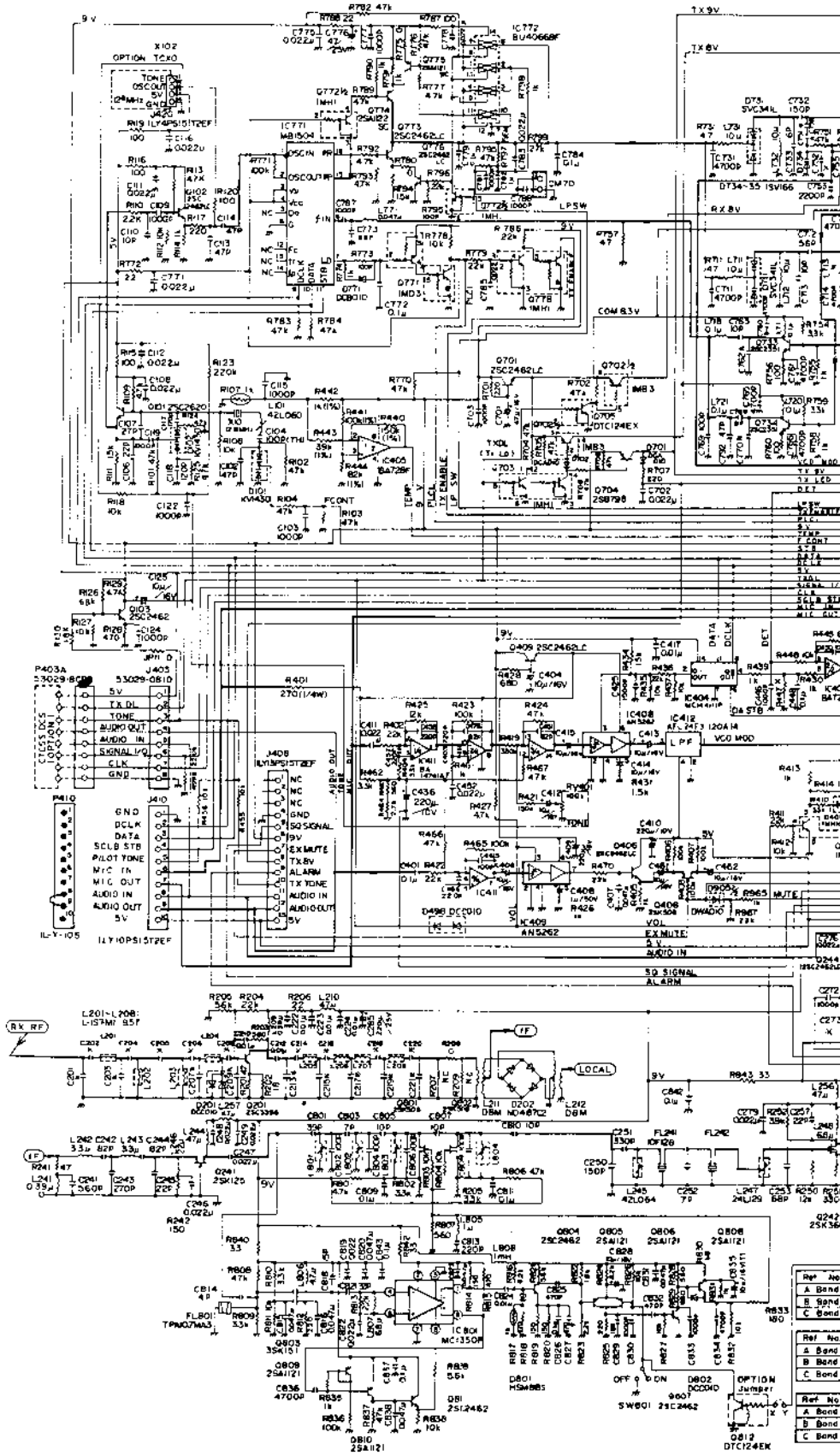
Band	220P	100P		270P	730P	680P	100P	33P	100P	560P	620P	270P	270P	750P	350P	270P	680P	270P	750P	1200P	270P	56P	39P	68P	100P	100P	220P	0022μ	330K	1.5K	3.5T	33	100K	100K	100K
Band	150P	68P		180P	470P	470P	150P	22P	130P	470P	390P	180P	180P	560P	180P	180P	560P	390P	680P	1800P	680P	47P	33P	68P	—	—	68P	004	330K	1.5K	3.5T	68	100K	100K	100K
Band	100P	—		150P	270P	390P	100P	15P	100P	390P	470P	120P	180P	270P	470P	150P	560P	150P	470P	1200P	180P	33P	22P	100μ	—	—	—	0.047	470K	2.2K	3.5T	68	100K	100K	100K

ref. No.	C508	C509	C519	C520	C521	C522	C525	C530	C531	C532	C533	C537	C538	C539	C540	C562	C563	C564	C565	C566	C567	C568	C569	L502	L503	L504	L507	L510	L511	L512	C570	R508	C574	C508
Band	—	470P	33P	390P	82P	82P	—	—	—	100P	—	1200P	150P	56P	—	68P	470P	120P	27P	150P	-	91P	—	4.5T	4.5T	3.3T	3.3T	3.3T	3.3T	5.5T	150P	33	100P	3.5T
Band	1500P	1000P	22P	220P	1500P	150P	2200P	—	—	120P	75P	120P	100P	120P	—	39P	56P	100P	15P	120P	7P	68P	220P	3.5ST	3.5ST	2.5T	0.5T	3.5ST	3.5T	9.5T	—	33	220H	4.2T
Band	150P	82P	—	270P	220P	220P	—	100P	100P	—	150P	1200P	220P	56P	—	39P	47P	82P	18P	100P	6P	56P	—	6.5T	6.5T	5L.5T	6.5T	6.5T	6.5T	8.5T	—	68	220P	5.5T

ref. No.	C734	C736	C739	C740	C712	C754	C752	C754	C756	C763	C762	C770	C789	C769	C792	L713	L733	C749	C720	C716	C733	C545	L519	R447	C768
Band	1100P	2200P	1000P	1000P	68P	90	470P	39P	8P	15P	15P	470P	150P	2200P	68P	22.0T	10.5T	100P	100P	150P	3P	3P	336H	1.8K	7P
Band	3300P	2200P	1200P	1200P	56P	7P	180P	33P	7P	10P	6P	330P	15P	2200P	470P	7.5T	9.5T	68P	68P	100P	6P	6P	4.7H	4.7H	8P
Band	2200P	1800P	1000P	1000P	56P	6P	220P	27P	6P	10P	5P	220P	39P	1500P	470P	6.5T	8.5T	68P	68P	100P	6P	6P	4.7H	4.7H	8P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TXDL
TEMP
FCONT
DATA
DCLK
DET
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MUTE
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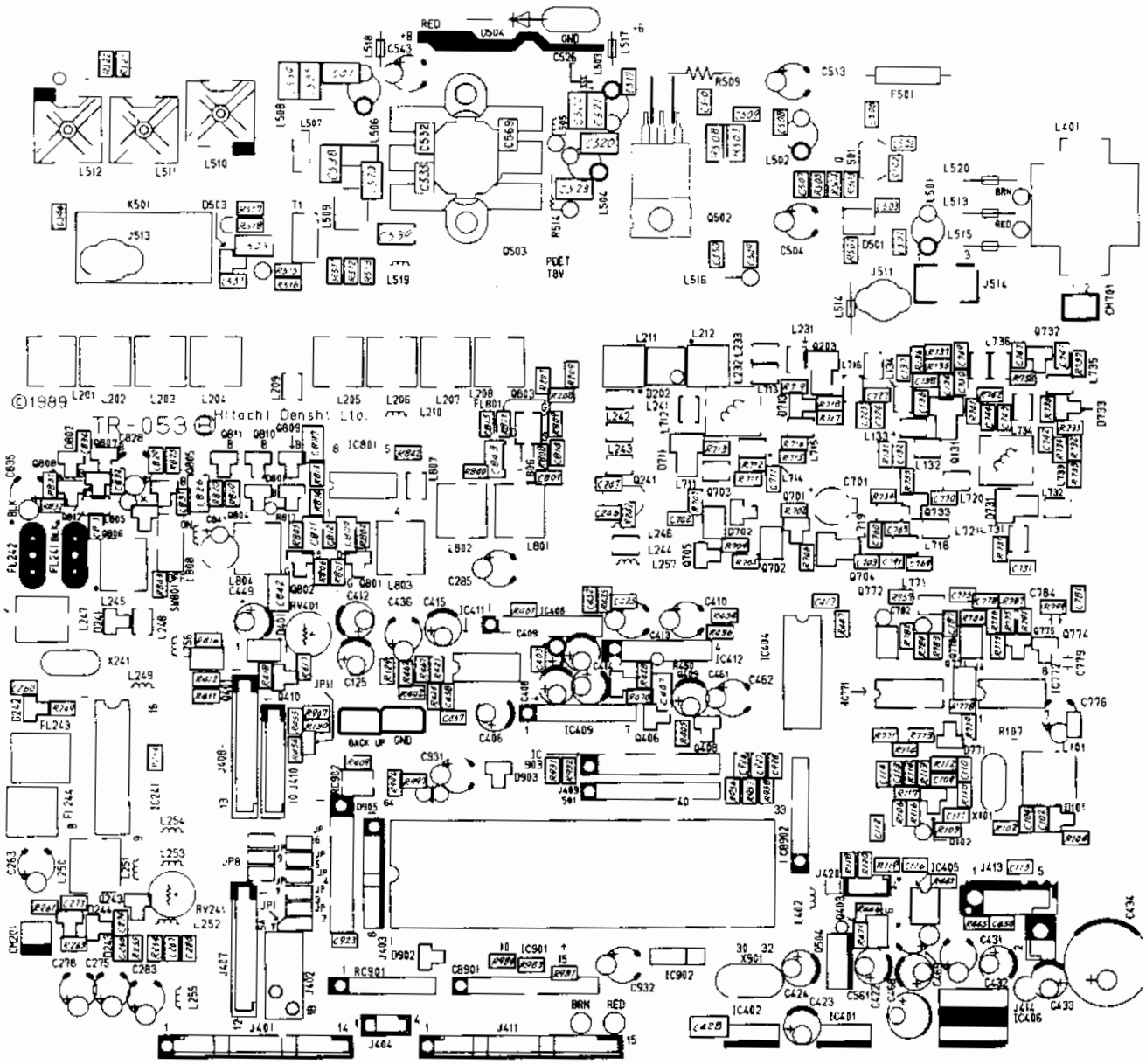
©1989 Hitachi Denshi Ltd.
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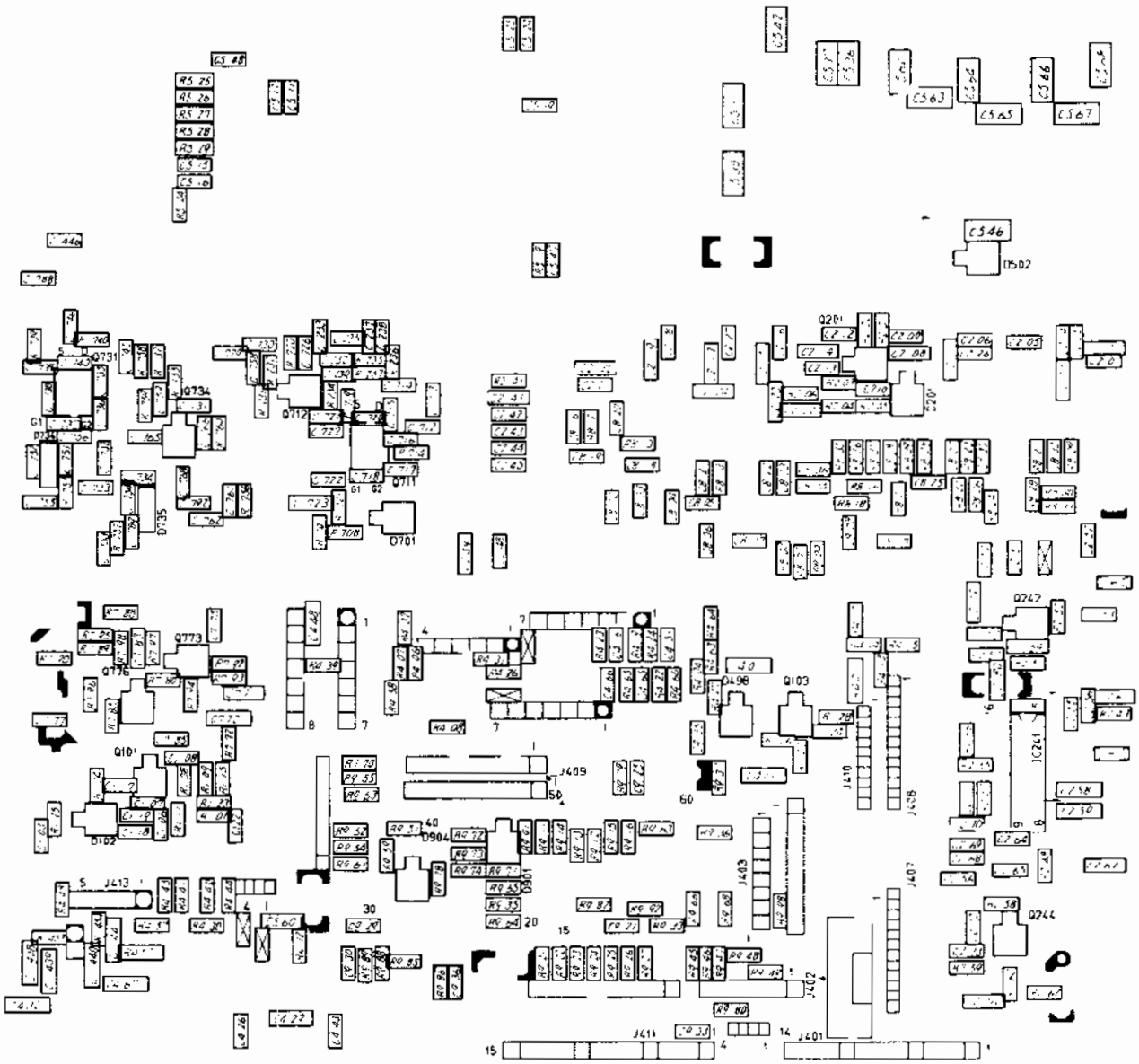
BOTTOM VIEW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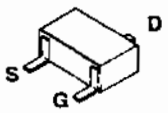

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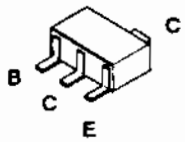

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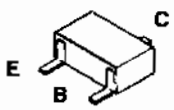

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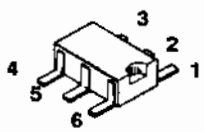

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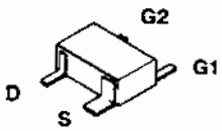

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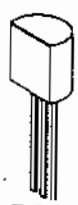
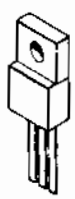


Q501



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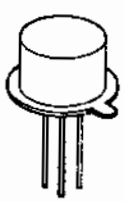

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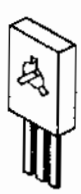
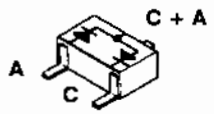
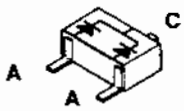


Q504

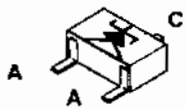
TR-053 DIODE PINOUTS



D201, D243, D502, D801



D101, D102, D713, D733, D771, D904



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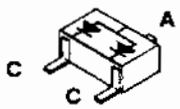
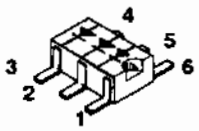


D241, D244, D502, D701, D702, D711, D731, D902, D904



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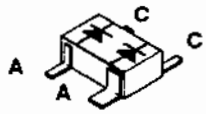
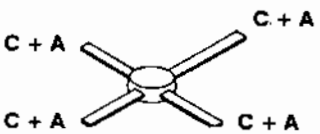
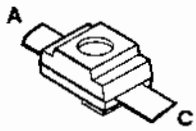


