



**MOTOROLA**

# R1225

Transceiver

146-174 MHz

444-474 MHz

Service Manual

The background of the entire page is a detailed, high-contrast black and white image of a printed circuit board (PCB). It shows a complex network of traces, vias, and circular pads, typical of a high-frequency transceiver board. The image is oriented diagonally, with the top-left corner of the board being the most prominent.

**Radius<sup>®</sup>**

6880908253-0

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## GENERAL:

This revision outlines changes that have occurred since the printing of your service manual. Use this information to correct your manual.

## INSTRUCTION MANUAL AFFECTED:

6880905Z53-O

R1225 Transceiver Service Manual

## REVISION DETAILS:

1. This supplement contains the new 1-10 W UHF and VHF transceiver model charts and a revised specifications page. In addition, the circuit board details, schematic diagrams and parts lists have been supplied. Please refer to the attached pages.
2. The Masked Logic Board has changed from an issue O to an issue B. Please refer to the attached pages.
3. The RF Board for VHF 146-174 MHz, 12.5 & 25 kHz has changed from an issue O to an issue A. Please refer to the attached pages.
4. The RF Board for UHF 444-474 MHz, 12.5 & 25 kHz has changed from an issue O to an issue A. Please refer to the attached pages.
5. The Power Amplifier schematic and parts list for VHF 146-174 MHz, 25-50 W has changed to reflect the latest modifications. Please refer to the attached pages.
6. On page 16 of your manual the following part numbers have changed for the UHF 444-474 MHz, 25-45 W power amplifier :

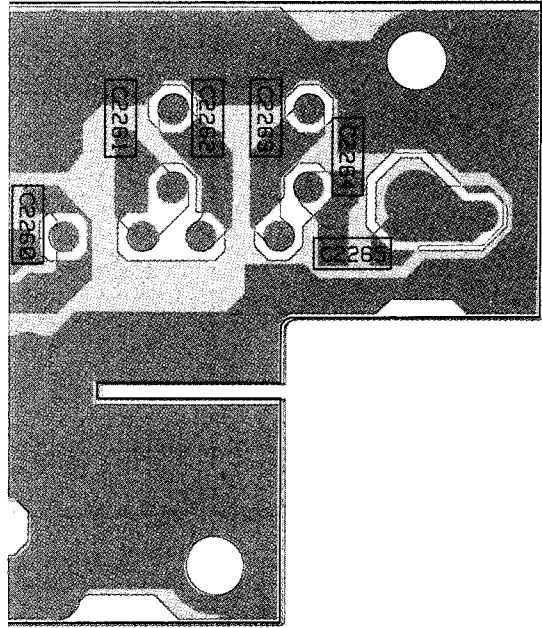
	<u>Old Number</u>	<u>New Number</u>
Heatsink assembly	01-04006J22	01-80747T27
P7 Cable assembly	0180556B01	0180747T27

7. On page 18 of your manual the transceiver exploded view the external tooth lockwasher, part number 0480943V01, cannot be order separately; it is supplied with the PA anntenna connector 0980131M01.

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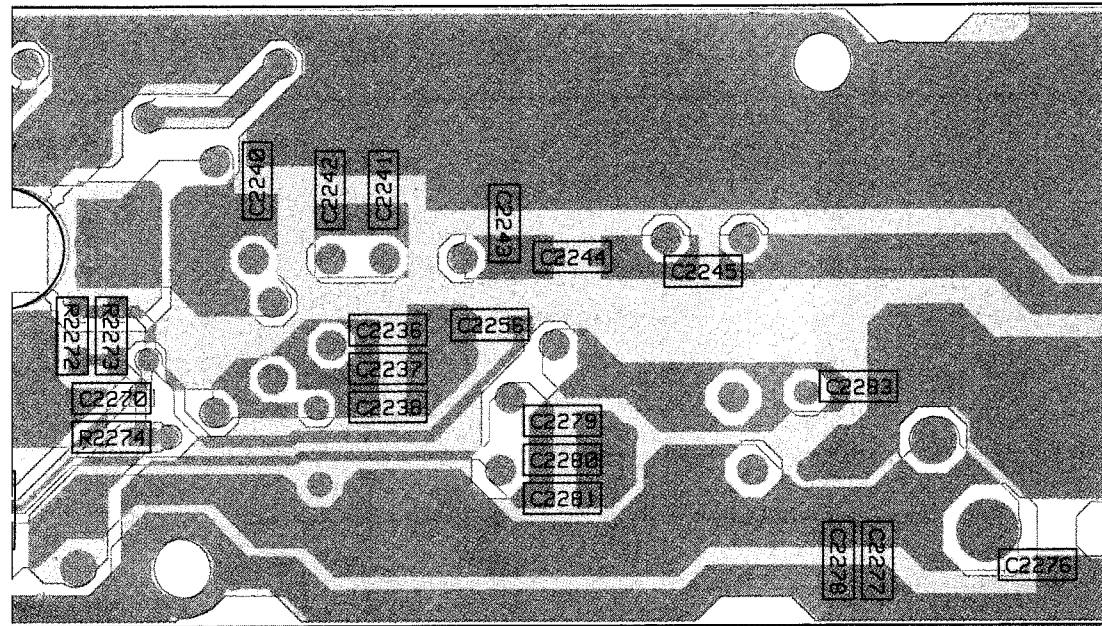


*Circuit Board Details for  
VHF Power Amplifier Board, 146-174 MHz, 1-10 W  
(Part of PMUD1533A Transceiver)*

R1225 PA VHF 1-10W

480647Z01 ISSUE 0 08-31-98

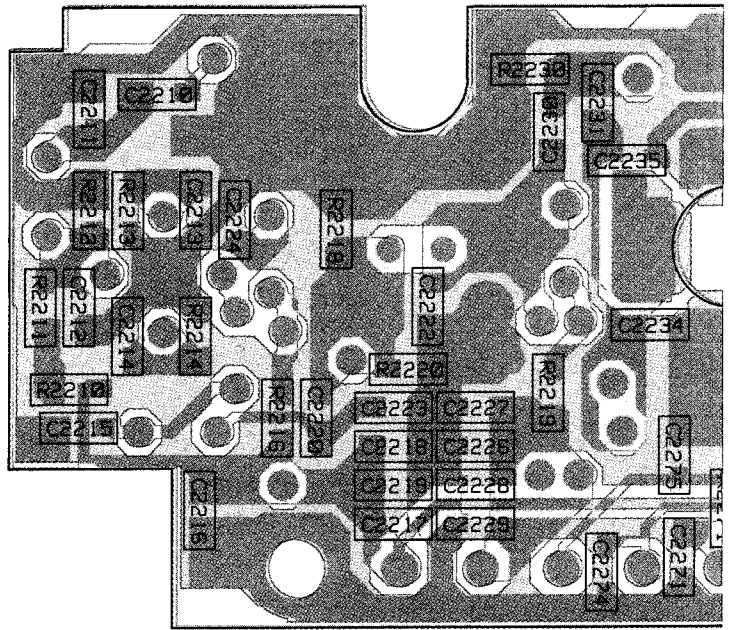
SOLDER SIDE



**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-98112-O (REV)  
RCB-98113-O (REV)  
RCB-98115-O (REV)

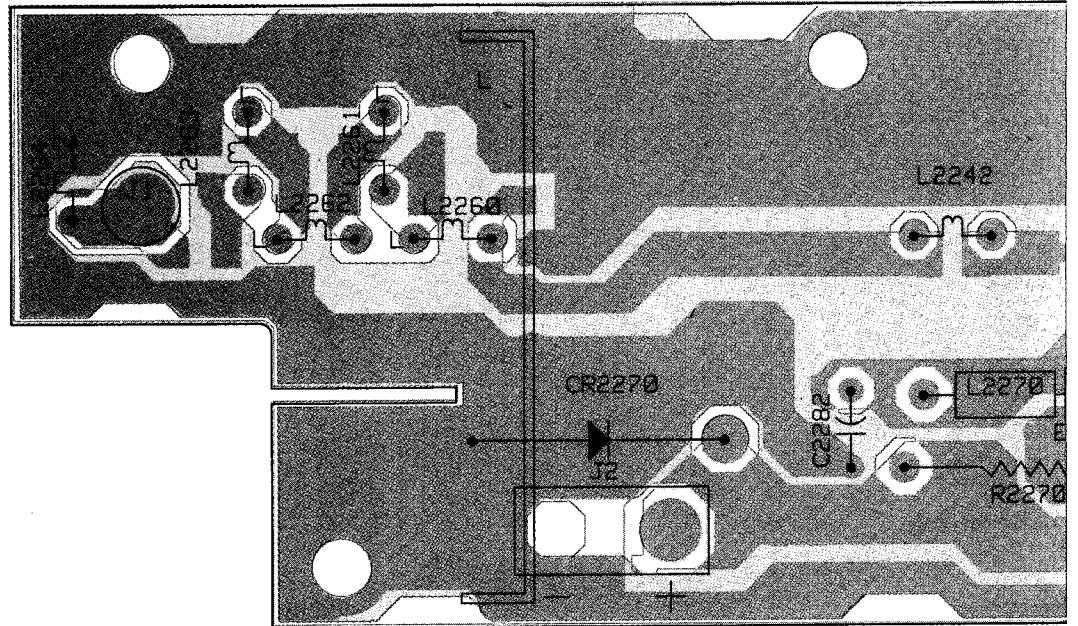
**SOLDER SIDE VIEW**



R1225

8480647Z01

COMPC

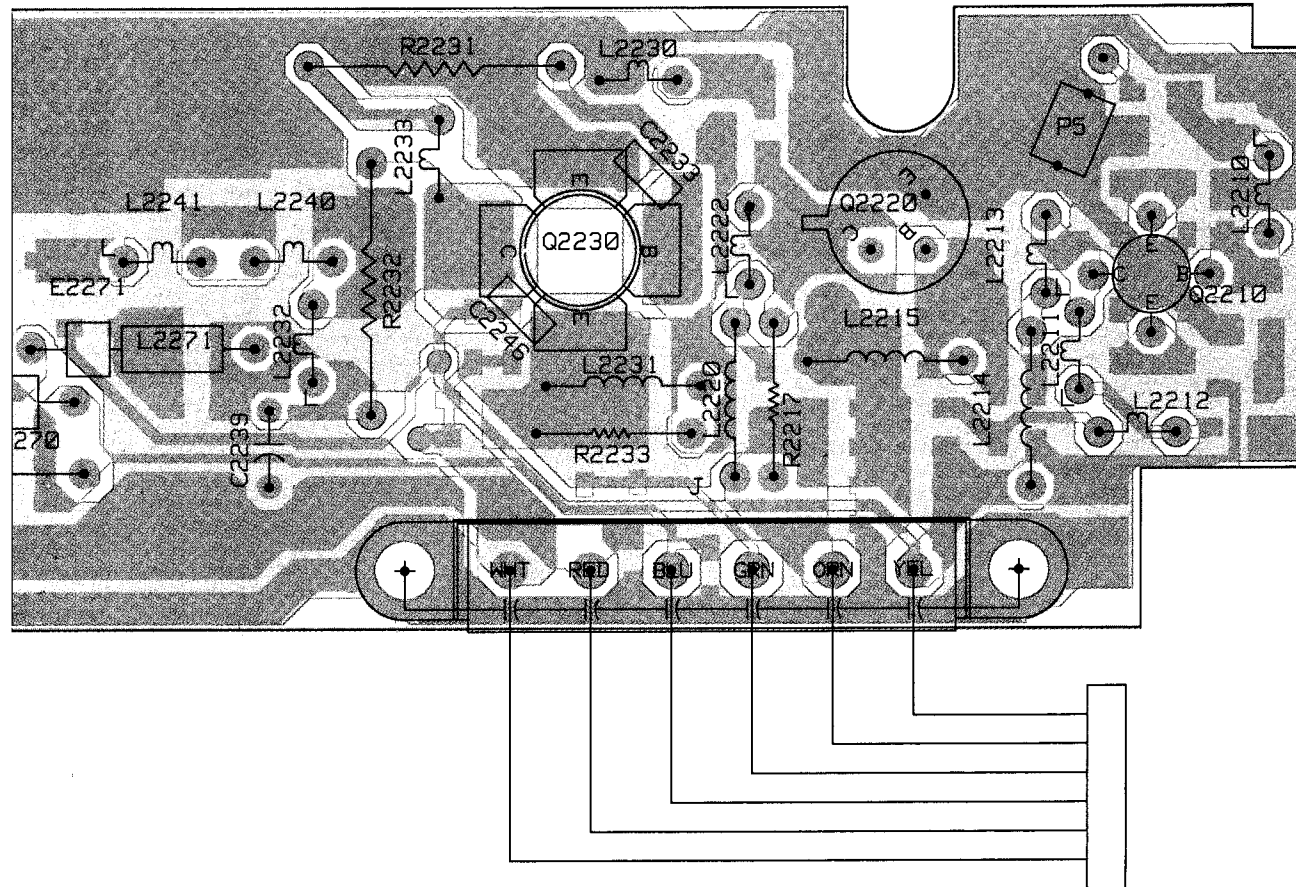


COMI  
SOLD  
OVER

PA VHF 1-10W

ISSUE 0 08-31-98

COMPONENT SIDE



COMPONENT SIDE (GRAY)  
FRONT SIDE (PINK)  
LAYER -----

RCB-98112-O  
RCB-98113-O  
RCB-98114-O

COMPONENT SIDE VIEW

**DESCRIPTION**

---

Fig:  
50 mm with plug  
connector assembly, 6-pin  
11-6 and feedthru

(see note)  
F559  
F237  
F2628

: +/-5%; 1/10 W:  
as stated

F  
)

@ 25 degrees C

---

heat sink ass'y  
10 and  
heat sink  
1 x 1/8 (for J1)  
1 x 8 (8 used)  
1 x 10 (2 used for J2)  
1 for J2)  
(for antenna post)

connector  
ory connector  
(2 used)

---

and integrated circuits



# Parts List

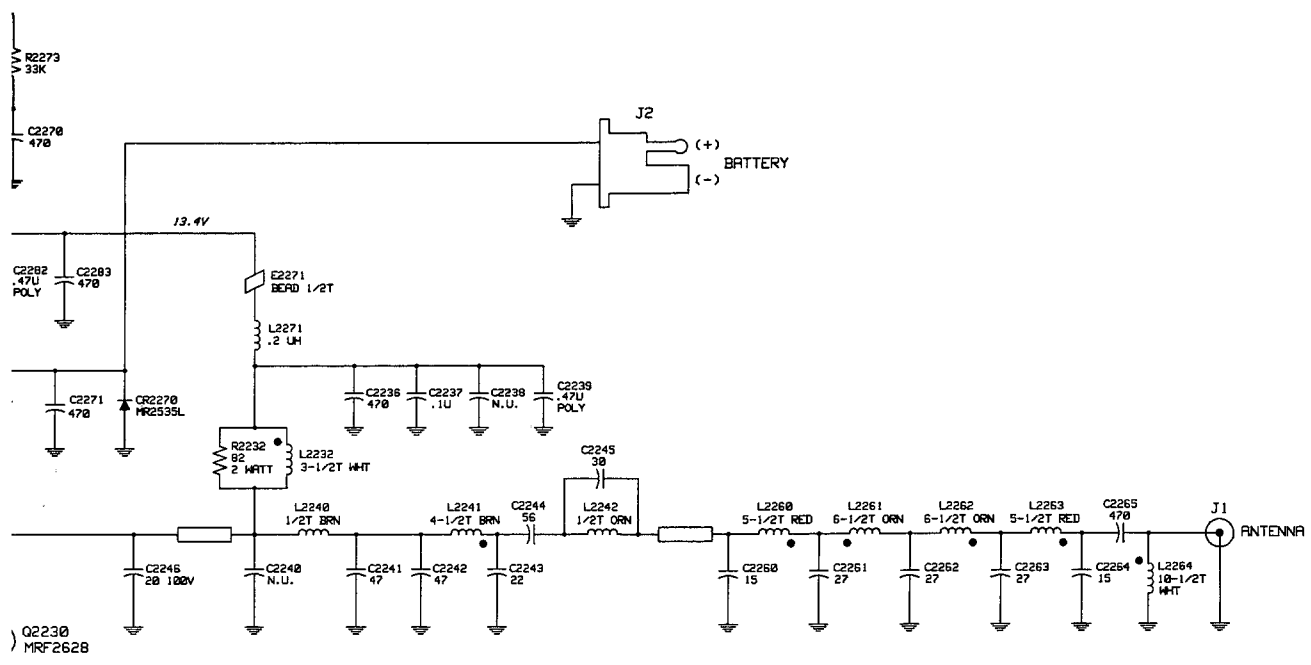
PMLD4134A VHF Power Amplifier, 146-174 MHz, 1-10 W PL-981009-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>capacitor, fixed: uF +/-5%; 50 V:</b> unless otherwise stated
C2201 thru 2206	21-84874K01	470 pF feedthru
C2210	21-13740B65	470 pF
C2211	21-13740B33	22 pF
C2212	---	Not Used
C2213, 2214	21-13740B73	1000 pF
C2215	21-13740B47	82 pF
C2216	21-13740B65	470 pF
C2217	21-13741B69	0.1 uF
C2218, 2219	---	Not Used
C2220	21-13740B65	470 pF
C2222	21-13740B33	22 pF
C2223	21-13740B47	82 pF
C2224	21-13740B36	30 pF
C2226	21-13741B69	0.1 uF
C2227	21-13740B65	470 pF
C2228, 2229	---	Not Used
C2230	21-13740B57	220 pF
C2231	21-13740B52	130 pF
C2233	21-11078B32	39 pF 100 V
C2234	21-13740B46	75 pF
C2235	21-13741B45	.01 uF
C2236	21-13740B65	470 pF
C2237	21-13741B69	0.1 uF
C2238	---	Not Used
C2239	08-04466J17	poly 0.47 uF 63 V
C2240	---	Not Used
C2241, 2242	21-13740B41	47 pF
C2243	21-13740B33	22 pF
C2244	21-13740B43	56 pF
C2245	21-13740B36	30 pF
C2246	21-11078B21	20 pF 100 V
C2256	21-13740B65	470 pF
C2260	21-13740B29	15 pF
C2261 thru 2263	21-13740B35	27 pF
C2264	21-13740B29	15 pF
C2265	21-13740B65	470 pF
C2270, 2271	21-13740B65	470 pF
C2274 thru 2276	21-13740B65	470 pF
C2277	21-13741B69	0.1 uF
C2278	---	Not Used
C2279	21-13740B65	470 pF
C2280	21-13741B69	0.1 uF
C2281	---	Not Used
C2282	08-04466J17	poly 0.47 uF 63 V
C2283	21-13740B65	470 pF
		<b>diode: (see note)</b> transient suppressor
CR2270	48-80236E07	
		<b>ferrite beads:</b> ferrite bead 1/2 turn
E2270	24-80036A01	
E2271	24-80036A01	
		<b>connector, receptacle:</b> mini UHF coax
J1	09-80131M01	
J2	09-80255E01	power (includes feedthru)
		<b>coil, rf:</b> 4-1/2 turns BRN
L2210	24-11030B08	
L2211	24-11030B07	3-1/2 turns WHT
L2212	24-11030E03	1/2 turn ORN
L2213	24-11030B15	10-1/2 turns WHT
L2214	24-80036A01	ferrite bead 1/2 turn
L2215	24-82723H37	6.2 uH
L2220	24-80036A01	ferrite bead 1/2 turn
L2222	24-11030E05	1/2 turn GRN
L2230	24-11030E01	1/2 turn BRN
L2231	24-82723H37	6.2 uH
L2232	24-11030B07	3-1/2 turns WHT
L2233	24-11030D03	4 turns YEL
L2240	24-11030E01	1/2 turn BRN
L2241	24-11030B08	4-1/2 turns BRN
L2242	24-11030E03	1/2 turn ORN
L2260	24-11030B10	5-1/2 turns RED
L2261	24-11030B11	6-1/2 turns ORN
L2262	24-11030B11	6-1/2 turns ORN
L2263	24-11030B10	5-1/2 turns RED
L2264	24-11030B15	10-1/2 turns WHT
L2270, 2271	24-82723H46	0.2 uH

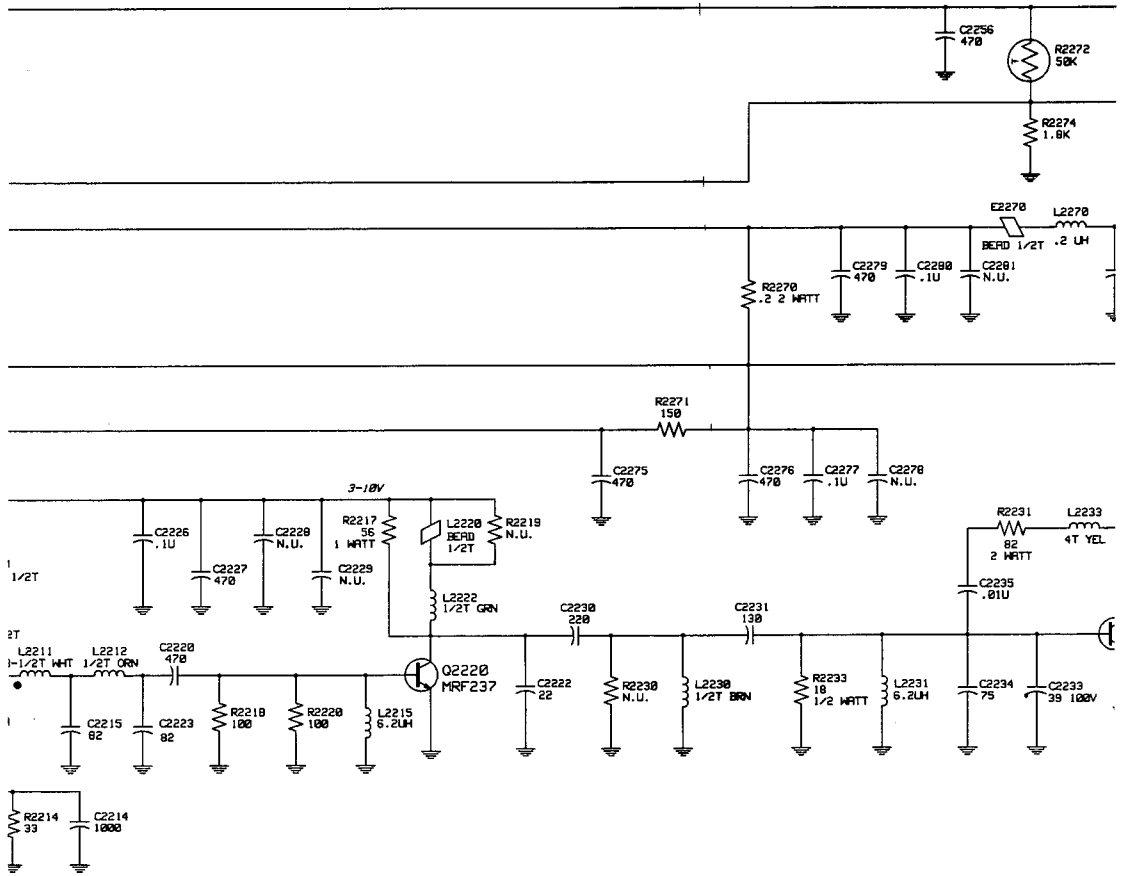
PMLD4134A VHF Power Amplifier, 146-174 MHz, 1-

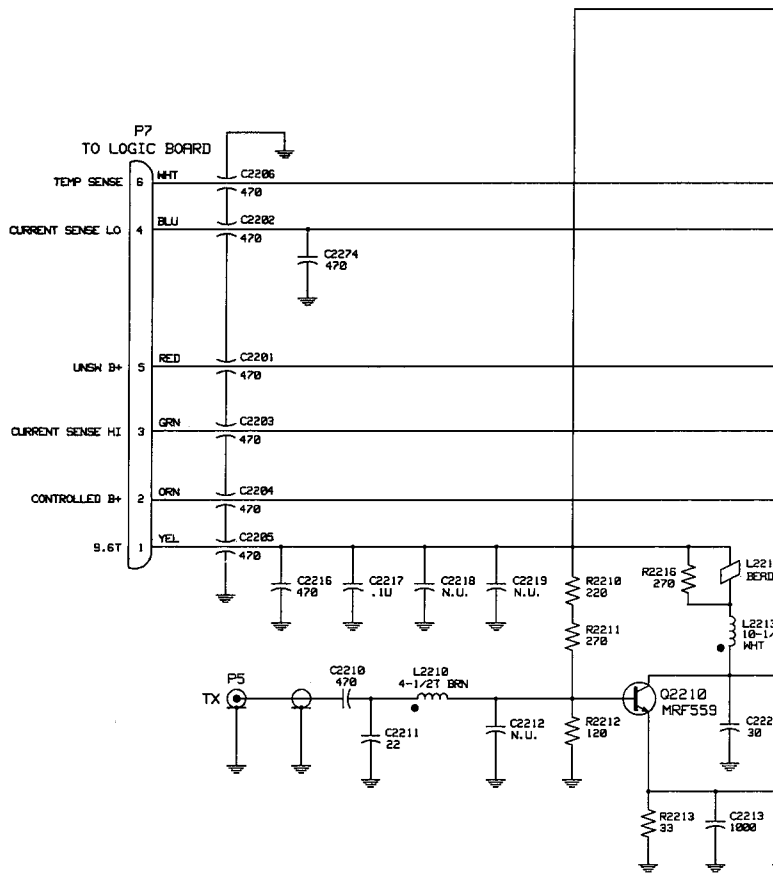
REFERENCE SYMBOL	MOTOROLA PART NO.	D
P5	30-80138M07	connector, p
P7	01-80704Y64	coaxial cable cable and cor (includes C22 bracket)
		<b>transistor: (€</b> NPN; type MI
Q2210	48-82233P39	
Q2220	48-80225C23	NPN; type MI
Q2230	48-80225C18	NPN; type MI
		<b>resistor, fixe</b> unless otherw
R2210	06-11077A58	220 1/8 watt
R2211	06-11077A60	270 1/8 watt
R2212	06-11077A52	120 1/8 watt
R2213, 2214	06-11077A38	33 1/8 watt
R2216	06-11077A60	270 1/8 watt
R2217	06-11086A29	56 1 watt FM
R2218	06-11077A50	100 1/8 watt
R2219	---	Not Used
R2220	06-11077A50	100 1/8 watt
R2230	---	Not Used
R2231, 2232	06-11086C33	82 2 watt FM
R2233	06-11045A07	18 1/2 watt F
R2270	06-11086D01	0.2 2 watt FM
R2271	06-11077A54	150 1/8 watt
R2272	06-05621T02	thermistor 50
R2273	06-11077B11	33k 1/8 watt
R2274	06-11077A80	1.8k 1/8 watt
		<b>non-referenced items</b>
	01-04006J22	transistor hea (includes Q22 26-80158L01
	02-00007003	nut 8-32 x 5/1
	03-10943M10	screw M3 x 0
	03-10943M11	screw M3 x 0
	04-00131974	washer (2 use
	04-05587G01	plastic washe
	26-80223M07	PA shield cov
	26-80475U01	heat sink
	29-80014A03	clip coax terr
	32-80014N03	gasket, acces
	42-80520B01	clip, groundin

**note:** For optimum performance, diodes, transistors, must be ordered by Motorola part numbers.

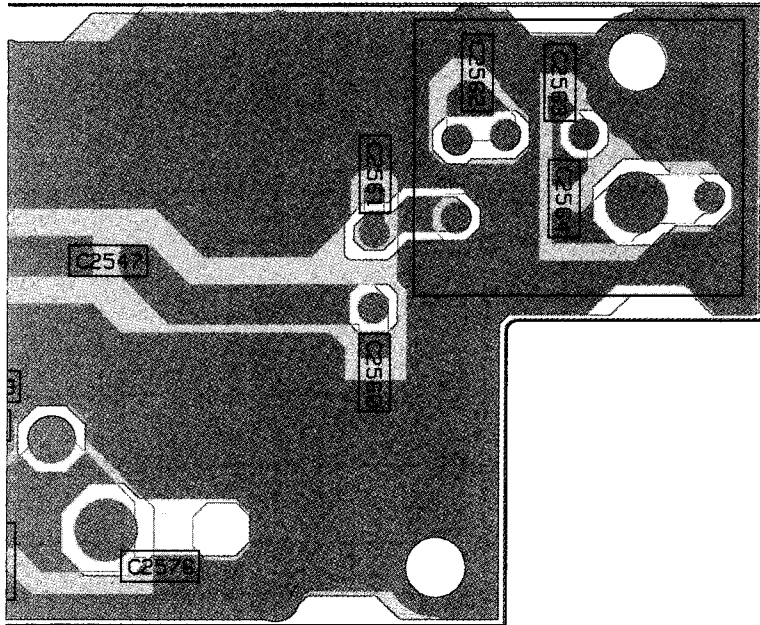


DOT (●) INDICATES LONGER COIL LEAD





*Schematic Diagram and Parts List for  
VHF Power Amplifier Board, 146-174 MHz, 1-10 W  
(Part of PMUD1533A Transceiver)*

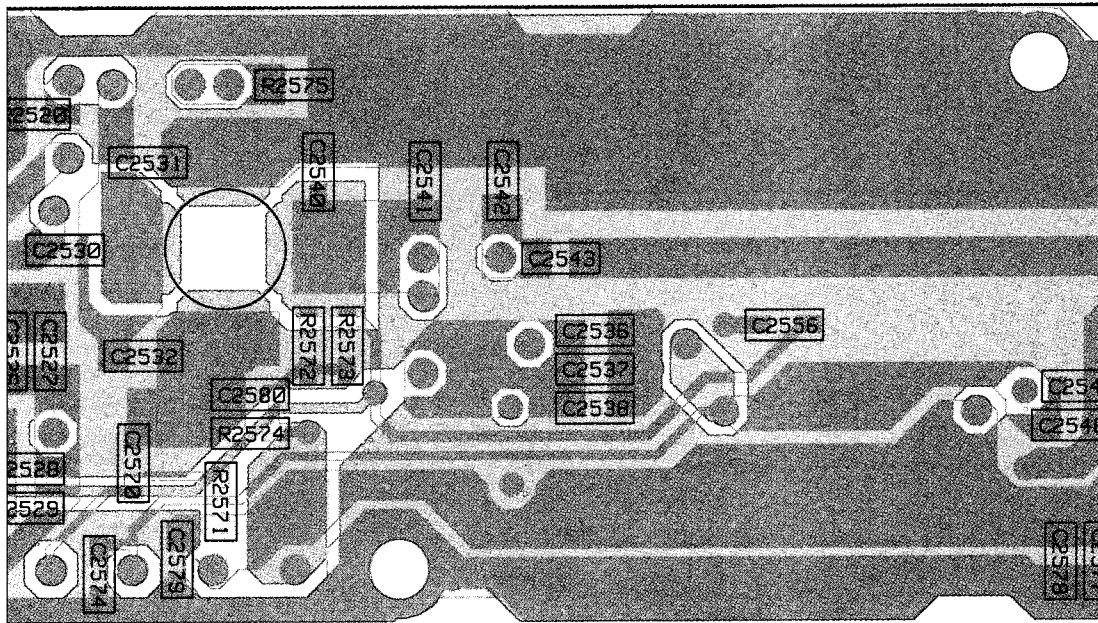


*Circuit Board Details for  
UHF Power Amplifier Board, 444-474 MHz, 1-10 W  
(Part of PMUE1505A Transceiver)*

R1225 PA UHF 1-10W

8480648Z01 ISS 0 8-31-9

SOLDER SIDE



**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-98108-O (REV)  
RCB-98109-O (REV)  
RCB-98111-O (REV)

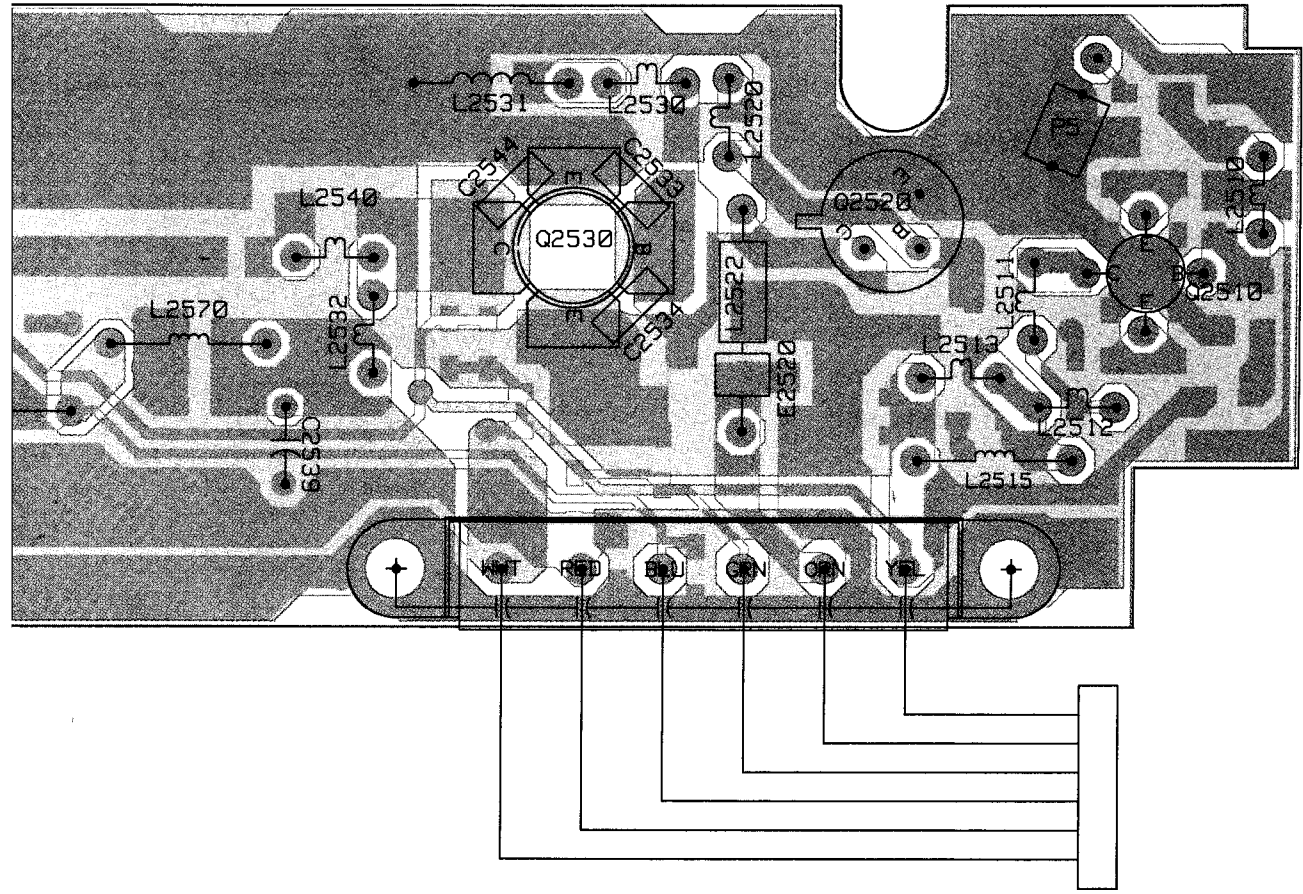
**SOLDER SIDE VIEW**



ISS 0 8-31-98

1A UHF 1-10W

FRONT SIDE



- DE (GRAY)      RCB-98108-O
- PINK)          RCB-98109-O
- RCB-98110-O

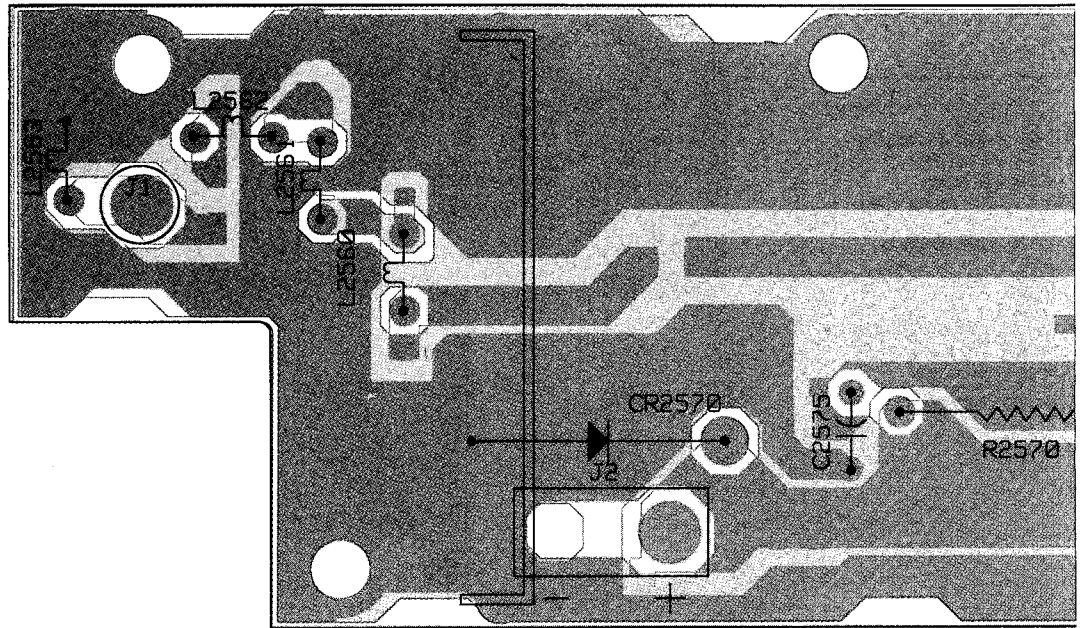
FRONT SIDE VIEW



8480648Z01:

R1225 F

COMPO



**COMPONENT S  
SOLDER SIDE (**  
**OVERLAY -----**

**COMPO**

**DESCRIPTION**

r: (see note)

- 3 MRF559
- 3 MRF630
- 3 MRF654

fixed: +/-5%; 1/10 W:

otherwise stated

att

att

att

tt

tt

FMO

att

50k @ 25 degrees C

att

att

tt

is

heatsink ass'y

Q2520 and 26-80158L01)

: 5/16 x 1/8 (for J1)

x 0.5 x 8 (8 used)

x 0.5 x 10 (2 used for J2)

used for J2)

sher (for antenna post)

cover

3r

enna connector

terminal

ccessory connector

ors, and integrated circuits

# Parts List

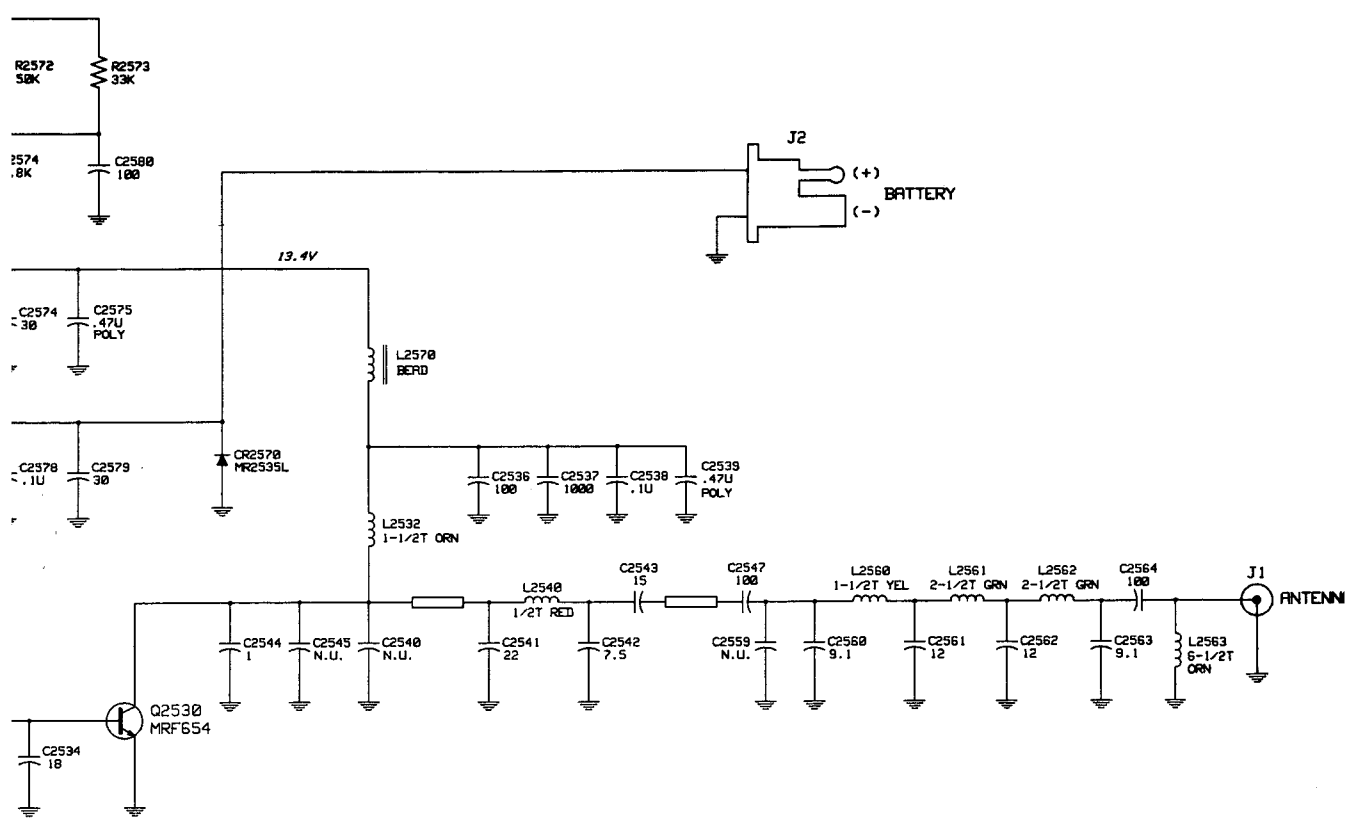
PMLE4145A UHF Power Amplifier, 444-474 MHz, 1-10 W PL-981008-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>capacitor, fixed: uF +/-5%; 50 V:</b> unless otherwise stated
C2501 thru 2506	21-84874K01	470 pF feedthru
C2510	21-13740B49	100 pF
C2511	21-13740B27	12 pF
C2512	21-13740B29	15 pF
C2513, 2514	21-13740B73	1000 pF
C2515	21-13740B25	10 pF
C2516	21-13741B69	0.1 uF
C2517	21-13740B36	30 pF
C2518	21-13740B49	100 pF
C2519	21-13740B73	1000 pF
C2520	21-13740B29	15 pF
C2521	21-13740B33	22 pF
C2522	---	Not Used
C2523	---	Not Used
C2526	21-13740B49	100 pF
C2527	21-13740B73	1000 pF
C2528	21-11032B15	0.22 uF +80/-20%
C2529	21-13740B36	30 pF
C2530	21-13740B37	33 pF
C2531 thru 2534	21-13740B31	18 pF
C2536	21-13740B49	100 pF
C2537	21-13740B73	1000 pF
C2538	21-13741B69	0.1 uF
C2539	08-11051A17	poly 0.47 uF 63 V
C2540	---	Not Used
C2541	21-13740B33	22 pF
C2542	21-13740B22	7.5 ±0.25 pF
C2543	21-13740B29	15 pF
C2544	21-13740B01	1 ±0.25 pF
C2545	---	Not Used
C2547	21-13740B49	100 pF
C2548	21-11032B15	0.22 uF +80/-20%
C2549	21-13740B49	100 pF
C2556	---	Not Used
C2559	---	Not Used
C2560	21-13740B24	9.1 ±0.25 pF
C2561, 2562	21-13740B27	12 pF
C2563	21-13740B24	9.1 ±0.25 pF
C2564	21-13740B49	100 pF
C2570	21-13740B36	30 pF
C2574	21-13740B36	30 pF
C2575	08-11051A17	poly 0.47 uF 63 V
C2576	21-13740B49	100 pF
C2577	21-13740B73	1000 pF
C2578	21-13741B69	0.1 uF
C2579	21-13740B36	30 pF
C2580	21-13740B49	100 pF
		<b>diode: (see note)</b> transient suppressor
CR2570	48-80236E07	
		<b>ferrite beads:</b> ferrite bead
E2520	76-83960B01	
		<b>connector, receptacle:</b> mini UHF coax power (includes feedthru)
J1	09-80131M01	
J2	09-80255E01	
		<b>coil, rf:</b>
L2510	24-11030E01	1/2 turn BRN
L2511	24-11030B04	1-1/2 turns YEL
L2512	24-11030E02	1/2 turn RED
L2513	24-11030B01	1-1/2 turns BRN
L2515	24-80036A01	ferrite bead 1/2 turn
L2520	24-11030E01	1/2 turn BRN
L2522	24-82723H44	39 nH
L2530	24-11030B03	1-1/2 turns ORN
L2531	24-80036A01	ferrite bead 1/2 turn
L2532	24-11030B03	1-1/2 turns ORN
L2540	24-11030E02	1/2 turn RED
L2560	24-11030B04	1-1/2 turns YEL
L2561	24-11030B05	2-1/2 turns GRN
L2562	24-11030B05	2-1/2 turns GRN
L2563	24-11030B11	6-1/2 turns ORN
L2570	24-80036A01	ferrite bead 1/2 turn
		<b>connector, plug:</b> coaxial cable 150 mm with plug cable and connector assembly, 6-pin (includes C2501-6 and feedthru bracket)
P5	30-80138M07	
P7	01-80704Y64	

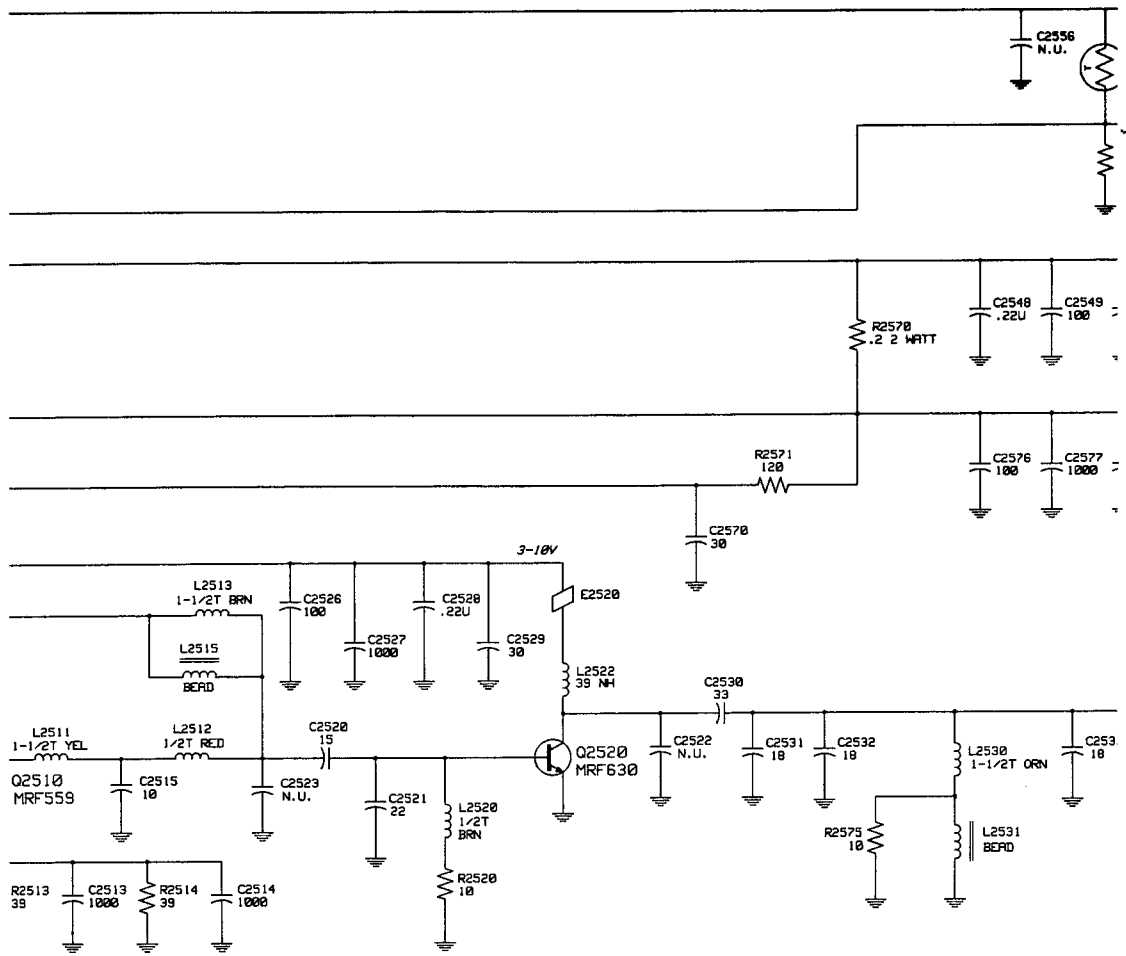
PMLE4145A UHF Power Amplifier, 444-474 MHz

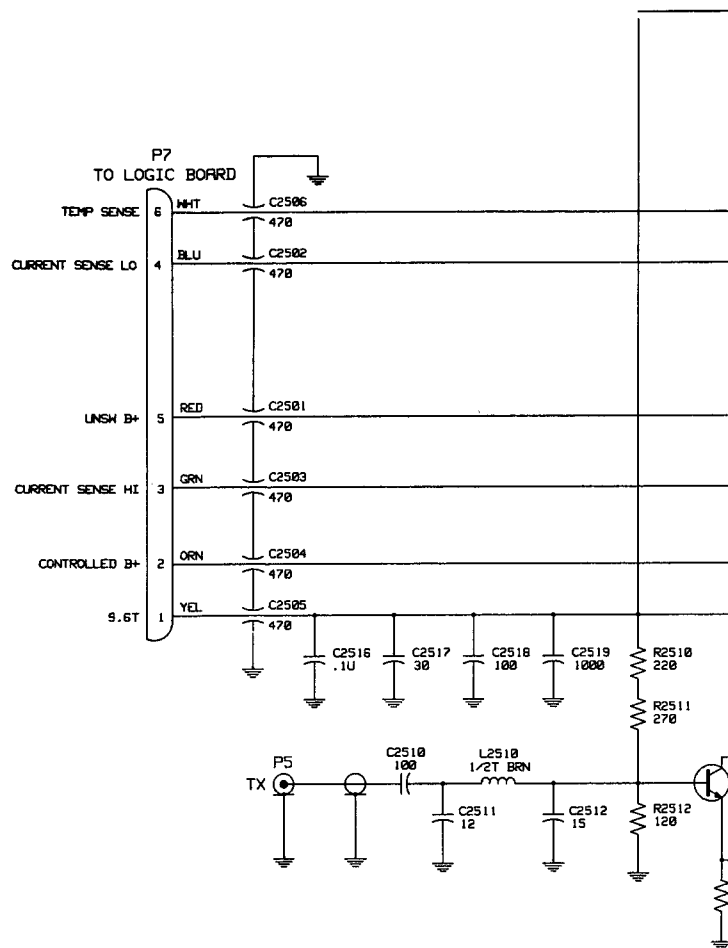
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>transistor:</b> NPN; tyf
Q2510	48-82233P39	
Q2520	48-80225C09	NPN; tyf
Q2530	48-80225C19	NPN; tyf
		<b>resistor:</b> unless o
R2510	06-11077A58	220 1/8 w
R2511	06-11077A60	270 1/8 w
R2512	06-11077A52	120 1/8 w
R2513, 2514	06-11077A40	39 1/8 w
R2520	06-11077A26	10 1/8 w
R2570	06-11086D01	0.2 2 wa
R2571	06-11077A52	120 1/8 w
R2572	06-05621T02	thermist
R2573	06-11077B11	33k 1/8 w
R2574	06-11077A80	1.8k 1/8 w
R2575	06-11077A26	10 1/8 w
		<b>non-referenced item:</b>
	01-80747T27	transistor (includes nut 8-32)
	02-00007003	nut 8-32
	03-10943M10	screw M
	03-10943M11	screw M
	04-00131974	washer
	04-05587G01	plastic w
	26-80223M07	PA shield
	26-80475U01	heatsink
	26-80514C01	shield, fil
	26-80551C01	shield, a
	29-80014A03	clip coax
	32-80014N03	gasket, ε

**note:** For optimum performance, diodes, transistors must be ordered by Motorola part numbers.

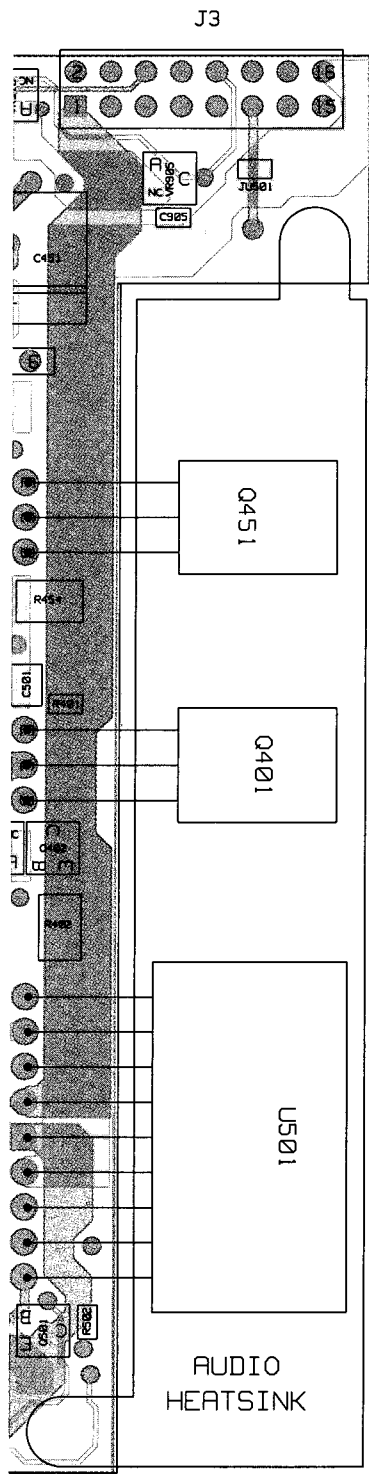


6/17/98 RPD-98111-4



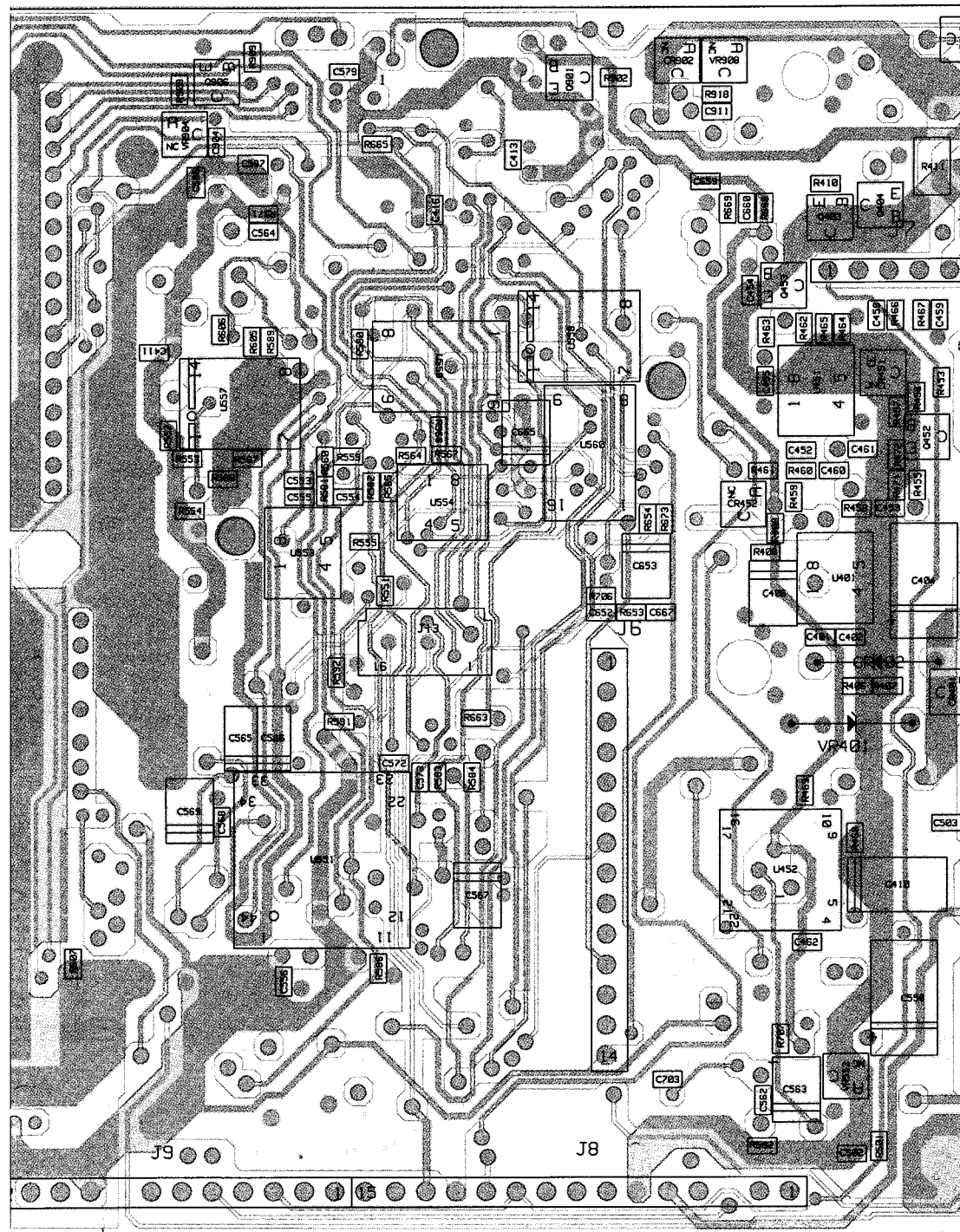


Schematic Diagram and Parts List for  
 UHF Power Amplifier Board, 444-474 MHz, 1-10 W  
 (Part of PMUE1505A Transceiver)



Circuit Board Details for Masked Logic Board, 4-Layer  
 (Part of HUD3119A, HUE3191A, PMUD1533A & PMUE1505A Transceivers)

4D80437U03 ISS B  
COMPONENT SIDE

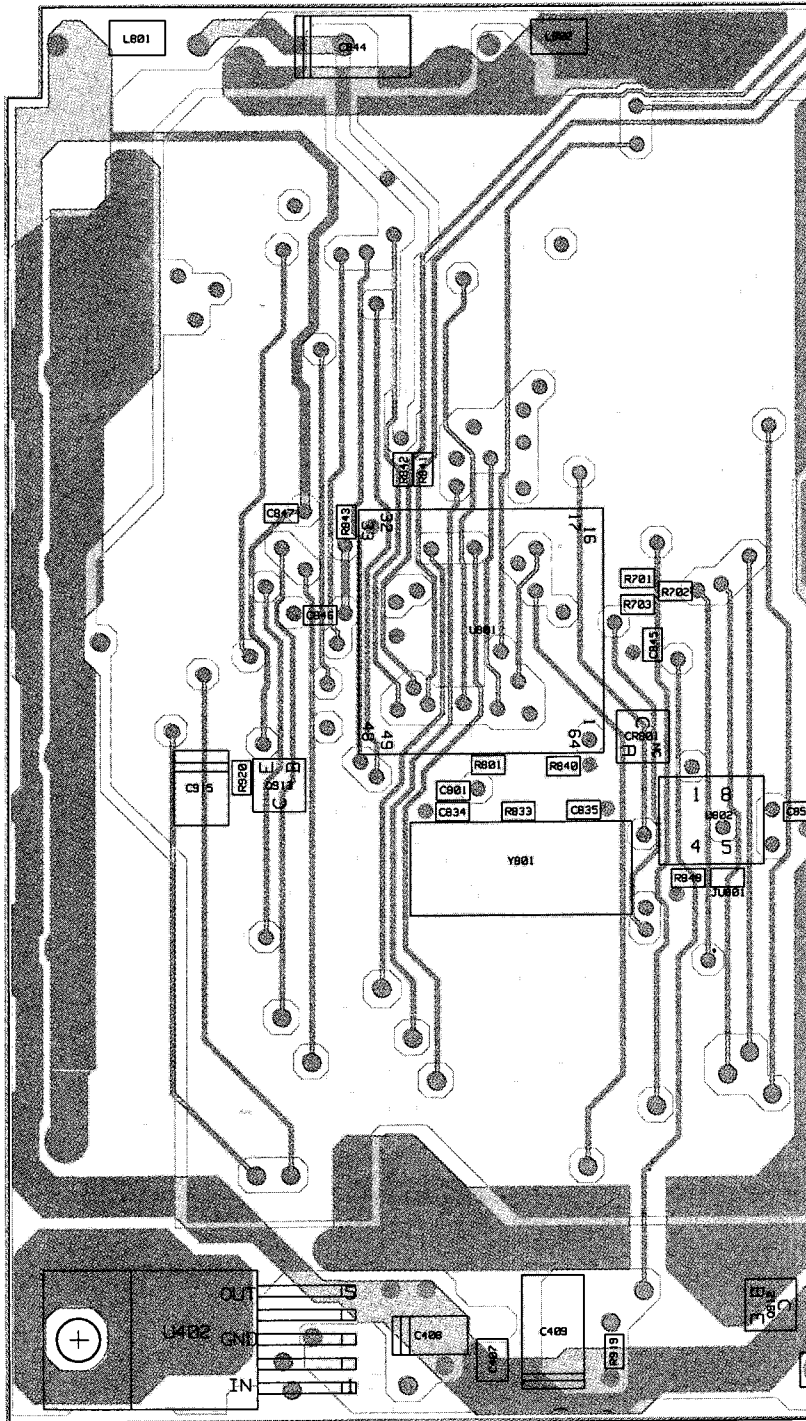


T SIDE INNER LAYER (GRAY)  
DIE INNER LAYER (PINK)

RCB-97154-A  
RCB-97155-A  
RCB-97157-A

COMPONENT SIDE VIEW



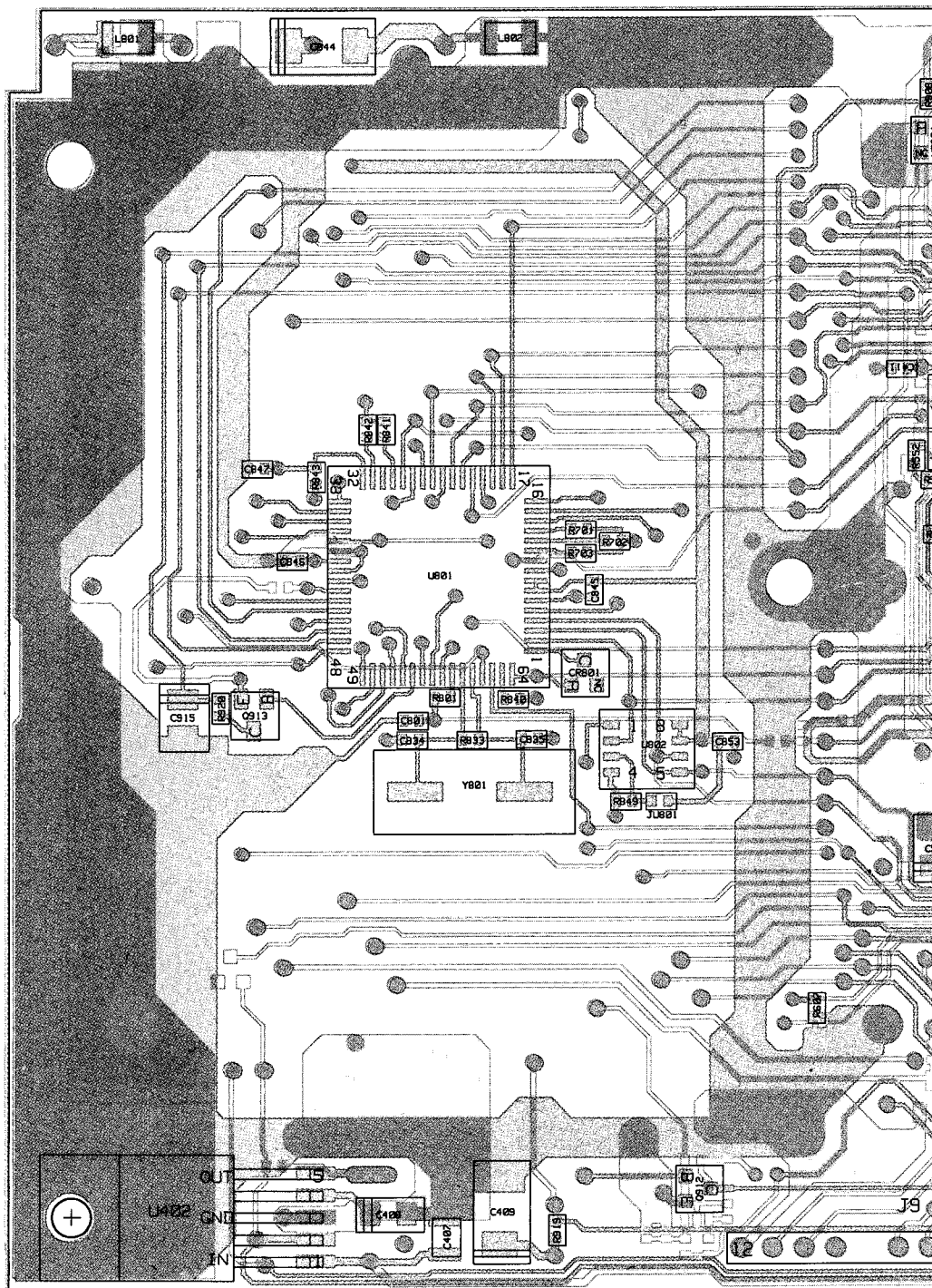


**COMPONENT  
SOLDER SITES  
OVERLAY --**



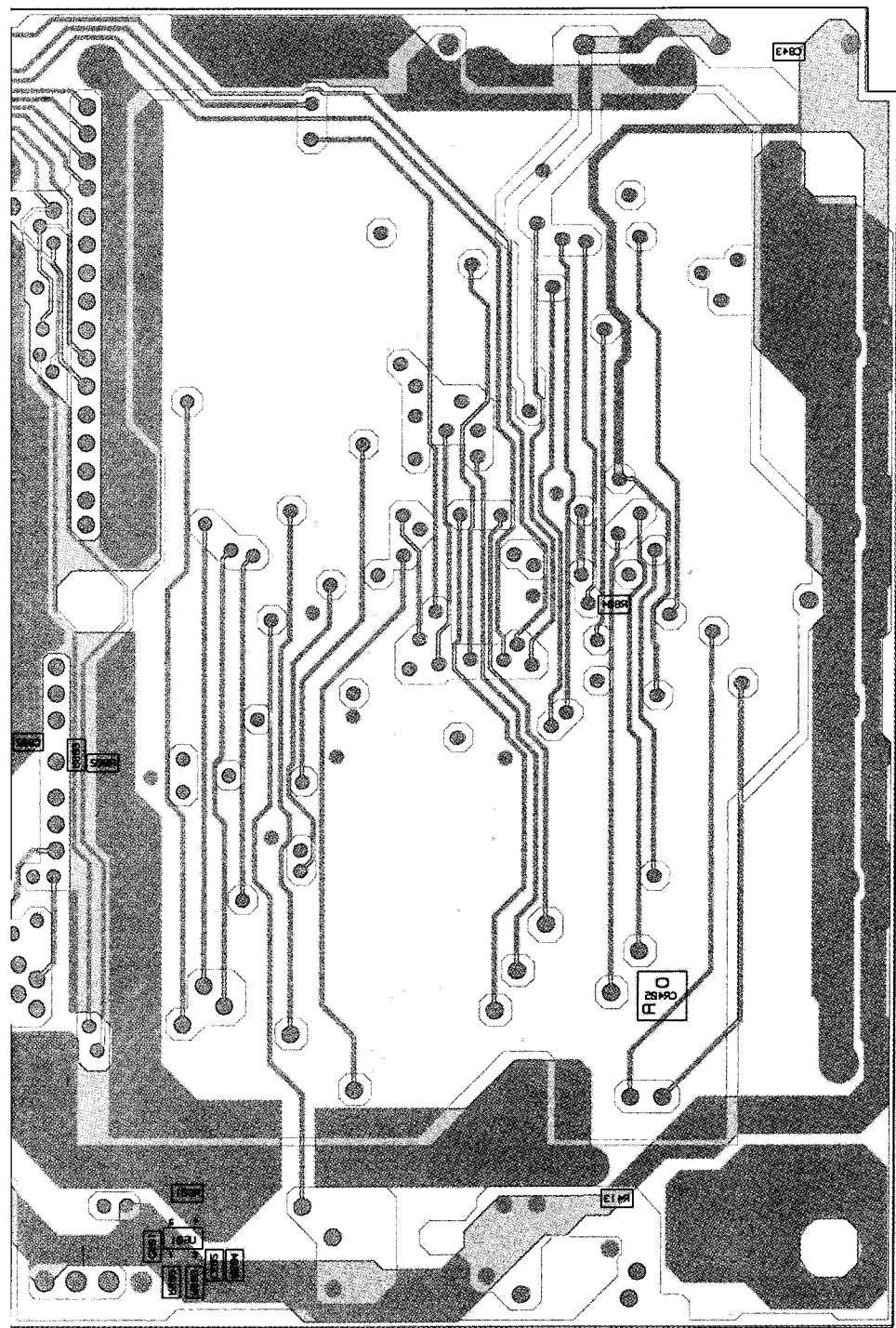
84D8043

COMPON



COMPONENT SIDE  
SOLDER SIDE (P1)  
OVERLAY -----

COMPON

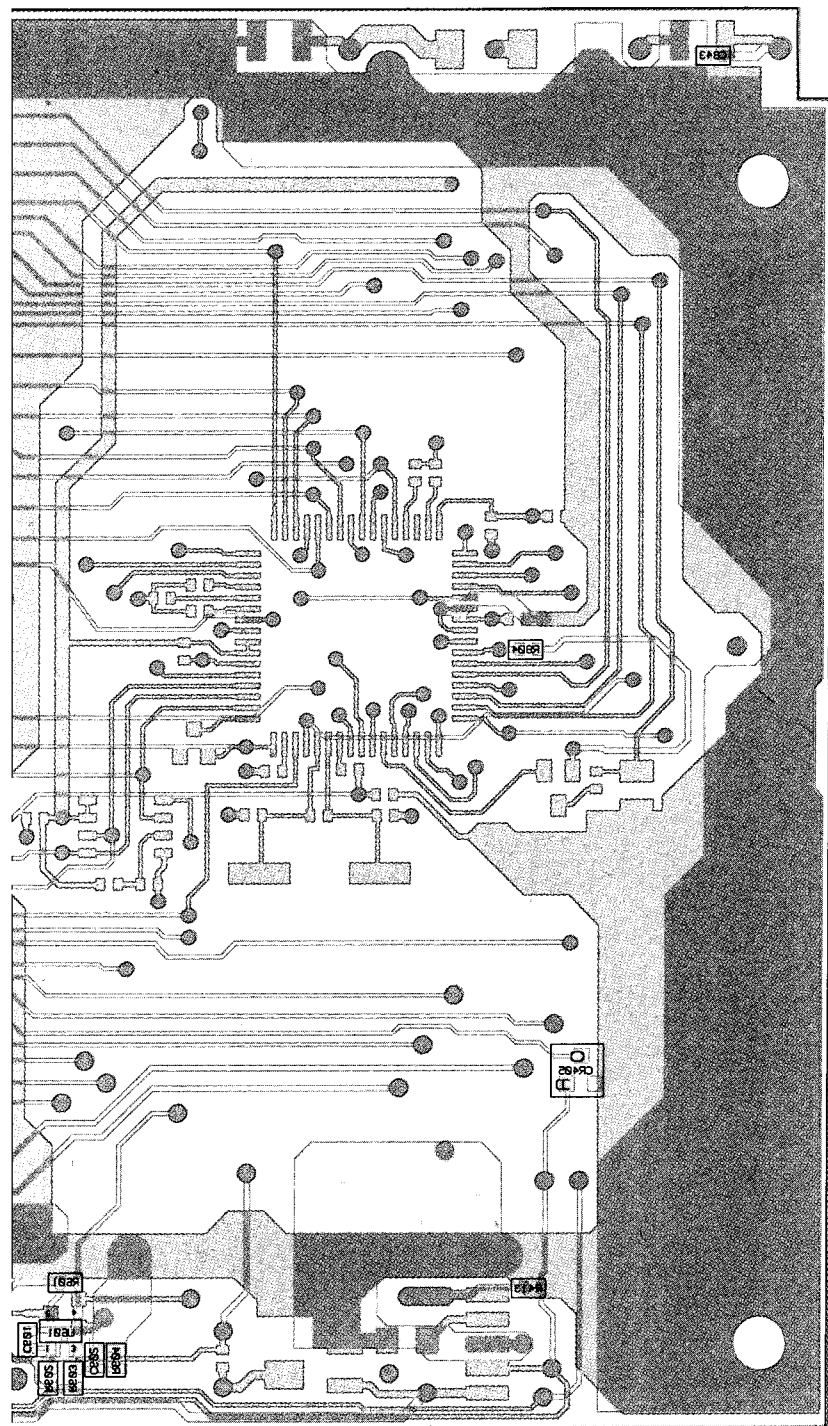


B 3-31-98

RCB-97154-A (REV)  
RCB-97155-A (REV)  
RCB-97158-A (REV)

