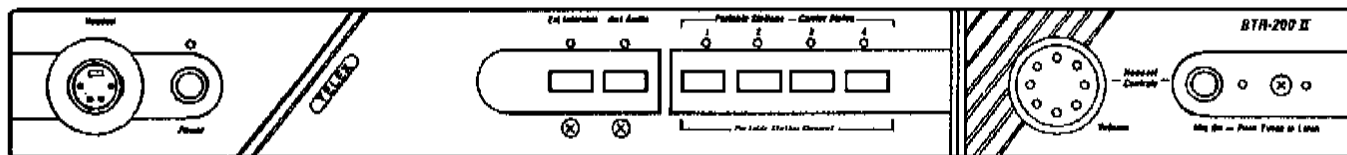


# TELEX

## Service Manual



# PROFESSIONAL WIRELESS INTERCOM SYSTEM BTR-200 SERIES

**TELEX**

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# CHAPTER 1

## GENERAL DESCRIPTION

The BTR-200 is a base station which communicates with up to four portable units simultaneously, in full duplex. It may be used alone with a headset or interfaced to other equipment such as a hardwired intercom system.

### SPECIFICATIONS BTR-200

#### *Overall*

Input Power .....	13.0 VAC RMS/300 mA with supplied adaptor or filtered 12 to 14 VDC/300 mA source.
Intercom Output .....	50 mV (Low) or 330 mV (Hi) RMS into 300 ohm load typical (at rated deviation)
Intercom Input (Gain Minimum) .....	300 mV RMS typical (for rated deviation)
Auxiliary Output .....	430 mV RMS into 600 ohm load typical (at rated deviation)
Auxiliary Input (Gain Maximum) .....	60 mV RMS typical (for rated deviation)
Local Headset Input .....	2 mV RMS input nominal
Local Headset Output .....	1.5 mV RMS input at compression (Dynamic)
Local Headset Output .....	32 mW maximum output into 600 ohms
Temperature Range .....	-4°F to 130°F (-20°C to 55°C)
Dimensions .....	15.75" W x 1.75" H x 10.5" D (40 cm x 4.5 cm x 26 cm)
Weight .....	4.5 lbs. (2 kg)

#### *Transmit*

RF Frequency Range .....	150-216 MHz
RF Frequency Stability .....	Crystal Controlled, 0.005%
RF Power Output .....	50 mW Typical
Modulation .....	FM, 3 KHz deviation, 115 micro-seconds Pre-emphasis
Transmit Antenna .....	5/8-wave (supplied) SO239 connector on chassis
Modulation Limiter .....	Internal Compressor
Modulation Frequency Range .....	300 to 5000 Hz $\pm$ 2 dB
Radiated Harmonics and Spurious Emissions .....	-45 dBC, Exceeds FCC Specifications
FCC .....	Type Accepted Under Parts 90 and 74

## SPECIFICATIONS BTR-200 (CONT.)

### Receive

RF Frequency Range.....	150-216 MHz
RF Frequency Stability.....	Crystal Controlled, 0.005%
Type.....	Dual Conversion superheterodyne, FM
RF Sensitivity.....	Less than 0.5 $\mu$ V for 12 dB SINAD
IF Selectivity.....	3 dB at 30 kHz (4 pole Monolithic Filter)
Image Rejection.....	65 dB or better
Squelch Quieting.....	90 dB
Squelch Threshold.....	1.0 $\mu$ V (Internal)
Signal-to-Noise Ratio.....	90 dB
Receive Antenna.....	5/8-wave (supplied) SO239 connector on chassis
Distortion.....	Less than 1% at Rated Output
FCC.....	Notification Under Part 15

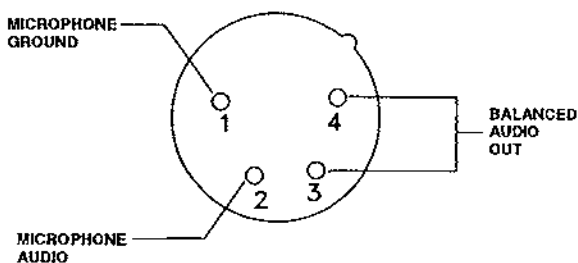
## CONTROLS and CONNECTIONS

### FRONT PANEL (Refer to Figure 2)

**Power ON/OFF Switch:** Push this switch once to turn power ON; push it again to turn the power OFF.

**Power ON Indicator:** The Power ON Indicator is illuminated when the Power ON/OFF Switch is pushed in the ON Position. It remains illuminated while the Transceiver is on.

**Local Headset Connector:** 4 Pin XLR Connector for Input/Output. The headset jack will accept 6 different Telex Model Headsets. Compatible with other intercom headsets with four pin XLR connectors that are wired as shown in Figure 1.



**Figure 1**  
**Headset XLR Connector Wiring**

**Local Headset Volume:** Adjusts volume to Local Headset. DOES NOT AFFECT MICROPHONE GAIN.

**Mic On-Push-to-Talk/Lock-to-Talk Switch:** Enables the local headset microphone audio function. NOTE: DOES NOT control base station RF transmit.

**Local Push-to-Talk Indicator:** Will be illuminated whenever the talk function is on.

**Local Microphone Gain Control and Overmodulation Indicator:** A screwdriver adjustable control is provided to control the input level of the local headset mic. This input is protected from overloads by means of a gain compressor whose operation is signaled by the gain LED indicator.

**Portable Enable Switches and Indicators:** When in the "IN" position, the Enable switches allow the user of the corresponding portable unit to be heard by others connected to the system. When in the "OUT" position, the respective portable will be muted, but this portable will still be able to hear all other selected remotes and interfaces. The indicators normally show the presence of a portable transceiver in use on the channel corresponding to that indicator.

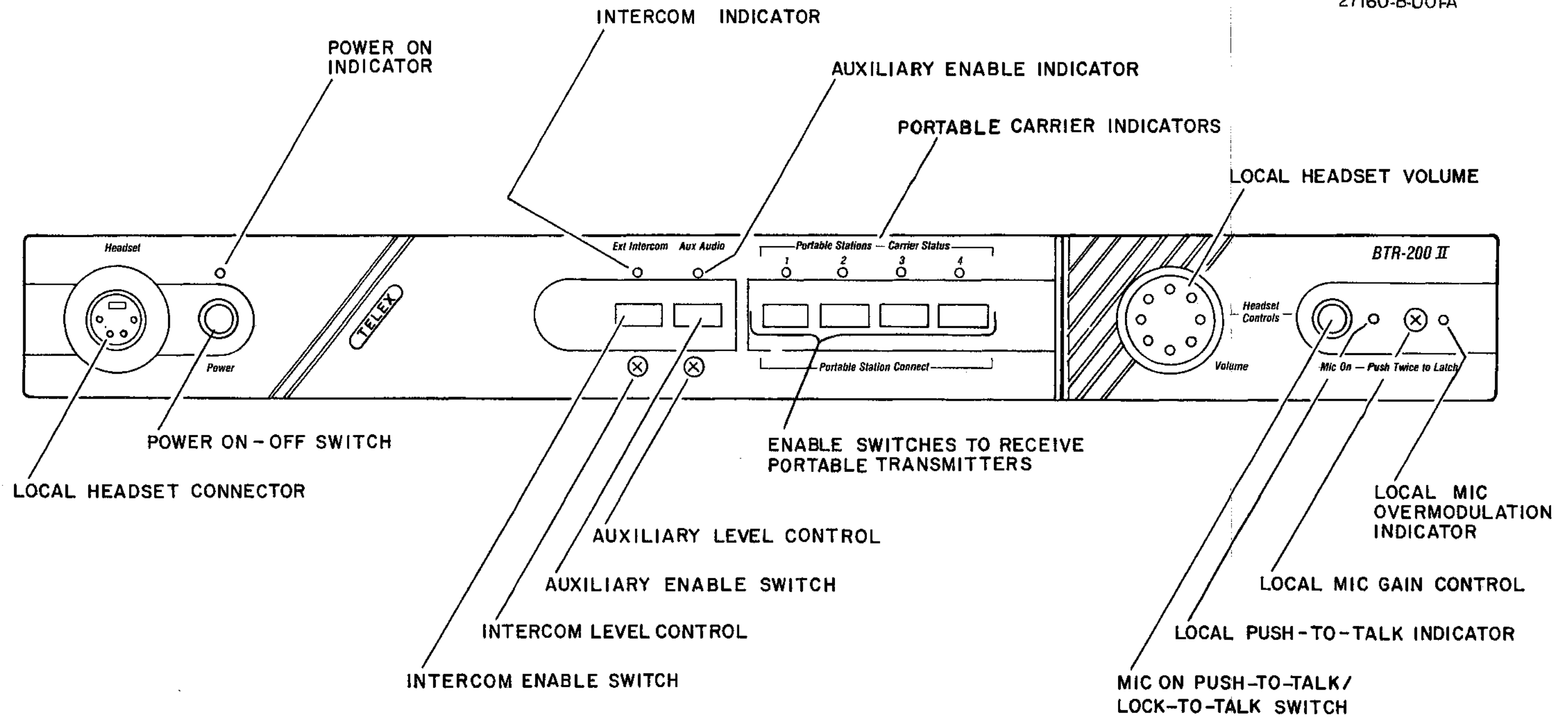


Figure 2  
Front Panel-BTR200

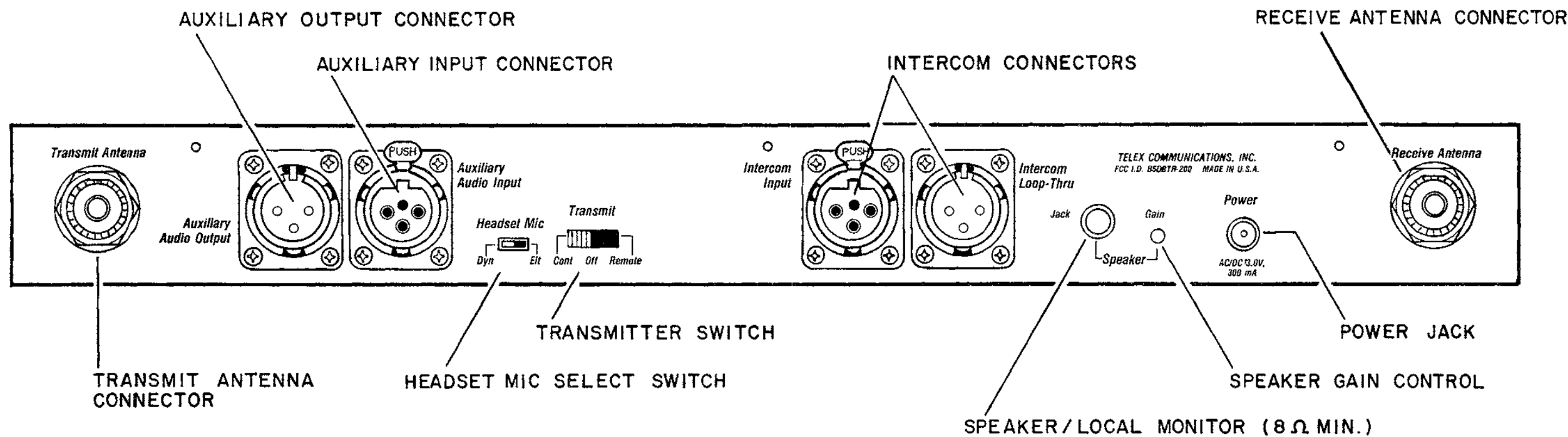


Figure 3  
Rear Panel BTR-200

**Ext Intercom Switch, Level Control, and Indicator:** This switch enables the wired intercom interface when "IN", and disables it when "OUT". For RTS intercoms, the "IN" position is channel A and the "OUT" position is channel B. A screwdriver adjustable control is provided to control the input level of the wired intercom.

**Auxiliary Audio Enable Switch, Level Control, and Indicator:** The switch enables and disables the Auxiliary interface when "IN" and "OUT", respectively. The function of the level control here is the same as that described for the intercom.

### REAR PANEL (Refer to Figure 3)

**Transmit Antenna Connector:** Connect 5/8-wave antenna (supplied) to this connector. Antenna color should match connector dot on BTR-200.

**Receive Antenna Connector:** Connect 5/8-wave antenna (supplied) to this connector. Antenna color should match connector dot on BTR-200.

**Transmit Switch:** Slide switch that allows the operator to select one of three transmit modes. In the "OFF" position, the transmitter is always off. This mode may be used if the base is functioning solely as a monitor. In the "CONT" position, the transmitter is always on. This continuous mode is recommended over the "REMOTE" mode. In the "REMOTE" position, the transmitter is enabled only when one or more portables are active.

**Headset Microphone Select Switch:** This switch allows the user to select either an Electret or Dynamic microphone. This switch is factory preset to DYN Position.

**NOTE:** All Telex headsets that are used with this intercom are dynamic type microphones.

**Intercom Connectors:** Connections to interface the BTR-200 with a wired intercom system.

**Auxiliary Output/Input Connectors:** Can be used for 2-way (four wire) input and output to the BTR-200 or as a simplex input or output. Typical uses are 4 wire low level intercoms, tape recorders, public address inputs or outputs, or when operating two BTR-200 units simultaneously.

**Power Jack:** For external AC wall supply adaptor (supplied) or any filtered 12 to 14 VDC/300 mA source, or 13.0 VAC RMS/300 mA source.

**Speaker Jack:** Allows the user to connect an external speaker (8 ohms minimum) to the unit.

**Speaker Gain Control:** Screwdriver adjustable. Adjust the gain control clockwise to increase speaker gain or counterclockwise to decrease speaker gain.

**NOTE:** Leave setting counterclockwise if no speaker is attached.



# CHAPTER 2

## IDENTIFICATION OF CIRCUIT BOARD REVISION AND VERSION

### AUDIO BOARDS

Version 1 and 2 use Rcv A circuit boards. The location for the Rev letter is shown below. Version 2 contains a small circuit board with a switch. See Figure 4.

This board is installed in the holes for C124 and C125 (see below). Version 1 does not have this switchboard. For Rev C and higher, the location for the Rev letter is shown in Figure 5.

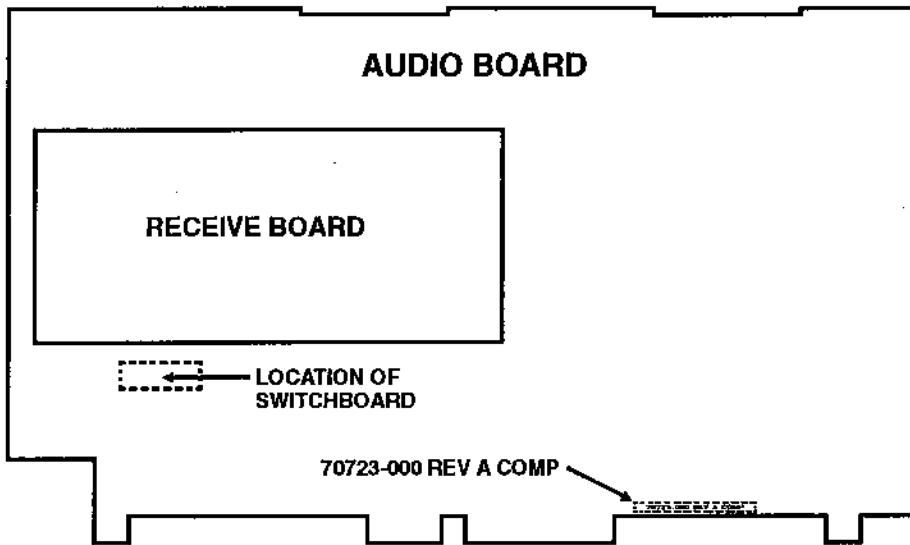


Figure 4  
Location of Rev Level for Versions 1 and 2

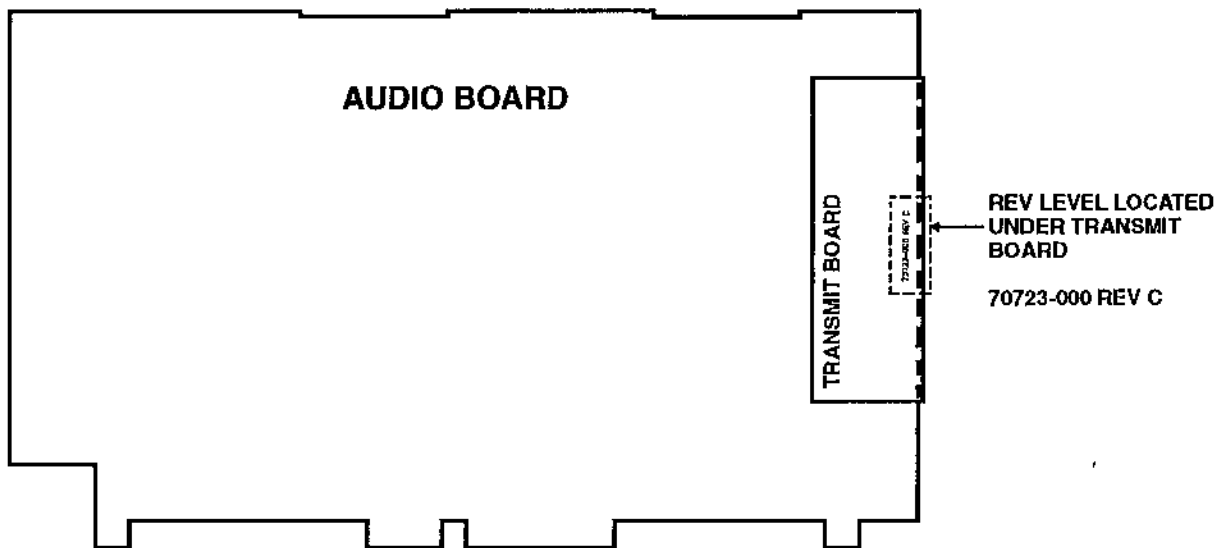


Figure 5  
Location of Rev Level for Versions 3 thru 6

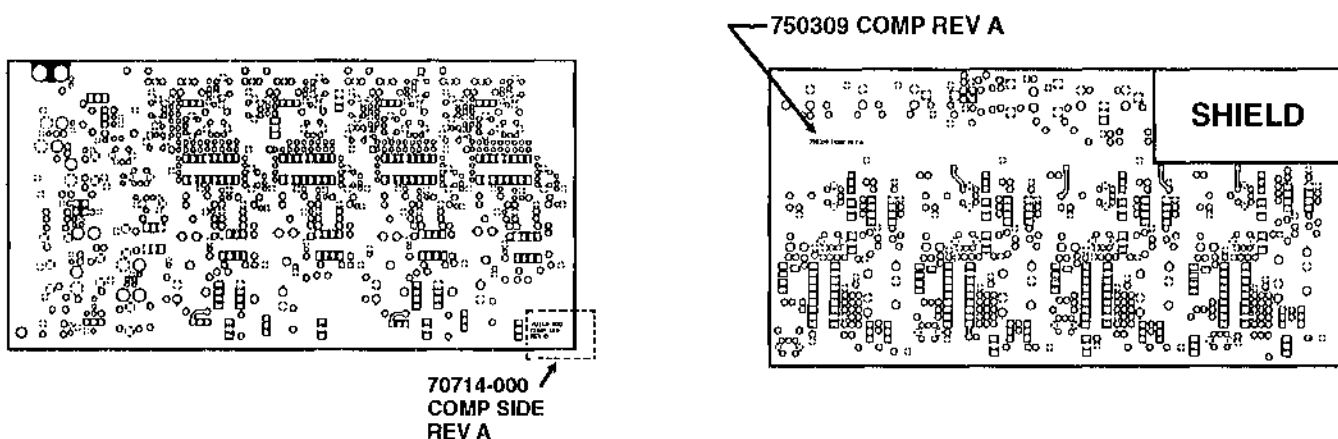
Rev C boards can be either Verion 3 or 4. The differences are all parts values:

Rev D boards are all version 5.  
 Rev E boards are all version 6.  
 Rev B was not produced.

Version	R101	R103	R125	R130	R131	R132	R133	R154	R162	R168	R170	C133
3	82K	82K	6.2K	1.5K	1.5K	1.5K	1.5K	5.6K	9.1K	68K	68K	10 $\mu$ F
4	200K	200K	4.7K	4.7K	4.7K	4.7K	4.7	8.2K	3.9K	15K	10K	22 $\mu$ F

## RECEIVE BOARD

The BTR-200 uses one of two receive boards.



**Figure 6**  
**Location of Rev Level for Versions 1 and 2**

Early production units came with 70714000, and 750309 was installed in later units. 70714000 came in two versions that differed slightly (See table below):

Version 2 was built only with Rev C boards.

Version 1 was built with Rev A, B, or C boards. The different revisions on this board were manufacturing changes that did not change the schematic.

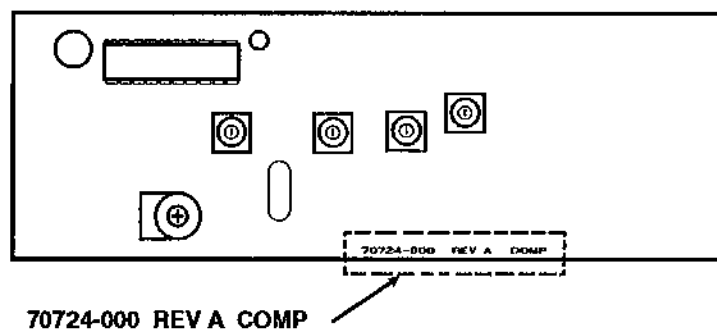
750309 Rev A boards are version 1.

750309 Rev B and C boards are version 2.

Some early version 1 boards did not have a shield over the oscillator section..