D501, D905



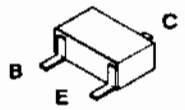
D202



D734, D735

70-2157 CTCSS FILTER BOARD SCHEMATIC

70-0351/0355



Q1, Q2

P403
5513-8CPB

Z - 592

+5V

TXDL

AUDIO IN

SIGNAL CLK

SIGNAL I/O

GND

IC50-4

IC2-14

R1 10k

R2 12k

R3 10k

C1 10/6.3V

Q1 2SC2462C

R13 22k

R18 22k

R50 820

C50 0.01

C51

C52

50-8

C53

R51 24k

R52 0

R53 27k

R61 180k

R62 100k

R6 150k

C2 680p

C4 10/6.3V

R17 39k

R5 100k

C8 0.022

IC1 Op AMP1

*A GND

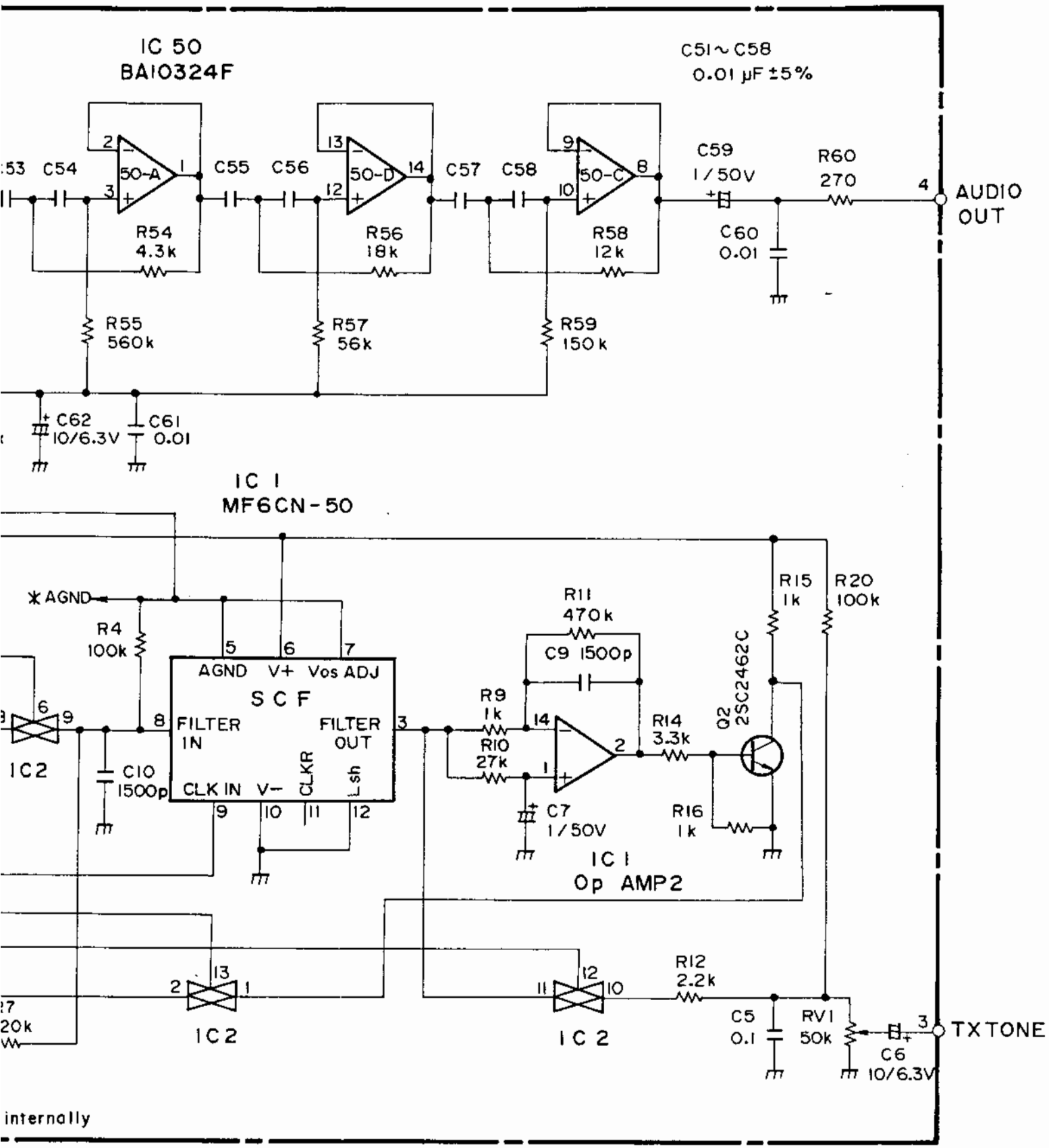
IC2-7

IC50-11

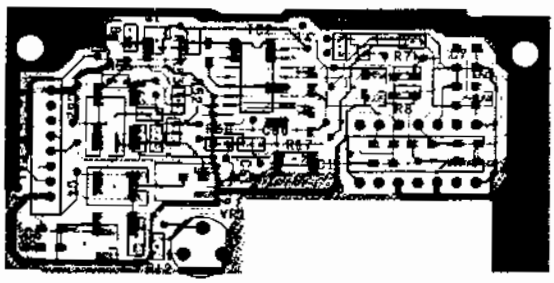
IC2 BU4066BF

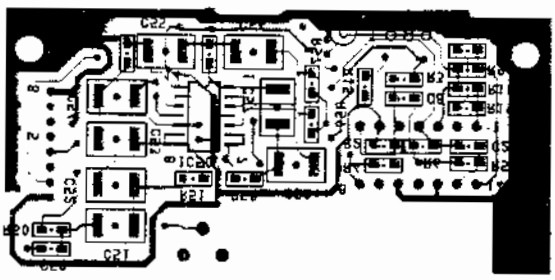
R7 120

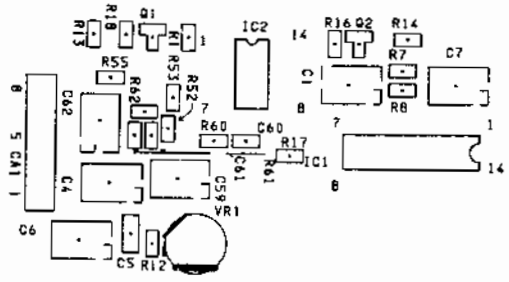
* Connected to AGND int


IC 50
BA10324F
C51 ~ C58
0.01 μF ±5%
50-A
50-D
50-C
C54
C55
C56
C57
C58
C59
1/50V
R60
270
AUDIO
OUT
R54
4.3k
R56
18k
R58
12k
C60
0.01
R55
560k
R57
56k
R59
150k
C62
10/6.3V
C61
0.01
IC 1
MF6CN-50
*AGND
R4
100k
AGND
V+
Vos ADJ
SCF
FILTER
IN
FILTER
OUT
CLK IN
V−
CLKR
Lsh
IC2
C10
1500p
R11
470k
C9 1500p
R9
1k
R10
27k
R14
3.3k
Q2
2SC2462C
R15
1k
R20
100k
C7
1/50V
R16
1k
IC 1
Op AMP2
R12
2.2k
C5
0.1
RV1
50k
C6
10/6.3V
TXTONE
IC2
IC 2
internally

