

NOTE: This manual incorporates
MMR-077, MMR-100, AND MMR-104



MOTOROLA

M120

Mobile Radios

146-174 MHz

403-433 MHz

438-470 MHz

465-495 MHz

490-520 MHz

Service Manual

The Radius logo, featuring a stylized 'R' and the word 'Radius' with a registered trademark symbol.

Radius®

6880902Z98-0



GENERAL:

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

INSTRUCTION MANUAL AFFECTED:

6880902Z98-O

M120 Service Manual

REVISION DETAILS:

1. On page 3-1, the standard position of jumper JU551, as shipped from the factory, should be **POSITION (B)**, instead of **POSITION (A)**.
2. On page 27, on PL-931018, the part number for reference symbol 4 should read 5080085D03.
3. The M120 mobile radio is now available in the following frequency bands and power levels:
 - VHF 136-162 MHz, 10-25 Watts RF Power
 - UHF 403-433 MHz, 1-10 Watts RF Power

This supplement contains the appropriate new model charts, schematic diagrams, circuit board details, and parts lists necessary for servicing these radios.

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MODEL	FREQ.	DESCRIPTION
M33GMC00A1AA	2	M120 12.5 kHz
M33GMC20A1AA	2	M120 20/25/30 kHz
M120 VHF Mobile Radio 136 - 162 MHz 10 - 25 Watts RF Power		
ITEM	DESCRIPTION	
HLD8029A	RF Board 12.5 kHz	
HLD8031A	RF Board 20/25/30 kHz	
HLN8074B	Logic Board, Masked	
HLN8439A	Display Board, 2 Frequency	
HLN8071A	Vol/Mic Board	
HLN8441A	Front Panel Hardware, 2 Frequency	
HLD8293A	PA Board	
HLN8295A	PA Hardware	
HLN8076A	Chassis Hardware	

	Item	Description										
X	HUD3834A	Chassis, 12.5 kHz, Masked	X	X								X
X	HUD3833A	Chassis, 25 kHz, Masked		X	X							X
X	X	HLD3850A	PA Kit (part of chassis)						X	X		
X	X	HLN3037A	Control Head, 2 Channel				X	X	X			
X	X	HKN4137A	Power Cable									
X	X	HHN8073A	Housing Kit, Masked									
X	X	HMN3413A	Microphone w/hangup clip									
X	X	HLN5189A	Installation Kit									
X	X	6880902Z96	M120 Operator Card									
X	X	6880902Z97	M120 Owner's Manual									

RADIUS M120 Comp. mikes

HMN 3413A

3596A mini

1035C HD.

HMN 1074A
MCS 3000

MODEL	FREQ.	DESCRIPTION
M04GMC00A1AA	2	M120 12.5 kHz
M04GMC20A1AA	2	M120 20/25 kHz
M120 UHF Mobile Radio 403 - 433 MHz 1 - 10 Watts RF Power		
ITEM	DESCRIPTION	
HLE8301A	RF Board 12.5 kHz	
HLE8300A	RF Board 20/25 kHz	
HLN8074B	Logic Board, Masked	
HLN8439A	Display Board 2 Frequency	
HLN8071A	Vol/Mic Board	
HLN8441A	Front Panel Hardware, 2 Frequency	
HLE8385A	PA Board	
HLN8386A	PA Hardware	
HLN8076A	Chassis Hardware	

	Item	Description								
X	HUE3944A	Chassis, 12.5 kHz, Masked	X		X					X
X	HUE3945A	Chassis, 25 kHz, Masked		X	X					X
X	X	HLE3929A	PA Kit (part of chassis)					X	X	
X	X	HCN3037A	Control Head, 2 Channel			X	X	X		
X	X	HKN4137A	Power Cable							
X	X	HHN8073A	Housing Kit, Masked							
X	X	HMN3413A	Microphone w/hangup clip							
X	X	HLN5189A	Installation Kit							
X	X	6880902Z96	M120 Operator Card							
X	X	6880902Z97	M120 Owner's Manual							

HLD8266A RF Board, 136-162 MHz, 12.5 kHz (N)
HLD8265A RF Board, 136-162 MHz, 25 kHz (W)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C1	21-13740B35	27 pF
C2	21-13740B38	36 pF
C3	21-13740B42	51 pF
C4	21-13740B31	18 pF
C5		not used
C6	21-13740B14	3.6 +/- .25 pF
C7		not used
C8	21-13740B31	18 pF
C9	21-13740B43	56 pF
C10	21-13740B40	43 pF
C11	21-13740B31	18 pF
C12	21-13740B65	470 pF
C13	21-13740B31	18 pF
C14	21-13740B46	75 pF
C15	21-13740B44	62 pF
C16	21-13740B35	27 pF
C17	21-13740B43	56 pF
C18	21-13740B28	13 pF
C19	21-13740B65	470 pF
C20	21-11032B15	.22 uF +80/-20%
C21	21-11032B15	.22 uF +80/-20%
C22	21-13741B45	.01 uF
C23	21-13741B45	.01 uF
C24	21-13740B38	36 pF (see note)
C51	21-13740B35	27 pF
C52	21-13740B35	27 pF
C53	21-13740B18	5.1 +/- .25 pF
C54	21-13740B47	82 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57	21-13740B29	15 pF
C58	21-13740B25	10 pF
C59	21-13740B29	15 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B29	15 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/- .25 pF
C85	21-13740B25	10 pF
C86		not used
C87	21-13741B45	.01 uF
C88	21-11032B15	.22 uF +80/-20%
C89		not used
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-13741B45	.01 uF
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112		not used
C113	21-13741B69	.1 uF
C114	21-13740B73	1000 pF
C115	21-13741B45	.01 uF
C116	21-13740B73	1000 pF
C117	21-13740B73	1000 pF
C118	21-13740B31	18 pF
C119	21-13740B73	1000 pF
C120	21-13740B73	1000 pF
C121	21-13740B29	15 pF
C122	21-13740B49	100 pF
C127		not used
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157	21-13741B45	.01 uF
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164	21-13741B69	.1 uF
C165	21-13740B73	1000 pF
C166	21-13740B49	100 pF
C167	21-13740B49	100 pF
C168	21-13740B49	100 pF
C169		not used
C176	21-13740B73	1000 pF
C177	21-13741B69	.1 uF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B73	1000 pF
C206	21-13740B32	20 pF
C207	21-13740B29	15 pF
C208	21-13740B27	12 pF
C209	21-13740B23	8.2 +/- .25 pF
C210	21-13740B73	1000 pF
C211	21-13740B73	1000 pF
C212	21-13740B73	1000 pF
C213	21-13740B19	5.6 +/- .25 pF
C214	21-13740B13	3.3 +/- .25 pF
C215	21-13740B73	1000 pF
C216	21-13740B47	82 pF
C217		not used
C218	21-13741B45	.01 uF
C219	21-13740B13	3.3 +/- .25 pF
C220	21-13740B73	1000 pF
C221	21-13740B05	1.5 +/- .25 pF
C222	21-13741B45	.01 uF
C223	21-13740B13	3.3 +/- .25 pF
C224	21-13740B73	1000 pF
C225	21-13740B73	1000 pF
C228	21-13740B80	2200 pF
C229	21-13740B05	1.5 +/- .25 pF
C230	21-13740B05	1.5 +/- .25 pF
C231	21-13740B38	36 pF
C232		not used
C233	21-13740B49	100 pF
C234	21-13740B32	20 pF
C235	21-13740B23	8.2 +/- .25 pF
C236	21-13740B23	8.2 +/- .25 pF
C237	21-13740B73	1000 pF
C238	21-13740B73	1000 pF
C239	21-13740B73	1000 pF
C240	21-13740B13	3.3 +/- .25 pF
C241	21-13740B19	5.6 +/- .25 pF
C242	21-13740B73	1000 pF
C243	21-13740B47	82 pF
C244		not used
C245	21-13740B73	1000 pF
C246	21-13740B25	10 pF
C247	21-13740B73	1000 pF
C248	21-13740B01	1 +/- .25 pF
C249	21-13741B45	.01 uF

C250	21-13740B17	4.7 +/- .25 pF
C251	21-13740B73	1000 pF
C252	21-13740B73	1000 pF
C253		not used
C256	21-13741B45	.01 uF
C258	08-11051A08	poly .015 uF 63V
C274	21-13740B49	100 pF
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C301	21-13741B45	.01 uF
C302		not used
C303	21-13740B65	470 pF
C304		not used
C305		not used
C306		not used
C307		not used
C308		not used
C309		not used
C310		not used
C311		not used
C312		not used
C313		not used

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR202	48-80006E11	silicon varactor SOT
CR203	48-80006E11	silicon varactor SOT
CR204	48-80006E11	silicon varactor SOT
CR205	48-80006E11	silicon varactor SOT
CR206	48-80154K03	dual Schottky SOT
CR209	48-80006E10	silicon varactor SOT
CR210	48-80006E11	silicon varactor SOT
CR211	48-80006E11	silicon varactor SOT
CR212	48-80006E11	silicon varactor SOT
CR213	48-80006E11	silicon varactor SOT
CR214	48-80154K03	dual Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Jumpers

JU201		not used
JU202		not used

Coils

L1	24-62587N51	chip 68 nH 5%
L2	24-62587N51	chip 68 nH 5%
L3	24-62587N51	chip 68 nH 5%
L4	24-62587N51	chip 68 nH 5%
L5	24-62587N51	chip 68 nH 5%
L6	24-62587N51	chip 68 nH 5%
L7	24-62587N51	chip 68 nH 5%
L8	24-62587N69	chip 1.2 uH 5%
L10	24-62587N69	chip 1.2 uH 5%
L11	24-62587N51	chip 68 nH 5%
L51	24-62587N61	chip .47 uH 5%

L52	24-62587N61	chip .47 uH 5%
L53	24-62587N61	chip .47 uH 5%
L54	24-62587N76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587N76	chip 4.7 uH 5%
L59	24-80164M03	tunable .7 uH E716
L60	24-62587N69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587N69	chip 1.2 uH 5%
L102	24-62587N47	chip 33 nH 5%
L103	24-62587N76	chip 4.7 uH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M05	tunable 3-1/2 turns
L203	24-62587N69	chip 1.2 uH 5%
L204	24-62587N50	chip 56 nH 5%
L205	24-62587N69	chip 1.2 uH 5%
L206	24-62587N69	chip 1.2 uH 5%
L207	24-62587N69	chip 1.2 uH 5%
L208	24-62587N47	chip 33 nH 5%
L209	24-62587N56	chip .18 uH 5%
L210	24-62587N52	chip 82 nH 5%
L211	24-62587N69	chip 1.2 uH 5%
L213	24-80148M08	tunable 4-1/2 turns
L214	24-62587N69	chip 1.2 uH 5%
L215	24-62587N54	chip .12 uH 5%
L216	24-62587N69	chip 1.2 uH 5%
L217	24-62587N69	chip 1.2 uH 5%
L218	24-62587N69	chip 1.2 uH 5%
L219	24-62587N47	chip 33 nH 5%
L220	24-62587N56	chip .18 uH 5%
L221	24-62587N54	chip .12 uH 5%
L222	24-62587N69	chip 1.2 uH 5%
L301	24-84657R01	ferrite bead

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906
Q105	48-80214G02	NPN; type MMBT3904
Q106	48-80214G02	NPN; type MMBT3904
Q107	48-11043C19	NPN; type M43C19/M9658
Q151	48-11043C19	NPN; type M43C19/M9658
Q152	48-11043C06	PNP; type M43C06/M9643
Q203	48-05128M66	field effect; type MMBFU310
Q204	48-11043C19	NPN; type M43C19/M9658
Q205	48-11043C19	NPN; type M43C19/M9658
Q206	48-05128M66	field effect; type MMBFU310
Q207	48-11043C19	NPN; type M43C19/M9658
Q208	48-11043C19	NPN; type M43C19/M9658
Q276	48-80214G02	NPN; type MMBT3904
Q277	48-05128M67	PNP; type MMBT3906
Q278	48-05128M67	PNP; type MMBT3906
Q279	48-05128M67	PNP; type MMBT3906

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A30	15
R3	06-11077A66	470
R4	06-11077A84	2.7k
R5	06-11077A56	180
R6	06-11077A98	10k
R7	06-11077A96	8.2k
R8	06-11077A98	10k
R9	06-11077A90	4.7k
R10	06-11077B07	22k
R11	06-11077B15	47k

R12	06-11077A50	100
R13	06-11077A68	560
R51	06-11077A43	51
R52	06-11077A54	150
R53	06-11077A88	3.9k
R54	06-11077A54	150
R56	06-11077B45	820k
R57	06-11077A72	820
R58	06-11077B23	100k
R59	06-11077B27	150k
R60	18-05500L08	variable 22k
R61(N)	06-11077B07	22k
R61(W)	06-11077B19	68k
R62(N)	06-11077A26	10
R62(W)	06-11077B09	27k
R63	06-11077B21	82k
R102	06-11077A62	330
R103	06-11077A98	10k
R104	06-11077A98	10k
R105	06-11077B11	33k
R106	06-11077A74	1k
R107	06-11077A78	1.5k
R108	06-11077A26	10
R109	06-11077A26	10
R110	06-11077B03	15k
R111	06-11077A72	820
R112	06-11077A86	3.3k
R113	06-11077A74	1k
R114	06-11077A72	820
R115	06-11077A70	680
R116	06-11077A92	5.6k
R118	06-11077A70	680
R119	06-11077A90	4.7k
R120	06-11077A88	3.9k
R121	06-11077A88	3.9k
R122	06-11077A43	51
R123	06-11077A50	100
R124	06-11077A84	2.7k
R125	06-11077A72	820
R151	06-11077B15	47k
R152	06-11077B11	33k
R153	06-11077B15	47k
R154	06-11077A34	22
R155	06-11077A98	10k
R156	06-11077B03	15k
R157	06-11077A78	1.5k
R158	06-11077A74	1k
R159	06-11077A74	1k
R160		not used
R161	06-11077A98	10k
R162		not used
R163(N)	06-11077B11	33k
R163(W)	06-11077A50	100
R164	18-05500L08	variable 22k
R165(N)	06-11077A98	10k
R165(W)	06-11077B03	15k
R176	06-11077G26	22.6k 1%
R177	06-11077G18	18.7k 1%
R178	06-11077F91	10.0k 1%
R179	06-11077F91	10.0k 1%
R180	06-11077G52	42.2k 1%
R181	06-11077F91	10.0k 1%
R182	06-11077G28	23.7k 1%
R207	06-11077A44	56
R208	06-11077A44	56
R209	06-11077A50	100
R210	06-11077A84	2.7k
R211	06-11077A98	10k
R212	06-11077A84	2.7k
R213	06-11077A72	820
R214	06-11077A50	100
R215	06-11077A84	2.7k
R216	06-11077A72	820
R217	06-11077A42	47
R218	06-11077A54	150
R219	06-11077A40	39
R220	06-11077A54	150
R222	06-11077A88	3.9k

R223(N)	06-11077A92	5.6k
R223(W)	06-11077A66	470
R224	06-11077B23	100k
R225(N)	06-11077A92	5.6k
R225(W)	06-11077B01	12k
R226	06-11077A44	56
R227	06-11077A44	56
R228	06-11077A50	100
R229	06-11077A84	2.7k
R230	06-11077A98	10k
R231	06-11077A84	2.7k
R232	06-11077A72	820
R233	06-11077A50	100
R234	06-11077A84	2.7k
R235	06-11077A72	820
R236	06-11077A42	47
R237	06-11077A62	330
R238	06-11077A32	18
R239	06-11077A62	330
R241	06-11077B23	100k
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301	06-11077A74	1k
R302	18-05500L08	variable 22k
R303	06-11077B01	12k

Transformers

T1	25-80163M02	balun
T2	25-80163M02	balun

Integrated circuits and modules (see note)

U1	48-80174R01	quad Schottky ring SOIC
U51	51-05479G05	receiver system
U101	51-84704M75	synthesizer
U102	51-84810F66	prescaler
U176	51-80932W01	dual op-amp

Voltage regulators (see note)

VR176	48-82256C11	zener diode 10V 5%
-------	-------------	--------------------

Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (10 used)
26-80228L01	shield can (2 used, for J4 and J5)
26-80229L03	shield VCO frame
75-05295B02	insulator (for Y151)
75-05295B07	insulator (3 used, for Y51A/B, Y52)

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

10/26/93

PL-931006-O

Note: C24 is mounted in the location for R2 on the pc board.

HLD8293A PA Board, 136-162 MHz, 10-25 Watts

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

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

C2308		not used
C2309		not used
C2310	21-13740B65	470 pF
C2311	21-13740B27	12 pF
C2312	21-13740B65	470 pF
C2313	21-13740B65	470 pF
C2314	21-13741B69	.1 uF
C2315	21-13740B51	120 pF
C2316	21-13740B65	470 pF
C2317	21-13740B41	47 pF
C2318	21-13740B50	110 pF
C2319	21-13740B65	470 pF
C2320	21-13740B65	470 pF
C2321	21-11032B15	.22 uF + 80/-20%
C2322	21-13741B69	.1 uF
C2323	21-13740B65	470 pF
C2324	21-13740B34	24 pF
C2325	21-13740B38	36 pF
C2326	21-13740B44	62 pF
C2327	21-13740B65	470 pF
C2330	21-13740B45	68 pF
C2331	21-13740B52	130 pF
C2332		not used
C2334		not used
C2336	21-80060M43	100 pF 100V
C2337	21-11078B38	68 pF 100V
C2338	21-80060M29	27 pF 500V
C2339	21-11032B15	.22 uF + 80/-20%
C2340	21-80060M03	2 +/- .25 pF 500V
C2341	21-13740B53	150 pF
C2342		not used
C2343	21-80060M45	120 pF 100V
C2351	21-13740B29	15 pF
C2352	21-13740B55	180 pF
C2353	21-13740B59	270 pF
C2354	21-13740B65	470 pF
C2360	21-80060M32	36 pF 500V
C2361	21-80060M32	36 pF 500V
C2362	21-80060M31	33 pF 500V
C2363	21-80060M30	30 pF 500V
C2364	21-80060M28	24 pF 500V
C2365	21-13740B73	1000 pF
C2370	21-13740B65	470 pF
C2371	21-13741B69	.1 uF
C2372	21-13740B51	120 pF
C2373	21-13740B65	470 pF
C2374	21-13740B65	470 pF
C2375	21-13740B65	470 pF
C2376	21-13741B69	.1 uF
C2378	23-11048A17	lytic 33 uF 20% 25V
C2379	21-13740B65	470 pF
C2380	21-13740B65	470 pF

Diodes (see note)

CR2350	48-80010E01	silicon PIN UM9401
CR2351	48-80010E01	silicon PIN UM9401
CR2370	48-80236E07	transient suppressor

Ferrite Beads

E2370	76-83960B01	ferrite bead
-------	-------------	--------------

Coils

L2310	24-11030D04	5 turns GRN
L2311	24-11030B07	3-1/2 turns WHT
L2312	24-11030E01	1/2 turn BRN
L2313	24-11030B15	10-1/2 turns WHT
L2321	24-80036A01	ferrite bead 1/2 turn
L2322	24-11030B07	3-1/2 turns WHT

L2323	24-80036A01	ferrite bead 1/2 turn
L2324	24-82723H46	.2 uH
L2325	24-11030B04	1-1/2 turns YEL
L2330	24-11030E04	1/2 turn YEL
L2331	24-11030B07	3-1/2 turns WHT
L2332	24-80036A01	ferrite bead 1/2 turn
L2333	24-11030D04	5 turns GRN
L2334	24-11030D01	2 turns RED
L2335	24-11030D02	3 turns ORG
L2336	24-11030D03	4 turns YEL
L2350	24-82723H49	1.2 uH
L2351	24-11030B10	5-1/2 turns RED
L2352	24-82723H44	39 nH
L2353	24-82723H49	1.2 uH
L2360	24-11030D05	6 turns BLU
L2361	24-11030B12	7-1/2 turns YEL
L2362	24-11030B12	7-1/2 turns YEL
L2363	24-11030D05	6 turns BLU
L2364	24-11030B15	10-1/2 turns WHT
L2370	24-84346A02	.23 uH

Transistors (see note)

Q2310	48-82233P39	NPN; type 33P39
Q2320	48-80225C23	NPN; type MRF237

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2307	06-11077A62	330
R2310	06-11077A46	68
R2311	06-11077A58	220
R2312	06-11077A60	270
R2313	06-11077A26	10
R2314	06-11077A26	10
R2320	06-11077A26	10
R2321	06-11077A50	100
R2329		not used
R2331	06-80279M01	metal film 82 3 watt
R2332	06-11077A26	10
R2350	06-11009A39	390 1/4 watt FCF
R2351	06-11077A66	470
R2352	06-11077A66	470
R2353	06-11077A50	100
R2370	06-11077A38	33
R2371	06-80147M01	metal plate .05 2 watt
R2372	06-05621T02	thermistor 50k
R2373	06-11077B11	33k
R2374	06-11077A74	1k

Non-referenced items

26-80158L01	heat sink (for Q2320)
26-80275M01	heat sink, diode (2 used for CR2350 and CR2351)
29-80014A03	clip coax terminal (2 used)

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

11/3/93

PL-931007-O

PA 136-162 MHz (10-25W)

01-80704Y64 Feedthru Bracket and Cable Assembly

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

Non-referenced items

01-80556B01	6-wire cable assembly (includes P7)
01-80634B01	feedthru bracket assembly (includes C2301 through C2306, 470 pF feedthru capacitors, 6 used)

HLN8295A PA Hardware Kit, 136-162 MHz, 10-25 Watts

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

Capacitors, chip

C2329		not used
C2333	21-11078B52	240 pF 100V
C2335	21-11078B36	56 pF 100V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2330	48-80225C22	NPN; type MRF1946
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Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
38-80014N01	plug button
42-80281L01	ground clip (2 used for Q2330)
42-80520B01	ground clip, pc board (2 used)

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

11/3/93

PL-931008-O

HLE8385A PA Board, 403-433 MHz, 1-10 Watts

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

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

C2510	21-13740B49	100 pF
C2511	21-13740B27	12 pF
C2512	21-13740B29	15 pF
C2513	21-13740B73	1000 pF
C2514	21-13740B73	1000 pF
C2515	21-13740B25	10 pF
C2516	21-13741B69	.1 uF
C2517	21-13740B36	30 pF
C2518	21-13740B49	100 pF
C2519	21-13740B73	1000 pF
C2520	21-13740B31	18 pF
C2521	21-13740B34	24 pF
C2522		not used
C2523		not used
C2526	21-13740B49	100 pF
C2527	21-13740B73	1000 pF
C2528	21-11032B15	.22 uF +80/-20%
C2529	21-13740B36	30 pF
C2530	21-13740B36	30 pF
C2531	21-13740B34	24 pF
C2532	21-13740B34	24 pF
C2536	21-13740B49	100 pF
C2537	21-13740B73	1000 pF
C2538	21-13741B69	.1 uF
C2539		not used
C2540		not used
C2541	21-13740B33	22 pF
C2542	21-13740B23	8.2 +/- .25 pF
C2543	21-13740B32	20 pF
C2547	21-13740B49	100 pF
C2548	21-11032B15	.22 uF +80/-20%
C2549	21-13740B49	100 pF
C2550		not used
C2551	21-13740B31	18 pF
C2552		not used
C2553	21-13740B31	18 pF
C2554	21-13740B15	3.9 +/- .25 pF
C2555	21-13740B49	100 pF
C2556		not used
C2557	21-13740B49	100 pF
C2559	21-13740B22	7.5 +/- .25 pF
C2560		not used
C2561	21-13740B24	9.1 +/- .25 pF
C2562	21-13740B25	10 pF
C2563	21-13740B21	6.8 +/- .25 pF
C2564	21-13740B49	100 pF
C2570	21-13740B36	30 pF
C2574	21-13740B36	30 pF
C2575	08-11051A17	poly .47 uF 63V
C2576	21-13740B49	100 pF
C2577	21-13740B73	1000 pF
C2578	21-13741B69	.1 uF
C2579	21-13740B36	30 pF
C2580	21-13740B49	100 pF

Diodes (see note)

CR2550	48-80010E01	silicon PIN UM9401
CR2551	48-80010E01	silicon PIN UM9401
CR2570	48-80236E07	transient suppressor

Ferrite Beads

E2520	76-83960B01	ferrite bead
-------	-------------	--------------

Coils

L2510	24-11030E02	1/2 turn RED
L2511	24-11030B04	1-1/2 turns YEL
L2512	24-11030E04	1/2 turn YEL
L2513	24-11030B01	1-1/2 turns BRN

L2515	24-80036A01	ferrite bead 1/2 turn
L2520	24-11030E02	1/2 turn RED
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	24-11030E03	1/2 turn ORN
L2550	24-82723H40	.29 uH
L2551	24-11030B04	1-1/2 turns YEL
L2552	24-82723H40	.29 uH
L2553	24-11030A06	7 turns VIO
L2560	24-11030B06	2-1/2 turns BLU
L2561	24-11030B07	3-1/2 turns WHT
L2562	24-11030B06	2-1/2 turns BLU
L2563	24-11030B11	6-1/2 turns ORN
L2570	24-80036A01	ferrite bead 1/2 turn

Transistors (see note)

Q2510	48-82233P39	NPN; type MRF559
Q2520	48-80225C09	NPN; type MRF630
Q2530	48-80225C19	NPN; type MRF654

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2510	06-11077A58	220
R2511	06-11077A60	270
R2512	06-11077A52	120
R2513	06-11077A38	33
R2514	06-11077A38	33
R2520	06-11077A26	10
R2550	06-11086C33	82 2 watt FMO
R2570	06-11086D01	0.2 2 watt FMO
R2571	06-11077A47	75
R2572	06-05621T02	thermistor 50k
R2573	06-11077B11	33k
R2574	06-11077A80	1.8k
R2575	06-11077A26	10

Non-referenced items

26-80158L01	heat sink (for Q2520)
29-80014A03	clip coax terminal (2 used)

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

9/8/93

PL-931002-O

PA 403-433 MHz (1-10W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2501 through C2506, 470 pF feedthru capacitors, 6 used)

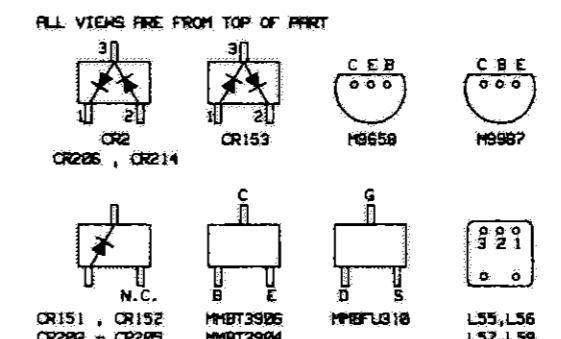
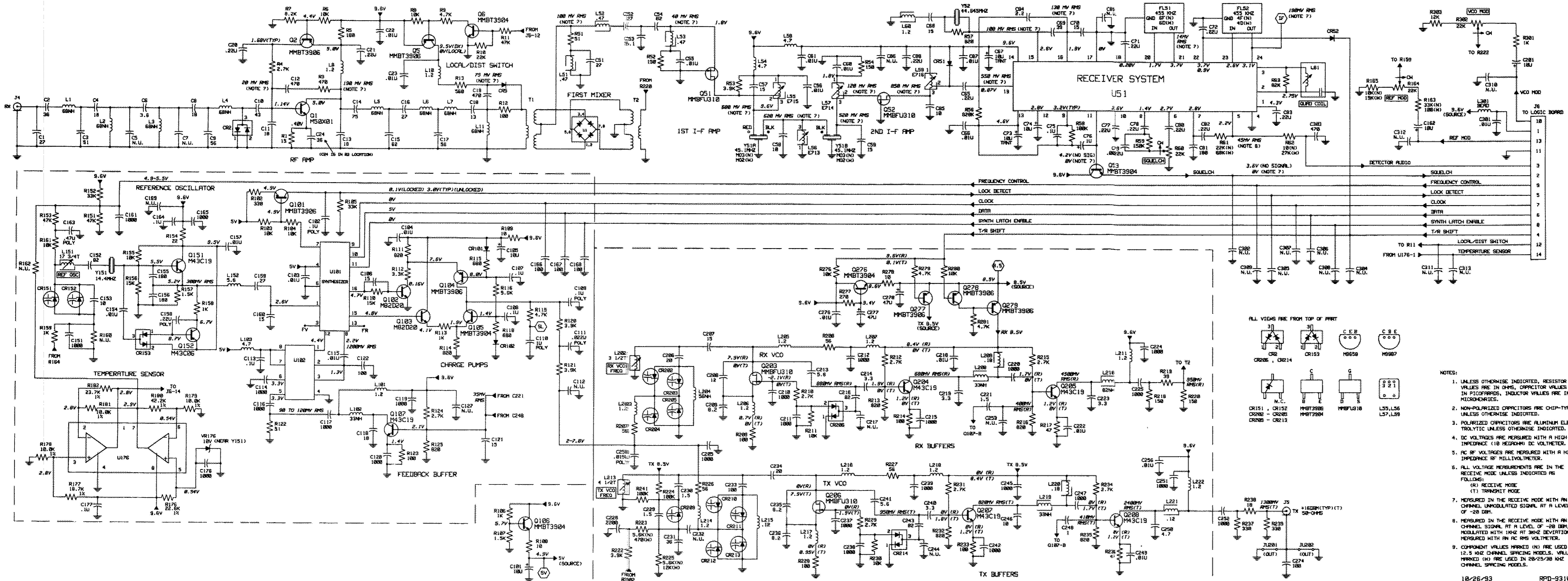
HLN8386A PA Hardware Kit, 403-433 MHz, 1-10 Watts

