MIDLAND SYN-TECH™

VHF (WIDE BAND)

SERVICE MANUAL

70-342XL / 442XL

MIDLAND LMR
LAND MOBILE RADIO

1690 North Topping Avenue
Kansas City, Missouri 64120

MANUAL NO. 70-342442
09-342/442XL
SM-8/86-1.5M

This service manual is intended to facilitate set-up and service of the 70-342XL and 70-442XL transceivers. In the first section of this manual, after transceiver description and specifications, instructions for transceiver preparation are found-- programming, calibration, installation, and summaries of available support equipment.

The second section of this service manual, entitled SERVICING, is dedicated to transceiver repair. Troubleshooting flow charts for locating likely problem areas are in the beginning of this section. General information follows, such as chip component identification and replacement instructions and realignment procedures.

Transceiver circuitry is contained on three PC boards and categorized herein respectively. Each PC board is detailed in text, charts, and diagrams; all of which can be viewed with their respective schematics. Each schematic page has a list of other applicable diagrams that can be viewed with it.

Because the PC boards have components and plating on both sides, layout diagrams show superimposed images of plating patterns and respective other-side-component maps. Any double-image layout of the three PC boards can be viewed with their respective schematic without turning pages.

Information in this book is focused on the basic transceiver. Because of the variety of readers' requirements, details of option add-ons are not included. A divider at the end of this book, entitled OPTIONS, is provided for allocating technical literature acquired with each add-on kit.

As necessary, service manual supplements will be published and distributed on the following forms:

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

Change Notice (CN).....For circuitry change details 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.

Many useful facts and tips are provided in the text. If the reader intends to service several of the transceivers described herein, spending time to read applicable text will save time in the end.

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The MIDLAND SYN-TECH 70-342XL and 70-442XL VHF wide-band Land-Mobile transceivers are mobile two-way radios designed to operate on FM channels between 136 to 174 MHz. There are two varieties of the SYN-TECH 70-342XL and 70-442XL transceivers, each designed to operate on a different channel frequency range: the A-band radios (70-342AXL & 70-442AXL) on the 136-163 MHz range; the B-band radios (70-342BXL & 70-442BXL) on the 148-174 MHz range. SYN-TECH transceivers have the capacity to operate on up to eighty operator selectable channels, each of which can be programmed in the service shop.

The SYN-TECH 70-342XL transceiver is configured for under-dash mounting. It has a control knobs, push buttons, and display all on a front panel for easy access to the operator. The SYN-TECH 70-442XL transceiver is configured for mounting in a vehicle trunk or other remote location. It does not have front panel controls; instead it has a 34-pin receptacle in its face-piece. The receptacle accepts the 4-meter long Control Cable that interconnects the 70-442XL remote unit with its Control Head. The Control Head contains all the operator controls and is much smaller in size for mounting where accessible by the operator.

As the SYN-TECH 70-342 and 70-442 transceivers, the XL models are wide-band radios. Electronic tuning of critical stages is used to allow them to operate over a 24 MHz spread of channel frequencies.

The XL models are revised 70-342 and 70-442 transceivers that used 5 KHz for their main VCO comparator frequency. The 70-342XL and 70-442XL models use 2.5 KHz, thus allowing channel frequency increments of 2.5 KHz for half-channels.

Many optional features, such as CTCSS, can be added at the factory. Complete add-on kits for field installation are readily available. A listing with brief kit descriptions can be found in later sections.

Operating parameters such as channel frequencies, CTCSS frequencies, and a variety of feature timing and codes are electronically contained in an alterable memory module for easy customizing. The plug-in memory module is reprogrammable in the service shop using the MIDLAND E/PROM Programmer.

The 70-342XL and 70-442XL transceivers contain three major printed circuit boards. The Transmitter Board contains transmitter, synthesizer, and microprocessor control circuitry. It lays horizontally, with components facing up, on the top side of the chassis center divider. The Receiver Board also lays horizontally, but on the underside of the chassis divider with components facing down. The third PC board is the RF Power Amplifier Board located inside the rear heat sink. It is accessible by removal of the heat sink top cover.

G E N E R A L

OPERATING VOLTAGE: Nominal.....13.6 VDC, negative ground
Range.....10.5 to 16 VDC

TEMPERATURE RANGE.....-30°C to +60°C

ANTENNA IMPEDANCE.....50 ohms, unbalanced

MICROPHONE.....Dynamic element (with amplifier)

FREQUENCY CONTROL.....Phase-Lock-Loop synthesized with EPROM Programming

FREQUENCIES OF OPERATION:
Models 70-342AXL/442AXL.....136 to 162 MHz
Models 70-342BXL/442BXL.....148 to 174 MHz

CHANNEL CAPABILITY: Standard.....Up to 80 transmit and 80 receive

CHANNEL FREQUENCY SPREAD without retuning:
Transmit.....24 MHz maximum
Receive.....24 MHz maximum

FREQUENCY TOLERANCE AND STABILITY..+/- 5 ppm both TX and RX (standard)
+/- 2.5 ppm optional
+/- 2.0 ppm optional

DUTY CYCLE.....Intermittent. 1 min TX, 4 min RX (Per EIA RS-152B)

HIGH HUMIDITY.....95% at 50°C per EIA RS-152B, sec.13

VIBRATION STABILITY.....Per EIA RS-152B, sec. 14

SHOCK STABILITY.....Per EIA RS-152B, sec. 15

CURRENT DRAIN:
Standby.....0.35 ampere DC (max)
Receive.....1.00 ampere DC (max)
Transmit (40W @ 50ohms)....8.50 amperes DC (max)

DIMENSIONS (H x W x D):
Transceiver (70-342XL/442XL)....65x188x270mm (2.6" x 7.4" x 10.6")
Control Head for 70-442XL.....50x88x80mm (2" x 3.5" x 3.2")
Speaker for 70-442XL.....100x100x77mm (4" x 4" x 3")

WEIGHT:
Transceiver (70342XL/442XL).....3.15 Kg (6.96 lb)
Control Head for 70-442XL.....0.8 Kg (1.8 lb)
Speaker for 70-442XL.....0.71 Kg (1.58 lb)

--All specifications subject to change without notice.--

T R A N S M I T T E R

Refer to EIA RS-152B and DOC RSS-119-Issue 3 for Method of Measurement and Standard of Performance.

CARRIER POWER OUTPUT.....40 watts minimum, adjustable from 20 to 40 watts

MODULATION SYSTEM.....Phase Modulation

AUDIO FREQUENCY RESPONSE.....Per EIA and DOC specifications

AUDIO HARMONIC DISTORTION.....3% THD (1 KHz tone at 3.0 KHz deviation)

SYSTEM DEVIATION.....+/-5 KHz maximum

MODULATION LIMITING.....Instantaneous peak clipping with low-pass audio filtering

HUM AND NOISE.....50 dB

OCCUPIED BANDWIDTH.....Less than -60 dB of carrier power 30 KHz outside carrier frequency

TRANSMIT CARRIER ATTACK TIME.....100 ms max. for 50% rated power

CONDUCTED SPURIOUS EMISSIONS.....Less than 25 uW from 1 to 1000 MHz

MICROPHONE INPUT LEVEL.....-8 dBm +/-3 dB at 600 ohms

OUTPUT PROTECTION: Shall withstand without damage, 5 minutes of operation into a 20:1 load mis-match with any standing wave variance.

OUTPUT STABILITY: Shall not exceed spurious emission limits herein while operating into a 5:1 load mis-match with full standing-wave variance.

--All specifications subject to change without notice--

R E C E I V E R

Refer to EIA RS-204C and DOC RSS-119 for Method of Measurement and Standard of Performance.

SENSITIVITY: 12 dB SINAD.....0.25 uV into 50 ohms

SQUELCH SENSITIVITY: Tight.....1.0 uV minimum, 2.0 uV maximum
Threshold....0.2 uV maximum or 6 dB SINAD

SQUELCH BLOCKING.....13 dB

RECEIVER ATTACK TIME.....100 ms
(squelch release)

RECEIVER SQUELCH CLOSING TIME.....200 ms

ACCEPTABLE RF DISPLACEMENT.....+/- 3.5 KHz minimum

ADJACENT CHANNEL REJECTION.....80 dB at +/-30 KHz

SPURIOUS RESPONSE IMMUNITY.....85 dB

INTERMODULATION IMMUNITY.....75 dB

AUDIO POWER OUTPUT:
Under-Dash Radio (70-342XL).....1 watt at 5% THD into its internal speaker, or
5 watts 5% THD into a 3.2 ohm external speaker
Trunk-Mount Radio (70-442XL)....5 watts at 5% THD into the 3.2 ohm external speaker

AUDIO FREQUENCY RESPONSE.....Per EIA and DOC specifications

HUM AND NOISE: Un-squelched.....40 dB
Squelched.....50 dB

CONDUCTED SPURIOUS EMISSIONS.....200 uV across 50 ohms (800 pW) from DC to 1 GHz

INTERMEDIATE FREQUENCIES.....21.4 MHz (1st) and 455 KHz (2nd)

--All specifications subject to change without notice--

S C A N O P T I O N

Several of these parameters are programmable by E/PROM programming.

CHANNEL CAPACITY.....2 scan groups of 64 each (duplicates allowed)

OPERATOR CONTROL OF SCAN.....Three modes selectable by push buttons

PRIORITY CHANNEL SELECTION.....Any channel selectable by the operator using the channel push buttons

INDICATION OF PRIORITY DETECTION...Two-beep audible alert (elective)

KEY-UP CHANNEL REVERT.....Transceiver transmits on Priority channel or last stopped channel (depending on scan mode selected)

EXTRANEOUSLY BUSY CHANNEL SKIP.....Channels can be skipped in scan by DOWN channel selection

PRIORITY CHANNEL SAMPLING RATE.....Every 4 or 8 channels, or every 1 or 2 seconds during scan hold

SIGNAL DETECTION.....of carrier presence or vacancy; or of correct CTCSS tone presence or vacancy with carrier

SCAN RESUME DELAY.....0.3, 2.5, or 5 seconds or lock & hold until reset

SCAN SPEED (with standard timing):
  Noise squelch busy detection.....20 idle channels per second
  CTCSS detection.....3 channels per second if all busy

C T C S S O P T I O N

CODE FREQUENCIES.....All EIA standard from 67 to 241.8Hz

MODULATION LIMITS.....500 to 1000 Hz carrier deviation

DECODE SENSITIVITY.....Less than 5 dB SINAD

RECEIVER RESPONSE TIME.....200 ms maximum

ENCODER RESPONSE TIME.....50 ms maximum

TRANSMITTER TONE DISTORTION.....5% maximum

AUDIO DISTORTION WITH CTCSS TONE...10%

--All specifications subject to change without notice--

The 70-342XL and 70-442XL transceivers contain an Erasable/Programmable Read Only Memory (E/PROM) module. The module holds specific customer frequencies, feature selections, and other parameters that determine radio operation.

Before final alignment and check, the module must be reprogrammed with customer specifics. If any option add-on kits are to be installed, appropriate parameters may also need to be programmed as instructed in respective kit installation literature.

To change E/PROM electronic information, the plug-in module must first be erased by exposing it to ultraviolet light using the MIDLAND 70-1100/1101 E/PROM Eraser. Then, reprogramming is necessary using the MIDLAND 70-1000 E/PROM Programmer. Operation parameter information is entered into the Programmer through its keypad, converted into binary data useful to the transceiver, then written into the E/PROM.

The following are programmable operation parameters in the SYN-TECH mobile transceivers. See the 70-1000 E/PROM Programmer Operator's Manual (No. 70-999113) for details.

1. All eighty transmit and eighty receive channel frequencies
2. All standard CTCSS tones for each TX and RX channel (requires installation of the CTCSS module within the transceiver)
3. Time-out-timer time (maximum continuous transmission duration)
4. Scan parameters as follows:
    a. Two scan groups, each containing up to sixty-four channels
    b. A variety of priority/scan channel revert arrangements utilizing the two channel lists.
    c. Either presence or absence of carrier or correct CTCSS tone to indicate a busy channel
    d. Channel sampling rate (time spent looking for carrier presence on each channel)
    e. CTCSS decode time (time allotted for decoding after carrier is detected)
    f. Scan hold time (delay of scan resume after channel clears)
    g. Post-transmit scan hold time (delay of scan resume after PTT release)
    h. Retention of scan list channels deleted (skipped) by operator activation of the DOWN selector while in scan mode. Normally, these selections are erased by release of the SCAN and PRI push buttons and power-down. Programming limits erasure to power-down only.
5. Busy channel lockout with or without alert tone to the operator. Adding jumpers allows busy channel inhibit by CTCSS tone status. See "BCLO JUMPERING".
6. Transmit-to-receive changeover delay of up to 200ms for special options.
7. Last selected channel recall on power-up may be disabled.

H1 VERSION UPGRADE

The E/PROM programmer, model 70-1000, must contain H1 or later version software to program all features and parameters into the Z-273 E/PROM modules that are used in the 70-342XL and 70-442XL transceivers. The version level of software installed in the programmer is identified for one second in the two far right digits displayed after power-up. If your programmer contains software that is older (lower letter) than the H1 version, upgrade is required. To date of this printing, the newer L3 version software is current and available (in its own E/PROM) in Update Kit No. 70-1411. The 70-1000 Operator's Manual also has been rewritten. The May, 1985 printing can be ordered as MIDLAND part number 70-999113.

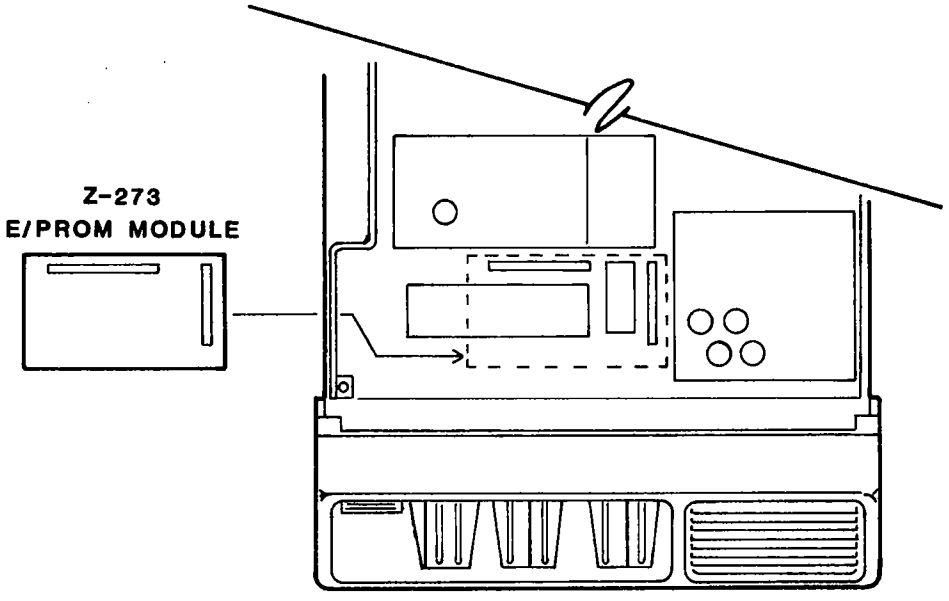
CDCSS OPTION

If the Continuous Digital Coded Squelch System option is installed in the transceiver, the E/PROM Module is different. This Module, MIDLAND number 70-2402, is larger in size to accommodate an additional receptacle for connection to the CDCSS board. When programming, the E/PROM type selection entered into the Programmer is the same as for the standard E/PROM.

E/PROM MODULE REMOVAL

The E/PROM module is a small (1" x 2") plug-in printed circuit board that contains IC951 and IC952, and is labeled Z-273. It is located on the Transmitter Board, over the microprocessor IC901. For replacement purposes, the E/PROM module model number is 70-2401.

Always disconnect primary power to the transceiver before removing the E/PROM module. Loosen the four transceiver top cover screws and lift the cover off. Pull the E/PROM module straight upward to separate it from its two connectors (see below).



70-342XL OR 70-442XL TRANSCEIVER

E/PROM MODULE LOCATION

PROGRAMMING

The following E/PROM programming procedure covers most programming for transceiver operation. Certain infrequently modified parameters are excluded (parameters listed as 4h, 6, and 7 on page nine). Complete programming procedures can be found in the Programmer Operator's Manual.

Heed this precaution:
Do not apply or remove AC-line power to the Programmer while an E/PROM module is plugged into it. It is not necessary, nor advisable, to plug the module onto the Programmer until all parameter information is keystroke entered. Connect the module only when ready for the BLANK-WRITE-VERIFY operation (step 25).

--E/PROM Erasure--

1. Erase the E/PROM module in the 70-1100/1101 Eraser. Assure the E/PROM window is clean, and set exposure time for 45 minutes. Refer to the Eraser instruction manual for details.

--Heading Entry--

2. Turn the 70-1000 Programmer on. One of these self-test messages must appear in the FREQUENCY display for one second: "PASSOL3", "PASS1L3", "PASSOH1", or "PASS1H1". The last two digits indicate the required software revision level H1 or L3 is installed in the programmer. After two seconds, "TYP" should appear in the BAND display. If an earlier version software is installed, see H1 VERSION UPGRADE preceding.

3. Enter the heading (not necessary for transceiver operation, but recommended for organization) by pressing [MANUAL], then [ENTER], then the following:
    a. The second part of the transceiver model number ('342A', for example). Then [ENTER].
    b. Transceiver eight digit serial number (ex.: '12345678'). Then [ENTER].
    c. First three digits of a ten digit customer number (ex.: '123'). Then [ENTER].
    d. The last seven digits of the customer number (ex.: '9ABCDEF'). Then [ENTER].
    e. The month numerically (ex.: March = '3'). Then [/].
    f. The date ('1' through '31'). Then [/].
    g. The last two digits of the year (ex.: '86'). Then [ENTER].
    h. Press [RESET] to close heading sequence.

--E/PROM Type Selection--

4. Press [1] to select the standard Z-273 E/PROM Module. "Z-273" should appear. (If the transceiver contains either Talk-Around option 70-2815 or 70-2816, select the Z-273TA E/PROM Module type by pressing [7] instead of [1]) Press [ENTER].

--Band Code--

5. Select the VHF band and 2.5 KHz PLL reference code by pressing [2], then [D]. "15d" should appear in the BAND display (if the transceiver has been modified with 70-2178 or 70-2179 High-Side Injection Kits, use band code [E] instead of [D]). Press [ENTER]. The Programmer should now be ready for channel frequency entry.

--Channel Frequency Programming--

The CHANNEL display indicates the numeric channel designator that will appear in the transceiver display. The STEP display indicates what entry is to be made for that channel--

"1" = receive frequency
"2" = receive CTCSS tone frequency or receive CDCSS code
"3" = transmit frequency
"4" = transmit CTCSS tone frequency or transmit CDCSS code

If an invalid frequency is entered in the following steps, the frequency display will flash. Press [CLEAR], then reenter the correct frequency.

6. CHANNEL "1" and STEP "1" should now be displayed. Key in the desired receive frequency for channel 1 including the decimal point. Then press [ENTER].

7. CHANNEL "1", STEP "2", should be displayed. If a coded squelch option is installed in the transceiver, the CTCSS tone frequency or CDCSS code can be entered as described below.

   CTCSS Key in the desired CTCSS tone frequency to be decoded including the decimal point (only standard EIA frequencies are valid). The digits will appear in the FREQUENCY display. Press [ENTER]. If carrier squelch operation is desired or no coded squelch option is not installed, enter zero.

   CDCSS Key in the desired three-digit standard decode code (only EIA standard codes are valid). The digits will appear in the FREQUENCY display. If signal is inverted, key [A] after digits. A "-" will appear. Press [ENTER]. If carrier squelch operation is desired or no coded squelch option is installed, enter zero.

   The Programmer contains a table of EIA standard CTCSS tone frequencies and CDCSS codes, any of which each are accessible in this mode. Press [D] to call the CTCSS tone frequencies and again to increment through them one at a time. The CDCSS codes are stacked on top of the CTCSS tone list, and should appear when scrolling past the highest CTCSS tone. Press [C] to decrement through the lists. When the desired frequency or code is displayed, press [ENTER] to program.

8. CHANNEL "1", STEP "3", should be displayed. Key in the desired transmit frequency for channel 1 including the decimal point. Then press [ENTER]. If the transmitter is to be disabled in channel 1, enter zero.

9. CHANNEL "1", STEP "4", should be displayed. If the transceiver is equipped with a coded squelch option, key in the desired CTCSS tone frequency or CDCSS code to be transmitted, or nothing for no tone/code transmission. Then press [ENTER]. The tone/code table can be used in this mode also.

10. Repeat steps 6 through 10 to program the remaining seventy-nine channels. Channels may be skipped and left unprogrammed. Channels can be scrolled and re-accessed using the up and down arrows.

--Center Frequency Programming--

To afford wideband capability, the self-tuned 70-342XL and 70-442XL transceivers switch the operating range of their VCO's when selected channel frequency crosses a range-center frequency. This switching is controlled by the microprocessor and must programmed into the E/PROM. Center Frequency values entered into the E/PROM depend on the transceiver frequency band (A-band or B-band).

11. Scroll backward through the channel list with the appropriate arrow push button. Whenever the list is looped backwards from channel 0 to channel 79, the Center Frequency 'channel' is accessed and "CF" appears in the CHANNEL display. Stop on the CF channel.

12. STEP "1" will also appear, showing readiness for receive Center Frequency entry. Key in '148.12' if the transceiver is an A-band model (136-162 MHz range) or key in '160.92' if the transceiver is a B-band model (148-174 MHz range). Press [ENTER].

13. STEP "3" will appear, showing readiness for transmit Center Frequency entry (STEP 2 and 4 do not apply, therefore do not appear with the CF channel). Key in '147.20' if the transceiver is an A-band model (136-161 MHz range) or '160.00' if the transceiver is a B-band model (148-174 MHz range). Press [ENTER].

--Scan Channel Entry--

14. Channel and tone frequency entry is complete. Press [SCAN] to begin scan channel programming sequence. The display will be blank except for the SCAN indicator.

    There are two lists of scan channels available--A and B. Each list can be up to 64 channels long. The two lists are used by the transceiver during scan operation differently, depending on selection of the PRI and SCAN push buttons and Function Mode programming. Details of operation are found in both the transceiver and the Programmer operator's manuals.

15. Press [A] to program the A list. "A" will appear in the STEP display and the first list sequence designator "0" will appear in the BAND display.

16. Key in the channel number to be scanned first in the A list, then press [ENTER]. While it is keyed, the channel number will appear in the CHANNEL display.

17. After [ENTER] is pressed, the A list sequence designator (BAND display) will increment to 1. Key in the second A scan channel and press enter. If you make an error, press [CLEAR] and re-enter. If the channel entered was left blank in the channel frequency entry steps above, the CHANNEL display will flash to indicate the error. Press [CLEAR] and enter a valid channel.

18. Continue entry of the A scan list. A channel can be entered in several scan sequence spots to cause it to be sampled more often. To scroll through the A list, press the up and down arrows to see each sequence designator assignment. The highest designator is 63.

19. When the A list entry is complete, press [B]. "b" should appear in the STEP display and the lowest B list scan sequence designator (0) should appear in the BAND display. Enter B scan list channels in the same manner as A list entry. Again, the highest list sequence designator is 63.

20. Press [RESET] to exit the scan programming mode. The Channel frequency entry mode will resume displaying CHANNEL "0", STEP "1", and the appropriate frequency.

--Function Entry--

The Busy Channel Lockout feature, Time-Out-Timer feature, and scan feature parameters are programmed in the Function Mode. Only four of these eight parameters need programming for most applications, therefore attention is given to only these four hereinafter. Procedures to program the others (timing adjustments, etc.) can be found in the Programmer Operator's Manual.

21. BCLO Press [FUNC.] then [ENTER]. "FnC" will appear in the BAND display and "1" in the STEP display. Function Code 1, for programming the Busy Channel Lockout (BCLO) feature, is now active. Key in one of the following values, then press [ENTER]. If no entry is made, the transceiver will operate per the default value of 3 --no BCLO. Also see "BCLO JUMPERING" in this section for jumper considerations.

21. continued...
BCLO parameters:
0= BCLO without alert. No audible indicating tone will be heard.
2= BCLO with alert. When the PTT button is pressed while the transceiver is inhibited, a tone will be applied to the speaker.
3= BCLO disabled. No transmit inhibiting per receive status.

Throughout Function Mode programming, the up and down arrows will sequentially select the Function Codes.

22. Time-Out-Timer "FnC" and "2" will be displayed. Key in the parameter value to set the Time-Out-Timer duration as listed below, then press [ENTER]. When the transmitter is continuously keyed for the programmed duration, the timer disables the transmitter and applies an audible alert tone to the speaker. The timer is reset upon PTT release. If no entry is made, the default value of 0 will be automatic, leaving the Time-Out-Timer inoperative.

0= Disable the Time-Out-Timer	4= 120 seconds
1= 30 seconds	5= 150 seconds
2= 60 seconds	6= 180 seconds
3= 90 seconds	7= 210 seconds

23. Press the up arrow four times to skip to Function Code 7. Function Codes 3 through 6 will automatically be programmed with their default values. If a special application requires altering scan timing, refer to the Programmer Operator's Manual for procedure.

24. Priority Monitoring "FnC" and "7" should be displayed. Entering a value in this mode either disables priority channel (see Operator's manual) sampling or changes its rate. If this function is not programmed, the default is one Priority channel sampling every eight channels scanned, and one Priority sampling every second when scan is stopped on an active non-priority channel.

Key in a value listed below, then [ENTER], to program the desired sampling rates.
0= Sample the Priority channel once every four non-priority channels scanned, and sample it every second when scan is stopped.
1= Sample the Priority channel once every eight non-priority channels scanned, and sample it every second when scan is stopped.
2= Sample the Priority channel once every four non-priority channels scanned, and sample it every two seconds when scan is stopped.
3= Sample the Priority channel once every eight non-priority channels scanned, and sample it every two seconds when scan is stopped.
4= Disable Priority monitoring

25. Scan Format "FnC" and "8" should be displayed. The scan feature operates in three different mode formats--'Normal', 'Modified', and 'Secondary'. Each is described in the Operator's Manual.

    While operating, scan is stopped by detection of received signal. Programming can set scan-stop by noise squelch carrier detection, CTCSS detection, absence of detected carrier, or absence of correct CTCSS tone with carrier presence. The latter two are used in in special applications.

    The parameter value determines both scan format and scan stop aspects as listed below. Key in the desired value and press [ENTER]. The default value if no entry is made is 1, which is correct whether a coded squelch feature is installed in the transceiver or not. If no CTCSS frequency nor CDCSS code is programmed to a channel (steps 6-11), any odd value parameter programmed will be decreased by one when read by the transceiver (ex.: If 1 is programmed and CTCSS is disabled, the transceiver will subtract 1 and operate per parameter 0.).

    Function Code 8 --

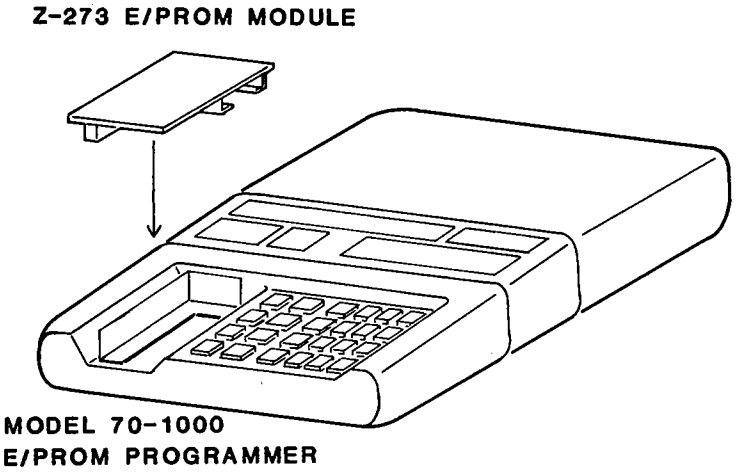
    0= 'NORMAL' Scan Mode with scan stopped by carrier presence
    * 1= 'NORMAL' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
    2= 'NORMAL' Scan Mode with scan stopped by absence of carrier
    * 3= 'NORMAL' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code
    4= 'MODIFIED' Scan Mode with scan stopped by carrier presence
    * 5= 'MODIFIED' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
    6= 'MODIFIED' Scan Mode with scan stopped by absence of carrier
    * 7= 'MODIFIED' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code
    8= 'SECONDARY' Scan Mode with scan stopped by carrier presence
    * 9= 'SECONDARY' Scan Mode with scan stopped by presence of correct CTCSS tone or CDCSS code
    A= 'SECONDARY' Scan Mode with scan stopped by absence of carrier
    * b= 'SECONDARY' Scan Mode with scan stopped by presence of carrier without correct CTCSS tone or CDCSS code

    * : If the selected channel does not have a CTCSS tone or CDCSS code programmed to it, the transceiver microprocessor will decrease this parameter value by one and operate accordingly.

26. This concludes the Function Mode programming sequence. Press [RESET] to exit.

Parameter entry is complete. If the last selected channel recall feature is to be disabled, or the operator-deleted scan channel recall feature is to be disabled, or scan timing needs modification; refer to the Programmer Operator's Manual for programming procedures.

27. Plug the erased Z-273 E/PROM module onto the 70-1000 Programmer as shown in Figure 2.



PROGRAMING THE E/PROM MODULE

28. Press [FUNC.] key, then the [4/B.W.V.] key. The BLANK, WRITE, and VERIFY indicators will each illuminate in succession as the module is programmed. "PASS" will be displayed if the new content in the E/PROM is correct. If the readout displays flashing numbers or "ERR", the E/PROM must be erased again, and validity of the previously entered channel information is in question.

29. Install the E/PROM Module into the transceiver.

BCLO JUMPERING

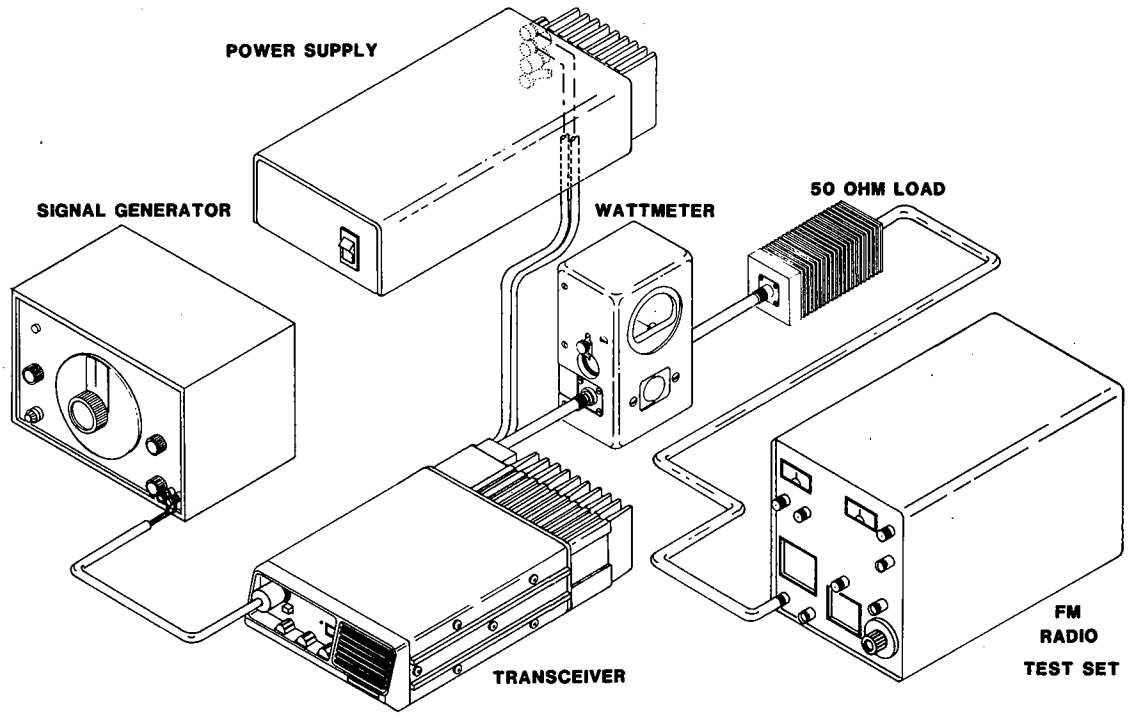
The Busy Channel Lock-out feature, if programmed as previously described, prevents transmission on a busy channel and can provide an audible alert when an attempt is made. The standard transceiver is configured for BCLO by carrier detection when enabled by programming. Therefore if neither CTCSS nor CDCSS are used, no jumpers change is necessary. If desired, and if CTCSS (or CDCSS) is installed in the transceiver, a jumper can be moved to an alternate location inside the transceiver to prevent transmission only when an appropriate CTCSS tone is received.

The BCLO jumper positions, JP107 and JP108, are located on the Transmitter Board between the modulator (L101, L102) shield and front PC board edge. Remove the jumper wire from JP107 position and install it into the JP108 position to set BCLO by CTCSS tone (or CDCSS code) detection. Do not install jumpers in both positions.

SUGGESTED TEST EQUIPMENT FOR TRANSMITTER CALIBRATION

Test Instrument	Instrument Capabilities	Instrument Type
DC Power Supply	13.8 VDC, 10 amps	Power Mate BPA-20PF
Wattmeter	50 watts, 136-174 MHz	Bird model 43 with 50C element and 50 ohm load
Deviation Meter	136-174 MHz. +/-5KHz range	p/o Cushman CE-31A
Frequency Meter or Frequency Counter	136-174 MHz 2.0 ppm accuracy	p/o Cushman CE-31A or Heath SM-4120
Audio Generator	0-10 KHz sine-wave, 0-5 Vrms output	Heath SG-5218

CALIBRATION SET-UP



The 70-342XL and 70-442XL wideband transceivers are capable of operating across a 24 MHz channel frequency spread. Therefore, receiver realignment is not needed, even when reprogrammed with new customer frequencies. Only transmit carrier calibration such as frequency, modulation, and output power may need adjustment. The transceivers are shipped from the factory programmed with test frequencies that must be changed to customer frequencies before installation.

REALIGNMENT MAY BE NECESSARY ONLY AFTER a component that affects transceiver tuning has been replaced. Realignment requires transceiver operation on special frequencies, therefore they must be programmed into the transceiver E/PROM specifically for alignment. The complete Alignment procedure can be found in the SERVICING SECTION of this manual.

* * * * ERROR CODES * * * *

Error code 90, 91, 92, 93, or 94 appearing in the channel display with continuous triple-beeps indicates the E/PROM module is missing, improperly inserted, or incorrectly programmed. Check the E/PROM module or refer to the E/PROM Programming section in this service manual.

Error code 95 appearing in the channel display with a triple-beep indicates the synthesizer phase-lock-loop cannot achieve lock. A defect exists and it must be corrected.

The following adjustments to calibrate transmit power output, transmit carrier frequency, and transmit modulation are all that should be necessary to prepare the wide-band 70-342XL or 70-442XL transceivers for end use.

1. Remove the 8 securing screws to remove the top and bottom covers.

2. Supply 13.6 volts DC power to transceiver J391. Connect [+] to pin 9 and [-] to pin 7. Connect a resistive, 50 ohm RF load (with a wattmeter) to antenna connector J392.

--Carrier Frequency Adjustment--

3. Monitor the unmodulated transmitted frequency on any channel. Adjust REFERENCE OSCILLATOR CV701 for zero carrier frequency.

--Modulation Adjustment--

4. Apply 0.15 Vrms of 2500 Hz signal to the Microphone Receptacle J393 pins 1 and 2 (J395 of the Control Head on trunk-mount transceivers). Pin 1 is signal high; pin 2 is ground.

   Key the transmitter by grounding pin 4 of the Microphone Receptacle, and monitor carrier modulation. Readjust applied signal level for 2.5 KHz carrier deviation (50% modulation). Adjust L101 and L102 for maximum deviation.

5. If the transceiver is not equipped with a CTCSS option, skip this step. Select any channel that is programmed for a CTCSS tone. Remove the modulating signal and key the transmitter. While monitoring carrier modulation, adjust the TONE OUTPUT LEVEL adjustment (RV1 on the 70-2101 or 70-2102 CTCSS boards) for desired modulation level (typically 750 Hz carrier deviation).

6. Reapply the 2500 Hz modulating signal, but increase its level to 1 Vrms. Key the transmitter and adjust MODULATION LIMITING RV101 for 5 KHz carrier deviation. Vary the signal level to ensure modulation does not exceed 5 KHz.

--RF Power Output Adjustment--

7. Set POWER SET RV502 for maximum (fully clockwise).

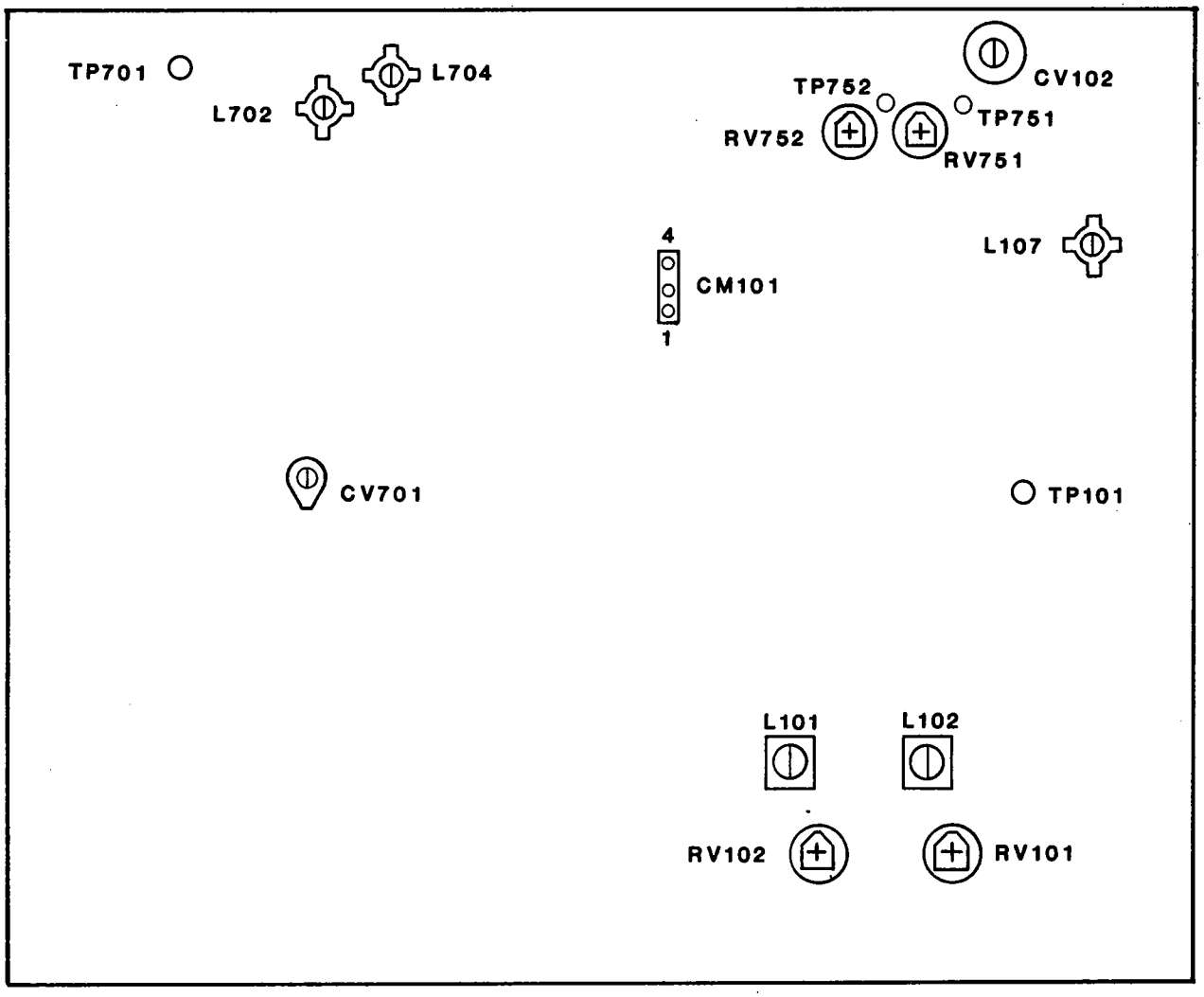
8. Select the channel that transmits the center-most TX frequency. Key the transmitter and adjust CV501 and CV504 for maximum RF power into 50 ohms at the Antenna Connector.

9. Readjust POWER SET RV501 for 40 watts RF output into 50 ohms at the Antenna Connector.

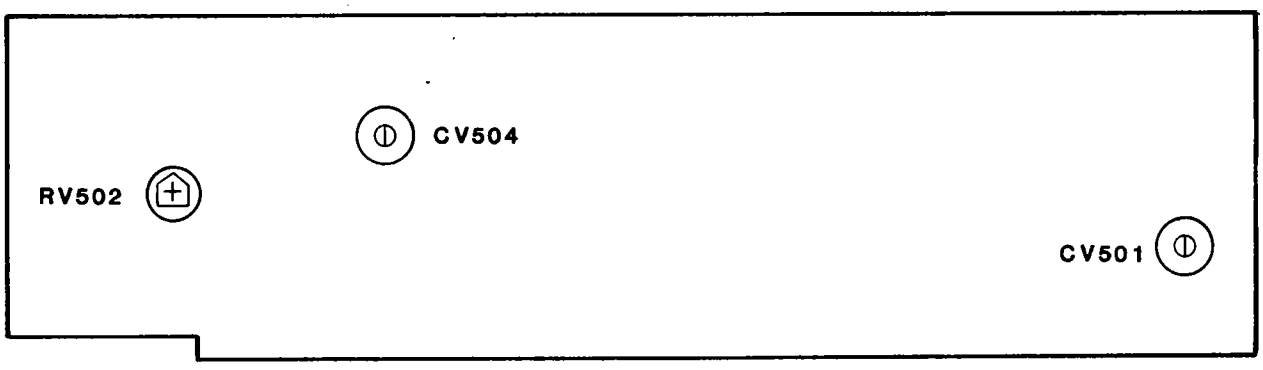
Calibration is complete. Normally, receiver realignment is not necessary.

TRANSMITTER AND SYNTHESIZER ADJUSTMENTS

TRANSMITTER BOARD



RF POWER AMPLIFIER BOARD



UNDER-DASH MOUNTING (Model 70-342XL only)

The 70-342XL transceiver is designed for use in automobiles, trucks, or other vehicles with 12 volt electrical systems. Where in the vehicle the transceiver is mounted does not affect its performance, provided its front panel controls are accessible to the operator. Typical mounting locations are under the dashboard or next to the driver's seat.