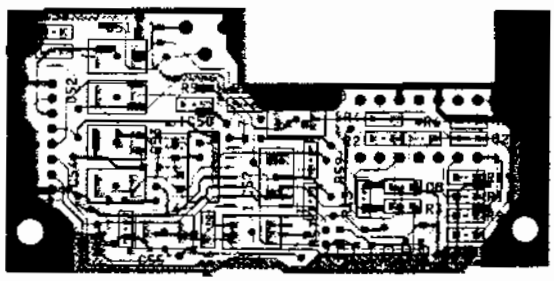
BOTTOM VIEW

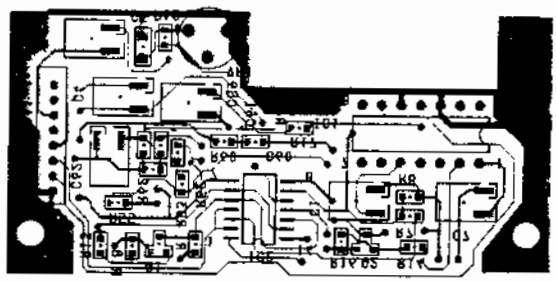


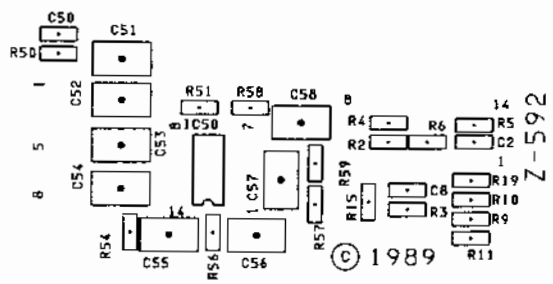




TOP VIEW





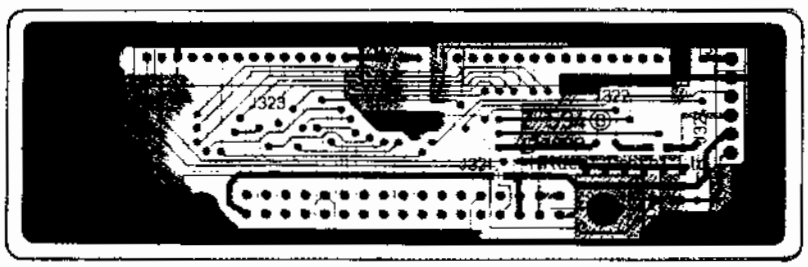


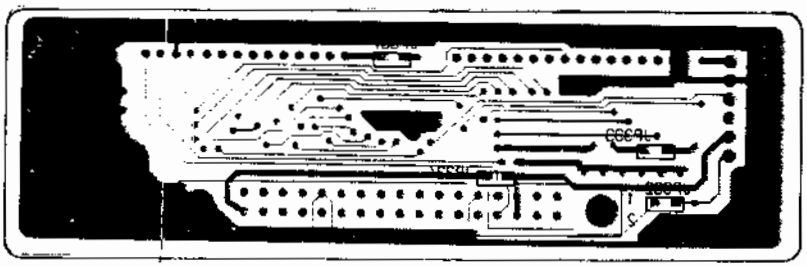
VISIBLE PLATING

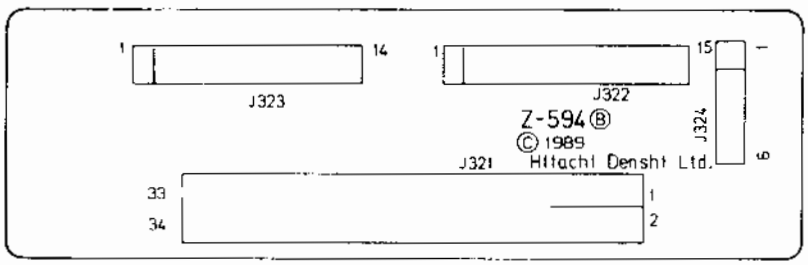
UNDERSIDE PLATING

Z-594 LAYOUT

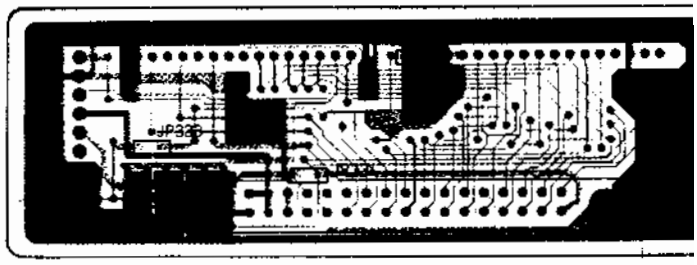
TOP VIEW

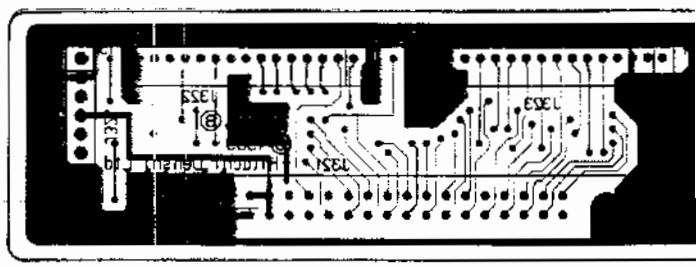


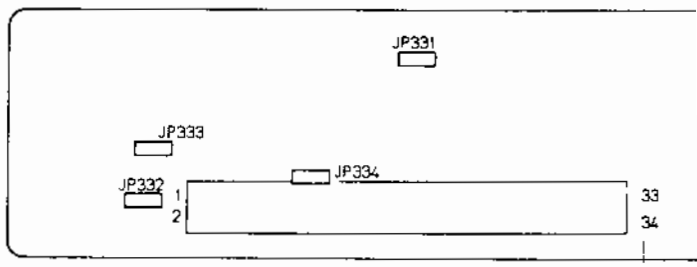




BOTTOM VIEW

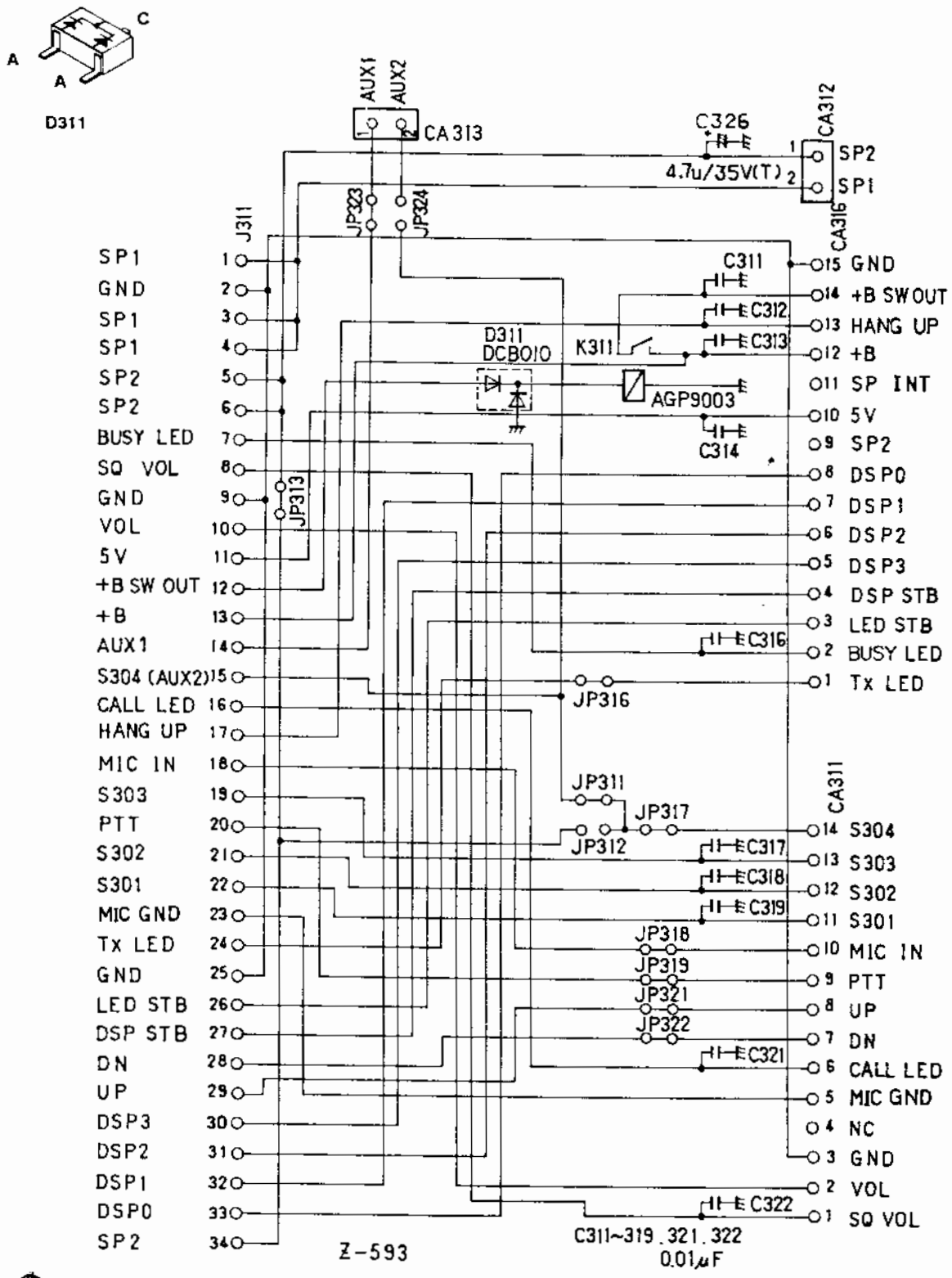




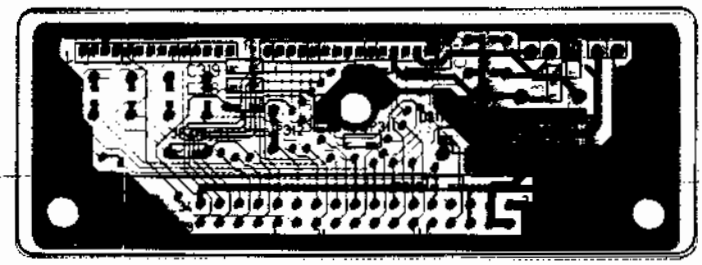


Z-593 TRUNK-MOUNT INTERFACE SCHEMATIC

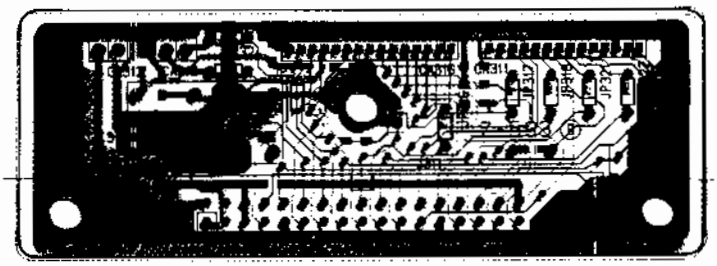
70-0351/0355

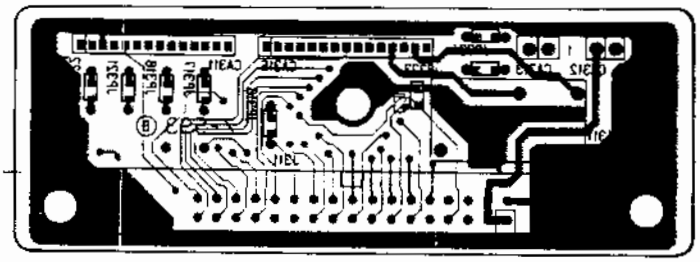


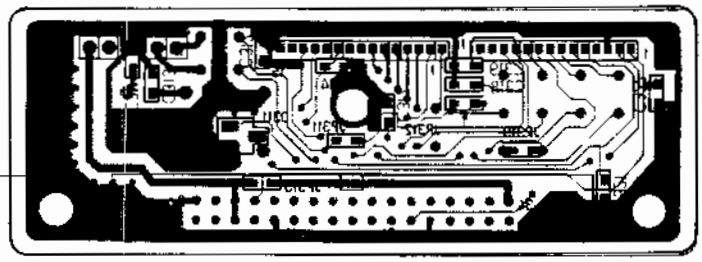
BOTTOM VIEW

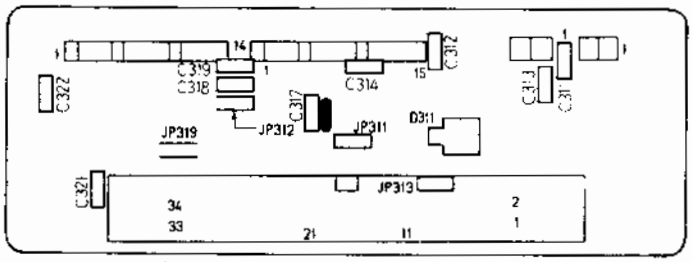


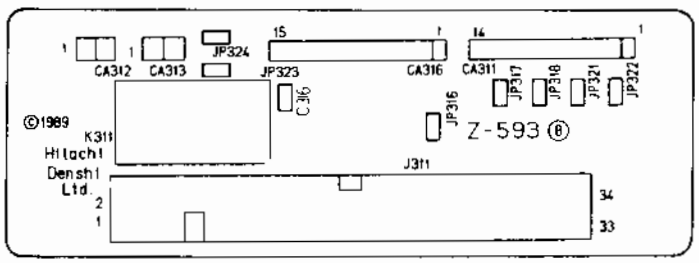
TOP VIEW



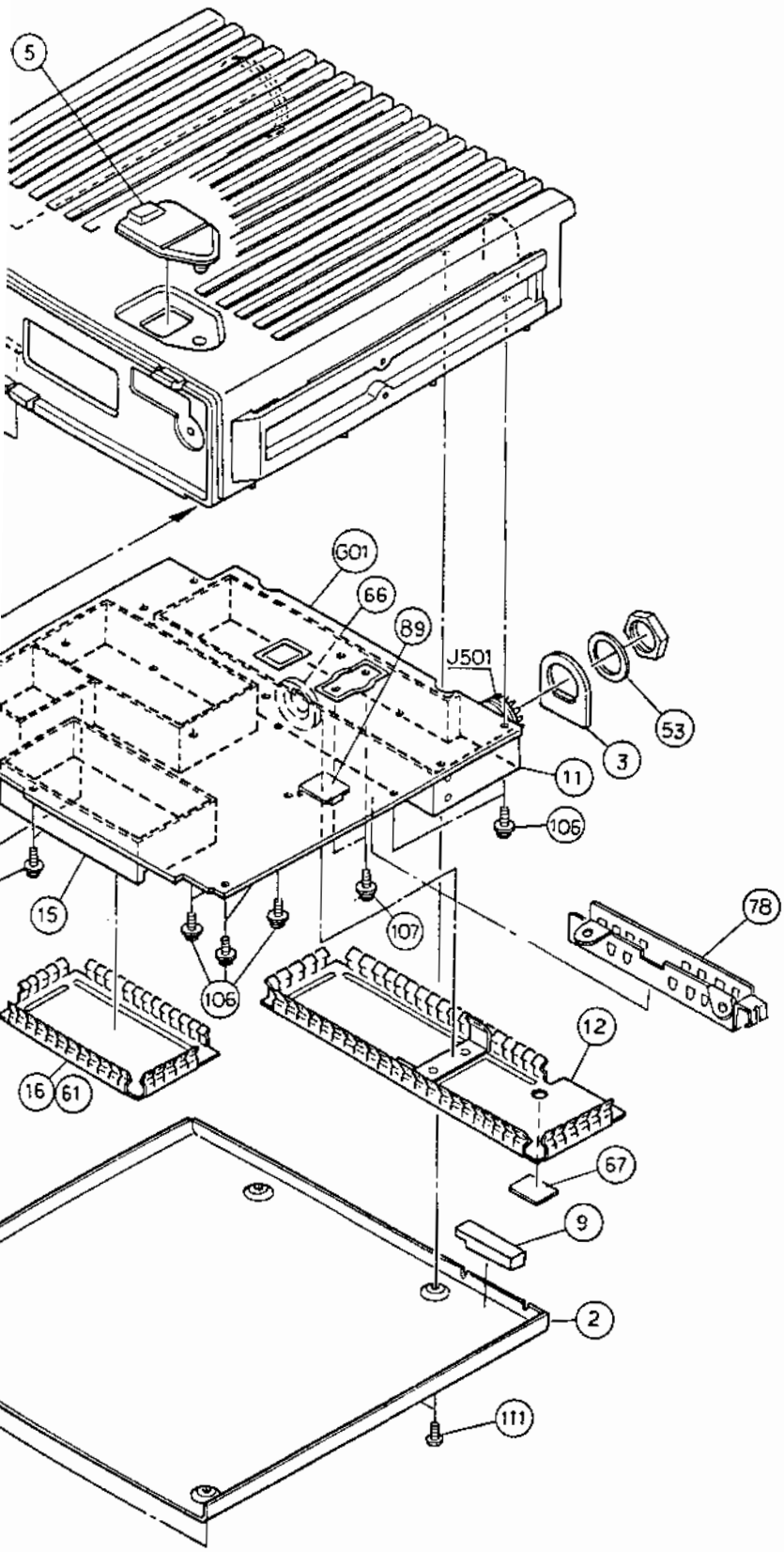




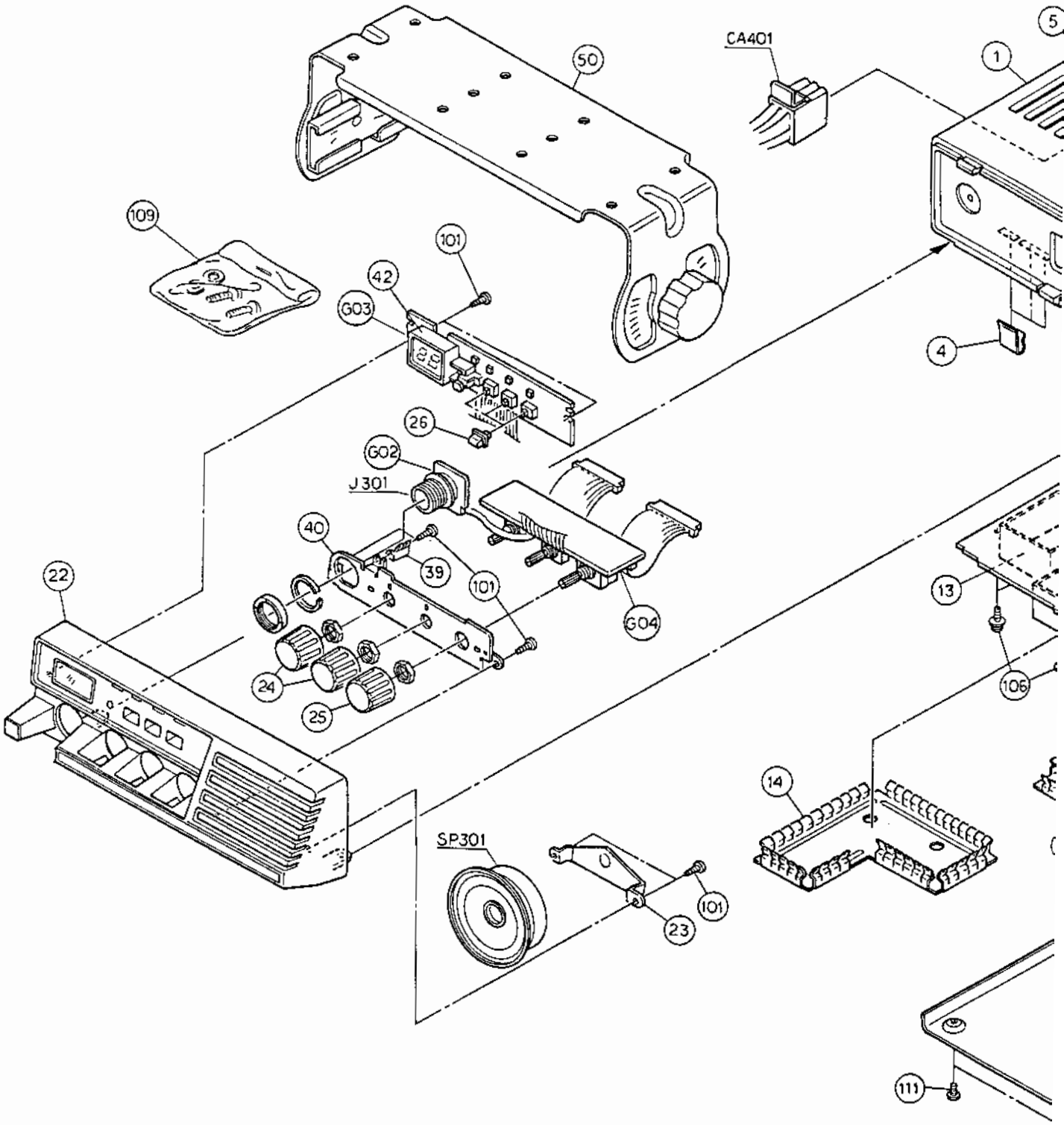




70-0351/0355



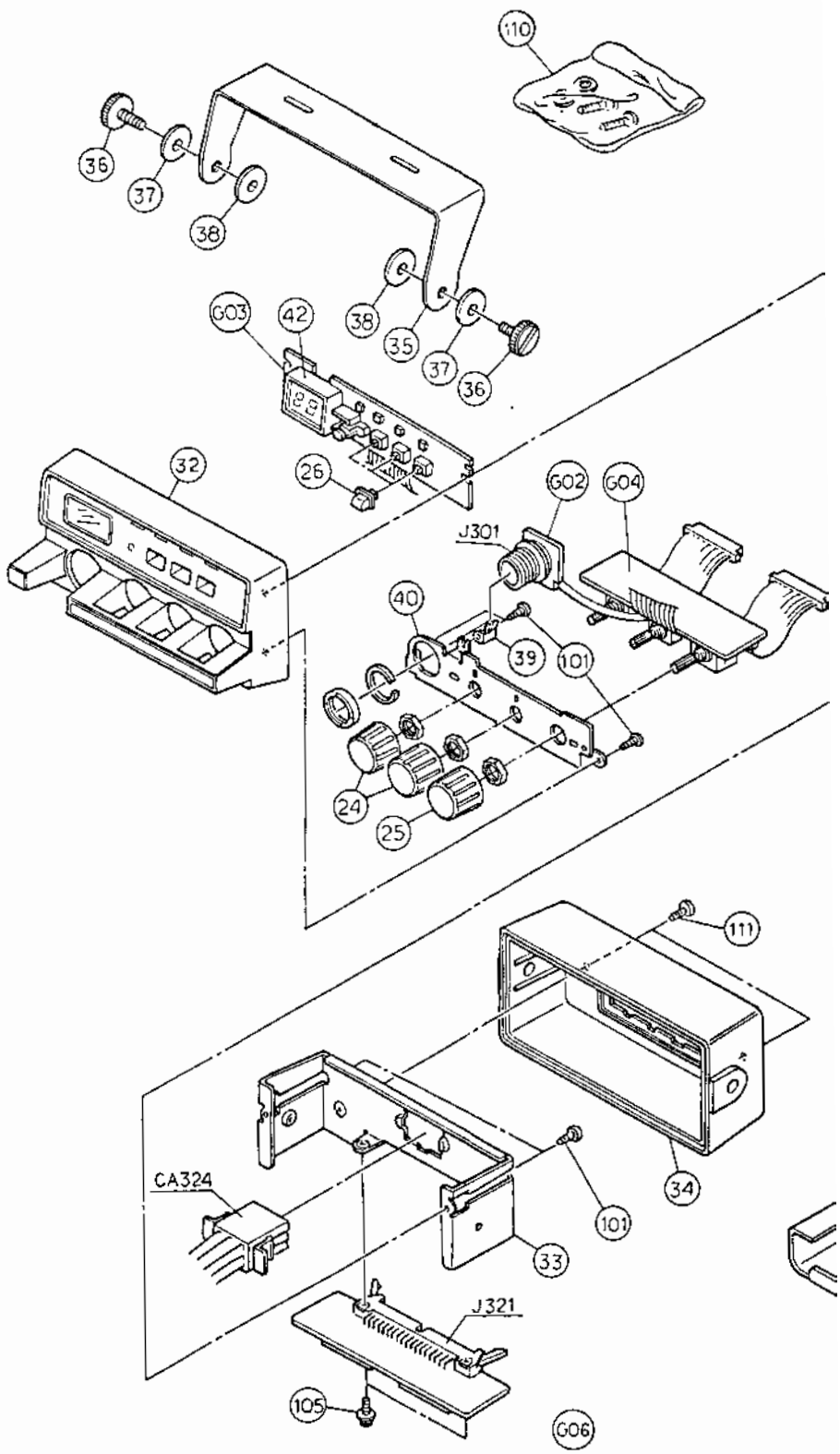
REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010261
2	COVER	70-010262
3	ANT PANEL	70-010313
4	CUP	70-150126
5	PROGRAMMER PORT PACKING	70-157358
9	DUST PACKING	70-157428
11	PA SHIELD CASE	70-089345
12	PA SHIELD COVER	70-089340
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
22	FRONT COVER ASSY	70-010289
23	SPEAKER BRACKET	70-158324
24	VOLUME KNOB	70-110066
25	VOLUME KNOB	70-110067
26	SWITCH BUTTON	70-110065
39	PCB GUIDE	70-158354
40	VOLUME BRACKET	70-158326
42	LED SPACER	70-150133
50	BRACKET ASSY	70-158327
53	WASHER	70-150150
61	INSULATOR	70-157409
66	RING	70-150148
78	FE GROUND SPRING	70-152123
89	IF SHIELD	70-089366
101	SCREW PLAX PAN HD M3 x 10	70-150138
106	SCREW SEMS M3 x 10	70-150180
107	SCREW SEMS M3 x 12	70-150151
109	FIXED SCREW PACK	70-000012
111	SCREW BIND HD M3 x 8	70-150146
CA401	CABLE ASSEMBLY	70-034094
J301	NS1504L	70-158100
J501	M-RM	70-156090
SP301	SPEAKER	70-080033
G01	TRX, LOGIC PCB	TR-053
G02	MIC CONNECTOR PCB	CX-90
G03	DISPLAY PCB	CX-91
G04	OPERATE PCB	CX-92