70714000 Version	R327	R345	R363	R381	VR302	VR304	VR306	VR308
1	4.7K	4.7K	4.7K	4.7K	10K	10K	10K	10K
2	10K	10K	10K	10K	20K	20K	20K	20K

# TRANSMIT BOARD



**Figure 7**  
**Location of Rev Level for Versions 1 and 2**

All Rev A boards are version 1. Rev B boards may be version 1 or 2:

Version	R503	R521	C531
1	4.7K	10K	.0033uF
2	15K	68K	.001 uF

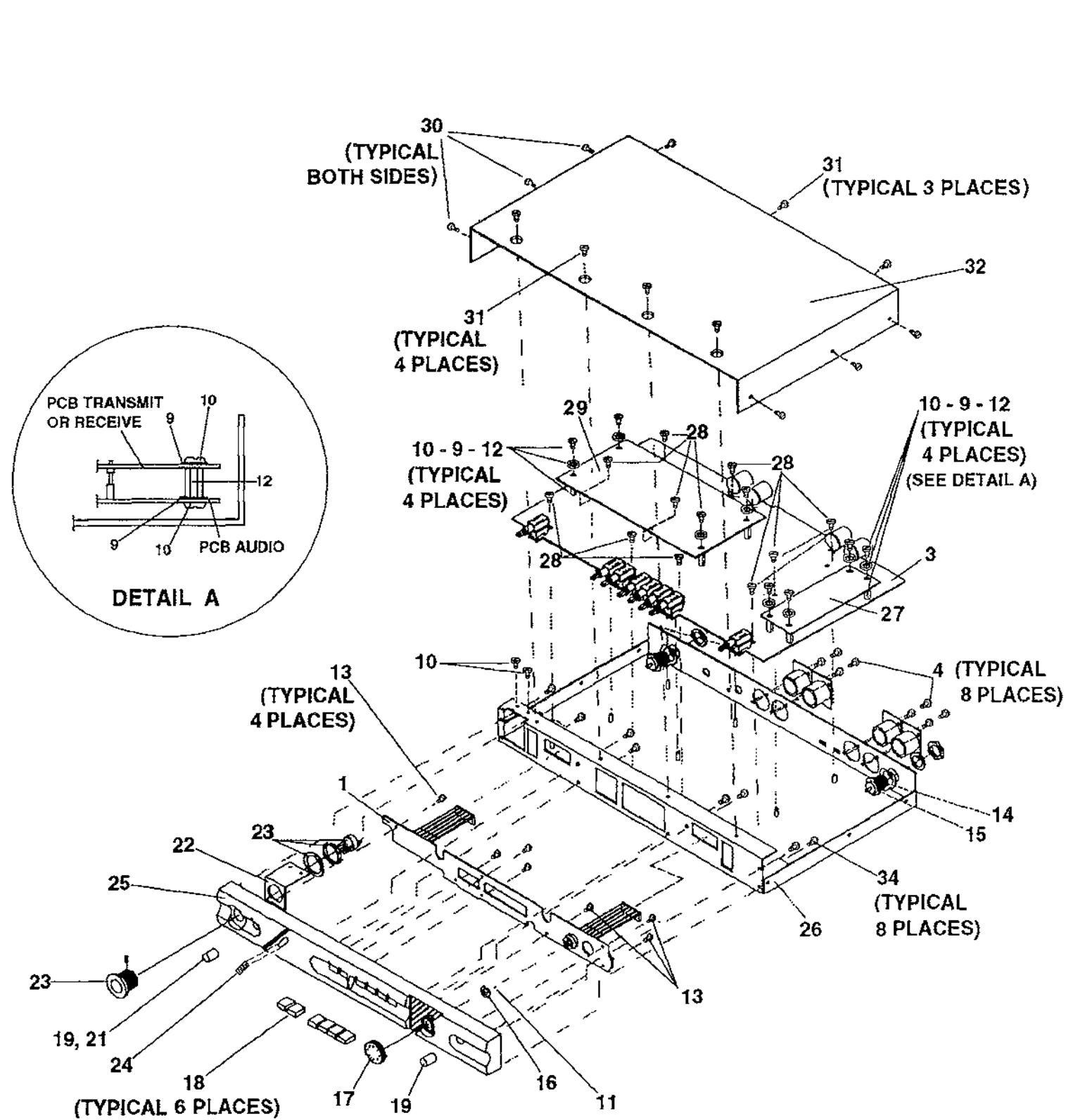
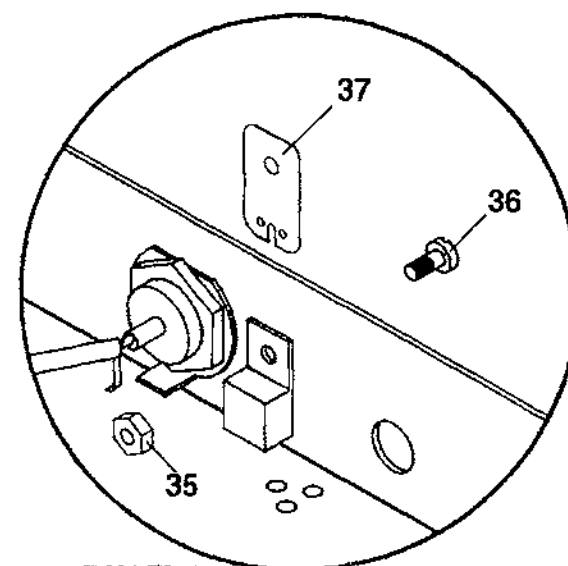
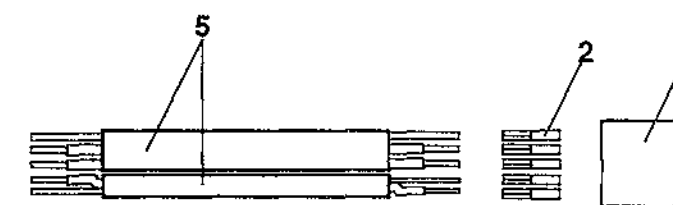


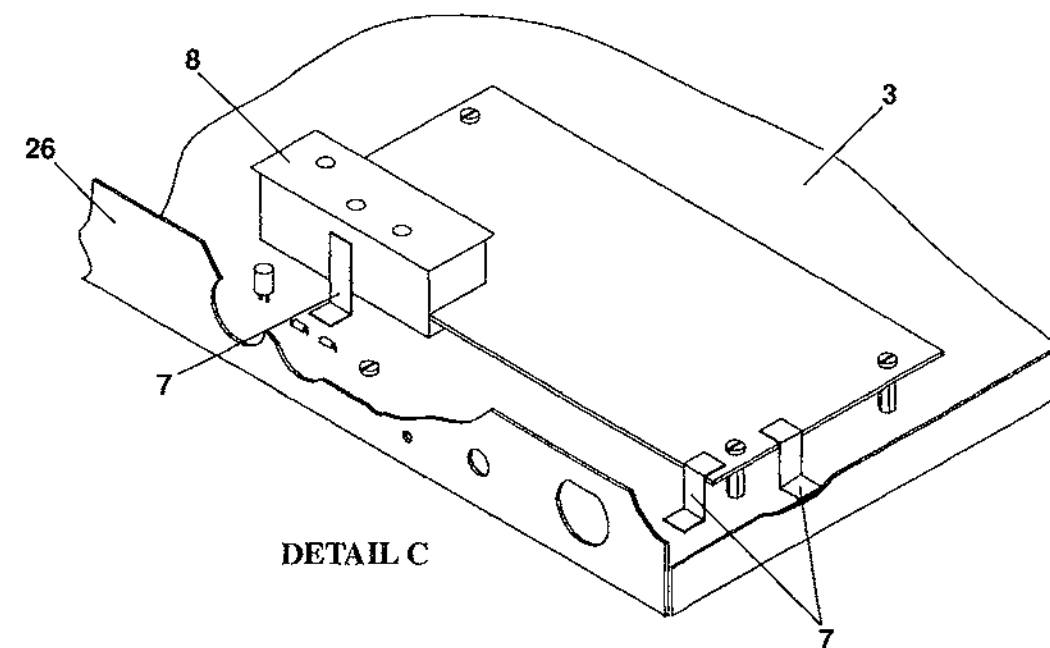
Figure 8  
Exploded View - BTR-200



DETAIL A



DETAIL B



DETAIL C

Mechanical Parts

Item No.	Part No.	Description	Qty
1	878519	PCB, Display	1
2	54460001	Receptacle, crimp	5
3	878520	PCB, Audio	1
4	51847011	Screw, #4-40 x 1/4", flathead	8
5	878560	Wireset	1
6	52264005	Connector Housing, 5 Pin	1
7	0086300	Copper strip, .343 x .005	A/R
8	970011-1	Fish Paper	1
9	50049003	Lockwasher	16
10	51845038	Screw, #4-40 x 1/4", pan head	18
11	51847003	Screw, #2-56 x 1/8" flathead	1
12	450520	Standoff	8
13	51856001	Screw, plastite, #2-28	7
14	270229	Lug	2
15	57722000	Connector, antenna	2
16	450464-1	Sprocket	1
17	450463-1	Volume Control Knob	1
18	53431002	Switch Button, rectangular	6

Item No.	Part No.	Description	Qty
19	53431005	Switch Button, round	2
20 & 21		(Not Used)	
22	878517	Connector bracket	1
23	59908001	Connector, B4MB Switchcraft	1
24	150624-3	Telex label	1
25	878439-3	Front Panel	1
26	878430	Chassis	1
27	878521	Transmit Board	1
28	51845091	Screw, #6-32 x 3/16"	10
29	878662	Receive Board	1
30	51845093	Screw, #6-32 x 3/8"	6
31	51845055	#4-40 x 3/16", pan head	7
32	878431	Cover	1
33		(Not Used)	
34	51845074	Screw, #6-32 x 1/4", pan head	8
35	557000	Nut, #6-32, hex	1
36	500322	Screw, #6-32 x 3/8", hex head	1
37	760386	Insulator, Pre-impreg.	1

# CHAPTER 3

## TRANSMIT, RECEIVE & AUDIO CIRCUIT BOARDS

### BTR-200 INSTRUMENT DISASSEMBLY

1. Remove 6 each #6 pan head phillips and 7 each #14 head phillips screws and remove cover. Refer to Figure 8.
2. Unsolder coax cables from transmit and receive boards.
3. Unsolder 3 copper straps from receive board (if present)
4. Remove transmit and receive boards. Early versions are equipped with snap-on nylon standoffs and later versions are held with #4 pan head phillips screws.
5. Remove ring nuts from the two RF connectors.
6. Remove the hex head nylon screw and nut holding Q108 to the chassis.
7. Remove 8 each #4 flat head phillips screws holding the four XLR connector housings to the chassis. On some early versions, the upper PEM nuts will be replaced with nuts and lock-washers.
8. Using an XLR tool or small flat bladed screwdriver, unlock the XLR housings by turning the locking screw counterclockwise. Then remove the XLR housings by pulling them to the rear.
9. Unplug the cable harness at P114 and the two ribbon cables at P102 and P103.
10. Remove 10 each #6 pan head phillips screws holding the circuit board to the chassis.
11. Slide the circuit board forward and lift up and out from the rear.
12. Remove 8 each #6 pan head phillips screws holding front panel to chassis.
13. Remove 2 each #4 pan head phillips screws holding headset connector bracket to chassis and remove front panel.
14. Remove 7 each phillips screws holding front circuit board to front panel and remove circuit board. NOTE: When refitting this circuit board the volume control on the front panel must be positioned so that the pins and slots mate properly.
15. Reassembly is the reverse of these procedures.

# TRANSMIT BOARD

## CIRCUIT DESCRIPTION

U501C is an amplifier whose gain is controlled by the level of audio entering the rectifier at pin 16. As the level here increases, the gain is decreased and this results in a 2:1 compression characteristic. Pre-emphasis is added by U501B. R504, R505, and C508 set this at 115uS. C531 rolls the response off above 10 KHz to further attenuate the 20 KHz call signal (see Audio Board Circuit Description). Q501 is a Colpitts oscillator with the collector tuned to the third harmonic. T501, VVC501 and VVC502 are added in series with the crystal to allow frequency modulation of the oscillator. The oscillator is operated 10 KHz below the series resonant point of the crystal. This improves linearity at the expense of some stability. Q502 is a tripler and Q503 is a straight through amplifier. The carrier frequency is thus nine times the crystal. C529, C530 and L503 function as a low pass filter and matching network.

## ALIGNMENT PROCEDURE

### EQUIPMENT REQUIRED:

- RF POWER METER
- FREQUENCY COUNTER
- DC VOLTMETER

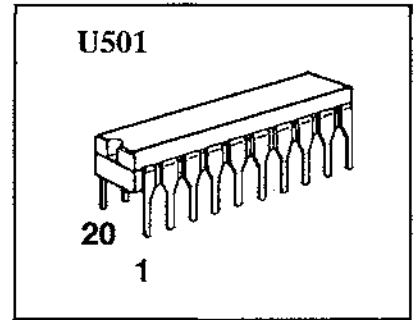
1. Connect the RF power meter and frequency counter to the Transmit Antenna jack. Make sure the Transmit switch on the rear panel is set the the Cont position.
2. Adjust T502, T503, T504, VC501, and VC502 for maximum power. Note: If adjustments are severly out of alignment and no output can be obtained, it may be necessary to first adjust T502 and T503 for maximum DC voltage at the emitter of Q502. Then adjust T504 for maximum DC voltage at the emitter of Q503. Now adjust VC501 and VC502 for maximum power.
3. Adjust T501 for the correct frequency:

Y501 Marking	Frequency
154T570	154.570
177T800	177.800
183T730	183.730

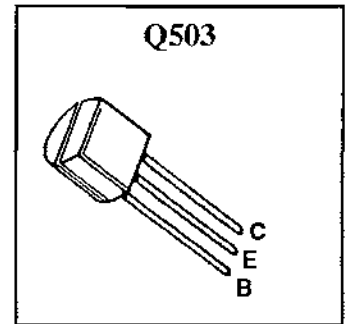
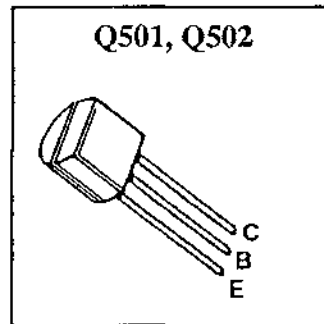
4. Repeat Steps 2 and 3 as necessary.
5. Deviation will be adjusted in the audio board alignment.

## Voltage Tables - Transmit Board (878521)

DEVICE	PIN NUMBER									
	20	19	18	17	16	15	14	13	12	11
U501	5	2.5	2.5	2.5	2.5	1	2.5	2.5	2.5	2.5
	-	-	-	-	-	-	-	2.5	-	0
	1	2	3	4	5	6	7	8	9	10
	PIN NUMBER									



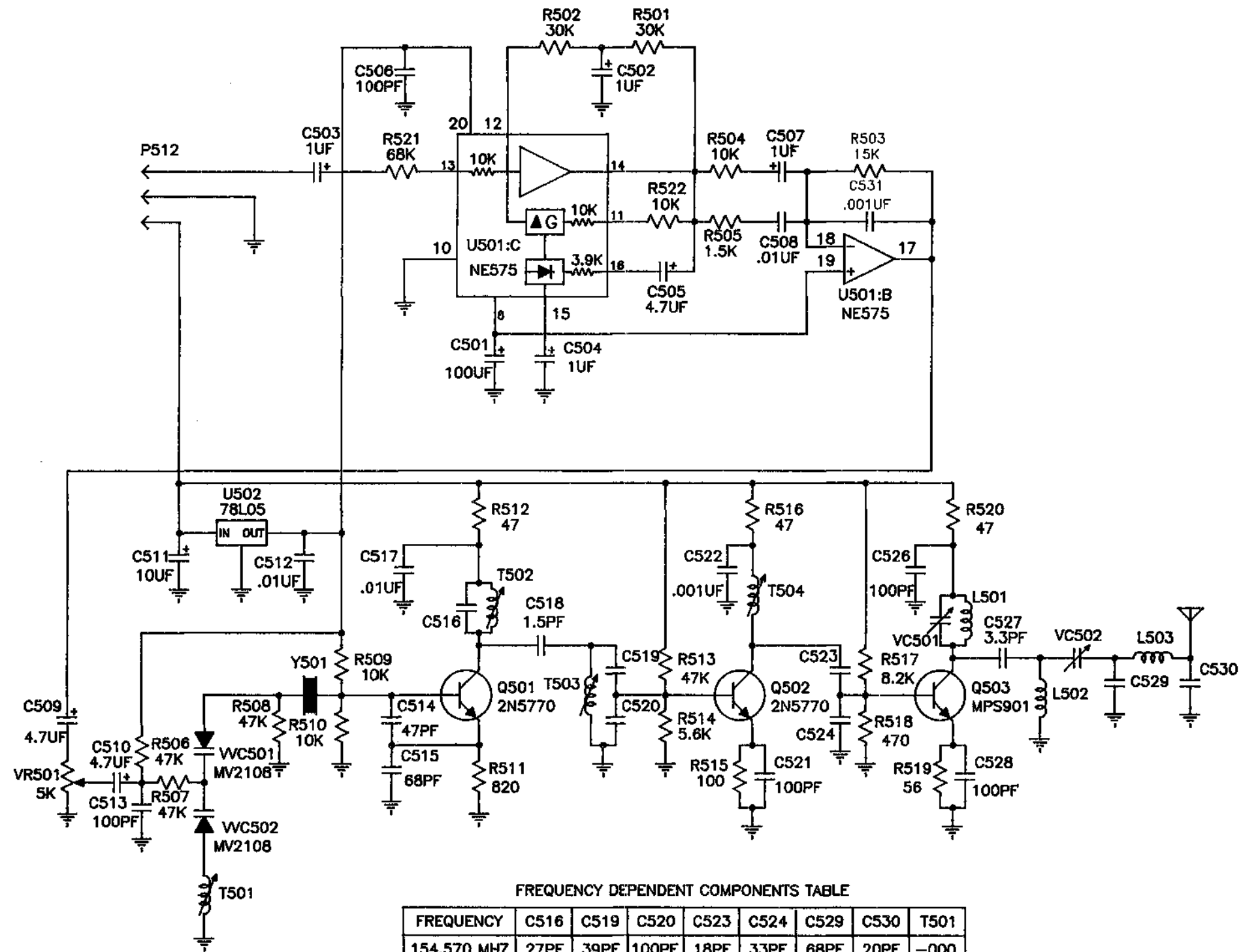
DEVICE	E	B	C
Q501	1.88	2.44	10
Q502	0.78	0.66	9.7
Q503	1.21	0.26	9.5











**Figure 12**  
**Schematic Diagram Transmit Board - Version 2**

## PCB Transmit Assembly (878521-\*)

Ref No.	Description	Part No.
PCB500	PCB Transmit	70724000
<b>Capacitors</b>		
All capacitors in microfarads unless noted.		
Ref No.	Description	Part No.
C501	Electrolytic, 100	51821524
C502-C504	Electrolytic, 1	51821106
C505	Electrolytic, 4.7	51821109
C506	Ceramic, 100 pF	35693019
C507	Electrolytic, 1	51821106
C508	Film, poly, .01	52719007
C509-C510	Electrolytic, 4.7	51821109
C511	Electrolytic, 10	52723008
C512	Ceramic, .01	52676107
C513	Ceramic, 100 pF	35693019
C514	Ceramic, TC, 47 pF	52713002
C515	Ceramic, TC, 68 pF	52713003
C516 <sup>1,2</sup>	Ceramic, 22 pF	35693011
C516 <sup>3</sup>	Ceramic, 27 pF	35693012
C517	Ceramic, .01	52676107
C518	Ceramic, 1.5 pF	35693047
C519 <sup>1,2</sup>	Ceramic, 30 pF	35693046
C519 <sup>3</sup>	Ceramic, 39 pF	35693014
C520 <sup>1,2</sup>	Ceramic, 75 pF	35693061
C520 <sup>3</sup>	Ceramic, 100 pF	35693019
C521	Ceramic, 100 pF	35693019
C522	Ceramic, .001	52676101
C523 <sup>1,2</sup>	Ceramic, 12 pF	35693008
C523 <sup>3</sup>	Ceramic, 18 pF	35693010
C524 <sup>1</sup>	Ceramic, 27 pF	35693012
C524 <sup>2</sup>	Ceramic, 24 pF	35693060
C524 <sup>3</sup>	Ceramic, 33 pF	35693013
C525	Ceramic, .001	52676101
C526	Ceramic, 100 pF	35693019
C527	Ceramic, 3.3 pF	35693002
C528	Ceramic, 100 pF	35693019
C529 <sup>1,2</sup>	Ceramic, 47 pF	35693015
C529 <sup>3</sup>	Ceramic, 68 pF	35693017
C530 <sup>1,2</sup>	Ceramic, 15 pF	35693009
C530 <sup>3</sup>	Ceramic, 20 pF	35693048
C531	Ceramic, .0033 (Version 1)	52719004
C531	Ceramic, .001 (Version 2)	52676101
<b>Variable Capacitors</b>		
VC501, VC502	Variable Capacitor	35837007
<b>Transistors</b>		
Q501, Q502	Transistor, 2N5770	54689000
Q503	Transistor, MPS-901	760376
<b>Integrated Circuits</b>		
U501	IC, NE575N	53277003
U502	IC, 78L05	54680005
<b>Diodes</b>		
VVC501	Diode, MV2108	58675000
VVC502	Diode, MV2108	58675000
<b>Variable Resistor</b>		
VR501	5K Variable resistor	57148068

Ref No.	Description	Part No.
<b>Coils</b>		
T501 <sup>3</sup>	Coil	52978000
T501 <sup>1,2</sup>	Coil	52978002
T502, T503	Coil	52979000
T504	Coil	52977003
L501 <sup>1,2</sup>	Coil, Air Wound	63725000
L501 <sup>3</sup>	Coil, Air Wound	63725005
L502 <sup>1,2</sup>	Coil, Air Wound	63725000
L502 <sup>3</sup>	Coil, Air Wound	63725005
L503 <sup>1,2</sup>	Coil, Air Wound	63725000
L503 <sup>3</sup>	Coil, Air Wound	63725005
<b>Crystals</b>		
Y501 <sup>1</sup>	Crystal, 177.800 MHz	52989120
Y501 <sup>2</sup>	Crystal, 183.730 MHz	52989214
Y501 <sup>3</sup>	Crystal, 154.570 MHz	52989100
All resistors in ohms, 1/8 Watt, 5%, unless noted.		
<b>Resistors</b>		
R501, R502	30K	52154025
R503	4.7K (Version 1)	52154044
R503	15K (Version 2)	52154032
R504	10K	52154036
R505	1.5K	52154056
R506-R508	47K	52154020
R509, R510	10K	52154036
R511	820	52154062
R512	47	52154092
R513	47K	52154020
R514	5.6K	52154042
R515	100	52154084
R516	47	52154092
R517	8.2K	52154038
R518	470	52154068
R519	56	52154090
R520	47	52154092
R521	10K (Version 1)	52154036
R521	68K (Version 2)	52154016
R522	10K	52154036
<b>Connector</b>		
P512	Header, 3 pin	670062

878521-*		
Frequency	*Dash No.	Reference No.
177.800 MHz	-177	1
183.730 MHz	-183	2
154.570 MHz	-154	3

# RECEIVE BOARD

## CIRCUIT DESCRIPTION

### PCB 70714000

This unit is a four channel single conversion receiver consisting of one front end and four I.F. strips. Signals entering the board proceed through 3 tuned circuits, Q301, and 3 more tuned circuits to the mixer. MX301 is a doubly balanced diode mixer and receives +7 dBm from the oscillator. Q302 is a Colpitts oscillator with the collector tuned to the second harmonic. Y301 operates on the fifth overtone with C319 and L308 acting as mode suppressor. L310 is used to set the oscillator on frequency. From the mixer the signal continues through a broadband filter to line driver Q303. VR309 is used to set the collector current to 20 mA. Q303 drives the four I.F. strips, beginning with crystal filters FL301-FL308. The four I.F. strips are the same except for component values. Also, the 10.7 MHz I.F. substitutes a ceramic filter for two tuned circuits. For the remainder of the description the parts in the 10.7 MHz I.F. will be referred to. The I.F. signal is amplified by Q304 and U301A, and limited and detected by U301B. U301B contains a quadrature detector which is tuned by T309. Squelch is of the amplitude type, the D.C. voltage at pin 5 of U301 varying in proportion to the signal strength. With no signal U302 pin 1 is low and the audio output is squelched. When the received signal causes the voltage at pin 3 of U302 to exceed that of pin 2 of U302, pin 1 goes high and the squelch opens. VR301 sets the threshold at pin 2 and thus the squelch. R320 provides hysteresis. Q305 is used to drive the LED on the front panel. From U301 the audio is amplified by U303A. R389, R328 and C354 set the de-emphasis at 115 $\mu$ S. VR302 is used to compensate for variations in detector output level. U303B is a 3 pole Butterworth low pass filter with a cutoff frequency of 10 KHz.

### PCB 750309

This unit is a four channel dual conversion receiver consisting of one front end and four I.F. strips. Signals entering the board proceed through 3 tuned circuits, Q301, and three more tuned circuits to the mixer. HY301 is a doubly balanced diode mixer and receives +7 dBm from the oscillator. Q302 is a Colpitts oscillator with the collector tuned to the second harmonic on version 1 boards and the third harmonic on version 2. Y301 operates on the fifth overtone with C311 and L308 acting as mode suppressor. L307 is used to set the oscillator on frequency. From the mixer the signal continues through Q303 to filter drivers Q320, Q370, Q420 and Q470. On version 1 boards the signal is resistively coupled to the filters. On version 2 boards it is inductively coupled. The four I.F. strips are the same except for component values. For the remainder of the description the parts in the 10.7 MHz I.F. will be referred to. U320A mixes the incoming signal with a 10.245 MHz oscillator to produce the second I.F. of 455 KHz. (The other three oscillators operate at 455 KHz above their respective input frequencies). U320B contains a limiter and quadrature detector, which is tuned by L322. U320C functions as a 94 KHz bandpass filter for operating the squelch. With no signal a large amount of noise is present at U320 pin 13 and a portion of this is rectified by Q321. If the emitter rises above .7V U320D clamps pin 16 to ground, muting the audio, and drives pin 15 low, extinguishing the LED on the front panel via Q322. When a signal is received, the noise at U320 pin 13 drops and lowers the voltage at the emitter of Q321, releasing the audio clamp and lighting the front panel LED. Since the LED current flows through R331, the voltage drop acts on Q321 and provides hysteresis. VR321 adjusts not only the noise amplitude delivered to Q321 but also the D.C. bias, and is used to set the squelch at 1 microvolt. From U320 the audio is buffered and filtered by U321. R328, C335, and VR320 set the de-emphasis at 115 $\mu$ S. U321A is a three pole Butterworth low pass filter with a cutoff frequency of 10 KHz.

# ALIGNMENT PROCEDURE

## Receive Board - 70714000

### Equipment Required:

- Signal Generator
- Sensitive RF Voltmeter
- DC Voltmeter
- AF Voltmeter

1. Connect the signal generator to the Receive Antenna jack. Set the deviation at  $\pm 3$  KHz at 1 KHz. Refer to the frequency chart below. Look at the marking on the Y301 and set the generator to the corresponding ALIGN frequency.
11. Place the RF voltmeter probe tip inside the top of L304.
12. Adjust VC304 for a peak indication.
13. Adjust VC305 for a null indication.
14. Adjust VC306 for a peak indication.
15. Place the RF voltmeter probe tip on the collector of Q303 and adjust T301, T302, and T303 for a peak indication.

Y301 Marking	Align	CH1	CH2	CH3	CH4
171R905	170.705	171.905	171.045	170.245	169.505
207R800	206.900	207.800	207.425	206.800	206.000
213R800	212.900	213.800	213.425	212.800	212.000

2. Adjust VR309 for 0.44 VDC across R312.
3. Place the RF voltmeter probe tip inside the top of L307 and adjust VC307 for a peak indication.
4. Set the RF voltmeter to its most sensitive scale without stray pickup.
5. Place the RF voltmeter probe tip inside the top of L301.
6. Increase the signal generator output level until the RF voltmeter indication just begins to rise.
7. When adjusting, reduce the signal generator output rather than reducing the RF voltmeter sensitivity.
8. Adjust VC301 for a peak indication.
9. Adjust VC302 for a null indication.
10. Adjust VC303 for a peak indication.
16. In the following alignment, unless otherwise directed, adjust the signal generator output level to maintain a DC voltage of between 1 and 1.5 volts.
17. Set the signal generator to the channel 1 frequency.
18. Adjust T304, T305, and T308 for maximum DC voltage at pin 5 of U301.
19. Set the signal generator output to 1 mV and adjust T309 for maximum audio at pin 7 of U303.
20. Adjust VR302 for 140 mV of audio at pin 7 of U303.
21. Set the signal generator output to 1  $\mu$ V and adjust VR301 to just extinguish the number 1 LED on the front panel.
22. Set the signal generator to the channel 2 frequency.

