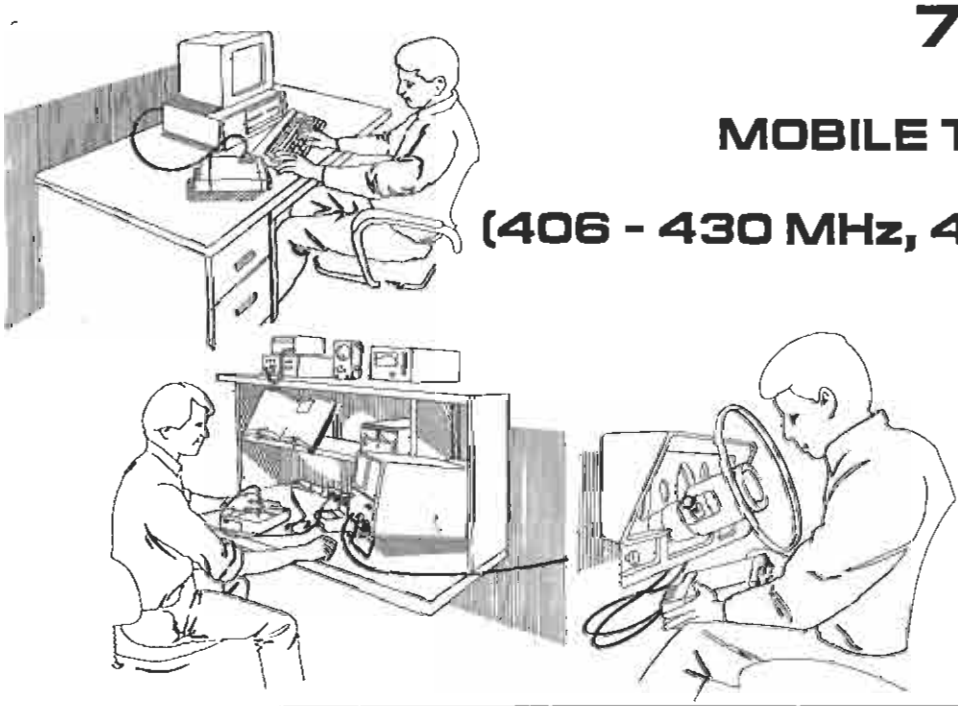
MIDLAND LMR
LAND MOBILE RADIO

SERVICE MANUAL
70-1526A/B

MOBILE TRANSCEIVER
UHF BAND
(406 - 430 MHz, 450 - 470 MHz)
15-25 WATT



MANUAL NO.: 70-152600
09-1526-SM-4/91-2M

This manual section is designed to facilitate the set-up and service of the Midland 70-1526 transceivers. As necessary, service maual 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

NOTES

DESCRIPTION

The 70-1526 Midland 8-Channel Wide Band transceivers are programmable frequency-synthesized two-way FM mobile radios that operate in the UHF frequency range. They are programmable for up to eight channels.

The 70-1526 is designed to operate within either of two frequency ranges: 406—430 MHz (A-Band), or 450—470 MHz (B-Band). Transmit RF power is adjustable for 15—25 Watts.

SPECIFICATIONS

Refer to EIA-152-C, EIA/TIA-204-D, EIA-220-B, and DOC RSS-119 for standard of performance and method of measurement.

GENERAL

OPERATING FREQUENCY RANGE:	
A-Band:	406—430 MHz
B-Band:	450—470 MHz
CHANNEL SEPARATION:	24 MHz
CHANNEL SPACING:	25 kHz
CHANNEL STEPPING:	12.5 kHz/5 kHz optional
CHANNEL CAPACITY:	Programmable for up to eight channels
POWER SUPPLY:	13.6 V DC negative to ground
CURRENT DRAIN:	
Transmit (at 25 W):	10.0 A
Receive (@ rated audio):	2.0 A
Standby (std, varies with options):	400 mA
OPERATING TEMPERATURE:	−30° C + 60° C
DIMENSIONS (H x W x D):	2 x 7 x 8⅞ in (50 x 178 x 225 mm)
WEIGHT:	2.5 kg

TRANSMITTER

RF POWER OUTPUT (adjustable):	15—25 W
FREQUENCY STABILITY:	±0.0005% (−30°C + 60° C)
MODULATION (FOR 100% AT 1000 Hz):	16K0F3E ±5.0 kHz @ 25 kHz
BANDWIDTH:	24/20 MHz without retuning
SPURIOUS AND HARMONICS:	−60 dB
FM HUM AND NOISE:	−50 dB
AUDIO RESPONSE:	per EIA and DOC specifications
AUDIO DISTORTION (±3 kHz deviation):	Less than 3% @ 1 kHz
OUTPUT IMPEDANCE:	50 Ω

RECEIVER

FREQUENCY STABILITY:	±0.0005% (−30° C + 60° C)
SENSITIVITY:	
12 dB SINAD:	0.30 μV
20 dB Quieting:	0.5 μV
SELECTIVITY:	−75 dB @ ±25 kHz
BANDWIDTH:	24/20 MHz without retuning
ACCEPTABLE RADIO FREQUENCY DISPLACEMENT:	±3.0 kHz @ 25 kHz
SPURIOUS REJECTION:	−80 dB
INTERMODULATION:	−75 dB
SQUELCH SENSITIVITY:	0.2 μV maximum
AUDIO OUTPUT:	
Internal Speaker:	2 W @ less than 3% distortion @ 8 Ω
External Speaker:	5 W @ less than 3% distortion @ 3.2 Ω
INPUT IMPEDANCE:	50 Ω

CTCSS/DCS

OPERATING TEMPERATURE RANGE: −30° C — +60° C

CTCSS TONES: All EIA tones from 67.0 Hz to 250.3 Hz, plus 97.4 Hz

DCS CODES: All codes from 000 to 777, normal and invert

ENCODE TONE/DCS MODULATION LEVEL: 500 Hz — 1000 Hz deviation

ENCODER RESPONSE TIME: CTCSS/DCS 50 ms max

ENCODER TONE DISTORTION (67 Hz—250.3): 3% max

TONE/SQUELCH OPENING SINAD: 8 dB max

HUM AND NOISE: 32 dB

DECODER RESPONSE TIME:
CTCSS: 200 ms max (for tones above 100 Hz)
DCS: 324 ms max

— Specifications subject to change without notice —

NOTES

SECTION 2

PREPARATION

NOTES

PRE-INSTALLATION CHECK

The 70-1526 TX/RX Units are capable of operating across a 20/24 MHz frequency spread and do not require optimizing alignment, even when reprogrammed with new customer frequencies. Only general transmitter/receiver performance should be checked. Complete realignment may be necessary after a component that affects transceiver tuning has been replaced. Either the 70-1080A Programmer or 70-1489 PC Programming software (with 70-1308A programming interface) may be used.

SET-UP

1. Remove the PWR/VOL knob. Using a flat blade screwdriver, carefully pry the unit cover outward at the slots marked "RELEASE" near the rear of each side. Lift the cover from the chasis, starting at the back.

2. Connect a resistive, 50-Ω RF load (with a wattmeter) to Antenna Connector J501. Connect 13.6 V DC power to J415. Turn the radio on, turn MON on, and turn selective signaling options off.

CARRIER FREQUENCY

1. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation and, if needed, set carrier frequency to within ±400 Hz of channel frequency using the programmer (either the 70-1080A programmer or 70-1489 software).

2. Initiate transmit on any channel. Measure power of RF output at 50-Ω Antenna Connector J501. Adjust RV402 to obtain 25 W RF output power.

MAXIMUM DEVIATION

1. Select a channel with a transmit frequency of 406 MHz for A-Band, or 450 MHz for B-Band. If CTCSS or DCS is used, be sure this channel is programmed to send the same.

2. 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. Make sure total carrier deviation is below ±5 kHz (including CTCSS/DCS signal). If adjustment is needed, see MODULATOR ALIGNMENT on page 2 - 4.

COMPLETE REALIGNMENT

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

SET-UP

1. Remove the PWR/VOL knob. Using a flat blade screwdriver, carefully pry the unit cover outward at the slots marked "RELEASE" near the rear of each side. Lift the cover from the chasis, starting at the back.

2. Connect a resistive 50-Ω RF load and wattmeter to Antenna Connector J501. Connect 13.6 V DC power to transceiver J415.

3. 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 removed 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 measurement will be half of true values.

4. Turn the radio on, set the VOLUME control to a mid-position.

5. Connect the programmer (the 70-1080A or 70-1308A interface) 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 details.

SYNTHESIZER ALIGNMENT

- **VCO Resonance**

1. Select the Remote-Control mode of the programmer. For A-Band models, enter a test frequencies of 406.00 MHz for both RX and TX. For B-Band models, enter a test frequency of 450.00 MHz.
2. Adjust Channel RX Tank L713 for 1.5 V DC at CM701 pin 2 (VCO steering).
3. Activate transmit mode (using the programmer) and adjust transmitter VCO L733 for 1.5 V DC at CM701 pin 2.

- **Reference Oscillator**

4. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation and, if needed, adjust the carrier frequency and bring the radio to within ±400 Hz of operating frequency.

25 W PA SECTION ALIGNMENT

1. Change the TX test frequency to the desired frequency.
2. Activate transmit mode, then adjust CV501 to obtain maximum RF power at Antenna Connector J501.
3. Set RF output power to 25 W using RV402.

MODULATOR ALIGNMENT

- **Modulation Limiting**

1. Disconnect the hand microphone from its front panel receptacle J301. Apply 3 V_{rms} of 1000 Hz signal to pin 1 of Mic Jack J301, then initiate transmit (if not using a programmer, ground J301 pin 4).
2. Measure total carrier deviation and, if needed adjust modulation limiting to obtain ±5 kHz using RV403.

- **Microphone Gain**

3. No alignment for Microphone gain is required.

- **CTCSS/DCS**

4. Remove the 1 kHz audio signal from external mic jack.
5. Add DCS code +023 to the transmit test mode testing frequency in the programmer.
6. Adjust RV1 for 750 Hz ±10 Hz deviation.
7. Adjust RV401 so that modulation waveform from modulation analyzer matches the correct waveform shown in **Figure 2 - 1**.
8. Change the transmit test code in the programmer to 250.3 Hz CTCSS tone. Carefully adjust RV401 for 750 Hz ±10 Hz deviation.
9. Change the transmit test code in the programmer to 67.0 Hz CTCSS tone. Carefully adjust RV1 for 750 Hz ±10 Hz deviation.

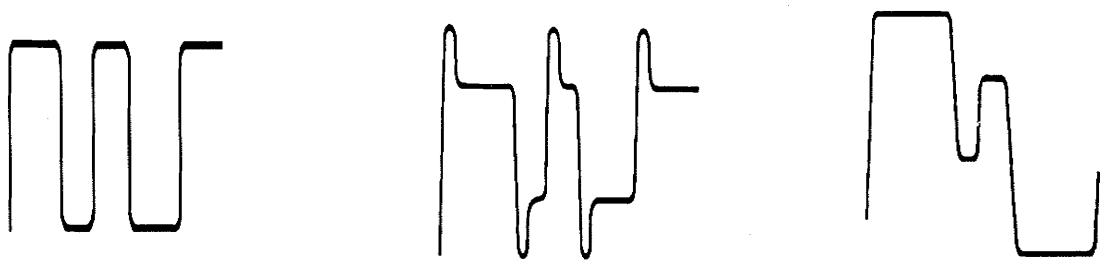


Figure 2 - 1 — Modulation Waveforms

RECEIVER

1. Change the RX test frequency to 418 MHz for A-Band radios, or 460 MHz for B-Band.

• First Injection

2. No adjustment for the first injection is needed.

• Preselector Alignment

3. No adjustment for the preselector (L201, L202, L203, L204, L205, L206 and L207) 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 I.F.

5. Apply enough modulated (by 1 kHz tone at ±3 kHz deviation) on-channel carrier to maintain 12 to 15 dB SINAD. Adjust L245—L247 for best SINAD.

• Squelch

6. Set the left side Squelch switch on. Set Squelch Range RV241 fully clockwise.

7. Apply 0.2 μV of unmodulated on-channel RF signal to the 50 Ω antenna connector. Adjust Squelch range RV241 counter-clockwise just until squelch opens (audio on).

Table 2 - 1 — Required Test Equipment

TEST INSTRUMENT	INSTRUMENT CAPABILITIES	USE
Regulated DC Power Supply	13.6 V DC, 10 A adjustable voltage	Radio power source
RF Wattmeter for 70-1526	50 W, 406—470 MHz 50-Ω circuit	Transmitter power measurements
RF Load Resistor	50-Ω; 50 W	Antenna dummy load
Frequency Modulation Meter	406—470 MHz; peak - responding, ±5 kHz range	Modulation level measurements
Frequency Meter or Frequency Counter	406—470 MHz 1.0 ppm accuracy	Carrier frequency measurements
Audio Generator	1000 kHz sine-wave; 0—4 V_{rms} output	Modulation level measurements
RF Signal Generator	406—470 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 10 V_{rms}	Audio level adjustments
Oscilloscope	DC to 500 kHz bandwidth	
Digital Multimeter	0.1 to 20 V DC	Test point measurements and power supply set-up
70-1080A Programmer, or 70-1489 PC Programming software and 70-1308A PC Programming interface		Manual radio control

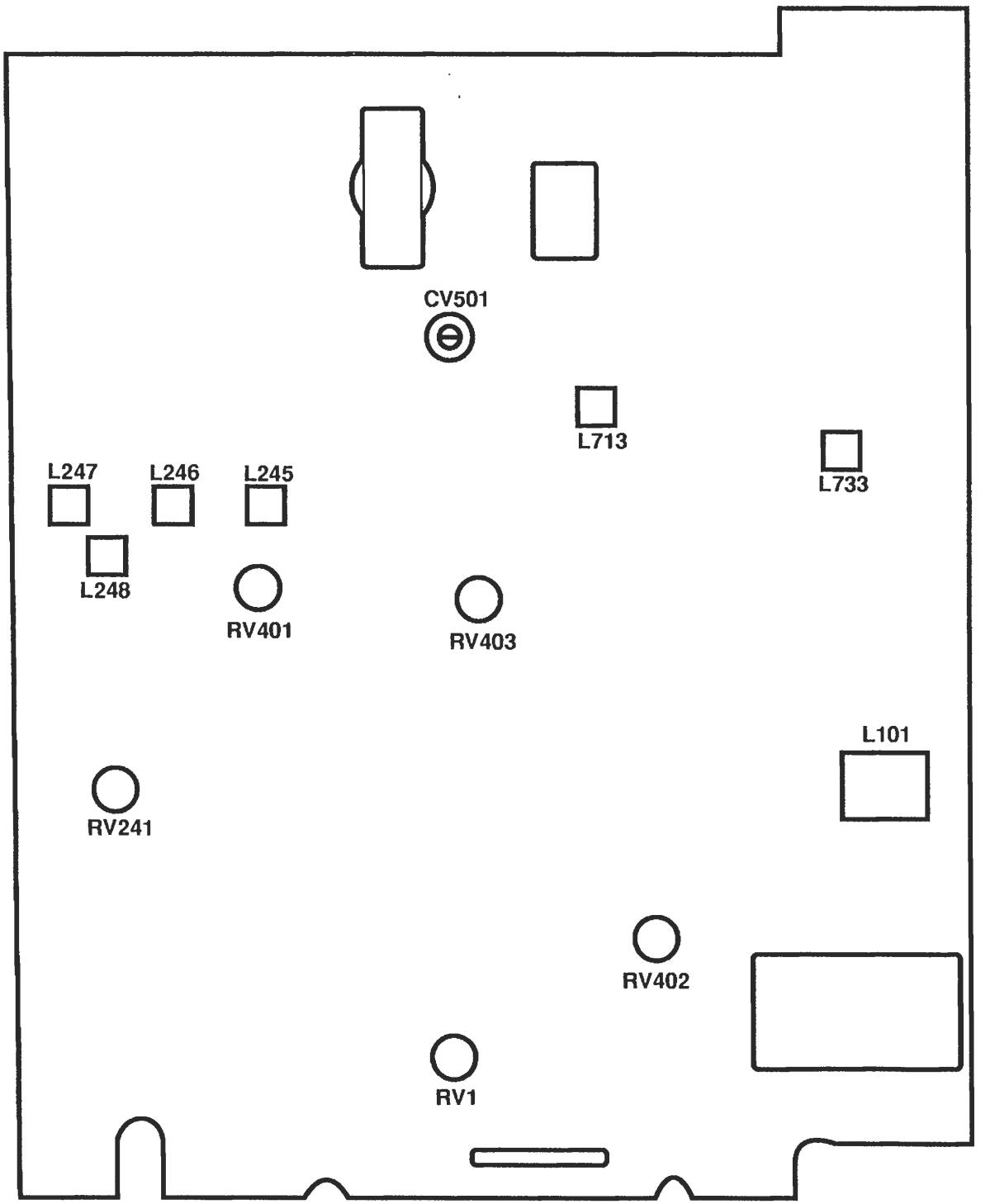


Figure 2 - 2 — Adjustment Map

SECTION 3

INSTALLATION

NOTES

INSTALLATION

MOUNTING

The 70-1526 mounting bracket bolts onto the transceiver sides. It provides a 2.25" x 7.00" flat surface across the transceiver top, with holes for bolting to an even surface in the vehicle. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided.

POWER

- **Connections**

The 70-1311 Power/Accessory Cable is equipped with two unterminated 14 gauge wires two meters in length for connection to the vehicle electrical system.

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. Because of current requirements, connection to an existing fused circuit should be avoided to prevent overload of that fuse. This wire has its own in-line fuse for protection against wire penetration and transceiver defect. 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-feature 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**

The 70-1526 transceiver is 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.

The transceiver is shipped with a 2 m Power/Accessory cable. Each cable includes fused power leads for connection to the 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

A 10-pin male Molex connector and a fused, 2 m power cable assembly (70-1311), mates to the power/accessory connector (J415) on the rear of the 70-1526. 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.

EXTERNAL SPEAKER

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

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

HANG-UP BOX (Optional)

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

AUXILIARY DEVICES

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

ACCESSORY PINS	
16 AWG	70-150308 (MOLEX 39-00-0078)
18-24 AWG	70-150309 (MOLEX 39-00-0039)

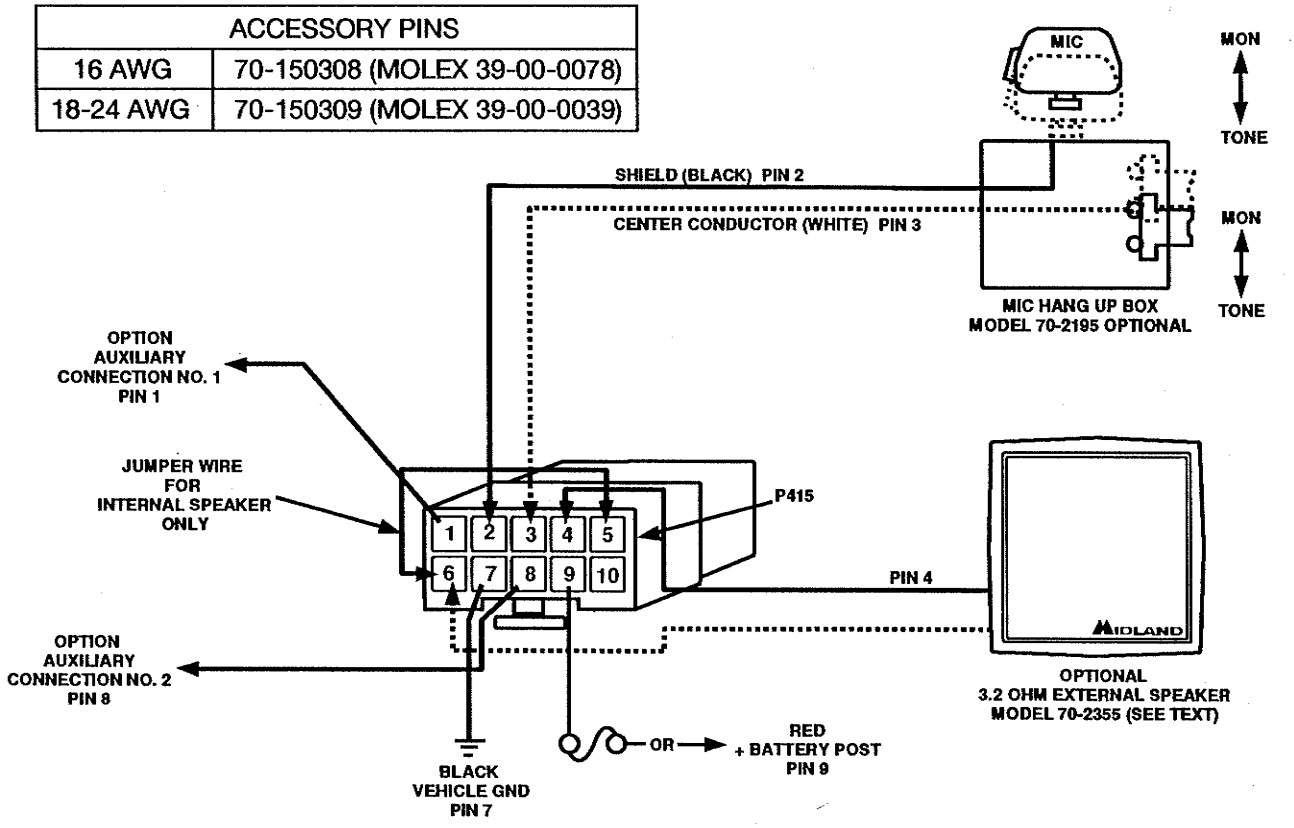


Figure 3 - 1 — Power and Accessory Plugs

SECTION 4

SERVICING

NOTES

COMPONENT REPLACEMENT

STATIC POTENTIALS

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

REPLACING CHIP CAPACITORS AND RESISTORS

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

- **ITEMS REQUIRED:**
    - Grounded temperature-controlled soldering iron with a 1/32 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 - 1**. Remove the component with tweezers or longnose pliers. Discard the component.