The transceiver is housed in a slim, small package to best conform to mounting locations. The mounting bracket slides into the transceiver siderails and provides a 3.25 x 7.75 inch flat surface across the transceiver top with holes for bolting to a flat surface in the vehicle. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided.

TRUNK MOUNTING (Model 70-442XL only)

The 70-442XL trunk mount transceiver is designed for remote mounting such as a vehicle trunk or under a seat. The operator controls are in a compact control head for operator access. The bulk of the transceiver is within the separate remotely mounted unit. Because of this design, its does not have an internal speaker. Instead, a separate 3.2-ohm external speaker (included with the 70-442XL package) must be installed and connected to the Control Head.

The cable that interconnects the control head to the trunk unit is four meters long and flat for laying under carpeting. The cable must not lay near hot areas (above the catalytic converter, for example) nor against sharp edges.

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

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

REMOTE SPEAKER (required and included with the 70-442XL)

As part of the standard trunk-mount transceiver configuration (model 70-442XL), the model 70-2353 5-watt speaker connects to the Control Head Accessory Plug. It also can be used optionally with the 70-342XL under-dash transceiver to substitute the transceiver internal speaker. Its 5 1/2 ft. cable is terminated with appropriate Molex pins for

insertion into the trunk-mount Accessory Plug on the Control Head or the under-dash Power/Accessory Plug. The speaker housing and mounting bracket assembly is 5x5 inches square by 3 inches deep. The mounting surface is 4 1/4 x 1 1/4 inches, with four 3/32" screw slots.

POWER REQUIREMENTS

Both the 70-342XL and 70-442XL transceivers are designed to operate from a 12 volt DC, negative ground, automotive electrical system. Current drain of at least 10 amperes 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 VOLTS) CAN SEVERELY DAMAGE THE TRANSCEIVER.

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

ANTENNA

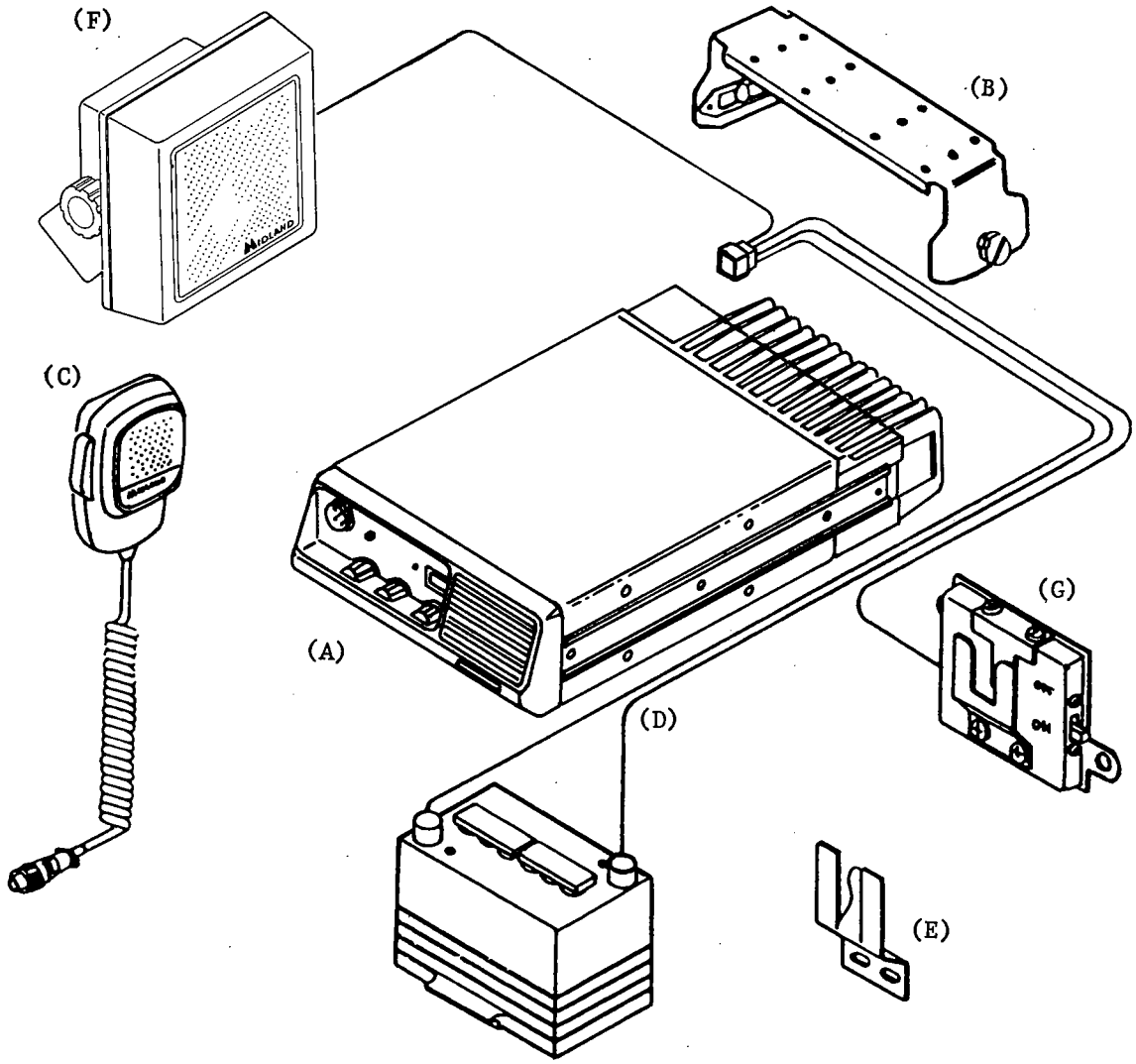
The most important communications system component that can affect overall performance is the antenna. A good quality antenna designed to provide 50 ohm terminating impedance at appropriate transceiver frequencies is recommended. When adjusting the antenna, be sure to follow its manufacturer's instructions. 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.

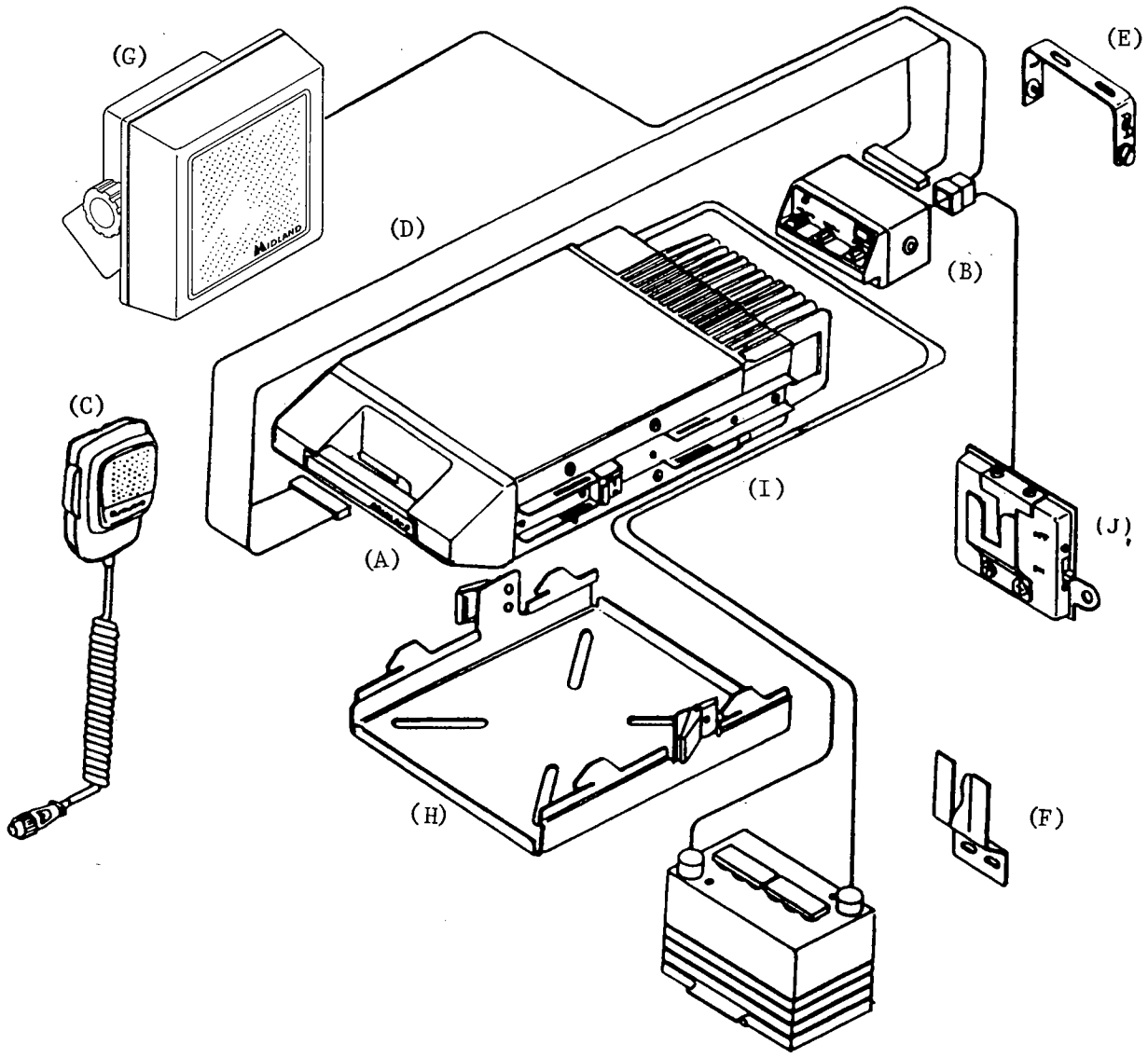
An optional microphone hanger (model 70-2195) is available for use with the CTCSS option. This hang-up box may be installed in place of the microphone clip on both metallic or non-metallic surfaces with two screws provided. Wiring instructions follow in the Power/Accessory Plug instructions.

UNDER - DASH CONFIGURATION



ITEM	DESCRIPTION	MODEL NUMBER	PART NUMBER
STANDARD EQUIPMENT:			
(A)	Under-Dash Transceiver	70-342XL	
(B)	Under-Dash Mounting Bracket	70-2201	
(C)	Dynamic Hand Microphone	70-2301	70-038013
(D)	Power/Accessory Plug and Cable, 2m	70-2211	70-034031
(E)	Microphone Hang-up Clip with screws		70-158015
-	Spare Fuse, 10A		70-204026
-	Mounting Hardware Kit		70-000012
OPTIONAL ACCESSORIES (also see ACCESSORIES section):			
(F)	External Speaker, 5 watt	70-2353	
(G)	Microphone Hang-up Box with switch	70-2195	

TRUNK - MOUNT CONFIGURATION



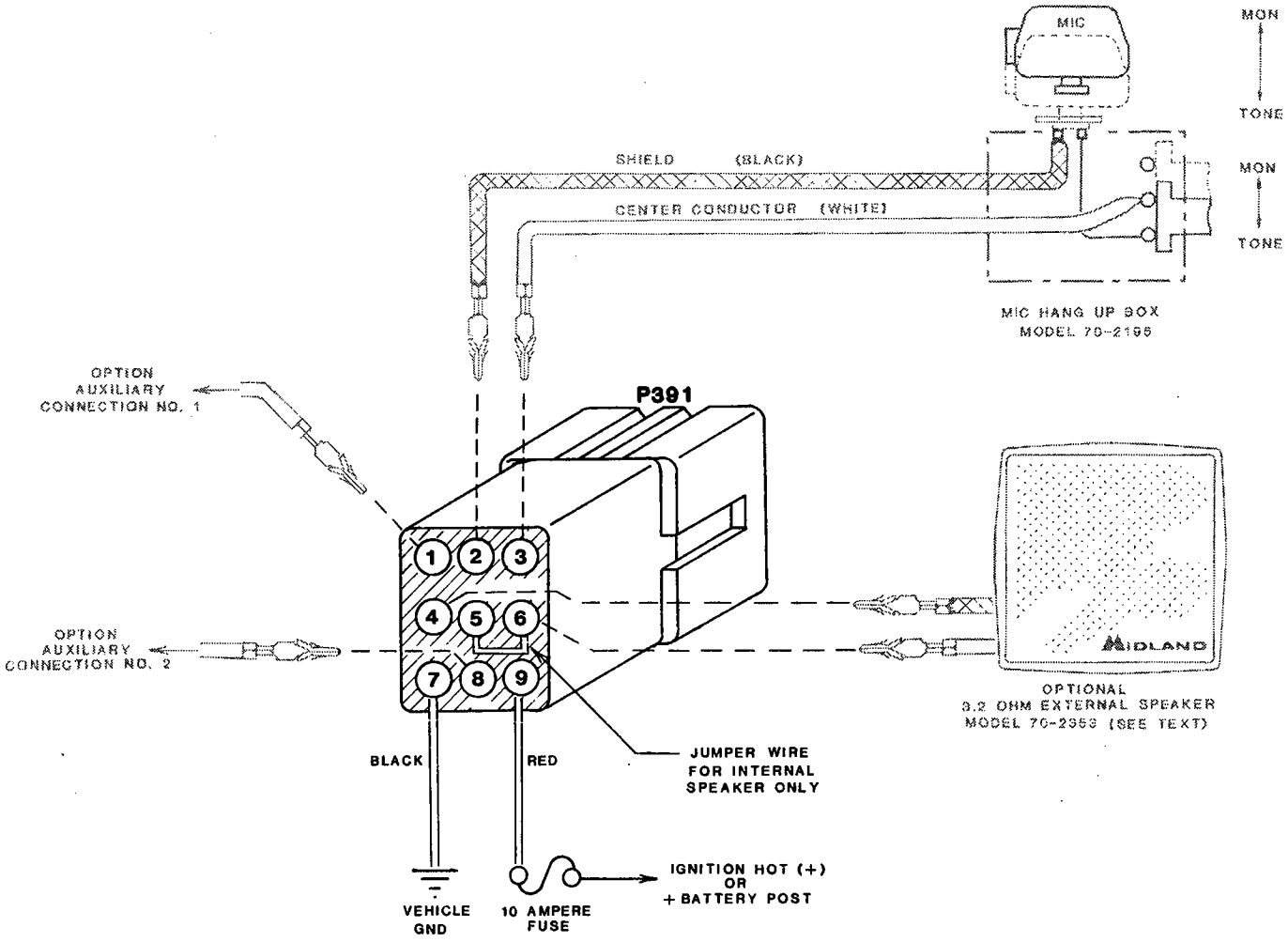
ITEM	DESCRIPTION	MODEL NUMBER	PART NUMBER
STANDARD EQUIPMENT:			
(A)	Trunk-Mount Transceiver	70-442XL	
(B)	Trunk-Mount Mounting Bracket	70-2206	
(C)	Dynamic Hand Microphone	70-2301	70-038013
(D)	Accessory Plug	70-2222	70-034061
(E)	Control Head Mounting Bracket		70-158069
(F)	Microphone Hang-up Clip with screws		70-158015
(G)	Speaker, 5 watt	70-2353	
(H)	Trunk Mounting Tray, with keys	70-2205	70-158068
(I)	Power Plug and Cable, 6m	70-2212	70-034032
-	Spare Fuse, 10A		70-204026
-	Mounting Hardware Kit		70-000013
OPTIONAL ACCESSORY (also see ACCESSORIES section):			
(J)	Microphone Hang-up Box with switch	70-2195	

U N D E R - D A S H P O W E R / A C C E S S O R Y P L U G

Nine-pin male Molex connector and fused, 2-meter power cable assembly, P/N 70-2211, mates to the power/accessory connector (J391) on the rear of the 70-342XL under-dash SYN-TECH transceiver. 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 respective vacant holes. Optional connections below are shown in lighter shade.

Refer to the ACCESSORIES section of this manual for pin, socket, connector body, and tool part numbers.



UNDER-DASH POWER CONNECTIONS

The Power/Accessory Cable is equipped with two 14 gauge wires for connection to the vehicle electrical system. The unterminated wires are 2 meters long; sufficient for typical connection to a fuse block and chassis ground.

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

Connect the red wire to the positive (+), or Hot 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 Ignition HOT to switch the transceiver with ignition, or to Battery HOT to enable the last-selected-channel feature of the transceiver. In the latter case, 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.

UNDER-DASH OPTIONAL CONNECTIONS

EXTERNAL SPEAKER (Models 70-2352, and 70-2353):

Normally, the transceiver internal speaker is connected to receive audio by the jumper to pins 5 and 6. If one of the MIDLAND external speakers is to be utilized, the jumper must be removed to disable the internal speaker and the two wires from the external speaker must connect to pins 4 and 6. NOTE: If the 70-2352 Power 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 (Model 70-2195):

If the CTCSS feature is included in the transceiver, the optional 70-2195 Microphone Hang-up contact/switch-box usually is installed to unmute CTCSS squelch when the microphone is lifted. The center conductor of the shielded hang-up box cable connects to pin 3, the shield to pin 2. Jumper JP2 on the 70-2102A CTCSS option board within the transceiver must also be removed.

AUXILIARY DEVICES:

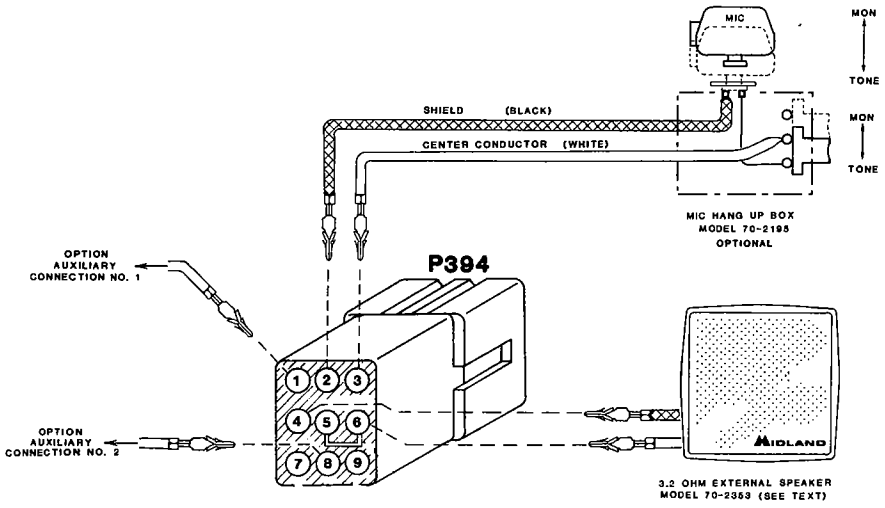
Pins 1 and 8 are available for auxiliary connections necessary with certain optional features. Wiring details for these are found in the respective literature for the option.

T R U N K - M O U N T P O W E R
A N D A C C E S S O R Y P L U G S

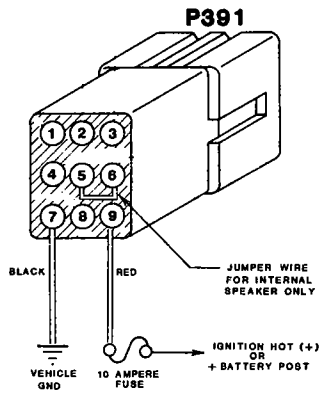
The 70-342XL trunk mount SYN-TECH transceiver has two 9-pin male Molex receptacles--J391 on the trunk unit; J394 on the Control Head. The trunk unit receptacle mates to the 70-2212 Power Cable assembly. The Power Cable includes an in-line fuse in its 6 meter power leads and a jumper between pins 5 and 6 that routes speaker audio to the control head.

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

Refer to the ACCESSORIES section of this manual for pin, socket, connector body, and tool part numbers.



ACCESSORY PLUG
on the Control Head



POWER PLUG
on the transceiver

TRUNK-MOUNT POWER CABLE CONNECTIONS

The 70-2212 Power Cable is equipped with two 12 AWG wires for connection to the vehicle electrical system. The unterminated wires are 6 meters long; sufficient for typical connection to a fuse block and chassis ground.

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

Connect the red wire to the positive (+), or Hot 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 Ignition HOT to switch the transceiver with ignition, or to Battery HOT. The latter enables the last-selected-channel feature of the transceiver, but 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.

CONTROL HEAD ACCESSORY PLUG CONNECTIONS

STANDARD EXTERNAL SPEAKER (Model 70-2353):

The two wires of 70-2353 speaker are terminated with Molex pins for insertion into positions 4 and 6 of the Accessory Plug that mates to the Control Head.

OPTIONAL 15 WATT POWER SPEAKER (Model 70-2352):

The 70-2352 power speaker has a shielded coaxial cable that is terminated with Molex pins for inserting into the Accessory Plug. The center conductor (white) of this audio signal cable must be connected to pin 6, and the shield (black) to pin 4. It also has red (+) and black (-) power leads that connect to the same points that the transceiver DC power leads are connected.

OPTIONAL HANG-UP BOX (Model 70-2195):

If the CTCSS feature is included in the transceiver, the 70-2195 microphone hang-up contact/switch-box usually is installed to unmute CTCSS squelch when the microphone is lifted. The center conductor of the shielded hang-up box cable connects to pin 3, the shield to pin 2. Jumper JP2 on the 70-2102A CTCSS option board within the transceiver must also be removed.

AUXILIARY DEVICES:

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

Occasionally, the technician who installs land-mobile radio equipment is plagued with interference originating somewhere in the automobile that produces annoying noises through the transceiver. Interference problems are solved by understanding the interference and its path into the transceiver, locating its source logically, then eliminating it the simplest way available.

Interference enters the transceiver two ways: by conduction or induction. Conducted interference passes through the DC power leads. Inductive interference is radiated through the air from a source that may be anywhere in the vehicle.

Conducted interference is simple noise voltage present in the vehicle electrical system. With many electrical devices turning on and off in a vehicle, current surges produce respective voltage drops across wire resistances. Thus, voltage transient (switching) spikes appear throughout the electrical system. Connecting the transceiver power leads to this noisy electrical system applies the noise voltage directly to the radio. Although most of the noise voltage is attenuated by power-line filters within the radio, spikes that are severe enough may be audible.

While interference conducted through power leads affects transceiver audio circuitry; inductive interference imitates receiver I.F. frequencies, or even channel frequencies, and is demodulated by the receiver. Inductive interference is an electromagnetic field that induces noise currents in the transceiver antenna, accessory cabling, or chassis (see Figure 1).

A spark is a common source of electromagnetic energy across the radio frequency spectrum; thus, a source of inductive interference. Typically in modern vehicles, sparks are found in the alternator, the ignition system, and fan motors.

Other common sources of inductive energy are within a variety of electronic gadgets found in modern vehicles. Their internal oscillators produce high frequency signals and radiate energy at multiples of the signal frequency.

LOCATING THE SOURCE

The first step toward eliminating interference is to determine the interference source and path-of-entry into the transceiver. Listening to the noise can tell a lot. For example: if the noise heard in the transceiver varies with engine speed, its source must be related to the engine; such as the alternator, ignition system, or tachometer.

Because the transceiver is an FM radio, determining interference coupling into the transceiver (by conduction or induction) is easy. With all squelch circuits open, apply an unmodulated signal to the transceiver that is strong enough to overcome any interference that could be radiated into the receiver. Because conducted interference

can only affect audio circuitry, it will still be heard if present. Another method of testing is to connect the power leads directly to the lowest noise point in the vehicle electrical system: the battery. Because the battery acts like a large capacitor, the noise, if conducted, will cease.

ELIMINATING CONDUCTED NOISE

If there is a conducted noise path, there probably is a defective item in the vehicle electrical system that needs repair. A common condition of this nature is a defective diode in the alternator, which creates a large current ripple at alternator output but may not noticeably impair vehicle operation. A bad alternator diode produces a whine in the transceiver that varies in pitch with engine speed. Also, the defective diode causes excessive arcing in the brushes, which may produce some inductive interference.

Another possible source of conducted interference is a fan motor. Because a fan also produces inductive interference, determine which path-of-entry is most predominant (see above). If the interference is mostly conducted, find a power connection point in the electrical system for the transceiver that is further from the fan circuit.

ELIMINATING INDUCTIVE INTERFERENCE FROM NEARBY OSCILLATORS

If testing proves interference is not conducted, there are two types of applicable inductive sources--sparks and high frequency oscillators. Modern vehicles utilize many electronic gadgets and systems that may produce a hash or whine in the transceiver. Oscillators within these devices, that 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 gadget is part of engine operation, the noise won't vary with engine speed. The interfering gadget can be isolated by temporarily removing power to it to check for absence of noise.

Because lead-in wires act like radiating antennas, inductive interference is more often radiated from the gadget's wiring than the gadget itself. If so, check that the wiring to the device is not near the transceiver or its wiring. If necessary, RF chokes can be connected in series with the 'sensitive' lead-in wires of the interfering device; close to its housing to kill the antenna effect. Sometimes, 'sensitive' wires may be identified if noise volume changes with wire movement.

Inductive interference may also enter through the radio receiver input--the antenna. This can be verified by substituting the antenna and its cable with a matched dummy load and short cable (The 50 ohm dummy load is necessary to properly balance the receiver input. Without it, the receiver may become less sensitive to any signal). If the noise stops, interference is entering the antenna port.

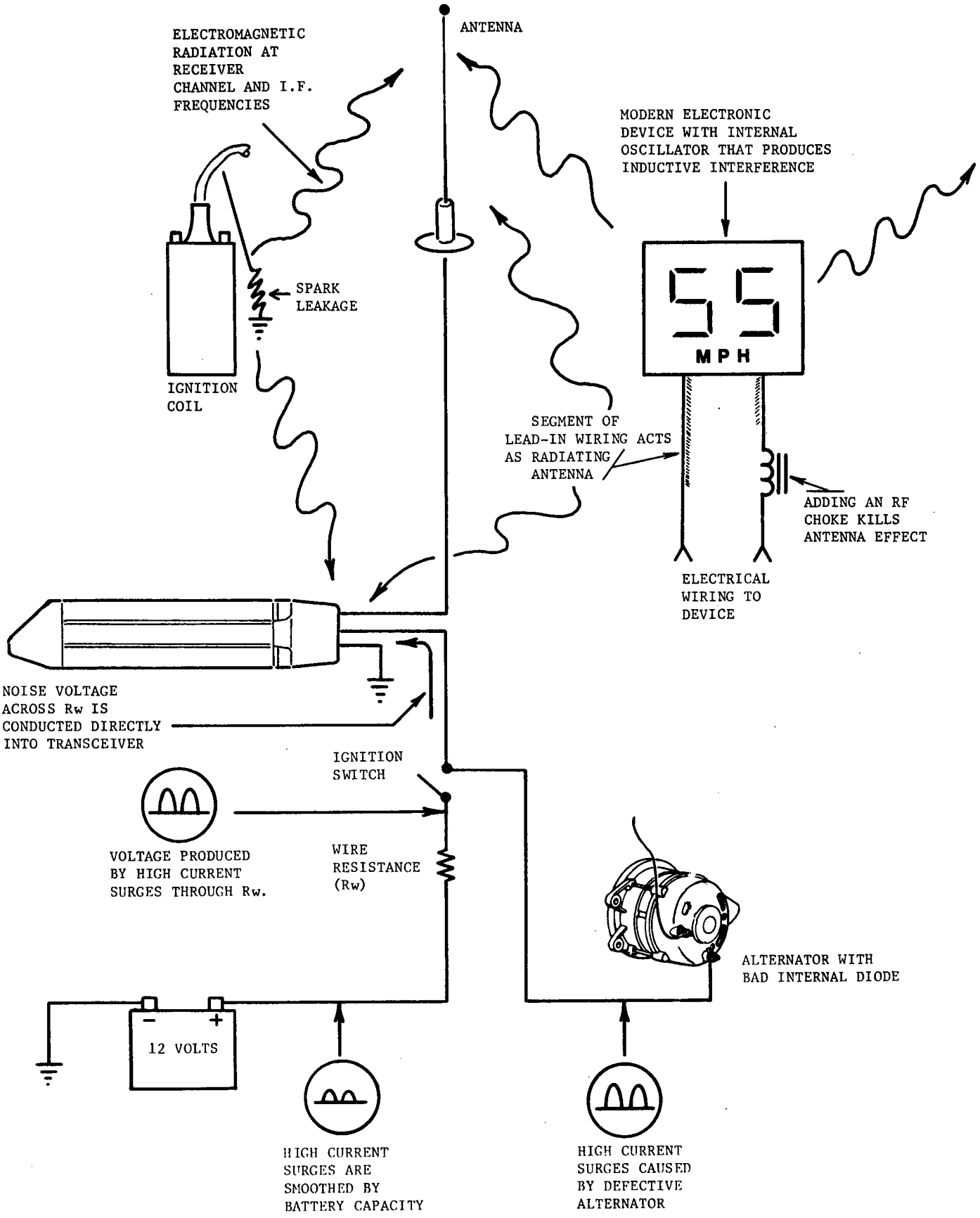


FIGURE 1 - CONDUCTIVE AND INDUCTIVE INTERFERENCE

If interference into the antenna originates from a poorly shielded gadget, reduce radiation from the source with RF chokes as described above. Sometimes, positioning the antenna further from the gadget may work.

ELIMINATING INDUCTIVE INTERFERENCE FROM SPARKS

Only a few areas remain in modern vehicles that produce sparks: the alternator, ignition system, and fan motors. Sparks in modern alternators generally do not produce sufficient inductive interference unless there is a related defect. If so, the defect probably will produce significant conducted interference, too.

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 in the transceiver that increases in pitch with engine speed, and seems to be the same rate as every spark, 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 popping sound in the transceiver at engine idle that seems to occur in time with firing of a single spark plug, and 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 are made with suppressive (resistive) conductors to reduce electromagnetic radiation. Older vehicles may not be equipped as such. Use an ohmmeter to verify, if applicable.

Fan motor interference from its brushes produces a whine that varies with fan speed. Badly worn brushes or bearings cause excessive sparks, therefore replacement may be necessary. A 0.1 uF coaxial capacitor can be connected to the positive lead as close to the motor as practical to reduce inductive interference. The capacitor body must connect securely to the grounded motor housing.

The following are optional mobile installation accessories that are available from MIDLAND.

CONTROL CABLE ASSEMBLIES

Assemblies of cables terminated with 34-pin female connectors to connect the SYN-TECH Control Head to trunk unit.

Flat ribbon cable, 6 meters long	Model No. 70-2221
Flat ribbon cable, 2 meters long	Model No. 70-2223
Round cable, 4 meters long	Model No. 70-2226
Round cable, 2 meters long	Model No. 70-2227

REMOTE SPEAKER (5 Watt) Model No. 70-2353

A 3.2 ohm, housed speaker with mounting bracket and screws to substitute the 70-342XL internal speaker (the 70-2353 speaker is standard with the 70-442XL transceiver). Its 5.5 ft. cable is terminated with appropriate Molex pins for insertion into the transceiver Power/Accessory Plug. The speaker with its mounting bracket is 5x5 inches square by 3 inches deep.

POWER SPEAKER (15 Watt) Model No. 70-2352

This self-contained amplified speaker is identically housed as the 70-2353 Remote Speaker. Its 5.5 ft. input cable is terminated with appropriate Molex pins to connect to the 70-342XL Power/Accessory Plug or the 70-442XL Accessory Plug. Its 5.5 ft. fused power leads must be connected to vehicle (+) and ground.

ALL WEATHER SPEAKER Model No. 70-S05

A 5 watt, 4 ohm, outdoor speaker that can be mounted in a vehicle grill. Its 8 ft. cable is terminated with appropriate Molex pins for insertion into the 70-342XL Power/Accessory Plug or the 70-442XL Accessory Plug. The speaker is 5 1/2 inches diameter, 4 inches deep, and mounts with a swivel tab.

MICROPHONE HANG-UP BOX Model No. 70-2195

Detects presence of a microphone in its clip for automatic channel monitoring by defeating CTCSS (or CDCSS) audio squelch. This accessory is useful only if the transceiver is equipped with the CTCSS (or CDCSS) feature. It is shipped with mounting screws and has 5.5 ft. cable terminated with appropriate Molex pins for insertion into the under-dash transceiver Power/Accessory Plug or the trunk-mount transceiver Accessory Plug.

HANDSET MICROPHONE Model No. 70-2311

A handset and cradle set with instructions and appropriate Molex wire terminations to connect to the 70-342XL Power/Accessory Plug or the 70-442XL Accessory Plug (on the Control Head). Minor internal wiring alteration is necessary to route audio signals through the connector.

HAND MICROPHONE WITH DTMF PAD Model No. 70-2103A

A hand microphone with built-in lighted four-by-four DTMF keypad (16 keys; 0-9, *, #, and A-D) and encoder to transmit DTMF tones for signaling and phone-patch access. It also has a keypad on/off switch and channel up and down select push buttons.

NOTE: A special 6-pin microphone receptacle must be installed and wired inside the transceiver or Control Head. This receptacle is included with the microphone.

HAND MICROPHONE WITH DTMF PAD AND A.N.I. Model No. 70-2104A

This complete hand microphone is the same as the 70-2103 except it also includes circuitry for the automatic number identifier feature.

NOTE: A special 6-pin microphone receptacle must be installed and wired inside the transceiver or Control Head. This receptacle is included with the microphone.

WEATHER-PROOF CONTROL HEAD Model No. 70-2210

A replacement for the 70-2209 SYN-TECH Control Head (with scan). It is identical in size and shape, but designed for outdoor use. Shipped with the same mounting hardware.

SLIDE BRACKET CONVERSION KIT Model No. 70-2255

The 70-2201 under-dash Slidemount Bracket with appropriate SYN-TECH siderails and hardware for mounting the 70-442XL trunk-mount unit with the Slidemount configuration.

TRUNK-MOUNTING TRAY CONVERSION KIT Model No. 70-2256

The 70-2205 Trunk-Mount Bracket with appropriate SYN-TECH siderails and hardware for mounting the SYN-TECH under-dash unit with a the Trunk-Mount configuration.

DESK MICROPHONE Model No. 70-2305

A desktop microphone with speech compressor circuitry for convenience. Not compatable with the SYN-TECH trunk-mount transceiver. Intended for low ambient noise base station use. Requires installation and appropriate wiring of the 70-K33 6-pin microphone jack kit in the transceiver.

DC POWER SUPPLY Model No. 70-2281

A 13.6 Volt DC output power supply for sourcing the 70-324XL in a base station application. Power supply input is either 110 or 220 Volts AC. Output current capacity is 8 Amperes continuous or 10 Amperes intermittent.

LMR LOCK KIT Model No. 70-7080

A lock assembly and parts to add a transceiver locking mechanism to the SYN-TECH slide-bracket mounting. A notch must be filed in the transceiver siderail. If the lock assembly is to be used with a trunk-mount transceiver, the transceiver must be mounted with the 70-2201 slide-bracket (see 70-2255 Slide-Bracket Conversion Kit).

E/PROM PROGRAMMER Model No. 70-1000

The SYN-TECH transceivers contain an Erasable/Programmable Read Only Memory (E/PROM) module that holds specific customer frequencies and feature selections to determine radio operation. To change this electronic information, the plug-in module must be erased with the 70-1100/1101 E/PROM Eraser and reprogrammed with the 70-1000 E/PROM Programmer. The information is entered into the Programmer by its keypad, converted into binary data useful to the transceiver, then written into the E/PROM.

The E/PROM Programmer may be operated from a 110 Volt or 220 Volt line. A provision exists to connect to the 70-1300A/B Printer for printout of an E/PROM contents.

E/PROM ERASER Model No. 70-1100/1101

The E/PROM Module contains an integrated memory circuit that holds electronic information until exposed to high intensity ultraviolet light. The E/PROM Eraser has a drawer large enough for positioning eight modules under its ultraviolet lamp, and a timer for automatic shut-off. The 70-1100 Eraser operates from a 110 Volt line, the 70-1101 Eraser operates from a 220 Volt line.

E/PROM PRINTER Model No. 70-1300A/B

This 5x7 dot-matrix impact printer connects to the 70-1000 E/PROM Programmer for producing a printout of an E/PROM Module contents. The printer uses standard 8.5-inch tractor-feed paper and operates from 110 (70-1300A) or 220 Volt (70-1300B) lines.

LMR TEST SET Model No. 70-E10

This portable test set connects to metering receptacles in all MIDLAND Land-Mobile-Radio transceivers for easier alignment and servicing.

DC POWER SUPPLY Model No. 70-2283

This power supply provides up to 15 Amperes of 13.6 Volts DC for bench testing and servicing MIDLAND Land-Mobile-Radio transceivers. It operates from 110 and 220 Volt lines.

TUNING TOOL: (P/N 70-156019) Green, with a small metal blade at one end and two hex sizes at the other.

TUNING TOOL: (P/N 70-156020) Black, with a smaller blade at one end and a larger blade at the other.

SPECIAL TOOL: (P/N 70-2235) Nut-driver style tool for removal of microphone jack retaining nuts.

CRIMPING TOOL: (P/N 70-2231) Designed for attaching to wire ends, Molex pins and sockets that fit the SYN-TECH Power and Accessory Plugs and receptacles.

EXTRACTING TOOL: (P/N 70-2232) Designed for removing Molex pins and sockets from the SYN-TECH Power and Accessory Plugs and receptacles.

HAND SHEAR: (P/N 70-2230) Plier-like hand tool with blade for cutting flat ribbon cable. Applicable use: Cutting bulk 34-conductor ribbon cable (P/N 70-034068) used to make special length SYN-TECH Control Cables that interconnect Control Heads to transceivers.

HAND PRESS: (P/N 70-2229) Plier-like hand tool with a special jaw to press compression-fit ribbon cable connectors onto ribbon cable ends. Applicable use: Fitting 34-pin SYN-TECH Control Cable connector assemblies (Model No. 70-2228) onto flat ribbon cable cut to special length.

REPLACEMENT POWER/ACCESSORY CONNECTOR PARTS:

* 9-pin Molex Plug Housing w/o pins (Pwr/Accy Plug)	P/N	70-151187
* 9-pin Molex Receptacle Housing w/o pins (transceiver)	P/N	70-159108
* 14-18 AWG Male Pin for plug (Molex #02-09-2103)	P/N	70-151187
* 18-24 AWG Male Pin for plug (Molex #02-09-2118)	P/N	70-151188
* 22-30 AWG Male Pin for plug (Molex #02-09-2143)	P/N	70-151190
* 14-18 AWG Female Pin for recept. (Molex #02-09-1103)	P/N	70-151186
* 18-24 AWG Female Pin for recept. (Molex #02-09-1118)	P/N	70-151189
* 22-30 AWG Female Pin for recept. (Molex #02-09-1143)	P/N	70-151183

SYN-TECH CONTROL CABLE PARTS (for trunk-mount transceivers):

* Flat Ribbon Cable, 34 cond., bulk (specify length)	P/N	70-034068
* Connector, female 34-pin double-row, insulation displacing compression fit, with strain relief	Model No.	70-2228

OPTIONAL FEATURE ADD - ON KITS

Although new transceivers are equipped with appropriate optional features per customer specifications, most features are available in add-on kit form for field modification. All kits are shipped with instructions and necessary parts for installing inside applicable transceivers.

CTCSS ENCODER — Model No. 70-2101

A PC board assembly that generates standard subaudible CTCSS tones (67.0 to 241.8 Hz) for transmitter modulation. Tone frequency is determined by transceiver E/PROM programming, thus frequencies can be different for each channel. This feature is usually used in transceivers equipped with the 70-2151 Two-Tone Sequential Decoder.

The 70-2101 Encoder mounts inside the transceiver and connects via two connector/cable assemblies to existing receptacles. If the transceiver also contains the 70-2151 Sequential Two-Tone Decoder, two additional wires must be soldered. E/PROM reprogramming and transmit modulation readjustment may be necessary.

CTCSS ENCODER/DECODER — Model No. 70-2102A

A PC board assembly that encodes and decodes standard CTCSS subaudible tones (67.0 to 241.8 Hz). Tone frequencies are contained in the transceiver E/PROM, thus frequencies can be different for each channel and each mode (TX/RX). The optional 70-2195 Microphone Hang-up Box (a mobile accessory item) can be installed to activate channel monitor automatically.

The 70-2102A Encoder/Decoder mounts inside the transceiver and connects via four connector/cables to existing receptacles. If all tone frequencies are in EIA standard groups A and B, or all in group C, then plating cuts and component changes are not necessary. E/PROM reprogramming and transmit modulation readjustment is necessary.

CTCSS/CDCSS ENCODER/DECODER OPTION — Not field installable

Two PC board assemblies together comprise the 70-2160 option that encodes and decodes Continuous Digital Coded Squelch data for use in DCS systems (Digital Coded Squelch is the digital complement to CTCSS). This option also provides CTCSS encoding and decoding. Mode of operation and standard frequencies or codes for encode and decode are defined for each mode (TX or RX) of each channel in E/PROM programming.

Installation of the 70-2160 option is complex, therefore the task is left to only MIDLAND personnel who have the necessary tools and equipment. The 70-2160 instruction/service manual, part number 70-999420, is available for the installed option.

2805 Hz DECODER (under-dash only) Model No. 70-2105

A PC board assembly that decodes and notch-filters received 2805 Hz tones for operation with 2805 Hz signaling systems. A 2 ampere maximum ground sinking output for a vehicle horn relay can be connected through the transceiver power connector. Compatibility of this kit is limited to only under-dash transceivers. The 70-2115 kit is the trunk-mount complement.

The decoder PC board mounts inside the transceiver and several wires must be soldered. An on-channel signal with continuous 2805 Hz tone modulation and an AC voltmeter are necessary for alignment.

DTMF DECODER Model No. 70-2106A

A PC board assembly that decodes received DTMF tone sequences for station calling and initiates an acknowledge tone. This decoder can distinguish a Primary sequence and a Secondary sequence, plus a group call response from receipt of 5 seconds of the "*" tone pair. Two outputs for controlling devices external to the transceiver are provided at the transceiver power connector: one provides a 1 ampere maximum sink to ground; the other a .25 ampere maximum sink to ground.

The 70-2106A is compatible only with under-dash transceivers. If installed in a transceiver equipped with the scan feature, the 70-2195 Microphone Hang-up Box is required.

The decoder mounts inside the transceiver. The transceiver front panel must be altered and several wires must be soldered. A DTMF tone generator and an RF signal generator are needed for decoder programming. Transmitter modulation may need readjustment.

TUNABLE VOICE SCRAMBLER Model No. 70-2107A

This PC board assembly scrambles and descrambles speech by frequency inversion for communications privacy. The scrambler is tunable for references between 2700 Hz to 3600 Hz.

The scrambler mounts inside the transceiver and several wires must be soldered. The 70-442XL Control Head may also require wiring. An audio frequency counter is needed for scrambler alignment and transmitter modulation will need readjustment.

BURST-TONE ENCODER Model No. 70-2109

This PC board assembly produces a burst of audio tone signal upon PTT for transmission. The tone burst is for a preset duration between 0.2 and 1 second at a preset frequency between 700 and 3000 Hz.