23. Adjust T310, T311, T312, T313, and T314 for maximum DC voltage at pin 5 of U304.
24. Set the signal generator output to 1 mV and adjust T315 for maximum audio at pin 7 of U305.
25. Adjust VR304 for 140 mV of audio at pin 7 of U305.
26. Set the signal generator output to 1  $\mu$ V and adjust VR303 to just extinguish the number 2 LED on the front panel.
27. Set the signal generator to the channel 3 frequency.
28. Adjust T316, T317, T318, T319, and T320 for maximum DC voltage at pin 5 of U306.
29. Set the signal generator output to 1 mV and adjust T321 for maximum audio at pin 7 of U307.
30. Adjust VR306 for 140 mV of audio at pin 7 of U307.
31. Set the signal generator output to 1  $\mu$ V and adjust VR305 to just extinguish the number 3 LED on the front panel.
32. Set the signal generator to the channel 4 frequency.
33. Adjust T322, T323, T324, T325 and T326 for maximum DC voltage at pin 5 of U309.
34. Set the signal generator output to 1 mV and adjust T327 for maximum audio at pin 7 of U310.
35. Adjust VR308 for 140 mV of audio at pin 7 of U310.
36. Set the signal generator output to 1  $\mu$ V and adjust VR307 to just extinguish the number 4 LED on the front panel.

### Receive Board - 750309

**Equipment Required:**

- Signal Generator
- Sensitive RF Voltmeter
- Audio Distortion Meter
- Spectrum Analyzer or VHF Monitor
- AF Voltmeter
- SINAD Meter

- 1A Version 1: Place the RF voltmeter probe tip inside the top of L309 and adjust VC307 for a peak indication.
- 1B Version 2: Place the RF voltmeter probe tip inside the top of L313 and adjust VC307 and VC308 for a peak indication.
2. Connect the signal generator to a short piece of wire and set it to the oscillator frequency as shown in the chart below:
3. Using either a spectrum analyzer or a VHF monitor, adjust L307 for a zero beat.

Y301 Marking	Oscillator	CH 1	CH 2	CH 3	CH 4
171 R905	182.605	171.905	171.045	170.245	169.505
207 R800	218.5	207.800	207.425	206.800	206.000
213 R800	224.5	213.800	213.425	212.800	212.000

4. Connect the signal generator to the Receive Antenna jack. Set the deviation to  $\pm 3$  KHz at 1 KHz. Refer to the chart and select the channel 3 frequency.
5. Connect the AF voltmeter, distortion meter, and SINAD meter to U421 pin 1.
6. Adjust VR421 to maximum counterclockwise.
7. Adjust VC301, VC302, VC303, VC304, VC305 and VC306 for best SINAD.
8. Increase signal generator output to 1 mV.
9. Adjust L422 for maximum audio.
- 10A. Version 1: Adjust L421 and L422 for minimum distortion.
- 10B. Version 2: Adjust L421, L422 and L423 for minimum distortion.
11. Adjust VR420 for 140 mV of audio.
12. Set the signal generator output to 1  $\mu$ V.
13. Adjust VR421 fully clockwise, then turn it counterclockwise until the number 3 LED on the front panel just comes on.
14. Set the signal generator to the channel 1 frequency and increase the output to 1 mV.
15. Move the audio hook up to U321 pin 1.
16. Adjust L322 for maximum audio.
- 17A. Version 1: Adjust L321 and L322 for minimum distortion.
- 17B. Version 2: Adjust L321, L322, and L323 for minimum distortion.
18. Adjust VR320 for 140 mV of audio.
19. Set the signal generator output to 1  $\mu$ V.
20. Adjust VR321 fully clockwise, then turn it counterclockwise until the number 1 LED on the front panel just comes on.
21. Set the signal generator to the channel 2 frequency and increase the output to 1 mV.
22. Move the audio hook up to U371 pin 1.
23. Adjust L372 for maximum audio.
- 24A. Version 1: Adjust L371 and L372 for minimum distortion.
- 24B. Version 2: Adjust L371, L372, and L373 for minimum distortion.
25. Adjust VR370 for 140 mV of audio.
26. Set the signal generator output to 1  $\mu$ V.
27. Adjust VR371 fully clockwise, then turn it counterclockwise until the number 2 LED on the front panel just comes on.
28. Set the signal generator to the channel 4 frequency and increase the output to 1 mV.
29. Move the audio hook up to U471 pin 1.
30. Adjust L472 for maximum audio.
- 31A. Version 1: Adjust L471 and L472 for minimum distortion.
- 31B. Version 2: Adjust L471, L472, and L473 for minimum distortion.
32. Adjust VR470 for 140 mV of audio.
33. Set the signal generator output to 1  $\mu$ V.
34. Adjust VR471 fully clockwise, then turn it counterclockwise until the number 4 LED on the front panel just comes on.

**NOTES:**

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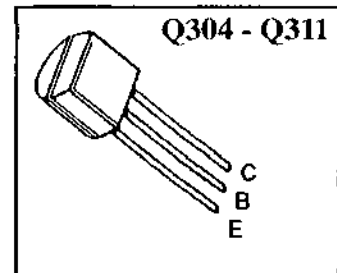
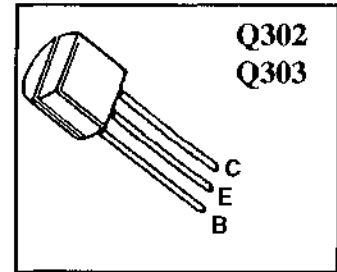


## Voltage Tables - Receive Board (70714000)



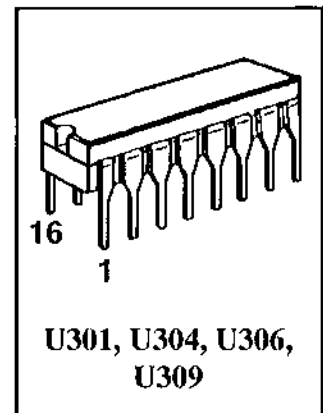
DEVICE	G1	S	G2	D
Q301	0	1.58	1.58	8.68

DEVICE	E	B	C	
Q302	2.54	3.3	8.56	
Q303	.44	1.23	4.2	
Q304, Q306, Q308, Q310	2.63	1.89	1.08	
Q305, Q307, Q309, Q311	0	0	10	NO SIGNAL
	6.65	7.34	10	UNSQUELCHED



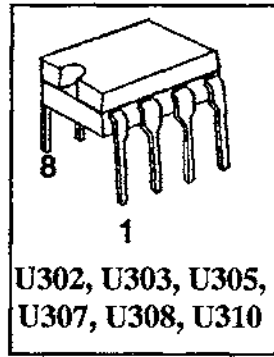
DEVICE	PIN NUMBER								
	16	15	14	13	12	11	10	9	
U301	1.58	1.58	1.61	0	1.59	1.59	1.59	1.73	<b>NO SIGNAL</b>
U304									
U306									
U309	1.58	0	0.05	6.09	0.21	2.07	1.84	3.44	
	1	2	3	4	5	6	7	8	
	PIN NUMBER								

DEVICE	PIN NUMBER								
	16	15	14	13	12	11	10	9	
U301	1.58	1.58	1.61	0	1.59	1.59	1.59	1.73	<b>1 mV RF IN</b>
U304									
U306									
U309	1.58	0	7.35	6.09	3.34	2.07	1.84	3.44	
	1	2	3	4	5	6	7	8	
	PIN NUMBER								



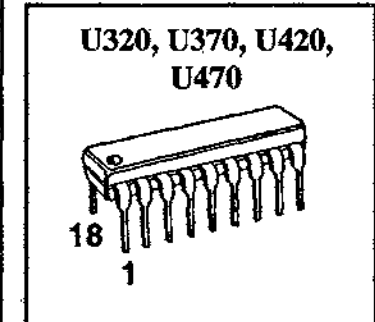
Voltage Tables - Receive Board (70714000) Continued

DEVICE	PIN NUMBER				DEVICE	PIN NUMBER				NO SIGNAL
	8	7	6	5		8	7	6	5	
U303	10	5	5	5	U302 U308	10	0.05	1	.21	NO SIGNAL
U305						0.05	1	.21	0	
U307	5	5	5	0						
U310										
	1	2	3	4		1	2	3	4	
	PIN NUMBER					PIN NUMBER				

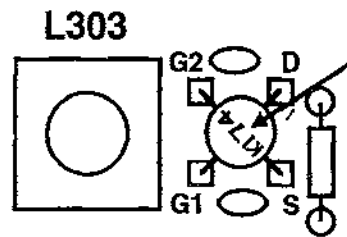


Voltage Tables - Receive Board (750309) Continued

DEVICE	PIN NUMBER									NO SIGNAL
	18	17	16	15	14	13	12	11	10	
U320	2.13	0	0	0	0.79	2.57	2.47	0	5.5	NO SIGNAL
U370										
U420	10	9.38	9.26	10	1.1	1.1	1.1	10	5.9	
U470										
	1	2	3	4	5	6	7	8	9	
	PIN NUMBER									



Voltage Tables - Receive Board (750309)

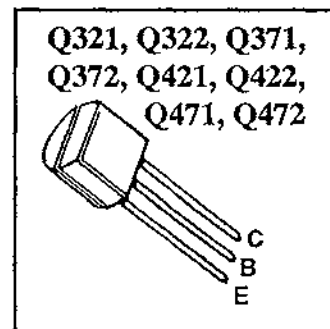
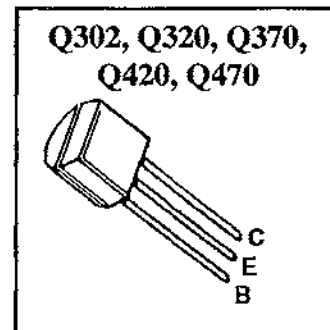


**NOTE:** If this part is absent, then surface mount part has been installed on foil side. Pad designations are the same.

DEVICE	VERSION	G1	G2	D	S
Q301	1	0	1	9.22	1
Q301	2	0	1.8	8.8	0.36

DEVICE	PIN NUMBER									UNSQUELCHED
	18	17	16	15	14	13	12	11	10	
U320	2.13	0	0	9.34	0.36	2.57	2.47	0	5.5	UNSQUELCHED
U370										
U420	10	9.38	9.26	10	1.1	1.1	1.1	10	5.9	
U470										
	1	2	3	4	5	6	7	8	9	
	PIN NUMBER									

DEVICE	VERSION	E	B	C	
Q302		3.69	4.37	9.22	
Q320, Q370, Q420, Q470	1	1.05	1.76	5	
	2	0.8	1.54	10	
Q321, Q371, Q421, Q471		0.79	0.77	10	NO SIGNAL
Q321, Q371, Q421, Q471		0.35	0.8	9.4	UNSQUELCHED
Q322, Q372, Q422, Q472		0.79	0	10	NO SIGNAL
Q321, Q371, Q421, Q471		8.67	9.34	9.4	UNSQUELCHED



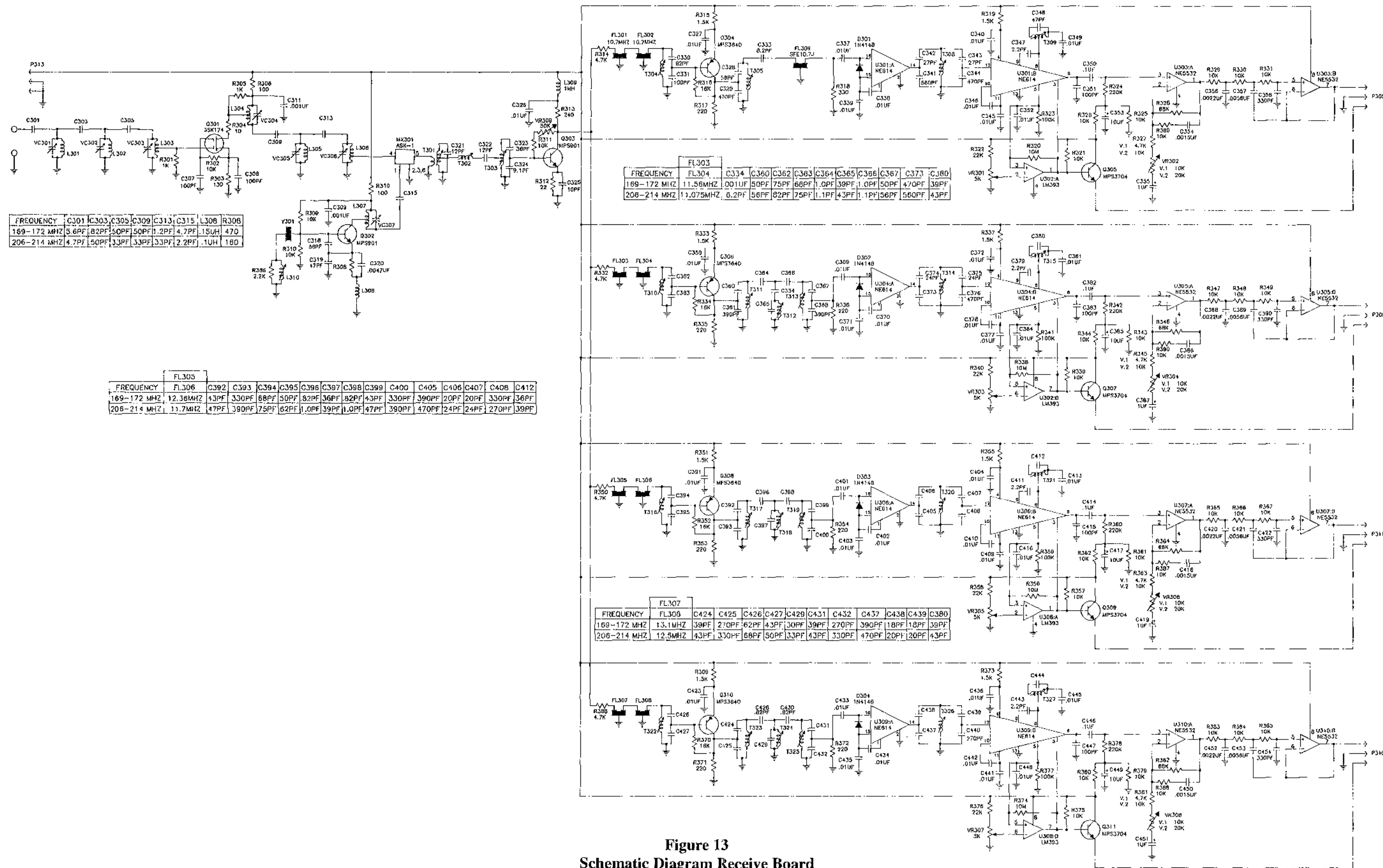


Figure 13  
Schematic Diagram Receive Board  
70714000  
PCB Assembly 878522

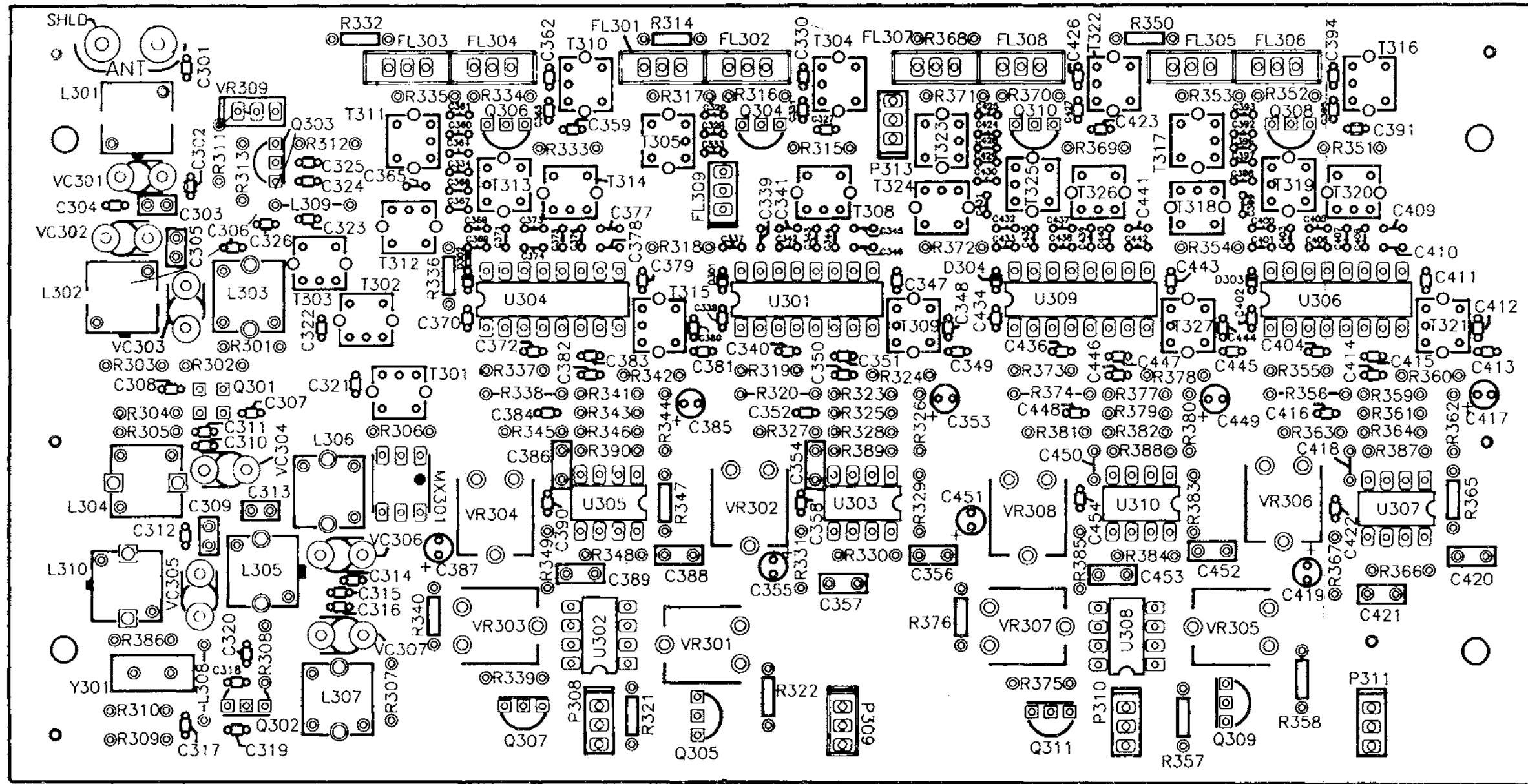
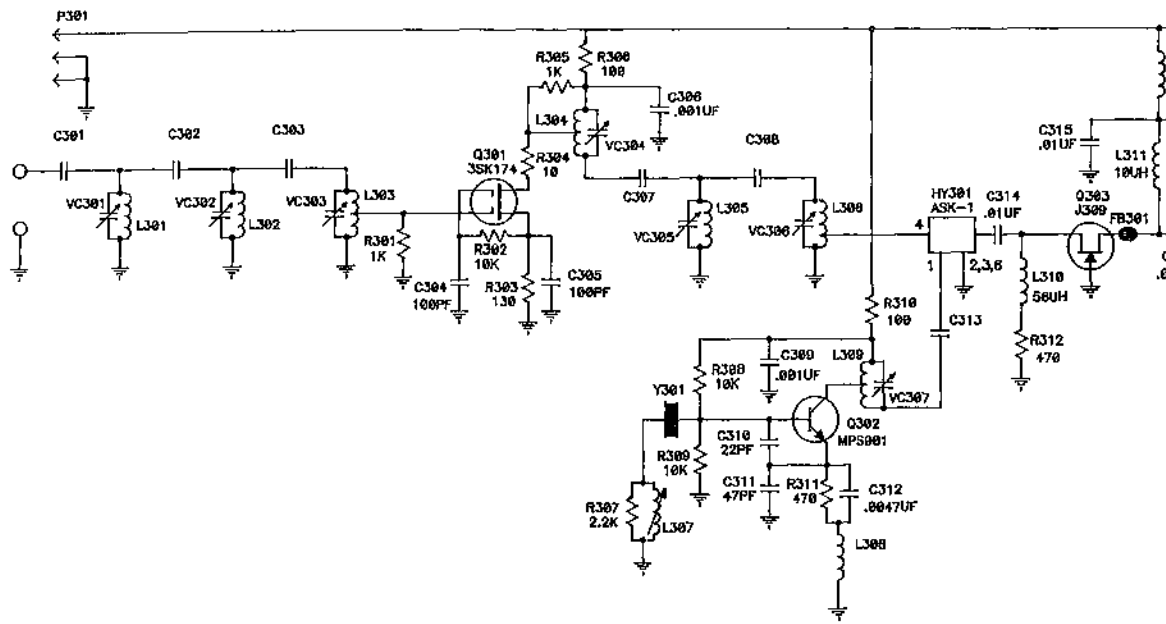


Figure 14  
 Receive Board Component Layout (Component Side)  
 Versions 1 and 2  
 70714000



FREQUENCY	C301	C302	C303	C307	C308	C313	C421	C422	C472	CF370 CF371	CF420 CF421	CF470 CF471	L308	Y301	Y370	Y420	Y470
169-172 MHz	5.6 pF	.02 pF	.50 pF	.50 pF	1.2 pF	4.7 pF	150 pF	43 pF	39 pF	11.58 MHz	12.36 MHz	13.1 MHz	.15 μH	171.905 MHz	12.015 MHz	12.815 MHz	12.555 MHz
206-208 MHz	4.7 pF	.50 pF	.33 pF	.33 pF	.33 pF	2.2 pF	180 pF	50 pF	43 pF	11.075 MHz	11.7 MHz	12.5 MHz	.10 μH	207.8 MHz	11.53 MHz	12.155 MHz	12.965 MHz
212-214 MHz	4.7 pF	.50 pF	.33 pF	.33 pF	.33 pF	2.2 pF	180 pF	50 pF	43 pF	11.075 MHz	11.7 MHz	12.5 MHz	.10 μH	213.8 MHz	11.53 MHz	12.155 MHz	12.965 MHz

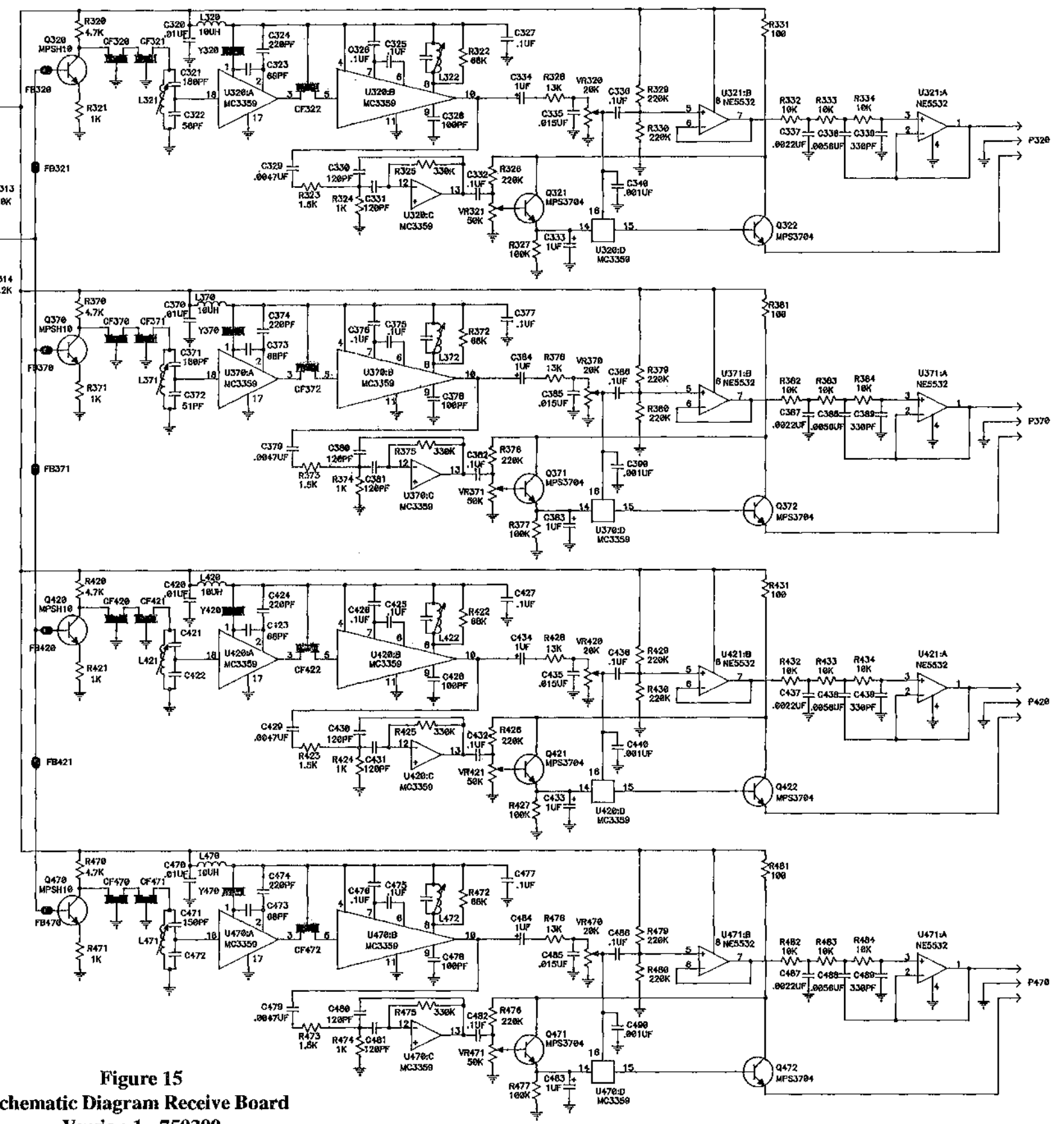


Figure 15  
Schematic Diagram Receive Board  
Version 1 - 750309  
PCB Assembly 878662