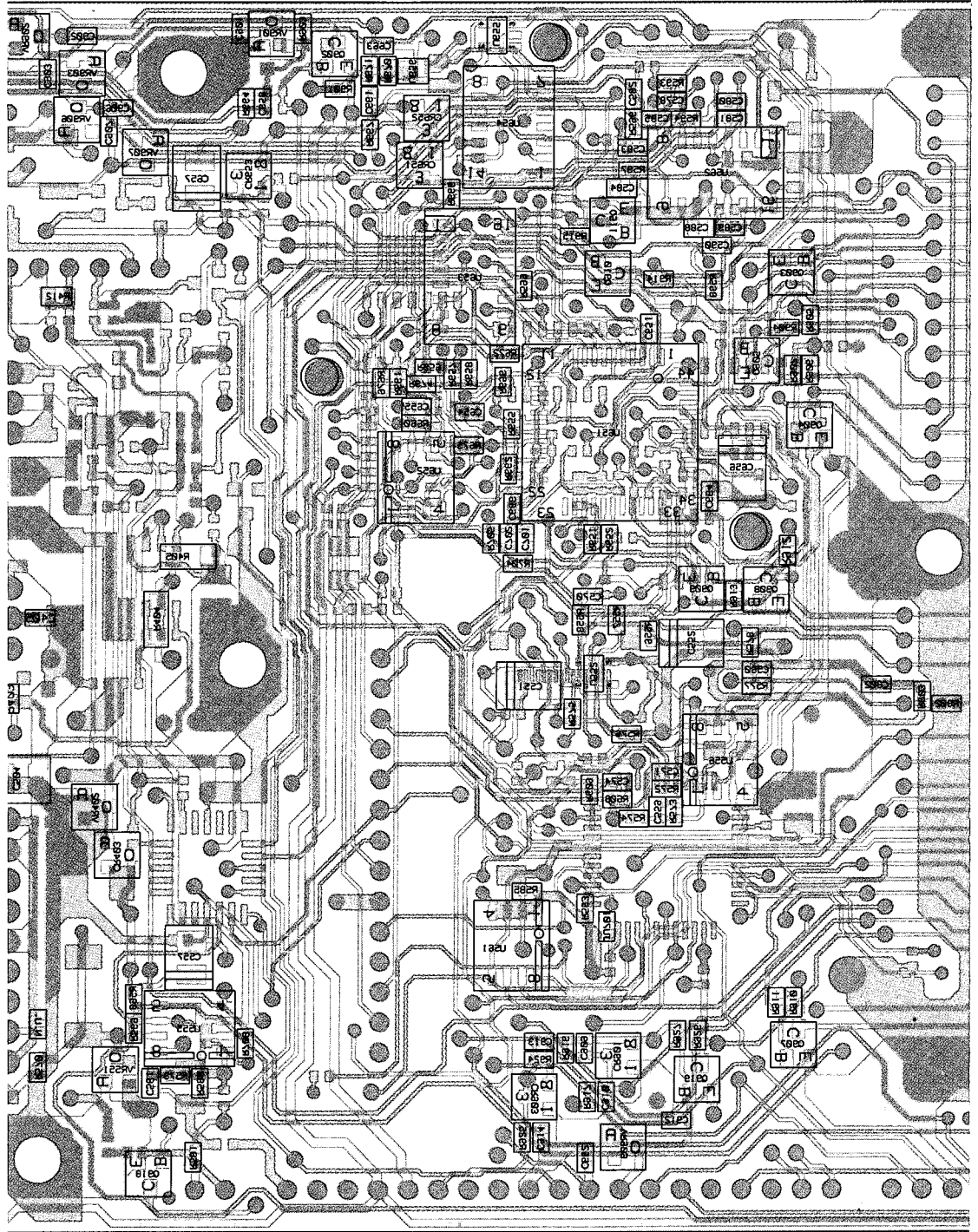






31-98

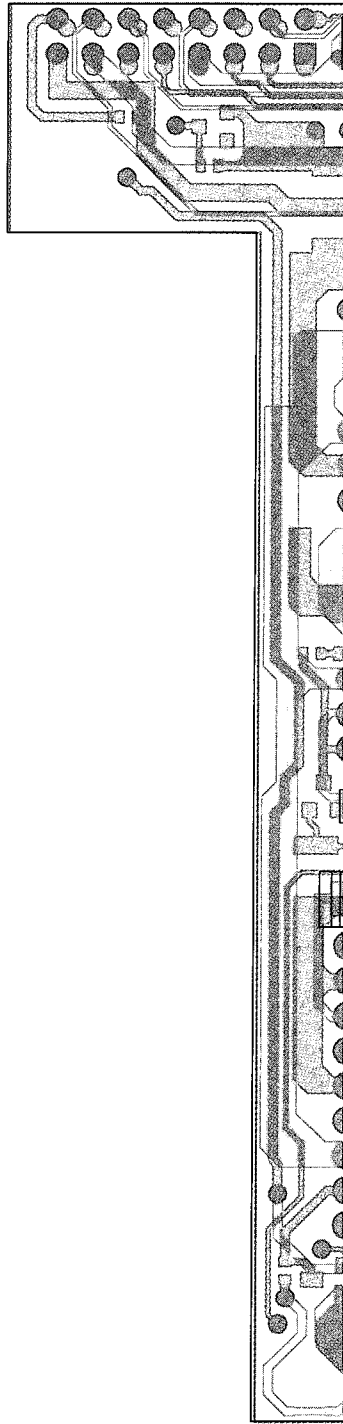
7153-A (REV)  
7156-A (REV)  
7158-A (REV)



84D80437U03 ISS B 3-  
SOLDER SIDE

<b>COMPONENT SIDE (GRAY)</b>	RCB-9
<b>SOLDER SIDE (PINK)</b>	RCB-9
<b>OVERLAY -----</b>	RCB-9

**SOLDER SIDE VIEW**



*Circuit Board Details for Masked Logic Board, 4-Layer  
(Part of HUE3191A, HUE3191A, PMUD1533A & PMUE1505A Transceivers)*



REFERENCE AMBOL	MOTOROLA PART NO.	DESCRIPTION
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A89	47k
	06-62057A65	4.7k
	06-62057A33	220
	06-62057A65	4.7k
	06-62057A75	12k
	06-62057A37	330
	06-62057A89	47k
	06-62057A33	220
	06-62057A89	47k
	06-62057A65	4.7k
		<b>Integrated circuit: (see note)</b>
	51-02198J22	dual op-amp 4558 SOIC
	51-04664J01	regulator, 5V with reset
	51-02198J22	dual op-amp 4558 SOIC
	51-05226P38	DAC
	51-02463J67	audio power amp TDA1519C
	51-80604E01	audio filter
554	51-62852A09	single opamp LMC7101
	51-80932W01	dual op-amp LM2904 SOIC
	51-02198J22	dual op-amp 4558 SOIC
	51-80932W01	dual op-amp LM2904 SOIC
558	51-05663U35	quad analog switch 4066B
560	51-84704M60	triple 2-channel switch 4053B
	51-80932W01	dual op-amp LM2904 SOIC
	51-13811A35	comparator MC33111
	51-62001R11	single comparator TA75S393F
	51-80604E01	audio filter
	51-80932W01	dual op-amp LM2904 SOIC
	51-84704M60	triple 2-channel switch 4053B
	51-05663U35	quad analog switch 4066B
	51-05461G61	NAND gate TC7S00F
	48-09939C04	dual transistor switch UMC3TL
	51-80629U01	microcomputer MC68HC11KA4 OTP
	---	Not Used
		<b>voltage regulator: (see note)</b>
01	48-83461E40	zener diode 5.1V 1%
02	48-80140L06	zener diode 5.1V SOT
03	48-80140L15	zener diode 10V SOT
03	48-80140L15	zener diode 10V SOT
01 thru 910	48-80948V01	zener diode 27V SOT
		<b>crystal: (see note)</b>
	48-80113R15	8.4 MHz

**non-referenced items**

03-10943M04	screw M2.5 x 0.45 x 8 (2 used, for Q401 and Q452)
03-10943M11	screw M3.0 x 0.5 x 10 (2 used for U501)
26-80497B01	heatsink

For optimum performance, diodes, transistors, and integrated circuits are ordered by Motorola part numbers.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C845, 846	21-13743E20	0.1 uF 10%; 16 V
C847	21-13741F25	1000 pF
C853	---	Not Used
C901 thru 914	21-13741F17	470 pF
C915	23-11049A57	tantalum 10 uF 10%; 16 V
CR401	48-05129M76	diode: (see note) silicon SOT
CR402	48-83654H02	silicon
CR403	48-05129M76	silicon SOT
CR405	48-05129M76	silicon SOT
CR451, 452	48-05129M76	silicon SOT
CR651 thru 653	48-13833C07	dual silicon SOT MMBD7000
CR801	48-80939T01	Schottky SOT
CR901	48-13833C07	dual silicon SOT MMBD7000
CR902	48-05129M76	silicon SOT
CR903	48-13833C07	dual silicon SOT MMBD7000
J3	28-80923V01	connector, receptacle: 16-pin, accessories
J6	09-80130M03	14-pin, RF board
J7	28-80128M03	6-pin, RF power amplifier
J8/J9	28-80600B02	27-pin, includes J8 and J9
J13	09-80472U01	16-pin, option board
JU501	06-62057B47	jumper: jumper
JU701	---	Not Used
JU801	---	Not Used
L801, 802	24-84657R01	coil, rf: ferrite bead
Q401	48-02245J25	transistor: (see note) PNP; type 2SB1142S
Q402	48-80214G02	NPN; type MMBT3904
Q403	48-80141L03	PNP; type BCW68G
Q404	48-80214G02	NPN; type MMBT3904
Q451	48-02245J25	PNP; type 2SB1142S
Q452, 453	48-80214G02	NPN; type MMBT3904
Q501	48-80947V01	digital NPN; type DTC144W
Q901	48-80947V01	digital NPN; type DTC144W
Q902	48-80141L03	PNP; type BCW68G
Q903 thru 912	48-80947V01	digital NPN; type DTC144W
Q913	48-80494U01	digital PNP; type DTA144W
Q918, 919	48-80947V01	digital NPN; type DTC144W
R401	06-62057A45	resistor, chip: +/-5%; 1/16 W: unless otherwise stated 680
R402	06-80195M37	330; 1/2 W
R403	06-62057A45	680
R404	06-11077F18	1.74k 1%; 1/8 W
R405	06-11077F28	2.21k 1%; 1/8 W
R406	06-62057A73	10k
R407	06-62057A51	1.2k
R408, 409	06-62057P10	10.0k 1%
R410	06-62057A45	680
R411	06-80195M37	330; 1/2 W
R412	06-62057C81	1.8k; 1/10 W
R413	06-62057A73	10k
R453	06-62057A45	680
R454	06-80195M37	330; 1/2 W
R455	06-62057A45	680
R456	06-62057A59	2.7k
R457	---	Not Used
R458, 459	06-62057A65	4.7k
R460	06-62057A75	12k
R461	06-62057A45	680
R462	06-62057A83	27k
R463	06-62057A73	10k
R464, 465	06-62057P95	100k 1%
R466, 467	06-62057P10	10k 1%
R468, 469	06-62057A91	56k
R471	06-62057A81	22k
R472	06-62057A67	5.6k
R501	06-62057A37	330
R502	06-62057A97	100k
R551 thru 553	06-62057A91	56k
R554	06-62057A73	10k
R555	06-62057A84	30k
R556	06-62057A95	82k
R557	06-62057B16	560k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	R1
R558	06-62057A73	10k	R9
R559	06-62057A93	68k	R9
R560, 561	06-62057A92	62k	R9
R562	06-62057A89	47k	R9
R563	06-62057A73	10k	R9
R564 thru 567	06-62057A89	47k	R9
R568	06-62057A84	30k	R9
R569	06-62057B06	220k	R9
R570	06-62057A43	560	R9
R571	06-62057A84	30k	R9
R572	06-62057A85	33k	R9
R573	06-62057B04	180k	R9
R574	06-62057A69	6.8k	R9
R575	06-62057A84	30k	R9
R576	06-62057A75	12k	R9
R577, 578	06-62057A73	10k	R9
R579	06-62057A84	30k	R9
R580	06-62057B04	180k	R9
R581	06-62057A77	15k	R9
R582	06-62057A43	560	R9
R583	06-62057A84	30k	R9
R584, 585	06-62057A73	10k	R9
R586	06-62057A90	51k	R9
R587	06-62057B04	180k	R9
R588	06-62057B07	240k	U4
R589, 590	06-62057A73	10k	U4
R591, 592	06-62057A69	6.8k	U4
R593	06-62057A85	33k	U4
R594	06-62057A90	51k	U5
R596	06-62057A90	51k	U5
R597	06-62057A85	33k	U5
R598	06-62057A43	560	U5
R599	06-62057A97	100k	U5
R601	06-62057A81	22k	U5
R602	06-62057A97	100k	U5
R603	06-62057A73	10k	U5
R604	06-62057B22	1 meg.	U5
R605	06-62057A95	82k	U5
R606	06-62057A89	47k	U5
R607	06-62057A73	10k	U6
R608	06-62057A57	2.2k	U6
R609	06-62057A89	47k	U6
R651	06-62057A84	30k	U6
R652	06-62057A73	10k	U6
R653	06-62057B11	360k	U6
R654	06-62057B01	130k	U6
R655	06-62057B04	180k	U8
R656	06-62057A01	10	U8
R657	06-62057B14	470k	
R658	06-62057B09	300k	VR
R659	06-62057A91	56k	VR
R660	06-62057A99	120k	VR
R661	---	Not Used	VR
R662	06-62057A73	10k	VR
R663	06-62057A91	56k	VR
R664	06-62057A97	100k	
R665	06-62057A82	24k	
R666, 667	06-62057A97	100k	Y8
R668	06-62057A40	430	
R669	06-62057A20	62	
R670	06-62057A40	430	
R671	06-62057A20	62	
R672	06-62057A90	51k	
R673	06-62057A82	24k	
R674	06-62057A91	56k	
R675, 676	06-62057A67	5.6k	
R701	06-62057B03	160k	note must
R702	06-62057B06	220k	
R703	06-62057A97	100k	
R704	06-62057A01	10	
R705	06-62057A68	6.2k	
R706	06-62057A73	10k	
R707, 708	06-62057A91	56k	
R801	06-62057A57	2.2k	
R802	06-62057A49	1k	
R803	06-62057A82	24k	
R804	06-62057A97	100k	
R833	06-62057B28	1.8 meg.	
R840 thru 483	06-62057A73	10k	
R849	---	Not Used	
R901	06-62057A53	1.5k	
R902	06-62057C85	2.7k 1/10; W	
R903	06-62057A73	10k	

# Parts List

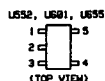
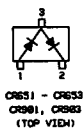
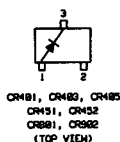
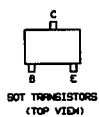
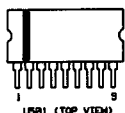
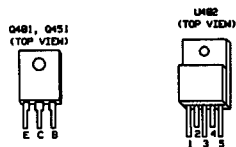
HLN9395A Audio/Logic Board

PL-971

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, chip: uF +/-5%; 50 V unless otherwise stated
C401	21-13741F49	.01 uF
C402	21-13743E07	.022 uF 10%; 16 V
C404	23-11049C05	tantalum 47 uF 10%; 16 V
C405	21-13741F49	.01 uF
C406	23-11049A57	tantalum 10 uF 10%; 16 V
C407	21-13741W01	1 uF 10%; 25V
C408	23-11049A05	tantalum 0.47 uF 10%; 25 V
C409, 410	23-11049A98	tantalum 47 uF 10%; 10 V
C411	21-13741F49	.01 uF
C413	21-13741F49	.01 uF
C416	21-13741F49	.01 uF
C451	23-11049C05	tantalum 47 uF 10%; 16 V
C452	21-13741F49	.01 uF
C453	21-13743E20	0.1 uF 10%; 16 V
C454	21-13741F49	.01 uF
C455	21-13743K16	0.22 uF +80/-20%; 16 V
C458, 459	21-13740F38	30 pF
C460 thru 462	21-13741F49	.01 uF
C501	21-13741W01	1 uF 10%; 25 V
C502	21-13743E20	0.1 uF 10%; 16 V
C503	21-13741F41	4700 pF
C504	23-11049A57	tantalum 10 uF 10%; 16 V
C505	21-13743K16	0.22 uF +80/-20%; 16 V
C551, 552	23-11049J11	tantalum 4.7 uF 10%; 16 V
C553	21-13741F23	820 pF
C554	21-13741F33	2200 pF
C555	21-13740F53	120 pF
C556	21-13743E20	0.1 uF 10%; 16 V
C557	23-11049A57	tantalum 10 uF 10%; 16 V
C558	23-11049C05	tantalum 47 uF 10%; 16 V
C559	21-13741F41	4700 pF
C560	21-13741F25	1000 pF
C561, 562	21-13743E20	0.1 uF 10%; 16 V
C563	23-11049A57	tantalum 10 uF 10%; 16 V
C564	21-13743E20	0.1 uF 10%; 16 V
C565	23-11049A05	tantalum 0.47 uF 10%; 25 V
C566	23-11049A07	tantalum 1 uF 10%; 16 V
C567	23-11049A90	tantalum 47 uF 10%; 4 V
C568	21-13743E20	0.1 uF 10%; 16V
C569	23-11049A11	tantalum 3.3 uF 10%; 16 V
C570	21-13741F41	4700 pF
C571 thru 574	21-13743E20	0.1 uF 10%; 16 V
C578	---	Not Used
C579	21-13743E20	0.1 uF 10%; 16 V
C580	21-13743K16	0.22 uF +80/-20%; 16 V
C581	21-13740F60	240 pF
C582	21-13743E20	0.1 uF 10%; 16 V
C583	21-13740F60	240 pF
C584	21-13928E01	1 uF 10%; 10 V
C585	21-13743E20	0.1 uF 10%; 16 V
C586	21-13928E01	1 uF 10%; 10 V
C587, 588	21-13743A24	0.33 uF 10%; 16 V
C589	21-13740F60	240 pF
C590	21-13743K16	0.22 uF +80/-20%; 16 V
C601	21-13743E20	0.1 uF 10%; 16 V
C602	21-13741F41	4700 pF
C651	21-13743E20	0.1 uF 10%; 16 V
C652	21-13741F49	.01 uF
C653	23-11049A09	tantalum 2.2 uF 10%; 20 V
C654	21-13741F25	1000 pF
C655	21-13741F17	470 pF
C656	23-11049A11	tantalum 3.3 uF 10%; 16 V
C657	23-11049J11	tantalum 4.7 uF 10%; 16 V
C658	21-13741F17	470 pF
C659	21-13743K16	0.22 uF +80/-20%; 16 V
C660	21-13743E20	0.1 uF 10%; 16 V
C661	21-13743K16	0.22 uF +80/-20%; 16 V
C662, 663	21-13741F17	470 pF
C664	21-13743E20	0.1 uF 10%; 16 V
C665	23-11049A90	tantalum 47 uF 10%; 4 V
C666	06-62057B47	jumper
C667	21-13741F25	1000 pF
C701	21-13743E11	.039 uF 10%; 16 V
C702	21-13741F49	.01 uF
C703	21-13743E11	.039 uF 10%; 16 V
C801	21-13740F39	33 pF
C802	21-13743E20	0.1 uF 10%; 16 V
C834	21-13740F35	22 pF
C835	21-13740F39	33 pF
C843	21-13743E20	0.1 uF 10%; 16 V
C844	23-11049A98	tantalum 47 uF 10%; 10 V

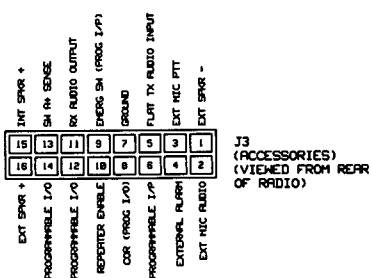
Parts List for Masked Logic Board, 4-Layer  
(Part of HUD3191A, HUE3191A, PMUD1533A & PMUE1505A Transceivers)

3  
 SD4  
 \*  
 LLED B+  
 IT SD4S HI  
 IT SD4S LO

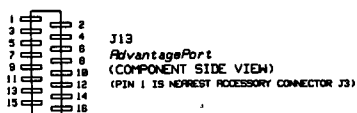


001-56  
 ; VIA  
 11101  
 (Y BD)  
 DATA  
 CLOCK  
 R ENABLE LED

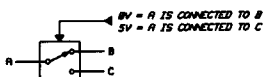
ENABLE



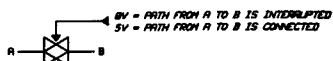
RADIO  
 IT TOP  
 IT0



OR +  
 OR -  
 INT MIPER



TS VIA  
 J5001  
 (1C BD)

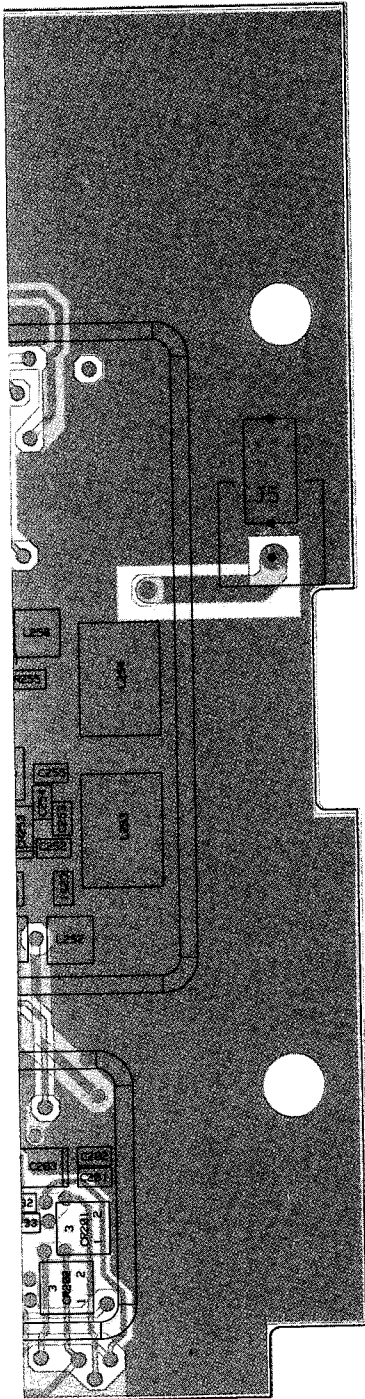


AUDIO VOLTAGE LEVELS ARE MEASURED AT 1 KHZ,  
 60% DEVIATION, UNLESS OTHERWISE SPECIFIED.

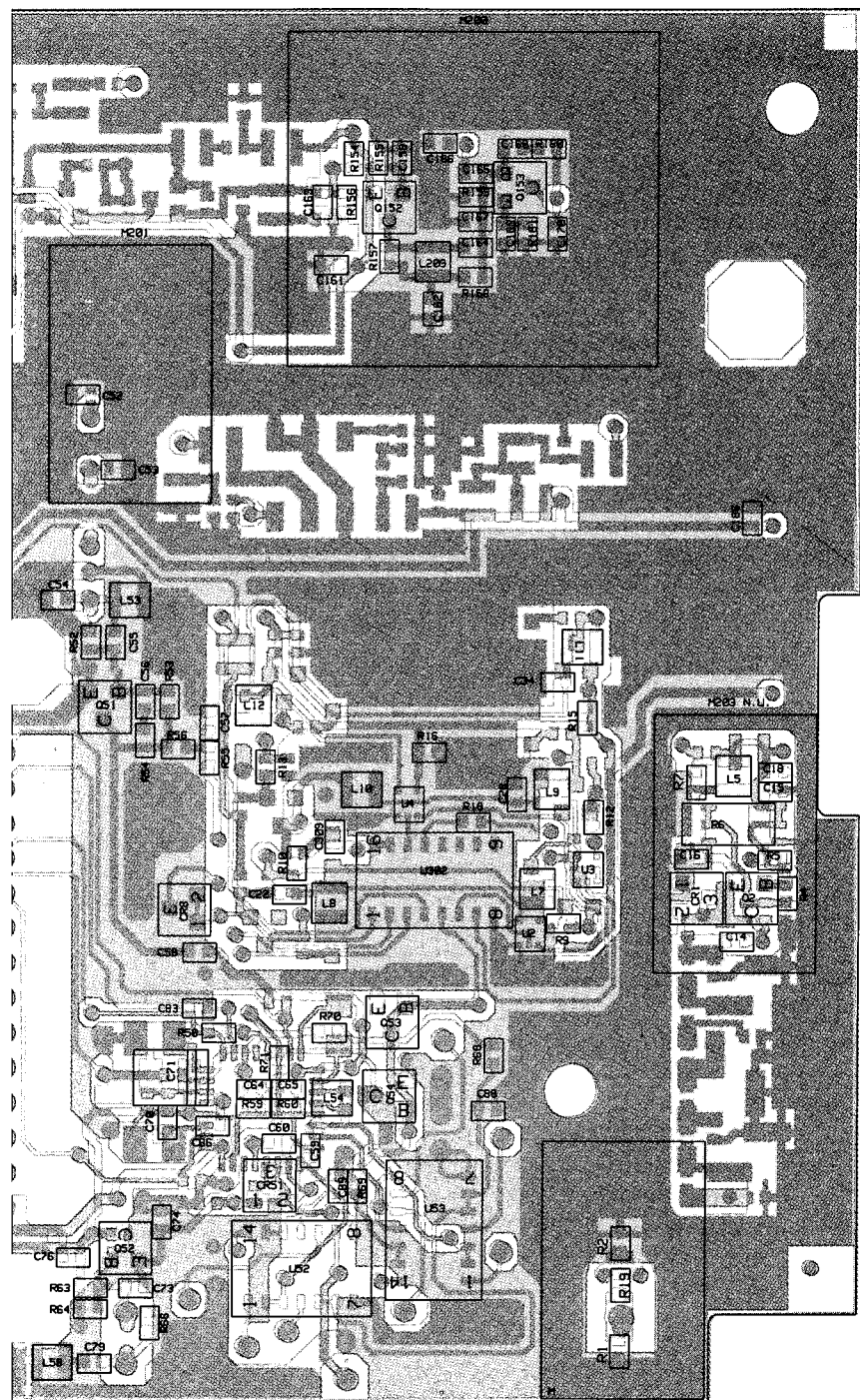
**Schematic Diagram for Masked Logic Board, 4-Layer**  
**(Part of HUD3119A, HUE3191A MPUD1533A & PMUE1505A Transceivers)**







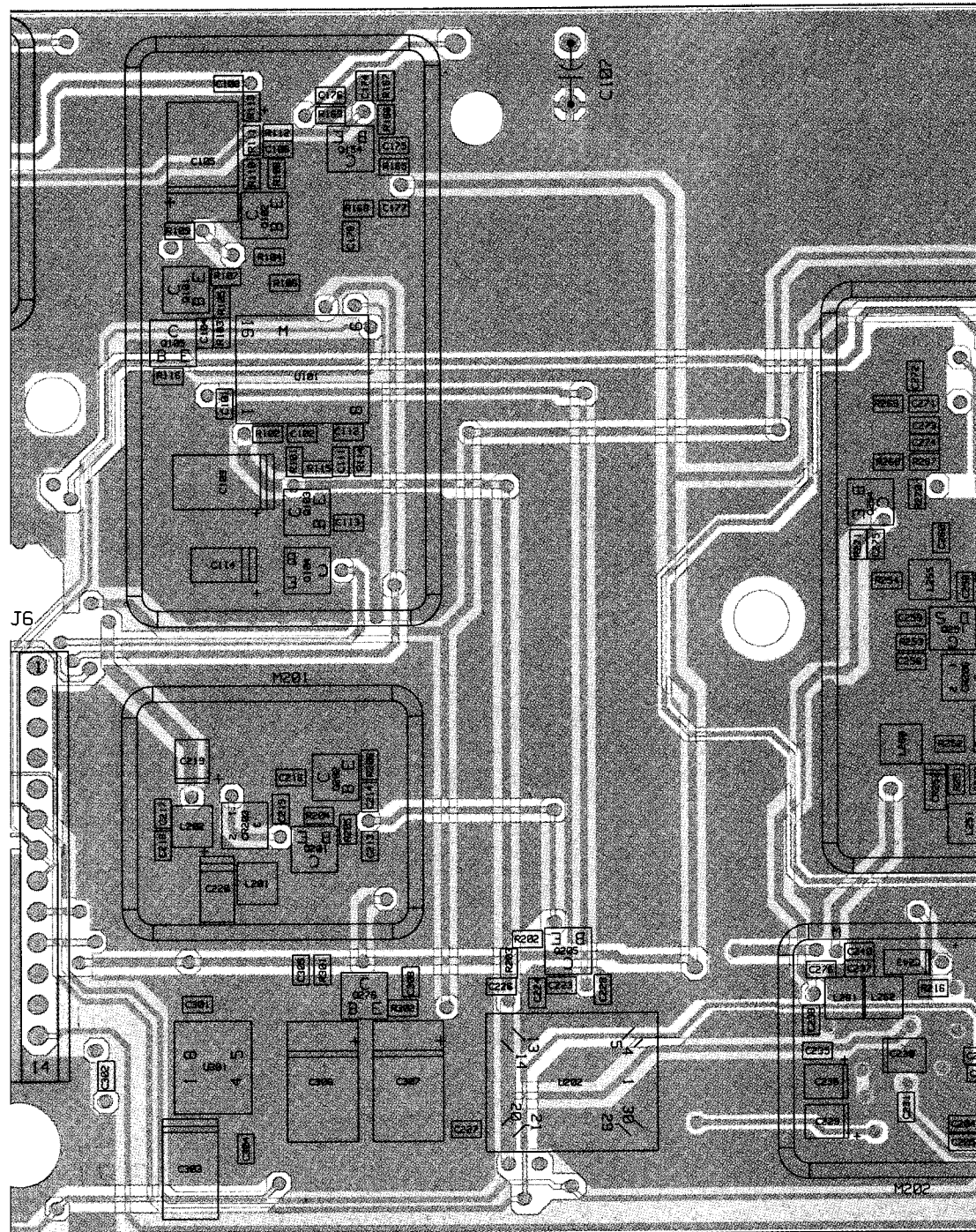
*Circuit Board Details for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A & PMUD1533A Transceivers)*





84D80432U02 ISSUE A

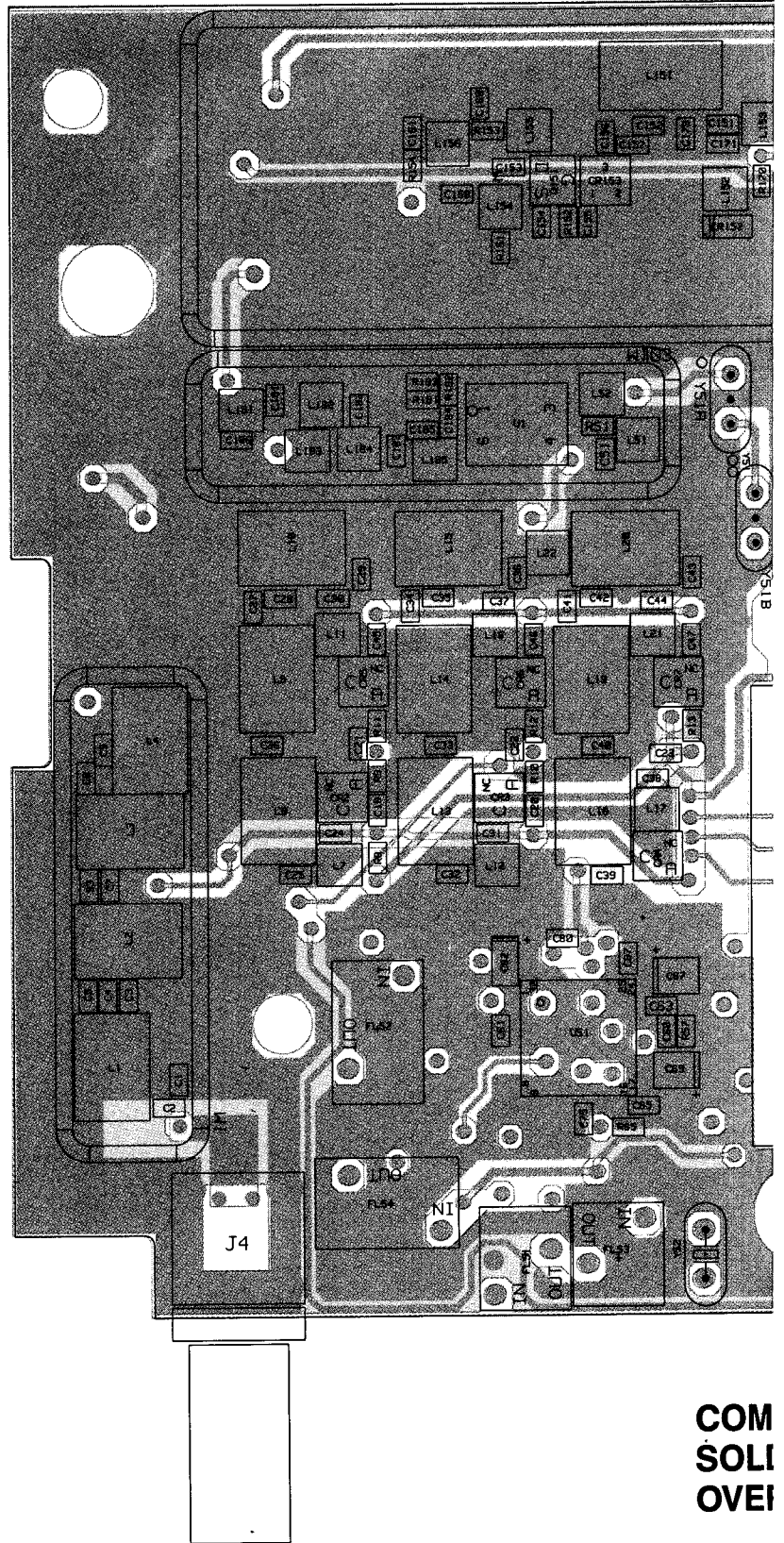
COMPONENT SIDE



COMPONENT SIDE INNER LAYER (GRAY)  
OTHER SIDE INNER LAYER (PINK)  
SILVER PASTE LAYER -----

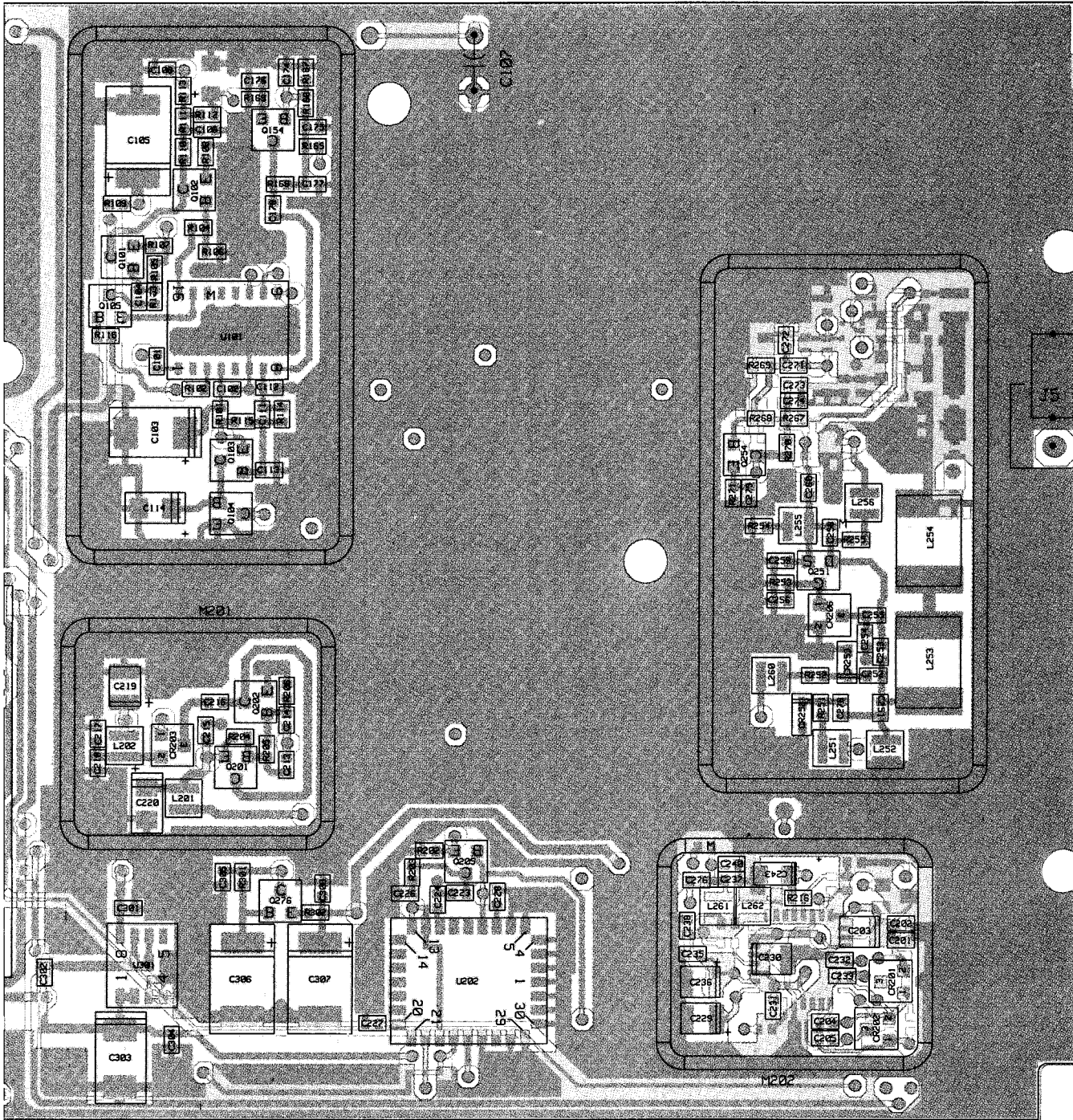
RCB-97160-A  
RCB-97161-A  
RCB-97163-A

COMPONENT SIDE VIEW



COM  
SOLI  
OVEI

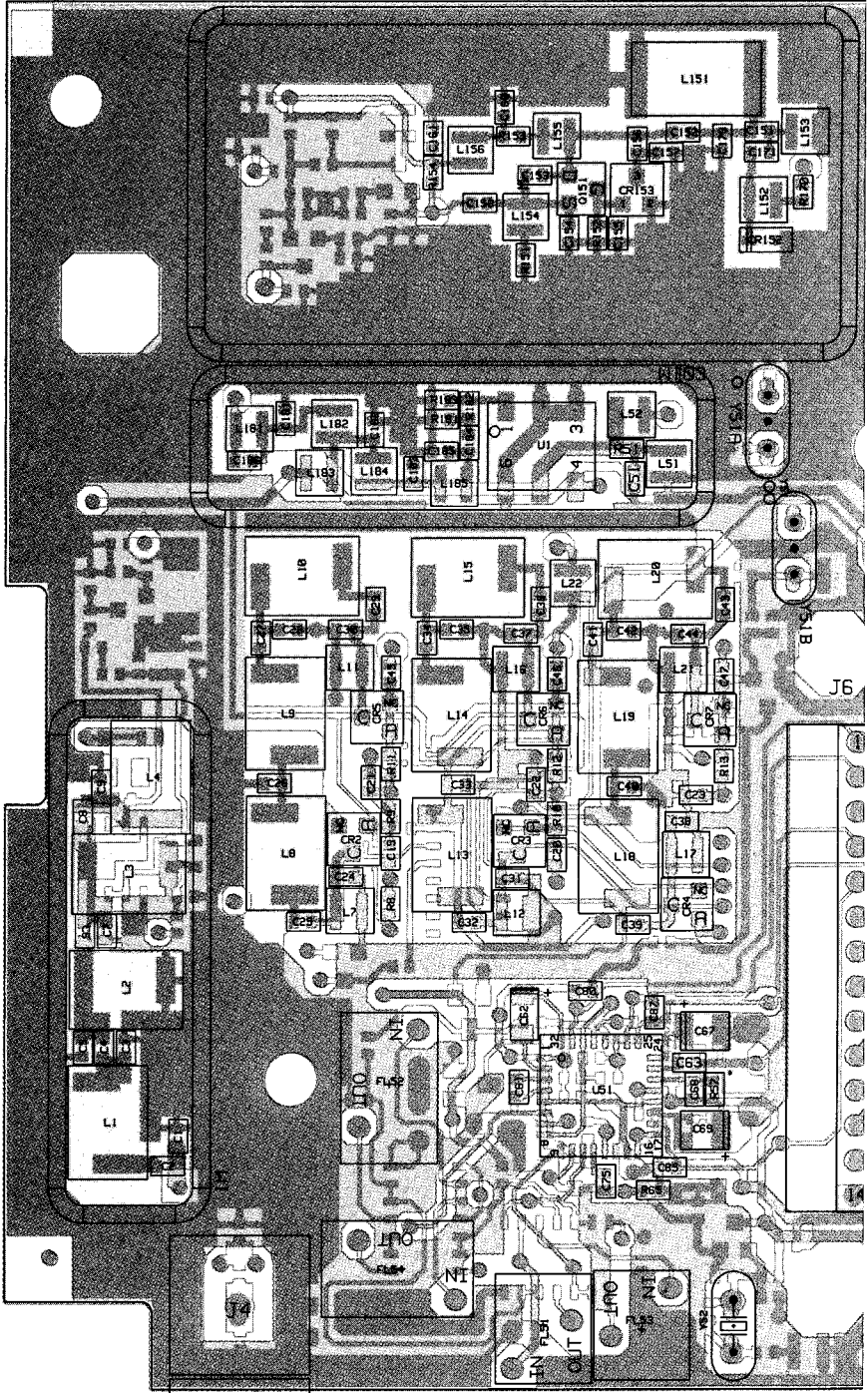




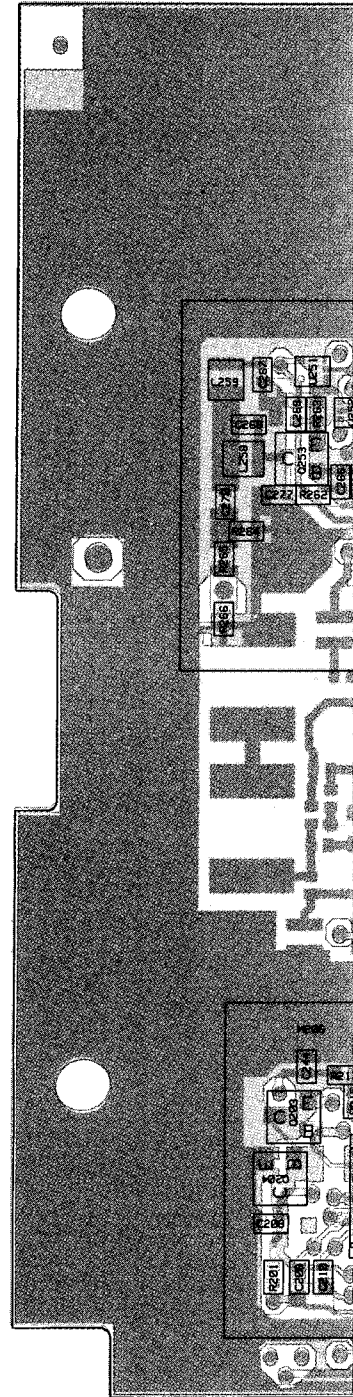
COMPONENT SIDE (GRAY)  
PCB LAYER SIDE (PINK)  
PCB LAYER -----

RCB-97159-A  
RCB-97162-A  
RCB-97163-A

COMPONENT SIDE VIEW

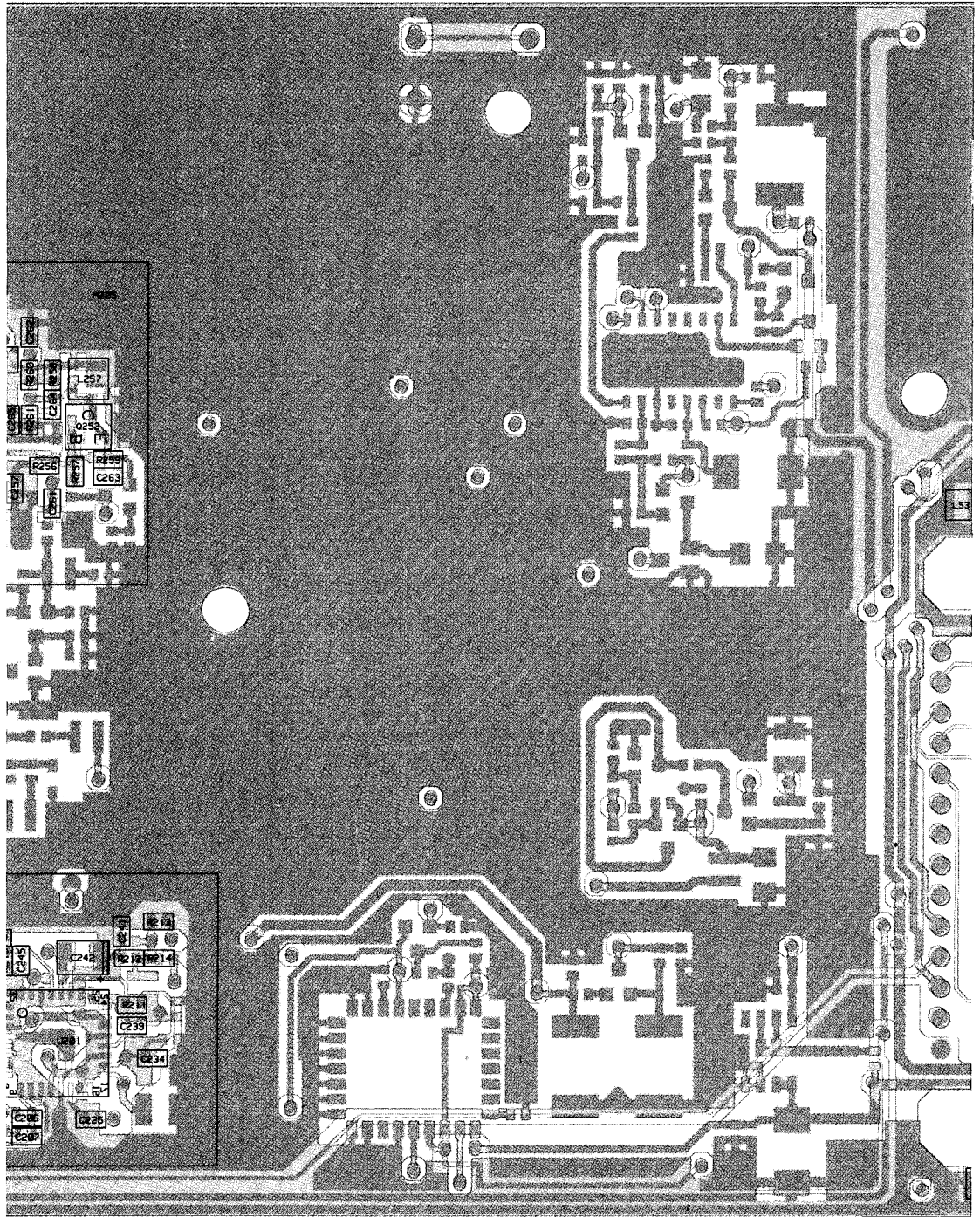


COM  
SOL  
OVE



*Circuit Board Details for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A & PMUD1533A Transceivers)*



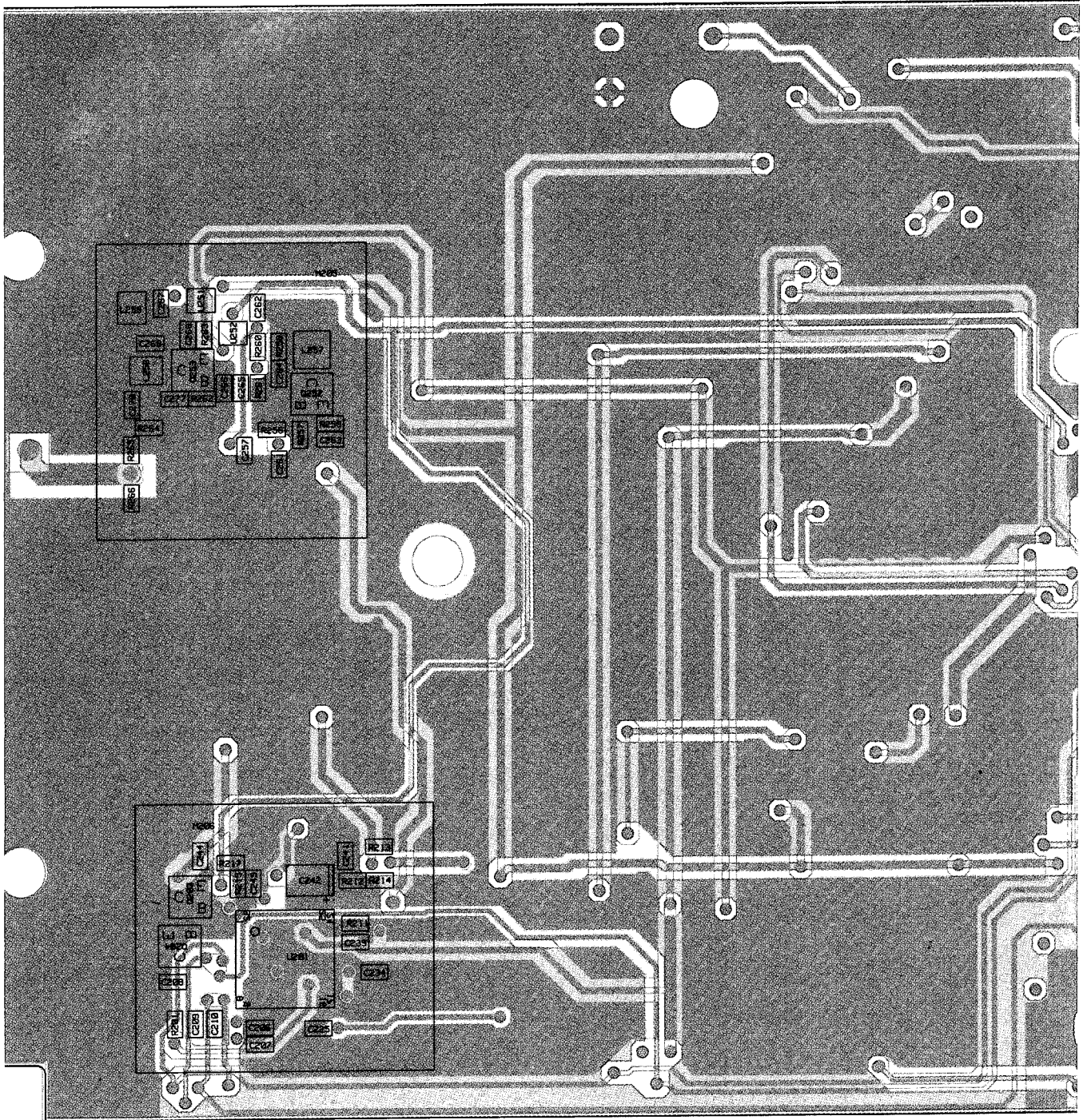


**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

**RCB-97159-A (REV)**  
**RCB-97162-A (REV)**  
**RCB-97164-A (REV)**

**SOLDER SIDE VIEW**

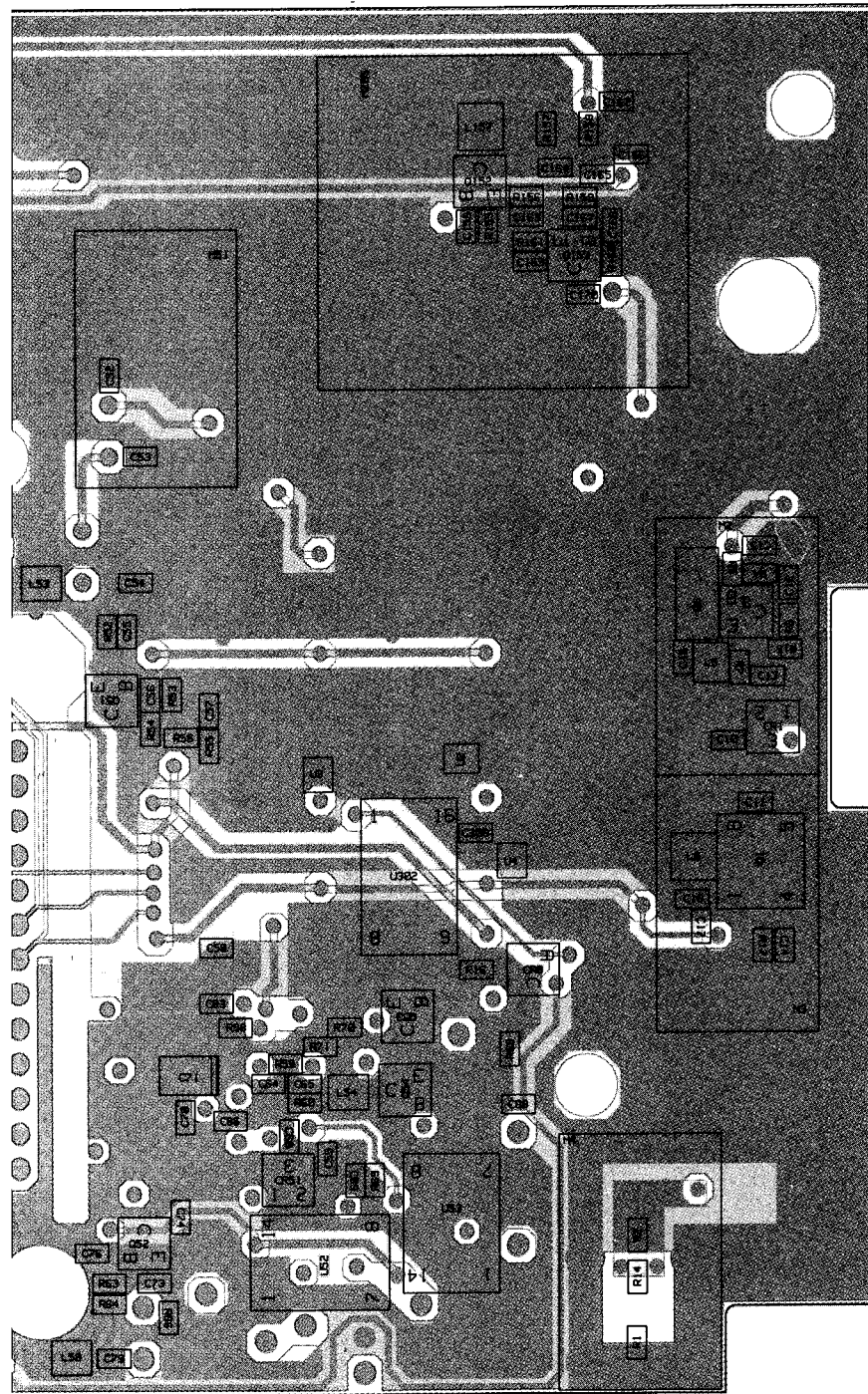




**COMPONENT SIDE INNER LAYER (GRAY)**  
**SOLDER SIDE INNER LAYER (PINK)**  
**OVERLAY -----**

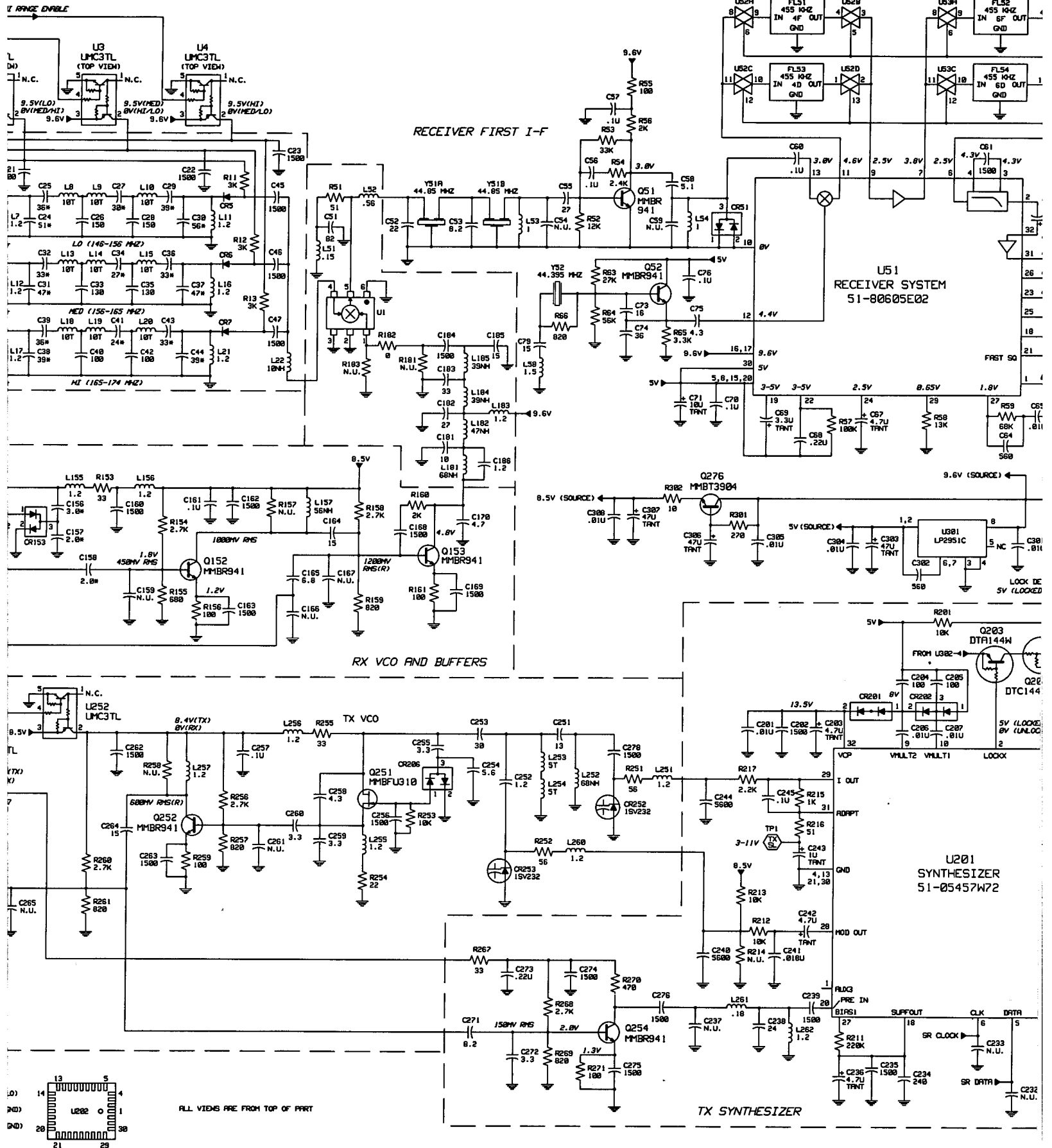
**SOLDER SIDE VIEW**





RCB-97160-A (REV)  
RCB-97161-A (REV)  
RCB-97164-A (REV)





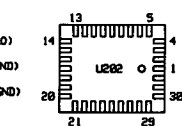
RECEIVER FIRST I-F

U1 RECEIVER SYSTEM  
51-80605E02

RX VCO AND BUFFERS

TX SYNTHESIZER

ALL VIEWS ARE FROM TOP OF FRPT

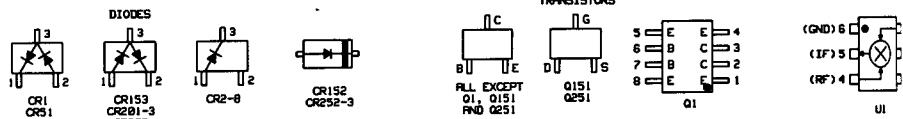
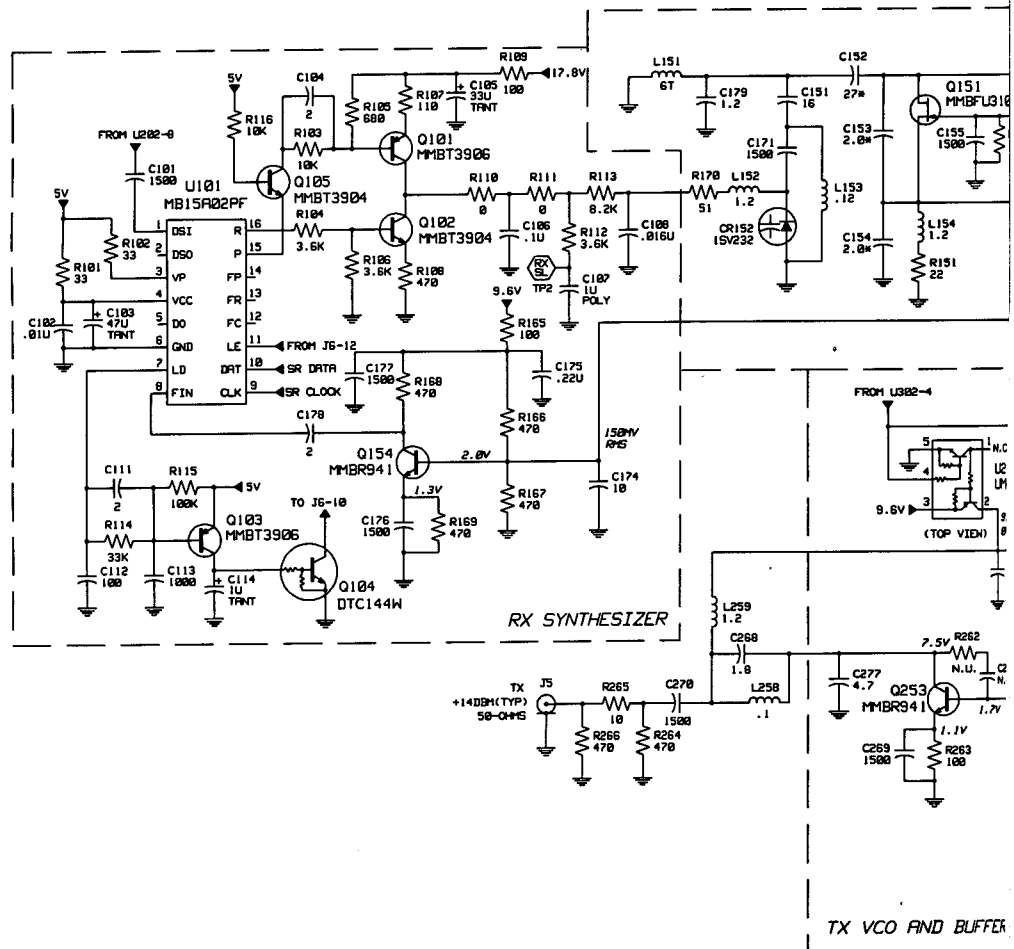
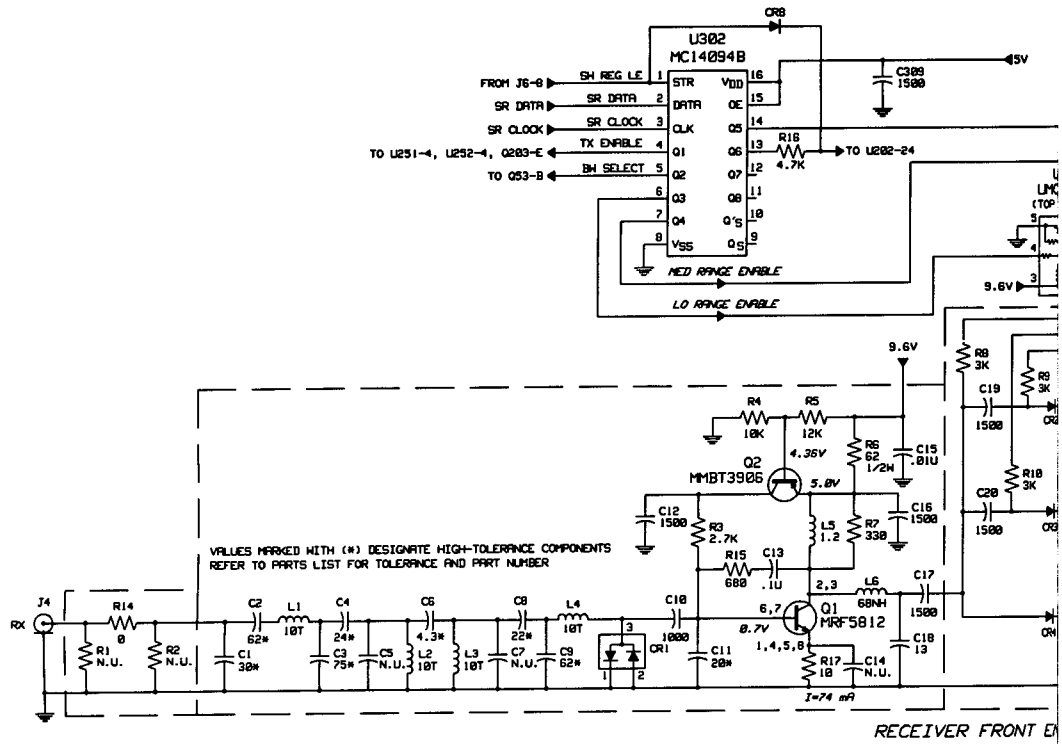


LOCK DE  
5V (LOCKED)

5V (LOCKE  
6V (UNLOC

U201  
SYNTHESIZER  
51-05457W72

SR CLOCK  
SR DATA



DESCRIPTION
NPN; type MMBT3904
resistor, chip +/-5%; 1/16 W: unless otherwise stated
Not Used
2.7k
10k
12k
62; 1/2 W
330
3k
0
680
4.7k
10
51
12k
33k
2.4k
100
2k
100k
13k
68k
22k
27k
56k
3.3k
820
10k
2.2k
33
10k
3.6k
680
3.6k
110
470
100
0
3.6k
8.2k
33k
100k
10k
22
10k
33
2.7k
680
100
Not Used
2.7k
820
2k
100
100
470
51
Not Used
0
Not Used
10k
470
100
4.7k
68k
4.7k
220k
10k
Not Used
1k
51
2.2k
56
10k
22
33
2.7k
820
Not Used
100
2.7k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R261	06-62057A47	820
R262	---	Not Used
R263	06-62057A25	100
R264	06-62057A41	470
R265	06-62057A01	10
R266	06-62057A41	470
R267	06-62057A13	33
R268	06-62057A59	2.7k
R269	06-62057A47	820
R270	06-62057A41	470
R271	06-62057A25	100
R301	06-62057A35	270
R302	06-62057A01	10
U1	51-80470U01	integrated circuit: (see note) double-balanced mixer
U2 thru 4	48-09939C04	dual transistor switch UMC3TL
U51	51-80605E02	receiver system
U52	51-05663U35	quad analog switch 4066B
U53	51-05663U35	quad analog switch 4066B
U101	51-80154R02	synthesizer MB15A02PF
U201	51-05457W72	synthesizer
U202	51-80404C08	reference oscillator 19.2 MHz
U251	48-09939C04	dual transistor switch UMC3TL
U252	48-09939C04	dual transistor switch UMC3TL
U301	51-05469E65	5 V regulator LP2951C
U302	51-13806A35	shift register MC14094B
Y51	91-80022M06	crystal: (see note) filter 44.85 MHz (includes Y51A and Y51B)
Y52	48-80606B07	44.395 MHz

non-referenced items		
	26-04398J01	shield component side (2 used, TX synthesizer and 17.8 V supply)
	26-04399J01	shield component side (2 used, RF amp and mixer)
	26-80473U01	shield component side (3 used, RX VCO, TX VCO and RX synthesizer)
	26-80520U01	shield solder side small (3 used)
	26-80588D05	shield solder side large (3 used)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