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

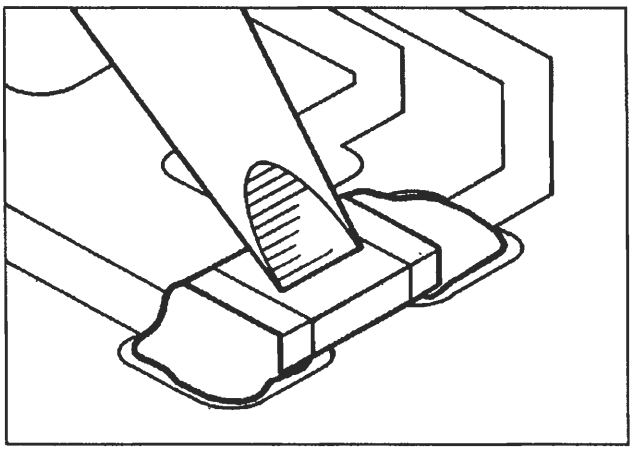


Figure 4 - 1

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

3. Apply only enough fresh solder to coat the clean PC pad as shown in **Figure 4 - 2.**

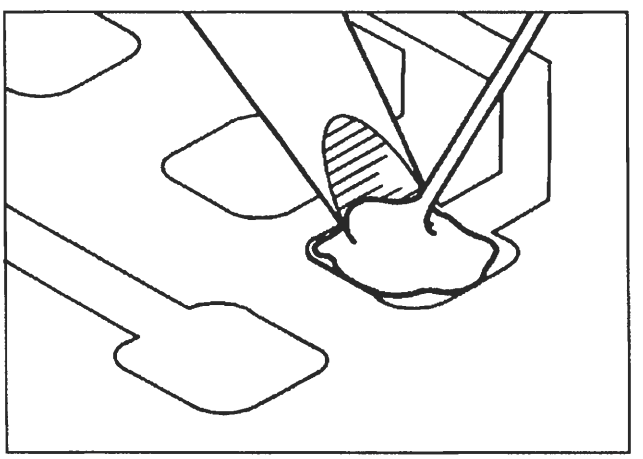


Figure 4 - 2

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

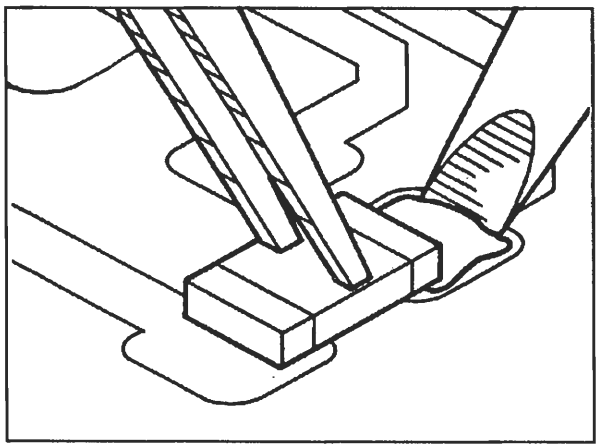


Figure 4 - 3

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

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

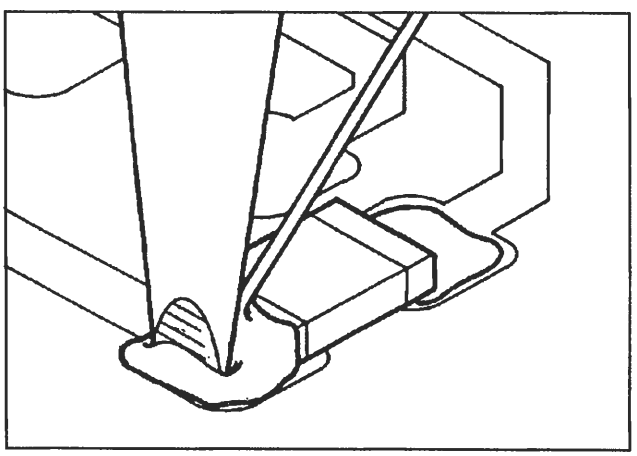


Figure 4 - 4

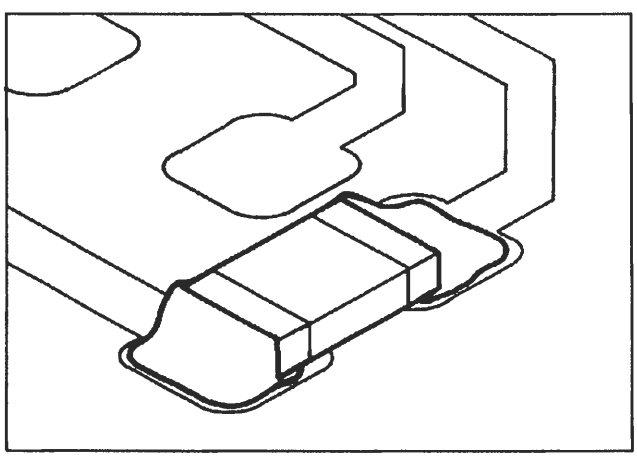


Figure 4 - 5

REPLACING COMPONENTS WITH FEED-THROUGH LEADS

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

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

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

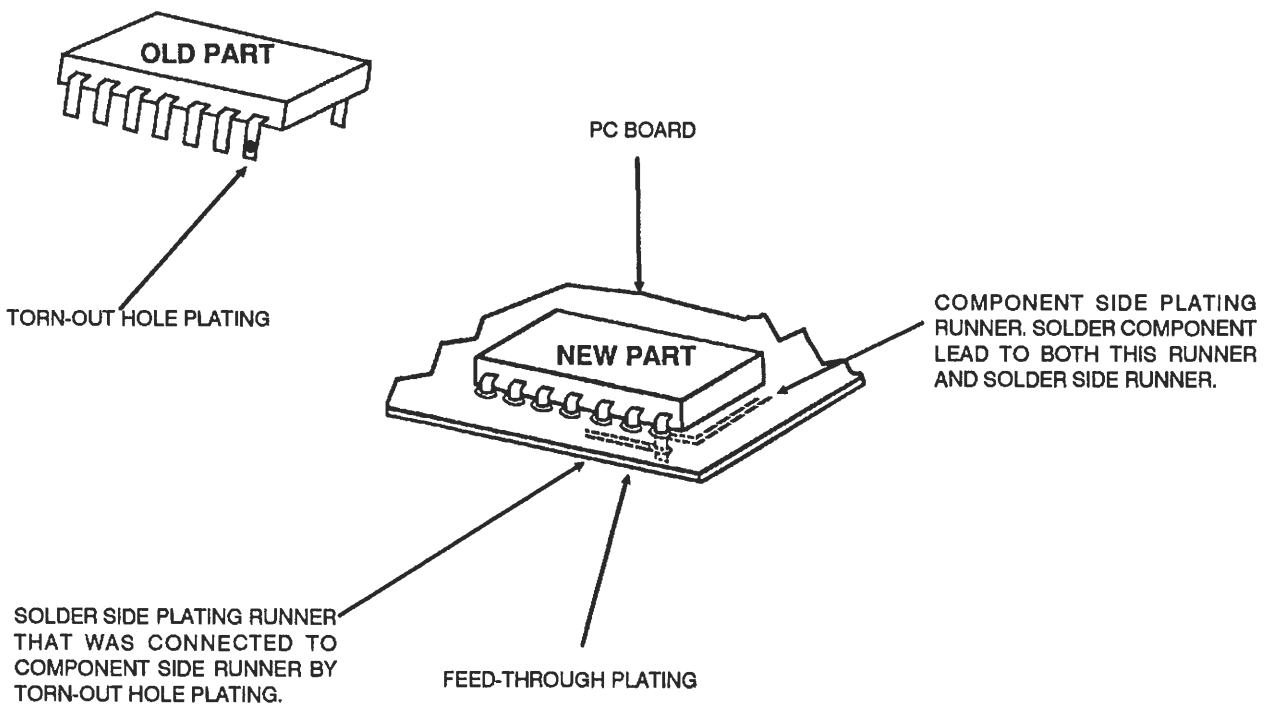


Figure 4 - 6

ELIMINATING RADIO INTERFERENCE

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

Interference may be conducted into the transceiver directly, or induced into it, or both. Conducted interference passes through the DC power leads or the accessory wiring of the radio. Radiated interference, which can originate from anywhere in the vehicle, simply produces noise voltages on conductors inside the radio or its antenna. See **Figure 4 - 7.**

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

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

IDENTIFYING THE INTERFERENCE

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

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

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

ELIMINATING CONDUCTED NOISE

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

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

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

Ground current of a fan motor finds its way to the vehicle battery through segments of metal body A-frame assemblies (see **Figure 4 - 8**). If the electrical bond between two parts is weak, and the radio ground current must also travel through this weak joint, a voltage drop induced across the joint by the fan current will appear at the radio power plug.

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

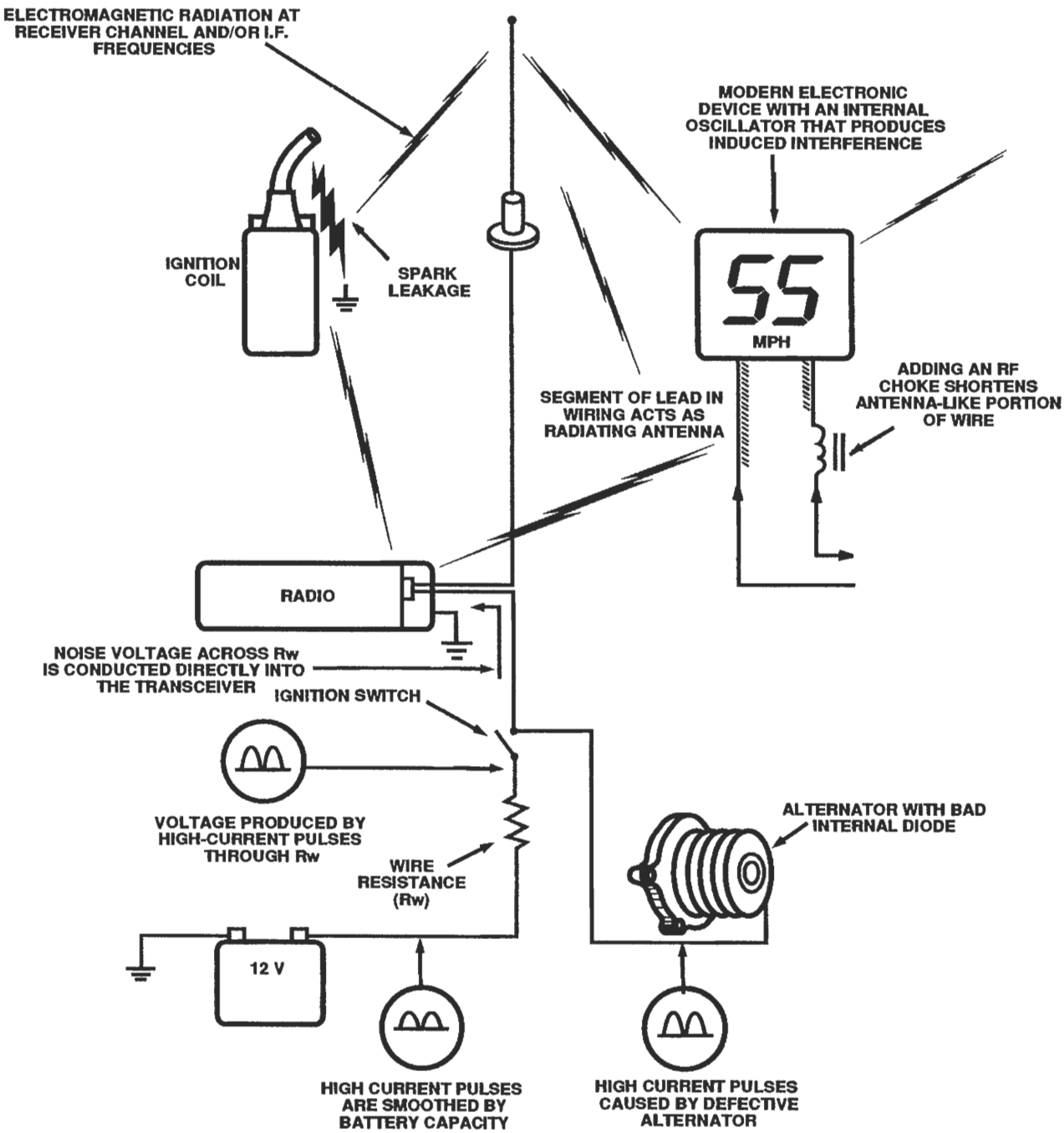


Figure 4 - 7 — Interference Paths

ELIMINATING RADIATED INTERFERENCE

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

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

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

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

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

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

ELIMINATING INTERFERENCE FROM SPARKS

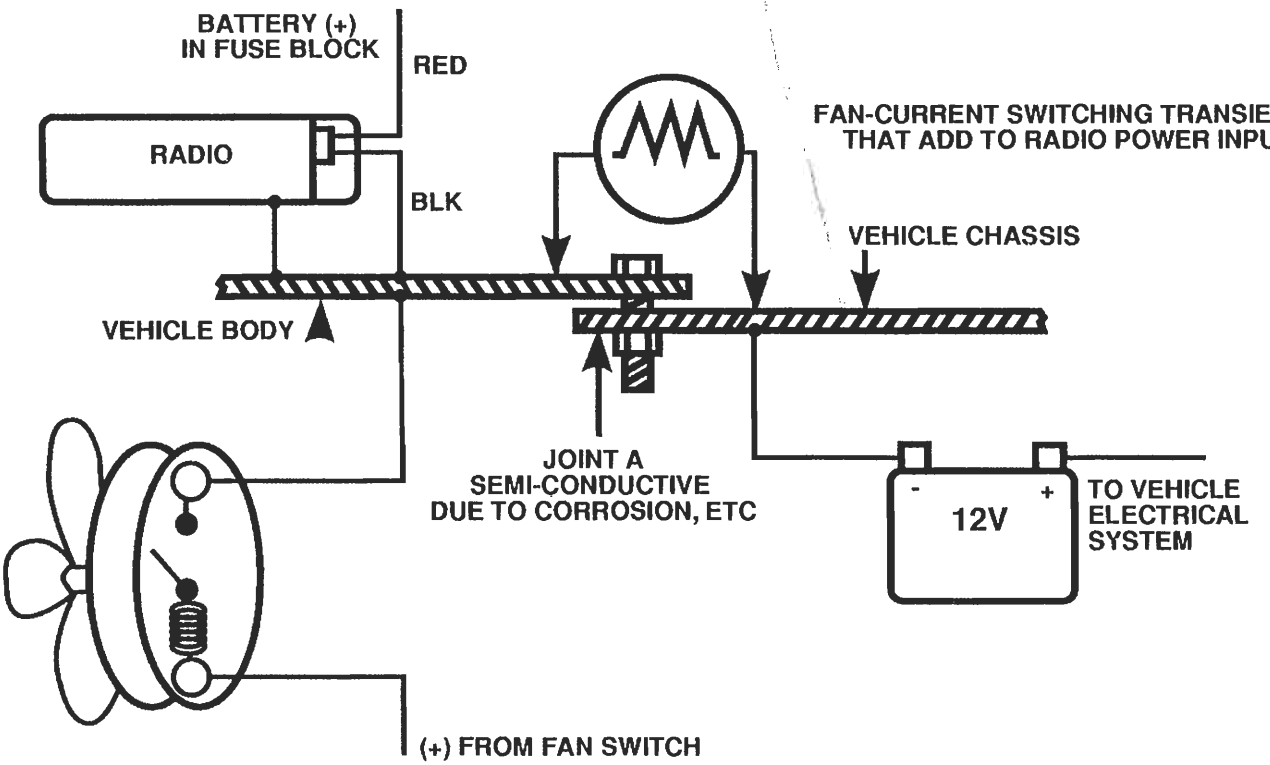
Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna. Therefore, the problem must be resolved at the source.

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

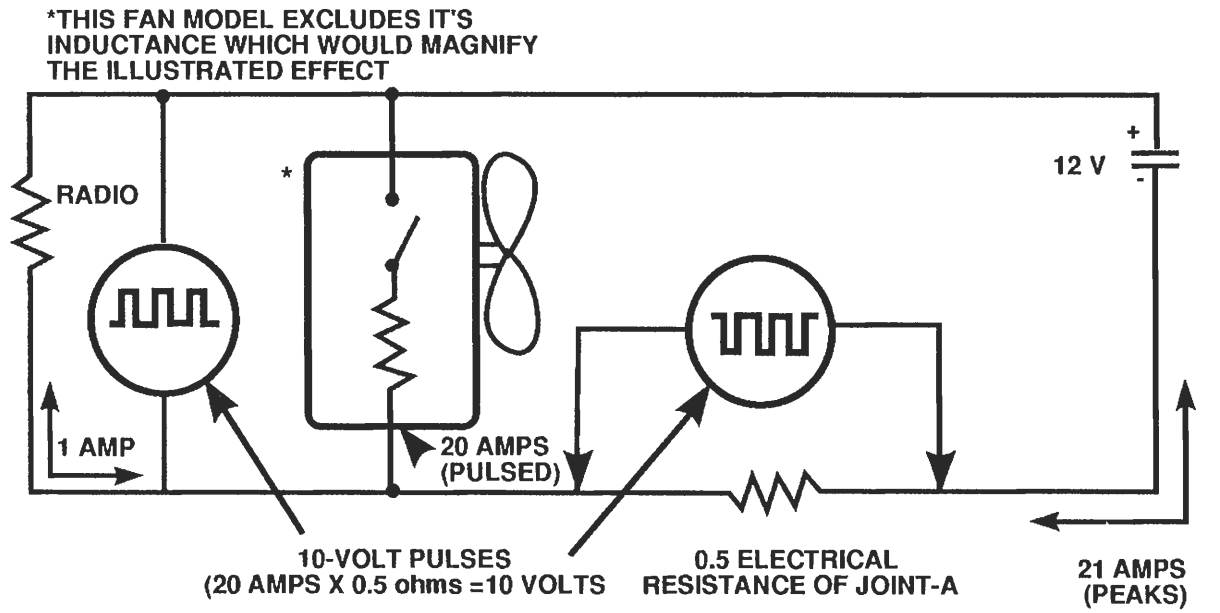
If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

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

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



GROUND PATH



EQUIVALENT CIRCUIT

Figure 4 - 8 — 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
Q131	TX	0.9	8.6	0.7
Q201	RX	0.9	8.6	0.2
Q203	RX	0.8	7.6	0.6
Q243	RX	3.1	9.1	2.2
Q244	RX	2.4	4.3	1.7
Q301	RX/TX	—	—	0.0
Q406	RX	3.7	5.0	3.1
Q410	RX BUSY RX STANDBY	4.9 0.0	5.0 5.0	4.2 0.0
Q411	RX/TX	13.5	13.6	13.4
Q501	TX	0.6	5.4	0.0
Q502	TX	0.0	12.6	0.0
Q503	TX	—	12.6	0.0
Q504	TX	12.5	5.4	13.6
Q701	RX/TX	9.0	9.1	8.2
Q704	RX	8.8	0.0	8.8
	TX	8.1	8.4	8.8
Q705	RX TX	4.7 0.0	0.0 7.9	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	8.0	1.3
Q734	TX	1.8	8.2	1.3
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
Q778	RX/TX	4.6	0.0	0.0
Q901	RX/TX	5.5	8.4	4.8

Table 4 - 2 — Transistor Packs

NAME	MODE	PIN NO. 1	2	3	4	5	6
Q302	RX	—	—	0.0	—	—	0.0
Q401	RX BUSY	4.8	0.0	0.0	0.7	0.0	0.0
	RX STANDBY	0.0	0.7	7.6	0.0	0.0	0.0
	TX	0.7	—	—	—	0.0	0.0
Q403	RX	—	—	12.7	0.0	0.0	—
	TX	—	—	11.6	2.0	1.4	—
Q702	RX	7.1	7.2	7.8	0.0	0.0	7.8
	TX	0.0	0.7	8.0	7.8	7.2	8.0
Q703	RX	0.0	0.0	0.0	8.6	4.6	0.0
	TX	2.9	2.9	0.0	0.0	0.2	0.0
Q771	RX/TX	3.8	4.4	4.7	0.0	0.0	0.0
Q778	RX	0.0	2.2	0.0	0.0	0.0	0.0
	TX	2.0	2.2	0.0	0.0	0.0	0.0