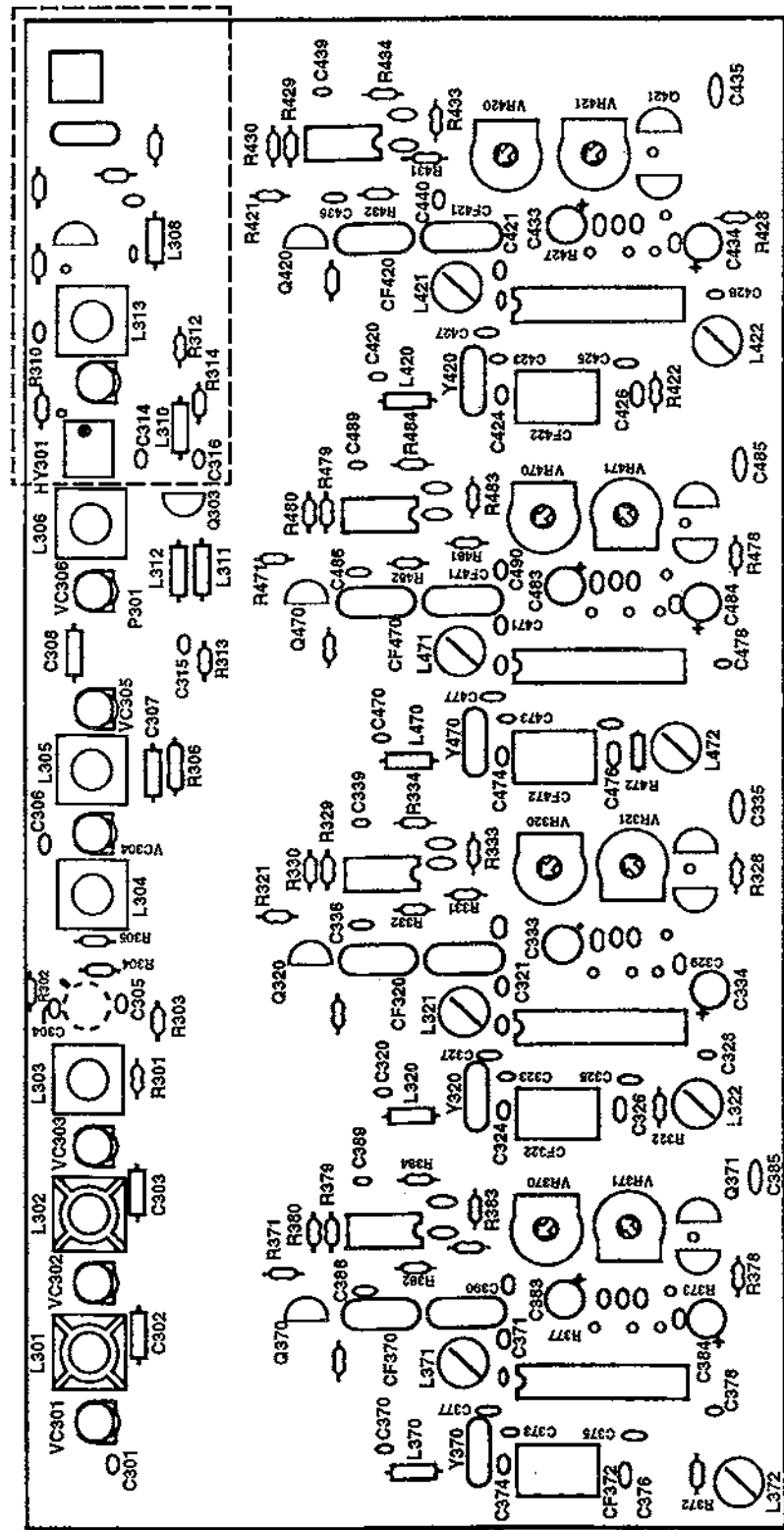


Figure 16  
Receive Board Component Layout (Component Side)  
Version 1  
750309

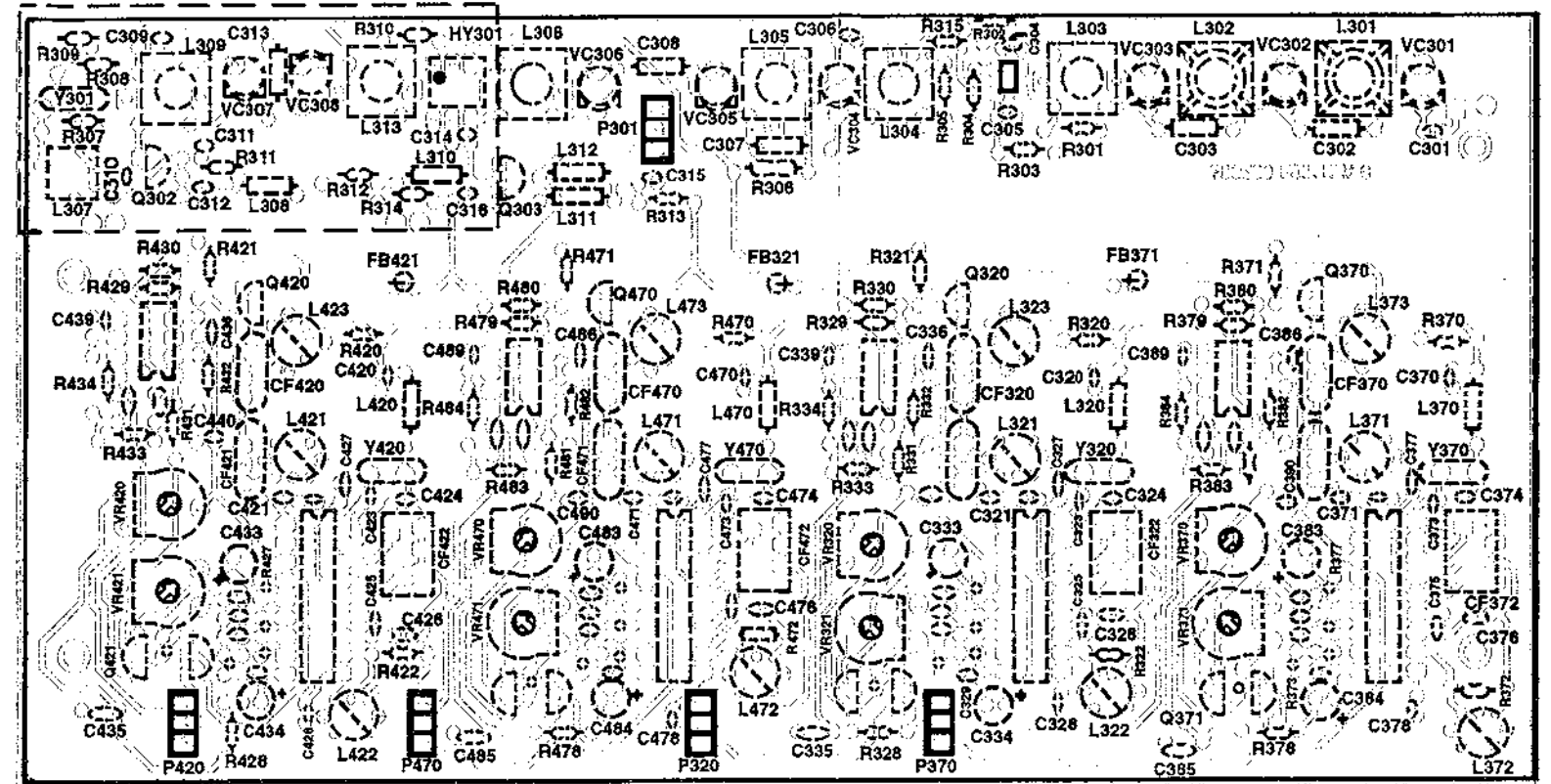


Figure 17A  
Receive Board Component Layout (Foil Side)

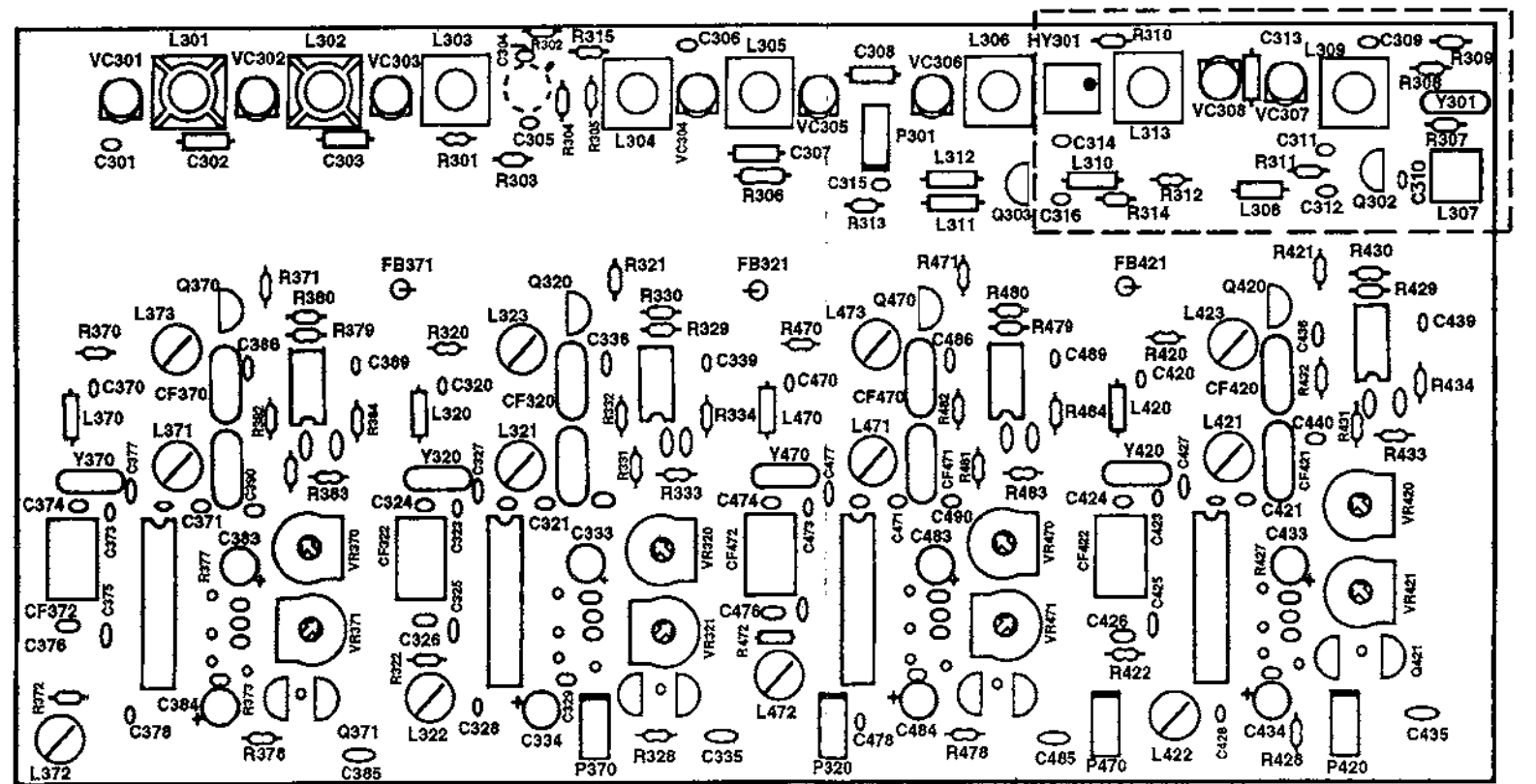
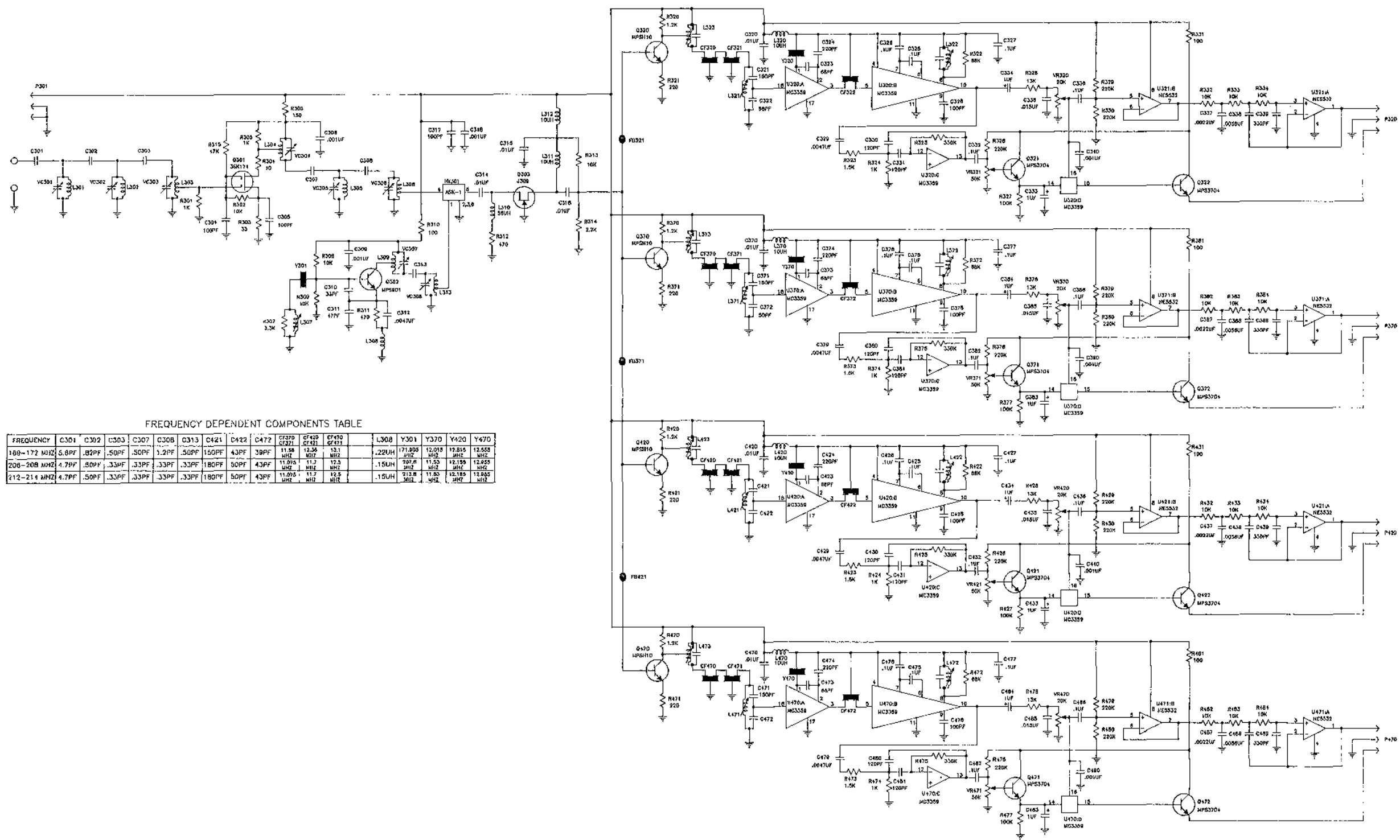


Figure 17B  
Receive Board Component Layout (Component Side)  
Version 2  
750309



## PCB Receive Assembly 878522-\*

Ref No.	Description	Part No.
PCB300/400	Printed Circuit Board, Receive	70714000
<b>Capacitors</b>		
All capacitors in microfarads unless noted.		
Ref No.	Description	Part No.
C301 <sup>1</sup>	Ceramic, 5.6 pF	35693004
C301 <sup>2,3</sup>	Ceramic, 4.7 pF	35693003
C302	(Not Used)	
C303 <sup>1</sup>	Ceramic, .82 pF	52007003
C303 <sup>2,3</sup>	Ceramic, .5 pF	52007000
C304	(Not Used)	
C305 <sup>1</sup>	Ceramic, .5 pF	52007000
C305 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C306	(Not Used)	
C307, C308	Ceramic, 100 pF	35693019
C309, C310	(Not Used)	
C311	Ceramic, .001	52676101
C312	(Not Used)	
C313 <sup>1</sup>	Ceramic, 1.2 pF	52007009
C313 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C314	(Not Used)	
C315 <sup>1</sup>	Ceramic, 4.7 pF	35693003
C315 <sup>2,3</sup>	Ceramic, 2.2 pF	35693000
C316	(Not Used)	
C317	Ceramic, .001	52676101
C318	Ceramic, 56 pF	35693016
C319	Ceramic, 47 pF	35693015
C320	Ceramic, 4700 pF	52676105
C321, C322	Ceramic, 12 pF	35693008
C323	Ceramic, 36 pF	35693078
C324	Ceramic, 9.1 pF	35693056
C325	Ceramic, 10 pF	35693007
C326, C327	Ceramic, .01	52676107
C328	Ceramic, 56 pF	35693016
C329	Ceramic, 470 pF	35693026
C330	Ceramic, 82 pF	35693018
C331	Ceramic, 100 pF	35693019
C332	(Not Used)	
C333	Ceramic, 8.2 pF	35693006
C334 <sup>1</sup>	Ceramic, .001	52676101
C334 <sup>2,3</sup>	Ceramic, 6.2 pF	35693074
C335, C336	(Not Used)	
C337-C340	Ceramic, .01	52676107
C341	Ceramic, 560 pF	35693027
C342, C343	Ceramic, 27 pF	35693012
C344	Ceramic, 470 pF	35693026
C345, C346	Ceramic, .01	52676107
C347	Ceramic, 2.2 pF	35693000
C348	Ceramic, 47 pF	35693015
C349	Ceramic, .01	52676107
C350	Ceramic, .1	52676113
C351	Ceramic, 100 pF	35693019
C352	Ceramic, .01	52676107
C353	Electrolytic, 10	52723008
C354	Ceramic, 1500 pF	35693032
C355	Electrolytic, 1	51821106
C356	Poly Film, .0022	52719053
C357	Poly Film, .0056	52719068
C358	Ceramic, 330 pF	35693024
C359	Ceramic, .01	52676107
C360 <sup>1</sup>	Ceramic, 50 pF	35693049
C360 <sup>2,3</sup>	Ceramic, 56 pF	35693016

Ref No.	Description	Part No.
C361	Ceramic, 390 pF	35693025
C362 <sup>1</sup>	Ceramic, 75 pF	35693061
C362 <sup>2,3</sup>	Ceramic, 82 pF	35693018
C363 <sup>1</sup>	Ceramic, 68 pF	35693017
C363 <sup>2,3</sup>	Ceramic, 75 pF	35693061
C364 <sup>1</sup>	Ceramic, 1 pF	35693054
C364 <sup>2,3</sup>	Ceramic, 1.1 pF	724772
C365 <sup>1</sup>	Ceramic, 39 pF	35693014
C365 <sup>2,3</sup>	Ceramic, 43 pF	35693070
C366 <sup>1</sup>	Ceramic, 1 pF	35693054
C366 <sup>2,3</sup>	Ceramic, 1.1 pF	724772
C367 <sup>1</sup>	Ceramic, 50 pF	35693049
C367 <sup>2,3</sup>	Ceramic, 56 pF	35693016
C368	Ceramic, 390 pF	35693025
C369-C372	Ceramic, .01	52676107
C373 <sup>1</sup>	Ceramic, 470 pF	35693026
C373 <sup>2,3</sup>	Ceramic, 560 pF	35693027
C374, C375	Ceramic, 24 pF	35693060
C376	Ceramic, 470 pF	35693026
C377, C378	Ceramic, .01	52676107
C379	Ceramic, 2.2 pF	35693000
C380 <sup>1</sup>	Ceramic, 39 pF	35693014
C380 <sup>2,3</sup>	Ceramic, 43 pF	35693070
C381	Ceramic, .01	52676107
C382	Ceramic, .1	52676113
C383	Ceramic, 100 pF	35693019
C384	Ceramic, .01	52676107
C385	Electrolytic, 10	52723008
C386	Ceramic, 1500 pF	35693032
C387	Electrolytic, 1	51821106
C388	Poly Film, .0022	52719053
C389	Poly Film, .0056	52719068
C390	Ceramic, 330 pF	35693024
C391	Ceramic, .01	52676107
C392 <sup>1</sup>	Ceramic, 43 pF	35693070
C392 <sup>2,3</sup>	Ceramic, 47 pF	35693015
C393 <sup>1</sup>	Ceramic, 330 pF	35693024
C393 <sup>2,3</sup>	Ceramic, 390 pF	35693025
C394 <sup>1</sup>	Ceramic, 68 pF	35693017
C394 <sup>2,3</sup>	Ceramic, 75 pF	35693061
C395 <sup>1</sup>	Ceramic, 50 pF	35693049
C395 <sup>2,3</sup>	Ceramic, 62 pF	35693071
C396 <sup>1</sup>	Ceramic, .82 pF	724771
C396 <sup>2,3</sup>	Ceramic, 1 pF	35693054
C397 <sup>1</sup>	Ceramic, 36 pF	35693078
C397 <sup>2,3</sup>	Ceramic, 39 pF	35693014
C398 <sup>1</sup>	Ceramic, .82 pF	724771
C398 <sup>2,3</sup>	Ceramic, 1 pF	35693054
C399 <sup>1</sup>	Ceramic, 43 pF	35693070
C399 <sup>2,3</sup>	Ceramic, 47 pF	35693015
C400 <sup>1</sup>	Ceramic, 330 pF	35693024
C400 <sup>2,3</sup>	Ceramic, 390 pF	35693025
C401-404	Ceramic, .01	52676107
C405 <sup>1</sup>	Ceramic, 390 pF	35693025
C405 <sup>2,3</sup>	Ceramic, 470 pF	35693026

878522-*		
Frequency	*Dash No.	Reference No.
169.505-171.905 MHz	-171	1
206.000-207.800 MHz	-207	2
212.000-213.800 MHz	-213	3



**PCB Receive Assembly 878522-\* (Continued)**

Ref No.	Description	Part No.
C406 <sup>1</sup>	Ceramic, 20 pF	35693048
C406 <sup>2,3</sup>	Ceramic, 24 pF	35693060
C407 <sup>1</sup>	Ceramic, 20 pF	35693048
C407 <sup>2,3</sup>	Ceramic, 24 pF	35693060
C408 <sup>1</sup>	Ceramic, 330 pF	35693024
C408 <sup>2,3</sup>	Ceramic, 270 pF	35693076
C409, C410	Ceramic, .01	52676107
C411	Ceramic, 2.2 pF	35693000
C412 <sup>1</sup>	Ceramic, 36 pF	35693078
C412 <sup>2,3</sup>	Ceramic, 39 pF	35693014
C413	Ceramic, .01	52676107
C414	Ceramic, .1	52676113
C415	Ceramic, 100 pF	35693019
C416	Ceramic, .01	52676107
C417	Electrolytic, 10	52723008
C418	Ceramic, 1500 pF	35693032
C419	Electrolytic, 1	51821106
C420	Poly Film, .0022	52719053
C421	Poly Film, .0056	52719068
C422	Ceramic, 330 pF	35693024
C423	Ceramic, .01	52676107
C424 <sup>1</sup>	Ceramic, 39 pF	35693014
C424 <sup>2,3</sup>	Ceramic, 43 pF	35693070
C425 <sup>1</sup>	Ceramic, 270 pF	35693076
C425 <sup>2,3</sup>	Ceramic, 330 pF	35693024
C426 <sup>1</sup>	Ceramic, 62 pF	35693071
C426 <sup>2,3</sup>	Ceramic, 68 pF	35693017
C427 <sup>1</sup>	Ceramic, 43 pF	35693070
C427 <sup>2,3</sup>	Ceramic, 50 pF	35693049
C428	Ceramic, .82 pF	724771
C429 <sup>1</sup>	Ceramic, 30 pF	35693046
C429 <sup>2,3</sup>	Ceramic, 33 pF	35693013
C430	Ceramic, .82 pF	724771
C431 <sup>1</sup>	Ceramic, 39 pF	35693014
C431 <sup>2,3</sup>	Ceramic, 43 pF	35693070
C432 <sup>1</sup>	Ceramic, 270 pF	35693076
C432 <sup>2,3</sup>	Ceramic, 330 pF	35693024
C433-C436	Ceramic, .01	52676107
C437 <sup>1</sup>	Ceramic, 390 pF	35693025
C437 <sup>2,3</sup>	Ceramic, 470 pF	35693026
C438 <sup>1</sup>	Ceramic, 18 pF	35693010
C438 <sup>2,3</sup>	Ceramic, 20 pF	35693038
C439 <sup>1</sup>	Ceramic, 18 pF	35693010
C439 <sup>2,3</sup>	Ceramic, 20 pF	35693038
C440	Ceramic, 270 pF	35693076
C441-C442	Ceramic, .01	52676107
C443	Ceramic, 2.2 pF	35693000
C444 <sup>1</sup>	Ceramic, 30 pF	35693046
C444 <sup>2,3</sup>	Ceramic, 33 pF	35693013
C445	Ceramic, .01	52676107
C446	Ceramic, .1	52676113
C447	Ceramic, 100 pF	35693019
C448	Ceramic, .01	52676107
C449	Electrolytic, 10	52723008
C450	Ceramic, 1500 pF	35693032
C451	Electrolytic, 1	51821106
C452	Poly Film, .0022	52719053
C453	Poly Film, .0056	52719068
C454	Ceramic, 330 pF	35693024
VC301-VC307	Capacitor, Variable	723086-4