35 104  
4 SF OL  
GND

5 NC

DATA

INCE OL	MOTOROLA PART NO.	DESCRIPTION
	21-13740L28	27 pF 2%
4	21-13740L01	2.0 ±0.1 pF
	21-13741F29	1500 pF
	21-13740L05	3.0 ±0.1 pF
3	21-13740L01	2.0 ±0.1 pF
	---	Not Used
	21-13741F29	1500 pF
	21-13743E20	0.1 uF 10%; 16 V
3	21-13741F29	1500 pF
	21-13740F31	15 pF
	21-13740F23	6.8 ±0.25 pF
7	---	Not Used
	21-13741F29	1500 pF
3	21-13740F19	4.7 ±0.25 pF
	21-13741F29	1500 pF
	21-13740F27	10 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
7	21-13741F29	1500 pF
	21-13740F10	2 ±0.25 pF
	21-13740F05	1.2 ±0.25 pF
	21-13740F27	10 pF
	21-13740F37	27 pF
	21-13740F39	33 pF
	21-13741F29	1500 pF
	21-13740F31	15 pF
	21-13740F05	1.2 ±0.25 pF
	21-13741F49	.01 uF
	21-13741F29	1500 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
5	21-13740F51	100 pF
7	21-13741F49	.01 uF
	21-13740F55	150 pF
	21-13740F60	240 pF
	21-13741F29	1500 pF
1	21-13741F17	470 pF
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	23-11049A09	tantalum 2.2 uF 10%; 20 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13743E20	0.1 uF 10%; 16 V
	21-13743E11	.039 uF 10%; 16 V
	21-13741F25	1000 pF
228	---	Not Used
	23-11049J11	tantalum 4.7 uF 10%; 16 V
233	---	Not Used
	21-13740F60	240 pF
	21-13741F29	1500 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	---	Not Used
	21-13740F36	24 pF
	21-13741F29	1500 pF
	21-13741F43	5600 pF
	21-13743E05	.018 uF 10%; 16 V
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13741F43	5600 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F32	16 pF
	21-13740F05	1.2 ±0.25 pF
	21-13740L32	39 pF 2%
	21-13740L13	6.2 ±0.1 pF
	21-13740F16	3.6 ±0.25 pF
	21-13741F29	1500 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F18	4.3 ±0.25 pF
	21-13740F15	3.3 ±0.25 pF
	---	Not Used
	21-13741F29	1500 pF
	21-13740F31	15 pF
	---	Not Used
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F09	1.8 ±0.25 pF
	21-13741F29	1500 pF
	21-13740F25	8.2 ±0.25 pF
	21-13740F15	3.3 ±0.25 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
276	21-13741F29	1500 pF
	21-13740F19	4.7 ±0.25 pF
	21-13741F29	1500 pF
	21-13741F49	.01 uF
	21-13740F69	560 pF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C303	23-11049A98	tantalum 47 uF 10%; 10 V
C304, 305	21-13741F49	.01 uF
C306, 307	23-11049C05	tantalum 47 uF 10%; 16V
C308	21-13741F49	.01 uF
C309	21-13741F29	1500 pF
CR1	48-80154K03	diode: (see note) dual Schottky SOT
CR2 thru 7	48-80142L01	silicon PIN SOT MMBV3401
CR8	48-80939T01	Schottky SOT
CR51	48-80154K03	dual Schottky SOT
CR152	48-62824C03	silicon varactor SOT 1SV232
CR153	48-80154K02	dual Schottky SOT
CR201 thru 203	48-13833C07	dual silicon SOT MMBD7000
CR206	48-80154K02	dual Schottky SOT
CR252, 253	48-62824C03	silicon varactor SOT 1SV232
FL51	91-80098D04	filter: 455 kHz 4F
FL52	91-80097D04	455 kHz 6F
FL53	91-80098D06	455 kHz 4D
FL54	91-80097D06	455 kHz 6D
J4	09-80476U01	connector, receptacle: mini UHF coax
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board
L1 thru 4	24-84562T19	coll, rf: 10 turns airwound 2%
L5	24-62587N69	chip 1.2 uH 5%
L6	24-62587N51	chip 68 nH 5%
L7	24-62587N69	chip 1.2 uH 5%
L8 thru 10	24-84562T19	10 turns airwound 2%
L11, 12	24-62587N69	chip 1.2 uH 5%
L13 thru 15	24-84562T19	10 turns airwound 2%
L16, 17	24-62587N69	chip 1.2 uH 5%
L18 thru 20	24-84562T19	10 turns airwound 2%
L21	24-62587N69	chip 1.2 uH 5%
L22	24-62587N41	chip 10 nH 5%
L51	24-62587N55	chip 0.15 uH 5%
L52	24-62587N62	chip 0.56 uH 5%
L53, 54	24-62587N68	chip 1 uH 5%
L58	24-62587N70	chip 1.5 uH 5%
L151	24-60591X04	6 turns
L152	24-62587N69	chip 1.2 uH 5%
L153	24-62587N54	chip 0.12 uH 5%
L154 thru 156	24-62587N69	chip 1.2 uH 5%
L157	24-62587N50	chip 56 nH 5%
L181	24-62587N51	chip 68 nH 5%
L182	24-62587N49	chip 47 nH 5%
L183	24-62587N69	chip 1.2 uH 5%
L184	24-62587N48	chip 39 nH 5%
L185	24-62587N48	chip 39 nH 5%
L201, 202	24-62587N76	chip 4.7 uH 5%
L251	24-62587N69	chip 1.2 uH 5%
L252	24-62587N51	chip 68 nH 5%
L253, 254	24-60591X03	5 turns
L255 thru 257	24-62587N69	chip 1.2 uH 5%
L258	24-62587N53	chip 0.1 uH 5%
L259, 260	24-62587N69	chip 1.2 uH 5%
L261	24-62587N56	chip 0.18 uH 5%
L262	24-62587N69	chip 1.2 uH 5%
Q1	48-13827A24	transistor: (see note) NPN; type MRF5812
Q2	48-13824A17	PNP; type MMBT3906
Q51, 52	48-13827A07	NPN; type MMBR941
Q53, 54	48-80947V01	digital NPN; type DTC144W
Q101	48-13824A17	PNP; type MMBT3906
Q102	48-80214G02	NPN; type MMBT3904
Q103	48-13824A17	PNP; type MMBT3906
Q104	48-80947V01	digital NPN; type DTC144W
Q105	48-80214G02	NPN; type MMBT3904
Q151	48-84235R02	field effect; type MMBFU310
Q152 thru 154	48-13827A07	NPN; type MMBR941
Q201	48-13824A17	PNP; type MMBT3906
Q202	48-80214G02	NPN; type MMBT3904
Q203	48-80494U01	digital PNP; type DTA144W
C204	48-80947V01	digital NPN; type DTC144W
Q205	48-80214G02	NPN; type MMBT3904
Q251	48-84235R02	field effect; type MMBFU310
Q252 thru 254	48-13827A07	NPN; type MMBR941

REFERENCE SYMBOL	MOTOROLA PART N
Q276	48-80214C
R1, 2	---
R3	06-62057A
R4	06-62057A
R5	06-62057A
R6	06-80195M
R7	06-62057A
R8 thru 13	06-62057A
R14	06-62057E
R15	06-62057A
R16	06-62057A
R17	06-62057A
R51	06-62057A
R52	06-62057A
R53	06-62057A
R54	06-62057A
R55	06-62057A
R56	06-62057A
R57	06-62057A
R58	06-62057A
R59	06-62057A
R60	06-62057A
R63	06-62057A
R64	06-62057A
R65	06-62057A
R66	06-62057A
R68 thru 70	06-62057A
R71	06-62057A
R101, 102	06-62057A
R103	06-62057A
R104	06-62057A
R105	06-62057A
R106	06-62057A
R107	06-62057A
R108	06-62057A
R109	06-62057A
R110, 111	06-62057E
R112	06-62057A
R113	06-62057A
R114	06-62057A
R115	06-62057A
R116	06-62057A
R151	06-62057A
R152	06-62057A
R153	06-62057A
R154	06-62057A
R155	06-62057A
R156	06-62057A
R157	---
R158	06-62057A
R159	06-62057A
R160	06-62057A
R161	06-62057A
R165	06-62057A
R166 thru 169	06-62057A
R170	06-62057A
R181	---
R182	06-62057E
R183	---
R201	06-62057A
R202	06-62057A
R203	06-62057A
R204	06-62057A
R205	06-62057A
R206	06-62057A
R211	06-62057A
R212, 213	06-62057A
R214	---
R215	06-62057A
R216	06-62057A
R217	06-62057A
R251, 252	06-62057A
R253	06-62057A
R254	06-62057A
R255	06-62057A
R256	06-62057A
R257	06-62057A
R258	---
R259	06-62057A
R260	06-62057A

# Parts List

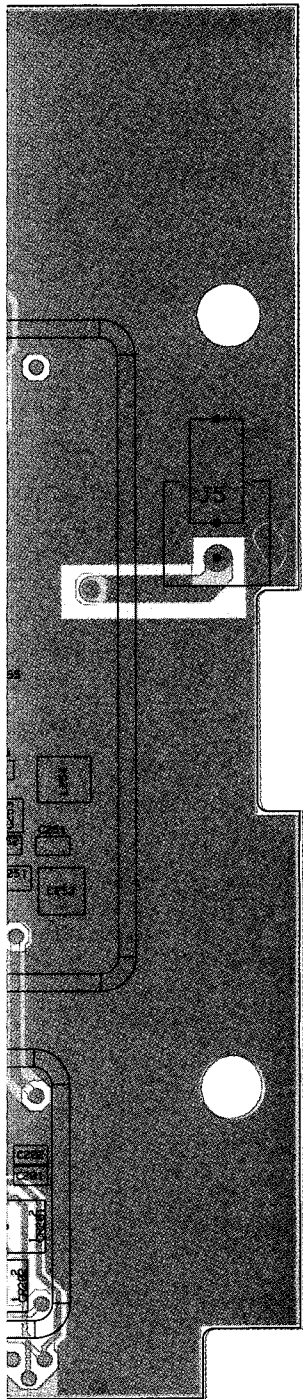
HLD9017A VHF RF Board, 146-174 MHz, 12.5/25 kHz

PL-971034-A

HLD901

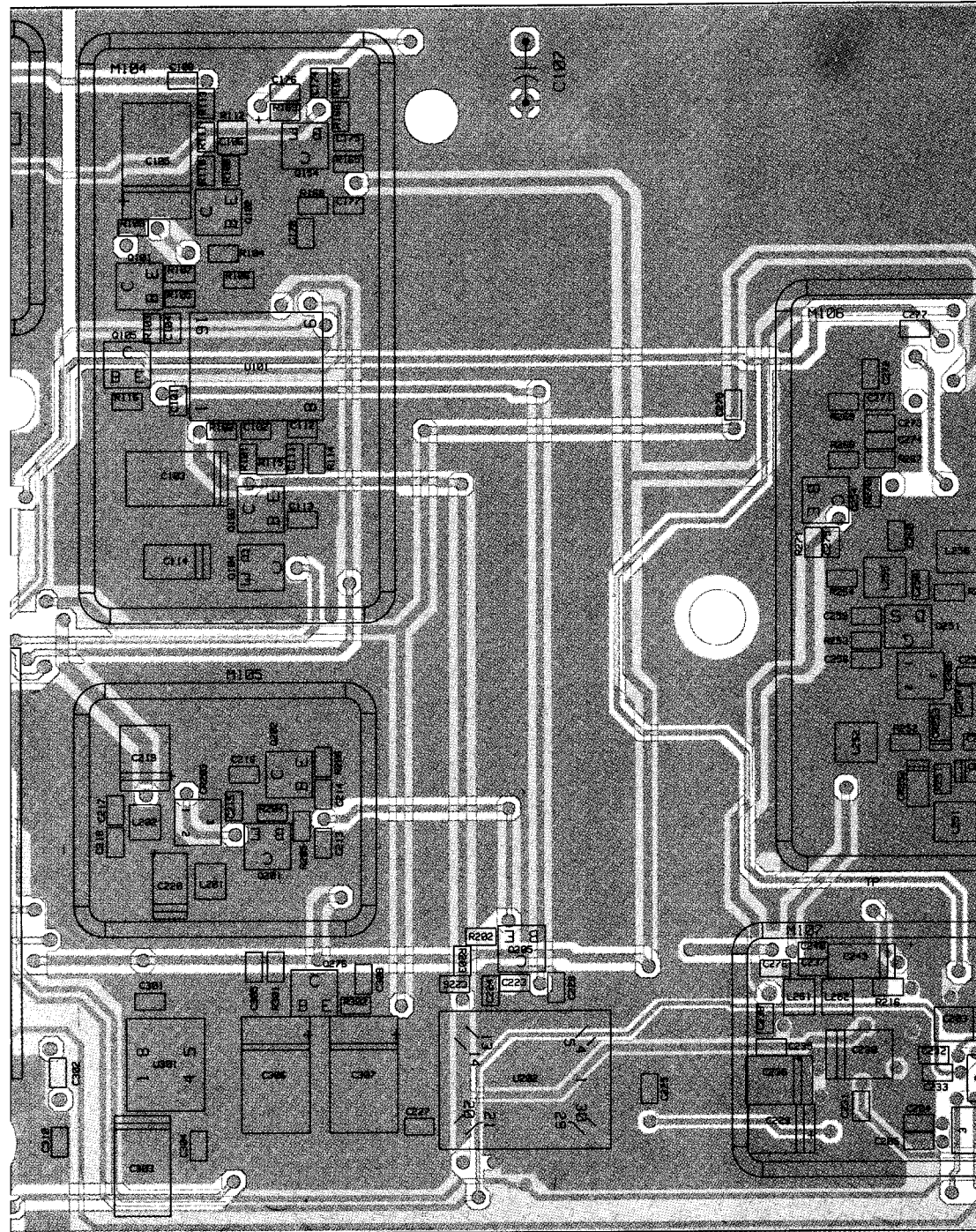
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFE SYI
		capacitor, fixed: uF +/-5%; 50 V: unless otherwise stated	C152
C1	21-13740L29	30 pF 2%	C153,
C2	21-13740L37	62 pF 2%	C155
C3	21-13740L39	75 pF 2%	C156
C4	21-13740L27	24 pF 2%	C157,
C5	---	Not Used	C159
C6	21-13740L09	4.3 ±0.1 pF	C160
C7	---	Not Used	C161
C8	21-13740L26	22 pF 2%	C162,
C9	21-13740L37	62 pF 2%	C164
C10	21-13741F25	1000 pF	C165
C11	21-13740L25	20 2%	C166,
C12	21-13741F29	1500 pF	C168,
C13	21-13743E20	0.1 uF 10%; 16 V	C170
C14	---	Not Used	C171
C15	21-13741F49	.01 uF	C174
C16, 17	21-13741F29	1500 pF	C175
C18	21-13740F30	13 pF	C176,
C19 thru 23	21-13741F29	1500 pF	C178
C24	21-13740L35	51 pF 2%	C179
C25	21-13740L31	36 pF 2%	C181
C26	21-13740F55	150 pF	C182
C27	21-13740L29	30 pF 2%	C183
C28	21-13740F55	150 pF	C184
C29	21-13740L32	39 pF 2%	C185
C30	21-13740L36	56 pF 2%	C186
C31	21-13740L34	47 pF 2%	C201
C32	21-13740L30	33 pF 2%	C202
C33	21-13740F54	130 pF	C203
C34	21-13740L28	27 pF 2%	C204, 2
C35	21-13740F54	130 pF	C206, 2
C36	21-13740L30	33 pF 2%	C208
C37	21-13740L34	47 pF 2%	C209
C38	21-13740L32	39 pF 2%	C210
C39	21-13740L31	36 pF 2%	C213, 2
C40	21-13740F51	100 pF	C215
C41	21-13740L27	24 pF 2%	C216
C42	21-13740F51	100 pF	C217
C43	21-13740L30	33 pF 2%	C218
C44	21-13740L32	39 pF 2%	C219
C45 thru 47	21-13741F29	1500 pF	C220
C51	21-13740F49	82 pF	C223
C52	21-13740F35	22 pF	C224
C53	21-13740F25	8.2 ±0.25 pF	C225
C54	---	Not Used	C226 th
C55	21-13740F37	27 pF	C229, 2
C56, 57	21-13743E20	0.1 uF 10%; 16 V	C231 th
C58	21-13740F20	5.1 ±0.25 pF	C234
C59	---	Not Used	C235
C60	21-13743E20	0.1 uF 10%; 16 V	C236
C61	21-13741F29	1500 pF	C237
C62	23-11049A05	tantalum 0.47 uF 10%; 25 V	C238
C63	21-13740F45	56 pF	C239
C64	21-13740F69	560 pF	C240
C65	21-13741F49	.01 uF	C241
C67	23-11049J11	tantalum 4.7 uF 10%; 16 V	C242
C68	21-13743K16	0.22 uF +80/-20%; 16 V	C243
C69	23-11049J07	tantalum 3.3 uF 10%; 20 V	C244
C70	21-13743E20	0.1 uF 10% 16V	C245
C71	23-11049A57	tantalum 10 uF 10%; 16 V	C251
C73	21-13740F32	16 pF	C252
C74	21-13740F40	36 pF	C253
C75	21-13740F18	4.3 ±0.25 pF	C254
C76	21-13743E20	0.1 uF 10%; 16 V	C255
C79	21-13740F31	15 pF	C256
C80	---	Not Used	C257
C83	21-13743E20	0.1 uF 10%; 16 V	C258
C85 thru 87	21-13740F55	150 pF	C259, 2
C88, 89	21-13741F49	.01 uF	C261
C101	21-13741F29	1500 pF	C262, 2
C102	21-13741F49	.01 uF	C264
C103	23-11049A98	tantalum 47 uF 10%; 10 V	C265, 2
C104	21-13740F10	2 ±0.25 pF	C267
C105	23-11049C08	tantalum 33 uF 10%; 20 V	C268
C106	21-13743E20	0.1 uF 10%; 16 V	C269, 2
C107	08-11051A19	poly 1 uF; 63 V	C271
C108	21-13743E04	.016 uF 10%; 16 V	C272
C111	21-13740F10	2 ±0.25 pF	C273
C112	21-13740F51	100 pF	C274 th
C113	21-13741F25	1000 pF	C277
C114	23-11049A07	tantalum 1 uF 10%; 16 V	C278
C151	21-13740F32	16 pF	C301
			C302

Parts List for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A & PMUD1533A Transceivers)



*Circuit Board Details for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUE3191A & PMUE1505A Transceivers)*

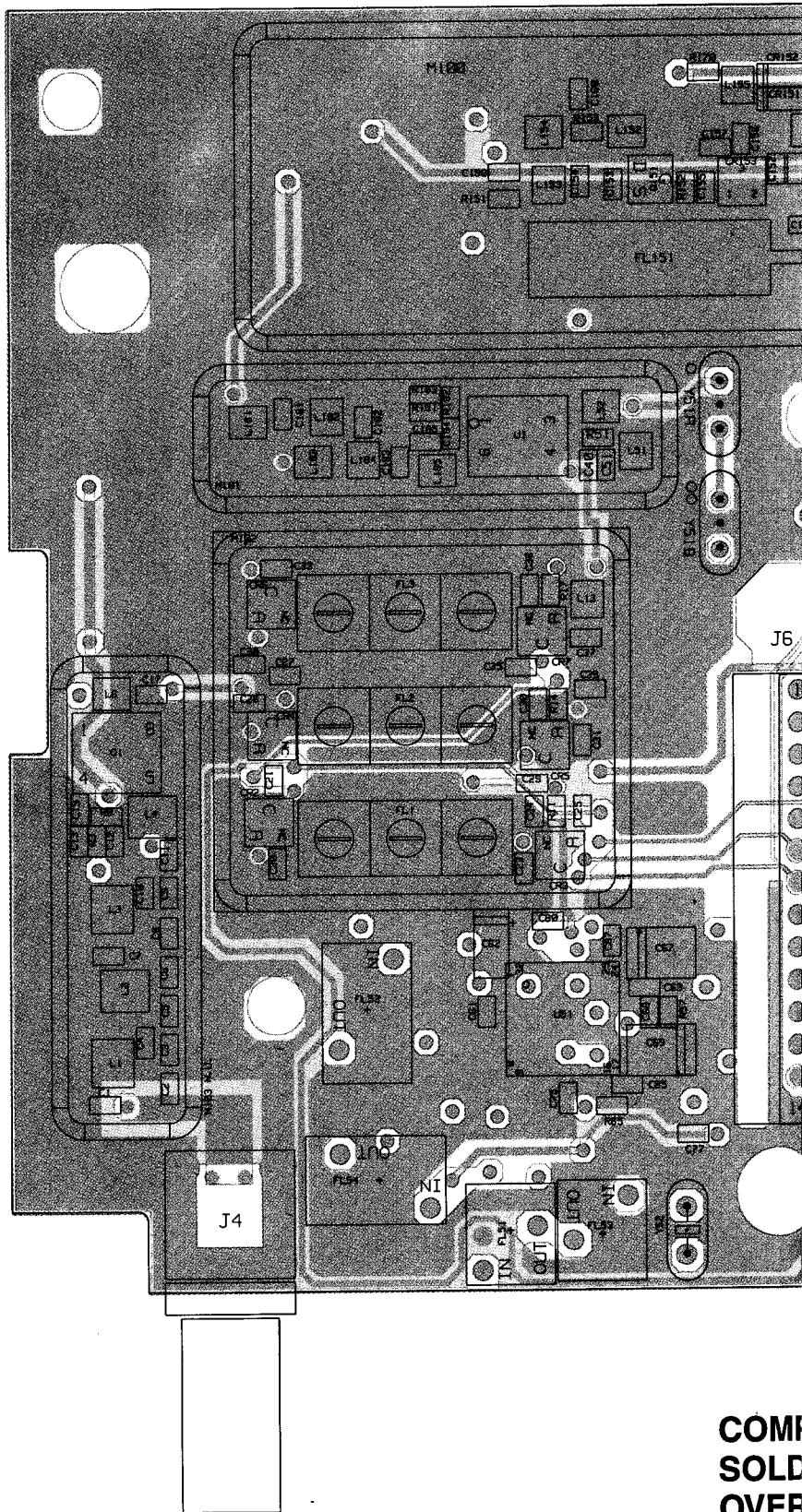




COMPONENT SIDE INNER LAYER (GRAY)  
OTHER SIDE INNER LAYER (PINK)  
LAY -----

RCB-97169-A  
RCB-97170-A  
RCB-97172-A

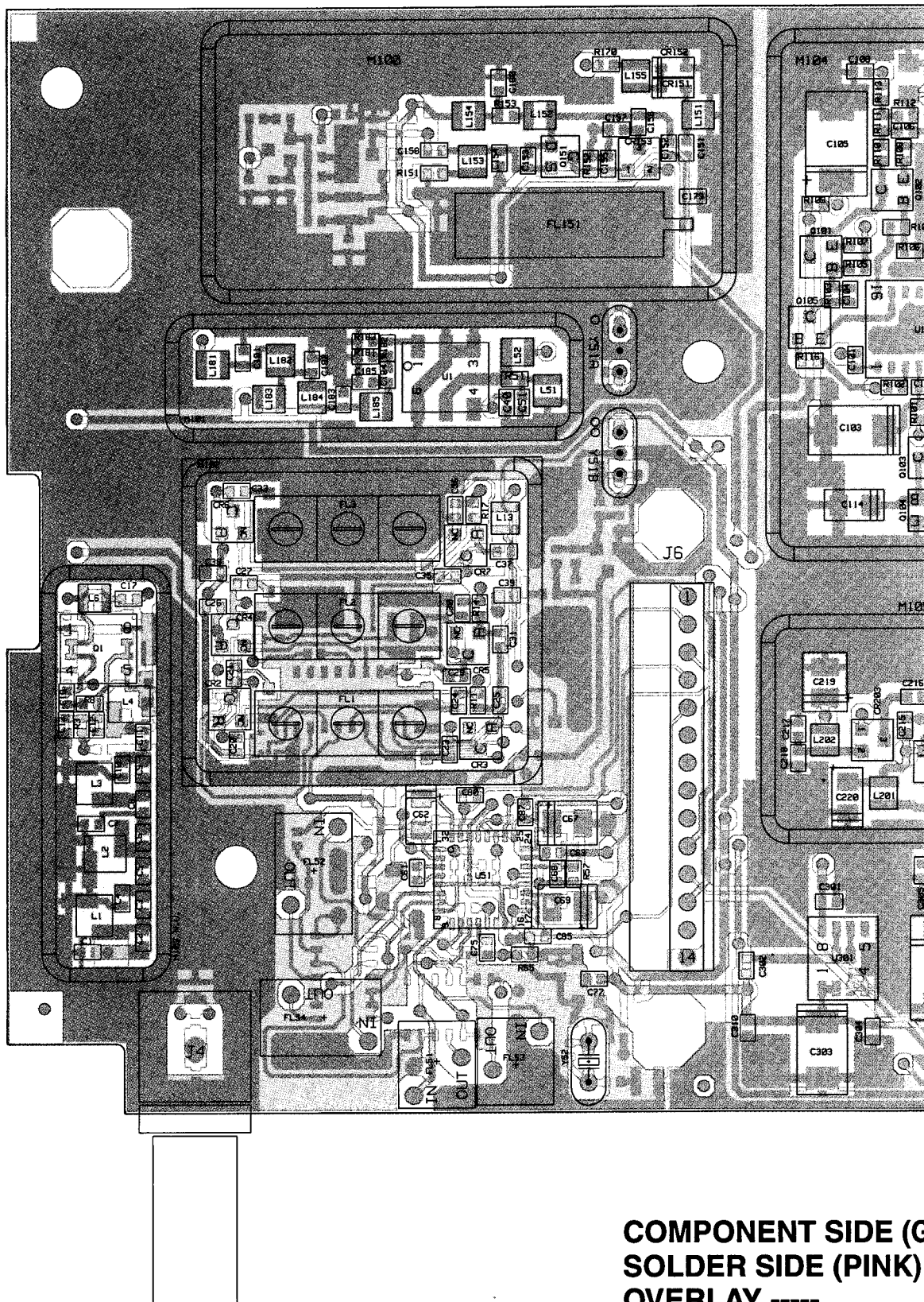
COMPONENT SIDE VIEW



COM  
SOLD  
OVER

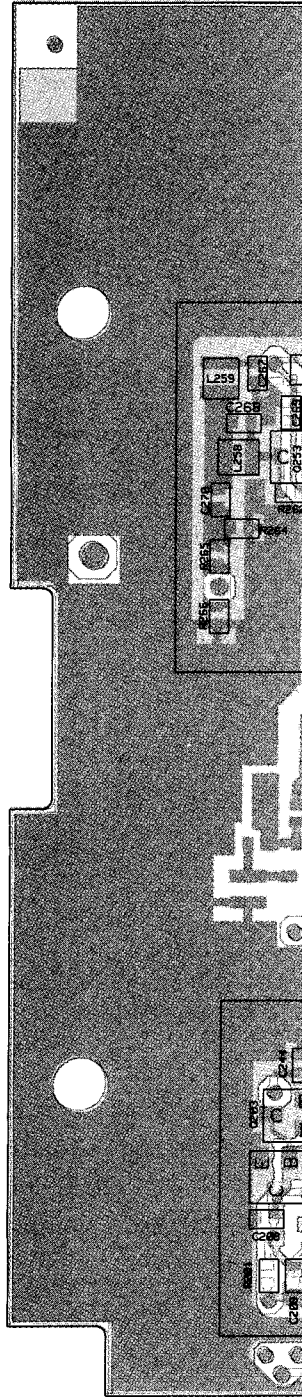




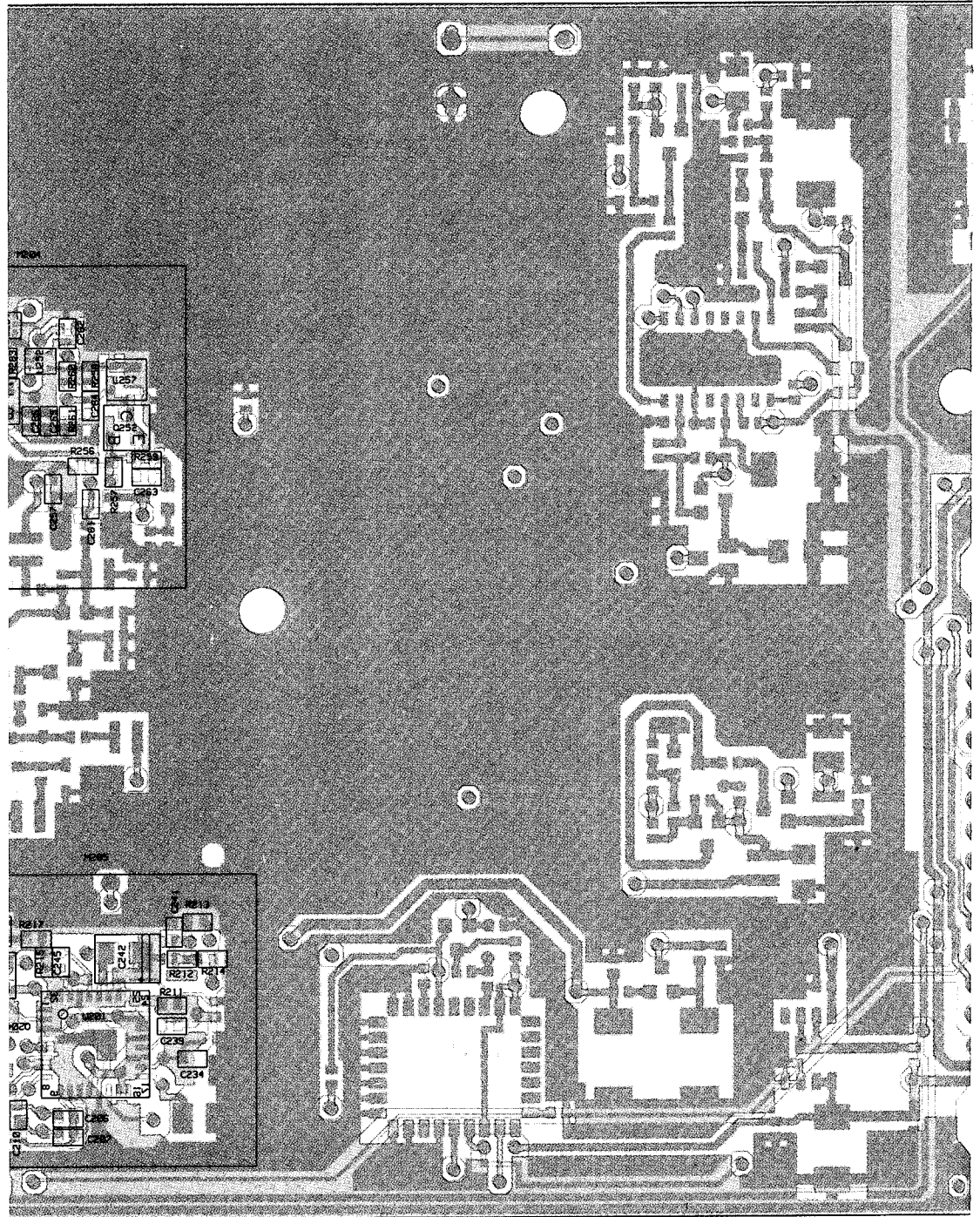


COMPONENT SIDE (G)  
SOLDER SIDE (PINK)  
OVERLAY -----

COMPONEN



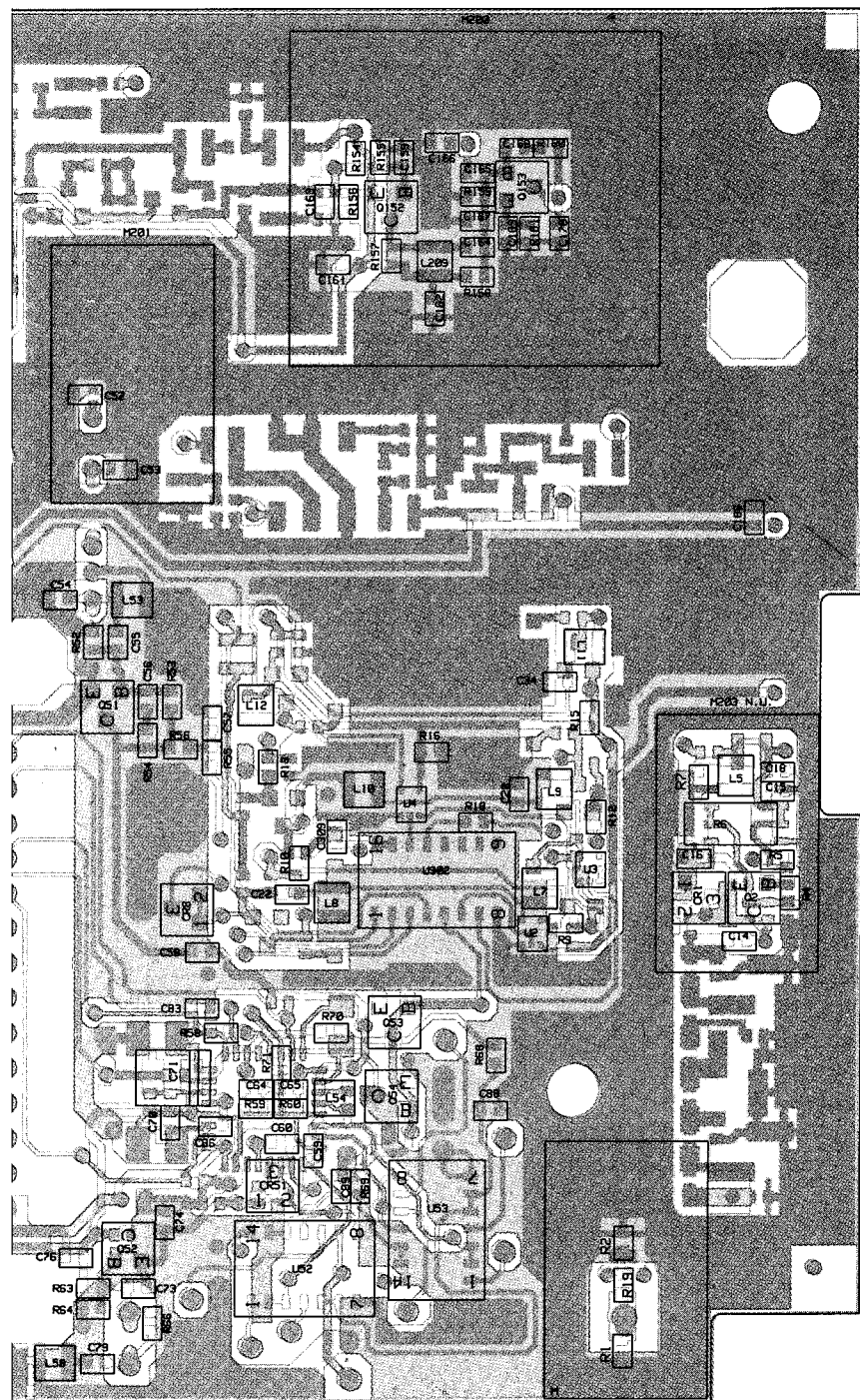
*Circuit Board Details for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUE3191A & PMUE1505A Transceivers)*



**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-97168-A (REV  
RCB-97171-A (REV  
RCB-97173-A (REV

**SOLDER SIDE VIEW**



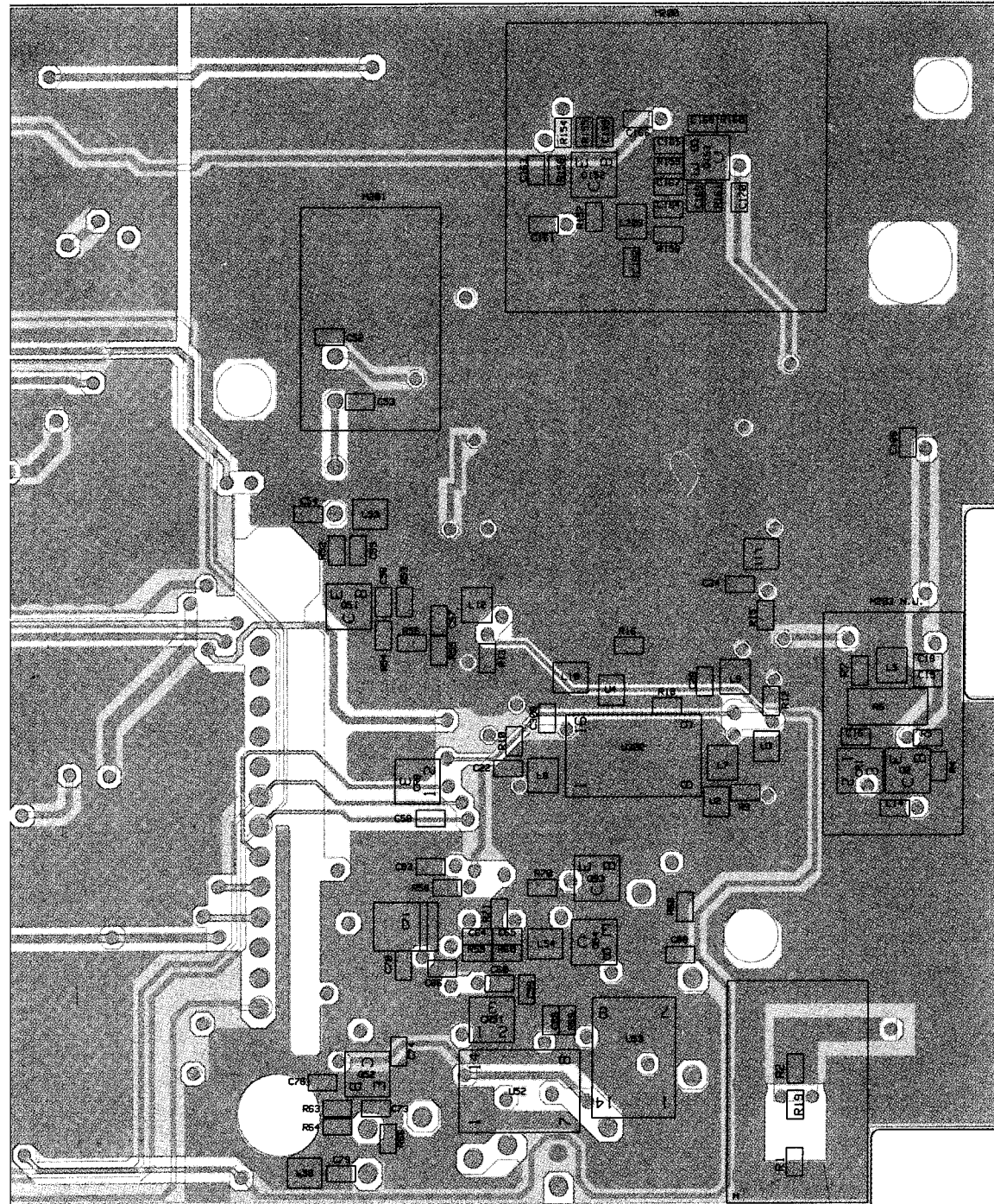






ISSUE A

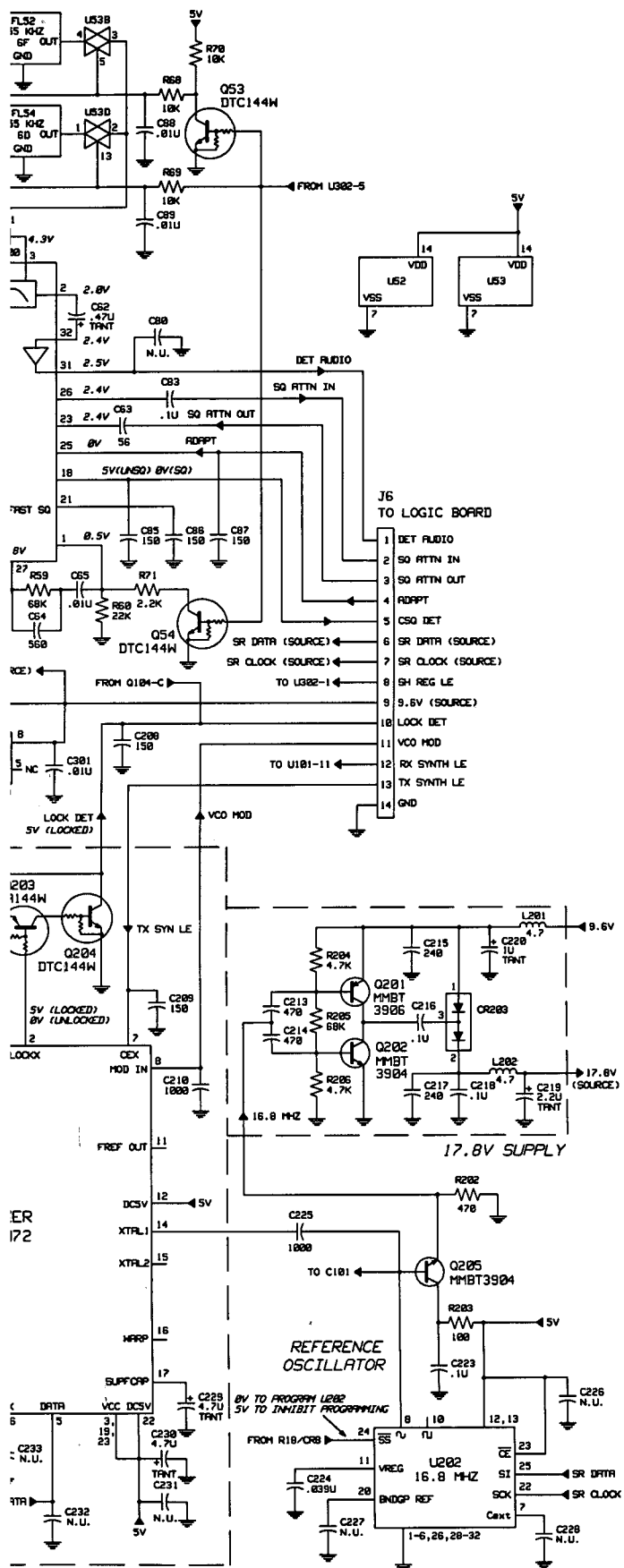
REVERSE SIDE



REVERSE SIDE (GRAY)  
FRONT SIDE (PINK)

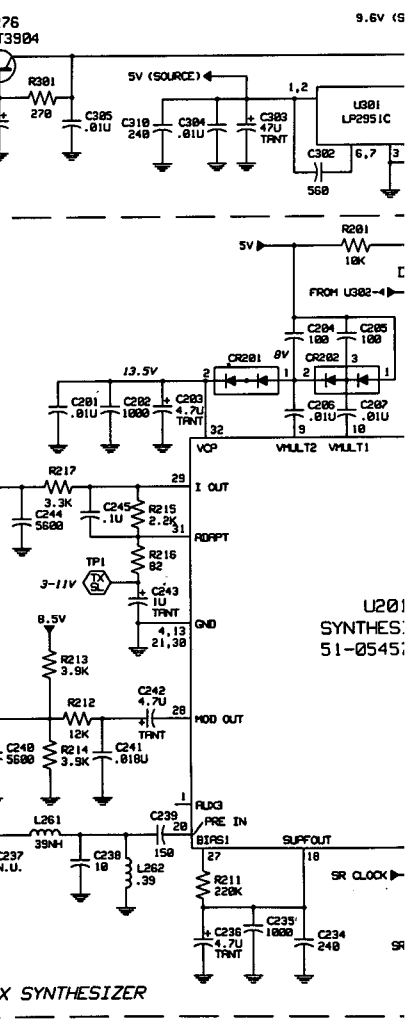
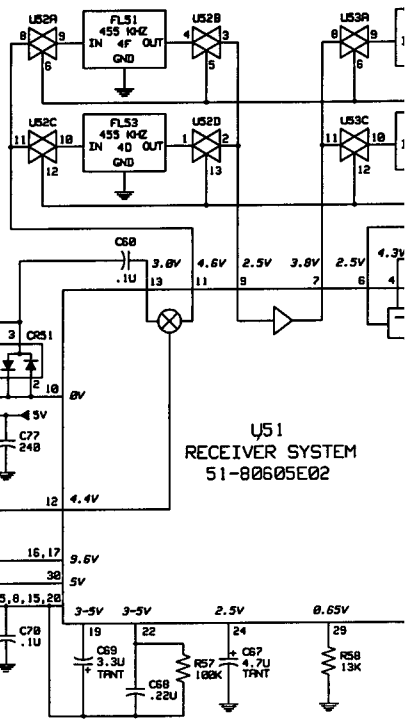
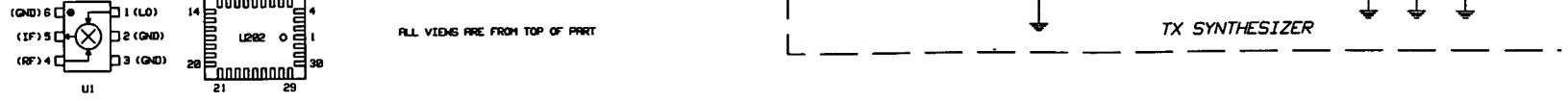
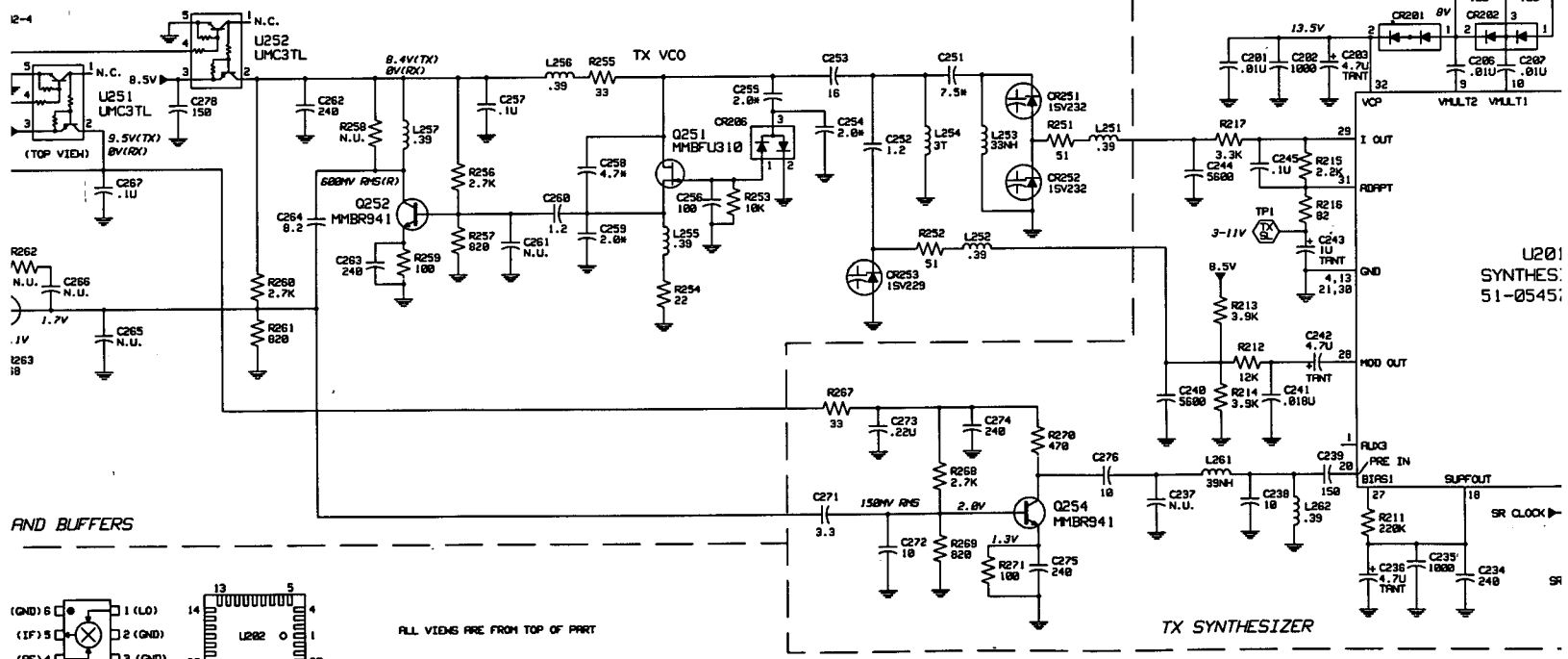
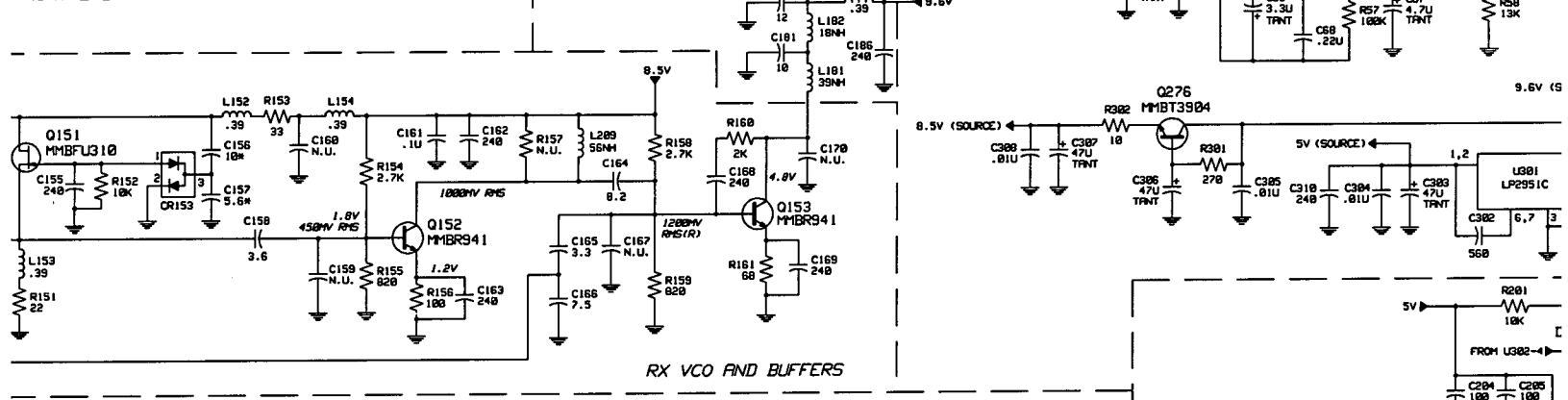
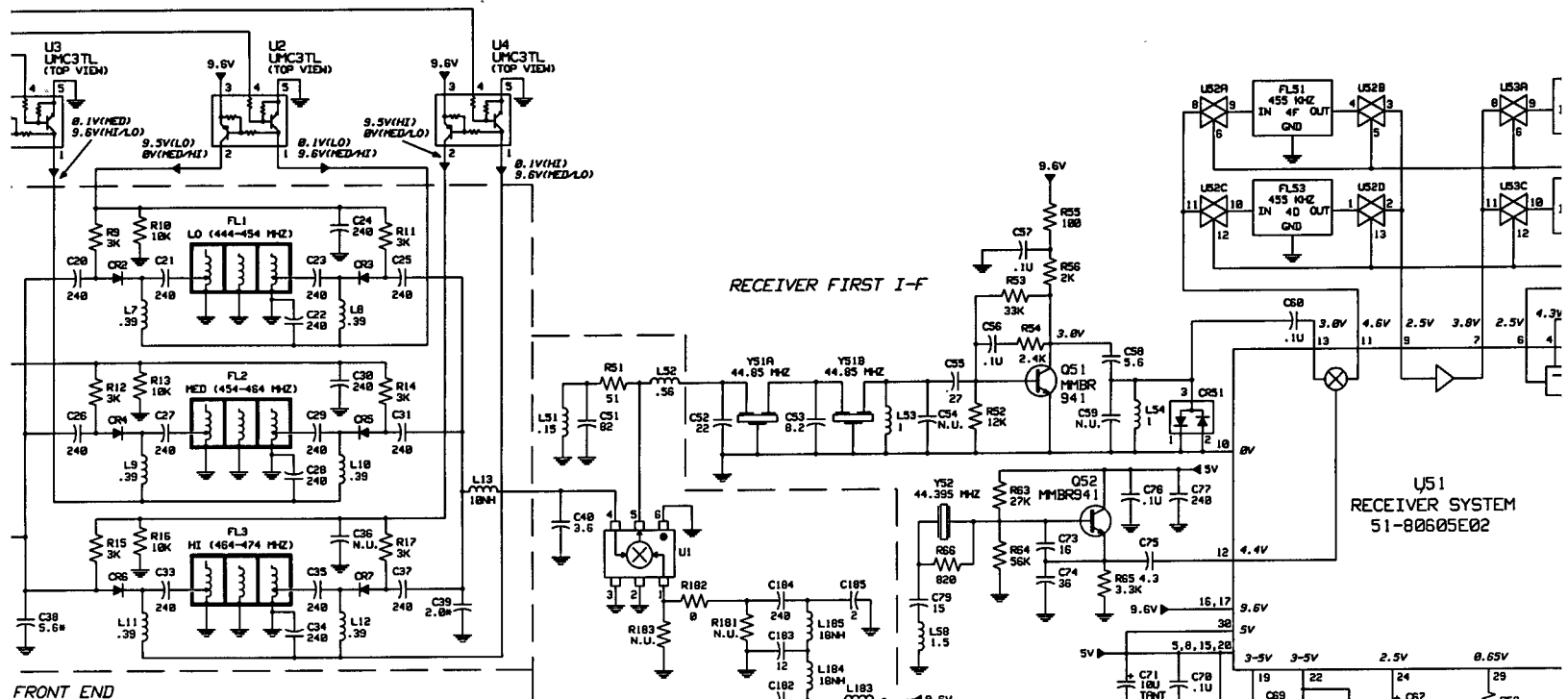
RCB-97169-A (REV)  
RCB-97170-A (REV)  
RCB-97173-A (REV)

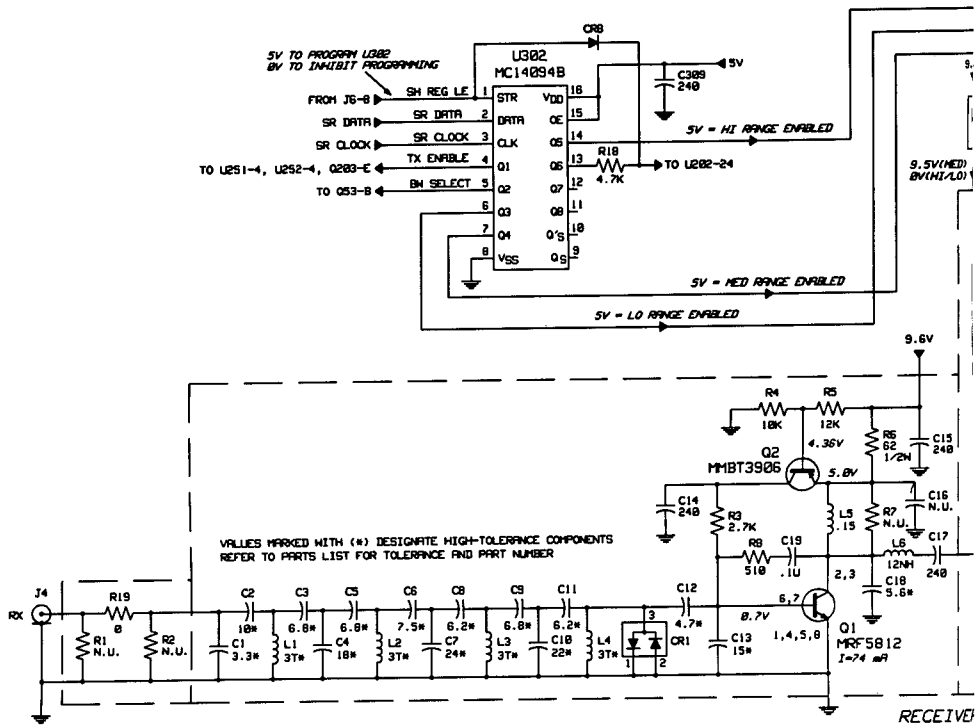
REVERSE SIDE VIEW



12/15/98 RPD-97148-A

Schematic Diagram for  
 UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
 (Part of HUE3191A & PMUE1505A Transceivers)





LA	DESCRIPTION
55	4.7k
47	0
18	51
75	12k
35	33k
58	2.4k
25	100
56	2k
37	100k
76	13k
33	68k
31	22k
33	27k
31	56k
31	3.3k
47	820
73	10k
57	2.2k
13	33
73	10k
32	3.6k
45	680
52	3.6k
26	110
41	470
25	100
47	0
52	3.6k
71	8.2k
55	33k
97	100k
73	10k
09	22
73	10k
13	33
59	2.7k
47	820
25	100
	Not Used
59	2.7k
47	820
56	2k
21	68
25	100
41	470
18	51
	Not Used
47	0
	Not Used
73	10k
41	470
25	100
55	4.7k
93	68k
55	4.7k
06	220k
75	12k
53	3.9k
57	2.2k
23	82
61	3.3k
18	51
73	10k
09	22
13	33
59	2.7k
47	820
	Not Used
25	100
59	2.7k
47	820
	Not Used
21	68
41	470
03	12
41	470
13	33
59	2.7k
47	820
41	470
25	100
35	270
01	10

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
<b>integrated circuit: (see note)</b>		
U1	51-80470U01	double-balanced mixer
U2, thru 4	48-09939C04	dual transistor switch UMC3TL
U51	51-80605E02	receiver system
U52, 53	51-05663U35	quad analog switch 4066B
U101	51-80154R02	synthesizer MB15A02PF
U201	51-05457W72	synthesizer
U202	51-80404C08	reference oscillator 19.2 MHz
U251, 252	48-09939C04	dual transistor switch UMC3TL
U301	51-05469E65	5 V regulator LP2951C
U302	51-13806A35	shift register MC14094B
<b>crystal: (see note)</b>		
Y51	91-80022M06	filter 44.85 MHz (includes Y51A and Y51B)
Y52	48-80606B07	44.395 MHz
<b>non-referenced items</b>		
	26-04398J01	shield component side (2 used, TX synthesizer and 17.8V supply)
	26-04399J01	shield component side (1 used, U1 mixer)
	26-80473U01	shield component side (3 used, RX VCO, TX VCO and RX synthesizer)
	26-80474U01	shield component side (1 used over FL1-3)
	26-80520U01	shield solder side small (2 used)
	26-80588D05	shield solder side large (3 used)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



NCE DL	MOTOROLA PART NO.	DESCRIPTION
	21-13740F60	240 pF
	21-13740F60	240 pF
	---	Not Used
	21-13740F27	10 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
	21-13740F60	240 pF
	21-13740F16	3.6 0.25 pF
	21-13740F05	1.2 0.25 pF
	21-13740F27	10 pF
	21-13740F29	12 pF
	21-13740F60	240 pF
	21-13740F10	2 0.25 pF
	21-13740F60	240 pF
	21-13741F49	.01 uF
	21-13741F25	1000 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	21-13740F51	100 pF
	21-13741F49	.01 uF
	21-13740F55	150 pF
	21-13741F25	1000 pF
	21-13741F17	470 pF
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	23-11049A09	tantalum 2.2 uF 10%; 20 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13743E20	0.1 uF 10%; 16 V
	21-13743E11	.039 uF 10%; 16 V
	21-13741F25	1000 pF
228	---	Not Used
	23-11049J11	tantalum 4.7 uF 10%; 16 V
233	---	Not Used
	21-13740F60	240 pF
	21-13741F25	1000 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	---	Not Used
	21-13740F27	10 pF
	21-13740F55	150 pF
	21-13741F43	5600 pF
	21-13743E05	.018 uF 10%; 16 V
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13741F43	5600 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740L15	7.5 0.1 pF
	21-13740F05	1.2 0.25 pF
	21-13740F32	16 pF
	21-13740L01	2.0 0.1 pF
	21-13740F51	100 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740L10	4.7 0.1 pF
	21-13740L01	2.0 0.1 pF
	21-13740F05	1.2 0.25 pF
	---	Not Used
	21-13740F60	240 pF
	21-13740F25	8.2 0.25 pF
	---	Not Used
	21-13743E20	0.1 uF 10%; 16 V
	---	Not Used
	21-13740F60	240 pF
	21-13740F15	3.3 0.25 pF
	21-13740F27	10 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
	21-13740F60	240 pF
	21-13740F27	10 pF
	21-13740F55	150 pF
	21-13741F49	.01 uF
	21-13740F69	560 pF
	23-11049A98	tantalum 47 uF 10%; 10 V
	21-13741F49	.01 uF
	23-11049C05	tantalum 47 uF 10%; 16 V
	21-13741F49	.01 uF
	21-13740F60	240 pF
		<b>diode: (see note)</b>
	48-80154K03	dual Schottky SOT
	48-80142L01	silicon PIN SOT MMBV3401
	48-80939T01	Schottky SOT
	48-80154K03	dual Schottky SOT
52	48-62824C03	silicon varactor SOT 1SV232
	48-80154K02	dual Schottky SOT
ru 203	48-13833C07	dual silicon SOT MMBD7000

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR206	48-80154K02	dual Schottky SOT
CR251, 252	48-62824C03	silicon varactor SOT 1SV232
CR253	48-62824C01	silicon varactor SOT 1SV229
		<b>filter:</b>
FL1	91-62994B08	helical filter 444-454 MHz
FL2	91-62994B09	helical filter 454-464 MHz
FL3	91-62994B10	helical filter 464-474 MHz
FL51	91-80098D04	455 kHz 4F
FL52	91-80097D04	455 kHz 6F
FL53	91-80098D06	455 kHz 4D
FL54	91-80097D06	455 kHz 6D
FL151	91-80513U01	resonator
		<b>connector, receptacle:</b>
J4	09-80476U01	mini UHF coax
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board
		<b>coil, rf:</b>
L1 thru 4	24-84562T13	3 turns airwound 2%
L5	24-62587N55	chip 0.15 uH 5%
L6	24-62587N42	chip 12 nH 5%
L7 thru 12	24-62587N60	chip 0.39 uH 5%
L13	24-62587N41	chip 10 nH 5%
L51	24-62587N55	chip 0.15 uH 5%
L52	24-62587N62	chip 0.56 uH 5%
L53, 54	24-62587N68	chip 1 uH 5%
L58	24-62587N70	chip 1.5 uH 5%
L151	24-62587N47	chip 33 nH 5%
L152 thru 155	24-62587N60	chip 0.39 uH 5%
L181	24-62587N48	chip 39 nH 5%
L182	24-62587N44	chip 18 nH 5%
L183	24-62587N60	chip 0.39 uH 5%
L184, 185	24-62587N44	chip 18 nH 5%
L201, 202	24-62587N76	chip 4.7 uH 5%
L209	24-62587N50	chip 56 nH 5%
L251, 252	24-62587N60	chip 0.39 uH 5%
L253	24-62587N47	chip 33 nH 5%
L254	24-84562T13	3 turns airwound 2%
L255 thru 257	24-62587N60	chip 0.39 uH 5%
L258	24-62587N47	chip 33 nH 5%
L259	24-62587N60	chip 0.39 uH 5%
L261	24-62587N48	chip 39 nH 5%
L262	24-62587N60	chip 0.39 uH 5%
		<b>transistor: (see note)</b>
Q1	48-13827A24	NPN; type MRF5812
Q2	48-13824A17	PNP; type MMBT3906
Q51, 52	48-13827A07	NPN; type MMBR941
Q53, 54	48-80947V01	digital NPN; type DTC144W
Q101	48-13824A17	PNP; type MMBT3906
Q102	48-80214G02	NPN; type MMBT3904
Q103	48-13824A17	PNP; type MMBT3906
Q104	48-80947V01	digital NPN; type DTC144W
Q105	48-80214G02	NPN; type MMBT3904
Q151	48-84235R02	field effect; type MMBFU310
Q152 thru 154	48-13827A07	NPN; type MMBR941
Q201	48-13824A17	PNP; type MMBT3906
Q202	48-80214G02	NPN; type MMBT3904
Q203	48-80494U01	digital PNP; type DTA144W
Q204	48-80947V01	digital NPN; type DTC144W
Q205	48-80214G02	NPN; type MMBT3904
Q251	48-84235R02	field effect; type MMBFU310
Q252 thru 254	48-13827A07	NPN; type MMBR941
Q276	48-80214G02	NPN; type MMBT3904
		<b>resistor, chip +/-5%; 1/16 W:</b> unless otherwise stated
R1, 2	---	Not Used
R3	06-62057A59	2.7k
R4	06-62057A73	10k
R5	06-62057A75	12k
R6	06-80195M20	62; 1/2 W
R7	---	Not Used
R8	06-62057A42	510
R9	06-62057A60	3k
R10	06-62057A73	10k
R11, 12	06-62057A60	3k
R13	06-62057A73	10k
R14, 15	06-62057A60	3k
R16	06-62057A73	10k
R17	06-62057A60	3k
R18		06-62057
R19		06-62057
R51		06-62057
R52		06-62057
R53		06-62057
R54		06-62057
R55		06-62057
R56		06-62057
R57		06-62057
R58		06-62057
R59		06-62057
R60		06-62057
R63		06-62057
R64		06-62057
R65		06-62057
R66		06-62057
R68 thru 70		06-62057
R71		06-62057
R101, 102		06-62057
R103		06-62057
R104		06-62057
R105		06-62057
R106		06-62057
R107		06-62057
R108		06-62057
R109		06-62057
R110, 111		06-62057
R112		06-62057
R113		06-62057
R114		06-62057
R115		06-62057
R116		06-62057
R151		06-62057
R152		06-62057
R153		06-62057
R154		06-62057
R155		06-62057
R156		06-62057
R157		---
R158		06-62057
R159		06-62057
R160		06-62057
R161		06-62057
R165		06-62057
R166 thru 169		06-62057
R170		06-62057
R181		---
R182		06-62057
R183		---
R201		06-62057
R202		06-62057
R203		06-62057
R204		06-62057
R205		06-62057
R206		06-62057
R211		06-62057
R212		06-62057
R213, 214		06-62057
R215		06-62057
R216		06-62057
R217		06-62057
R251, 252		06-62057
R253		06-62057
R254		06-62057
R255		06-62057
R256		06-62057
R257		06-62057
R258		---
R259		06-62057
R260		06-62057
R261		06-62057
R262		---
R263		06-62057
R264		06-62057
R265		06-62057
R266		06-62057
R267		06-62057
R268		06-62057
R269		06-62057
R270		06-62057
R271		06-62057
R301		06-62057
R302		06-62057

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R18		06-62057
R19		06-62057
R51		06-62057
R52		06-62057
R53		06-62057
R54		06-62057
R55		06-62057
R56		06-62057
R57		06-62057
R58		06-62057
R59		06-62057
R60		06-62057
R63		06-62057
R64		06-62057
R65		06-62057
R66		06-62057
R68 thru 70		06-62057
R71		06-62057
R101, 102		06-62057
R103		06-62057
R104		06-62057
R105		06-62057
R106		06-62057
R107		06-62057
R108		06-62057
R109		06-62057
R110, 111		06-62057
R112		06-62057
R113		06-62057
R114		06-62057
R115		06-62057
R116		06-62057
R151		06-62057
R152		06-62057
R153		06-62057
R154		06-62057
R155		06-62057
R156		06-62057
R157		---
R158		06-62057
R159		06-62057
R160		06-62057
R161		06-62057
R165		06-62057
R166 thru 169		06-62057
R170		06-62057
R181		---
R182		06-62057
R183		---
R201		06-62057
R202		06-62057
R203		06-62057
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R206		06-62057
R211		06-62057
R212		06-62057
R213, 214		06-62057
R215		06-62057
R216		06-62057
R217		06-62057
R251, 252		06-62057
R253		06-62057
R254		06-62057
R255		06-62057
R256		06-62057
R257		06-62057
R258		---
R259		06-62057
R260		06-62057
R261		06-62057
R262		---
R263		06-62057
R264		06-62057
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R268		06-62057
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R270		06-62057
R271		06-62057
R301		06-62057
R302		06-62057

# Parts List

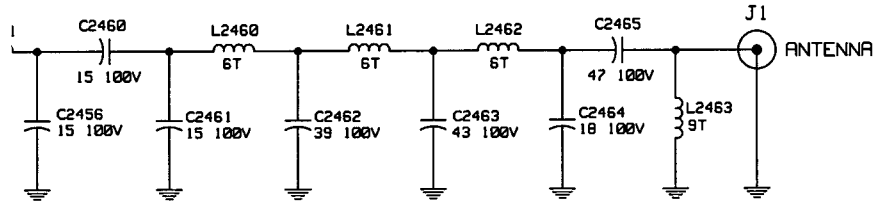
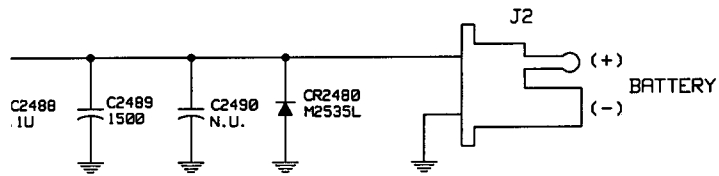
HLE9051A UHF RF Board, 444-474 MHz, 12.5/25 kHz