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip, 5%, 50V		
C2533	21-13740B31	18 pF
C2534	21-13740B31	18 pF
C2544	21-13740B18	5.1 +/- .25 pF
C2545	21-13740B18	5.1 +/- .25 pF
Connector, receptacle		
J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)
Connector, plug		
P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug
Non-referenced items		
	02-00007003	nut 8-32x5/16x1/8 (for J1)
	03-10943M10	screw M3x.5x8 (6 used)
	03-10943M11	screw M3x.5x10 (2 used for J2)
	04-00131974	washer (2 used for J2)
	04-05587G01	washer nylon (for J2)
	04-80943V01	lockwasher (for J1)
	26-80124L01	heat sink
	26-80223M07	PA shield
	26-80514C01	filter shield
	26-80551C01	antenna connector shield
	32-80014N03	gasket, accessory connector

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

9/8/93

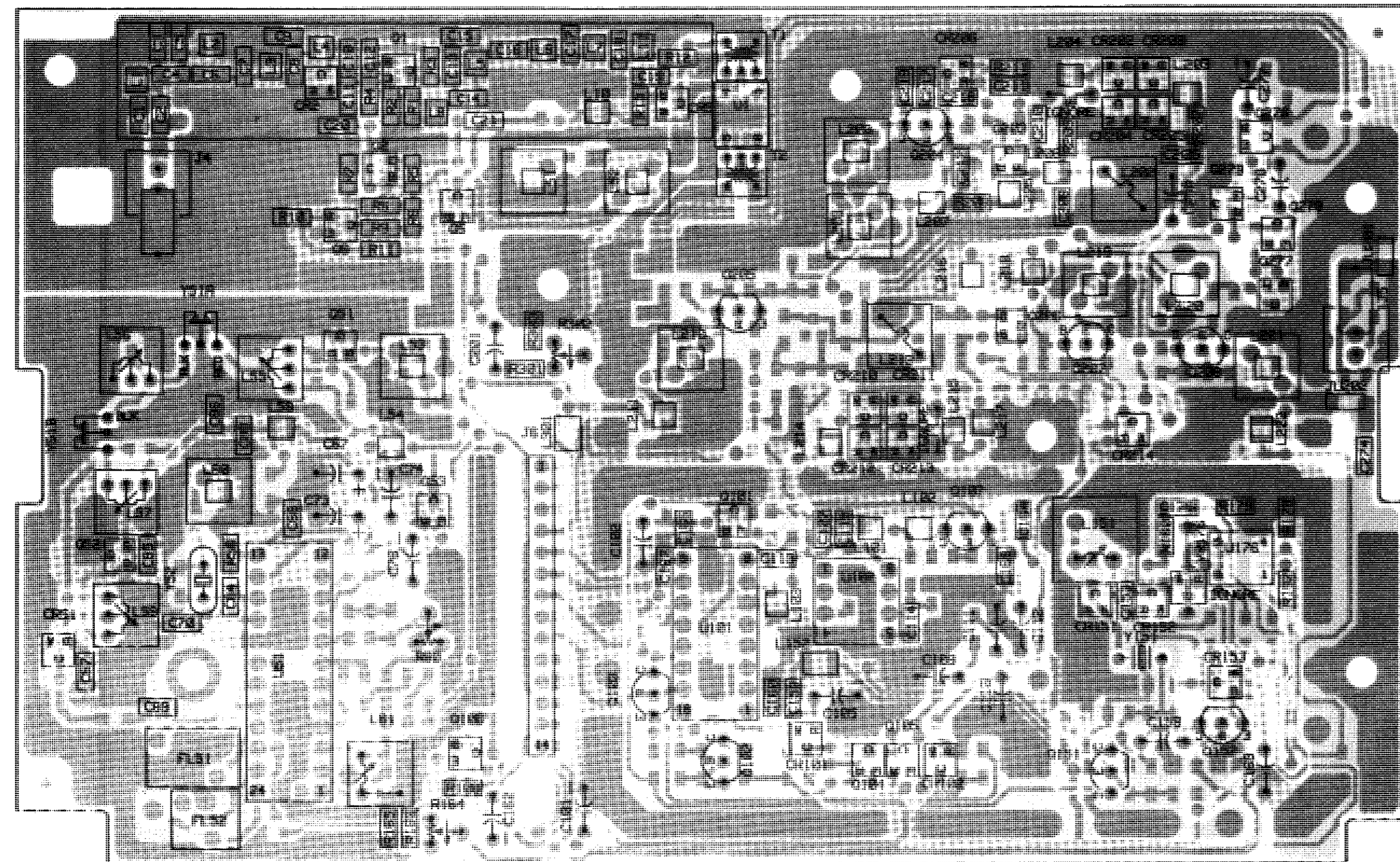
PL-931003-O



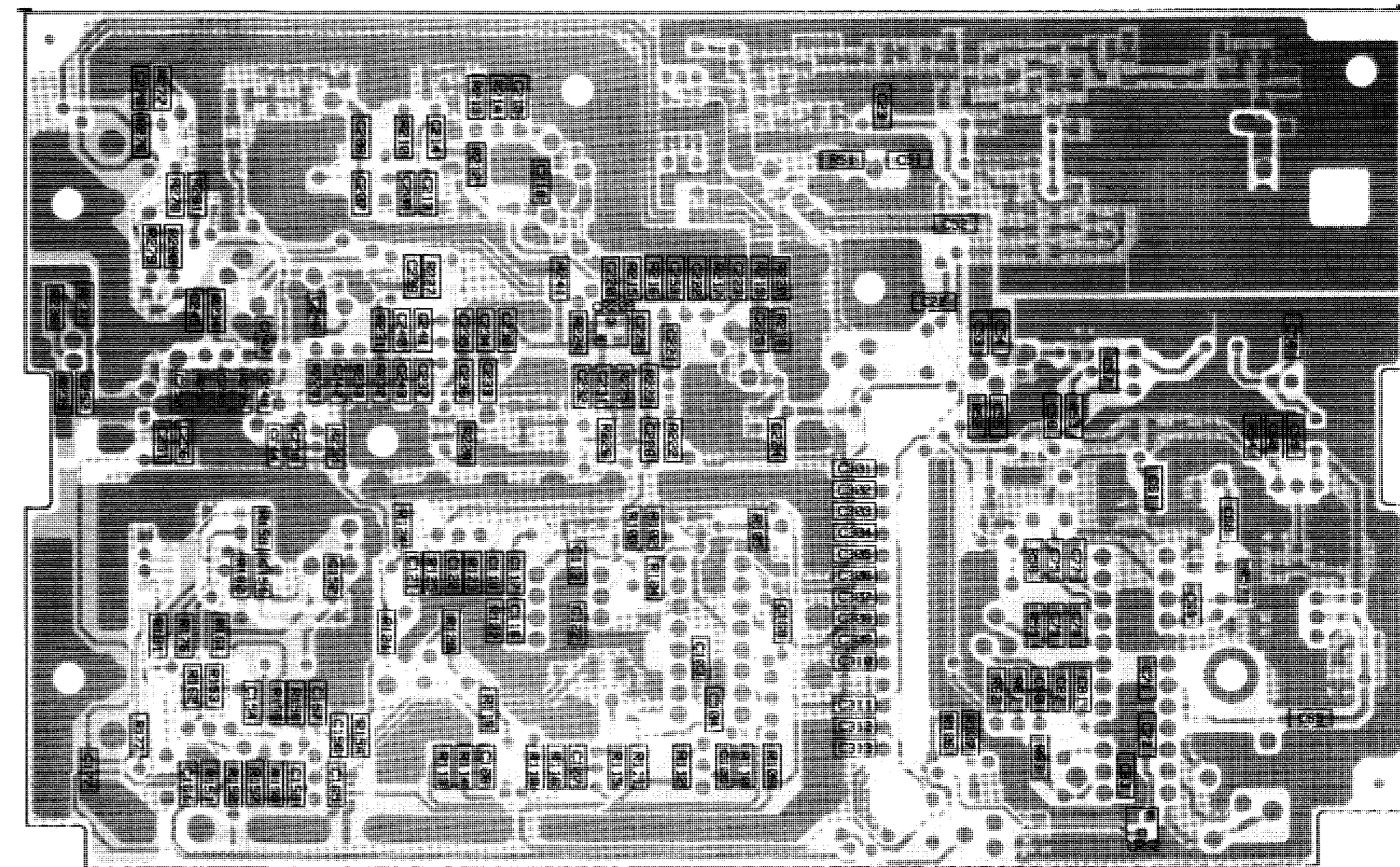
- NOTES:
- UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
 - NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 - POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
 - DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 - AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 - ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 1000 AT 3000 DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
 - COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODES. VALUES MARKED (H) ARE USED IN 20.25/30 KHZ CHANNEL SPACING MODES.

Schematic Diagram for HLD8265A and HLD8266A VHF RF Boards, 136-162 MHz

COMPONENT SIDE



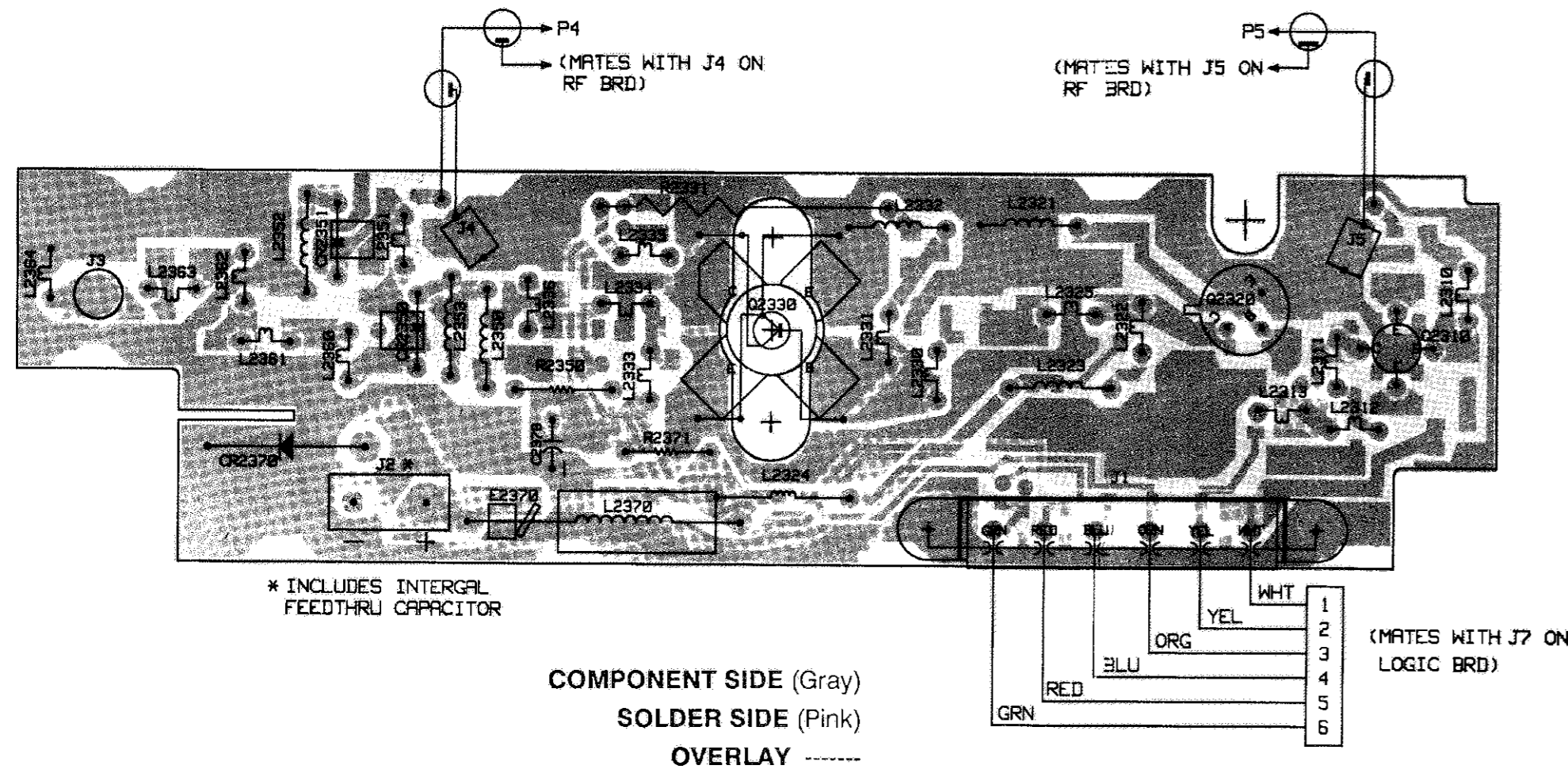
SOLDER SIDE



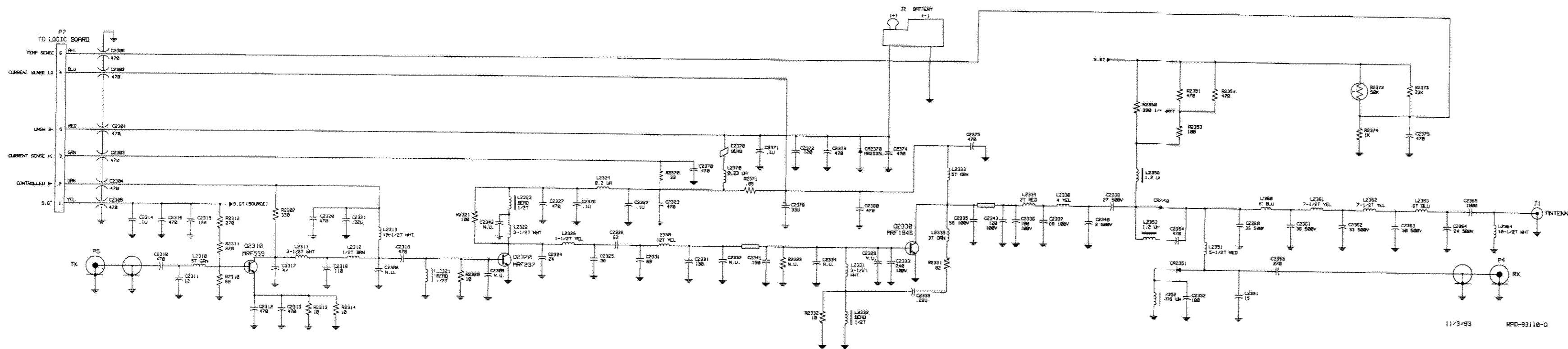
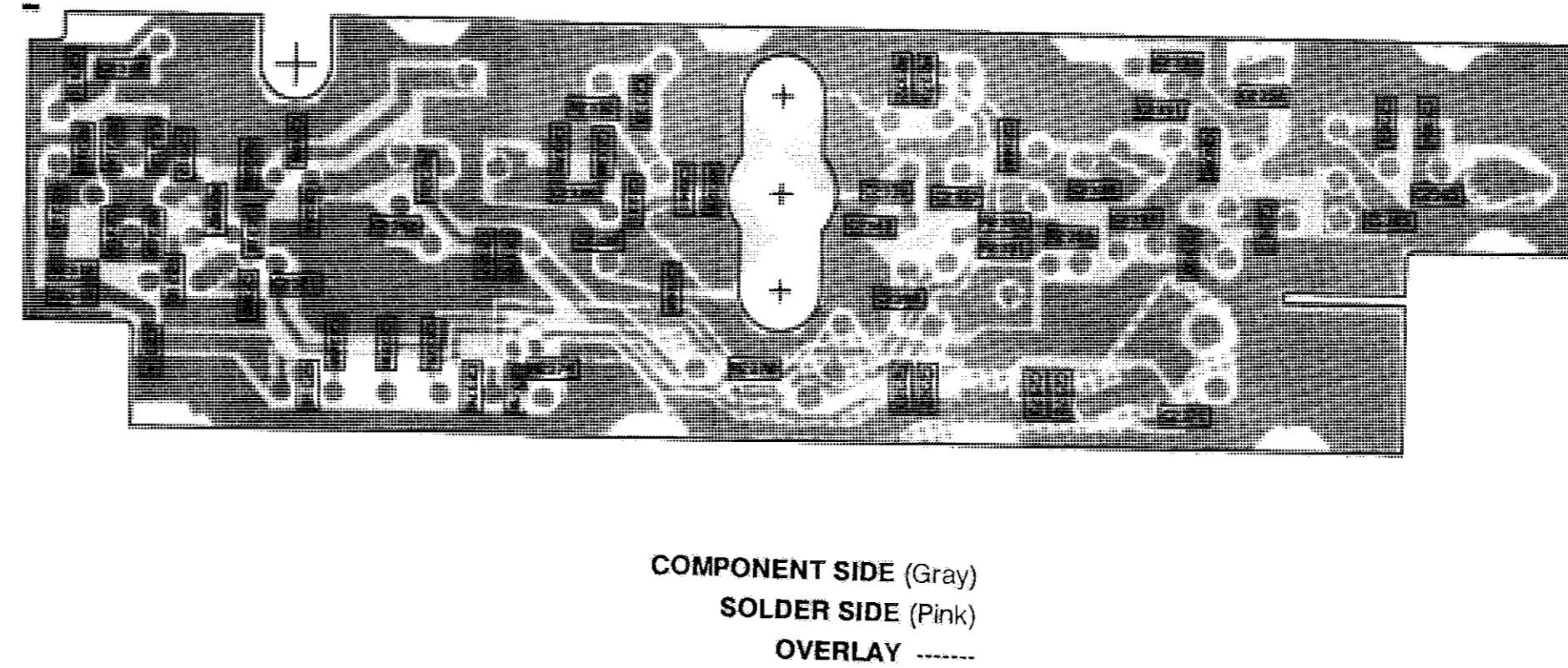
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE

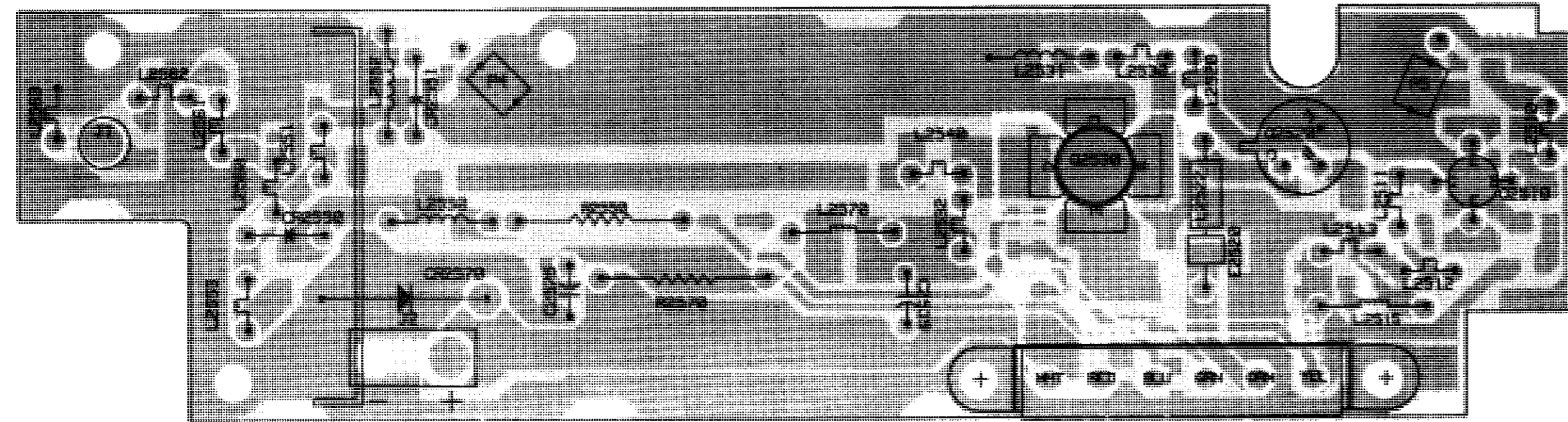


SOLDER SIDE

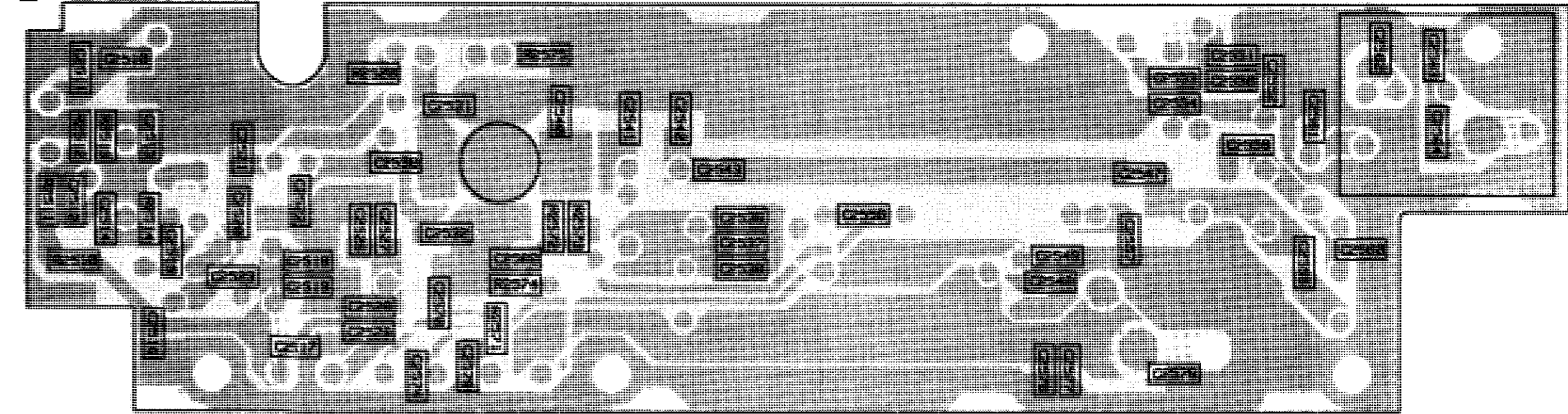


Circuit Board Details and Schematic for HLD8293A
VHF Power Amplifier, 136-162 MHz, 10-25 Watts

COMPONENT SIDE

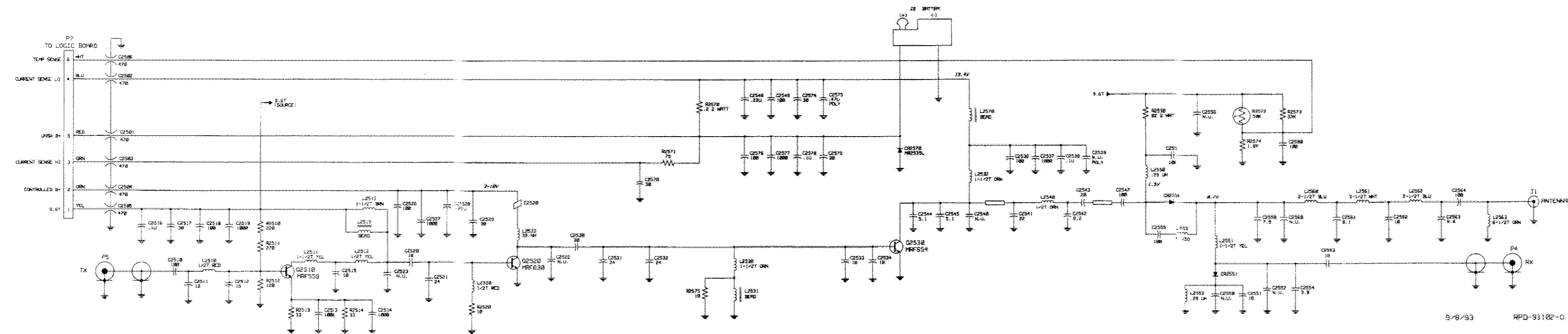


SOLDER SIDE



COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----



9-9-93 RPD-93182-0

Instructions for Expanded Accessory Connector

General

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

Pin #	Description
1	External Speaker Negative
2	Microphone Audio 80 mV RMS @ 60% Deviation
3	Microphone PTT
4	External Alarm (not supported)
5	Flat Transmit Audio 150 mV RMS @ 60% Deviation
6	Not Used
7	Ground
8	COR Output-Receiver Unsilenced Indicator (Active Low)
9	Emergency Alert Input (not supported)
10	Ignition Control Input
11	Discriminator Audio Output 600 mV RMS
12	Not Used
13	Switch A + Sense 0.5 Amps Max.
14	Remote Hook Switch Input
15	Internal Speaker Positive
16	External Speaker Positive

Extracting a Terminal

The extraction tool HLN9491 (shown in Figure 2.) is included in the radio packing carton. To remove a terminal:

1. Insert the extraction tool in the bottom of the opening in the terminal housing at the front (refer to Figure 2.).
2. Pull gently on the wire in the rear end of the terminal housing until it can be removed completely.

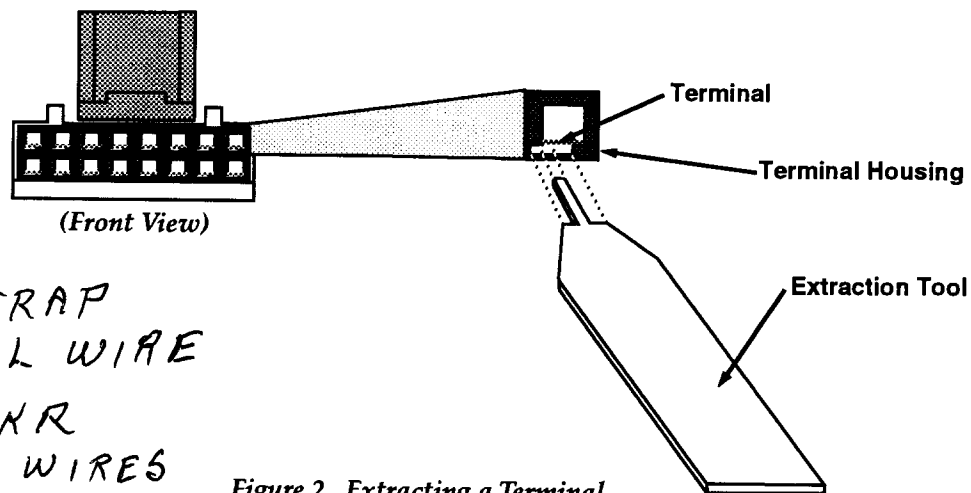


Figure 2. Extracting a Terminal

Inserting a Pin

1. Crimp the wire which leads to the terminal.
2. Insert the terminal into the desired housing location, with its locking tab facing down toward the strain relief tab. Refer to Figure 1. for pin locations.

IMPORTANT

Make sure that the terminal clicks into place.

NOTE

The following can be ordered through the Radius Division:

- Hardware Kit that includes 16 connector pins, an extra housing, and (9) 8-inch wires with connector pins attached (Kit #HLN9457).
- 3-foot long, 16 conductor cable, with connectors on both ends (Kit #HLN9969).