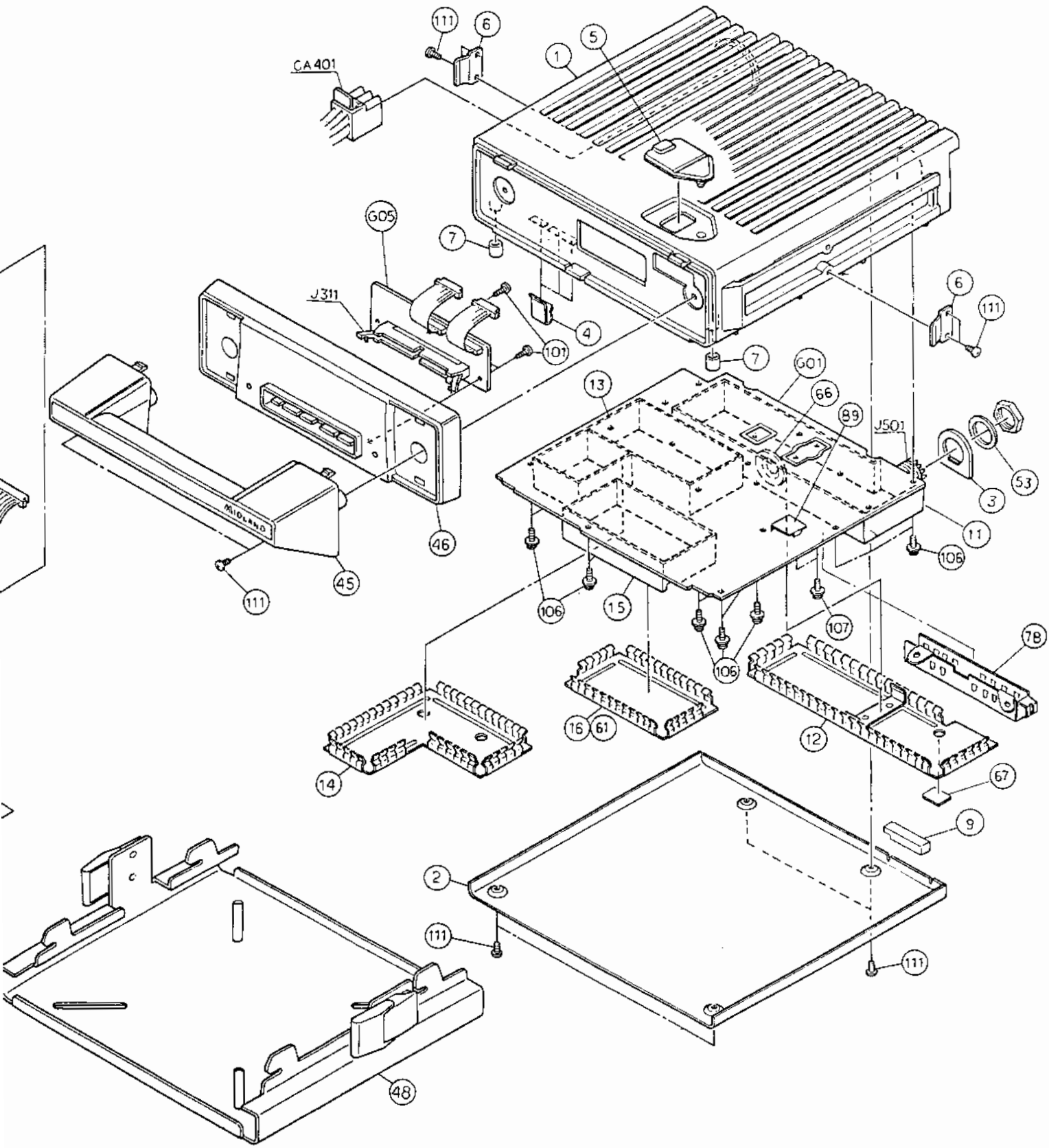

50
CA401
5
1
109
101
42
G03
4
26
G02
J301
40
39
101
G04
22
13
106
24
25
14
SP301
101
23
111

TRUNK-MOUNT EXPLODED VIEW

70-0351/0355

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010261
2	COVER	70-010262
3	ANT PANEL	70-010313
4	CLIP	70-150126
5	PROGRAMMER PORT PACKING	70-157358
6	BRACKET	70-158323
7	CAP	70-150127
9	DUST PACKING	70-157428
11	PA SHIELD CASE	70-089345
12	PA SHIELD COVER	70-089340
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
24	VOLUME KNOB	70-110066
25	VOLUME KNOB	70-110067
26	SWITCH BUTTON	70-110065
32	CONTROL CASE ASSEMBLY	70-010260
33	CONTROL CHASSIS	70-010267
34	CONTROL COVER	70-010268
35	CONTROL BRACKET	70-158329
36	COIN SCREW	70-150130
37	FIBER WASHER	70-151363
38	RUBBER WASHER	70-151363
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158326
42	LED SPACER	70-150133
45	HANDLE	70-158325
46	HANDLE BASE	70-150132
48	BRACKET ASSY	70-158326
53	WASHER	70-150150
61	INSULATOR	70-157409
66	RING	70-150148
78	FE GROUND SPRING	70-152123
89	IF SHIELD	70-089366
101	SCREW PLAX PAN HD M3 x 10	70-150138
105	SCREW SEMS PAN HD M3 x 14	70-150191
106	SCREW SEMS M3 x 10	70-150180
107	SCREW SEMS M3 x 12	70-150151
110	FIXED SCREW PACK	70-000013
111	SCREW BIND HD M3 x 8	70-150146
CA401	CABLE ASSEMBLY	70-C34094
J301	NS1504L	70-159100
J311	D3431	70-159592
J321	D3431	70-159593
J501	M-RM	70-159090
SP301	SPEAKER	70-060033
G01	TRX, LOGIC PCB	TR-053
G02	MIC CONNECTOR PCB	CX-90
G03	DISPLAY PCB	CX-91
G04	OPERATE PCB	CX-92
G05	ADAPTOR (HANDLE) PCB	Z-593
G06	ADAPTOR (SMALL REMOTE)	Z-594




111
6
5
1
CA401
605
7
J311
101
4
6
111
7
601
13
66
89
J501
53
3
11
106
46
45
111
106
15
107
78
16
61
12
14
67
9
2
111
111
48

SECTION 7

PARTS

NOTES

MECHANICAL PARTS

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

REF NO.		DESCRIPTION	PART NO.
1		CHASSIS	70-010261
2		COVER	70-010262
3		ANT PANEL	70-010313
4		CLIP	70-150126
5		PROGRAMMER PORT PACKING	70-157358
6	T/M	BRACKET	70-158323
7	T/M	CAP	70-150127
9		DUST PACKING	70-157426
11		PA SHIELD CASE	70-089345
12		PA SHIELD COVER	70-089340
13		VCO SHIELD CASE	70-089341
14		VCO SHIELD COVER	70-089342
15		LOG SHIELD CASE	70-089343
16		LOG SHIELD COVER	70-089344
19		GROUND LUG	70-150181
21	T/M	FRONT COVER ASSY	70-010264
22	U/D	FRONT COVER ASSY	70-010289
23	U/D	SPEAKER BRACKET	70-158324
24	U/D	VOLUME KNOB	70-110066
25	U/D	VOLUME KNOB	70-110067
26	U/D	SWITCH BUTTON	70-110065
31	U/D	CONTROL CASE ASSEMBLY	70-010266
32	T/M	CONTROL CASE ASSEMBLY	70-010290
33	T/M	CONTROL CHASSIS	70-010267
34	T/M	CONTROL COVER	70-010268
35	T/M	CONTROL BRACKET	70-158329
36	T/M	COIN SCREW	70-150130
37	T/M	FIBER WASHER	70-151363
38	T/M	RUBBER WASHER	70-150135
39	T/M	PCB GUIDE	70-150140
39	U/D	PCB GUIDE	70-158354
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
53		WASHER	70-150150
61		INSULATOR	70-157409
66		RING	70-150148
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
78		FE GROUND SPRING	70-152123
88		IF SHIELD	70-089386
101		SCREW PLAX PAN HD M3 x 10	70-150138
105	T/M	SCREW SEMS PAN HD M2 x 14	70-150191
106		SCREW SEMS M3 x 10	70-150180
107		SCREW SEMS M3 x 12	70-150151
109	U/D	FIXED SCREW PACK	70-000012
110	T/M	FIXED SCREW PACK	70-000013
111	T/M	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-053
G02		MIC CONNECTOR PCB	CX-90
G03		DISPLAY PCB	CX-91
G04		OPERATE PCB	CX-92
G05	T/M	ADAPTOR (HANDLE) PCB	Z-593
G06	T/M	ADAPTOR (SMALL REMOTE)	Z-594

TR-053 BOARD

70-0351/0355 A BAND USE "A"
70-0351/0355 B BAND USE "B"
70-0351/0355 C BAND USE "C"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C102	47 pF, 50 V, CER	70-138185
C103	1000 pF, 50 V, CER	70-138255
C104	100 pF, 50 V, CER	70-138364
C106	22 pF, 50 V, CER	70-138171
C107	27 pF, 50 V, CER	70-138185
C108	0.022 uF, 50 V, CER	70-138162
C109	1000 pF, 50 V, CER	70-138255
C110	10 pF, 50 V, CER	70-138187
C111	0.022 uF, 50 V, CER	70-138162
C112	0.022 uF, 50 V, CER	70-138162
C113	47 pF, 50 V, CER	70-138185
C114	47 pF, 50 V, CER	70-138185
C115	1000 pF, 50 V, CER	70-138255
C116	0.022 uF, 50 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	70-138255
C122	1000 pF, 50 V, CER	70-138255
C124	1000 pF, 50 V, CER	70-138255
C125	10 uF, 16 V, AL, ELYC	70-136191
C131	0.022 uF, 50 V, CER	70-138162
C132	4700 pF, 50 V, CER	70-138163
C134	100 pF, 50 V, CER	70-138175
C136 A	220 pF, 50 V, CER	70-138349
C136 B	150 pF, 50 V, CER	70-138231
C136 C	100 pF, 50 V, CER	70-138175
C137	100 pF, 50 V, CER	70-138175
C137	100 pF, 50 V, CER	70-138175
C138 A	100 pF, 50 V, CER	70-138175
C138 B	68 pF, 50 V, CER	70-138229
C138 C	100 pF, 50 V, CER	70-138175
C201 A	270 pF, 50 V, CER	70-138403
C201 B	180 pF, 50 V, CER	70-138230
C201 C	150 pF, 50 V, CER	70-138231
C202 A	750 pF, 50 V, CER	70-138405
C202 B	470 pF, 50 V, CER	70-138404
C202 C	270 pF, 50 V, CER	70-138403
C203 A	680 pF, 50 V, CER	70-138252
C203 B	470 pF, 50 V, CER	70-138404
C203 C	390 pF, 50 V, CER	70-138363
C204 A	100 pF, 50 V, CER	70-138175
C204 B	130 pF, 50 V, CER	70-138406
C204 C	100 pF, 50 V, CER	70-138175
C205 A	33 pF, 50 V, CER	70-138188
C205 B	22 pF, 50 V, CER	70-138171
C205 C	15 pF, 50 V, CER	70-138205
C206 A	100 pF, 50 V, CER	70-138175
C206 B	130 pF, 50 V, CER	70-138406
C206 C	100 pF, 50 V, CER	70-138175
C207 A	680 pF, 50 V, CER	70-138252
C207 B	470 pF, 50 V, CER	70-138404
C207 C	390 pF, 50 V, CER	70-138363
C208 A	820 pF, 50 V, CER	70-138408
C208 B	560 pF, 50 V, CER	70-138407
C208 C	470 pF, 50 V, CER	70-138404
C209 A	270 pF, 50 V, CER	70-138403
C209 B	180 pF, 50 V, CER	70-138230
C209 C	120 pF, 50 V, CER	70-138303
C210	0.01 uF, 50 V, CER	70-138270
C212 A	68 pF, 50 V, CER	70-138229
C212 B	0.01 uF, 50 V, CER	70-138270
C212 C	0.01 uF, 50 V, CER	70-138270
C213 A	270 pF, 50 V, CER	70-138403
C213 B	220 pF, 50 V, CER	70-138176
C213 C	180 pF, 50 V, CER	70-138230
C214 A	750 pF, 50 V, CER	70-138405
C214 B	470 pF, 50 V, CER	70-138404
C214 C	270 pF, 50 V, CER	70-138403
C215 A	750 pF, 50 V, CER	70-138405
C215 B	560 pF, 50 V, CER	70-138407
C215 C	470 pF, 50 V, CER	70-138404
C216 A	270 pF, 50 V, CER	70-138403
C216 B	180 pF, 50 V, CER	70-138230
C216 C	130 pF, 50 V, CER	70-138406

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C217 A	680 pF, 50 V, CER	70-138252
C217 B	680 pF, 50 V, CER	70-138252
C217 C	560 pF, 50 V, CER	70-138407
C218 A	270 pF, 50 V, CER	70-138403
C218 B	180 pF, 50 V, CER	70-138230
C218 C	130 pF, 50 V, CER	70-138406
C219 A	750 pF, 50 V, CER	70-138405
C219 B	560 pF, 50 V, CER	70-138407
C219 C	470 pF, 50 V, CER	70-138404
C220 A	750 pF, 50 V, CER	70-138405
C220 B	390 pF, 50 V, CER	70-138363
C220 C	220 pF, 50 V, CER	70-138176
C221 A	270 pF, 50 V, CER	70-138403
C221 B	220 pF, 50 V, CER	70-138176
C221 C	180 pF, 50 V, CER	70-138230
C222	0.01 uF, 50 V, CER	70-138270
C223	0.01 uF, 50 V, CER	70-138270
C224	0.01 uF, 50 V, CER	70-138270
C232 A	56 pF, 50 V, CER	70-138254
C232 B	47 pF, 50 V, CER	70-138185
C232 C	33 pF, 50 V, CER	70-138188
C233	4700 pF, 50 V, CER	70-138163
C235	100 pF, 50 V, CER	70-138175
C237 A	39 pF, 50 V, CER	70-138233
C237 B	33 pF, 50 V, CER	70-138188
C237 C	22 pF, 50 V, CER	70-138171
C238	100 pF, 50 V, CER	70-138175
C239	0.022 uF, 50 V, CER	70-138162
C241	560 pF, 50 V, CER	70-138407
C242	82 pF, 50 V, CER	70-138250
C243	270 pF, 50 V, CER	70-138403
C244	82 pF, 50 V, CER	70-138250
C245	22 pF, 50 V, CER	70-138171
C246	0.022 uF, 50 V, CER	70-138162
C247	0.022 uF, 50 V, CER	70-138162
C248	0.022 uF, 50 V, CER	70-138162
C249	0.022 uF, 50 V, CER	70-138162
C250	150 pF, 50 V, CER	70-138231
C251	330 pF, 50 V, CER	70-138228
C252	7 pF, 50 V, CER	70-138181
C253	68 pF, 50 V, CER	70-138229
C254	0.022 uF, 50 V, CER	70-138162
C255	47 pF, 50 V, CER	70-138185
C256	100 pF, 50 V, CER	70-138175
C257	22 pF, 50 V, CER	70-138171
C258	0.1 uF, 25 V, CER	70-138327
C259	0.1 uF, 25 V, CER	70-138327
C260	0.01 pF, 50 V, CER	70-138270
C261	0.022 uF, 50 V, CER	70-138162
C262	0.022 uF, 50 V, CER	70-138162
C263	120 uF, 16 V, AL, ELYC	70-135167
C264	0.022 uF, 50 V, CER	70-138162
C265	4700 pF, 50 V, CER	70-138163
C266	0.022 uF, 50 V, CER	70-138162
C267	0.022 uF, 50 V, CER	70-138162
C268	6800 pF, 50 V, CER	70-138173
C269	2200 pF, 50 V, CER	70-138235
C270	6800 pF, 50 V, CER	70-138173
C271	4700 pF, 50 V, CER	70-138163
C272	1000 pF, 50 V, CER	70-138255
C273	0.047 uF, 16 V, CER	70-138408
C274	4700 pF, 50 V, CER	70-138163
C275	1 uF, 35 V, TA, ELYC	70-138087
C276	0.022 pF, 50 V, CER	70-138162
C277	1000 pF, 50 V, CER	70-138255
C278	1 uF, 50 V, AL, ELYC	70-135147
C279	0.022 uF, 50 V, CER	70-138162
C280	1000 pF, 50 V, CER	70-138255
C281	47 pF, 50 V, CER	70-138185
C283	47 uF, 25 V, AL, ELYC	70-135144
C284	0.022 uF, 50 V, CER	70-135162
C285	220 uF, 25 V, AL, ELYC	70-131300
C401	0.1 uF, 25 V, CER	70-138327
C403	220 pF, 50 V, CER	70-138349

TR-053 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
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, 10 V, CER	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	70-135186
C423	10 uF, 16 V, AL, ELYC	70-138191
C424	10 uF, 16 V, AL, ELYC	70-138191
C425	1000 pF, 50 V, CER	70-138255
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, 25 V, CER	70-138327
C439	0.1 uF, 25 V, CER	70-138327
C443	0.01 uF, 50 V, CER	70-138270
C446	1000 pF, 50 V, CER	70-138255
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	70-138255
C451	82 pF, 50 V, CER	70-138250
C452	0.022 uF, 50 V, CER	70-138162
C457	220 pF, 50 V, CER	70-138176
C458	220 pF, 50 V, CER	70-138176
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	70-138176
C467	0.1 uF, 25 V, CER	70-138327
C468	4.7 uF, 35 V, TA, ELYC	70-138088
C502	0.01 uF, 50 V, CER	70-138270
C503	1000 pF, 50 V, CER	70-138255
C504	47 uF, 25 V, AL, ELYC	70-135055
C506	150 pF, 50 V, CER	70-138231
C507	0.01 uF, 50 V, CER	70-138270
C508 B	100 pF, 50 V, CER	70-138175
C508 C	150 pF, 50 V, CER	70-138231
C509 A	470 pF, 50 V, CER	70-138404
C509 B	100 pF, 50 V, CER	70-138175
C509 C	82 pF, 50 V, CER	70-138250
C511	1000 pF, 50 V, CER	70-138255
C512	0.01 uF, 25 V, CER	70-138270
C513	15 uF, 25 V, AL, ELYC	70-135154
C515	1000 pF, 50 V, CER	70-138255
C516	0.01 pF, 50 V, CER	70-138270
C517	1000 pF, 50 V, CER	70-138255
C519 B	22 pF, 50 V, CER	70-138171
C520 A	360 pF, 50 V, CER	70-131270
C520 B	220 pF, 50 V, CER	70-131199
C520 C	270 pF, 50 V, CER	70-131226
C521 A	120 pF, 50 V, CER	70-132057
C521 B	150 pF, 50 V, CER	70-132055
C521 C	220 pF, 50 V, CER	70-131199
C522 A	120 pF, 50 V, CER	70-131057
C522 B	150 pF, 50 V, CER	70-132055
C522 C	220 pF, 50 V, CER	70-131199
C523	220 pF, 50 V, CER	70-131199
C524	1000 pF, 50 V, CER	70-138255
C525	0.01 uF, 50 V, CER	70-138270
C526	2200 uF, 25 V, AL, ELYC	70-135235
C530 C	100 pF, 100 V, MICA	70-138115
C531 A	100 pF, 500 V, CER	70-138264
C531 B	100 pF, 500 V, CER	70-138264
C531 C	100 pF, 100 V, MICA	70-138115
C532 A	100 pF, 100 V, MICA	70-138115
C532 B	120 pF, 100 V, MICA	70-138116