Table 4 - 3 — FET's

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

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

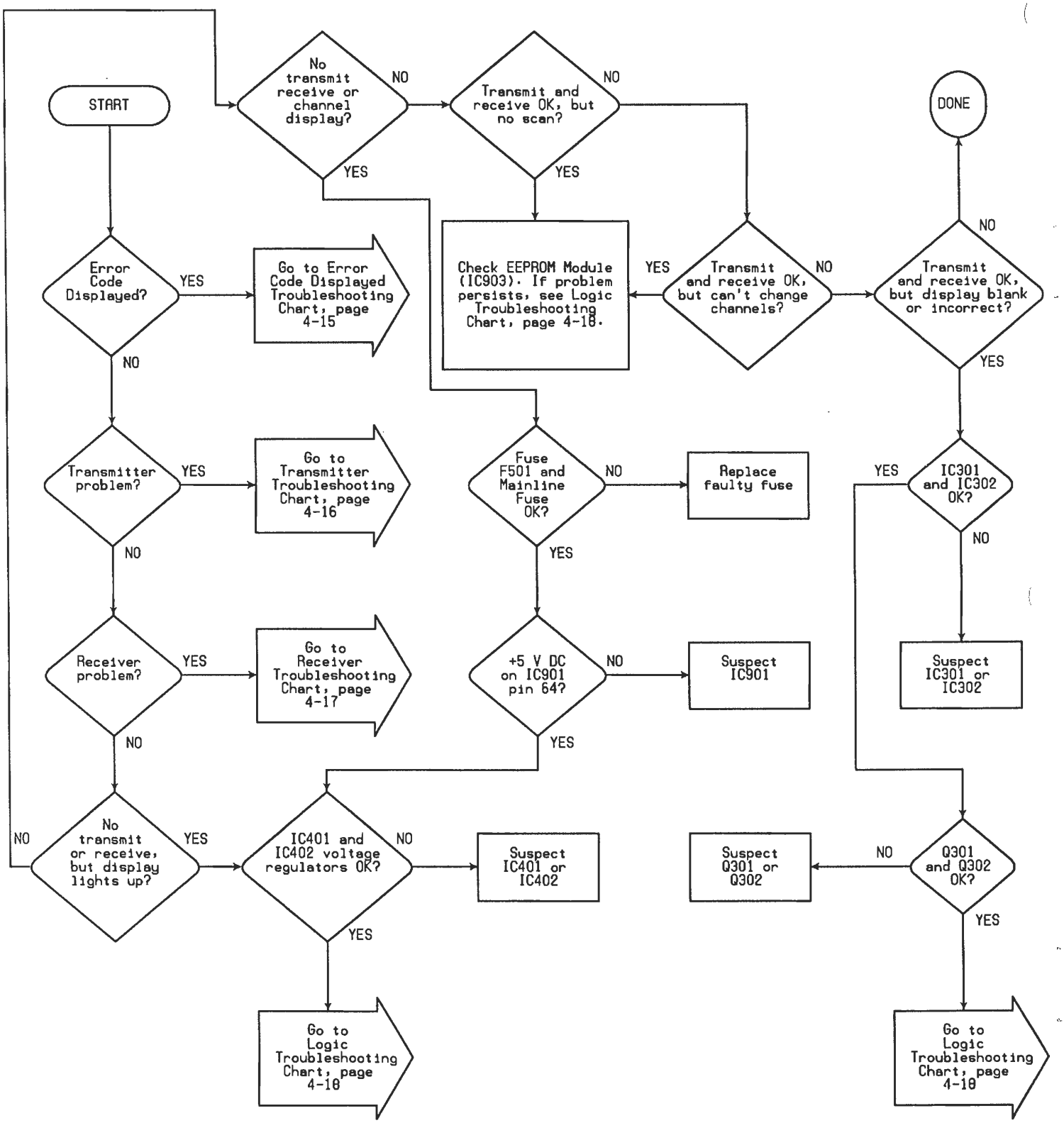
NAME	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC401	RX/TX	13.5	0.0	9.1	—	—	—	—	—
IC402	RX/TX	13.5	0.0	5.0	—	—	—	—	—
IC405	RX/TX	0.9	2.8	2.8	0.0	4.1	4.1	3.3	9.0
IC406	RX	6.5	6.5	6.4	0.0	6.0	13.5	6.5	—
IC407	RX/TX	—	—	—	0.0	4.4	4.4	4.4	9.0
IC902	RX/TX	4.9	4.9	0.0	—	—	—	—	—
IC903	RX/TX	0.0	0.0	0.0	8.2	—	1.2	9.1	3.6

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

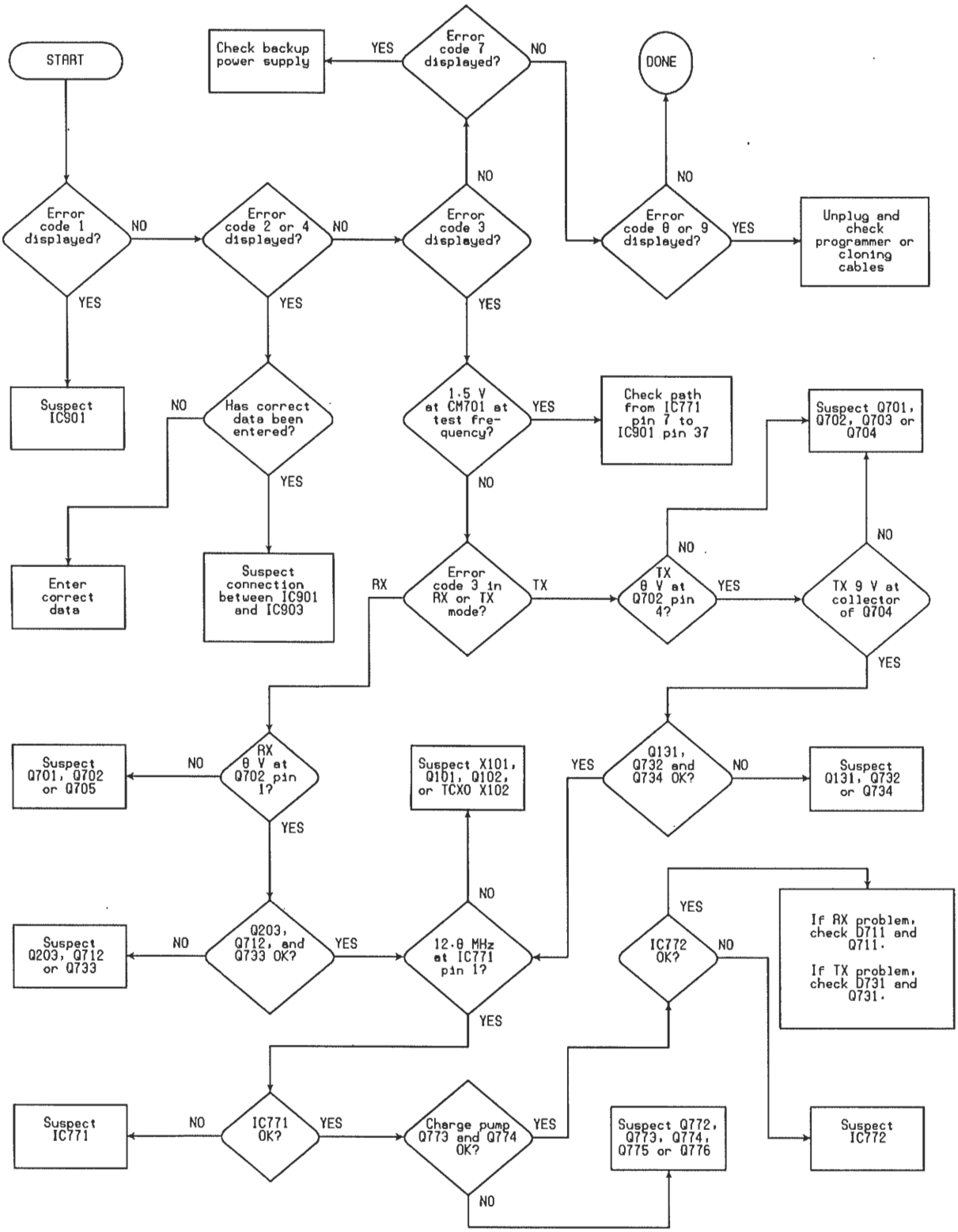
NAME	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC1	RX/TX	—	—	—	2.3	2.3	2.3	2.3	2.2
IC2	TX	—	—	—	—	5.0	0.0	0.0	2.3
	RX	—	—	—	—	0.0	5.0	0.0	2.3
IC50	RX/TX	1.7	1.7	1.7	5.0	1.7	1.7	1.7	1.7
IC241	SQ OPEN	6.7	6.6	6.6	6.8	6.4	6.4	6.4	6.8
	SQ CLOSED	6.7	6.0	6.6	6.8	6.4	6.4	6.4	6.8
IC301	RX/TX	—	—	—	—	—	—	—	0.0
IC302	RX/TX	—	—	—	—	—	—	—	0.0
IC411	RX/TX	4.4	4.4	4.4	5.0	4.4	4.4	4.4	4.4
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	—	—
IC411	RX/TX	4.4	4.4	0.0	4.4	4.4	4.4	—	—
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	—	—

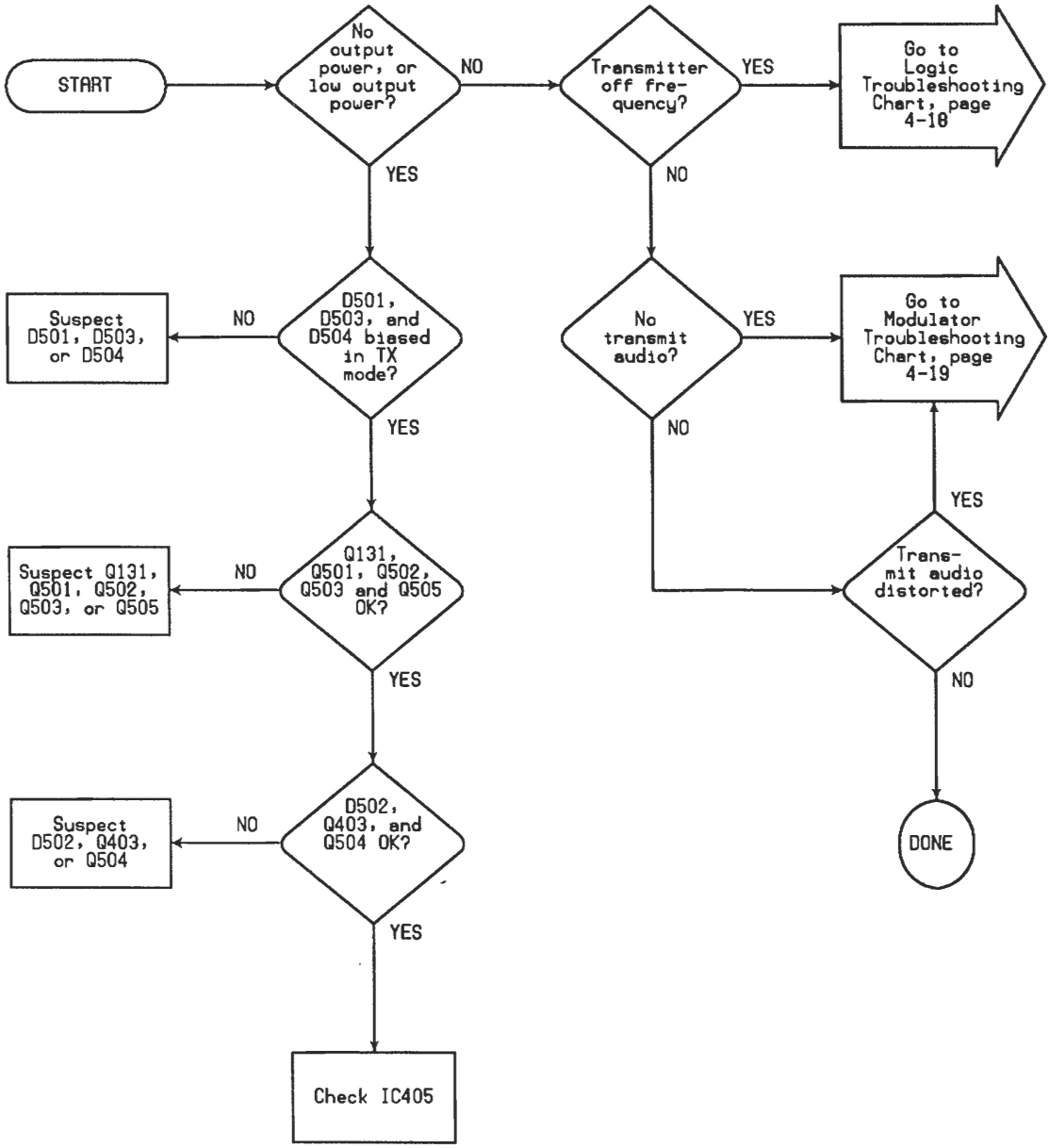
TROUBLESHOOTING CHARTS



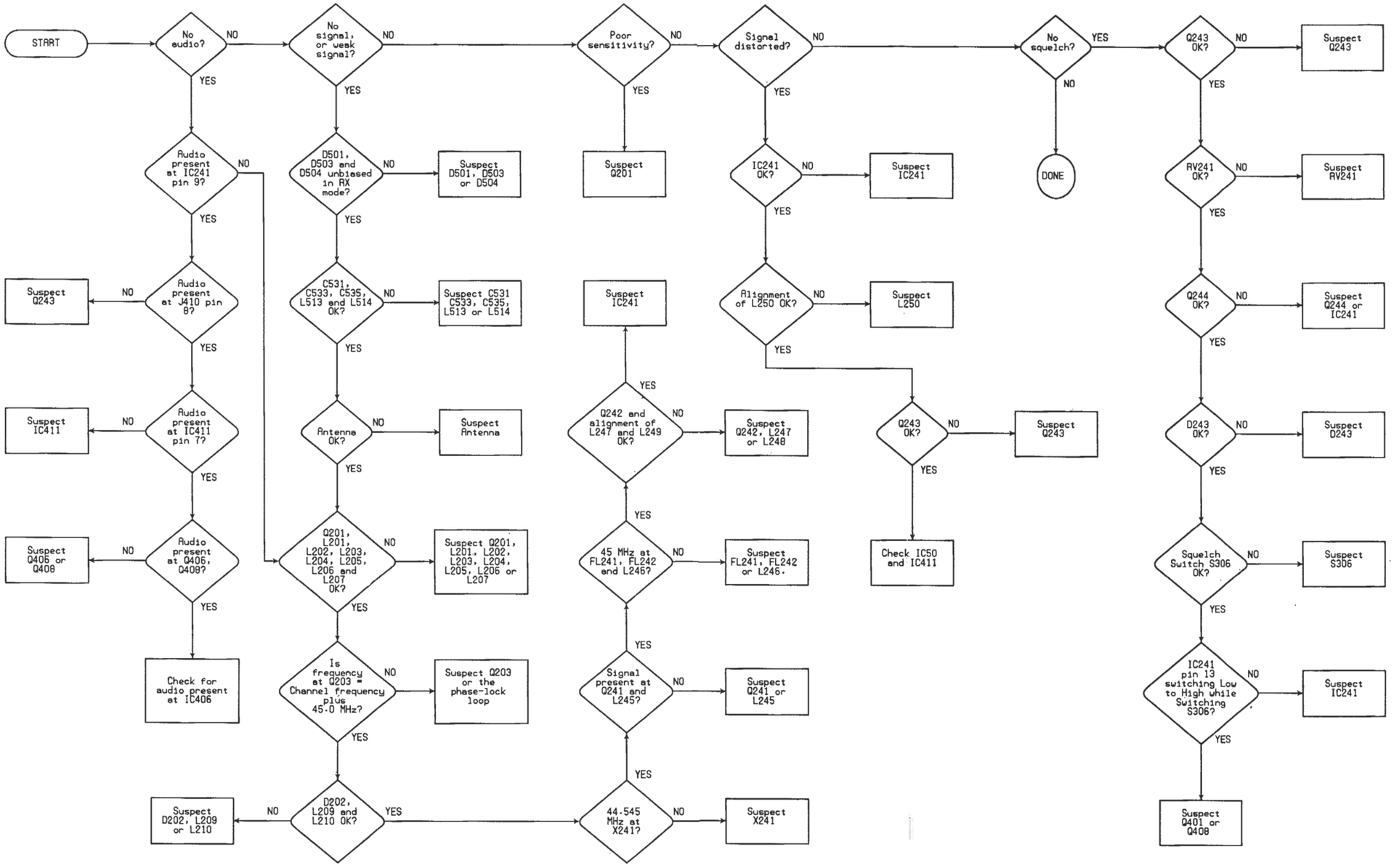
Troubleshooting Chart 4 - 1 — Getting Started



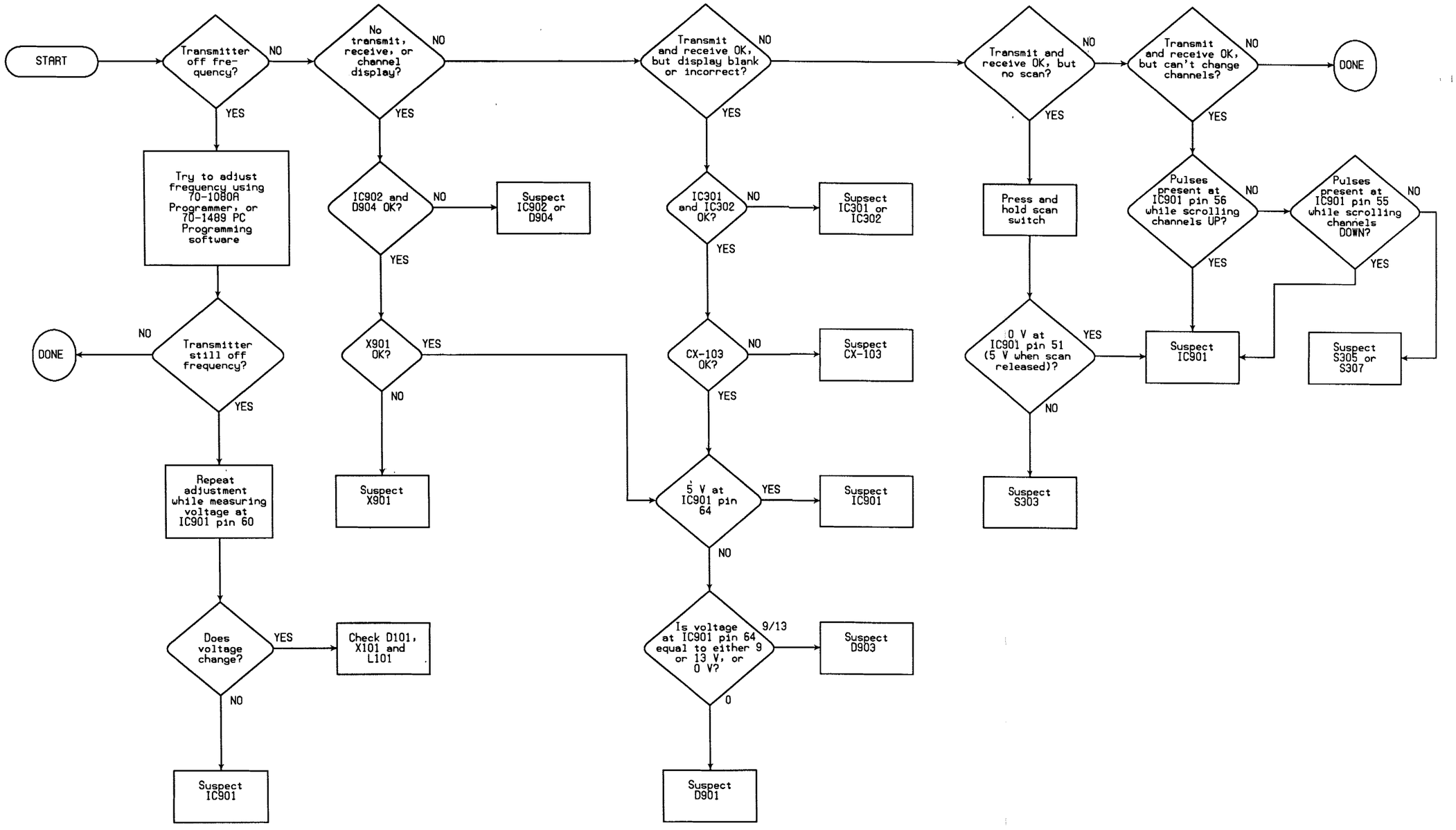
Trobuleshooting Chart 4 - 2 — Error Code Displayed



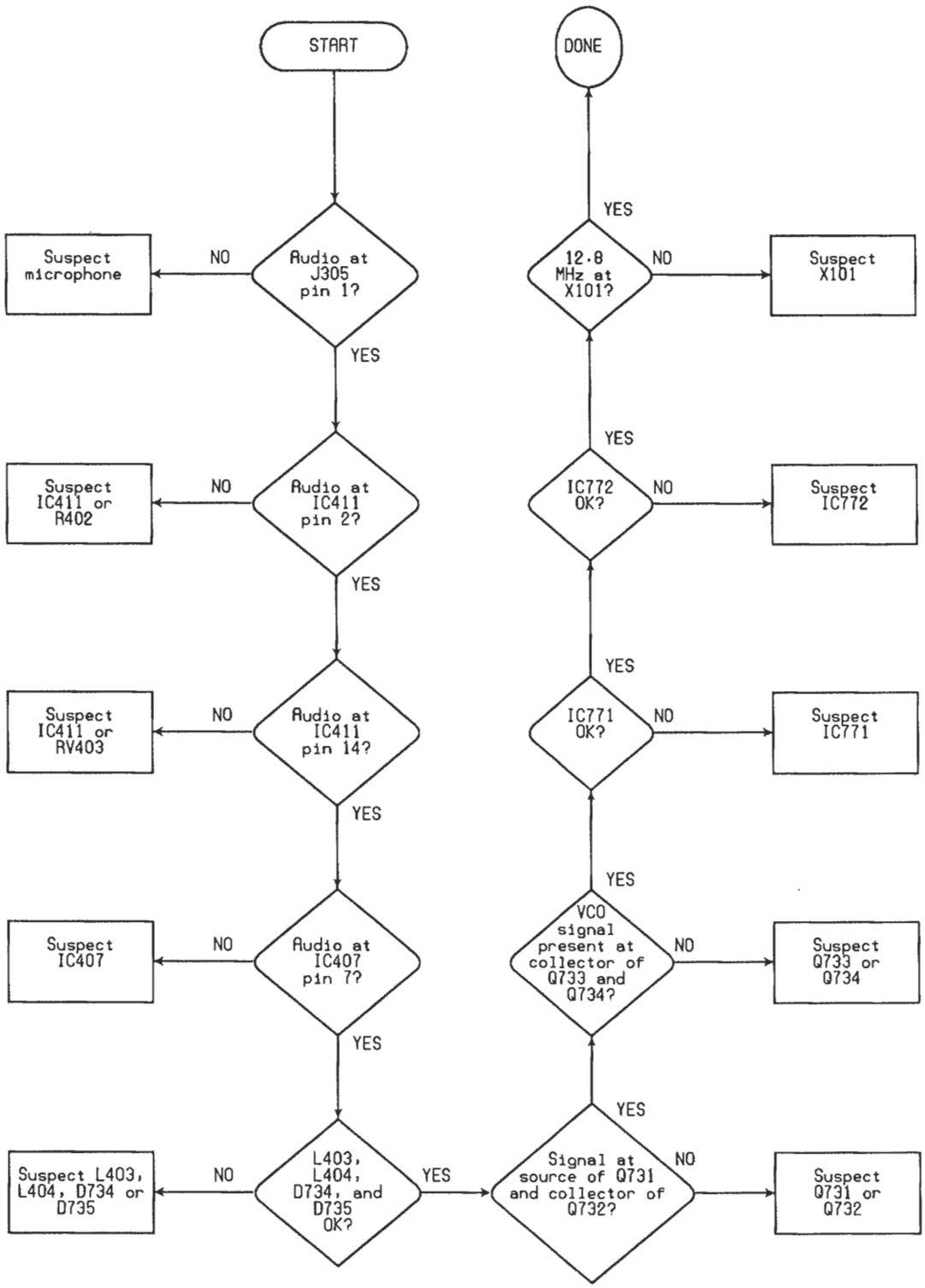
Troubleshooting Chart 4 - 3 — Transmitter Problem



Troubleshooting Chart 4 - 4 — Receiver Problem



Troubleshooting Chart 4 - 5 — Logic Problem



Troubleshooting Chart 4 - 6 — Modulator Problem

NOTES

SECTION 5

CIRCUIT DESCRIPTIONS

NOTES

The 70-1526 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 Oscillators

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. Output of the buffers are amplified by Q131 and Q203 respectively. RF signal at receiver injection frequency (F_C – 45.0 MHz) is applied from the LO amplifier Q203 in the receiver circuit. RF signal from Q131 is amplified further by the PA portion.