The encoder mounts inside the transceiver, and several connections must be soldered. Encoder alignment requires a frequency counter and measurement of transmit modulation.

MULTI BURST-TONE ENCODER Model No. 70-2110

For multiple repeater access, this encoder produces a burst of audio tone signal upon PTT that is transmitted. The tone burst is for a preset duration between 0.3 and 3 seconds. Up to ten tone frequencies are selectable by a rotary switch, but all ten must be either between 300 and 1600 Hz, or between 800 and 3500 Hz. The encoder is a housed unit that mounts near the transceiver (or the Control Head of trunk-mount transceivers) where accessible to the operator.

Four wires must be connected from the encoder unit to the transceiver Power/Accessory Plug (or the Control Head Accessory Plug). Some rewiring inside the transceiver (and the Control Head) is necessary to accommodate encoder connections. If either the 70-2195 Hang-Up Box or the 70-2353 External Speaker are connected to the Plug, the Plug must also be rewired to open pin positions. Encoder alignment requires a frequency counter and measurement of transmit modulation.

2805 Hz DECODER (trunk-mount only) Model No. 70-2115

Decoder circuitry is identical to the 70-2105 2805Hz Decoder. Only installation parts and instructions are different. This kit is compatible only with the 70-442XL trunk-mount transceiver. The 70-2105 2805Hz kit is the under-dash complement.

The decoder PC board mounts inside the transceiver and several wires must be soldered inside both the transceiver and Control Head. An on-channel signal with continuous 2805 Hz tone modulation and an AC voltmeter are necessary for alignment.

2.0 or 2.5 ppm OSCILLATOR CONVERSION Model Nos. 70-2124/2125

These kits contain the necessary components for replacing the transceiver master oscillator crystal to improve the oscillator frequency stability from 5 ppm to 2.0 ppm (70-2124) or to 2.5 ppm (70-2125). Frequency realignment is necessary.

TWO-TONE SEQUENTIAL DECODER Model No. 70-2151/2152

A PC board assembly that decodes sequential two-tone calling signals between 280 and 3500 Hz (including Group call). Output is an alert tone to the transceiver speaker, plus two relays are energized to control external devices. Relay contact connection is limited by availability of only two transceiver Power/Accessory connector pins and ground. Relay closure is momentary or latched per jumper selection and contact current capacity of each is 1 ampere maximum.

The 70-2151 Decoder kit contains parts to install the feature into the under-dash SYN-TECH transceivers; the 70-2152 kit contains parts to install into trunk-mount transceivers and Control Heads.

The decoder mounts inside the transceiver and requires front panel or Control Head alteration. Internal wiring is to existing connectors. Alignment requires at least an audio tone generator and AC voltmeter, or an audio frequency counter.

2+2 SELECTIVE SIGNALING DECODER Models No. 70-2153/2154

A PC board assembly that decodes 2+2 tone signaling between 280 and 1200 Hz (including Group call). Output is an alert tone to the transceiver speaker, plus two relays are energized to control external devices. Relay contact connection is limited by availability of only two transceiver Power/Accessory connector pins and ground. Relay closure is momentary or latched per jumper selection and contact current capacity of each is 1 ampere maximum.

The 70-2153 Decoder kit contains parts to install the feature into the under-dash SYN-TECH transceivers; the 70-2154 kit contains parts to install into trunk-mount transceivers and Control Heads.

The decoder PC board mounts inside the transceiver and requires front panel or Control Head alteration. Internal wiring is to existing connectors. Alignment requires an audio tone generator and AC voltmeter or an audio frequency counter, and measurement of transmit modulation.

HIGH-SIDE SECOND LOCAL OSCILLATOR CONVERSION Model No. 70-2164

If the transceiver is installed in an fixed environment where it is afflicted by a high level RF signal at certain frequencies, installation of this kit may eliminate receiver response to the interfering signal. This kit replaces the 20.945MHz second oscillator crystal with a 21.855MHz crystal which changes second injection from standard low-side to high-side, thus shifting the spurious response frequencies that are a function of the second I.F. image. This kit is effective only if one or more the interference signals, or their harmonics, mix to produce: Fc (channel frequency) minus 910KHz (2x 2nd I.F.); or Fc minus 41.89 MHz (2x 2nd L.O.). After the kit is installed, all receiver spurious response frequencies are the same except the above formulated two change to: Fc plus 910 KHz; and Fc minus 43.71MHz.

HIGH-SIDE FIRST INJECTION MODIFICATION Not field installable

If the transceiver is installed in an fixed environment where it is afflicted by a high level RF signal at certain frequencies, installation of this kit may eliminate receiver response to the interfering signal. This modification changes the first injection frequency from standard low-side to high-side, thus shifting the spurious response frequencies that are a function of the first I.F. image. This modification is effective only if one or more the interference signals, or their harmonics, mix to produce: Fc (channel frequency) minus 42.8 MHz (2x 1st I.F.); or Fc minus 41.89 MHz (2x 2nd L.O.). After the kit is installed, all receiver spurious response frequencies are the same except the above formulated two change to: Fc plus 42.8MHz; and Fc minus 43.71MHz.

This modification is complex, therefore the task is left to only MIDLAND personnel who have the necessary tools and equipment.

CTCSS KIT REVERSE BURST MODIFICATION Model No. 70-2199

A PC board assembly that modifies the 70-2102A CTCSS Encoder/ Decoder to cause an out-of-phase burst of CTCSS tone at the tail of transmission (after PTT release). The reverse burst is used to stop vibrations in old-style mechanically resonant tone decoder reeds, thereby shortening the "squelch tail" at the listening receiver.

The modifier kit is installed inside the transceiver and several wires must be soldered to the transceiver and the 70-2102A Encode/Decoder. Transmit modulation may require readjustment.

PARALLEL CONTROL HEAD ADAPTOR Model No. 70-2207

An adaptor cable to connect two Control Heads to one trunk-mount transceiver. This adaptor is a "Y" cable that installs in the Control Cable to parallel all Control Head connections.

MICROPROCESSOR KEEP-ALIVE KIT Model No. 70-2215

Wire and components to provide constant low-current DC power from the vehicle battery to the transceiver microprocessor in installations where the transceiver DC power connections are connected to the vehicle ignition circuit. With microprocessor internal memory always active, last selected operating and Priority channels are maintained while the vehicle ignition is off.

The fused B+ wire included in this kit must be added to the transceiver Power/Accessory Plug and connected to the vehicle battery or a non-switched circuit. Other components must also be added.

SYN-TECH TRUNK-MOUNT TO UNDER-DASH CONVERSION Model No. 70-2251

A kit containing the SYN-TECH under-dash front panel assembly and appropriate under-dash mounting hardware to convert the transceiver configuration.

SYN-TECH UNDER-DASH TO TRUNK-MOUNT CONVERSION Model No. 70-2252

A kit containing the Trunk-mount transceiver front assembly, Control Head, and appropriate trunk-mount hardware and accessories to convert the transceiver configuration.

TALK-AROUND PUSH BUTTON KIT (for under-dash units) Model No. 70-2815

A PC board and parts to provide an additional switch on the transceiver front panel that, when pressed while a duplex channel (transmit frequency and receive frequency different for communications through a repeater) is selected, causes the transceiver to operate in simplex mode (transmit and receive frequencies identical). The 70-2815 kit is compatible to the under-dash transceivers only. The 70-2816 kit is the trunk-mount complement.

A front panel push button function is changed by replacing the face plate. Several soldered connections must be made.

TALK-AROUND PUSH BUTTON KIT (for trunk-mount units) Model No. 70-2816
Same as the 70-2815 kit for under-dash SYN-TECH transceivers, except some parts are different for compatibility to trunk-mount transceivers.

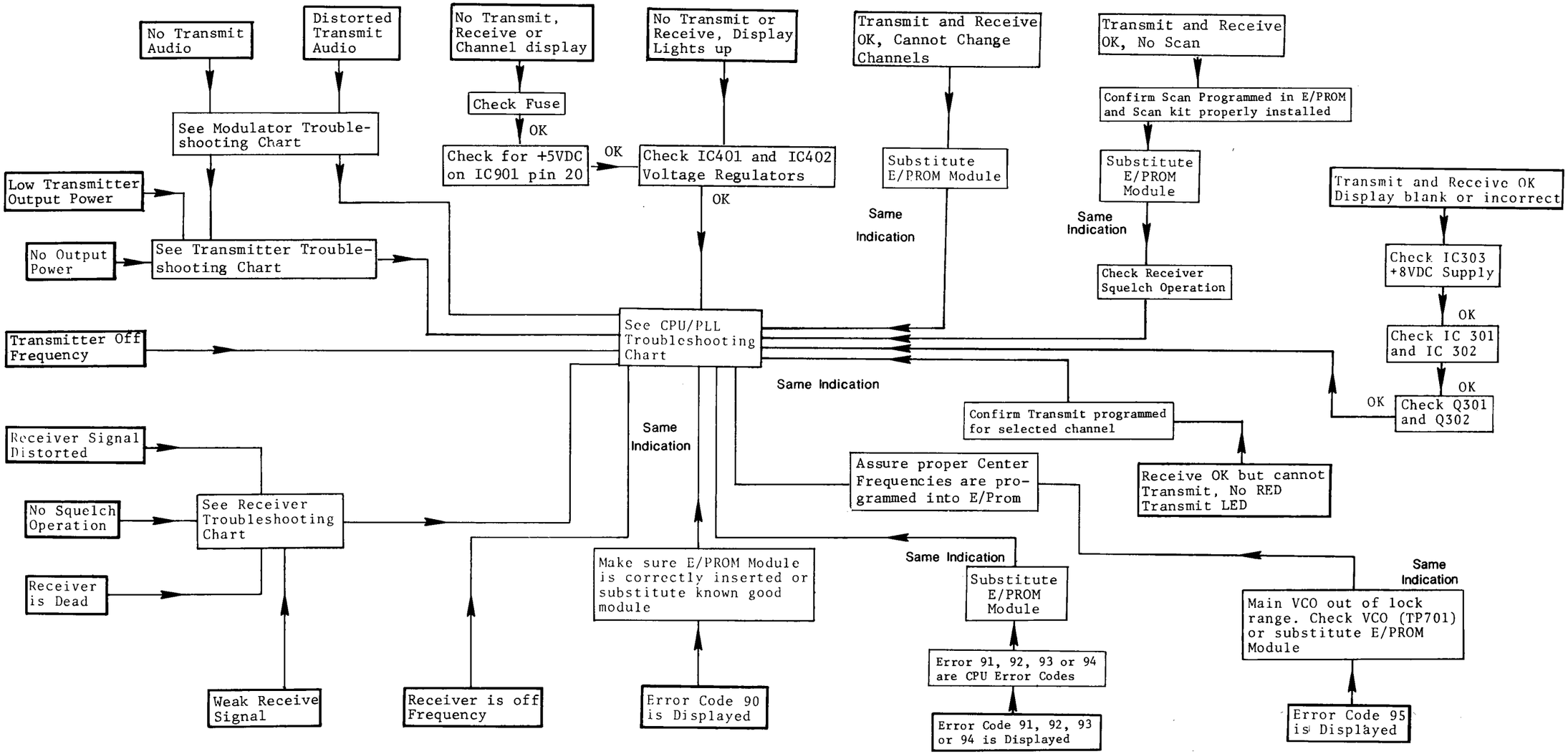
6-PIN MICROPHONE JACK REPLACEMENT Model No. 70-K33
This kit contains a 6-pin jack and parts to replace the 4-pin microphone jack in either the under-dash transceiver (J393), or the trunk-mount transceiver Control Head (J395). The 6-pin jack is necessary for connection with the 70-2305 Desk Microphone. It is also needed for connection of the 70-2103A/70-2104A DTMF Encoding Microphones, but is included with each of them.

Jack wiring inside the transceiver for the Desk Microphone is not the same as for the DTMF Encoder Microphones. The 70-2235 Jack Removal Tool makes removal of the front jack retaining nut easy.

SERVICING

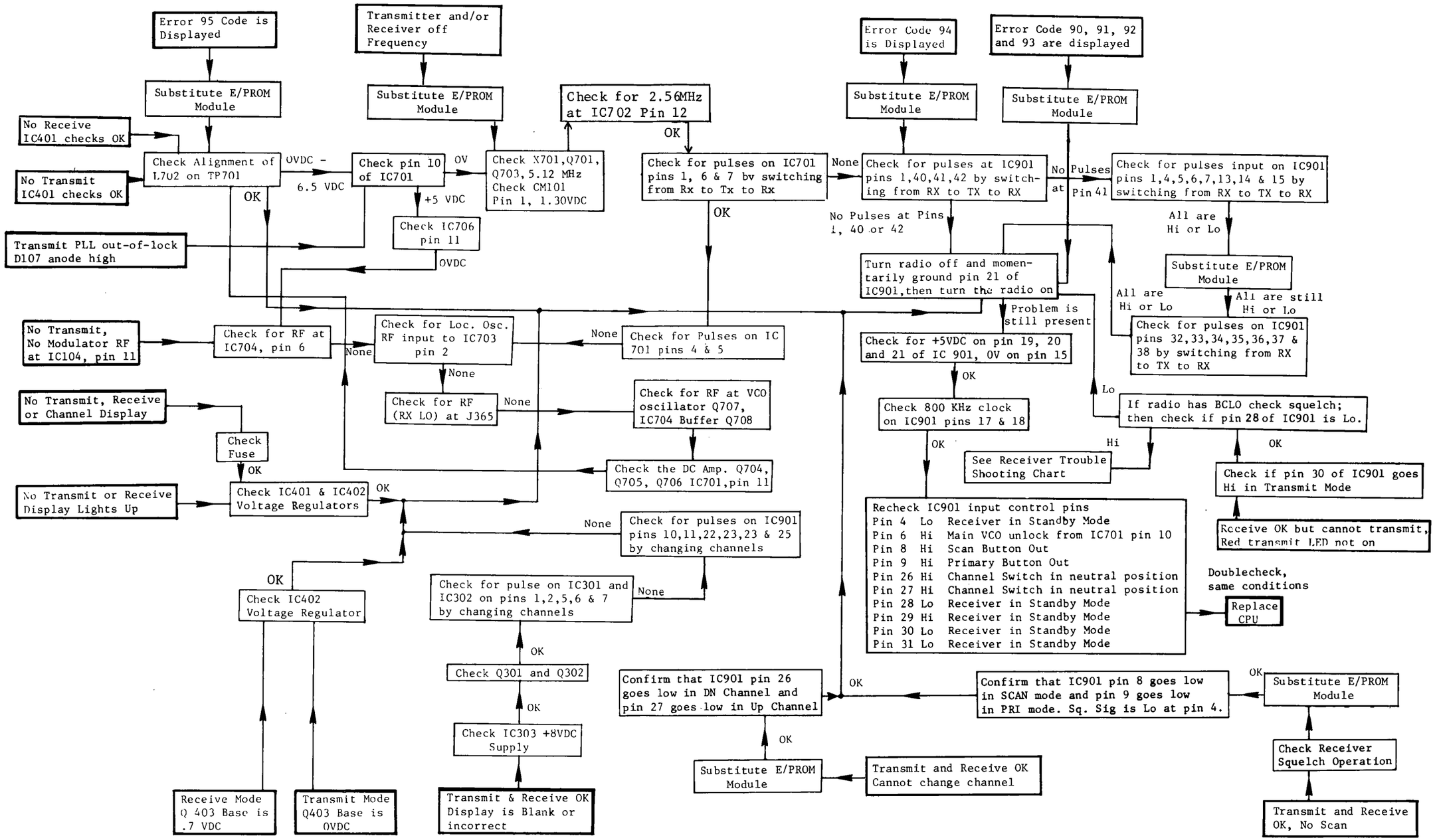
GENERAL TROUBLESHOOTING CHART

70-342XL/442XL



CPU/PLL TROUBLESHOOTING CHART

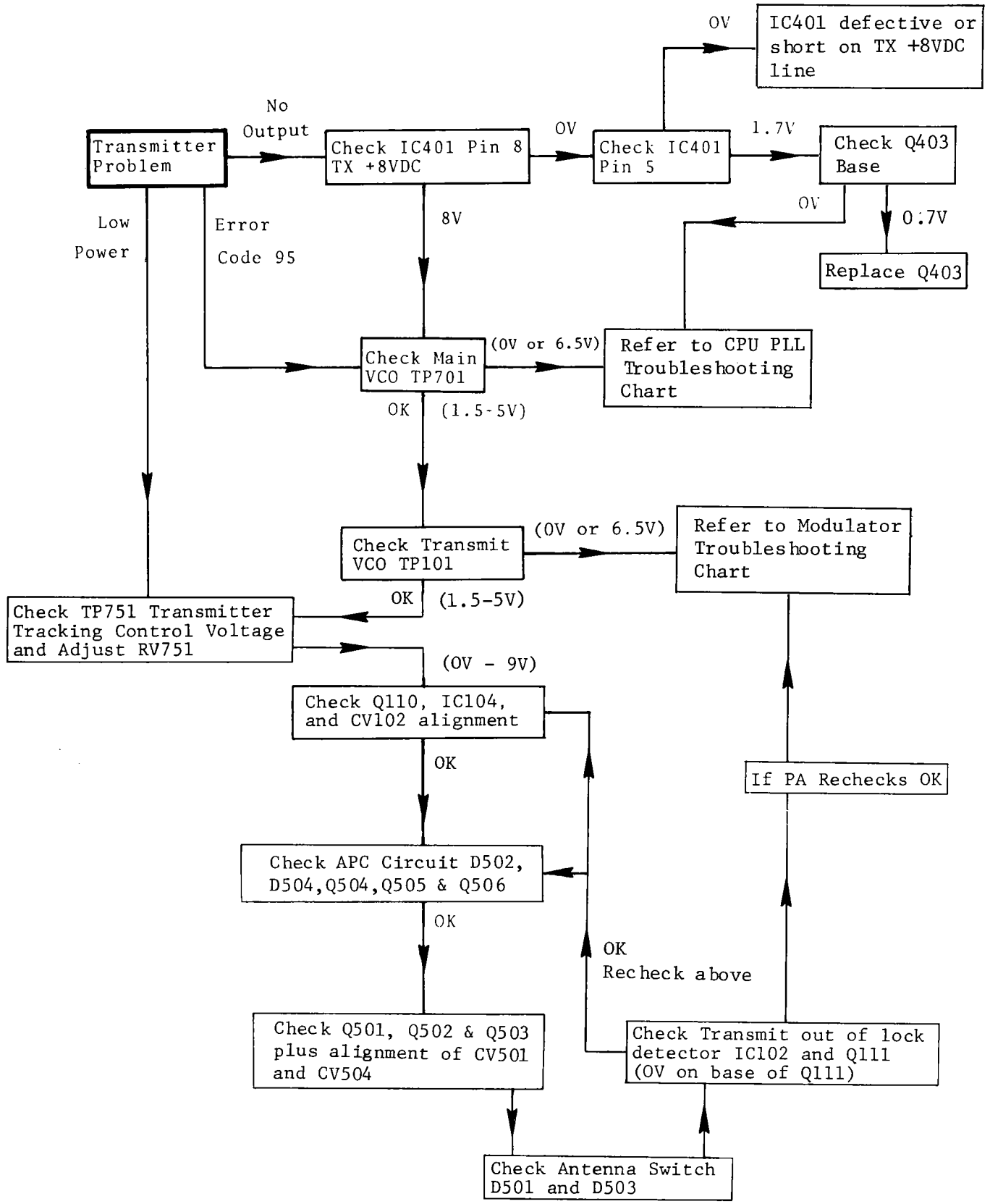
70-342XL/442XL



Fold Out

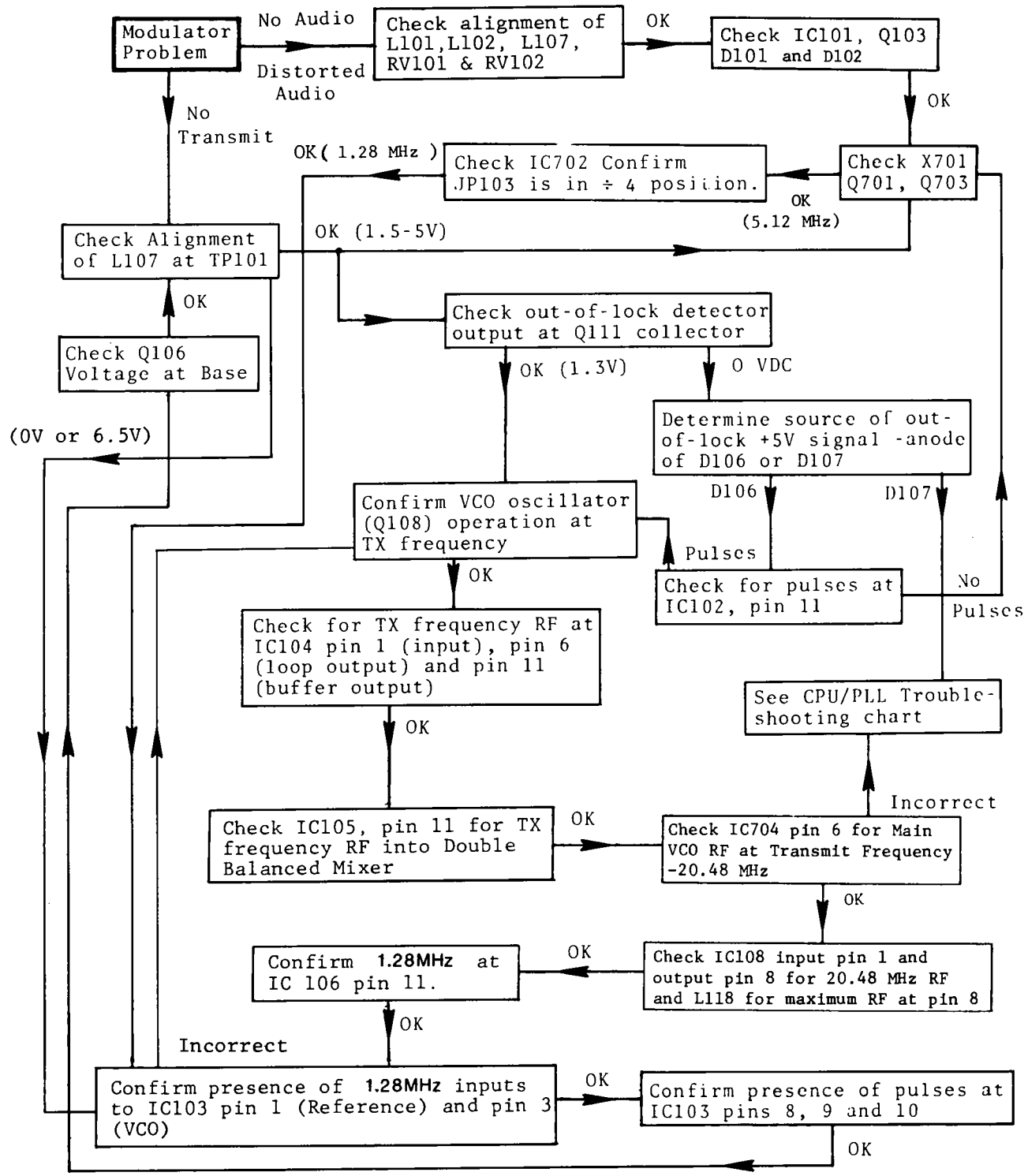
TRANSMITTER TROUBLESHOOTING CHART

70-342XL/442XL



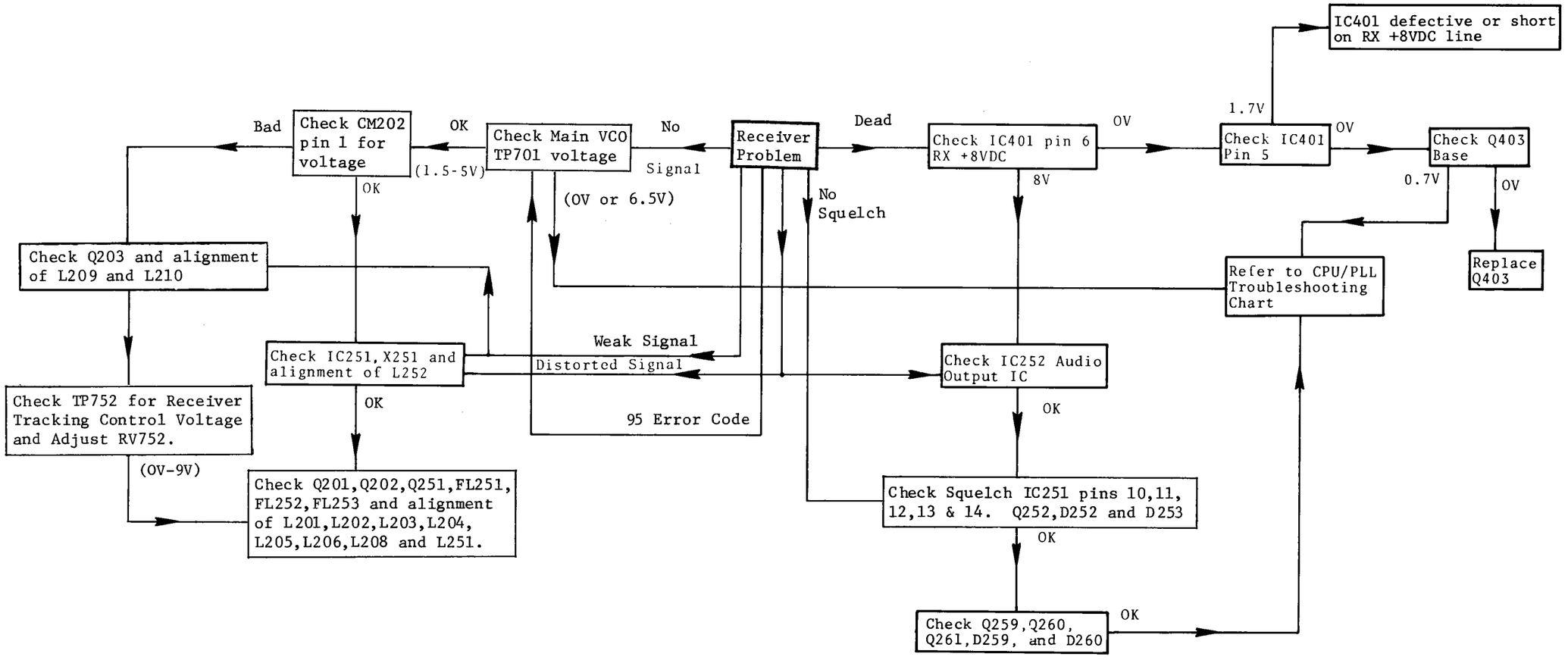
MODULATOR TROUBLESHOOTING CHART

70-342XL/442XL



RECEIVER TROUBLESHOOTING CHART

70-342XL/442XL



Fold Out

CHIP COMPONENT IDENTIFICATION

CHIP CAPACITORS: Chip capacitors typically are brown, green or white and marked with one alphabetical character followed by a numerical multiplier. Bars above, below, or beside these characters define temperature characteristic.

ALPHABET CHARACTER	NUMERICAL VALUE	ALPHABET CHARACTER	NUMERICAL VALUE	NUMERICAL CHARACTER	MULTIPLIER VALUE
A	1.0	T	5.1	0	1.0
B	1.1	U	5.6		
C	1.2	V	6.2	1	10
D	1.3	W	6.8		
E	1.5	X	7.5	2	100
F	1.6	Y	8.2		
G	1.8	Z	9.1	3	1000
H	2.0	a	2.5		
J	2.2	b	3.5	4	10,000
K	2.4	d	4.0		
L	2.7	e	4.5	5	100,000
M	3.0	f	5.0		
N	3.3	m	6.0	8	0.01
P	3.6	n	7.0		
R	4.3	t	8.0	9	0.1
S	4.7	y	9.0		

TEMP. COEFF. (PPM/°C)	NPO	N150	N220	N330	N470	N750	N1500	+350 -1000	+20% -20%	+80% -20%
BAR LOCATION	$\overline{\overline{A1}}$	$\overline{A1}$	$A\overline{1}$	$\underline{A1}$	$\underline{A}1$	$A\underline{1}$	|A1	A1	A1|	$\underline{A\underline{1}}$

Example: $\overline{\overline{A1}}$ marking indicates a 10 pF NPO capacitor.
A = 1.0, 1 = x10, two bars above = NPO

CHIP RESISTORS: Chip resistors used in the SYN-TECH typically are white with blue value markings. Resistance in ohms can be determined from value markings as follows:

1st two digits -- significant numerals (00 to 99)
3rd digit -- amount of following zeros

Example: 125 = 12 & 00000 = 1,200000 ohms = 1.2 megohm

REPLACING COMPONENTS WITH LEADS

STATIC POTENTIALS

Many of the components utilized in the transceiver are susceptible to higher voltages whether they are in or out of a circuit. Before handling and soldering components and circuit boards, take measures to avoid static or AC-line potentials. It is best to use a grounded soldering iron to prevent AC-line and static 'hot' soldering tips.

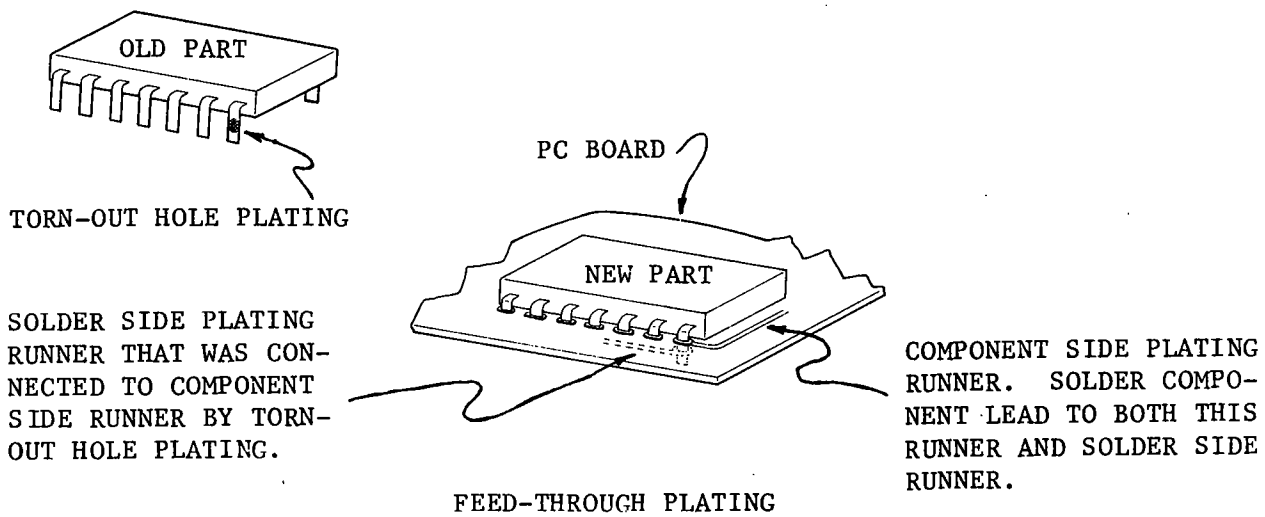
Because the objects that touch the circuitry during the component replacement process each carry a different static potential, the only way to alleviate risk of component damage from static discharge is to make all these contacting objects carry the same potential. Since the soldering iron is grounded, 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 make sure you and the grounded work area are at the same potential by touching bench ground when sitting down.

DESOLDERING AND RESOLDERING

Extreme care must be exercised 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.

A solder suction tool or braided desoldering wick can be used 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. Cutting the defective component away from its leads first makes removal of the leads and solder easier.

Before installing a new component, remove all solder from lead holes and assure proper orientation of the device. 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.



CHIP CAPACITOR AND RESISTOR REPLACEMENT

The following describes how to remove a chip component and affix a new one with maximum solder-bond success. A soldering iron that regulates its tip temperature between 600-700 degrees Fahrenheit is required.

Because of thermal stresses involved, no chip component can be unsoldered, then resoldered, without damage. Never reuse chip components. Also, do not apply heat to pads or components any longer than necessary--chip components burn easily.

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

1. Place a solder iron tip directly on the defective component to melt the glue under the component and solder as shown in Figures 1 and 2. Remove component with tweezers or longnose pliers. Discard the component.

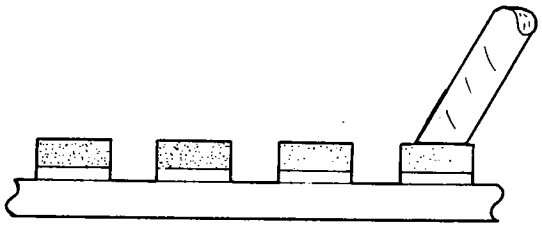


FIG. #1

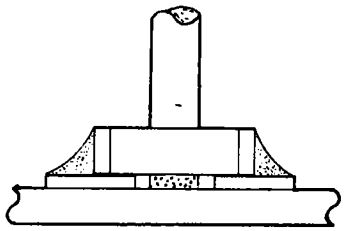


FIG. #2

2. Completely remove old solder, old glue, and any other contaminants from the area with a desoldering tool and alcohol. Desoldering wick also works well.

3. Apply a small amount of fresh solder to the clean PC pad as shown in Figure 3.

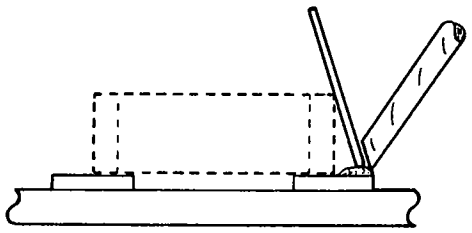


FIG. #3

CHIP REPLACEMENT (continued)

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.

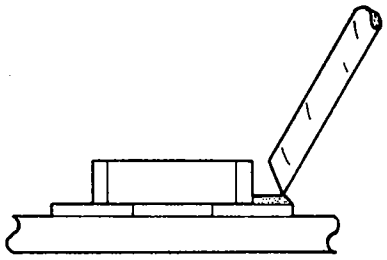


FIG. #4

5. With one component end tacked to hold it, the other end can be soldered. Carefully apply heat to the PC pad while adding only enough fresh solder to produce a clean fillet as in Figure 5--do not apply too much solder, otherwise it may flow underneath and short the pads together. Let the hot solder flow onto the component--never 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 of component as in Figure 6.

CAUTION: Never apply an iron tip directly to a chip component. Too much heat and contamination will break down the metallic film on component ends resulting in loss of connection to one or more capacitor wafers. 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.

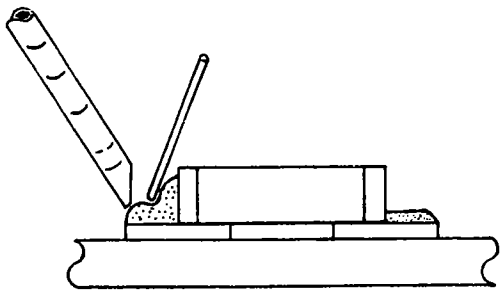


FIG. #5

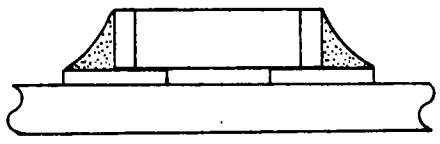


FIG. #6

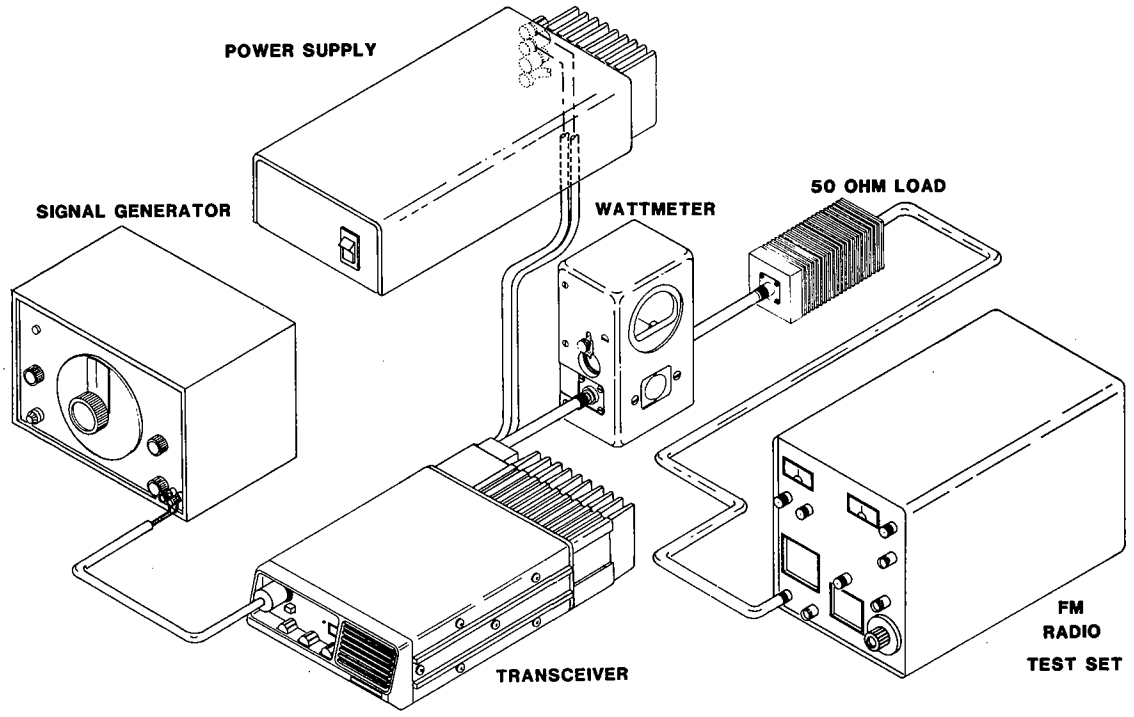
The 70-342XL and 70-442XL wideband transceivers are capable of operating over a 24 MHz channel frequency spread without retuning. Maintenance calibration described previously is sufficient alignment in most cases. The following procedure is for realignment of the transceiver upon replacement of a component that may affect alignment. This realignment procedure requires the presence of test channel frequencies in the E/PROM, therefore E/PROM reprogramming is necessary (see the E/PROM Programming section).

SUGGESTED TEST EQUIPMENT

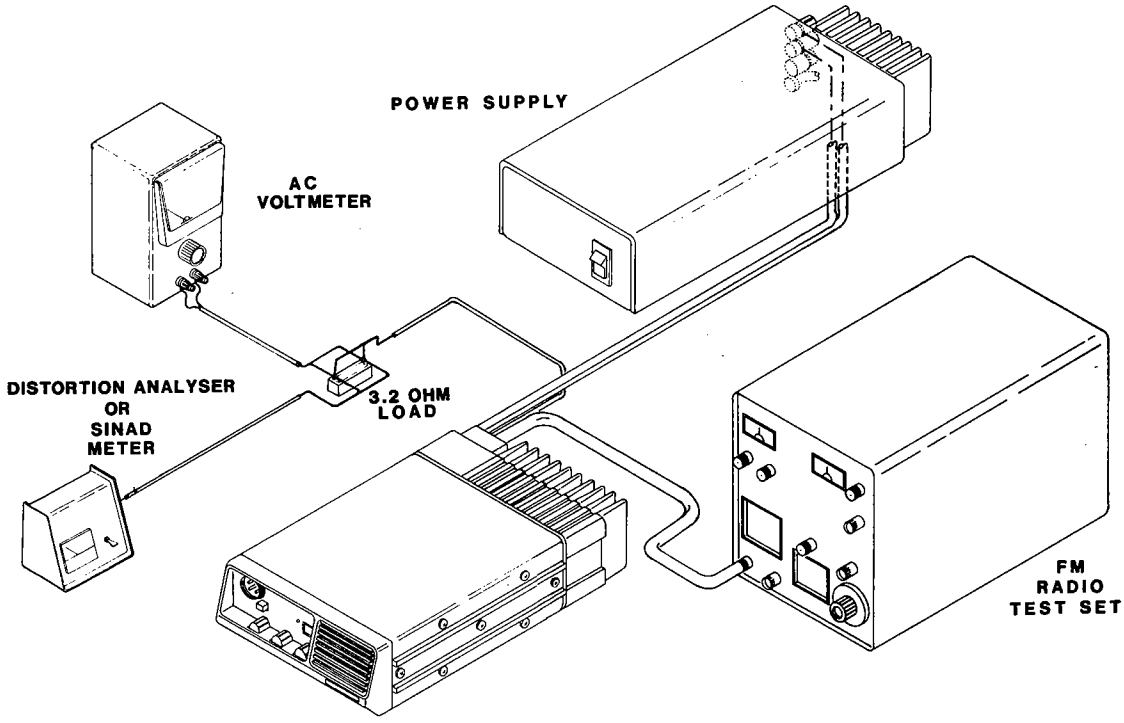
Test Instrument	Instrument Capabilities	Instrument Type
DC Power Supply	13.8 VDC, 10 amps	Power Mate BPA-20PF
Wattmeter	50 watts, 136-174 MHz	Bird model 43 with 50C element and 50 ohm load
Digital Multimeter	0.1 to 20 volts DC & AC	B-K 2810
Distortion Analyzer	1KHz, < 2% range	HP-333A
Speaker Load	3.2 ohms, 10 watt	
RF Signal Generator	136-174 MHz range. 0.1-1KuV output, FM modulated	Cushman CE-31A
Deviation Meter	136-174 MHz. +/-5KHz range	p/o Cushman CE-31A
Frequency Meter or Frequency Counter	136-174 MHz 2.0 ppm accuracy	p/o Cushman CE-31A or Heath SM-4120
Audio Generator	0-10 KHz sine-wave, 0-5 Vrms output	Heath SG-5218

For Factory Presets alignment:

RF Probe for DVM	.25-30 Vrms input	HP 11096B or Fluke 83RF



TRANSMITTER AND SYNTHESIZER ALIGNMENT SET-UP



RECEIVER ALIGNMENT SET-UP

* * * * ERROR CODES * * * *

Error code 90, 91, 92, 93, and 94 appearing in the channel display with continuous triple-beeps indicates the E/PROM module is missing, improperly inserted, or incorrectly programmed. Check the E/PROM module or refer to the E/PROM Programming section in this service manual.

Error code 95 appearing in the channel display with a triple-beep indicates the synthesizer phase-lock-loop cannot achieve lock. A defect is present and must be corrected.

REALIGNMENT PROCEDURE

THIS PROCEDURE IS ONLY NECESSARY if alignment has been changed by component change or tampering. THE E/PROM MUST BE REPROGRAMMED for special test frequencies.

-- Set-Up --

1. Remove the 8 securing screws to remove the top and bottom covers.

2. Remove the E/PROM Module. Replace it with another E/PROM Module that has been programmed with the following channels. INCLUDE THE CENTER FREQUENCIES as described in the E/PROM Programming section.