PL-971036-A

HLE905

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFE SYI
		capacitor, fixed: uF +/-5%; 50 V: unless otherwise stated	C168
C1	21-13740L06	3.3 0.1 pF	C169
C2	21-13740L18	10 pF 2%	C170
C3	21-13740L14	6.8 0.1 pF	C174
C4	21-13740L24	18 pF 2%	C175
C5	21-13740L14	6.8 0.1 pF	C176
C6	21-13740L15	7.5 0.1 pF	C178
C7	21-13740L27	24 pF 2%	C179
C8	21-13740L13	6.2 0.1 pF	C181
C9	21-13740L14	6.8 0.1 pF	C182
C10	21-13740L26	22 pF 2%	C184
C11	21-13740L13	6.2 0.1 pF	C185
C12	21-13740L10	4.7 0.1 pF	C186
C13	21-13740L22	15 pF 2%	C201
C14	21-13740F60	240 pF	C202
C15	21-13740F60	240 pF	C203
C16	---	Not Used	C204
C17	21-13740F60	240 pF	C206
C18	21-13740L12	5.6 0.1 pF	C208
C19	21-13743E20	0.1 uF 10%; 16 V	C210
C20 thru 31	21-13740F60	240 pF	C213
C33 thru 35	21-13740F60	240 pF	C215
C36	---	Not Used	C216
C37	21-13740F60	240 pF	C217
C38	21-13740L12	5.6 0.1 pF	C218
C39	21-13740L01	2.0 0.1 pF	C219
C40	21-13740F16	3.6 0.25 pF	C220
C51	21-13740F49	82 pF	C223
C52	21-13740F35	22 pF	C224
C53	21-13740F25	8.2 0.25 pF	C225
C54	---	Not Used	C226
C55	21-13740F37	27 pF	C229
C56, 57	21-13743E20	0.1 uF 10%; 16 V	C231
C58	21-13740F21	5.6 ±0.25 pF	C234
C59	---	Not Used	C235
C60	21-13743E20	0.1 uF 10%; 16 V	C236
C61	21-13741F29	1500 pF	C237
C62	23-11049A05	tantalum 0.47 uF 10%; 25 V	C238
C63	21-13740F45	56 pF	C239
C64	21-13740F69	560 pF	C240
C65	21-13741F49	.01 uF	C241
C67	23-11049J11	tantalum 4.7 uF 10%; 16 V	C242
C68	21-13743K16	0.22 uF +80/-20% 16 V	C243
C69	23-11049A11	tantalum 3.3 uF 10%; 16 V	C244
C70	21-13743E20	0.1 uF 10%; 16 V	C245
C71	23-11049A57	tantalum 10 uF 10%; 16 V	C251
C73	21-13740F32	16 pF	C252
C74	21-13740F40	36 pF	C253
C75	21-13740F18	4.3 0.25 pF	C254
C76	21-13743E20	0.1 uF 10%; 16 V	C256
C77	21-13740F60	240 pF	C257
C79	21-13740F31	15 pF	C258
C80	---	Not Used	C259
C83	21-13743E20	0.1 uF 10%; 16 V	C260
C85 thru 87	21-13740F55	150 pF	C261
C88, 89	21-13741F49	.01 uF	C262
C101	21-13741F25	1000 pF	C264
C102	21-13741F49	.01 uF	C265
C103	23-11049A98	tantalum 47 uF 10%; 10 V	C267
C104	21-13740F10	2 0.25 pF	C268
C105	23-11049C08	tantalum 33 uF 10%; 20 V	C269
C106	21-13743E20	0.1 uF 10%; 16 V	C271
C107	08-11051A19	poly 1 uF; 63 V	C272
C108	21-13743E04	.016 uF 10%; 16 V	C273
C111	21-13740F10	2 0.25 pF	C274
C112, 113	21-13740F51	100 pF	C276
C114	23-11049A07	tantalum 1 uF 10%; 16 V	C277
C151	21-13740L13	6.2 0.1 pF	C301
C152	21-13740L26	22 pF 2%	C302
C153	21-13740L18	10 pF 2%	C303
C154	21-13740L15	7.5 0.1 pF	C304
C155	21-13740F60	240 pF	C306
C156	21-13740L18	10 pF 2%	C308
C157	21-13740L12	5.6 0.1 pF	C309
C158	21-13740F16	3.6 0.25 pF	
C159, 160	---	Not Used	CR1
C161	21-13743E20	0.1 uF 10%; 16 V	CR2
C162, 163	21-13740F60	240 pF	CR8
C164	21-13740F25	8.2 0.25 pF	CR51
C165	21-13740F15	3.3 0.25 pF	CR151
C166	21-13740F24	7.5 0.25 pF	CR153
C167	---	Not Used	CR201

Parts List for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUD3191A & PMUE1505A Transceivers)

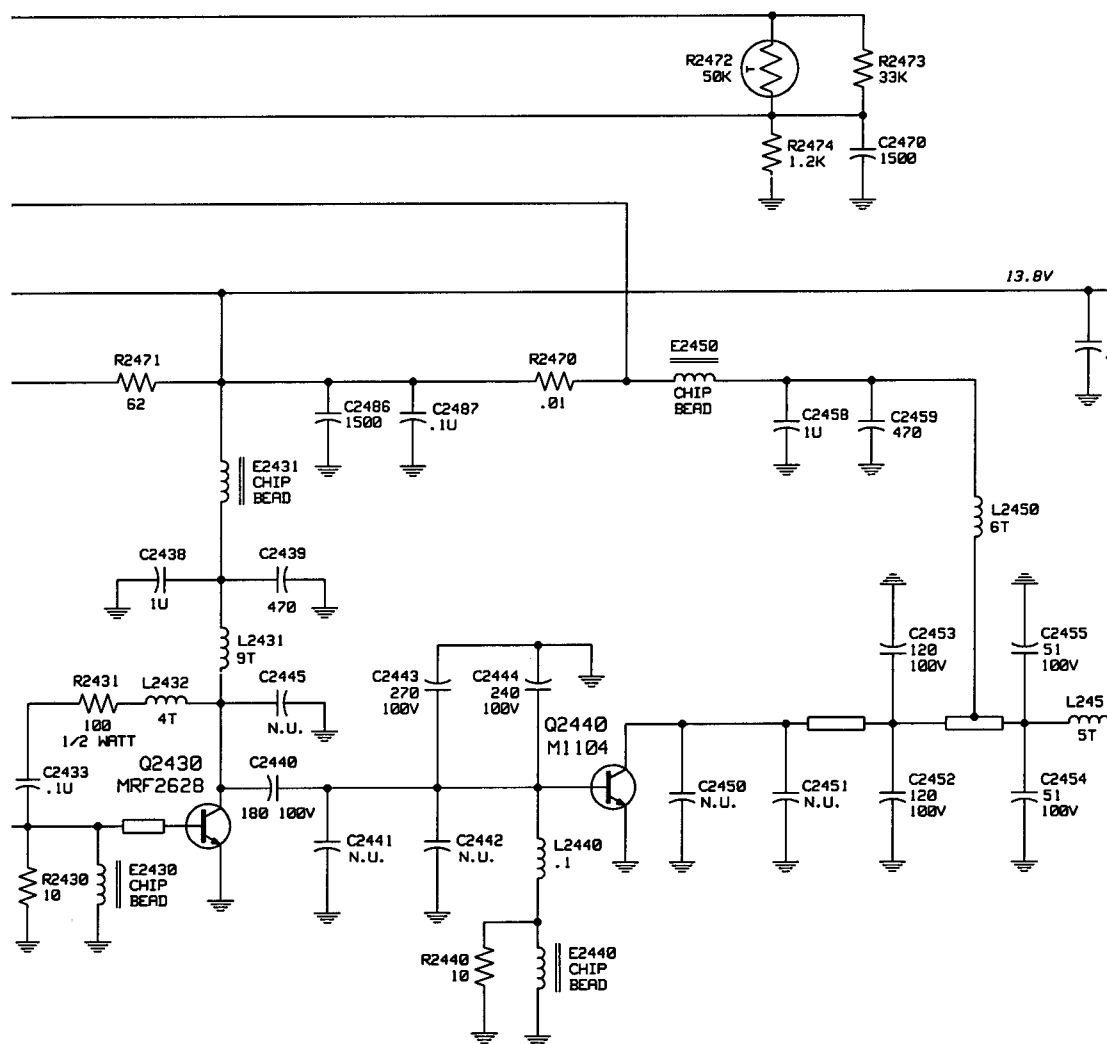


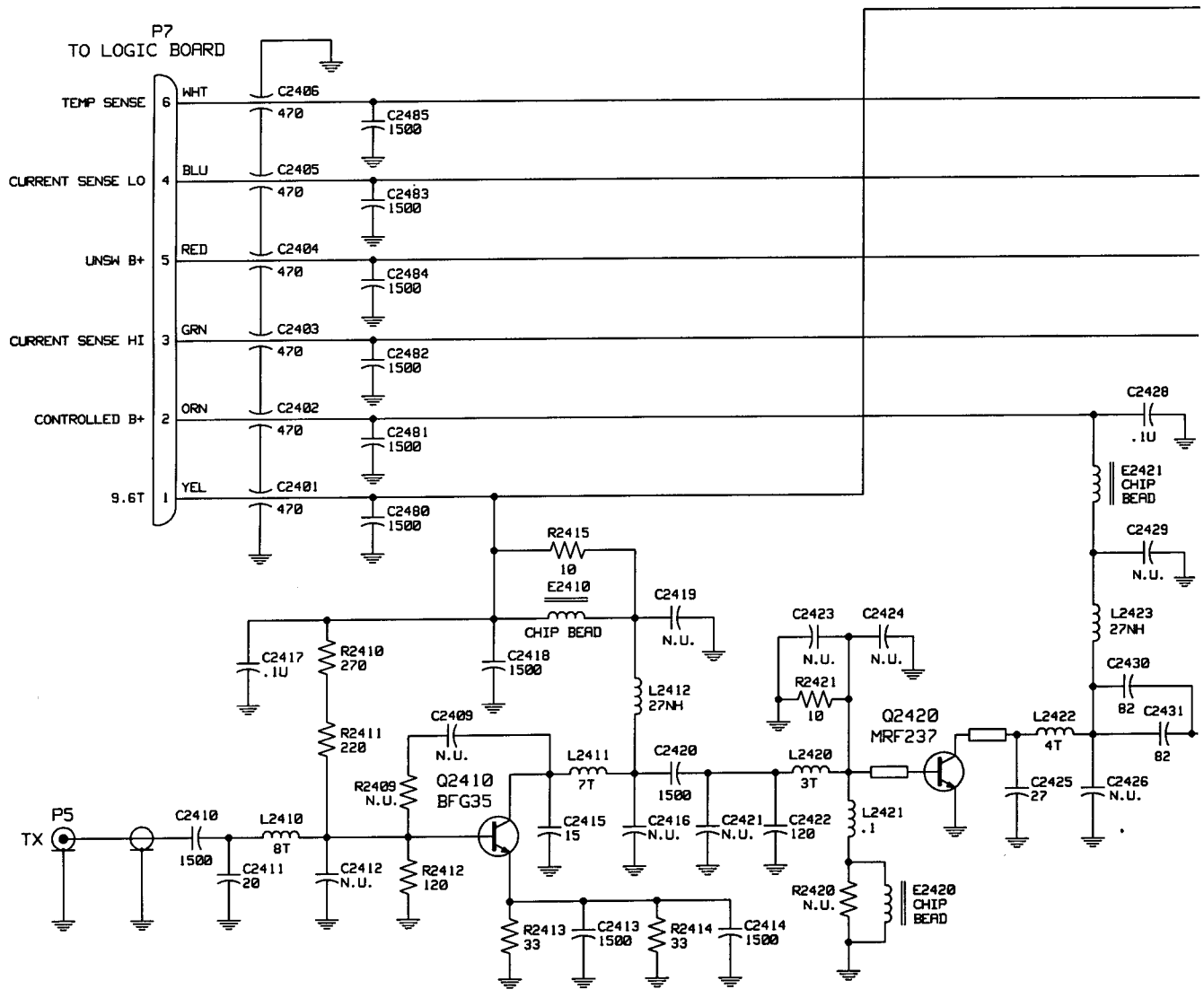
12/15/98

RPD-97147-A

*Schematic Diagram and Parts List for  
VHF Power Amplifier Board, 146-174 MHz, 25-50 W  
(Part of HUD3119A Transceiver)*







MOTOROLA NO.	DESCRIPTION
	<b>capacitor, fixed: uF +/-5%; 50 V:</b> unless otherwise stated
74K01	470 pF feedthru
	Not Used
41F29	1500 pF
40F34	20 pF
	Not Used
41F29	1500 pF
40F31	15 pF
	Not Used
43E20	0.1 uF 10%; 16 V
41F29	1500 pF
	Not Used
41F29	1500 pF
	Not Used
40F53	120 pF
	Not Used
40F37	27 pF
	Not Used
43E20	0.1 uF 10%; 16 V
	Not Used
40F49	82 pF
41B69	0.1 uF
41W01	1 uF 10%; 25 V
40B65	470 pF
78B49	180 pF 100 V
	Not Used
78B53	270 pF 100 V
78B52	240 pF 100 V
	Not Used
	Not Used
78B44	120 pF 100 V
78B35	51 pF 100 V
78B18	15 pF 100 V
41W01	1 uF 10%; 25 V
40B65	470 pF
78B18	15 pF 100 V
78B32	39 pF 100 V
78B33	43 pF 100 V
78B20	18 pF 100 V
78B34	47 pF 100 V
41F29	1500 pF
41F29	1500 pF
41B69	0.1 uF
41F29	1500 pF
	Not Used
	<b>diode: (see note)</b>
36E07	transient suppressor
	<b>ferrite beads:</b>
57R01	ferrite bead
57R01	ferrite bead
57R01	ferrite bead
57R01	ferrite bead
57R01	ferrite bead
	<b>connector, receptacle:</b>
31M01	mini UHF coax
55E01	power (includes feedthru)
	<b>coil, rf:</b>
91F77	8 turns
91E77	7 turns
87N46	chip 27 nH 5%
91A01	3 turns
87N53	chip .1 uH 5%
91B73	4 turns
87N46	chip 27 nH 5%
91S77	9 turns
91B73	4 turns
87N53	chip 0.1 uH 5%
91X04	6 turns
91X03	5 turns
91X04	6 turns
91S77	9 turns
	<b>connector, plug:</b>
38M07	coaxial cable 150 mm with plug
04Y64	cable and connector assembly, 6-pin (includes C2401-6 and feedthru bracket)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>transistor: (see note)</b>
Q2410	48-02245J24	NPN; type BFG35
Q2420	48-80225C23	NPN; type MRF237
Q2430	48-80225C18	NPN; type MRF2628
Q2440	48-84411L04	NPN; type M1104
		<b>resistor, fixed: +/-5%; 1/16 W:</b> unless otherwise stated
		Not Used
R2409	---	
R2410	06-11077A60	270; 1/8 W
R2411	06-11077A58	220; 1/8 W
R2412	06-62057A27	120
R2413, 2414	06-11077A38	33; 1/8 W
R2415	06-62057A01	10
R2420	---	Not Used
R2421	06-62057A01	10
R2430	06-11077A26	10; 1/8 W
R2431	06-80195M25	100; 1/2 W
R2440	06-11077A26	10; 1/8 W
R2470	17-05603W01	metal .01
R2471	06-62057A20	62
R2472	06-05621T02	thermistor 50k @ 25° C
R2473	06-62057A85	33k
R2474	06-62057A51	1.2k
<b>non-referenced items</b>		
	01-04006J22	transistor heatsink ass'y (includes Q2420 and 26-80158L01 heatsink)
	02-00007003	nut 8-32 x 5/16 x 1/8 (for Q2430)
	03-10943M10	screw M3 x .5 x 8 (8 used)
	03-10943M11	screw M3 x .5 x 10 (2 used for J2)
	04-00131974	washer (2 used for J2)
	04-05587G01	plastic washer (for antenna post)
	26-80223M07	PA shield
	26-80475U01	heat sink
	29-80014A03	clip coax terminal
	32-80014N03	gasket, accessory connector
	42-80281L01	ground clip (2 used for Q2440)
	42-80520B01	ground clip

**note:** For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

# Parts List

HLD3014A VHF Power An

REFERENCE SYMBOL	MOT/ PAR
------------------	----------

C2401 thru 2406	21-8/
C2409	--
C2410	21-1/
C2411	21-1/
C2412	--
C2413, 2414	21-1/
C2415	21-1/
C2416	---
C2417	21-1/
C2418	21-1/
C2419	---
C2420	21-1/
C2421	---
C2422	21-1/
C2423, 2424	---
C2425	21-1/
C2426	---
C2428	21-1/
C2429	---
C2430, 2431	21-1/
C2433	21-1/
C2438	21-1/
C2439	21-1/
C2440	21-1/
C2441, 2442	---
C2443	21-1/
C2444	21-1/
C2445	---
C2450, 2451	---
C2452, 2453	21-1/
C2454, 2455	21-1/
C2456	21-1/
C2458	21-1/
C2459	21-1/
C2460, 2461	21-1/
C2462	21-1/
C2463	21-1/
C2464	21-1/
C2465	21-1/
C2470	21-1/
C2480 thru 2486	21-1/
C2487, 2488	21-1/
C2489	21-1/
C2490	---
CR2480	48-8/
E2410	24-8/
E2420, 2421	24-8/
E2430, 2431	24-8/
E2440	24-8/
E2450	24-8/
J1	09-8/
J2	09-8/
L2410	24-6/
L2411	24-6/
L2412	24-6/
L2420	24-6/
L2421	24-6/
L2422	24-6/
L2423	24-6/
L2431	24-6/
L2432	24-6/
L2440	24-6/
L2450	24-6/
L2451	24-6/
L2460 thru 2462	24-6/
L2463	24-6/
P5	30-8/
P7	01-8/

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## GENERAL:

This revision outlines changes that have occurred since the printing of your service manual. Use this information to correct your manual.

## INSTRUCTION MANUAL AFFECTED:

6880905Z53-O

R1225 Transceiver Service Manual

## REVISION DETAILS:

1. The transceiver's Receiver Selectivity within the Specifications section on page vii has been changed as follows:  
  
VHF 12.5 kHz = 75 dB  
VHF 25 kHz = 80 dB  
UHF 12.5 kHz = 70 dB
2. Manuals 6880904Z89, Basic use of the R1225 Transceiver; 6880905Z34, R1225 Safety/Licensing Guide; and 6880905Z51, R1225 Accessory Sheet are part of manual kit HLN9535 and cannot be ordered separately.
3. Manual 6880904Z93 is part of kit HVN9054 and cannot be ordered separately.
4. A revised Troubleshooting section for the R1225 transceiver has been supplied. Please refer to the attached pages.

## ATTACHMENTS

Section 3 – Troubleshooting ..... Pages 3-1 through 3-6

# Section 3 Troubleshooting

**Table 3-1. Troubleshooting for R1225 Transceiver (General)**

Symptom	Problem(s)	Possible Solution(s)
1. GR400 & GR500 X-Pand and GR1225 repeaters dead (7-segment LED display does not light).	1a. AC line cord not plugged into power supply or AC mains outlet. 1b. Repeater not turned ON. 1c. Loose or bad cable from front panel to transceiver. 1d. DC cord not plugged into R1225 transceiver. 1e. Open fuse in power supply.	1a. Plug power supply cord into power supply CEE receptacle or AC mains outlet. 1b. Turn on repeater. 1c. Check cable connections to front panel and transceiver or replace cable, if necessary. 1d. Plug DC cable into connector at the rear of the R1225 transceiver. 1e. Check fuse in power supply and replace as necessary.
2. No field radios can access system.	2a. Repeater programmed with wrong TPL/DPL code. 2b. Loose or bad coaxial cable from receiver antenna connector to duplexer or receiver antenna. 2c. Incorrect programming of field radios. 2d. Repeater not enabled or set up (if applicable).	2a. Check TPL/DPL code of repeater and reprogram, if necessary. 2b. Check repeater cable connections to receiver antenna connector and replace cable if necessary. 2c. Check programming on field radios and reprogram, if necessary. 2d. Check repeater enable and setup condition(s).
3. First part of message not repeated.	3. User speaking too soon after pressing PTT.	3. Delay conversation to allow for delays in system due to: <ul style="list-style-type: none"> <li>• TPL/DPL decoding.</li> <li>• Requirements of signalling systems.</li> </ul>
4. Loss of receiver sensitivity when repeater is keyed (repeater toggles from transmit to receive repeatedly when attempting to communicate through it).	4a. Leaky coaxial cable(s). 4b. Loose antenna connector(s). 4c. Faulty antenna connector(s). 4d. Duplexer not tuned correctly (if applicable). 4e. Inadequate distance between receiver and transmitter antennas (if applicable). 4f. Improper or faulty coaxial cable(s) to antenna(s).	4a. Check coaxial cables and replace if necessary. 4b. Check antenna connector(s) and replace, if necessary. 4c. Replace antenna connector(s). 4d. Re-tune duplexer. 4e. Read "Antenna Spacing" on page 1-4 of the GR1225 Repeater service manual (6880904Z90) or "Antenna Spacing" on page 1-5 of the GR400 & GR500 X-Pand Repeater Service manual (6880905Z54) and adjust distance between antennas. 4f. Read "Cables" on page 1-4 of the GR1225 Repeater service manual (6880904Z90) or "Cables" on page 1-5 of the GR400 & GR500 X-Pand Repeater service manual (6880905Z54) to determine the types of cables required or replace cable(s), if necessary.

**Table 3-1. Troubleshooting for R1225 Transceiver (General) (Cont'd.)**

Symptom	Problem(s)	Possible Solution(s)
5. Partial (RapidCall) PTT ID message repeated.	5a. Pre-time too short. 5b. "Pre" PTT ID used.	5a. Increase pre-time in field radio. 5b. Use "Post" PTT ID.
6. Fan in the repeater runs all the time.	6a. Repeater environment is hot (>60°C). 6b. Defective temperature switch in power supply 6c. For the GR500 X-Pand repeater. 6d. Only happens if battery revert module is used in GR400 X-Pand repeater.	6a. Normal operation at elevated ambient temperatures or extended repeater keying. 6b. Replace power supply. 6c. Normal operation of GR500 X-Pand repeater. 6d. Normal operation with battery revert in GR400 X-Pand repeater.
7. Fan still runs with repeater power switch turned OFF.	7a. Normal operation if repeater was transmitting prior to turning OFF. 7b. Repeater environment is hot (>60°C). 7c. Battery revert module is installed in GR400 X-Pand repeater.	7a. Wait until repeater cools. 7b. Move repeater to cooler environment. 7c. Normal operation with battery revert module in GR400 X-Pand repeater. 7d. Disconnect AC cord from AC mains outlet.
8. Power supply stays ON with repeater power switch OFF.	8. Normal operation.	8. Power switch on front panel turns OFF B+ only to transceiver.
9. Repeater constantly keyed.	9a. Accessory connector of transceiver not programmed correctly or not operating correctly. 9b. Transceiver PTT pin pulled LOW by an accessory.	9a. Check programming of accessory connector and reprogram, if necessary. 9b. Remove or correct accessory.
10. Front panel display does not light but repeater is warm.	10. Power supply is in overvoltage/overcurrent protection.	10a. Disconnect AC cord from AC mains outlet; wait 5 seconds, then reconnect AC cord to AC mains outlet. 10b. If step 10a does not reset power supply, transceiver or external controller may have a short circuit.
11. Repeater will not enable with "RPT EN" pushbutton.	11a. Repeater programmed as Base Station only. 11b. Pin 10 of accessory connector programmed for "Repeater Knockdown" and is activated.	11a. Use RSS to reprogram for repeater operation. 11b. Check wiring from pin 10 to an external controller or accessory and correct, if necessary.
12. Remote "Repeater Knockdown" (pin 10 of accessory connector) not functioning.	12. Pin 10 programmed with "Null" default.	12. Use RSS to reprogram pin 10 as "Repeater Knockdown".
13. CWID stops and starts many times.	13. CWID programmed as interruptible.	13. Use RSS to reprogram CWID as non-interruptible.
14. Desk mic does not put station in monitor mode when monitor button is pushed.	14. "Permanant On-Hook" enabled.	14. Use RSS to reprogram "Permanant On-Hook" as disabled.
15. Local microphone (front panel jack) overrides repeat audio.	15. None.	15. Normal operation. PTT priorities are (low to high): COR, External, Local, Page.
16. I hear voices coming from my repeater mounted in a closet.	16a. "PA Mute" not enabled. 16b. Ghosts/spirits.	16a. Use RSS to program "PA Mute" as enabled. 16b. Exorcism.

**Table 3-2. Troubleshooting for Transceiver Receiver**

<b>Symptom</b>	<b>Problem</b>	<b>Solution</b>
1. No speaker audio heard.	1a. No speaker connected to volume/microphone board or to pins 1 and 16 of accessory connector. 1b. Volume control turned down. 1c. Speaker cable not plugged into volume/microphone board. 1d. External speaker (if applicable) not connected between pins 1 and 16 of accessory connector on controller. 1e. Defective speaker (internal or external, if applicable). 1f. "PA Mute" enabled.	1a. Normal operation. No speaker is supplied with GR400 and GR500 X-Pand conversion kits. Use handset for servicing. 1b. Turn up volume. 1c. Connect speaker cable. 1d. Connect external speaker between pins 1 and 16. 1e. Check speaker and replace if necessary. 1f. Use RSS to reprogram "PA Mute" as disabled.



**Table 3-3. Troubleshooting for Transceiver Transmitter**

Symptom	Problem	Solution
1. Transmitter not keying when a properly identified signal is presented to receiver.	1a. Repeater not enabled. 1b. Repeater on wrong channel (mode). 1c. No transmit frequency programmed. 1d. Incorrect receive frequency or TPL/DPL programmed. 1e. Accessory connector pin 10 (remote knockdown) activated or not operating correctly.	1a. Enable repeater. 1b. Set repeater to correct channel (mode). 1c. Program transmit frequency. 1d. Check receive frequency and TPL/DPL and reprogram, if necessary. 1e. Check connections to pin 10 of accessory connector and correct, if necessary.
2. Transmitter keying continuously or keying without a properly identified signal presented to the receiver.	2a. Repeater on wrong channel (mode). 2b. Wrong TPL/DPL programmed. 2c. Pin 3 of accessory connector pulled LOW by an accessory. 2d. Accessory connector not programmed correctly or not operating correctly.	2a. Set repeater to correct channel (mode). 2b. Check TPL/DPL and reprogram, if necessary. 2c. Remove accessory and correct LOW condition. 2d. Check programming of accessory connector and reprogram, if necessary.
3. Low or erratic output power level, or no output power level from the transmitter.	3a. Loose RF cable connector(s). 3b. Faulty antenna or feedline. 3c. Faulty duplexer (if applicable). 3d. Output voltage from power supply drops during transmit. 3e. Excessive power supply current drain.	3a. Tighten RF cable connectors to <ul style="list-style-type: none"> <li>• transmitter output</li> <li>• duplexer</li> <li>• antenna</li> </ul> 3b. Replace faulty component. 3c. Check: <ul style="list-style-type: none"> <li>• Tuning of duplexer</li> <li>• Tightness of locking nuts on tuning screws.</li> <li>• Replace duplexer if duplexer is correctly tuned and nuts are properly tightened.</li> </ul> 3d. Check: <ul style="list-style-type: none"> <li>• Correct position of "115/230" switch on power supply.</li> <li>• High output power from transmitter; do not set greater than 10% over rated RF output power (measured at transmitter output, NOT at duplexer antenna connector).</li> </ul> 3e. Disconnect components, one at a time, to locate faulty piece. Replace faulty piece.
4. Transmitter keys but no or low audio is transmitted.	4a. Repeater gain improperly set. 4b. Incorrect "Operation Mode" programmed.	4a. Use RSS to set repeater gain. 4b. Use RSS to reprogram "Operation Mode."

Table 3-4. Troubleshooting for External Controllers (General)

Symptom	Problem	Solution
1. Controller dead, no LED indications.	1a. Loose or bad cable from transceiver. 1b. Blow fuse in controller (if applicable).	1a. Check cable from transceiver and replace if necessary. 1b. Replace fuse in controller (if applicable) and check for short or open circuit(s).
2. Transmitter not keying when a properly identified signal is presented to receiver.	2a. Controller not enabled, if applicable. 2b. R1225 not enabled. 2c. Loose or bad repeater cable. 2d. Accessory connector of transceiver not programmed correctly or not operating correctly. 2e. Incorrect receive frequency or TPL/DPL programmed. 2f. Repeater on wrong channel (mode). 2g. Pin 10 programmed as "repeater knockdown" and activated by a controller or accessory. 2h. No transmit frequency programmed into transceiver.	2a. Enable controller. 2b. Press front panel "RPT EN" push-button. 2c. Check repeater cable connection(s) and replace cable, if necessary. 2d. Check programming of accessory connector and reprogram, if necessary. 2e. Check frequency and TPL/DPL code and reprogram, if necessary. 2f. Change repeater channel (mode). 2g. Check wiring to pin 10 and correct, if necessary. 2h. Program transmit frequency.
3. Transmitter keying continuously or keying without a properly identified signal presented to receiver.	3. Pin 3 of accessory connector on controller pulled LOW by an accessory.	3. Remove accessory and correct LOW condition.
4. First part of message not repeated.	4. User speaking too soon after pressing PTT.	4. Delay conversation to allow for delays in repeater and field radios from: <ul style="list-style-type: none"> <li>• TPL/DPL decoding.</li> <li>• Requirements of signalling systems.</li> </ul>
5. Transmitter keys, but low or no audio is transmitted.	5a. "External Mic" input (pin 2) of accessory connector not enabled. 5b. Controller not adjusted correctly.	5a. Use RSS to enable "External Mic". 5b. Adjust controller. Perform alignment procedures.
6. "Tinny" repeated audio (lacks low frequencies).	6. Flat receive audio selected with microphone transmit audio.	6. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
7. "Bassy" repeated audio (lacks high frequencies).	7. EIA de-emphasized receive audio selected with flat transmit audio.	7. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
8. TPL/DPL signalling "passing through" controller.	8. Flat repeat audio selected.	8. Use RSS to reprogram repeat audio as "EIA."
9. TPL/DPL signalling not "passing through" controller.	9. EIA de-emphasized repeat selected.	9. use RSS to reprogram repeat audio as "Flat."
10. DPL sense inverted in "pass through" mode (flat audios).	10. Inversion caused by processing of signal in receiver circuits.	10. Use RSS to change "Flat Repeat Audio Polarity".
11. Undesirable squelch tails and noise transmitted during drop-out delay.	11. Unmuted transmit and receive audios selected	11. Use RSS to reprogram for "Muted" audios.

**Table 3-4. Troubleshooting for External Controllers (General) (Cont'd.)**

Symptom	Problem	Solution
<p>12. Cannot remotely setup repeater with Call Alert.</p>	<p>12a. No option board installed into the R1225 transceiver.                      12b. Both external controller and R1225 transceiver are programmed for remote setup/knockdown and are operating out of sequence.</p>	<p>12a. Install an option board into the R1225 transceiver.                      12b. Disable remote setup/knockdown function in the external controller or R1225 transceiver.</p>
<p>13. TRA100R will not channel steer or will not channel steer to channels (modes) 2, 3, 6 or 7.</p>	<p>13a. R1225 transceiver accessory connector pins are not programmed.                      13b. Wire missing in cable from pin 9 of R1225 transceiver connector to pin 9 of "Tx" connector.                      13c. R1225 transceiver channel steering pins are programmed with debounce "Off."</p>	<p>13a. Program R1225 transceiver accessory connector:                      Pin 6 - Chan Steer 0                      Pin 9 - Chan Steer 1                      Pin 12 - Chan Steer 2                      All active Low, Debounce On.                      13b. Add wire from pin 9 of R1225 transceiver connector to pin 9 of "Tx" connector.                      13c. Use RSS to reprogram channel steer pins with debounce "On."</p>

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## Glossary



## Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by service manual revisions. These revisions are added to the manuals as the engineering changes are incorporated into the equipment.

## How to Use This Manual

This manual contains introductory material such as model charts, accessories, and specifications, as well as four sections that deal with specific service aspects of the R1225 Transceiver. Refer to the Table of Contents for a general overview of the manual, or to the "Overview" paragraph in each section for a specific overview of the information in that section.

## Other Documentation

Table 1 lists other documentation for the R1225 Transceiver.

*Table 1. Other Documentations*

Information	Location
Basic Use of Transceiver	R1225 Operator Guide (6880904Z89)
Accessories	R1225 Accessory/Feature Sheet (6880905Z51)
Safety and Licensing	R1225 Safety/Licensing Guide (6880905Z34)
Programming	1225 Series RSS Getting Started (6880904Z93) p/o HVN9054
GR1225 Service	GR1225 Service Manual (6880904Z90)
GR400 & GR500 X-Pand Service	GR400 & GR500 X-Pand Installation and Service Manual (6880905Z54)

## Technical Support

To obtain technical support, you may call Motorola's Radius Product Services. When you call, we ask that you have ready the model and serial numbers of the respective radio or its parts.

## Service Policy

If malfunctions occur within 30 days that cannot be resolved over the phone with Radius Product Services, a defective major component should be returned. You

must obtain authorization from Radius Product Services before returning the component.

## Ordering Replacement Parts

You can order additional components and some piece parts directly through your Radius price pages. When ordering replacement parts, include the complete identification number for all chassis, kits, and components. If you do not know a part number, include with your order the number of the chassis or kit which contains the part, and a detailed description of the desired component. If a Motorola part number is identified on a parts list, you should be able to order the part through Motorola Parts. If only a generic part is listed, the part is not normally available through Motorola. If no parts list is shown, generally, no user serviceable parts are available for the kit.

**Radius 30-Day Warranty  
Technical Support  
Radius Product Services**  
1000 W. Washington St.  
Mt. Pleasant, IA 52641 USA

**Motorola Radio Support Center**  
Attention: Warranty Return  
3760 South Central Avenue  
Rockford, IL 61102 USA  
1-800-227-6772 (U.S. & Canada)

**Radius Major Component Repair  
Motorola Radio Support Center**  
3760 South Central Avenue  
Rockford, IL 61102 USA

**Motorola Parts  
Worldwide System and  
Aftermarket Products Division**  
Attention: Order Processing  
1313 E. Algonquin Road  
Schaumburg, IL 60196

**Worldwide System and  
Aftermarket Products Division**  
Attention: International Order Processing  
1313 E. Algonquin Road  
Schaumburg, IL 60196

**Customer Service**  
1-800-422-4210  
1-847-538-8198 (FAX)

**Parts Identification**  
1-847-538-0021  
1-847-538-8194 (FAX)

# Model Charts

<b>MODEL</b>	<b>FREQ.</b>	<b>DESCRIPTION</b>	<h2 style="margin: 0;">R1225</h2> <h3 style="margin: 0;">VHF Transceiver</h3> <h3 style="margin: 0;">146 - 174 MHz</h3> <h3 style="margin: 0;">25-50 Watts RF Power</h3>			
M43GRC90C2AA	16	12.5/25 kHz, 25-50 W				
<b>ITEM</b>	<b>DESCRIPTION</b>					
HLN9196_	PA Hardware Kit					
(See Note)	Main Board, 12.5/25 kHz, 25-50 W					
HLD9018_	P.A. PCB Kit					
	<b>Item</b>	<b>Description</b>				
X	HUD3119_	Transceiver, 12.5/25 kHz		X		
X	HLD3014_	P.A. , 25-50 W	X			X
X	HLD9017_	RF Board				
X	HLN9395_	Logic Board				
X	HLN9396_	Transceiver Chassis Hardware Kit				
X	HLN9535_	R1225 Operator Kit				

**Note:** Main board kits are not available separately for field replacement

MODEL	FREQ.	DESCRIPTION
M44GRC90C2AA	16	12.5/25 kHz, 25-50 W
<b>R1225 UHF Transceiver 444 - 474 MHz 25-50 Watts RF Power</b>		
ITEM	DESCRIPTION	
HLN9195_	PA Hardware Kit	
(See Note)	Main Board, 12.5/25 kHz, 25-45 W	
HLE9057_	P.A. PCB Kit	
Item	Description	
X HUE3191_	Transceiver, 12.5/25 kHz	
X HLE3013_	P.A., 25-45 W	
X HLE9051_	RF Board	
X HLN9395_	Logic Board	
X HLN9396_	Transceiver Chassis Hardware Kit	
X HLN9535_	R1225 Operator Kit	

**Note:** Main board kits are not available separately for field replacement

## Specifications

### GENERAL

	VHF	UHF
Model Series:	M43GRC	M44GRC
Frequency Range:	146-174 MHz	444-474 MHz
RF Output:	25-50 W	25-45 W
Channel Spacing:	Switchable 12.5/20/25/30 kHz	
Duty Cycle:	Continuous @ 25 Watts, 50% @ 45/50 Watts (5 min. on / 5 min. standby)	
Dimensions:	H 2.0" x W 7.125" x D 7.375" (H 50.8mm x W 181mm x D 212.8mm)	
Weight:	5.0 lbs. (2.4 kg)	
Channel Capacity:	16 Channels	
Freq. Separation:	28 MHz	30 MHz
Input Voltage: Repeater Transceiver	115/230 V ac $\pm 10\%$ 13.8 V dc $\pm 10\%$	
Input Drain: Repeater	2.6 A ac (maximum @ 115 V ac 1.3 A ac (maximum) @ 115 V ac	
Transceiver (@13.8 V dc) Standby Receive @ 3 W audio Transmit @ 50/45 W	0.45 A dc 1.5 A dc	
	14.0 A dc	12.5 A dc
Squelch Code Capabilities:	TPL/DPL/CSQ	

### TRANSMITTER

	VHF	UHF
Frequency Stability:	$\pm 2.5$ ppm	$\pm 1.5$ ppm
Spurs/Harmonics:	-23 dBm	
Audio Response:	+1/-3 dB, relative to 6 dB/octave pre-emphasis, 300-3000 Hz	
FCC Designation:	ABZ99FT3023	ABZ99FT4023
FCC Modulation: 25 kHz 12.5 kHz	16K0F3E 11K0F3E	
Output Impedance:	50 ohms	
Modulation Sensitivity:	80 mV rms for 60% deviation @ 1000 Hz	
FM Noise: 25 kHz 12.5 kHz	45 dB 40 dB	45 dB 40 dB
Audio Distortion:	<3% EIA (60% of Rated Max. Deviation @1000 Hz)	

### RECEIVER

	VHF		UHF	
	12.5 kHz	25 kHz	12.5 kHz	25 kHz
Freq. Stability (-30C to +60C):	$\pm 2.5$ ppm		$\pm 1.5$ ppm	
Sensitivity @ 12 dB SINAD*:	0.35 $\mu$ (-116.1 dBm)			
Internal Squelch (SINAD):	10 dB nominal setting; adjustable from off to 20 dB			
Selectivity*:	65 dB	85 dB	65 dB	80 dB
Intermodulation*:	80 dB		80 dB	
Spurious Rejection:	85 dB		85 dB	
Image / Half IF Rejection:	80 dB		80 dB	
Audio Output: 8 ohms (external) 16 ohms (internal)	7.5 W 3.0 W Nominal			
Input impedance:	50 ohms			
EIA Usable Bandwidth:	1.2 kHz	2.0 kHz	1.2 kHz	2.0 kHz
Audio Response:	+1/-3 dB, relative to 6 dB/octave pre-emphasis, 300-3000 Hz			

\* Typical measurements per EIA/TIA-603.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

## Service Aids

**Service Aids**

The following table lists service aids recommended for working on the R1225 Transceiver.

Motorola Part No.	Description	Application
HLN9214	Radio Interface Box	Enables communication between the radio and the computer's serial communications adapter.
HSN9412	RIB Power supply	Used to supply power to the RIB.
HKN9216	Computer Interface cable	Connects the computer's serial communications adapter to the RIB.
HKN9217	Program Test Cable	RIB to Radio Cable
HKN9402	Power Supply Cable	Connects the power supply to the radio.
HVN9054	Radio Service Software	Software on 3-1/2 in. diskettes.

**Test Equipment**

The following table lists test equipment required to service the R1225 Transceiver.

Motorola Model No.	Description	Characteristics	Application
R2200, R2400, or R2001	Service Monitor	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1049	Digital Multimeter		Two meters recommended for ac/dc voltage and current measurements
*S1100	Audio Oscillator	67 to 200 Hz tones	Used with service monitor for injection of PL tones
*S1053, *SKN6009, *SKN6001	AC Voltmeter, Power Cable for meter, Test leads for meter	1mV to 300V, 10-Megohm input impedance	Audio voltage measurements
R1053	Dual-trace Oscilloscope	20 MHz bandwidth, 5mV/cm - 20V/cm	Waveform measurements
*S1350, *ST1215 (VHF) *ST1223 (UHF) *T1013	Wattmeter, Plug-in Elements (VHF & UHF), RF Dummy Load	50 Ohm, $\pm 5\%$ accuracy, 1-0 Watts, maximum 0-1000 MHz, 300 Watts	Transmitter power output measurements
S1339	RF Millivolt Meter	100 $\mu$ V to 3V RF, 10 kHz to 1.2 GHz	RF level measurements
*R1013	SINAD Meter		Receiver sensitivity
S1347 or S1348 (prog)	DC Power Supply	0-20 Vdc, 0-5 Amps	Bench supply for 12.5 Vdc

# Section 1 Transceiver Disassembly/Reassembly

## Overview

This section explains, step-by-step, how to disassemble and reassemble the R1225 Transceiver.

## Disassemble Transceiver

### IMPORTANT

Before disassembling and reassembling the transceiver, wear a conducting wrist strap to prevent damage to any component on the main board from electrostatic discharge.

## Remove Housing Covers

1. Remove the flat ribbon cable cover screw using a T10 Torx® driver (Figure 1-1).
2. Gently remove the two flat ribbon cables from the 27-pin connector (Figure 1-1).
3. Remove the two front panel screws using a T20 Torx driver (Figure 1-1) and pull front panel off.
4. Remove the four housing cover screws using a T10 Torx driver (Figure 1-1).
5. Remove top and bottom housing covers from chassis.

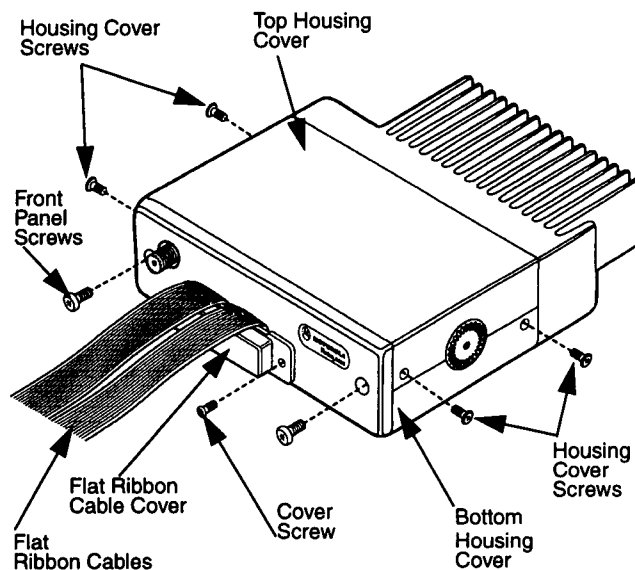


Figure 1-1.

## Remove Chassis Shields

Remove the top and bottom chassis shields by prying each of the four corners at the indentations provided (Figure 1-2). Be careful not to over bend any one corner.

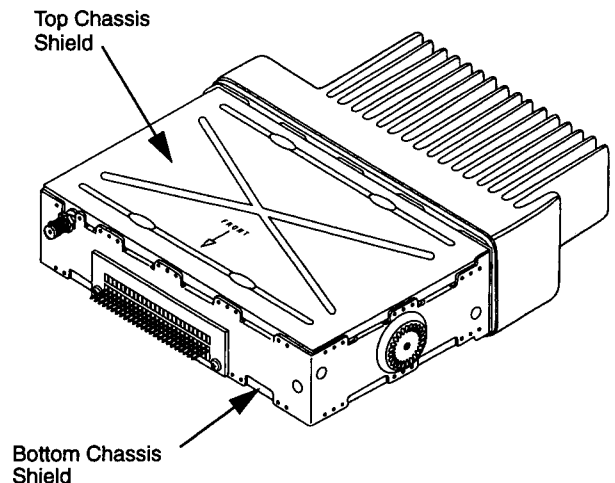


Figure 1-2.

## Remove the PA Heatsink

1. Disconnect the transmit coax cable from the RF board (Figure 1-3).

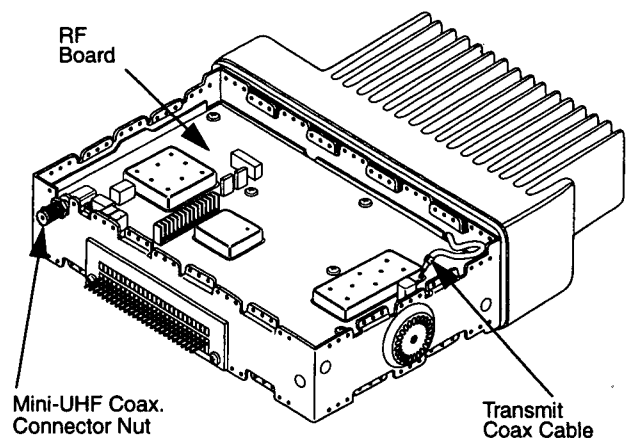


Figure 1-3.



## Disassemble Transceiver

2. Disconnect the 6-pin connector from the logic board (Figure 1-4).

**IMPORTANT**

If an option board has been installed, gently pry the option board upward, with your hand, until the board snaps out from the logic board. Disconnect the flex connector cable from the 16-pin connector on the option board.

3. Remove the two heatsink mounting screws using a T15 Torx driver (Figure 1-4).

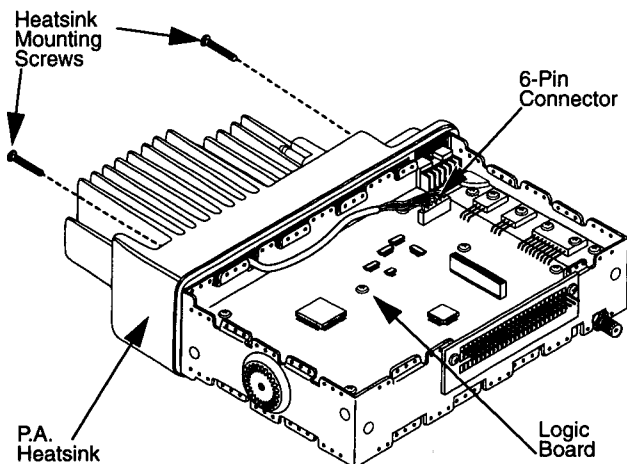


Figure 1-4.

4. Pull heatsink off of chassis while carefully feeding the transmit coax cable through its clearance hole in the chassis.

**Remove the RF Circuit Board**

1. Remove all seven RF board mounting screws using a T10 Torx driver.
2. Loosen the Mini-UHF coax. connector nut on the front of the transceiver using a 1/2" Hex nut driver, and lift out the RF board (Figure 1-5).

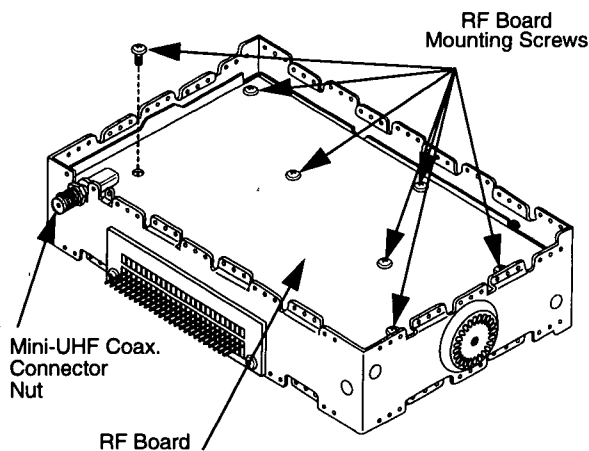


Figure 1-5.

**Remove the Logic Circuit Board**

1. Turn the chassis over and remove all eight logic board mounting screws using a T10 Torx driver (Figure 1-6).
2. Remove the two filter board screws from the front of the chassis using a T10 Torx driver (Figure 1-6).
3. Lift the logic and filter boards assembly out of the chassis.

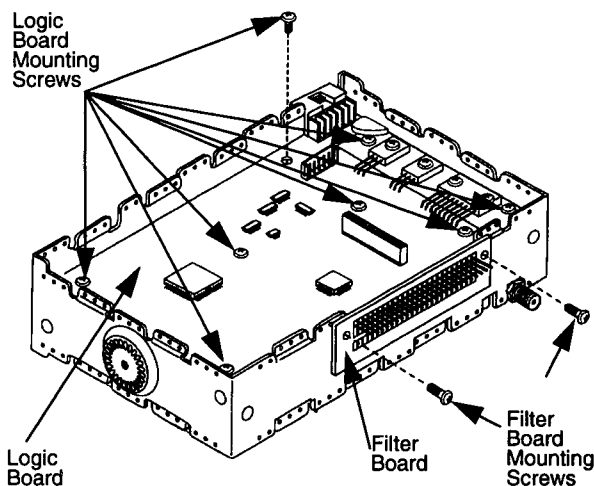


Figure 1-6.

**Remove the PA Circuit Board**

1. Remove the power amplifier shield by carefully prying each corner and side until you can slide the shield off easily (Figure 1-7).

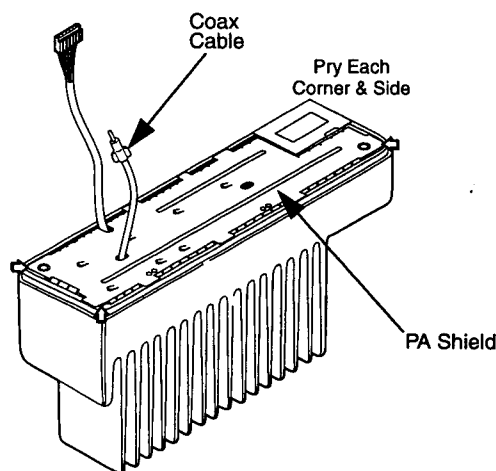


Figure 1-7.

2. Slide out the coax cable from under the grounding clip, that is located on the back of the shield.

- Remove the shield completely by guiding the coax cable out.
- Unsolder the A+ power connector feed-thru pin and the antenna connector pin (Figure 1-8).

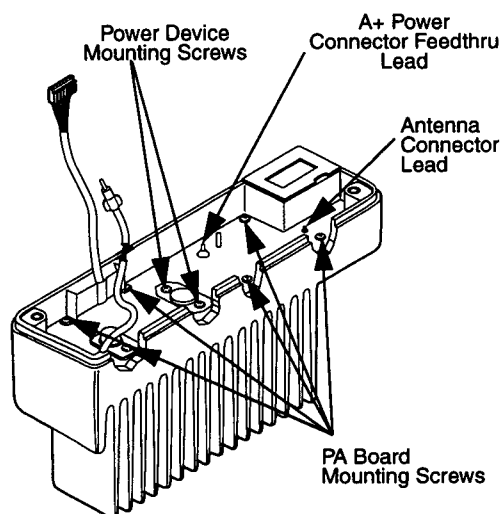


Figure 1-8.

- Remove the stud mount transistor nut from the back of the heatsink using a 5/16" Hex nut driver (Figure 1-9).

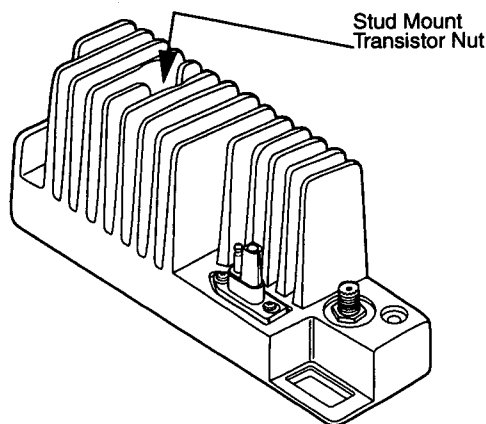


Figure 1-9.

- Remove the two power device mounting screws and the six PA board mounting screws using a T10 Torx driver (Figure 1-8).
- Lift out the PA board.

## Reassemble Transceiver

Reverse the disassembly procedure and tighten all screws to the torques specified in Table 1-2.

## Alignment

The advanced design and manufacturing procedures eliminate the need for traditional tuning tasks. All the circuits in the R1225 transceiver have been aligned at the factory with specialized equipment. Alignment in the field should not be attempted or necessary.

## Install an Advantage™ Board into the AdvantagePort™

The R1225 transceiver has been designed with an AdvantagePort interface that allows compatible Advantage Boards to be field installed.

### IMPORTANT

Before disassembling and reassembling the radio, wear a conducting wrist strap to prevent damage to any component on the main board from electrostatic discharge.

## Disassemble Transceiver

- Follow the procedures in the "Remove Housing Covers" section of this chapter.
- Remove the chassis shield of the logic board side of the transceiver by prying each of the four corners at the indentations provided. Be careful not to over bend any one corner. (Refer to Figure 1-4.)

## Insert Advantage Board

### CAUTION

Avoid excessive force when opening or closing the cover flaps of the 16-pin connectors on both the Advantage Board and main board. Damage to the connector's could result!

- Locate the 16-pin connector on the Advantage Board and gently lift cover flap.

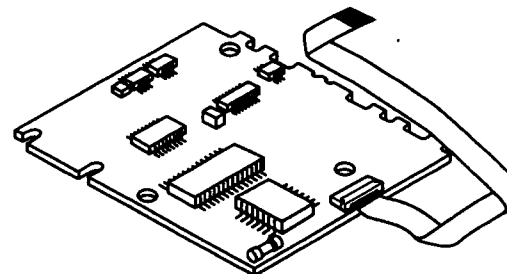


Figure 1-10.

- With the component side of the Advantage Board facing up, insert and properly align folded end (blue side up) of flex connector cable into the 16-pin connector on the Advantage Board as shown in Figure 1-10.

## Programming

3. While holding flex connector cable in place, gently close cover flap.
4. Locate and insert the black O-rings onto the snap lock side of the support posts. (Refer to Figure 1-11.)

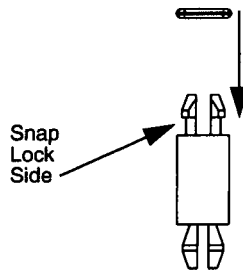


Figure 1-11.

5. With the component side of the Advantage Board still facing up, firmly insert the snap lock side side of the three support posts into the holes on the Advantage Board.
6. With the component side of the Advantage Board facing down, insert and properly align the other end (blue side up) of flex connector cable into the 16-pin connector on the main board.
7. While holding flex connector cable in place, gently close cover flap.
8. Locate the three holes on the logic board, where the Advantage Board is to be attached, using Figure 1-12 as a reference.

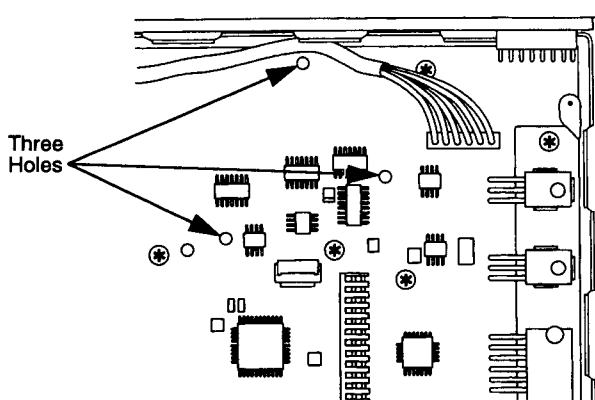


Figure 1-12.

9. Position the support posts over the three holes on the logic board and firmly press down on Advantage Board until the support posts snap into the holes. (Refer to Figure 1-13.)

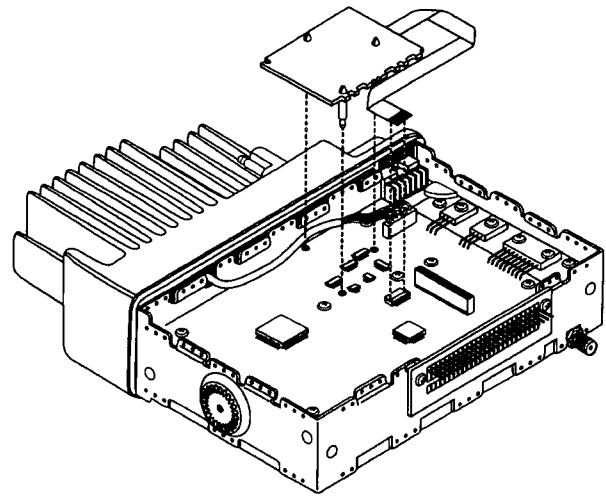


Figure 1-13.

10. Replace the chassis shield and reverse the disassembly procedure in the "Remove Housing Covers" section of this chapter and tighten all screws to the torques specified in Table 1-2.

## Programming

The R1225 transceiver can be programmed in the field to these parameters:

- Receive and transmit frequencies
- Transmit Frequency Adjustment (warp)
- PL or DPL encode and decode Codes
- Transmit Power Output
- Transmit Deviation
- Time Out Timer
- Repeater Drop-out Delay (Relay Delay)
- CWID
- Repeater or Base Station operation only
- 25 kHz or 12.5 kHz Operation
- Courtesy "Over" Beep

Configuration information for programming these parameters is contained in the 1225 Series Radio Service Software package HVN9054 with the 3.5 inch drive diskettes.

A personal computer (P.C.) and the appropriate software diskette will be required in addition to the items listed in Recommended Test Equipment.

We strongly suggest the servicer become familiar with the programming techniques applicable to the R1225 transceiver.

## Recommended Test Equipment

R2001D: Communication Systems Analyzer

or

R2200B: Service Monitor

R1011B: Power Supply

R1037A: Digital Multimeter

or

R1024B: Digital Multimeter

formed with the Motorola Radio Service Software. The procedures for calibration are covered in the 1225 Series Radio Service Software (RSS) Manual.

Failure to perform the required calibration procedure will affect the performance of the Reference Oscillator, RF Power Leveling and Protection, and Transmitter Modulation over frequency and temperature. An uncalibrated transceiver may not comply with your Local Communications Agency rules and may be unreliable at temperature extremes.

## Board Replacement and Calibration

Replacement of the Logic board, RF board, or Power Amplifier requires that recalibration must be per-

The R1225 transceiver was designed to be serviced at the board level only. There are a number of non-field serviceable parts in the transceiver. If any of these parts fail, board replacement is the only way to service the transceiver.

Table 1-1. Error Tones

Tone	Problem
High pitch Beep (900 Hz 119ms) on initial turn on or when key is pressed.	Normal operation - no error.
Low pitched tone (163 Hz) for 5 seconds following turn on.	Code plug error. For all code plug errors try to re-program radio. If this does not clear the fault or if problem recurs, replace the logic board
Low frequency (163Hz) continuous tone present whenever radio is on.	Logic board failure. Replace logic board.
Low pitch beep (300 Hz 200 MS) when a button is pressed.	Button is not allowed in the current operating condition. Change operating condition (select another mode, etc.)
Low frequency (150 Hz or 112.5 Hz) continuous tone while PTT is held.	Transmit is not allowed. If time-out-timer has expired, you should release PTT, press PTT again, then continue your call.

Table 1-2. Fasteners, Tools and Torques

Part Number	Description	Location	Qty	Drv	Input Torq.	Repair Torq.
03-80271L01	Screw, Mach. M4 x 0.7 x 27 Slot Torx® Pan Hd., Blk	Heatsink Mount	2	T15	12-14 in.-lbs.	12-14 in.-lbs.
03-10943M04	Screw, TT M2.5 x 8 Slot Torx Pan Hd	Device to Logic Heatsink	2	T8	6-8 in.-lbs.	4-6 in.-lbs.
03-10943M09	Screw, TT M3 x 6 Slot Torx Pan Hd.	RF Board Mount Logic Board Mount Chassis Feedthru Plate Front Panel Filter Board	7 6 2 2	T10	8-10 in.-lbs.	6-8 in.-lbs.
03-10943M10	Screw, TT M3 x 8 Slot Torx Pan Hd.	PA Device Mount PA Board Mount Logic Heatsinkto Chassis	2 6 2	T10	8-10 in.-lbs. 8-10 in.-lbs. 11-13 in.-lbs.	6-8 in.-lbs. 6-8 in.-lbs. 8-10 in.-lbs.
03-10943M11	Screw, TT M3 x 10 Slot Torx Pan Hd.	Power Connector Device to Logic Heatsink	2 2	T10	8-10 in.-lbs. 9-11 in.-lbs.	6-8 in.-lbs. 7-9 in.-lbs.
03-10943R55	Screw, TT M3 x 8 Slot Torx Flat Hd., Blk	Chassis Covers	4	T10	8-10 in.-lbs.	6-8 in.-lbs.
02-00007003	Nut, Hex 8-32	PA - Stud Device Mount	1	5/16" Hex	5.0-5.5 in.-lbs.	5.0-5.5 in.-lbs.
04-00131974	Washer, Flat	Power Connector	2	--	--	--

## Board Replacement and Calibration

Table 1-2. Fasteners, Tools and Torques (Cont'd.)

Part Number	Description	Location	Qty	Drv	Input Torq.	Repair Torq.
0480943V01	Lock Washer 3/8 Ext. Tooth Stl. Zinc	Mini-UHF Coax. Con- nector on Front of Unit. PA Antenna Connector	1	--	--	--
			1			
0280477U01	Nut, Hex 3/8-24	Mini-UHF Coax. Con- nector on Front of Unit. PA Antenna Connector	1	1/2" Hex.	18-20 in.-lbs.	18-20 in.-lbs.
			1			
0310920A25	Screw, Mach. M4 x 0.7 x 10 Torx Cap Hd., Blk	Front Panel to Chassis	2	T20	6-8 in.-lbs.	6-8 in.-lbs.
0310944A59	Screw, P3.12 x 8 Torx Pan Hd., Blk	Cover to Front Panel	1	T10	6-8 in.-lbs	4-6 in.-lbs.



## Receiver Circuits

the four pole crystal filter, Y51A and Y51B, at the IF frequency of 44.85 MHz. All other frequencies at the output of the mixer are terminated in a 51 ohm resistor, R51.

**Receiver Back End**

Transistor Q51 amplifies the IF signal from Y51B by approximately 20 dB and improves the noise figure of the 44.85 MHz IF. The output of Q51 is applied to the input of the receiver system IC U51-13. Diode CR51 prevents overload of the second mixer in the receiver system IC.

Transistor Q52, crystal Y52 and associated components form a third overtone crystal oscillator at 44.395 MHz. The output of the oscillator provides the low side injection signal to the second mixer at U51-12. The filtered and amplified 44.85 MHz first IF signal mixes with the second local oscillator signal at 44.395 MHz to produce a second IF signal at 455 kHz. The second IF signal is then filtered by switchable ceramic filter FL51 or FL53, amplified, then filtered by switchable ceramic filter FL52 or FL54 and applied to the audio detector. U302-5 controls the bandwidth select switch, Q53, to switch the narrower bandwidth ceramic filters FL51 and FL52 for 12.5 kHz channel spacing or the wider ceramic filters FL53 and FL54 for 25/30 kHz channel spacing.

The audio detector is a phase-locked loop type. The free-running oscillator frequency is determined by capacitor C61. Detected audio from U51-31 is routed to connector J6-1 for further audio processing in the circuitry of the audio/logic board.

U51 also contains the carrier-squelch circuitry. When an on-channel signal is present, the amount of high-frequency audio noise, at the detector, is reduced. This change in noise level is sensed to indicate the presence of an on-channel signal. The bandwidth of the sample noise is determined by C64, C65, R59, R60, and R71 switched by Q54. U302-5 controls Q54 for 12.5 kHz or 25/30 kHz channel spacing operation. Squelch sensitivity is adjusted electronically by an attenuator in U551, the RX AFIC, on the audio/logic board. Squelch noise is routed from U51-26 to connector J6-2 and then to U551-23. The adjusted noise level is returned from U551-26 back to connector J6-3 and then to U51-23. This noise level is detected in U51 and compared to a preset threshold. Noise levels greater than a preset threshold, indicating weak or no signal present, cause U51-18 to go low. This U51-18 dc level is routed to connector J6-5 and then to microcomputer port PH2 (U801-26). When the noise level decreases below the threshold, due to on-channel quieting, U51-18 and therefore U801-26 go high. This indicates an on-channel signal is present, and the microcomputer unmutes the appropriate audio path(s).

Components R57, C68 and C69 determine the squelch time constants as a function of the charging currents

supplied by U51. These charging currents vary from weak to strong signal conditions, providing a variable squelch closing time-constant. For weak signals the time constant is long to minimize "chattering" or rapid muting and unmuting of the audio during reception of rapidly fading signals. For strong signals, where the difference between the carrier-absent and carrier-present conditions is substantial, the closing time-constant is shortened to minimize the length of the "squelch-tail" noise burst.

**Frequency Generation System**

The frequency generation system consists of Voltage Controlled Oscillators (VCOs), buffer amplifiers to isolate and increase the output levels of the VCOs, two Synthesizer IC's (U201 for the transmitter and U101 for the receiver) and a 1 ppm integrated 16.8 MHz crystal reference oscillator. The synthesizer ICs and the reference oscillator are powered from the 5 Vdc supply regulated by U301.

**Receiver VCO**

The VHF and UHF receiver VCOs use discrete junction field effect transistors (FET, Q151), and low loss resonators for low noise operation. The VHF receiver VCO uses a discrete inductor wound with heavy gauge wire. The UHF VCO uses a ceramic resonator. The oscillator FETs are operated in the common gate configuration. A small sample of the output signal from the oscillator is rectified by dual diode CR153. The resulting dc is fed back to the gate of the FET to maintain a constant oscillator output that is independent of FET characteristics. The output signals from the VCOs are amplified by discrete buffer amplifier strings consisting of transistors Q152 and Q153. Harmonics of the VCO signals are reduced with low pass filtering between the output of Q153 and the input of the first mixer. The output power of the buffer string, or the input to the mixer, is +16 dBm.

**Transmitter VCO**

The VHF and UHF transmitter VCOs use discrete junction field effect transistors (FET, Q251), and discrete inductors. The oscillator FETs are operated in the common gate configuration. A small sample of the output signal from the oscillator is rectified by dual diode CR206. The resulting dc is fed back to the gate of the FET to maintain constant oscillator output that is independent of FET characteristics. The output signals from the VCOs are amplified by discrete buffer amplifier strings consisting of transistors Q252 and Q253.

In the receive or standby mode, shift register U302-5 output is low, which turns OFF transistor switch ICs U251 and U252. This action disables the transmit VCO and buffer amplifiers Q252 and Q253.



During transmit, U302-5 is high, activating transistor switch ICs U251 and U252 and enabling the transmit VCO and buffer amplifiers. The output power of the buffer string, after a 2 dB attenuator formed by R264, R265 and R266, is +14 dBm to be fed to the RF power amplifier.

### 16.8 MHz Reference Oscillator

The reference oscillator for the synthesizers is an integrated, digitally compensated and adjusted crystal oscillator, U202. Temperature compensation is accomplished with a microcomputer within the oscillator package and the required parameters are determined at the time of manufacture. No programming of the compensation data is necessary in the field. Adjustment of the nominal operating frequency is performed with the Radio Service Software (RSS) and consists of a serial data stream "written" to the oscillator using the SR DATA (U202-25), SR CLOCK (U202-22), and SS (U202-24) lines of U202. The oscillator is programmed with a low at the SS input. This "latch" signal is derived from the combined, "OR-ed", output of shift register U302-13 and the shift register latch enable, U302-1. The oscillator and the shift register require opposite polarity data latch signals. A high latches the data into the shift register, which includes setting U302-13 low. This high is coupled to U202-24 through CR8 to inhibit writing to the oscillator. When the SH REG LE signal goes low it is OR-ed with the low at U302-13 through R18 to allow writing the data to the oscillator.

### Receiver Synthesizer

The output signal of the receive VCO is sampled from buffer amplifier Q152 and further buffered by amplifier Q154. The output of Q154 is applied to the prescaler RF input (FIN) of the receive synthesizer IC, U101-8. The prescaler divider value is 64/65 for the VHF receiver and 128/129 for the UHF receiver. The prescaler output is applied to the programmable divider. The operating frequency within the band determines the divide ratio.

The output of the reference oscillator, U202, is divided down to provide a loop reference frequency of 6.25 kHz, 5.00 kHz, 3.75 kHz or 2.50 kHz. The particular loop reference frequency is determined by the operating frequency of the receive VCO and the channel spacing desired.

The prescaled and divided frequency of the receive VCO signal is compared to the loop frequency from the divided output of the reference oscillator. If the two divided down frequencies differ, a correction voltage, or steering line voltage, is generated by the synthesizer charge pump outputs, U101-15 and U101-16 and charge pump amplifiers Q101, Q102 and Q105 to change the receive VCO to the proper frequency. The steering line voltage is from the pulsing action of the

charge pumps is applied to the main loop filter of R112 and C107. This voltage, when the synthesizer is locked, is between 3 and 13 V depending on VCO frequency. Reference frequency spurious signals on the steering line voltage are further reduced by C106, R113 and C108 before being applied to varactor diodes CR151 and CR152 to control the frequency of the receive VCO.

The charge pumps receive their dc supply from a voltage-multiplier, rectifier circuit acting upon the 16.8 MHz squarewave output of the reference oscillator, U202. The complimentary-symmetry amplifier formed by Q201 and Q202 drives the voltage doubler of C213, CR202, C214 and C216-C219. The resulting dc is added to the regulated 9.6 Vdc supply to yield a 17.8 Vdc charge pump supply. Further filtering of this voltage is afforded by R109 and C105 at the charge pump.

The receive synthesizer also interfaces with the microcomputer circuitry. Synthesizer programming is accomplished through the serial bus lines SR DATA (U101-10), SR CLOCK (U101-9), and RX SYNTH LE (U101-11) from the microcomputer U801 on the audio/logic board. A serial data stream of 98 bits is sent whenever the synthesizer is programmed. Synthesizer lock is indicated by a logic high at LOCK DET pin U101-7.