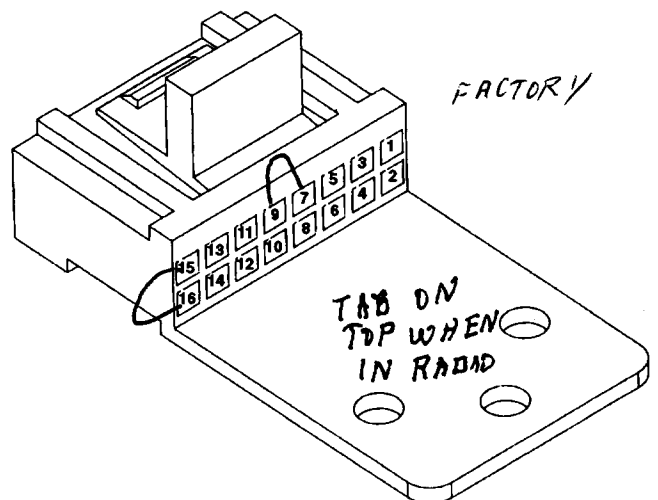


Figure 1. Accessory Connector, Rear View

CUT 15-16 STRAP
 ADDED YEL WIRE
 FOR INT. SPKR
 CON. 2 YEL WIRES
 TOGETHER. JULY 1998

Table 1. M120 Radio Accessory Connector

Pin	Function
4	External Alarm NULL2 PL/DPL & CSQ Detect CSQ Detect Clear to Send
6,9	NULL1 Emergency Switch Tx PL Inhibit TOC Disable Tx Audio Mute Rx Audio Mute Special Off Hook Channel Select 1-5 Mic Off Hook Auto PTT Request to Send Ext. Call Button
8,12,14	External Alarm (low current drive on these pins) NULL1 PL/DPL & CSQ Detect CSQ Detect Emergency Switch Tx PL Inhibit TOC Disable Tx Audio Mute Clear to Send Rx Audio Mute Special Off Hook Channel Select 1-5 Mic Off Hook Auto PTT Request to Send Ext. Call Button NULL2



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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 instruction manual revision. 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 aspects of M120 service. 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 M120 Mobile Radios.

Table 1.

Information	Location
Basic Use of M120	M120 Owner's Manual (6880902Z97)
Simplified Use of M120	M120 Operator Card (6880902Z96)
Programming	GM300 Basic RSS Manual (6880902Z36)

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.

Technical Support

Radius Product Services

Hwy. 34 West

Mt. Pleasant, IA 52641 USA

1-800-356-1520 ← /A

319-385-5395 (International)

Radius 30-Day Warranty

Radius Repair Depot

Attention: Warranty Return

1000 W. Washington Street

Mt. Pleasant, IA 52641 USA

1-800-356-1520

319-385-5395 (International)

Radius Major Component Repair

Radius Repair Depot

1000 W. Washington Street

Mt. Pleasant, IA 52641 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 ✓

1-708-538-8198 (FAX)

Parts Identification

1-708-538-0021

1-708-538-8194

MODEL	FREQ.	DESCRIPTION
M03GMC00A2AA	2	M120 12.5 kHz
M03GMC20A2AA	2	M120 20/25/30 kHz

ITEM	DESCRIPTION
HLD8029A	RF Board 12.5 kHz
HLD8031A	RF Board 20/25/30 kHz
HLN8074B	Logic Board, Masked
HLN8499A	Display Board, 2 Frequency
HLN8071A	Vol/Mic Board
HLN8441A	Front Panel Hardware, 2 Frequency
HLD8299A	PA Board
HLN8274A	PA Hardware
HLN8076A	Chassis Hardware

	Item	Description								
X	HUD3794A	Chassis, 12.5 kHz, Masked	X	X						X
X	HUD3792A	Chassis, 25 kHz, Masked		X	X					X
X	X	HLD3852A	PA Kit (part of chassis)					X	X	
X	X	HLN3037A	Control Head, 2 Channel			X	X	X		
X	X	HKN4137A	Power Cable							
X	X	HHN8073A	Housing Kit, Masked							
X	X	HMN3413A	Microphone w/hangup clip							
X	X	HLN5189A	Installation Kit							
X	X	6880902Z96	M120 Operator Card							
X	X	6880902Z97	M120 Owner's Manual							

MODEL		FREQ.	DESCRIPTION
M33GMC00A2AA		2	M120 12.5 kHz
M33GMC20A2AA		2	M120 20/25/30 kHz
M120 VHF Mobile Radio 146 - 174 MHz 10 - 25 Watts RF Power			
ITEM	DESCRIPTION		
HLD8029A	RF Board 12.5 kHz		
HLD8031A	RF Board 20/25/30 kHz		
HLN8074B	Logic Board, Masked		
HLN8439A	Display Board, 2 Frequency		
HLN8071A	Vo/Mic Board		
HLN8441A	Front Panel Hardware, 2 Frequency		
HLD8033A	PA Board		
HLN8069A	PA Hardware		
HLN8076A	Chassis Hardware		

	Item	Description										
X	HUD3409A	Chassis, 12.5 kHz, Masked	X		X							X
X	HUD3410A	Chassis, 25 kHz, Masked		X	X							X
X	X	HLD3502A	PA Kit (part of chassis)							X	X	
X	X	HCN3037A	Control Head, 2 Channel				X	X	X			
X	X	HKN4137A	Power Cable									
X	X	HHN8073A	Housing Kit, Masked									
X	X	HMN3413A	Microphone w/hangup clip									
X	X	HLN5189A	Installation Kit									
X	X	6880902Z96	M120 Operator Card									
X	X	6880902Z97	M120 Owner's Manual									

MODEL	FREQ.	DESCRIPTION
M43GMC00A2AA	2	M120 12.5 kHz
M43GMC20A2AA	2	M120 20/25/30 kHz

ITEM	DESCRIPTION
HLD8029A	RF Board 12.5 kHz
HLD8031A	RF Board 20/25/30 kHz
HLN8074B	Logic Board, Masked
HLN8439A	Display Board 2 Frequency
HLN8071A	Vol/Mic Board
HLN8441A	Front Panel Hardware, 2 Frequency
HLD8287A	PA Board
HLN8289A	PA Hardware
HLN8076A	Chassis Hardware

	Item	Description								
X	HUD3931A	Chassis, 12.5 kHz, Masked	X	X						X
X	HUD3790A	Chassis, 25 kHz, Masked		X	X					X
X	X	HLD3848A	PA Kit (part of chassis)					X	X	
X	X	HCN3037A	Control Head, 2 Channel			X	X	X		
X	X	HKN4137A	Power Cable							
X	X	HHN8073A	Housing Kit, Masked							
X	X	HMN3413A	Microphone w/hangup clip							
X	X	HLN5189A	Installation Kit							
X	X	6880902Z96	M120 Operator Card							
X	X	6880902Z97	M120 Owner's Manual							

MODEL	FREQ.	DESCRIPTION
M44GMC00A1AA	2	M120 12.5 kHz
M44GMC20A1AA	2	M120 20/25 kHz

M120 UHF Mobile Radio 403-433 MHz 25 - 40 Watts RF Power	
ITEM	DESCRIPTION
HLE8230A	RF Board 12.5 kHz
HLE8229A	RF Board 20/25 kHz
HLN8074B	Logic Board, Masked
HLN8439A	Display Board 2 Frequency
HLN8071A	Vol/Mic Board
HLN8441A	Front Panel Hardware, 2 Frequency
HLE8275A	PA Board
HLN8277A	PA Hardware
HLN8076A	Chassis Hardware

	Item	Description									
X	HUE3812A	Chassis, 12.5 kHz, Masked	X		X						X
X	HUE3811A	Chassis, 25 kHz, Masked		X	X						X
X	X	HLE3853A	PA Kit (part of chassis)						X	X	
X	X	HCN3037A	Control Head, 2 Channel			X	X	X			
X	X	HKN4137A	Power Cable								
X	X	HHN8073A	Housing Kit, Masked								
X	X	HMN3413A	Microphone w/hangup clip								
X	X	HLN5189A	Installation Kit								
X	X	6880902Z96	M120 Operator Card								
X	X	6880902Z97	M120 Owner's Manual								

MODEL	FREQ.	DESCRIPTION
M04GMC00A3AA	2	M120 12.5 kHz
M04GMC20A3AA	2	M120 20/25 kHz

ITEM	DESCRIPTION
HLE8301A	RF Board 12.5 kHz
HLE8300A	RF Board 20/25 kHz
HLN8074B	Logic Board, Masked
HLN8439A	Display Board 2 Frequency
HLN8071A	Vol/Mic Board
HLN8441A	Front Panel Hardware, 2 Frequency
HLE8267A	PA Board
HLN8268A	PA Hardware
HLN8076A	Chassis Hardware

		Item	Description														
X		HUE3816A	Chassis, 12.5 kHz, Masked	X		X											X
	X	HUE3815A	Chassis, 25 kHz, Masked		X	X											X
X	X	HLE3770A	PA Kit (part of chassis)										X	X			
X	X	HCN3037A	Control Head, 2 Channel					X	X	X							
X	X	HKN4137A	Power Cable														
X	X	HHN8073A	Housing Kit, Masked														
X	X	HMN3413A	Microphone w/hangup clip														
X	X	HLN5189A	Installation Kit														
X	X	6880902Z96	M120 Operator Card														
X	X	6880902Z97	M120 Owner's Manual														

MODEL		FREQ.	DESCRIPTION
M34GMC00A3AA		2	M120 12.5 kHz
M34GMC20A3AA		2	M120 20/25 kHz
M120 UHF Mobile Radio 438 - 470 MHz 10 - 25 Watts RF Power			
ITEM	DESCRIPTION		
HLE8301A	RF Board 12.5 kHz		
HLE8300A	RF Board 20/25 kHz		
HLN8074B	Logic Board, Masked		
HLN8439A	Display Board, 2 Frequency		
HLN8071A	Vo/Mic Board		
HLN8441A	Front Panel Hardware, 2 Frequency		
HLE8034A	PA Board		
HLN8068A	PA Hardware		
HLN8076A	Chassis Hardware		

	Item	Description								
X	HUE3820A	Chassis, 12.5 kHz, Masked	X	X						X
X	HUE3819A	Chassis, 25 kHz, Masked		X	X					X
X	X	HLE3501A	PA Kit (part of chassis)						X	X
X	X	HCN3037A	Control Head, 2 Channel			X	X	X		
X	X	HKN4137A	Power Cable							
X	X	HHN8073A	Housing Kit, Masked							
X	X	HMN3413A	Microphone w/hangup clip							
X	X	HLN5189A	Installation Kit							
X	X	6880902Z96	M120 Operator Card							
X	X	6880902Z97	M120 Owner's Manual							

MODEL	FREQ.	DESCRIPTION
M44GMC00A3AA	2	M120 12.5 kHz
M44GMC20A3AA	2	M120 20/25 kHz
M120 UHF Mobile Radio 438 - 470 MHz 25 - 40 Watts RF Power		
ITEM	DESCRIPTION	
HLE8301A	RF Board 12.5 kHz	
HLE8300A	RF Board 20/25 kHz	
HLN8074B	Logic Board, Masked	
HLN8439A	Display Board 2 Frequency	
HLN8071A	Vol/Mic Board	
HLN8441A	Front Panel Hardware, 2 Frequency	
HLE8271A	PA Board	
HLN8272A	PA Hardware	
HLN8076A	Chassis Hardware	

	Item	Description												
X	HUE3918A	Chassis, 12.5 kHz, Masked	X		X									X
	X	HUE3822A	Chassis, 20/25 kHz, Masked		X	X								X
X	X	HLE3772A	PA Kit (part of chassis)							X	X			
X	X	HCN3037A	Control Head, 2 Channel				X	X	X					
X	X	HKN4137A	Power Cable											
X	X	HHN8073A	Housing Kit, Masked											
X	X	HMN3413A	Microphone w/hangup clip											
X	X	HLN5189A	Installation Kit											
X	X	6880902Z96	M120 Operator Card											
X	X	6880902Z97	M120 Owner's Manual											

MODEL	FREQ.	DESCRIPTION
M44GMC00A4AA	2	GM300 12.5 kHz
M44GMC20A4AA	2	GM300 20/25 kHz

M120 UHF Mobile Radio 465 - 495 MHz 25 - 40 Watts RF Power	
ITEM	DESCRIPTION
HLE8264A	RF Board 12.5 kHz
HLE8263A	RF Board 20/25 kHz
HLN8074B	Logic Board Masked
HLN8070A	Logic Board, Expanded
HLN8075A	Display Board 8/16 Frequency
HLN8071A	Vol/Mic Board
HLN8072A	Front Panel Hardware, 8/16 Freq
HLE8284A	PA Board
HLN8286A	PA Hardware
HLN8076A	Chassis Hardware

	Item	Description																
X	HUE3842A	Chassis, 12.5 kHz, Masked		X	X													X
X	HUE3841A	Chassis, 20/25 kHz, Masked			X	X												X
X	X	HLE3847A	PA Kit (part of chassis)															X
X	X	HCN3037A	Control Head, 2 Channel						X	X	X							X
X	X	HKN4137A	Power Cable															
X	X	HHN8073A	Housing Kit, masked															
X	X	HMN3413A	Microphone w/hangup clip															
X	X	HLN5189A	Installation Kit															
X	X	6880902Z96	M120 Operator Card															
X	X	6880902Z97	M120 Owner's Manual															

MODEL	FREQ.	DESCRIPTION
M44GMC00A5AA	2	M120 12.5 kHz
M44GMC20A5AA	2	M120 20/25/30 kHz
M120 UHF Mobile Radio 490-520 MHz 25 - 35 Watts RF Power		
ITEM	DESCRIPTION	
HLE8228A	RF Board 12.5 kHz	
HLE8227A	RF Board 20/25/30 kHz	
HLN8074B	Logic Board, Masked	
HLN8439A	Display Board, 2 Frequency	
HLN8071A	Vol/Mic Board	
HLN8441A	Front Panel Hardware, 2 Frequency	
HLE8269A	PA Board	
HLN8270A	PA Hardware	
HLN8076A	Chassis Hardware	

	Item	Description																		
X	HUE3838A	Chassis, 12.5 kHz, Masked	X		X															X
	X	HUE3837A	Chassis, 25 kHz, Masked		X	X														X
X	X	HLE3771A	PA Kit (part of chassis)																	
X	X	HCN3037A	Control Head, 2 Channel					X	X	X										
X	X	HKN4137A	Power Cable																	
X	X	HHN8073A	Housing Kit, Masked																	
X	X	HMN3413A	Microphone w/hangup clip																	
X	X	HLN5189A	Installation Kit																	
X	X	6880902Z96	M120 Operator Card																	
X	X	6880902Z97	M120 Owner's Manual																	

Accessories

Radius offers several accessories to increase communications efficiency. Many of the accessories available are listed below, but for a complete list, consult your Radius dealer.

Antennas:

HAD4007_R	VHF 146-150.8 MHz, 1/4 wave roof mount
HAD4008_R	VHF 150.8-162 MHz, 1/4 wave roof mount
HAD4009_R	VHF 162-174 MHz, 1/4 wave roof mount
HAD4014_R	VHF 146-172 MHz, 3dB gain roof mount
HAE4003_R	UHF 450-470 MHz, 1/4 wave roof mount
HAE4004_R	UHF 470-512 MHz, 1/4 wave roof mount
HAE4002_R	UHF 403-430 MHz, 1/4 wave roof mount
HAE4010_R	UHF 406-420 MHz, 3.5 dB gain roof mount
HAE4011_R	UHF 450-470 MHz, 3.5 dB gain roof mount
HAE4012_R	UHF 470-512 MHz, 3.5 dB gain roof mount
HAE4013_R	UHF 494-512 MHz, 3.5 dB gain roof mount
HAE4019_R	UHF 450-470 MHz, 3.5 dB gain roof mount

Microphones:

HMN3596_R	Compact Palm Microphone with 7 foot cord
HMN1035_R	Heavy Duty Palm Microphone with 10.5 ft. cord
HMN1037_R	Touch-code Microphone with hang-up clip
TDN8305_R	Touch-code Mic. with backlit keypad & hang-up clip
TMN6169_R	Touch-code Mic. with memory dial, backlit keypad & hang-up clip
HMN3141_R	Handset with hang-up cup
HLN9559_R	7 foot coil cord for Compact and Heavy Duty Microphones
HLN9560_R	10.5 foot extended coil cord for Compact and Heavy Duty Microphones
HLN9073_R	Microphone hang-up clip (all microphones)
HMN3001_R	M10 compact LED microphone with hang-up clip
HMN3002_R	M10 compact LED microphone without hang-up clip

Installation Accessories:

HLN9284_R	Key lock mount
HLN5189_R	Non-locking bracket
HLN5226_R	Extra stability mount (use with HLN5189)
HLN9450_R	45 - 60 degree floor mount wedge (requires HLN9404)
HLN9404_R	Sleeve mounting bracket
HKN4137_R	VHF/UHF/800 MHz low power cable
HLN5282_R	Mini-U connector (all bands)
HKN9557_R	PL259/Mini-U antenna adapter - 8 inch cable
HLN8027_R	Mini - UHF to BNC antenna adapter
HLN8097_R	Removable slide mount tray package
HLN8098_R	Radio slide mount tray
HLN8099_R	Vehicle slide mount tray
HLN8143_R	Remote mount kit (17 ft. length)
HLN8144_R	Remote mount kit (8 FT. length)
HLN8413_R	Slide mount tray bracket

Accessories

Control Station Accessories:

HMN1038_R	Desk Microphone
HPN4001_R	Power supply and cable (all models)
HPN4002_R	Power supply and cable (1-10, 10-25 watt models)
HKN4139_R	Low power control station power cable (VHF/UHF)
HKN9455_R	High power control station power cable (VHF/UHF)
HLN5292_R	Base tray for control station

Accessories / Kits Interfacing with the 16 Pin Connector:

HKN9327_R	Ignition switch cable
HSN8145_R	7.5 Watt external speaker - for receiver audio
HKN9969_R	Accessory for repeater interface communications kit-additional 3 foot, 16 conductor cable for connection to other accessories
HLN3333_R	Repeater interface communications kit- includes interface box, mounting bracket, and two 6 conductor cables
HLN9457_R	Hardware kit-includes 16 connector pins, (9) 8" wires with pins & extra housing
TDN8300	DC Remote adapter and service manual, 2-channel operation (order desktop controller separately)
TDN8301	Tone remote adapter and service manual, 2-channel operation (order desktop controller separately)

Manuals:

6880902Z98	Service Manual
6880902Z97	Owner's Manual
6880902Z96	Operator's Card
6880902Z43	DTMF Manual
TDN8198	i50X Radio-Telephone Interconnect Service Manual
TDN8448	DC Remote Adapter Manual
TDN8449	Tone Remote Adapter Manual

Specifications

GENERAL

	VHF			UHF						
	Model Series:	M03GMC	M33GMC	M43GMC	M04GMC	M34GMC	M44GMC			
Frequency Range:	146-174 MHz			438-470 MHz		403-433 MHz	438-470 MHz	465-495 MHz	490-520 MHz	
RF Output:	1-10W*	10-25W*	25-45W*	1-10W*	10-25W*	25-40W*		25-35W*		
Channel Capacity:	2									
Frequency Separation:	28 MHz			32 MHz		30 MHz	32 MHz	30 MHz		
Primary Input Voltage	13.8 ± 10%									
EIA:										13.2 ± 20%
CEPT 84:										
FCC Designation:	ABZ99FT3032	ABZ99FT3030	ABZ99FT3033	ABZ99FT4033	ABZ99FT4030	ABZ99FT4032	ABZ99FT4034	ABZ99FT4035	ABZ99FT4036	
Typical Current Drain Rated Audio (7.5 W):	1.5A									
Transmit:	4.0A	7.0A	15.0A	4.0A	7.5A	12.5A				
Standby:	350mA									
Squelch Capability:	Tone Coded, Digital Coded, and/or Carrier Squelch									
Dimensions:	2' x 7' x 7.75' (50.8 x 178 x 198 mm)									
Weight:	61 oz. (1.7 kg)									

*Continuously variable power

TRANSMITTER

	VHF		UHF	
Frequency Stability (-30°C to +60°C):	±.00025%			
Spurs/Harmonics 1 to 25W: >25W: Exceptions:	-36 dBm (25µW) -13 dBm (50µW) (403-433 MHz) -36 dBm (25µW)			
Audio Response: (From a 6 dB/Oct. Pre-Emphasis 300 to 3000 Hz, 2550 Hz @ 12.5 kHz)	+1/-3 dB			
Audio Distortion: (@ 1000 Hz, 60% of Rated Max. Deviation)	<3% EIA			
FCC Modulation @ 20/25/30 kHz @ 12.5 kHz	16K0F1D, 16K0F2D, 16K0F3E 11K0F1D, 11K0F2D, 11K0F3E			
Output Impedance:	50Ω			
Modulation Sensitivity:	80 mV for 60% max. deviation at 1000 Hz			
Channel Spacing:	20/25/30 kHz	12.5 kHz	20/25 kHz	12.5 kHz
FM Noise EIA:	45 dB	40 dB	40 dB	35 dB
CEPT 84:	55 dB	50 dB	50 dB	45 dB

MILITARY STANDARDS 810 C, D, & E

Applicable MIL-STD:	810C		810D		810E	
	Methods	Procedures	Methods	Procedures	Methods	Procedures
Vibration:	514.2	8, 10	514.3	1	514.4	1
Shock:	516.2	1, 3, 5	516.3	1, 5	516.4	1, 5

RECEIVER

	VHF		UHF	
Channel Spacing:	12.5 kHz	20/25/30 kHz	12.5 kHz	20/25 kHz
Sensitivity				
EIA: 12 dB SINAD:	.35 µV	.30 µV	.35 µV	.30 µV
CEPT 84: 20 dB SINAD:	.45 µV	.40 µV	.45 µV	.40 µV
Squelch:	10 dB SINAD			
Selectivity				
EIA:	-70 dB	-80 dB	-65 dB	-75 dB
CEPT 84:	-70 dB	-80 dB	-65 dB	-75 dB
Intermodulation*				
EIA:	-70 dB	-78 dB	-65 dB	-75 dB
CEPT 84:	-73 dB	-73 dB	-70 dB	-70 dB
Frequency Stability: (-30°C to +60°C)	.00025%			
Spur Rejection				
EIA:	-80 dB		-75 dB	
CEPT 84:	-75 dB		-70 dB	
Image Rejection				
EIA:	-80 dB		-75 dB	
CEPT 84:	-80 dB		-75 dB	
Audio Output: External Speaker (8Ω) EIA (@ <5% Dist): CEPT 84 (@ <10% Dist): Internal Speaker:	7.5 W 5.0 W 3.0 W Nominal			
EIA Usable Bandwidth:	1.2 kHz	2.0 kHz	1.2 kHz	2.0 kHz
Input Impedance:	50W			

*Local mode provides an additional 10 dB protection against wideband interference

Overview

This section explains how to disassemble and assemble the M120 radio, and provides information about setup and preliminary adjustments and tests.

Disassemble Radio

Remove Control Head and Chassis Covers

1. Remove mounting screws for control head (Figure 1-1).

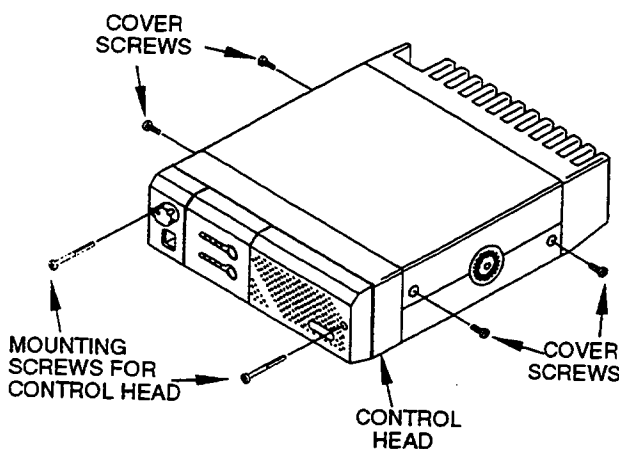


Figure 1-1. Mounting and Cover Screws

2. Pull control head off and away from the radio.
3. Carefully remove control head connectors from chassis.
4. Remove the two chassis cover screws from each side (Figure 1-1).
5. Remove top and bottom covers from chassis.

Remove RF Chassis Shield

1. Gently pry each of the four corners of the RF chassis shield at the indentations provided (Figure 1-2).
2. Remove RF chassis shield.

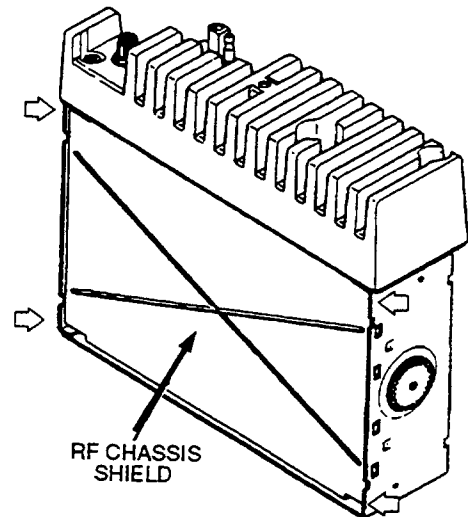


Figure 1-2. Chassis Shield

Remove PA Heatsink

1. Disconnect the transmit and receive coaxial cables from the RF board (Figure 1-3).
2. Disconnect the 6-pin connector from the logic board (Figure 1-4).
3. Remove the heatsink mounting screws (Figure 1-4).
4. Pull heatsink off of chassis while carefully feeding the transmit and receive coaxial cables through their respective holes in the chassis.

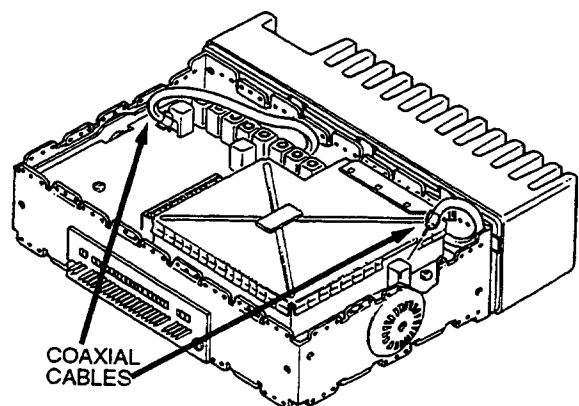


Figure 1-3. Inside Chassis, Coaxial Cables

Assemble Radio

Remove RF Circuit Board

1. Pry off the RF shield (Figure 1-5), being careful not to bend the shield.
2. Remove all the RF board mounting screws.
3. Remove the RF board (Figure 1-5).

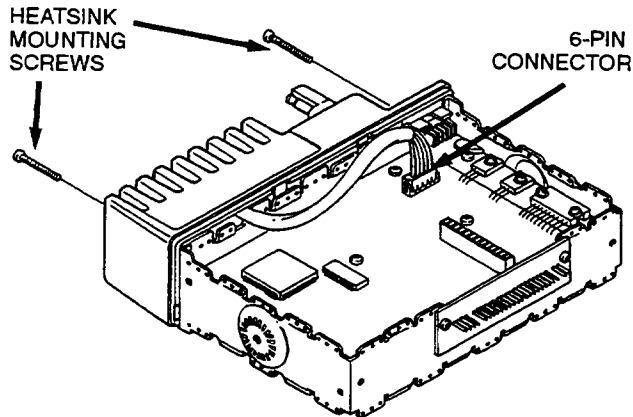


Figure 1-4. Chassis, Connector and Heatsink Screws

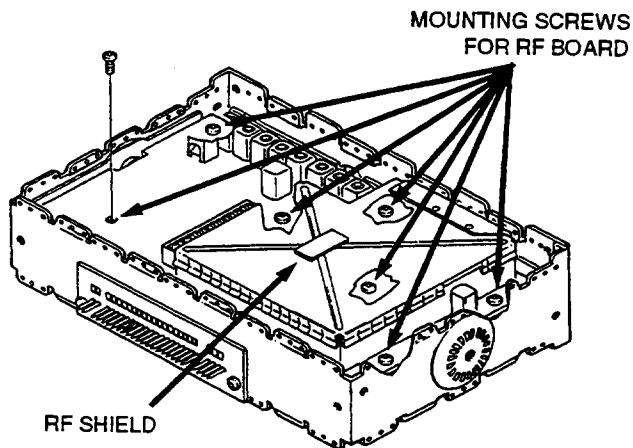


Figure 1-5. RF Shield and Board

Remove Logic Circuit Board

1. Turn the radio over.
2. Pry off the logic shield, being careful not to bend the shield.
3. Remove all mounting screws from the logic board (Figure 1-6).
4. Remove the two screws from the filter board at the front of the chassis (Figure 1-6).
5. Lift the logic and filter boards out of the chassis.