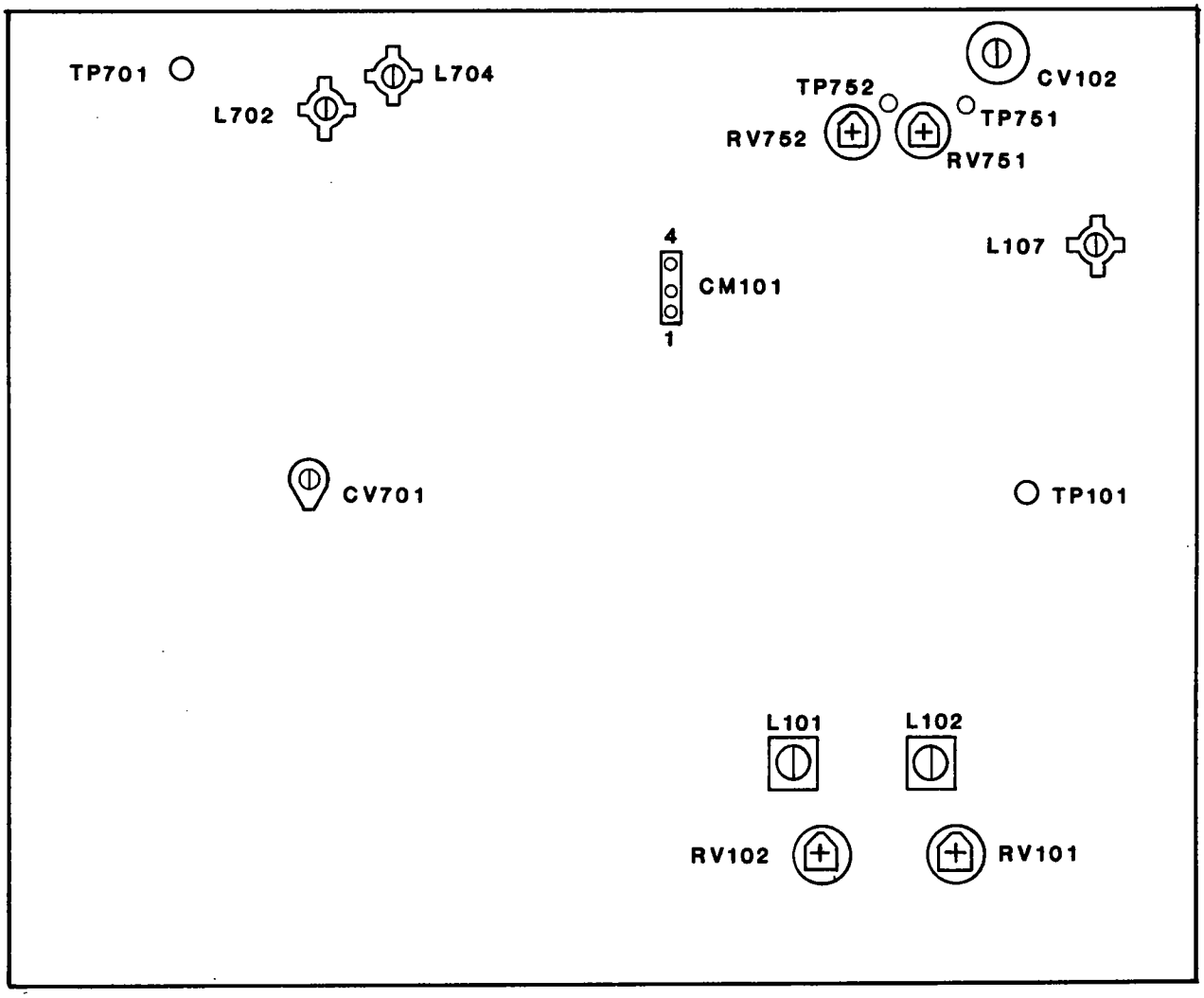
CHANNEL	A-BAND XCVR	B-BAND XCVR
Test Channel 1 - RX	156.00 MHz	174.00 MHz
Test Channel 1 - TX	156.00 MHz	174.00 MHz
Test Channel 2 - RX	148.00 MHz	160.00 MHz
Test Channel 2 - TX	148.00 MHz	160.00 MHz
Test Channel 3 - RX	136.00 MHz	150.00 MHz
Test Channel 3 - TX	136.00 MHz	150.00 MHz

3. Turn the volume control to a mid position and the squelch control fully counterclockwise.

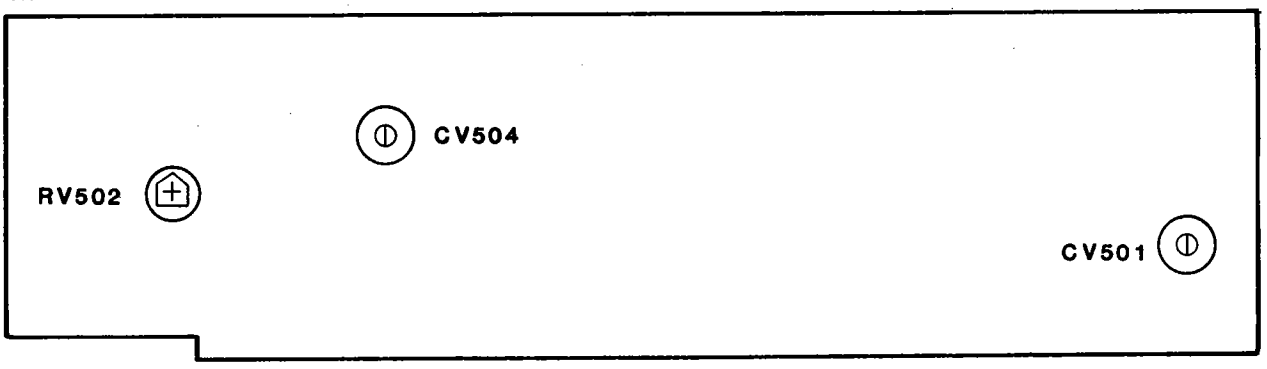
4. Supply 13.6 volts DC power to transceiver J391. Connect [+] to pin 9 and [-] to pin 7. Connect a resistive, 50 ohm RF load (with a wattmeter) to antenna connector J392.

TRANSMITTER AND SYNTHESIZER ADJUSTMENTS

TRANSMITTER BOARD



RF POWER AMPLIFIER BOARD



SYNTHESIZER ALIGNMENT

--VCO Resonance--

5. Select Test Channel 1. Activate the transmit mode by shorting MICROPHONE J393 (or J395 of the Control Head) pins 2 and 4. Adjust MAIN VCO RESONANCE L702 for 5.5 volts DC on MAIN VCO STEERING TP101.

6. Continue transmitting on Test Channel 1. Adjust L107 for 5.5 volts DC on TX VCO STEERING TP101.

7. Select Test Channel 2. While in receive mode, adjust MAIN VCO RESONANCE L704 for 5.5 volts DC on MAIN VCO STEERING TP701.

8. Select Test Channel 3. If MAIN VCO STEERING TP701 is not at least 1.0 volt DC in receive mode, repeat steps 5 through 8.

--Electronic Tuning Tracking--

9. With the transceiver set to receive Test Channel 3, adjust RX TRACKING RV752 for 1.0 volt DC on TP752.

10. Select Test Channel 1 and key the transmitter. Adjust TX TRACKING RV751 for 9.0 volts DC on TP751.

TRANSMITTER ALIGNMENT

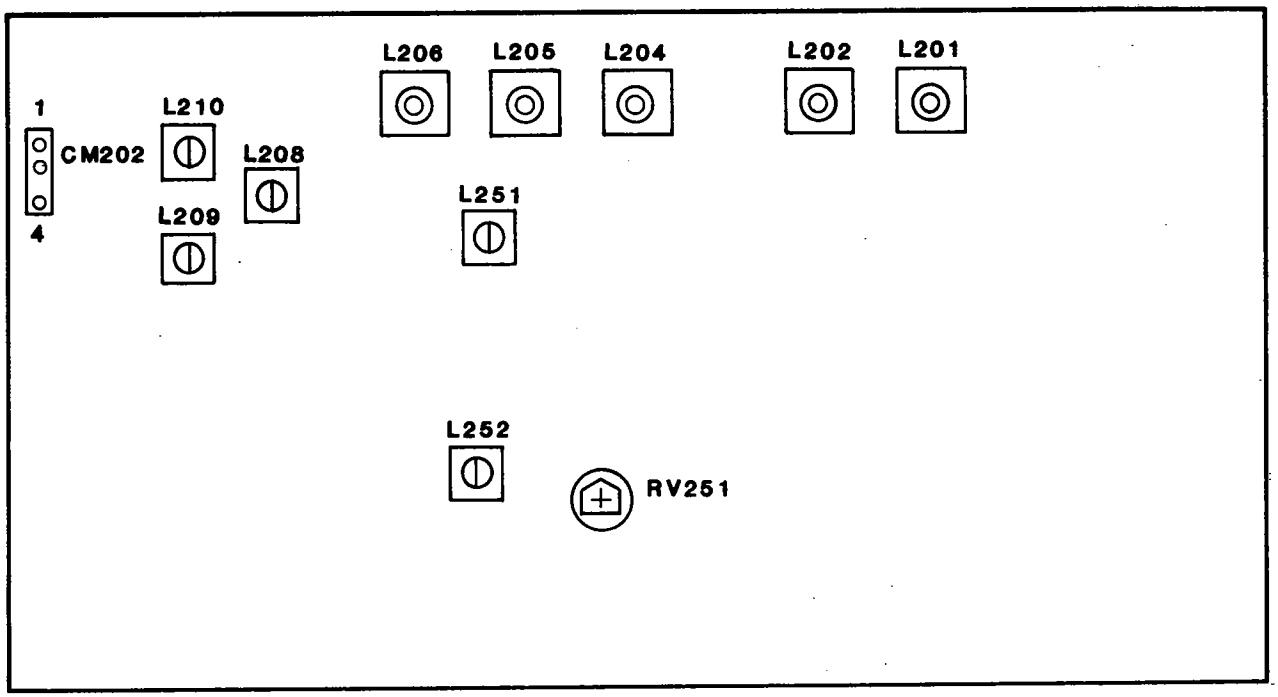
11. Select Test Channel 3 and key the transmitter. Adjust CV102 for a minimum DC voltage on CM101 pin 2 (TX Preamplifier Collector Current).

12. Align carrier frequency, modulation, and power output as instructed in the Maintenance Calibration procedure. Use Test Channel 3 for RF Output Power Adjustment.

13. Apply 0.15 Vrms of 1 KHz signal to the Microphone Receptacle J393 pins 1 and 2 (J395 on the trunk-mount Control Head). Pin 1 is signal high; pin 2 is ground. Key the transmitter, then adjust MIC SENSITIVITY RV102 for +/- 2.5 KHz deviation of transmitted carrier (excluding CTCSS deviation, if present).

RECEIVER ADJUSTMENTS

RECEIVER BOARD



RECEIVER ALIGNMENT

All audio measurements in the following steps are taken across an external 3.2 ohm, 10 watt resistor connected to pins 4 and 6 of the Power/Accessory Plug P393 (or the Power Plug J391 on trunk-mount units) in place of the wire jumper in pins 5 and 6 . The internal speaker will be disabled.

--First Injection--

14. Select Test Channel 3 (lowest test frequency). Adjust L209 and L210 for maximum DC voltage on Injection Metering Point CM202 pin 1.

--Preselector Alignment--

15. With Test Channel 3 selected, apply sufficient unmodulated, on-channel RF signal to the antenna connector to maintain approximately 20 to 30 dB quieting. Adjust L201, L202, L204, L205, and L206 for maximum quieting indication (peak positive voltage) at CM202 pin 2.

--Quadrature Detector--

16. Apply 1 mV of modulated (1 KHz tone, +/-3 KHz deviation) on-channel RF signal to the 50-ohm antenna connector. Adjust DETECTOR L252 for maximum audio output.

--First I.F.--

17. Apply enough modulated (1 KHz tone, +/-3 KHz deviation) on-channel carrier to maintain 12 to 15 dB SINAD. Adjust L208 and L251 for best SINAD.

18. Apply 1 mV modulated (1 KHz tone, +/-3 KHz deviation) on-channel carrier. Readjust L208 and L251 for minimum receive audio distortion. NOTE: If a distortion analyzer is not available, this step may be deleted--although distortion specifications may not be met.

--Tight Squelch--

19. Set the front panel SQUELCH control to maximum (full clockwise). Set SQUELCH RANGE RV251 fully counterclockwise.

20. Apply unmodulated on-channel RF signal to the 50-ohm antenna connector at a level equal to the desired tight squelch sensitivity (usually 1.5 microvolts). Adjust SQUELCH RANGE RV251 clockwise just until squelch opens (audio on).

--Maximum Audio--

21. Apply modulated (1 KHz tone, +/-3KHz deviation) on-channel RF signal to the antenna connector. Turn the front panel VOLUME control to maximum and adjust MAXIMUM VOLUME RV252 for desired audio output power (below 5 watts) into the 3.2 ohm audio load.

FACTORY PRESETS

DO NOT ADJUST THE FOLLOWING coils unless components connected to them have been changed, or the coils themselves have been replaced, or they have been accidently turned. Undisturbed, their factory settings should provide optimum performance for the life of the transceiver.

If any of these coils need alignment, the following steps require direct measurement of RF levels in circuitry. These measurements can only be taken with an RF probe that has a diode close to the probing tip to convert RF signal to DC for measurement with a DVM. See the Suggested Equipment List for recommendation.

** All adjustments following must be made with the Test E/PROM installed in the transceiver and with Test Channel 2 selected.

L707, L708, L709 (Main VCO) Adjust L709 for maximum Injection RF signal level at J365. Adjust L707 and L708 for maximum PLL feedback RF signal level at IC703 pin 2.

L110, L111, L112 (Transmit VCO) With the transmitter keyed, adjust L110 and L111 for maximum transmit RF signal level at IC104 pin 11 (probe the component-side runner from pin 11 to the feed-through pad of C176). Adjust L112 for a maximum PLL feedback signal level on L117 (probe a wire loop of the coil).

L118 (Down-converted transmit PLL feedback) With the transmitter keyed, adjust L118 for a maximum RF signal level at IC106 pin 14.

The 70-342XL and 70-442XL transceivers contain three major PC boards: the Transmitter Board, the Receiver Board, and the RF Power Amplifier. The Transmitter Board is the subject of this section and contains transmitter, frequency synthesizer, and microprocessor control circuits.

MICROPROCESSOR CONTROL CIRCUITRY

Activity of the entire transceiver is manipulated by microprocessor IC901 via control signal interconnects. Microprocessor activity in turn is a result of its own internal activity. Repetitive operations based on an internal 800 KHz oscillator continuously access and perform step-by-step instructions from an internal list. The instructions cause the microprocessor to sample logic high and low voltages on its input pins and apply appropriate logic voltages at its output pins with speed such that response seems instantaneous.

Various interconnections to IC901 carry logic high and low potentials as status input to the microprocessor and control output from the microprocessor. These status and control interconnects are routed throughout the transceiver to manipulate its operation. See MICROPROCESSOR (IC901) PINOUTS in this section for details of microprocessor pins and functions.

Note that certain port interconnects are both and input and an output. This is a time sharing situation. At one instance a logic potential is applied from transceiver status circuitry to both the microprocessor and transceiver control circuitry connected to the same point. At another instance the microprocessor applies a logic potential to the control circuitry.

These information gathering (status) and manipulating (control) interconnects are the media of the data moving operation of the microprocessor, therefore they are identified hereinafter as ports. Other connections to the microprocessor are supportive to the microprocessor itself and are identified respectively.

E/PROM READ

A table of radio operating parameters and channel frequencies is contained in E/PROM IC951. The parameter data 'words' in the form of on or off cell states within addressable locations are copied as logic highs and lows to the microprocessor; one 'word' at a time when needed. The microprocessor reads each 8-bit word by calling, or addressing, the cells in groups of eight. Once addressed, the cells apply respective logic potentials at eight E/PROM outputs for transfer to the microprocessor.

Each data 'word', or byte, is addressed from the E/PROM bank of 2048 bytes by a combination of logic potentials present at its address inputs A0-A10. The microprocessor applies this address in two sets from ports R20-R23, R30, and R31. The first set is latched into six-bit latch IC952 with a pulse from the R32 port that strobes IC952. The second set of E/PROM data address immediately follows on the same R20-R23 and R30 microprocessor ports--but bit-latch IC952 is not strobed. Thus, the second set is applied to the A0, A1, and A8-A10 E/PROM address inputs while the first latched set is simultaneously applied to the A2-A7 inputs. The parameter data byte then appears on the O0-O7 E/PROM outputs.

When a channel is changed or the transceiver operating mode changes from TX to RX or vice versa, parameter data is read from the E/PROM. After the E/PROM address sequence, port R31 of the microprocessor (not used when the second address set is applied) applies a logic high to activate chip enable and output enable inputs of IC951. The E/PROM then applies the data contained in the addressed location to IC902 through its O0-O7 outputs.

Shift register IC902 loads the E/PROM data output when its strobe input is pulsed by microprocessor port D0. The microprocessor then applies eight pulses from its D2 port to IC902 clock input which causes each loaded bit to appear on IC902 serial data output pin 3, one at a time. The eight bit string is applied back to the microprocessor port D1, completing the E/PROM data read sequence.

TOP PANEL CONTROLS

Various status inputs connect from, and control outputs connect to, the front panel controls and option via microprocessor ports R00-R03, R10-R13, D4-D7, and D10-D13. A respective logic potential on each dictates appropriate functions.

To display a channel number, the microprocessor applies appropriate logic potentials from its four DSPL outputs that are latched into LED drivers IC301 and IC302 (in the control panel). The drivers decode the latched-in logic high and low potentials, then gate current to appropriate LED segments.

PHASE-LOCK-LOOP PROGRAMMING

Frequency dividers in the synthesizer phase-lock-loop are programmed when the appropriate data word is read from the E/PROM by the microprocessor. These dividers, that are within IC701, require a string of bits (one bit is the logic voltage present during a given instant in time) to set A and N counter values. Each bit is loaded serially into IC701 as it is applied to the microprocessor from IC902 output port. Each bit is loaded concurrently with bit-clock pulses from IC901 D2 port. After all bits are loaded into IC701, a strobe pulse from the microprocessor port D3 latches the loaded bits and reprograms the dividers.

MICROPROCESSOR (IC901) PINOUTS

PIN NO.	PIN NAME	INPUT/ OUTPUT	SIGNAL NAME	FUNCTION
1	D3	OUT	DSTB+	Strobe for serial data to synthesizer
2	D4	OUT	TXTM-	TX/RX mode control to option (TX Mode = LO)
3	D5	OUT	ALM-	Alert tone (2 KHz)
4	D6	IN	SQSIG+	Noise squelch status (HI = carrier present)
5	D7	BOTH	TSQMON-	LO in = Sq Tone decoded or MONITOR push button is in Scan activity (scan stopped = LO out)
6	D8	BOTH	PLCL-	Synthesizer PLL status (LO in = PLL unlocked) RX Mute and TX inhib during channel change,etc.=LO out
7	D9	OUT	VCOCNTL	VCO band switch control (Upper channels selected = LO)
8	D10	IN	SCAN-	SCAN push button status (LO = pushbutton is in)
9	D11	IN	PRI-	PRI push button status (LO = push button is in)
10	D12	OUT	DSPSTL-	Strobe for ONE's digit of CHANNEL display data
11	D13	OUT	DSPSTH-	Strobe for TEN's digit of CHANNEL display data
12	D14	IN	ALBH-	A-band/B-band jumper status
13	D15	OUT	TXDL	TX/RX Mode control (TX = LO)
14	nc	--	--	
15	RESET	IN		CPU Reset (HI = Reset)
16	GND			
17	OSC1			Clock oscillator (800 KHz +/-5%)
18	OSC2			Clock oscillator (800 KHZ +/-5%)
19	HLT	IN		Standby Mode (HI = Sleep)
20	TEST			not used
21	Vcc			Vcc (5 Volts, +/-10%)
22	RO0	OUT	DSP0+	LED Display data (8 Volt logic levels)
23	RO1	OUT	DSP1+	LED Display data (8 Volt logic levels)
24	RO2	OUT	DSP2+	LED Display data (8 Volt logic levels)
25	RO3	OUT	DSP3+	LED Display data (8 Volt logic levels)
26	R10	IN	UP-	CHANNEL UP pushbutton status (LO = pressed)
27	R11	IN	DWN-	CHANNEL DOWN pushbutton status (LO = pressed)
28	R12	IN	INH+	PTT inhibit status (HI = Deactivate PTT)
29	R13	IN	TA-	Talk-Around select(HI=TX/RX freq same;LO=TX/RX offset)
30	INT0	IN	PTT+	PTT (Push-To-Talk) status (HI = PTT activated)
31	INT1	IN		not used
32	R20	OUT	RMA0+	E/PROM addressing
33	R21	OUT	RMA1+	E/PROM addressing
34	R22	OUT	RMA2+	E/PROM addressing
35	R23	OUT	RMA3+	E/PROM addressing
36	R30	OUT	RMA4+	E/PROM addressing
37	R31	OUT	RMA5+	E/PROM low-order addressing; or E/PROM Enable
38	R32	OUT	ASTB+	Strobe for E/PROM address latch
39	R33	OUT	AUXSTB+	Strobe for AUXILIARY data to option
40	D0	OUT	PSST+	Strobe for E/PROM data out. into shift register IC902
41	D1	IN	CHDT+	Serial data from shift register IC902
42	D2	OUT	DCLK	Clock for CHDT+

HI = 3.5 to 5 Volts DC; LO = 0 to 1.5 Volts DC

AUXILIARY DATA

Options such as CTCSS are programmed from data in the E/PROM parameter table. Data is transferred directly from the E/PROM data outputs to the option when the microprocessor initiates an E/PROM read cycle. An E/PROM read sequence that loads the option is distinguished from other read cycles by the presence of an auxiliary data strobe applied from the microprocessor port R33. This strobe causes the option to load and latch the auxiliary data logic potentials simultaneously present on the E/PROM outputs.

PUSH-TO-TALK

The PTT logic low that is applied to IC706 where it is inverted, then applied to the interrupt input (INTO) of the microprocessor. This forces the microprocessor to revert to its radio transmit routine by which it first reads E/PROM data at an address respective of the selected channel. After reading TX channel frequency, it sets PLCL port to a logic low which inhibits the transmitter stages and mutes the receiver (thus preventing erroneous activity while the synthesizer is reprogrammed). It then sends new data to the synthesizer and option, changes the display, and finally sets TXDL and TXTM ports to logic low and PLCL back to logic high. When PTT is released, the process repeats; except RX channel frequency data is read and TXDL and TXTM are switched back to logic high.

When the microprocessor is not applying a logic low to its PLCL port, the port serves as an input to receive an out-of-lock indication (logic low) from the synthesizer phase lock loop. The out-of-lock logic low from IC701 pin 10 also disables the transmitter stages and mutes the receiver.

SCAN OPERATION

Most operating functions of the optional scan feature are performed within the microprocessor. Also, carrier detection is already available to the microprocessor for BCLO operation. Therefore, only operator control circuitry is dedicated to scan. This is provided by the SCAN and PRI front panel push buttons that apply logic low status to respective microprocessor ports.

ERROR CODES

Numerals '90', '91', '92', '93' or '94' appearing in the channel display accompanied by continuous triple-beeps indicate the E/PROM module (IC951 and IC952) is unplugged, unprogrammed, or defective. When the microprocessor is unable to read the operating parameter data table from the E/PROM upon power-up, it continues this error routine until E/PROM integrity is returned or power is removed.

Numeral '95' appearing in the channel display accompanied by one triple-beep on power-up or channel change is a result of the PLCL port remaining logic low, thereby indicating the synthesizer phase-lock-loop cannot attain lock. The triple-beep sounds again when the radio is keyed if the PLCL port still stays logic low.

SYNTHESIZER CIRCUITRY

The SYN-TECH mobile transceivers utilize two individual phase-lock-loops (PLL). One always runs to produce, in receive mode, receiver injection frequency that is 21.4 MHz below (low-side injection is standard) channel frequency. In transmit mode it produces a beat frequency for generation of a 20.48 MHz mix-down signal used in the other PLL. The other PLL is active only in the transmit mode and produces actual channel frequency that is phase modulated by Transmit Audio. Logic voltage control signals from the microprocessor set PLL frequency dividers, switch appropriate loop circuits, and activate the transmit string.

MAIN PHASE-LOCK-LOOP

RF signal is produced by the Voltage Controlled Oscillator (VCO) in the main PLL (the one that is always active). It consists of Q707, Q708, and D702. Its output, which is at channel frequency minus 21.4 MHz in receive mode or channel frequency minus 20.48 MHz in transmit mode, is buffered by Q702 for connection to the receiver mixer. This buffered signal is buffered again by part of IC704 and applied to the second PLL. The other part of IC704 buffers that signal for frequency division by prescaler IC703.

Prescaler IC703 divides the VCO sample by 64 and 65 to produce approximately 2.5 MHz at its output pin 5. The prescaled count is then divided by the programmable divider within IC701, leaving 2.5 KHz at one of the two phase/frequency comparator inputs (also within IC701). The other comparator input is a 2.5 KHz reference produced by division of the 5.12 MHz master oscillator X701 output. The master oscillator output at Q703-collector is divided by two in IC702 and divided by a fixed ratio of 1024 within IC701.

Phase/frequency comparator output is noisy DC potential that varies in level with respect to frequency difference between its inputs. The noise is filtered by the main loop filter consisting of Q704, Q705, and Q706. Clean DC potential is then applied to varactor diode D702 in the VCO, which regulates VCO resonance.

The signal loop described hereinbefore keeps the VCO output at whatever frequency is necessary to produce a divided-down (by the programmable dividers) signal that exactly matches the 2.5 KHz reference. When the VCO output drifts up in frequency, the 2.5 KHz loop feedback input to the phase/frequency comparator deviates slightly from the reference frequency; thereby causing the VCO steering voltage to shift. The DC shift brings VCO resonance back to the frequency determined by programmable divider division. To set channel frequency, the programmable divider is programmed with a pre-calculated value that will result in correct VCO output frequency.

TRANSMIT PHASE-LOCK-LOOP

In transmit mode, transmitter channel frequency is produced by the transmit VCO consisting of Q108 and Q109. VCO output is buffered by IC104 for application to the transmit RF preamplifier Q110. After only one stage of buffering in IC104, VCO output signal is also applied to Q112 mixer driver. The buffered transmit VCO output sample is mixed with the main PLL sample (channel frequency minus 20.48 MHz) by the double balanced mixer consisting of L119 and L120. The mixer output signal of 20.48 MHz is amplified by IC108 and frequency divided by sixteen to produce 1.28 MHz for application to phase/frequency comparator IC103.

A reference frequency of 1.28 MHz, derived from master oscillator division by four in IC702, is applied to the other input of the phase/frequency comparator through modulator D101 and D102. Comparator output is DC potential that is filtered and buffered by Q106, then applied across varactor diode D104 to steer VCO resonance. If the VCO drifts from exactly main VCO output plus 20.48 MHz, the steering potential corrects its resonance. This holds true regardless of the main VCO output frequency. Thus, as channel frequency programming of the main PLL changes, the transmit PLL VCO output follows at 20.48 MHz above; resulting in actual selected channel frequency.

LOCK DETECT

There is a lock detect circuit in each PLL. The main lock detect circuit is internal to IC701 and produces a constant logic high when the loop is in lock. When the two comparator inputs are output of phase, as is while changing frequencies, negative going pulses appear at the lock detect output. These pulses cause a drop in voltage to the microprocessor D15 and IC706 pin 13 inputs to indicate the out of lock condition.

The transmit PLL lock detect circuit consists of IC102 gates that subtract the signals to the two inputs of comparator IC103. When these inputs differ in phase, positive pulses appear at IC102 pin 13 and their widths widen as phase difference increases. In an out-of-lock condition the pulses are wide enough to turn Q111 on, which removes bias to the transmit RF preamplifier. An out-of-lock condition in the main PLL also results in Q111 turn-on through D107.

WIDEBAND TUNING

For the 70-342XL and 70-442XL transceivers to operate across the 24 MHz frequency spread, electronic tuning is used in five areas: each VCO, the receive preselector, the receive injection amplifier, and the transmit RF preamplifier. Tuning of the preamplifier, preselector, and injection amplifier is continuous across the frequency range by using VCO steering voltage to vary bias to varactor diodes in the tuned circuits.

Electronic tuning of each VCO is done by simply switching additional inductance into the VCO tank to shift its operating limit window down 12 MHz. Certain frequencies must be programmed into the E/PROM (see Center Frequencies in the E/PROM Programming section) so that the microprocessor can determine if the selected channel is above or below them. If above, the D9 port is logic low; if below, it is logic high.

In the main VCO, the junction between L702 and L704 is grounded by on-biasing of D708 which couples this junction to RF ground through C744 and C745. When a channel frequency at the lower end of the band is selected, microprocessor port D9 switches Q752 on which pulls DC potential at L704 low. Thus, D708 is reverse biased which disconnects the RF ground to the coil junction, leaving L704 in the tank circuit. Electronic switching of the transmit VCO is identical to the main VCO.

Analog amplifiers in IC751 use a sample of the main VCO steering voltage from Q706 to derive a tracking potential to bias varactor diodes in tuned circuits. Because the PLL holds the main VCO steering voltage at a level relative to channel frequency (a higher voltage is present at high channel frequencies) and the voltage follows in a near linear fashion, the steering voltage makes a good tracking voltage guide.

DC potentials at the two IC751 outputs increase with increase in channel frequency. Because varactor diode capacitance decreases with reverse bias increase, the net capacitance of the tuned circuits in which the varactors are components of, decreases. Lower capacitance results in an increase in tuned circuit resonance.

Because the main VCO resonance is also changed halfway through the channel frequency spread by electronic tuning, its steering voltage is also affected. D751 couples the microprocessor D9 port to analog amplifiers in IC751 to compensate.

MODULATION

Transmit audio is integrated into the synthesizer in the transmit PLL 1.28 MHz reference frequency feed path. Because the PLL will force its VCO output to follow its reference frequency, modulation of the reference causes modulation of the transmit VCO output that is used to drive the transmitter stages.

Transmit audio is pre-emphasized, amplified, and limited in IC101. Odd order harmonics of the limited audio signal are filtered by L103 and L104. The contoured signal is buffered by Q103, then applied across phase modulator varactor diodes D101 and D102.

The phase modulator consists of two LC tanks. Because the capacitance in each tank is D101 or D102 internal capacitance, each tank resonance varies with modulation voltage across the diodes. With the 1.28 MHz signal from IC702 applied to the first tank through C103, a phase-shifted copy of the same signal voltage appears across the tank. Because the degree of phase shift is determined by how much difference there is between the tank resonance frequency and signal frequency, variances in the tank resonance with modulation audio causes respective variances in the signal phase. This phase modulated 1.28 MHz signal is then applied to the following cascade connected varactor tank to supplement the effect.

TRANSMIT RF PREAMPLIFIER

Modulated transmit carrier signal from the transmit PLL is preamplified by Q110. Q110 collector tank is electronically tuned across the wide frequency spread by varactor Q110 that is biased by IC751 tracking voltage output. This produces approximately 50 mW into 50 ohm J366 at any channel in the 24 MHz operating band. To prevent erroneous transmission during PLL out of lock conditions, Q111 shuts down bias to Q110 when its base is biased positive by PLL lock detect circuits or the microprocessor.

The RF power amplifier is part of the heat sink module on the rear of the radio. This three-stage amplifier produces up to 50 Watts into 50 ohm J392 from 20 mW applied to its 50 ohm input J371. Its output level is sampled by a directional coupler to regulate gain of the first stage for power control. A diode gate network switches RF signal routing from the power amplifier to the antenna connector J392 in transmit mode or from J392 to the receiver in receive mode.

TRANSMIT RF POWER AMPLIFIER STAGES

RF signal from the preamplifier is applied to Q501 base circuit via 50 ohm cable to J371. When CV501 is peaked for maximum RF at the antenna, all reactances appearing at J371 are balanced out (capacitive reactance equals inductive reactance), leaving only the transformed-to-50-ohm resistive element as load across J371 for maximum power transfer.

The striplines from Q501 collector to Q502 base and attached capacitors transform impedance to match the transistor elements. All reactances appearing to Q501 collector are balanced allowing maximum power transfer. Because the circuit is not as critical, tuning is not necessary. Energy is transformed and coupled from Q502 collector to Q503 base in a similar fashion.

All reactances from Q503 collector circuit through the antenna switch (D501), through the harmonic filter (L511-L514), to the antenna connector are balanced when CV504 is set for maximum output at J392. With all reactances balanced, a resistive load appears to Q503 collector at correct impedance, thus maximum energy is drawn by the load. If a peak cannot be obtained when adjusting the trimmer, an excessive imbalance exists caused by a defect.

In transmit mode, the receiver input port J372 and associated components have negligible effect on RF signal at C521. C521 couples the signal to a harmonic filter consisting of L511-L514 and C525-C529.

As the only conductive route, R511 bleeds static charges that may develop between antenna and chassis.

POWER CONTROL

A sample of forward RF energy is coupled from the harmonic filter input stripline by a PC runner adjacent to it. The RF sample is rectified by D502 to produce a DC voltage that varies in proportion to the square-root of forward power at the power adjust potentiometer RV502. The differential amplifier consisting of Q505 and Q506 compares the detected voltage to a 1.3 volt reference established by R515, R516, and D504.

As forward power increases, increased voltage at RV501 tap increases Q505 collector current which decreases forward bias current to Q504. With Q504 bias reduced, the first RF stage Q501 source current is less. Consequently, reduced current surges (at carrier frequency rate) into Q501 tuned collector circuit result in less net energy, thus decreasing forward power output until equilibrium with the power set point of RV501 is achieved.

ANTENNA SWITCH

RF signal to/from the antenna connector J392 is gated from C520 or to receiver port J372 by diodes D501 and D503. In the receive mode both diodes are unbiased; therefore they present higher impedance to the circuit. Reactances of L515, C522, C523, and C524 balance, allowing the resistive 50 ohm receiver load at J372 to appear at the passive harmonic filter.

When the diodes are forward biased during transmit mode, they present low RF impedance. The altered reactance of the network coupling the receiver port presents a high RF impedance at L515. Forward biased D501 couples the third transmit amplifier output to C521.

Diode bias current flows from ground through D503, through L515, through D501 and RF blocking L510, through current limiting R518, to TX 8 Volts.

The receiver circuitry is contained on one PC board--the Receiver Board. It is of dual-conversion variety with first IF frequency of 21.4 MHz and second IF frequency of 455 KHz. First local-oscillator injection signal is at the low side of channel frequency and is applied from the synthesizer VCO. A crystal oscillator injects second local oscillator signal to the low side as standard.

A single integrated circuit, IC251, contains the second mixer, second local oscillator, second IF amplifier, demodulator, and squelch hysteresis circuitry. Audio amplifier IC252 provides up to 5 watts of audio signal into a 3.2 ohm speaker.

Antenna signal from the diode gate antenna switch on the RF Power Amplifier Board is connected to the Receiver Board through J355. Local oscillator injection signal from the synthesizer on the Transmitter Board is connected to the Receiver Board through J356. Multi-pin J357 and J358 provide connection for various optional feature add-on kits.

PRESELECTOR

Antenna signal is applied to the 50 ohm preselector stage input consisting of five tunable-coil tanks and Q201. All RF frequencies outside its pass-window are rejected, including most of the first I.F. image frequency. Q201 gain is sufficient to compensate for insertion loss through the tanks.

For tunability across the specified 24 MHz channel spread, each of the five preselector tanks are electronically tuned. Contoured VCO steering voltage is applied to varactor diodes in each tank to change tank resonance. By the nature of the diodes, increased reverse bias decreases its internal capacitance, hence preselector tank resonance variance in proportion to channel frequency.

Preselector amplifier Q201 is sourced by switched 13.6 Volt primary power through Q204. In transmit mode R8V is logic low, which cuts off Q204 and Q205.

MIXER

Injection frequency signal is superimposed into the drain-source circuit of mixer FET Q202. Preselector output is applied to Q202-gate. Because both input signal voltages, injection and carrier, are applied to opposite phase terminals of Q202, they are subtracted analogously. As a result, two new signals are produced that at vector-difference amplitudes and at sum and difference frequencies of the input signals. Because the drain circuit is tuned for 21.4 MHz by L208 and C220, only the difference frequency signal is amplified.

The high DC impedance gate of Q202 is DC shunted to ground by R213. DC voltage drop across R214 raises source terminal to 2.5 Volts. The potential at the gate, with respect to the source-terminal, is then negative 2.5 Volts. Hence, negative bias to Q202.

FIRST I.F.

Crystal filter FL251 passes frequencies within a 15 KHz window centered art 21.4 MHz. L208 and L251 match the filter input and output to circuitry when properly tuned. High-gain Q251 amplifies second I.F. signal that is coupled to the second mixer within second I.F. IC251.

Impedance mismatch from component failure or incorrectly tuned L208 or L251 affects the filter characteristics, resulting in a distorted 15 KHz passband. When modulation is present on received carrier, the distorted portion of the modulation window will attenuate part of the signal, causing receiver sensitivity degradation.

SECOND I.F. AND DEMODULATION

The second oscillator includes a 20.945 MHz crystal (X251) and active circuitry within IC251. The 20.945 MHz oscillator output and the 21.4 MHz I.F. signal are applied to a double-balanced mixer within IC251. By its configuration, the mixer nulls both input signal components leaving only the sum and difference frequency signals at its output.

The 455 KHz second mixer output at IC251 pin-3 is applied to two 455 KHz filters, FL252 and FL253, that pass only the down-converted carrier frequency and modulation within a 15 KHz window. Filter output is applied to the second I.F. amplifier and limiter at IC251 pin 5. The 100 dB gain second I.F. amplifier boosts even receiver zero-signal noise into clipping.

IC251 internal limiter output is applied to an internal quadrature detector demodulator consisting of an external 455 KHz tank (L252) and a double balanced mixer within IC251. Mixer output at pin 9 is demodulated audio.

INJECTION AMPLIFIER

First injection of channel frequency minus 21.4 MHz, from the synthesizer on the the Transmitter Board, is amplified by Q203. Q203 stage is tuned by L209. L210 couples the injection signal into the mixer with its secondary as part of the mixer source-terminal circuit. A sample of this voltage is extracted by C228 and rectified by D217 to produce a metering voltage that indicates injection level at CM202.

The injection amplifier stage is electronically tuned across the channel frequency spread by varactor diodes that are reverse-biased by contoured VCO steering voltage.

RECEIVER AUDIO

Detected audio signal from IC251 pin-9 is band-stop filtered at 73 KHz by L253 and C276, then buffered by Q257. Q257 output routes through a jumper at J358 to the control panel VOLUME control through J354. Attenuated audio signal returns through J358, is routed through audio gate Q259, then applied to maximum volume trimmer RV252. IC252 amplifies RV252 attenuated audio signal to drive one of three speaker configurations: 5 watts into a 3.2 external speaker connected to power connector J391; 5 watts through T301 to a 3.2 speaker connected to the control head (70-442XL only); or to the front panel speaker and series connected 4.7 ohm resistor combination leaving 1 watt applied to the speaker (70-342XL only).

Positive bias is sourced to the gate terminal of audio gate Q259 by squelch switch output at IC251 pin 13 when carrier is present. Q259 source terminal is resistor biased below that voltage, which leaves a net positive bias to turn it on. The impedance across Q259 source-to-drain terminals is then low to pass audio. Conversely, when its gate terminal is a logic low, Q259 is biased off which blocks audio coupling.

SQUELCH

Detector output audio signal is also coupled to the squelch range potentiometer RV251. The attenuated audio signal is applied to two 60 KHz parallel tanks L254/C261 and L255/C263 to couple only the 60 KHz component of demodulated noise floor signal to the squelch amplifier at IC251 pin 10. As the noise floor increases due to less carrier input, so does this 60 KHz component. The amplifier output at pin 11 drives detector Q252. 60 KHz voltage spikes are then rectified by D252 and D253 to produce a noise floor proportionate DC level at IC251 pin 12.

A sample of the 60 KHz noise-floor-indicating signal is also rectified by D254 for metering at CM201. The metering voltage is negative to subtract from positive bias from R262, producing a net positive DC metering voltage that increases (positively) with carrier input level.

A hysteresis circuit with input at IC251 pin 12 controls the audio mute gate Q254 with its output at pin 13. As voltage to the hysteresis circuit input increases to 0.7 volts, output at pin 13 switches to a logic high voltage to unmute audio circuitry. When carrier level decreases, pin 13 does not switch back until voltage to pin 12 increases to 0.8 volts. This 0.1 Volt switching hysteresis prevents squelch jitter under threshold conditions.

If carrier is present to provide unmuting positive bias to audio mute gate Q259, the gate can remain muted by application of a logic low to its gate from three sources. Referring to the Simplified Squelch Circuitry Schematic following, a logic low can be applied from; 1) J353 pin 1 when the synthesizer PLL is out of lock or while the microprocessor is reloading synthesizer dividers; 2) J353 pin 5 (TXTM) in transmit mode; or 3) activation of Q261.