### Transmitter Synthesizer

The output signal of the transmit VCO is sampled from buffer amplifier Q252 and further buffered by amplifier Q254. The output of Q254 is applied to the prescaler RF input of the Fractional-N synthesizer IC, U201. The prescaler divider value is determined by the frequency band of operation. The prescaler output is applied to the programmable divider. The operating frequency within the band determines the divide ratio.

The output of the reference oscillator, U202, is divided down to provide a loop reference frequency of 6.25 kHz, 5.00 kHz, 3.75 kHz or 2.50 kHz. The particular loop reference frequency is determined by the operating frequency of the transmit VCO and the channel spacing desired.

The prescaled and divided frequency of the transmit VCO signal is compared to the loop frequency from the divided output of the reference oscillator. If the two divided down frequencies differ, the necessary correction voltage, or steering line voltage, is generated by the synthesizer to change the transmit VCO to the proper frequency. The steering line voltage from U201-29 is applied to the main loop filter of R215, R216 and C243. This voltage, when locked, is between 3 and 10 V depending on VCO frequency. Reference frequency spurious signals on the steering line voltage are further reduced by C245, R217 and C244 before being applied to varactor diode CR252 to control the frequency of the transmit VCO. To achieve fast lock time, an internal adaptive charge pump provides higher

## Transmit and Receive Audio Circuitry

momentary current to C243 at U201-31 than in the normal steady-state mode. The current for the normal mode charge pump is set by R211.

The normal and adapt charge pumps receive their dc supply from a voltage-multiplier circuit which includes CR201, CR202 and associated capacitors C201-C203, C206 and C207. By combining two 5 V square waves which are 180 degrees out-of-phase and adding the result to the regulated 5 Vdc supply, a source of approximately 13.5 Vdc is available at U201-32.

The transmit synthesizer also interfaces with the microcomputer circuitry. Synthesizer programming is accomplished through the serial bus lines SR DATA (U201-5), SR CLOCK (U201-6), and TX SYNTH LE (U201-7) from the microcomputer U801 on the audio/logic board. A serial data stream of 98 bits is sent whenever the synthesizer is programmed. Synthesizer lock is indicated by a logic high at LOCK DET pin U201-2 and an out-of-lock condition is indicated by a logic low.

Modulation from the attenuators in the TX AFIC (U651-27 and -28) is resistively summed and applied to U201-8. The audio is digitized within U201 and applied to the loop divider to provide the low-port modulation. The audio is also routed through an internal attenuator for balancing of the high and low port modulation, before being applied from U201-28 to the transmit VCO modulation varactor diode CR253.

## Transmit and Receive Audio Circuitry

The majority of receiver and transmitter audio processing are performed by U551, the Receive Audio Filter IC (RX AFIC) and by U651, the Transmit Audio Filter IC (TX AFIC). The RX AFIC provides the following functions:

- Tone/Digital PL decoding
- PL rejection filter in receiver audio path
- Carrier squelch digitally-controlled attenuator
- Microcomputer output port expansion
- 2.5 Vdc reference source voltage for the other receiver audio circuitry

The TX AFIC provides the following functions:

- Tone/Digital PL encoding
- Transmit pre-emphasis amplifier
- Transmit audio limiter
- Post-limiter (splatter) lowpass filter

- Transmit deviation adjust digitally-controlled attenuators
- Programmable microphone gain attenuator
- Microcomputer output port expansion
- 2.5 Vdc reference source voltage for the other transmitter audio circuitry

The parameters of U551 and U651 that are programmable are selected by the microcomputer via the SR CLOCK (U551-39 and U551-39), SR DATA (U551-38 and U551-38) and CHIP ENABLE (U551-41 and U551-41) lines.

The AFIC employs switched-capacitor filters which require an external 2.1 MHz clock signal. This clock is obtained from the E-clock output of the microcomputer, U801-58. The E-clock of the microcomputer is one-fourth the crystal frequency (8.4 MHz). The signal is filtered and attenuated by R801-R803, C801 and C802 and applied to both U551-43 and U651-43 at a level of approximately 2 Vp-p.

### Rx Audio Path

#### Low-Level Rx Audio

Detected audio from the IFIC U51-31 on the rf board is routed through J6-1 to PL IN of the Receive Audio Filter IC, (RX AFIC, U551-15) and via C551 to the switchable-gain limiter stage, U552, and the inverting buffer amplifier, U553A. The gains of the limiter stage and buffer amplifier are changed for 12.5 kHz or 25 kHz channels. The limiter stage, U552, is set to limit at slightly greater than full system deviation in either case. This limits the loudness of noise relative to voice during fading, weak signal conditions and squelch tails. Output is taken from two places of this stage.

The first output from the limiter stage comes from pin 4, the (-) input, and is an output for a third order low-pass filter, U553B. The negative feedback around the U552 stage maintains the signal at U552-4 exactly equal to the signal applied to the (+) input U552-3, but the signal at U554-4 benefits from the selectable noise limiting threshold. Gain adjustments in the receive and EIA repeater audio paths for 12.5 or 25 kHz channels are then made in the RX AFIC, U551.

The second output from the limiter stage comes from pin 1 and is affected by the gain change of U552 so that the level is a constant 840 mV rms at 60% deviation for either 12.5 or 25 kHz channels. This level is attenuated 12 dB by R573, R579 and R580 and routed to the Detector Audio Send pin of the AdvantagePort connector (J13-16).

The output of the lowpass filter, U553B, feeds the RX AFIC U551-14 (RX IN) and the polarity inverter, U554A and U554B. The gain of U554A is switchable to provide

the same output for 12.5 kHz and 25 kHz channels. The polarity inverter is used for the flat repeater audio and allows compensating for the inversion of DPL or digital data through the repeater system. The inversion may be required in a transparent repeater configuration.

The output of the switchable-gain inverting buffer amplifier U553A is routed to analog switch U5593B and is the source of the accessory receive flat audio (see "Accessory Connector Rx Audio Path" section).

The audio applied to the RX AFIC at U551-14 (RX IN) is sharply highpass filtered to remove all PL tones and DPL signalling below 300 Hz. Audio is then routed through a digitally controlled attenuator which is set to approximately 6 dB attenuation. This attenuation is not adjustable and maintains the output at U551-31 (RX OUT) at a fixed and defined level of 450 mV rms for 60% deviation. The U551-31 output is applied to de-emphasis stage U556A. The unity gain frequency of the de-emphasis is 1 kHz. The internal de-emphasis characteristic of U551 is not used in this application. Receive volume adjustment is accomplished by the volume control, R9002, on the front panel.

The output of U556A supplies the EIA repeater audio via switch U560C and mute gate U558A. It also is processed by the option board, if present, buffered by U556B, and routed through the expander portion of compander IC, U562. The operation of the compander is described below. U561B raises the compander output level by 4 dB when the compander is on, providing equal subjective volume levels. The output of U561 is routed to the volume control and handset audio via U558C and U555B, and to the accessory connector pin 11 via U559B, U558B, U558C, and U555A.

### Audio Power Amplifier

Audio from the wiper of the volume control is amplified by the audio power amplifier IC U501. This is a bridge amplifier capable of delivering 7.8 V rms between pins 4 and 6 with low distortion. This is sufficient to develop 7.5 Watts of audio power into an external 8 Ohm load, or approximately 3 Watts of audio power into an internal 22 Ohm speaker (under this condition, undistorted audio output voltage swing exceeds 8 Volts rms). The audio power amplifier is muted whenever speaker audio is not required, to reduce current drain and eliminate noise in the speaker. The muting occurs when U501-8 is driven low by Q501 (U551-9 high) or when the radio is turned off. The current drain into supply pin U501-7 is negligible when U501-8 is low.

Because the power amplifier is a bridge configuration, neither speaker terminal is grounded. Care should be taken that any test equipment used to measure the speaker audio voltage does not ground either speaker output terminal, otherwise damage to the audio power

amplifier IC may result. If the test equipment input is not isolated from ground, voltage measurements may be made from one of the speaker output terminals (J3-1 or J3-16) to ground, in which case the voltage indicated will be one half of the voltage applied to the speaker or load resistor. When an 8-ohm load resistor is used, it should be connected across pins 1 and 16 of the accessory connector, J13, and **never** connected between pin 1 or pin 16 and ground.

### Accessory Connector Rx Audio Path

Receiver audio is buffered by amplifier U555A and is available at the accessory connector, J3-11. This audio may be one of two types, depending on the RSS programming of analog switch U559B.

If U559B-10 is programmed low, the audio fed to U555A comes from the receiver's detector audio via a switchable-gain stage U553A. In this case, audio at the accessory connector (J3-11) is "flat" (non-de-emphasized).

If U559B-10 is programmed high, the audio fed to U555A comes from the output of the compander expander circuit through U561B. Audio at J3-11 is de-emphasized. This path will also be affected by any receive audio processing circuits on the option board, if installed, and by the compander, if enabled.

Both the "flat" and the de-emphasized audios may be muted or unmuted. If U559C-9 is programmed low, the audio input for U555A is routed from U559B through mute switch U558B and analog switch U559C. The accessory audio is muted during no carrier or incorrect coded squelch conditions. Unmuting occurs with carrier (CSQ operation), the correct Tone PL or Digital PL subaudible signalling, and monitor and volume set conditions. If U559C-9 is programmed high, the audio input for U555A is taken directly from switch U559B and is not muted.

### PL Decoder

Detected Receiver Audio from the RF board is applied to the AFIC PL IN port (U551-15), where it first passes through the Tone PL filter or Digital PL filter, depending on the PL option selected for the current operating mode. Filtered PL is then coupled to the PL detector circuit, with detected output at U551-35. The detected PL signal is coupled from U551-35 to microcomputer port PA1 (U801-15) where algorithms perform the final PL decoding. Data for the tone PL frequency or the Digital PL code for each mode is programmed through the Radio Service Software.

### AdvantagePort™ Internal Option Board Rx Audio Path

De-emphasized, unmuted audio is available at J13-6 for use by an internally installed option board. If this audio is to be processed and returned to the receive

## Transmit and Receive Audio Circuitry

audio path, the processed audio will be returned from a low-impedance source on the option board to J13-8. The unprocessed audio through R575 is shunted due to the low source impedance of the option board at J13-8. Since the gain of the AFIC is different for 12.5 or 25 kHz channels, the RX audio level at J13-6 is always 450 mV at 1 kHz and 60% deviation, regardless of the channel spacing. Similarly, audio returned to J13-8 from the option board should be supplied at a level of 130 mV rms at 60% deviation, regardless of the channel spacing.

Flat receiver detector, unmuted audio is available at J13-16. Options requiring flat audio may use this, or may pre-emphasize the audio at J13-6, depending on the design of the option board. Because the gain of stage U552 is different for 12.5 or 25 kHz channels, the receiver audio level at J13-16 is always 210 mV at 60% deviation, regardless of the channel spacing.

### Noise Squelch Attenuator

The AFIC contains a 16 step programmable digital squelch attenuator whose input is U551-23, from J6-2, and output is U551-26, to J6-3. Noise squelch sensitivity is set using RSS, with open squelch at step 0 and maximum (tight) squelch at step 15.

### Transmitter Audio Path

#### Voice Path via Front Panel

Microphone audio from the front panel microphone jack J11-5 enters the audio/logic board on J8-14. The level is attenuated from 80 mV rms (for 60% deviation at 1 kHz) to 65 mV by R668 and R669. When PTT is sensed from front panel microphone jack J11-6, through J8-13, CMOS gate U654A is enabled by a logic high at U651-5.

This audio is fed to the compander IC, U562, where it is amplified from 65 mV to 100 mV by an internal auxiliary gain stage (pins 7 and 6) and then applied to the compressor portion of the compander (pin 3). The output (pin 2) is attenuated back to the original 65 mV rms level by another internal auxiliary stage (pins 9 and 10) and applied as a low-impedance source to the Tx Audio Send pin of the AdvantagePort connector (J13-10).

#### Voice Path via Accessory Connector

Microphone audio from an accessory such as a desk set applied to the External Mic Audio input J3-2 is attenuated from 80 mV rms (for 60% deviation at 1 kHz) to 65 mV by R670 and R671. When External Mic PTT is sensed at J3-3 (or from any programmable input to which Ext Mic PTT has been assigned), CMOS gate U654C is enabled by a logic high from U651-3.

This audio is fed to the compander IC and processed as described above for the Voice Path via Front Panel.

### AdvantagePort™ Internal Option Board Tx Audio Path

Flat (non-pre-emphasized) microphone audio is available at J13-10 for use by an internally installed option board. If this audio is to be processed and returned to the transmit audio path, the processed audio will be returned from a low-impedance source on the option board to J13-12 (Tx Audio Return). The unprocessed audio through R655 is shunted due to the low source impedance of the option board at J13-12. Since deviation is adjusted appropriately by the AFIC for 12.5 or 25 kHz channels, the transmit audio level at J13-10 and J13-12 is always 65 mV for 60% deviation at 1 kHz, regardless of the channel spacing.

Some option boards must be able to modulate the transmitter with very low frequency data. The Post-Limiter Flat Tx Audio Return pin (J13-2) is used for this application. Audio from this pin is routed to the AUX TX IN pin on the AFIC (U651-20) via summing amplifier stage U652B. A level of 150 mV rms will produce 60% deviation regardless of channel spacing. This path bypasses the limiter stage in the AFIC, therefore the option board must provide the necessary amplitude limiting of this signal to prevent overdeviation. The AUX TX IN path of the AFIC must be enabled via software control for this path to be active.

### Pre-emphasis of Microphone Audio Signals

Pre-emphasis of the front panel or accessory microphone audio signal occurs after the AdvantagePort option board processing has occurred. The series network of capacitor C654 and resistor R665 provide the pre-emphasis characteristic of audio applied to the TX IN pin of the AFIC (U651-17). This pin is the summing junction of an inverting operational amplifier gain stage within U651. Audio processing, including limiting, splatter filtering, and level adjustment are performed within U651. The outputs of the two programmable deviation-adjustment attenuators (U651-27 and -28) are resistively summed and applied to the VCO modulation input of the frequency generation system.

### Flat Tx Audio Path via Accessory Connector

Audio applied at the accessory connector, J3-5, routed through C657, may be applied to the transmitter AFIC either before the limiter (PRE-LIM) or after the limiter (POST-LIM). This function is programmed using RSS. The pre/post-limiter path is controlled by CMOS gate U653A, as controlled by U651-8 (low for PRE-LIM and high for POST-LIM). When the POST-LIM path is chosen, audio is routed via divider R674/R675 and summing amplifier stage U652B to the AUX TX INPUT (U651-20), therefore this input of the AFIC must be

enabled via software control whenever an accessory connector PTT is sensed at J3-3 (or from any programmable input to which Accessory PTT has been assigned).

If the PRE-LIM path is chosen, audio is coupled by R658 to the summing input of the amplifier within U651 (pin 17). Because R658 is significantly larger than R674, R659 provides a charging path for C657 when the PRE-LIM route is selected which is equivalent to the charging path via R674 in the POST-LIM path.

Audio present at J3-5 is muted during transmitter key-up until the frequency synthesizer has settled and locked on-frequency. This prevents unintentional frequency offset due to the presence of modulation while PTT is keyed. Muting occurs when U651-9 provides a low to U653B-10. While muted, R659 maintains the same dc bias on C657 to prevent switching transients.

### Tx Data Encoder (D/A Converter)

The CWID (Morse code station identification), the courtesy "over" beep, the "on battery" alert tone and data such as MDC-1200 or DTMF signalling can be encoded into the transmit audio path by generating the waveform at ports PA3, PA4 and PA5 of U801 (pins 13, 12 and 11 respectively). These outputs are resistively summed and weighted to allow either square waves or pseudo-sinewaves to be encoded. Operational amplifier U652A provides active summing and outputs the signal through C652 and R653 to the TX IN port of the AFIC (U651-17).

### Compander Operation

The compander circuit of U562 is used to improve the signal-to-noise ratio of the voice communications path. This is accomplished by compressing the microphone signal during transmit by a ratio of 2:1 (in dB) so that a 60 dB range of level changes at the microphone are reduced to only a 30 dB change before being transmitted. A complimentary expander circuit in the receiver audio path restores the 30 dB range of the received signal to its original 60 dB range before being applied to the speaker. Any noise occurring in the over-the-air transmission which is more than 30 dB below full deviation is reduced to greater than 60 dB below the peak voice level at the speaker, making such noise essentially inaudible.

The effectiveness of the compander system requires that both the transmitter and receiver utilize companding. It is possible to program the compander off on a per-channel basis using RSS, for use in systems with other radios that do not have the compander feature. The compander is active when U562-8 is low, and is bypassed when U562-8 is high. When in the bypass mode, the gain of the compressor (pin 3 in and pin 2 out) and expander (pin 14 in and pin 15 out) circuits is

unity. U562-8 is driven directly by the microcomputer, U801-54.

The compander, U562, is not used in the repeater audio path. The compander operates only on the receiver to speaker, handset and accessory receiver audio paths and on the local and external microphone transmitter audio paths.

The compander is turned on and off by the microcomputer port PC4, U801-54 and switch Q913. If the compander should be on, U801-54 is set high which turns off Q913. The output of Q913 is applied to the electronic switch input of the compander, U562-8, and the gain adjust switch, U557D-12. The compander is turned off by a high at U562-8.

Switchable gain stage U561B is used to increase the receive audio path gain by approximately 4 dB whenever the compander is turned on. This maintains the same subjective audio level for both companded and non-companded channels.

## Transmitter Circuitry

### VHF 50 Watt Transmitter RF Power Amplifier

The 50 watt VHF power amplifier is designed to cover the range of 146-174 MHz and has four stages. The first stage, Q2410, operates in a quasi-Class A state from the 9.6T source. It provides 13 dB of power gain and an output power of 400 mW.

The second stage, Q2420, operates in Class C with a nominal power gain of 9.4 dB and output power of up to 3.5 Watts. The output of this stage is adjusted by the controlled B+ voltage which supplies its collector. ( $V_{B+max} = 6.55 V$ ).

The third stage, Q2430, operates in Class C with a nominal power gain of 8.1 dB gain and output power of up to 22 Watts. Collector voltage is directly from the power supply 13.8 Vdc output.

The fourth stage, Q2440, is the final RF power amplifier and operates in Class C. Collector voltage is directly from the power supply 13.8 Vdc output. It provides an output power of 65 Watts.

The collector current of the final PA transistor is sampled as a voltage drop across R2470. This sampled voltage is compared with the voltage drop across R2471 and a preset voltage from a Digital to Analog Converter, all in the power leveling circuitry on the audio/logic board. The collector current is maintained at a constant value regardless of the load impedance the antenna may present to the power amplifier.

The harmonic filter is a seven pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approxi-

## Transmitter Circuitry

mately 200 MHz and less than 1 dB insertion loss in the passband.

### **UHF 45 Watt Transmitter RF Power Amplifier**

The 45 watt UHF power amplifier is designed to cover the range of 444-474 MHz and has four stages. The first stage, Q2610, operates in a quasi-Class A state from the 9.6T source. It provides a nominal power gain of 11.8 dB and an output power of 300 mW.

The second stage, Q2620, operates in Class C with a nominal power gain of 8.2 dB and output power of up to 2 Watts. The output of this stage is adjusted by the controlled B+ voltage which supplies its collector.

The third stage, Q2630, operates in Class C with a nominal power gain of 8.1 dB and output power of up to 13 Watts. Collector voltage is directly from the power supply 13.8 Vdc output.

The fourth stage, Q2640, is the final RF power amplifier, which operates Class C directly from the power supply 13.8 Vdc output. It provides output power up to 60 Watts.

The collector current of the final PA transistor is sampled as a voltage drop across R2670. This sampled voltage is compared with the voltage drop across R2671 and a preset voltage from a Digital to Analog Converter, all in the power control circuitry on the audio/logic board. The collector current is maintained at a constant value regardless of the load impedance the antenna may present to the power amplifier.

The harmonic filter is a seven pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 550 MHz and less than 1 dB insertion loss in the passband.

### **Power Control Circuit**

The transmit power control circuitry is common to all R1225 models. The following is an explanation of the different sections of power control.

#### **Control Lines**

**Unswitched B+:** This line is connected directly to the power supply output. The voltage is supplied to the third and fourth stages of RF amplification.

**9.6T:** This line goes to 9.6 V when in the transmit mode. During transmit, the 9.6T line provides base bias for the first stage amplifier.

**Controlled B+:** This line controls the power out of the PA by regulating the collector voltage to the second stage amplifier.

**Current Sense HI/LO:** The transceiver uses current sensing of the output stage as an indication of RF power output. These two lines provide negative feedback to the transmitter power control, located on the logic board, so that power regulation is achieved.

#### **Over-Current Protection**

When the transceiver is keyed up and the RF signal is sent through the PA deck, the final PA stage will draw current. A small value metering resistor, R2470 or R2670, is used to measure the final collector current. CURRENT SENSE HI (P7-3) is tied directly to the top of the metering resistor, which is tied to the + power supply lead. CURRENT SENSE LO (P7-4) is tied to the bottom of the metering resistor, and under normal conditions should be no more than a few hundred millivolts below B+. These lines are connected to the ± inputs of operational amplifier U451B on the audio/logic board. The output of U451B is a positive voltage (6-8 Vdc) directly proportional to the amount of current drawn by the final PA stage.

The current detect voltage is then sent to the emitter follower Q453, the output of which is summed with samples of the 9.6Vdc and the SW B+ lines. This summed voltage is applied to the inverting input of the comparator U451A. If there is an increase in the +9.6 Vdc, the SW B+ or the PA current, the voltage at U451A-2 will increase causing a decrease in the voltage at output of U451A-1.

The decreased voltage output from U451A is applied to the base of Q452 and will cause a decrease in the output current of Q452. This decrease results in a decrease in the base drive for the series pass control device, Q451, which also conducts less. This will then decrease the Controlled B+ line and reduce the output power of the PA.

#### **DAC Reference Voltage**

The drive for the non-inverting input of comparator U451A-3 is the two outputs of Digital to Analog Converter U452. This input voltage to U451A is typically 3-5 Vdc. When the transceiver is keyed, the microcomputer loads data into U452 using the DIN, CLK and EN lines of the IC. U452 converts this digital data into an analog voltage at DAC1 and DAC2 outputs. By summing the two outputs through R468 and R469 onto C461, a more precise output voltage can be obtained. The voltage across C461 is applied to the positive input of U451A.

#### **Over-Temperature Protection**

In order to protect against excessive temperature in the PA, the microcomputer analog to digital (ADC) input port PE2, U801-35, receives a voltage from a resistor/thermistor network on the PA board via TEMP SENSE (P7-6). The voltage is proportional to temperature

when the PA reaches approximately 80°C. As the temperature approaches 100°C, the microcomputer reloads DAC U452 with data representing lower Controlled B+. This Controlled B+ is reduced, as necessary, to maintain the PA temperature less than 100°C.

### Control Voltage Shutback

A sample of the Controlled B+ is fed to the microcomputer analog to digital input port PE3, U801-34. The ADC output is written into RAM approximately every 20 ms. This value is compared against the maximum control voltage variable in the code plug. If the control voltage exceeds the maximum control voltage variable, DAC U452 is updated to decrement the output by one step. Decrementing continues until the control voltage is equal to or less than the maximum value.

### PTT Circuits

The logic system uses a single microcomputer A/D input port PE1 (U801-36) and resistor network R916-R918 to distinguish between the different types of PTT information. This is done by assigning different voltage levels to the different PTT functions as follows:

0 to 2.1 Vdc (0.6 Vdc typ): Local Microphone PTT

2.2–3.6 Vdc (2.6 Vdc typ): Accessory PTT

4.75 to 5.0 Vdc (5.0 Vdc typ): Receive, COR (repeater) and I/O PTT Modes

A microphone connected via the front panel jack J5 must present a low of less than approximately 2.0 V dc to be correctly interpreted as Local PTT and cause the appropriate audio paths to be enabled. Similarly, an accessory whose PTT output is connected to the accessory connector, J3-3, must present a low of less than approximately 2.0 V dc to be interpreted as an accessory PTT. This voltage is shifted to the range between 2.2 and 3.6 V by series resistor R918.

Some accessories connected to J3 need to sense microphone PTT by looking for a low at J3-3. Diode CR902 causes J3-3 to be pulled low whenever the Local PTT line is low.

### Programmable I/O's

Pins 4, 6, 8, 9, 10, 12, and 14 of the accessory connector, J3, are programmable inputs, outputs or input/outputs (I/O). They are used to control an external repeater controller or accessories by the repeater module, or for control of repeater module functions by an external repeater controller or accessories.

Pin 4 is an output only. When microcomputer port PC3, U801-53, is high, Q901 and Q902 are on, and pin 4 is pulled high to the supply voltage (nominally, 13.8 Vdc). This is normally used as a CSQ Detect signal

to an external repeater controller but may be used to turn on a relay for activating an alarm.

Pin 6 is an input only. Normally, R905 pulls pin 6 high, turning on Q903 and pulling microcomputer port PB1, U801-23, low. If pin 6 is pulled low, U801-23 goes high.

Pin 8 is an I/O. To function as an input, Q905 is turned off by keeping microcomputer port PC0, U801-50, low. Then, R907 pulls pin 8 high, turning on Q904 and pulling U801-21 low. If pin 8 is pulled low, U801-21 goes high. To function as an output, Q905 pulls pin 8 low whenever U801-50 is high.

Pin 9 is an input only. Normally, R909 pulls pin 9 high, turning on Q906 and pulling microcomputer port PB2, U801-22, low. If pin 9 is pulled low, U801-22 goes high. The emergency switch accessory, if used, is connected here.

Pin 10 is an input only, the only function of which is remote repeater enable/disable. Normally, R911 pulls pin 10 high, turning on Q907 and pulling microcomputer port PB0, U801-24, low. If pin 10 is pulled low, U801-24 goes high.

Pin 12 is another I/O. To function as an input, Q909 is turned off by keeping microcomputer port PC1, U801-51, low. Then, R913 pulls pin 12 high, turning on Q908 and pulling U801-20 low. If pin 12 is pulled low, U801-20 goes high. To function as an output, Q909 pulls pin 12 low whenever U801-51 is high.

Pin 14 is also an I/O. To function as an input, Q911 is turned off by keeping microcomputer port PC2, U801-52, low. Then, R915 pulls pin 14 high, turning on Q910 and pulling U801-19 low. If pin 14 is pulled low, U801-19 goes high. To function as an output, Q910 pulls pin 14 low whenever U801-52 is high.

Zener diodes and bypass capacitors on each programmable I/O line prevent damage or abnormal operation due to ESD transients or RF fields.

The extent to which programmable I/O functions are supported may vary with different transceiver models. RSS allows the functions which are supported to be programmed.

### DC Regulation and Distribution

Unswitched B+ supplies operating voltage directly to the RF power amplifier third and fourth stages, the power control series pass device Q451-E, the RAM keep-alive constant voltage supply to U801-62, the audio power amplifier supply pin U501-7, the 9.6 Vdc regulator series pass device Q401-E, the external alarm switch transistor Q902-E and to J8-8 for the on-off switch on the front panel. All of these circuits draw negligible current when the radio is turned off (less than 15 mA total).



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**Transmitter Circuitry**

When the on-off switch is "on," the power supply output voltage is applied to 5 Volt regulator U402, and via R502 to pin 8 of the audio power amplifier U501 which turns it on unless muted by Q501. The regulated output of U402 is routed to all circuits operating on 5 Vdc and to J9-9 for the display board. The 5Vdc regulator includes a reset timer which holds the reset lines of the microcomputer, U801-61, and the RX AFIC, U551-42 low for a predetermined time after the radio is turned on.

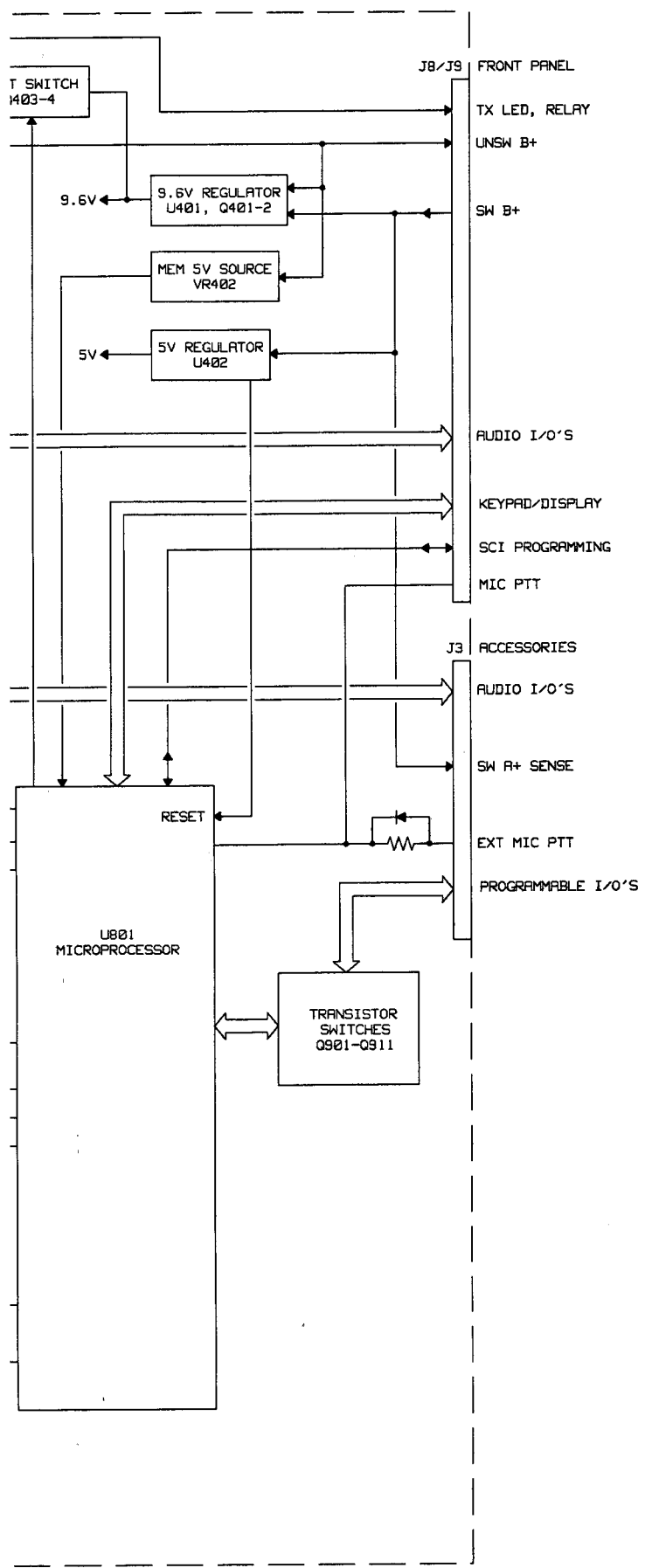
**Front Panel Display Board**  
*(Part of GR1225 Repeater & GR400 and GR500 X-Pand Repeaters)*

The display board contains function indicating LEDs, back lighting LEDs, and a 2-character, 7 segment LED display, U1109, that is driven by the driver IC, U1101.

When the LED driver, U1101, is enabled via the DISPLAY ENABLE input, the desired display information is then loaded serially via the SERIAL DATA line into U1101 from the microcomputer. U1101 also has a clock input that is connected to the audio/logic board SERIAL CLOCK.

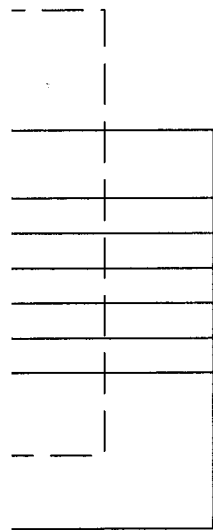
The five pushbuttons apply voltage to the bases of five digital transistors, Q1101 through Q1105. The appropriate transistor, in turn, grounds a tap on the series resistor ladders R1126 through R1129 on the display board and R919 on the audio/logic board, producing a different DC level depending on which button is pressed. These DC levels are interpreted by A/D input PE0 of the microcomputer (U801-37) and the corresponding function is enabled. The transistors ensure that the DC ladder voltage is consistent, although the series resistance of the keypad may vary.

**AUDIO/LOGIC BOARD**

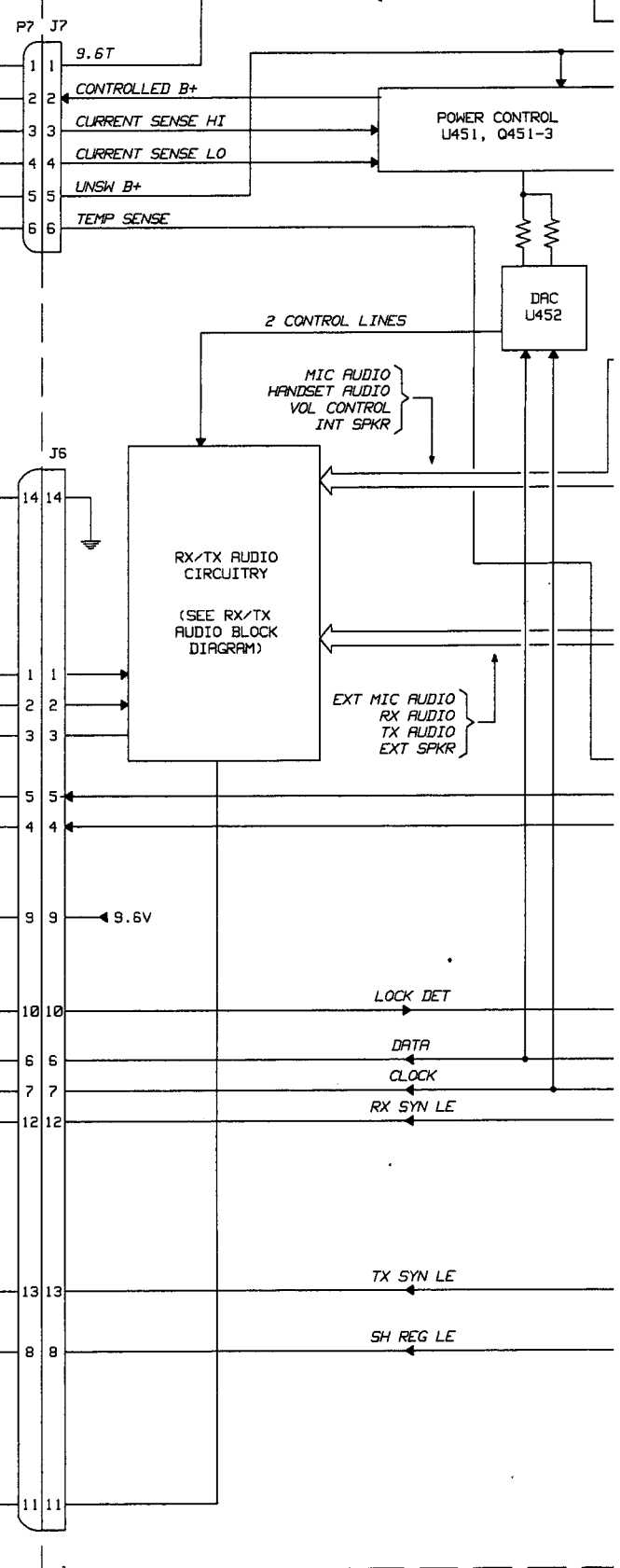
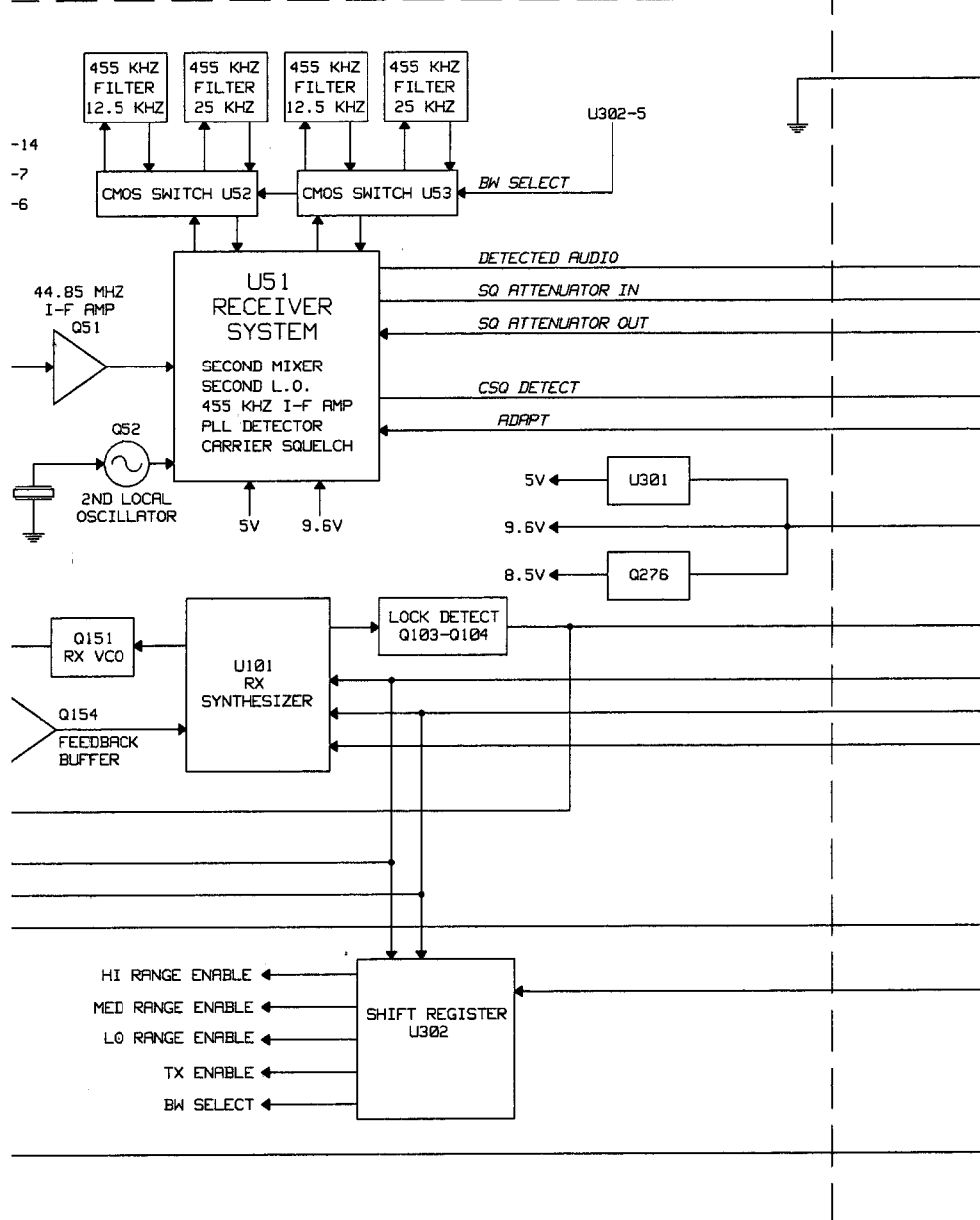


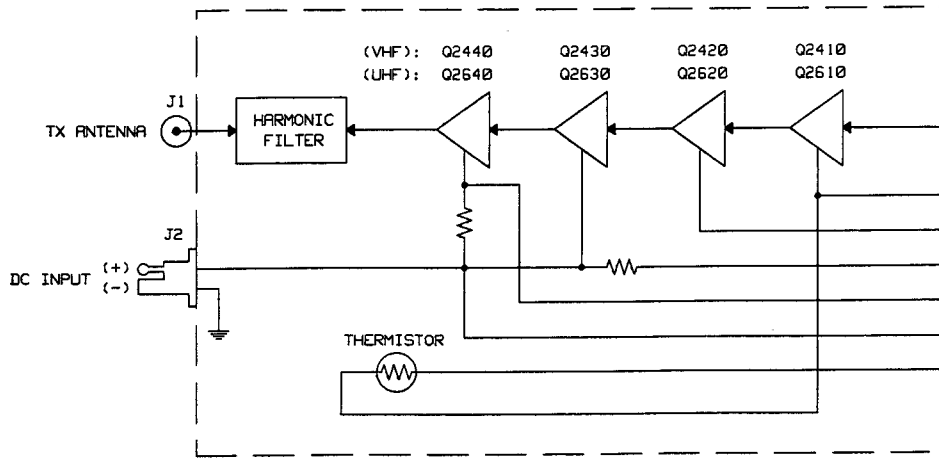
*R1225 Transceiver Overall Functional Block Diagram*

**LIFIER**

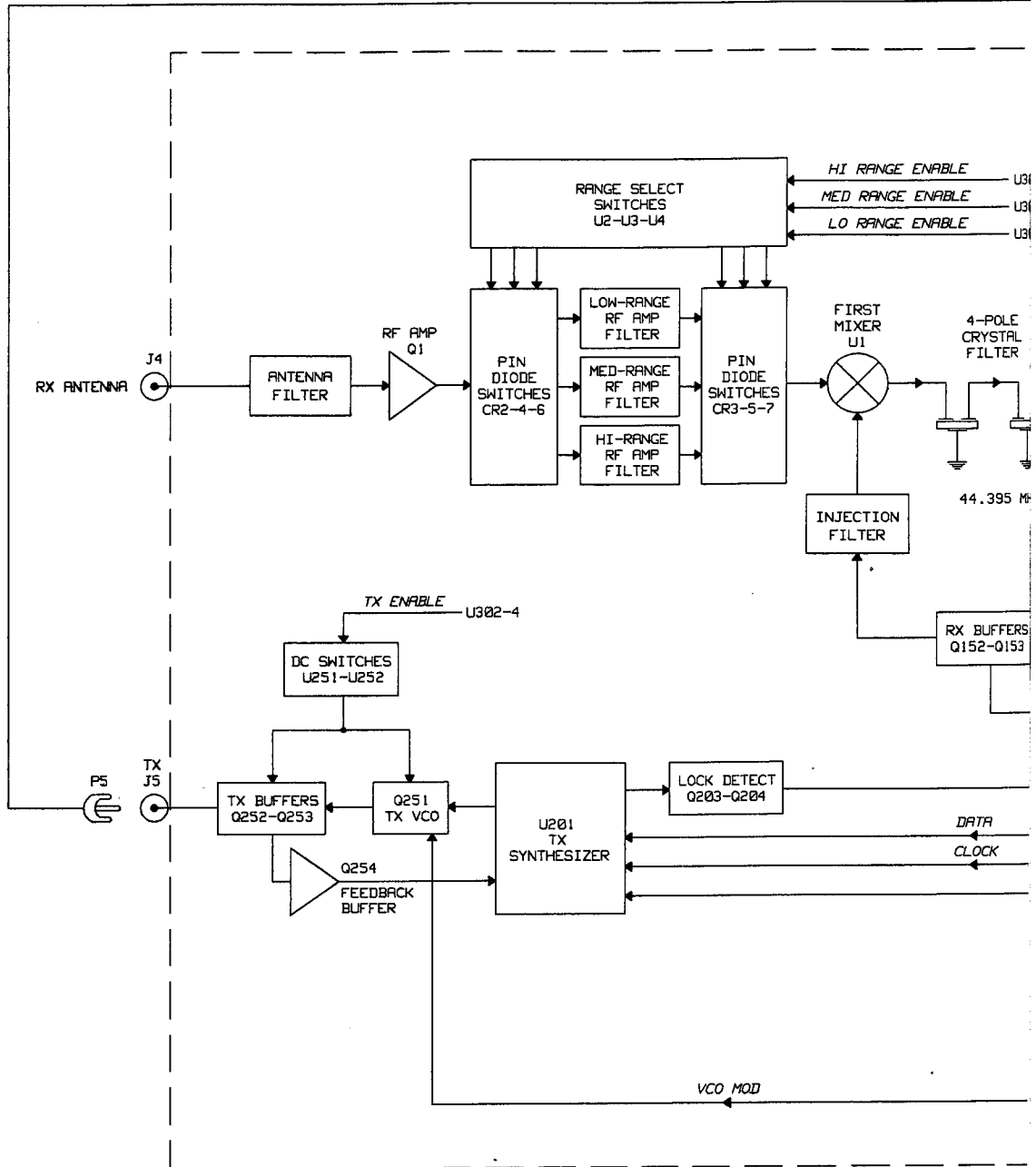


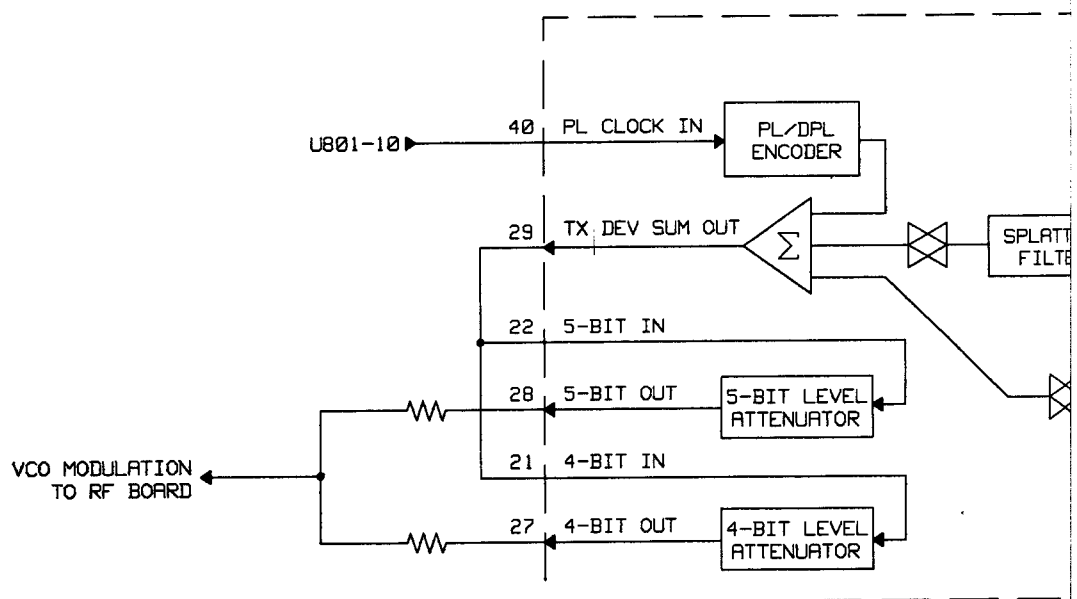
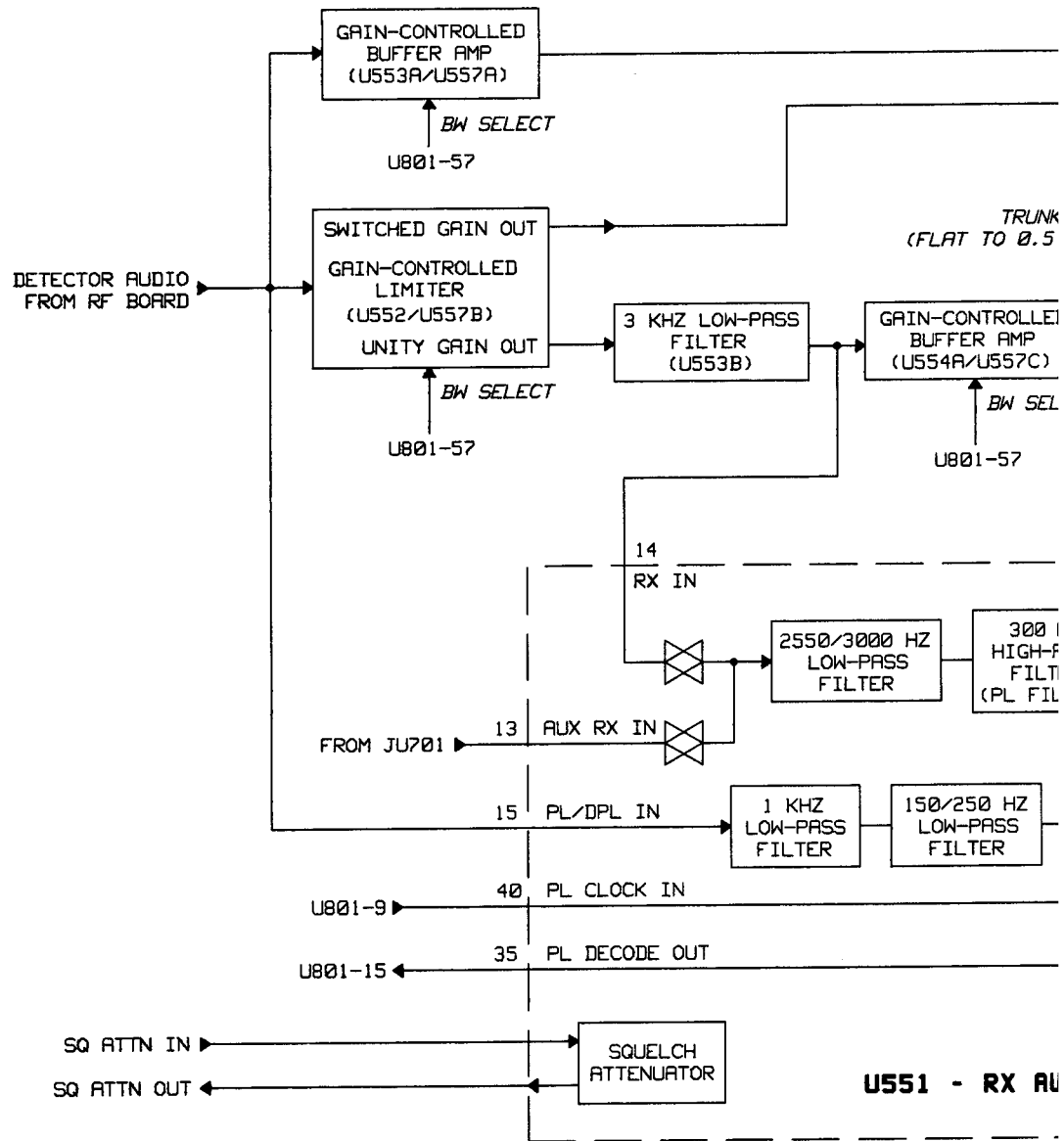
**RF BOARD**



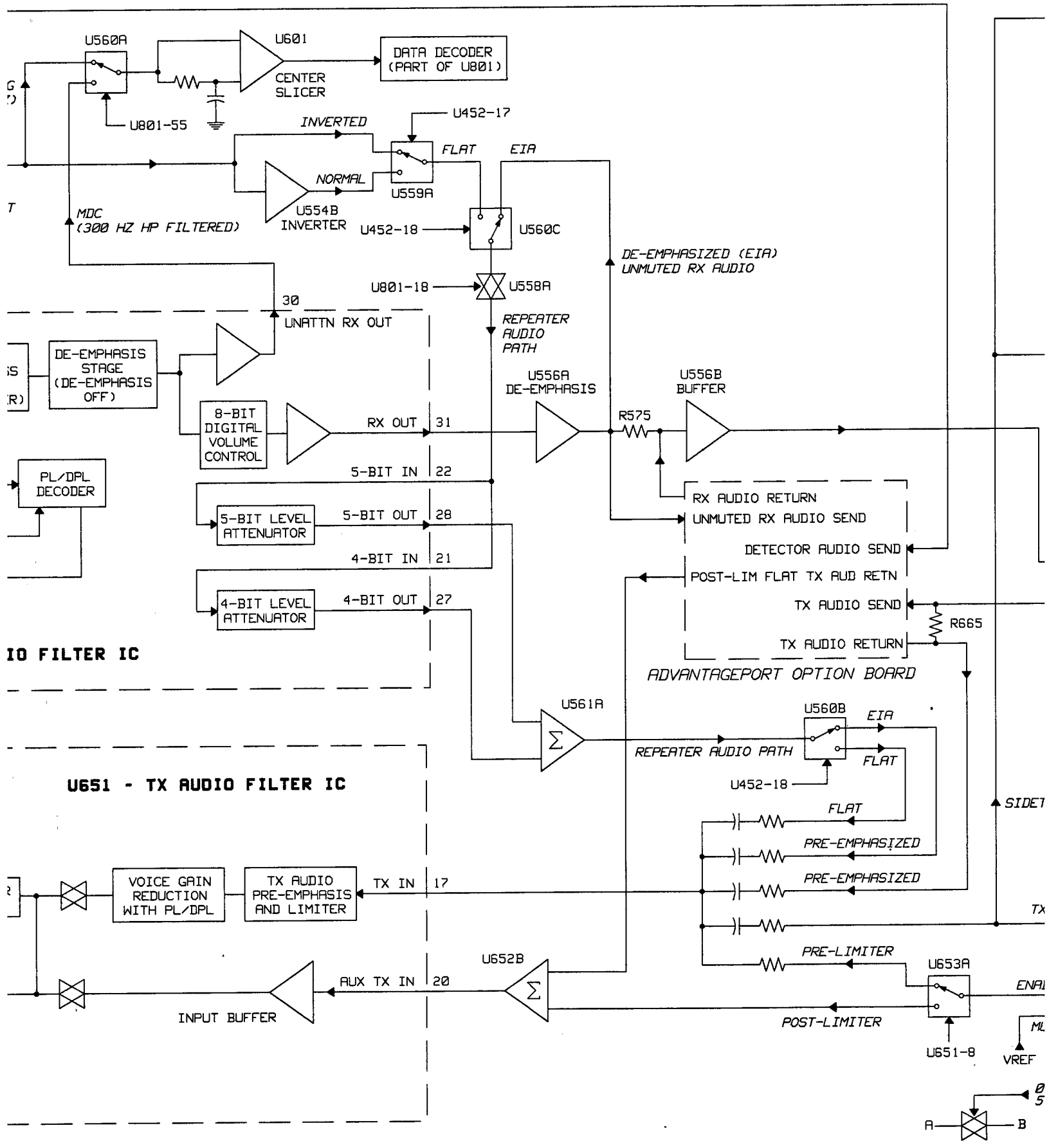


(COAXIAL CABLE)





R1225 Transceiver RX/TX Audio Block Diagram



DATA DECODER  
(PART OF U801)

U601  
CENTER  
SLICER

U560A

U801-55

INVERTED

U452-17

FLAT

EIA

NORMAL

U554B  
INVERTER

U452-18

U560C

DE-EMPHASIZED (EIA)  
UNMUTED RX AUDIO

MDC  
(300 HZ HP FILTERED)

UNATTN RX OUT  
30

U801-18

U558A

REPEATER  
AUDIO  
PATH

U556A  
DE-EMPHASIS

U556B  
BUFFER

DE-EMPHASIS  
STAGE  
(DE-EMPHASIS  
OFF)

8-BIT  
DIGITAL  
VOLUME  
CONTROL

RX OUT 31

5-BIT IN 22

5-BIT LEVEL  
ATTENUATOR

5-BIT OUT 28

4-BIT LEVEL  
ATTENUATOR

4-BIT IN 21

4-BIT OUT 27

PL/DPL  
DECODER

RX AUDIO RETURN  
UNMUTED RX AUDIO SEND

DETECTOR AUDIO SEND

POST-LIM FLAT TX AUD RETN

TX AUDIO SEND

TX AUDIO RETURN

ADVANTAGEPORT OPTION BOARD

R665

IO FILTER IC

U561A

REPEATER AUDIO PATH

U560B

EIA

FLAT

U452-18

FLAT

PRE-EMPHASIZED

PRE-EMPHASIZED

PRE-EMPHASIZED

PRE-LIMITER

U651 - TX AUDIO FILTER IC

VOICE GAIN  
REDUCTION  
WITH PL/DPL

TX AUDIO  
PRE-EMPHASIS  
AND LIMITER

TX IN 17

U652B

AUX TX IN 20

INPUT BUFFER

POST-LIMITER

U653A

ENAI

U651-8

ML

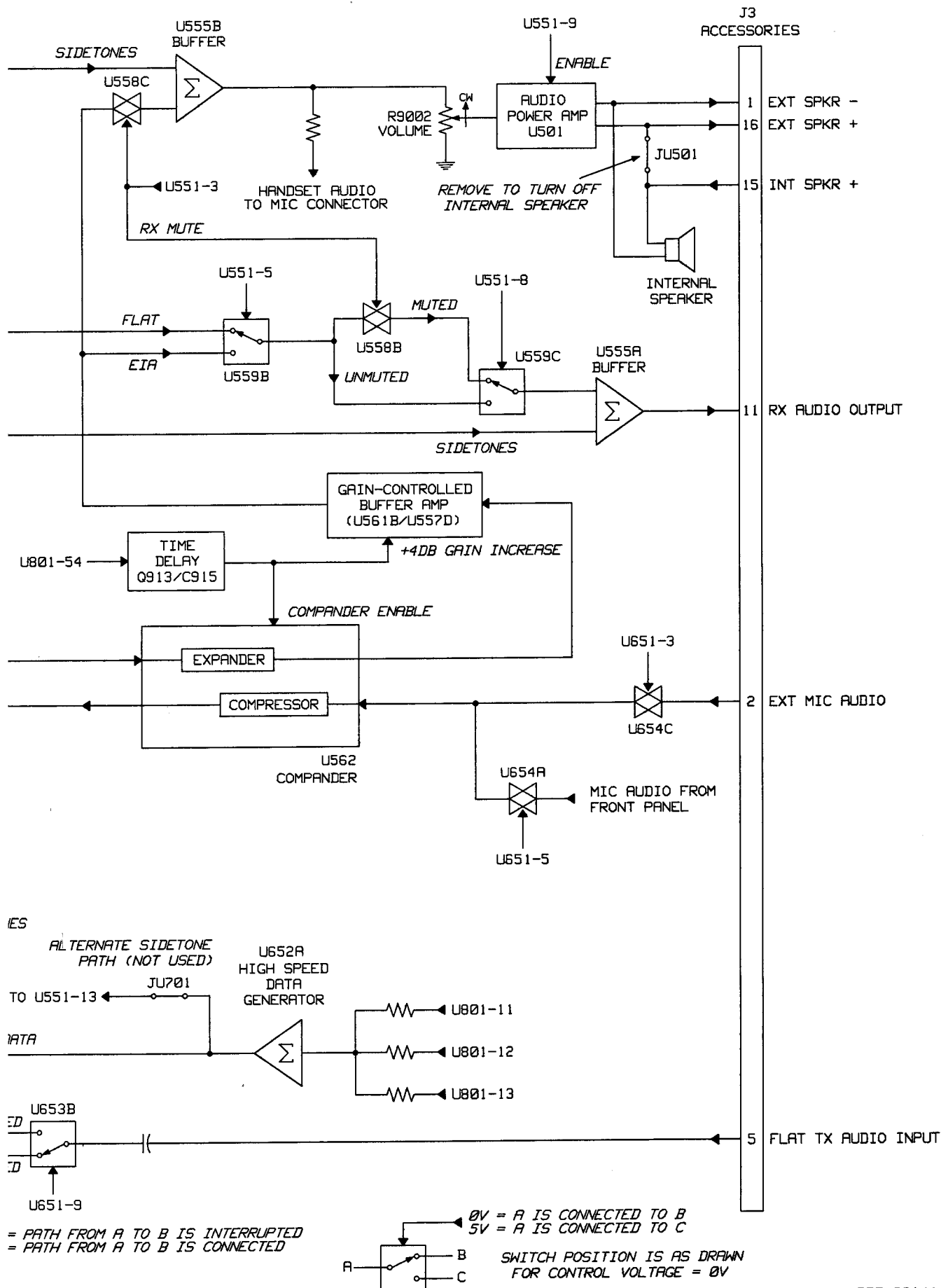
VREF

5

A B

SIDE1

TX



TRP



# Section 3

## Troubleshooting

**Table 3-1. Troubleshooting for R1225 Transceiver (General)**

Symptom	Problem(s)	Possible Solution(s)
1. GR1225, GR400 X-pand, or GR500 X-pand repeaters dead (7-segment LED display does not light).	1a. AC line cord not plugged into power supply or AC mains outlet. 1b. Repeater not turned ON. 1c. Loose or bad cable from front panel to transceiver. 1d. Open fuse in power supply.	1a. Plug power supply cord into power supply CEE receptacle or AC mains outlet. 1b. Turn on repeater. 1c. Check cable connections to front panel and transceiver or replace cable, if necessary. 1d. Check fuse in power supply and replace as necessary.
2. No field radios can access system.	2a. Repeater programmed with wrong TPL/DPL code. 2b. Loose or bad coaxial cable from receiver antenna connector to duplexer or receiver antenna. 2c. Incorrect programming of field radios. 2d. Repeater not enabled or set up (if applicable).	2a. Check TPL/DPL code of repeater and reprogram, if necessary. 2b. Check repeater cable connections to receiver antenna connector and replace cable if necessary. 2c. Check programming on field radios and reprogram, if necessary. 2d. Check repeater enable and setup condition(s).
3. First part of message not repeated.	3. User speaking too soon after pressing PTT.	3. Delay conversation to allow for delays in system due to: <ul style="list-style-type: none"> <li>• TPL/DPL decoding.</li> <li>• Requirements of signalling systems.</li> </ul>
4. Loss of receiver sensitivity when repeater is keyed (repeater toggles from transmit to receive repeatedly when attempting to communicate through it).	4a. Leaky coaxial cable(s). 4b. Loose antenna connector(s). 4c. Faulty antenna connector(s). 4d. Duplexer not tuned correctly (if applicable). 4e. Inadequate distance between receiver and transmitter antennas (if applicable). 4f. Improper or faulty coaxial cable(s) to antenna(s).	4a. Check coaxial cables and replace if necessary. 4b. Check antenna connector(s) and replace, if necessary. 4c. Replace antenna connector(s). 4d. Re-tune duplexer. 4e. Read "Antenna Spacing" on page 1-4 of the GR1225 Repeater Service manual (6880904Z90) and adjust distance between antennas. 4f. Read "Cables" on page 1-4 GR1225 Repeater Service manual (6880904Z90) to determine the types of cables required or replace cable(s), if necessary.
5. Partial (RapidCall) PTT ID message repeated.	5a. Pre-time too short. 5b. "Pre" PTT ID used.	5a. Increase pre-time in field radio. 5b. Use "Post" PTT ID.
6. Fan in the repeater runs all the time.	6a. Repeater environment is hot (>60°C). 6b. Defective temperature switch in power supply	6a. Normal operation at elevated ambient temperatures or extended repeater keying. 6b. Replace power supply.

**Table 3-1. Troubleshooting for R1225 Transceiver (General) (Cont'd.)**

Symptom	Problem(s)	Possible Solution(s)
7. Fan still runs with repeater power switch turned OFF.	7a. Normal operation if repeater was transmitting prior to turning OFF. 7b. Repeater environment is hot (>60°C).	7a. Wait until repeater cools. 7b. Move repeater to cooler environment. 7c. Disconnect AC cord from AC mains outlet.
8. Power supply stays ON with repeater power switch OFF.	8. Normal operation.	8. Power switch on front panel turns OFF B+ only to transceiver.
9. Repeater constantly keyed.	9a. Accessory connector of transceiver not programmed correctly or not operating correctly. 9b. Transceiver PTT pin pulled LOW by an accessory.	9a. Check programming of accessory connector and reprogram, if necessary. 9b. Remove or correct accessory.
10. Front panel display does not light but repeater is warm.	10. Power supply is in overvoltage/overcurrent protection.	10a. Disconnect AC cord from AC mains outlet; wait 5 seconds, then reconnect AC cord to AC mains outlet. 10b. If step 10a does not reset power supply, transceiver or external controller may have a short circuit.
11. Repeater will not enable with "RPT EN" pushbutton.	11a. Repeater programmed as Base Station only. 11b. Pin 10 of accessory connector programmed for "Repeater Knockdown" and is activated.	11a. Use RSS to reprogram for repeater operation. 11b. Check wiring from pin 10 to an external controller or accessory and correct, if necessary.
12. Remote "Repeater Knockdown" (pin 10 of accessory connector) not functioning.	12. Pin 10 programmed with "Null" default.	12. Use RSS to reprogram pin 10 as "Repeater Knockdown".

**Table 3-2. Troubleshooting for Transceiver Receiver**

Symptom	Problem	Solution
1. No speaker audio heard.	1a. Volume control turned down. 1b. Speaker cable not plugged into volume/microphone board. 1c. External speaker (if applicable) not connected between pins 1 and 16 of accessory connector on controller. 1d. Defective speaker (internal or external, if applicable). 1e. "PA Mute" enabled.	1a. Turn up volume. 1b. Connect speaker cable. 1c. Connect external speaker between pins 1 and 16. 1d. Check speaker and replace if necessary. 1e. Use RSS to reprogram "PA Mute" as disabled.

Table 3-3. Troubleshooting for Transceiver Transmitter

Symptom	Problem	Solution
1. Transmitter not keying when a properly identified signal is presented to receiver.	1a. Repeater not enabled. 1b. Repeater on wrong channel (mode). 1c. No transmit frequency programmed. 1d. Incorrect receive frequency or TPL/DPL programmed. 1e. Accessory connector pin 10 (remote knockdown) activated or not operating correctly.	1a. Enable repeater. 1b. Set repeater to correct channel (mode). 1c. Program transmit frequency. 1d. Check receive frequency and TPL/DPL and reprogram, if necessary. 1e. Check connections to pin 10 of accessory connector and correct, if necessary.
2. Transmitter keying continuously or keying without a properly identified signal presented to the receiver.	2a. Repeater on wrong channel (mode). 2b. Wrong TPL/DPL programmed. 2c. Pin 3 of accessory connector pulled LOW by an accessory. 2d. Accessory connector not programmed correctly or not operating correctly.	2a. Set repeater to correct channel (mode). 2b. Check TPL/DPL and reprogram, if necessary. 2c. Remove accessory and correct LOW condition. 2d. Check programming of accessory connector and reprogram, if necessary.
3. Low or erratic output power level, or no output power level from the transmitter.	3a. Loose RF cable connector(s). 3b. Faulty antenna or feedline. 3c. Faulty duplexer (if applicable). 3d. Output voltage from power supply drops during transmit. 3e. Excessive power supply current drain.	3a. Tighten RF cable connectors to <ul style="list-style-type: none"> <li>• transmitter output</li> <li>• duplexer</li> <li>• antenna</li> </ul> 3b. Replace faulty component. 3c. Check: <ul style="list-style-type: none"> <li>• Tuning of duplexer</li> <li>• Tightness of locking nuts on tuning screws.</li> <li>• Replace duplexer if duplexer is correctly tuned and nuts are properly tightened.</li> </ul> 3d. Check: <ul style="list-style-type: none"> <li>• Correct position of "115/230" switch on power supply.</li> <li>• High output power from transmitter; do not set greater than 10% over rated RF output power (measured at transmitter output, NOT at duplexer antenna connector).</li> </ul> 3e. Disconnect components, one at a time, to locate faulty piece. Replace faulty piece.

**Table 3-3. Troubleshooting for Transceiver Transmitter (Cont'd.)**

Symptom	Problem	Solution
4. Transmitter keys but no or low audio is transmitted.	4a. Repeater gain improperly set. 4b. Incorrect "Operation Mode" programmed.	4a. Use RSS to set repeater gain.. 4b. Use RSS to reprogram "Operation Mode."

**Table 3-4. Troubleshooting for External Controllers (General)**

Symptom	Problem	Solution
1. Controller dead, no LED indications.	1a. Loose or bad cable from transceiver. 1b. Blow fuse in controller (if applicable).	1a. Check cable from transceiver and replace if necessary. 1b. Replace fuse in controller (if applicable) and check for short or open circuit(s).
2. Transmitter not keying when a properly identified signal is presented to receiver.	2a. Controller not enabled, if applicable. 2b. Loose or bad repeater cable. 2c. Accessory connector of transceiver not programmed correctly or not operating correctly. 2d. Incorrect receive frequency or TPL/DPL programmed. 2e. Repeater on wrong channel (mode). 2f. Pin 10 programmed as "repeater knockdown" and activated by a controller or accessory. 2g. No transmit frequency programmed into transceiver.	2a. Enable controller. 2b. Check repeater cable connection(s) and replace cable, if necessary. 2c. Check programming of accessory connector and reprogram, if necessary. 2d. Check frequency and TPL/DPL code and reprogram, if necessary. 2e. Change repeater channel (mode). 2f. Check wiring to pin 10 and correct, if necessary. 2g. Program transmit frequency.
3. Transmitter keying continuously or keying without a properly identified signal presented to receiver.	3. Pin 3 of accessory connector on controller pulled LOW by an accessory.	3. Remove accessory and correct LOW condition.
4. First part of message not repeated.	4. User speaking too soon after pressing PTT.	4. Delay conversation to allow for delays in repeater and field radios from: <ul style="list-style-type: none"> <li>• TPL/DPL decoding.</li> <li>• Requirements of signalling systems.</li> </ul>
5. Transmitter keys, but low or no audio is transmitted.	5a. "External Mic" input (pin 2) of accessory connector not enabled. 5b. Controller not adjusted correctly.	5a. Use RSS to enable "External Mic". 5b. Adjust controller. Perform alignment procedures.
6. "Tinny" repeated audio (lacks low frequencies).	6. Flat receive audio selected with microphone transmit audio.	6. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
7. "Bassy" repeated audio (lacks high frequencies).	7. EIA de-emphasized receive audio selected with flat transmit audio.	7. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
8. TPL/DPL signalling "passing through" controller.	8. Flat repeat audio selected.	8. Refer to "6. 'Tinny' repeated audio" above.
9. TPL/DPL signalling not "passing through" controller.	9. EIA de-emphasized repeat selected.	9. Refer to "7. 'Bassy' repeated audio" above.

*Table 3-4. Troubleshooting for External Controllers (General) (Cont'd.)*

<b>Symptom</b>	<b>Problem</b>	<b>Solution</b>
10. DPL sense inverted in "pass through" mode (flat audios).	10. Inversion caused by processing of signal in receiver circuits.	10. Use RSS to change "Flat Repeat Audio Polarity".
11. Undesirable squelch tails and noise transmitted during drop-out delay.	11. Unmuted transmit and receive audios selected	11. Use RSS to reprogram for "Muted" audios.