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C533 C	150 pF, 100 V, MICA	70-138111
C534 A	100 pF, 100 V, MICA	70-138115
C534 B	220 pF, 100 V, MICA	70-138112
C534 C	220 pF, 100 V, MICA	70-138112
C535	220 pF, 100 V, MICA	70-138112
C536	220 pF, 100 V, MICA	70-138112
C537 A	220 pF, 100 V, MICA	70-138112
C537 B	120 pF, 100 V, MICA	70-138116
C537 C	220 pF, 100 V, MICA	70-138112
C538 C	220 pF, 100 V, CER	70-138261
C538 B	100 pF, 500 V, CER	70-138264
C538 A	1000 pF, 100 V, CER	70-138239
C539 A	56 pF, 500 V, CER	70-138285
C539 B	120 pF, 500 V, CER	70-138306
C541	1000 pF, 100 V, CER	70-138239
C542	0.01 uF, 50 V, CER	70-131297
C543	47 uF, 25 V, AL, ELYC	70-135055
C544	0.01 uF, 50 V, CER	70-138270
C545	8 pF, 500 V, CER	70-138329
C546	1000 pF, 100 V, CER	70-138239
C547	1000 pF, 50 V, CER	70-138255
C548	1000 pF, 50 V, CER	70-138255
C549	0.01 uF, 50 V, CER	70-138270
C550	0.01 uF, 50 V, CER	70-138270
C551	150 pF, 50 V, CER	70-138231
C560	0.1 uF, 25 V, CER	70-138327
C561	10 uF, 25 V, AL, ELYC	70-135173
C562 A	47 pF, 500 V, CER	70-138268
C562 B	39 pF, 500 V, CER	70-138266
C562 C	39 pF, 500 V, CER	70-138266
C563 A	47 pF, 500 V, CER	70-138268
C563 B	56 pF, 500 V, CER	70-138285
C564 A	120 pF, 500 V, CER	70-138306
C564 B	100 pF, 500 V, CER	70-138264
C564 C	82 pF, 500 V, CER	70-138259
C565 A	27 pF, 500 V, CER	70-138305
C565 B	15 pF, 500 V, CER	70-138267
C565 C	18 pF, 500 V, CER	70-138265
C566 A	150 pF, 100 V, CER	70-138258
C566 B	120 pF, 500 V, CER	70-138306
C566 C	100 pF, 500 V, CER	70-138264
C567 A	5 pF, 500 V, CER	70-138312
C567 B	7 pF, 500 V, CER	70-138310
C567 C	6 pF, 500 V, CER	70-138329
C568 A	91 pF, 500 V, CER	70-138307
C568 B	68 pF, 500 V, CER	70-138288
C568 C	56 pF, 500 V, CER	70-138285
C701	47 uF, 16 V, AL, ELYC	70-135219
C702	0.022 uF, 50 V, CER	70-138162
C703	1000 pF, 50 V, CER	70-138255
C711	4700 pF, 50 V, CER	70-138163
C712 A	68 pF, 50 V, CER	70-138229
C712 B	56 pF, 50 V, CER	70-138254
C712 C	56 pF, 50 V, CER	70-138254
C713	10 pF, 50 V, CER	70-138187
C714	4700 pF, 50 V, CER	70-138163
C715	22 pF, 50 V, CER	70-138171
C716 A	150 pF, 50 V, CER	70-138231
C716 B	100 pF, 50 V, CER	70-138175
C716 C	100 pF, 50 V, CER	70-138175
C717	4700 pF, 50 V, CER	70-138163
C718	4700 pF, 50 V, CER	70-138163
C719 A	100 pF, 50 V, CER	70-138175
C719 B	68 pF, 50 V, CER	70-138229
C719 C	68 pF, 50 V, CER	70-138229
C720 A	100 pF, 50 V, CER	70-138175
C720 B	68 pF, 50 V, CER	70-138229
C720 C	68 pF, 50 V, CER	70-138229
C721	2 pF, 50 V, CER	70-138169
C722	4700 pF, 50 V, CER	70-138163
C723	0.1 uF, 25 V, CER	70-138327
C724	0.022 uF, 50 V, CER	70-138162
C725	4700 pF, 50 V, CER	70-138163
C726	4700 pF, 50 V, CER	70-138163
C727	22 pF, 50 V, CER	70-138171
C730	100 pF, 50 V, CER	70-138175
C731	4700 pF, 50 V, CER	70-138163
C732	150 pF, 50 V, CER	70-138231
C733 A	5 pF, 50 V, CER	70-137085

TR-053 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C733 B	6 pF, 50 V, CER	70-138210
C733 C	6 pF, 50 V, CER	70-138210
C734 A	330 pF, 50 V, CER	70-138228
C734 B	330 pF, 50 V, CER	70-138228
C734 C	220 pF, 50 V, CER	70-138176
C735	10 pF, 50 V, CER	70-138187
C736 A	220 pF, 50 V, CER	70-138176
C736 B	220 pF, 50 V, CER	70-138176
C736 C	180 pF, 50 V, CER	70-138230
C737	4700 pF, 50 V, CER	70-138163
C738	4700 pF, 50 V, CER	70-138163
C739 A	100 pF, 50 V, CER	70-138175
C739 B	120 pF, 50 V, CER	70-138303
C739 C	100 pF, 50 V, CER	70-138175
C740 A	100 pF, 50 V, CER	70-138175
C740 B	120 pF, 50 V, CER	70-138303
C740 C	100 pF, 50 V, CER	70-138175
C741	3 pF, 50 V, CER	70-138164
C742	0.022 uF, 50 V, CER	70-138162
C743	4700 pF, 50 V, CER	70-138163
C744	0.022 uF, 50 V, CER	70-138162
C745	4700 pF, 50 V, CER	70-138163
C746	4700 pF, 50 V, CER	70-138163
C747	10 pF, 50 V, CER	70-138187
C750	100 pF, 50 V, CER	70-138175
C751 A	9 pF, 50 V, CER	70-138186
C751 B	7 pF, 50 V, CER	70-138181
C751 C	6 pF, 50 V, CER	70-138210
C752 A	27 pF, 50 V, CER	70-138185
C752 B	18 pF, 50 V, CER	70-138206
C752 C	22 pF, 50 V, CER	70-138171
C753	2200 pF, 50 V, CER	70-138235
C754 A	39 pF, 50 V, CER	70-138233
C754 B	33 pF, 50 V, CER	70-138188
C754 C	27 pF, 50 V, CER	70-138185
C755	2200 pF, 50 V, CER	70-138235
C756 A	8 pF, 50 V, CER	70-138203
C756 B	7 pF, 50 V, CER	70-138181
C756 C	6 pF, 50 V, CER	70-138210
C758	3 pF, 50 V, CER	70-138164
C759	3 pF, 50 V, CER	70-138164
C760	4700 pF, 50 V, CER	70-138163
C761	4700 pF, 50 V, CER	70-138163
C762 A	15 pF, 50 V, CER	70-138205
C762 B	6 pF, 50 V, CER	70-138210
C762 C	3 pF, 50 V, CER	70-138164
C763	15 pF, 50 V, CER	70-138205
C765	4700 pF, 50 V, CER	70-138163
C766	4700 pF, 50 V, CER	70-138163
C768	8 pF, 50 V, CER	70-138203
C769 A	220 pF, 50 V, CER	70-138349
C769 B	100 pF, 50 V, CER	70-138175
C769 C	100 pF, 50 V, CER	70-138175
C770 A	56 pF, 50 V, CER	70-138254
C770 B	33 pF, 50 V, CER	70-138188
C770 C	22 pF, 50 V, CER	70-138171
C771	0.022 uF, 50 V, CER	70-138162
C772	0.1 uF, 25 V, CER	70-138327
C773	68 pF, 50 V, CER	70-138228
C775	0.022 uF, 50 V, CER	70-138162
C776	47 uF, 25 V, AL, ELYC	70-135144
C777	1000 pF, 50 V, CER	70-138255
C778	0.022 uF, 50 V, CER	70-138162
C779	0.1 uF, 50 V, PLAS	70-138189
C781	1000 pF, 50 V, CER	70-138255
C782	1 uF, 63 V, PLAS	70-137101
C783	0.022 uF, 50 V, CER	70-138162
C784	0.1 uF, 50 V, PLAS	70-138189
C785	0.022 uF, 50 V, CER	70-138162
C787	1000 pF, 50 V, CER	70-138255
C788	1000 pF, 50 V, CER	70-138255
C789 A	15 pF, 50 V, CER	70-138205
C789 B	15 pF, 50 V, CER	70-138205
C789 C	39 pF, 50 V, CER	70-138233
C792 A	56 pF, 50 V, CER	70-138254
C792 B	47 pF, 50 V, CER	70-138185
C792 C	47 pF, 50 V, CER	70-138185
C801	39 pF, 50 V, CER	70-138233
C802	100 pF, 50 V, CER	70-138175

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C803	7 pF, 50 V, CER	70-138181
C804	100 pF, 50 V, CER	70-138175
C805	10 pF, 50 V, CER	70-138187
C806	100 pF, 50 V, CER	70-138175
C807	10 pF, 50 V, CER	70-138187
C808	100 pF, 50 V, CER	70-138175
C809	0.1 uF, 25 V, CER	70-138327
C810	10 pF, 50 V, CER	70-138187
C811	0.1 uF, 25 V, CER	70-138327
C813	220 pF, 50 V, CER	70-138176
C814	4 pF, 50 V, CER	70-138179
C815	0.047 uF, 16 V, CER	70-138409
C816	0.047 uF, 16 V, CER	70-138409
C818	15 pF, 50 V, CER	70-138205
C819	0.022 uF, 50 V, CER	70-138162
C820	0.047 uF, 16 V, CER	70-138409
C821	33 pF, 50 V, CER	70-138188
C822	0.022 uF, 50 V, CER	70-138162
C823	0.047 uF, 16 V, CER	70-138409
C824	0.01 uF, 50 V, CER	70-138270
C825	470 pF, 50 V, CER	70-138404
C826	0.1 uF, 50 V, CER	70-138327
C827	470 pF, 50 V, CER	70-138404
C828	10 uF, 16 V, TA, ELYC	70-135165
C829	18 pF, 50 V, CER	70-138206
C830	1000 pF, 50 V, CER	70-138255
C831	0.047 uF, 50 V, CER	70-138409
C832	470 pF, 50 V, CER	70-138404
C833	1000 pF, 50 V, CER	70-138255
C834	4700 pF, 50 V, CER	70-138163
C835	10 uF, 16 V, CER	70-135165
C836	4700 pF, 50 V, CER	70-138163
C837	0.1 uF, 25 V, CER	70-138327
C838	0.047 uF, 16 V, CER	70-138409
C842	0.1 uF, 25 V, CER	70-138327
C843	0.1 uF, 25 V, CER	70-138327
C921	0.022 uF, 50 V, CER	70-138162
C923	1000 pF, 50 V, CER	70-138255
C925	0.01 uF, 50 V, CER	70-138270
C926	1000 pF, 50 V, CER	70-138255
C927	1000 pF, 50 V, CER	70-138255
C928	1000 pF, 50 V, CER	70-138255
C929	22 pF, 50 V, CER	70-138171
C930	47 pF, 50 V, CER	70-138185
C931	10 uF, 16 V, AL, ELYC	70-138191
C932	10 uF, 16 V, AL, ELYC	70-138191
C933	1000 pF, 50 V, CER	70-138255
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	70-085313
D202	ND487C2-3R	70-085228
D241	DCA010-TA	70-085250
D242	MA3088-M TW	70-085273
D243	HSM88S	70-085154
D244	DCA010-TA	70-085250
D401	IMN10	70-085339
D501	DWA010	70-085246
D502	DCA010	70-085250
D503	HSM88S	70-085154
D504	RM4AM	70-085157
D701	DCA010-TA	70-085250
D702	DCA010-TA	70-085250
D711	SVC341L	70-085352
D713	MA704A	70-085247
D731	SVC341L	70-085352
D733	MA704A	70-085247
D734	1SV166	70-085159
D735	1SV166	70-085159
D771	DCB010-TA	70-085245
D801	DCC010	70-085313
D901	DCB010-TA	70-085245
D902	DCA010	70-085250
D903	HZM5B	70-085253
D904	DCA010	70-085250
D905	DWA010-TF	70-085246

TR-053 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	FILTERS	
FL241	10F12B	70-179100
FL242	10F12B	70-179100
FL243	CFU455G2	70-179093
FL244	CFU455F2	70-179078
FL801	TPA 10.7 MA3	70-179101
	INTEGRATED CIRCUITS	
IC241	MC3361	70-076216
IC401	AN6541	70-076253
IC402	HA17805W	70-076567
IC404	MC144111P	70-076568
IC405	BA726F	70-076569
IC406	TDA7240AV	70-076570
IC408	AN5262	70-076571
IC409	AN5262	70-076571
IC411	MPC4741G2	70-076628
IC412	AFL24F3120A14	70-076629
IC771	MB1504PF-G-BND-TF	70-076598
IC772	BU4066BF-T1	70-076573
IC801	MC1350P	70-076627
IC901	M37450M4-273SP	70-076574
IC902	MN1280R	70-076575
IC903	M6M80021L	70-076576
	JACKS	
J401	IL-S-14P-S2T2-EF	70-159558
J402	PS-10PE-D4T1-B1	70-159426
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-E	70-159565
J420	IL-Y-4P-S15T2-EF	70-159560
J501	M-RM	70-159090
	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
	COILS	
L101	42L-060	70-090462
L132	LQH3N 1R0M02M00-100	70-090535
L133	LQN2AR22	70-090463
L134	LQN2AR22	70-090463
L201	L-1S7-M1 9.5T	70-090536
L202	L-1S7-M1 9.5T	70-090536
L203	L-1S7-M1 9.5T	70-090536
L204	L-1S7-M1 9.5T	70-090536
L205	L-1S7-M1 9.5T	70-090536
L206	L-1S7-M1 9.5T	70-090536
L207	L-1S7-M1 9.5T	70-090536
L208	L-1S7-M1 9.5T	70-090536
L209	LQH3N R39M	70-090537
L210	ELESN470KA	70-090544
L211	DBM	70-090407
L212	DBM	70-090407
L231	LQH3N1R0M02M00	70-090535
L232	LQN2AR22K	70-090463
L233	LQN2AR22K	70-090463
L241	LQH3NR39	70-090537
L242	LQH3N3P3	70-090538
L243	LQH3N3P3	70-090538
L244	LQH3N470	70-090538
L245	42L064	70-090540

REF NO.	DESCRIPTION	PART NO.
	COILS (CONTINUED)	
L246	ELESN220KA	70-090541
L247	24L129	70-090542
L248	LQH3N6R8	70-090543
L249	ELESN470KA	70-090544
L250	41L001	70-090423
L251	ELESN102KA	70-090474
L252	ELESN47KA	70-090544
L253	ELESN331KA	70-090476
L254	ELESN331KA	70-090476
L255	ELESN47KA	70-090544
L256	ELESN47KA	70-090544
L401	1.0 MH	70-178057
L402	ELESN4.7KA	70-090466
L501	C6.5T	70-090481
L502 A	C6.5T	70-090481
L502 B	C6.5T	70-090481
L502 C	C5.5T	70-090486
L503 A	C5.5T	70-090486
L503 B	S5.5T	70-090478
L503 C	C3.5T	70-090494
L504 A	S3.5T	70-090491
L504 B	S2.5T	70-090490
L504 C	S1.5T	70-090495
L505	BL02RN1-R62	70-090122
L506	C6.5T	70-090481
L507 A	Z1.2S4D 1.5T	70-090642
L507 B	Z1.2C5D 0.5T	70-090132
L507 C	L=7.5 W=5.0	70-090552
L508 A	Z1.2C5D 3.5T	70-090553
L508 B	Z1.2C5D 2.5T	70-090102
L508 C	Z1.2C5D 2.5T	70-090102
L509 A	Z1.2C5D 2.5T	70-090102
L509 B	Z1.2C5D 3.5T	70-090553
L510 A	S10-J 5.5T	70-090556
L510 B	S10-H6 5.5T	70-090555
L510 C	S10-H6 4.5T	70-090554
L511 B	S10-H6 8.5T	70-090557
L511 C	S10-J 5.5T	70-090556
L512 A	S10-J 7.5T	70-090559
L512 B	S10-H6 8.5T	70-090557
L512 C	S10-H6 7.5T	70-090558
L513	BL01RN-A62B1	70-090560
L514	BL01RN-A62B1	70-090560
L515	BL01RN-A62B1	70-090560
L516	BL02RN1-R62	70-090122
L517	BL01RN1-A62	70-090483
L518	BL01RN1-A62	70-090483
L519	ELESN4R7KA	70-090466
L520	BL01RN-A62B1	70-090560
L521	ELESN 1R0	70-090480
L525	BL01RN-A62	70-090482
L526	BL01RN-A62	70-090482
L527	BL01RN-A62	70-090482
L528	BL01RN-A62	70-090482
L530	BL01RN-A62	70-090482
L711	LQH3N100K02M00-100	70-090545
L712	LQH3N100K02M00-100	70-090545
L713 A	L-157-M1 7.5 T	70-090547
L713 B	L-157-M1 7.5 T	70-090547
L713 C	L-157-M1 8.5 T	70-090546
L714	LQH3N100K02M00-100	70-090545
L715	LQH3N100K02M00-100	70-090545
L716	LQH3N1R0M02M00-100	70-090535
L718	LQN2AR10K	70-090548
L719	LQN2AR10K	70-090548
L720	LQN2AR10K	70-090548
L721	LQN2AR10K	70-090548
L731	LQH3N100K02M00-100	70-090545
L732	LQH3N100K02M00-100	70-090545
L733 A	L-1S7-M1 10.5T	70-090551
L733 B	L-1S7-M1 9.5 T	70-090550
L733 C	L-1S7-M1 8.5T	70-090549
L734	LQH3N100K02M00-100	70-090545
L735	LQH3N100K02M00-100	70-090545
L736	LQH3N100K02M00-100	70-090545
L771	LQN2A47NM	70-090464
L801	42L064	70-090540
L802	42L064	70-090540
L803	42L064	70-090540
L804	42L064	70-090540