Ref No.	Description	Part No.
<b>Integrated Circuits</b>		
U301	IC, NE614	760375
U302	IC, LM393	53284000
U303	IC, NE 5532AN	53295001
U304	IC, NE614	760375
U305	IC, NE 5532AN	53295001
U306	IC, NE614	760375
U307	IC, NE 5532AN	53295001
U308	IC, LM393	53284000
U309	IC, NE614	760375
U310	IC, NE 5532AN	53295001
<b>Potentiometers</b>		
VR301	5K Potentiometer	57148068
VR302	20K Potentiometer	57148071
VR303	5K Potentiometer	57148068
VR304	20K Potentiometer	57148071
VR305	5K Potentiometer	57148068
VR306	20K Potentiometer	57148071
VR307	5K Potentiometer	57148068
VR308	20K Potentiometer	57148071
VR309	50K Variable Resistor	723091-1
<b>Coils and Inductors</b>		
L301, L302	Coil, 2 1/2T, 10 mm	724778
L303 <sup>1</sup>	Coil, 1 3/4T,	724777
L303 <sup>2,3</sup>	Coil, 1 1/4T,	724766
L304 <sup>1</sup>	Coil, 1 3/4T,	724777
L304 <sup>2,3</sup>	Coil, 1 1/4T,	724766
L305	Coil, MC120 red w/case	724775
L306	Coil, 1/4T red w/case	724765
L307 <sup>1</sup>	Coil, 1 3/4T,	724777
L307 <sup>2,3</sup>	Coil, 1 1/4T,	724766
L308 <sup>1</sup>	Inductor, .15 µH	35689041
L308 <sup>2,3</sup>	Inductor, .1 µH	35689045
L309	Inductor, 1 mH	35689035
L310 <sup>1</sup>	Coil, MC120 blue w/case	724767
L310 <sup>2,3</sup>	Coil, MC120 green w/case	724769
<b>Transistors</b>		
Q301	Transistor, NE 25137	760488
Q302, Q303	Transistor, MPS-901	760376
Q304	Transistor, MPS-3640	54734000
Q305	Transistor, MPS-3704	54712000
Q306	Transistor, MPS-3640	54734000
Q307	Transistor, MPS-3704	54712000
Q308	Transistor, MPS-3640	54734000
Q309	Transistor, MPS-3704	54712000
Q310	Transistor, MPS-3640	54734000
Q311	Transistor, MPS-3704	54712000

878522-*		
Frequency	*Dash No.	Reference No.
169.505-171.905 MHz	-171	1
206.000-207.800 MHz	-207	2
212.000-213.800 MHz	-213	3

**PCB Receive Assembly 878522-\* (Continued)**

Ref No.	Description	Part No.
<b>Crystals and Filters</b>		
MX301	Crystal Filter Insulator	450471
Y301 <sup>1</sup>	Mixer, ASK-1	760382
Y301 <sup>2</sup>	Crystal, Receive, 171.905 MHz	780089-1
Y301 <sup>3</sup>	Crystal, Receive, 207.800 MHz	780089-2
FL301, FL302	Crystal, Receive, 213.800 MHz	780089-3
FL303 <sup>1</sup>	Filter, 10.7 Crystal	780087-0
FL303 <sup>2,3</sup>	Filter, 11.56 MHz Crystal	780087-4
FL304 <sup>1</sup>	Filter, 11.075 MHz Crystal	780087-7
FL304 <sup>2,3</sup>	Filter, 11.56 MHz Crystal	780087-4
FL305 <sup>1</sup>	Filter, 11.075 MHz Crystal	780087-7
FL305 <sup>2,3</sup>	Filter, 12.36 MHz Crystal	780087-5
FL306 <sup>1</sup>	Filter, 11.7 MHz Crystal	780087-2
FL306 <sup>2,3</sup>	Filter, 12.36 MHz Crystal	780087-5
FL307 <sup>1</sup>	Filter, 11.7 MHz Crystal	780087-2
FL307 <sup>2,3</sup>	Filter, 13.1 MHz Crystal	780087-6
FL308 <sup>1</sup>	Filter, 12.5 MHz Crystal	780087-3
FL308 <sup>2,3</sup>	Filter, 13.1 MHz Crystal	780087-6
FL309	Filter, 12.5 MHz Crystal	780087-3
	Filter, SFE 10.7 MHz J red	52990001
All resistors in ohms, 1/8 Watt, 5%, unless noted.		
<b>Resistors</b>		
R301	1K	52154060
R302	10K	52154036
R303	130	52154081
R304	10	52154108
R305	1K	52154060
R306, R307	100	52154084
R308 <sup>1</sup>	470	52154068
R308 <sup>2,3</sup>	180	52154078
R309-R311	10K	52154036
R312	22	52154100
R313	240	52154075
R314	4.7K	52154044
R315	1.5K	52154056
R316	16K	52154031
R317	220	52154076
R318	330	52154072
R319	1.5K	52154056
R320	10M, 1/4 watt	52154185
R321	10K	52154036
R322	22K	52154028
R323	100K	52154012
R324	220K	52154004
R325-R327	10K	52154036
R328	68K	52154016
R329-R331	10K	52154036
R332	4.7K	52154044
R333	1.5K	52154056
R334	16K	52154031
R335, R336	220	52154076
R337	1.5K	52154056
R338	10M, 1/4 watt	52154185
R339	10K	52154036
R340	22K	52154028
R341	100K	52154012
R342	220K	52154004
R343-R345	10K	52154036
R346	68K	52154016
R347-R349	10K	52154036
R350	4.7K	52154044

Ref No.	Description	Part No.
R351	1.5K	52154056
R352	16K	52154031
R353, R354	220	52154076
R355	1.5K	52154056
R356	10M, 1/4 watt	52154185
R357	10K	52154036
R358	22K	52154028
R359	100K	52154012
R360	220K	52154004
R361-R363	10K	52154036
R364	68K	52154016
R365-R367	10K	52154036
R368	4.7K	52154044
R369	1.5K	52154056
R370	16K	52154031
R371, R372	220	52154076
R373	1.5K	52154056
R374	10M, 1/4 watt	52154185
R375	10K	52154036
R376	22K	52154028
R377	100K	52154012
R378	220K	52154004
R379-R381	10K	52154036
R382	68K	52154016
R383-R385	10K	52154036
R386	2.2K	52154052
R387-R390	10K	52154036

<b>Connectors</b>		
P301-P307	(Not Used)	
P308-P311	3 Pin Header	670062
P312	(Not Used)	
P313	3 Pin Header	670062

<b>Transformers</b>		
T301-T303	Transformer	724770
T304, T305	Transformer	724774
T306, T307	(Not Used)	
T308-T324	Transformer	724774

<b>Diodes</b>		
D301-D304	Diode, 1N4148	52228000

878522-*		
Frequency	*Dash No.	Reference No.
169.505-171.905 MHz	-171	1
206.000-207.800 MHz	-207	2
212.000-213.800 MHz	-213	3

## PCB Receive Assembly 878662-\*

Ref No.	Description	Part No.
	Printed Circuit Board, Receive	750309
<b>Capacitors</b>		
All capacitors in microfarads unless noted.		
Ref No.	Description	Part No.
C301 <sup>1</sup>	Ceramic, 5.6 pF	35693004
C301 <sup>2,3</sup>	Ceramic, 4.7 pF	35693003
C302 <sup>1</sup>	Ceramic, .82 pF	52007003
C302 <sup>2,3</sup>	Ceramic, .5 pF	52007000
C303 <sup>1</sup>	Ceramic, .5 pF	52007000
C303 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C304, C305	Ceramic, 100 pF	35693019
C306	Ceramic, Z5U, .001	52676101
C307 <sup>1</sup>	Ceramic, .5 pF	52007000
C307 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C308 <sup>1</sup>	Ceramic, 1.2 pF	52007009
C308 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C309	Ceramic, Z5U, .001	52676101
C310	Ceramic, .33 pF	35693013
C311	Ceramic, 47 pF	35693015
C312	Ceramic, Z5U, .0047	52676105
C313 <sup>1</sup>	Ceramic, .5 pF	52007000
C313 <sup>2,3</sup>	Ceramic, .33 pF	52007012
C314-C316	Ceramic, Z5U, .01	52676107
C317	Ceramic, 100 pF	723023
C318	Ceramic, .001	102881301
C319	(Not Used)	
C320	Ceramic, Z5U, .01	52676107
C321	Ceramic, 180 pF	35693022
C322	Ceramic, 56 pF	35693016
C323	Ceramic, 68 pF	35693017
C324	Ceramic, 220 pF	35693023
C325-C327	Ceramic, Z5U, .1	52676113
C328	Ceramic, 100 pF	35693019
C329	Ceramic, Z5U, .0047	52676105
C330, C331	Ceramic, 120 pF	35693020
C332	Ceramic, Z5U, .1	52676113
C333, C334	Electrolytic, 1.0	52723025
C335	Mylar, .015	52719058
C336	Ceramic, Z5U, .1	52676113
C337	Mylar, .0022	52719053
C338	Mylar, .0056	52719068
C339	Ceramic, 330 pF	35693024
C340	Ceramic, Z5U, .001	52676101
C341-C369	(Not Used)	
C370	Ceramic, Z5U, .01	52676107
C371	Ceramic, 180 pF	35693022
C372	Ceramic, 50 pF	35693049
C373	Ceramic, 68 pF	35693017
C374	Ceramic, 220 pF	35693023
C375-C377	Ceramic, Z5U, .1	52676113
C378	Ceramic, 100 pF	35693019
C379	Ceramic, Z5U, .0047	52676105
C380, C381	Ceramic, 120 pF	35693020
C382	Ceramic, Z5U, .1	52676113
C383, C384	Electrolytic, 1.0	52723025
C385	Mylar, .015	52719058
C386	Ceramic, Z5U, .1	52676113
C387	Mylar, .0022	52719053
C388	Mylar, .0056	52719068
C389	Ceramic, 330 pF	35693024
C390	Ceramic, Z5U, .001	52676101
C391-C419	(Not Used)	

Ref No.	Description	Part No.
C420	Ceramic, Z5U, .01	52676107
C421 <sup>1</sup>	Ceramic, 150 pF	35693021
C421 <sup>2,3</sup>	Ceramic, 180 pF	35693022
C422 <sup>1</sup>	Ceramic, 43 pF	35693070
C422 <sup>2,3</sup>	Ceramic, 50 pF	35693049
C423	Ceramic, 68 pF	35693017
C424	Ceramic, 220 pF	35693023
C425-C427	Ceramic, Z5U, .1	52676113
C428	Ceramic, 100 pF	35693019
C429	Ceramic, Z5U, .0047	52676105
C430, C431	Ceramic, 120 pF	35693020
C432	Ceramic, Z5U, .1	52676113
C433, C434	Electrolytic, 1.0	52723025
C435	Mylar, .015	52719058
C436	Ceramic, Z5U, .1	52676113
C437	Mylar, .0022	52719053
C438	Mylar, .0056	52719068
C439	Ceramic, 330 pF	35693024
C440	Ceramic, Z5U, .001	52676101
C441-C469	(Not Used)	
C470	Ceramic, Z5U, .01	52676107
C471	Ceramic, 150 pF	35693021
C472 <sup>1</sup>	Ceramic, 39 pF	35693014
C472 <sup>2,3</sup>	Ceramic, 43 pF	35693070
C473	Ceramic, 68 pF	35693017
C474	Ceramic, 220 pF	35693023
C475-C477	Ceramic, Z5U, .1	52676113
C478	Ceramic, 100 pF	35693019
C479	Ceramic, Z5U, .0047	52676105
C480, C481	Ceramic, 120 pF	35693020
C482	Ceramic, Z5U, .1	52676113
C483, C484	Electrolytic, 1.0	52723025
C485	Mylar, .015	52719058
C486	Ceramic, Z5U, .1	52676113
C487	Mylar, .0022	52719053
C488	Mylar, .0056	52719068
C489	Ceramic, 330 pF	35693024
C490	Ceramic, Z5U, .001	52676101
VC301-VC308	Capacitor, Trimmer	723086-4
<b>Integrated Circuits</b>		
U320	IC, MC3359 MOT	760494
U321	IC, NE 5532	53295001
U370	IC, MC3359 MOT	760494
U371	IC, NE 5532	53295001
U420	IC, MC3359 MOT	760494
U421	IC, NE 5532	53295001
U470	IC, MC3359 MOT	760494
U471	IC, NE 5532	53295001

878662-*		
Frequency	*Dash No.	Reference No.
171 MHz	-171	1
207 MHz	-207	2
213 MHz	-213	3

**PCB Receive Assembly 878662-\* (Continued)**

Ref No.	Description	Part No.
<b>Potentiometers</b>		
VR320	20K Potentiometer	57148071
VR321	50K Potentiometer	57148072
VR370	20K Potentiometer	57148071
VR371	50K Potentiometer	57148072
VR420	20K Potentiometer	57148071
VR421	50K Potentiometer	57148072
VR470	20K Potentiometer	57148071
VR321	50K Potentiometer	57148072
<b>Coils and Chokes</b>		
L301, L302	Coil, 2 1/2T, 10 mm	724778
L303, L304	Coil, 2 1/2 CT, 10 mm	724766
L305	Coil, 2 1/2T, 10 mm	724775
L306	Coil, 2 1/4T, 1/4 Tap, 10 mm	724765
L307 <sup>1</sup>	Coil, TOKO, Red	723403-3
L307 <sup>2</sup>	Coil, TOKO, Brown	723403-2
L307 <sup>3</sup>	Coil, TOKO, Black	723403-1
L308 <sup>1</sup>	Inductor, .22 μH	35689047
L308 <sup>2,3</sup>	Inductor, .15 μH	35689041
L309	Coil, 2 1/2 CT 10 mm	724766
L310	Inductor, 56 μH	35689020
L311, L312	Inductor, 10 μH	35689011
L313	Coil, 2 1/4T, 1/4 Tap, 10 mm	724765
L314-L319	(Not Used)	
L320	Inductor, 10 μH	35689011
L321	Inductor, 3.95 μH	724774
L322	Coil, 455 kHz, discriminator	52982000
L323	Coil, IF, 10.7 MHz	53029000
L324-L369	(Not Used)	
L370	Inductor, 10 μH	35689011
L371	Inductor, 3.95 μH	724774
L372	Coil, 455 kHz, discriminator	52982000
L373	Coil, IF, 10.7 MHz	53029000
L374-L419	(Not Used)	
L420	Inductor, 10 μH	35689011
L421	Inductor, 3.95 μH	724774
L422	Coil, 455 kHz, discriminator	52982000
L423	Coil, IF, 10.7 MHz	53029000
L424-L469	(Not Used)	
L470	Inductor, 10 μH	35689011
L471	Inductor, 3.95 μH	724774
L472	Coil, 455 kHz, discriminator	52982000
L473	Coil, IF, 10.7 MHz	53029000
FB321	Ferrite Bead	56632007
FB371	Ferrite Bead	56632007
FB421	Ferrite Bead	56632007
<b>Transistors</b>		
Q301	GAASFET, NE 25139	760392
Q302	Transistor, MPS901	760376
Q303	JFET, J309	54722000
Q320	Transistor, MPSH10	54736000
Q321, Q322	Transistor, MPS3704	54712000
Q370	Transistor, MPSH10	54736000
Q371, Q372	Transistor, MPS3704	54712000
Q420	Transistor, MPSH10	54736000
Q421, Q422	Transistor, MPS3704	54712000
Q470	Transistor, MPSH10	54736000
Q471, Q472	Transistor, MPS3704	54712000

Ref No.	Description	Part No.
<b>Crystals and Filters</b>		
	Crystal Filter Insulator	450471
	Crystal Insulator	450474
	Mixer, ASK1	760382
HY301		
Y301 <sup>1</sup>	Crystal, Receive, 171.905 MHz	780092-1
Y301 <sup>2</sup>	Crystal, Receive, 207.8 MHz	780092-2
Y301 <sup>3</sup>	Crystal, Receive, 213.8 MHz	780092-3
Y320	Crystal, Receive, 10.245 MHz	780088
Y370 <sup>1</sup>	Crystal, Receive, 12.015 MHz	780088-6
Y370 <sup>2,3</sup>	Crystal, Receive, 11.53 MHz	780088-3
Y420 <sup>1</sup>	Crystal, Receive, 12.815 MHz	780088-7
Y420 <sup>2,3</sup>	Crystal, Receive, 12.155 MHz	780088-4
Y470 <sup>1</sup>	Crystal, Receive, 12.555 MHz	780088-8
Y470 <sup>2,3</sup>	Crystal, Receive, 12.955 MHz	780088-5
CF320, CF321	Filter, 10.7 Crystal	780087-0
CF322	Filter, 455 kHz Ceramic	723088
CF370 <sup>1</sup>	Filter, 11.56 MHz Crystal	780087-4
CF370 <sup>2,3</sup>	Filter, 11.075 MHz Crystal	780087-7
CF371 <sup>1</sup>	Filter, 11.56 MHz Crystal	780087-4
CF371 <sup>2,3</sup>	Filter, 11.075 MHz Crystal	780087-7
CF372	Filter, 455 kHz Ceramic	723088
CF420 <sup>1</sup>	Filter, 12.36 MHz Crystal	780087-5
CF420 <sup>2,3</sup>	Filter, 11.7 MHz Crystal	780087-2
CF421 <sup>1</sup>	Filter, 12.36 MHz Crystal	780087-5
CF421 <sup>2,3</sup>	Filter, 11.7 MHz Crystal	780087-2
CF422	Filter, 455 kHz Ceramic	723088
CF470 <sup>1</sup>	Filter, 13.1 MHz Crystal	780087-6
CF470 <sup>2,3</sup>	Filter, 12.5 MHz Crystal	780087-3
CF471 <sup>1</sup>	Filter, 13.1 MHz Crystal	780087-6
CF471 <sup>2,3</sup>	Filter, 12.5 MHz Crystal	780087-3
CF472	Filter, 4% kHz, Ceramic	620088
<b>All resistors in ohms, 1/8 Watt, 5%, unless noted.</b>		
<b>Resistors</b>		
R301	1K	52154060
R302	10K	52154036
R303	33	52154096
R304	10	52154108
R305	1K	52154060
R306	150	52154301
R307	3.3K	52154048
R308, R309	10K	52154036
R310	100	52154084
R311, R312	470	52154068
R313	10K	52154036
R314	2.2K	52154052
R315	47K	52154020
R316-R319	(Not Used)	
R320	1.2K	52154058
R321	220	52154076
R322	68K	52154016
R323	1.5K	52154056
R324	1K	52154060
R325	330K	52154000
R326	220K	52154004

<b>878662-*</b>		
Frequency	*Dash No.	Reference No.
171 MHz	-171	1
207 MHz	-207	2
213 MHz	-213	3

**PCB Receive Assembly 878662-\* (Continued)**

**Resistors (Continued)**

Ref No.	Description	Part No.
R327	100K	52154012
R328	13K	52154033
R329, R330	220K	52154004
R331	100	52154084
R332-R334	10K	52154036
R335-R369	(Not Used)	
R370	1.2K	52154058
R371	220	52154076
R372	68K	52154016
R373	1.5K	52154056
R374	1K	52154060
R375	330K	52154000
R376	220K	52154004
R377	100K	52154012
R378	13K	52154033
R379, R380	220K	52154004
R381	100	52154084
R382-R384	10K	52154036
R385-R419	(Not Used)	
R420	1.2K	52154058
R421	220	52154076
R422	68K	52154016
R423	1.5K	52154056
R424	1K	52154060
R425	330K	52154000
R426	220K	52154004

Ref No.	Description	Part No.
R427	100K	52154012
R428	13K	52154033
R429, R430	220K	52154004
R431	100	52154084
R432-R434	10K	52154036
R435-R469	(Not Used)	
R470	1.2K	52154058
R471	220	52154076
R472	68K	52154016
R473	1.5K	52154056
R474	1K	52154060
R475	330K	52154000
R476	220K	52154004
R477	100K	52154012
R478	13K	52154033
R479, R480	220K	52154004
R481	100	52154084
R482-R484	10K	52154036
Connectors		
P301	3 Pin Header	670062
P320	3 Pin Header	670062
P370	3 Pin Header	670062
P420	3 Pin Header	670062
P470	3 Pin Header	670062

# AUDIO BOARD

## AUDIO BOARD CIRCUIT DESCRIPTION

The audio board receives signals from the receive board, the headset microphone, intercom input and auxiliary input, and outputs to the transmit board, the headset carpiece, an external speaker, intercom out and auxiliary out (see block diagram).

### Receive Expanders

Audio from the receive board is routed through J108, J109, J110 and J111 to U112 and U113. The gain of these devices is controlled by the audio level at the rectifier pins (4 and 16). As the level increases, so does the gain, and this results in a 2:1 linear expander characteristic. This complements the processing done in the transmitter. The audio is then buffered and delivered to the remote select switches.

### Microphone Amplifier

From the headset connector the microphone signal is amplified by U103. Depending upon which type of microphone is used, S102 is set by the user to dynamic or electret. The electret position provides an 11 dB drop in gain to compensate for the extra output. The amplifier is peak limiting, and responds to either positive or negative peaks exceeding about 1.1 volts in amplitude. Peak detectors Q106 and Q107 charge C120 and C121, driving Q105 toward pinchoff. This reduces the gain momentarily until the input signal is reduced. Visual indication of peak limiting is provided by D608 which is driven by U105 when the voltage at pin 6 exceeds half a volt. D111 (version 3 and later) isolates the time constant of the amplifier from that of the LED driver. The latter is much shorter than the former, and causes the LED to extinguish immediately upon removing the input signal. On versions 1 and 2 the LED will remain lit for several seconds. VR604 is adjusted by the user for maximum input with minimal limiting. Q104 is used to turn the microphone on and off and is driven by the push-to-talk latch circuit. When S110 is pressed in and held, the state of U116B follows the switch and turns on Q110 and Q111 via D110. This lights D609 and gates on the microphone audio. Releasing S110 turns off the microphone.

U116A does not change state under these conditions because C182 is discharged when the clock is pulsed. If, however, S110 is depressed twice in quick succession, C182 will be charged for the second clock pulse and this will set U116A. Now the microphone is latched on via D109 and will remain on until S110 is depressed once again, resetting U116A.

### Auxiliary Input Amplifier

Audio from J101 is attenuated and converted from balanced to single-ended by U101A. U101B, U102A, Q101, Q102 and Q103 form a peak limiting amplifier identical to that described for the microphone above. S101 not only enables the audio path for the auxiliary input but also lights D607 to half-brilliance to indicate active auxiliary. When peak limiting occurs U105A shorts out R120 and D607 is brought to full brilliance.

### Intercom Driver

U107A is configured as an AC current source whose output current equals the input voltage at C125 divided by the value of R158. Thus the voltage gain is dependent on the value of the load. In this way many such intercom stations can be connected in parallel without each successive station loading the line. A single load resistor is usually located in the power supply for the wired intercom. On versions 3 and later, U107B is used to drive the lower end of T101. This section is not a current source and was added to provide more headroom. To this end, U107 is operated from the higher voltage ahead of the regulator. S104 is a 9 section DIP switch which is used to configure the base for compatibility with a specific wired intercom. S103 functions as either an intercom on/off switch (Telex, Clearcom standard) or as a channel A/B switch (RTS, Clearcom TW). In the case where the intercom interface is disconnected by S103, R186 functions as the load resistor. The full secondary of T101 is used for 300 ohm intercoms; the tap is used for 200 ohm systems. On version 2 and later, S112 allows selection of either low output (100 mV) or high output (800 mV).

### **Intercom Input**

Since U107A is a current source, signals arriving from an external intercom appear unloaded at pin 1 and are coupled via C126 and R154 to U106. To prevent intercom output signals from appearing at the output of U106, these signals are nulled by the branch containing C124, VR101 and R152. U106A and U109 form a peak limiting amplifier similar to that described for the microphone amplifier above, except that CA101 is used instead of a JFET to control the gain. The reason for this is that the higher level signals being handled by U106A would cause high distortion if a JFET were used. CA101 is merely an LDR (light dependent resistor) together with an LED in the same package. More current through the LED reduces the value of resistance.

### **Headset and Speaker Amplifiers**

U111 and U119B (U107B in versions 1 and 2) drive the headset while U108 drives the external speaker jack. On versions 1 and 2 this signal was derived by mixing the microphone signal with the intercom output, via R175 and R177. On later versions the intercom output alone is used, being first amplified by U119A. S112B maintains the headset/speaker level constant when switching intercom output levels.