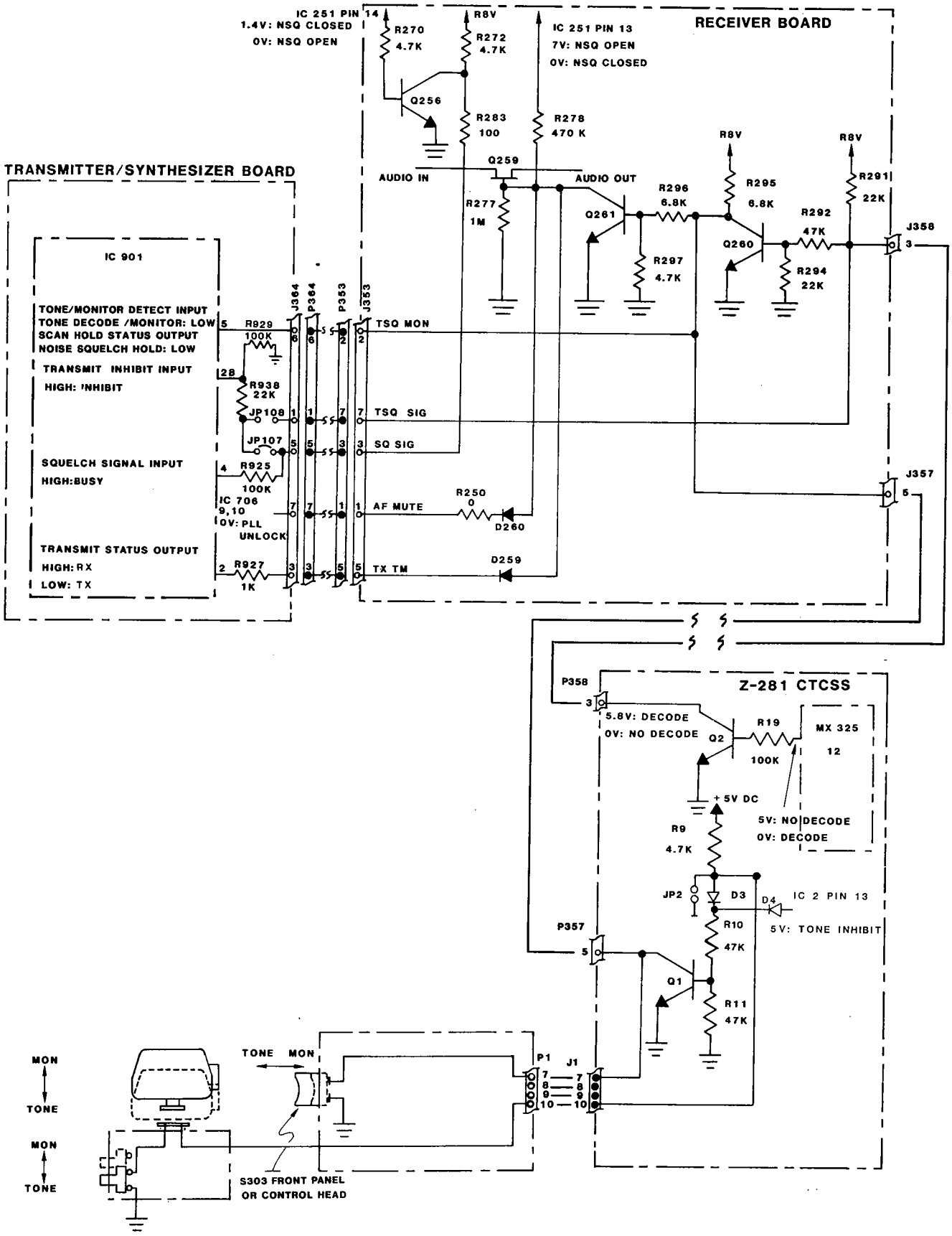
CTCSS SQUELCH

Q261 can pull the audio mute gate input low when it is positive biased from R8V through R295, resulting in muted receive audio (see SQUELCH CIRCUITRY - SIMPLIFIED, following). The audio is again unmuted (only if carrier squelch is open) when one of the following occurs: 1) A logic low is applied to TSQ MON from the microprocessor when scan is stopped on a channel with busy scan status (this port also applies a logic low status back to the microprocessor when items 2 and 3 occur); 2) A logic low is applied when the MONITOR push button is in or when the microphone is not in its hang-up clip; 3) A logic high is applied from the optional CTCSS decoder (inverted by Q260) when a correct tone or code is received.

The CTCSS module is connected directly to the E/PROM Module through J903. Transmit and receive CTCSS tone frequency data is programmed to the Module by the D0-D5 E/PROM outputs and strobed by a pulse appearing at the R33 port of the microprocessor.

Receive audio signal from FM detector output buffer Q257 is routed through the CTCSS option board before application to the VOLUME control. The signal is low-pass filtered in the option board to remove the the subaudible CTCSS tone. When the option is not included in the transceiver, the audio signal path must be completed with a jumper plug connected to J358 that shorts pins 4 and 5 together.

SIMPLIFIED SQUELCH CIRCUIT SCHEMATIC



There are two metering receptacles, CM101 and CM202, in the 70-342XL and 70-442XL transceivers. The MIDLAND LMR Test Set model 70-E10 can be connected to these receptacles; or metering potentials present at receptacle pins can be measured with a high input impedance voltmeter referenced to transceiver ground.

TRANSMITTER BOARD -- CM101

The three pin metering receptacle (CM101) is located on the Transmitter Board near its center, approximately two inches from the RF Power Amplifier Deck. It provides two metering DC voltages that are relative indicators of key signal levels in the transmitter and synthesizer circuitry.

CM101 PIN 1: SYNTHESIZER REFERENCE OSCILLATOR OUTPUT LEVEL. The 5.12 MHz signal at Q703 collector is sampled through a 5 pF capacitor and rectified by D709. The resulting DC potential is applied to CM101 pin 1 through a 22K ohm resistor. Typical voltage at this metering point is 1 Volt.

CM101 pin 2: TRANSMIT RF PREAMPLIFIER OUTPUT LEVEL. The DC voltage drop across transmit preamplifier Q110 emitter resistor R175 is measurable at this pin. This DC voltage varys in proportion to the current absorbed by the preamplifier output tank, thereby a null (minimum) indicates output resonance and maximum power transfer to the RF Power Amplifier Deck. Typical DC voltage at CM101 pin 2 is 0.7 Volts.

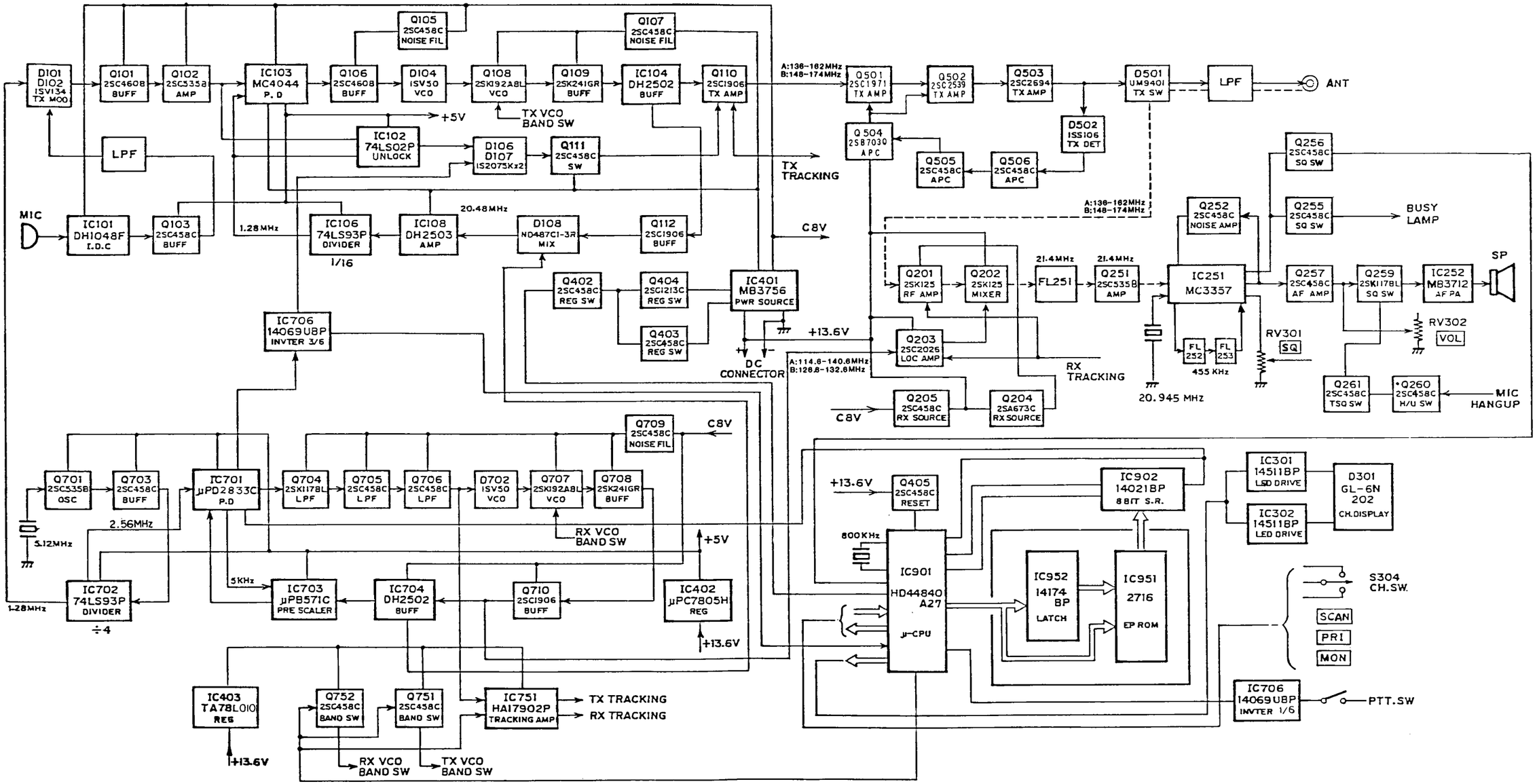
RECEIVER BOARD - CM202

The three pin metering receptacle (CM202) is located on the Receiver Board at the edge adjacent to the right side-rail, next to Audio IC252 and its heat sink. CM202 provides two metering DC voltages that are relative indicators of key signal levels in the receiver circuitry.

CM202 pin 1: FIRST LOCAL OSCILLATOR INJECTION LEVEL. Synthesizer produced first injection signal, after tuned circuit filtering, is sampled across L210 secondary where the signal is applied into the first mixer circuit. The sample is rectified and the resulting DC potential is applied to CM201 pin 1 through a 1000 ohm resistor. Tuning of L209 and L210 affects this metering voltage that typically is 0.6 Volts.

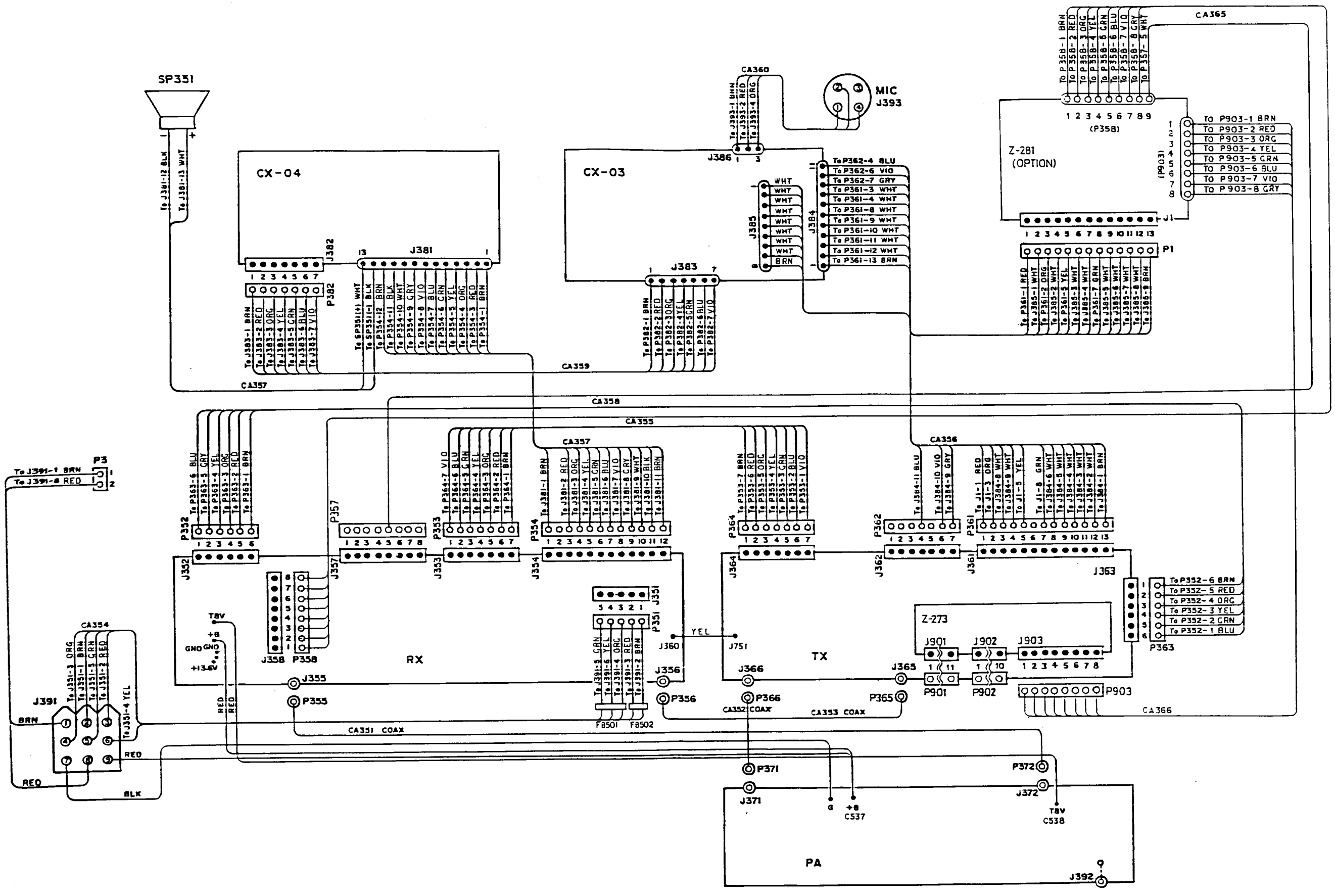
CM202 pin 2: RECEIVED SIGNAL LEVEL. DC potential at this metering point is a biased, rectified sample the squelch detector output. The 60 KHz squelch noise detector output at Q252-collector is rectified to apply negative voltage to CM202 pin 2 that increases with received channel signal level decrease. Positive bias is also applied to the metering pin. Thus, net voltage on the pin is a DC voltage that increases in proportion to received signal level. Typical voltage swing is -.25 Volts with no received signal, to 1 Volt with full quieting signal. The setting of SQUELCH RANGE RV251 will affect this metering voltage.

BLOCK DIAGRAM



UNDER-DASH INTERCONNECT DIAGRAM

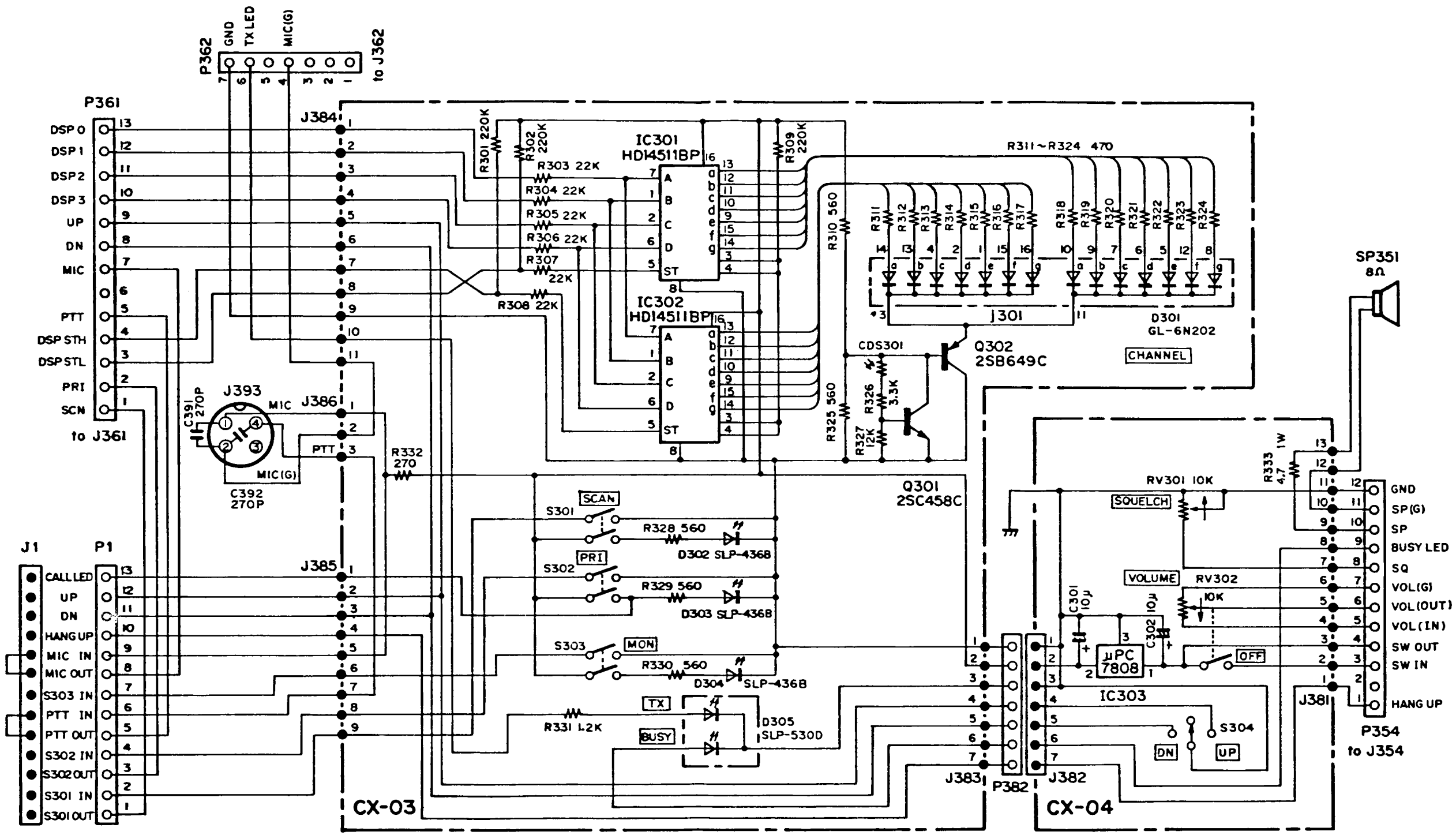
70-342XL



Fold Out

FRONT PANEL SCHEMATIC DIAGRAM

70-342XL
(UNDER-DASH)

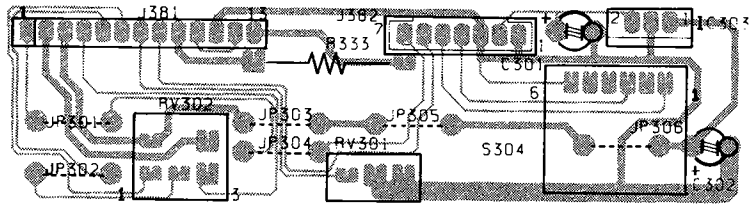


Fold Out

FRONT PANEL PC BOARDS

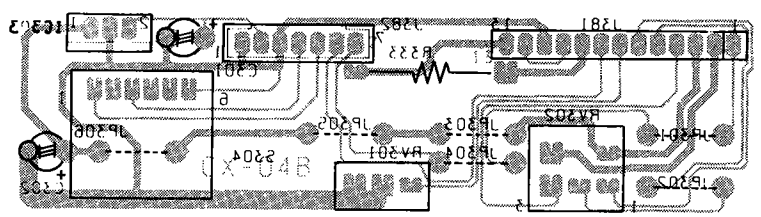
CONTROL BOARD (CX-04)

COMPONENT-SIDE VIEW



NOTE: PLATING SHOWN IS ON OTHER SIDE

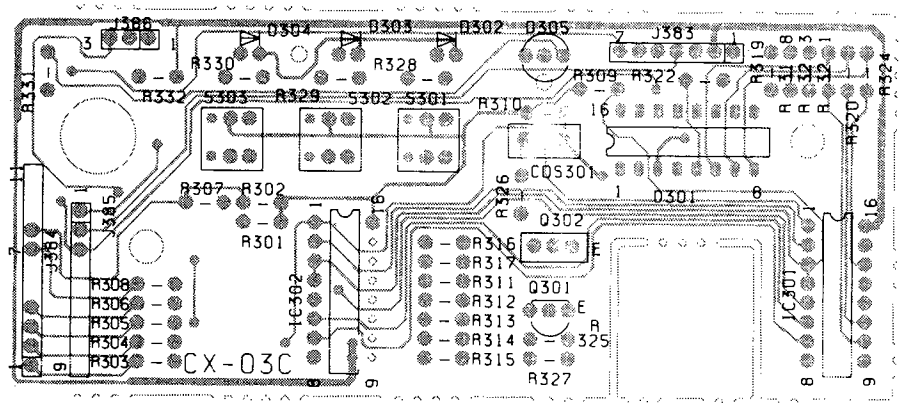
SOLDER-SIDE VIEW



NOTE: COMPONENTS SHOWN ARE ON THE OTHER SIDE

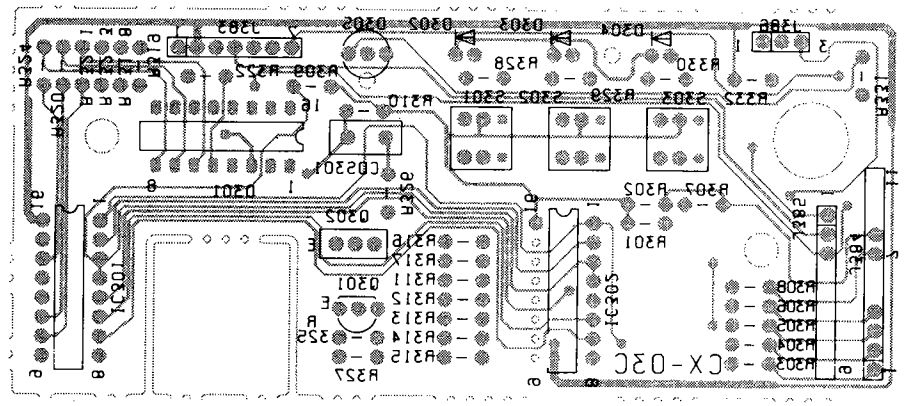
DISPLAY BOARD (CX-03)

COMPONENT-SIDE VIEW



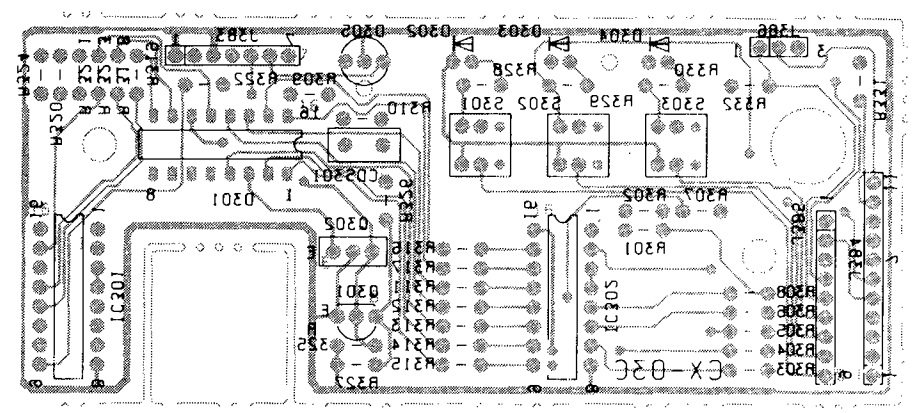
NOTE: PLATING SHOWN IS ON OTHER SIDE

SOLDER-SIDE VIEW



NOTE: COMPONENTS SHOWN ARE ON THE OTHER SIDE

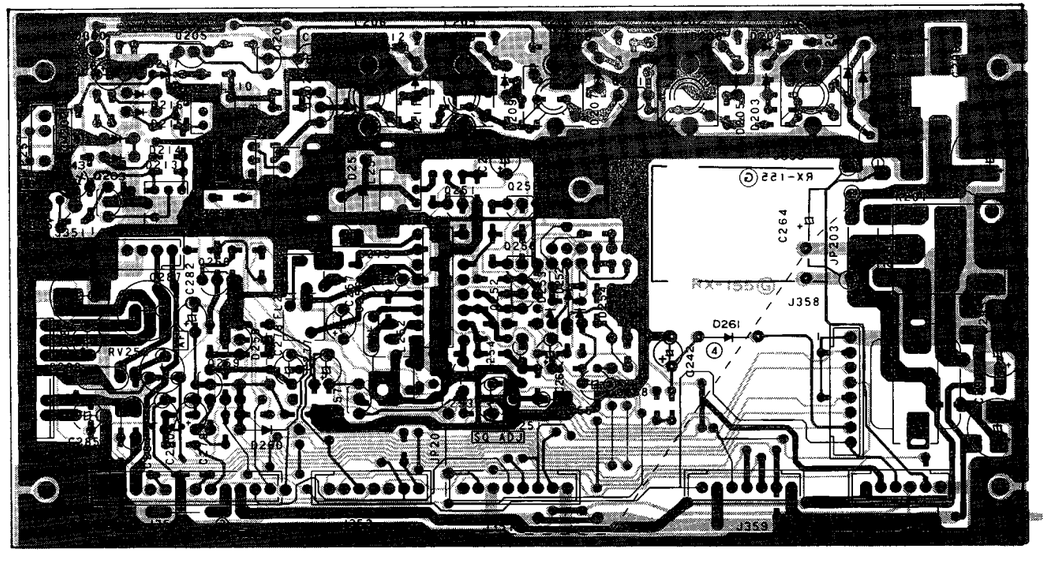
COMPONENT SIDE AS SEEN THROUGH SOLDER SIDE



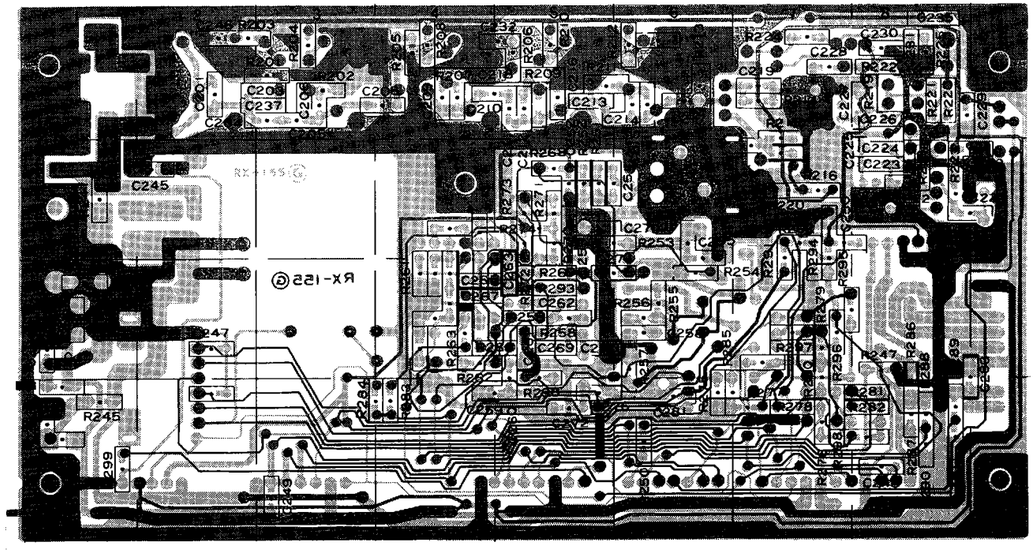
NOTE: COMPONENTS AND PLATING SHOWN ARE ON THE OTHER SIDE

RECEIVER PC BOARD

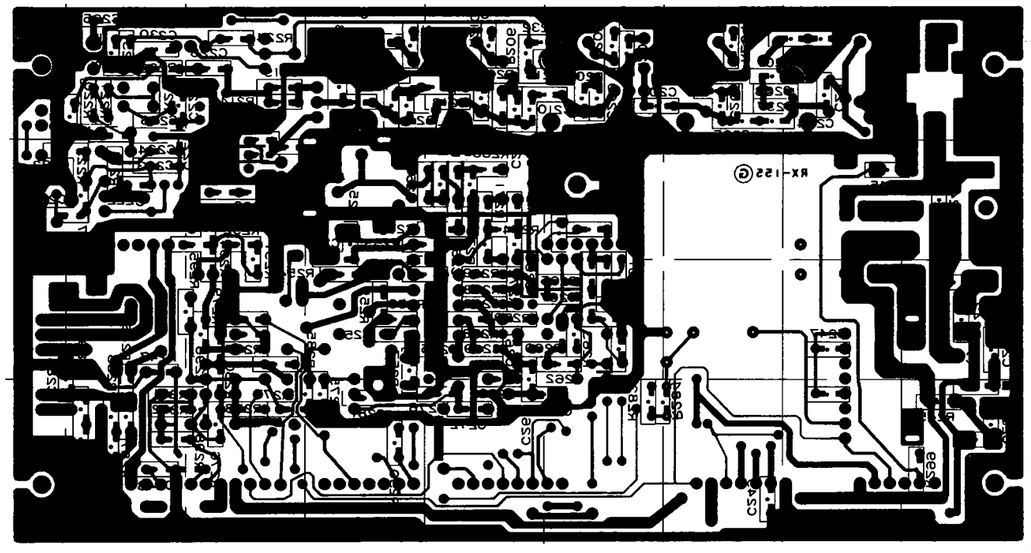
TOP VIEW



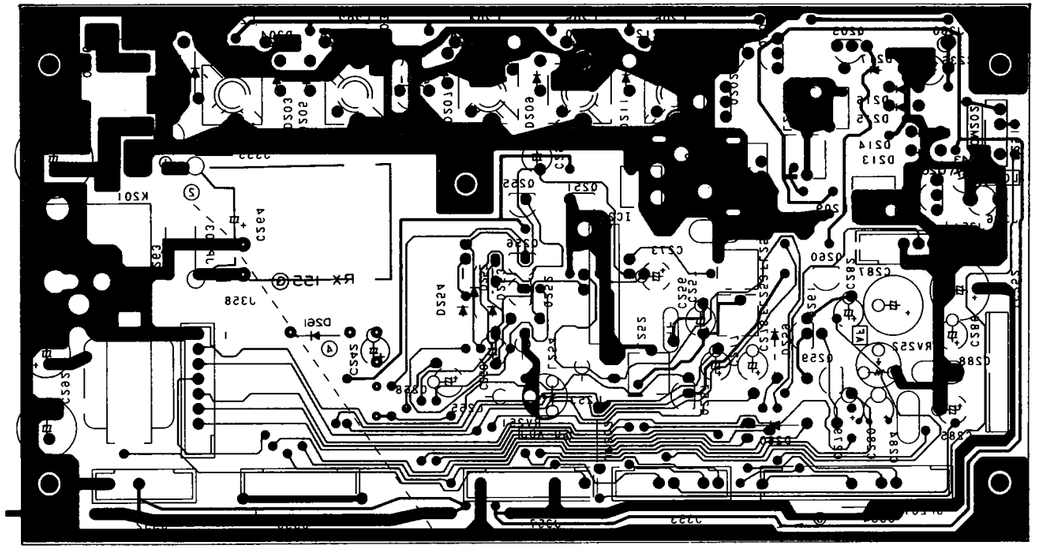
BOTTOM VIEW



SOLDER SIDE SEEN THROUGH PC BOARD TOP



COMPONENT SIDE SEEN THROUGH PC BOARD BOTTOM



Fold Out

DC VOLTAGES - RECEIVER BOARD

TRANSISTORS

SYMBOL	TYPE	MODE	BASE (GATE)	COLL. (DRAIN)	EMITTER (SOURCE)	FUNCTION
Q201	2SK125	RX	0.0	10.5	2.5	RF Amplifier
Q202	2SK125	RX	0.0	11.0	2.5	First Mixer
Q203	2SC1906	RX	0.6	6.0	0.0	Injection Amplifier
Q204	2SA673C	RX	13.0	11.5	13.6	Regulator
Q205	2SC458C	RX	8.0	13.0	7.4	Regulator Switch
Q251	2SC535B	RX	0.7	3.8	0.0	First I.F. Amplifier
Q252	2SC458C	SQ CLD	2.1	3.4	1.5	Squelch Noise Amp.
		SQ OPN	1.9	5.0	1.6	
Q255	2SC458C	RX	0.0	2.0	0.0	Busy LED Driver
Q256	2SC458C	RX	0.0	7.4	0.0	Sq Status Port Driver
Q257	2SC458C	RX	3.5	8.0	2.8	Audio Preamplifier
Q259	2SK117BL	SQ CLD	0.0	3.2	3.3	Audio Gate
		SQ OPN	3.3	3.2	3.3	
Q260	2SC458C	RX	0.6	0.1	0.0	Tone Sq. Driver
Q261	2SC458C	SQ CLD	0.0	0.1	0.0	Tone Sq. Mute Driver
		SQ OPN	0.0	4.7	0.0	
Q301	2SC458C	BOTH	* 0.7	* 1.3	0.0	Dimmer Driver
Q302	2SC458C	BOTH	* 1.3	0.0	* 2.0	Dimmer Current Gate

* : Varies with ambient light

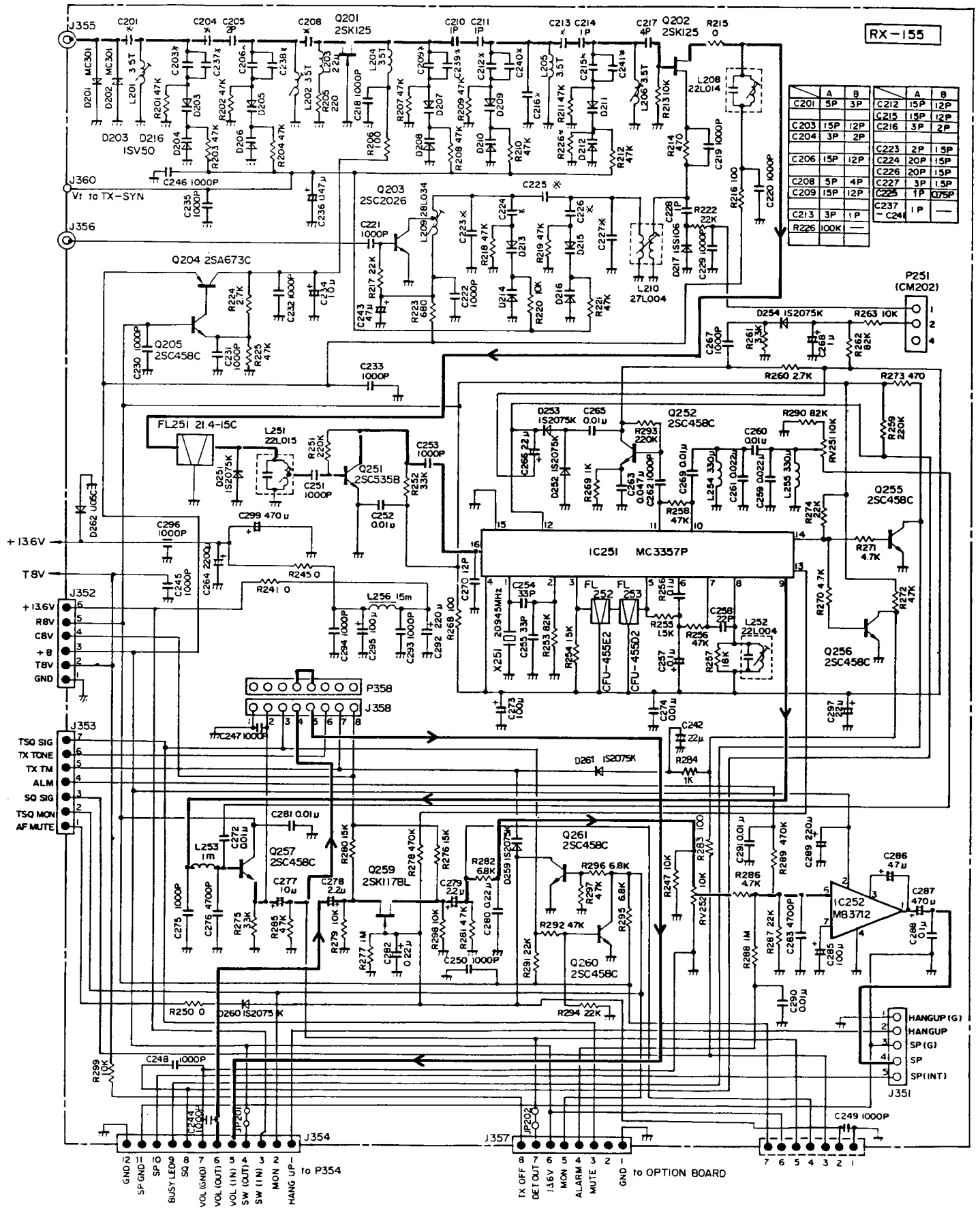
ANALOG IC's

SYMBOL	TYPE	FUNCTION	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC251	MC3357P	2nd IF	SQ CLD	7.6	7.1	7.6	7.6	1.0	1.0	1.0	7.5
			SQ OPN	7.6	7.1	7.6	7.6	1.0	1.0	1.0	7.5
IC252	MB3712	AUDIO AMP	RX	7.0	13.8	13.0	0.0			0.6	---
IC303	uPC7808H	8V REGLTR	BOTH	13.8	8.0	0.0	---	---	---	---	---

ANALOG IC's continued:

SYMBOL	TYPE	FUNCTION	MODE	PIN NO. 9	10	11	12	13	14	15	16
IC251	MC3357P	2nd IF	SQ CLD	3.7	1.9	1.9	0.8	0.0	1.4	0.0	2.0
			SQ OPN	3.7	1.9	1.9	0.2	7.0	0.0	0.0	2.0

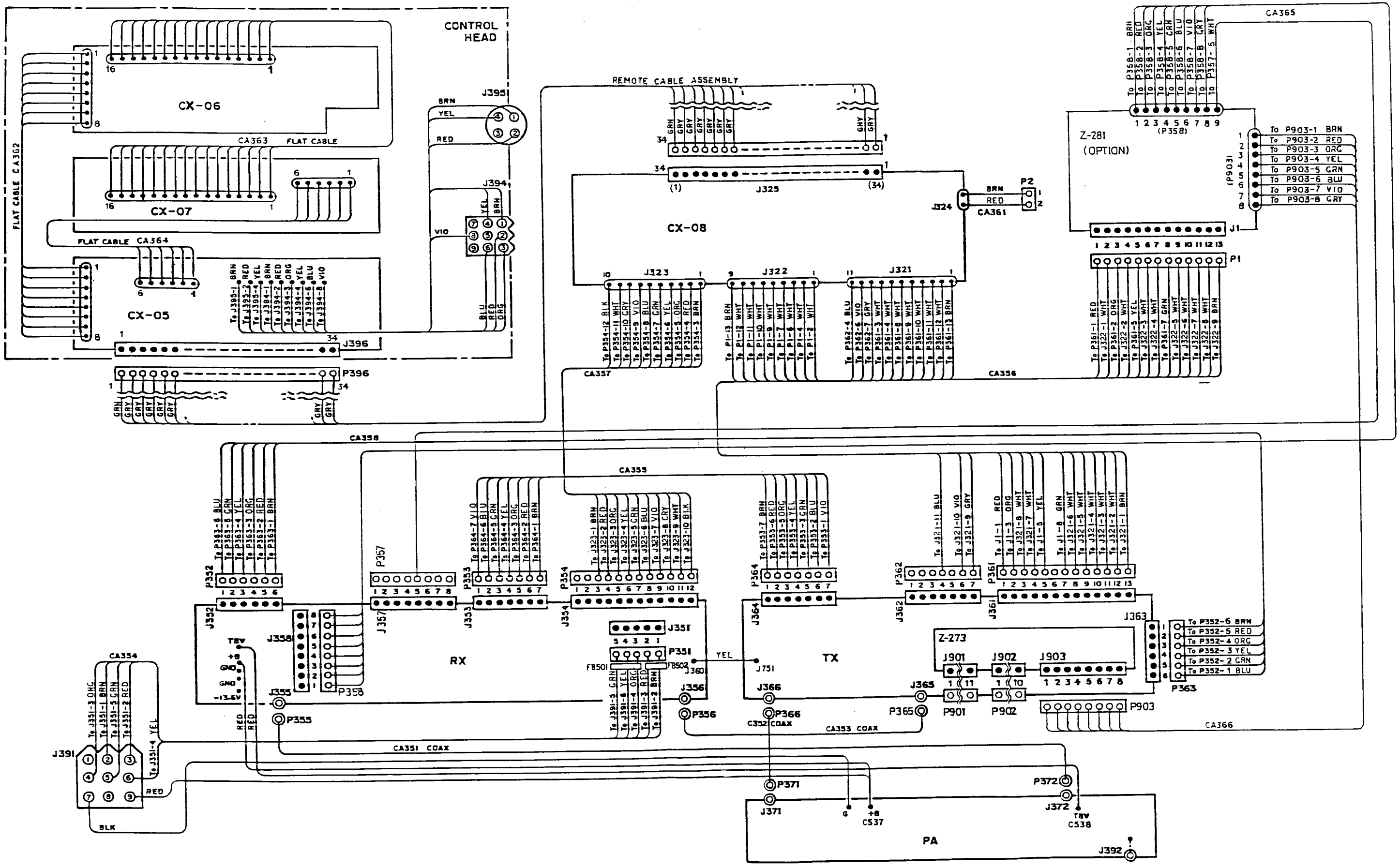
RECEIVER BOARD SCHEMATIC DIAGRAM



Other side viewable with:
RECEIVER BOARD LAYOUTS, page 82
FRONT PANEL SCHEMATIC, page 80
UNDER-DASH INTERCONNECT DIAGRAM, page 78

TRUNK-MOUNT INTERCONNECT DIAGRAM

70-442XL

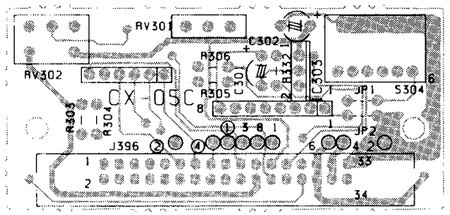


Fold Out

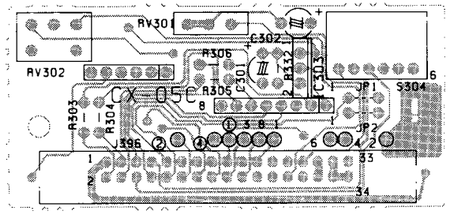
CONTROL HEAD PC BOARDS

CONTROL BOARD (CX-05)

COMPONENT-SIDE VIEW



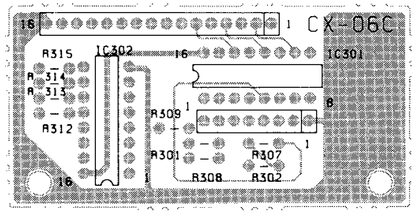
SOLDER SIDE
AS SEEN THROUGH COMPONENT SIDE



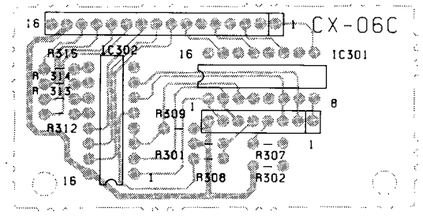
NOTE: PLATING SHOWN IS ON THE OTHER SIDE

DISPLAY DRIVER BOARD (CX-06)