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

A single VCO tank can tune across the entire 24/20 MHz channel spread. Only one of the two tanks is switched in at a time and they are selected by TXDL from the Logic portion. The microcomputer sets TXDL to logic low during transmit mode.

Resonance of each VCO tank is voltage-tuned by varactor diodes D711 and D731 respectively. Loop steering voltage applies reverse bias to all these varactor diodes simultaneously. As steering voltage increases, varactor diode capacitance decreases, so that net capacitance in each tank decreases, This increases resonant frequency of the tanks.

• Loop Dividers

The amplitude of the VCO signal from the collector of Q733 (for TX) and the collector of Q713 (for RX) is amplified by Q751 to feed prescaling frequency divider IC771, which applies an output pulse once every 64 or 65 input cycles. Additional frequency division is also performed within IC771 to produce 12.5 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 12.5 kHz, which is compared to the down-counted 12.5 kHz sample of VCO output. Normally the loop response is slowed enough by the active filter to block 12.5 kHz reference noise and prevent loop correction of voice modulation during transmit. Higher active filter rolloff frequency is selected by the microcomputer system in the Logic Section 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 12.5 kHz reference and low going pulses appear here, which produce a logic low at pin 7. This logic low is applied to Q778 and Q771 to switch to 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 audio filter IC411, where frequency response is pre-emphasized and splatter filtered. Gain is such that stronger signals bring IC411 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 RV403 so that modulation at limiting at IC407 will produce transmitted carrier deviation of ±5 kHz. Output of processed voice signals at IC411 pin 14 is fed to the gain control IC407.

RECEIVER

• Preselector

Through PIN-diode gates in the PA, RF signals are routed to the receiver input. Signals at image frequencies and frequencies far removed from the desired channel are rejected by a preselector comprised of six top-coupled, parallel tanks: L201, L202, L203, L204, L205, L206, and L207. No tuning of these tanks is required for the entire 20/24 MHz channel frequency spread. Q201 provides adequate gain to overcome preselector signal losses and maximize receiver sensitivity.

• Injection

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

• First Mixer

To maximize intermodulation immunity, a balanced configuration is used for the first mixer stage. High injection is applied to L210-primary and preselector output is applied to its secondary center tap. A 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 L209 is designed to operate at the 45 MHz first IF frequency.

• First IF

Mixer output is applied to Q241, which drives L245. L245 tunes to match the input impedance of 45 MHz monolithic crystal filter FL241. L246 matches the output of FL241 to the input of FL242. FL241 and FL242 reject signals outside the channel bandwidth. L247 matches the output of FL242 to the input of Q242. Q242 amplifies the first IF signal at least 20 dB, and applies it to second IF IC241

IC241 contains all second IF circuitry, a quadrature demodulator, and a threshold gate. X241 and circuitry in IC241 generate second LO injection of 44.545 MHz. A double-balanced mixer, that cancels both input signals is used so that additional tuned circuits at its output are not needed. Mixer output signal of 455 kHz (IC241 pin 3) is bandpass filtered further by FL243 and FL244 then super-amplified (100+ dB) by the second IF amplifier/limiter within IC241 (pin 5).

• Demodulation

The quadrature detector in IC241 is another double-balanced mixer to which limiter output is applied. Its second input is taken from 455 kHz tank L250, which is also fed with limiter output (IC241 pin 7). Frequency deviation from carrier center will cause phase difference between the two demodulator input, which produces output. Preamplified recovered audio appears at demodulator output, pin 9. C264, C265, and L251 attenuate signals above 100 kHz.

• Audio

Recovered audio from Q243 is applied to the active filter IC411, and applied to volume control RV301. Output of the RV301 is applied to the squelch gate Q406/Q408, then to audio amp IC406. Power Amplifier IC406 amplifies the audio signal and drives the speaker.

• Squelch

Audio signals at lowpass filter L251 are routed through Squelch Range RV241, which calibrates squelch-break level when the side panel squelch switch is on. Signals at RV241 top feed a two-tank 60 kHz filter. The resulting 60 kHz signal is amplified by IC241 and Q244, then rectified by D243 to produce a DC voltage that varies inversely with received RF-carrier level. When the squelch switch is in the off position, it sinks all current from D243 so that squelch is open. When the squelch switch is in the on position, RV241 and a temperature-compensated circuit made up of R271, R272, and R273 limits the current from D243 to set a squelch threshold of 0.2μV. 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 pin 58, so that the microcomputer can take appropriate action.

25-WATT PA SECTION

RF POWER AMPLIFIER

A PC-board stripline is used to match the base of Q501 to the coax. RF impedance at the collector of Q501 is transformed by PC-board stripline to the base terminal of driver Q502 and the collector of Q502 is transformed to the base of Q503. RF impedance at the collector of final-stage Q502 is again transformed by PC stripline and fine-tuned by CV501 match circuit impedance at RF-gate D501. L510—L512 and C527—C530 comprise the harmonic filter. R517 and R518 serve to drain static and other DC potentials from the antenna.

ANTENNA GATE

In receive mode, PIN diodes D501, D503 and D504 are unbiased. The RF signal path from the final amplifier Q503 is severed, and the impedance matching network consisting of L513, L514, C531, and C533 routes signals from the antenna to the receiver input through 50 Ω coax at J501.

D501, D503 and D504 are biased on in transmit mode. The receiver port network (L513 etc.) is detuned so that it appears as a high impedance to the antenna, and D501 couples final amplifier output to the antenna at J501.

AUTOMATIC POWER CONTROL

A PC stripline ahead of the harmonic filter, and a thin PC runner adjacent to it, serves as a directional coupler. D502 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 applied to the inverting input of the comparator IC405 pin 6. The reference voltage applied to the comparator IC405 pin 5 is fed from RV402.

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 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 RV402.

5

LOGIC SECTION

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**

Pressing S305 (UP) or S307 (DN) applies a 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 via Q301. Once latched, the appropriate channel is diplayed on the channel display, D302.

Pressing S301 (MON) applies a logic low to pin 50 of IC901. IC901 responds by putting CTCSS/DCS decode 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, D304.

Pressing optional switch S303 (PSCAN) applies a logic low to pin 51 of IC901. IC901 places the radio in the scan 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, D305.

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. In receive mode, the receive audio signal is high-pass filtered at IC50 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. 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 thorugh 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.

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.

Table 5-1—IC901 PINOUTS

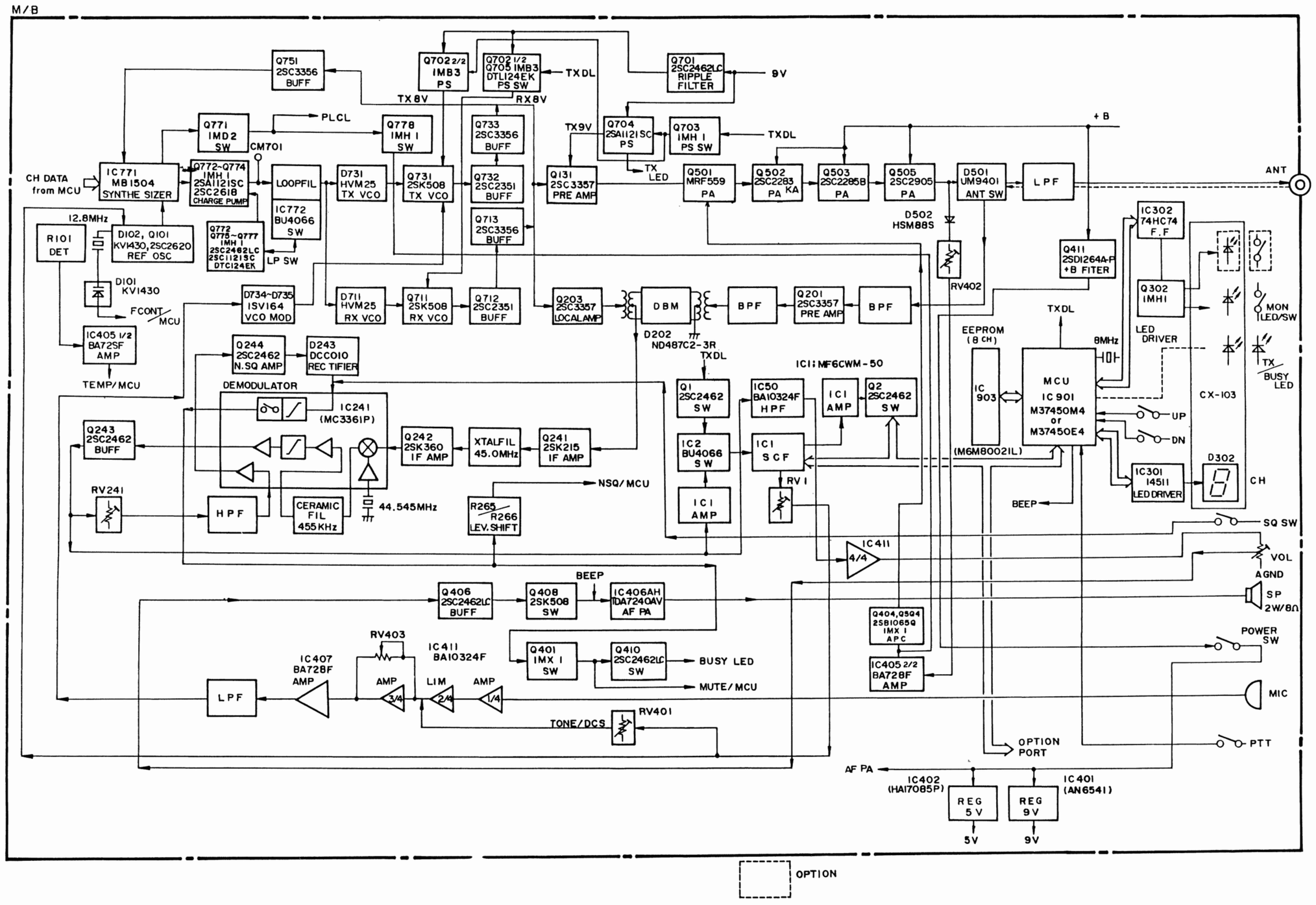
Pin No.	Pin Name	I/O Flow	Function Label	Logic & Function
1	P37	I	PC RTS	Programmer Interface
2	P36	O	PC CTS	Programmer Interface
3	P35	O	PC RD	Programmer Interface
4	P34	I	PC SD	Programmer Interface
5	P33	I	PC CD	Programmer Interface
6	P32	O	BEEP	Beep Tone Output
7	P31	O	CLK	Clock Output for CTCSS/CDCSS
8	P30	I/O	SIGNAL 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	$\overline{RESET}$	I	----	Low = MICROCOMPUTER RESET
29	X_{IN}	I	----	Crystal Oscillator, 8 MHZ
30	X_{OUT}	O	----	Crystal Oscillator, 8 MHz
31	0	O	----	not used
32	V_{SS}	I	----	GND
33	P27	O	TXDL	Low = TX ACTIVATE
34	P26	O	DA STB	Serial Data Strobe for D/A Converter
35	P25	O	VCOCHG	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	DATA	Serial Data Output
41	P17	I/O	----	not used
42	P16	I/O	----	not used
43	P15	I/O	----	not used
44	P14	I/O	----	not used
45	P13	I/O	CS1	Chip Select for EEPROM
46	P12	O	SK	Clock for EEPROM
47	P11	O	DI	Data Input into EEPROM
48	P10	I	DO	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	P.SCAN/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	TEMP	Thermal Sensor Input
60	DA2	O	F CONT	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

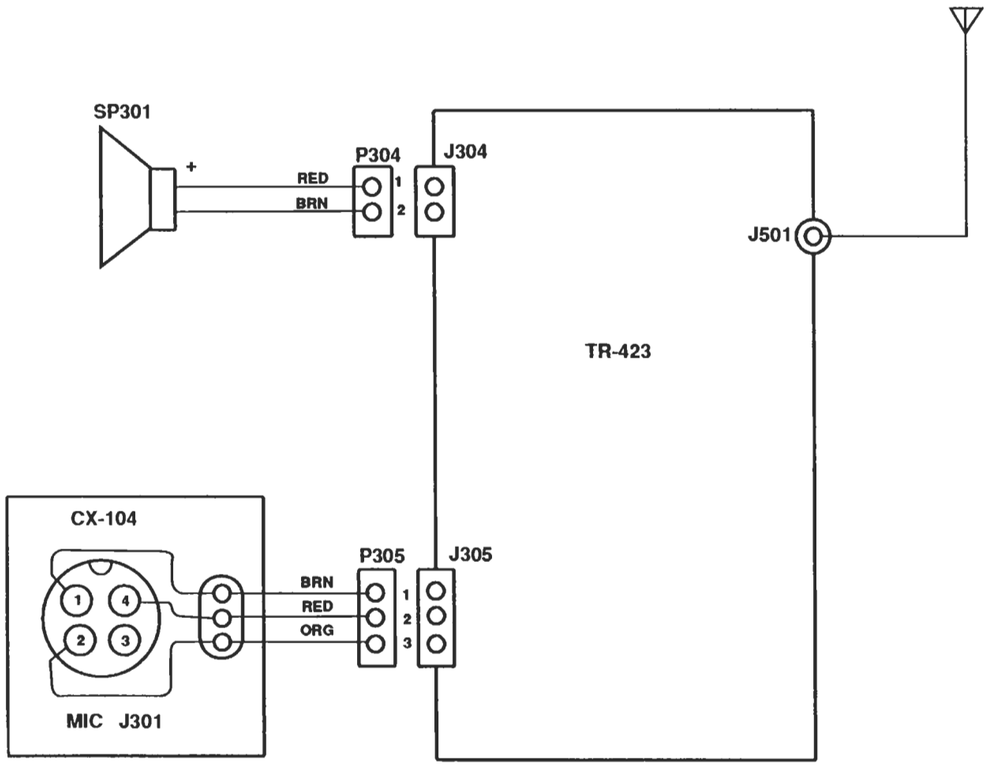
DIAGRAMS

NOTES


M/B
Q751 2SC3356 BUFF
Q702 2/2 IMB3 PS
Q702 1/2 Q705 IMB3 DTL124EK PS SW
TXDL
Q701 2SC2462LC RIPPLE FILTER
9V
TX8V
RX8V
Q771 IMD2 SW
PLCL
Q778 IMH1 SW
Q733 2SC3356 BUFF
TX9V
Q704 2SA1121SC PS
Q703 IMH1 PS SW
TXDL
+B
CM701
CH DATA from MCU
IC771 MB1504 SYNTHE SIZER
Q772~Q774 IMH1 2SA1121SC 2SC2618 CHARGE PUMP
LOOPFIL
IC772 BU4066 SW
D731 HVM25 TX VCO
Q731 2SK508 TX VCO
Q732 2SC2351 BUFF
Q131 2SC3357 PRE AMP
TX LED
Q501 MRF559 PA
Q502 2SC2283 PA KA
Q503 2SC2285B PA
Q505 2SC2905 PA
D501 UM9401 ANT SW
L P F
ANT
12.8MHz
R101 DET
D102, Q101 KV1430, 2SC2620 REF OSC
Q772 Q775~Q777 IMH1 2SC2462LC 2SC1213C DTC124EK
LP SW
Q713 2SC3356 BUFF
D502 HSM88S
RV402
Q411 2SD1264A-P +B FITER
IC302 74HC74 F.F
D101 KV1430
FCONT
MCU
D734~D735 ISV164 VCO MOD
D711 HVM25 RX VCO
Q711 2SK508 RX VCO
Q712 2SC2351 BUFF
Q203 2SC3357 LOCAL AMP
DBM
BPF
Q201 2SC3357 PRE AMP
BPF
Q302 IMH1
LED DRIVER
MON LED/SW
TX BUSY LED
CX-103
TXDL
EEPROM (8 CH)
8MHz
IC405 1/2 BA728F AMP
Q244 2SC2462 N.SQ AMP
D243 DCC010 REC TIFIER
D202 ND487C2-3R
TXDL
IC1: MF6CWM-50
TEMP/MCU
DEMODULATOR
IC241 (MC3361P)
Q1 2SC2462 SW
IC50 BA10324F HPF
IC1 AMP
Q2 2SC2462 SW
IC903
MCU IC901 M37450M4 or M37450E4
UP
DN
Q243 2SC2462 BUFF
Q242 2SK360 IF AMP
XTALFIL 45.0MHz
Q241 2SK215 IF AMP
IC2 BU4066 SW
IC1 SCF
RV1
(M6M8002IL)
D302
CH
IC301 14511 LED DRIVER
NSQ/MCU
RV241
HPF
CERAMIC FIL 455KHz
44.545MHz
R265 R266 LEV. SHIFT
IC1 AMP
BEEP
SQ SW
IC411 4/4
VOL
AGND
SP 2W/8Ω
Q406 2SC2462LC BUFF
Q408 2SK508 SW
IC406AH TDA7240AV AF PA
BEEP
Q404, Q504 2SB1065Q IMX1 APC
POWER SW
RV403
IC411 BA10324F
IC407 BA728F AMP
Q401 IMX1 SW
Q410 2SC2462LC SW
BUSY LED
MUTE/MCU
IC405 2/2 BA728F AMP
MIC
AMP
LIM
AMP
3/4
2/4
1/4
LPF
RV401
TONE/DCS
PTT
OPTION PORT
AF PA
IC402 (HA17085P)
IC401 (AN6541)
REG 5V
REG 9V
5V
9V
OPTION