Remove PA Circuit Board

1. Carefully pry each corner and side of the power amplifier (PA) shield until you can slide it off easily (Figure 1-7).

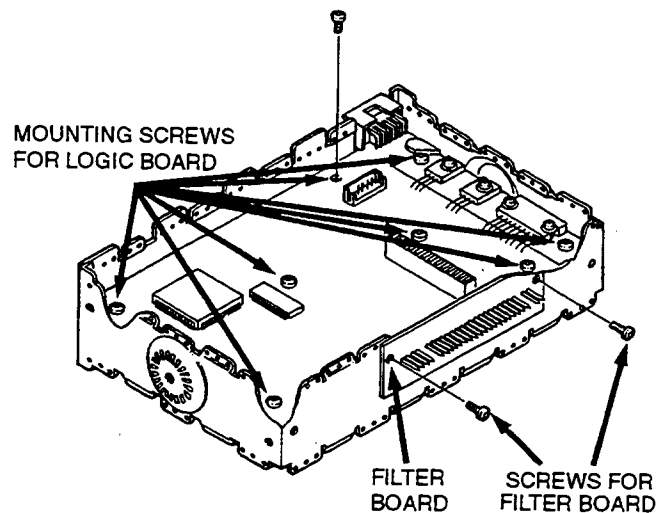


Figure 1-6. Logic and Filter Boards

2. Remove the shield completely by guiding the coaxial cables out of the openings.
3. Unsolder the A+ power connector feed-thru leads and the antenna connector lead (Figure 1-8).
4. UHF ONLY - Remove the stud mount transistor mounting nut from the back of the heat-sink (Figure 1-9).
5. Remove two power device mounting screws and all PA board mounting screws (Figure 1-8).
6. Take out the PA board.

Assemble Radio

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

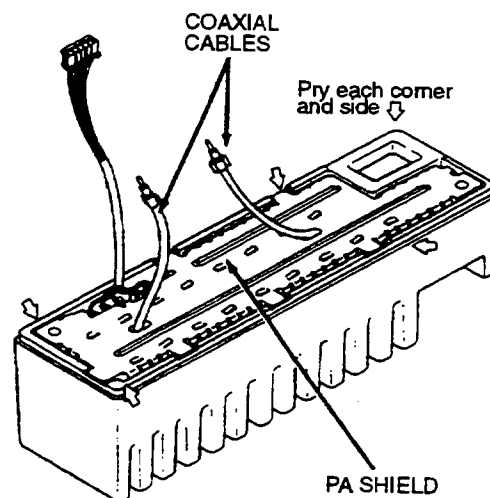


Figure 1-7. PA Shield

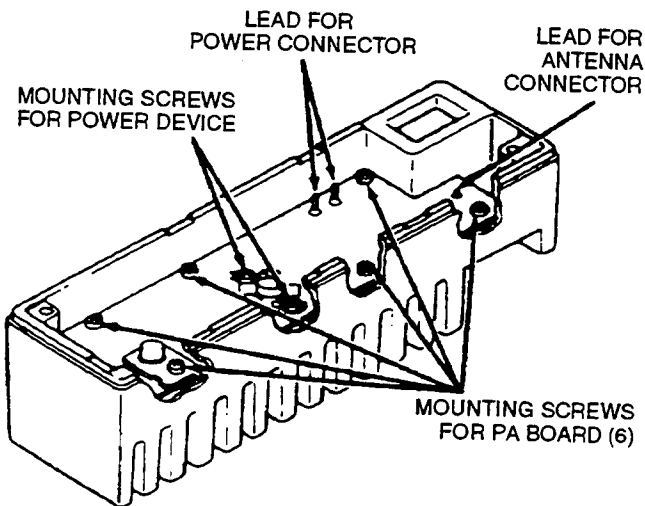


Figure 1-8. Leads and Mounting Screws

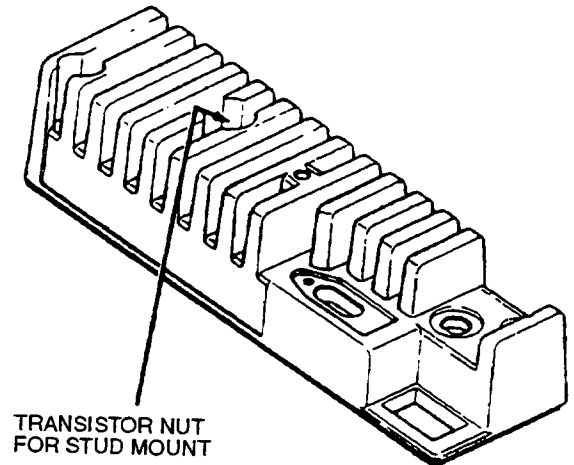


Figure 1-9. Transistor Mounting Nut

Table 1-1.

Part Number	Description	Location	Quantity	Drive	Input Torque	Repair Torque
03-10945A11	M3 x 8 Plastite Slit Torx Pan Head	Control Head Board and Internal Speaker	9	T10	8 in.-lbs	7 in.-lbs.
03-80270L01	M4 x 0.7 x 38 Machine Torx Cap Screw Black	Control Head Mtg	2	T15	8 in.-lbs.	8 in.-lbs.
03-80271L01	M4 x 0.7 x 27 Machine Slit Torx Pan Head Black	Heat sink Mtg.	2	T15	12-14 in.-lbs.	12-14 in.-lbs.
03-10943M04	M2.5 x 8 Taptite Slit Torx Pan Head	Logic Heatsink Device Mtg.	2	T8	6-8 in.-lbs.	4-6 in.-lbs.
03-10943M09	M3 x 6 Taptite Slit Torx Pan Head	RF Board Mtg. Logic Board Mtg. Chassis Feedthru Plt Front Panel Filter Board	7 6 2 2	T10	8-10 in.-lbs.	6-8 in.-lbs.
03-10943M10	M3 x 8 Taptite Slit Torx Pan Head	PA Device/Board Mtg. Logic Heatsink to Chassis	8	T10	11-13 in.-lbs.	8-10 in.-lbs.
03-10943M11	M3 x 10 Taptite Slit Torx Pan Head	Power connector Device to Logic Heatsink	2	T10	9-11 in.-lbs	7-9 in.-lbs.
03-10943R55	M3 x 8 Taptite Torx Flat Head Black	Chassis covers	4	T10	8-10 in.-lbs.	6-8 in.-lbs.
02-00007003	Hex Nut 8-32	PA -Stud Device Mtg.	1	5/16" Hex	5 in.-lbs.	5 in.-lbs.
04-00136334	Flat Washer	Device to Logic Heatsink Power connector	2 2	--	--	--
04-80943V01	Washer-Lock 3/8 Ext, Std. Zinc	Antenna connector	1	--	--	--
09-80131M01	3/8 Nut	Antenna connector	1	3/8" Hex	18-20 in.-lbs.	18-20 in.-lbs.
38-80041M01	Plug, button	Heatsink plug	1	--	--	--
03-11994A23	5-20 x 7/8" Plastite Phl Pan Head.	Mic. Rear Housing to Front Housing	3	1	9-11 in.-lbs.	9-11 in.-lbs.

Align Circuits

The advanced design and manufacturing procedures eliminate the need for traditional tuning tasks. All the circuits in the M120 radio have been aligned at the factory with specialized equipment. Alignment in the field should not be attempted or necessary.

Program Radio

The M120 radio 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

Configuration information for programming these parameters is contained in the **M120 Radio Service Software package HVN8177A** for 5.25 inch drives and 3.5 inch drive diskettes.

An IBM or compatible personal computer (PC) 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 M120 radios.

Recommended Test Equipment

We recommend using the following equipment to test the M120:

- R2001D Communication Systems Analyzer

and ONE of the following

- R2200B Service Monitor
- R1011B Power Supply
- R1037A Digital Multimeter
- R1024B Digital Multimeter

Replace and Calibrate Logic Board

If replaced, the logic board, RF board, or power amplifier must be recalibrated using the Motorola Radio Service Software. Refer to the M120 Radio Service Software Manual for the calibration procedures.

Failure to perform the required calibration procedures will affect the performance of the reference oscillator, RF power leveling and protection, and transmitter modulation over frequency and temperature. An uncalibrated radio may not comply with your local communications agency rules and may be unreliable at temperature extremes.

The M120 radio was designed to be serviced at the board level only. There are a number of non-field serviceable parts in the radio. Field replacement of these parts will affect the factory calibrated numbers on the tuning label. If any of these parts fail, the board must be replaced.

Table 1-2. Error Tones/Troubleshooting

Tone	Problem/Solution
High-pitched beep (900Hz 119ms) on initial turn on or when key is pressed.	Normal operation/No error
Low-pitched tone (163Hz) for 5 seconds following turn-on.	Code plug error/Re-program radio *
Low frequency (163Hz) continuous tone present whenever radio is on.	Logic board failure/Replace logic board
Low-pitched beep (300Hz 200 MS) when a button is pressed.	Button not allowed in current operating condition/Change operating condition (select another mode, etc.)
Low frequency (150Hz or 112.5Hz) continuous tone while PTT is held.	Transmit not allowed/Release PTT, and continue call (if timed out)

*If this does not clear the fault or if the problem recurs, replace the logic board.

Overview

This section provides detailed theory of operation for the M120 and its components.

RF Board

VHF Receiver Front End, 146-174 MHz

The received signal applied to the radio's antenna input connector is first routed through the harmonic filter/antenna switch on the RF Power Amplifier Board, and then applied via coax to J4 on the RF Board. The insertion loss of the harmonic filter/antenna switch is less than 1 dB.

The signal applied to J4 is routed to a fixed-tuned 4-pole filter having a 3 dB bandwidth of 57 MHz and a 1 dB bandwidth of 37 MHz centered at 160 MHz. Insertion loss is 1.5 dB typically, and 2 dB at 146 MHz. Attenuation for image protection is 32 dB at 236 MHz, with increasing attenuation at higher frequencies.

The output of the filter is matched to the base of RF amplifier Q1, which provides 12 dB of gain and has a noise figure of 3.6 dB. Current source Q2 is used to maintain the collector current of Q1 constant at 26 mA. Diode CR2 clamps excessive input signals, protecting Q1.

The output of Q1 is applied to a 3-pole fixed-tuned filter having a 3 dB bandwidth of 59 MHz and a 1 dB bandwidth of 48 MHz centered at 160 MHz. Insertion loss is 1.3 dB. Attenuation for image protection is 35 dB at 236 MHz, with increasing attenuation at higher frequencies. Additional image protection is provided by the transmitter harmonic filter, which provides at least 20 dB of attenuation at 236 MHz and above.

A pin diode attenuator is located between the 3 pole filter and the first mixer. In the Distance mode, Q5 and Q6 are turned on, CR5 is forward-biased which bypasses R12, and no loss is introduced. In the Local mode, Q5, Q6 and CR5 are off, inserting 10 dB of attenuation due to R12. Because the attenuator is located after the RF amplifier, receiver sensitivity is reduced by only 5 dB, while the overall third order input intercept is raised by 15 dB. Thus, the local mode significantly reduces the susceptibility to IM-related interference.

The first mixer is a passive, double-balanced type consisting of T1, T2 and U1. This mixer provides all of the necessary rejection of the half-IF spurious response, since the improvement due to filter selectivity is negligible for much of the band. High-side injection at +13 dBm is delivered to the first mixer from the second RX buffer in the synthesizer circuit.

The mixer output is connected to a duplexer network which matches its output to the first IF amplifier Q51 at the IF frequency of 45.1 MHz, and terminates it in a 50 ohm resistor, R51, at all other frequencies.

UHF Receiver Front End

The received signal applied to the radio's antenna input connector is first routed through the harmonic filter/antenna switch on the RF Power Amplifier Board, and then applied via coax to J4 on the RF Board. The insertion loss of the harmonic filter/antenna switch is less than 1 dB.

The signal applied to J4 is routed to a fixed-tuned 3 pole shunt resonator filter with the characteristics listed in Table 2-1.

Table 2-1. Characteristics of Resonator Filter

Range	403-433	438-470	465-495	490-520
1 dB BW	41 MHz	45 MHz	40 MHz	40 MHz
3 dB BW	77 MHz	65 MHz	60 MHz	55 MHz
Loss	3 dB	1.8 dB	2.2 dB	2.2 dB
f_{CENTER}	418 MHz	455 MHz	480 MHz	510 MHz
Image Rej	33 dB	30 dB	35 dB	37 dB
At f_{IMAGE}	343 MHz	380 MHz	405 MHz	430 MHz

Attenuation for image protection increases for frequencies lower than f_{IMAGE} .

The output of the filter is matched to the base of RF amplifier Q1. Current source Q2 is used to maintain the collector current of Q1 constant at 30 mA. Transistors Q3 and Q4 turn off the DC supply to Q1 and Q2 during transmit, reducing the dissipation in Q1. Diodes CR2 and CR3 clamp excessive input signals, protecting Q1. The RF amplifier parameters are listed in Table 2-2.

Table 2-2. RF Amplifier Parameters

Range	403-433	438-470	465-495	490-520
Gain	16 dB	15 dB	15 dB	15 dB
N.F.	1.4 dB	1.4 dB	1.8 dB	1.8 dB

The output of Q1 is applied to a tunable 4 pole shunt resonator filter with the characteristics listed in Table 2-3.

Table 2-3. Characteristics of Resonator Filter

Range	403-433	438-470	465-495	490-520
1 dB BW	35 MHz	45 MHz	40 MHz	40 MHz
3 dB BW	44 MHz	60 MHz	60 MHz	55 MHz
Loss	4.2 dB	3.7 dB	3.8 dB	3.8 dB
f_{CENTER}	418 MHz	455 MHz	480 MHz	510 MHz
Image Rej	55 dB	40 dB	52 dB	54 dB
At f_{IMAGE}	343 MHz	380 MHz	405 MHz	430 MHz

RF Board

Again, image attenuation increases for frequencies lower than f_{IMAGE} .

A pin diode attenuator is located between the 4 pole filter and the first mixer. In the Distance mode, Q5 and Q6 are turned on, CR5 is forward-biased which bypasses R12, and no loss is introduced. In the Local mode, Q5, Q6 and CR5 are off, inserting 10 dB of attenuation due to R12. Because the attenuator is located after the RF amplifier, receiver sensitivity is reduced only by 5 dB, while the overall third order input intercept is raised by 15 dB. Thus, the Local mode significantly reduces the susceptibility to IM-related interference.

The first mixer is a passive, double-balanced type consisting of T1, T2 and U1. This mixer provides all of the necessary rejection of the half-IF spurious response, since the improvement due to filter selectivity is negligible at 470 MHz. Low-side injection is delivered to the first mixer from the second RX buffer in the synthesizer

circuit. The injection level is +11.6 dBm for 403-433 range, +5 dBm for the 438-470 MHz range, and +6.5 dBm for the 465-495 and 490-520 MHz ranges.

The mixer output is connected to a duplexer network which matches its output to the first IF amplifier Q51 at the IF frequency of 45.1 MHz, and terminates it in a 50 ohm resistor, R51, at all other frequencies.

Receiver Back End

Q51 amplifies the IF signal by approximately 17 dB. The output of Q51 is filtered by a four pole crystal filter (comprised of two matched units Y51A and Y51B). The 3 dB bandwidth of the crystal filter is 14 kHz for 20/25 kHz channel spacing models, and 8 kHz for 12.5 kHz channel spacing models. The signal is amplified 18 dB by the second IF amplifier Q52, and applied to the input of the receiver system IC U51-19 (refer to Figure 2-1).

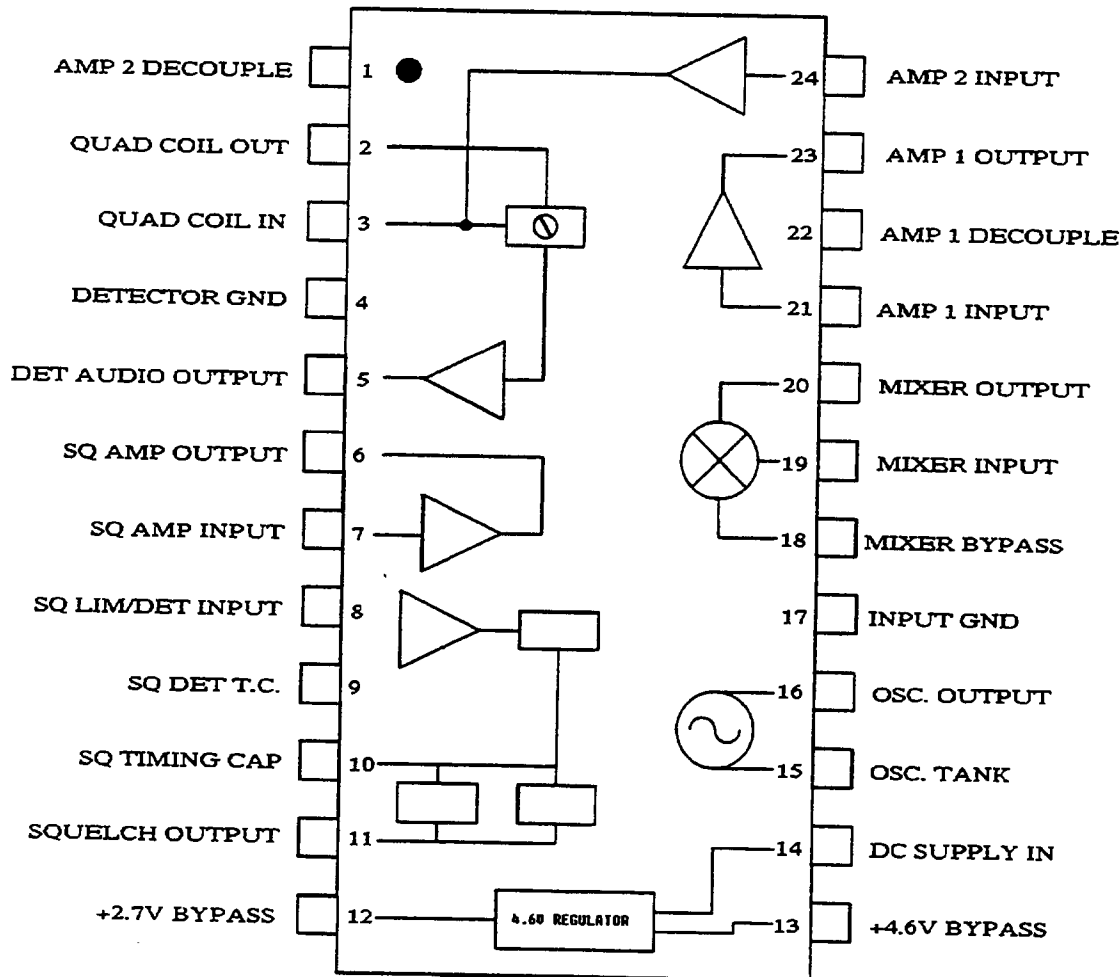


Figure 2-1. Receiver IC Block Diagram

The 45.1 MHz first IF signal is applied to the second mixer section of U51. A 44.645 MHz crystal oscillator provides the low side injection signal, which is also applied to U51-19. The output of the second mixer is a 455 kHz second IF signal which is filtered by ceramic filter FL51, amplified, filtered by ceramic filter FL52, and applied to the audio detector. As with the crystal filter, the bandwidth of the ceramic filters are narrower for 12.5 kHz channel spacing models than for 20/25 kHz. The IF test point is located at the output of filter FL52. The level of the 455 kHz signal at this test point is linearly related to the input signal level at the antenna, allowing a convenient metering point for filter tuning and gain measurements.

The audio detector is a peak-differential type, with the necessary phase shift (90° at 455 KHz) provided by L-C network L61. Recovered audio from U51-5 is routed to the receiver audio circuitry on the logic board, and to the squelch circuitry contained in U51. When an on-channel signal is present, the amount of high-frequency audio noise at the detector output is reduced. This change in noise level is sensed to indicate the presence of an on-channel signal. Audio noise at U51-5 is applied to U51-7 via R61 and C82. Extreme high-frequency noise is removed by C81. The noise is amplified and appears at U51-6 where it is coupled via C80 to the SQUELCH adjust pot R60. The output of this control is applied via R59, C79 and C78 to pin 8 which is the input of a limiting amplifier and threshold detector.

Noise levels greater than a preset threshold cause U51-11 to go high. U51-11 is buffered by Q53 and routed to the microcomputer circuitry on the logic board. This buffering corresponds to no channel activity. When the noise level decreases below the threshold, due to on-channel quieting, U51-11 goes low, providing a low to the logic circuitry. This implies an on-channel signal is present, causing unmuting of the receive audio path by the microcomputer.

Components R58, C75 and C76 determine 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. For strong signals, where the carrier-absent to carrier-present conditions are substantial, the closing time-constant is shortened to minimize the length of the "squelch-tail".

Frequency Synthesizer

To determine the synthesizer's operating frequency, the microcomputer loads the frequency divider information into the PLL IC U101 (see Figure 2-2). The PLL IC contains three programmable dividers. The program is serially loaded via the SR DATA line to U101-10. The data is loaded one bit at a time, with each low-to-high transition of the SR CLOCK at U101-11 latching data

from shift registers into the reference divider (R), divide-by-N, or divide-by-A latches depending on the control bit. A logic high of the control bit selects the reference counter latch, while a logic low selects the divide-by-N, or divide-by-A counter latch.

After the microcomputer loads data into the PLL IC, the SYNTH LATCH ENABLE line goes low. The synthesizer is then ready to generate a receive first-injection or transmit frequency.

In UHF radios, for example, the latches are loaded with data to give 5 kHz (or 6.25 kHz) at the output of the divide-by-R counter when the reference signal is applied at U101-1, and 5 kHz (or 6.25 kHz) at the output of the divide-by-N counter when the VCO is operating at the desired receive injection or transmit frequency.

During the frequency synthesis, the divide-by-A and divide-by-N counters begin counting down from the programmed values (A and N respectively) at the same time. The modulus control line U101-12 is low so the divide-by-127/128 prescaler divides by 128. Therefore, the effect of the prescaler U102 is to divide the VCO output by 128 and apply it to U102-8. When the divide-by-A counter completes counting down, the control logic sets the modulus control line high, and the divide-by-127/128 prescaler divides by 127 until the divide-by-N counter completes the programmed value on N. After the divide-by-N counter completes counting down, the counters are set back to their programmed values. The effect of the prescaler and divide-by-A, divide-by-N counters is to divide the VCO frequency by a number, N, where:

$$N_T = 128 \times A + 127 \times (N - A) = 127 \times N + A$$

The output of the divide-by-N counter is equal to:

$$f_{VCO} / (127 \times N + A)$$

When the phase-locked loop is locked:

$$f_{VCO} / (127 \times N + A) = 5 \text{ kHz} = f_{VCO} / N_T$$

The reference oscillator frequency is 14.4 MHz and the output of the divide-by-R must be 5 kHz. Therefore:

$$R = 14.4 \text{ MHz} / 5 \text{ kHz}$$

The values of A and N are dependent on the desired VCO frequency which is equal to the transmit frequency, or to the receive frequency minus 45.1 MHz (for UHF radios).

$$N = \text{integer part of } N_T / 127$$

$$A = \text{remainder of } N_T / 127$$

The 5 kHz outputs of the divide-by-A and divide-by-N counters are applied to phase detector A. The output of phase detector A is applied to phase detector B. There are two output signals for phase detector B, phase R

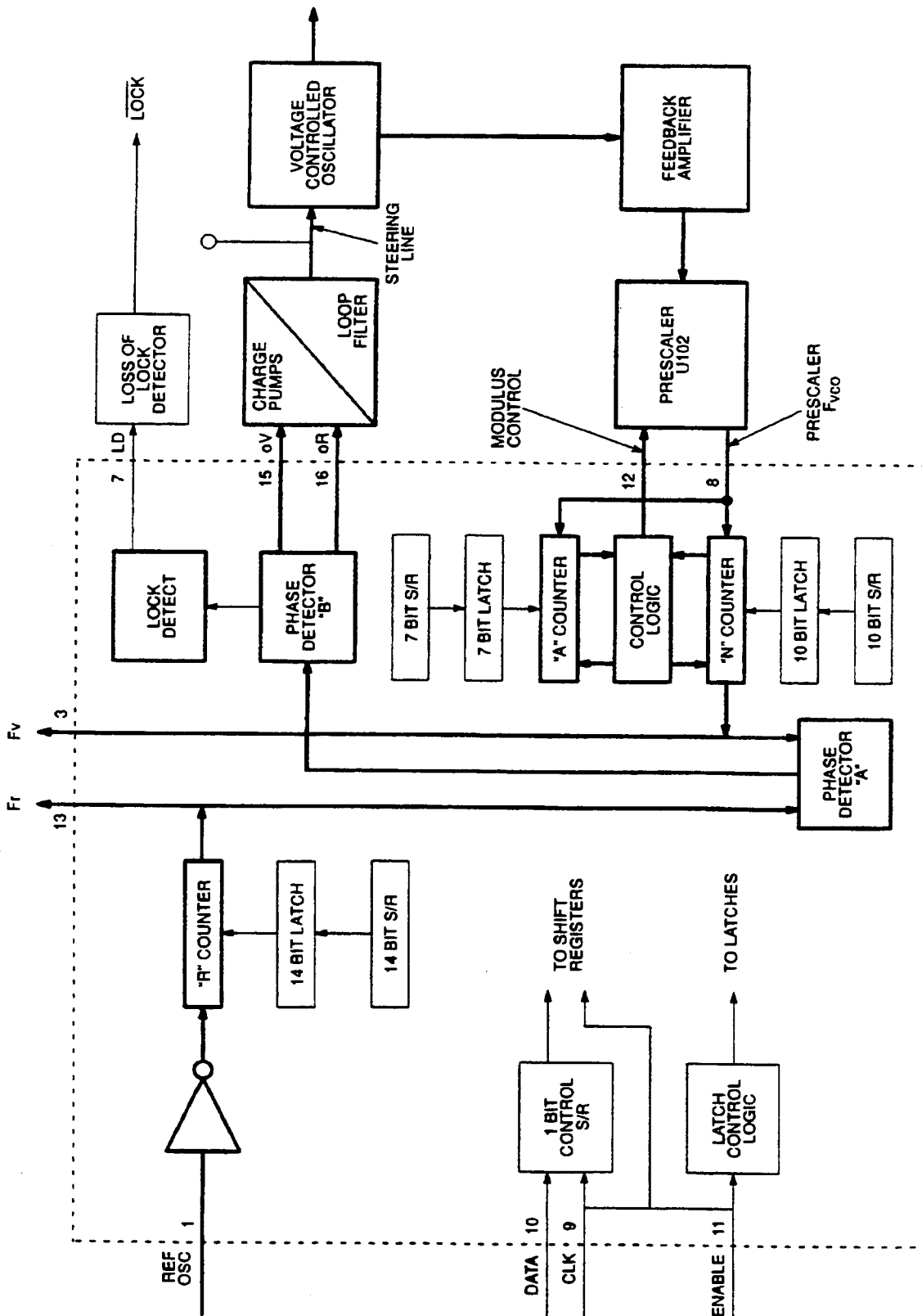


Figure 2-2. Synthesizer Section Block Diagram

(U101-16) and phase V (U101-15), which consist of pulses whose pulse width depends on the phase error between the two signals at phase detector A. If the frequency f_V is greater than f_R , then error information is provided by phase V pulsing low, while phase R remains essentially high. When f_V and f_R are both in phase, both phase V and phase R remain high, except for a small minimum time period, and they both pulse low in phase. These pulses are applied to the charge pump and are used to correct (steer) the VCO frequency.

The above discussion is for a UHF radio with a 5 kHz reference frequency. VHF radios use a divide-by-64/65 prescaler, and the receive VCO frequency is equal to the receive frequency plus 45.1 MHz. Either a 5 or 6.25 kHz reference frequency may be used depending on the desired frequencies and channel spacing.

When the synthesizer is locked, U101-7 applies a high level signal with very narrow negative-going pulses to the out-of-lock detector. The very narrow low pulses have a high average DC level that is not sufficient to turn on transistor Q101. This keeps the voltage across C102 low, which indicates an in-lock condition.