COMPONENT-SIDE VIEW



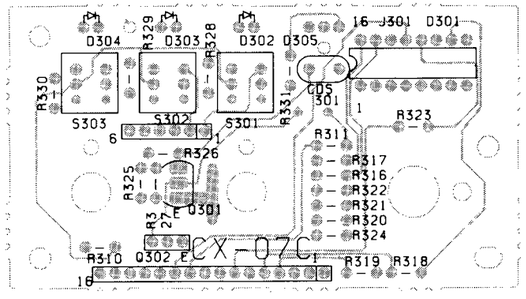
SOLDER SIDE
AS SEEN THROUGH COMPONENT SIDE



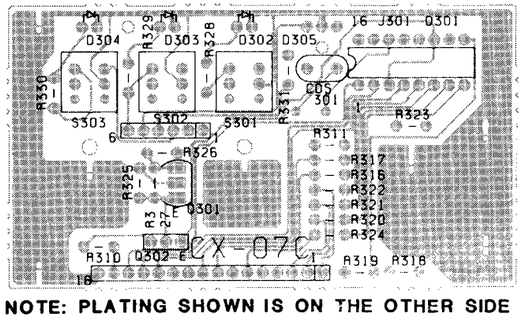
NOTE: PLATING SHOWN IS ON THE OTHER SIDE

DISPLAY BOARD (CX-07)

COMPONENT-SIDE VIEW

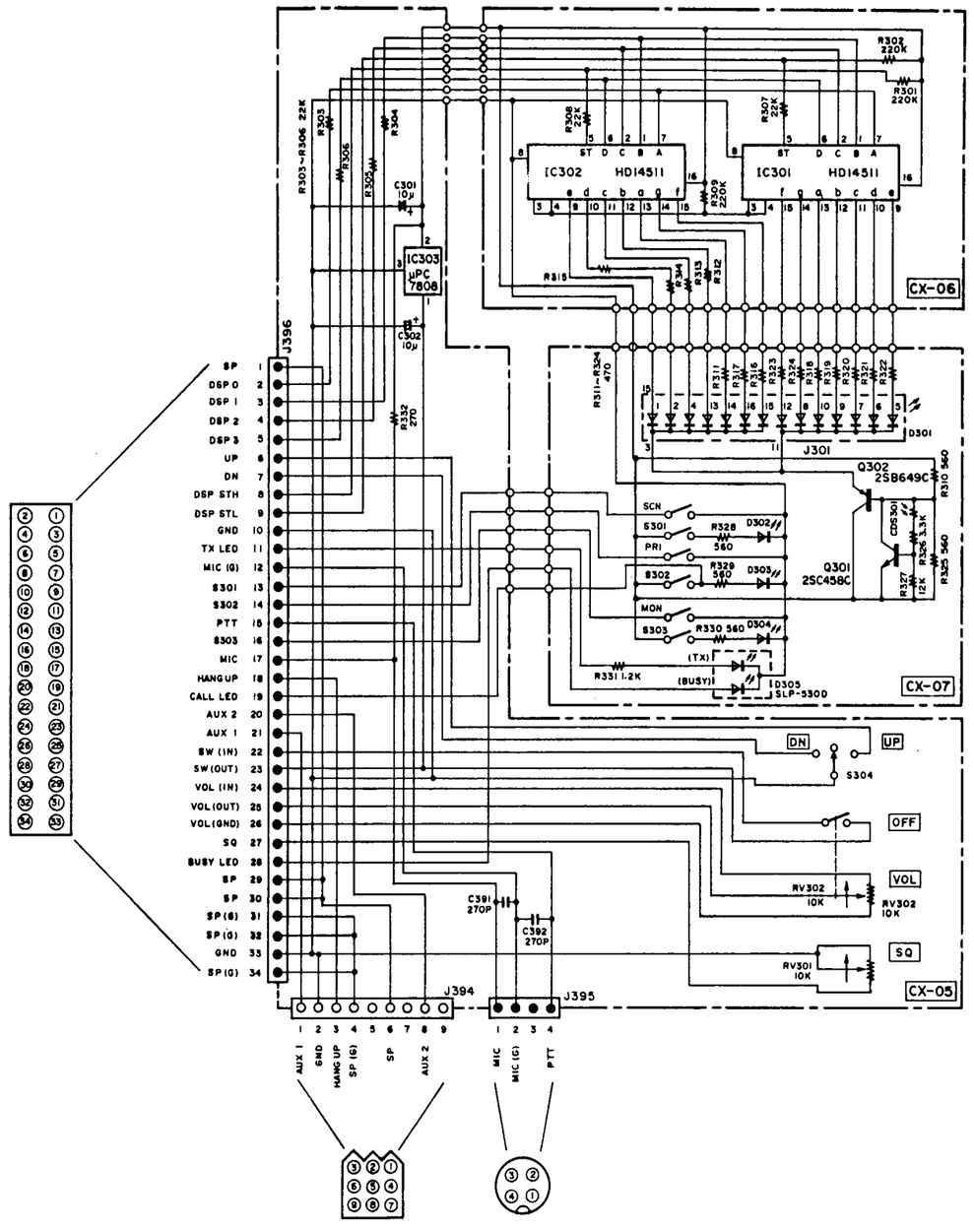


SOLDER SIDE
AS SEEN THROUGH COMPONENT SIDE



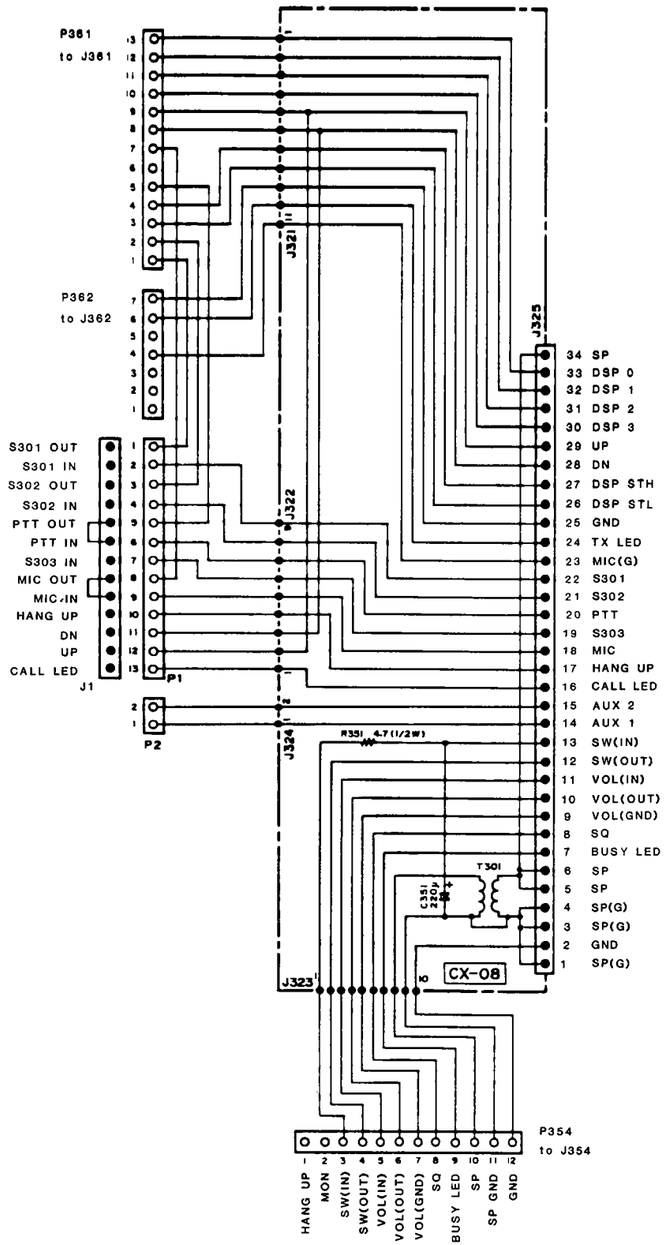
NOTE: PLATING SHOWN IS ON THE OTHER SIDE

CONTROL HEAD SCHEMATIC DIAGRAM



CONTROL-CABLE INTERFACE BOARD SCHEMATIC DIAGRAM

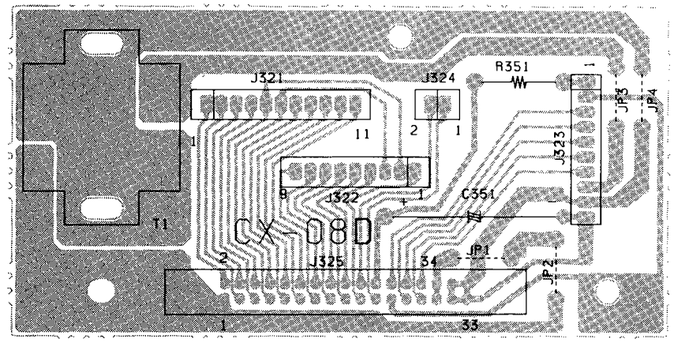
70-442XL
(TRUNK-MOUNT)



CONTROL-CABLE INTERFACE PC BOARD

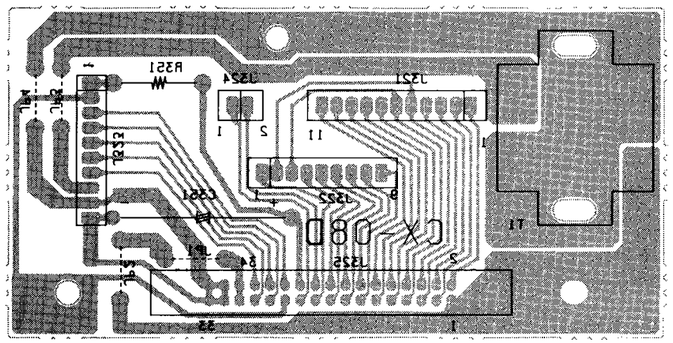
70-442XL
(TRUNK-MOUNT)

COMPONENT-SIDE VIEW



NOTE: PLATING SHOWN IS ON OTHER SIDE

SOLDER-SIDE VIEW



NOTE: COMPONENTS SHOWN ARE ON THE OTHER SIDE

Fold Out

DC VOLTAGES - RECEIVER BOARD

TRANSISTORS

SYMBOL	TYPE	MODE	BASE (GATE)	COLL. (DRAIN)	EMITTER (SOURCE)	FUNCTION
Q201	2SK125	RX	0.0	10.5	2.5	RF Amplifier
Q202	2SK125	RX	0.0	11.0	2.5	First Mixer
Q203	2SC1906	RX	0.6	6.0	0.0	Injection Amplifier
Q204	2SA673C	RX	13.0	11.5	13.6	Regulator
Q205	2SC458C	RX	8.0	13.0	7.4	Regulator Switch
Q251	2SC535B	RX	0.7	3.8	0.0	First I.F. Amplifier
Q252	2SC458C	SQ CLD	2.1	3.4	1.5	Squelch Noise Amp.
		SQ OPN	1.9	5.0	1.6	
Q255	2SC458C	RX	0.0	2.0	0.0	Busy LED Driver
Q256	2SC458C	RX	0.0	7.4	0.0	Sq Status Port Driver
Q257	2SC458C	RX	3.5	8.0	2.8	Audio Preamplifier
Q259	2SK117BL	SQ CLD	0.0	3.2	3.3	Audio Gate
		SQ OPN	3.3	3.2	3.3	
Q260	2SC458C	RX	0.6	0.1	0.0	Tone Sq. Driver
Q261	2SC458C	SQ CLD	0.0	0.1	0.0	Tone Sq. Mute Driver
		SQ OPN	0.0	4.7	0.0	
Q301	2SC458C	BOTH	* 0.7	* 1.3	0.0	Dimmer Driver
Q302	2SC458C	BOTH	* 1.3	0.0	* 2.0	Dimmer Current Gate

* : Varies with ambient light

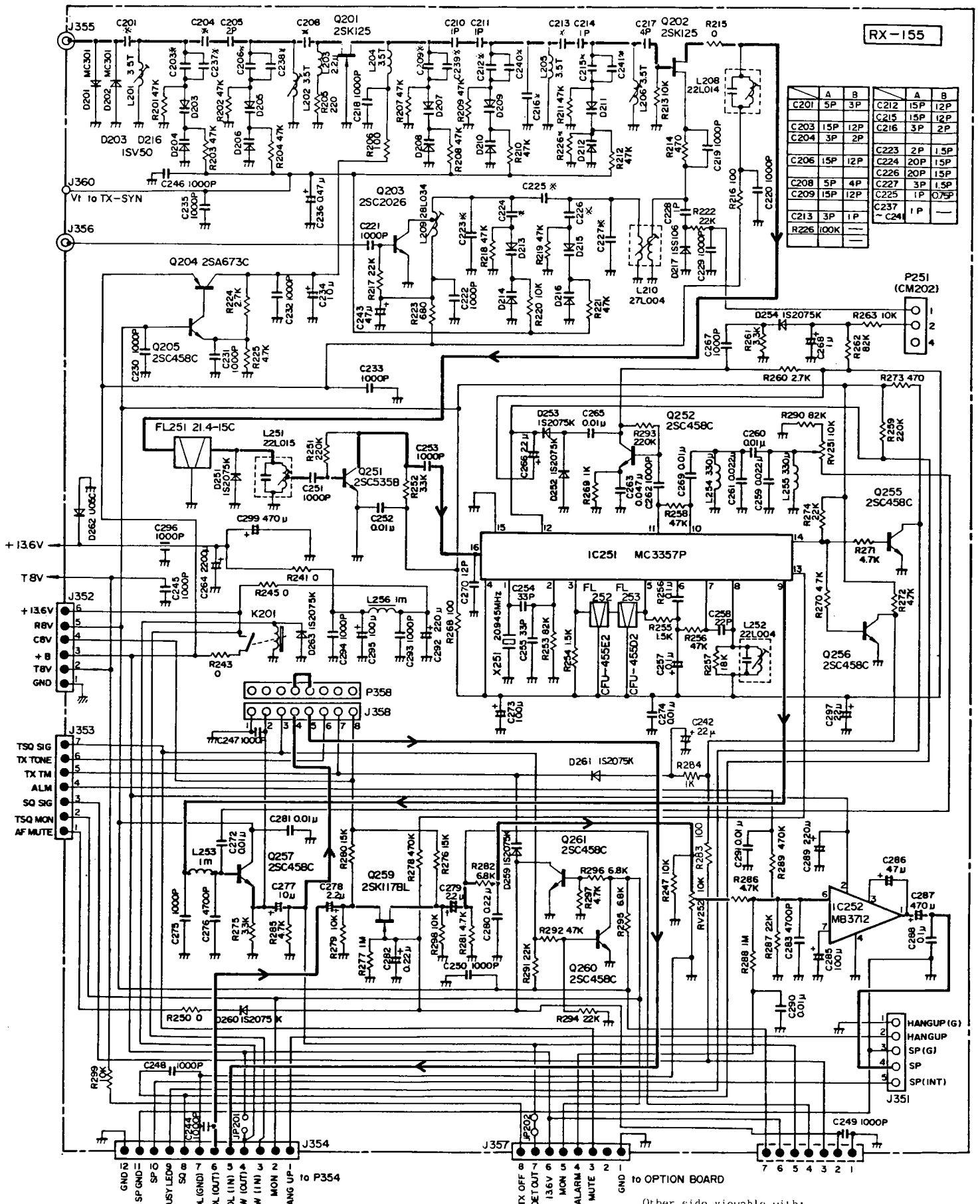
ANALOG IC's

SYMBOL	TYPE	FUNCTION	MODE	PIN NO. 1	2	3	4	5	6	7	8
IC251	MC3357P	2nd IF	SQ CLD	7.6	7.1	7.6	7.6	1.0	1.0	1.0	7.5
			SQ OPN	7.6	7.1	7.6	7.6	1.0	1.0	1.0	7.5
IC252	MB3712	AUDIO AMP	RX	7.0	13.8	13.0	0.0			0.6	---
IC303	uPC7808H	8V REGLTR	BOTH	13.8	8.0	0.0	---	---	---	---	---

ANALOG IC's continued:

SYMBOL	TYPE	FUNCTION	MODE	PIN NO. 9	10	11	12	13	14	15	16
IC251	MC3357P	2nd IF	SQ CLD	3.7	1.9	1.9	0.8	0.0	1.4	0.0	2.0
			SQ OPN	3.7	1.9	1.9	0.2	7.0	0.0	0.0	2.0

RECEIVER BOARD SCHEMATIC DIAGRAM



DC VOLTAGES - TRANSMITTER BOARD

TRANSISTORS

SYMBOL	TYPE	MODE	BASE (GATE)	COLL. (DRAIN)	EMITTER (SOURCE)	FUNCTION
Q101	2SC460B	TX	3.2	8.0	2.5	Modulator Buffer
Q102	2SC535B	TX	2.5	3.2	1.8	Modulator Buffer
Q103	2SC458C	TX	3.2	5.0	2.5	Modulation Driver
Q105	2SC458C	TX	7.9	8.0	7.3	Active Capacitor
Q106	2SC460B	TX	* 5.4	7.3	* 4.7	Steering Buffer
Q107	2SC1906	TX	7.9	8.0	7.3	Active Capacitor
Q108	2SK192A BL	TX	0.0	7.3	0.3	TX VCO
Q109	2SK241GR	TX	0.0	2.9	0.0	VCO Buffer
Q110	2SC1906	TX	1.2	8.0	0.5	RF Preamplifier
Q111	2SC458C	TX	0.0	8.0	0.0	Bias Switch
Q112	2SC1906	TX	1.9	7.6	1.4	Mixer Driver
Q402	2SC458C	TX	0.0	0.7	0.0	TX/RX Control
		RX	0.7	0.0	0.0	
Q403	2SC458C	TX	0.7	0.0	0.0	Regulator Switch
		RX	0.0	2.0	0.0	
Q404	2SC1213C	TX	0.7	0.0	0.0	RX 8V Off-Clamp
		RX	0.0	8.0	0.0	
Q405	2SC458C	TX	0.6	0.0	0.0	IC901 Reset Gate
		RX	0.6	0.0	0.0	
Q501	2SC1971	TX	0.8	** 9.0	0.0	RF Predriver
Q502	2SC2539	TX	-0.1	13.6	0.0	RF Driver
Q503	2SC2694	TX	0.0	13.6	0.0	RF Final
Q504	2SB834Y	TX	12.9	** 9.0	13.6	Current Regulator
Q505	2SC458C	TX	1.3	12.9	0.6	APC Differential Amp.
Q506	2SC458C	TX	1.3	8.0	0.6	APC Differential Amp.
Q701	2SC535B	BOTH	2.9	4.5	2.4	Reference Oscillator
Q703	2SC458C	BOTH	0.7	2.8	0.0	Buffer
Q704	2SK117BL	BOTH	* 3.3	7.3	* 3.5	Main Loop Filter
Q705	2SC458C	BOTH	0.6	* 5.0	0.0	Main Loop Filter
Q706	2SC458C	BOTH	* 5.0	7.3	* 4.4	VCO Steering Driver
Q707	2SK192A BL	BOTH	0.0	7.4	0.3	Main VCO
Q708	2SK241GR	BOTH	0.0	3.0	0.6	VCO Buffer
Q709	2SC458C	BOTH	8.2	8.2	7.4	Active Capacitor
Q710	2SC1906	BOTH	1.9	7.3	1.4	RF Amplifier
Q751	2SC458C	HI CHNL	0.1	4.5	0.0	TX VCO Band Switch
		LO CHNL	0.7	0.0	0.0	
Q752	2SC458C	HI CHNL	0.1	4.5	0.0	RX VCO Band Switch
		LO CHNL	0.7	0.0	0.0	

* : Varies with selected channel frequency.
** : Varies with RV502 adjustment and power output.

ANALOG IC's

SYMBOL	TYPE	FUNCTION	PIN NO. MODE	1	2	3	4	5	6	7	8
IC101	DH1048	IDC	TX		3.8	4.5	3.8	0.0		4.5	8.0
IC104	DH2502	BUFFER/AMP	TX	0.0	0.0	0.0	7.5	7.5	0.0	0.0	0.0
IC108	CH2503	BUFFER/AMP	TX	0.0	0.0	7.5	0.0	7.5	0.0	7.5	1.6
IC401	MB3756	SW. RGLTR	TX	8.0	13.6	8.0	0.0	0.0	0.0	0.0	8.0
			RX	8.0	13.6	8.0	0.0	1.7	8.0	0.0	0.0
IC402	uPC7805H	5V REGLTR	BOTH	13.8	0.0	4.9	---	---	---	---	---
IC403	2930L5.0	10V RGLTR	BOTH	13.8	10.0	5.0	---	---	---	---	---
IC704	DH2502	BUFFER/AMP	RX	0.0	0.0	6.8	6.8	0.0	0.0	0.0	6.8

ANALOG IC's continued:

SYMBOL	TYPE	FUNCTION	PIN NO. MODE	9	10	11	12	13	14	15	16
IC101	DH1048	IDC	TX			4.5	---	---	---	---	---
IC104	DH2502	BUFFER/AMP	TX	7.5	7.5	0.0	0.0	---	---	---	---
IC108	CH2503	BUFFER/AMP	TX	---	---	---	---	---	---	---	---
IC401	MB3756	SW. RGLTR	TX	---	---	---	---	---	---	---	---
			RX	---	---	---	---	---	---	---	---
IC402	uPC7805H	5V REGLTR	BOTH	---	---	---	---	---	---	---	---
IC403	2930L5.0	10V RGLTR	BOTH	---	---	---	---	---	---	---	---
IC704	DH2502	BUFFER/AMP	RX	6.8	0.0	0.0	0.0	---	---	---	---

Fold Out

MICROPROCESSOR (IC901) PINOUTS - Duplicate Chart

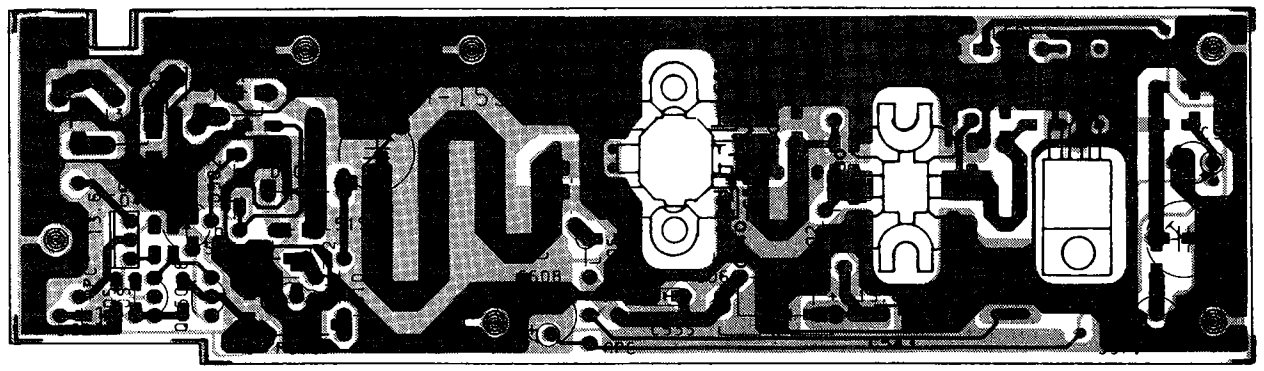
PIN NO.	PIN NAME	INPUT/ OUTPUT	SIGNAL NAME	FUNCTION
1	D3	OUT	DSTB+	Strobe for serial data to synthesizer
2	D4	OUT	TXTM-	TX/RX mode control to option (TX Mode = LO)
3	D5	OUT	ALM-	Alert tone (2 KHz)
4	D6	IN	SQSIG+	Noise squelch status (HI = carrier present)
5	D7	BOTH	TSQMON-	LO in = Sq Tone decoded or MONITOR push button is in Scan activity (scan stopped = LO out)
6	D8	BOTH	PLCL-	Synthesizer PLL status (LO in = PLL unlocked) RX Mute and TX inhib during channel change,etc.=LO out
7	D9	OUT	VCOCNTL	VCO band switch control (Upper channels selected = LO)
8	D10	IN	SCAN-	SCAN push button status (LO = pushbutton is in)
9	D11	IN	PRI-	PRI push button status (LO = push button is in)
10	D12	OUT	DSPSTL-	Strobe for ONE's digit of CHANNEL display data
11	D13	OUT	DSPSTH-	Strobe for TEN's digit of CHANNEL display data
12	D14	IN	ALBH-	A-band/B-band jumper status
13	D15	OUT	TXDL	TX/RX Mode control (TX = LO)
14	nc	--	--	
15	RESET	IN		CPU Reset (HI = Reset)
16	GND			
17	OSC1			Clock oscillator (800 KHz +/-5%)
18	OSC2			Clock oscillator (800 KHZ +/-5%)
19	HLT	IN		Standby Mode (HI = Sleep)
20	TEST			not used
21	Vcc			Vcc (5 Volts, +/-10%)
22	R00	OUT	DSP0+	LED Display data (8 Volt logic levels)
23	R01	OUT	DSP1+	LED Display data (8 Volt logic levels)
24	R02	OUT	DSP2+	LED Display data (8 Volt logic levels)
25	R03	OUT	DSP3+	LED Display data (8 Volt logic levels)
26	R10	IN	UP-	CHANNEL UP pushbutton status (LO = pressed)
27	R11	IN	DWN-	CHANNEL DOWN pushbutton status (LO = pressed)
28	R12	IN	INH+	PTT inhibit status (HI = Deactivate PTT)
29	R13	IN	TA-	Talk-Around select(HI=TX/RX freq same;LO=TX/RX offset)
30	INT0	IN	PTT+	PTT (Push-To-Talk) status (HI = PTT activated)
31	INT1	IN		not used
32	R20	OUT	RMA0+	E/PROM addressing
33	R21	OUT	RMA1+	E/PROM addressing
34	R22	OUT	RMA2+	E/PROM addressing
35	R23	OUT	RMA3+	E/PROM addressing
36	R30	OUT	RMA4+	E/PROM addressing
37	R31	OUT	RMA5+	E/PROM low-order addressing; or E/PROM Enable
38	R32	OUT	ASTB+	Strobe for E/PROM address latch
39	R33	OUT	AUXSTB+	Strobe for AUXILIARY data to option
40	D0	OUT	PSST+	Strobe for E/PROM data out. into shift register IC902
41	D1	IN	CHDT+	Serial data from shift register IC902
42	D2	OUT	DCLK	Clock for CHDT+

HI = 3.5 to 5 Volts DC; LO = 0 to 1.5 Volts DC

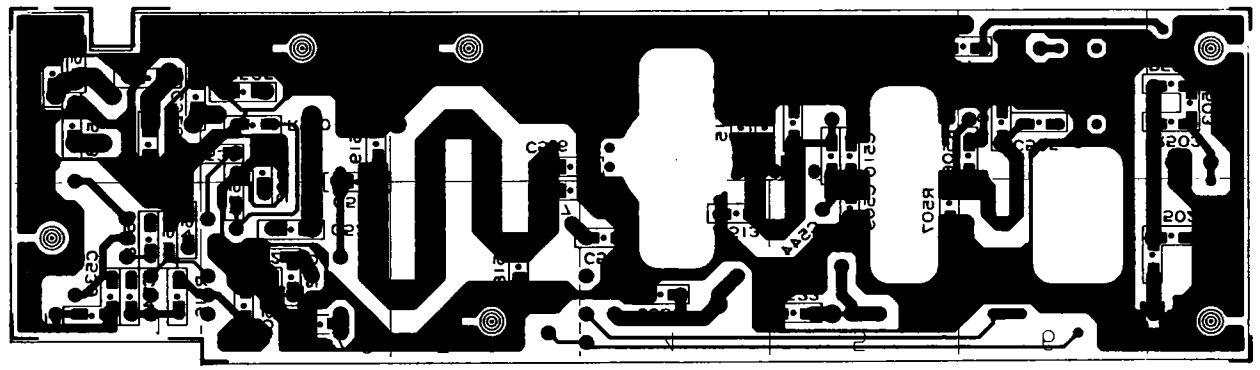
RF POWER AMPLIFIER PC BOARD

70-342XL/442XL

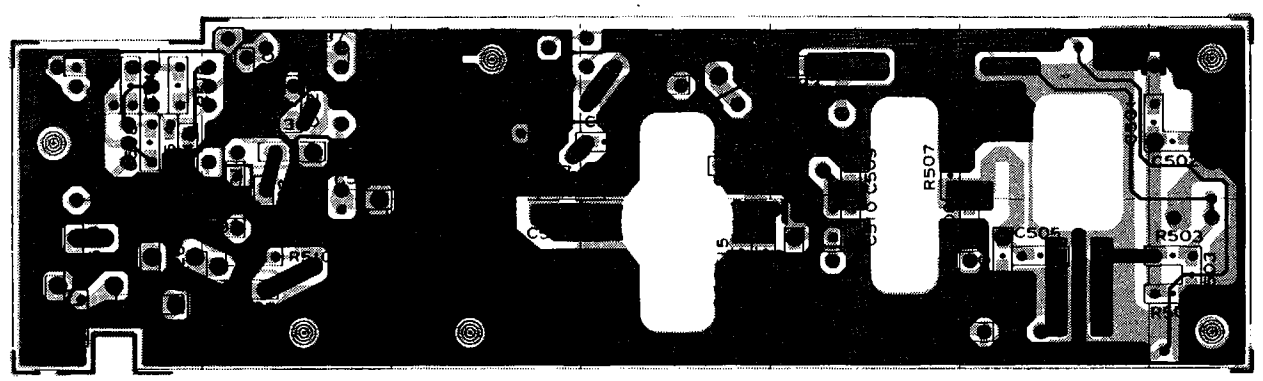
COMPONENT-SIDE VIEW



SOLDER SIDE AS SEEN THROUGH COMPONENT SIDE



SOLDER-SIDE VIEW



LEGEND:

GRAY ○ VISIBLE PLATING

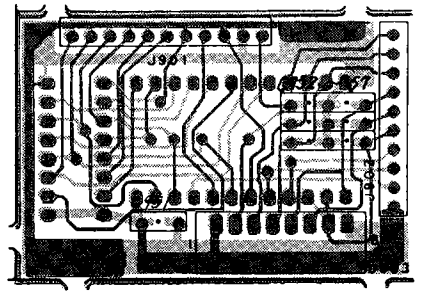
RED ○ OPPOSITE-SIDE PLATING

Fold Out →

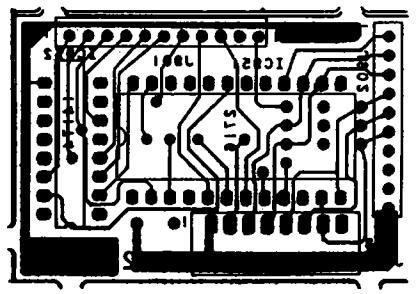
E/PROM MODULE PC BOARD

70-342XL/442XL

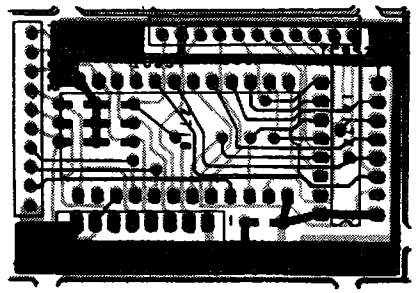
SOLDER-SIDE VIEW



COMPONENT SIDE
AS SEEN THROUGH SOLDER SIDE



COMPONENT-SIDE VIEW



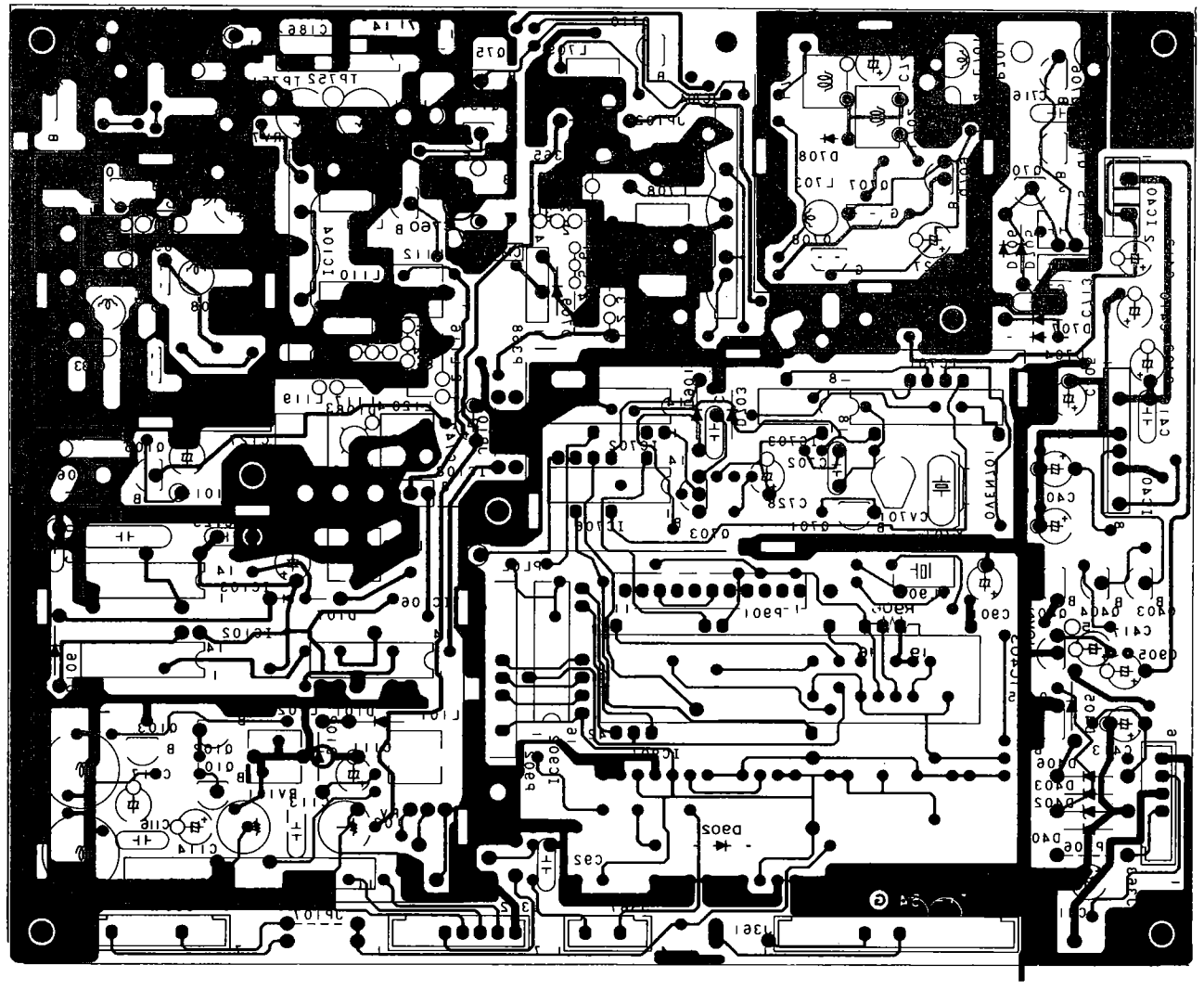
LEGEND:

GRAY ○ VISIBLE PLATING

RED ○ OPPOSITE-SIDE PLATING

TRANSMITTER PC BOARD (BOTTOM VIEW)

70-342XL/442XL

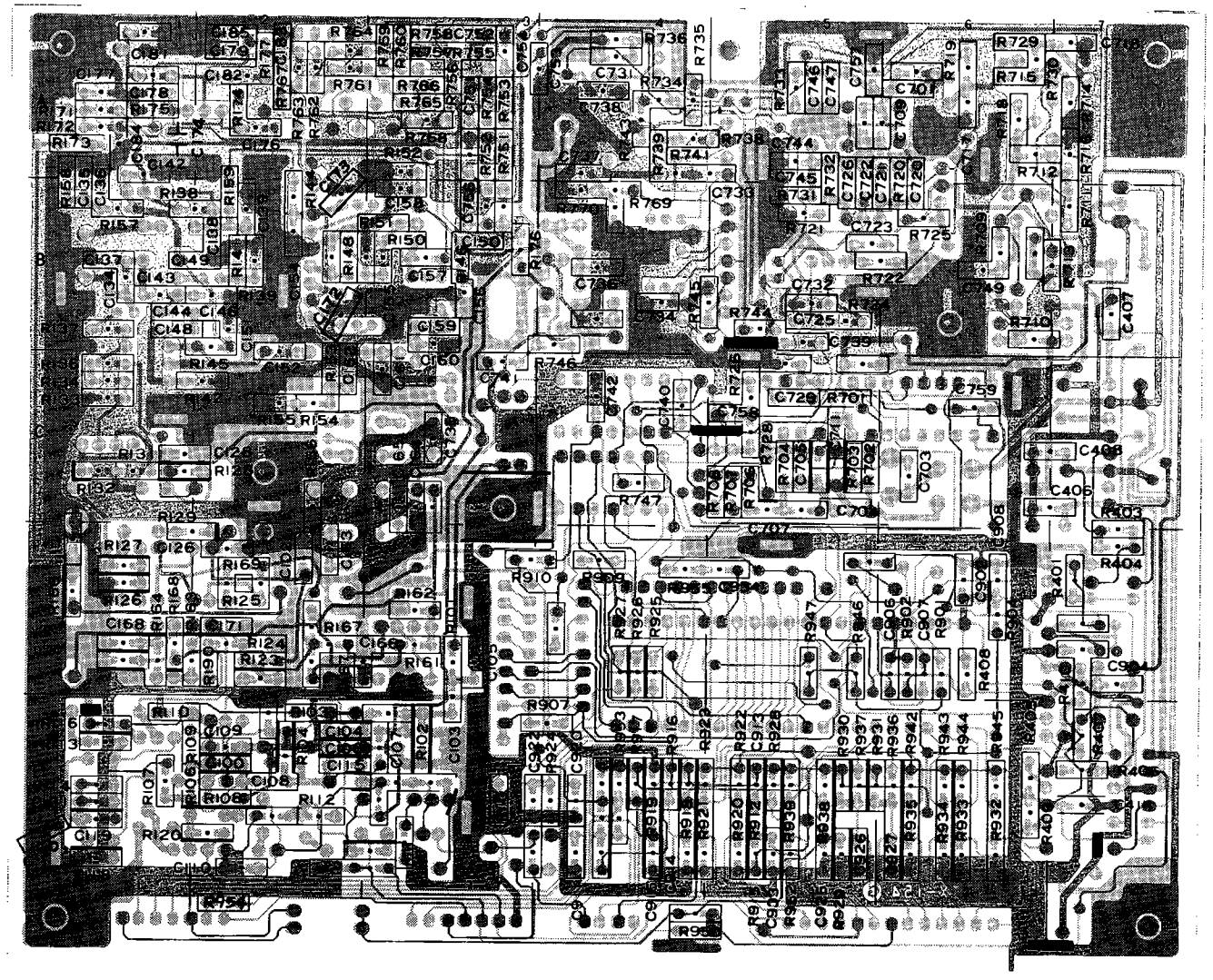


LEGEND:

RED ○ COMPONENT-SIDE PATTERN AS SEEN THROUGH PC BOARD BOTTOM

BLACK ○ COMPONENT-SIDE COMPONENTS AS SEEN THROUGH PC BOARD BOTTOM

NOTE:
COMPONENT-SIDE COMPONENTS APPEAR REVERSED
WHEN VIEWED FROM BOTTOM SIDE OF BOARD.