### **Transmit Mixer and Filter**

U106B mixes the intercom input, auxiliary input, microphone and receive board signals together to modulate the transmitter. VR102 is used to set the level going into the transmit compressor for proper tracking. On versions 3 and later, U118 acts as a four pole Chebyshev low pass filter with a cutoff frequency of 5 KHz. This is to prevent transmission of the 20 KHz tone which Telex intercoms use as the call signal.

### **Auxiliary Output**

U110A mixes together intercom input, microphone, and receive board signals. U110B inverts the resultant to provide a balanced output.

### **Remote Transmit Circuit**

When the transmit switch on the rear panel is in the remote position, the transmitter will only operate when at least one receive squelch is open. On versions 1 through 4 this is done with U115 which turns on Q109. Versions 3 and 4 have a circuit board error, however, which prevents this option from working. To correct this move the inputs of U115 to the left side (on the schematic) of R195, R198, R201, and R204. The version 3 and 4 schematics show these inputs as they are unmodified, that is, connected to the right side of the resistors. On versions 5 and above, U115 is replaced with Q112, Q113, Q114 and Q115 and no modifications are necessary.

### **Power Supply**

Q108 and U114 form a 10 volt regulated power supply. On versions 1 and 2, ZD101 is used as the 5 volt reference while on later versions this comes from U117. U112 and U113 are also supplied by U117.

## ALIGNMENT PROCEDURE:

### Equipment Required:

- Signal Generator
- Audio Generator
- Deviation Meter
- Audio Voltmeter

1. Connect the audio generator to the AUX IN jack and set the output to 20 mV at 1 KHz.
2. Select the AUX pushbutton on the front panel.
3. Adjust VR601 (located just under the I/C pushbutton on the front panel) to maximum counterclockwise.
4. If the base is configured for an RTS intercom connect the load to the I/C jack on the rear panel.
5. Connect the audio voltmeter to the AUX OUT jack on the rear panel.
6. Adjust VR101 for a minimum reading.
7. Disconnect the generator and meter from the AUX jacks and de-select the AUX pushbutton on the front panel.
8. Connect the signal generator to the Receive Antenna jack. Set the deviation to  $\pm 3$  KHz at 1 KHz. Set the output to 1 mV. Set the frequency to the channel 1 frequency listed in the chart of the receive board alignment.
9. Select the channel 1 pushbutton on the front panel.
10. Connect the deviation meter to the ANT TRANS jack.
11. Connect the audio voltmeter to U106 pin 7.
- 12A. On version 1 and 2 audio boards, adjust VR102 for 300 mV of audio.
- 12B. On version 3 and later audio boards with version 1 transmit boards, adjust VR102 for 1 volt of audio.
- 12C. On version 3 and later audio boards with version 2 transmit boards, first move the audio voltmeter to U501 pin 16 (on the transmit board). Then adjust VR102 for 140 mV of audio.
13. Adjust VR501 for  $\pm 4.2$  KHz deviation.



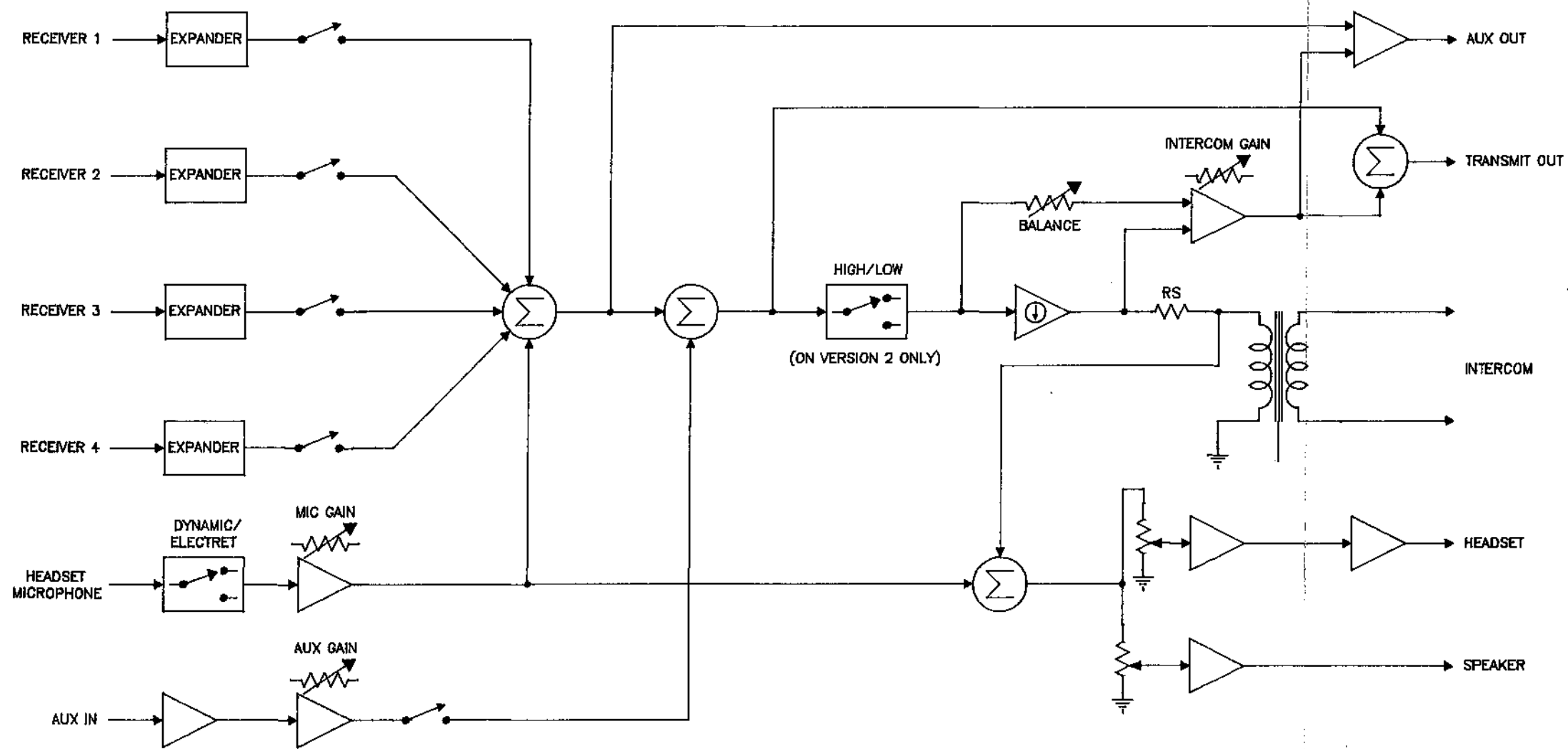


Figure 19  
Block Diagram Versions 1 and 2

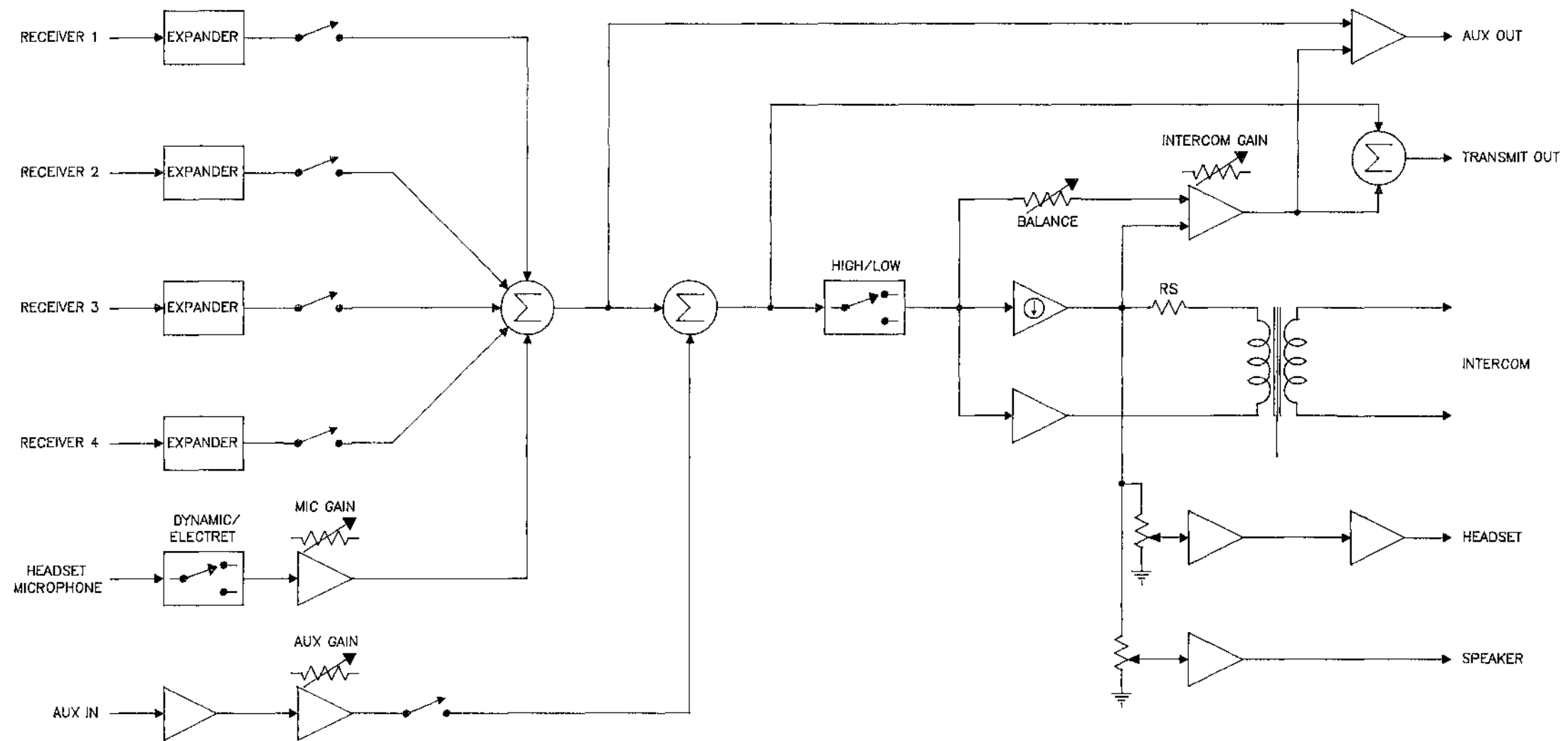


Figure 20  
Block Diagram Versions 3 thru 6

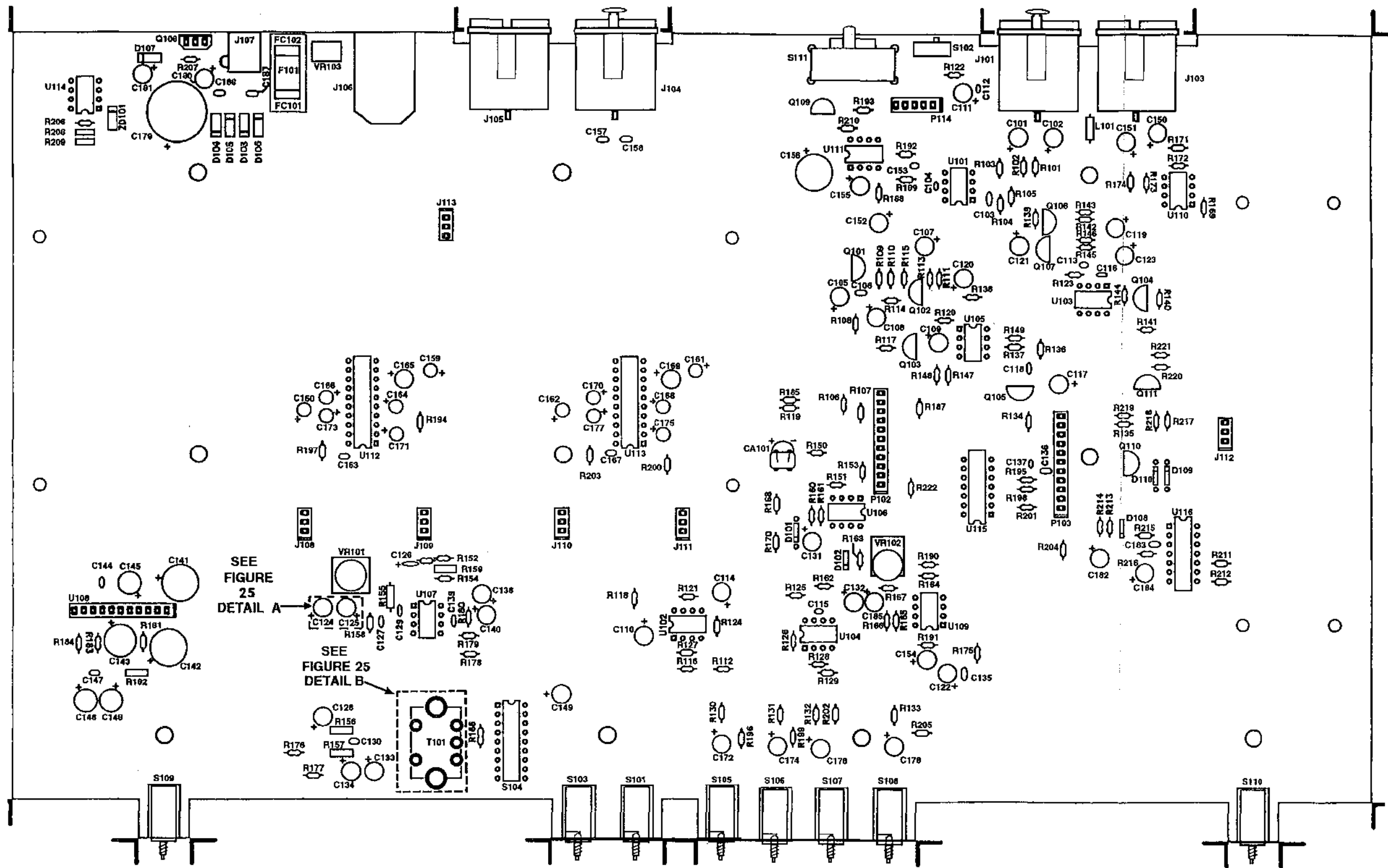


Figure 21  
Audio Board Component Layout (Component Side)  
Versions 1 and 2

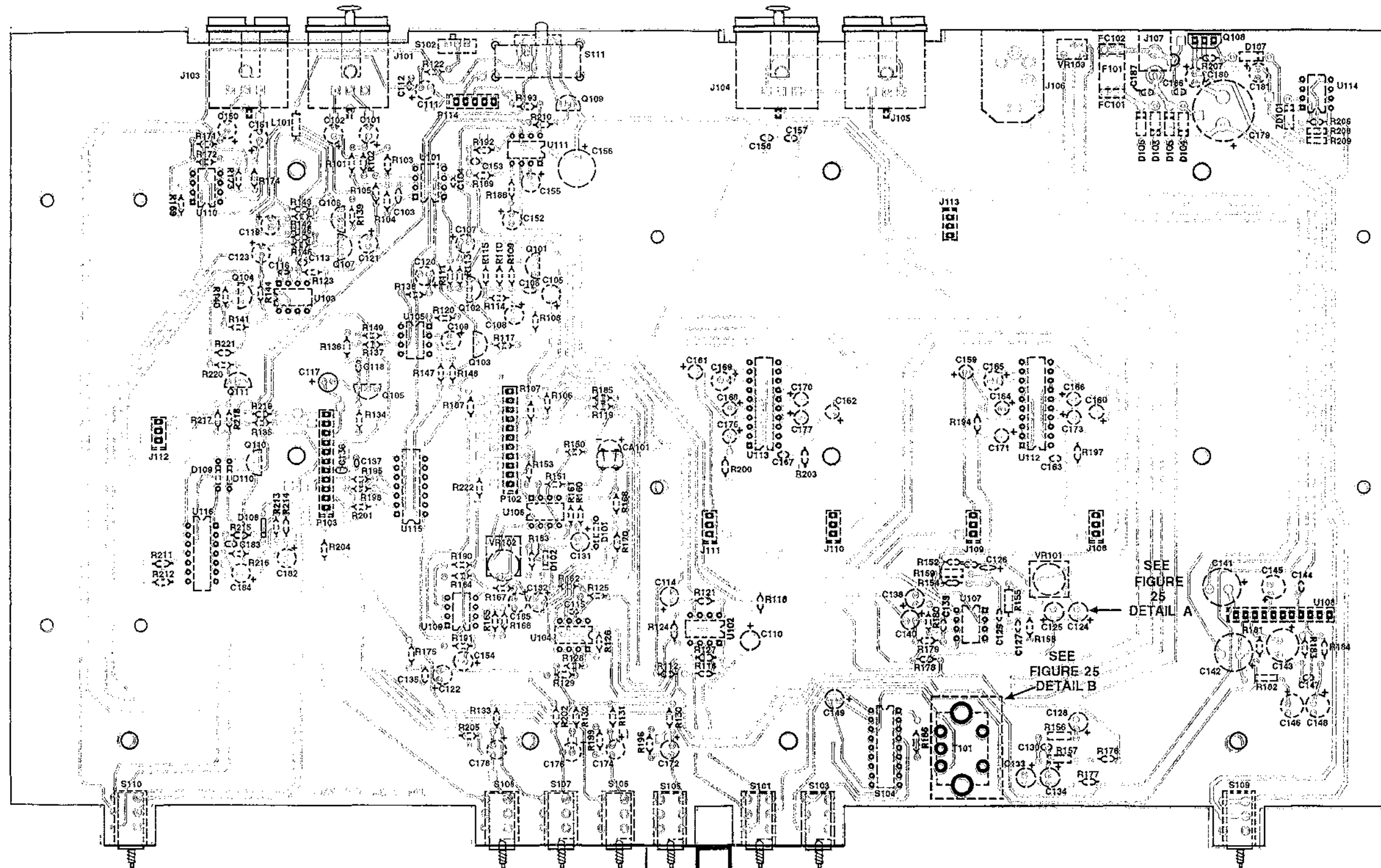
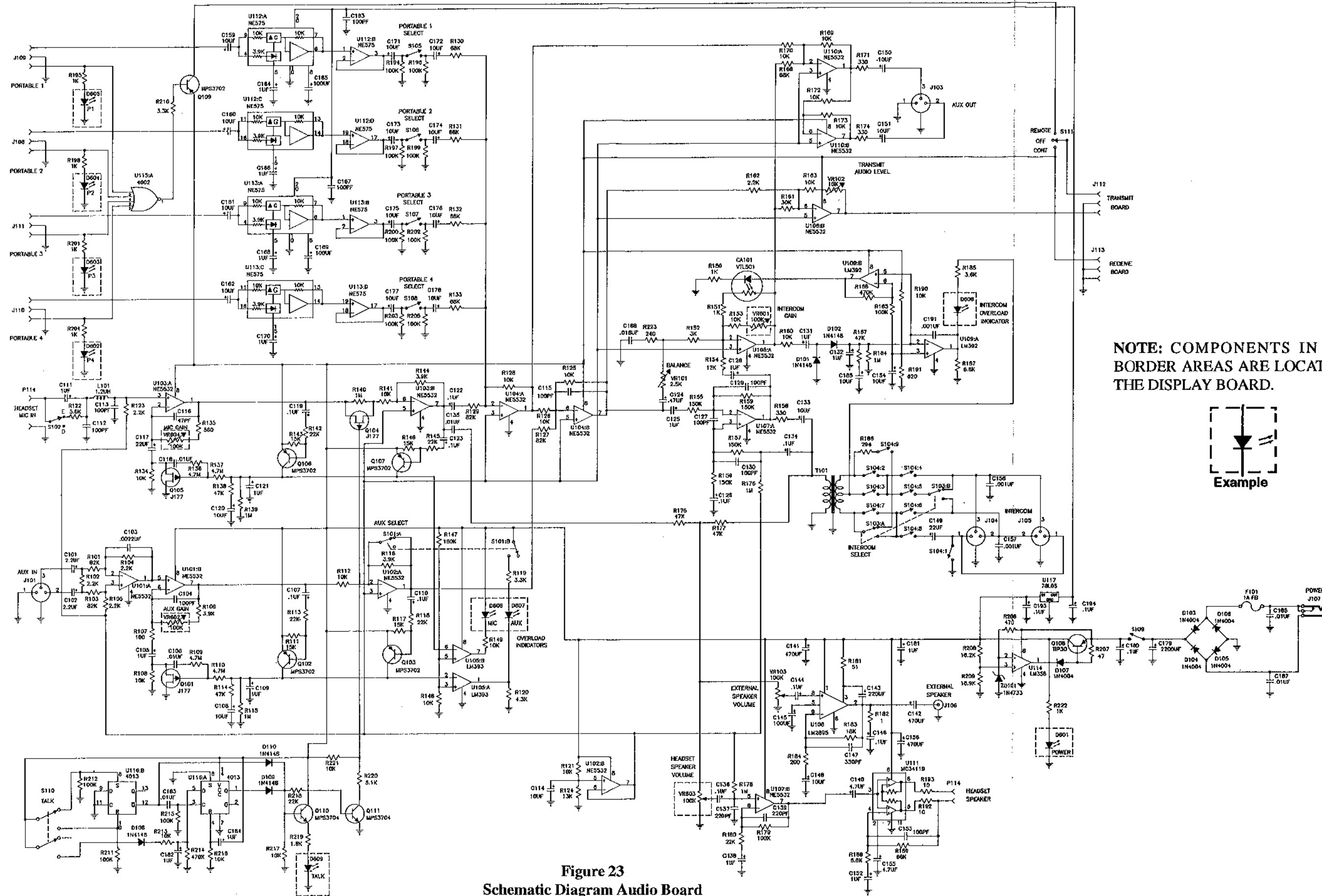


Figure 22  
 Audio Board Component Layout (Foil Side)  
 Versions 1 and 2



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

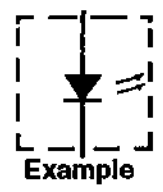
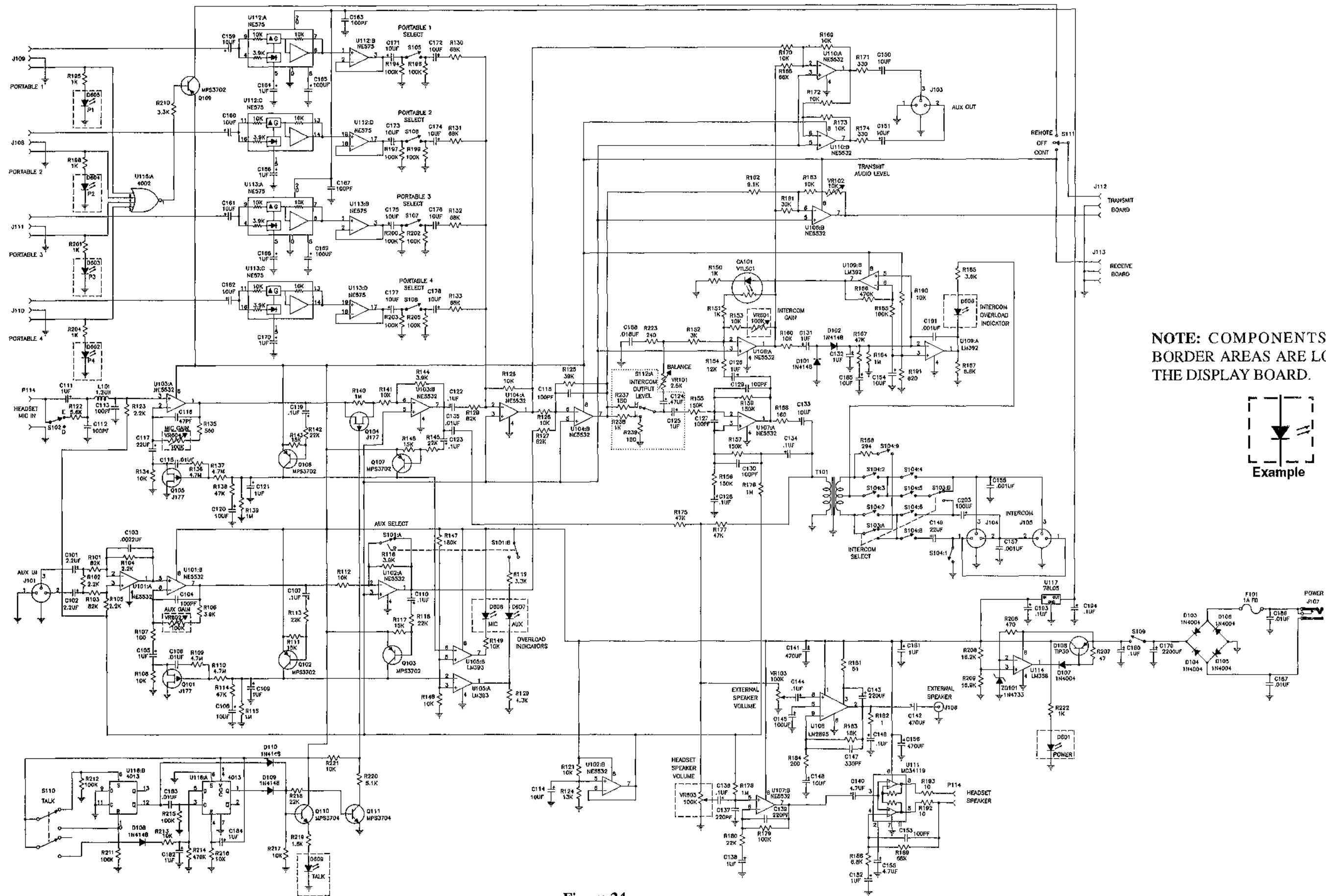