When the synthesizer is out-of-lock, the output of U101-7 becomes a pulsating DC signal with an average DC level that varies between 0.5V and 4.4V. This turns on Q101 and charges C102 to at least 3.0 volts, indicating an out-of-lock condition. Transmitter output and receiver audio are inhibited under these circumstances.

The 5V DC operating voltage for the synthesizer and prescaler is derived from a voltage divider buffered by Q106. Due to the low and relatively constant current drain requirements, a more elaborate regulator is unnecessary.

Charge Pump

The charge pump consists of Q102-Q105. The phase V (U101-15) signal from the PLL IC is applied to Q103 while phase R (U101-16) is applied to Q102. Then the synthesizer is locked, both signals consist of a pulse train with a period of 160 or 200 μ sec and negative-going pulses. The phase R negative pulse turns off Q102 and brings the emitter of Q104 to 9.6V which turns on Q104. The negative pulse of phase V turns Q103 off which reduces the current flow to R114 and in turn reduces the voltage across R114. This will cause Q105 to turn on and sink current from Q104.

When the synthesizer reaches lock, the voltage at the steering line will be between 1.3V and 7.8 V DC. When the synthesizer is reprogrammed to a new frequency, the previous SL voltage would now give a wrong frequency and will cause the phase R and phase V to have different pulse widths. This will cause Q104 and Q105 to turn on and off at different times, resulting in a series of summed current pulses to the loop filter that charges or discharges C110 to the new SL voltage. If the fre-

quency of the VCO is higher than that of phase R, then C110 discharges; if lower, C110 charges.

Loop Filter

The loop filter consists of R119 through R121 and C109 through C112, as well as C205 and C258 in the VCO compartment. The loop filter is a low pass filter that attenuates noise and rejects the loop reference frequency so that these signals cannot modulate the VCO. The voltage across C110 is the steering line voltage which controls the VCO frequency.

Reference Oscillator

The reference oscillator is a Colpitts design using a 14.4 MHz crystal element. Each crystal has a unique 8-digit temperature coefficient code which must be keyed into the radio during chassis auto tune. The reference oscillator is warped to the desired range by adjusting L151 while supplying 5.2 ± 0.01 V DC at J6-9. Further frequency warp adjustment is done electronically by changing the control voltage applied to varactors CR151 and CR152 by the logic board.

Temperature compensation is applied in the same manner, based on the temperature of the crystal as sensed by zener diode VR176, which is physically close to Y151. The forward voltage drop of this diode is proportional to the actual crystal temperature. This forward voltage is amplified by a precision DC amplifier, U176 and associated components, to a DC level sufficient to be read by one of the A/D inputs of the microcomputer on the logic board. The appropriate control voltage is applied, based on the crystal's temperature coefficient code, to maintain ± 2.5 ppm stability over the entire operating temperature range.

For transmissions of PL/DPL or data with low-frequency content, the reference oscillator is modulated to extend the low frequency modulation capability of the synthesizer below the loop filter cutoff frequency. Modulation is applied to the frequency control varactors CR151 and CR152 via J6-13 and REF MOD adjust pot R164.

VCOs and Buffers

Two VCOs are used, one for transmit and one for receive. These are selected by switching circuitry Q277 through Q279, which applies 8.5V DC supply voltage to the appropriate oscillator and buffers. The incoming 9.6V DC voltage is first filtered by Q276 to remove noise which might be introduced into the VCO's. Q276 acts as a C-multiplier, which effectively multiplies the capacitance of C277 by the gain of transistor Q276. In the receive mode, J6-4 is pulled high by R276, turning off Q277 and Q278, allowing Q279 to conduct and supply RX 8.5V. In the transmit mode, J6-4 is pulled low by the logic board. Q277 conducts to supply TX 8.5V, and

Logic Board

Q278 saturates across the base-emitter of Q279, turning it off.

Each VCO consists of a FET oscillator whose frequency is determined by a parallel L-C network consisting of a tunable coil and a network of varactors. As the steering line varies over the range of 2V to 7.8V DC, the capacitance of the varactors decreases as voltage is raised, causing the oscillator frequency to increase. The transmit VCO has an additional varactor, CR208, which is very lightly coupled to the tank circuit, which provides frequency modulation of the VCO from the audio signal applied at J6-10 and adjusted by VCO MOD adjust pot R302.

Each VCO has an AGC rectifier circuit (CR206 or CR214) which varies the DC gate bias on the VCO FET as a function of the RF output level at the VCO's drain. This helps maintain a more constant VCO output level, and prevents RF voltages from increasing to levels which might cause rectification by the varactors.

Transistors Q204, Q205 are receive buffer amplifiers. These raise the RF output of the VCO to the level required as injection for the first mixer, typically between +5 and +13 dBm depending on the frequency band, as detailed in the sections under VHF Receiver Front End and UHF Receiver Front End. The RF at Q205's base is sampled and fed back to the synthesizer via buffer Q107, allowing the synthesizer to "know" if the VCO is operating at the correct frequency.

Similarly, transistors Q207, Q208 are transmit buffer amplifiers. These raise the RF output of the VCO to the level required by the RF power amplifier, typically +13 to +14.5 dBm, as measured at J5, which is a 50 ohm port. The VCO frequency is sampled at Q208's base and fed back to the synthesizer via buffer Q107.

Logic Board

The "masked" logic board used in M120 series mobile radios is a two-layer circuit board, with all software functions contained in a single masked microcomputer IC.

The logic board circuitry consists of five major sections:

- DC distribution and regulation
- Microcomputer and logic
- Receiver audio circuitry
- Transmitter audio circuitry
- Transmitter power control circuitry

DC Distribution and Regulation

All operating voltage for the radio is supplied from the RF power amplifier's battery input connector J2. This voltage is protected from reverse polarity or excessive

positive transients by CR2270, CR2370, CR2470, CR2570, CR2670 or CR2770 (depending on power amplifier kit), which acts as a power diode for reverse polarity protection, as well as a power transient suppressor due to its reverse avalanche characteristics. The supply voltage is routed to the logic board via J7-5 (UNSW B+).

Whenever UNSW B+ is supplied, a continuous source of 5V DC is applied to pin 2 of the microcomputer from the RAM 5V supply (VR402, CR403, R410 and C408). This maintains the radio's scan list, current operating mode, etc., when the radio is turned off. Due to the storage of C408, this information can be maintained for up to several hours even if the battery supply voltage is interrupted.

When ignition control is not used, UNSW B+ via fuse F801 becomes B+ which is routed through the on-off switch to become SW B+. When ignition control is used, fuse F801 is removed, and the vehicle's ignition-switched voltage is supplied to J3-10 which is the B+ that is routed through the on-off switch to become SW B+. Thus, with ignition control, ignition-controlled voltage must be present at J3-10 for the radio to operate.

When the radio is turned on, SW B+ turns on Q404 via R414, which then turns on Q403 via R412. When Q403 is on, UNSW B+ is applied to the supply pins of opamps U401 and U451 (energizing the 9.6 volt regulator and transmitter power control circuits). The low saturation voltage of Q403 keeps the supply voltage of the transmitter power control circuit essentially equal to the UNSW B+ voltage present in the RF Power Amplifier. This is important for accurate power control operation. SW B+ is also routed to 5 volt regulator U402 (powering the microcomputer and logic circuitry) and to J3-13, the SW A+ sense pin on the accessory connector. The current drawn through the on-off switch is relatively low, less than 400 mA, and the majority is that required by the 5V regulator. All high current stages, such as the RF and audio power amplifiers, operate from UNSW B+ and are controlled by low currents.

The 9.6V regulator uses an opamp as a controlling element. The regulated output voltage is divided by R404 and R405 and compared with an accurate reference voltage (5.03V DC) determined by VR401. The opamp's output voltage (U401A-1) varies the amount of conduction in Q402 and Q401 as necessary to keep these two voltages (U401A-2 and -3) equal. A characteristic of the opamp which allows the regulator to start up is the fact that the output is high when both inputs are low, which occurs momentarily at turn-on. Diode CR401 is used to protect Q401 if the 9.6V line is grounded. When this happens, Q402's base can only be 0.7V DC and Q401 will be turned off. Diode CR402 provides temperature compensation of the regulated output voltage. The 9.6V supply powers the opamps in the receive and transmit audio circuits, the D/A converter,

the RF board circuitry, and low level stages of the RF power amplifier.

The 4.8V DC reference is formed by divider R408-R409, filtered by C405, and buffered by unity gain opamp U401B to provide a low-impedance and low noise half-supply reference voltage for the opamps in the audio circuits.

The 5V regulator uses an IC, U402, to provide operating voltage for the microcomputer and logic circuits and the front panel LED indicators. This IC generates a low reset pulse when turned on which is used to initialize the microcomputer at power-up. The timing of this pulse is determined by C409.

Microcomputer and Logic

M120 radios use the Motorola 68HC11E9 microcomputer, U802, which utilizes:

- 7.776 MHz clock rate
- Multiplexed 8 bit address/data lines
- 16 bit addressing
- Internal watchdog circuitry
- Analog to digital conversion input ports

Additional control logic surrounding U802 consists of a D/A converter IC, U801, used to generate precision analog voltages for transmitter power control, deviation adjustment, and reference oscillator frequency warp.

The microcomputer's operating program is permanently written or "masked" within the microcomputer. Included in U802 is an EEPROM memory which stores channel, signaling, and scan list information.

Microcomputer Start-Up Routine

The microcomputer is operational after the RESET line is released by U402 at turn-on. Y801, the crystal oscillator, should be stable at this point. Y801's frequency is divided by four by U802 to produce the E-CLOCK (1.944 MHz, at U802-5) which is the data clock for microcomputer and, in expanded logic boards, gate array U803. The microcomputer then executes a self-test routine and generates an error tone if a failure is detected. Q807 shifts the crystal frequency very slightly by introducing network L801/C831 when Q807 is off. This can be used to remove an on-channel self-quieting signal which is a harmonic of the crystal, if necessary.

Programmable I/O

The function of J3-14 is programmable by the placement of push-on jumper JU809. In the "REMOTE" position, J3-14 provides the hook function for a remote desk set. When pulled low, the radio is forced "off-hook" or

into a monitor condition. In the "PA" position, J3-14 provides the public address enable function; when pulled low, transmitter PTT is inhibited.

Receiver Audio

Voice Path

Detector audio from the RF board is routed via J6-3 to U551A. A series resistor on the RF board, R62, is chosen to provide an additional 6 dB of receiver audio gain in 12.5 kHz channel spacing models, where full system deviation is one half of that used for 25/30 kHz channel spacing. The gain of U551A is chosen so that supply-rail limiting occurs at 20% above full system deviation. This limits the amplitude of impulse-type ignition noise. Noise above 3 kHz is attenuated by a 3-pole low pass filter (U551B) whose Bessel-Thompson characteristic is chosen to minimize ringing due to impulse-type noise. Following is a 5-pole biquadratic 300 Hz high-pass filter (U552A and B) which attenuates subaudible signaling tones such as PL and DPL. This is followed by de-emphasis amplifier U553A, mute gate Q551 and summing amplifier U553B which combines the receive audio signal with alert tones generated by the microcomputer at U802-29 and filtered by C566 and C567. The output of U553B is routed to the volume control via J8-1, from the volume control via J8-2 to the input of the audio power amplifier, U501.

The audio power amplifier is a BTL (bridge-tied load) configuration providing 7.5 watts rms into an external 8 ohm speaker. Both sides of the speaker are driven with out-of-phase signals, therefore neither side of the speaker can be grounded. The outputs are internally protected against accidental short circuits to supply or ground. The internal speaker has a 22 ohm impedance which limits the power delivered to it to 3 watts, which is within its rating. The audio power amplifier is turned on when a sense voltage greater than 8 volts DC is applied to pin 8. This is obtained from SW B+ via R501. When no audio output is required, U501 is turned off by saturating transistor Q501, providing 0 volts to U451 pin 8. This allows muting of the audio power amplifier. When the radio is turned off, SW B+ is not present, so there is no source of voltage to pin 8 via R501, keeping U501 off. When muted (pin 8 low), U501 draws no current from the UNSW B+ source. Capacitor C504 controls the turn on and turn off timing of the power amplifier to minimize transients. C501 and C502 provide low and high frequency filtering respectively.

When a front panel button is pressed, a beep is heard in the speaker. This is produced by the microcomputer-generated alert tone applied to stage U553B, as discussed above. U501 is enabled by turning off Q501, however mute gate Q551 remains muted so that the beep is heard but noise or signals from the receiver are not. Alert tones are also used by various signaling systems, or for error tones during self-test.

Logic Board

Receiver audio is available at the accessory connector J3-11. Depending on the position of push-on jumper JU551, audio may be either de-emphasized, filtered and muted, derived from the output of U553B, or flat and unmuted, derived from the output of U551A.

Data Path

Receiver audio is also used for decoding of signaling tones or codes. There are two general classifications of the types of data involved. High-speed data refers to data which occupies the voice range of frequencies (between 300 and 3000 Hz, although it can also occupy the entire range from less than 1 Hz to 3000 Hz). This data is not transmitted simultaneously with voice. The other type is low-speed data, which is contained to frequencies below 300 Hz, generally at reduced deviation levels, and may be transmitted simultaneously with voice. MDC1200 and Select 5 are examples of high-speed data; PL and DPL are examples of low-speed data.

Low speed data is obtained from U551B-7, which contains frequencies between 0.6 Hz and 3000 Hz. It is buffered by U602A and filtered by U603A and U603B. These form a 5-pole biquadratic low pass filter, attenuating all signals above 250 Hz. This filter prevents voice from interfering with low-speed data detection. This is fed to a center-slicer, U601B, which converts the tone or data into a symmetrical square wave which can be decoded by the microcomputer. The center slicer tracks out near-DC offsets to maintain waveform symmetry.

High speed data can be obtained from either U551B-7, the same point as for low-speed data, or from U552B-7, which only contains frequencies between 300 and 3000 Hz. If the type of data does not contain information below 300 Hz, the use of additional 300 Hz high-pass filtering improves detector sensitivity. No additional filtering is required, only that the signal is squared up by center-slicer U601A before being applied to the microcomputer for decoding.

Transmitter Audio**Voice Path**

Microphone audio is routed from the front panel mic jack via J8-14, or from accessory connector J3-2, to the mic mute gate Q651. DC bias is applied to operate the transistor amplifier within the microphone. Q651 is controlled by Q652 and mutes the microphone audio path during receive mode or during transmission of high-speed signaling or data. When low mic gain (80 mV rms for 60% deviation) is selected by JU551, the signal is pre-emphasized by C652 and R655; for high-gain (40 mV rms), by C667 and R647. Supply rail limiting by U651A prevents over-deviation.

The signal is then routed to the RF board reference oscillator modulation input via J6-13, and, via buffer

U652A, to voltage controlled attenuator U652. Deviation is adjusted by programming the DC output voltage of D/A converter U801-6. This allows electronic adjustment of deviation, compensation for sensitivity variations across the operating frequency band, and choice of full system voice deviation on non-PL or DPL channels, or reduced voice deviation on channels with PL or DPL. The output of attenuator U653 is routed through U652B, a 3-pole biquadratic 3000 Hz low-pass "splatter" filter, before being applied to the RF board as VCO modulation via J6-10.

Radios used in 12.5 kHz channel spacing systems require full deviation of 2.5 kHz, instead of 5 kHz for 25/30 kHz systems. This reduction is accomplished by resistor values on the RF board surrounding the VCO MOD and REF MOD adjust posts.

Data Path

High speed data is generated by microcomputer outputs U802-30 and 31 which are summed by opamp U602B. The ratio of R701 and R702, and the relative timing of the transitions of the two microcomputer outputs, allow low-distortion simulated sinewaves to be generated. The opamp output is routed to the input of limiter U651A, where it is summed with pre-emphasized mic audio. The audio path from U651A to the limiter is not pre-emphasized. The remainder of the audio path to the modulator is the same as for the voice signal path.

Audio applied to accessory connector J3-5 is applied, without pre-emphasis, to the input of the limiter U651A.

Low speed data is generated by microcomputer outputs U802-27 and 28 which are summed by opamp U651B. The ratio of R706 and R707 allow low-distortion simulated sinewaves to be generated. The opamp is configured as a 3-pole biquadratic low pass filter to remove any distortion components of the low speed data signal above 300 Hz which would fall within the voice range. This audio is resistively summed with the output of the limiter U651A. In this manner, limiting on voice peaks will not affect the continuous low speed data transmission. The summed audio is then routed to the REF MOD input of the RF board via J6-13, and to the voltage controlled attenuator, splatter filter, and VCO MOD input of the RF board (J6-10), following the same path as voice signals.

Transmitter Power Control**Control Line Functions**

As discussed earlier, all DC operating voltage for the radio originates from the RF power amplifier via J7-5 (UNSW B+). In addition, J7 receives DC control voltages from, and supplied DC control voltages to, the RF power amplifier circuitry.

In the transmit mode, Q455 conducts, supplying 9.6T (keyed 9.6V DC) via J7-1 to the antenna switch and providing bias (and collector voltage, in UHF models) for the first transmitter stage.

Controlled B+ is supplied via J7-2 to the collector of the first (VHF) or second (UHF) transmitter stage. As this voltage varies over the range of 3 to 12.5V DC, transmitter output power is varied over the range of 10 to 25 watts.

A small-value (.01 to 0.2 ohm) resistor is placed in series with the DC supply to the RF final amplifier, and the voltage across this resistor is measured via the current sense high (J7-3) and low (J7-4) lines.

The temperature of the final RF amplifier is monitored by a thermistor mounted next to it. The thermistor is part of a voltage divider network whose output voltage is routed, via J7-6, to an A/D input of the microcomputer, U802-49.

Power Control Operation

**AT THE FACTORY*

Power is programmed electronically during radio tune-up ~~and may be different for each channel~~. The software varies the DC output voltages of D/A converters U801-2 and U801-4 (two D/A's are summed for increased resolution) and applied to the (+) input of opamp U451A. As D/A voltage increases, U451A-1 output voltage increases, which causes greater conduction in Q453 and Q452, thus increasing the control voltage and RF power output. The values of R810, R811, R462 and R463 reduce the D/A output voltage range (0 to 9V DC) to the required 4V to 6V DC range at U451A-3.

If the DC current of the final RF amplifier increases excessively due to, for example, an antenna system fault, the increased voltage drop across the series resistor will be sensed by U451B, causing the current through Q454 to increase until the two inputs of U451B are again equal (the collector resistor of Q454 is on the RF power amplifier board since its value is optimized for different power amplifiers). The increase in Q454 current raises its emitter voltage which is applied to the (-) input of U451A. This is in a direction to reduce the output voltage of U451A-1, reducing conduction in Q453 and Q452, lowering the controlled B+ voltage to counteract the excessive current condition.

Excessive RF final amplifier temperature causes an increase in the THERMAL DC voltage at U802-49. The microcomputer reduces power via the D/A converter to achieve a safe equilibrium.

Under any circumstance, controlled B+ is prevented from exceeding a pre-programmed DC voltage. The voltage is divided by R471 and R472 and monitored by microcomputer A/D input U802-45 every 17 msec. If voltage exceeds the maximum allowable, the DAC is

decremented one step, and this process is repeated as needed.

RF Power Amplifiers

This manual covers several different power amplifier kits. Each is optimized for the specific frequency and power output range of the radio model in which it is used. All are similar in that they can be divided into three basic circuits:

- Power amplifier
- Antenna switch
- Harmonic filter

1-10 Watt VHF Power Amplifier

The 1-10 watt VHF power amplifier is designed to cover the range of 146-174 MHz. It consists of three stages. The first stage, Q2210, operates in Class A with its operating voltage supplied by the 9.6T source. It has a gain of 9 dB and delivers 160 mW of output power.

The second stage, Q2220, is operated in Class C and also has 9 dB of gain. The collector voltage is supplied from controlled B+. The output level of this stage is varied by changes in the controlled B+ voltage. This stage delivers up to 1.3 watts output.

The third stage, Q2230, is the Class C RF final power amplifier. It can output in excess of 14 watts. Collector current is monitored by the power control circuit by measuring the voltage drop across a 0.2 ohm resistor, R2274, placed in series with the collector DC supply lead.

The antenna switch consists of two pin diodes, CR2250 and CR2251. L2252 is parallel-resonant with the off capacitance of CR2250, increasing its attenuation when off. C2253 is a DC block.

In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2251, C2251 and C2252 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2230 is routed through CR2250, and via the harmonic filter to the antenna jack. CR2251 conducts, shunting RF power and preventing it from reaching the receiver. L2251 is selected to appear as a 1/4 wave at VHF, so that the low impedance of CR2251 appears as a high impedance at the junction of CR2250 and the harmonic filter input.

The harmonic filter is a nine pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 205 MHz and less than 1 dB insertion loss in the passband.

10-25 Watt VHF Power Amplifier

The 10-25 watt VHF power amplifier is designed to cover the range of 146-174 MHz. It consists of three stages. The first stage, Q2310, operates in Class A with base bias supplied by the 9.6T source. The collector voltage is supplied from controlled B+. The output level of this stage is varied by changes in the controlled B+ voltage.

The second stage, Q2320, is operated in Class C. Collector voltage is supplied by UNSW B+. This stage delivers up to 3 watts output.

The third stage, Q2330, is the Class C RF final power amplifier. It can output in excess of 30 watts with 3 watts input power. Collector current is monitored by the power control circuit by measuring the voltage drop across a .05 ohm resistor, R2371, placed in series with the collector DC supply lead.

The antenna switch consists of two pin diodes, CR2350 and CR2351. L2353 is parallel-resonant with the off capacitance of CR2350, increasing its isolation when turned off. C2354 is a DC block. L2352 and C2352, combined with the "on" inductance of CR2351, form a series resonant circuit to lower the shunt impedance presented by CR2351 when it is turned on.

In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2351, C2351 and C2353 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2330 is routed through CR2350, and via the harmonic filter to the antenna jack. CR2351 conducts, shunting RF power and preventing it from reaching the receiver. L2351 is selected to appear as a 1/4 wave at VHF, so that the low impedance of CR2351 appears as a high impedance at the junction of CR2350 and the harmonic filter input.

The harmonic filter is a nine pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 205 MHz and less than 1 dB insertion loss in the passband.

25-45 Watt VHF Power Amplifier

The 25-45 watt VHF power amplifier is designed to cover the range of 146-174 MHz. It consists of four stages. The first stage, Q2410, operates in Class A with its operating voltage supplied by the 9.6T source. It provides 11 dB of gain and has an output power of 250 mW.

The second stage, Q2320, is operated in Class C. The collector voltage is supplied from controlled B+. The output level of this stage is varied by changes in the controlled B+ voltage. It has a gain of 9.1 dB and provides up to 2 watts of output power.

The third stage, Q2430, also operates in Class C. The collector voltage is supplied directly from the UNSW B+ source. This stage has a gain of 8.8 dB and an output power of 15 watts. Feedback is used to control the gain and maintain stability.

The fourth stage, Q2440, is the Class C RF final power amplifier. It has a gain of 6 dB and can output in excess of 60 watts with 15 watts of input power. The power control circuit monitors this stage's collector current by measuring the voltage drop across a .01 ohm resistor, R2471, placed in series with the collector DC supply lead.

The antenna switch consists of two pin diodes, CR2450 and CR2451. L2453 and C2453, combined with the internal "on" inductance of CR2451, form a series resonant circuit to lower the shunt impedance presented by CR2451 when it is conducting. In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2452, C2454 and C2455 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2440 is routed through CR2450, and via the harmonic filter to the antenna jack. CR2451 conducts, shunting RF power and preventing it from reaching the receiver. L2452 is selected to appear as a 1/4 wave at VHF, so that the low impedance of CR2451 appears as a high impedance at the junction of CR2450 and the harmonic filter input.

The harmonic filter is a seven pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 200 MHz and a typical insertion loss of 0.8 dB in the passband.

1-10 Watt UHF Power Amplifier

The 1-10 watt UHF power amplifier is designed to cover the range of 438-470 MHz and has three stages. The first stage, Q2510, operates in Class A. Its operating voltage is supplied from 9.6T. This stage provides 9 dB of gain and an output of 200 milliwatts.

The second stage, Q2520, has a nominal gain of 10 dB and power output of up to 2 watts. The output of this stage is adjusted by varying the controlled B+ which supplies DC operating voltage to its collector. This stage operates in Class C.

The third stage, Q2530, is the Class C RF final power amplifier. It provides 8.75 dB of gain and an output power of up to 15 watts. Collector voltage is supplied from UNSW B+ via a 0.2 ohm resistor, R2570. By measuring the voltage drop across this resistor, the power control circuit compensates for variations in Q2530's collector current.

The antenna switch consists of two pin diodes, CR2550 and CR2551. L2553 is parallel-resonant with the off capacitance of CR2550, increasing the diode's isolation when turned off. C2555 is a DC block. L2552 and

C2551, combined with the "on" inductance of CR2551, form a series resonant circuit to lower the shunt impedance presented by CR2551 when it is turned on.

In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2551, C2552 and C2553 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2530 is routed through CR2550, and via the harmonic filter to the antenna jack. CR2551 conducts, shunting RF power and preventing it from reaching the receiver. L2551 is selected to appear as a 1/4 wave at UHF, so that the low impedance of CR2551 appears as a high impedance at the junction of CR2550 and the harmonic filter input.

The harmonic filter is a seven pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 700 MHz and less than 1 dB insertion loss.

10-25 Watt UHF Power Amplifier

The 10-25 watt UHF power amplifier is designed to cover the range of 438-470 MHz and has four stages. The first stage, Q2610, operates in Class A with base bias from 9.6T. It provides 11.8 dB of gain and an output of 300 milliwatts.

The second stage, Q2620, has a nominal gain of 8.2 dB and power output 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 8.1 dB gain and a power output of up to 13 watts. Collector voltage is directly from UNSW B+.

The fourth stage, Q2640, is the final RF power amplifier, which operates Class C directly from UNSW B+. It provides up to 30 watts output. Collector current is monitored by the power control circuit by measuring the voltage drop across a .05 ohm resistor, R2670, in series with the collector DC supply lead.

The antenna switch consists of two pin diodes, CR2650 and CR2651. L2652 and C2651-2, combined with the "on" inductance of CR2651, form a series resonant circuit to lower the shunt impedance presented by CR2651 when it is turned on. In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2651, C2652 and C2653 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2640 is routed through CR2650, and via the harmonic filter to the antenna jack. CR2651 conducts, shunting RF power and preventing it from reaching the receiver. L2651 is selected to appear as a 1/4 wave at UHF, so that the low impedance of CR2651 appears as a high impedance at the junction of CR2650 and the harmonic filter input.

The harmonic filter is a seven pole 0.1 dB ripple Chebyshev low pass filter with a 3 dB frequency of approximately 500 MHz and less than 1 dB insertion loss in the passband.

25-35/40 Watt UHF Power Amplifiers

There are four high-power UHF amplifiers, which provide 25-40 watts output in the 403-433, 438-470 or 465-490 MHz bands, or 25-35 watts output in the 490-520 MHz band. All have four stages and are similar in circuitry and layout.

The first stage, Q2710, operates in Class A with operating voltage obtained from 9.6T. The second stage, Q2720, is a gain-controlled Class C stage, the output power of which is adjusted by varying the controlled B+ collector DC supply. The third stage, Q2730, operates in Class C with collector voltage obtained directly from UNSW B+. The fourth stage, Q2740, is the final RF power amplifier, which operates Class C directly from UNSW B+. Specific operating parameters are:

Range	403-433	438-470	465-495	490-520
Stage 1: Gain P _{OUT}	11.8 dB 300 mW	11.8 dB 300 mW	10 dB 200 mW	10 dB 200 mW
Stage 2: Gain P _{OUT}	8.2 dB 2 W	8.2 dB 2 W	9.5 dB 1.8 W	9.5 dB 1.8 W
Stage 3: Gain P _{OUT}	8.1 dB 13 W	8.1 dB 12.9 W	8.5 dB 13 W	8.5 dB 13 W
Stage 4: Gain P _{OUT}	5.9 dB 50 W	6.1 dB 52.8 W	6.3 dB 55 W	5.7 dB 48 W

Collector current of the final stage is monitored by the power control circuit by measuring the voltage drop across a .01 ohm resistor, R2770, in series with the collector DC supply lead.