## Section 4

# Expanded Accessory Connector

### General

The following is a description of the pin functions on the Expanded Accessory Connector for the R1225 Transceiver module. Refer to Figure 1 for pin locations in the connector housing.

Pin	Description	Application
1	External Speaker (-)	Connect external 8-ohm speaker to pins 1 and 16. CAUTION: Bridge-type output. Neither pin 1 nor 16 is ground.
2	External Mic Audio	Input impedance: 500 ohms. 80 mV rms at 1 kHz for 60% deviation. This path is enabled when external mic PTT is keyed.
3	External Mic PTT	Pull this pin low (less than 1.8 V dc) to key transmitter and enable external mic audio path. This pin is pulled low via a diode when front panel mic PTT is pulled low to allow sensing of mic PTT by an accessory. This pin is pulled high to 5 V dc via 9.6k ohms.
4	Programmable Output	Defaults to Null. Provides an active high to 13.8 V dc battery supply. Maximum current: 0.25 Amps. Refer to "Programmable Pins" below.
5	Flat Tx Audio Input	Input impedance: 35k ohms. 150 mV rms for 60% deviation. May be programmed to bypass limiter using RSS.
6	Programmable Input	Defaults to Null. Refer to "Programmable Pin."
7	Ground	
8	Programmable Input/Output	Defaults to COR carrier detect. Refer to "Programmable Pins."
9	Programmable Input	Defaults to Null. Refer to "Programmable Pins."
10	Programmable Input	This pin has two functions: Null and Repeater knockdown (disable). This pin is defaulted to Null Input, but may be programmed for repeater knockdown by the RSS. In Repeater Mode of operation, activating this pin disables (knockdown) the repeat function and places the unit in Base Station Mode. The front panel "RPT EN" pushbutton is overridden by pin 10.
11	Rx Audio Output	Output impedance: 560 ohms. 330 mV rms (at 1 kHz if de-emphasized) at 60% deviation. Minimum load resistance: 5k ohms. Default is de-emphasized, muted. May be programmed for flat, unmuted using RSS.
12	Programmable Input/Output	Defaults to Null. Refer to "Programmable Pins."
13	Switched A+ Sense	13.8 V dc source for accessories when radio is turned on. Maximum current: 0.5 Amps. CAUTION: Accidentally shorting this pin to ground with transceiver turned on may damage the PC board plating.
14	Programmable Input/Output	Defaults to Null. Refer to "Programmable Pins."
15	Internal Speaker (+)	If jumper JU501 is removed, connect to pin 16 to enable internal speaker. NOTE: If the HLN3145 Public Address and Speaker A/B Switch kit is used, jumper JU501 must be removed if it is desired to mute the internal speaker when the switch is in position B.
16	External Speaker (+)	Connect external 8-ohm speaker to pins 1 and 16. CAUTION: Bridge-type output. Neither pin 1 nor 16 is ground.

## Programmable Pins

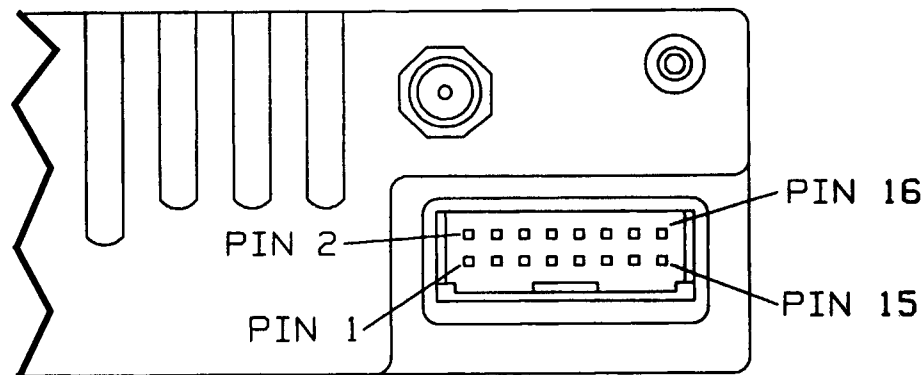
**Programmable Pins**

Pins 4, 6, 8, 9, 10, 12, and 14 are programmable I/O's. The functions of the pins can be assigned using RSS. Information on the available functions and how to program them is contained in the RSS help files in the Appendices section.

Pin 4 is an output only. It provides an active high to the 13.8 V dc supply (0.25 Amps maximum), otherwise it is pulled low via 10k ohms.

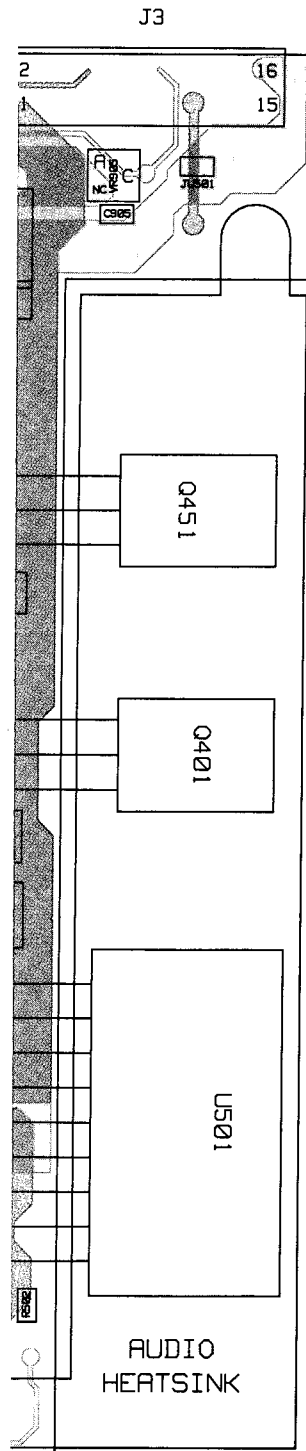
Pins 6, 10, and 9 are inputs only. They are normally pulled high to 5 V dc via 4.7k ohms. To activate the input, it should be pulled low to within 0.7 V dc of ground.

Pins 8, 12, and 14 may each be programmed as either an input or output. If programmed as an input, the pin is pulled high to 5 V dc via 4.7k ohms. To activate the input, it should be pulled low to within 0.7 V dc of ground. If programmed as an output, the pin is normally pulled high to 5 V dc via 4.7k ohms. When enabled, the output goes active low. Maximum sinking current is 50 mA.



*Figure 4-1. Expanded Accessory Connector Pin Locations (viewed from rear of transceiver)*

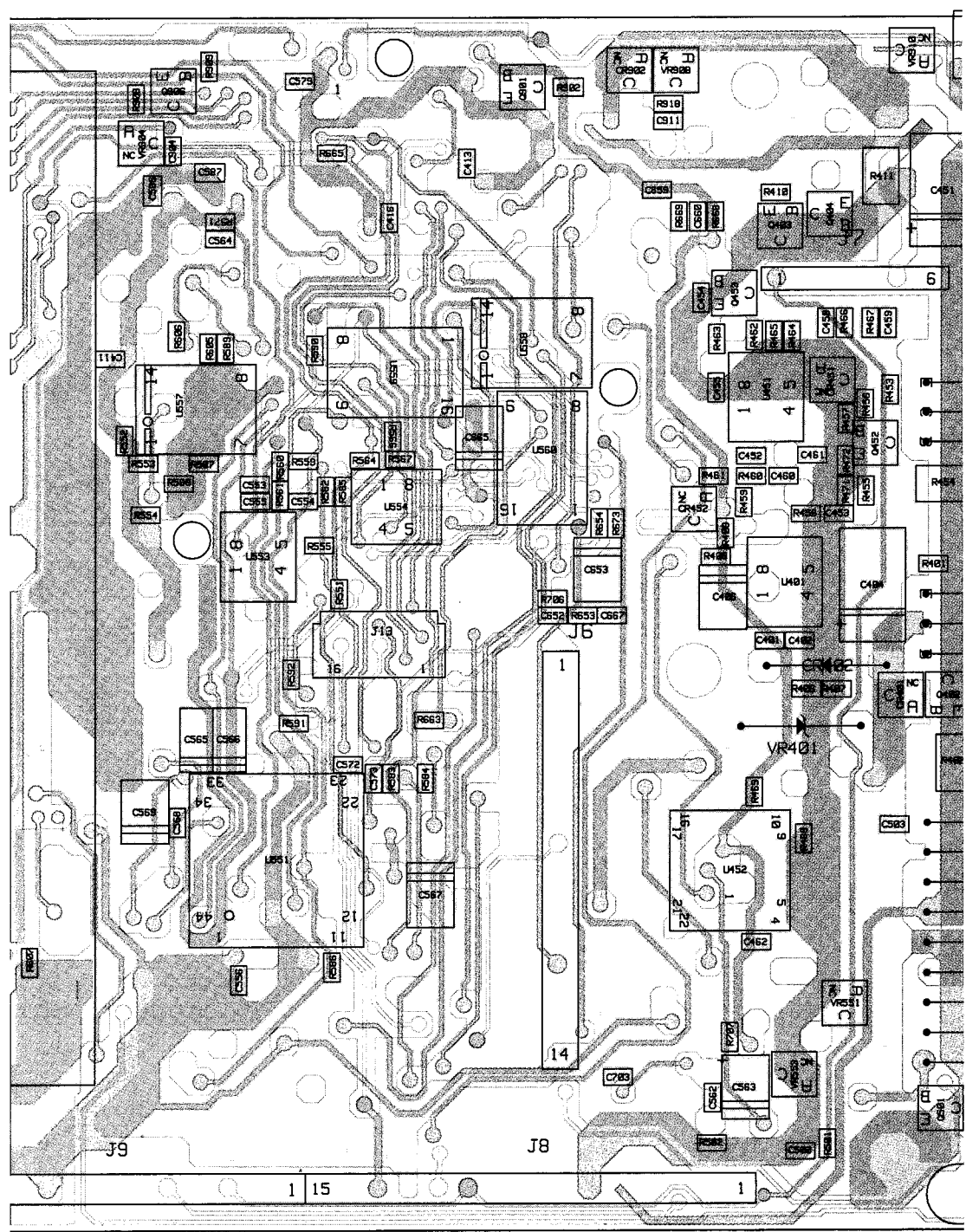




*Circuit Board Details for Masked Logic Board, 4-Layer  
(Part of HUD3119A & HUE3191A Transceivers)*

37U01 ISS 0 6-20-97

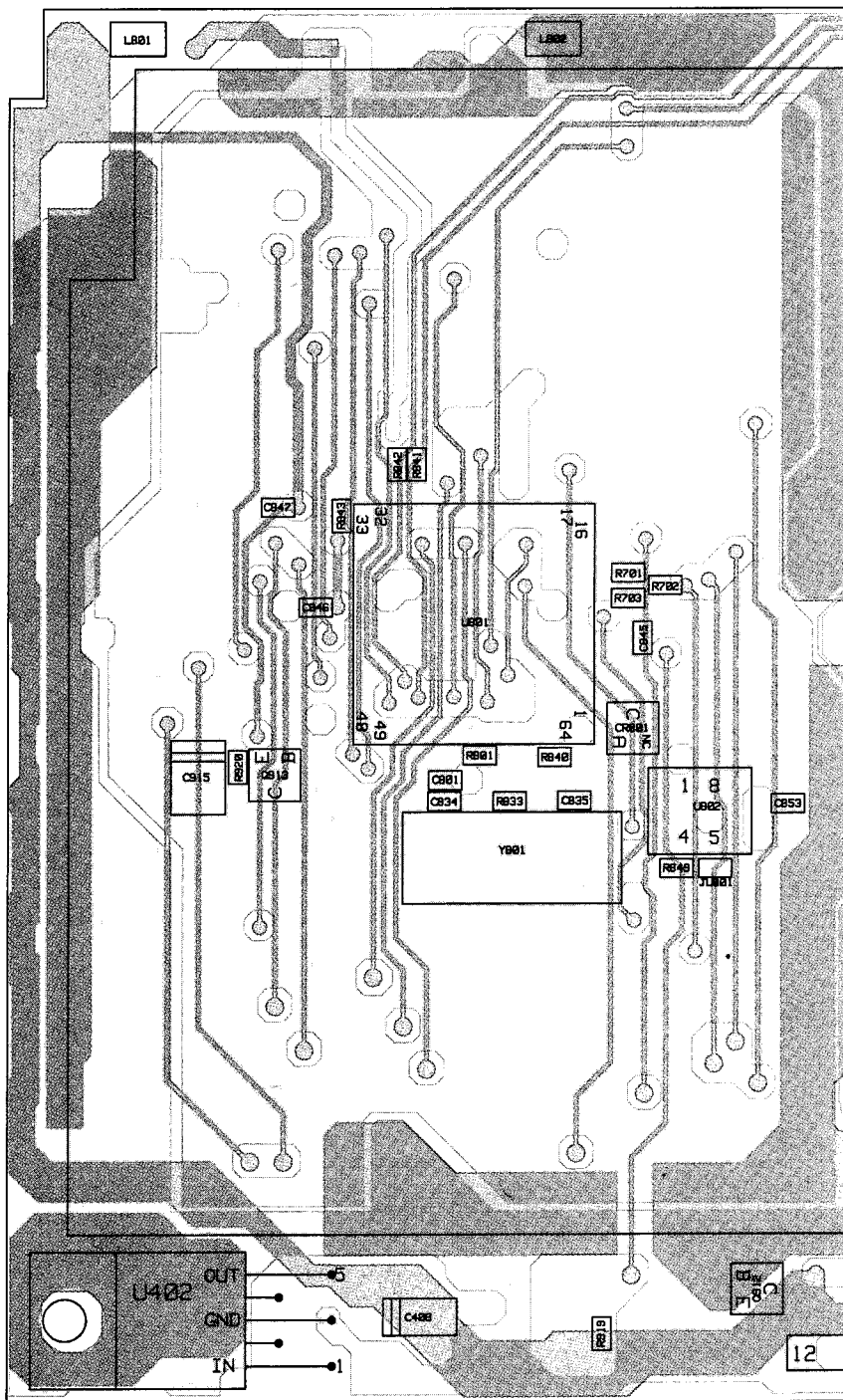
COMPONENT SIDE



INNER LAYER (GRAY)  
OUTER LAYER (PINK)

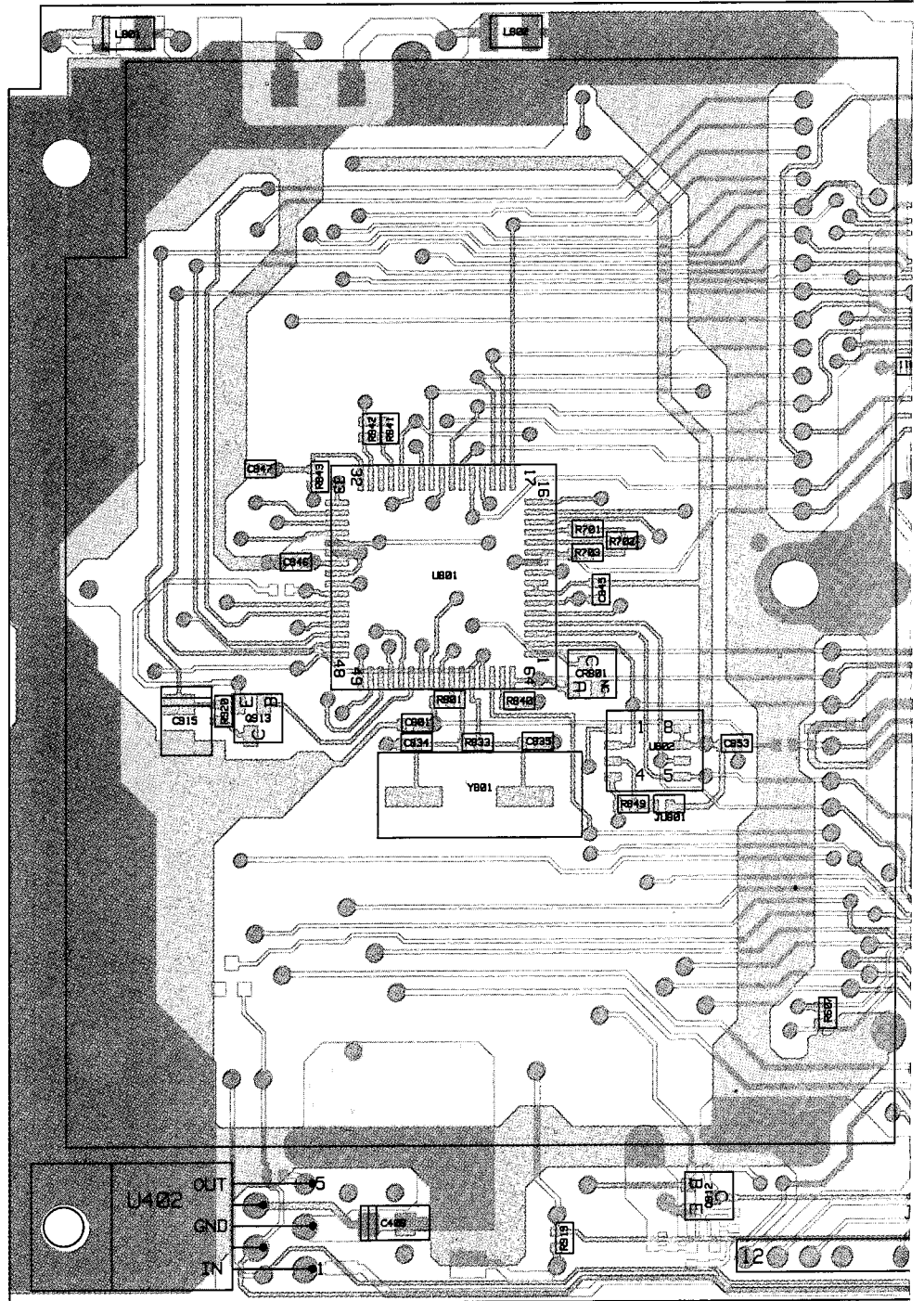
RCB-97154-O  
RCB-97155-O  
RCB-97157-O

COMPONENT SIDE VIEW

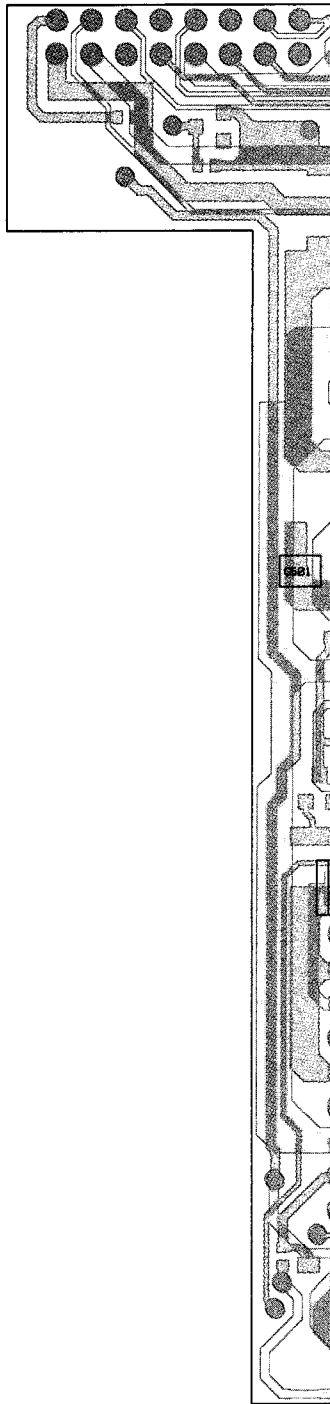


**COMPONENT SIDE  
SOLDER SIDE INN  
OVERLAY -----**



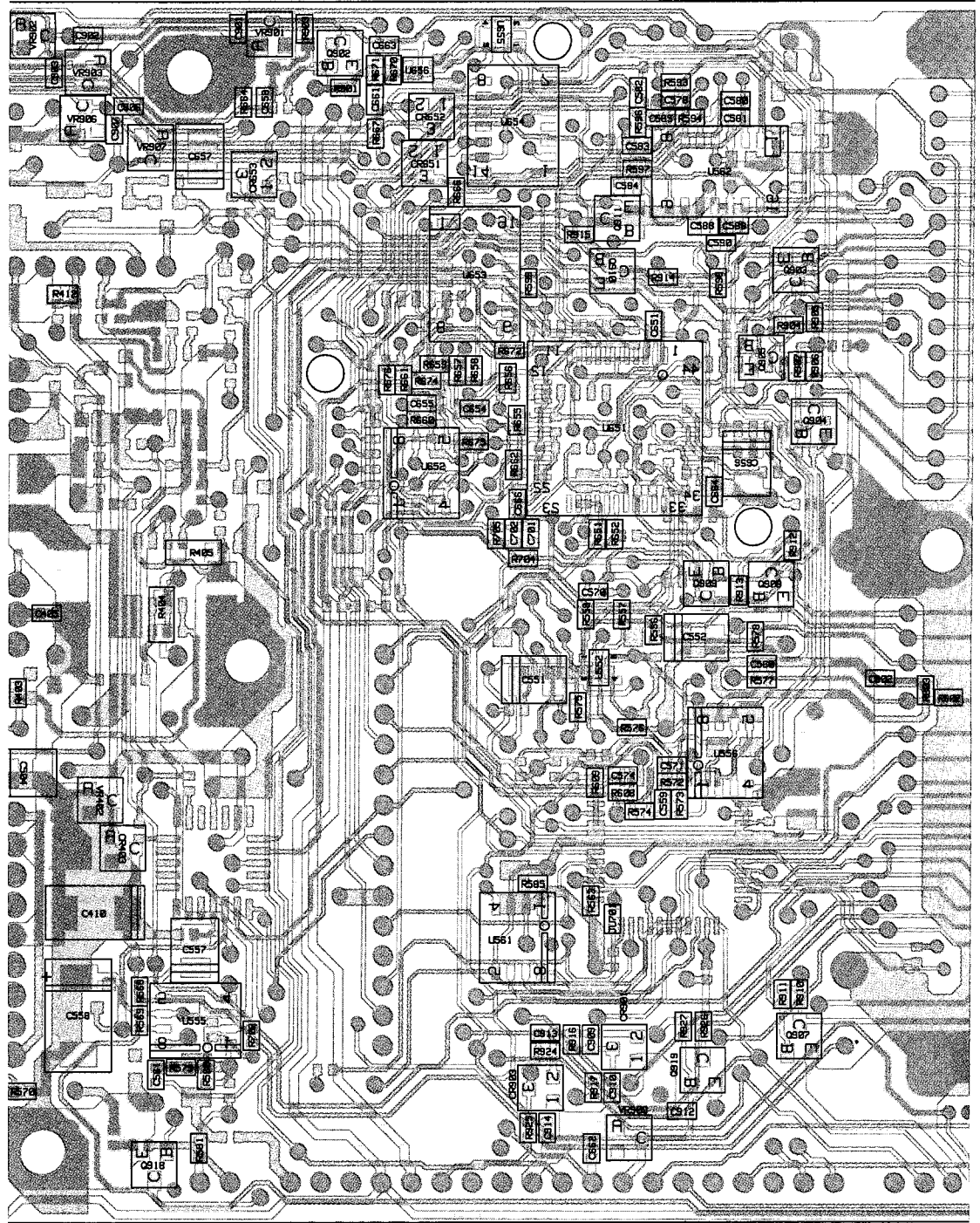


COMPON  
SOLDER  
OVERLA



*Circuit Board Details for Masked Logic Board, 4-Layer  
(Part of HUE3191A & HUE3191A Transceivers)*



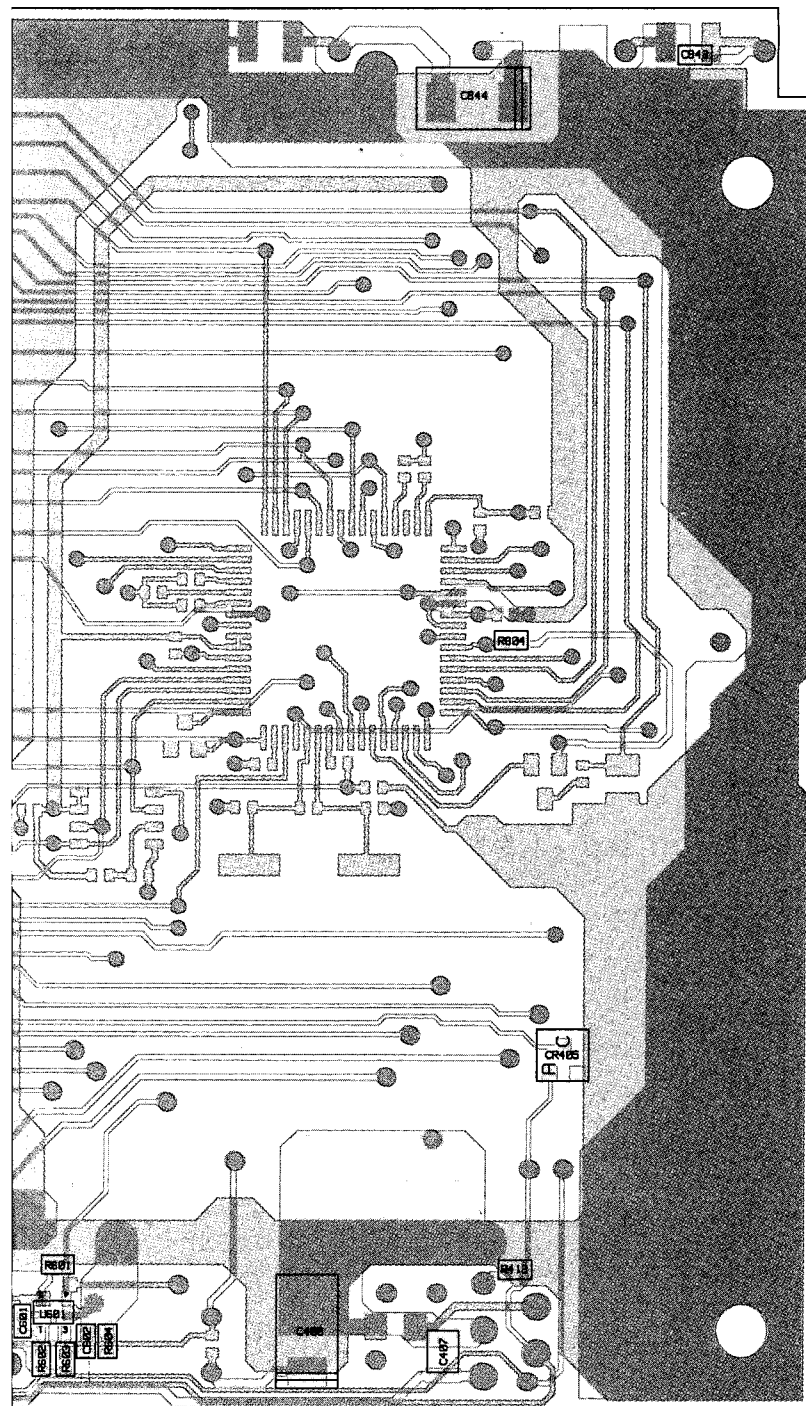


84D80437U01 ISS 0 6-  
SOLDER SIDE

**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-9;  
RCB-9;  
RCB-9;

**SOLDER SIDE VIEW**

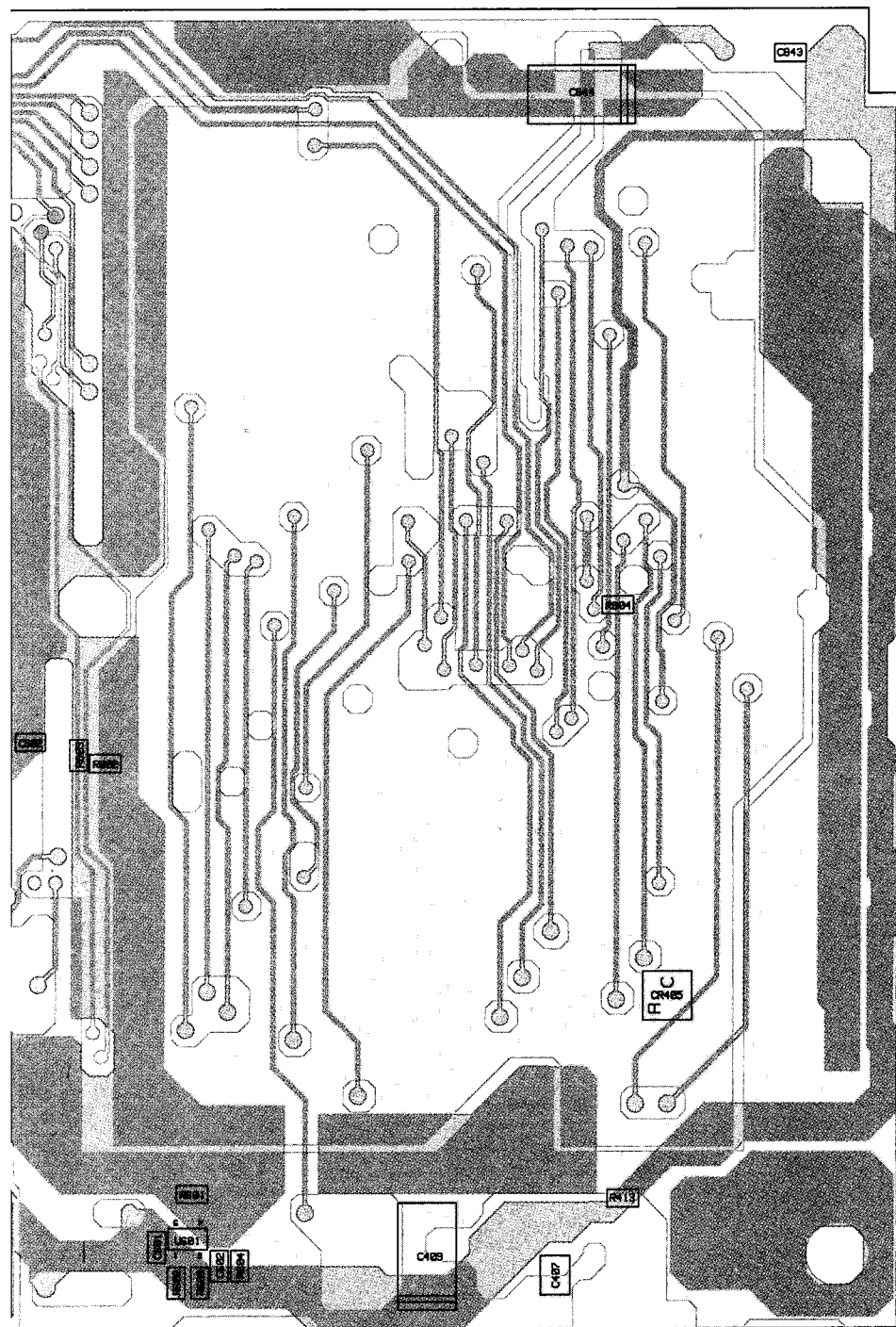


26-97

153-O (REV)  
156-O (REV)  
158-O

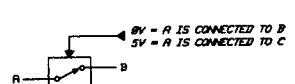
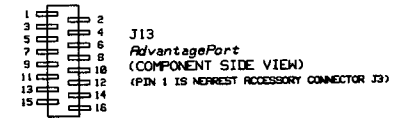
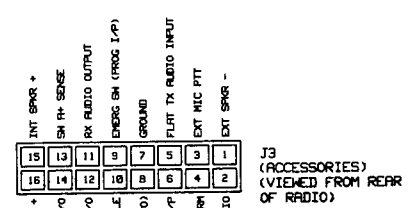
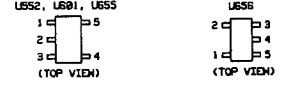
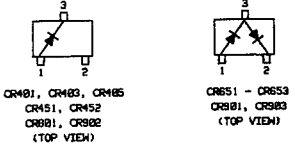
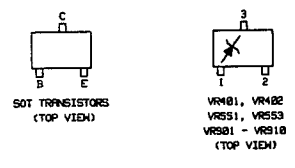
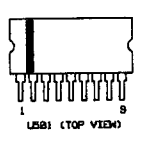
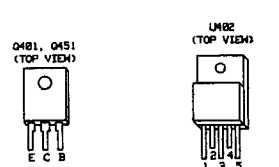
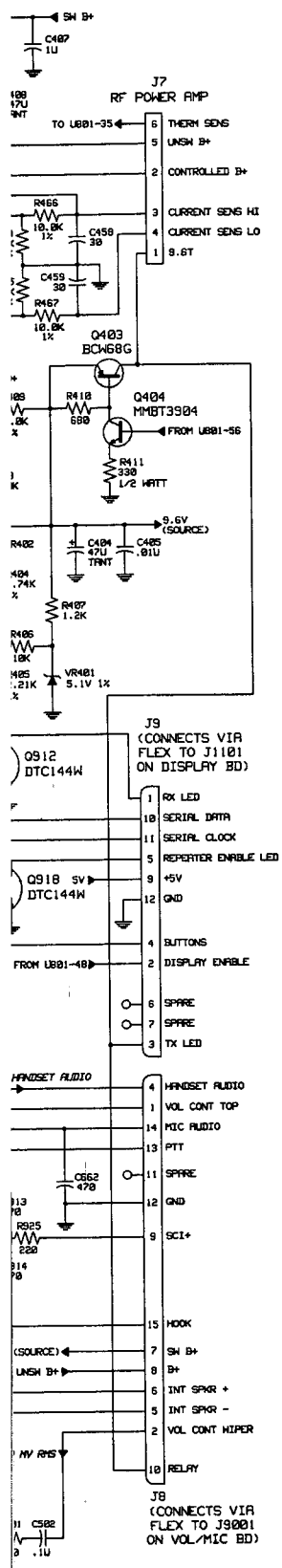






0 6-26-97

RCB-97154-O (REV)  
RCB-97155-O (REV)  
RCB-97158-O



AUDIO VOLTAGE LEVELS ARE MEASURED AT 1 KHZ, 68% DEVIATION, UNLESS OTHERWISE SPECIFIED.

Schematic Diagram for Masked Logic Board, 4-Layer (Part of HUD3119A & HUE3191A Transceivers)





# Parts List

HLN9395A Audio/Logic Board

PL-971033-O

HLN93

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REF S
		capacitor, chip: uF +/-5%; 50 V: unless otherwise stated	C847
C401	21-13741F49	.01 uF	C855
C402	21-13743E07	.022 uF 10%; 16 V	C901
C404	23-11049C05	tantalum 47 uF 10%; 16 V	C918
C405	21-13741F49	.01 uF	
C406	23-11049A57	tantalum 10 uF 10%; 16 V	CR41
C407	21-13741W01	1 uF 10%; 25V	CR41
C408	23-11049A05	tantalum 0.47 uF 10%; 25 V	CR41
C409, 410	23-11049A98	tantalum 47 uF 10%; 10 V	CR41
C411	21-13741F49	.01 uF	CR41
C413	21-13741F49	.01 uF	CR6
C416	21-13741F49	.01 uF	CR8
C451	23-11049C05	tantalum 47 uF 10%; 16 V	CR9
C452	21-13741F49	.01 uF	CR9
C453	21-13743E20	0.1 uF 10%; 16 V	CR9
C454	21-13741F49	.01 uF	
C455	21-13743K16	0.22 uF +80/-20%; 16 V	
C458, 459	21-13740F38	30 pF	J3
C460 thru 462	21-13741F49	.01 uF	J6
C501	21-13741W01	1 uF 10%; 25 V	J7
C502	21-13743E20	0.1 uF 10%; 16 V	J8/J9
C503	21-13741F25	1000 pF	J13
C504	23-11049A57	tantalum 10 uF 10%; 16 V	
C551, 552	23-11049J11	tantalum 4.7 uF 10%; 16 V	
C553	21-13741F23	820 pF	JU50
C554	21-13741F33	2200 pF	JU70
C555	21-13740F53	120 pF	JU80
C556	21-13743E20	0.1 uF 10%; 16 V	
C557	23-11049A57	tantalum 10 uF 10%; 16 V	
C558	23-11049C05	tantalum 47 uF 10%; 16 V	L801
C559	21-13741F41	4700 pF	
C560	21-13741F25	1000 pF	
C561, 562	21-13743E20	0.1 uF 10%; 16 V	Q401
C563	23-11049A57	tantalum 10 uF 10%; 16 V	Q402
C564	21-13743E20	0.1 uF 10%; 16 V	Q403
C565	23-11049A05	tantalum 0.47 uF 10%; 25 V	Q404
C566	23-11049A07	tantalum 1 uF 10%; 16 V	Q451
C567	23-11049A90	tantalum 47 uF 10%; 4 V	Q452
C568	21-13743E20	0.1 uF 10%; 16V	Q501
C569	23-11049A11	tantalum 3.3 uF 10%; 16 V	Q901
C570	21-13741F41	4700 pF	Q902
C571 thru 574	21-13743E20	0.1 uF 10%; 16 V	Q903
C578	---	Not Used	Q913
C579	21-13743E20	0.1 uF 10%; 16 V	Q918
C580	21-13743K16	0.22 uF +80/-20%; 16 V	
C581	21-13740F60	240 pF	
C582	21-13743E20	0.1 uF 10%; 16 V	
C583	21-13740F60	240 pF	R401
C584	21-13928E01	1 uF 10%; 10 V	R402
C585	21-13743E20	0.1 uF 10%; 16 V	R403
C586	21-13928E01	1 uF 10%; 10 V	R404
C587, 588	21-13743A24	0.33 uF 10%; 16 V	R405
C589	21-13740F60	240 pF	R406
C590	21-13743K16	0.22 uF +80/-20%; 16 V	R407
C601	21-13743E20	0.1 uF 10%; 16 V	R408
C602	21-13741F41	4700 pF	R410
C651	21-13743E20	0.1 uF 10%; 16 V	R411
C652	21-13741F49	.01 uF	R412
C653	23-11049A09	tantalum 2.2 uF 10%; 20 V	R413
C654	21-13741F25	1000 pF	R453
C655	21-13741F17	470 pF	R454
C656	23-11049A11	tantalum 3.3 uF 10%; 16 V	R455
C657	23-11049J11	tantalum 4.7 uF 10%; 16 V	R456
C658	21-13741F17	470 pF	R457
C659	21-13743K16	0.22 uF +80/-20%; 16 V	R458
C660	21-13743E20	0.1 uF 10%; 16 V	R460
C661	21-13743K16	0.22 uF +80/-20%; 16 V	R461
C662, 663	21-13741F17	470 pF	R462
C664	21-13743E20	0.1 uF 10%; 16 V	R463
C665	23-11049A90	tantalum 47 uF 10%; 4 V	R464
C666	06-62057B47	jumper	R468
C667	21-13741F25	1000 pF	R471
C701	21-13743E11	.039 uF 10%; 16 V	R472
C702	21-13741F49	.01 uF	R501
C703	21-13743E11	.039 uF 10%; 16 V	R502
C801	21-13740F39	33 pF	R551
C802	21-13743E20	0.1 uF 10%; 16 V	R554
C834	21-13740F35	22 pF	R555
C835	21-13740F39	33 pF	R556
C843	21-13743E20	0.1 uF 10%; 16 V	R557
C844	23-11049A98	tantalum 47 uF 10%; 10 V	R558
C845, 846	21-13743E20	0.1 uF 10%; 16 V	R559

Parts List for Masked Logic Board, 4-Layer  
(Part of HUD3191A & HUE3191A Transceivers)

REFERENCE BOL	MOTOROLA PART NO.	DESCRIPTION
	21-13741F25	1000 pF
	---	Not Used
ru 914	21-13741F17	470 pF
	23-11049A57	tantalum 10 uF 10%; 16 V
		<b>diode: (see note)</b>
	48-05129M76	silicon SOT
	48-83654H02	silicon
	48-05129M76	silicon SOT
	48-05129M76	silicon SOT
452	48-05129M76	silicon SOT
thru 653	48-13833C07	dual silicon SOT MMBD7000
	48-80939T01	Schottky SOT
	48-13833C07	dual silicon SOT MMBD7000
	48-05129M76	silicon SOT
	48-13833C07	dual silicon SOT MMBD7000
		<b>connector, receptacle:</b>
	28-80923V01	16-pin, accessories
	09-80130M03	14-pin, RF board
	28-80128M03	6-pin, RF power amplifier
	28-80600B02	27-pin, includes J8 and J9
	09-80472U01	16-pin, option board
		<b>jumper:</b>
	06-62057B47	jumper
	---	Not Used
	---	Not Used
		<b>coil, rf:</b>
02	24-84657R01	ferrite bead
		<b>transistor: (see note)</b>
	48-02245J25	PNP; type 2SB1142S
	48-80214G02	NPN; type MMBT3904
	48-80141L03	PNP; type BCW68G
	48-80214G02	NPN; type MMBT3904
	48-02245J25	PNP; type 2SB1142S
153	48-80214G02	NPN; type MMBT3904
	48-80947V01	digital NPN; type DTC144W
	48-80947V01	digital NPN; type DTC144W
	48-80141L03	PNP; type BCW68G
ru 912	48-80947V01	digital NPN; type DTC144W
	48-80494U01	digital PNP; type DTA144W
319	48-80947V01	digital NPN; type DTC144W
		<b>resistor, chip: +/-5%; 1/16 W;</b> unless otherwise stated
	06-62057A45	680
	06-80195M37	330; 1/2 W
	06-62057A45	680
	06-11077F18	1.74k 1%; 1/8 W
	06-11077F28	2.21k 1%; 1/8 W
	06-62057A73	10k
	06-62057A51	1.2k
409	06-62057P10	10.0k 1%
	06-62057A45	680
	06-80195M37	330; 1/2 W
	06-62057C81	1.8k; 1/10 W
	06-62057A73	10k
	06-62057A45	680
	06-80195M37	330; 1/2 W
	06-62057A45	680
	06-62057A59	2.7k
	06-62057A57	2.2k
459	06-62057A65	4.7k
	06-62057A75	12k
	06-62057A45	680
	06-62057A83	27k
	06-62057A73	10k
hru 467	06-62057P95	100k 1%
469	06-62057A91	56k
	06-62057A81	22k
	06-62057A67	5.6k
	06-62057A37	330
	06-62057A97	100k
hru 553	06-62057A91	56k
	06-62057A73	10k
	06-62057A53	1.5k
	06-62057A95	82k
	06-62057B16	560k
	06-62057A73	10k
	06-62057A93	68k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R560, 561	06-62057A92	62k
R562	06-62057A89	47k
R563	06-62057A73	10k
R564 thru 567	06-62057A89	47k
R568	06-62057A84	30k
R569	06-62057A97	100k
R570	06-62057A43	560
R571	06-62057A84	30k
R572	06-62057A85	33k
R573	06-62057B04	180k
R574	06-62057A69	6.8k
R575	06-62057A84	30k
R576	06-62057A75	12k
R577, 578	06-62057A73	10k
R579	06-62057A84	30k
R580	06-62057B04	180k
R581	06-62057A73	10k
R582	06-62057A43	560
R583	06-62057A84	30k
R584, 585	06-62057A73	10k
R586	06-62057A90	51k
R587	06-62057B04	180k
R588	06-62057B07	240k
R589, 590	06-62057A73	10k
R591, 592	06-62057A69	6.8k
R593	06-62057A85	33k
R594	06-62057A90	51k
R596	06-62057A90	51k
R597	06-62057A85	33k
R598	06-62057A43	560
R599	06-62057A97	100k
R601	06-62057A81	22k
R602	06-62057A97	100k
R603	06-62057A73	10k
R604	06-62057B22	1 meg.
R605	06-62057A95	82k
R606	06-62057A89	47k
R607	06-62057A73	10k
R608	06-62057A57	2.2k
R609	06-62057A89	47k
R651	06-62057A84	30k
R652	06-62057A73	10k
R653	06-62057B11	360k
R654	06-62057B01	130k
R655	06-62057B04	180k
R656	06-62057A01	10
R657	06-62057B14	470k
R658	06-62057B09	300k
R659	06-62057A91	56k
R660	06-62057A99	120k
R661	---	Not Used
R662	06-62057A73	10k
R663	06-62057A91	56k
R664	06-62057A97	100k
R665	06-62057A82	24k
R666, 667	06-62057A97	100k
R668	06-62057A40	430
R669	06-62057A20	62
R670	06-62057A40	430
R671	06-62057A20	62
R672	06-62057A90	51k
R673	06-62057A82	24k
R674	06-62057A91	56k
R675, 676	06-62057A67	5.6k
R701	06-62057B03	160k
R702	06-62057B06	220k
R703	06-62057A97	100k
R704	06-62057A01	10
R705	06-62057A68	6.2k
R706	06-62057A73	10k
R707, 708	06-62057A91	56k
R801	06-62057A57	2.2k
R802	06-62057A49	1k
R803	06-62057A82	24k
R804	06-62057A97	100k
R833	06-62057B28	1.8 meg.
R840 thru 843	06-62057A73	10k
R849	---	Not Used
R901	06-62057A53	1.5k
R902	06-62057C85	2.7k 1/10; W
R903	06-62057A73	10k
R904	06-62057A89	47k
R905	06-62057A65	4.7k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R906		06-6;
R907		06-6;
R908		06-6;
R909		06-6;
R910		06-6;
R911		06-6;
R912		06-6;
R913		06-6;
R914		06-6;
R915		06-6;
R916		06-6;
R917		06-6;
R918		06-6;
R919		06-6;
R920		06-6;
R924		06-6;
R925		06-6;
R926		06-6;
R927		06-6;
U401		51-0;
U402		51-8;
U451		51-0;
U452		51-0;
U501		51-0;
U551		51-8;
U552		51-6;
U553, 554		51-8;
U555		51-0;
U556		51-8;
U557, 558		51-0;
U559, 560		51-8;
U561		51-8;
U562		51-1;
U601		51-8;
U651		51-8;
U652		51-8;
U653		51-8;
U654		51-0;
U655		51-0;
U656		48-0;
U801		51-8;
U802		---
VR401		48-8;
VR402		48-8;
VR551		48-8;
VR553		48-8;
VR901 thru 910		48-8;
Y801		48-8;
		03-1
		03-1
		26-8

note: For optimum perf must be ordered by Mot

ROLA NO.	DESCRIPTION
i7A89	47k
i7A65	4.7k
i7A89	47k
i7A65	4.7k
i7A89	47k
i7A65	4.7k
i7A89	47k
i7A65	4.7k
i7A89	47k
i7A65	4.7k
i7A33	220
i7A65	4.7k
i7A75	12k
i7A37	330
i7A89	47k
i7A33	220
i7A89	47k
i7A65	4.7k
<b>Integrated circuit: (see note)</b>	
i8J22	dual op-amp 4558 SOIC
i2T01	regulator, 5V with reset
i8J22	dual op-amp 4558 SOIC
i6P38	DAC
i9X01	audio power amp TDA1519AC
i4E01	audio filter
i2A09	single opamp LMC7101
i2W01	dual op-amp LM2904 SOIC
i8J22	dual op-amp 4558 SOIC
i2W01	dual op-amp LM2904 SOIC
i3U35	quad analog switch 4066B
i4M60	triple 2-channel switch 4053B
i2W01	dual op-amp LM2904 SOIC
i1A35	compander MC33111
i6U01	single comparator TA75S393F
i4E01	audio filter
i2W01	dual op-amp LM2904 SOIC
i4M60	triple 2-channel switch 4053B
i3U35	quad analog switch 4066B
i1G61	NAND gate TC7S00F
i9C04	dual transistor switch UMC3TL
i9U01	microcomputer MC68HC11KA4 OTP Not Used
<b>voltage regulator: (see note)</b>	
i1E40	zener diode 5.1V 1%
i0L06	zener diode 5.1V SOT
i0L15	zener diode 10V SOT
i0L15	zener diode 10V SOT
i8V01	zener diode 27V SOT
<b>crystal: (see note)</b>	
i3R15	8.4 MHz

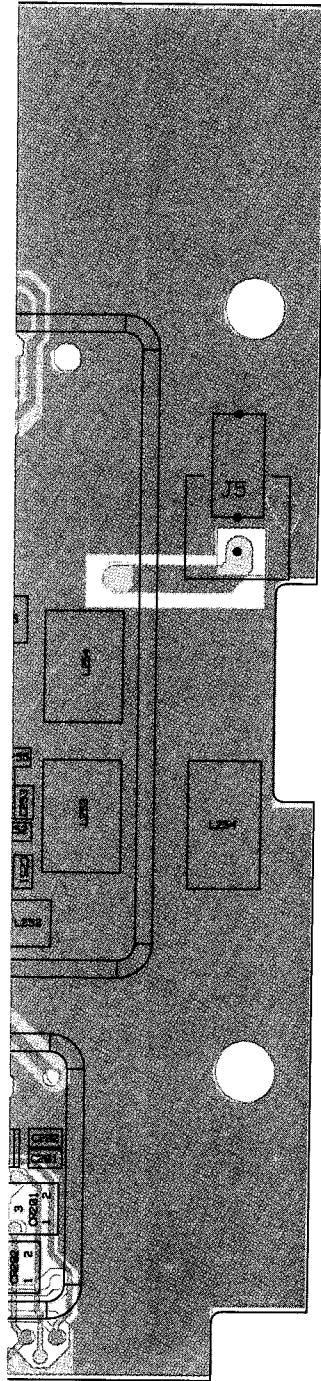
non-referenced items	
i3M04	screw M2.5 x 0.45 x 8 (2 used, for Q401 and Q452)
i3M11	screw M3.0 x 0.5 x 10 (2 used for U501)
i7B01	heatsink

ance, diodes, transistors, and integrated circuits  
la part numbers.

Q:  
Q'

A  
B



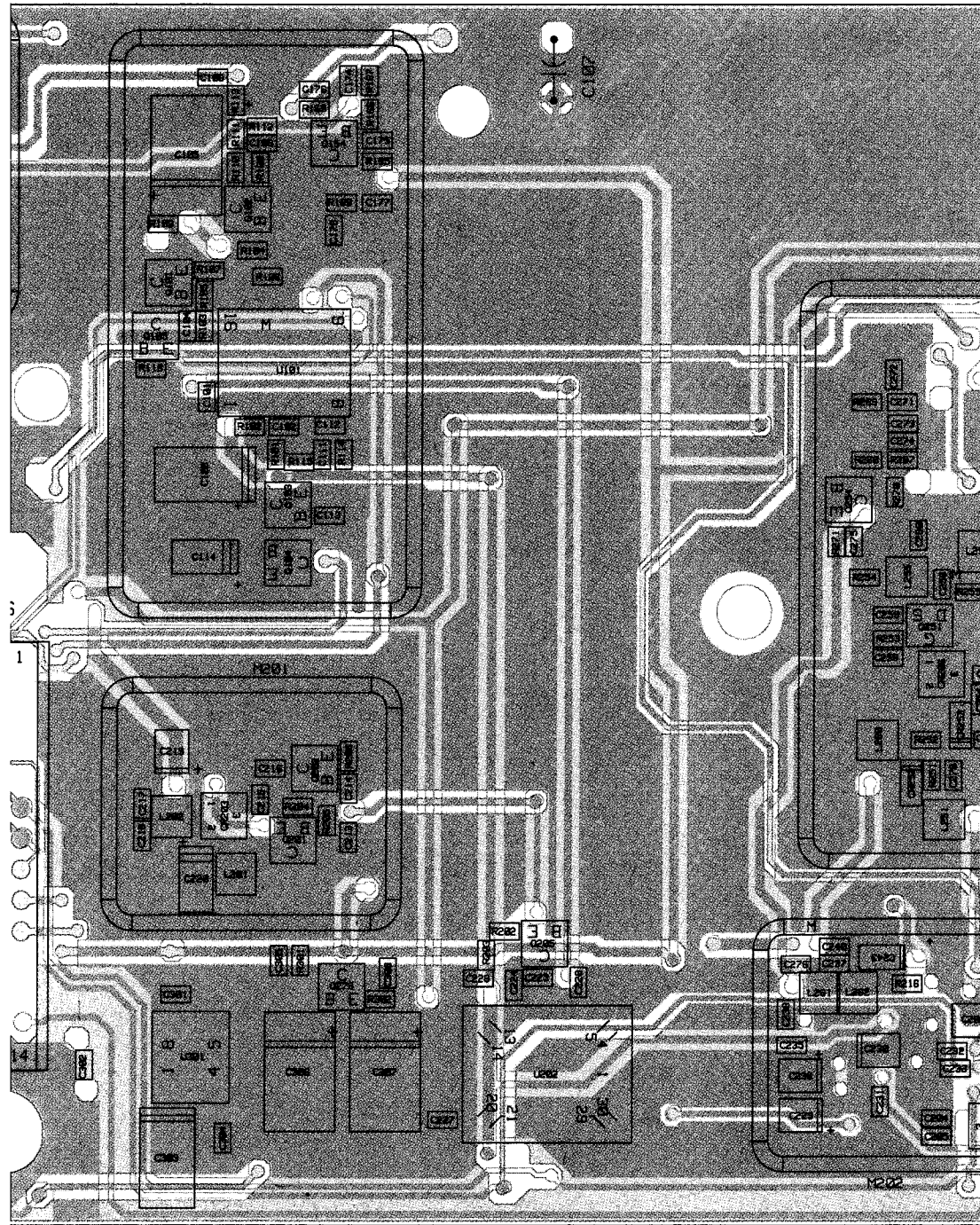


*Circuit Board Details for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A Transceiver)*

7-1-97

84D80432U01 ISSUE 0

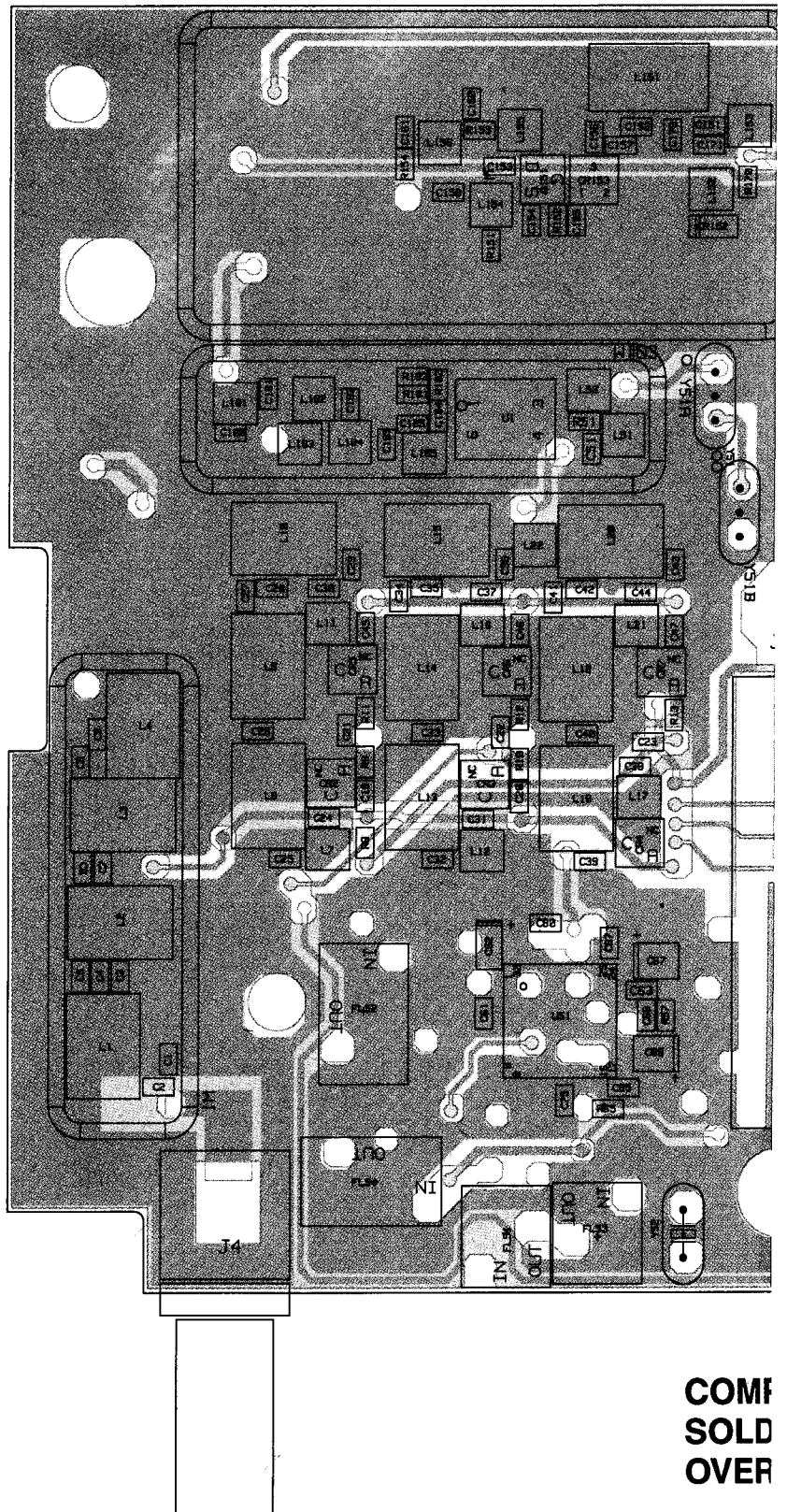
COMPONENT SIDE



COMPONENT SIDE INNER LAYER (GRAY)  
FRONT SIDE INNER LAYER (PINK)  
LAY ----

RCB-97160-O  
RCB-97161-O  
RCB-97163-O

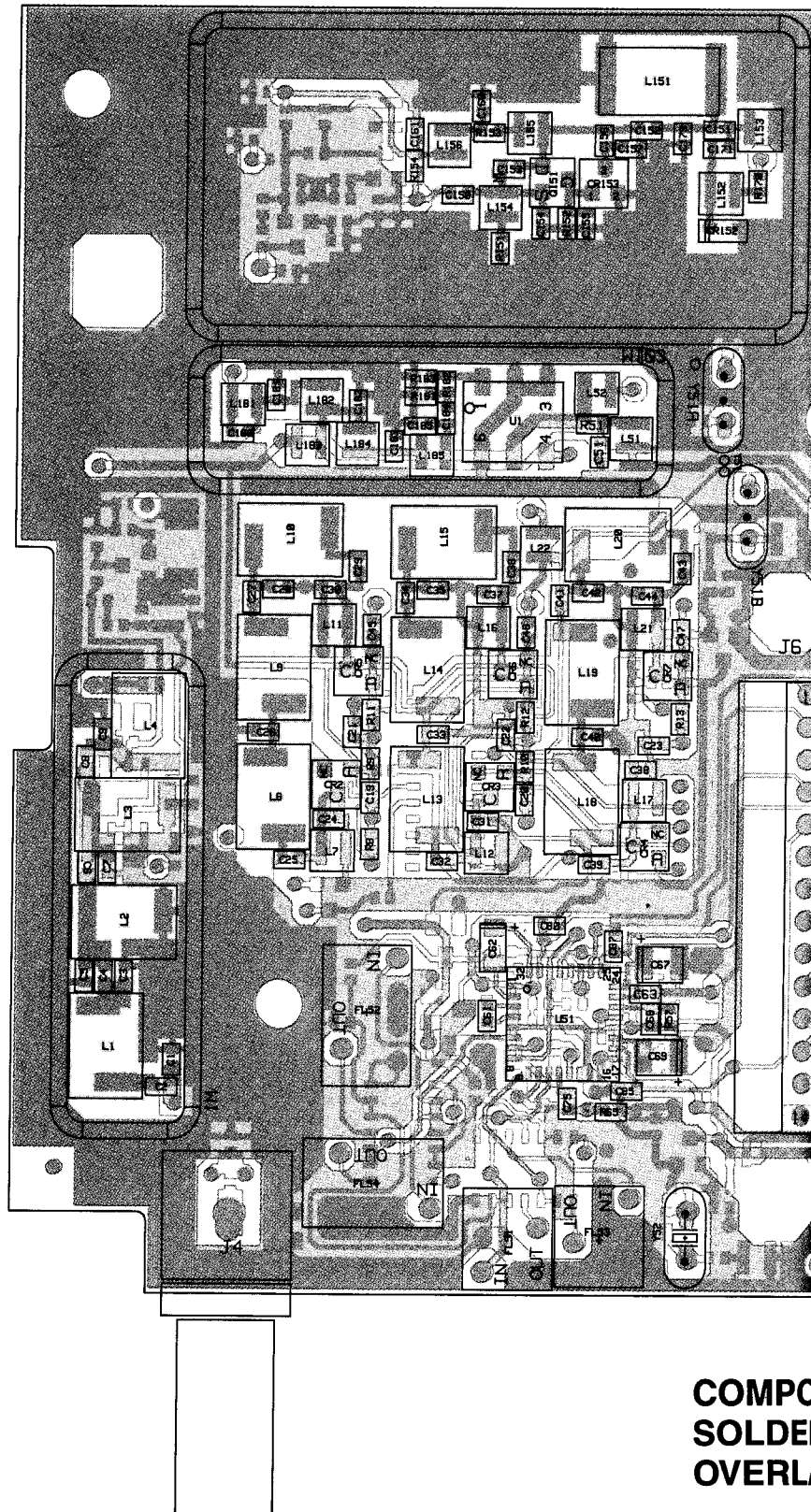
COMPONENT SIDE VIEW



COMF  
SOLD  
OVER

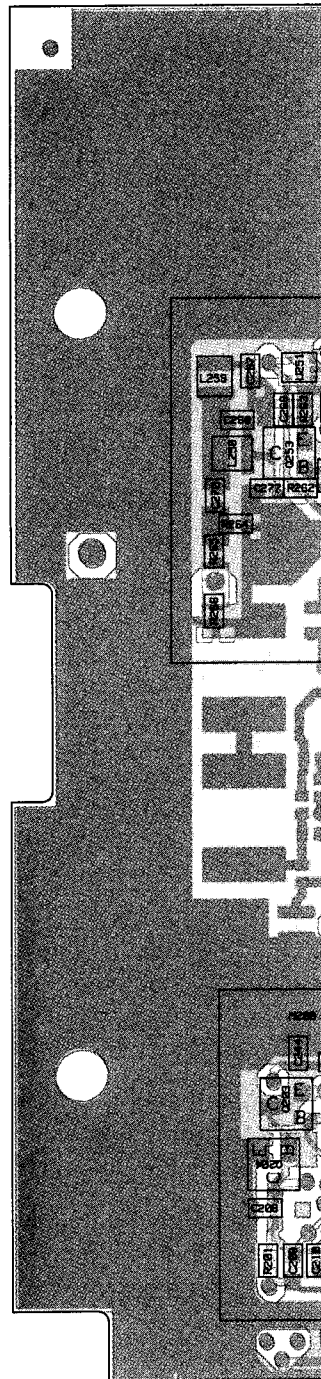






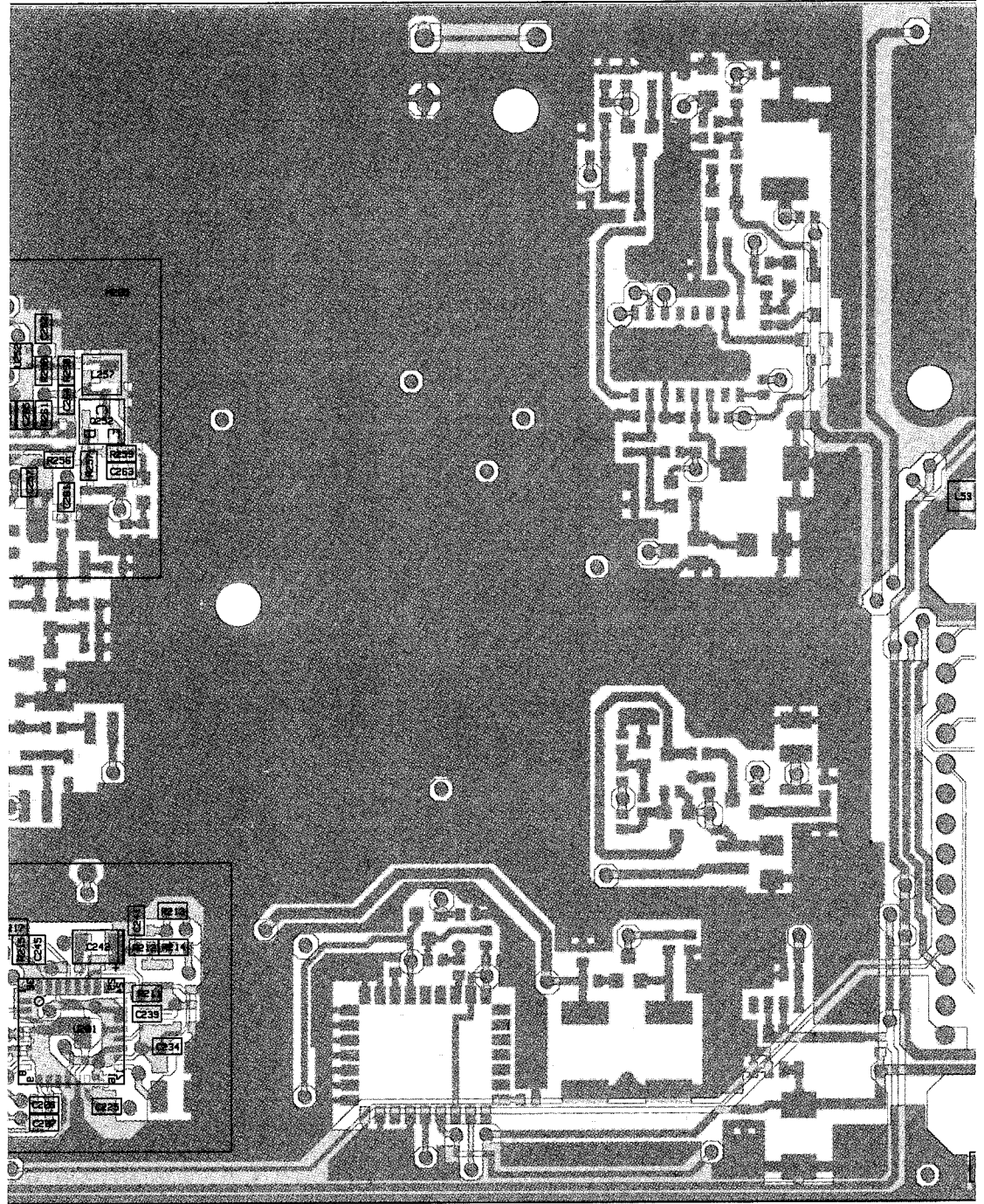
COMPO  
SOLDE  
OVERL

C



*Circuit Board Details for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A Transceiver)*