TR-053 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	COILS (CONTINUED)	
L805	LQH3N1R0	70-090535
L806	LQH3N4R7	70-090513
L807	LQH3N6R8	70-090543
L808	ELESN102K	70-090474
T1	17005	70-090399
	TRANSISTORS	
Q101	2SC2620B-TR (QB)	70-080181
Q102	2SC2462C-TR (LC)	70-080288
Q103	2SC2462C-TR (LC)	70-080288
Q131	2SC3357-T2	70-080375
Q201	2SC3356	70-080192
Q203	2SC3357	70-080375
Q241	2SK125	70-080089
Q242	2SK360E	70-080362
Q243	2SC2462	70-080294
Q244	2SC2462	70-080294
Q401	IMX2-T108 (X2)	70-080363
Q403	IMX2-T108 (X2)	70-080363
Q406	2SC2462	70-080294
Q408	2SK508	70-080191
Q409	2SC2462	70-080294
Q410	2SC2462	70-080294
Q501	2SC2538	70-080108
Q502	2SC1971	70-080054
Q503	2SC2630	70-080091
Q504	2SB1065Q	70-080367
Q701	2SC2462C	70-080288
Q702	IMB3-T110 (B3)	70-080364
Q703	IMH1-T1	70-080296
Q704	2SB798	70-080164
Q705	DTC124EK	70-080274
Q711	3SK151GR	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	2SC2462C	70-080288
Q774	2SA1122C	70-080162
Q775	2SA1121C	70-080339
Q776	2SC2462LC	70-080294
Q778	IMH1	70-080296
Q801	2SK508K52	70-080324
Q802	2SK508K52	70-080324
Q803	3SK151GR	70-080303
Q804	2SC2462C	70-080288
Q805	2SA1121C	70-080339
Q806	2SA1121C	70-080339
Q807	2SC2462	70-080160
Q808	2SA1121C	70-080339
Q809	2SSA1121C	70-080339
Q810	2SA1121C	70-080339
Q811	2SC2462C	70-080160
Q812	DTC124EK	70-080300
	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
R106	22 kOHM, 1/10 W, MET	70-144121
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	70-144134
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
R118	10 kOHM, 1/10 W, MET	70-144120
R119	100 kOHM, 1/10 W, MET	70-145148

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
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	70-145122
R125	47 kOHM, 1/10 W, MET	70-145122
R126	15 kOHM, 1/10 W, MET	70-144119
R127	4.7 kOHM, 1/10 W, MET	70-144120
R128	470 OHM, 1/10 W, MET	70-144152
R129	680 OHM, 1/10 W, MET	70-144123
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
R135	100 OHM, 1/10 W, MET	70-145146
R136	68 OHM, 1/10 W, MET	70-144114
R137	100 OHM, 1/10 W, MET	70-145146
R201 A	47 OHM, 1/10 W, MET	70-145130
R201 B	33 OHM, 1/10 W, MET	70-140320
R201 C	47 OHM, 1/10 W, MET	70-145130
R202	18 kOHM, 1/10 W, MET	70-144171
R203	560 OHM, 1/10 W, MET	70-144130
R204	22 kOHM, 1/10 W, MET	70-144121
R205	5.6 kOHM, 1/10 W, MET	70-144168
R206	22 OHM, 1/10 W, MET	70-144160
R207 B	470 OHM, 1/10 W, MET	70-144152
R207 C	270 OHM, 1/10 W, MET	70-144116
R208 B	10 OHM, 1/10 W, MET	70-144115
R208 C	0 OHM, 1/10 W, MET	70-144106
R209 B	470 OHM, 1/10 W, MET	70-144152
R209 C	270 OHM, 1/10 W, MET	70-144116
R231	470 OHM, 1/10 W, MET	70-144152
R232	10 KOHM, 1/10 W, MET	70-144120
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	150 OHM, 1/10 W, MET	70-140321
R243	470 OHM, 1/10 W, MET	70-144152
R244	5.6 kOHM, 1/10 W, MET	70-144168
R245	3.3 kOHM, 1/10 W, MET	70-144118
R246	100 OHM, 1/10 W, MET	70-145146
R247	82 kOHM, 1/10 W, MET	70-144173
R248	22 kOHM, 1/10 W, MET	70-144121
R249	150 OHM, 1/10 W, MET	70-140321
R250	12 kOHM, 1/10 W, MET	70-144111
R251	330 OHM, 1/10 W, MET	70-144164
R252	3.9 kOHM, 1/10 W, MET	70-145132
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	70-144122
R258	470 kOHM, 1/10 W, MET	70-144196
R259	2.2 kOHM, 1/10 W, MET	70-144113
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	70-144231
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	70-144321
R407	100 kOHM, 1/10 W, MET	70-144321
R408	100 kOHM, 1/10 W, MET	70-144321
R409	100 kOHM, 1/10 W, MET	70-144321
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	150 kOHM, 1/10 W, MET	70-144129
R422	22 kOHM, 1/10 W, MET	70-144121
R423	100 kOHM, 1/10 W, MET	70-144321

TR-053 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R424	47 kOHM, 1/10 W, MET	70-145145
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	22 kOHM, 1/10 W, MET	70-144121
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	70-144322
R442	1 kOHM, 1/10 W, MET	70-144288
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	70-144119
R446	22 kOHM, 1/10 W, MET	70-144188
R447	4.7 kOHM, 1/10 W, MET	70-144123
R448	10 kOHM, 1/10 W, MET	70-144120
R452	330 OHM, 1/8 W, MET	70-144065
R453	100 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	70-144113
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 OHM, 1/10 W, MET	70-144130
R464	2.7 kOHM, 1/10 W, MET	70-144159
R465	100 kOHM, 1/10 W, MET	70-144321
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
R501	2.2 kOHM, 1/10 W, MET	70-144113
R502	220 OHM, 1/10 W, MET	70-144194
R503	10 OHM, 1/10 W, MET	70-144115
R504	10 OHM, 1/10 W, MET	70-144115
R505	10 OHM, 1/10 W, MET	70-144115
R507 A	33 OHM, 1/10 W, MET	70-144005
R507 B	68 OHM, 1/10 W, MET	70-144008
R507 C	68 OHM, 1/10 W, MET	70-144008
R508 A	68 OHM, 1/10 W, MET	70-144008
R508 B	33 OHM, 1/10 W, MET	70-144005
R508 C	68 OHM, 1/10 W, MET	70-144006
R509 A	33 OHM, 1 W, MET	70-144201
R509 B	180 OHM, 1 W, MET	70-144313
R509 C	180 OHM, 1 W, MET	70-144313
R511	150 OHM, 1/10 W, MET	70-140321
R512	150 OHM, 1/10 W, MET	70-140321
R513	250 OHM, 1/10 W, MET	70-140321
R514	33 OHM, 2 W, MET	70-144135
R515	100 OHM, 1/10 W, MET	70-145146
R516	100 OHM, 1/10 W, MET	70-145146
R517	100 OHM, 1/10 W, MET	70-145146
R518	100 OHM, 1/10 W, MET	70-145146
R519	4.7 kOHM, 1/10 W, MET	70-144123
R521	100 kOHM, 1/10 W, MET	70-144321
R522	100 kOHM, 1/10 W, MET	70-144321
R524	1 kOHM, 1/10 W, MET	70-144125
R525	180 OHM, 1/8 W, MET	70-144012
R526	180 OHM, 1/8 W, MET	70-144012
R527	180 OHM, 1/8 W, MET	70-144012
R528	180 OHM, 1/8 W, MET	70-144012
R529	180 OHM, 1/8 W, MET	70-144012
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	4.7 kOHM, 1/10 W, MET	70-144123
R711	47 OHM, 1/10 W, MET	70-145130
R712	6.8 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

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R716	6.8 kOHM, 1/10 W, MET	70-144158
R717	150 OHM, 1/10 W, MET	70-140321
R718	3.3 kOHM, 1/10 W, MET	70-144118
R719	1 kOHM, 1/10 W, MET	70-144125
R720	100 OHM, 1/10 W, MET	70-145146
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	70-144158
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	1 kOHM, 1/10 W, MET	70-144125
R737	150 OHM, 1/10 W, MET	70-140321
R738	3.3 kOHM, 1/10 W, MET	70-144118
R739	1 kOHM, 1/10 W, MET	70-144125
R740	100 OHM, 1/10 W, MET	70-145146
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	3.3 kOHM, 1/10 W, MET	70-144118
R755	1 kOHM, 1/10 W, MET	70-144125
R756	100 OHM, 1/10 W, MET	70-145146
R757	47 OHM, 1/10 W, MET	70-145130
R758	1 kOHM, 1/10 W, MET	70-144125
R759	3.3 kOHM, 1/10 W, MET	70-144118
R760	100 OHM, 1/10 W, MET	70-145146
R761	0 OHM, 1/10 W, MET	70-144106
R762	0 OHM, 1/10 W, MET	70-144106
R770	47 kOHM, 1/10 W, MET	70-145145
R771	100 kOHM, 1/10 W, MET	70-144321
R772	22 OHM, 1/10 W, MET	70-144160
R773	100 kOHM, 1/10 W, MET	70-144321
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	10 kOHM, 1/10 W, MET	70-144120
R779	22 kOHM, 1/10 W, MET	70-144121
R780	0 OHM, 1/10 W, MET	70-144106
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	70-144321
R786	22 kOHM, 1/10 W, MET	70-144121
R787	100 OHM, 1/10 W, MET	70-145146
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	1 kOHM, 1/10 W, MET	70-144125
R792	4.7 kOHM, 1/10 W, MET	70-144123
R793	47 kOHM, 1/10 W, MET	70-145145
R794	1.5 kOHM, 1/10 W, MET	70-144134
R795	47 kOHM, 1/10 W, MET	70-145145
R796	22 kOHM, 1/10 W, MET	70-144121
R797	5.6 kOHM, 1/10 W, MET	70-144166
R798	1 kOHM, 1/10 W, MET	70-144125
R799	2.7 kOHM, 1/10 W, MET	70-144159
R801	4.7 kOHM, 1/10 W, MET	70-144123
R802	3.3 kOHM, 1/10 W, MET	70-144118
R803	10 kOHM, 1/10 W, MET	70-144120
R804	10 kOHM, 1/10 W, MET	70-144120
R805	3.3 kOHM, 1/10 W, MET	70-144118
R806	4.7 kOHM, 1/10 W, MET	70-144123
R807	560 OHM, 1/10 W, MET	70-144130
R808	4.7 kOHM, 1/10 W, MET	70-144123
R809	3.3 kOHM, 1/10 W, MET	70-144118
R810	3.3 kOHM, 1/10 W, MET	70-144118
R811	10 kOHM, 1/10 W, MET	70-144120
R812	220 OHM, 1/10 W, MET	70-144194
R813	2.2 kOHM, 1/10 W, MET	70-144113
R814	150 OHM, 1/10 W, MET	70-140321
R815	470 OHM, 1/10 W, MET	70-144152
R816	8.2 kOHM, 1/10 W, MET	70-14305
R817	1 kOHM, 1/10 W, MET	70-144286
R818	470 OHM, 1/10 W, MET	70-144152
R819	150 OHM, 1/10 W, MET	70-140321
R820	150 OHM, 1/10 W, MET	70-140321
R821	5.6 kOHM, 1/10 W, MET	70-144166

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R822	1.8 kOHM, 1/10 W, MET	70-144154
R823	2.2 kOHM, 1/10 W, MET	70-144113
R824	8.2 kOHM, 1/10 W, MET	70-140305
R825	220 OHM, 1/10 W, MET	70-144194
R826	10 kOHM, 1/10 W, MET	70-144120
R827	10 kOHM, 1/10 W, MET	70-144120
R828	560 OHM, 1/10 W, MET	70-144130
R829	680 OHM, 1/10 W, MET	70-144157
R830	68 OHM, 1/10 W, MET	70-144114
R831	1 kOHM, 1/10 W, MET	70-144125
R832	10 kOHM, 1/10 W, MET	70-144120
R833	180 OHM, 1/10 W, MET	70-144150
R835	1 kOHM, 1/10 W, MET	70-144125
R836	100 kOHM, 1/10 W, MET	70-144321
R837	47 kOHM, 1/10 W, MET	70-144145
R838	10 kOHM, 1/10 W, MET	70-144120
R839	5.6 kOHM, 1/10 W, MET	70-144168
R840	33 OHM, 1/10 W, MET	70-140320
R842	33 OHM, 1/10 W, MET	70-140320
R843	33 OHM, 1/10 W, MET	70-140320
R811	22 kOHM, 1/10 W, MET	70-144121
R812	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
R938	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
R971	47 kOHM, 1/10 W, MET	70-145145
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
R978	100 kOHM, 1/10 W, MET	70-144321
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	70-144321
R998	220 kOHM, 1/10 W, MET	70-144131
	VARIABLE RESISTORS	
RV241	RH082KCJ3 (2.2K)	70-164109
RV401	100K	70-164110
	MISCELLANEOUS	
	INSULATION PLATE	70-157357
	SHIELD CASE	70-089339
CA511	CABLE, L = 150	70-034059
CA513	CABLE, L = 250	70-034644
CB901	CNTL12XS102M	70-088071
CB902	CNTL9XS102M	70-088072
CM201	IL-S-2P-S2T2-EF	70-159399
CM701	IL-S-2P-S2T2-EF	70-159399
F501	FUSE, 5A	70-204062
K501	RELAY, HB1-DC6V	70-105010
P403	PLUG, 53029-8CPB	70-159587
P410	PLUG, IL-Y-105	70-159654
RC901	RC9019/CRB602	70-088073
RC902	RC9020/CRB402	70-088074
SW801	SWITCH	70-183119
X101	CRYSTAL, HC-431u 12.8 MHz	70-128097
X241	43U 10.245 MHz	70-128025
X801	XTAL, AT-51, 8.000 MHz	70-128099

CONTROL HEAD

70–0351/0355 A BAND USE "A"
70–0351/0355 B BAND USE "B"
70–0351/0355 C BAND USE "C"

UD = Under-dash only
TM = Trunk-mount only

REF NO.	DESCRIPTION	PART NO.
	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
C305	1000 pF, 50 V, CER	70-138170
C306	1000 pF, 50 V, CER	70-138170
C307 (UD)	470 uF, 25 V, AL, ELYC	70-135237
C331 TM	1000 pF, 45 V, CER	70-131387
	CABLE ASSEMBLIES	
CA301	SMV 2d 15x21	70-034620
CA302	SMV 2d 3x8	70-034621
CA303-1	ILYB-15P-ILS 15S	70-034622
CA303-2	ILYB-14P-ILS 14S	70-034623
CA304	ILG 2S-S3C2	70-034624
CA324 TM	1282R L=120	70-034630
	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	70-060338
Q302	IMH1-T1	70-060296
Q303	IMH1-T1	70-060296
	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
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	70-144164
	VARIABLE RESISTORS	
RV301	K1214005L (10KB)	70-160025
RV302	K1214105G (10KB)	70-160026
	SWITCHES	
S301	ESB-64803	70-183080
S302	ESB-64803	70-183080
S303	ESB-64803	70-183080
S304	ESB-64803	70-183080
S305	SRBU1C L=15MM	70-183094
	JACKS	
J301	NS1504L	70-159100
J304	IL-G-2P-S3T2-EF	70-159565
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	IL-S-14P-S2T2-EF	70-159558
J325 TM	IL-S-14P-S2T2-EF	70-159558
	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
JP331 TM	0 OHM, 1/10 W, MET	70-144106
JP332 TM	0 OHM, 1/10 W, MET	70-144106
JP333 TM	0 OHM, 1/10 W, MET	70-144106
JP334 TM	0 OHM, 1/10 W, MET	70-144106
	MISCELLANEOUS	
CD301	PHOTO SENSOR P1201	70-085054
SP301 UD	SPEAKER	70-060033

Z-593 TRUNK-MOUNT INTERFACE BOARD

70-0355 A BAND	USE "A"
70-0355 B BAND	USE "B"
70-0355 C BAND	USE "C"

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	70-136066
	CABLE ASSEMBLIES	
CA311	IL-YB-14P-IL-S-14S	70-034827
CA312	IL-3-2P-IL-G-2S	70-034826
CA313	ILJ2P-EMCHUM0201W	70-034625
CA316	IL-YE-15P-IL-S-15S	70-034595
	DIODES	
D311	DCB010	70-085323

REF NO.	DESCRIPTION	PART NO.
	CONNECTORS	
J311	D3431	70-159592
	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

70-2157 CTCSS FILTER BOARD

70-0351/0355 A BAND	USE "A"
70-0351/0355 B BAND	USE "B"
70-0351/0355 C BAND	USE "C"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C1	6.3 uF, 10 V, AL, ELYC	70-135335
C2	860 pF, 50 V, CER	70-138252
C4	6.3 uF, 10 V, AL, ELYC	70-135335
C5	0.1 uF, 25 V, CER	70-138327
C6	6.3 uF, 10 V, AL, ELYC	70-135335
C7	1 uF, 50 V, CER	70-135257
C8	0.022 uF, 25 V, CER	70-138162
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	70-137126
C52	0.01 uF, 25 V, PLAS	70-137126
C53	0.01 uF, 25 V, PLAS	70-137126
C54	0.01 uF, 25 V, PLAS	70-137126
C55	0.01 uF, 25 V, PLAS	70-137126
C56	0.01 uF, 25 V, PLAS	70-137126
C57	0.01 uF, 25 V, PLAS	70-137126
C58	0.01 uF, 25 V, PLAS	70-137126
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	70-135335
	INTEGRATED CIRCUITS	
IC1	MF6CN-50	70-078611
IC2	BU4066BF	70-078573
IC50	BA10324F	70-078612
	TRANSISTORS	
Q1	2SC2462C	70-080288
Q2	2SC2462C	70-080288
	VARIABLE RESISTORS	
RV1	50 kOHM	70-184114

REF NO.	DESCRIPTION	PART NO.
	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	70-144166
R18	22 kOHM, 1/10 W, MET	70-144121
R20	100 kOHM, 1/10 W, MET	70-145126
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	70-144106
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	70-144195
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
	MISCELLANEOUS	
	SCREW BIND HD M26 x 8	70-150169
P403	CONNECTOR 5513-8CP8	70-159567

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).