Figure 23  
Schematic Diagram Audio Board  
Version 1



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

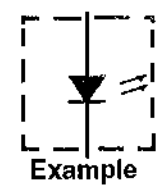
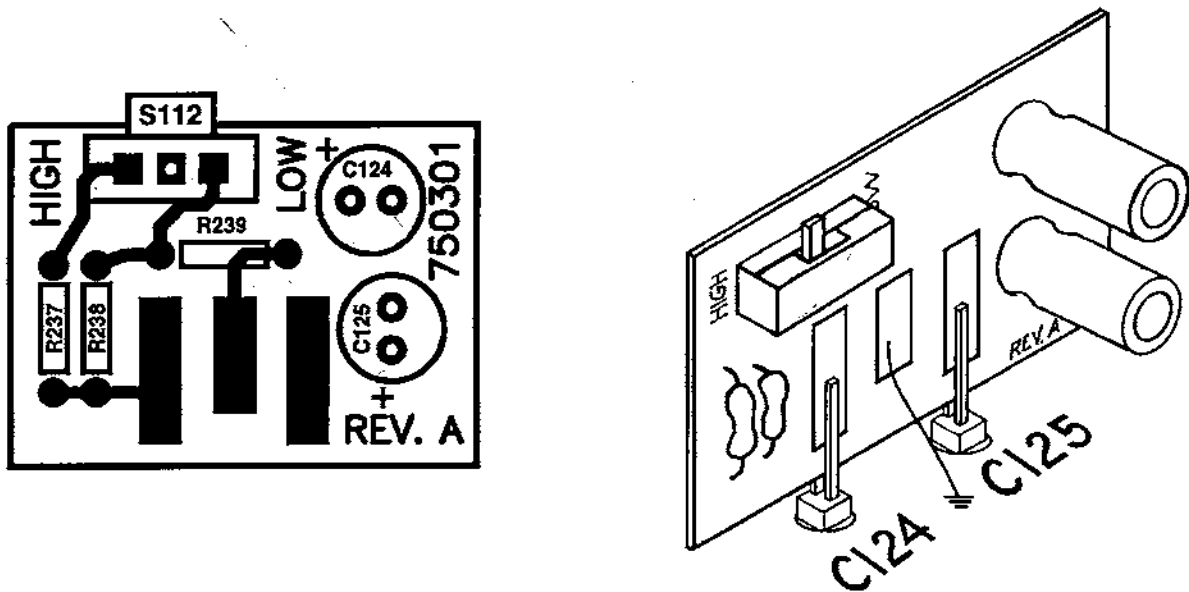


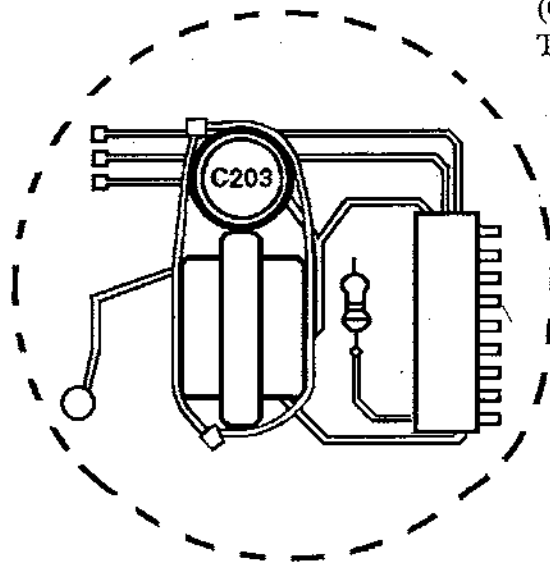
Figure 24  
Schematic Diagram Audio Board  
Version 2

**NOTE: VERSION 1 DOES NOT HAVE THE SWITCH BOARD ASSEMBLY. C124 AND C125 WILL BE LOCATED ON THE AUDIO BOARD RATHER THAN ON THE SWITCH BOARD.**



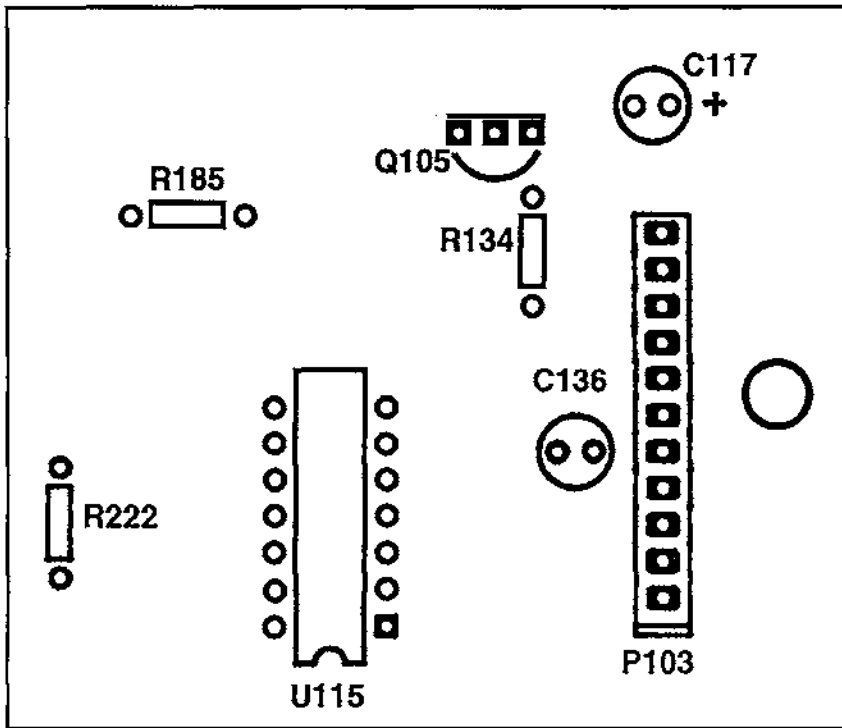
**Detail A**

**NOTE: VERSION 1 DOES NOT HAVE THE ADDED CAPACITOR (C203) LOCATED NEXT TO THE TRANSFORMER.**



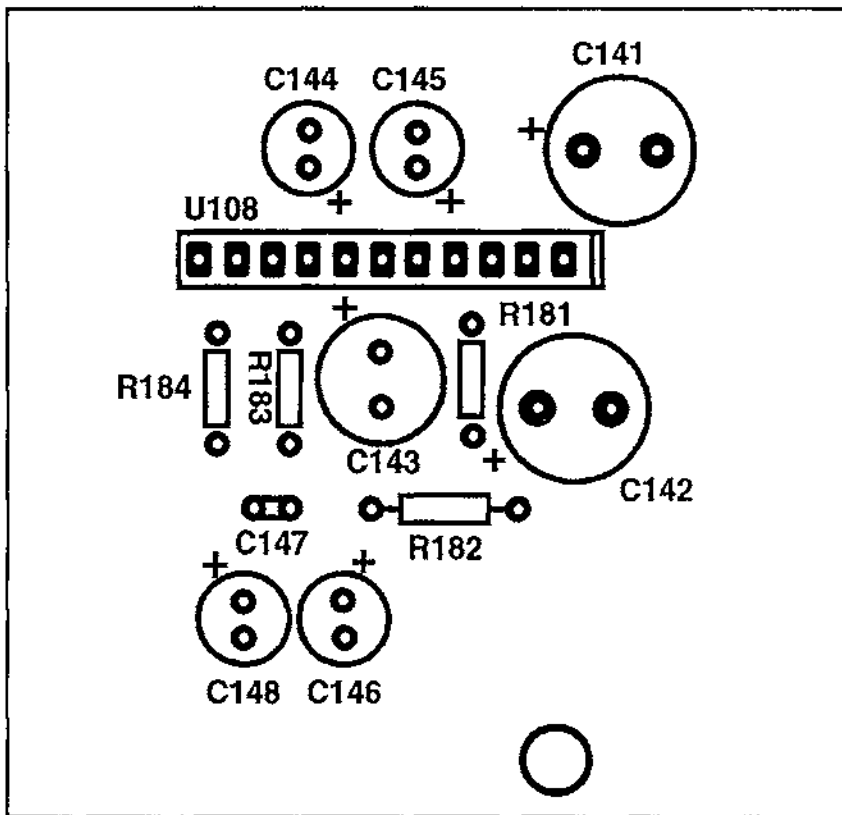
**Detail B**

**Figure 25  
Details of Board Differences Between Versions 1 and 2**



NOTE: THIS AREA OF THE BOARD WILL LOOK LIKE THIS ON VERSION 3 AND 4 BOARD ONLY. VERSIONS 5 AND 6 WILL REFLECT WHAT IS SHOWN ON FIGURE 27.

Detail A



NOTE: THIS AREA OF THE BOARD WILL LOOK LIKE THIS ON VERSIONS 3, 4, AND 5 BOARD ONLY. VERSIONS 6 WILL REFLECT WHAT IS SHOWN ON FIGURE 27.

Detail B

Figure 26  
Details of Board Difference in Versions 3, 4, 5, and 6



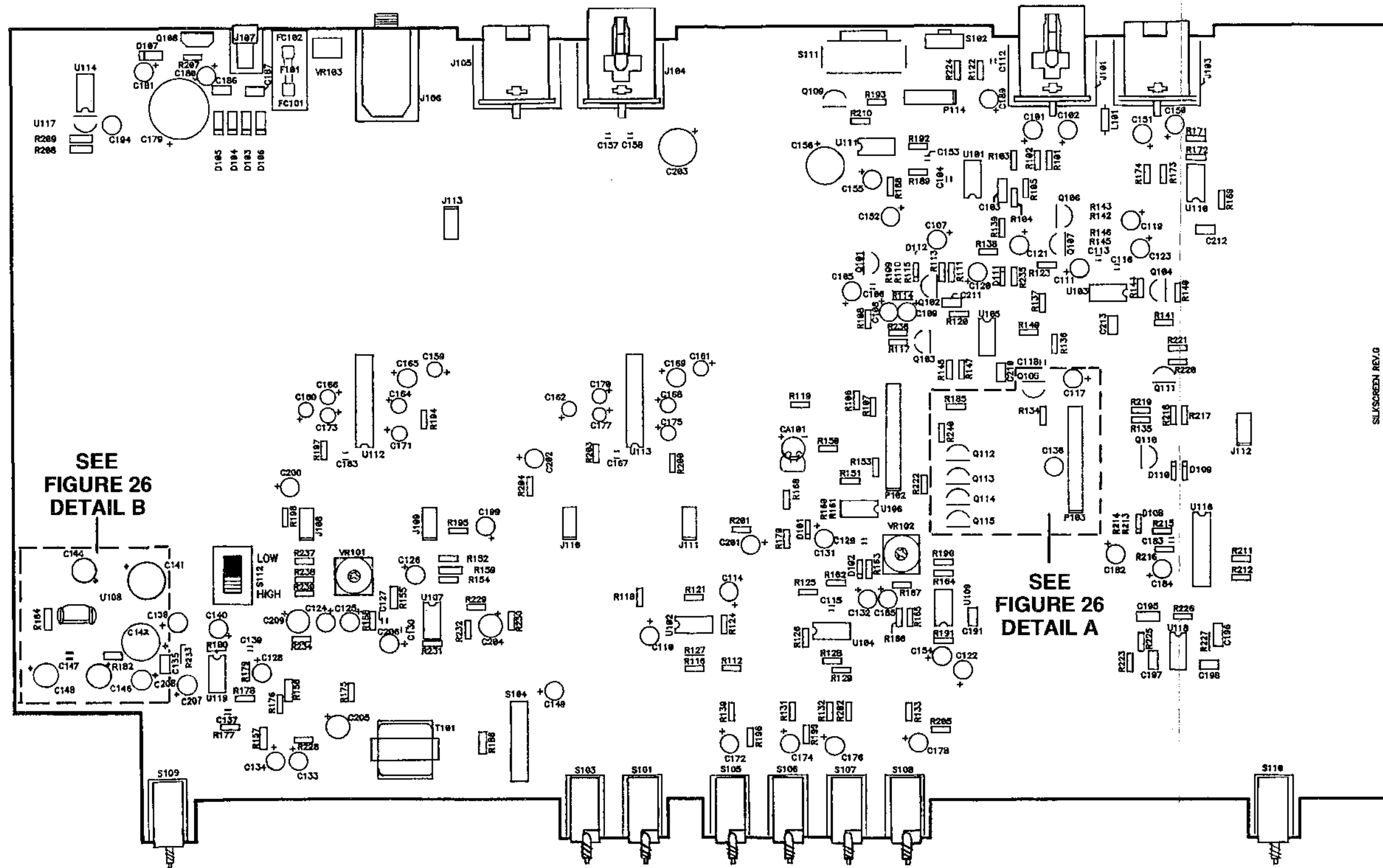


Figure 27  
 Audio Board Component Layout (Component Side)  
 Version 6 with Detailed Areas Showing Differences of Versions  
 3, 4, 5, and 6

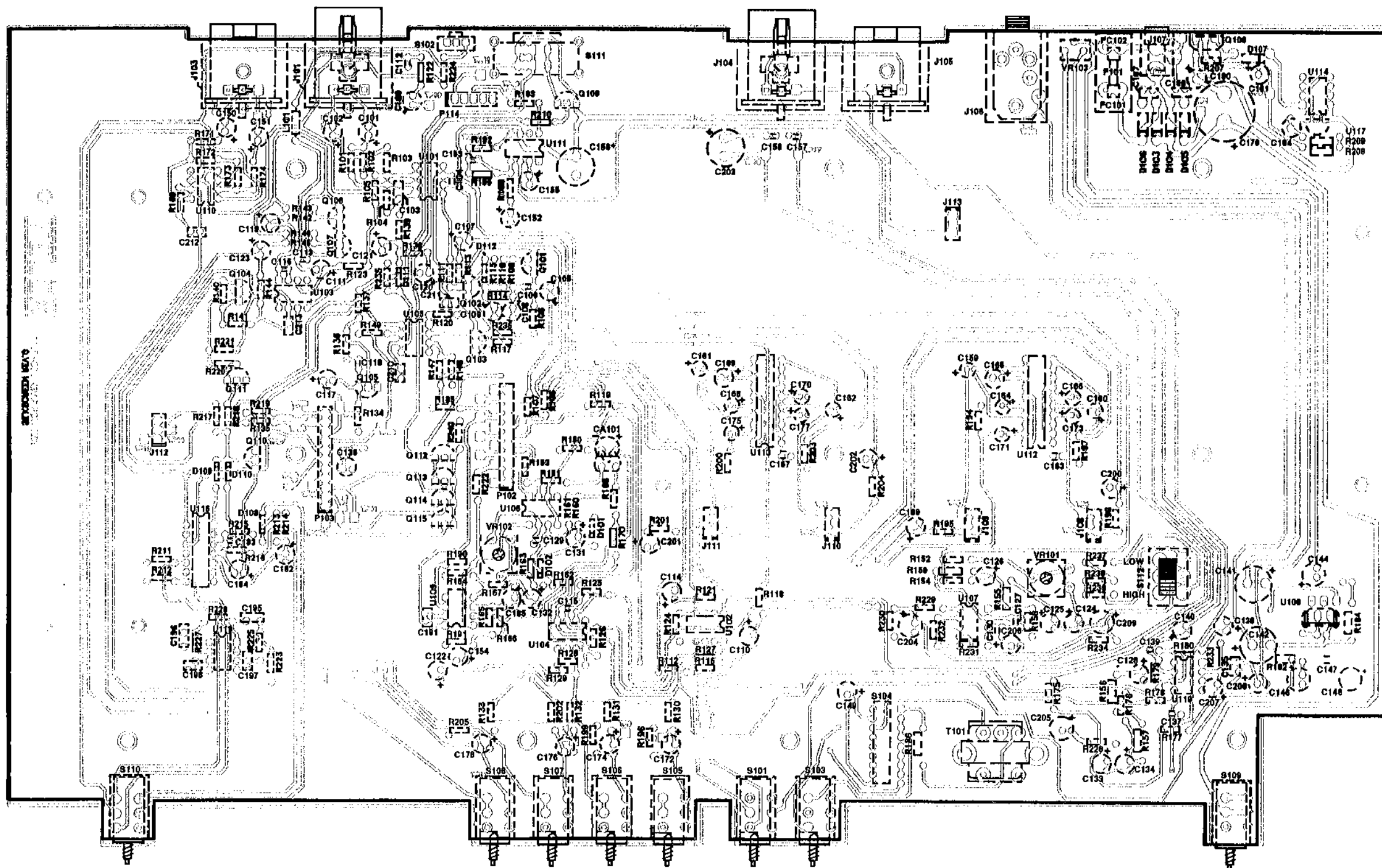
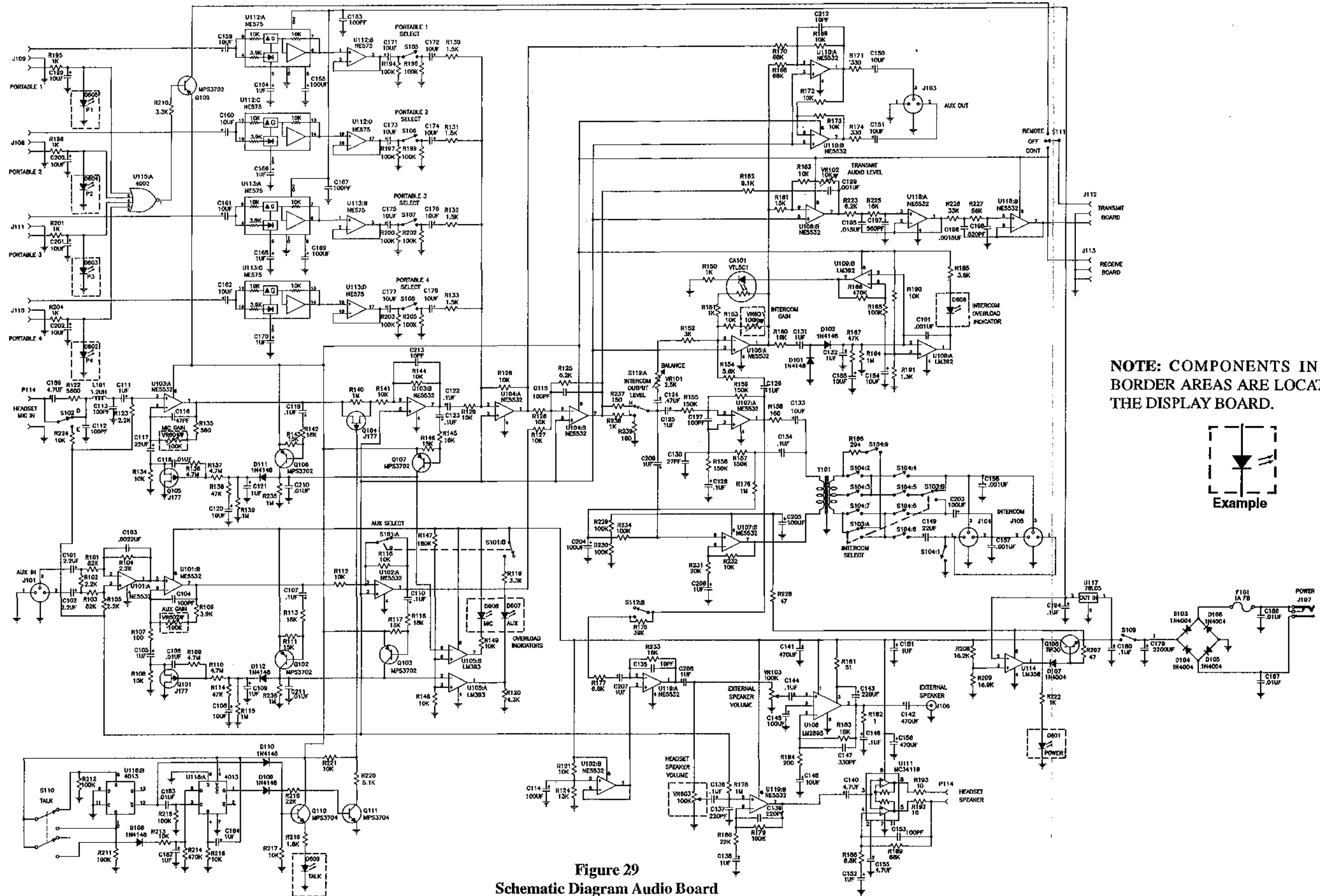


Figure 28  
 Audio Board Component Layout (Foil Side)  
 Version 6

NOTE: REFER TO FIGURES 26  
 AND 27 FOR DIFFERENCES IN  
 VERSIONS 3, 4, AND 5.



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

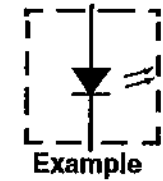
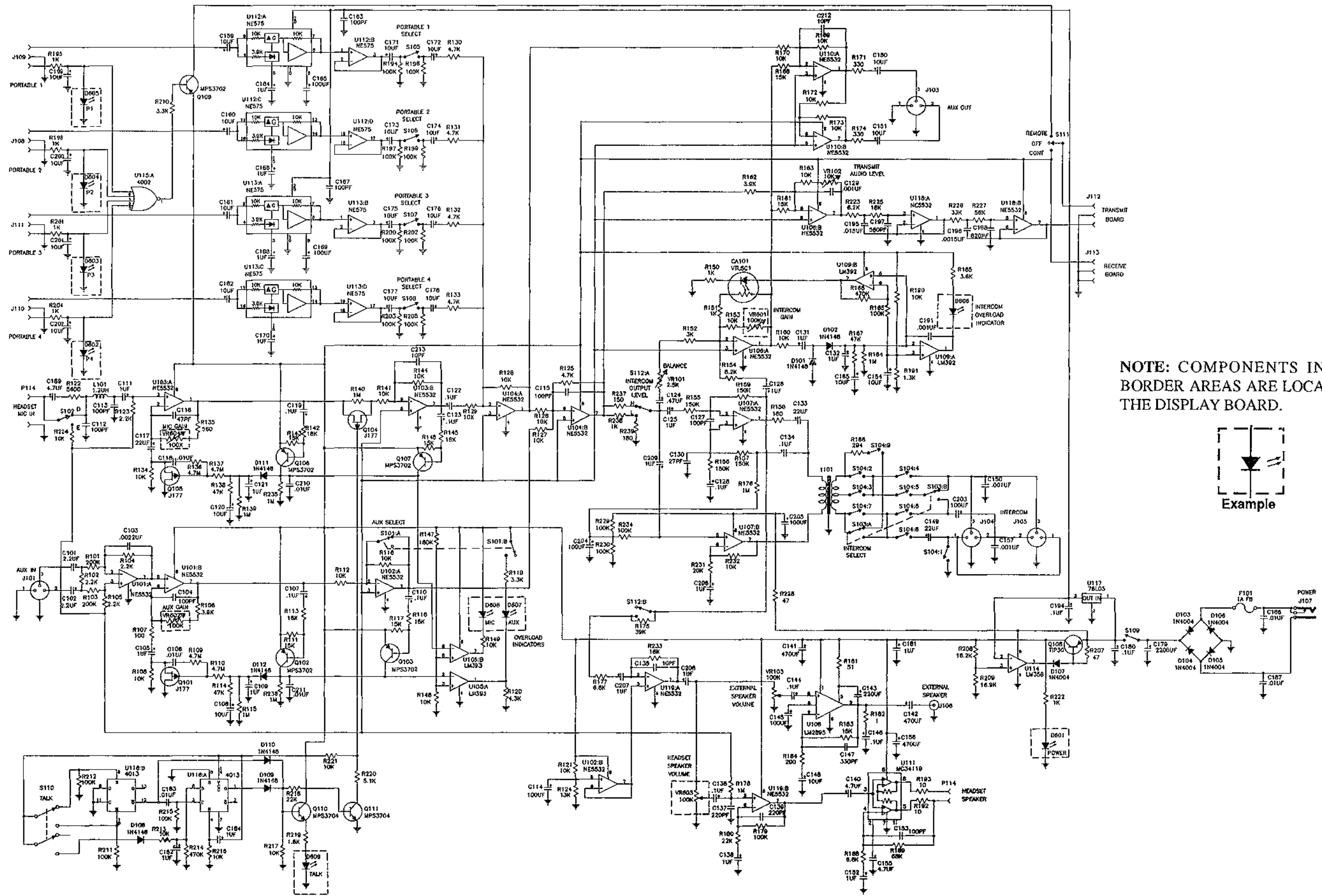