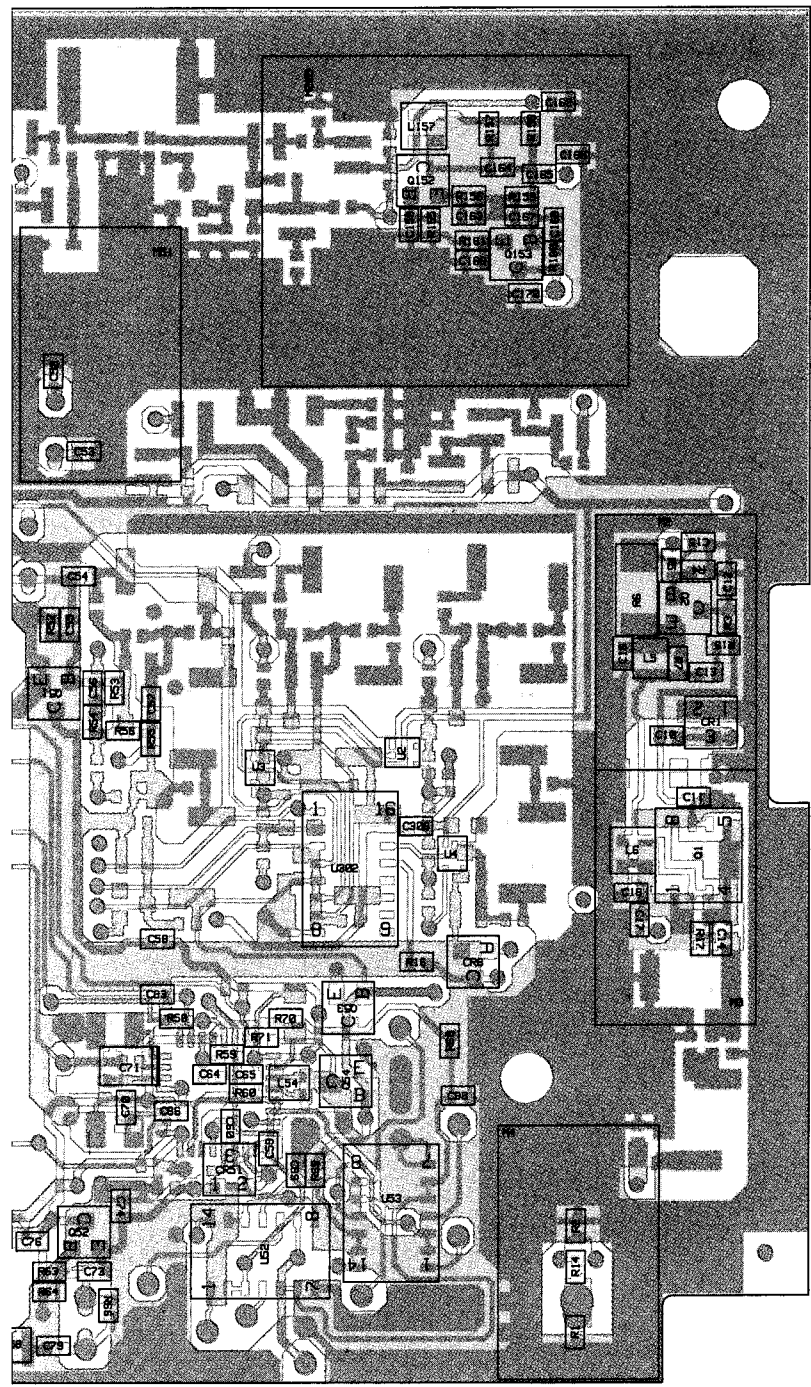




**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-97159-O (REV  
RCB-97162-O (REV  
RCB-97164-O

### SOLDER SIDE VIEW

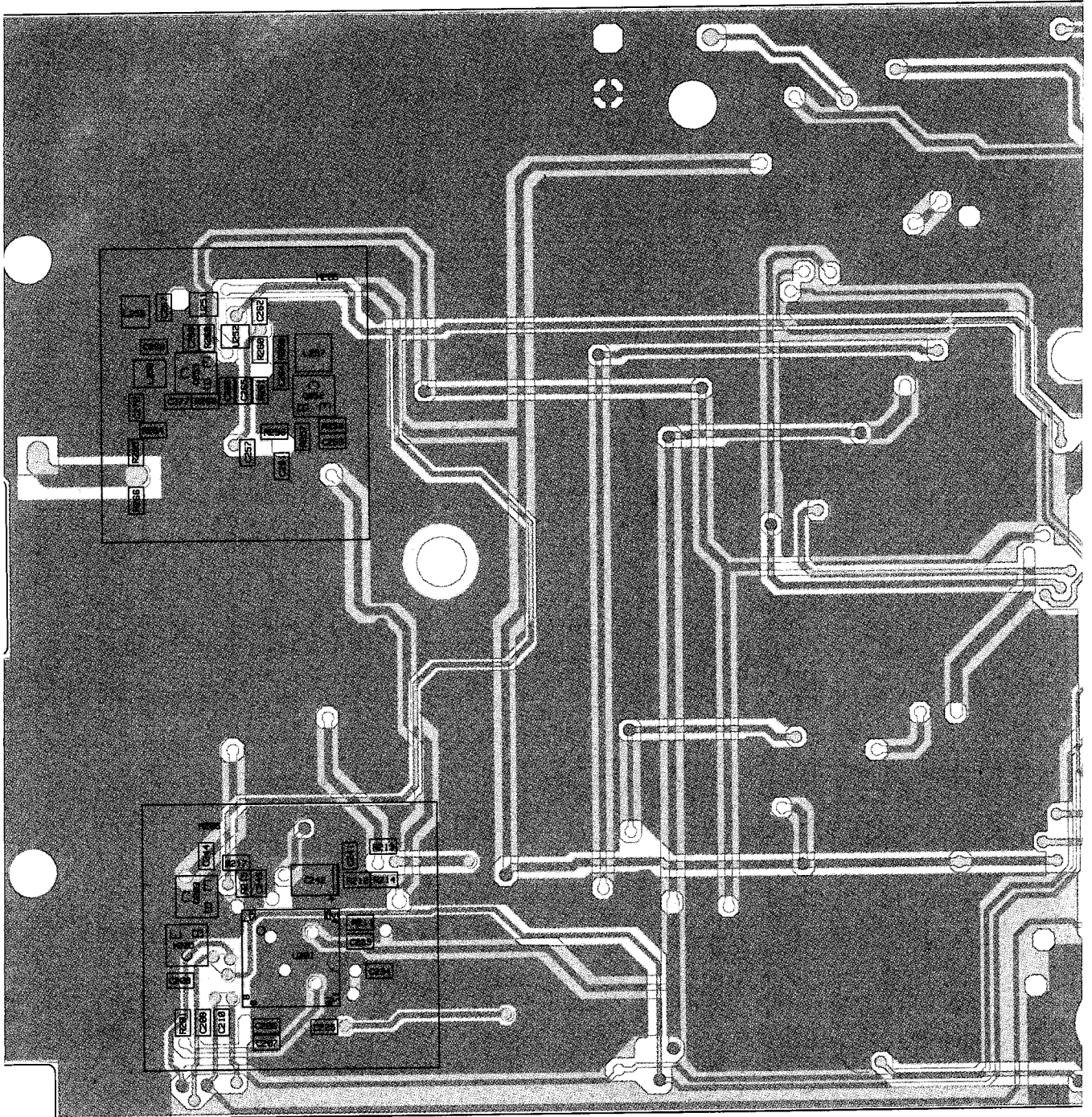




7-1-97

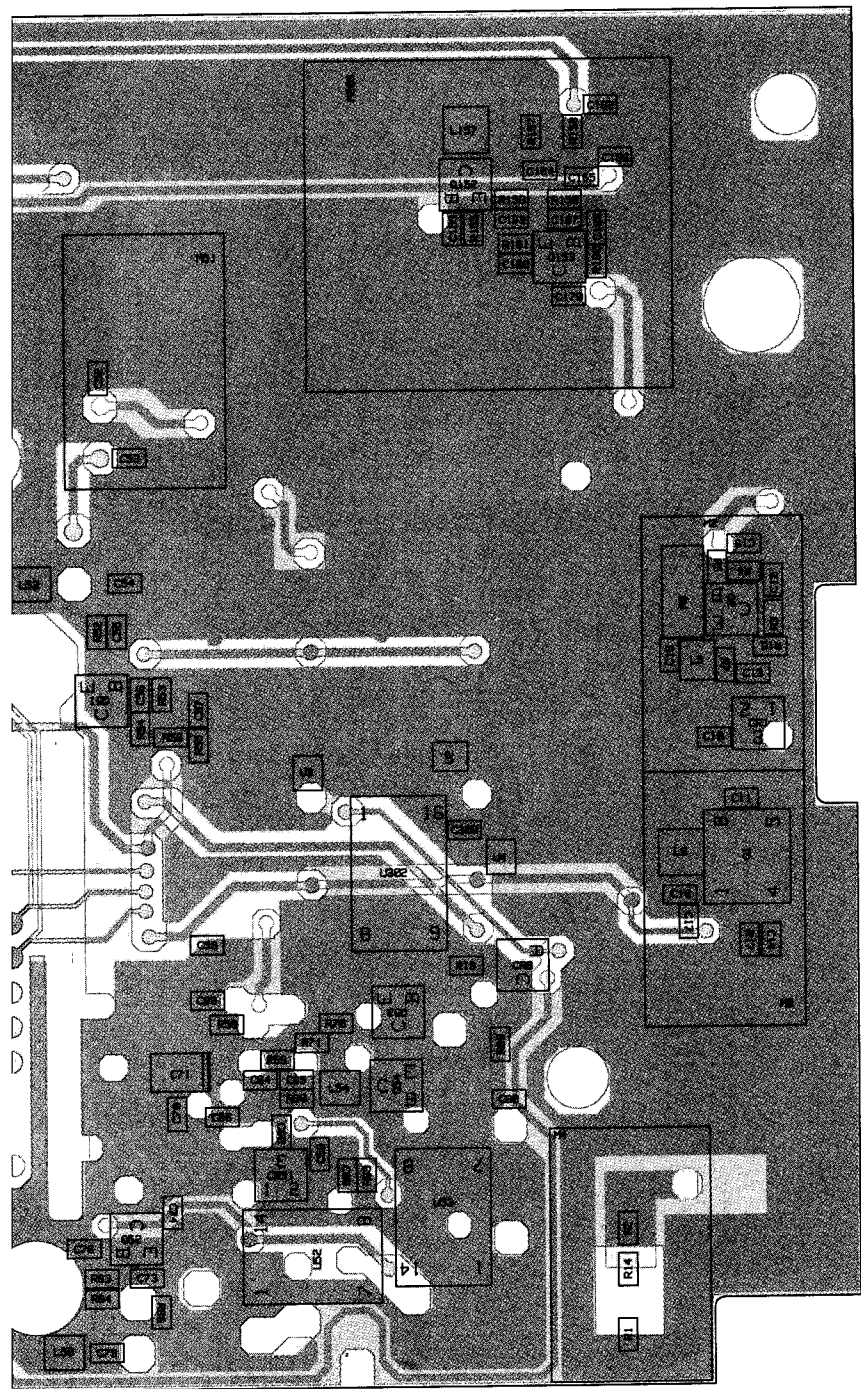
84D80432U01 ISSUE 0

SOLDER SIDE

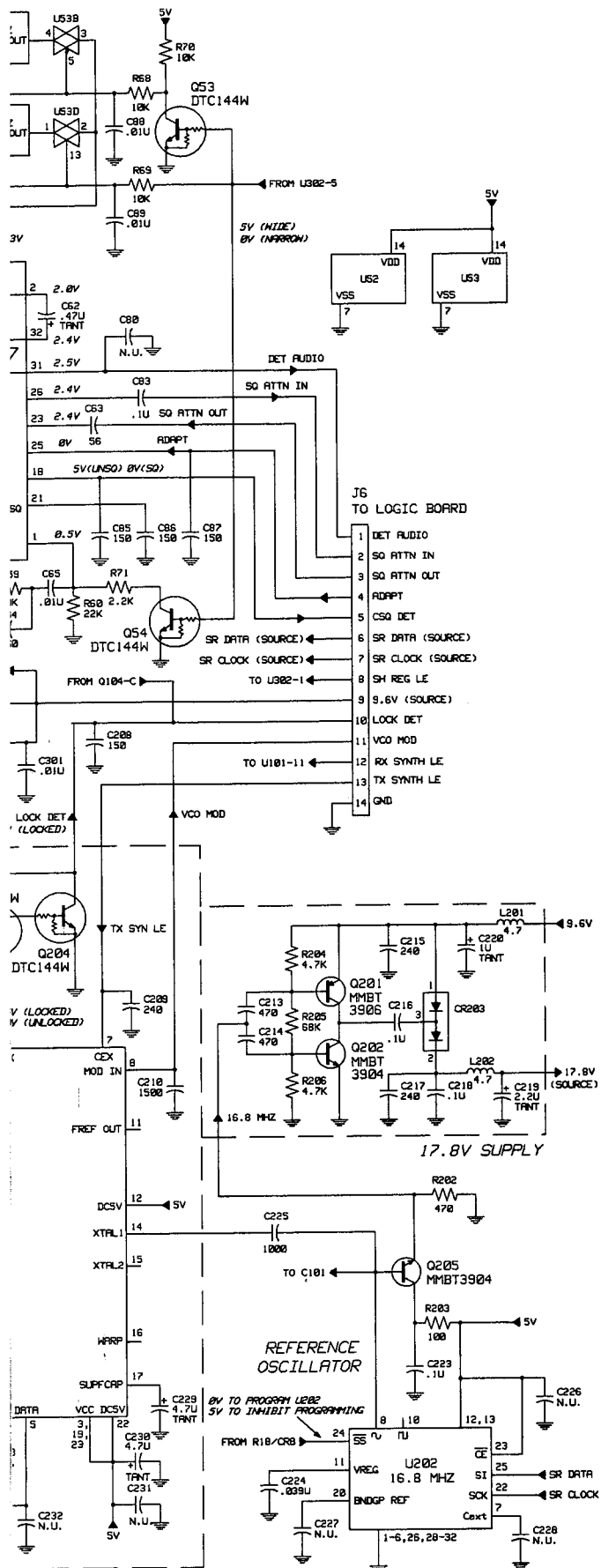


**COMPONENT SIDE INNER LAYER (GRAY)**  
**SOLDER SIDE INNER LAYER (PINK)**  
**OVERLAY -----**

**SOLDER SIDE VIEW**

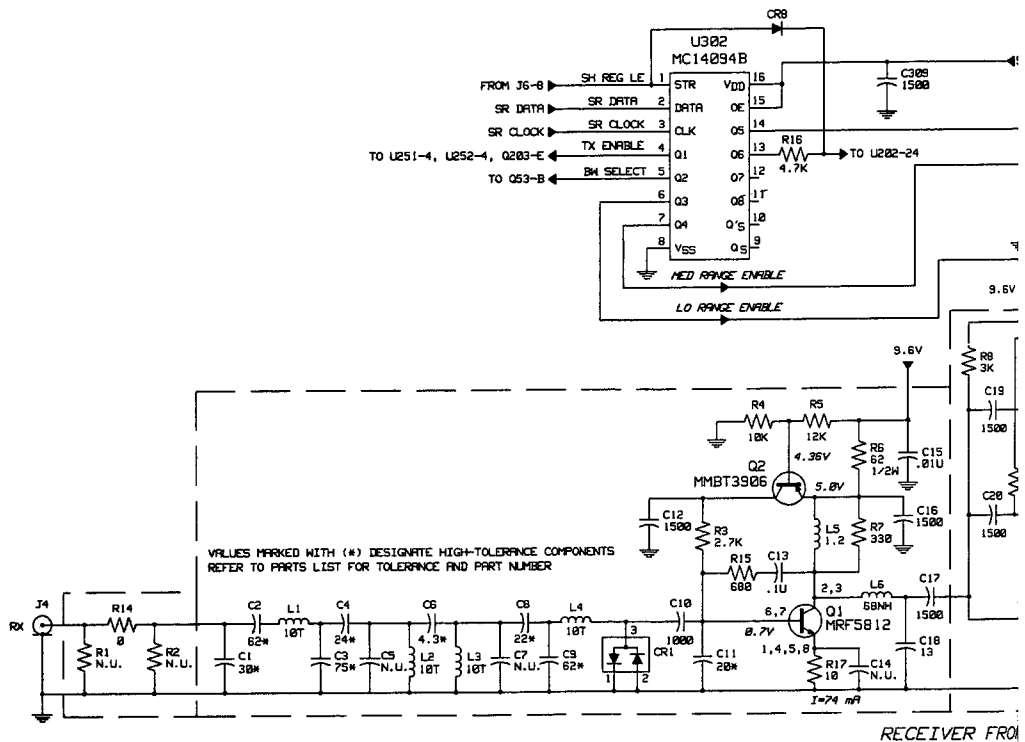


RCB-97160-O (REV)  
RCB-97161-O (REV)  
RCB-97164-O

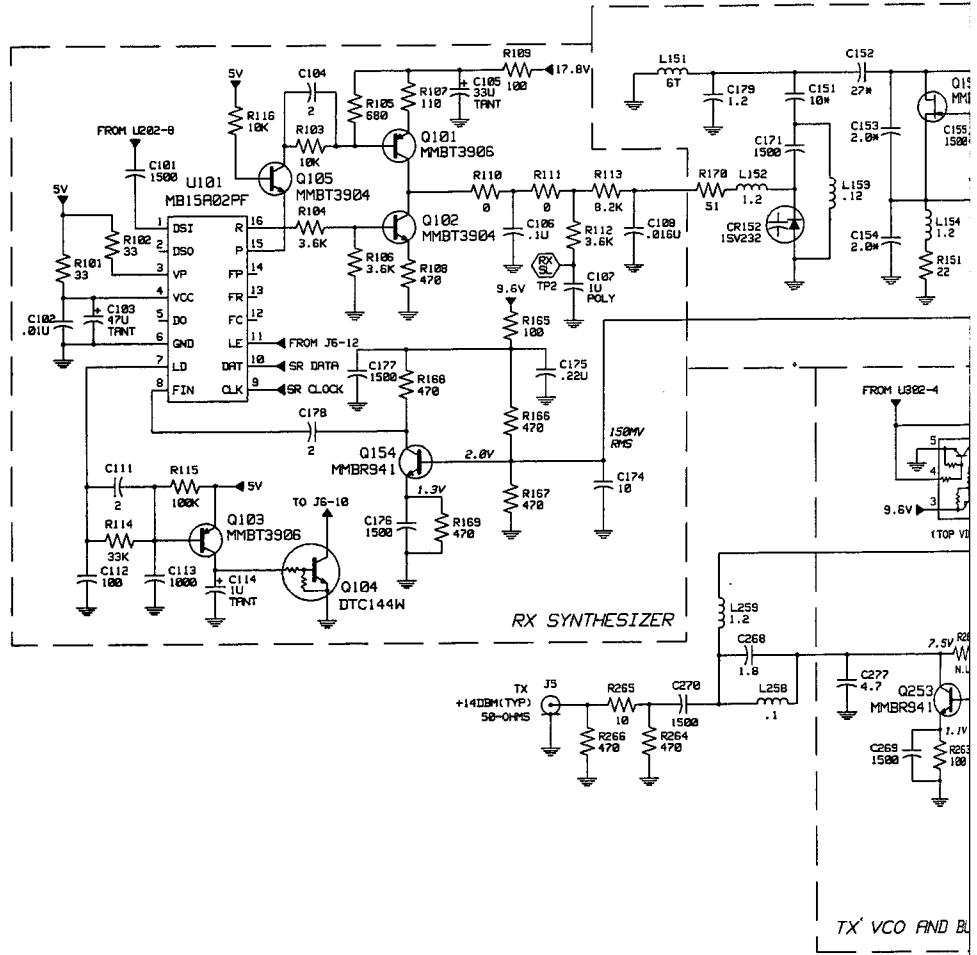


Schematic Diagram for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A Transceiver)





RECEIVER FROM



# Parts List

HLD9017A VHF RF Board, 146-174 MHz, 12.5/25 kHz

PL-971034-O

HLD9017

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFE I SYM
		capacitor, fixed: uF +/-5%; 50 V: unless otherwise stated	C152
C1	21-13740L29	30 pF 2%	C153, 1
C2	21-13740L37	62 pF 2%	C155
C3	21-13740L39	75 pF 2%	C156
C4	21-13740L27	24 pF 2%	C157, 1
C5	---	Not Used	C159
C6	21-13740L09	4.3 ±0.1 pF	C160
C7	---	Not Used	C161
C8	21-13740L26	22 pF 2%	C162, 1
C9	21-13740L37	62 pF 2%	C164
C10	21-13741F25	1000 pF	C165
C11	21-13740L25	20 2%	C166, 1
C12	21-13741F29	1500 pF	C168, 1
C13	21-13743E20	0.1 uF 10%; 16 V	C170
C14	---	Not Used	C171
C15	21-13741F49	.01 uF	C174
C16, 17	21-13741F29	1500 pF	C175
C18	21-13740F30	13 pF	C176, 1
C19 thru 23	21-13741F29	1500 pF	C178
C24	21-13740L35	51 pF 2%	C179
C25	21-13740L31	36 pF 2%	C181
C26	21-13740F55	150 pF	C182
C27	21-13740L29	30 pF 2%	C183
C28	21-13740F55	150 pF	C184
C29	21-13740L32	39 pF 2%	C185
C30	21-13740L36	56 pF 2%	C186
C31	21-13740L34	47 pF 2%	C201
C32	21-13740L30	33 pF 2%	C202
C33	21-13740F54	130 pF	C203
C34	21-13740L28	27 pF 2%	C204, 2
C35	21-13740F54	130 pF	C206, 2
C36	21-13740L30	33 pF 2%	C208
C37	21-13740L34	47 pF 2%	C209
C38	21-13740L32	39 pF 2%	C210
C39	21-13740L31	36 pF 2%	C213, 2
C40	21-13740F51	100 pF	C215
C41	21-13740L27	24 pF 2%	C216
C42	21-13740F51	100 pF	C217
C43	21-13740L30	33 pF 2%	C218
C44	21-13740L32	39 pF 2%	C219
C45 thru 47	21-13741F29	1500 pF	C220
C51	21-13740F49	82 pF	C223
C52	21-13740F35	22 pF	C224
C53	21-13740F25	8.2 ±0.25 pF	C225
C54	---	Not Used	C226 th
C55	21-13740F37	27 pF	C229, 2
C56, 57	21-13743E20	0.1 uF 10%; 16 V	C231 th
C58	21-13740F20	5.1 ±0.25 pF	C234
C59	---	Not Used	C235
C60	21-13743E20	0.1 uF 10%; 16 V	C236
C61	21-13741F29	1500 pF	C237
C62	23-11049A05	tantalum 0.47 uF 10%; 25 V	C238
C63	21-13740F45	56 pF	C239
C64	21-13740F69	560 pF	C240
C65	21-13741F49	.01 uF	C241
C67	23-11049J11	tantalum 4.7 uF 10%; 16 V	C242
C68	21-13743E20	0.1 uF 10% 16V	C243
C69	23-11049J07	tantalum 3.3 uF 10%; 20 V	C244
C70	21-13743E20	0.1 uF 10% 16V	C245
C71	23-11049A57	tantalum 10 uF 10%; 16 V	C251
C73	21-13740F32	16 pF	C252
C74	21-13740F40	36 pF	C253
C75	21-13740F18	4.3 ±0.25 pF	C254
C76	21-13743E20	0.1 uF 10%; 16 V	C255
C79	21-13740F31	15 pF	C256
C80	---	Not Used	C257
C83	21-13743E20	0.1 uF 10%; 16 V	C258, 2
C85 thru 87	21-13740F55	150 pF	C260
C88, 89	21-13741F49	.01 uF	C261
C101	21-13741F29	1500 pF	C262, 2
C102	21-13741F49	.01 uF	C264
C103	23-11049A98	tantalum 47 uF 10%; 10 V	C265, 2
C104	21-13740F10	2 ±0.25 pF	C267
C105	23-11049C08	tantalum 33 uF 10%; 20 V	C268
C106	21-13743E20	0.1 uF 10%; 16 V	C269, 2
C107	08-11051A19	poly 1 uF; 63 V	C271
C108	21-13743E04	.016 uF 10%; 16 V	C272
C111	21-13740F10	2 ±0.25 pF	C273
C112	21-13740F51	100 pF	C274 th
C113	21-13741F25	1000 pF	C277
C114	23-11049A07	tantalum 1 uF 10%; 16 V	C278
C151	21-13740L18	10 pF 2%	C301
			C302

Parts List for  
VHF RF Board, 146-174 MHz, 12.5 & 25 kHz  
(Part of HUD3119A Transceiver)



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	21-13740L28	27 pF 2%
	21-13740L01	2.0 ±0.1 pF
	21-13741F29	1500 pF
	21-13740L05	3.0 ±0.1 pF
3	21-13740L01	2.0 ±0.1 pF
	---	Not Used
	21-13741F29	1500 pF
	21-13743E20	0.1 uF 10%; 16 V
3	21-13741F29	1500 pF
	21-13740F31	15 pF
	21-13740F25	8.2 ±0.25 pF
	---	Not Used
7	21-13741F29	1500 pF
9	21-13740F19	4.7 ±0.25 pF
	21-13741F29	1500 pF
	21-13740F27	10 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
7	21-13741F29	1500 pF
	21-13740F10	2 ±0.25 pF
	21-13740F05	1.2 ±0.25 pF
	21-13740F27	10 pF
	21-13740F37	27 pF
	21-13740F39	33 pF
	21-13741F29	1500 pF
	21-13740F31	15 pF
	21-13740F05	1.2 ±0.25 pF
	21-13741F49	.01 uF
	21-13741F29	1500 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
5	21-13740F51	100 pF
7	21-13741F49	.01 uF
	21-13740F55	150 pF
	21-13740F60	240 pF
	21-13741F29	1500 pF
4	21-13741F17	470 pF
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F60	240 pF
	21-13743E20	0.1 uF 10%; 16 V
	23-11049A09	tantalum 2.2 uF 10%; 20 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13743E20	0.1 uF 10%; 16 V
	21-13743E11	.039 uF 10%; 16 V
	21-13741F25	1000 pF
	---	Not Used
228	23-11049J11	tantalum 4.7 uF 10%; 16 V
233	---	Not Used
	21-13740F60	240 pF
	21-13741F29	1500 pF
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	---	Not Used
	21-13740F36	24 pF
	21-13741F29	1500 pF
	21-13741F43	5600 pF
	21-13743E05	.018 uF 10%; 16 V
	23-11049J11	tantalum 4.7 uF 10%; 16 V
	23-11049A07	tantalum 1 uF 10%; 16 V
	21-13741F43	5600 pF
	21-13743E20	0.1 uF 10%; 16 V
	21-13740F30	13 pF
	21-13740F03	1 ±0.25 pF
	21-13740F38	30 pF
	21-13740F21	5.6 ±0.25 pF
	21-13740F15	3.3 ±0.25 pF
	21-13741F29	1500 pF
	21-13743E20	0.1 uF 10%; 16 V
9	21-13740F15	3.3 ±0.25 pF
	21-13740F21	5.6 ±0.25 pF
	---	Not Used
	21-13741F29	1500 pF
3	21-13740F31	15 pF
	---	Not Used
6	21-13743E20	0.1 uF 10%; 16 V
	21-13740F09	1.8 ±0.25 pF
0	21-13741F29	1500 pF
	21-13740F25	8.2 ±0.25 pF
	21-13740F15	3.3 ±0.25 pF
	21-13743K16	0.22 uF +80/-20%; 16 V
276	21-13741F29	1500 pF
	21-13740F19	4.7 ±0.25 pF
	21-13741F29	1500 pF
	21-13741F49	.01 uF
	21-13740F69	560 pF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	C303	23-11049A98 tantalum 47 uF 10%; 10 V
	C304, 305	21-13741F49 .01 uF
	C306, 307	23-11049C05 tantalum 47 uF 10%; 16V
	C308	21-13741F49 .01 uF
	C309	21-13741F29 1500 pF
		<b>diode: (see note)</b>
	CR1	48-80154K03 dual Schottky SOT
	CR2 thru 7	48-80142L01 silicon PIN SOT MMBV3401
	CR8	48-80939T01 Schottky SOT
	CR51	48-80154K03 dual Schottky SOT
	CR152	48-62824C03 silicon varactor SOT 1SV232
	CR153	48-80154K02 dual Schottky SOT
	CR201 thru 203	48-13833C07 dual silicon SOT MMBD7000
	CR206	48-80154K02 dual Schottky SOT
	CR252, 253	48-62824C03 silicon varactor SOT 1SV232
		<b>filter:</b>
	FL51	91-80098D04 455 kHz 4F
	FL52	91-80097D04 455 kHz 6F
	FL53	91-80098D06 455 kHz 4D
	FL54	91-80097D06 455 kHz 6D
		<b>connector, receptacle:</b>
	J4	09-80476U01 mini UHF coax
	J5	09-80135M01 coaxial (TX)
	J6	09-80130M03 14-pin, RF board
		<b>coil, rf:</b>
	L1 thru 4	24-84562T19 10 turns airwound 2%
	L5	24-62587N69 chip 1.2 uH 5%
	L6	24-62587N51 chip 68 nH 5%
	L7	24-62587N69 chip 1.2 uH 5%
	L8 thru 10	24-84562T19 10 turns airwound 2%
	L11, 12	24-62587N69 chip 1.2 uH 5%
	L13 thru 15	24-84562T19 10 turns airwound 2%
	L16, 17	24-62587N69 chip 1.2 uH 5%
	L18 thru 20	24-84562T19 10 turns airwound 2%
	L21	24-62587N69 chip 1.2 uH 5%
	L22	24-62587N41 chip 10 nH 5%
	L51	24-62587N55 chip 0.15 uH 5%
	L52	24-62587N62 chip 0.56 uH 5%
	L53, 54	24-62587N68 chip 1 uH 5%
	L58	24-62587N70 chip 1.5 uH 5%
	L151	24-60591X04 6 turns
	L152	24-62587N69 chip 1.2 uH 5%
	L153	24-62587N54 chip 0.12 uH 5%
	L154 thru 156	24-62587N69 chip 1.2 uH 5%
	L157	24-62587N50 chip 56 nH 5%
	L181	24-62587N51 chip 68 nH 5%
	L182	24-62587N49 chip 47 nH 5%
	L183	24-62587N69 chip 1.2 uH 5%
	L184	24-62587N48 chip 39 nH 5%
	L185	24-62587N48 chip 39 nH 5%
	L201, 202	24-62587N76 chip 4.7 uH 5%
	L251	24-62587N69 chip 1.2 uH 5%
	L252	24-62587N51 chip 68 nH 5%
	L253, 254	24-60591X03 5 turns
	L255 thru 257	24-62587N69 chip 1.2 uH 5%
	L258	24-62587N53 chip 0.1 uH 5%
	L259, 260	24-62587N69 chip 1.2 uH 5%
	L261	24-62587N56 chip 0.18 uH 5%
	L262	24-62587N69 chip 1.2 uH 5%
		<b>transistor: (see note)</b>
	Q1	48-13827A24 NPN; type MRF5812
	Q2	48-13824A17 PNP; type MMBT3906
	Q51, 52	48-13827A07 NPN; type MMBR941
	Q53, 54	48-80947V01 digital NPN; type DTC144W
	Q101	48-13824A17 PNP; type MMBT3906
	Q102	48-80214G02 NPN; type MMBT3904
	Q103	48-13824A17 PNP; type MMBT3906
	Q104	48-80947V01 digital NPN; type DTC144W
	Q105	48-80214G02 NPN; type MMBT3904
	Q151	48-84235R02 field effect; type MMBFU310
	Q152 thru 154	48-13827A07 NPN; type MMBR941
	Q201	48-13824A17 PNP; type MMBT3906
	Q202	48-80214G02 NPN; type MMBT3904
	Q203, 204	48-80494U01 digital PNP; type DTA144W
	Q205	48-80214G02 NPN; type MMBT3904
	Q251	48-84235R02 field effect; type MMBFU310
	Q252 thru 254	48-13827A07 NPN; type MMBR941
	Q276	48-80214G02 NPN; type MMBT3904

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	R1, 2	---
	R3	06-62057#
	R4	06-62057#
	R5	06-62057#
	R6	06-80195#
	R7	06-62057#
	R8 thru 13	06-62057#
	R14	06-62057E
	R15	06-62057#
	R16	06-62057#
	R17	06-62057#
	R51	06-62057#
	R52	06-62057#
	R53	06-62057#
	R54	06-62057#
	R55	06-62057#
	R56	06-62057#
	R57	06-62057#
	R58	06-62057#
	R59	06-62057#
	R60	06-62057#
	R63	06-62057#
	R64	06-62057#
	R65	06-62057#
	R66	06-62057#
	R68 thru 70	06-62057#
	R71	06-62057#
	R101, 102	06-62057#
	R103	06-62057#
	R104	06-62057#
	R105	06-62057#
	R106	06-62057#
	R107	06-62057#
	R108	06-62057#
	R109	06-62057#
	R110, 111	06-62057#
	R112	06-62057#
	R113	06-62057#
	R114	06-62057#
	R115	06-62057#
	R116	06-62057#
	R151	06-62057#
	R152	06-62057#
	R153	06-62057#
	R154	06-62057#
	R155	06-62057#
	R156	06-62057#
	R157	---
	R158	06-62057#
	R159	06-62057#
	R160	06-62057#
	R161	06-62057#
	R165	06-62057#
	R166 thru 169	06-62057#
	R170	06-62057#
	R181	---
	R182	06-62057#
	R183	---
	R201	06-62057#
	R202	06-62057#
	R203	06-62057#
	R204	06-62057#
	R205	06-62057#
	R206	06-62057#
	R211	06-62057#
	R212, 213	06-62057#
	R214	---
	R215	06-62057#
	R216	06-62057#
	R217	06-62057#
	R251, 252	06-62057#
	R253	06-62057#
	R254	06-62057#
	R255	06-62057#
	R256	06-62057#
	R257	06-62057#
	R258	---
	R259	06-62057#
	R260	06-62057#
	R261	06-62057#
	R262	---

DESCRIPTION
resistor, chip +/-5%; 1/16 W:
unless otherwise stated
Not Used
2.7k
10k
12k
62; 1/2 W
330
3k
0
680
4.7k
10
51
12k
33k
2.4k
100
2k
100k
13k
68k
22k
27k
56k
3.3k
820
10k
2.2k
33
10k
3.6k
680
3.6k
110
470
100
0
3.6k
8.2k
33k
100k
10k
22
10k
33
2.7k
680
100
Not Used
2.7k
820
2k
100
100
470
51
Not Used
0
Not Used
10k
470
100
4.7k
68k
4.7k
220k
10k
Not Used
1k
51
2.2k
56
10k
22
33
2.7k
820
Not Used
100
2.7k
820
Not Used

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R263	06-62057A25	100
R264	06-62057A41	470
R265	06-62057A01	10
R266	06-62057A41	470
R267	06-62057A13	33
R268	06-62057A59	2.7k
R269	06-62057A47	820
R270	06-62057A41	470
R271	06-62057A25	100
R301	06-62057A35	270
R302	06-62057A01	10
<b>integrated circuit: (see note)</b>		
U1	51-80470U01	double-balanced mixer
U2 thru 4	48-09939C04	dual transistor switch UMC3TL
U51	51-80605E02	receiver system
U52	51-05663U35	quad analog switch 4066B
U53	51-05663U35	quad analog switch 4066B
U101	51-80154R02	synthesizer MB15A02PF
U201	51-05457W72	synthesizer
U202	51-80404C08	reference oscillator 19.2 MHz
U251	48-09939C04	dual transistor switch UMC3TL
U252	48-09939C04	dual transistor switch UMC3TL
U301	51-05469E65	5 V regulator LP2951C
U302	51-13806A35	shift register MC14094B
<b>crystal: (see note)</b>		
Y51	91-80022M06	filter 44.85 MHz (includes Y51A and Y51B)
Y52	48-80606B07	44.395 MHz

non-referenced items		
	26-04398J01	shield component side (2 used, TX synthesizer and 17.8 V supply)
	26-04399J01	shield component side (2 used, RF amp and mixer)
	26-80228L01	shield component side (1 used over J5)
	26-80473U01	shield component side (3 used, RX VCO, TX VCO and RX synthesizer)
	26-80520U01	shield solder side small (3 used)
	26-80588D05	shield solder side large (3 used)

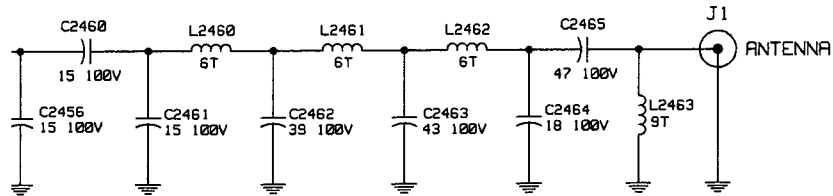
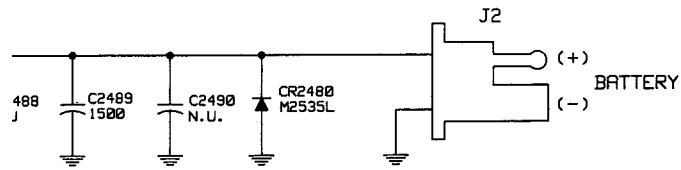
**note:** For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

C157, C159

C22, C22'

C22



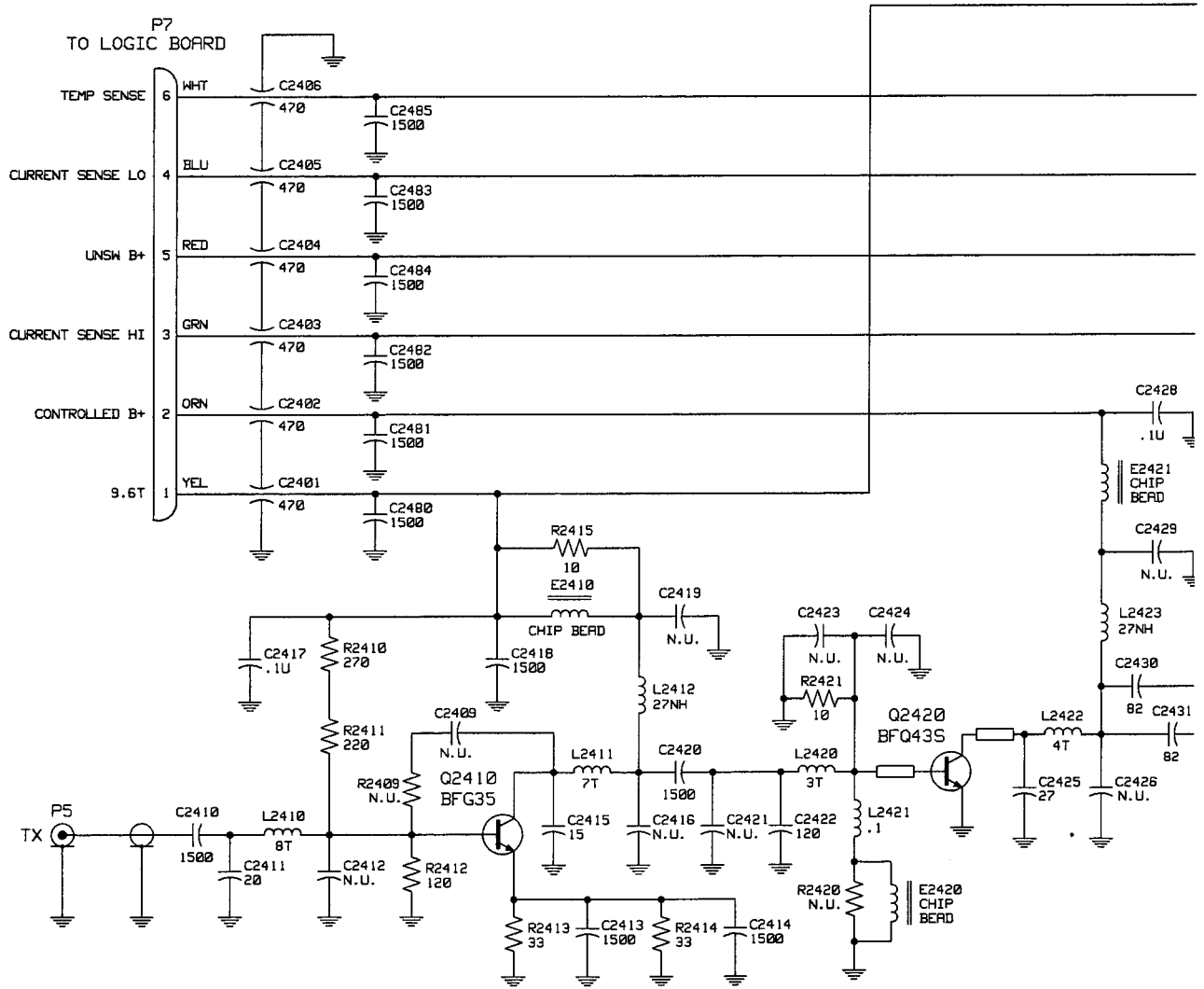


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RPD-97147-0

*Circuit Board Details and Schematic Diagram for  
VHF Power Amplifier Board, 146-174 MHz, 25-50 W  
(Part of HUD3119A Transceiver)*









# Parts Li

HLD3014A VHF

## REFERENCE SYMBOL

- C2401 thru 24
- C2409
- C2410
- C2411
- C2412
- C2413, 2414
- C2415
- C2416
- C2417
- C2418
- C2419
- C2420
- C2421
- C2422
- C2423, 2424
- C2425
- C2426
- C2428
- C2429
- C2430, 2431
- C2433
- C2438
- C2439
- C2440
- C2441, 2442
- C2443
- C2444
- C2445
- C2450, 2451
- C2452, 2453
- C2454, 2455
- C2456
- C2458
- C2459
- C2460, 2461
- C2462
- C2463
- C2464
- C2465
- C2470
- C2480 thru 24
- C2487, 2488
- C2489
- C2490
  
- CR2480
  
- E2410
- E2420, 2421
- E2430, 2431
- E2440
- E2450
  
- J1
- J2
  
- L2410
- L2411
- L2412
- L2420
- L2421
- L2422
- L2423
- L2431
- L2432
- L2440
- L2450
- L2451
- L2460 thru 24
- L2463
  
- P5
- P7

Parts List for  
VHF Power Amplifier Board, 146-174 MHz, 25-50 W  
(Part of HUD3119A Transceiver)

st

Power Amplifier, 146-174 MHz, 25-50 W PL-971035-O

MOTOROLA PART NO.	DESCRIPTION
	<b>capacitor, fixed: uF +/-5%; 50 V:</b>
06 21-84874K01	470 pF feedthru
--	Not Used
21-13741F29	1500 pF
21-13740F34	20 pF
--	Not Used
21-13741F29	1500 pF
21-13740F31	15 pF
---	Not Used
21-13743E20	0.1 uF 10%; 16 V
21-13741F29	1500 pF
---	Not Used
21-13741F29	1500 pF
---	Not Used
21-13740F53	120 pF
---	Not Used
21-13740F37	27 pF
---	Not Used
21-13743E20	0.1 uF 10%; 16 V
---	Not Used
21-13740F49	82 pF
21-13741B69	0.1 uF
21-13741W01	1 uF 10%; 25 V
21-13740B65	470 pF
21-11078B49	180 pF 100 V
---	Not Used
21-11078B53	270 pF 100 V
21-11078B52	240 pF 100 V
---	Not Used
---	Not Used
21-11078B44	120 pF 100 V
21-11078B35	51 pF 100 V
21-11078B18	15 pF 100 V
21-13741W01	1 uF 10%; 25 V
21-13740B65	470 pF
21-11078B18	15 pF 100 V
21-11078B32	39 pF 100 V
21-11078B33	43 pF 100 V
21-11078B20	18 pF 100 V
21-11078B34	47 pF 100 V
21-13741F29	1500 pF
186 21-13741F29	1500 pF
21-13741B69	0.1 uF
21-13741F29	1500 pF
---	Not Used
	<b>diode: (see note)</b>
48-80236E07	transient suppressor
	<b>ferrite beads:</b>
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
	<b>connector, receptacle:</b>
09-80131M01	mini UHF coax
09-80255E01	power (includes feedthru)
	<b>coil, rf:</b>
24-60591F77	8 turns
24-60591E77	7 turns
24-62587N46	chip 27 nH 5%
24-60591A01	3 turns
24-62587N53	chip .1 uH 5%
24-60591B73	4 turns
24-62587N46	chip 27 nH 5%
24-60591S77	9 turns
24-60591B73	4 turns
24-62587N53	chip 0.1 uH 5%
24-60591X04	6 turns
24-60591X03	5 turns
162 24-60591X04	6 turns
24-60591S77	9 turns
	<b>connector, plug:</b>
30-80138M07	coaxial cable 150 mm with plug
01-80556B01	cable and connector assembly, 6-pin (includes C2401-6 and feedthru bracket)

HLD3014A VHF Power Amplifier, 146-174 MHz, 25-50 W

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>transistor: (see note)</b>
Q2410	48-02245J24	NPN; type BFG35
Q2420	48-02245J28	NPN; type BFG43S
Q2430	48-80225C18	NPN; type MRF2628
Q2440	48-84411L04	NPN; type M1104
		<b>resistor, fixed: +/-5%; unless otherwise stated</b>
R2409	---	Not Used
R2410	06-11077A60	270; 1/8 W
R2411	06-11077A58	220; 1/8 W
R2412	06-62057A27	120
R2413, 2414	06-11077A38	33; 1/8 W
R2415	06-62057A01	10
R2420	---	Not Used
R2421	06-62057A01	10
R2430	06-11077A26	10; 1/8 W
R2431	06-80195M25	100; 1/2 W
R2440	06-11077A26	10; 1/8 W
R2470	17-05603W01	metal .01
R2471	06-62057A13	33
R2472	06-05621T02	thermistor 50k @ 25° C
R2473	06-62057A85	33k
R2474	06-62057A51	1.2k
		<b>non-referenced items</b>
	01-04006J22	transistor heatsink ass'y
	02-00007003	Q2420 and 26-80158L
	03-10943M10	nut 8-32 x 5/16 x 1/8 (for
	03-10943M11	screw M3 x .5 x 8 (8 us
	04-00131974	washer (2 used for J2)
	04-05587G01	plastic washer (for ante
	26-80223M07	PA shield
	26-80475U01	heat sink
	29-80014A03	clip coax terminal
	32-80014N03	gasket, accessory conn
	42-80281L01	ground clip (2 used for
	42-80520B01	ground clip

**note:** For optimum performance, diodes, transistors, and interconnects must be ordered by Motorola part numbers.

16 W:

---

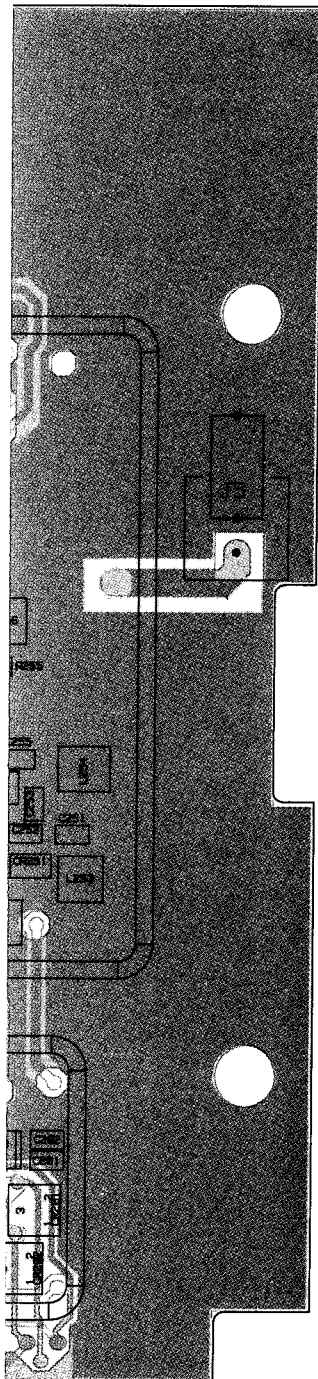
(includes  
1 heatsink  
(J1)  
d)  
ed for J2)  
na post)

ector  
(2440)

---

ated circuits



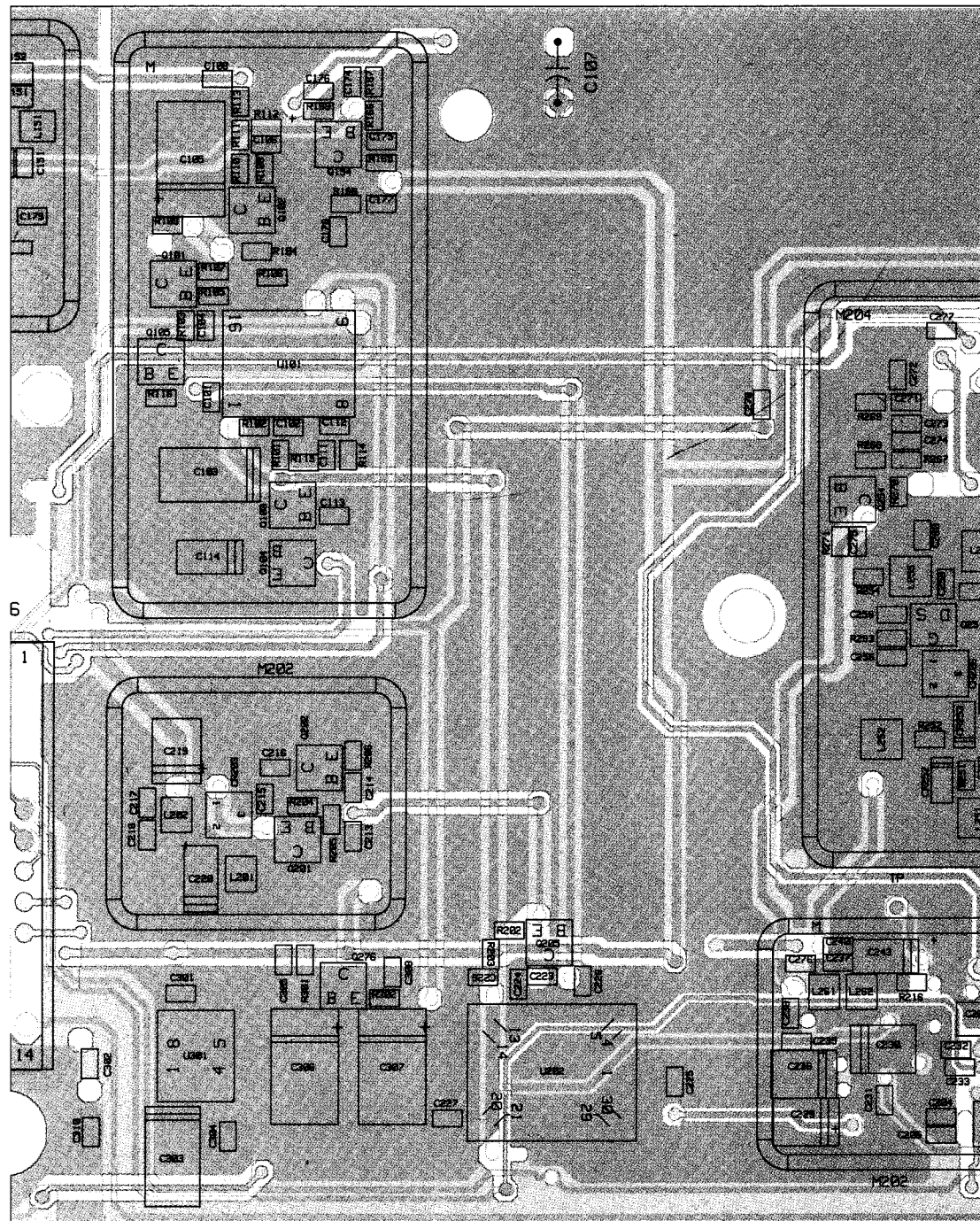


*Circuit Board Details for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUE3191A Transceiver)*

6-25-97

84D80433U01 ISSUE 0

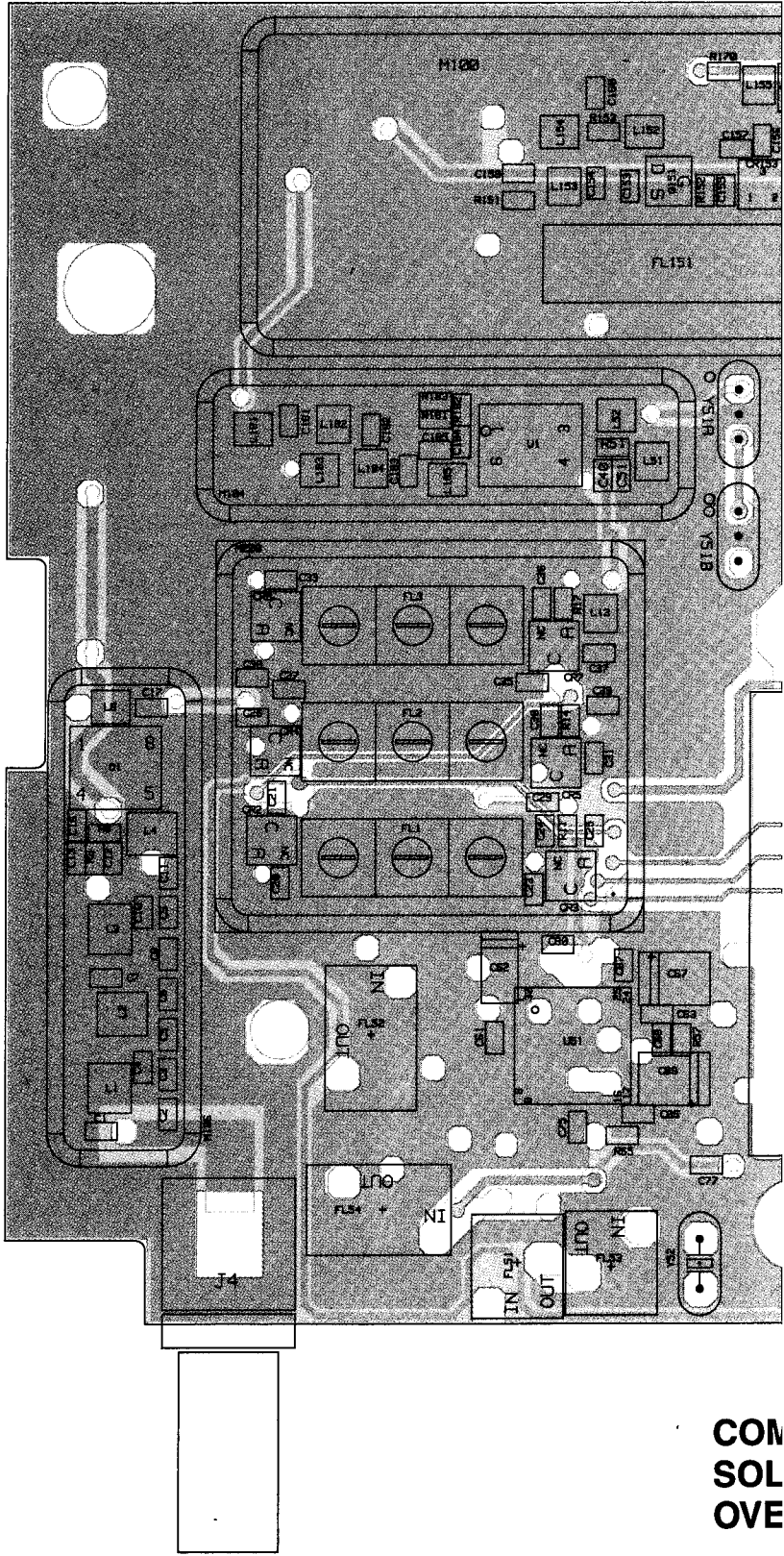
COMPONENT SIDE



COMPONENT SIDE INNER LAYER (GRAY)  
OTHER SIDE INNER LAYER (PINK)  
SILVER PASTE LAYER -----

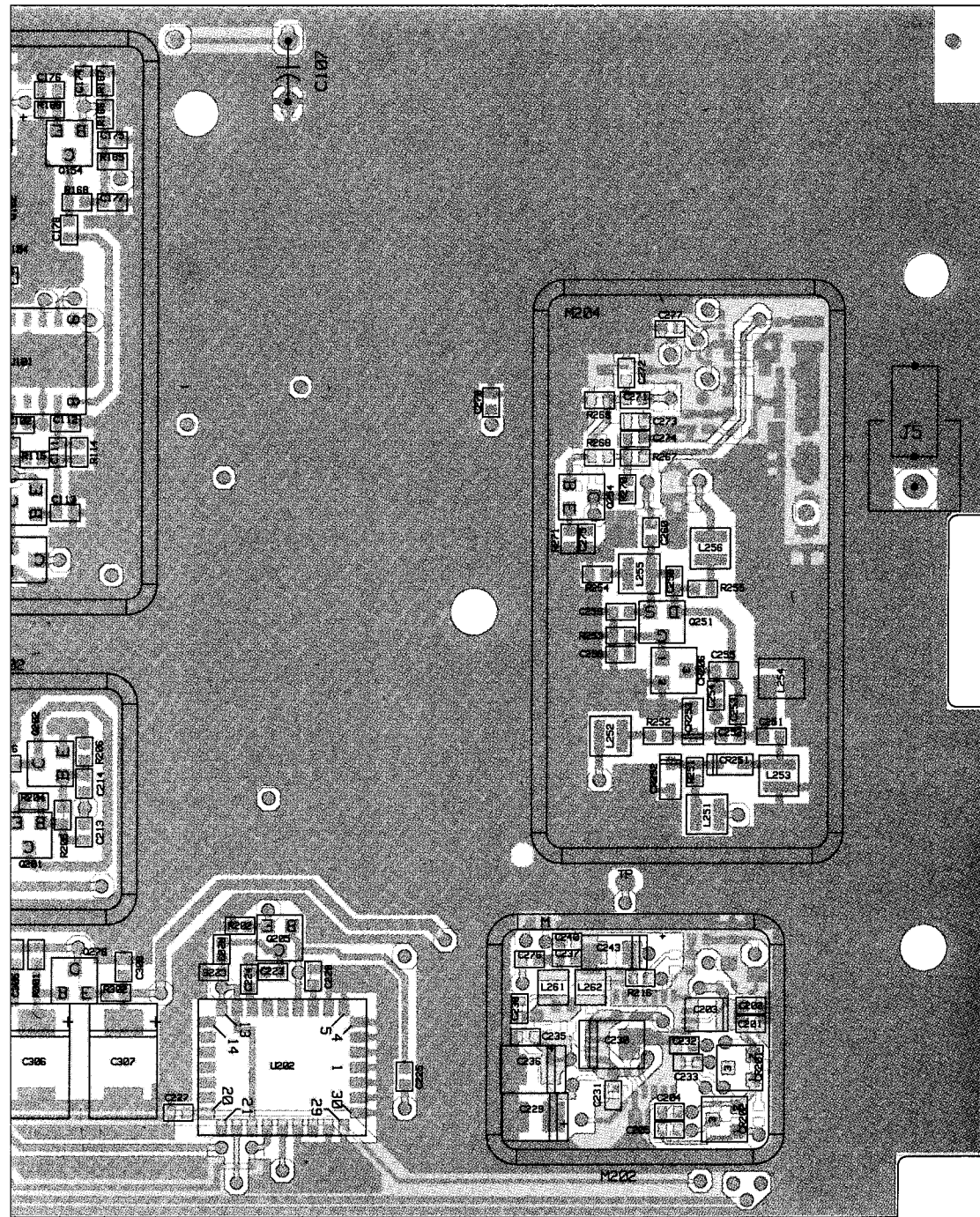
RCB-97169-O  
RCB-97170-O  
RCB-97172-O

COMPONENT SIDE VIEW



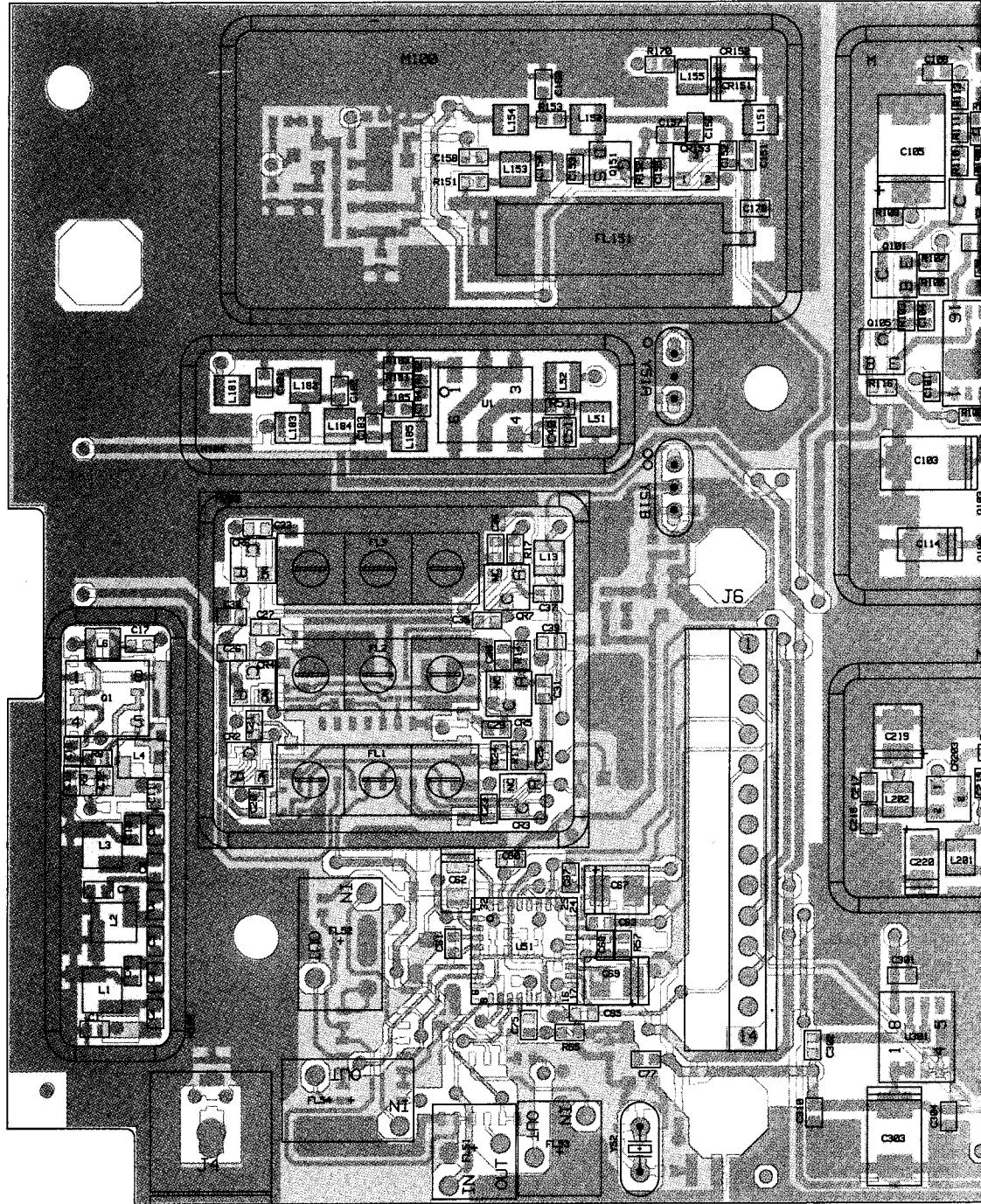
CON  
SOL  
OVE





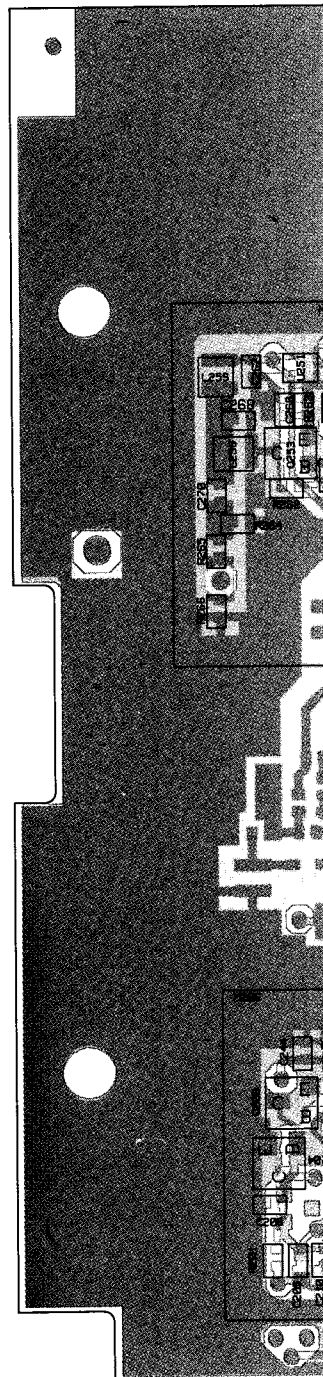
RAY) RCB-97168-O  
RCB-97171-O  
RCB-96172-O

NT SIDE VIEW



COMPONENT SIDE (C  
SOLDER SIDE (PINK)  
OVERLAY -----

COMPONEN



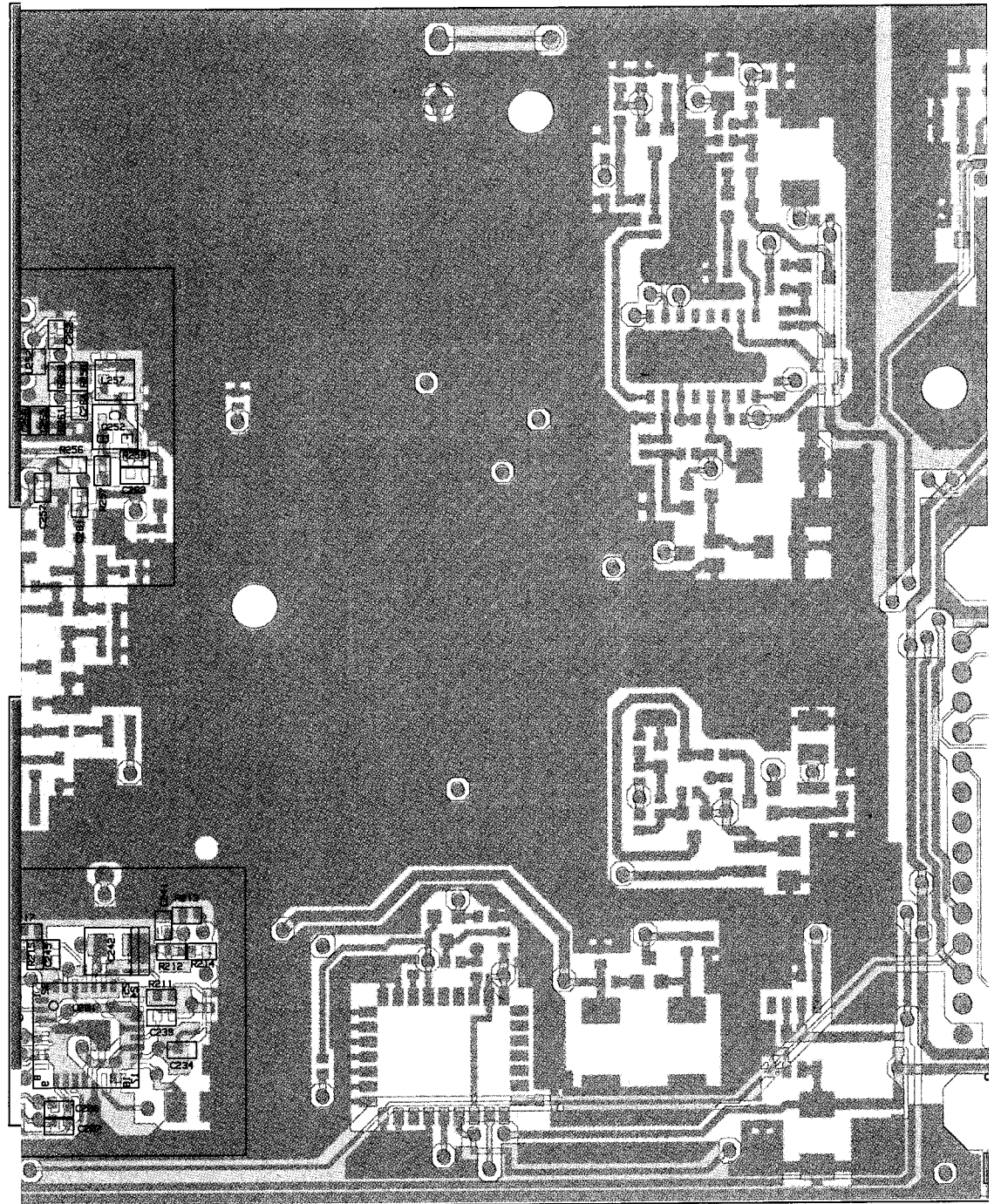
*Circuit Board Details for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUE3191A Transceiver)*