Mail or phone your order to:

MIDLAND INTERNATIONAL CORPORATION
1690 North Topping Avenue
Kansas City, Missouri 64120
(816) 241-8500

MIDLAND LMR
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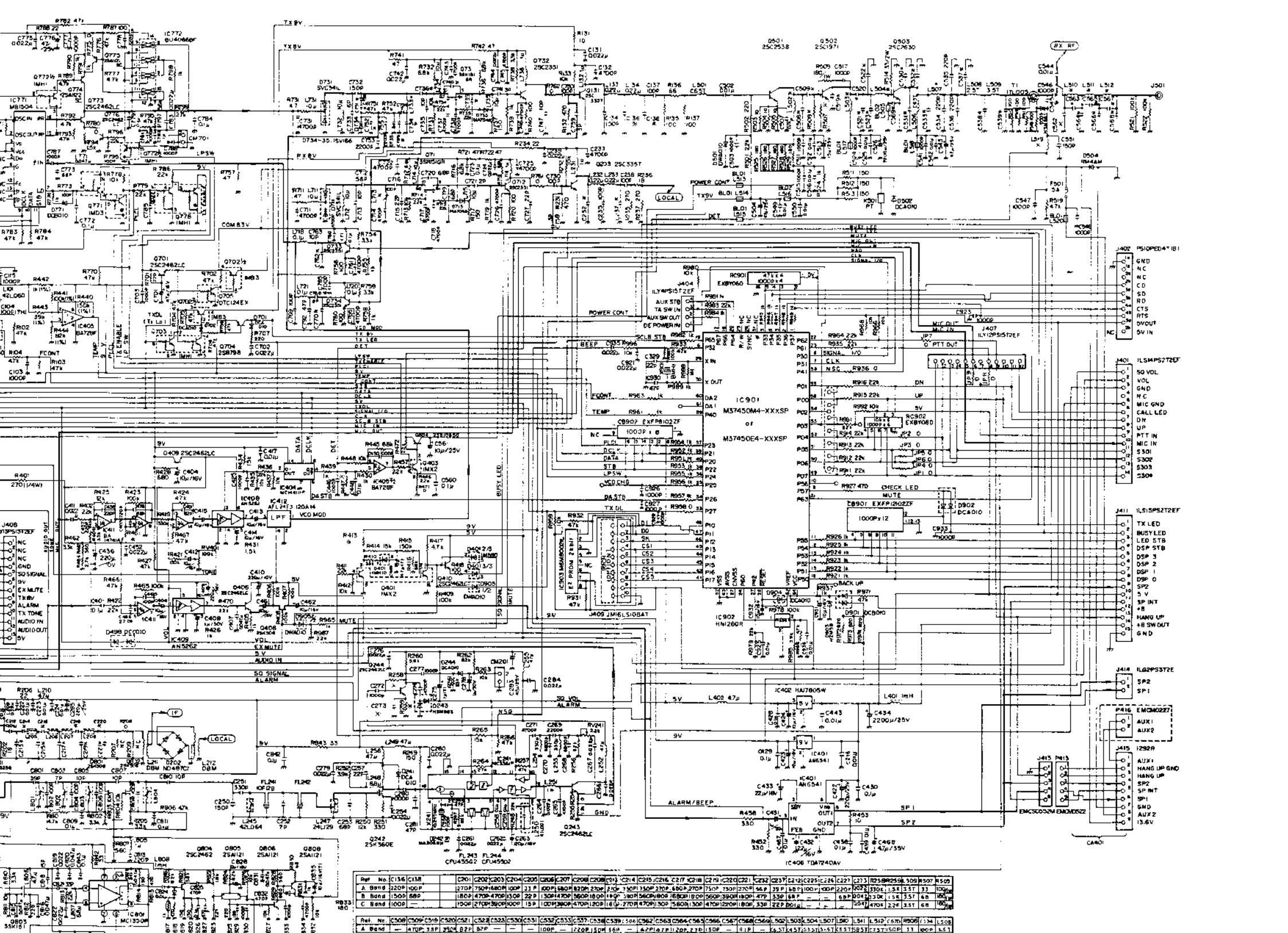
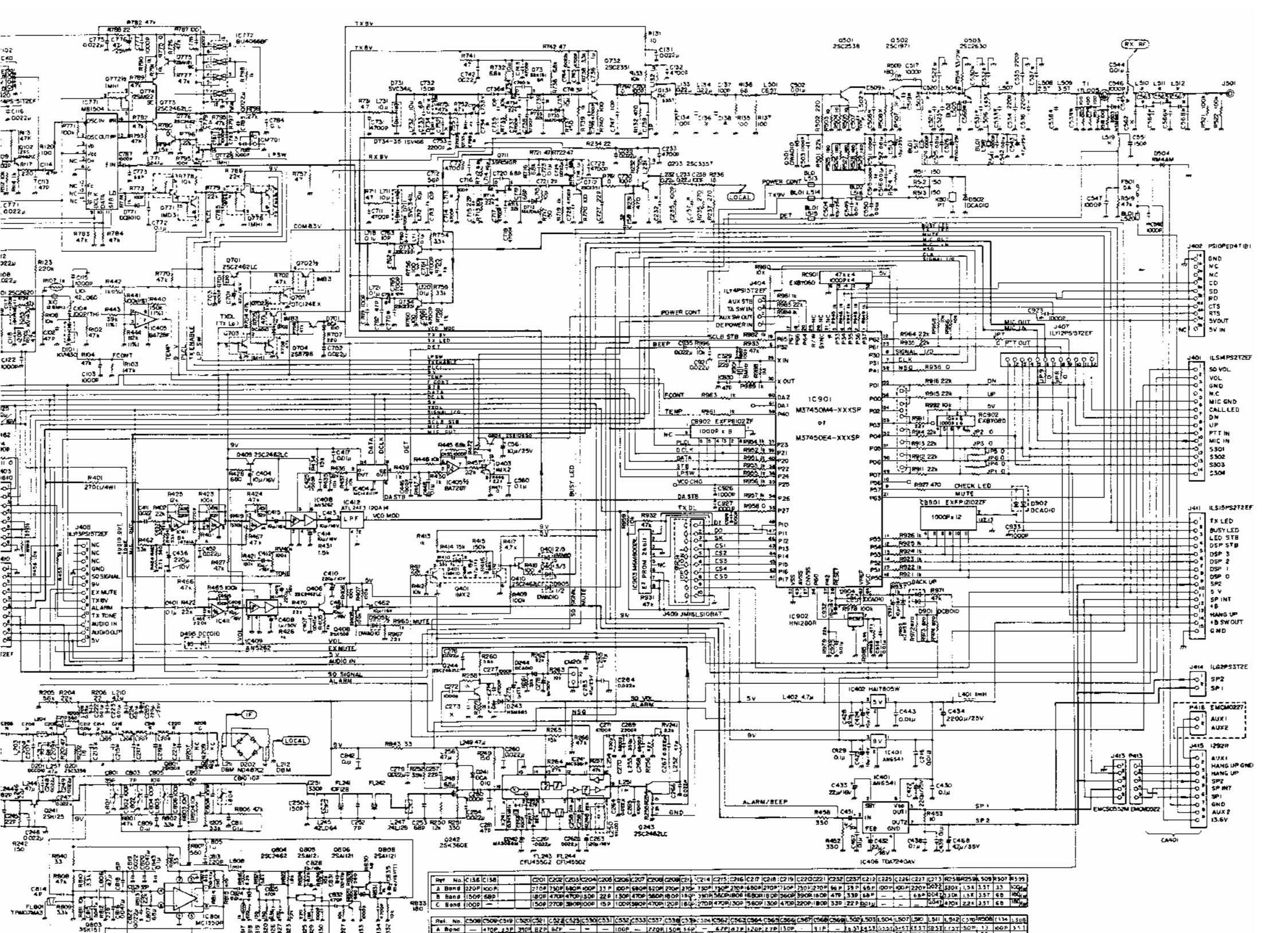
1690 NORTH TOPPING • KANSAS CITY • MISSOURI • 64120
(P.O. BOX 419903 • KANSAS CITY • MISSOURI • 64141)
TELEPHONE: (816) 241-8500 • FAX: (816) 245-1144



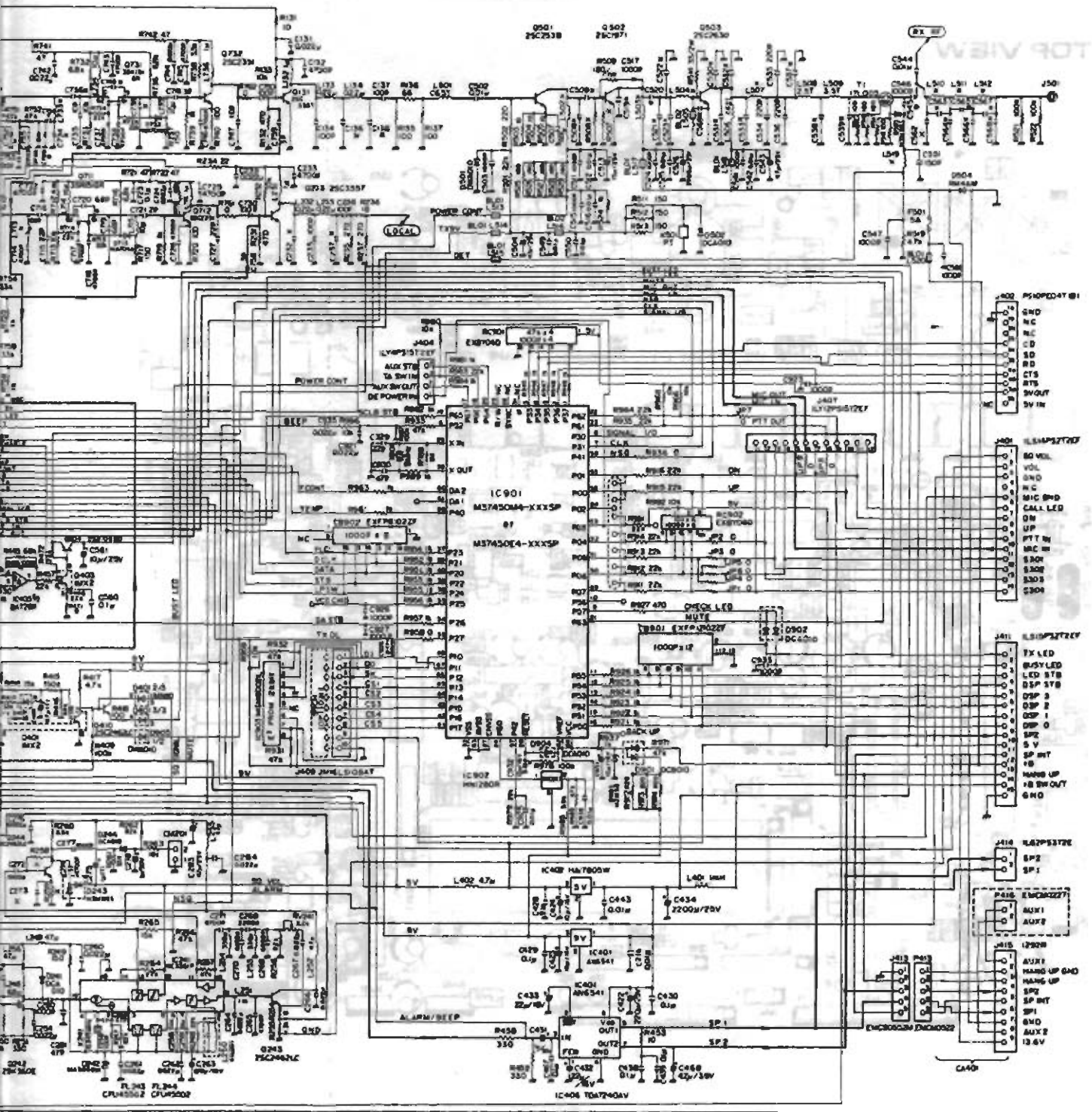
Ref. No.	C136	C138		C201	C202	C203	C204	C205	C206	C207	C208	C209	C211	C214	C215	C216	C217	C218	C219	C220	C221	C232	C237	C242	C295	C296	C297	C373	R258	R259	R508	R507	R505
A Band	220P	100P		270P	750P	1680P	100P	33 P	100P	580P	820P	270P	330P	750P	2700P	680P	270P	750P	750P	270P	56 P	39 P	68P	100P	100P	220P	0022	330K	1.5K	3.5T	33	100
B Band	150P	68P		180P	470P	470P	150P	22 P	130P	470P	560P	180P	190P	390P	560P	1800P	680P	1800P	560P	390P	180P	47P	33P	68P	—	—	68P	0047	330K	1.5K	3.5T	68	150
C Band	100P	—		150P	270P	390P	100P	15P	100P	390P	470P	120P	180P	270P	470P	130P	560P	1800P	330P	270P	120P	0022	22P	47P	—	—	—	0047	470K	2.2K	3.5T	68	180

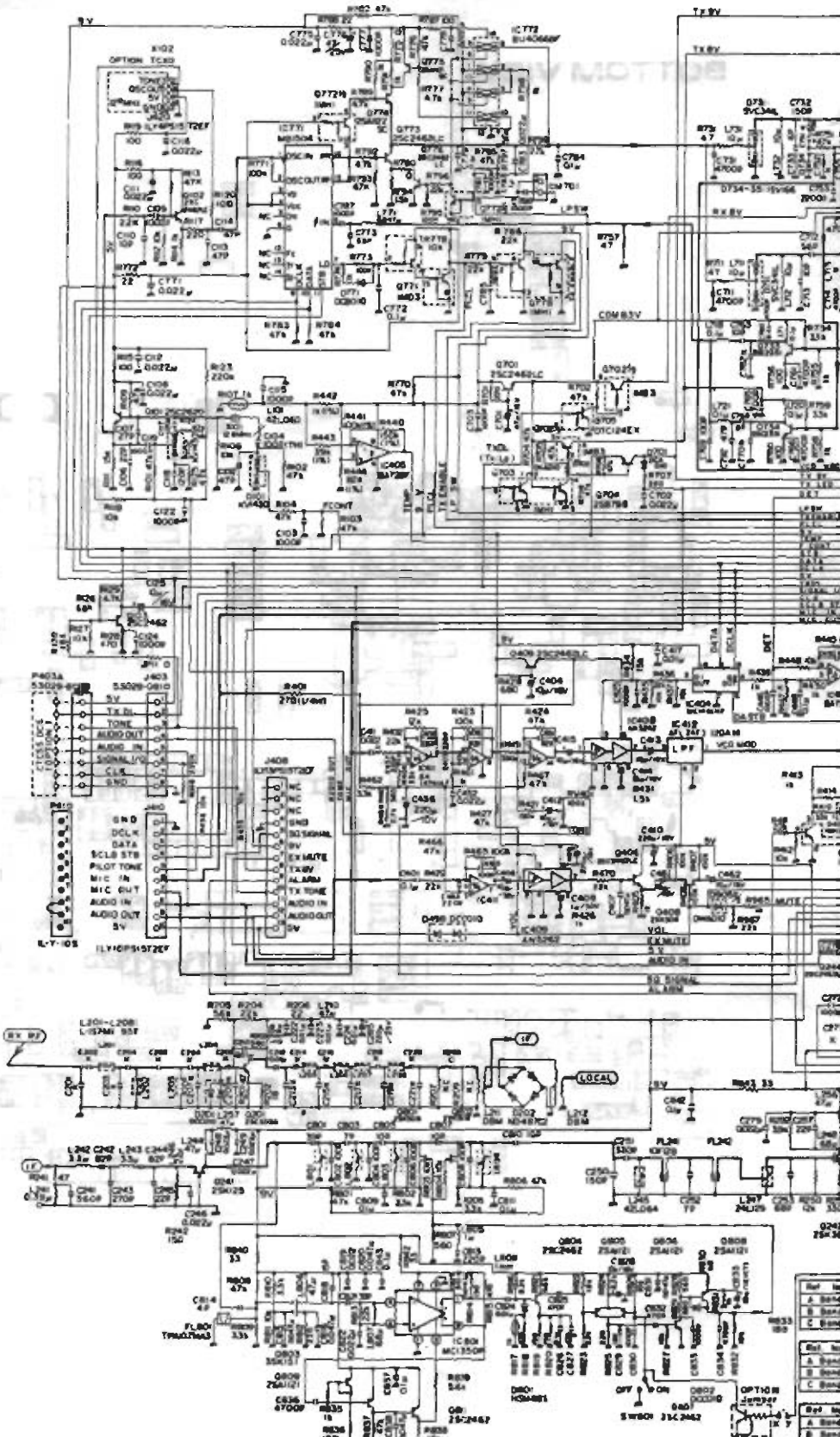
Ref. No.	C508	C509	C519	C520	C521	C522	C523	C530	C531	C532	C533	C537	C538	C539	C561	C562	C563	C564	C565	C566	C567	C568	C569	L502	L503	L504	L507	L510	L511	L512	C570	R506	C534	L508
A Band	—	470P	33P	390P	82P	B2P	—	—	—	100P	—	1220P	150P	68P	—	62P	47P	120P	22P	150P	—	0 P	—	4.5T	4.5T	3.5T	3.5T	5.5T	5.5T	5.5T	15OP	33	100	5.5T
B Band	—	330P	33P	390P	82P	B2P	—	—	—	100P	—	1220P	150P	68P	—	62P	47P	120P	22P	150P	—	0 P	—	4.5T	4.5T	3.5T	3.5T	5.5T	5.5T	5.5T	15OP	33	100	5.5T