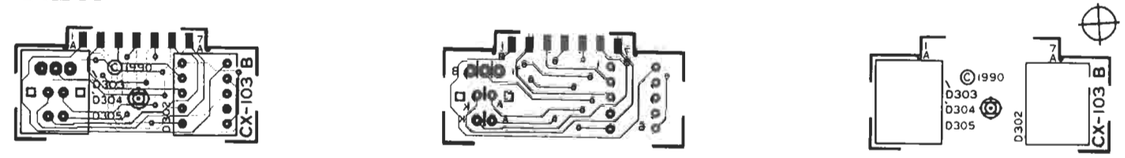
WIRING DIAGRAM

70-1526

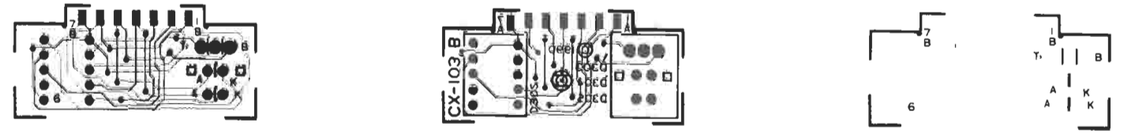


CX-103 LAYOUT

TOP VIEW



BOTTOM VIEW



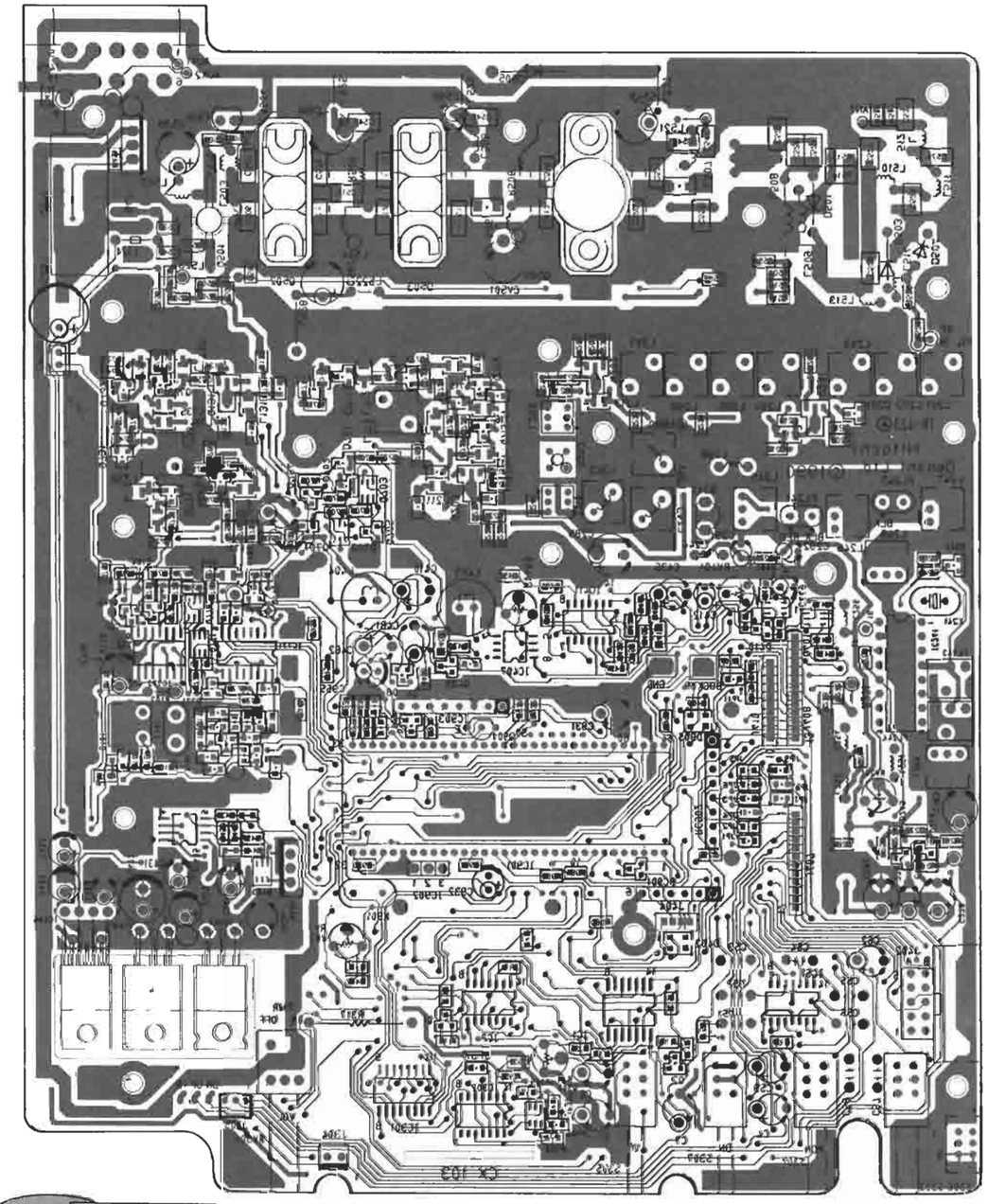
CX-104 LAYOUT

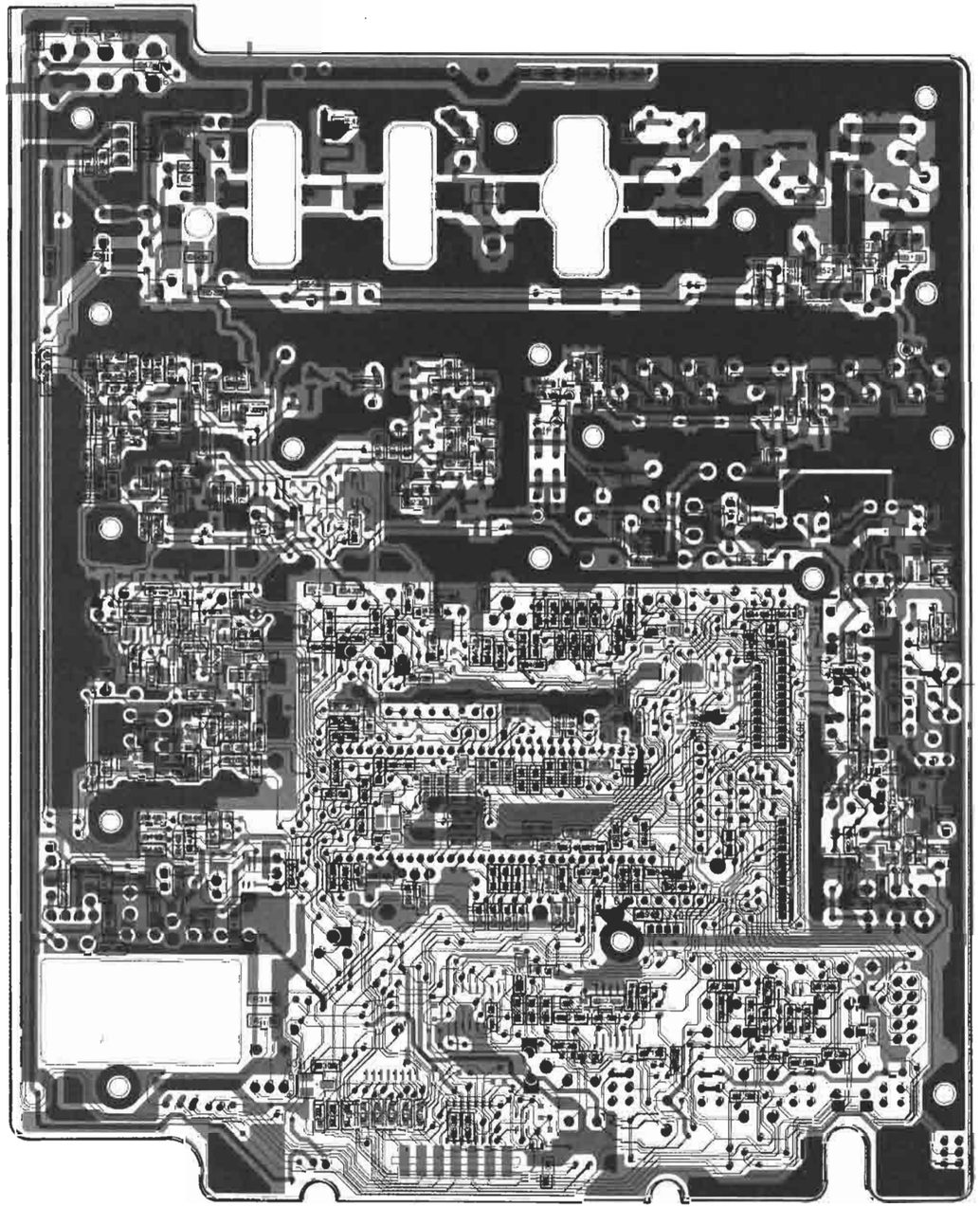
TOP VIEW

BOTTOM VIEW

BLUE VISIBLE PLATING

GOLD UNDERSIDE PLATING



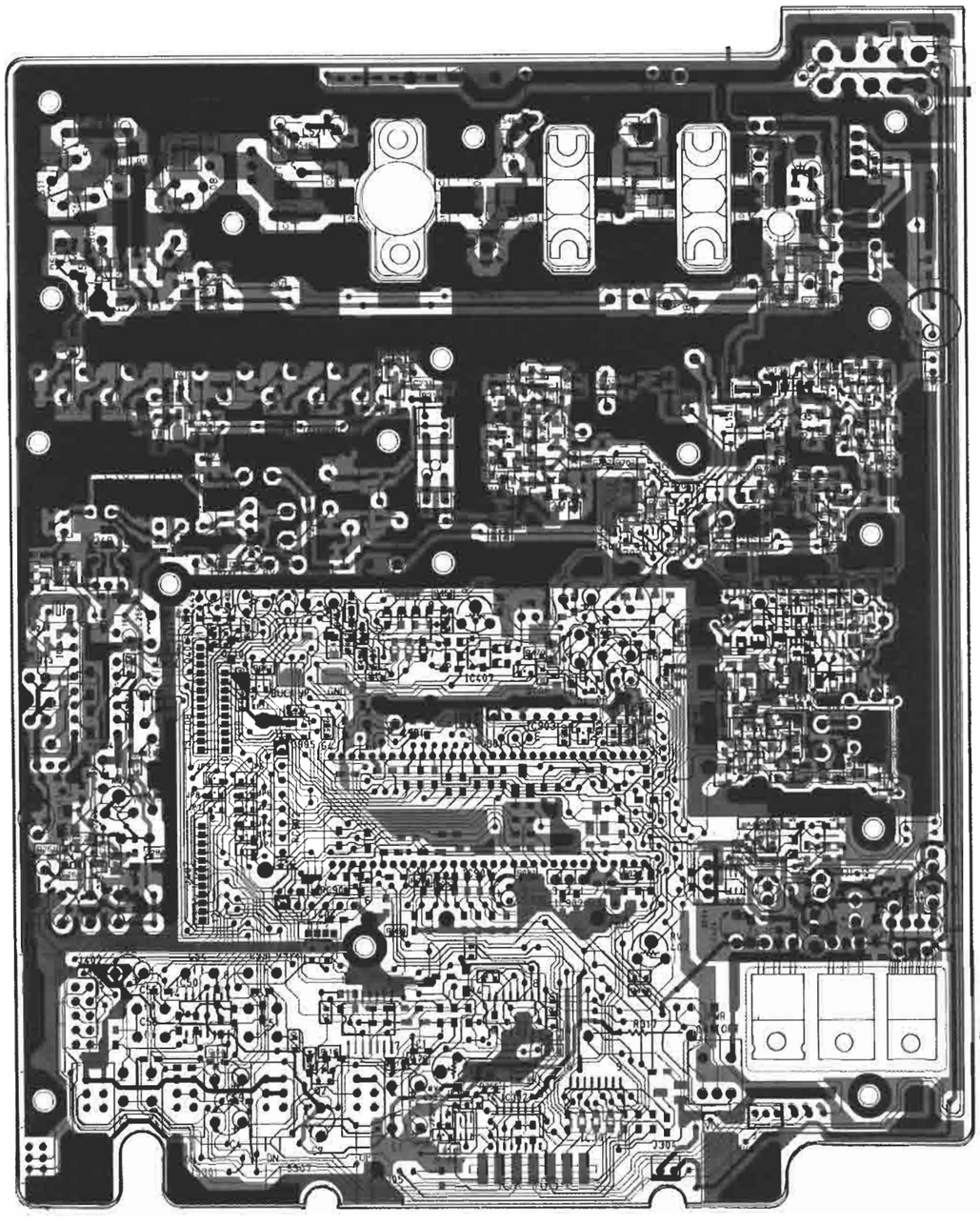


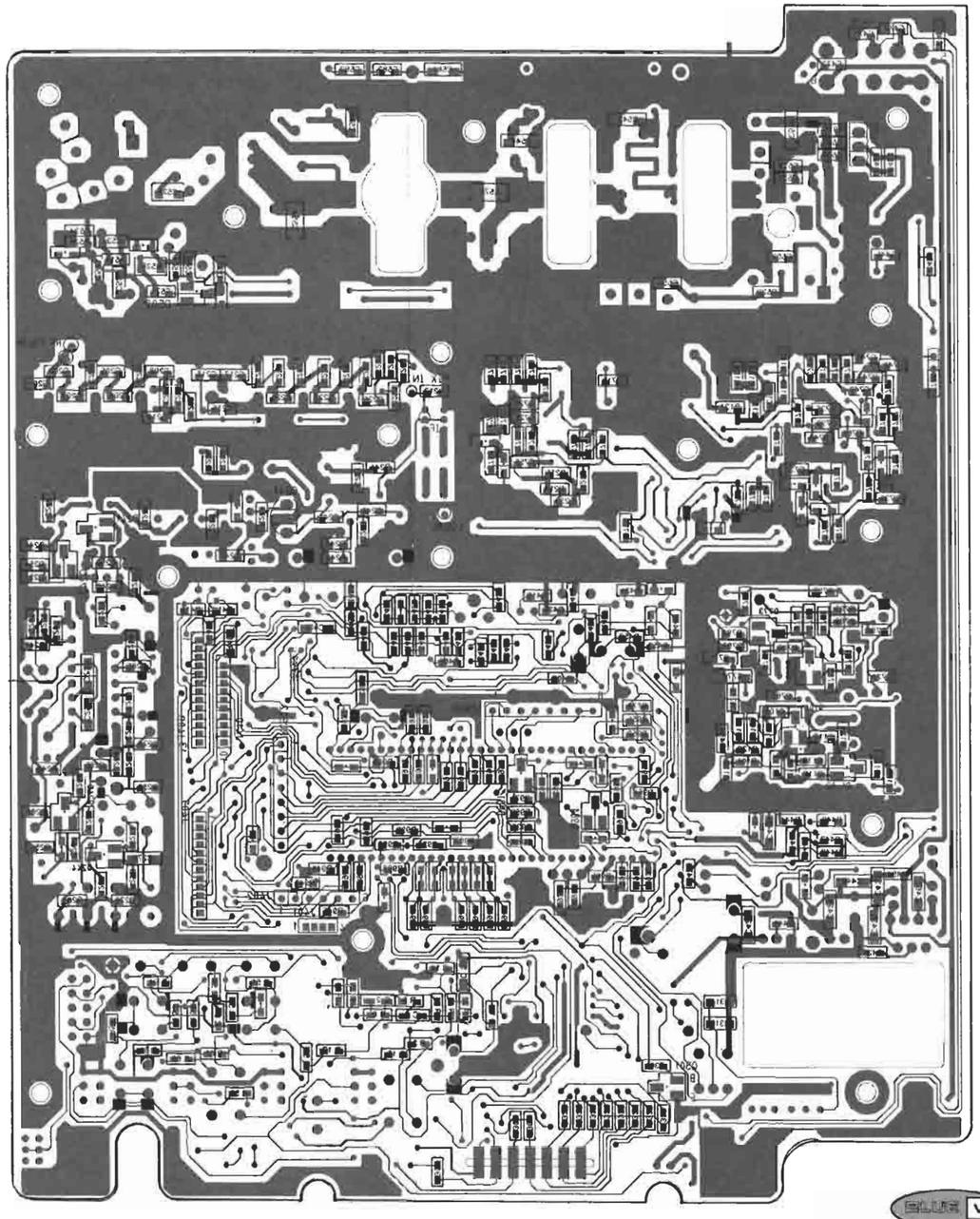
BLUE VISIBLE PLATING

UNDERSIDE PLATING

TR-423 LAYOUT -- TOP VIEW

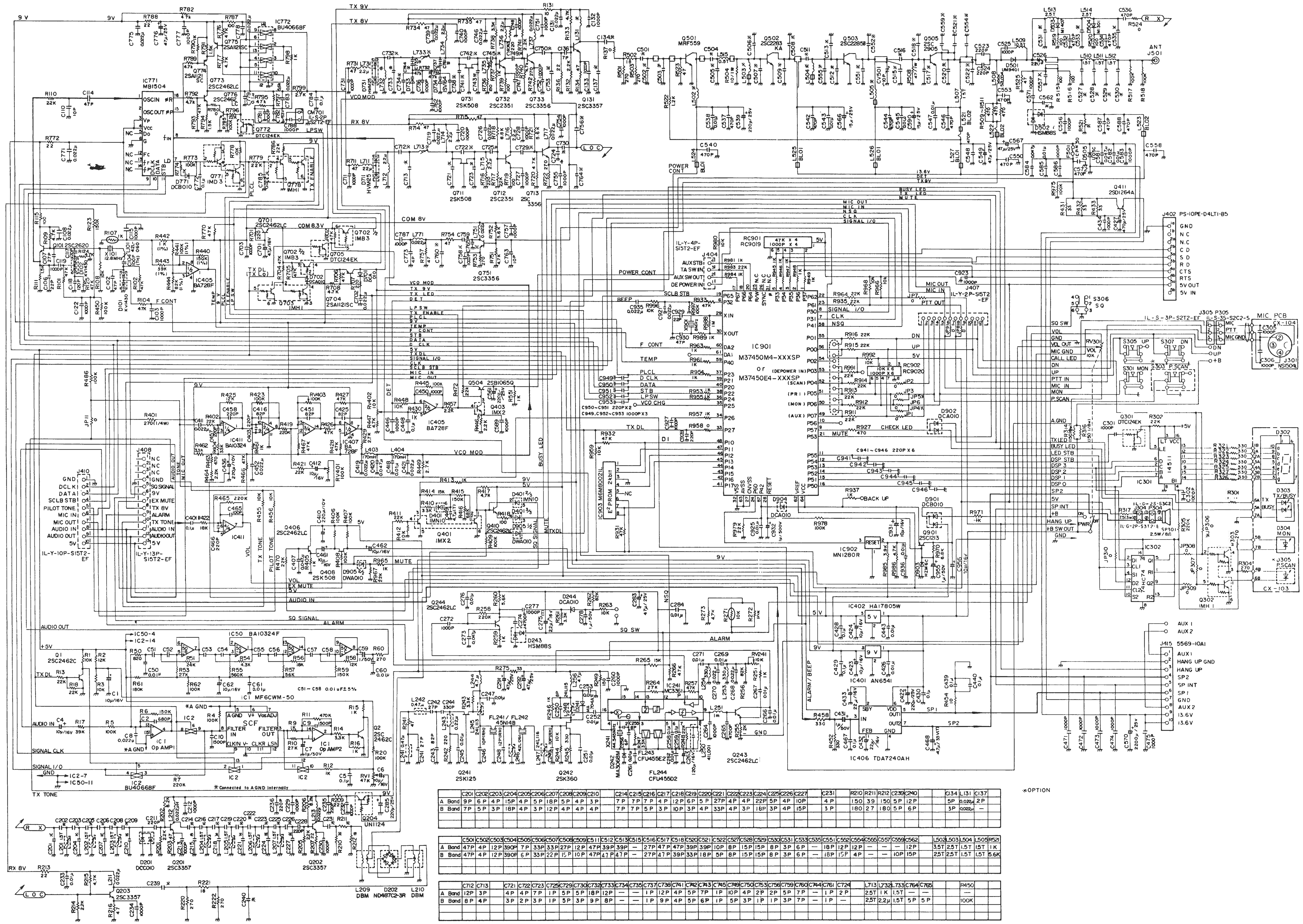
70-1526





BLUE VISIBLE PLATING

RED UNDERSIDE PLATING



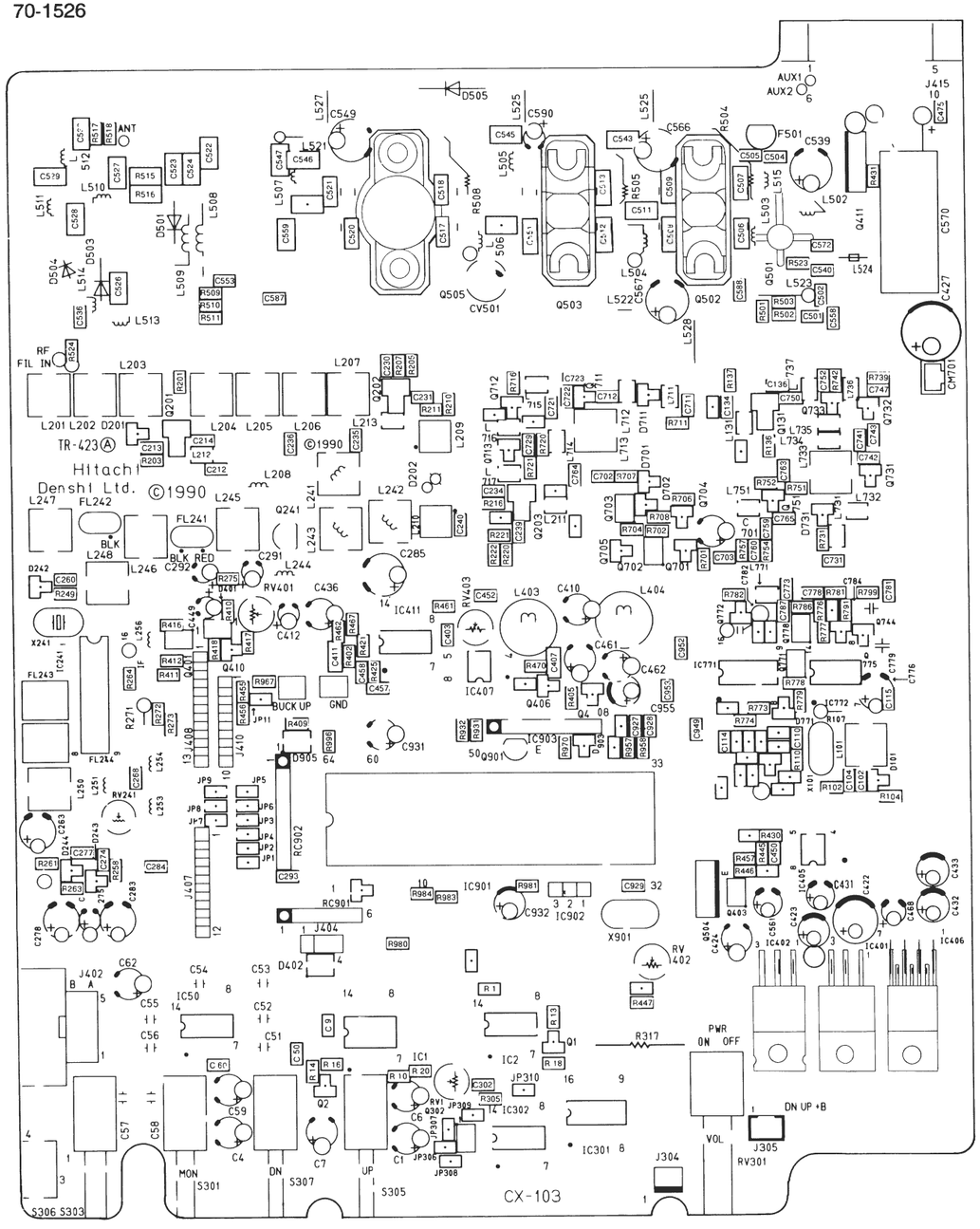
	C201	C202	C203	C204	C205	C206	C207	C208	C209	C210	C214	C215	C216	C217	C218	C219	C220	C221	C222	C223	C224	C225	C226	C227	C231	R210	R211	R212	C239	C240	C134	L131	C137
A Band	9P	6P	4P	15P	4P	5P	18P	5P	4P	3P	7P	7P	7P	4P	12P	6P	5P	27P	4P	4P	22P	5P	4P	10P	4P	150	39	150	5P	12P	5P	0.022μ	2P
B Band	7P	5P	3P	18P	4P	3P	12P	4P	4P	4P	7P	7P	5P	3P	10P	3P	4P	33P	4P	3P	18P	3P	4P	15P	3P	180	27	180	5P	6P	3P	0.022μ	—