6-25-97

84D80433U01 ISSUE 0

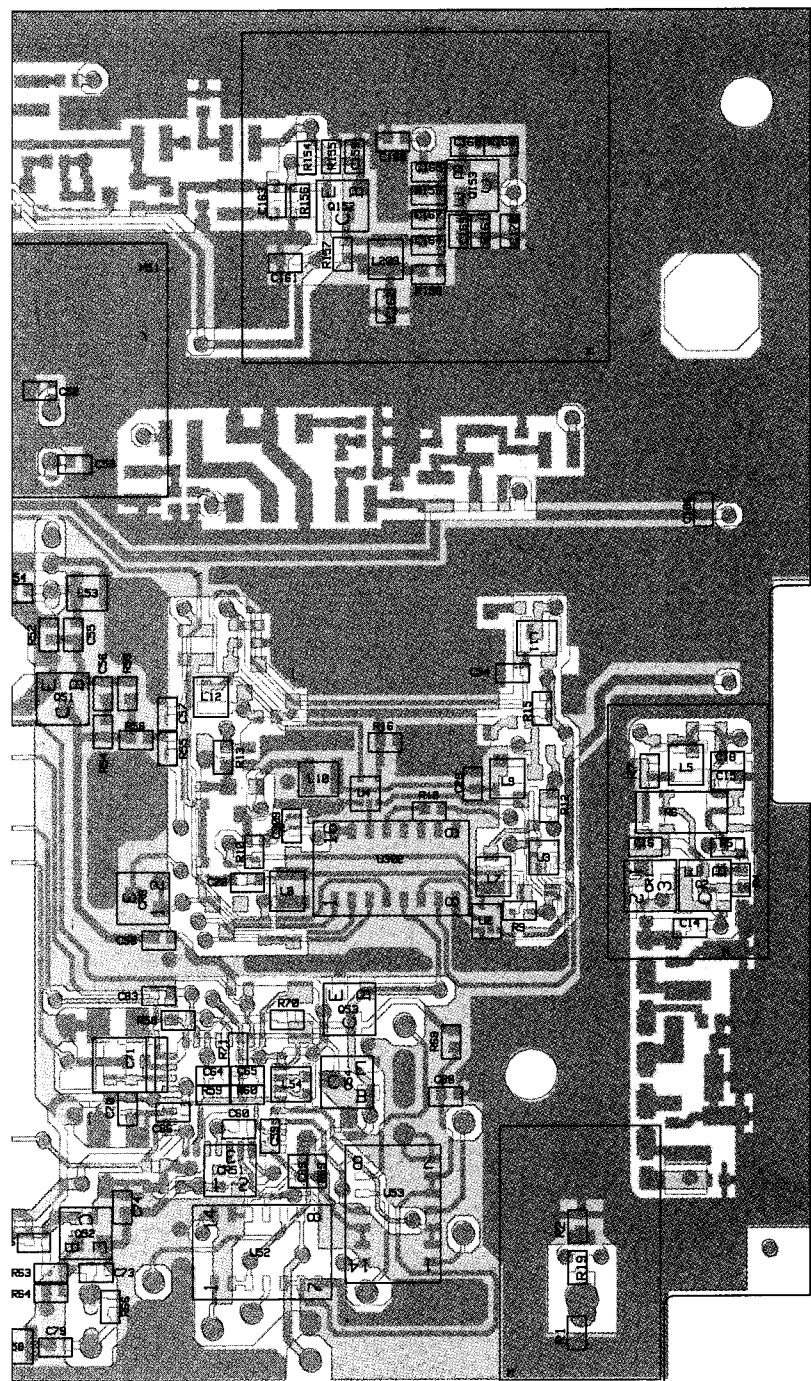
SOLDER SIDE



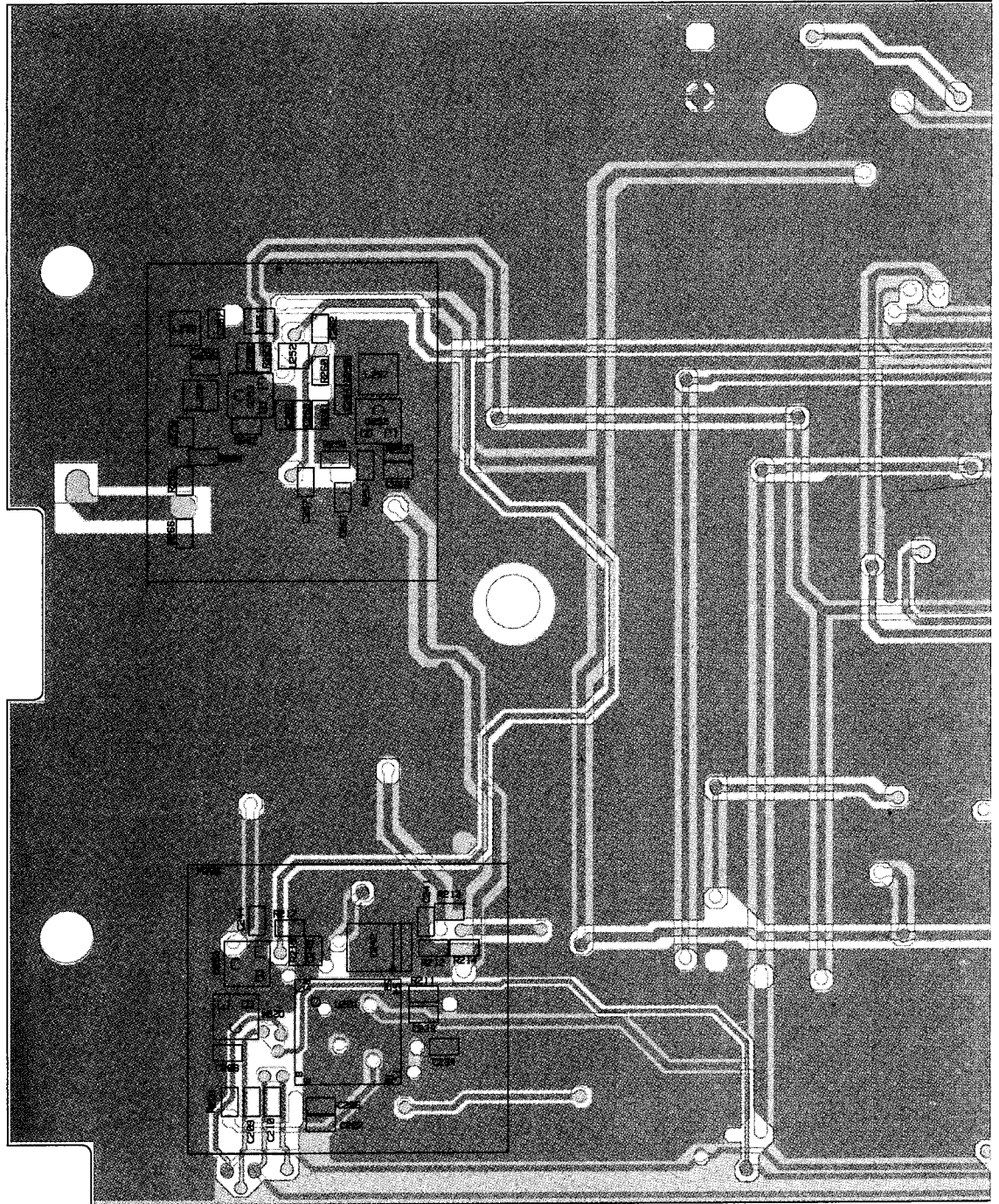
**COMPONENT SIDE (GRAY)**  
**SOLDER SIDE (PINK)**  
**OVERLAY -----**

RCB-97168-O (REV)  
RCB-97171-O (REV)  
RCB-97173-O

**SOLDER SIDE VIEW**





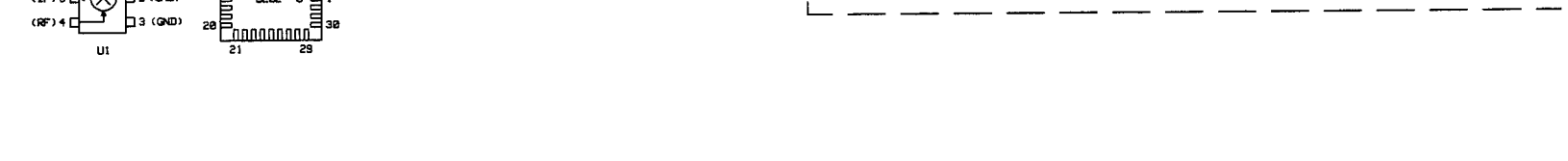
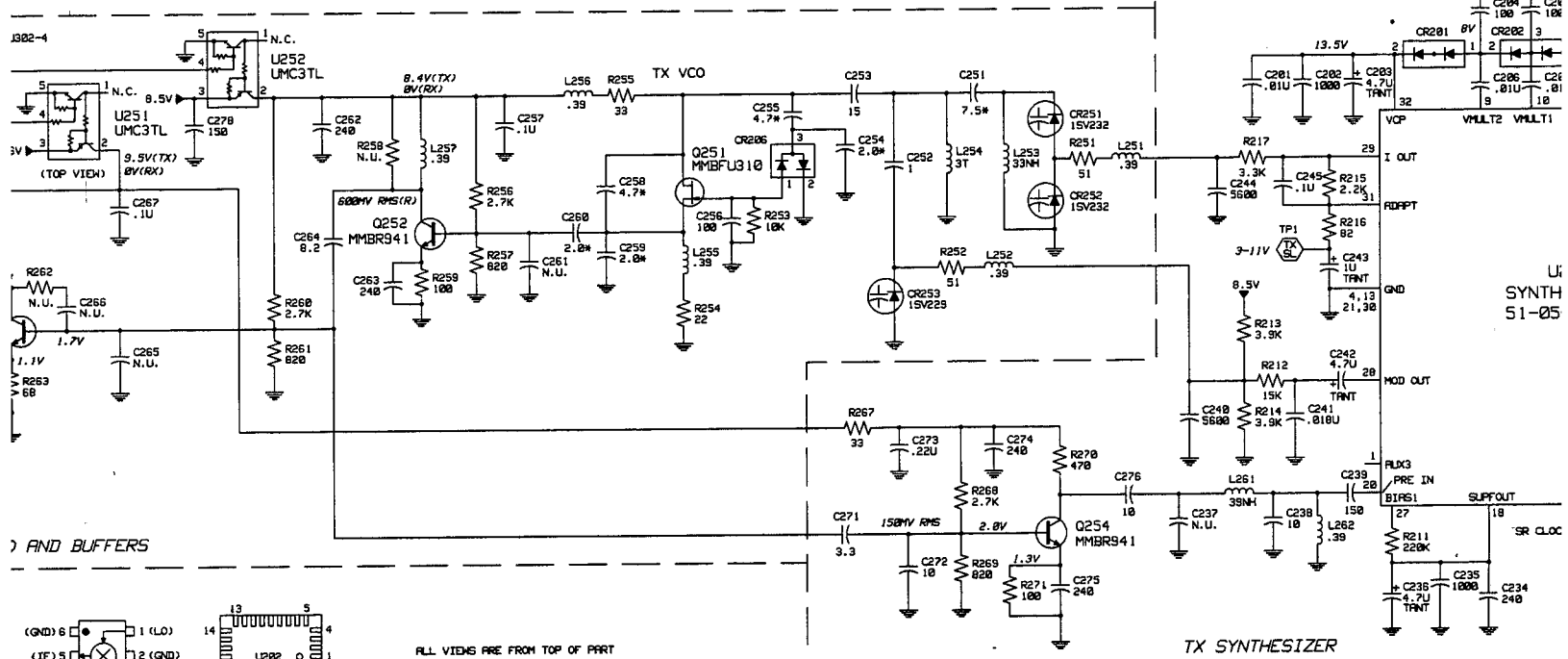
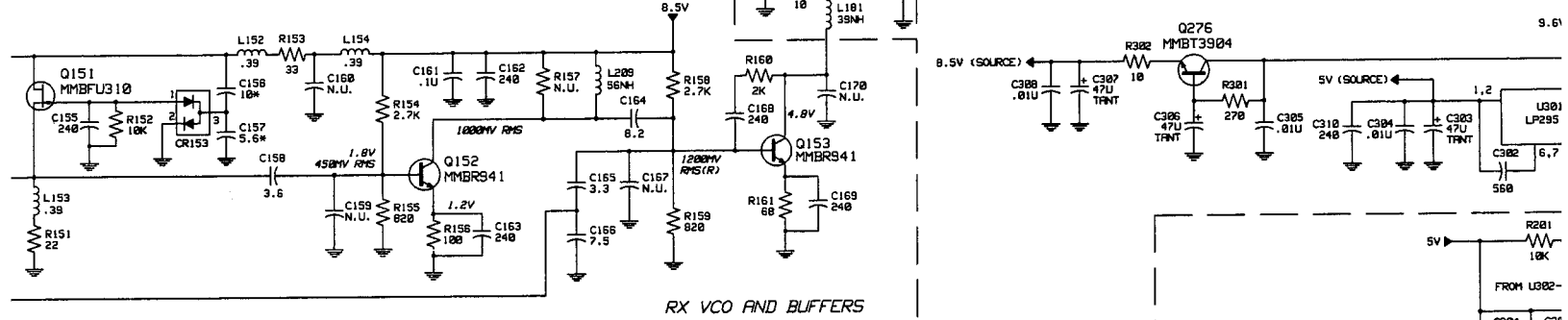
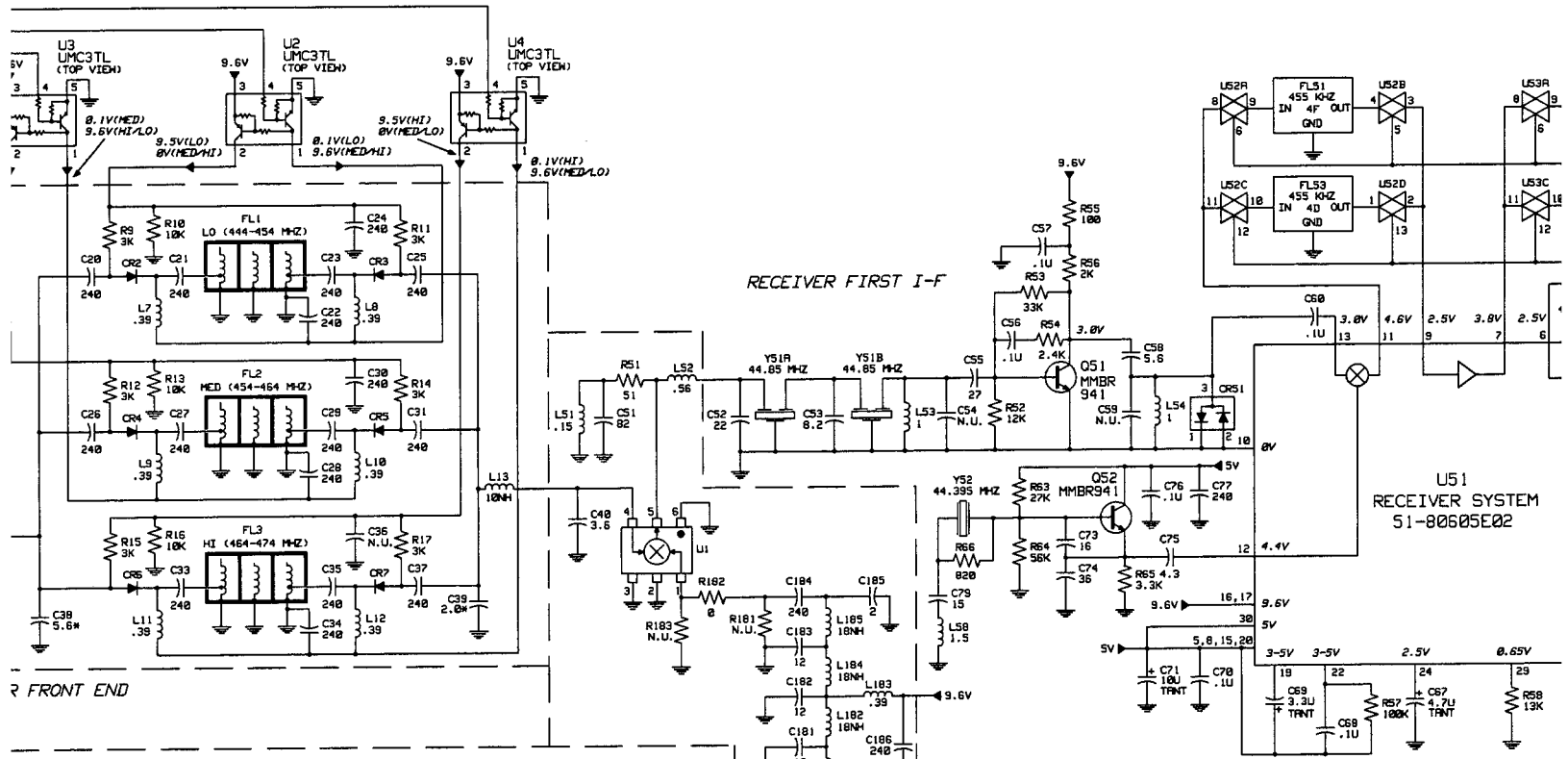


**COMPONENT SIDE INNER LAY  
SOLDER SIDE INNER LAYER (   
OVERLAY -----**

**SOLDER SI**









DESCRIPTION
0
51
12k
33k
2.4k
100
2k
100k
13k
68k
22k
27k
56k
3.3k
820
10k
2.2k
33
10k
3.6k
680
3.6k
110
470
100
0
3.6k
8.2k
33k
100k
10k
22
10k
33
2.7k
820
100
Not Used
2.7k
820
2k
68
100
470
51
Not Used
0
Not Used
10k
1k
100
4.7k
68k
4.7k
220k
15k
3.9k
2.2k
82
3.3k
51
10k
22
33
2.7k
820
Not Used
100
2.7k
820
Not Used
68
470
12
470
33
2.7k
820
470
100
270
10

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
U1	51-80470U01	<b>integrated circuit: (see note)</b> double-balanced mixer
U2, thru 4	48-09939C04	dual transistor switch UMC3TL
U51	51-80605E02	receiver system
U52, 53	51-05663U35	quad analog switch 4066B
U101	51-80154R02	synthesizer MB15A02PF
U201	51-05457W72	synthesizer
U202	51-80404C08	reference oscillator 19.2 MHz
U251, 252	48-09939C04	dual transistor switch UMC3TL
U301	51-05469E65	5 V regulator LP2951C
U302	51-13806A35	shift register MC14094B
Y51	91-80022M06	<b>crystal: (see note)</b> filter 44.85 MHz (includes Y51A and Y51B)
Y52	48-80606B07	44.395 MHz
<b>non-referenced items</b>		
	26-04398J01	shield component side (2 used, TX synthesizer and 17.8V supply)
	26-04399J01	shield component side (1 used, U1 mixer)
	26-80228L01	shield component side (1 used over J5)
	26-80473U01	shield component side (3 used, RX VCO, TX VCO and RX synthesizer)
	26-80474U01	shield component side ( 1 used over FL1-3)
	26-80520U01	shield solder side small (2 used)
	26-80588D05	shield solder side large (3 used)

**note:** For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

175  
176, 17

242  
243  
244

JR51  
CR151  
CR15

MOTOROLA PART NO.	DESCRIPTION
21-13740F60	240 pF
21-13740F60	240 pF
---	Not Used
21-13740F27	10 pF
21-13743K16	0.22 uF +80/-20%; 16 V
21-13740F60	240 pF
21-13740F16	3.6 0.25 pF
21-13740F13	2.7 0.25 pF
21-13740F27	10 pF
21-13740F29	12 pF
21-13740F60	240 pF
21-13740F10	2 0.25 pF
21-13740F60	240 pF
21-13741F49	.01 uF
21-13741F25	1000 pF
23-11049J11	tantalum 4.7 uF 10%; 16 V
21-13740F51	100 pF
21-13741F49	.01 uF
21-13740F55	150 pF
21-13741F25	1000 pF
21-13741F17	470 pF
21-13740F60	240 pF
21-13743E20	0.1 uF 10%; 16 V
21-13740F60	240 pF
21-13743E20	0.1 uF 10%; 16 V
23-11049A09	tantalum 2.2 uF 10%; 20 V
23-11049A07	tantalum 1 uF 10%; 16 V
21-13743E20	0.1 uF 10%; 16 V
21-13743E11	.039 uF 10%; 16 V
21-13741F25	1000 pF
---	Not Used
23-11049J11	tantalum 4.7 uF 10%; 16 V
---	Not Used
21-13740F60	240 pF
21-13741F25	1000 pF
23-11049J11	tantalum 4.7 uF 10%; 16 V
---	Not Used
21-13740F27	10 pF
21-13740F55	150 pF
21-13741F43	5600 pF
21-13743E05	.018 uF 10%; 16 V
23-11049J11	tantalum 4.7 uF 10%; 16 V
23-11049A07	tantalum 1 uF 10%; 16 V
21-13741F43	5600 pF
21-13743E20	0.1 uF 10%; 16 V
21-13740L15	7.5 0.1 pF
21-13740F03	1 0.25 pF
21-13740F31	15 pF
21-13740L01	2.0 0.1 pF
21-13740L10	4.7 0.1 pF
21-13740F51	100 pF
21-13743E20	0.1 uF 10%; 16 V
21-13740L10	4.7 0.1 pF
21-13740L01	2.0 0.1 pF
---	Not Used
21-13740F60	240 pF
21-13740F25	8.2 0.25 pF
---	Not Used
21-13743E20	0.1 uF 10%; 16 V
---	Not Used
21-13740F60	240 pF
21-13740F15	3.3 0.25 pF
21-13740F27	10 pF
21-13743K16	0.22 uF +80/-20%; 16 V
21-13740F60	240 pF
21-13740F27	10 pF
21-13740F55	150 pF
21-13741F49	.01 uF
21-13740F69	560 pF
23-11049A98	tantalum 47 uF 10%; 10 V
21-13741F49	.01 uF
23-11049C05	tantalum 47 uF 10%; 16 V
21-13741F49	.01 uF
21-13740F60	240 pF
---	diode: (see note)
48-80154K03	dual Schottky SOT
48-80142L01	silicon PIN SOT MMBV3401
48-80939T01	Schottky SOT
48-80154K03	dual Schottky SOT
48-62824C03	silicon varactor SOT 1SV232
48-80154K02	dual Schottky SOT
203 48-13833C07	dual silicon SOT MMBD7000

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR206	48-80154K02	dual Schottky SOT
CR251, 252	48-62824C03	silicon varactor SOT 1SV232
CR253	48-62824C01	silicon varactor SOT 1SV229
---	---	filter:
FL1	91-62994B08	helical filter 444-454 MHz
FL2	91-62994B09	helical filter 454-464 MHz
FL3	91-62994B10	helical filter 464-474 MHz
FL51	91-80098D04	455 kHz 4F
FL52	91-80097D04	455 kHz 6F
FL53	91-80098D06	455 kHz 4D
FL54	91-80097D06	455 kHz 6D
FL151	91-80513U01	resonator
---	---	connector, receptacle:
J4	09-80476U01	mini UHF coax
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board
---	---	coil, rf:
L1 thru 4	24-84562T13	3 turns airwound 2%
L5	24-62587N55	chip 0.15 uH 5%
L6	24-62587N42	chip 12 nH 5%
L7 thru 12	24-62587N60	chip 0.39 uH 5%
L13	24-62587N41	chip 10 nH 5%
L51	24-62587N55	chip 0.15 uH 5%
L52	24-62587N62	chip 0.56 uH 5%
L53, 54	24-62587N68	chip 1 uH 5%
L58	24-62587N70	chip 1.5 uH 5%
L151	24-62587N47	chip 33 nH 5%
L152 thru 155	24-62587N60	chip 0.39 uH 5%
L181	24-62587N48	chip 39 nH 5%
L182	24-62587N44	chip 18 nH 5%
L183	24-62587N60	chip 0.39 uH 5%
L184, 185	24-62587N44	chip 18 nH 5%
L201, 202	24-62587N76	chip 4.7 uH 5%
L209	24-62587N50	chip 56 nH 5%
L251, 252	24-62587N60	chip 0.39 uH 5%
L253	24-62587N47	chip 33 nH 5%
L254	24-84562T13	3 turns airwound 2%
L255 thru 257	24-62587N60	chip 0.39 uH 5%
L258	24-62587N47	chip 33 nH 5%
L259	24-62587N60	chip 0.39 uH 5%
L261	24-62587N48	chip 39 nH 5%
L262	24-62587N60	chip 0.39 uH 5%
---	---	transistor: (see note)
Q1	48-13827A24	NPN; type MRF5812
Q2	48-13824A17	PNP; type MMBT3906
Q51, 52	48-13827A07	NPN; type MMBR941
Q53, 54	48-80947V01	digital NPN; type DTC144W
Q101	48-13824A17	PNP; type MMBT3906
Q102	48-80214G02	NPN; type MMBT3904
Q103	48-13824A17	PNP; type MMBT3906
Q104	48-80947V01	digital NPN; type DTC144W
Q105	48-80214G02	NPN; type MMBT3904
Q151	48-84235R02	field effect; type MMBFU310
Q152 thru 154	48-13827A07	NPN; type MMBR941
Q201	48-13824A17	PNP; type MMBT3906
Q202	48-80214G02	NPN; type MMBT3904
Q203, 204	48-80494U01	digital PNP; type DTA144W
Q205	48-80214G02	NPN; type MMBT3904
Q251	48-84235R02	field effect; type MMBFU310
Q252 thru 254	48-13827A07	NPN; type MMBR941
Q276	48-80214G02	NPN; type MMBT3904
---	---	resistor, chip +/-5%; 1/16 W: unless otherwise stated
R1, 2	---	Not Used
R3	06-62057A59	2.7k
R4	06-62057A73	10k
R5	06-62057A75	12k
R6	06-80195M20	62; 1/2 W
R7	---	Not Used
R8	06-62057A42	510
R9	06-62057A60	3k
R10	06-62057A73	10k
R11, 12	06-62057A60	3k
R13	06-62057A73	10k
R14, 15	06-62057A60	3k
R16	06-62057A73	10k
R17	06-62057A60	3k
R18	06-62057A65	4.7k
R19	06-62057B47	---
R51	06-62057A18	---
R52	06-62057A75	---
R53	06-62057A85	---
R54	06-62057A58	---
R55	06-62057A25	---
R56	06-62057A56	---
R57	06-62057A97	---
R58	06-62057A76	---
R59	06-62057A93	---
R60	06-62057A81	---
R63	06-62057A83	---
R64	06-62057A91	---
R65	06-62057A61	---
R66	06-62057A47	---
R68 thru 70	06-62057A73	---
R71	06-62057A57	---
R101, 102	06-62057A13	---
R103	06-62057A73	---
R104	06-62057A62	---
R105	06-62057A45	---
R106	06-62057A62	---
R107	06-62057A26	---
R108	06-62057A41	---
R109	06-62057A25	---
R110, 111	06-62057B47	---
R112	06-62057A62	---
R113	06-62057A71	---
R114	06-62057A85	---
R115	06-62057A97	---
R116	06-62057A73	---
R151	06-62057A09	---
R152	06-62057A73	---
R153	06-62057A13	---
R154	06-62057A59	---
R155	06-62057A47	---
R156	06-62057A25	---
R157	---	---
R158	06-62057A59	---
R159	06-62057A47	---
R160	06-62057A56	---
R161	06-62057A21	---
R165	06-62057A25	---
R166 thru 169	06-62057A41	---
R170	06-62057A18	---
R181	---	---
R182	06-62057B47	---
R183	---	---
R201	06-62057A73	---
R202	06-62057A49	---
R203	06-62057A25	---
R204	06-62057A65	---
R205	06-62057A93	---
R206	06-62057A65	---
R211	06-62057B06	---
R212	06-62057A77	---
R213, 214	06-62057A62	---
R215	06-62057A57	---
R216	06-62057A22	---
R217	06-62057A61	---
R251, 252	06-62057A1E	---
R253	06-62057A72	---
R254	06-62057A0E	---
R255	06-62057A13	---
R256	06-62057A5E	---
R257	06-62057A47	---
R258	---	---
R259	06-62057A22	---
R260	06-62057A5E	---
R261	06-62057A47	---
R262	---	---
R263	06-62057A22	---
R264	06-62057A47	---
R265	06-62057A02	---
R266	06-62057A47	---
R267	06-62057A13	---
R268	06-62057A5E	---
R269	06-62057A47	---
R270	06-62057A47	---
R271	06-62057A22	---
R301	06-62057A32	---
R302	06-62057A02	---

REFERENCE SYMBOL	MOTOROLA PART NO.
R19	06-62057B47
R51	06-62057A18
R52	06-62057A75
R53	06-62057A85
R54	06-62057A58
R55	06-62057A25
R56	06-62057A56
R57	06-62057A97
R58	06-62057A76
R59	06-62057A93
R60	06-62057A81
R63	06-62057A83
R64	06-62057A91
R65	06-62057A61
R66	06-62057A47
R68 thru 70	06-62057A73
R71	06-62057A57
R101, 102	06-62057A13
R103	06-62057A73
R104	06-62057A62
R105	06-62057A45
R106	06-62057A62
R107	06-62057A26
R108	06-62057A41
R109	06-62057A25
R110, 111	06-62057B47
R112	06-62057A62
R113	06-62057A71
R114	06-62057A85
R115	06-62057A97
R116	06-62057A73
R151	06-62057A09
R152	06-62057A73
R153	06-62057A13
R154	06-62057A59
R155	06-62057A47
R156	06-62057A25
R157	---
R158	06-62057A59
R159	06-62057A47
R160	06-62057A56
R161	06-62057A21
R165	06-62057A25
R166 thru 169	06-62057A41
R170	06-62057A18
R181	---
R182	06-62057B47
R183	---
R201	06-62057A73
R202	06-62057A49
R203	06-62057A25
R204	06-62057A65
R205	06-62057A93
R206	06-62057A65
R211	06-62057B06
R212	06-62057A77
R213, 214	06-62057A62
R215	06-62057A57
R216	06-62057A22
R217	06-62057A61
R251, 252	06-62057A1E
R253	06-62057A72
R254	06-62057A0E
R255	06-62057A13
R256	06-62057A5E
R257	06-62057A47
R258	---
R259	06-62057A22
R260	06-62057A5E
R261	06-62057A47
R262	---
R263	06-62057A22
R264	06-62057A47
R265	06-62057A02
R266	06-62057A47
R267	06-62057A13
R268	06-62057A5E
R269	06-62057A47
R270	06-62057A47
R271	06-62057A22
R301	06-62057A32
R302	06-62057A02



# Parts List

HLE9051A UHF RF Board, 444-474 MHz, 12.5/25 kHz

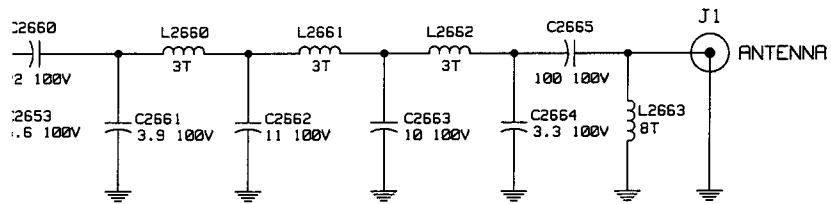
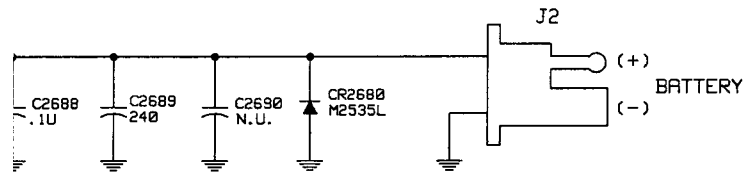
PL-971036-O

HLE9051A U

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFEREN SYMBO
		capacitor, fixed: uF +/-5%; 50 V: unless otherwise stated	C168
C1	21-13740L06	3.3 0.1 pF	C169
C2	21-13740L18	10 pF 2%	C170
C3	21-13740L14	6.8 0.1 pF	C174
C4	21-13740L24	18 pF 2%	C175
C5	21-13740L14	6.8 0.1 pF	C176, 177
C6	21-13740L15	7.5 0.1 pF	C178
C7	21-13740L27	24 pF 2%	C179
C8	21-13740L13	6.2 0.1 pF	C181
C9	21-13740L14	6.8 0.1 pF	C182, 183
C10	21-13740L26	22 pF 2%	C184
C11	21-13740L13	6.2 0.1 pF	C185
C12	21-13740L10	4.7 0.1 pF	C186
C13	21-13740L22	15 pF 2%	C201
C14	21-13740F60	240 pF	C202
C15	21-13740F60	240 pF	C203
C16	---	Not Used	C204, 205
C17	21-13740F60	240 pF	C206, 207
C18	21-13740L12	5.6 0.1 pF	C208, 209
C19	21-13743E20	0.1 uF 10%; 16 V	C210
C20 thru 31	21-13740F60	240 pF	C213, 214
C33 thru 35	21-13740F60	240 pF	C215
C36	---	Not Used	C216
C37	21-13740F60	240 pF	C217
C38	21-13740L12	5.6 0.1 pF	C218
C39	21-13740L01	2.0 0.1 pF	C219
C40	21-13740F16	3.6 0.25 pF	C220
C51	21-13740F49	82 pF	C223
C52	21-13740F35	22 pF	C224
C53	21-13740F25	8.2 0.25 pF	C225
C54	---	Not Used	C226 thru 2
C55	21-13740F37	27 pF	C229, 230
C56, 57	21-13743E20	0.1 uF 10%; 16 V	C231 thru 2
C58	21-13740F21	5.6 ±0.25 pF	C234
C59	---	Not Used	C235
C60	21-13743E20	0.1 uF 10%; 16 V	C236
C61	21-13741F29	1500 pF	C237
C62	23-11049A05	tantalum 0.47 uF 10%; 25 V	C238
C63	21-13740F45	56 pF	C239
C64	21-13740F69	560 pF	C240
C65	21-13741F49	.01 uF	C241
C67	23-11049J11	tantalum 4.7 uF 10%; 16 V	C242
C68	21-13743E20	0.1 uF 10%; 16 V	C243
C69	23-11049A11	tantalum 3.3 uF 10%; 16 V	C244
C70	21-13743E20	0.1 uF 10%; 16 V	C245
C71	23-11049A57	tantalum 10 uF 10%; 16 V	C251
C73	21-13740F32	16 pF	C252
C74	21-13740F40	36 pF	C253
C75	21-13740F18	4.3 0.25 pF	C254
C76	21-13743E20	0.1 uF 10%; 16 V	C255
C77	21-13740F60	240 pF	C256
C79	21-13740F31	15 pF	C257
C80	---	Not Used	C258
C83	21-13743E20	0.1 uF 10%; 16 V	C259, 260
C85 thru 87	21-13740F55	150 pF	C261
C88, 89	21-13741F49	.01 uF	C262, 263
C101	21-13741F25	1000 pF	C264
C102	21-13741F49	.01 uF	C265, 266
C103	23-11049A98	tantalum 47 uF 10%; 10 V	C267
C104	21-13740F10	2 0.25 pF	C268
C105	23-11049C08	tantalum 33 uF 10%; 20 V	C269, 270
C106	21-13743E20	0.1 uF 10%; 16 V	C271
C107	08-11051A19	poly 1 uF; 63 V	C272
C108	21-13743E04	.016 uF 10%; 16 V	C273
C111	21-13740F10	2 0.25 pF	C274, 275
C112, 113	21-13740F51	100 pF	C276
C114	23-11049A07	tantalum 1 uF 10%; 16 V	C277, 278
C151	21-13740L13	6.2 0.1 pF	C301
C152	21-13740L24	18 pF 2%	C302
C153	21-13740L18	10 pF 2%	C303
C154	21-13740L15	7.5 0.1 pF	C304, 305
C155	21-13740F60	240 pF	C306, 307
C156	21-13740L18	10 pF 2%	C308
C157	21-13740L12	5.6 0.1 pF	C309, 310
C158	21-13740F16	3.6 0.25 pF	
C159, 160	---	Not Used	CR1
C161	21-13743E20	0.1 uF 10%; 16 V	CR2 thru 7
C162, 163	21-13740F60	240 pF	CR8
C164	21-13740F25	8.2 0.25 pF	CR51
C165	21-13740F15	3.3 0.25 pF	CR151, 152
C166	21-13740F24	7.5 0.25 pF	CR153
C167	---	Not Used	CR201 thru

Parts List for  
UHF RF Board, 444-474 MHz, 12.5 & 25 kHz  
(Part of HUD3191A Transceiver)



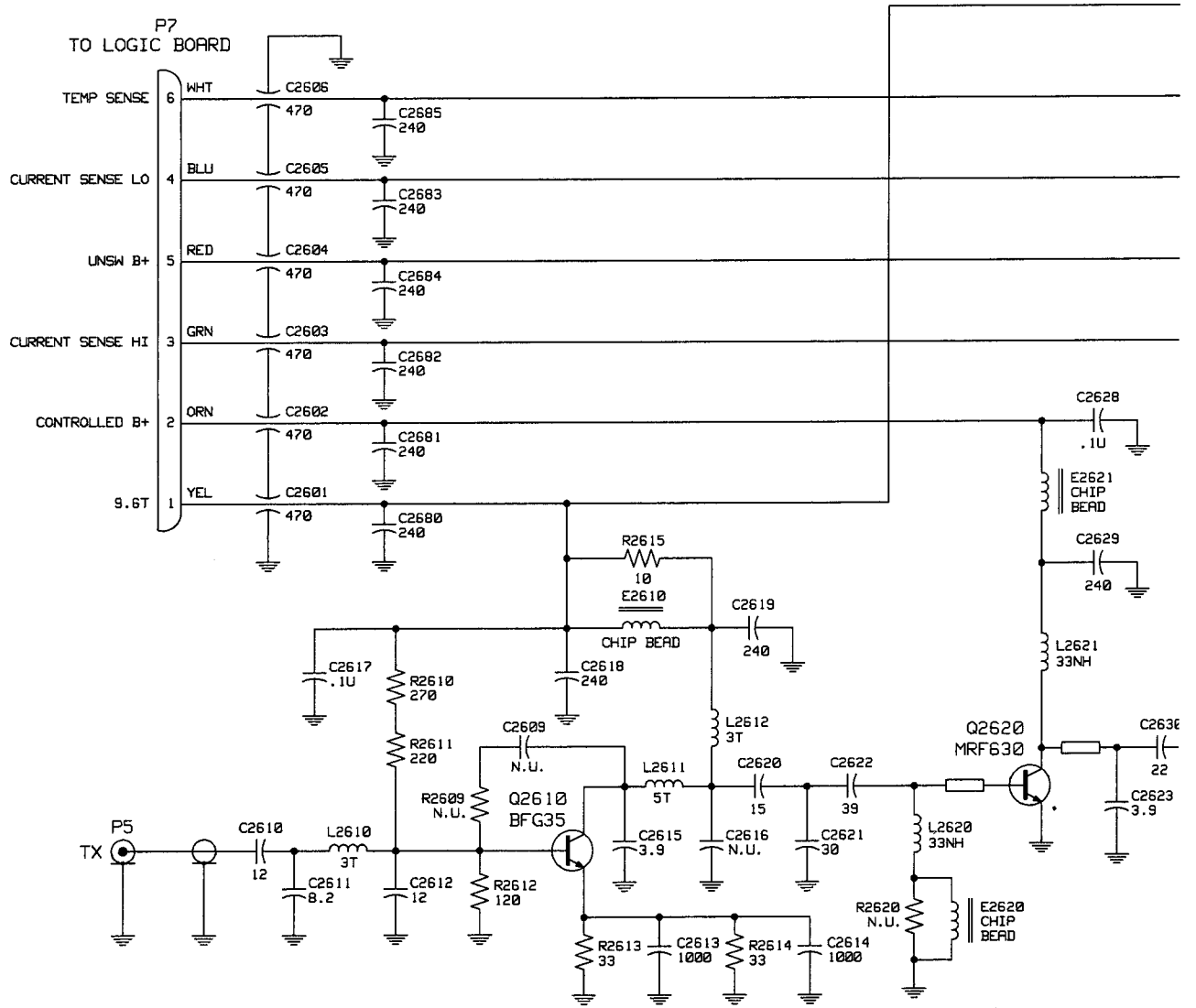


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RPD-97149-0

*Circuit Board Details and Schematic Diagram for  
 UHF Power Amplifier Board, 146-174 MHz, 25-45 W  
 (Part of HUD3191A Transceiver)*









# Parts Li

HLE3013A UHF

## REFERENCE SYMBOL

C2601 thru 260  
C2609  
C2610  
C2611  
C2612  
C2613, 2614  
C2615  
C2616  
C2617  
C2618, 2619  
C2620  
C2621  
C2622  
C2623  
C2628  
C2629  
C2630  
C2631  
C2632  
C2638  
C2639  
C2640  
C2641, 2642  
C2650, 2651  
C2652  
C2653  
C2658  
C2659  
C2660  
C2661  
C2662  
C2663  
C2664  
C2665  
C2670  
C2680 thru 26  
C2687, 2688  
C2689  
C2690

CR2680

E2610  
E2620, 2621  
E2630, 2631  
E2640  
E2650

J1  
J2

L2610  
L2611  
L2612  
L2620, 2621  
L2630  
L2631  
L2640  
L2650  
L2651  
L2660 thru 266  
L2663

P5  
P7

Q2610  
Q2620  
Q2630  
Q2640

Parts List for  
UHF Power Amplifier Board, 444-474 MHz, 25-45 W  
(Part of HUD3191A Transceiver)

st

RF Power Amplifier, 444-474 MHz, 25-45 W PL-971037-O

MOTOROLA PART NO.	DESCRIPTION
	<b>capacitor, chip: uF +/-5%; 50 V:</b> unless otherwise stated
06 21-84874K01	470 pF feedthru
---	Not Used
21-13740F29	12 pF
21-13740F25	8.2 ±0.25 pF
21-13740F29	12 pF
21-13740A79	1000 pF
21-13740F17	3.9 ±0.25 pF
---	Not Used
21-13743E20	0.1 uF 10%; 16 V
21-13740F60	240 pF
21-13740F31	15 pF
21-13740F38	30 pF
21-13740F41	39 pF
21-13740F17	3.9 ±0.25 pF
21-13743E20	0.1 uF 10%; 16 V
21-13740F60	240 pF
21-13740F35	22 pF
21-13740F36	24 pF
21-13740F36	24 pF
21-13741W01	1 uF 10%; 25 V
21-13740B49	100 pF
21-11078B29	33 pF; 100 V
21-11078B36	56 pF; 100 V
21-80964X35	clamped mica 39 pF; 250 V
21-11078B13	10 pF; 100 V
21-11078B07	5.6 ±0.25 pF; 100 V
21-13741W01	1 uF 10%; 25 V
21-13740B49	100 pF
21-11078B22	22 pF; 100 V
21-11078B03	3.9 ±0.25 pF; 100 V
21-11078B14	11 pF; 100 V
21-11078B13	10 pF; 100 V
21-11078B01	3.3 ±0.25 pF; 100 V
21-11078B42	100 pF; 100 V
21-13740F60	240 pF
36 21-13740F60	240 pF
21-13741B69	0.1 uF
21-13740F60	240 pF
---	Not Used
	<b>diode: (see note)</b>
48-80236E07	transient suppressor
	<b>ferrite beads:</b>
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
24-84657R01	ferrite bead
	<b>connector, receptacle:</b>
09-80131M01	mini UHF coax
09-80255E01	power (includes feedthru)
	<b>coil, rf:</b>
24-60591A33	3 turns
24-60591C49	5 turns
24-60591A77	3 turns
24-62587N47	chip 33 nH 5%
24-60591E73	7 turns
24-60591G73	9 turns
24-60591E73	7 turns
24-60591E69	7 turns
24-60591A13	3 turns
22 24-60591X01	3 turns
24-60591R53	8 turns
	<b>connector, plug:</b>
30-80138M07	coaxial cable 150 mm with plug
01-80556B01	cable and connector assembly, 6-pin (includes C2401-6 and feedthru bracket)
	<b>transistor: (see note)</b>
48-02245J24	NPN; type BFG35
48-80225C09	NPN; type MRF630
48-80225C19	NPN; type MRF654
48-80225C24	NPN; type MRF650

HLE3013A UHF RF Power Amplifier, 444-474 MHz, 25-45 W

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>resistor, chip: +/-5%; 1</b> unless otherwise stated
R2609	---	Not Used
R2610	06-11077A60	270; 1/8 W
R2611	06-11077A58	220; 1/8 W
R2612	06-62057A27	120
R2613, 2614	06-11077A38	33; 1/8 W
R2615	06-62057A01	10
R2620	---	Not Used
R2630	06-11077A26	10; 1/8 W
R2640	06-11077A26	10; 1/8 W
R2670	17-05603W01	metal .01
R2671	06-62057A13	33
R2672	06-05621T02	thermistor 50k @ 25' C
R2673	06-62057A85	33k
R2674	06-62057A51	1.2k
<b>non-referenced items</b>		
	01-04006J22	transistor heatsink ass'y Q2620 and 26-80158L0
	02-00007003	nut 8-32 x 5/16 x 1/8 (fo
	03-10943M10	screw M3 x 0.5 x 10 (2)
	04-00131974	washer (2 used for J2)
	04-05587G01	plastic washer (for anten
	26-80223M07	PA shield
	26-80475U01	heat sink
	29-80014A03	clip coax terminal
	32-80014N03	gasket, accessory conn
	42-80281L01	ground clip (2 used for (
	42-80520B01	ground clip

**note:** For optimum performance, diodes, transistors, and integ  
Motorola part numbers.

IN  
16 W:

includes  
heatsink)  
J1)  
sed for J2)  
a post)

ctor  
2640)

ited circuits m



01-80704Y83 Front Panel Filter Board

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
------------------	-------------------	-------------

Capacitor, chip, 5%, 50V unless otherwise indicated.

C1401	21-13740B33	22 pF
C1402	21-13740B33	22 pF
C1403	21-13740B33	22 pF
C1404	21-13740B33	22 pF
C1405	21-13740B33	22 pF
C1406	21-13740B33	22 pF
C1407	21-13740B33	22 pF
C1408	21-13740B33	22 pF
C1409	21-13740B33	22 pF
C1410	21-13740B33	22 pF
C1411	21-13740B33	22 pF
C1412	21-13740B33	22 pF
C1413	21-13740B33	22 pF
C1414	21-13740B33	22 pF
C1415	21-13740B33	22 pF
C1416	21-13740B33	22 pF
C1417	21-13740B33	22 pF
C1418	21-13740B33	22 pF
C1419	21-13740B33	22 pF
C1420	21-13740B33	22 pF
C1421	21-13740B33	22 pF
C1422	21-13740B33	22 pF
C1423	21-13740B33	22 pF

Voltage regulators (see note)

VR1406	48-80948V01	zener diode 27V SOT
VR1407	48-80948V01	zener diode 27V SOT
VR1408	48-80948V01	zener diode 27V SOT
VR1409		not used
VR1410		not used
VR1411	48-80948V01	zener diode 27V SOT
VR1412	48-80948V01	zener diode 27V SOT
VR1413	48-80948V01	zener diode 27V SOT
VR1414	48-80948V01	zener diode 27V SOT
VR1415	48-80948V01	zener diode 27V SOT
VR1416	48-80948V01	zener diode 27V SOT
VR1417	48-80948V01	zener diode 27V SOT
VR1418	48-80948V01	zener diode 27V SOT
VR1419	48-80948V01	zener diode 27V SOT
VR1420	48-80948V01	zener diode 27V SOT
VR1421	48-80948V01	zener diode 27V SOT
VR1422	48-80948V01	zener diode 27V SOT
VR1423	48-80948V01	zener diode 27V SOT

Note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

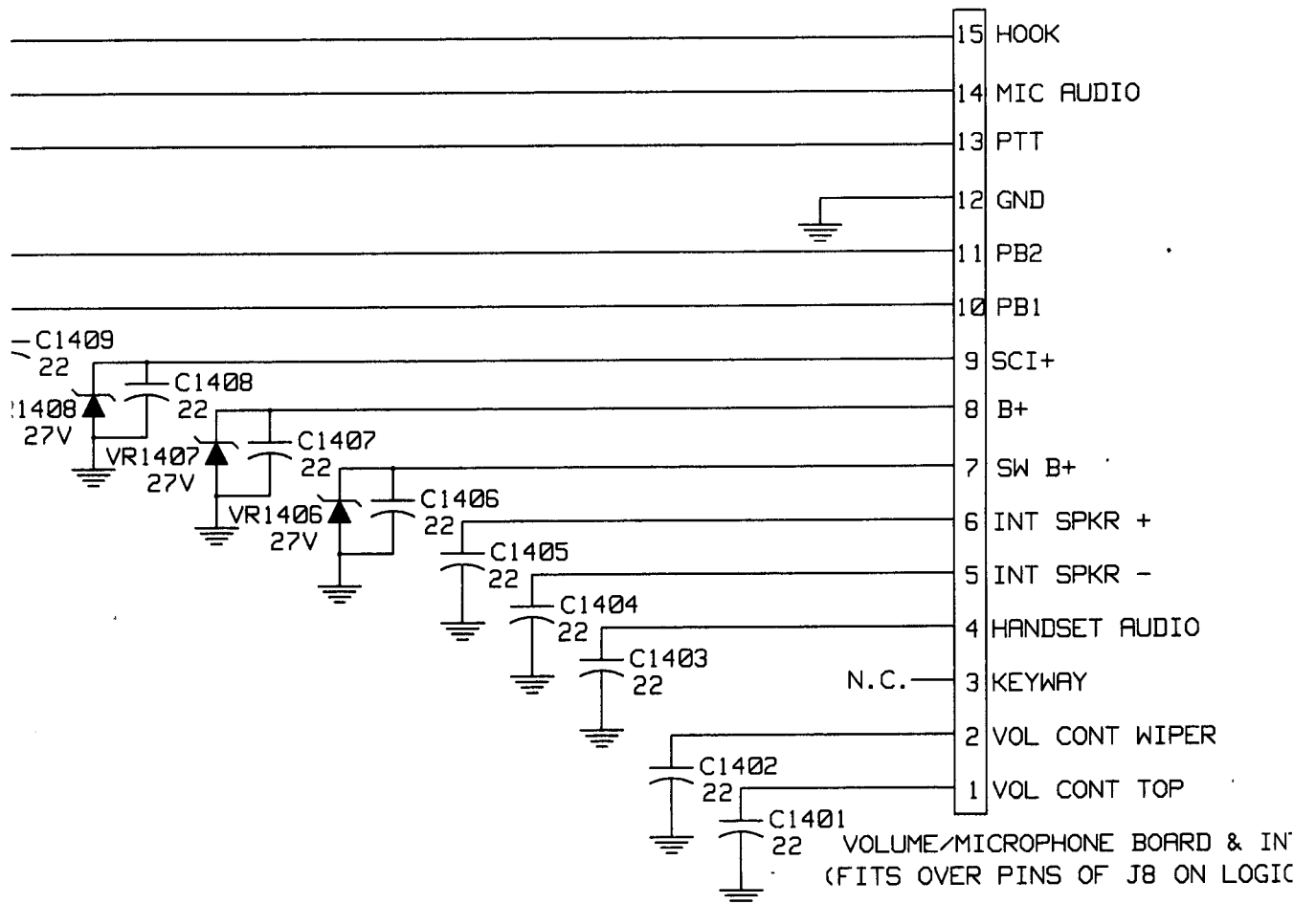
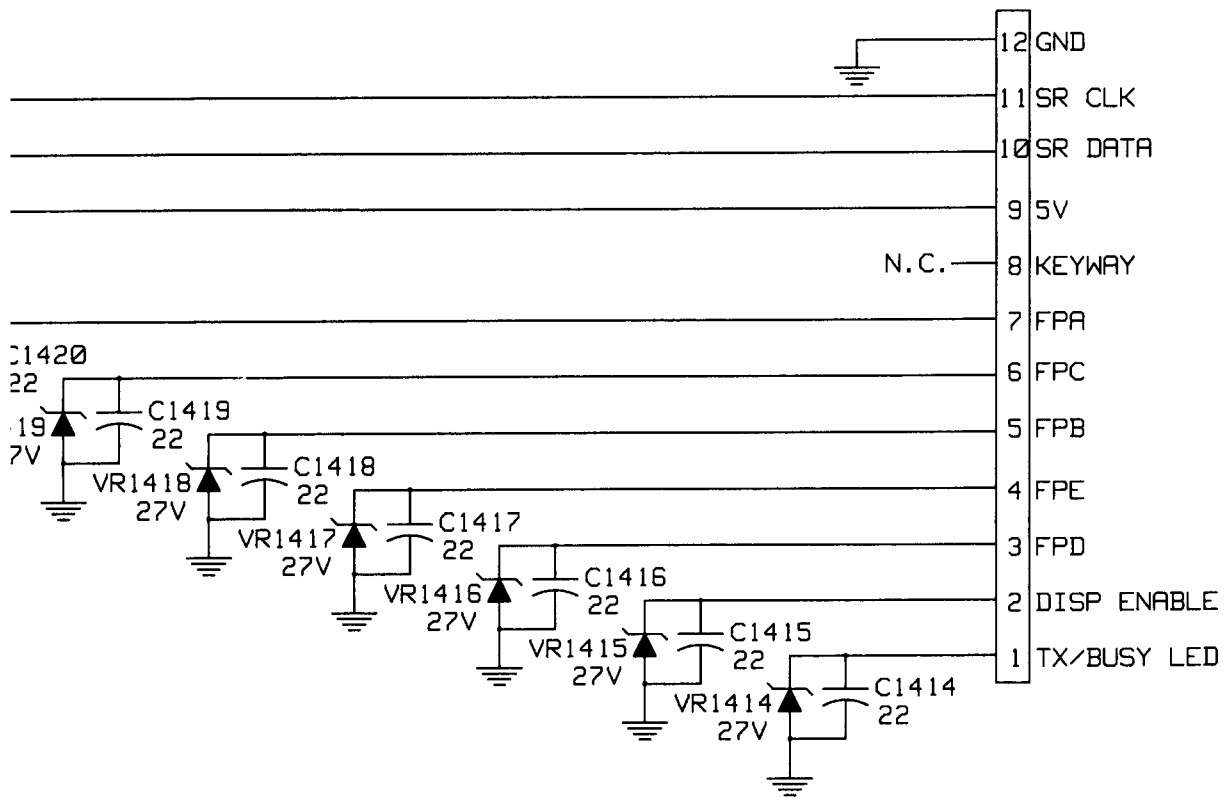
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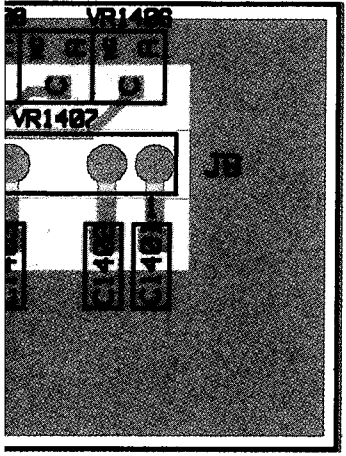
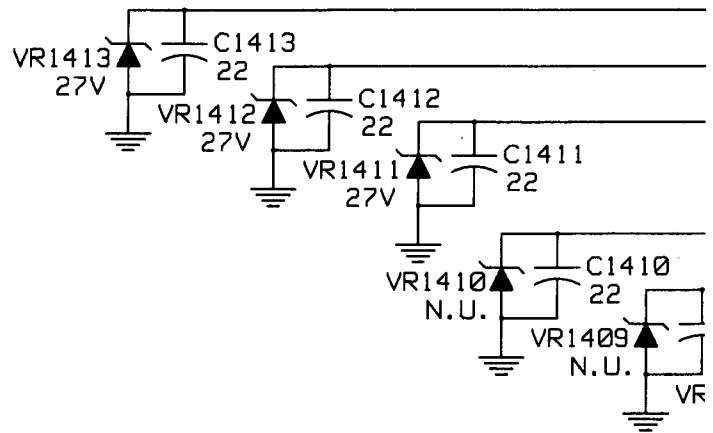
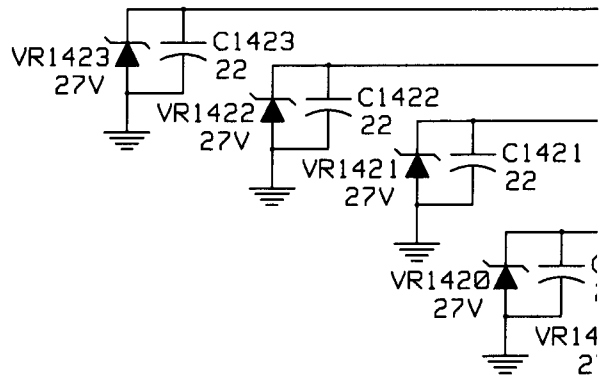
PL-921014-O

SPKR  
BOARD)

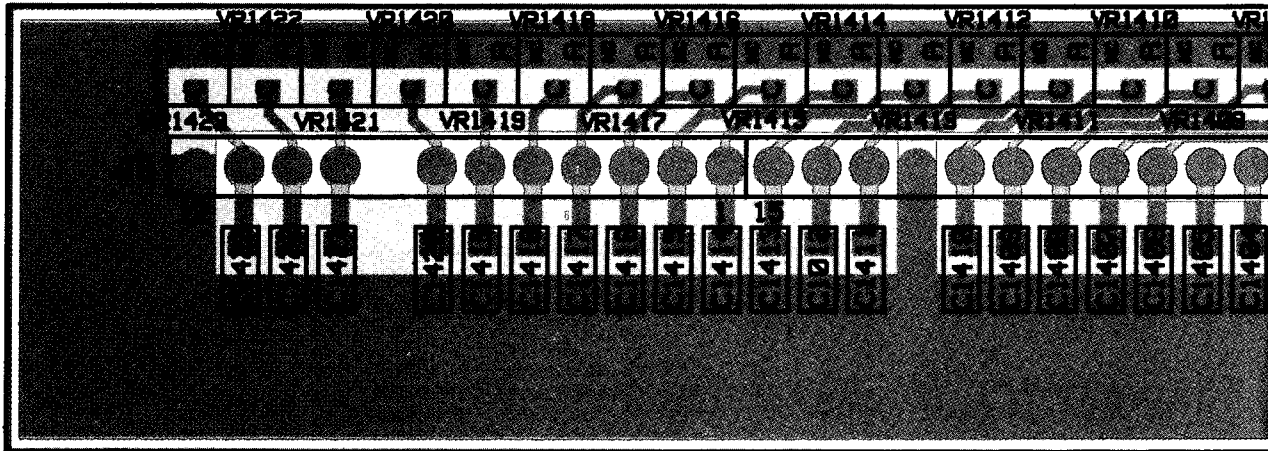
PD-92113-0

DISPLAY PCB  
(FITS OVER PINS OF J9 ON LOGIC BOARD)





# COMPONENT SIDE



COMPONENT SIDE (Gray)

SOLDER SIDE (Pink)

OVERLAY -----

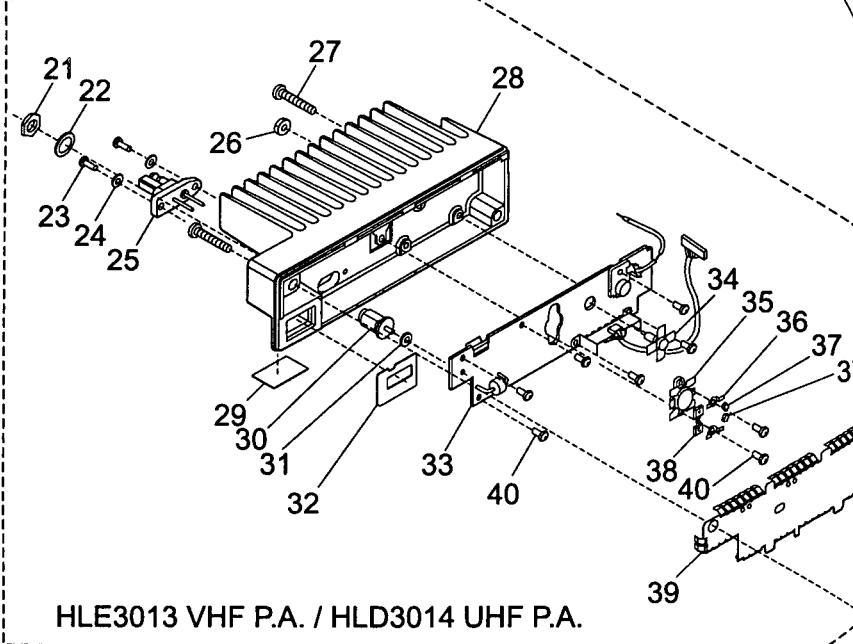
# Parts List

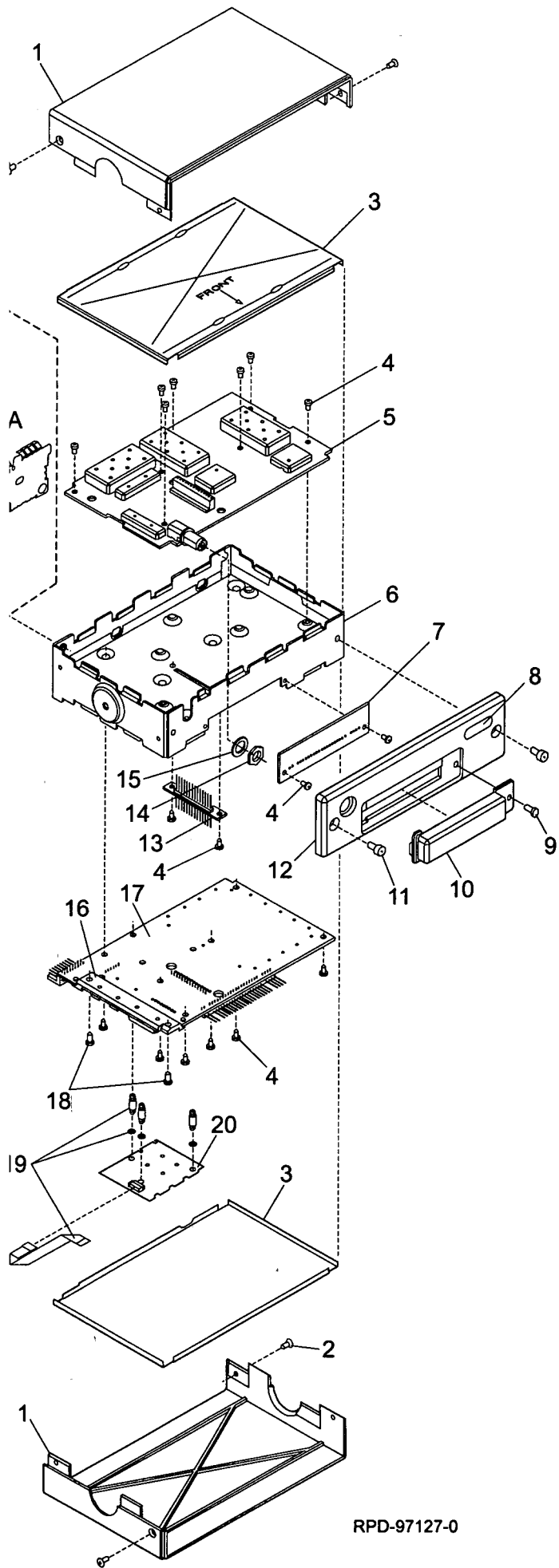
R1225 Transceiver Exploded View, Mechanical

PL-971018-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	QTY. USED
1	1580127L01	Cover, housing, top/bottom	2
2	0310943R55	Screw (TT 3 x 0.5 x 8) Star flat head	4
3	0104001J47	RF chassis shield	2
4	0310943M09	Screw (TT 3 x 0.5 x 6) Star slot pan head	17
5	HLE9051 or HLD9017	UHF, RF board assembly VHF, RF board assembly	1 1
6	2780496B02	Chassis	1
7	0180704Y83	Front panel filter board, assembly	1
8	1380482U02	Escutcheon	1
9	0310944A59	Screw (P 3.12 x 1.27 x 8) Star pan head, black	1
10	1580692U02	Cover	1
11	0310920A25	Screw (M4 x 0.7 x 10) Star cap head, black	2
12	1580692U01	Housing, front panel	1
13	2804637J01	Feedthru connector (RF/logic board)	1
14	0280477U01	Nut, hex. 3/8-24	1
15	0480943V01	Lockwasher, 3/8 ext. tooth stl. zinc	1
16	0180704Y76	Heatsink/logic device, assembly	1
17	HLN9395	Audio/logic board, assembly (includes ref. symbol 16)	1
18	0310943M10	Screw (TT 3 x 0.5 x 8) Star slot pan head	2
19	HLN9403	Installation kit, option board (optional)	1
20	---	Board, option (optional)	1
<b>UHF HLE3013 or VHF HLD3014 PA, consists of:</b>			
21	0280477U01	Nut, hex. 3/8-24	1
22	0480943V01	Lockwasher, 3/8 ext. tooth stl. zinc	1
23	0310943M11	Screw (TT 3 x 0.5 x 10) Star slot pan head	2
24	0400131974	Washer, flat	2
25	0980255E01	Connector, power	1
26	0200007003	Nut, hex. #8-32	1
27	0380271L01	Screw (M4 x 0.7 x 27) Star slot pan head, black	2
28	2680475U01	Heatsink, P.A.	1
29	5480675D01	Label, warning	1
30	0980131M01	Mini-UHF coax. connector (P.A. antenna conn.)	1
31	0405587G01	Washer, nylon .098" i.d. x .219" o.d. x .032" thk.	1
32	3280014N03	Gasket, accessory connector	1
33	HLE9057 or HLD9018	UHF, P.A. board assembly VHF, P.A. board assembly	1 1
34	4880225C19 or 4880225C18	UHF Transistor M2519 VHF Transistor M2518	1 1
35	4880225C24 or 4884411L04	UHF Transistor M25C24 VHF Transistor M1104	1 1
36	4280281L01	Clip, ground	2
37	2111078B36 or 2111078B52	UHF chip, capacitor, 56 pF VHF chip, capacitor, 240 pF	2 1
37A	2111078B53	VHF chip, capacitor, 270 pF	1
38	2180964X35	mica, capacitor, 39 pF	2
39	2680223M07	P.A. SHIELD	1
40	0310943M10	Screw (TT 3 x 0.5 x 8) Star slot pan head	8

R1225 Transceiver Exploded Mechanical View and Parts List





RPD-97127-0





**Full Duplex Base Station:**

A base station with which a dispatcher can hear receiver activity (if any occurs) while transmitting. An advantage of this mode is the ability of field radios to interrupt the dispatcher for "instantaneous" repeating of information without the need to wait until the dispatcher terminates transmission. Requires two operating frequencies and a duplexer or separate receive and transmit antennas.

**i20R:**

A repeater controller that provides service for up to 10 different user groups (TPL/DPL).

**i50R:**

A basic telephone interconnect with single user repeater operation.

**i750R:**

A repeater controller that provides telephone interconnect and revertive, selective calling. TPL, DPL, Quik-Call II and MDC-1200 signalling formats are supported.

**Internal Repeater Controller:**

The repeater controller functions of the R1225 transceiver module.

**Linked Repeater:**

A uni-directional repeater that sends receiver audio and COR signals to an external "link" radio (or another repeater such as a GR1225) for the purpose of relaying repeated information to another location. Receiver audio and COR signals from the "link" radio are applied to the R1225 transceiver as transmit audio and PTT signals. For example, VHF coverage can be extended between two cities with a UHF link between the two VHF, uni-directional repeaters.

**Local PTT:**

The PTT signal from a microphone plugged into the front panel of the a GR1225 repeater.

**Normal Receiver Audio:**

See EIA de-emphasized audio.

**Normal Transmitter Audio:**

See EIA pre-emphasized audio.

**"On Battery" Alert Tone:**

An alert tone ("beep") transmitted periodically to indicate to field radio operators that the repeater is operating on a battery backup power source and they should limit their transmissions (number and duration). Requires external switching source such as battery revert module.

**PAC\*RT:**

Portable Area Communications RepeaTer; a specialized cross band, bi-directional repeater configuration. Example: paramedics at an accident scene may use

450-470 MHz UHF portable radios to communicate with a highband VHF dispatcher.

**Page PTT:**

A PTT signal that is a programmable function on an input or input/output pin of the accessory connector. May be used to gate either EIA transmit audio (microphone on pin 2) or flat transmit audio (on pin 5) of the accessory connector. "Debounce" of page PTT may be eliminated to reduce transmitter turn on/turn off times.

**PTT Priority:**

Defines which PTT signal will override or be overridden by other PTT signals. The highest priority (overrides all other PTT's) in the R1225 transceiver module is Page PTT, followed by Local PTT, then External PTT, and, finally, COR PTT.

**Power-up:**

The initial application of operating potential (voltage) to the R1225 transceiver and any optional, external repeater controller.

**"Properly" Identified Signal:**

All signals being received on a CSQ receiver or those signals with the correct TPL tone or DPL code being received on a coded squelch receiver.

**R1225 Transceiver:**

A specialized transceiver module capable of full duplex operation. Basic and a few advanced repeater controller features are standard in the hardware and software of the module.

**Repeater Controller:**

A module or option card that fits into the GR1225 repeater station and provides advanced features beyond the basic repeater operation of the R1225 transceiver module.

**Repeater Knockdown:**

To deactivate a repeater or to remove it from service.

**Repeater Setup:**

To activate a repeater or to place it into service.

**Revertive Signalling (paging):**

Accessing a repeater with one signalling format (e.g., DTMF) and selective signalling with a different format (e.g., QCII).

**Selective Signalling (calling):**

A method of signalling with TPL, DPL, multiple tones or digital words to alert an individual radio user in a group.

**Single Band Repeater:**

A repeater in which both the receiver and the transmitter operate in the same frequency band. *Example:* receive at 456.650 MHz and transmit at 451.650 MHz in the 450-470 MHz UHF band.

**ST-853M SmarTrunk II:**

A repeater controller that allows trunking operation of the R1225 transceiver module. Up to 4096 subscriber units (field radios) with individual identification can be serviced. Telephone interconnect, individual and group selective calling are supported.

**TRA100R:**

A repeater controller that provides tone remote control capability to the repeater.

**Unidirectional Repeater:**

The basic repeater function of the R1225 transceiver module.

**VOX:**

Voice controlled transmission; the transmitter is keyed

by a circuit that detects the presence of voice output from the receiver or from a telephone line.

**ZR310:**

A repeater controller that provides individualized repeater service for up to 70 different customer groups (TPL/DPL).

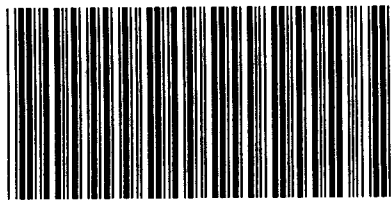
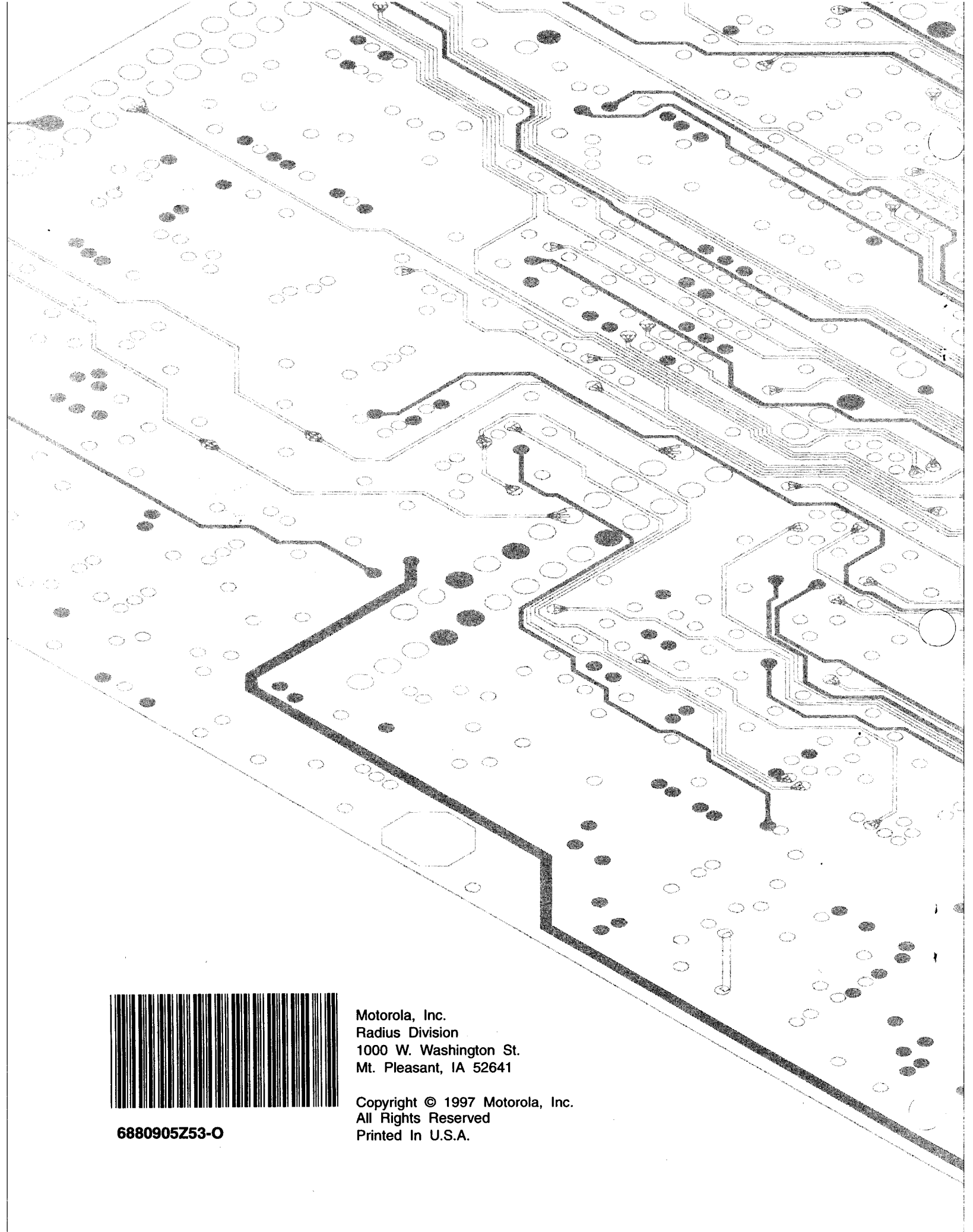
**ZR320:**

A repeater controller that acts as an interface to the telephone line, providing selective calling telephone interconnect features and repeater operation. TPL, DPL, and Quik-Call II signalling formats are supported.

**ZR340:**

A repeater controller that provides telephone interconnect with expanded sign-on/sign-off code features and CWID for the single user repeater.





6880905Z53-O

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