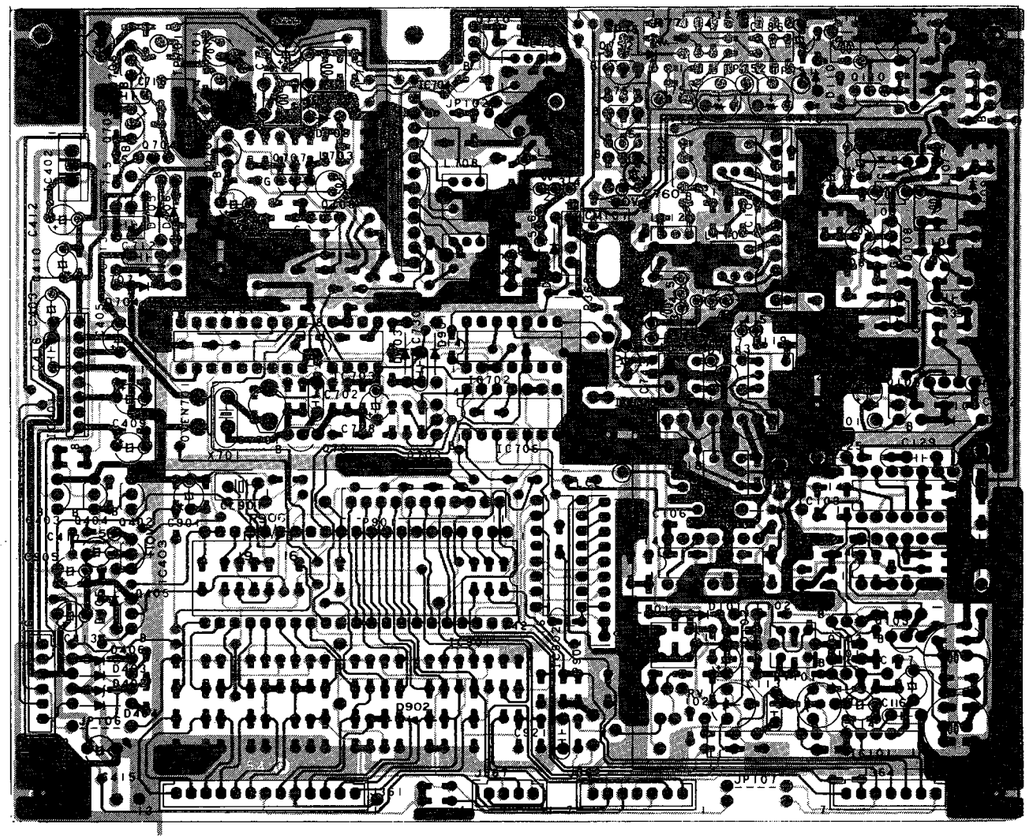
LEGEND:

GRAY ○ SOLDER-SIDE PATTERN

RED ○ COMPONENT-SIDE PATTERN AS SEEN THROUGH PC BOARD BOTTOM

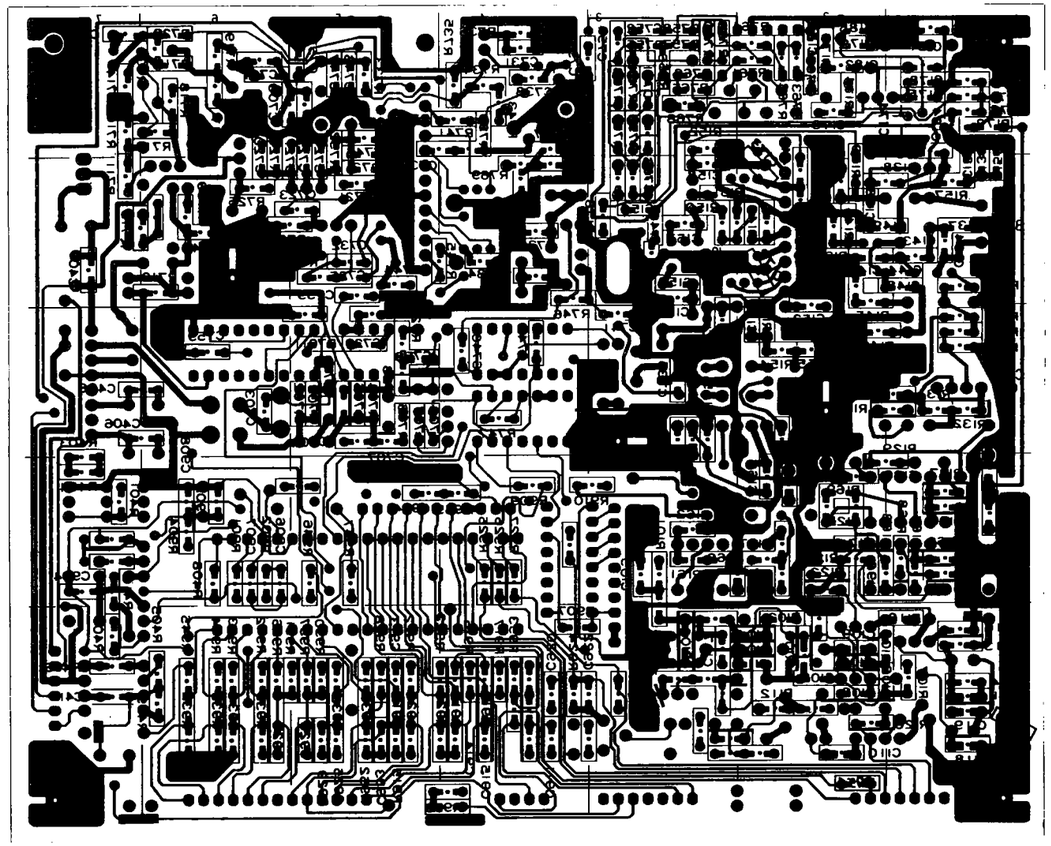
BLACK ○ SOLDER-SIDE CHIP COMPONENTS

TRANSMITTER PC BOARD (TOP VIEW)



LEGEND:

GRAY o COMPONENT-SIDE PATTERN
RED o SOLDER-SIDE PATTERN AS SEEN THROUGH PC BOARD TOP
BLACK o COMPONENT-SIDE COMPNENTS



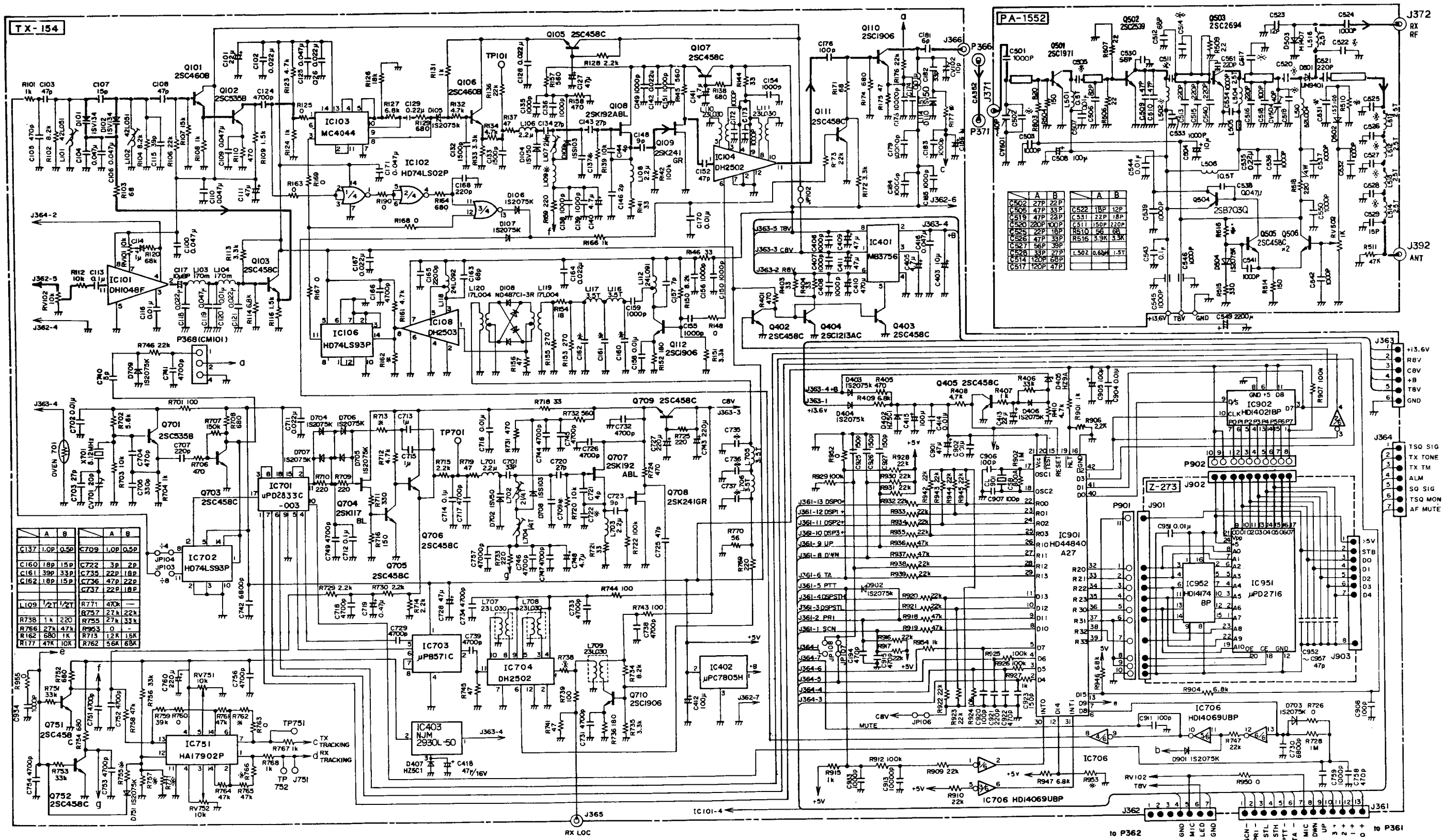
LEGEND:

RED o SOLDER-SIDE PATTERN AS SEEN THROUGH PC BOARD TOP
BLACK o SOLDER-SIDE COMPONENTS AS SEEN THROUGH PC BOARD TOP

NOTE:
SOLDER-SIDE COMPONENTS APPEAR REVERSED
WHEN VIEWED FROM TOP SIDE OF BOARD.

Fold Out

TRANSMITTER BOARD SCHEMATIC DIAGRAM 70-342XL/442XL



	A	B
C137	1.0P	0.5P
C160	18P	15P
C161	39P	33P
C162	18P	15P
L109	1/2T	1/2T
R738	1k	220
R766	27k	47k
R162	680	1K
R177	47K	10K

	A	B
C709	1.0P	0.5P
C722	3P	2P
C735	22P	18P
C736	47P	22P
C737	22P	18P
R771	470k	—
R757	27k	22k
R755	27k	33k
R953	0	-
R713	1.2K	1.5K
R762	56K	68K

	A	B
C502	27P	22P
C506	47P	33P
C519	47P	33P
C520	220P	100P
C525	22P	18P
C526	47P	33P
C527	56P	39P
C528	33P	27P
C514	120P	68P
C517	120P	47P

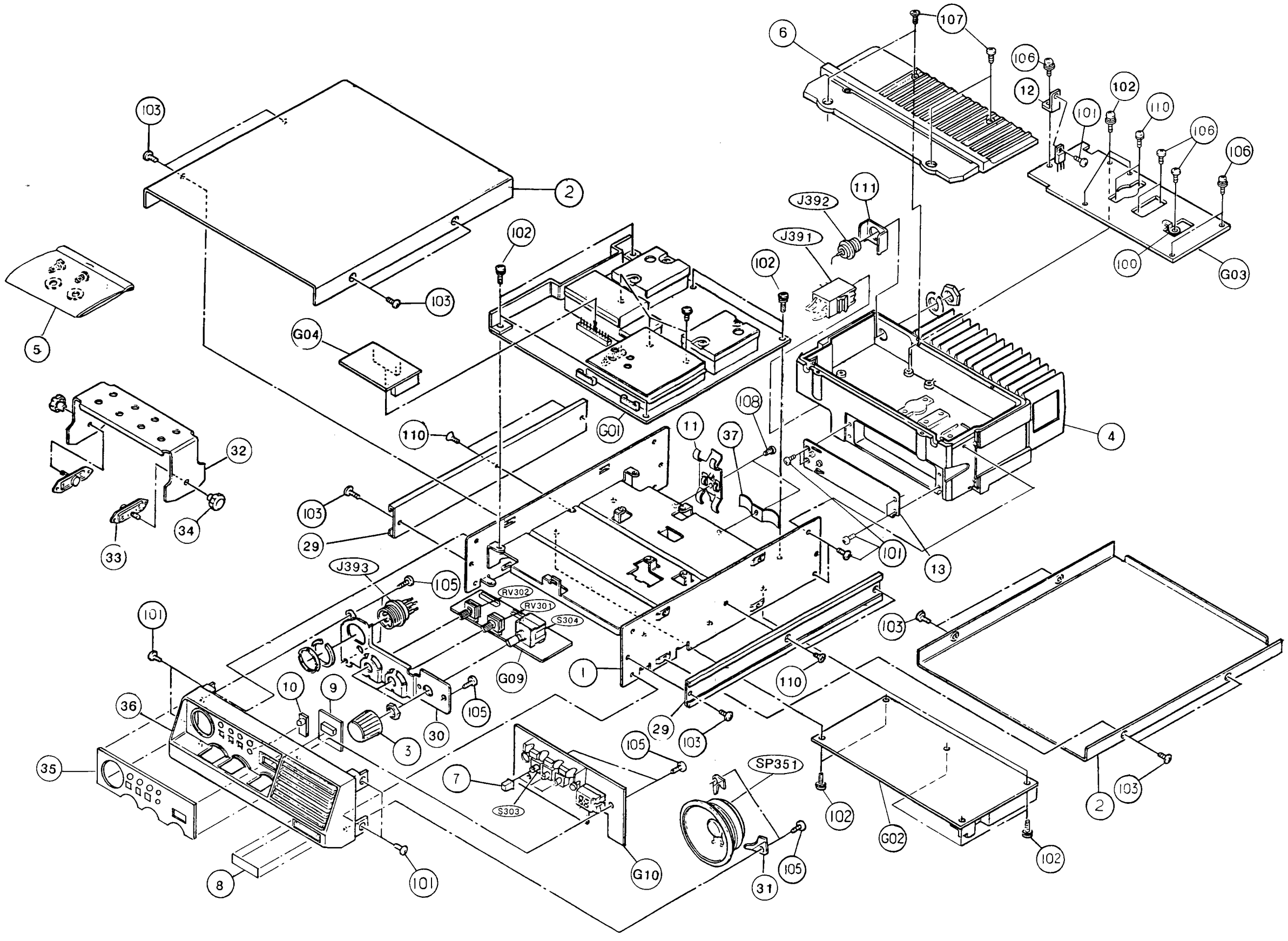
	A	B
C522	18P	12P
C531	22P	18P
C511	150P	220P
R510	56	68
R516	3.9K	3.3K
L502	0.62μH	1.5T

This schematic is simultaneously viewable with:
- CONTROL-CABLE INTERFACE BOARD SCHEMATIC, page 86
- CONTROL HEAD SCHEMATIC, page 85 (flipped over)
- TRUNK-MOUNT INTERCONNECT DIAGRAM, page 84
- UNDER-DASH RECEIVER SCHEMATIC, page 83 (flipped over)
- FRONT PANEL SCHEMATIC, page 80
- UNDER-DASH INTERCONNECT DIAGRAM, page 78

This schematic is simultaneously viewable with:
- TRANSMITTER BOARD--TOP VIEW LAYOUT, page 92
- TRANSMITTER BOARD--BOTTOM VIEW LAYOUT, page 91 (flipped over)
- RF POWER AMPLIFIER BOARD LAYOUTS, page 90
- MICROPROCESSOR PINOUTS CHART, page 89 (flipped over)
- DC VOLTAGES--TRANSMITTER BOARD, page 88
- TRUNK-MOUNT RECEIVER BOARD SCHEMATIC, page 87 (flipped over)

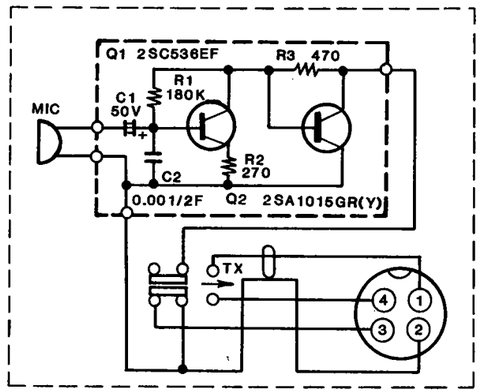
EXPLODED MECHANICAL VIEW

70-342XL
(UNDER-DASH)



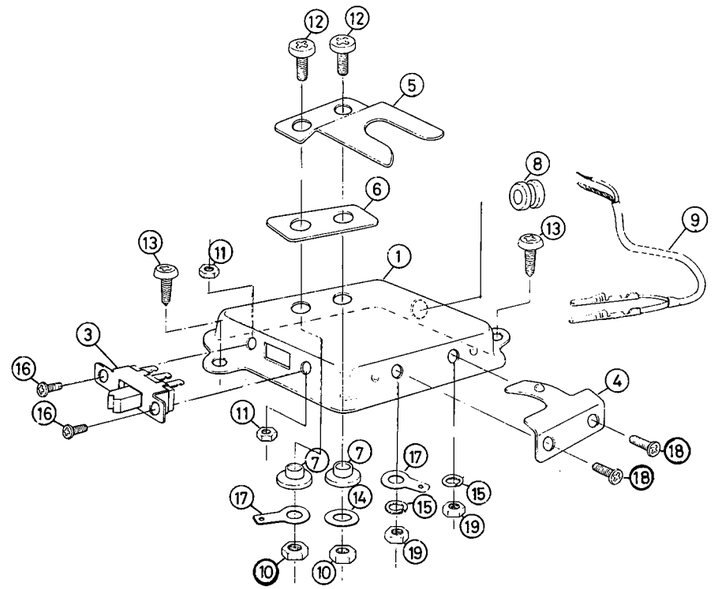
Fold Out

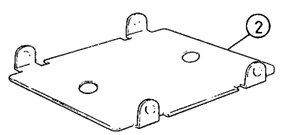
70-2301 MICROPHONE DETAIL



PART DESCRIPTION	PART NUMBER
Front Panel	70-010072
Name Plate	70-020022
Front Case	70-010073
Dynamic Element	70-038004
PTT Switch	70-183004
PTT Button	70-118007
PC Board with components	70-075014
Transistor, 2SA1015	70-080025
Transistor, 2SC536	70-080026
Elect. Capacitor, 10uF, 50V	70-135002
Ceramic Capacitor 1000pF	70-132005
Cushion, PTT Button	70-157015
Resistor, 270ohm, 1/4W	70-141010
Resistor, 470ohm, 1/4W	70-141016
Resistor, 180Kohm, 1/4W	70-141037
Cord with contacts	70-034074
Cord without contacts	70-034075
Mic Plug, 4-pin	70-159015
Rear Case	70-013017
Case Gasket	70-157016
Screw, Case	70-151076
Screw, Hang-up Button	70-151078
Screw, Front Panel	70-151077
Mic Hang-up Button	70-118008
Hang-up Button Washer	70-151079
Rear Case Plate	70-020024
Ballast Weight	70-151369

70-2195 HANG-UP BOX DETAIL

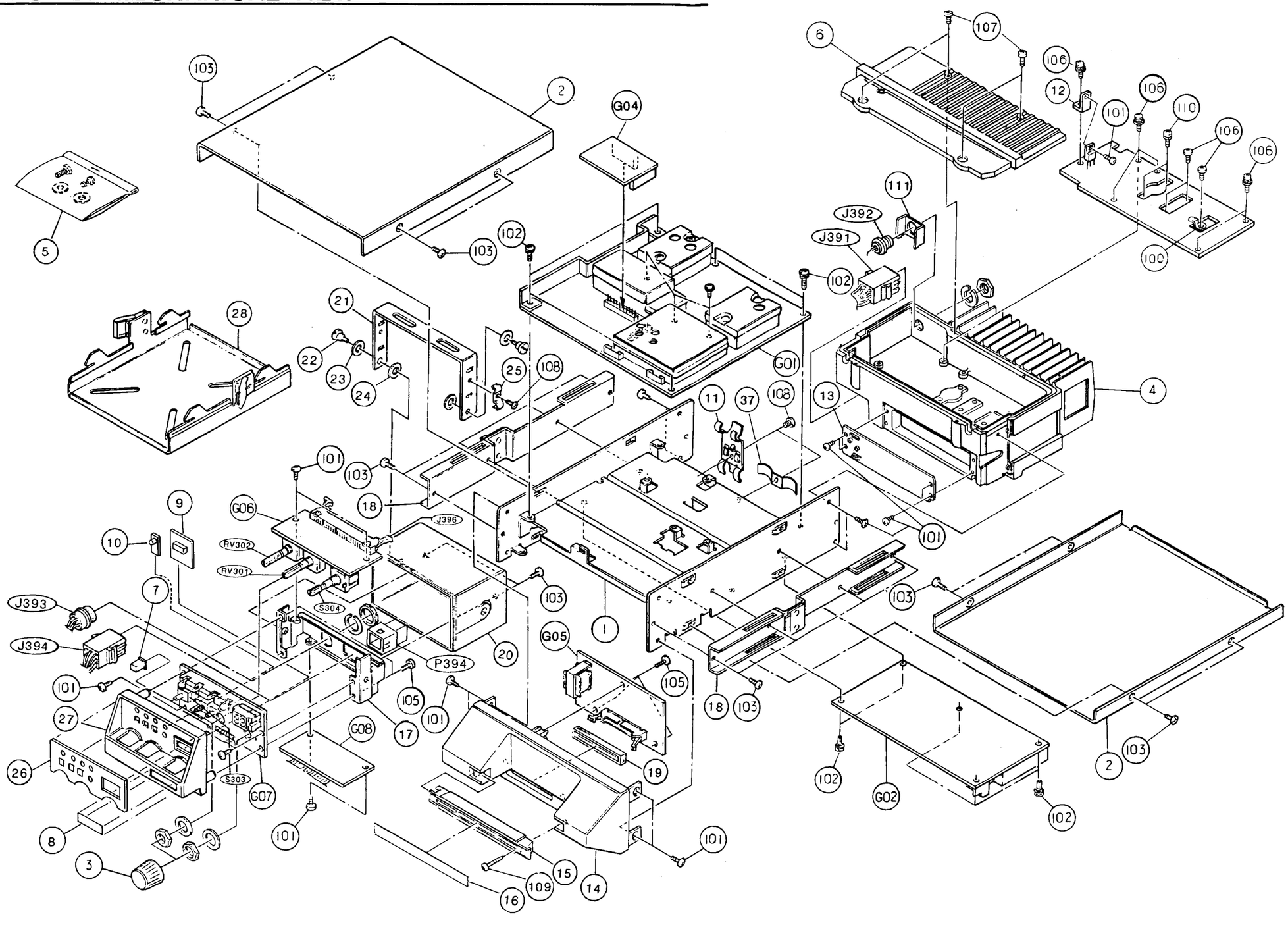




ITEM NO.	DESCRIPTION	PART NO.
1	Top Cover	70-010068
2	Bottom Cover	70-010069
3	Slide Switch	70-183003
4	Hanger Spring	70-158022
5	Hanger	70-158023
6	Spacer	70-151062
7	Insulating Washer	70-151063
8	Cord Grommet	70-156006
9	Cord with pins	70-151064
10	Hex Nut, M3	70-151065
11	Hex Nut, M2	70-151066
12	Bind-Head Screw 3x8	70-151067
13	Tapping Screw 3x8	70-151068
14	Washer 3.2	70-151069
15	Washer 2.6	70-151070
16	Bind-Head Screw 2x6	70-151071
17	Terminal	70-151072
18	Bind-Head Screw 2.6 x 8	70-151073
19	Hex Nut, M2.6	70-161074

EXPLODED MECHANICAL VIEW

70-442XL
(TRUNK-MOUNT)



Fold Out

The following parts list is a composite listing for the 70-342AXL, 70-342BXL, 70-442AXL and 70-442BXL. For the application of each individual part, refer to the "USE" column as follows:

"USE" DESIGNATION	PART APPLICATION
A	70-342AXL, 70-442AXL
B	70-342BXL, 70-442BXL
UD	70-342AXL, 70-342BXL
TM	70-442AXL, 70-442BXL
NO DESIGNATION	70-342AXL, 70-342BXL 70-442AXL, 70-442BXL

Refer to the separate exploded mechanical views for mechanical parts unique to trunk-mount or under-dash models. Mechanical parts common to both trunk-mount and under-dash versions are shown with the same reference number on both drawings and in the parts list.

REF. NO.	USE	DESCRIPTION	PART NO.
CASE MATERIALS EXPLODED MECHANICAL VIEW			
1		Chassis	70-015028
2		Cover	70-010040
3		Knob, Volume	70-110012
4		Heatsink	70-089110
5		Fixed Screws	70-000012
6		Cover, PA	70-089111
7		Button, Switch	70-110013
8		Plate, Brand	70-020070
9		Lens, Channel	70-020071
10		Lens, CDS	70-020072
11		Earth Spring	70-152039
12		APC Heatsink	70-089112
13		IC501 Cover	70-015025
14	TM	Panel, Front	70-010041
15	TM	Grip	70-158077
16	TM	Plate, Grip	70-158078
17	TM	Chassis, Control	70-015023
18	TM	Side Rail	70-158076
19	TM	Rubber Spacer	70-157056
20	TM	Cover, Cntrl.Hd.	70-010066
21	TM	Mtng. Bracket	70-158069
22	TM	Mtng. Screw	70-151362
23	TM	Washer	70-151363
24	TM	Washer	70-151364
25	TM	Clamp	70-158079
26	TM	Face Plate, Scan	70-020067
27	TM	Panel Front	70-010067

REF. NO.	USE	DESCRIPTION	PART NO.
CASE MATERIALS EXPLODED MECHANICAL VIEW CONT.			
28	TM	Mtng.Brkt.Assy.	70-158107
29	UD	Side Rail	70-158067
30	UD	Holder,Vol.Cont.	70-158073
31	UD	Brkt.Speaker	70-158074
32	UD	Brkt. Mtng.	70-158130
33	UD	Plate, Slide	70-158075
34	UD	Nut,Mtng.Brkt.	70-151354
35	UD	FacePlate, Scan	70-020066
36	UD	Panel Front	70-011032
37		Earth Spring	70-089119
100		Lug, PA	70-151271
101		Screw, Bind Hd.	70-151616
102		Screw, Bind Hd.	70-151414
103		Screw, Bind Hd.	70-151357
105		Screw, Top BndHd.	70-151359
106		Screw, Pan Hd.	70-151273
107		Screw, PA	70-151409
108		Screw, Bnd. Hd.	70-151366
109	TM	Screw Top Bnd.Hd.	70-151365
110	UD	Screw, Flat Hd.	70-151272
111		Shield	70-204042
PCB ASSEMBLIES			
G01	A	TX-154 PCB Assy.	70-075216
G01	B	TX-154 PCB Assy.	70-075217
G02	A	RX-155 PCB Assy.	70-075218
G02	B	RX-155 PCB Assy.	70-075219

REF. NO.	USE	DESCRIPTION	PART NO.
		PCB ASSEMBLIES CONT.	
G03	A	PA-1552 PCB Assy.	70-075221
G03	B	PA-1552 PCB Assy.	70-075222
G04		Z-273 E/PromBlnk.	70-070070
G05	TM	CX-08 PCB Assy.	70-075033
G06	TM	CX-05 PCB Assy.	70-075209
G07	TM	CX-07 PCB Assy.	70-075210
G08	TM	CX-06 PCB Assy.	70-075211
G09	UD	CX-04 PCB Assy.	70-075031
G10	UD	CX-03 PCB Assy.	70-075031
		JACKS & CONNECTORS	
J391		Pwr/Accy.Conn.	70-159108
J392		RF Conn.	70-159090
J393		Mic Jack	70-159100
J394	TM	Molex Conn.	70-159108
J396	TM	Conn. Rem. Cbl.	70-159107
P394	TM	Conn. Cont. Hd.	70-159112
		CONTROLS	
RV301	TM	Squelch, 10K	70-164030
RV302	TM	Vol. W/Sw, 10K	70-164027
RV301	UD	Squelch, 10K	70-164031
RV302	UD	Vol. W/Sq. 10K	70-164026
		SWITCHES	
S303		Mod./Scn, Pri	70-180012
S304	TM	Chnl. Select	70-180014
S304	UD	Chnl. Select	70-180013
		SPEAKER	
SP351	UD	Speaker	70-060011
		CABLE ASSEMBLIES	
CA351		P355 to P372	70-034059
CA352		P366 to P371	70-034198
CA353		P356 to P365	70-034060
CA354	UD	J391 to P351	70-034239
CA354	TM	J391 to P351	70-034240
CA355		P353 to P364	70-034204
CA356		P361,362 to P1	70-034112
CA357	UD	P354toJ381,SP351	70-034205
CA357	TM	P354 to J323	70-034206
CA358		P352 to P363	70-034207
CA359	UD	P382 to J383	70-034208
CA360	UD	P386 to J393	70-034209
CA361	TM	J324 to P2	70-034211
CA362	TM	CX05 to CX06	70-034071

REF. NO.	USE	DESCRIPTION	PART NO.
		CABLE ASSEMBLIES CONT.	
CA363	TM	CX06 to CX07	70-034072
CA364	TM	CX05 to CX07	70-034073
	TM	Remote Cable Assy	70-034061
		MISCELLANEOUS	
C391		270PF, 50V	70-131225
C392		250PF, 50V	70-131255
F391		Fuse, 10A	70-204026
		Shield,Mix, TX	70-089105
		Mix.Cvr. TX	70-089078
		Shield Syn TX	70-089079
		Syn Cvr., TX	70-089080
		Shield VCO	70-089081
		Cover, VCO TX	70-089087
		Cover, VCO RX	70-089082
		Shld, VCO RX Rear	70-089084
		Insltr RX	70-089086
		Shield, RX	70-089085
		Heatsink	70-089076
	UD	342 Pwr Cord 2M	70-034031
	TM	442 Pwr Cord 6M	70-034032
		Mic Dynamic	70-038013
		Mic Hanger	70-158015

TRANSMIT/SYNTHESIZER PCB
TX-154
TOPSIDE COMPONENTS

		TRANSISTORS	
Q101,106		2SC460B	70-080083
Q102,701		2SC535B	70-080095
Q103,105, 107,111, 402,403, 405,703, 705,706, 709,751, 752		2SC458C	70-080082
Q108,707		2SK192ABL	70-080087
Q109,708		2SK241	70-080110
Q110,112, 710		2SC1906	70-080086
Q704		2SK117BL	70-080127
Q404		2SC1213C	70-080085
		INTEGRATED CIRCUITS	
IC101		DH1048F	70-076141
IC102		HD74LS02P	70-076099

REF. NO.	USE	DESCRIPTION	PART NO.
		INTEGRATED CIRCUITS	
IC103		MC4344	70-076086
IC104		DH2502	70-076100
IC106		HD74LS93P	70-076084
IC108		DH2503	70-076101
IC401		MB3756H	70-076139
IC402		UPC7805H	70-076087
IC403		NJM2930L-50	70-076210
IC701		UPD2833-003	70-076187
IC702		HD74LS93P	70-076084
IC703		UPB571C	70-076102
IC704		DH2502	70-076100
IC706		HD14069UBP	70-076097
IC751		HA17902P	70-076272
IC901		HD44840A27	70-076273
IC902		HD14021BP	70-076079
		COILS AND TRANSFORMERS	
L101,102		Trnsfrmr 42L051	70-090105
L103,104		Inductor	70-178047
L106,108, 701,703		Coil,FL-4H,2.2UH	70-178045
L107,702		Coil, MC111S	70-090183
L109	"A"	Coil, ZO.8C5D,.5T	70-090160
L109	"B"	Coil,ZO.8C5D,.5T	870-090188
L110,111, 707,708, 709		Transfrmr32L030	70-090106
L112		Transfrmr24L091	70-090107
L114		Coil, 1.5T	70-090192
L116,117		Coil, 3.5T	70-090101
L118		Trnsfrmr24L092	70-090108
L119,120		Trnsfrmr 17L004	70-090114
L704	"A"	Coil, 1 1/4 T	70-090184
L704	"B"	Coil, 1 1/4 T	70-090171
L705,706		Coil,ZO.8C5D	70-090099
		MYLAR CAPACITORS	
C113,712, 714		.1UF, 50V	70-137039
C116,170, 702,716		.01UF, 50V	70-137037
C125,416		.047UF, 50V	70-137038
C132,133		1500PF, 50V	70-137035
C713,715		1UF, 50V	70-137012
C730		6800PF, 50V	70-137036
C129		.22UF, 50V	70-137040

REF. NO.	USE	DESCRIPTION	PART NO.
		ELECTROLYTIC CAPACITORS	
C101		22UF, 50V	70-135060
C111,127, 409,410, 411		47UF, 25V	70-135055
C114		1UF, 50V	70-135057
C117		10UF, 16V	70-135083
C141,405, 413		4.7UF, 50V	70-135058
C727		220UF, 10V	70-135095
C728,901		47UF, 10V	70-135052
C743		220UF, 16V	70-135081
C760		220UF, 25V	70-135063
C905,412, 415		100UF, 10V	70-135053
C403		10UF, 50V	70-135059
C418		47UF, 16V	70-135010
		TANTALUM CAPACITORS	
C140		4.7UF, 16V	70-130200
C186		1UF, 35V	70-138087
C719		.47UF, 16V	70-138133
C748		4.7UF, 16V	70-138101
		CERAMIC DISC CAPACITOR	
C921		470 PF, SL, 50V	70-132056
		DIODES	
D101,102		ISV134	70-085093
D104,110, 702		ISV50	70-085078
D105,106, 107,403, 404,406, 703,704, 705,706, 707,751, 901,902		1S2075K	70-085001
D108		ND87C1-3R	70-085058
D109,708		1SS103	70-085085
D402,407		HZ5C1	70-085046
D405		HZ9A	70-085076
		TRIMMER CAPACITORS	
CV102		10PF Trim Cap.	70-123034
CV701		20PF Trim Cap.	70-123048

REF. NO.	USE	DESCRIPTION	PART NO.
		VARIABLE RESISTORS	
RV101,102, 751,752		Trim Pot, 10K	70-144045
		CRYSTALS	
X701		Crystal, 5.12MHz	70-128019
		CERAMIC OSCILLATOR	
CL901		Ceramic Osc.	70-179028
		JACKS, PLUGS, SOCKETS	
J361		13 Pin Jack	70-159109
J362,364		7 Pin Jack	70-159095
J363		6 Pin Jack	70-159094
J365,366		Jack, Coax	70-159089
P368(CM101)		3 Pin Plug	70-159092
P901		11 Pin Plug	70-159103
P902		10 Pin Plug	70-159104
TP101,701, 751,752		Test Point	70-151368
		MISCELLANEOUS	
Oven 701		Posister	70-086010
G01		TX-154 PCB(Blank)	70-080110
		CARBON RESISTORS	
R906		2.2K, 1/8 W	70-144107

TRANSMIT/SYNTHESIZER PCB
TX-154
BOTTOMSIDE COMPONENTS

REF. NO.	USE	DESCRIPTION	PART NO.
		CERAMIC CHIP CAPACITORS	
C100,104, 106,109, 110,119, 171,757		.047UF,W5R, 50V	70-132034
C102,118, 121,126, 128,142, 164,167		.022UF,W5R, 50V	70-132033
C103,108, 152,725		47PF, CH, 50V	70-131196
C105,914, 915,922		470PF, SL, 50V	70-131204
C107		15PF, CH, 50V	70-131185
C115		39PF, CH, 50V	70-131194
C120,158, 178,179, 184,902, 904,913, 414		.01UF, W5R, 50V	70-132032
C132,133		1500PF, 50V	70-137035
C134,143		27PF, CH, 50V	70-131190
C135,136, 138,139, 149,150, 151,154, 155,156, 159,172, 173,176, 177,183, 185,933, 934,406, 407,408, 759		1,000pf,W5R,50V	70-131205
C137	"A"	1PF, CK, 50V	70-131173
C137	"B"	.5PF, CK, 50V	70-131172
C144,721		4PF, CH, 50V	70-131176
C146		2PF, CK, 50V	70-131174
C148,723		9PF, CH, 50V	70-131181
C157		7PF, CH, 50V	70-131179
C160	"A"	18PF, CH, 50V	70-131186
C160	"B"	15PF, CH, 50V	70-131185
C161	"A"	39PF, CH, 50V	70-131194
C161	"B"	33PF, CH, 50V	70-131192
C162	"A"	18PF, CH, 50V	70-131186
C162	"B"	15PF, CH, 50V	70-131185
C163		68PF, CH, 50V	70-131198
C165		2200PF,W5R, 50V	70-131206
C168		220PF, CH, 50V	70-131199
C174		1,000PF, 50V	70-131260
C181		6PF, CH, 50V	70-131248
C182,701		33PF, CH, 50V	70-131192
C703,720		27PF, CH, 50V	70-131190
C704,758		470PF, CH, 50V	70-132053
C705		330PF, CH, 50V	70-131233
C124,166, 706,717, 718,726, 729,731, 732,733, 734,738, 739,741, 744,745, 746,747, 749,751,		4700PF,W5R, 50V	70-131207

REF. NO.	USE	DESCRIPTION	PART NO.
		CERAMIC CHIP CAPACITORS CONT.	
C752,753, 754,756		4700PF, W5R, 50V	70-131207
C709	"A"	1PF, CK, 50V	70-131173
C709	"B"	.5PF, CK, 50V	70-131172
C722	"A"	3PF, CJ, 50V	70-131175
C722	"B"	2PF, CK, 50V	70-131174
C735	"A"	22PF, CH, 50V	70-131188
C735	"B"	18PF, CH, 50V	70-131186
C736	"A"	47PF, CH, 50V	70-131196
C736	"B"	22PF, CH, 50V	70-131188
C737	"A"	22PF, CH, 50V	70-131188
C737	"B"	18PF, CH, 50V	70-131186
C740		5PF, CH, 50V	70-131177
C742		6800PF,W5R, 50V	70-131208
C906,907		100PF, CH, 50V	70-132051
C908,911,920		100PF, SL, 50V	70-132040
C921		220PF, Y, 50V	70-132056
C923,924, 925,926, 927		150PF, SL, 50V	70-131201
		METAL CHIP RESISTORS	
R101,108, 124,131, 162,166, 407,704,738, 767,768, 901,915, 927,954		1K, 1/8 W	70-144019
R102,104, 150,734		8.2K, 1/8 W	70-144028
R103,171		68 ohm, 1/8 W	70-144008
R106,136, 173,176, 746,747, 909,910, 916,917, 920,921, 922,923, 928,930, 931,932, 933,934, 935,938, 939,942, 943,944, 945,757		22K, 1/8 W	70-144032
R107		15K, 1/8 W	70-144031
R109,116		1.5K, 1/8 W	70-144021
R110,158,		470 ohm, 1/8 W	70-144015

REF. NO.	USE	DESCRIPTION	PART NO.
		METAL CHIP RESISTORS	
R401,405, 706,724, 731		470 ohm, 1/8 W	70-144015
R112,139, 703,720, 924		10K, 1/8 W	70-144029
R113,133, 151,172, 735		3.3K, 1/8 W	70-144023
R114,127,756, 409,904, 946,947		6.8K, 1/8 W	70-144027
R120,762		68K, 1/8 W	70-144035
R123,132, 134,161, 408,410, 712		4.7K, 1/8 W	70-144025
R125,148, 163,167, 168,169, 190,726, 760,763, 950,952, 953,955		Zero ohm, 1/8 W	70-144001
R126		18K, 1/8 W	70-144073
R128,714, 715,729, 730		2.2K, 1/8 W	70-144022
R129,138, 162,164, 174,708, 752,754		680 ohm, 1/8 W	70-144017
R137,156, 175,719, 741,745		47 ohm, 1/8 W	70-144006
R141,144, 146,403, 404,718, 721		33 ohm, 1/8 W	70-144005
R142,722, 907,912, 925,926, 929		100K, 1/8 W	70-144037
R145,157, 732		560 ohm, 1/8 W	70-144016
R152,736		180 ohm, 1/8 W	70-144012
R153,155		270 ohm, 1/8 W	70-144014
R154		18 ohm, 1/8 W	70-144004
R159,709, 710,725		220 ohm, 1/8 W	70-144013

REF. NO.	USE	DESCRIPTION	PART NO.
		METAL CHIP RESISTORS CONT.	
R769		220 ohm, 1/8 W	70-144013
R177	"A"	47K,1/8 W	70-144034
R177	"B"	10K, 1/8 W	70-144029
R701,739, 743,744		100 ohm, 1/8 W	70-144009
R702		5.6K, 1/8 W	70-144026
R707		150K, 1/8 W	70-144038
R711		330 ohm, 1/8 W	70-144065
R713		1.2K, 1/8 W	70-144020
R716		150 ohm, 1/8 W	70-144011
R728,902		1M ohm, 1/8 W	70-144042
R758,761, 764,765, 766,918, 919,936, 937		47K, 1/8 W	70-144034
R406,751, 753,755, 756		33K, 1/8 W	70-144033
R766		27K, 1/8 W	70-144075
R759		39K, 1/8 W	70-144084
R770		56 ohm, 1/8 W	70-144007
		RECEIVER PCB RX - 155 TOPSIDE COMPONENTS	
		COILS & TRANSFORMERS	
L201,202, 204,205, 206		Coil, 3.5T	70-090116
L203		Coil, ELE-Y 2R2MA	70-090121
L208		Trnsfrmr,22L014	70-090234
L209		Trnsfrmr,28L0345	70-090190
L210		Trnsfrmr,27L004S	70-090191
L251		Trnsfrmr,22L015	70-090240
L252		Trnsfrmr,22L004	70-090112
L253		Coil ELE-Y 102KA	70-090169
L254,255		Coil ELE-Y 331KA	70-090170
L256	"A"	Coil 5220001 1.5 MH	70-090126
L256	"B"	Coil 1.0 MH	70-178057
		JACKS, PLUGS, SOCKETS	
P251		Plug, 3 Pin	70-159091
J351		Jack, 5 Pin	70-159093
J352		Jack, 6 Pin	70-159094
J353		Jack, 7 Pin	70-159095

REF. NO.	USE	DESCRIPTION	PART NO.
		JACKS, PLUGS, SOCKETS CONT.	
J354		Jack, 12 Pin	70-159097
J355,356		Jack, Coax	70-159089
J357,358		Jack, 8 Pin	70-159096
		INTEGRATED CIRCUITS	
IC251		MC3557P	70-076138
IC252		MB3712	70-076168
		TRANSISTORS	
Q201,202		2SK125	70-080089
Q203		2SC2026	70-080134
Q204		2SA673C	70-080079
Q205,252, 255,256, 257,260, 261		2SC458C	70-080082
Q251		2SC535B	70-080082
Q259		2SK117BL	70-080088
		DIODES	
D201,202		MC301	70-085077
D203,204, 205,206, 207,208, 209,210, 211,212, 213,214, 215,216		1SV50	70-085078
D217		1SS106	70-085043
D251,252, 253,254, 259,260, 261,263		1S2075K	70-085001
D262		U05C	70-085048
		ELECTROLYTIC CAPACITORS	
C234,277		10UF, 50V	70-135059
C285,273		100UF, 10V	70-135053
C286,243		47UF, 25V	70-135055
C287		470UF, 25V	70-135062
C289,292		220UF, 25V	70-135063
C295		1000PF, 500V	70-135056
C299		470, 25V	70-135082
C242		22UF, 25V	70-135054
C264		2200UF, 25V	70-135088

REF. NO.	USE	DESCRIPTION	PART NO.
		TANTALUM CAPACITORS	
C236		.47UF, 35V	70-135094
C278,279		2.2UF, 16V	70-138035
C280,282		.22UF, 35V	70-138102
C266		2.2UF, 16V	70-138213
C268		1UF, 35V	70-131202
C297		22UF, 16V	70-135098
		MYLAR CAPACITORS	
C288,256		.1UF, 50V	70-137039
C257		.1UF, 35V	70-138086
		RESISTORS	
R293		220K, 1/8 W	70-144039
		MISCELLANEOUS	
K201	TM	Relay	70-105009
X251		Xtal 20.945 MHz	70-128021
FL251		Filter, 21.4-15C	70-179017
FL252		Filter,CFU455E2	70-179019
FL253		Filter,CFU55D2	70-179018
RV251,252		Trim Pot	70-144045
		RX-155 PCB	70-070111
C296		1000PF, 500V Cap	70-132043
		Heatsink, IC252	70-089076
CL201,202, 204,205, 206		Coil Case	70-090187
G02		RX-155 PCB(Blank)	70-090111

RECEIVER PCB
RX-155
BOTTOMSIDE COMPONENTS

		METAL CHIP RESISTORS	
R201,202, 203,204, 207,208, 209,210, 211,212, 218,219, 221,256, 258,292		47K, 1/8 W	70-144034
R205		220 ohm, 1/8 W	70-144013
R206,216, 283		100 ohm, 1/8 W	70-144009
R213,247, 263,279		10K ohm, 1/8 W	70-144029
R298,299		10K ohm, 1/8 W	70-144029
R214,273		470 ohm, 1/8 W	70-144015
R215,241, 243,245, 250		0 ohm	70-144001
R217,294, 222,257, 274,287, 291		22K, 1/8 W	70-144032
R220		10 ohm, 1/8 W	70-144022
R223		680 ohm, 1/8 W	70-144017
R224,260		2.7K, 1/8 W	70-144046
R225,270, 271,272, 281,285, 286,297		4.7K, 1/8 W	70-144025
R226,268		100K, 1/8 W	70-144037
R257		18K, 1/8 W	70-144073
R251,259		220K, 1/8 W	70-144039
R252,261, 275		3.3K, 1/8 W	70-144023
R253,262, 290		82K, 1/8 W	70-144036
R254,255		1.5K, 1/8 W	70-144021
R269,284		1K, 1/8 W	70-144019
R276,280		15K, 1/8 W	70-144031
R277,288		1M, 1/8 W	70-144042
R278,289		470K, 1/8 W	70-144041
R282,295, 296		6.8K, 1/8 W	70-144027
		CERAMIC CHIP CAPACITORS	
C201	"A"	5PF, CH, 50V	70-131177
C201	"B"	3PF, CJ, 50V	70-131175
C203	"A"	15PF,CH, 50V	70-131185
C203	"B"	12PF, CH, 50V	70-131183
C204	"A"	3PF, CH, 50V	70-131175
C204	"B"	2PF, CH, 50V	70-131174
C205		2PF, CH, 50V	70-131174
C206	"A"	15PF, CH, 50V	70-131185
C206	"B"	12PF, CH, 50V	70-131183
C208	"A"	5PF, CH, 50V	70-131177
C208	"B"	4PF, CH, 50V	70-131176
C209	"A"	15PF, CH, 50V	70-131185
C209	"B"	12PF, CH, 50V	70-131183
C210	"A"	1PF, CK, 50V	70-131173
C210	"B"	.5PF, CK, 50V	70-131172
C211,237, 228,214, 238,239,		1PF, CK, 50V	70-131173