The antenna switch consists of two pin diodes, CR2750 and CR2751. L2753, when used, is parallel-resonant with the off capacitance of CR2750, increasing the diode's isolation when turned off. C2755 is a DC block, present if L2753 is used. L2752 and C2750-1, combined with the internal "on" inductance of CR2751, form a series resonant circuit to lower the shunt impedance presented by CR2751 when it is conducting.

In the receive mode, both diodes are off. Signals applied at the antenna jack J1 are routed, via the harmonic filter, through network L2751, C2752 and C2753 to the receiver input. In the transmit mode, 9.6T is present and both diodes are forward-biased into conduction. The transmitter RF from Q2740 is routed through CR2750, and via the harmonic filter to the antenna jack. CR2751 conducts, shunting RF power and preventing it from reaching the receiver. L2751 is selected to appear as a 1/4 wave at the appropriate operating frequency range so that the low impedance

Front Panel Boards

of CR2751 appears as a high impedance at the junction of CR2750 and the harmonic filter input.

The harmonic filters are seven pole low pass designs having either a 0.1 dB ripple Chebychev response (403-433 MHz and 438-470 MHz bands) or a Butterworth response (465-495 and 490-520 MHz). They are characterized as follows:

Range	403-433	438-470	465-495	490-520
f(-3 dB)	520 MHz	510 MHz	620 MHz	650 MHz
Loss	0.8 dB	0.8 dB	0.8 dB	0.8 dB

Front Panel Boards

The front panel housing itself contains two circuit boards, the Display Board and the Volume/Mic Board. A third board, the Front Panel Filter Board, is located on the front of the radio chassis.

Display Board

The 2 Frequency Display Board consists of four discrete LED's. Two are dual color type. They indicate channel 1 or 2, and turn from green to red when the radio is in the transmit mode. The logic board provides the following control signals: TX/BUSY (P9-1) is floating in RX mode, and active low in TX mode; FPE (P9-4) supplies 5V via 10k for F2, and 0V via 10k for F1. This allows four display conditions, as follows:

- F1 RECEIVE: P9-4 is low, therefore Q1003 is off (DS1002 cannot light) and Q1001 is on (DS1001 cathodes are grounded). In receive, P9-1 floats, causing DS1001 GRN to light via R1003, and Q1002 is saturated, shorting out DS1001 RED so it doesn't light.
- F1 TRANSMIT: P9-4 is low, therefore Q1003 is off (DS1002 cannot light) and Q1001 is on (DS1001 cathodes are grounded). In transmit, P9-1 is active low, turning off Q1002 and allowing DS1001 RED to light via R1004. Also, since P9-1 is low, DS1001 GRN is shorted out and cannot light.
- F2 RECEIVE: P9-4 is high via 10k, therefore Q1003 is saturated, grounding the cathodes of DS1002 and turning off Q1001. Since Q1001 is off, DS1001 cannot light. In receive, P9-1 floats, causing DS1002 GRN to light via R1003, and Q1002 is saturated, shorting out DS1002 RED so it doesn't light.

- F2 TRANSMIT: P9-4 is high via 10k, therefore Q1003 is saturated, grounding the cathodes of DS1002 and turning off Q1001. Since Q1001 is off, DS1001 cannot light. In transmit, P9-1 is active low, turning off Q1002 and allowing DS1002 RED to light via R1004. Also, since P9-1 is low, DS1002 GRN is shorted out and cannot light.

DS1004 (Monitor) lights when Q1004 is saturated by 5V via 10k applied to FPD (P9-3). DS1004 (Busy) lights when Q1005 is saturated by 5V via 10k applied to FPC (P9-6).

SW1001 (Mode) and SW1002 (Monitor) are normally-open pushbuttons which provide a low to FPA (P9-7) and FPB (P9-5) respectively.

VOL/MIC Board

The VOL/MIC circuit board provides mounting and electrical connection to the microphone jack J11 and the on-off/volume control R9002. Connections are made to the logic board via P8. This cable/connector assembly also contains the two wires which route receiver audio to the internal 22 ohm speaker mounted in the front panel.

A 10 ohm resistor, R9001, is located between the CCW side of the volume control element and ground. At minimum volume setting, this maintains the attenuation at no greater than 46 dB, to avoid missing a message if the volume control is inadvertently turned to minimum.

Front Panel Filter Board

The front panel filter board is mounted to the front of the radio chassis. The pins of logic board connectors J8 and J9 pass through this board and are soldered to it. This board allows capacitive bypassing of all signal leads leaving the front of the radio chassis. This, combined with the shielding covers over the RF board, logic board and RF power amplifier, reduces the levels of cabinet radiation to extremely low levels.

In addition, the front panel filter board also provides protection against electrostatic discharge into front panel controls or indicators. Zener diodes are installed on any lines which are susceptible to damage from excessive static voltage transients, limiting voltage excursions to +27V or -0.7V DC.

Section 3

Jumper-Selectable Options

Overview

Push-on jumpers, located on the logic board, allow the operation of the M120 radio to be customized to specific applications, as explained below. This section contains information about the possible positions for each jumper, and the corresponding options.

Jumper Positions

The standard position of each jumper, as shipped from the factory, is indicated in bold.

JU551	POSITION (A)	The receiver audio applied to the accessories connector J3 pin 11 is flat (not de-emphasized) and unmuted.
	STD → POSITION (B)	The receiver audio applied to the accessories connector J3 pin 11 is de-emphasized and muted. Muting is controlled by the RX MUTE output from the microcomputer, as determined by carrier or tone squelch status.
JU601	POSITION (A)	The high-speed receive data path to the microcomputer is filtered to remove audio information below 300 Hz. This is used when decoding signaling data or tones which do not contain low frequency information.
	POSITION (B)	The high-speed receive data path to the microcomputer is essentially flat over the frequency range of less than 1 Hz to 3 kHz. This is used when decoding signaling data which includes very low frequency components.
JU651	POSITION (A)	Selects low microphone audio sensitivity, which is 80 mV rms for 60% of full system deviation.
	POSITION (B)	Selects high microphone audio sensitivity, which is 40 mV rms for 60% of full system deviation. This position is not recommended in applications where high ambient noise is present.
JU809	POSITION (A)	Allows the use of a remote desk set which is connected to accessories connector J3. Pin 14 functions as the HOOK line. When pulled low, the radio is forced into the monitor (off-hook) position. Note that this is the opposite polarity of the HOOK function on the microphone connector J11.
	POSITION (B)	Allows the use of an HLN3145 Public Address system. Pin 14 of accessories connector J3 functions as the PA ENABLE line. In the public address mode this line is pulled low, inhibiting transmit PTT operation, but leaving all other radio functions unchanged. Note: When a R*I*C*K Repeater adapter is used, the push-on jumper JU809 must be removed entirely.

Section 4

Non-Field-Serviceable Components

Overview

This section explains the operation of the reference oscillator and lists all non-field-serviceable components in the M120 mobile radios.

Operation of the Reference Oscillator

The frequency stability of the reference oscillator in M120 mobile radios is maintained by electronically measuring the temperature of the oscillator's crystal, computing the control voltage needed to accurately compensate for the temperature-dependent frequency shift of the crystal, and applying this voltage to the tuning varactors in the oscillator circuit.

For accurate temperature compensation, the characteristics of the oscillator and crystal are measured at the factory, and this information is programmed into the microcomputer on the logic board.

Non-Field-Serviceable Components

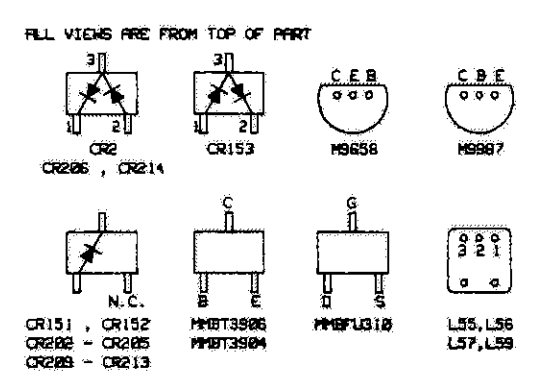
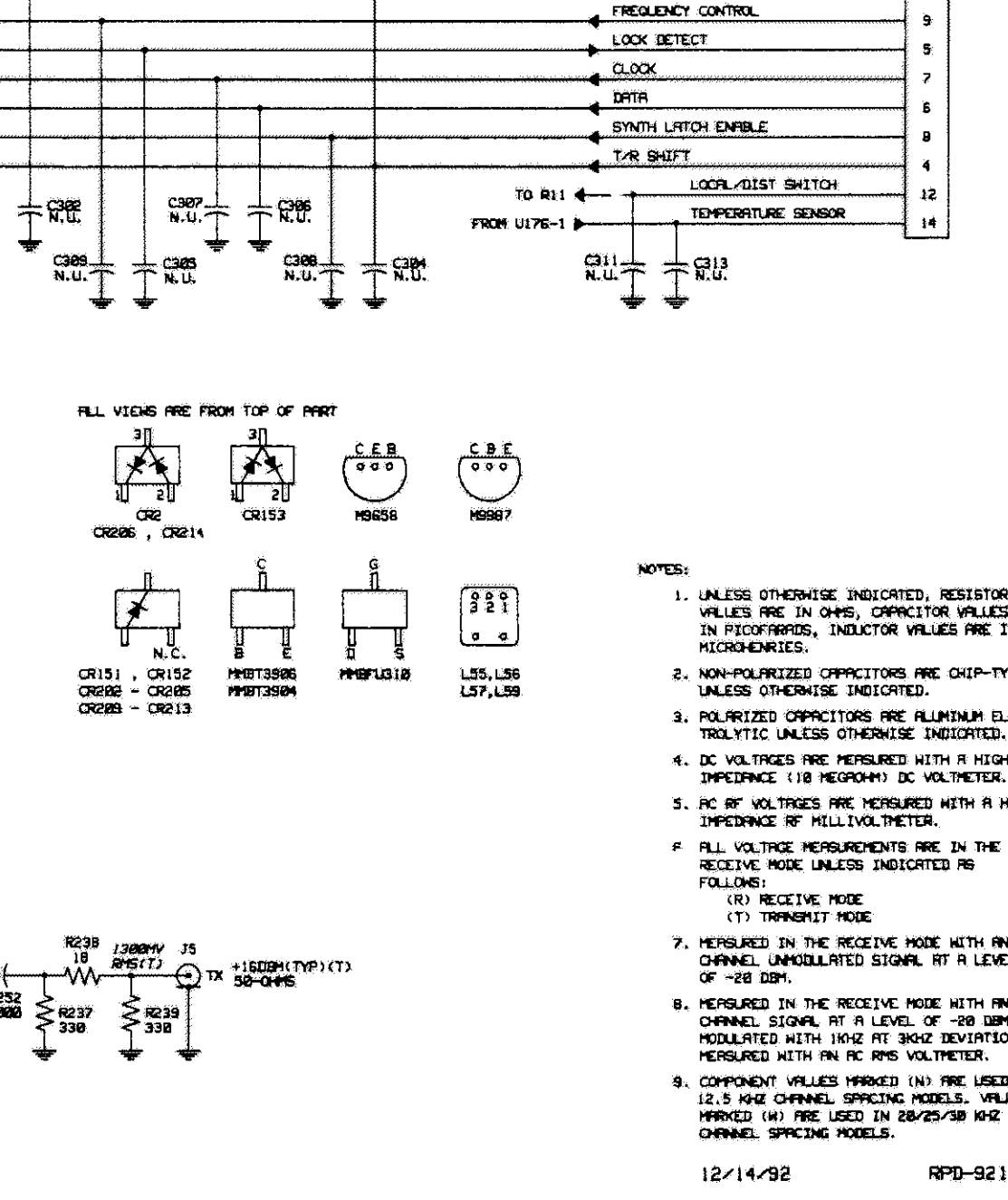
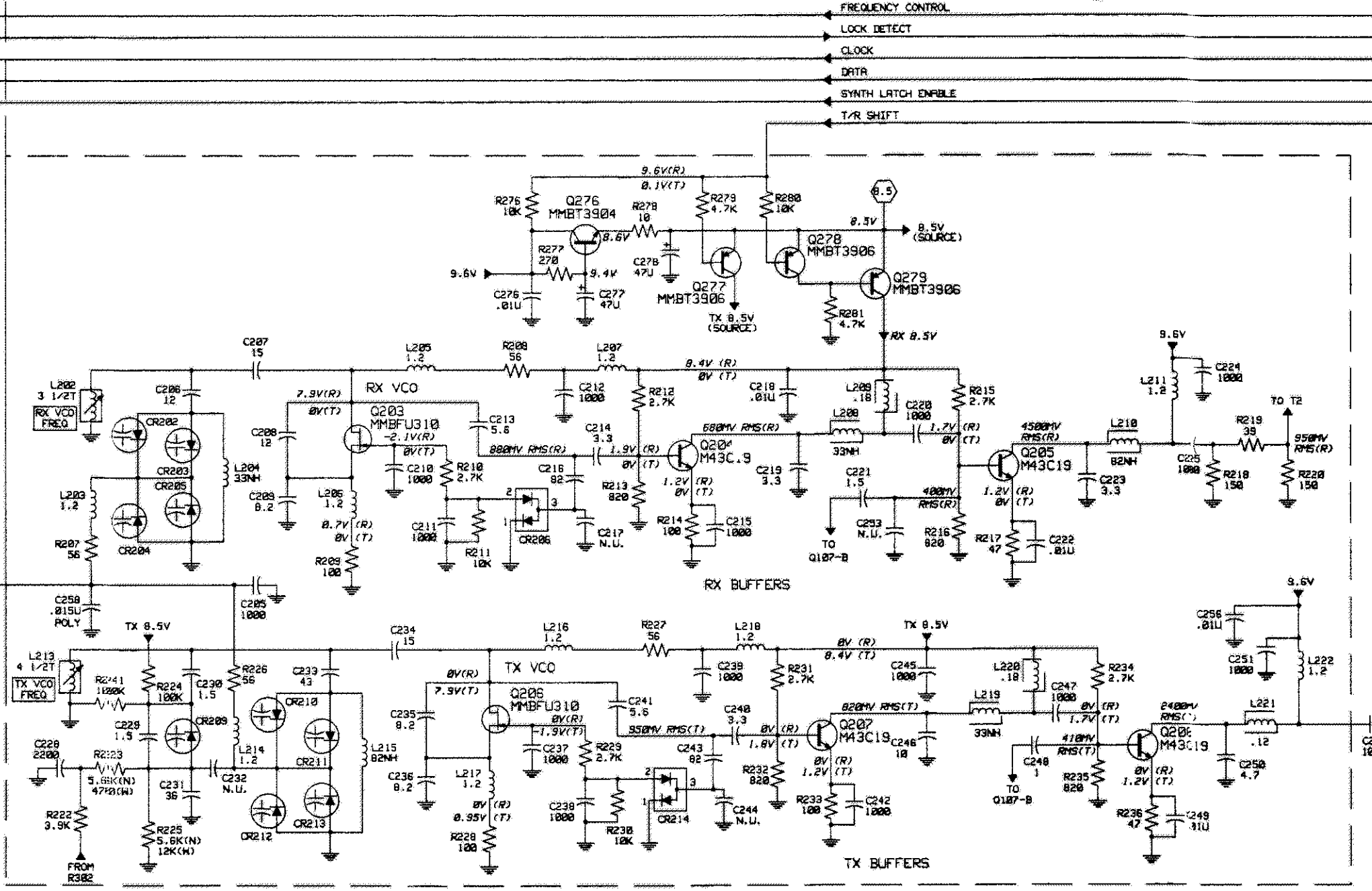
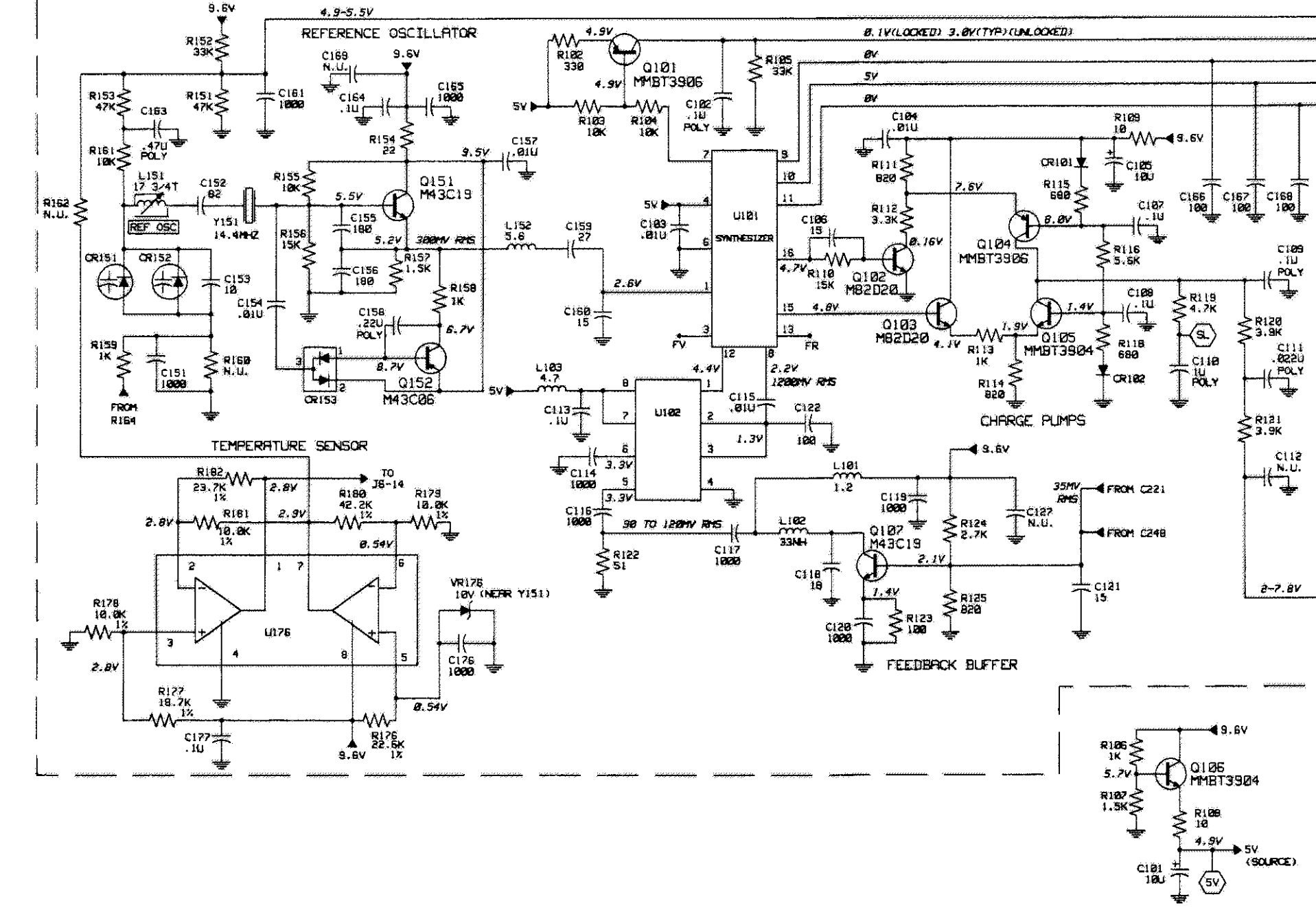
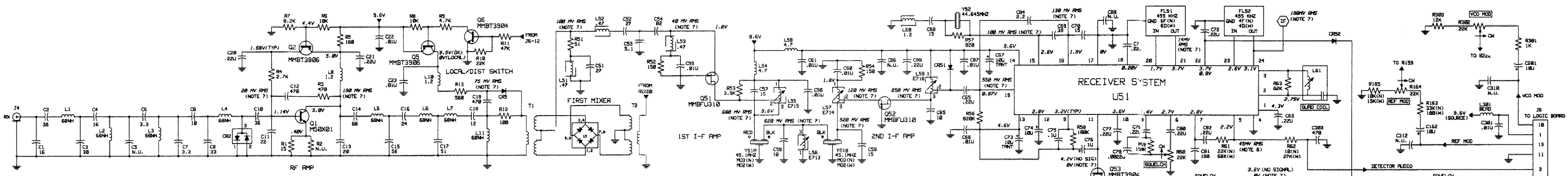
While in the field, if you replace the microcomputer on the logic board or any components of the reference oscillator or temperature-sensing circuit (on the RF Board), the accuracy of the compensation technique of the reference oscillator will be impaired. For this reason, **these components cannot be replaced in the field**. If any of these components require service, the entire RF or logic board must be replaced. The Radio Service Software calibration procedure for board replacement must be performed after the new board has been installed. This step re-enters the temperature characteristic of the new oscillator into the old microcomputer, or vice-versa.

The following components are not field-serviceable:

REF. NO.	PART NO.	DESCRIPTION	LOCATION
C151	21-13740B73	chip capacitor, 1000 pF	RF Board
C152	21-13740B47	chip capacitor, 82 pF	RF Board
C153	21-13740B25	chip capacitor, 10 pF	RF Board
C154	21-13741B45	chip capacitor, .01 uF	RF Board
C155, C156	21-13740B55	chip capacitor, 180 pF	RF Board
C157	21-13741B45	chip capacitor, .01 uF	RF Board
C158	08-11051A15	poly capacitor, .22 uF, 63V	RF Board
C159	21-13740B35	chip capacitor, 27 pF	RF Board
C160	21-13740B29	chip capacitor, 15 pF	RF Board
C161	21-13740B73	chip capacitor, 1000 pF	RF Board
C163	08-11051A17	poly capacitor, .47 uF, 63V	RF Board
C164	21-13741B69	chip capacitor, .1 uF	RF Board
C165	21-13740B73	chip capacitor, 1000 pF	RF Board
C166, C167, C168	21-13740B49	chip capacitor, 100 pF	RF Board
C176	21-13740B73	chip capacitor, 1000 pF	RF Board
C177	21-13741B69	chip capacitor, .1 uF	RF Board
CR151, CR152	48-80006E10	silicon varactor SOT	RF Board
CR153	48-84336R03	dual silicon SOT MMBD7000	RF Board
L151	24-80299D01	coil, tunable 17-3/4 turns	RF Board
L152	24-11087A35	chip coil, 5.6 uH 10%	RF Board
Q151	48-11043C19	NPN; type M43C19/M9658	RF Board
Q152	48-11043C06	PNP; type M43C06/M9643	RF Board
R151	06-11077B15	chip resistor, 47k	RF Board
R152	06-11077B11	chip resistor, 33k	RF Board
R153	06-11077B15	chip resistor, 47k	RF Board
R154	06-11077A34	chip resistor, 22	RF Board
R155	06-11077A98	chip resistor, 10k	RF Board
R156	06-11077B03	chip resistor, 15k	RF Board
R157	06-11077A78	chip resistor, 1.5k	RF Board
R158, R159	06-11077A74	chip resistor, 1k	RF Board

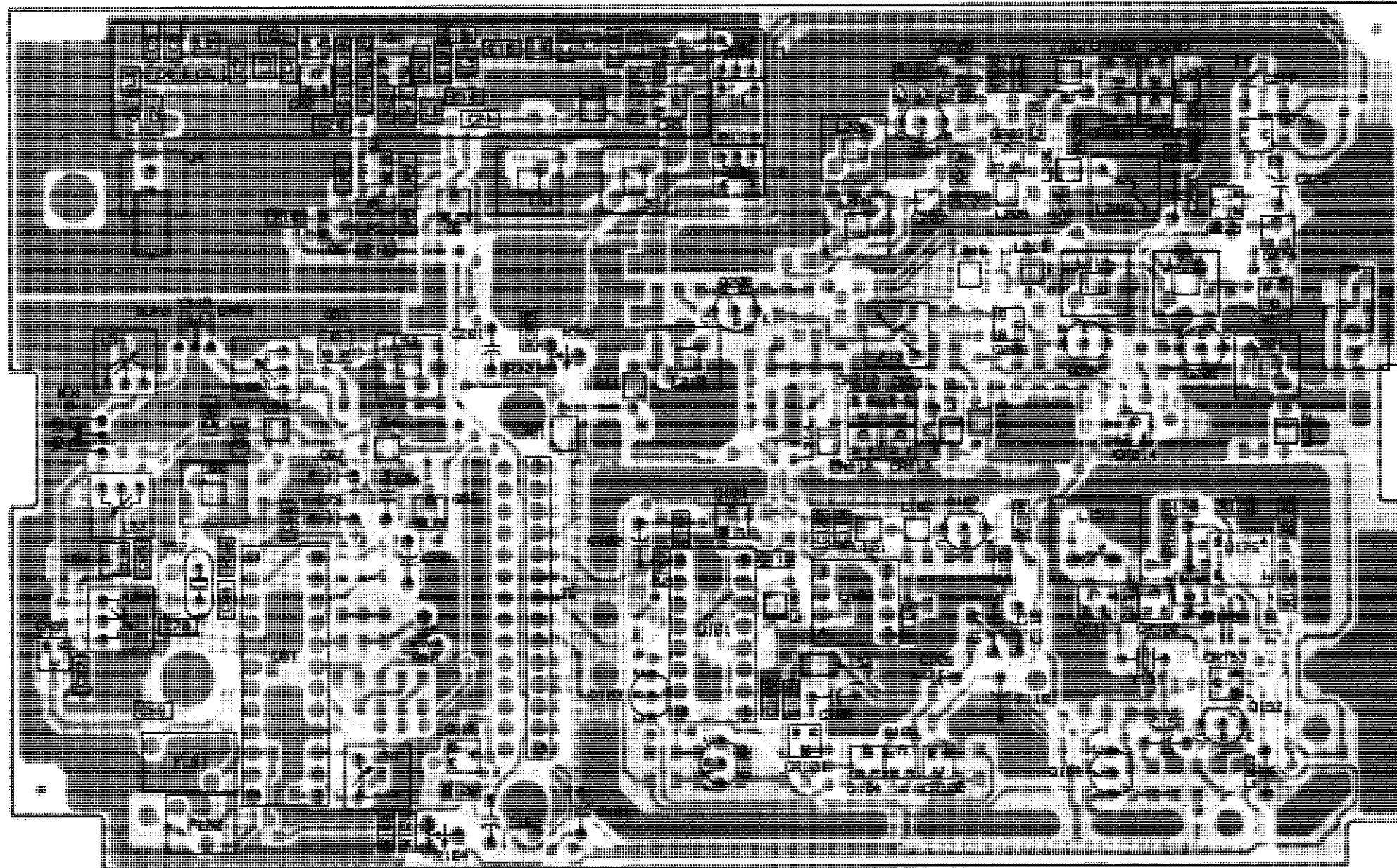
Non-Field-Serviceable Components

REF. NO.	PART NO.	DESCRIPTION	LOCATION
R161	06-11077A98	chip resistor, 10k	RF Board
R176	06-11077G26	chip resistor, 22.6k 1%	RF Board
R177	06-11077G18	chip resistor, 18.7k 1%	RF Board
R178, R179	06-11077F91	chip resistor, 10.0k 1%	RF Board
R180	06-11077G52	chip resistor, 42.2k 1%	RF Board
R181	06-11077F91	chip resistor, 10.0k 1%	RF Board
R182	06-11077G28	chip resistor, 23.7k 1%	RF Board
U176	51-80932W01	dual op-amp	RF Board
VR176	48-82256C11	zener diode 10V 5%	RF Board
Y151	48-80174D05	crystal, 14.4 MHz	RF Board
U401	51-80649B01	microcomputer	2-Layer Masked Logic Board



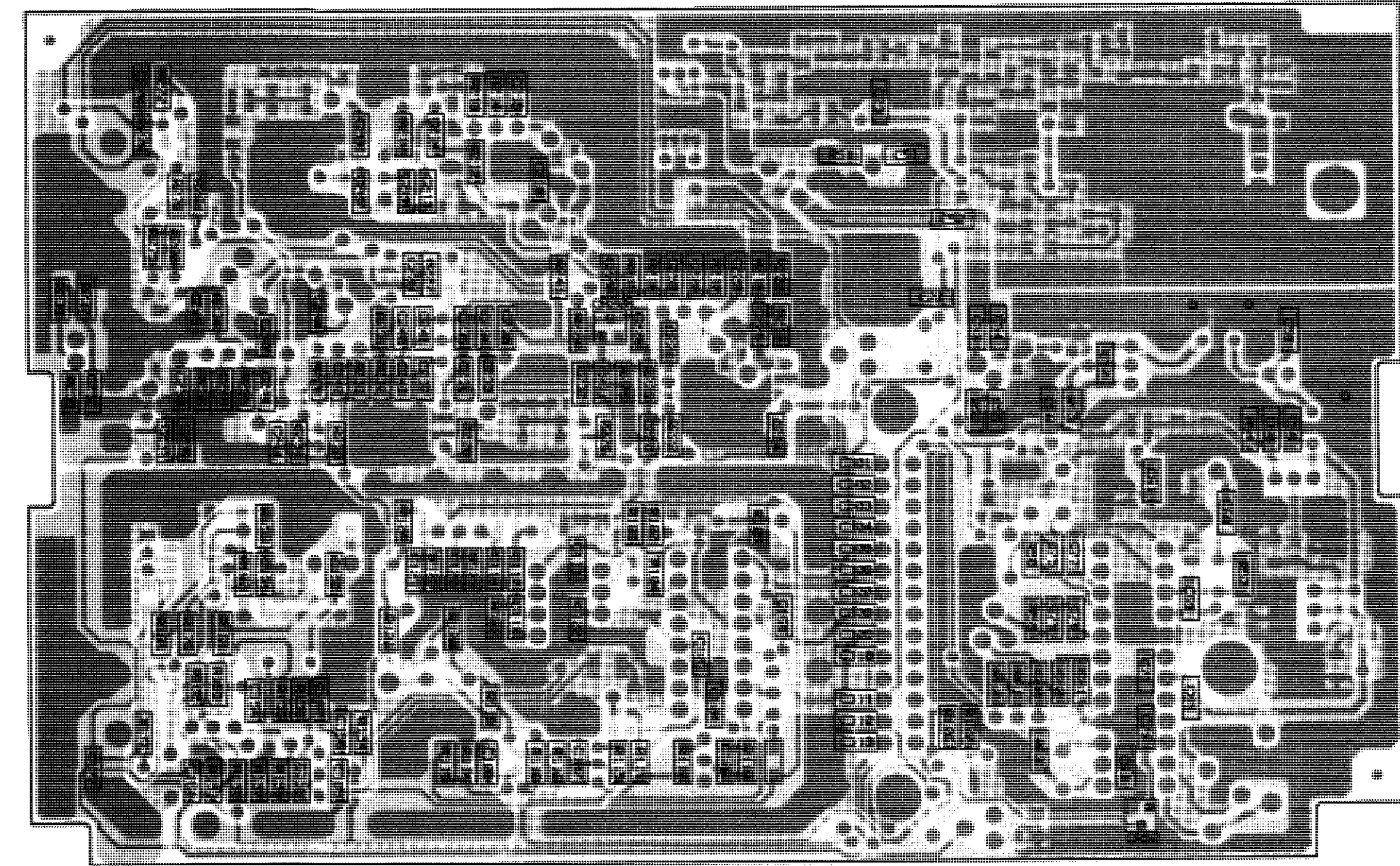
- NOTES:
- UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICRohenries.
 - NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 - POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
 - DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 - AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 - ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 10KHZ AT 30% DEVIATION, MEASURED WITH AN AC RMS VOLTMETER.
 - COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODELS, VALUES MARKED (H) ARE USED IN 20.25/30 KHZ CHANNEL SPACING MODELS.