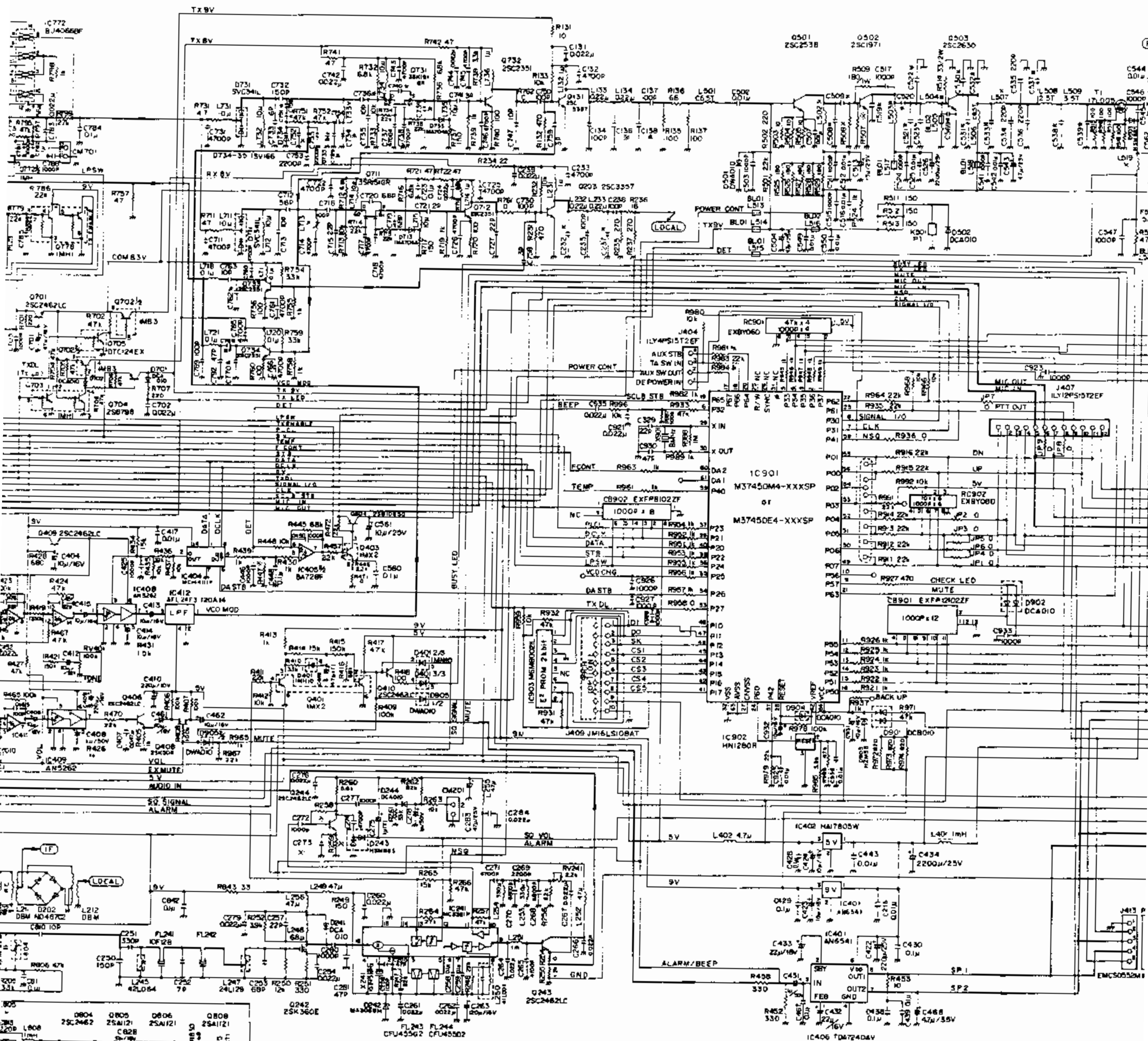
Ref. No.	C136	C138		C201	C202	C203	C204	C205	C206	C207	C208	C209	C211	C214	C215	C216	C217	C218	C219	C220	C221	C232	C237	C212	C225	C226	C227	C273	R258	R259	R509	R507	R539
A Band				270P	750P	680P	100P	33 P	100P	680P	820P	270P	270P	750P	750P	270P	680P	270P	750P	270P	270P	56 P	39 P	68 P	100P	100P	220P	0022	330K	1.5K	3.5T	33	100
B Band		150P	68P		180P	470P	470P	330	22 P	150P	470P	560P	180P	150P	390P	560P	180P	680P	180P	270P	390P	180P	47P	33P	68P	—	—	68P	0047	330K	1.5K	3.5T	68	180
C Band		100P	—		150P	270P	390P	100P	15 P	100P	390P	470P	120P	180P	270P	470P	150P	560P	150P	470P	220P	180P	33P	22 P	82P	—	—	—	0047	470K	2.2K	3.5T	68	180

Ref. No.	C508	C509	C519	C520	C521	C522	C523	C530	C531	C532	C533	C537	C538	C539	C540	C562	C563	C564	C565	C566	C567	C568	C569	L502	L503	L504	L507	L510	L511	L512	C570	R508	L134	L508
A Band	—	470P	33P	3100	82P	82K	—	—	—	100P	—	2200	1500	560P	—	47P	47P	1200	270P	150P	—	91P	—	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	50P	1.2	100P	3.5T
B Band		470P	33P	3100	82P	82K	—	—	—	100P	—	2200	1500	560P	—	47P	47P	1200	270P	150P	—	91P	—	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	50P	1.2	100P	3.5T
C Band		470P	33P	3100	82P	82K	—	—	—	100P	—	2200	1500	560P	—	47P	47P	1200	270P	150P	—	91P	—	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	3.5T	50P	1.2	100P	3.5T





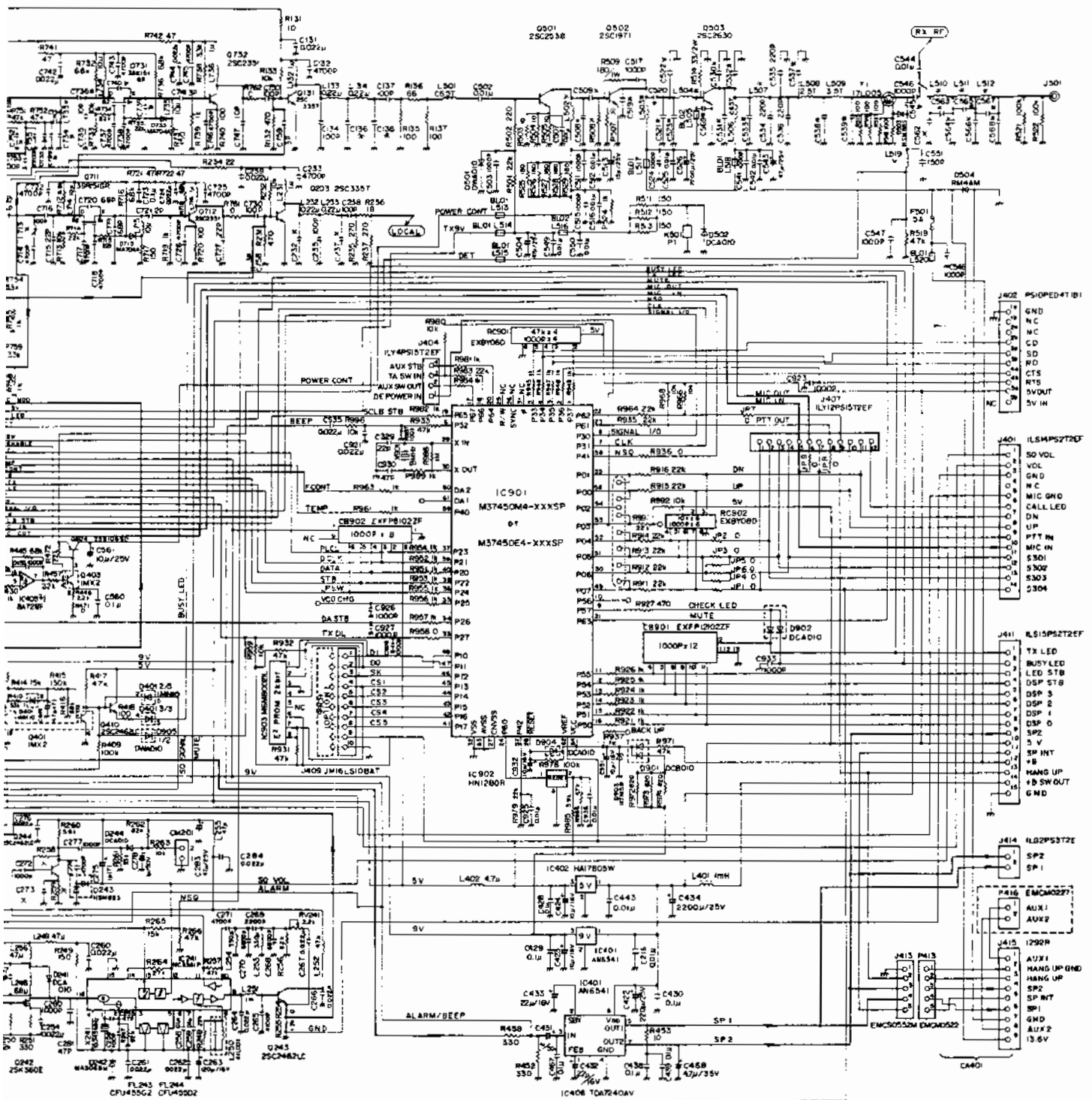
TR-053 SCHE



Ref No.	C136	C138			C201	C202	C203	C204	C205	C206	C207	C208	C209	C213	C214	C215	C216	C217	C218	C219	C220	C221	C232	C237	C212	C225	C226	C227	C273	R258	R259	L509	R507	R509
A Band	220P	100P			270P	750P	680P	100P	33P	100P	680P	820P	270P	270P	750P	750P	270P	680P	270P	750P	750P	270P	56P	39P	68P	100P	100P	220P	0.022	330k	1.5k	3.5T	33	100
B Band	150P	68P			180P	470P	470P	130P	22P	130P	470P	560P	180P	180P	390P	560P	180P	680P	180P	560P	390P	180P	47P	33P	68P	—	—	68P	0.047	330k	15k	3.5T	68	180
C Band	100P	—			150P	270P	390P	100P	15P	100P	390P	470P	120P	180P	270P	470P	130P	560P	130P	470P	220P	180P	33P	22P	0.01μ	—	—	—	0.047	470k	2.2k	3.5T	68	180

Ref No.	C508	C509	C519	C520	C521	C522	C523	C530	C531	C532	C533	C537	C538	C539	C506	C562	C563	C564	C565	C566	C567	C568	C569	L502	L503	L504	L507	L510	L511	L512	C570	R508	C534	L508
A Band	—	470P	33P	390P	82P	82P	—	—	—	100P	—	220P	150P	56P	—	62P	47P	120P	27P	150P	—	91P	—	6.5T	4.5T	5.5T	5.5T	5.5T	5.5T	7.5T	150P	33	100P	3.5T
B Band	150P	100P	22P	220P	150P	150P	220P	—	—	120P	75P	120P	100P	120P	—	39P	56P	100P	15P	120P	7P	68P	220P	6.5T	5.5T	5.5T	0.5T	5.5T	5.5T	5.5T	—	33	220P	2.5T
C Band	150P	82P	—	270P	220P	220P	—	100P	100P	—	150P	220P	220P	56P	—	39P	47P	82P	18P	100P	6P	56P	—	5.5T	3.5T	6.5T	2.5T	4.5T	5.5T	5.5T	—	68	220P	2.5T

Ref No.	C734	C736	C738	C740	C712	C751	C752	C754	C756	C763	C762	C770	C789	C769	C792	L713	L733	C719	C720	C716	C733	C345	L519	R447	C768
A Band	330P	220P	100P	100P	68P	9P	27P	39P	8P	15P	15P	47P	15P	220P	68P	1.5T	10.5T	100P	100P	150P	5P	3P	330μ	1.8k	7P
B Band	330P	220P	120P	120P	56P	7P	18P	33P	7P	10P	6P	33P	15P	220P	47P	25T	9.5T	68P	68P	100P	6P	4P	4.7μ	4.7k	8P
C Band	220P	180P	100P	100P	56P	6P	22P	27P	6P	10P	3P	22P	39P	100P	47P	6.5T	8.5T	68P	68P	100P	6P	4P	4.7μ	4.7k	8P



Ref No.	C134	C138		C201	C202	C203	C204	C205	C206	C207	C208	C209	C213	C214	C215	C216	C217	C218	C219	C220	C221	C232	C237	C242	C225	C226	C227	C273	R258	R259	S09	R507	R509
A Band	220P	100P		270P	750P	680P	100P	33 P	100P	680P	820P	270P	270P	150P	750P	270P	680P	270P	750P	750P	270P	56 P	39 P	68 P	100P	100P	220P	0022	330R	1.5K	3.5T	33	100
B Band	150P	68P		180P	470P	470P	330P	22P	130P	470P	560P	180P	180P	390P	560P	180P	680P	180P	560P	390P	180P	47P	33P	68 P	—	—	68P	0047	330R	1.5K	3.5T	68	150
C Band	100P	—		150P	270P	390P	100P	15 P	100P	390P	470P	120P	180P	270P	470P	150P	560P	150P	470P	220P	180P	33P	22P	100μ	—	—	47P	4704	2.2K	3.5T	68	150

Ref No.	C508	C509	C519	C520	C521	C522	C525	C532	C533	C537	C538	C539	C540	C562	C563	C564	C565	C566	C567	C568	C569	L502	L503	L504	L507	L510	L511	L512	L571	R508	L534	L508
A Band	—	470P	33P	390P	82P	82P	—	—	—	100P	—	220P	150P	56P	—	82P	47P	120P	270P	150P	—	91P	—	3.3T	4.7T	5.6T	3.3T	5.6T	5.6T	7.5T	150P	33	100P	3.3T
B Band	150P	100P	22P	220P	150P	150P	220P	—	—	120P	75P	120P	100P	120P	—	39P	56P	100P	15P	120P	7P	68P	220P	0.65T	3.3T	5.6T	2.2T	3.3T	3.3T	5.6T	—	33	220P	4.7T
C Band	150P	82P	—	270P	220P	220P	—	100P	100P	—	150P	220P	220P	56P	—	39P	47P	82P	18P	100P	6P	56P	—	0.65T	3.3T	5.6T	1.5T	2.2T	2.2T	4.7T	—	68	220P	4.7T

Ref No.	C734	C736	C739	C740	C742	C751	C752	C754	C756	C763	C770	C789	C707	C712	C713	L733	C719	C720	C721	C743	L519	R447	R768
A Band	1300P	2200P	100P	100P	68P	9P	27P	39P	8P	15P	15P	47P	15P	220P	68P	22T	90.2T	180P	150P	3P	330μ	1.0K	T7
B Band	330P	2200P	120P	120P	56P	7P	18P	33P	7P	8P	33P	15P	270P	47P	15T	9.5T	68P	68P	100P	6P	4.7μ	4.7K	8T
C Band	2200P	1800P	100P	100P	56P	6P	22P	27P	6P	10P	3P	22P	39P	100P	47P	6.5T	8.5T	68P	68P	100P	6P	4.7μ	4.7K	8P