REF. NO.	USE	DESCRIPTION	PART NO.
		CERAMIC CHIP CAPACITORS CONT.	
C240,241		1PF, CK, 50V	70-131173
C212	"A"	15PF, CH, 50V	70-131185
C212	"B"	12PF, CH, 50V	70-131183
C213	"A"	3PF, CJ, 50V	70-131175
C213	"B"	1PF, CK, 50V	70-131173
C215	"A"	15PF, CH, 50V	70-131185
C215	"B"	12PF, CH, 50V	70-131183
C216	"A"	3PF, CJ, 50V	70-131175
C216	"B"	2PF, CK, 50V	70-131174
C217		4PF, CH, 50V	70-131176
C218,219, 220,221, 222,229, 230,231, 232,233, 235,293, 294,251, 253,262, 267,275, 244,245, 246,247, 248,249, 250		1000PF, W5R, 50V	70-131205
C223	"A"	2PF, CK, 50V	70-131174
C223	"B"	1.5PF, CH, 50V	70-131223
C224	"A"	18PF, CH, 50V	70-131186
C224	"B"	15PF, CH, 50V	70-131185
C225		.5PF, CK, 50V	70-131249
C226	"A"	18PF, CH, 50V	70-131186
C226	"B"	15PF, CH, 50V	70-131185
C227	"A"	3PF, CJ, 50V	70-131175
C227	"B"	1.5PF, CK, 50V	70-131223
C281,290, 291,252, 260,265, 269,272, 274		.01UF, W5R, 50V	70-132032
C283,276		4700PF, W5R, 50V	70-131207
C254,255,		33PF, CH, 50V	70-131192
C258		22PF, CH, 50V	70-131188
C259,261		.022UF, W5R, 50V	70-132033
C263		.047UF, W5R, 50V	70-132034
C270		12PF, CH, 50V	70-131183

REF. NO.	USE	DESCRIPTION	PART NO.
		TRANSMIT POWER AMPLIFIER PA - 1552 TOPSIDE COMPONENTS	
		METAL CHIP RESISTORS	
R508		33 ohm	70-145143
R509		2.2 ohm	70-145050
		CARBON RESISTORS	
R518		220 ohm	70-145009
		VARIABLE CAPACITORS	
CV501,504		40 PF	70-123024
		VARIABLE RESISTORS	
RV502		1K	70-144044
		TRANSISTORS	
Q501		2SC1971	70-080054
Q502		2SC2539	70-080090
Q503		2SC2694	70-080133
Q504		2SB703-Q	70-080198
Q505,506		2SC458TZ	70-080195
		DIODES	
D501		UM9401	70-085056
D502		ISS106	70-085043
D503		MI407	70-085047
D504		IS2075K	70-085001
		CERAMIC CHIP CAPACITORS	
C530		560PF, JY,50V	70-133020
C545		1000PF, 50V	70-132043
C546		1000PF, 50V	70-131231
		MICA CHIP CAPACITORS	
C540,551		220PF, W5R, 50V	70-138112
		MYLAR CAPACITORS	
C543		.1UF, 50V	70-138189
C535		.22UF, 50V	70-138160

REF. NO.	USE	DESCRIPTION	PART NO.
		COILS & TRANSFORMERS	
L501		Z0.8C5D - 0.5T	70-090242
L502	"A"	BL02RN1-R62	70-090122
L502	"B"	Z0.8C5D - 1.5T	70-090097
L504		Z0.8C5D - 2.5T	70-090245
L505		BL02RN1-R62	70-090122
L506		Z0.8C5D - 10.5T	70-090100
L510		52L004	70-090127
L511,512, 513,514		Z1.2C5D - 2.5T	70-090102
L515		Z0.8C5D - 2.5T	70-090098
		ELECTROLYTIC CAPACITORS	
C504		10UF, 50V	70-135059
C508	"A"	220UF, 25V	70-135063
C508	"B"	100UF, 25V	70-135056
C549		2200UF, 25V	70-135088
		JACKS	
J371,372		Connector Jack	70-159089
J392		Antenna Jack	70-159090
		MISCELLANEOUS	
G03		PA-1552 PCB	70-070200
111		RF Shield	70-204042
		Washer	70-151440
		Spacer	70-151617

TRANSMIT POWER AMPLIFIER
PA - 1552
BOTTOM SIDE COMPONENTS

		METAL CHIP RESISTORS	
R502		0 ohm	70-144001
R503		820 ohm, 1/8 W	70-144018
R504,514		150 ohm, 1/8 W	70-144011
R506,507		22 ohm, 1/8 W	70-144074
R510	"A"	56 ohm, 1/8 W	70-144007
R510	"B"	68 ohm, 1/8 W	70-144008
R511		47K, 1/8 W	70-144034
R515		330 ohm, 1/8 W	70-144065
R516	"A"	3.9K ohm, 1/8 W	70-144024
R516	"B"	3.3K ohm, 1/8 W	70-144023
		CERAMIC CHIP CAPACITORS	
C501,503		1000PF, W5R, 50V	70-131205

REF. NO.	USE	DESCRIPTION	PART NO.
		CERAMIC CHIP CAPACITORS CONT.	
C524,532, 533,534, 536,537, 541,542, 550		1000PF, W5R, 50V	70-131205
C502	"A"	22PF, CH, 50V	70-131188
C502	"B"	27PF, CH, 50V	70-131190
C505	"A"	47PF, CH, 50V	70-131196
C505	"B"	33PF, CH, 50V	70-131192
C506		82PF, CH, 50V	70-132038
C507,544		.01UF, W5R, 50V	70-132032
C509,510		47PF, CH, 50V	70-131196
C514		68PF, 50V	70-131198
C523		12PF, CH, 50V	70-131183
C531		22PF, CH, 50V	70-131188
C538		47,000PF,W5R,50V	70-132034
		MICA CHIP CAPACITORS	
C511	"A"	220PF, 100V	70-138112
C511	"B"	150PF, 100V	70-138111
C512		68PF, CH, 50V	70-131198
C513,551		220PF, 100V	70-138112
C514	"A"	120PF, 100V	70-138116
C514	"B"	68PF, 50V	70-131198
C515,516		220PF, 100V	70-138112
C517	"A"	120PF, 100V	70-138116
C517	"B"	47PF, 100V	70-138114
C518		100PF, 100V	70-138115
C519	"A"	47PF, 500V	70-138114
C519	"B"	22PF, 500V	70-138107
C520	"A"	220PF, 100V	70-138112
C520	"B"	100PF, 100V	70-138115
C521		220PF, 100V	70-138112
C522	"A"	18PF, 500V	70-138096
C522	"B"	12PF, 500V	70-138115
C525	"A"	22PF, 500V	70-138107
C525	"B"	18PF, 500V	70-138081
C526	"A"	47PF, 500V	70-138114
C526	"B"	33PF, 500V	70-138083
C527	"A"	56PF, 500V	70-138117
C527	"B"	39PF, 500V	70-138084
C528	"A"	33PF, 500V	70-138083
C528	"B"	27PF, 500V	70-138082
C529		15PF, 500V	70-138080

REF. NO.	USE	DESCRIPTION	PART NO.
		EPROM PCB	
		Z 273	
		CAPACITORS	
C951		0.01 UF, 50V	70-132032
C952-957		47 PF, 50V	70-131200
		INTEGRATED CIRCUITS	
IC 951		uPD 2716D	70-076089
IC 952		HD 14174 BP	70-076081
		CONNECTORS	
J901		Jack, 11 Pin	70-159101
J902		Jack, 10 Pin	70-159102
J903		Jack, 8 Pin	70-159099
		PC BOARD	
Z273		PCB	70-070070
		DISPLAY PCB	
		CX - 03	
		SWITCHES	
S301	UD	Scan	70-180012
S302	UD	PRI	70-180012
S303	UD	MON	70-180012
		RESISTORS	
R332	UD	270 ohm 1/8 W	70-144047
R311-324	UD	470 ohm 1/8 W	70-145004
R310,325, 328-330	UD	560 ohm 1/8 W	70-145003
R331	UD	1.2K ohm 1/8 W	70-145007
R326	UD	3.3K ohm 1/8 W	70-145005
R327	UD	12K ohm 1/8 W	70-145006
R303-308	UD	22K ohm 1/8 W	70-145002
R301,302, 309	UD	220K ohm 1/8 W	70-145001
		INTEGRATED CIRCUITS	
IC301,302	UD	HD 14511BP	70-076082
		TRANSISTORS	
Q301	UD	2SC458C	70-080082
Q302	UD	2SB649C	70-080080
		DIODES	
D301	UD	GL-6N202	70-085051
D302,303, 304	UD	SLP436B	70-085052
D305	UD	SLP530D	70-085053
CDS301	UD	CDS CELL	70-085054
		PC BOARD	
CX-03C	UD	PCB	70-070201
		CABLE ASSEMBLY	
J1	UD	Jack 13 Pin	70-034063
CA356	UD	Cable J384,J385	70-034058
CA357	UD	Cable W/J381	70-034057
CA359	UD	Cable W/J383	70-034051
CA360	UD	Cable W/J386	70-034050
		MISCELLANEOUS	
		LED Holder	70-159113
		CONTROL PCB	
		CX - 04	
		SWITCHES	
S 304	UD	SW, Rotary	70-180013
		CONTROLS	
RV 301	UD	Squelch	70-164031
RV 302	UD	Volume	70-164026
		RESISTORS	
R333	UD	1W 4.7 ohm	70-144043
		CAPACITORS	
C301,302	UD	10UF 50V	70-135059

REF. NO.	USE	DESCRIPTION	PART NO.
		CONTROL PCB	
		CX - 04 CONT.	
		INTEGRATED CIRCUITS	
IC303	UD	uPC 78084	70-076088
		CONNECTORS	
J382	UD	Jack, 7 Pin	70-159095
		PCB	
CX - 04	UD	PCB	70-070072
		CONTROL/INTERFACE PCB	
		CX - 05	
		SWITCHES	
S304	TM	SW, Rotary	70-180014
		CONTROLS	
RV 301	TM	Squelch Control	70-164030
RV 302	TM	Volume Control	70-164027
		RESISTORS	
R332	TM	270 ohm 1/8 W	70-144047
R303-306	TM	22K ohm 1/8 W	70-145002
		CAPACITORS	
C301,302	TM	10uf 50V	70-135059
		INTEGRATED CIRCUITS	
IC303	TM	uPC7808H	70-076088
		CONNECTORS	
J396	TM	Jack 34 Pin	70-159107
		PCB	
CX-05C	TM	PCB	70-070202

REF. NO.	USE	DESCRIPTION	PART NO.
		DISPLAY DRIVER PCB	
		CX - 06	
		RESISTORS	
R312,313, 314,315	TM	470 ohm 1/8 W	70-145004
R307,308	TM	22K ohm 1/8 W	70-145002
R301,302, 309	TM	220K ohm 1/8 W	70-145001
		INTEGRATED CIRCUITS	
IC301,302	TM	HD14511BP	70-076082
		PC BOARD	
CX-06C	TM	PCB	70-070203
		DISPLAY PCB	
		CX - 07	
		SWITCHES	
S301,302, 303	TM	Scan,Pri,Mon	70-180012
		RESISTORS	
R311,316-324	TM	470 ohm 1/8 W	70-145004
R310,325, 328-330	TM	560 ohm 1/8 W	70-145003
R331	TM	1.2K ohm 1/8 W	70-145007
R326	TM	3.3K ohm 1/8 W	70-145005
R327	TM	12K ohm 1/8 W	70-145006
		TRANSISTORS	
Q301	TM	2SC458C	70-080082
Q302	TM	2SB649C	70-080080
		DIODES	
D301	TM	GL-6N202	70-085051
D302,303, 304	TM	SLP436B	70-085052
D305	TM	SLP530D	70-085053

REF. NO.	USE	DESCRIPTION	PART NO.
		DISPLAY PCB	
		CX - 07 CONT.	
		CONNECTORS	
J301	TM	Jack, 16 Pin	70-159105
		PC BOARD	
CX-07C	TM	PCB	70-070204
		MISCELLANEOUS	
		LED Holder	70-159113
CONTROL CABLE INTERFACE PCB			
CX - 08			
		RESISTORS	
R351		4.7 ohm 1/2 W	70-145052
REF. NO.	USE	DESCRIPTION	PART NO.
		CONTROL CABLE INTERFACE PCB	
		CX - 08 CONT.	
		CAPACITORS	
C351	TM	220UF 25V	70-131224
		TRANSFORMER	
T301	TM	8392159	70-090144
		CONNECTORS	
J325	TM	Jack, 34 Pin	70-159106
		PC BOARD	
CS-08C	TM	PCB	70-070089
		CABLE ASSEMBLY	
CA357	TM	Cable W/J323	70-034069

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

1. Best identification of the part.
   A. MIDLAND part number, or
   B. Model and Serial numbers of equipment in which the part is used, with
   C. Part description, and
   D. Schematic reference designator, and,
   E. If necessary, return the old part as sample

2. Specify quantity desired of each part.

3. Ship-to address (and billing address if different)

Mail or phone your order to:

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

OPTIONS

MIDLAND LAND MOBILE RADIO LMR
1690 N. TOPPING • KANSAS CITY • MISSOURI • 64120
(P. O. BOX 419903 • KANSAS CITY • MISSOURI • 64141)
TELEPHONE: (816) 241-8500 • TELEX: 43-4045 • CABLE: MICO

SERVICE MANUAL CORRECTION

MODEL NO.:(s) 70-342/442A/BXL
SERIAL NO:(s) all
SERVICE MANUAL NO.: 70-342442
SERVICE MANUAL PRINT DATE: 8/86

MANUAL CORRECTION NO.: MC-126
DATE: 11/11/86
SUBJECT: Parts List Correction

REF. NO.	DESCRIPTION	OLD PART NO.	NEW PART NO.
IC403	NJM2930L-50	70-076210	70-076307

SERVICE MANUAL ADDITION

MODEL NO. (s): All Syntech trunk-mount models
SERIAL NO. (s): ALL
SERVICE MANUAL NO. (s)
SERVICE MANUAL PRINTING DATE:

MANUAL ADDITION NO. MA-110
DATE: 12/20/82
SUBJECT: SYN-TECH Round Control Cable Fabrication

Control cables for SYN-TECH trunk-mount units can be fabricated using 34 conductor round cable (Model number 70-2224, Part Number 70-034067) and connector/strain relief Model number 70-2228, available from Midland. Recommended tools are the 3M 3640 Assembly Press and 3480-1 Discrete Wire Fixture. The Hand Press (Model number 70-2229, Part number 70-156077) may be used but assembly is more difficult and not recommended for quantity fabrication.

FABRICATION INSTRUCTIONS

1. Cut the cable to the desired length plus 5 inches.
2. Carefully cut and remove 2½ inches of the outer insulation, shield, and paper insulator from each end. Slip a 2 inch length of ½ inch diameter heat-shrinkable tubing (Part Number 70-157046) over each end of the cable.
3. Group the wires into the 5 color groups, brown, green, white, violet and yellow.
4. Place the small connector half in the wiring fixture. Following the color code below, position the wires across the connector and into the wire fixture. Note that the separate columns must apply for opposite cable ends so that pin 1 connects to pin 34, etc.

1	Brown	W/1	Red Dash	34
2	Brown	W/2	Red Dashes	33
3	Brown	W/3	Red Dashes	32
4	Brown	W/4	Red Dashes	31
5	Brown	W/1	Black Dash	30
6	Brown	W/2	Black Dashes	29
7	Brown	W/3	Black Dashes	28
8	Brown	W/4	Black Dashes	27
9	Green	W/1	Red Dash	26
10	Green	W/2	Red Dashes	25
11	Green	W/3	Red Dashes	24
12	Green	W/1	Black Dash	23
13	Green	W/2	Black Dashes	22
14	Green	W/3	Black Dashes	21
15	White	W/1	Red Dash	20
16	White	W/2	Red Dashes	19
17	White	W/3	Red Dashes	18
18	White	W/1	Black Dash	17
19	White	W/2	Black Dashes	16
20	White	W/3	Black Dashes	15
21	Violet	W/1	Red Dash	14
22	Violet	W/2	Red Dashes	13
23	Violet	W/3	Red Dashes	12
24	Violet	W/1	Black Dash	11
25	Violet	W/2	Black Dashes	10
26	Violet	W/3	Black Dashes	9
27	Yellow	W/1	Red Dash	8
28	Yellow	W/2	Red Dashes	7

29	Yellow	W/3 Red Dashes	6
30	Yellow	W/4 Red Dashes	5
31	Yellow	W/1 Black Dash	4
32	Yellow	W/2 Black Dashes	3
33	Yellow	W/3 Black Dashes	2
34	Yellow	W/4 Black Dashes	1

5. Position the mating connector half in place and press together. Cut the loose ends off flush with the connector. Fold the wire over the top of the connector and snap the strain relief in place. Position the heat-shrinkable tubing to cover as much of the unshielded wires as possible and shrink into place. (Recommend using Ungar Model #6966 heat gun.)

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SERVICE MANUAL REVISION

MODEL NO.(s) 70-342B-XL
SERIAL NO.(s) 229131 and up
SERVICE MANUAL NO.: 70-136175
SERVICE MANUAL PRINTING DATE: 2/86

REVISION NO: CN - 241
DATE: 5-6-86
SUBJECT: CIRCUIT CHANGES

REF. NO.	DESCRIPTION	FROM	TO	PART NO.	LOCATION
C547	.1uf Mylar Cap		Added	70-137039	Parallel W/C536

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SERVICE MANUAL REVISION

MODEL NO.(s): 70-342/442XL
SERIAL NO.(s) 235681 and up
SERVICE MANUAL NO.: 70-342/442
SERVICE MANUAL PRINTING DATE: 8/86

REVISION NO.: CN-278
DATE: 9/2/86
SUBJECT: CIRCUIT CHANGES

REF. NO.	DESCRIPTION	FROM	TO	PART NO.	LOCATION
D261	1S2075K Diode	Delete		70-085001	TX TM Line
R284	1K Chip Resistor	Delete		70-144019	TX TM Line
C242	22uf Elect. Cap	Delete		70-135060	TX TM Line

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SERVICE MANUAL REVISION

MODEL NO.(s) 70-342/442XL
SERIAL NO.(s): 241121 and up
SERVICE MANUAL NO.: 70-342442
SERVICE MANUAL PRINTING DATE: 8/86

REVISION NO.: CN-280
DATE: 9/2/86
SUBJECT: CIRCUIT CHANGES

REF. NO.	DESCRIPTION	FROM	TO	PART NO.	LOCATION
D408	1S2075K Diode		added	70-085001	Pins 1 & 2, IC403

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SERVICE MANUAL REVISION

MODEL NO.(s) 70-342AXL
SERIAL NO.(s) 255981 and up
SERVICE MANUAL NO. 70-342442
SERVICE MANUAL PRINTING DATE: 10-86

REVISION NO. CN-281
DATE: 10/1/86
SUBJECT: Circuit Changes

REF. #	DESCRIPTION	FROM	TO	PART NO.	LOCATION
C531	Chip Cap	22Pf		70-131188	D502 to gnd.
C531	Chip Cap		18Pf	70-131186	D502 to gnd.

4/7/86

*****IMPORTANT NOTES*****

70-342AXL/-342BXL

70-442AXL/-442BXL

BEFORE REPROGRAMMING THESE UNITS PLEASE NOTE:

THE 70-342AXL/342BXL/442AXL/442BXL MODELS ARE EQUIPPED WITH 2.5 KHZ CHANNEL STEPPING FROM THE FACTORY AND MUST BE PROGRAMMED ACCORDINGLY. THE BAND CODE 2D MUST BE USED AND THE CENTER FREQUENCY MUST BE PROGRAMMED AS DETAILED IN THE 70-1000 OPERATORS MANUAL.

BEFORE ATTEMPTING ANY ALIGNMENT PLEASE NOTE:

THE 70-342AXL/342BXL/442AXL/442BXL MODELS ARE <u>WIDEBAND</u> (24 MHZ TRANSMIT AND RECEIVE) UNITS AND DO NOT REQUIRE ANY ALIGNMENT WHATSOEVER TO COVER THEIR FULL RANGE (136-162 MHZ A BAND, 148-174 MHZ B BAND).

Remove the screws securing the top and bottom covers. Remove the PA cover retaining screws and the cover. If the 70-E10 Test Set is used, the RED 5 pin test socket should be connected to CM101 for transmitter alignment and the WHITE 5 pin test socket to CM202 for receiver alignment. Both sockets should be installed with the unused socket position toward the rear of the radio. Supply power to the radio and connect a wattmeter and dummy load with a reduced power output for a frequency counter and modulation meter.

TRANSMITTER ALIGNMENT

The 70-342/442 is factory aligned for operation over the rated bandwidth without further adjustment. The oscillator frequency and RF output power should be periodically checked and adjusted as necessary as part of the normal maintenance program.

OSCILLATOR FREQUENCY ADJUSTMENT

1. Monitor the frequency of the transmitted signal and adjust CV701 for the correct frequency.

RF POWER ADJUSTMENT

2. Adjust CV502 and CV 503 for maximum RF power output. Adjust RV 502 for 40 watts RF output.

3. If the CTCSS or other encoder options are field installed, transmitter modulation should be adjusted as follows:

MODULATION ADJUSTMENT

4. If an encoder option is installed, select any channel for which encode occurs. Key the transmitter and adjust the encoder for the desired modulation.

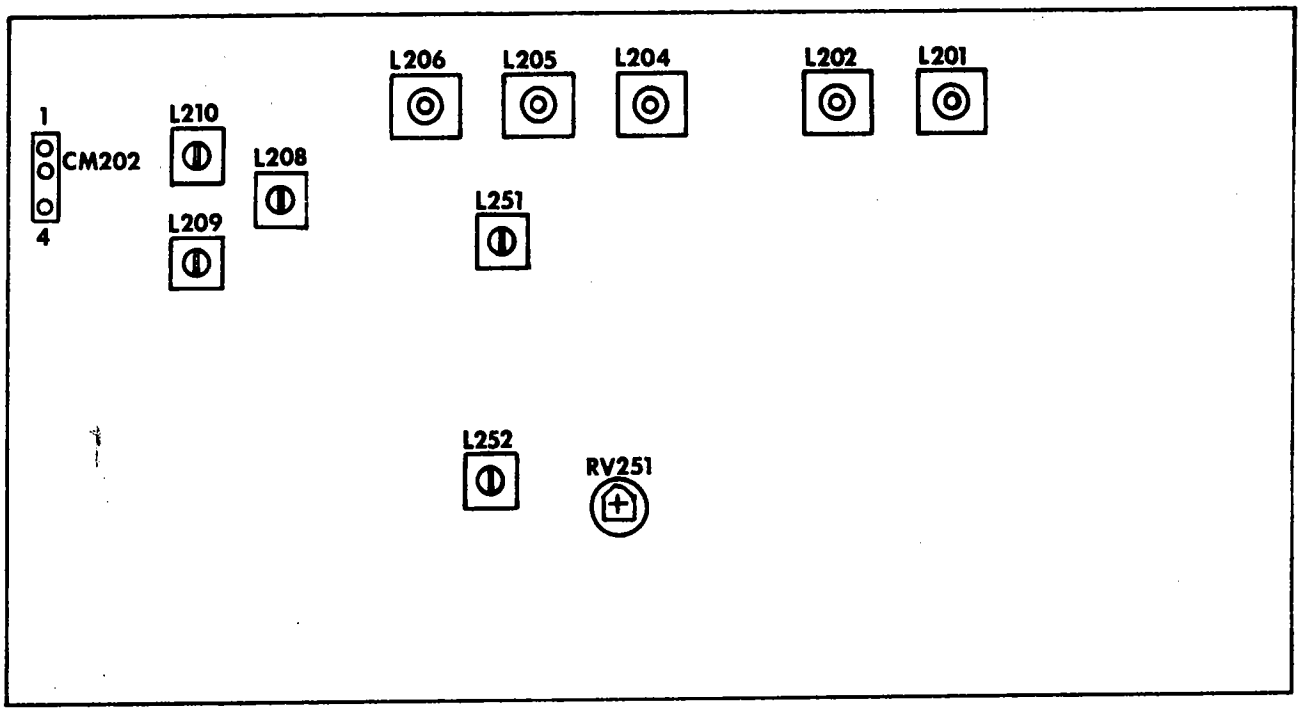
5. Input audio modulation of 2500 Hz and adjust RV101 for 5 KHz deviation. Adjust L101 and L102 if necessary for balanced deviation. Vary the modulating signal level to insure the deviation does not exceed $\pm$ 5 KHz.

In case of component replacement or inadvertent misadjustment, refer to the supplemental alignment instructions on the following pages.

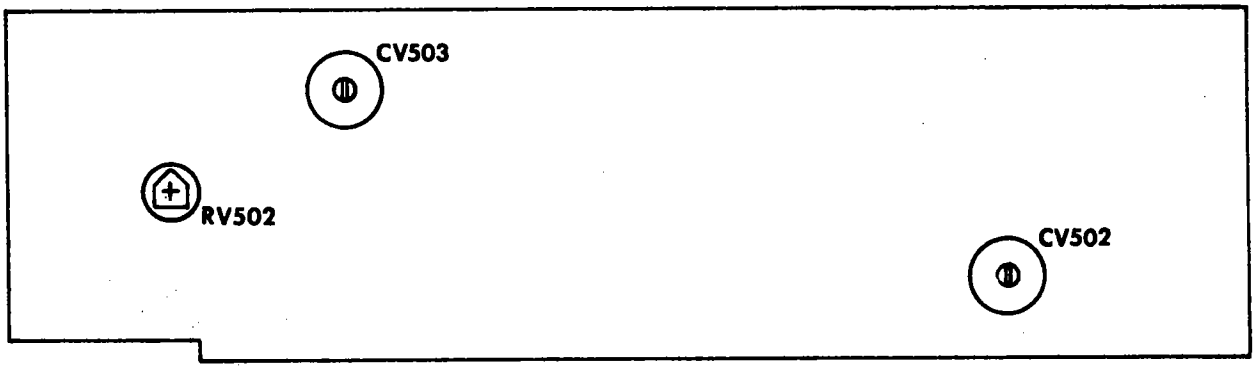
RECEIVER ALIGNMENT

No receiver alignment should be necessary for operation over the rated bandwidth. Refer to the supplemental alignment instructions in case of component replacement or misadjustment.

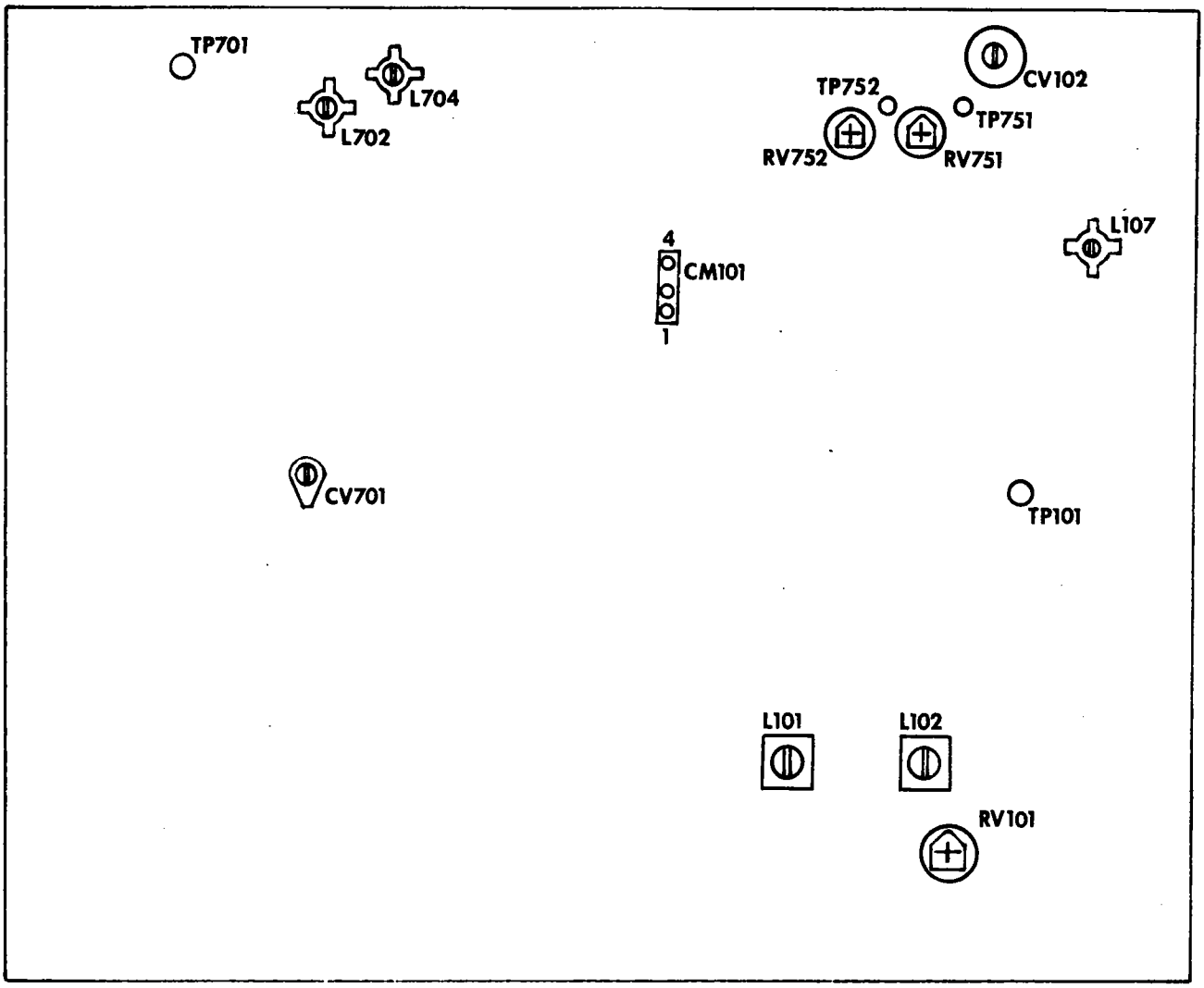
RECEIVER ALIGNMENT POINTS



PA BOARD ALIGNMENT POINTS



TRANSMITTER ALIGNMENT POINTS



The alignment instructions given on the preceding page should be adequate for normal conditions. In case of component replacement or misadjustment, the following procedures should be used.

1. Program the E/PROM module with the 3 following channels.

	A Band	B Band
CH 1	156.00 MHz TX/RX	174.00 MHz TX/RX
CH 2	148.00 MHz TX/RX	160.00 MHz TX/RX
CH 3	136.00 MHz TX/RX	150.00 MHz TX/RX

2. Program the Center Frequency information as follows:
   a. Press RESET then the △ key.
   b. The display will now show channel CF and step 1.
   c. Enter 148.1200 MHz for A band models or 160.900 MHz for B band models for the Receiver frequency.
   d. Enter 147.2000 MHz for A band models or 160.0000 MHz for B band models for the Transmitter frequency.
   e. The Center Frequency will be listed after the channel frequencies on the printout.

3. Install the E/PROM module in the radio and re-align the Main and Transmit VCOs as follows:
   a. Select channel 1 and while transmiting adjust L702 for 5.5 VDC at TP701.
   b. While transmitting on channel 1, adjust L107 for 5.5 VDC at TP101.
   c. Select channel 2 and while receiving adjust L704 for 4.0 VDC at TP701.
   d. Select channel 3 and in the receive mode confirm TP701 reads 1.0 VDC or greater. If not, recheck steps a-c above.

4. Re-align the Receiver and Transmitter Tracking controls as follows:
   a. In the receive mode select channel 3 and adjust RV752 for 1.00 VDC at TP752.
   b. In the transmit mode on channel 1, adjust RV751 for 9.00 VDC at TP751.

TRANSMIT DRIVER ALIGNMENT

Select channel 3, monitor CM101 pin 2 (Test Set position 9) and adjust CV102 for a minimum reading. Adjust the transmitter modulation and RF output power as described in the basic alignment instructions.

RECEIVER ALIGNMENT

1. Select channel 3 for the following steps.

LOCAL OSCILLATOR AMPLIFIER ADJUSTMENT

2. Monitor CM202 pin 1 (Test Set position 2) and adjust L209 and L210 for a maximum reading.

RF - IF ALIGNMENT

3. Connect an on-channel signal generator to the antenna connector. Adjust L201, L202 and L204, L205 and L206 for a maximum indication at CM202 pin 2 (Test Set position 3).

4. Adjust L208 and L251 for minimum audio distortion.

QUADRATURE COIL ALIGNMENT

5. Adjust L252 for maximum audio output.

TIGHT SQUELCH ADJUSTMENT

6. Adjust RV251 for the desired tight squelch sensitivity.

ADDITIONAL ADJUSTMENT POINTS

TRANSMITTER/SYNTHESIZER BOARD

RV102 - Microphone Gain Control. Adjust near the center position and perform the standard service manual modulator alignment. Input a 150 MV RMS 1 KHz signal at the microphone audio input and adjust RV102 to give 2.5 KHz deviation on the transmitted signal.

L118 - Transmit IF. Monitor IC106 pin 14 with an RF voltmeter or oscilloscope. Adjust L118 for the maximum level of the Transmit IF signal.

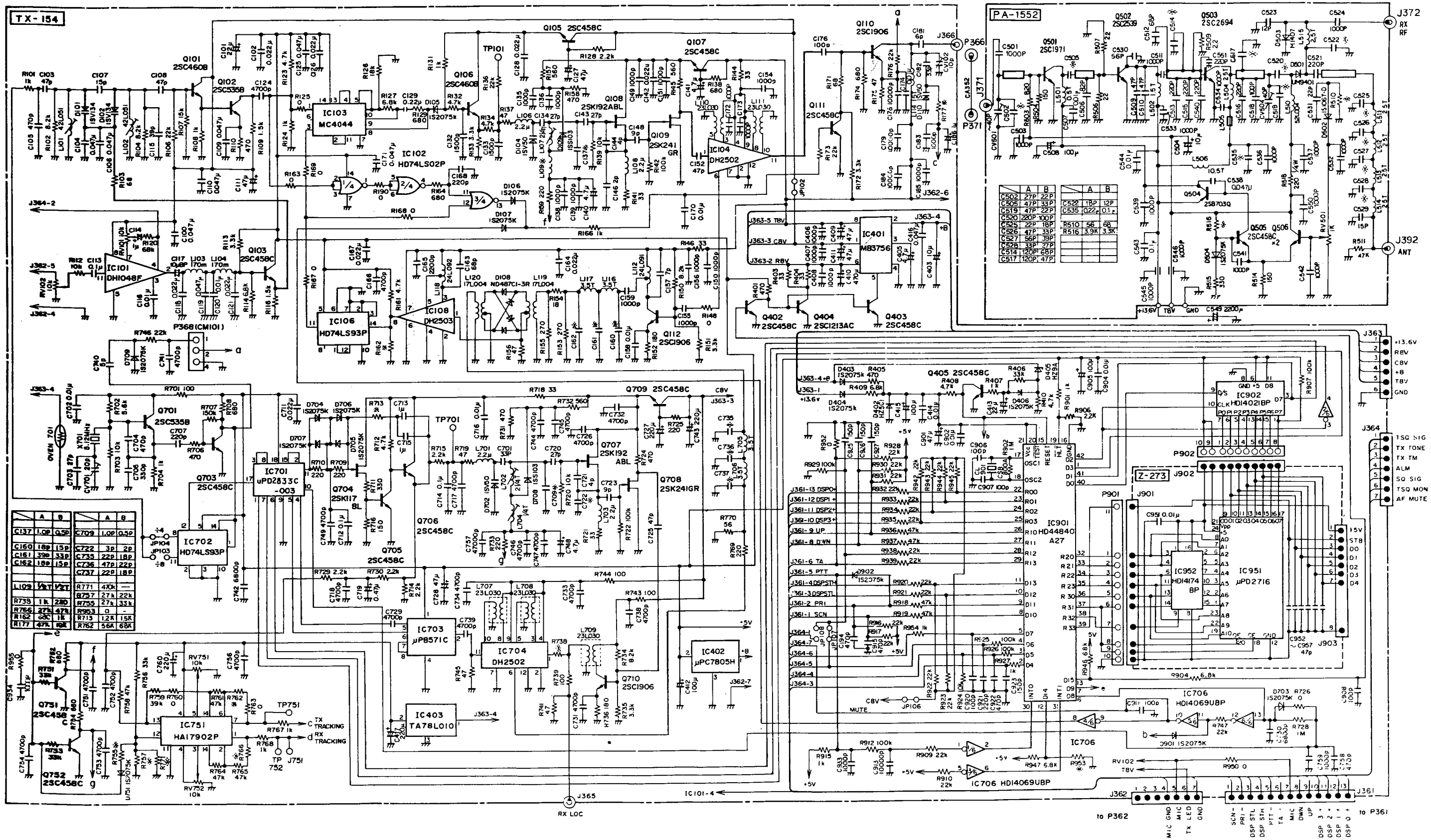
L110, L111, L112 - Transmit VCO. Install an E/PROM programmed for a transmit frequency at the center of the unit's operational range. Monitor the transmit VCO signal at IC104 pin 11 with an RF voltmeter or high frequency oscilloscope. Adjust L110 and L111 for maximum signal level while in the transmit mode. Monitor the junction of L116, C159 and C160 with the RF voltmeter or oscilloscope. Adjust L112 for maximum transmit VCO signal level while in the transmit mode.

L707, L708, L709 - Main VCO. Install an E/PROM programmed for a receive frequency at the center of the unit's operational range. Monitor the Local Oscillator injection signal at J365 with an RF voltmeter or high frequency oscilloscope and adjust L709 for maximum signal level. Monitor IC703 pin 2 with the RF voltmeter or oscilloscope and adjust L707 and L708 for maximum signal level.

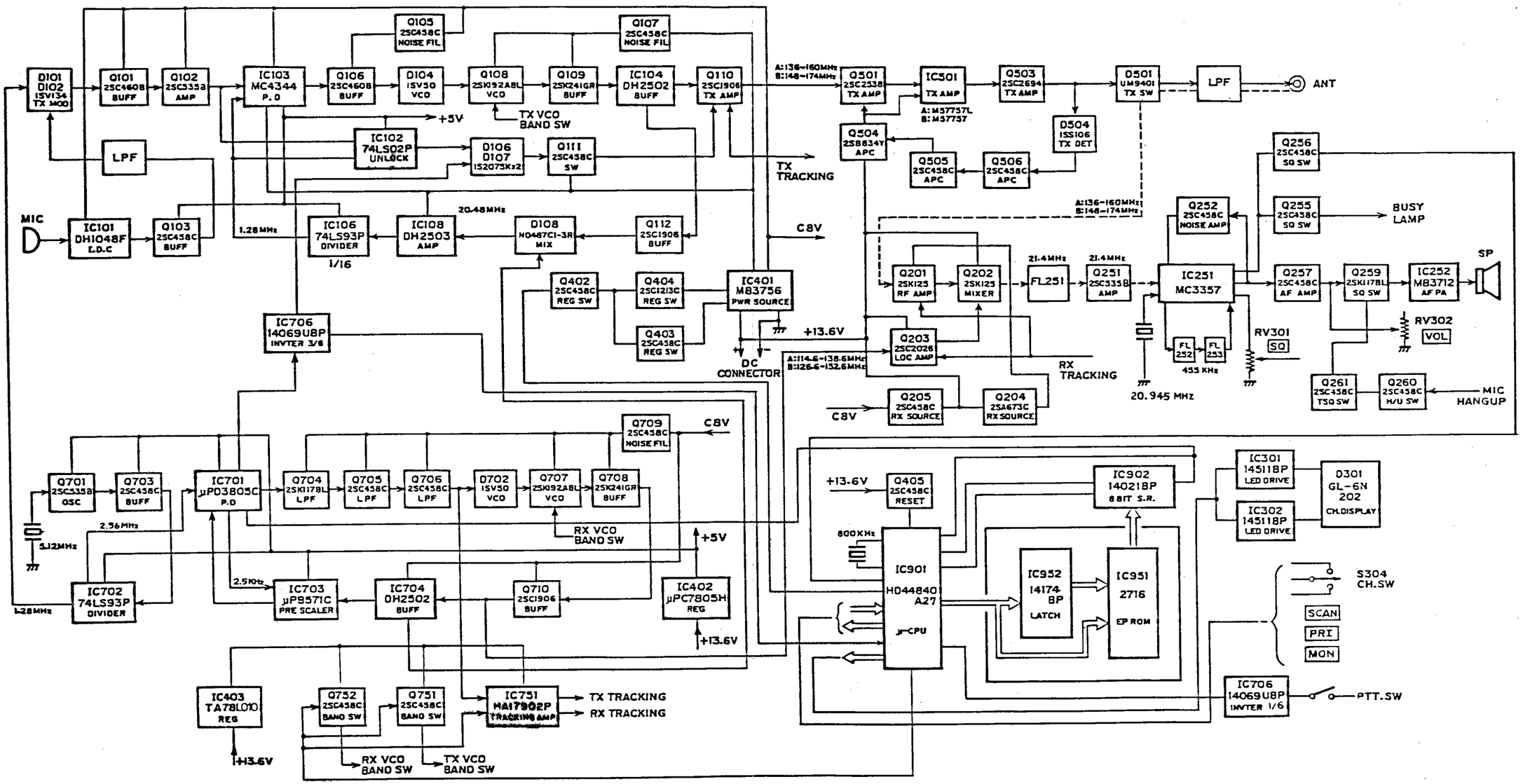
RECEIVER BOARD

RV252 - Maximum Audio Output Control. Input a standard test signal and turn the radio volume control maximum clockwise. Adjust RV252 to yield the maximum output power not exceeding 10% distortion.

70-342/442 A/B XL SCHEMATIC DIAGRAM



70-342/442XL BLOCK DIAGRAM



Fold Out