Schematic Diagram for HLD8029A and HLD8031A VHF RF Boards, 146-174 MHz



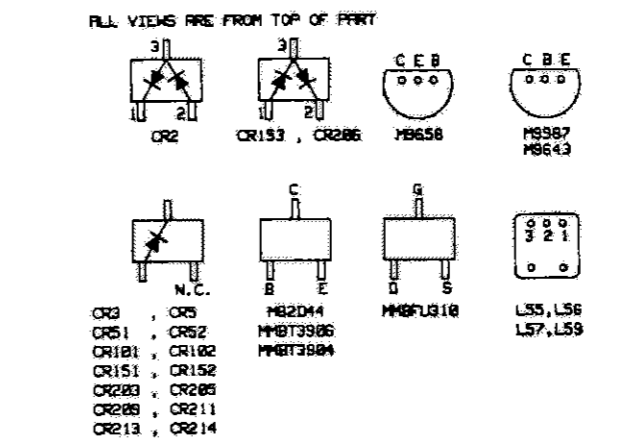
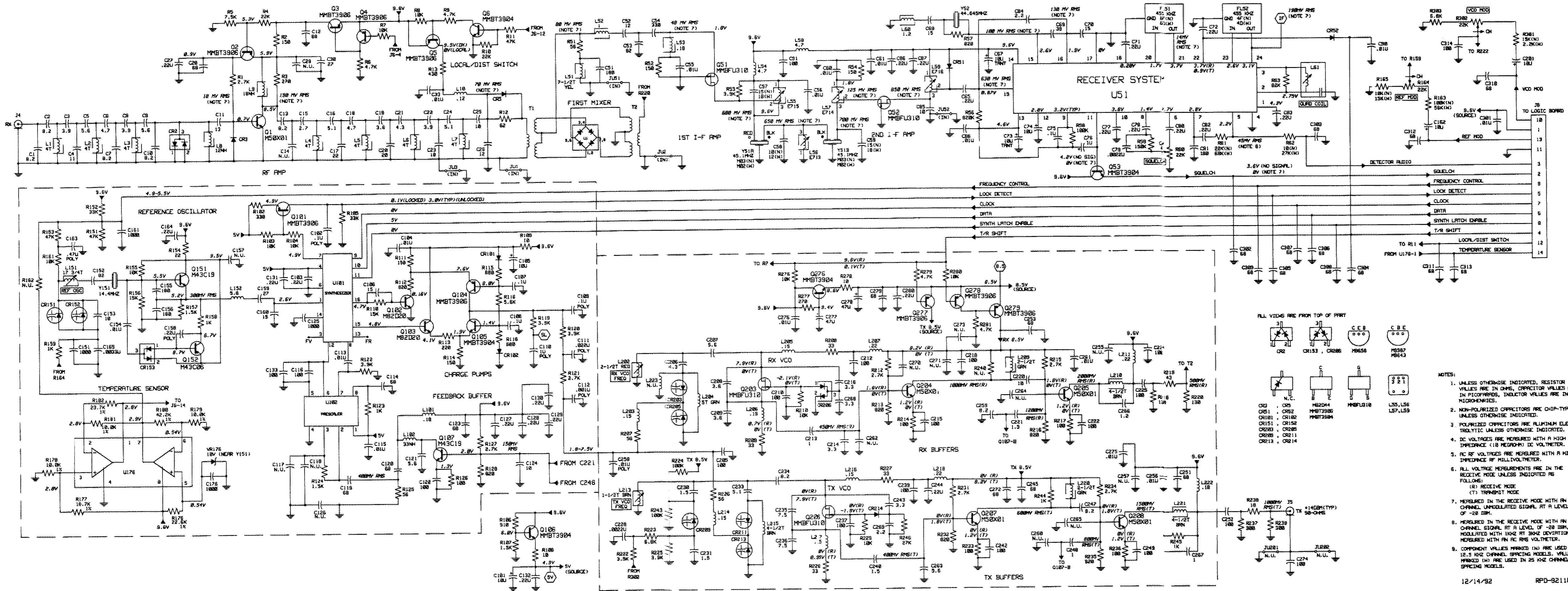
COMPONENT SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



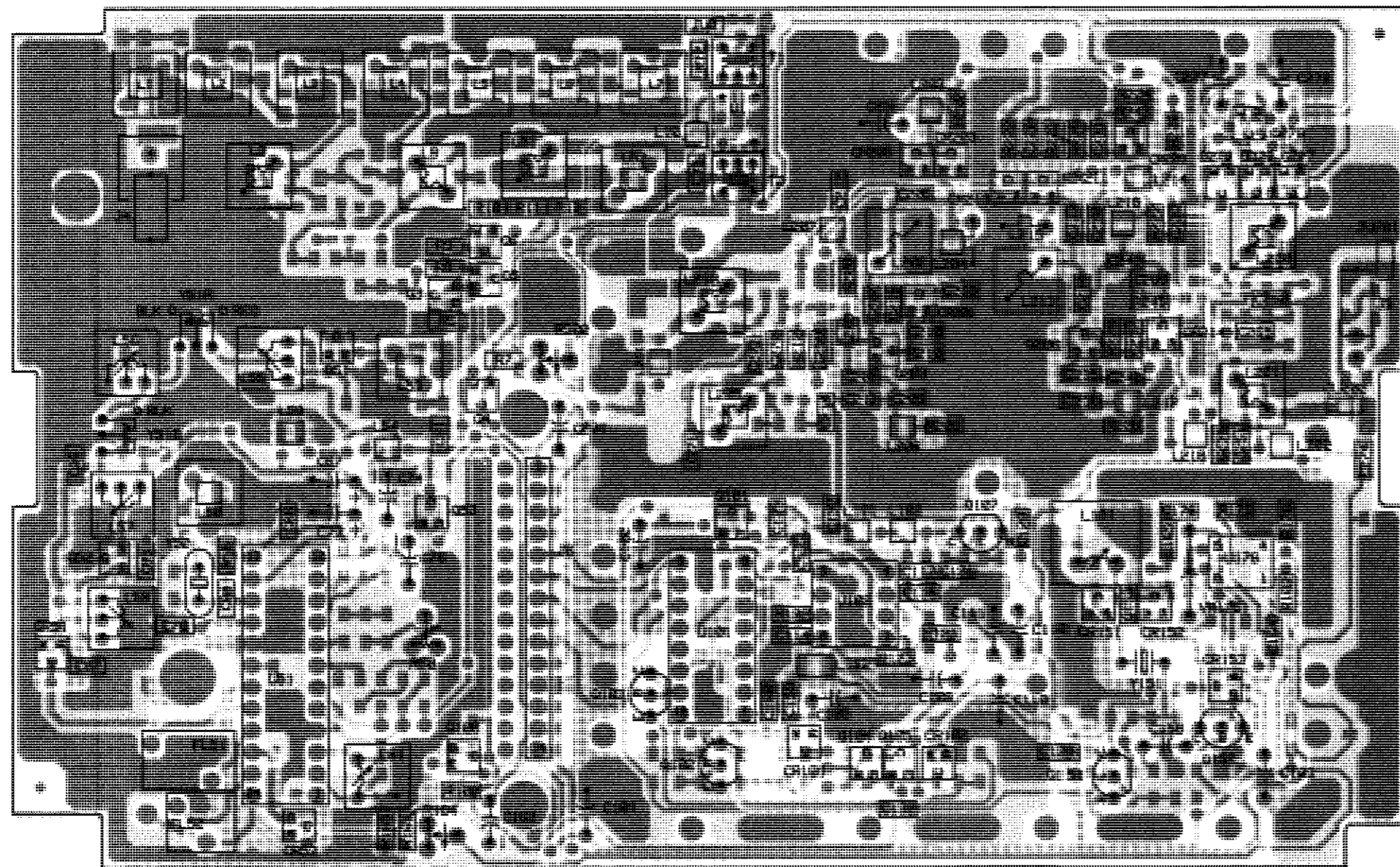
SOLDER SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



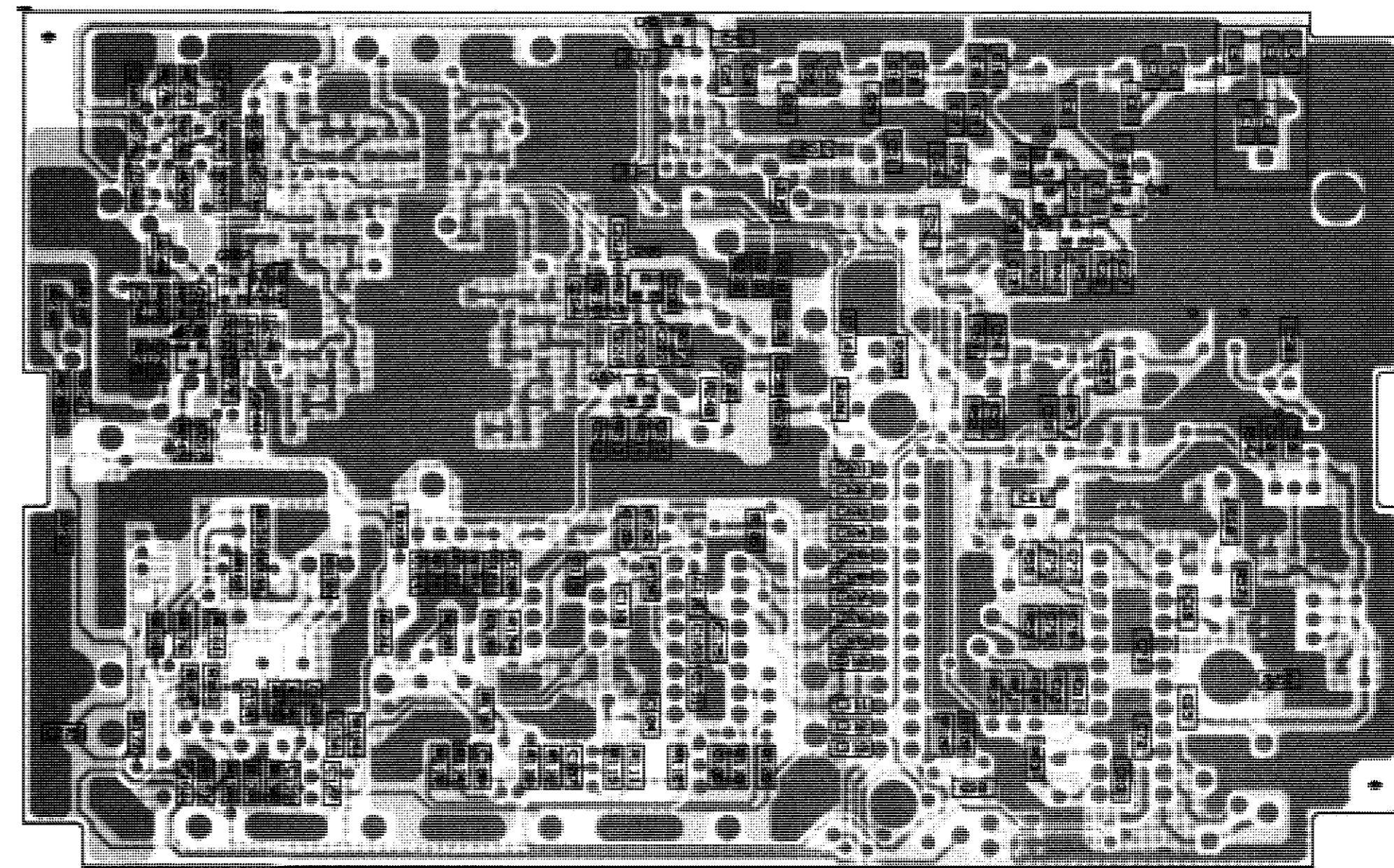
- NOTES:
- UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROMHENRIES.
 - NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 - POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
 - DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 - AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 - ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 - MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 10KHZ AT 30% DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
 - COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODELS. VALUES MARKED (H) ARE USED IN 25 KHZ CHANNEL SPACING MODELS.

Schematic Diagram for HLE8230A and HLE8230A UHF RF Boards, 403-433 MHz



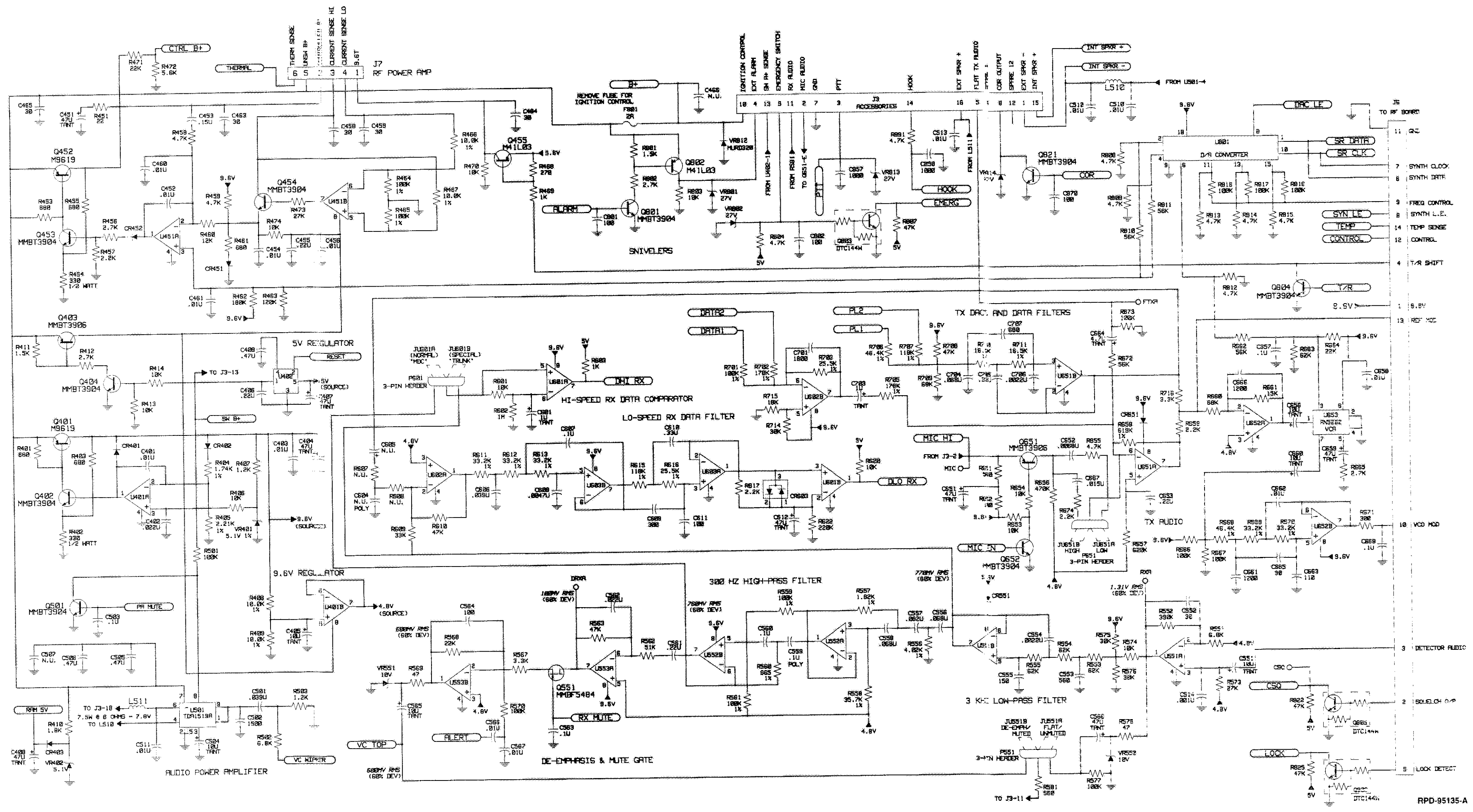
COMPONENT SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----

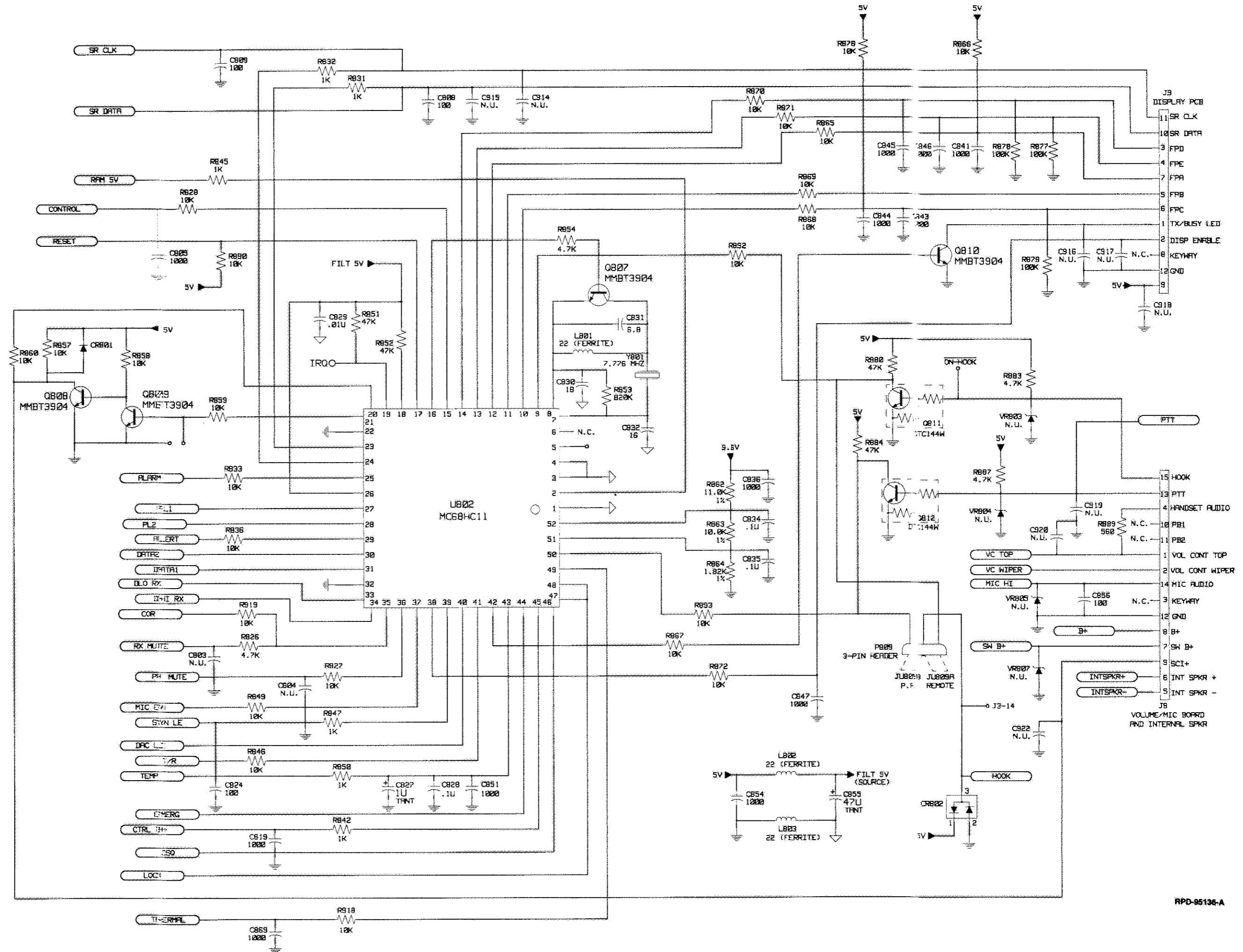


SOLDER SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



NEW
Schematic Diagram for HLN8074E
Masked Logic Board (2-Layer)
(Sheet 1 of 2)



Schematic Diagram for HLN8074E
Masked Logic Board (2-Layer)
(Sheet 2 of 2)

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:

6880902Z98-O

M120 Service Manual

REVISION DETAILS:

Effective February 16, 1996, the following RF boards have been up-issued:

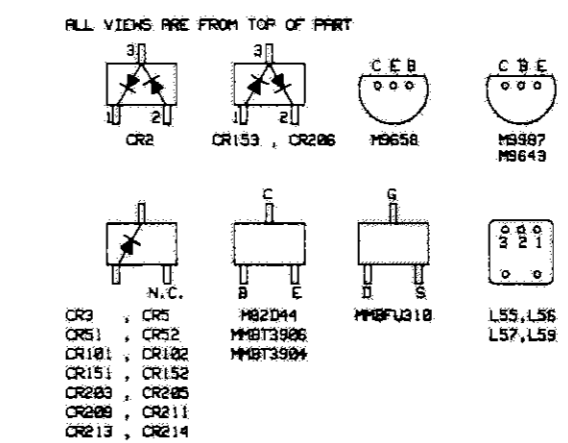
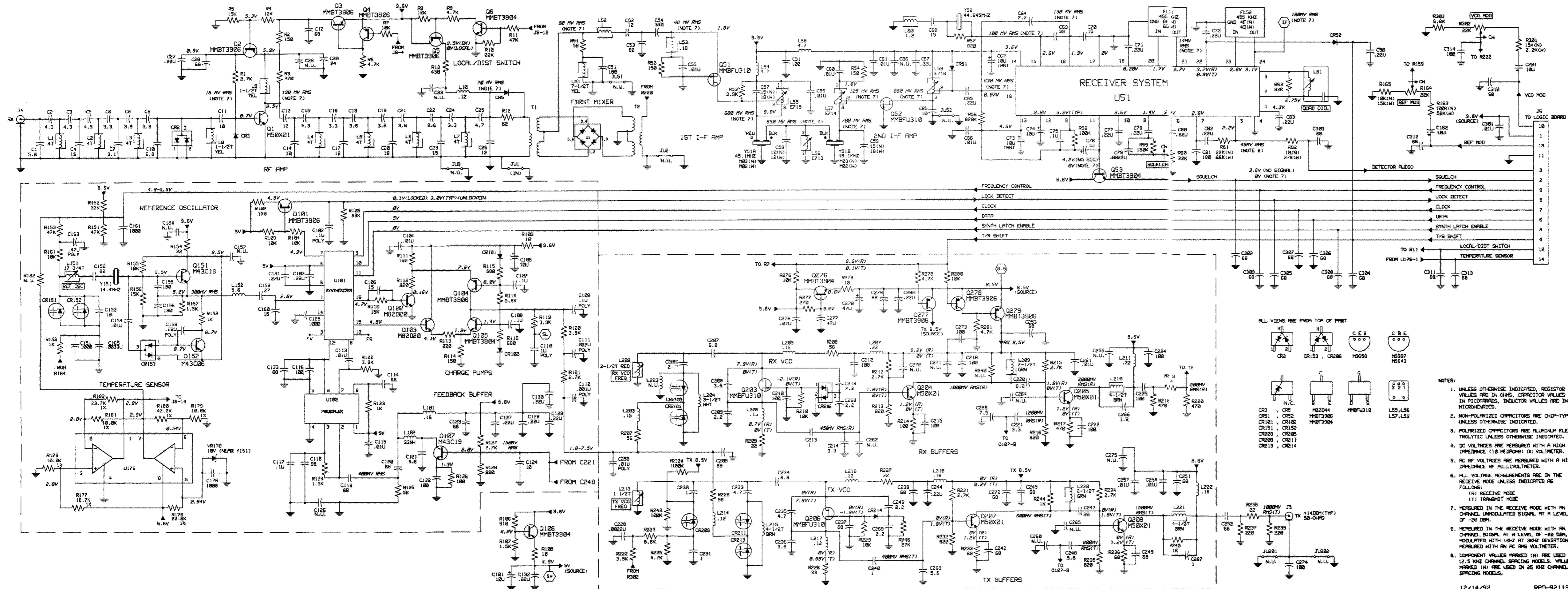
New Version	Replaces	Description
HLE8300B	HLE8300A	RF Board, 438-470 MHz, 25 kHz
HLE8301B	HLE8301A	RF Board, 438-470 MHz, 12.5 kHz

The new version boards contain minor component value changes, as follows:

Reference No.	Old Part	New Part
L202	2480148M02, leaded coil	2480145S09, SMD coil
C207	2113740B22, 7.5 pF	2113740B21, 6.8 pF
C209	2113740B17, 4.7 pF	2113740B07, 1.8 pF

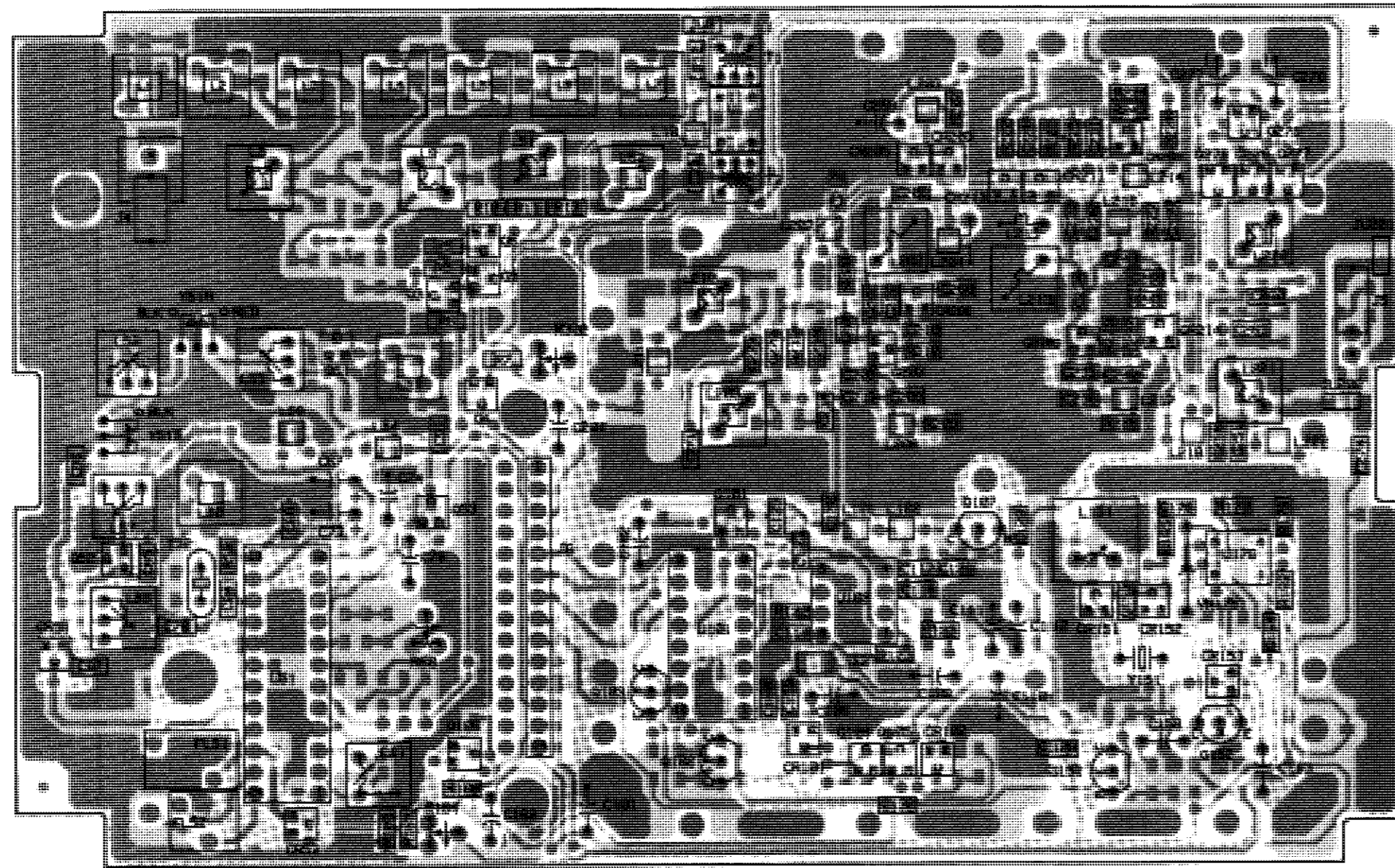
The new board can be identified by the part number "65C05." The part number of the old board is "65C03."