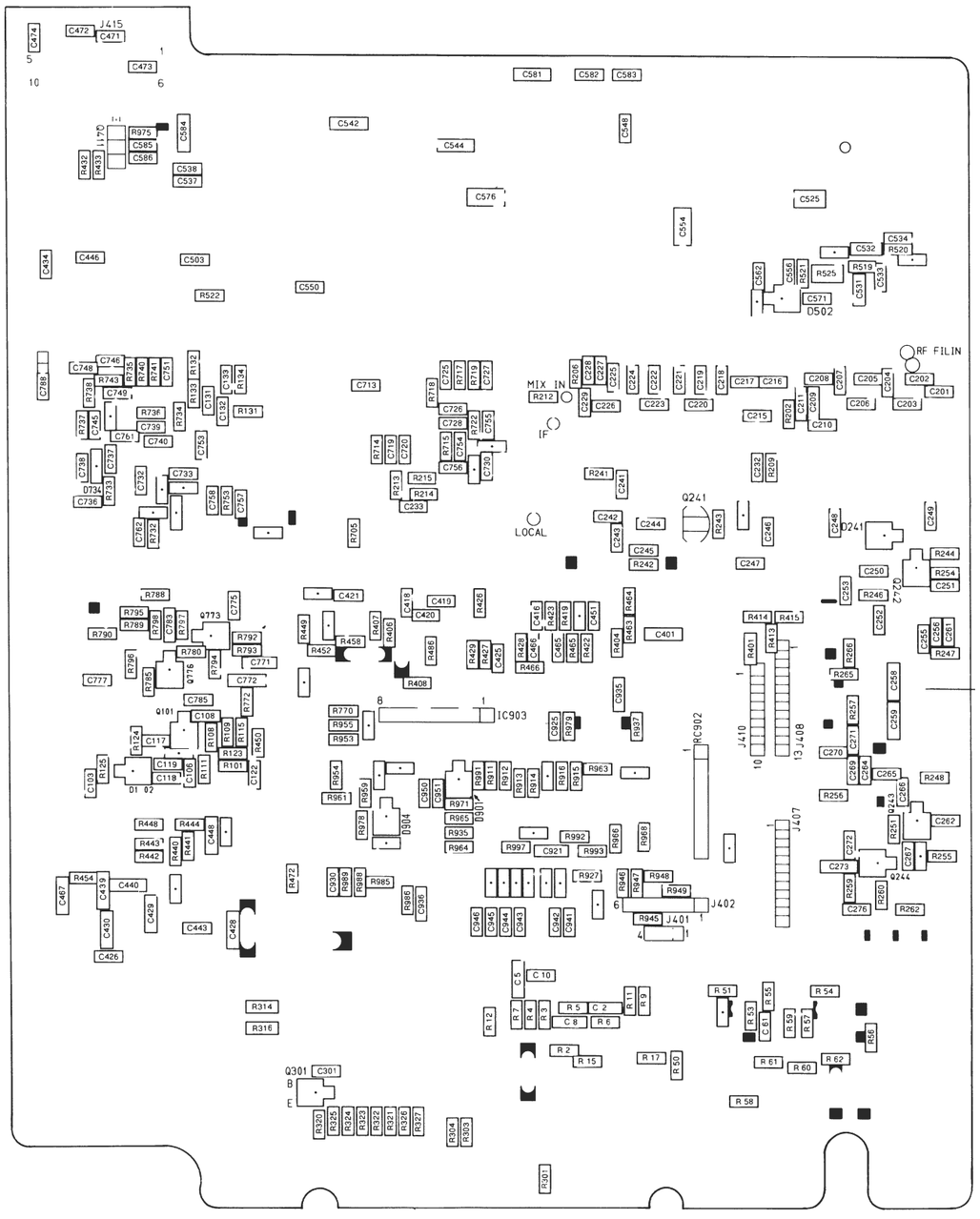
	C501	C502	C503	C504	C505	C506	C507	C508	C509	C511	C512	C513	C515	C516	C517	C518	C520	C521	C522	C527	C528	C529	C530	C531	C533	C535	C551	C552	C554	C555	C557	C559	C562	L502	L503	L504	L505	R521
A Band	47P	4P	12P	390P	7P	33P	33P	27P	12P	47P	39P	39P	—	27P	47P	47P	39P	39P	10P	8P	15P	15P	8P	3P	6P	—	18P	12P	12P	—	—	—	12P	3.5T	2.5T	1.5T	1.5T	1K
B Band	47P	4P	12P	390P	6P	33P	22P	15P	10P	47P	47P	47P	—	27P	47P	39P	33P	18P	5P	8P	15P	15P	8P	3P	6P	—	18P	15P	4P	—	—	10P	15P	2.5T	2.5T	1.5T	1.5T	5.6K

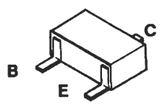
	C712	C713	C721	C722	C723	C725	C729	C730	C732	C733	C734	C735	C737	C738	C741	C742	C743	C745	C749	C750	C753	C756	C759	C760	C744	C761	C724	L713	L732	L733	C764	C765	R450
A Band	12P	3P	4P	4P	7P	1P	5P	5P	18P	12P	—	—	1P	12P	4P	5P	7P	1P	10P	4P	2P	2P	5P	7P	—	1P	2P	2.5T	1K	1.5T	—	—	—
B Band	8P	4P	3P	2P	3P	1P	5P	3P	9P	8P	—	—	1P	9P	4P	5P	6P	1P	5P	3P	1P	1P	3P	7P	—	1P	—	2.5T	2.2μ	1.5T	5P	5P	100K

COMPONENT LAYOUT

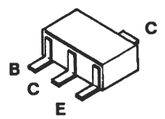
70-1526



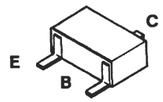




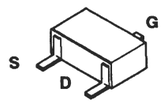
Q1, Q2, Q101, Q102, Q243, Q244, Q301, Q406, Q410, Q701, Q704, Q705, Q712, Q713, Q732, Q751, Q733, Q772, Q773, Q774, Q775, Q776



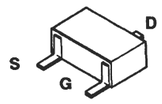
Q131, Q201, Q202, Q203



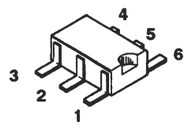
Q702



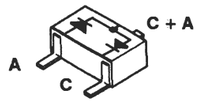
Q408, Q711, Q731



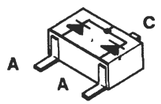
Q242



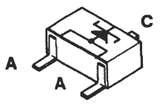
Q302, Q401, Q403, Q703, Q771, Q778



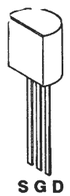
D201, D241, D243, D502



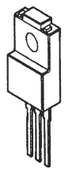
D101, D102, D711, D731, D771, D901



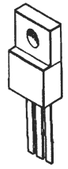
D903



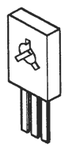
Q241



Q411



Q501

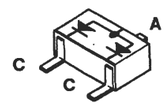


Q504

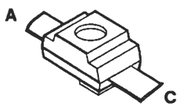
Q901

Q502, Q503

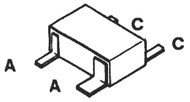
Q505



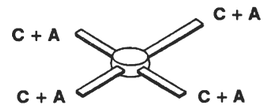
D244, D701, D702, D904



D734

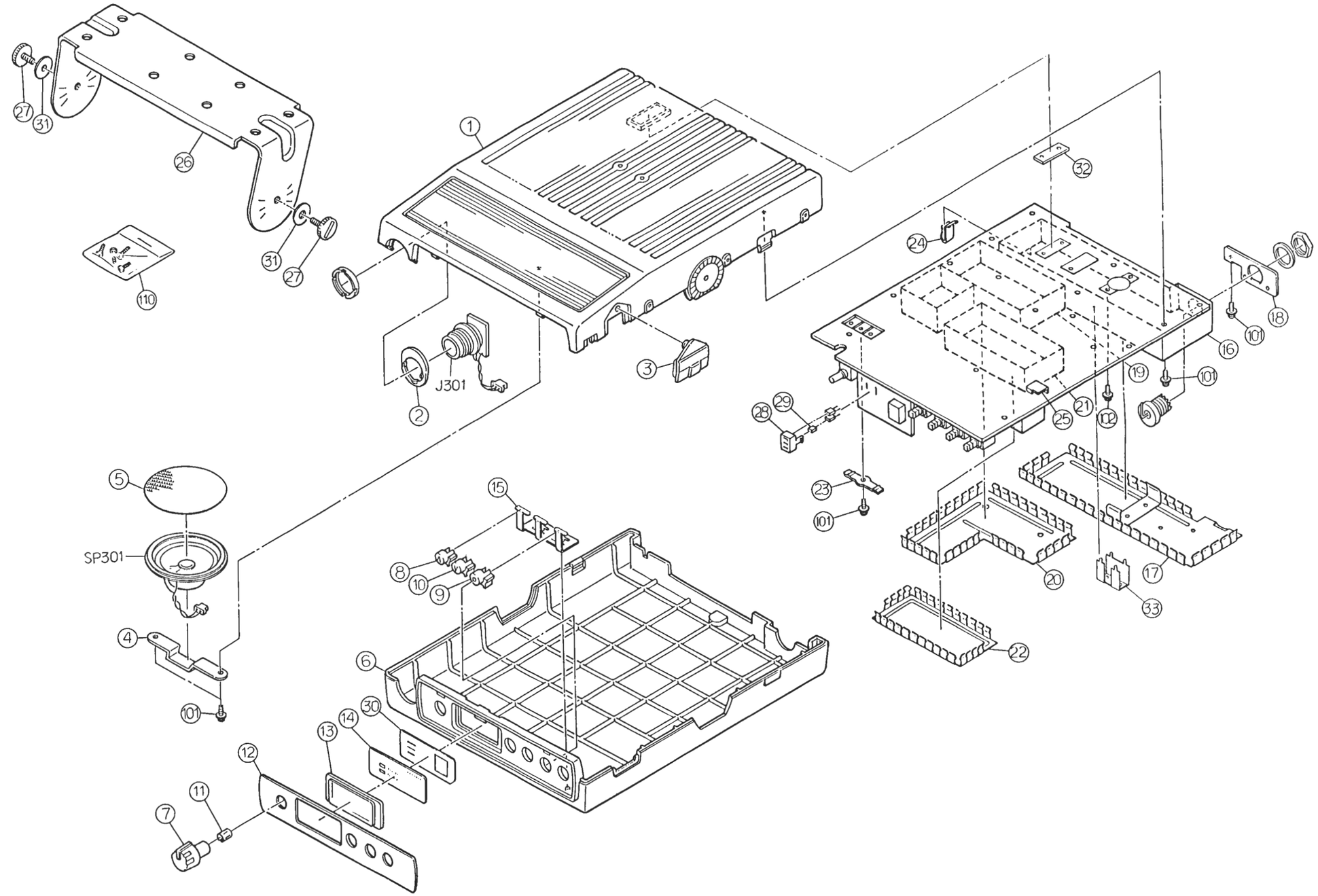


D905



D202

70-1526



SECTION 7

PARTS

NOTES

MECHANICAL PARTS

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010344
2	MIC HOLDER	70-158378
3	ROM CAP	70-157664
4	SP HOLDER	70-158379
5	SP NET	70-157665
6	BOTTOM COVER	70-010346
7	VOLUME KNOB	70-110098
8	SWITCH BUTTON	70-110099
9	SWITCH BUTTON	70-110100
10	SWITCH BUTTON	70-110101
11	KNOB SPRING	70-152127
12	FRONT PANEL	70-010345
13	FILTER	70-020312
14	LED FILM	70-020313
15	SWITCH SPRING	70-152134
16	PA SHIELD CASE	70-089388
17	PA SHIELD COVER	70-089389
18	ANT HOLDER	70-158380
19	VCO SHIELD CASE	70-089341
20	VCO SHIELD COVER	70-089342
21	LOG SHIELD CASE	70-089343
22	LOG SHIELD COVER	70-089390
23	IC HOLDER	70-158383
24	CLIP	70-150126
25	IF SHIELD	70-089349
26	BRACKET	70-158381
27	COIN SCREW	70-150291
28	LED HOLDER	70-158381
29	SILICONE RUBBER	70-157667
30	LEXAN FILM	70-157666
31	WASHER	70-151383
32	SPACER	70-151902
33	RF CASE	70-089393
101	SCREW	70-150180
102	SCREW	70-150151
110	FIXED SSCREW	70-151850
G01		TR-423
G02		CX-104
J501	M-RM	70-159090
SP301	SPEAKER	70-060037
	POWER CORD 2M	70-034766
	FUSE (135 V, 2A)	70-204026
	MICROPHONE (DYNAMIC)	70-038064

TR-423 BOARD

70-1526 TR-423 Assembly, A-Band, USE "A"
70-1526 TR-423 Assembly, B-Band, USE "B"

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C1	10 uF, 50 V, AL, ELYC	70-138191
C2	680 pF, 50 V, CERAMIC	70-138252
C4	10 uF, 50 V, AL, ELYC	70-138191
C5	0.1 uF, 50 V, CERAMIC	70-138327
C6	10 uF, 50 V, AL, ELYC	70-138191
C7	1 uF, 50 V, AL, ELYC	70-138194
C8	0.22 uF, 50 V, CERAMIC	70-138162
C9	1500 pF, 50 V, CERAMIC	70-138204
C10	1500 pF, 50 V, CERAMIC	70-138204
C50	0.01 uF, 50 V, PLASTIC	70-138770
C51	0.01 uF, 50 V, PLASTIC	70-138770
C52	0.01 uF, 50 V, PLASTIC	70-138770
C53	0.01 uF, 50 V, PLASTIC	70-138770
C54	0.01 uF, 50 V, PLASTIC	70-138770
C55	0.01 uF, 50 V, PLASTIC	70-138770
C56	0.01 uF, 50 V, PLASTIC	70-138770
C57	0.01 uF, 50 V, PLASTIC	70-138770
C58	0.01 uF, 50 V, PLASTIC	70-138770
C59	1 uF, 50 V, AL, ELYC	70-138194
C60	0.01 uF, 50 V, PLASTIC	70-138770
C61	0.01 uF, 50 V, PLASTIC	70-138770
C62	0.01 uF, 16 V, AL, ELYC	70-138191
C102	47 pF, 50 V, CERAMIC	70-138185
C103	1000 pF, 50 V, CERAMIC	70-138255
C104	100 pF, 50 V, CERAMIC	70-138364
C106	22 pF, 50 V, CERAMIC	70-138171
C107	27 pF, 50 V, CERAMIC	70-138165
C108	0.022 uF, 25 V, CERAMIC	70-138253
C109	1000 pF, 50 V, CERAMIC	70-138255
C110	10 pF, 50 V, CERAMIC	70-138187
C111	0.022 uF, 25 V, CERAMIC	70-138162
C112	0.022 uF, 25 V, CERAMIC	70-138162
C113	47 pF, 50 V, CERAMIC	70-138185
C114	47 pF, 50 V, CERAMIC	70-138185
C115	1000 pF, 50 V, CERAMIC	70-138255
C117	120 pF, 50 V, CERAMIC	70-138303
C118	120 pF, 50 V, CERAMIC	70-138303
C119	1000 pF, 50 V, CERAMIC	70-138255
C122	1000 pF, 50 V, CERAMIC	70-138255
C131	0.022 uF, 25 V, CERAMIC	70-138162
C132	1000 pF, 50 V, CERAMIC	70-138255
C133	1000 pF, 50 V, CERAMIC	70-138255
C134 B	3 pF, 50 V, CERAMIC	70-138164
C134 A	5 pF, 50 V, CERAMIC	70-138166
C136	7 pF, 50 V, CERAMIC	70-138181
C137 A	2 pF, 50 V, CERAMIC	70-138174
C138	220 pF, 50 V, CERAMIC	70-138349
C201 A	9 pF, 50 V, CERAMIC	70-138186
C201 B	7 pF, 50 V, CERAMIC	70-138181
C202 A	6 pF, 50 V, CERAMIC	70-138210
C202 B	5 pF, 50 V, CERAMIC	70-138166
C203 A	4 pF, 50 V, CERAMIC	70-138179
C203 B	3 pF, 50 V, CERAMIC	70-138184
C204 A	15 pF, 50 V, CERAMIC	70-138205
C204 B	18 pF, 50 V, CERAMIC	70-138206
C205	4 pF, 50 V, CERAMIC	70-138179
C206 A	5 pF, 50 V, CERAMIC	70-138166
C206 B	3 pF, 50 V, CERAMIC	70-138184
C207 A	18 pF, 50 V, CERAMIC	70-138206
C207 B	12 pF, 50 V, CERAMIC	70-138209
C208 A	5 pF, 50 V, CERAMIC	70-138166
C208 B	4 pF, 50 V, CERAMIC	70-138179
C209	4 pF, 50 V, CERAMIC	70-138186
C210 A	3 pF, 50 V, CERAMIC	70-138184
C210 B	4 pF, 50 V, CERAMIC	70-138186
C211	220 pF, 50 V, CERAMIC	70-138349
C212	1000 pF, 50 V, CERAMIC	70-138255
C213	1000 pF, 50 V, CERAMIC	70-138255
C214	7 pF, 50 V, CERAMIC	70-138181
C215	7 pF, 50 V, CERAMIC	70-138181
C216 A	7 pF, 50 V, CERAMIC	70-138181
C216 B	5 pF, 50 V, CERAMIC	70-138166
C217 A	4 pF, 50 V, CERAMIC	70-138166
C217 B	3 pF, 50 V, CERAMIC	70-138164
C218 A	12 pF, 50 V, CERAMIC	70-138209

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C218 B	10 pF, 50 V, CERAMIC	70-138330
C219 A	6 pF, 50 V, CERAMIC	70-138210
C219 B	3 pF, 50 V, CERAMIC	70-138164
C220 A	5 pF, 50 V, CERAMIC	70-138166
C220 B	4 pF, 50 V, CERAMIC	70-138179
C221 A	27 pF, 50 V, CERAMIC	70-138175
C221 B	33 pF, 50 V, CERAMIC	70-138188
C222	4 pF, 50 V, CERAMIC	70-138179
C223 A	4 pF, 50 V, CERAMIC	70-138179
C223 B	3 pF, 50 V, CERAMIC	70-138164
C224 A	22 pF, 50 V, CERAMIC	70-138171
C224 B	18 pF, 50 V, CERAMIC	70-138206
C225 A	5 pF, 50 V, CERAMIC	70-138166
C225 B	3 pF, 50 V, CERAMIC	70-138164
C226	4 pF, 50 V, CERAMIC	70-138179
C227 A	10 pF, 50 V, CERAMIC	70-138187
C227 B	15 pF, 50 V, CERAMIC	70-138205
C228	220 pF, 50 V, CERAMIC	70-138349
C229	1000 pF, 50 V, CERAMIC	70-138255
C230	1000 pF, 50 V, CERAMIC	70-138255
C231 A	4 pF, 50 V, CERAMIC	70-138179
C231 B	3 pF, 50 V, CERAMIC	70-138164
C232	1000 pF, 50 V, CERAMIC	70-138255
C233	0.01 uF, 50 V, CERAMIC	70-138770
C234	1000 pF, 50 V, CERAMIC	70-138255
C235	220 pF, 50 V, CERAMIC	70-138249
C236	220 pF, 50 V, CERAMIC	70-138249
C238	0.01 uF, 50 V, CERAMIC	70-138770
C239	5 pF, 50 V, CERAMIC	70-138166
C240 A	12 pF, 50 V, CERAMIC	70-138209
C240 B	6 pF, 50 V, CERAMIC	70-138210
C241	27 pF, 50 V, CERAMIC	70-138165
C242	27 pF, 50 V, CERAMIC	70-138165
C243	560 pF, 50 V, CERAMIC	70-138260
C244	330 pF, 50 V, CERAMIC	70-138228
C245	0.01 pF, 50 V, CERAMIC	70-138770
C246	10 pF, 50 V, CERAMIC	70-138346
C247	0.01 pF, 50 V, CERAMIC	70-138770
C248	12 pF, 50 V, CERAMIC	70-138347
C249	10 pF, 50 V, CERAMIC	70-138346
C250	8 pF, 50 V, CERAMIC	70-138203
C251	0.01 pF, 50 V, CERAMIC	70-138770
C252	0.01 pF, 50 V, CERAMIC	70-138770
C253	0.01 pF, 50 V, CERAMIC	70-138770
C255	8 pF, 50 V, CERAMIC	70-138203
C256	6 pF, 50 V, CERAMIC	70-138210
C258	0.1 pF, 50 V, CERAMIC	70-138327
C259	0.1 pF, 50 V, CERAMIC	70-138327
C260	1000 pF, 50 V, CERAMIC	70-138255
C261	0.01 pF, 50 V, CERAMIC	70-138255
C262	0.01 pF, 50 V, CERAMIC	70-138255
C263	0.01 pF, 50 V, CERAMIC	70-135167
C264	1000 pF, 50 V, CERAMIC	70-138255
C265	4700 pF, 50 V, CERAMIC	70-138163
C266	0.01 uF, 50 V, CERAMIC	70-138170
C267	0.01 uF, 50 V, CERAMIC	70-138170
C268	0.022 uF, 25 V, CERAMIC	70-138162
C269	0.01 uF, 50 V, CERAMIC	70-138170
C270	0.022 uF, 25 V, CERAMIC	70-138162
C271	0.01 uF, 50 V, CERAMIC	70-138170
C272	1000 pF, 50 V, CERAMIC	70-138255
C273	0.047 uF, 50 V, CERAMIC	70-131298
C274	4700 pF, 50 V, CERAMIC	70-138163
C275	1.0 uF, 50 V, CERAMIC	70-138087
C276	0.01 uF, 35 V, TA, ELYC	70-138170
C277	1000 pF, 50 V, CERAMIC	70-138255
C278	1 uF, 50 V, AL, ELYC	70-135147
C283	47 uF, 25 V, AL, ELYC	70-135144
C284	0.01 uF, 50 V, CERAMIC	70-138170
C285	220 uF, 25 V, AL, ELYC	70-131300
C301	1000 pF, 50 V, CERAMIC	70-138255
C302	1000 pF, 50 V, CERAMIC	70-138255
C305	1000 pF, 50 V, CERAMIC	70-138255
C306	1000 pF, 50 V, CERAMIC	70-138255
C401	0.1 uF, 25 V, CERAMIC	70-138327