Figure 29  
Schematic Diagram Audio Board  
Version 3



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

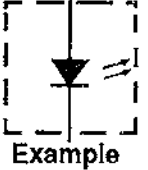
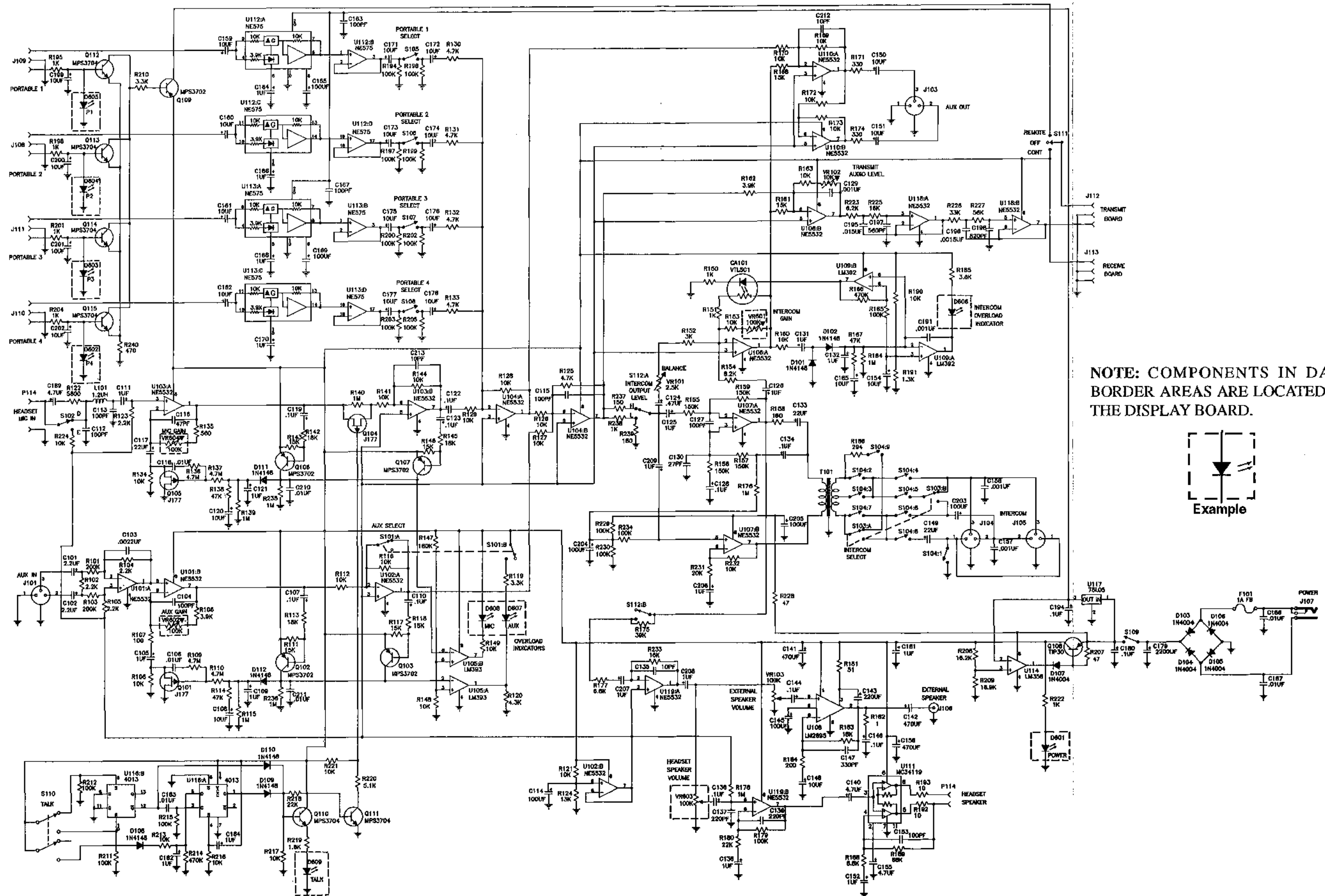


Figure 30  
Schematic Diagram Audio Board  
Version 4



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

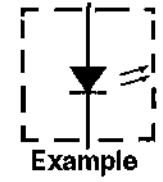
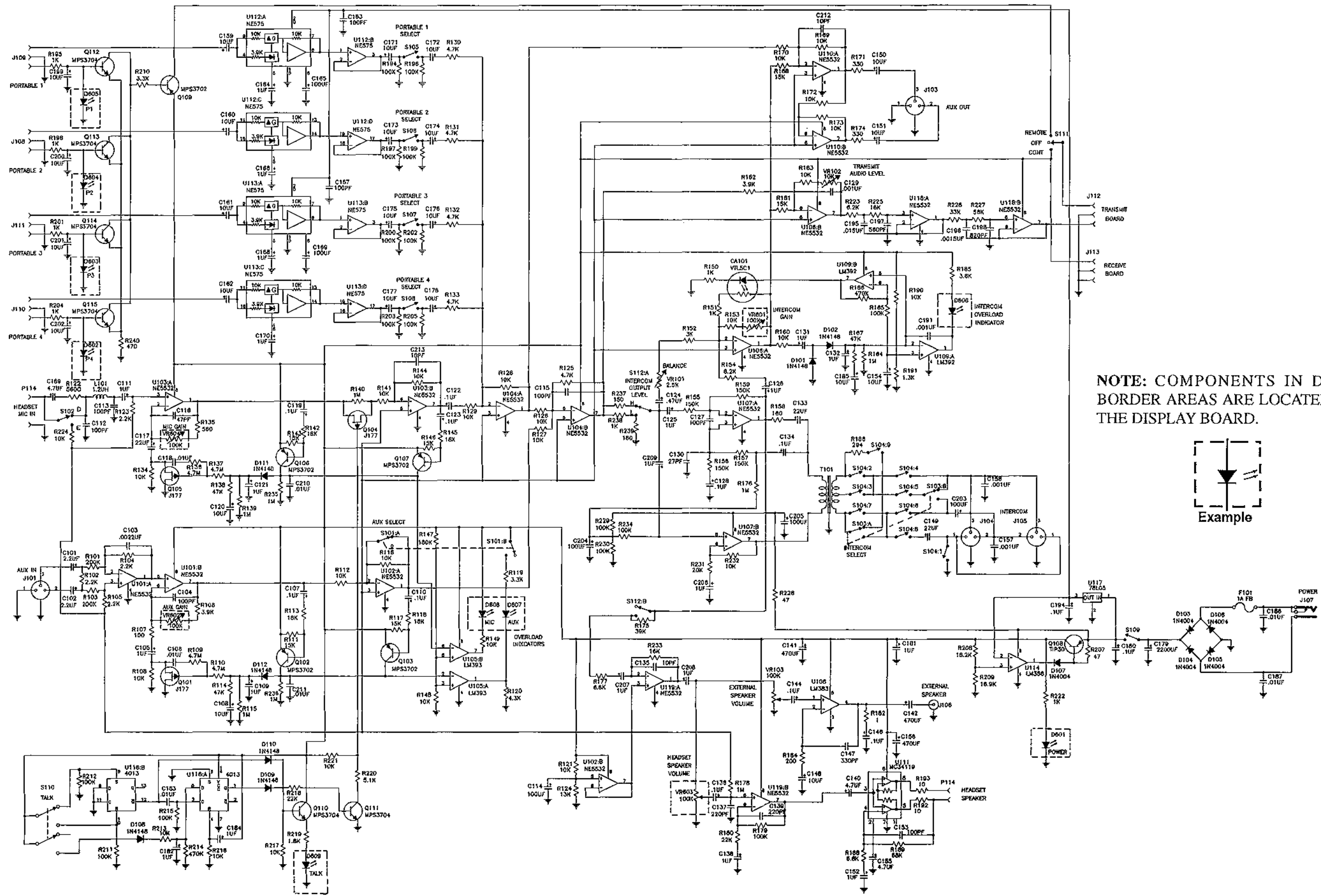


Figure 31  
Schematic Diagram Audio Board  
Version 5



NOTE: COMPONENTS IN DASH BORDER ARE LOCATED ON THE DISPLAY BOARD.

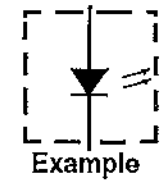


Figure 32  
Schematic Diagram Audio Board  
Version 6

## PCB Audio Assembly (878520) Versions 1 thru 6

Ref No.	Description	Part No.
PCB100/200	Printed Circuit Board, Audio	70723000
<b>Capacitors</b>		
All capacitors in microfarads unless noted.		
Ref No.	Description	Part No.
C101, C102	Electrolytic, 2.2	51821107
C103	Poly film, .0022	52719053
C104	Ceramic, 100 pF	35693019
C105	Electrolytic, 1	51821106
C106	Ceramic, .01	52676107
C107	Electrolytic, .1	51821065
C108	Electrolytic, 10	52723008
C109	Electrolytic, 1	51821106
C110	Electrolytic, .1	51821065
C111	Electrolytic, 1	51821106
C112, C113	Ceramic, 100 pF	35693019
C114	Electrolytic, 100	52723004
C115	Ceramic, 100 pF	35693019
C116	Ceramic, 47 pF	35693015
C117	Electrolytic, 22	52723009
C118	Ceramic, .01	52676107
C119	Electrolytic, .1	51821065
C120	Electrolytic, 10	52723008
C121	Electrolytic, 1	51821106
C122, C123	Electrolytic, .1	51821065
C124	Electrolytic, .47	51821105
C125, C126	Electrolytic, 1	51821106
C127	Ceramic, 100 pF	35693019
C128	Electrolytic, .1	51821065
C129 <sup>1,2</sup>	Ceramic, 100 pF	35693019
C129 <sup>3-6</sup>	Ceramic, 1000 pF	35693030
C130 <sup>1,2</sup>	Ceramic, 100 pF	35693019
C130 <sup>3-6</sup>	Ceramic, 27 pF	35693012
C131, C132	Electrolytic, 1	51821106
C133 <sup>1,2</sup>	Electrolytic, 10	52723008
C133 <sup>3-6</sup>	Electrolytic, 22	52723009
C134	Electrolytic, .1	51821065
C135 <sup>1,2</sup>	Ceramic, .01	52676107
C135 <sup>3-6</sup>	Ceramic, 10 pF	35693007
C136	Ceramic, .1	52676113
C137	Ceramic, 220 pF	35693023
C138	Electrolytic, 1	51821106
C139	Ceramic, 220 pF	35693023
C140	Electrolytic, 4.7	51821109
C141, C142	Electrolytic, 470	51821071
C143 <sup>1-5</sup>	Electrolytic, 220	51821525
C143 <sup>6</sup>	(Not Used)	
C144	Ceramic, .1	52676113
C145 <sup>1-5</sup>	Electrolytic, 100	51821524
C145 <sup>6</sup>	(Not Used)	
C146 <sup>1-5</sup>	Electrolytic, .1	51821065
C146 <sup>6</sup>	Ceramic, .1	52676113
C147	Ceramic, 330 pF,	35693024
C148	Electrolytic, 10	52723008
C149	Electrolytic, 22, 63 WV	51821538
C150, C151	Electrolytic, 10	52723008
C152	Electrolytic, 1	51821106
C153	Ceramic, 100 pF	35693019
C154	Electrolytic, 10	52723008
C155	Electrolytic, 4.7	51821109
C156	Electrolytic, 470	51821071
C157, C158	Ceramic, .001	52676101

Ref No.	Description	Part No.
C159-C162	Electrolytic, 10	52723008
C163	Ceramic, 100 pF	35693019
C164	Electrolytic, 1.0	52723025
C165	Electrolytic, 100	52723004
C166	Electrolytic, 1.0	52723025
C167	Ceramic, 100 pF	35693019
C168	Electrolytic, 1.0	52723025
C169	Electrolytic, 100	52723004
C170	Electrolytic, 1.0	52723025
C171-C178	Electrolytic, 10	52723008
C179	Electrolytic, 2200, 35WV	51821232
C180	Electrolytic, .1	51821065
C181, C182	Electrolytic, 1	51821106
C183	Ceramic, .01	52676107
C184	Electrolytic, 1	51821106
C185	Electrolytic, 10	52723008
C186, C187	Ceramic, .01	52676107
C188 <sup>1,2</sup>	Poly Film, .018	52719183
C188 <sup>3-6</sup>	(Not Used)	
C189 <sup>1,2</sup>	(Not Used)	
C189 <sup>3-6</sup>	Electrolytic, 4.7	51821109
C190	(Not Used)	
C191	Ceramic, .001	52676101
C192	(Not Used)	
C193 <sup>1,2</sup>	Ceramic, .1	52676113
C193 <sup>3-6</sup>	(Not Used)	
C194	Ceramic, .1	52676113
C195-C213 <sup>1,2</sup>	(Not Used)	
C195 <sup>3-6</sup>	Poly film, .015	52719008
C196 <sup>3-6</sup>	Poly film, .0015	52719052
C197 <sup>3-6</sup>	Ceramic, 560 pF	35693027
C198 <sup>3-6</sup>	Ceramic, 820 pF	35693029
C199-C202 <sup>3-6</sup>	Electrolytic, 10	52723008
C203 <sup>2-6</sup>	Electrolytic, 100, 50v	51821115
C204 <sup>3-6</sup>	Electrolytic, 100	51821524
C205 <sup>3-6</sup>	Electrolytic, 100, 50v	51821115
C206-C209 <sup>3-6</sup>	Electrolytic, 1.0	52723025
C210, C211 <sup>3-6</sup>	Ceramic, .01	52676107
C212, C213 <sup>3-6</sup>	Ceramic, 10 pF	35693007
<b>Diodes and LEDs</b>		
CA101	Diode, Photoelectric, VTLSC1	58693001
D101, D102	Diode, 1N4148	52228000
D103-D107	Diode, 1N4004	85759002
D108-D110 <sup>1,2</sup>	Diode, 1N4148	52228000
D108-D112 <sup>3-6</sup>	Diode, 1N4148	52228000
<b>Integrated Circuits</b>		
U101-U104	IC NE5532AN	53295001
U105	IC LM393	53284000
U106, U107	IC NE5532AN	53295001
U108 <sup>1-5</sup>	IC LM2895P	760381
U108 <sup>6</sup>	LM383	
U109	IC LM392	59521000
U110	IC NE5532AN	53295001
U111	IC MC34119P	760374-1
U112, U113	IC NE575N	53277003
U114	IC LM358	53227004
U115 <sup>1-4</sup>	IC CMOS 4002	53266003
U115 <sup>5,6</sup>	(Not Used)	
U116	IC CMOS 4013B	53266095
U117	IC 78L05	54680005
U118, U119 <sup>1,2</sup>	(Not Used)	
U118, U119 <sup>3-6</sup>	IC NE5532AN	53295001

**PCB Audio Assembly (878520) Versions 1 thru 6 Continued**

Ref No.	Description	Part No.
<b>Connectors</b>		
J101	Connector, 3 Pin, XLR Female	59893001
J102	(Not Used)	
J103	Connector, 3 Pin, XLR Male	59892001
J104	Connector, 3 Pin, XLR Female	59893001
J105	Connector, 3 Pin, XLR Male	59892001
J106	Jack, speaker, 1/4" phone	53326000
J107	Jack, power, 2.1 mm	59697001
J108-J113	Socket, 3 pin	640064
P102, P103	Header, 11 pin	670061
P114	Header, 5 pin	52263005
<b>Coils and Chokes</b>		
L101	Inductor, 1.2 mh	35689000
<b>Transistors</b>		
Q101	Transistor, J177	54687003
Q102, Q103	Transistor, MPS-3702	54713000
Q104, Q105	Transistor, J177	54687003
Q106, Q107	Transistor, MPS-3702	54713000
Q108	Transistor, TIP-30	760384
Q109	Transistor, MPS-3702	54713000
Q110, Q111	Transistor, MPS-3704	54712000
Q112-Q115 <sup>1-4</sup>	(Not Used)	
Q112-Q115 <sup>5,6</sup>	Transistor, 2N4124	35573000
<b>Miscellaneous</b>		
F101	Fuse	710081
FC101, FC102	Fuse Holder	710082
<b>All resistors in ohms, 1/8 watt, 5% unless noted.</b>		
<b>Resistors &amp; Potentiometers</b>		
R101 <sup>1-3</sup>	82K	52154014
R101 <sup>4-6</sup>	200K	52154005
R102	2.2K	52154052
R103 <sup>1-3</sup>	82K	52154014
R103 <sup>4-6</sup>	200K	52154005
R104, R105	2.2K	52154052
R106	3.9K	52154046
R107	100	52154084
R108	10K	52154036
R109, R110	4.7M	52154972
R111	15K	52154032
R112	10K	52154036
R113 <sup>1,2</sup>	22K	52154028
R113 <sup>3-6</sup>	18K	52154030
R114	47K	52154020
R115	1M	52154988
R116 <sup>1,2</sup>	3.9K	52154046
R116 <sup>3-6</sup>	10K	52154036
R117	15K	52154032
R118 <sup>1,2</sup>	22K	52154028
R118 <sup>3-6</sup>	18K	52154030
R119	3.3K	52154048
R120	4.3K	52154045
R121	10K	52154036
R122	5.6K	52154042
R123	2.2K	52154052
R124	13K	52154033
R125 <sup>1</sup>	10K	52154036
R125 <sup>2</sup>	39K	52154022
R125 <sup>3</sup>	6.2K	52154041
R125 <sup>4-6</sup>	4.7K	52154044

Ref No.	Description	Part No.
R126	10K	52154036
R127 <sup>1,2</sup>	82K	52154014
R127 <sup>3-6</sup>	10K	52154036
R128	10K	52154036
R129 <sup>1,2</sup>	82K	52154014
R129 <sup>3-6</sup>	10K	52154036
R130-133 <sup>1,2</sup>	68K	52154016
R130-133 <sup>3</sup>	1.5K	
R130-133 <sup>4-6</sup>	4.7K	52154044
R134	10K	52154036
R135	560	52154066
R136, R137	4.7M	52154972
R138	47K	52154020
R139, R140	1M	52154988
R141	10K	52154036
R142 <sup>1,2</sup>	22K	52154028
R142 <sup>3-6</sup>	18K	52154030
R143	15K	52154032
R144 <sup>1,2</sup>	3.9K	52154046
R144 <sup>3-6</sup>	10K	52154036
R145 <sup>1,2</sup>	22K	52154028
R145 <sup>3-6</sup>	18K	52154030
R146	15K	52154032
R147	180K	52154006
R148, R149	10K	52154036
R150, R151	1K	52154060
R152	3K	52154049
R153	10K	52154036
R154 <sup>1,2</sup>	12K	52154034
R154 <sup>3</sup>	5.6K	52154042
R154 <sup>4-6</sup>	8.2K	52154038
R155-R157	150K, 1%	54046150
R158 <sup>1</sup>	330	52154072
R158 <sup>2-6</sup>	160	52154079
R159	150K, 1%	54046150
R160	10K	52154036
R161 <sup>1,2</sup>	30K	52154025
R161 <sup>3-6</sup>	15K	52154032
R162 <sup>1</sup>	2.2K	52154052
R162 <sup>2,3</sup>	9.1K	52154037
R162 <sup>4-6</sup>	3.9K	52154046
R163	10K	52154036
R164	1M	52154988
R165	100K	52154012
R166	470K	52154996
R167	47K	52154020
R168 <sup>1-3</sup>	68K	52154016
R168 <sup>4-6</sup>	15K	52154032
R169	10K	52154036
R170 <sup>1-2</sup>	10K	52154036
R170 <sup>3</sup>	68K	52154016
R170 <sup>4-6</sup>	10K	52154036
R171	330	52154072
R172, 173	10K	52154036
R174	330	52154072
R175 <sup>1,2</sup>	47K	52154020
R175 <sup>3-6</sup>	39K	52154022
R176	1M	52154988
R177 <sup>1,2</sup>	47K	52154020
R177 <sup>3-6</sup>	6.8K	52154040
R178	1M	52154988
R179	100K	52154012
R180	22K	52154028
R181 <sup>1-5</sup>	51	52154091
R181 <sup>6</sup>	(Not Used)	



PCB Audio Assembly (878520) Versions 1 thru 6 Continued

All resistors in ohms, 1/8 watt, 5% unless noted.

Resistors & Potentiometers Continued

Ref No.	Description	Part No.
R182	1, 1/4 watt	52154909
R183 <sup>1-5</sup>	18K	52154030
R183 <sup>6</sup>	(Not Used)	
R184	200	52154077
R185	3.6K	52154047
R186	294, 1%, 1/4 watt	54042294
R187 <sup>1,2</sup>	6.8K	52154040
R187 <sup>3-6</sup>	(Not Used)	
R188	6.8K	52154040
R189	68K	52154016
R190	10K	52154036
R191 <sup>1,2</sup>	620	52154065
R191 <sup>3-6</sup>	1.3K	52154057
R192, R193	10	52154108
R194	100K	52154012
R195	1K	52154060
R196, R197	100K	52154012
R198	1K	52154060
R199, R200	100K	52154012
R201	1K	52154060
R202, R203	100K	52154012
R204	1K	52154060
R205	100K	52154012
R206 <sup>1,2</sup>	470	52154068
R206 <sup>3-6</sup>	(Not Used)	
R207	47	52154092
R208	16.2K, 1%	54045162
R209	16.9K, 1%	54045169
R210	3.3K	52154048
R211, R212	100K	52154012
R213	10K	52154036
R214	470K	52154996
R215	100K	52154012
R216, R217	10K	52154036
R218	22K	52154028
R219	1.8K	52154054
R220	5.1K	52154043
R221	10K	52154036
R222	1K	52154060
R223-R236 <sup>1,2</sup>	(Not Used)	
R223 <sup>3-6</sup>	6.2K	52154041
R224 <sup>3-6</sup>	10K	52154036
R225 <sup>3-6</sup>	16K	52154031
R226 <sup>3-6</sup>	33K	52154024
R227 <sup>3-6</sup>	56K	52154018
R228 <sup>3-6</sup>	47	52154092
R229, R230 <sup>3-6</sup>	100K	52154012
R231 <sup>3-6</sup>	20K	52154020
R232 <sup>3-6</sup>	10K	52154036
R233 <sup>3-6</sup>	16K	52154031
R234 <sup>3-6</sup>	100K	52154012
R235, R236 <sup>3-6</sup>	1M	52154988
R237-R239 <sup>1</sup>	(Not Used)	
R237 <sup>2-6</sup>	150	52154080
R238 <sup>2-6</sup>	1K	52154060
R239 <sup>2-6</sup>	180	52154078
R240 <sup>1-4</sup>	(Not Used)	
R240 <sup>5,6</sup>	470	52154068
VR101	2.5K, variable	57148067
VR102	10K, variable	57148069
VR103	100K, speaker potentiometer	57148013

Ref No.	Description	Part No.
<b>Switches</b>		
S101	Switch, push button	57604001
S102	Switch, 2 position, slide	700127
S103	Switch, push button	57604001
S104	Switch, Dip, 9 position	700128-1
S105-S109	Switch, push button	57604001
S110	Switch, momentary push button	57604002
S111	Switch, 3 position, slide	700126
S112	Switch, DPDT	700091
<b>Transformers</b>		
T101	Transformer	730094

1,2,3,4,5,6 - Indicates the Version number in which that part is used.

# DISPLAY BOARD

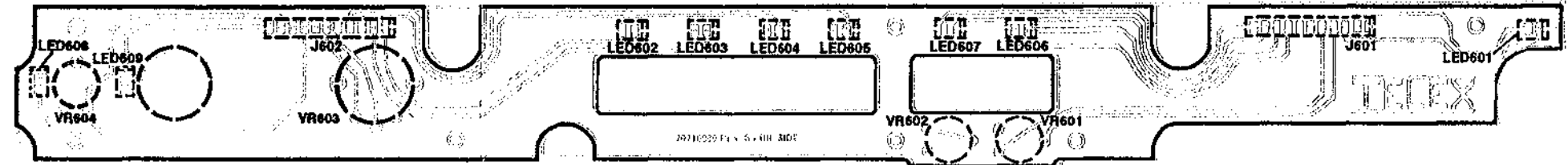


Figure 33  
Display Board Component Layout (Foil Side)

## PCB Display (878519)

Ref No.	Description	Part No.
J601	Cable Assembly	640063-3
J602	Cable Assembly	640063-3
	Sprocket	450464
VR601	Piber Potentiometer, 100K	724779
VR602	Piber Potentiometer, 100K	724779
VR603	Volumne Potentiometer	723087
VR604	Piber Potentiometer, 100K	724779
PCB600	PCB, Display	70716000
LED601	LED, Red	58713000
LED602	LED, Green	58714000
LED603	LED, Green	58714000
LED604	LED, Green	58714000
LED605	LED, Green	58714000
LED606	LED, Yellow	58676000
LED607	LED, Yellow	58676000
LED608	LED, Red	58713000
LED609	LED, Green	58714000

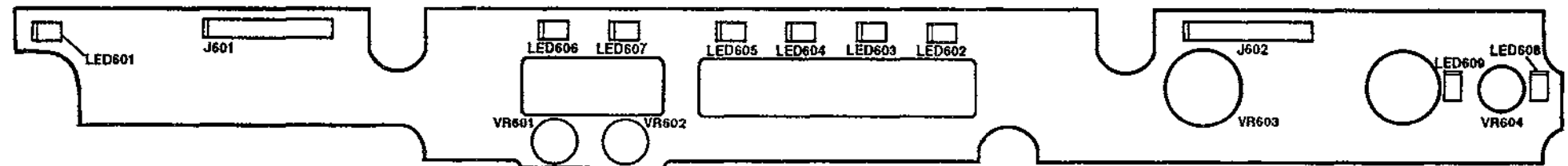


Figure 34  
Display Board Component Layout (Component View)

**TELEX**<sup>®</sup>