TR-423 BOARD (Continued)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C403	220 pF, 50 V, CERAMIC	70-138349
C407	0.047 uF, 50 V, CERAMIC	70-131298
C410	220 uF, 10 V, CERAMIC	70-135217
C411	0.022 uF, 50 V, CERAMIC	70-132033
C412	10 uF, 16 V, CERAMIC	70-138191
C416	82 pF, 50 V, CERAMIC	70-138250
C417	0.01 uF, 50 V, CERAMIC	70-138770
C418	0.01 uF, 50 V, CERAMIC	70-138770
C419	0.022 uF, 50 V, CERAMIC	70-132033
C420	0.047 uF, 50 V, CERAMIC	70-131298
C421	0.022 uF, 50 V, CERAMIC	70-132033
C422	220 uF, 25 V, CERAMIC	70-135166
C423	10 uF, 16 V, CERAMIC	70-138191
C424	10 uF, 16 V, AL, ELYC	70-138191
C425	82 uF, 50 V, CERAMIC	70-138260
C426	0.01 uF, 50 V, CERAMIC	70-138770
C427	470 uF, 25 V, AL, ELYC	70-131305
C428	0.1 uF, 25 V, CERAMIC	70-138327
C429	0.1 uF, 25 V, CERAMIC	70-138327
C430	0.1 uF, 25 V, CERAMIC	70-138327
C431	1 uF, 50 V, AL, ELYC	70-138194
C432	22 uF, 16 V, AL, ELYC	70-135277
C433	22 uF, 16 V, AL, ELYC	70-135277
C434	1000 pF, 50 V, CERAMIC	70-138255
C436	220 uF, 10 V, AL, ELYC	70-135217
C439	0.1 uF, 25 V, CERAMIC	70-138327
C440	0.1 uF, 25 V, CERAMIC	70-138327
C443	0.01 uF, 50 V, CERAMIC	70-138770
C446	1000 pF, 50 V, CERAMIC	70-138255
C448	0.1 uF, 25 V, CERAMIC	70-138327
C449	4.7 uF, 16 V, AL, ELYC	70-138101
C450	1000 pF, 50 V, CERAMIC	70-138255
C451	82 pF, 50 V, CERAMIC	70-138250
C452	0.022 uF, 25 V, CERAMIC	70-138162
C457	220 pF, 50 V, CERAMIC	70-138349
C458	220 pF, 50 V, CERAMIC	70-138349
C461	10 uF, 16 V, AL, ELYC	70-138191
C462	10 uF, 16 V, AL, ELYC	70-138191
C465	100 pF, 50 V, CERAMIC	70-138175
C466	220 pF, 50 V, CERAMIC	70-138176
C467	0.1 uF, 25 V, CERAMIC	70-138327
C468	4.7 uF, 35 V, AL, ELYC	70-138088
C471	0.01 uF, 50 V, CERAMIC	70-138770
C472	0.01 uF, 50 V, CERAMIC	70-138770
C473	1000 pF, 50 V, CERAMIC	70-138168
C474	1000 pF, 50 V, CERAMIC	70-138168
C475	1000 pF, 50 V, CERAMIC	70-138168
C501	47 pF, 50 V, CERAMIC	70-138185
C502	4 pF, 50 V, CERAMIC	70-138179
C503	12 pF, 50 V, CERAMIC	70-138209
C504	390 pF, 50 V, CERAMIC	70-138363
C505 A	7 pF, 50 V, CERAMIC	70-138181
C505 B	4 pF, 50 V, CERAMIC	70-138179
C506	33 pF, 50 V, CERAMIC	70-131192
C507	33 pF, 50 V, CERAMIC	70-131192
C508 A	27 pF, 50 V, CERAMIC	70-138319
C508 B	10 pF, 50 V, CERAMIC	70-131182
C509	12 pF, 50 V, CERAMIC	70-131183
C511	47 pF, 50 V, CERAMIC	70-131196
C512	39 pF, 50 V, CERAMIC	70-131194
C513	39 pF, 50 V, CERAMIC	70-131194
C516	27 pF, 500 V, CERAMIC	70-138305
C517 A	47 pF, 500 V, MICA	70-138114
C517 B	39 pF, 500 V, MICA	70-138099
C518 A	47 pF, 500 V, MICA	70-138114
C518 B	39 pF, 500 V, MICA	70-138099
C520 A	39 pF, 500 V, MICA	70-138099
C520 B	33 pF, 500 V, MICA	70-138083
C521 A	39 pF, 500 V, MICA	70-138099
C521 B	18 pF, 500 V, MICA	70-138083
C522 A	10 pF, 500 V, CERAMIC	70-138309
C522 B	8 pF, 500 V, CERAMIC	70-138362
C523	220 pF, 100 V, CERAMIC	70-138261
C524	220 pF, 100 V, CERAMIC	70-138261
C525	1000 pF, 100 V, CERAMIC	70-138239
C526	220 pF, 100 V, CERAMIC	70-138261
C527	8 pF, 500 V, CERAMIC	70-138362
C528	15 pF, 500 V, CERAMIC	70-138267

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C529	15 pF, 500 V, CERAMIC	70-138267
C530	8 pF, 500 V, CERAMIC	70-138362
C531	3 pF, 500 V, CERAMIC	70-138311
C532	470 pF, 100 V, CERAMIC	70-138238
C533	6 pF, 50 V, CERAMIC	70-138210
C534	470 pF, 50 V, CERAMIC	70-138404
C535	1 pF, 500 V, CERAMIC	70-138174
C536	470 pF, 50 V, CERAMIC	70-138404
C537	470 pF, 50 V, CERAMIC	70-138404
C538	0.01 uF, 50 V, CERAMIC	70-138770
C539	15 uF, 25 V, AL, ELYC	70-135154
C540	470 pF, 50 V, CERAMIC	70-138404
C542	470 pF, 50 V, CERAMIC	70-132053
C543	0.01 uF, 50 V, CERAMIC	70-131297
C544	470 pF, 50 V, CERAMIC	70-132053
C545	0.01 uF, 50 V, CERAMIC	70-131297
C546	470 pF, 100 V, CERAMIC	70-138238
C547	0.01 uF, 50 V, CERAMIC	70-131297
C548	470 pF, 50 V, CERAMIC	70-138404
C549	47 uF, 50 V, AL, ELYC	70-135055
C550	470 pF, 50 V, CERAMIC	70-138404
C551 A	18 pF, 500 V, CERAMIC	70-138265
C551 B	15 pF, 500 V, CERAMIC	70-138267
C553	470 pF, 50 V, CERAMIC	70-138404
C554 A	12 pF, 500 V, CERAMIC	70-138266
C554 B	4 pF, 500 V, CERAMIC	70-138328
C556	1000 pF, 50 V, CERAMIC	70-138255
C558	470 pF, 50 V, CERAMIC	70-138404
C561	220 uF, 25 V, AL, ELYC	70-135166
C562 A	12 pF, 50 V, CERAMIC	70-131183
C562 B	15 pF, 50 V, CERAMIC	70-138185
C566	15 uF, 25 V, AL, ELYC	70-135154
C567	47 uF, 50 V, AL, ELYC	70-135055
C570	2200 uF, 25 V, AL, ELYC	70-135235
C571	1000 pF, 50 V, CERAMIC	70-138255
C572	470 pF, 50 V, CERAMIC	70-138404
C581	0.047 uF, 50 V, CERAMIC	70-131298
C582	0.01 uF, 50 V, CERAMIC	70-138168
C583	1000 pF, 50 V, CERAMIC	70-138255
C584	0.047 uF, 50 V, CERAMIC	70-131298
C585	0.01 uF, 50 V, CERAMIC	70-138168
C586	1000 pF, 50 V, CERAMIC	70-138255
C587	470 pF, 50 V, CERAMIC	70-138404
C588	470 pF, 50 V, CERAMIC	70-138404
C589	1000 pF, 50 V, CERAMIC	70-138255
C590	47 uF, 25 V, AL, ELYC	70-135055
C701	47 uF, 16 V, AL, ELYC	70-135219
C702	0.022 uF, 25 V, CERAMIC	70-138162
C703	1000 pF, 50 V, CERAMIC	70-138255
C711	1000 pF, 50 V, CERAMIC	70-138255
C712 A	12 pF, 50 V, CERAMIC	70-138209
C712 B	8 pF, 50 V, CERAMIC	70-138203
C713 A	3 pF, 50 V, CERAMIC	70-138164
C713 B	4 pF, 50 V, CERAMIC	70-138179
C719	0.022 uF, 50 V, CERAMIC	70-138162
C720	1000 pF, 50 V, CERAMIC	70-138255
C721 A	4 pF, 50 V, CERAMIC	70-138179
C721 B	3 pF, 50 V, CERAMIC	70-138164
C722 A	4 pF, 50 V, CERAMIC	70-138179
C722 B	2 pF, 50 V, CERAMIC	70-138169
C723 A	6 pF, 50 V, CERAMIC	70-138210
C723 B	3 pF, 50 V, CERAMIC	70-138164
C724 A	2 pF, 50 V, CERAMIC	70-138169
C725	1 pF, 50 V, CERAMIC	70-138174
C726	0.022 uF, 25 V, CERAMIC	70-138162
C727	1000 pF, 50 V, CERAMIC	70-138255
C728	1000 pF, 50 V, CERAMIC	70-138255
C729 B	5 pF, 50 V, CERAMIC	70-138166
C730 A	5 pF, 50 V, CERAMIC	70-138166
C730 B	3 pF, 50 V, CERAMIC	70-138164
C731	1000 pF, 50 V, CERAMIC	70-138255
C732 A	18 pF, 50 V, CERAMIC	70-138206
C732 B	9 pF, 50 V, CERAMIC	70-138186
C733 A	12 pF, 50 V, CERAMIC	70-138209
C733 B	6 pF, 50 V, CERAMIC	70-138203
C736	1000 pF, 50 V, CERAMIC	70-138255
C737	10 pF, 50 V, CERAMIC	70-138174
C738 A	12 pF, 50 V, CERAMIC	70-138209

TR-423 BOARD (Continued)

REF NO.	DESCRIPTION	PART NO.
	CAPACITORS (CONTINUED)	
C738 B	9 pF, 50 V, CERAMIC	70-138186
C739	0.022 uF, 25 V, CERAMIC	70-138162
C740	1000 pF, 50 V, CERAMIC	70-138255
C741	4 pF, 50 V, CERAMIC	70-138179
C742	5 pF, 50 V, CERAMIC	70-138166
C743 A	7 pF, 50 V, CERAMIC	70-138181
C743 B	6 pF, 50 V, CERAMIC	70-138208
C745	1 pF, 50 V, CERAMIC	70-138174
C746	0.022 uF, 25 V, CERAMIC	70-138253
C747	1000 pF, 50 V, CERAMIC	70-138255
C748	1000 pF, 50 V, CERAMIC	70-138255
C749 A	10 pF, 50 V, CERAMIC	70-138187
C749 B	5 pF, 50 V, CERAMIC	70-138166
C750 A	4 pF, 50 V, CERAMIC	70-138179
C750 B	3 pF, 50 V, CERAMIC	70-138164
C751	1000 pF, 50 V, CERAMIC	70-138255
C752	1000 pF, 50 V, CERAMIC	70-138255
C753 A	2 pF, 50 V, CERAMIC	70-138169
C753 B	1 pF, 50 V, CERAMIC	70-138174
C754	1000 pF, 50 V, CERAMIC	70-138255
C755	1000 pF, 50 V, CERAMIC	70-138255
C756 A	2 pF, 50 V, CERAMIC	70-138169
C756 B	1 pF, 50 V, CERAMIC	70-138174
C757	1000 pF, 50 V, CERAMIC	70-138255
C758	1000 pF, 50 V, CERAMIC	70-138255
C759 A	5 pF, 50 V, CERAMIC	70-138181
C759 B	3 pF, 50 V, CERAMIC	70-138164
C760	7 pF, 50 V, CERAMIC	70-138181
C761 A	1 pF, 50 V, CERAMIC	70-138174
C761 B	1 pF, 50 V, CERAMIC	70-138174
C762	1000 pF, 50 V, CERAMIC	70-138255
C763	10 pF, 50 V, CERAMIC	70-138187
C771	0.022 uF, 25 V, CERAMIC	70-138162
C772	0.1 uF, 25 V, CERAMIC	70-138327
C773	4 pF, 50 V, CERAMIC	70-138179
C775	0.022 uF, 25 V, CERAMIC	70-138162
C776	47 uF, 25 V, SL, RLYV	70-135144
C777	1000 pF, 50 V, CERAMIC	70-138255
C778	0.022 uF, 25 V, CERAMIC	70-138162
C779	0.1 uF, 50 V, PLASTIC	70-138189
C781	1000 pF, 50 V, CERAMIC	70-138255
C782	MHM-105J63B, PLASTIC	70-137101
C783	0.022 uF, 25 V, CERAMIC	70-138162
C784	0.1 uF, 50 V, PLASTIC	70-138189
C785	0.022 uF, 25 V, CERAMIC	70-138162
C787	1000 pF, 50 V, CERAMIC	70-138255
C788	1000 pF, 50 V, CERAMIC	70-138255
C921	0.022 uF, 25 V, CERAMIC	70-138162
C923	1000 pF, 50 V, CERAMIC	70-138255
C925	0.01 uF, 50 V, CERAMIC	70-138770
C927	1000 pF, 50 V, CERAMIC	70-138255
C928	1000 pF, 50 V, CERAMIC	70-138255
C929	22 pF, 50 V, CERAMIC	70-138171
C930	47 pF, 50 V, CERAMIC	70-138185
C931	10 uF, 16 V, CERAMIC	70-138191
C932	1 uF, 50 V, CERAMIC	70-138194
C933	1000 pF, 50 V, CERAMIC	70-138255
C935	0.022 uF, 25 V, CERAMIC	70-138162
C936	0.01 uF, 50 V, CERAMIC	70-138770
C941	1000 pF, 50 V, CERAMIC	70-138255
C942	1000 pF, 50 V, CERAMIC	70-138255
C943	1000 pF, 50 V, CERAMIC	70-138255
C944	1000 pF, 50 V, CERAMIC	70-138255
C945	1000 pF, 50 V, CERAMIC	70-138255
C946	1000 pF, 50 V, CERAMIC	70-138255
C947	1000 pF, 50 V, CERAMIC	70-138255
C948	1000 pF, 50 V, CERAMIC	70-138255
C949	1000 pF, 50 V, CERAMIC	70-138255
C950	1000 pF, 50 V, CERAMIC	70-138255
C951	1000 pF, 50 V, CERAMIC	70-138255
C952	1000 pF, 50 V, CERAMIC	70-138255
C953	1000 pF, 50 V, CERAMIC	70-138255
C954	1000 pF, 50 V, CERAMIC	70-138255
C955	1 uF, 50 V, AL, ELYC	70-135147
C956	10 uF, 16 V, AL, ELYC	70-138191

REF NO.	DESCRIPTION	PART NO.
	DIODES	
D101	KV1430TL01-34	70-085312
D102	KV1430TL01-34	70-085312
D201	DCC010-TA	70-085513
D202	ND487C2-3R	70-085228
D241	HSM88S	70-085154
D242	MA3068-M TW	70-085273
D243	HSM88S	70-085154
D244	DCA010-TA	70-085250
D501	UM8401	70-085056
D502	HSM88S-TR	70-085154
D503	MI407	70-085152
D504	MI301	70-085272
D505	RM4AM LF-J8	70-085269
D701	DCA010-TA	70-085250
D702	DCA010-TA	70-085250
D711	HVM25-02-TR	70-085322
D731	HVM25-02-TR	70-085322
D734	1SV164-T2	70-085250
D771	DCB010-TA	70-085245
D901	DCB010-TA	70-085245
D902	DCA010-TA	70-085250
D903	HZM5B	70-085253
D904	DCA010-TA	70-085250
D905	DWA-010-TF	70-085248
	FILTERS	
FL241	45N14BA 45.000 MHz	70-179122
FL242	CFU455E2	70-179019
FL244	CFU455D2	70-179018
	INTEGRATED CIRCUITS	
IC1	MF6CWN-50	70-076611
IC2	BU4066BF-T1	70-076573
IC241	MC3361P	70-076522
IC301	HD14511BP	70-076082
IC302	BU74HC74F	70-076578
IC401	AN6541	70-076253
IC402	HA17805W	70-076567
IC405	BA728F-T1	70-076569
IC406	TDA7240AH	70-076676
IC407	BA728F-T1	70-076569
IC411	BA14741AF-T1	70-076628
IC50	BA1032AF-T1	70-076612
IC771	MB1504PF	70-076598
IC772	BU4066 BF	70-076649
IC901	M37450 M4	70-076678
IC902	MN1280R	70-076575
IC903	M6M8002IL	70-076576
	CONNECTORS	
J301	NS1504L	70-159100
J304	IL-G-2P-S3T2-E	70-159656
J305	IL-G-3P-S3T2-EF	70-158254
J402	PS-10PE-D4LT1-BE	70-159708
J415	5569-10A1	70-159709
J501	M-RM	70-159090
P304	IL-G-2S-S3C2	70-034624
P305	CABLE ASSEMBLY	70-034764
	JUMPERS	
JP1	0 OHM, 1/10 W, METAL	70-144106
JP2	0 OHM, 1/10 W, METAL	70-144106
JP3	0 OHM, 1/10 W, METAL	70-144106
JP6	0 OHM, 1/10 W, METAL	70-144106
JP7	0 OHM, 1/10 W, METAL	70-144106
JP8	0 OHM, 1/10 W, METAL	70-144106
JP9	0 OHM, 1/10 W, METAL	70-144106
JP11	0 OHM, 1/10 W, METAL	70-144106
JP307	0 OHM, 1/10 W, METAL	70-144106
JP308	0 OHM, 1/10 W, METAL	70-144106
JP309	0 OHM, 1/10 W, METAL	70-144106
JP310	0 OHM, 1/10 W, METAL	70-144106

TR-423 BOARD (Continued)

REF NO.	DESCRIPTION	PART NO.
	COILS AND INDUCTORS	
L101	42L-060	70-090482
L131	LQN2A22NM	70-090412
L201	7MPS 1.5 AL	70-090500
L202	7MPS 1.5 AL	70-090500
L203	7MPS 1.5 AL	70-090500
L204	7MPS 1.5 AL	70-090500
L205	7MPS 1.5 AL	70-090500
L206	7MPS 1.5 AL	70-090500
L207	7MPS 1.5 AL	70-090500
L208	ELESN4R7KA	70-090466
L209	DBM	70-090407
L210	DBM	70-090407
L211	LQN2A33NM	70-090412
L212	LQN2A22NM	70-090412
L213	LQN2A22NM	70-090412
L241	ELESNR47MA	70-090468
L242	ELESNR47MA	70-090468
L243	ELESNR22MA	70-090469
L244	ELESN4R7KA	70-090466
L245	24K113	70-090470
L246	42L061	70-090471
L247	24L116	70-090472
L248	24L116	70-090473
L249	24L115	70-090466
L250	ELESN4R7KA	70-090423
L251	ELESN102KA	70-090474
L252	ELESN4R7KA	70-090466
L253	ELESN331KA	70-090476
L254	ELESN331KA	70-090476
L255	ELESN4R7KA	70-090466
L256	ELESN4R7KA	70-090466
L402	ELESN4R7KA	70-090465
L403	FS1012S-174K	70-178055
L404	FS1012S-174K	70-178055
L502 A	Z0.8C5D 3.5T	70-090099
L502 B	Z0.8C5D 2.5T	70-090098
L503	Z0.8C3D 2.5T	70-090098
L504	ZB0.8C5D 1.5T	70-090497
L505	Z0.8C3D 1.5T	70-090155
L506	ZB0.8C5D 2.5T	70-090049
L507	Z0.8C5D 1.5T	70-090097
L508	52L004	70-090252
L509	Z0.8C3D 10.5T	70-090484
L510	Z1.0S3D 1.5T	70-090484
L511	Z1.0S3D 1.5T	70-090484
L512	Z1.0S3D 1.5T	70-090484
L513	Z0.8C3D 2.5T	70-090168
L514	Z0.8C3D 2.5T	70-090168
L515	Z0.8C3D 0.5T	70-090164
L521	BL02RN1-R62	70-090122
L522	BL02RN1-R62	70-090122
L523	BL02RN1-R62	70-090122
L524	BL02RN1-R62	70-090122
L525	BL01RN1-A62	70-090483
L526	BL01RN1-A62	70-090483
L527	BL01RN1-A62	70-090483
L529	BL01RN1-A62	70-090483
L711	LQH3N2R2M02M00-100	70-090477
L712	LQH3N2R2M02M00-100	70-090477
L713	L-1S7-M1 2.5T	70-090501
L714	LQH3N2R2M02M00-100	70-090477
L715	LQH3N2R2M02M00-100	70-090477
L716	LQH3N2R2M02M00-100	70-090477
L717	LQN2A22NM	70-090412
L731	LQH3N2R2M02M00-100	70-090477
L732 A	1 kOHM, 1/10 W, METAL	70-144125
L732 B	LQH3N2R2M02M00-100	70-090477
L733	L-1S7-M1 1.5T	70-090597
L734	LQH3N2R2M02M00-100	70-090477
L735	LQH3N2R2M02M00-100	70-090477
L736	LQH3N2R2M02M00-100	70-090477
L737	LQN2A22NM	70-090412
L751	LQN2A22NM	70-090412
L771	LQN2A22NM	70-090412

REF NO.	DESCRIPTION	PART NO.
	TRANSISTORS	
Q1	2SC2462C-TR(LC)	70-080288
Q2	2SC2462C-TR(LC)	70-080288
Q101	2SC2620B	70-080161
Q102	2SC2462C	70-080288
Q131	2SC3357-T2	70-080298
Q201	2SC3357-T2	70-080375
Q202	2SC3357-T2	70-080375
Q203	2SC3357-T2	70-080375
Q241	2SK125	70-080089
Q242	2SK360E	70-080362
Q243	2SC2462C-TR	70-080288
Q244	2SC2462C-TR	70-080288
Q301	DTC124EK-T1	70-080300
Q302	IMH1-T1	70-080296
Q401	IMX2-T108	70-080363
Q403	IMX2-T108	70-080363
Q406	2SC2462C-TR	70-080288
Q408	2SK508K52-T2NV	70-080324
Q410	2SC2462-TR	70-080288
Q411	2SD1264A-P	70-080424
Q501	MRF559	70-080129
Q502	2SC2283KA	70-080118
Q503	2SC2285B	70-080119
Q504	2SB1065Q	70-080367
Q505	2SC2905	70-080142
Q701	2SC2462LC	70-080288
Q702	IMB3-T110	70-080364
Q703	IMH1-T1	70-080296
Q704	2SA1121C	70-080289
Q705	DTC124EK	70-080274
Q711	2SK508 K52	70-080191
Q712	2SC2351	70-080218
Q713	2SC3356-T2	70-080411
Q731	2SK508 K52	70-080191
Q732	2SC2351	70-080218
Q733	2SC3356-T2	70-080411
Q751	2SC3356-T2	70-080411
Q771	IMD3-T1	70-080297
Q772	DTC124EK	70-080300
Q773	2SC2462LC	70-080288
Q774	2SA1121C-TR	70-080339
Q775	2SA1121C-TR	70-080339
Q776	2SC2462LC	70-080288
Q778	IMH1-T1	70-080296
Q901	2SC1213C	70-080096
	RESISTORS	
R1	10 kOHM, 1/10 W, METAL	70-144120
R2	12 kOHM, 1/10 W, METAL	70-144111
R3	10 kOHM, 1/10 W, METAL	70-144121
R4	100 kOHM, 1/10 W, METAL	70-144321
R5	100 kOHM, 1/10 W, METAL	70-144321
R6	150 kOHM, 1/10 W, METAL	70-144129
R7	220 kOHM, 1/10 W, METAL	70-144131
R9	1 kOHM, 1/10 W, METAL	70-144125
R10	27 kOHM, 1/10 W, METAL	70-144163
R11	470 kOHM, 1/10 W, METAL	70-144199
R12	1.0 kOHM, 1/10 W, METAL	70-144125
R14	3.3 kOHM, 1/10 W, METAL	70-144118
R15	1 kOHM, 1/10 W, METAL	70-144125
R16	1 kOHM, 1/10 W, METAL	70-144125
R17	39 kOHM, 1/10 W, METAL	70-144196
R20	100 OHM, 1/10 W, METAL	70-144321
R50	820 OHM, 1/10 W, METAL	70-144165
R51	24 kOHM, 1/10 W, METAL	70-144306
R53	27 kOHM, 1/10 W, METAL	70-144163
R54	4.3 kOHM, 1/10 W, METAL	70-144307
R55	560 kOHM, 1/10 W, METAL	70-144308
R56	18 kOHM, 1/10 W, METAL	70-144195
R57	56 kOHM, 1/10 W, METAL	70-144169
R58	12 kOHM, 1/10 W, METAL	70-144111
R59	150 kOHM, 1/10 W, METAL	70-144129
R60	270 OHM, 1/10 W, METAL	70-144116

TR-423 BOARD (Continued)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R61	180 kOHM, 1/10 W, METAL	70-144309
R62	100 OHM, 1/10 W, METAL	70-144321
R101	47 kOHM, 1/10 W, METAL	70-145145
R102	47 kOHM, 1/10 W, METAL	70-145145
R103	47 kOHM, 1/10 W, METAL	70-145145
R104	47 kOHM, 1/10 W, METAL	70-145145
R107	1 kOHM, 1/4 W, METAL	70-144268
R108	10 kOHM, 1/10 W, METAL	70-144120
R109	4.7 kOHM, 1/10 W, METAL	70-144123
R110	2.2 kOHM, 1/10 W, METAL	70-144113
R111	1.5 kOHM, 1/10 W, METAL	70-144134
R112	10 kOHM, 1/10 W, METAL	70-144120
R113	4.7 kOHM, 1/10 W, METAL	70-144123
R114	1 kOHM, 1/10 W, METAL	70-144125
R115	100 OHM, 1/10 W, METAL	70-145136
R116	100 OHM, 1/10 W, METAL	70-145136
R117	220 OHM, 1/10 W, METAL	70-144194
R123	220 kOHM, 1/10 W, METAL	70-144131
R124	47 kOHM, 1/10 W, METAL	70-145145
R125	47 kOHM, 1/10 W, METAL	70-145145
R131	10 OHM, 1/10 W, METAL	70-144115
R132	2.2 kOHM, 1/10 W, METAL	70-144113
R133	4.7 kOHM, 1/10 W, METAL	70-144123
R134	47 OHM, 1/10 W, METAL	70-144130
R136	27 OHM, 1/10 W, METAL	70-144160
R137	0 OHM, 1/10 W, METAL	70-144106
R201	2.2 kOHM, 1/10 W, METAL	70-144113
R202	8.2 kOHM, 1/10 W, METAL	70-144305
R203	47 kOHM, 1/10 W, METAL	70-144160
R205	2.2 kOHM, 1/10 W, METAL	70-144166
R206	8.2 kOHM, 1/10 W, METAL	70-140160
R207	22 kOHM, 1/10 W, METAL	70-144150
R208 A	120 kOHM, 1/10 W, METAL	70-144166
R209	22 kOHM, 1/10 W, METAL	70-144160
R210	150 OHM, 1/10 W, METAL	70-140321
R210 B	180 kOHM, 1/10 W, METAL	70-144150
R211 A	39 OHM, 1/10 W, METAL	70-144124
R211 B	27 kOHM, 1/10 W, METAL	70-144219
R212 A	150 OHM, 1/10 W, METAL	70-140321
R212 B	180 kOHM, 1/10 W, METAL	70-144150
R213	22 kOHM, 1/10 W, METAL	70-144160
R214	2.2 kOHM, 1/10 W, METAL	70-144113
R215	4.7 kOHM, 1/10 W, METAL	70-144123
R216	47 kOHM, 1/10 W, METAL	70-144113
R220	270 OHM, 1/10 W, METAL	70-144116
R221	18 OHM, 1/10 W, METAL	70-144171
R222	270 OHM, 1/10 W, METAL	70-144116
R241	47 OHM, 1/10 W, METAL	70-145130
R242	220 OHM, 1/10 W, METAL	70-144194
R243	3.3 kOHM, 1/10 W, METAL	70-144118
R244	10 kOHM, 1/10 W, METAL	70-144120
R245	330 OHM, 1/10 W, METAL	70-144120
R246	3.9 kOHM, 1/10 W, METAL	70-145132
R247	33 kOHM, 1/10 W, METAL	70-145112
R248	22 kOHM, 1/10 W, METAL	70-145121
R249	150 OHM, 1/10 W, METAL	70-144321
R254	0 OHM, 1/10 W, METAL	70-144106
R255	1.2 kOHM, 1/10 W, METAL	70-144167
R256	82 kOHM, 1/10 W, METAL	70-144173
R257	47 kOHM, 1/10 W, METAL	70-145145
R258	220 kOHM, 1/10 W, METAL	70-144131
R259	1 kOHM, 1/10 W, METAL	70-144125
R260	5.6 kOHM, 1/10 W, METAL	70-144168
R261	3.3 kOHM, 1/10 W, METAL	70-144118
R262	82 kOHM, 1/10 W, METAL	70-144173
R263	10 kOHM, 1/10 W, METAL	70-144120
R264	27 kOHM, 1/10 W, METAL	70-144163
R265	15 kOHM, 1/10 W, METAL	70-144122
R266	47 kOHM, 1/10 W, METAL	70-145145
R271	10 kOHM, 1/10 W, METAL	70-144423
R272	10 kOHM, 1/10 W, METAL	70-144120
R273	4.7 kOHM, 1/10 W, METAL	70-145134
R275	33 OHM, 1/10 W, METAL	70-140320
R301	680 OHM, 1/10 W, METAL	70-144157
R302	22 kOHM, 1/10 W, METAL	70-144121
R303	270 OHM, 1/10 W, METAL	70-144116
R304	270 OHM, 1/10 W, METAL	70-144116
R305	220 kOHM, 1/10 W, METAL	70-144131

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R314	150 OHM, 1/8 W, METAL	70-144011
R316	150 OHM, 1/8 W, METAL	70-144011
R317	3.3 OHM, 2 W, METAL	70-145050
R401	270 kOHM, 1/4 W, METAL	70-144193
R402	22 kOHM, 1/10 W, METAL	70-144121
R403	100 kOHM, 1/10 W, METAL	70-144321
R404	33 kOHM, 1/10 W, METAL	70-144112
R405	1 kOHM, 1/10 W, METAL	70-144125
R406	100 kOHM, 1/10 W, METAL	70-144321
R407	100 kOHM, 1/10 W, METAL	70-144321
R408	100 kOHM, 1/10 W, METAL	70-144321
R409	100 kOHM, 1/10 W, METAL	70-144321
R410	33 kOHM, 1/10 W, METAL	70-144112
R411	22 kOHM, 1/10 W, METAL	70-144121
R412	10 kOHM, 1/10 W, METAL	70-144120
R413	1 kOHM, 1/10 W, METAL	70-144125
R414	15 kOHM, 1/10 W, METAL	70-144122
R415	150 kOHM, 1/10 W, METAL	70-144129
R416	68 kOHM, 1/10 W, METAL	70-144119
R417	4.7 kOHM, 1/10 W, METAL	70-144123
R418	100 OHM, 1/10 W, METAL	70-145136
R419	330 kOHM, 1/10 W, METAL	70-144318
R421	22 kOHM, 1/10 W, METAL	70-144121
R422	22 kOHM, 1/10 W, METAL	70-144121
R423	100 kOHM, 1/10 W, METAL	70-144321
R424	56 kOHM, 1/10 W, METAL	70-144169
R425	12 kOHM, 1/10 W, METAL	70-144411
R426	47 kOHM, 1/10 W, METAL	70-145145
R427	47 kOHM, 1/10 W, METAL	70-145145
R428	47 kOHM, 1/10 W, METAL	70-145145
R429	2.7 kOHM, 1/10 W, METAL	70-144159
R430	1 kOHM, 1/10 W, METAL	70-144125
R432	22 OHM, 1/10 W, METAL	70-144160
R433	22 OHM, 1/10 W, METAL	70-144160
R440	150 kOHM, 1/10 W, METAL	70-144287
R441	100 kOHM, 1/10 W, METAL	70-144288
R442	1 kOHM, 1/10 W, METAL	70-144289
R443	39 kOHM, 1/10 W, METAL	70-144290
R444	82 kOHM, 1/10 W, METAL	70-144291
R445	100 kOHM, 1/10 W, METAL	70-144321
R446	2.2 kOHM, 1/10 W, METAL	70-144113
R447	4.7 kOHM, 1/10 W, METAL	70-144123
R448	1 kOHM, 1/10 W, METAL	70-144125
R449	2.7 kOHM, 1/10 W, METAL	70-144159
R452	330 OHM, 1/10 W, METAL	70-144164
R453	10 OHM, 1/8 W, METAL	70-144068
R454	10 OHM, 1/8 W, METAL	70-144068
R455	10 kOHM, 1/10 W, METAL	70-144120
R456	10 kOHM, 1/10 W, METAL	70-144120
R457	2.2 kOHM, 1/10 W, METAL	70-144113
R456	330 OHM, 1/10 W, METAL	70-144164
R461	1 kOHM, 1/10 W, METAL	70-144125
R462	3.3 kOHM, 1/10 W, METAL	70-144118
R463	560 OHM, 1/10 W, METAL	70-144130
R464	2.7 kOHM, 1/10 W, METAL	70-144159
R465	100 kOHM, 1/10 W, METAL	70-144321
R466	47 kOHM, 1/10 W, METAL	70-145145
R467	47 kOHM, 1/10 W, METAL	70-145145
R470	22 kOHM, 1/10 W, METAL	70-144121
R472	22 kOHM, 1/10 W, METAL	70-144121
R501	270 OHM, 1/10 W, METAL	70-144116
R502	18 OHM, 1/10 W, METAL	70-144171
R503	270 OHM, 1/10 W, METAL	70-144116
R504	10 OHM, RSF1BL15, METAL	70-144411
R508	47 OHM, RSF1BL15, METAL	70-144434
R509	470 OHM, 1/10 W, METAL	70-144156
R510	470 OHM, 1/10 W, METAL	70-144156
R511	470 OHM, 1/10 W, METAL	70-144156
R515	100 OHM, 1/10 W, METAL	70-144009
R516	100 OHM, 1/10 W, METAL	70-144009
R517	1 MOHM, 1/10 W, METAL	70-144321
R518	1 MOHM, 1/10 W, METAL	70-144321
R519	100 kOHM, 1/10 W, METAL	70-144136
R520	100 kOHM, 1/10 W, METAL	70-144136
R521 A	1 kOHM, 1/10 W, METAL	70-144125
R521 B	5.6 kOHM, 1/10 W, METAL	70-144168
R522	1.2 kOHM, 1/10 W, METAL	70-144167
R523	47 OHM, 1/10 W, METAL	70-144130

TR-423 BOARD (Continued)

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R525	47 OHM, 1/10 W, METAL	70-144006
R551	1 kOHM, 1/10 W, METAL	70-144125
R701	220 OHM, 1/10 W, METAL	70-144194
R702	47 kOHM, 1/10 W, METAL	70-145145
R704	47 kOHM, 1/10 W, METAL	70-145145
R705	47 kOHM, 1/10 W, METAL	70-145145
R706	47 kOHM, 1/10 W, METAL	70-145145
R707	220 kOHM, 1/10 W, METAL	70-144194
R708	4.7 kOHM, 1/10 W, METAL	70-144123
R711	47 OHM, 1/10 W, METAL	70-145130
R714	47 OHM, 1/10 W, METAL	70-145130
R715	47 OHM, 1/10 W, METAL	70-145130
R716	220 OHM, 1/10 W, METAL	70-144194
R717	2.2 kOHM, 1/10 W, METAL	70-144113
R718	6.8 kOHM, 1/10 W, METAL	70-145139
R719	100 OHM, 1/10 W, METAL	70-145136
R720	4.7 kOHM, 1/10 W, METAL	70-144123
R721	5.6 kOHM, 1/10 W, METAL	70-144168
R722	270 OHM, 1/10 W, METAL	70-144116
R731	47 OHM, 1/10 W, METAL	70-145130
R732	47 kOHM, 1/10 W, METAL	70-145145
R733	47 kOHM, 1/10 W, METAL	70-145145
R734	47 OHM, 1/10 W, METAL	70-145130
R735	47 OHM, 1/10 W, METAL	70-145130
R736	150 OHM, 1/10 W, METAL	70-140321
R737	1 kOHM, 1/10 W, METAL	70-144125
R738	3.3 kOHM, 1/10 W, METAL	70-144118
R739	47 OHM, 1/10 W, METAL	70-145130
R740	4.7 kOHM, 1/10 W, METAL	70-144123
R741	2.2 kOHM, 1/10 W, METAL	70-144113
R742	270 OHM, 1/10 W, METAL	70-144116
R743	220 OHM, 1/10 W, METAL	70-144194
R751	4.7 kOHM, 1/10 W, METAL	70-144123
R752	5.6 kOHM, 1/10 W, METAL	70-144168
R753	270 OHM, 1/10 W, METAL	70-144116
R754	47 OHM, 1/10 W, METAL	70-145130
R770	47 kOHM, 1/10 W, METAL	70-145145
R771	1 MOHM, 1/10 W, METAL	70-144321
R772	22 OHM, 1/10 W, METAL	70-144160
R773	1 MOHM, 1/10 W, METAL	70-144321
R774	1 kOHM, 1/10 W, METAL	70-144125
R776	47 kOHM, 1/10 W, METAL	70-145145
R777	4.7 kOHM, 1/10 W, METAL	70-144123
R778	1 MOHM, 1/10 W, METAL	70-144120
R779	22 kOHM, 1/10 W, METAL	70-144121
R780	0 OHM, 1/10 W, METAL	70-144106
R782	4.7 kOHM, 1/10 W, METAL	70-144123
R783	47 kOHM, 1/10 W, METAL	70-145145
R784	47 kOHM, 1/10 W, METAL	70-145145
R785	100 kOHM, 1/10 W, METAL	70-144321
R786	22 kOHM, 1/10 W, METAL	70-144121
R787	100 OHM, 1/10 W, METAL	70-145136
R788	22 OHM, 1/10 W, METAL	70-144160
R789	4.7 kOHM, 1/10 W, METAL	70-144123
R790	1 kOHM, 1/10 W, METAL	70-144125
R791	1.5 kOHM, 1/10 W, METAL	70-144134
R792	4.7 kOHM, 1/10 W, METAL	70-144123
R793	47 kOHM, 1/10 W, METAL	70-145145
R794	1.5 kOHM, 1/10 W, METAL	70-144134
R795	47 kOHM, 1/10 W, METAL	70-145145
R796	22 kOHM, 1/10 W, METAL	70-144121
R797	5.6 kOHM, 1/10 W, METAL	70-144168
R798	1 kOHM, 1/10 W, METAL	70-144125
R799	2.7 kOHM, 1/10 W, METAL	70-144159
R911	22 kOHM, 1/10 W, METAL	70-144121
R912	22 kOHM, 1/10 W, METAL	70-144121
R913	22 kOHM, 1/10 W, METAL	70-144121
R914	22 kOHM, 1/10 W, METAL	70-144121
R915	22 kOHM, 1/10 W, METAL	70-144121
R916	22 kOHM, 1/10 W, METAL	70-144121
R918	22 kOHM, 1/10 W, METAL	70-144121
R921	1 kOHM, 1/10 W, METAL	70-144125
R922	1 kOHM, 1/10 W, METAL	70-144125
R923	1 kOHM, 1/10 W, METAL	70-144125
R924	1 kOHM, 1/10 W, METAL	70-144125
R925	1 kOHM, 1/10 W, METAL	70-144125
R926	1 kOHM, 1/10 W, METAL	70-144125
R931	47 kOHM, 1/10 W, METAL	70-145145

REF NO.	DESCRIPTION	PART NO.
	RESISTORS (CONTINUED)	
R932	47 kOHM, 1/10 W, METAL	70-145145
R933	47 kOHM, 1/10 W, METAL	70-145145
R935	22 kOHM, 1/10 W, METAL	70-144121
R936	0 OHM, 1/10 W, METAL	70-144106
R937	1 kOHM, 1/10 W, METAL	70-144125
R945	1 kOHM, 1/10 W, METAL	70-144125
R946	1 kOHM, 1/10 W, METAL	70-144125
R947	1 kOHM, 1/10 W, METAL	70-144125
R948	1 kOHM, 1/10 W, METAL	70-144125
R949	1 kOHM, 1/10 W, METAL	70-144125
R951	1 kOHM, 1/10 W, METAL	70-144125
R952	1 kOHM, 1/10 W, METAL	70-144125
R953	1 kOHM, 1/10 W, METAL	70-144125
R954	1 kOHM, 1/10 W, METAL	70-144125
R955	1 kOHM, 1/10 W, METAL	70-144125
R957	1 kOHM, 1/10 W, METAL	70-144125
R959	10 kOHM, 1/10 W, METAL	70-144120
R961	1 kOHM, 1/10 W, METAL	70-144125
R963	1 kOHM, 1/10 W, METAL	70-144125
R964	22 kOHM, 1/10 W, METAL	70-144121
R965	1 kOHM, 1/10 W, METAL	70-144125
R966	10 kOHM, 1/10 W, METAL	70-144120
R967	22 kOHM, 1/10 W, METAL	70-144121
R968	10 kOHM, 1/10 W, METAL	70-144120
R970	6.8 kOHM, 1/10 W, METAL	70-144139
R971	47 kOHM, 1/10 W, METAL	70-145145
R975	100 kOHM, 1/10 W, METAL	70-144321
R978	100 kOHM, 1/10 W, METAL	70-144321
R979	22 kOHM, 1/10 W, METAL	70-144121
R980	10 kOHM, 1/10 W, METAL	70-144120
R981	1 kOHM, 1/10 W, METAL	70-144125
R982	1 kOHM, 1/10 W, METAL	70-144125
R983	22 kOHM, 1/10 W, METAL	70-144121
R984	1 kOHM, 1/10 W, METAL	70-144125
R985	3.9 kOHM, 1/10 W, METAL	70-145132
R986	4.7 kOHM, 1/10 W, METAL	70-144123
R988	1 MOHM, 1/10 W, METAL	70-144155
R989	1 kOHM, 1/10 W, METAL	70-144125
R991	22 kOHM, 1/10 W, METAL	70-144121
R992	10 kOHM, 1/10 W, METAL	70-144120
R996	10 kOHM, 1/10 W, METAL	70-144120
R997	100 kOHM, 1/10 W, METAL	70-144321
	VARIABLE RESISTORS	
RV1	RH064JC47KB, METAL	70-164123
RV241	2.2K RH062KCJ3	70-164109
RV301	10K RK097111	70-164097
RV401	100K RH062KC15	70-164110
RV402	10K RH064JC14	70-164122
RV403	100K RH064JC15	70-164110
	SWITCHES	
S301	PUSH SWITCH SPUP19F	70-183122
S304	PUSH SWITCH SPUP19F	70-183122
S305	PUSH SWITCH SPUP19F	70-183122
S306	SWITCH SSSJ12	70-183123
	CRYSTALS	
X101	HC-431U 12.8 MHz	70-128111
X241	UM-1 44.545 MHz	70-128098
X901	AT-51 8.000 MHz	70-128114
	MISCELLANEOUS	
CM701	IL-S-2P-S2T2-EF	70-159399
CV501	(10 pF) VARIABLE CAPACITOR	70-123034
F501	FUSE	70-204080
RC901	RC NETWORK RC90191 CRB602	70-086073
RC902	RC NETWORK RC90201 CRB402	70-086074
SP301	SPEAKER	70-060037
	INSULATION PLATE	70-157357
	SHIELD CASE 7SM	70-089339
	LED ASSEMBLY	CX-103

REPLACEMENT PARTS ORDERING

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

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

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