The component values of the two versions of boards are not interchangeable. If replacement is necessary, the component should be replaced with the same type as originally used.



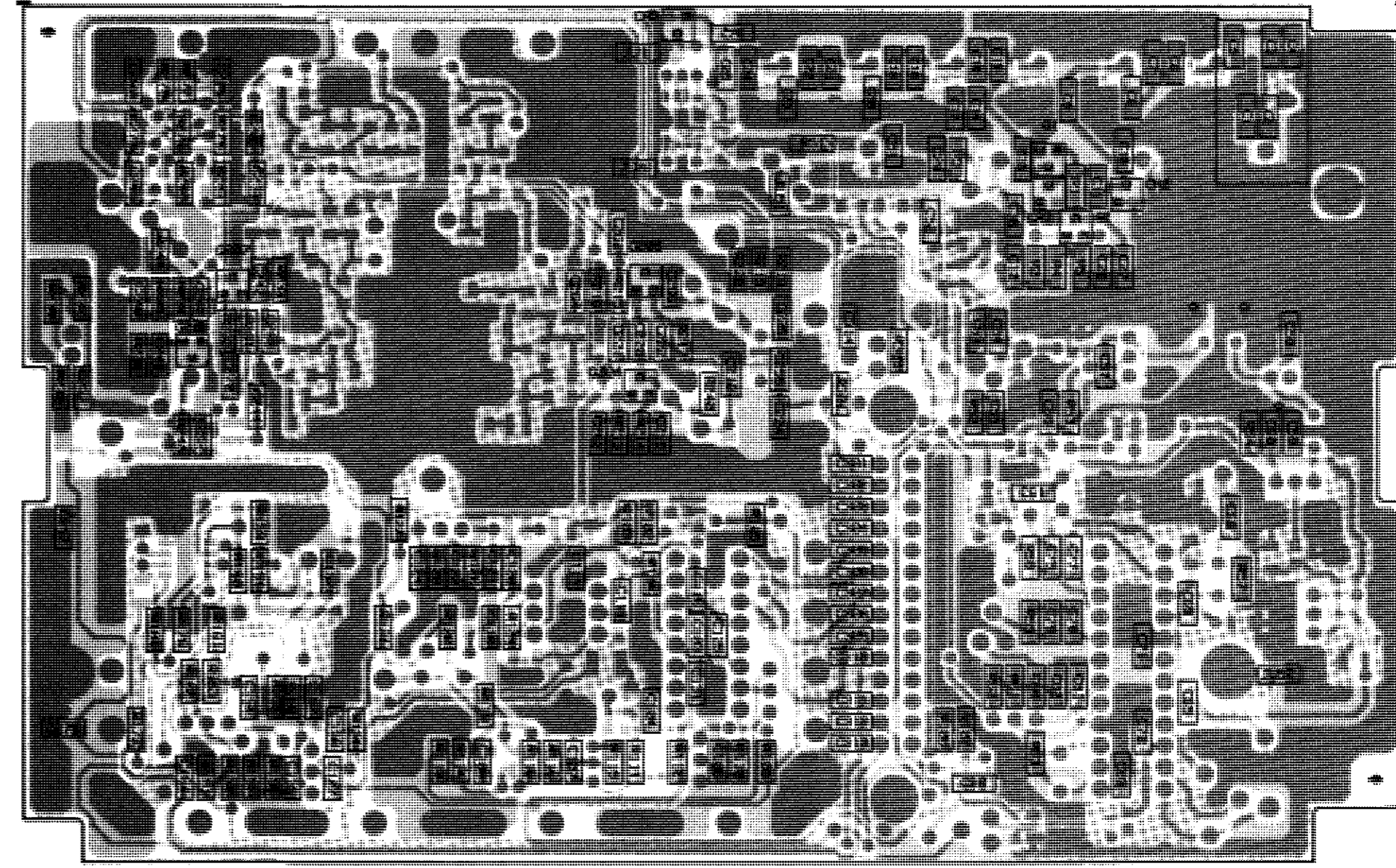
- NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
 2. NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 3. POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
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 5. AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 6. ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 7. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 8. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 1KHZ AT 30% DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
 9. COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODELS. VALUES MARKED (H) ARE USED IN 25 KHZ CHANNEL SPACING MODELS.

Schematic Diagram for HLE8300A and HLE8301A UHF RF Boards, 438-470 MHz



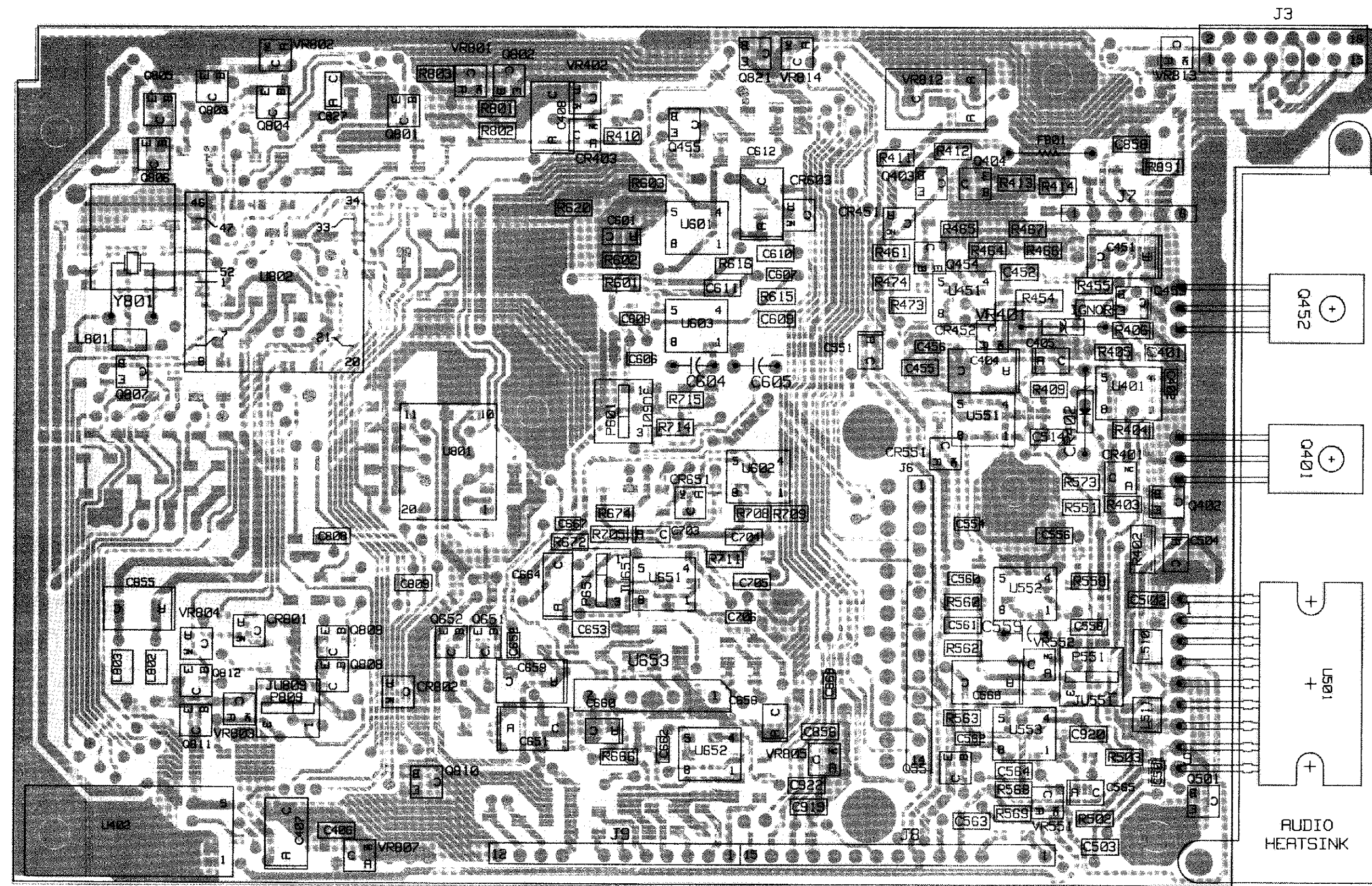
COMPONENT SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



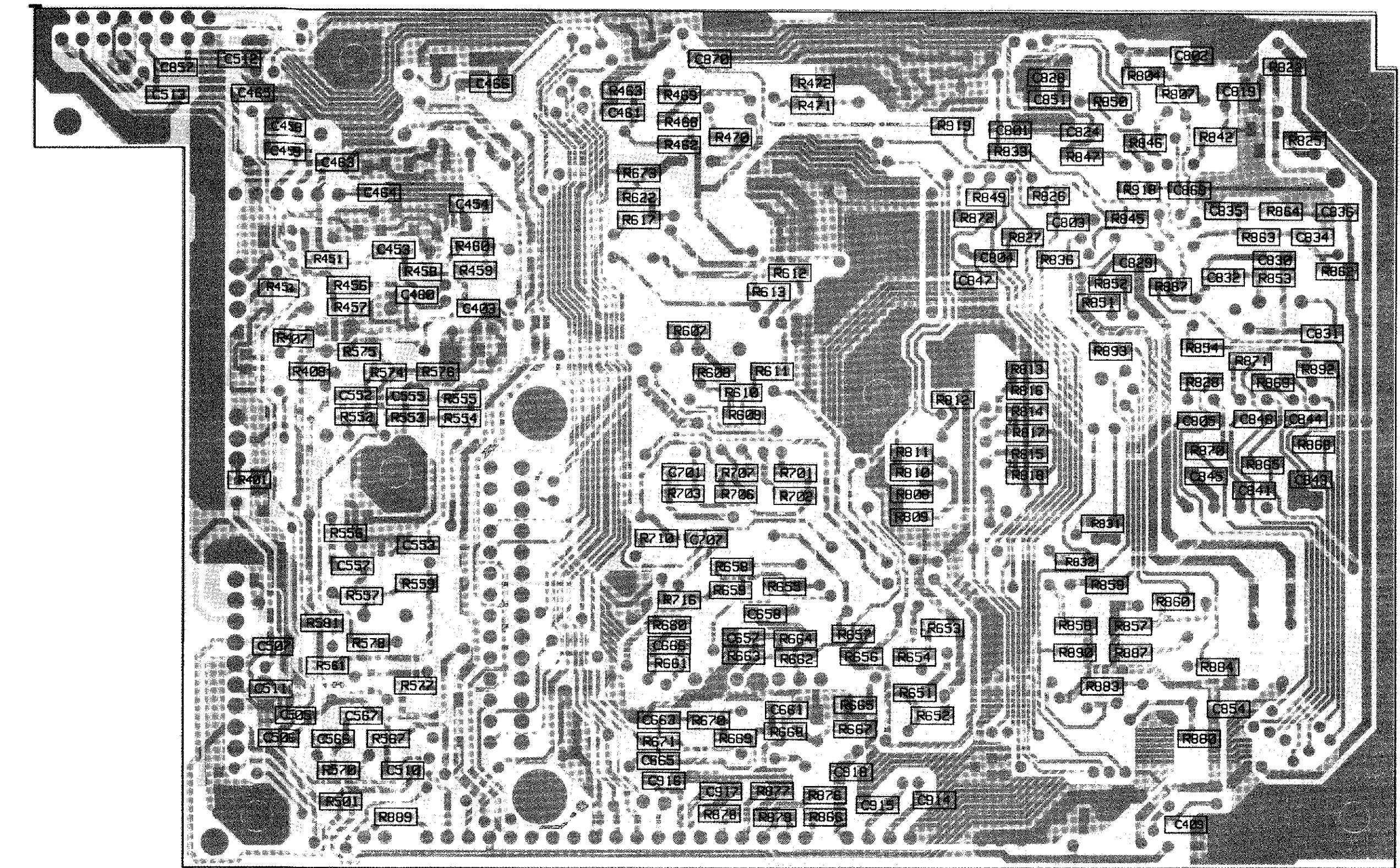
SOLDER SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



COMPONENT SIDE (GRAY) RCB-95153-A
 SOLDER SIDE (PINK) RCB-95154-A
 OVERLAY ----- RCB-95155-A

COMPONENT SIDE VIEW



COMPONENT SIDE (GRAY) RCB-95153-A (REV)
 SOLDER SIDE (PINK) RCB-95154-A (REV)
 OVERLAY ----- RCB-95156-A

SOLDER SIDE VIEW

NEW
 Circuit Board Details for HLN8074E
 Masked Logic Board (2-Layer)

HLN8074E Logic Board 2-Layer Masked, Leadless

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C401	21-13741B45	.01 uF
C402	21-04554J12	.022 uF 10%
C403	21-13741B45	.01 uF
C404	23-11049C10	tantalum 47 uF 10% 16V
C405	23-11049A57	tantalum 10 uF 10% 16V
C406	21-04554J02	.22 uF 10%
C407	23-11049A92	tantalum 47 uF 10% 6V
C408	23-11049C10	tantalum 47 uF 10% 16V
C409	21-04554J01	.47 uF 10%
C451	23-11049C10	tantalum 47 uF 10% 16V
C452	21-13741B45	.01 uF
C453	21-11032B14	.15 uF +80/-20%
C454	21-13741B45	.01 uF
C455	21-04554J02	.22 uF 10%
C456	21-04554J03	.01 uF 10%
C458	21-13740B36	30 pF
C459	21-13740B36	30 pF
C460	21-13741B45	.01 uF
C461	21-13741B45	.01 uF
C463	21-13740B36	30 pF
C464	21-13740B36	30 pF
C465	21-13740B36	30 pF
C466		not used
C501	21-04554J09	.039 uF 10%
C502	21-13740B76	1500 pF
C503	21-13741B69	.1 uF
C504	23-11049A57	tantalum 10 uF 10% 16V
C505	21-04554J01	.47 uF 10%
C506	21-04554J01	.47 uF 10%
C507		not used
C510	21-13741B45	.01 uF
C511	21-13741B45	.01 uF
C512	21-13741B45	.01 uF
C513	21-13741B45	.01 uF
C514	21-13741B21	1000 pF
C551	23-11049A57	tantalum 10 uF 10% 16V
C552	21-13740B36	30 pF
C553	21-13740B67	560 pF
C554	21-04554J08	.0022 uF 10%
C555	21-13740B51	120 pF
C556	21-04554J06	.068 uF 10%
C557	21-13741B67	.082 uF
C558	21-04554J06	.068 uF 10%
C559	08-11051A13	poly .1 uF 63V
C560	21-04554J11	.1 uF 10%
C561	21-04554J02	.22 uF 10%
C562	21-04554J12	.022 uF 10%
C563	21-13741B69	.1 uF
C564	21-13740B49	100 pF
C565	23-11049A57	tantalum 10 uF 10% 16V
C566	21-13741B45	.01 uF
C567	21-13741B45	.01 uF
C568	23-11049C10	tantalum 47 uF 10% 16V
C601	23-11049A07	tantalum 1 uF 10% 16V
C604		not used
C605		not used
C606	21-04554J09	.039 uF 10%
C607	21-04554J11	.1 uF 10%
C608	21-04554J10	.0047 uF 10%
C609	21-13740B60	300 pF
C610	21-04554J07	.33 uF 10%
C611	21-13740B49	100 pF
C612	23-11049C10	tantalum 47 uF 10% 16V
C651	23-11049C10	tantalum 47 uF 10% 16V
C652	21-04554J04	.0068 uF 10%
C653	21-04554J02	.22 uF 10%
C656	23-11049A57	tantalum 10 uF 10% 16V
C657	21-13741B69	.1 uF
C658	21-13741B45	.01 uF
C659	23-11049A92	tantalum 47 uF 10% 6V
C660	23-11049A57	tantalum 10 uF 10% 16V

C661	21-13740B74	1200 pF
C662	21-04554J03	.01 uF 10%
C663	21-13740B50	110 pF
C664	23-11049A14	tantalum 4.7 uF 10% 20V
C665	21-13740B36	30 pF
C666	21-13740B74	1200 pF
C667	21-04554J05	.015 uF 10%
C668	21-04554J11	.1 uF 10%
C701	21-13740B78	1800 pF
C703	23-11049A07	tantalum 1 uF 10% 16V
C704	21-04554J06	.068 uF 10%
C705	21-04554J07	.33 uF 10%
C706	21-04554J08	.0022 uF 10%
C707	21-13740B69	680 pF
C801	21-13740B49	100 pF
C802	21-13740B49	100 pF
C803		not used
C804		not used
C805	21-13740B73	1000 pF
C808	21-13740B49	100 pF
C809	21-13740B49	100 pF
C819	21-13740B73	1000 pF
C824	21-13740B49	100 pF
C827	23-11049A07	tantalum 1 uF 10% 16V
C828	21-13741B69	.1 uF
C829	21-13741B45	.01 uF
C830	21-13740B31	18pF
C831	21-13740B21	6.8 +/- .25 pF
C832	21-13740B30	16 pF
C834	21-13741B69	.1 uF
C835	21-13741B69	.1 uF
C836	21-13740B73	1000 pF
C841	21-13740B73	1000 pF
C843	21-13740B73	1000 pF
C844	21-13740B73	1000 pF
C845	21-13740B73	1000 pF
C846	21-13740B73	1000 pF
C847	21-13740B73	1000 pF
C851	21-13740B73	1000 pF
C854	21-13740B73	1000 pF
C855	23-11049A92	tantalum 47 uF 10% 6V
C856	21-13740B49	100 pF
C857	21-13740B73	1000 pF
C858	21-13740B73	1000 pF
C869	21-13740B73	1000 pF
C870	21-13740B49	100 pF
C914		not used
C915		not used
C916		not used
C917		not used
C918		not used
C919		not used
C920		not used
C922		not used

Diodes (see note)

CR401	48-05129M76	silicon SOT
CR402	48-83654H02	silicon
CR403	48-05129M76	silicon SOT
CR451	48-05129M76	silicon SOT
CR452	48-05129M76	silicon SOT
CR551	48-05129M76	silicon SOT
CR603	48-84336R03	dual silicon SOT MMBD7000
CR651	48-05129M76	silicon SOT
CR801	48-05129M76	silicon SOT
CR802	48-84336R03	dual silicon SOT MMBD7000
CR803	48-83553T02	4A 200 PIV MUR420

Fuse

F801	65-05214E04	2 amp axial lead
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Connector, receptacle

J3	28-80923V01	16-pin, accessories
J6	09-80130M03	14-pin, RF board
J7	28-80128M03	6 pin, RF power amplifier

NEW

2-LAYER LOGIC

J8	28-80600B01	27-pin, includes J8 and J9	R462	06-11077B29	180k
Jumpers			R463	06-11077B25	120k
JU551	09-80601B01	push-on jumper, 2-pin	R464	06-11077G88	100k 1%
JU601	09-80601B01	push-on jumper, 2-pin	R465	06-11077G88	100k 1%
JU651	09-80601B01	push-on jumper, 2-pin	R466	06-11077F91	10.0k 1%
JU809	09-80601B01	push-on jumper, 2-pin	R467	06-11077F91	10.0k 1%
Coils			R468	06-11077A60	270
L510	24-84657R01	ferrite bead	R469	06-11077A74	1k
L511	24-84657R01	ferrite bead	R470	06-11077A98	10k
L801	24-11087A42	chip 22 uH ferrite	R471	06-11077B07	22k
L802	24-11087A42	chip 22 uH ferrite	R472	06-11077A92	5.6k
L803	24-11087A42	chip 22 uH ferrite	R473	06-11077B09	27k
Connector, Plug			R474	06-11077A98	10k
P551	28-04519J01	3-pin header	R501	06-11077B23	100k
P601	28-04519J01	3-pin header	R502	06-11077A90	4.7k
P651	28-04519J01	3-pin header	R503	06-11077A78	1.5k
P809	28-04519J01	3-pin header	R551	06-11077A94	6.8k
Transistors (see note)			R552	06-11077B37	390k
Q401	48-00869619	PNP; type M9619	R553	06-11077B18	62k
Q402	48-80214G02	NPN; type MMBT3904	R554	06-11077B18	62k
Q403	48-05128M67	PNP; type MMBT3906	R555	06-11077B18	62k
Q404	48-80214G02	NPN; type MMBT3904	R556	06-11077F53	4.02k 1%
Q452	48-00869619	PNP; type M9619	R557	06-11077F20	1.82k 1%
Q453	48-80214G02	NPN; type MMBT3904	R558	06-11077G45	35.7k 1%
Q454	48-80214G02	NPN; type MMBT3904	R559	06-11077G88	100k 1%
Q455	48-80141L03	PNP; type M41L03	R560	06-11077E77	665 1%
Q501	48-80214G02	NPN; type MMBT3904	R561	06-11077G88	100k 1%
Q551	48-80949V01	field effect; type MMBF5484	R562	06-11077B16	51k
Q651	48-05128M67	PNP; type MMBT3906	R563	06-11077B15	47k
Q652	48-80214G02	NPN; type MMBT3904	R567	06-11077A86	3.3k
Q801	48-80214G02	NPN; type MMBT3904	R568	06-11077B07	22k
Q802	48-80141L03	PNP; type M41L03	R569	06-11077A42	47
Q803	48-80947V01	digital NPN; type DTC144W	R570	06-11077B23	100k
Q804	48-80214G02	NPN; type MMBT3904	R573	06-11077B09	27k
Q805	48-80947V01	digital NPN; type DTC144W	R574	06-11077A98	10k
Q806	48-80947V01	digital NPN; type DTC144W	R575	06-11077B10	30k
Q807	48-80214G02	NPN; type MMBT3904	R576	06-11077B10	30k
Q808	48-80214G02	NPN; type MMBT3904	R577	06-11077B23	100k
Q809	48-80214G02	NPN; type MMBT3904	R578	06-11077A42	47
Q810	48-80214G02	NPN; type MMBT3904	R581	06-11077A68	560
Q811	48-80947V01	digital NPN; type DTC144W	R601	06-11077A98	10k
Q812	48-80947V01	digital NPN; type DTC144W	R602	06-11077B47	1 meg
Q821	48-80214G02	NPN; type MMBT3904	R603	06-11077A74	1k
Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.			R607		not used
R401	06-11077A70	680	R608		not used
R402	06-80195M37	330 1/2 watt	R609	06-11077B11	33k
R403	06-11077A70	680	R610	06-11077B15	47k
R404	06-11077F18	1.74k 1%	R611	06-11077G42	33.2k 1%
R405	06-11077F28	2.21k 1%	R612	06-11077G42	33.2k 1%
R406	06-11077A98	10k	R613	06-11077G42	33.2k 1%
R407	06-11077A76	1.2k	R615	06-11077G95	118k 1%
R408	06-11077F91	10.0k 1%	R616	06-11077G31	25.5k 1%
R409	06-11077F91	10.0k 1%	R617	06-11077A82	2.2k
R410	06-11077A80	1.8k	R620	06-11077A98	10k
R411	06-11077A78	1.5k	R622	06-11077B31	220k
R412	06-11077A84	2.7k	R651	06-11077A68	560
R413	06-11077A98	10k	R652	06-11077A50	100
R414	06-11077A98	10k	R653	06-11077A98	10k
R451	06-11077A34	22	R654	06-11077A98	10k
R453	06-11077A70	680	R655	06-11077A90	4.7k
R454	06-80195M37	330 1/2 watt	R656	06-11077B39	470k
R455	06-11077A70	680	R657	06-11077B42	620k
R456	06-11077A84	2.7k	R658	06-11077H65	619k 1%
R457	06-11077A82	2.2k	R659	06-11077A82	2.2k
R458	06-11077A90	4.7k	R660	06-11077B19	68k
R459	06-11077A90	4.7k	R661	06-11077B03	15k
R460	06-11077B01	12k	R662	06-11077B17	56k
R461	06-11077A70	680	R663	06-11077B18	62k
			R664	06-11077B07	22k
			R665	06-11077A84	2.7k
			R666	06-11077B23	100k
			R667	06-11077B23	100k
			R668	06-11077G56	46.4k 1%
			R669	06-11077G42	33.2k 1%
			R670	06-11077G42	33.2k 1%
			R671	06-11077A61	300
			R672	06-11077B17	56k
			R673	06-11077B23	100k

R674	06-11077A82	2.2k
R701	06-11077G88	100k 1%
R702	06-11077H13	178k 1%
R703	06-11077G31	25.5k 1%
R705	06-11077H13	178k 1%
R706	06-11077G56	46.4k 1%
R707	06-11077G95	118k 1%
R708	06-11077B15	47k
R709	06-11077B19	68k
R710	06-11077G13	16.5k 1%
R711	06-11077G13	16.5k 1%
R714	06-11077B10	30k
R715	06-11077B05	18k
R716	06-11077A86	3.3k
R801	06-11077A78	1.5k
R802	06-11077A84	2.7k
R803	06-11077A98	10k
R804	06-11077A90	4.7k
R807	06-11077B15	47k
R808	06-11077A90	4.7k
R809	06-11077A90	4.7k
R810	06-11077B17	56k
R811	06-11077B17	56k
R812	06-11077A90	4.7k
R813	06-11077A90	4.7k
R814	06-11077A90	4.7k
R815	06-11077A90	4.7k
R816	06-11077B23	100k
R817	06-11077B23	100k
R818	06-11077B23	100k
R822	06-11077B15	47k
R825	06-11077B15	47k
R826	06-11077A90	4.7k
R827	06-11077A98	10k
R828	06-11077A98	10k
R831	06-11077A74	1k
R832	06-11077A74	1k
R833	06-11077A98	10k
R836	06-11077A98	10k
R842	06-11077A74	1k
R845	06-11077A74	1k
R846	06-11077A98	10k
R847	06-11077A74	1k
R849	06-11077A98	10k
R850	06-11077A74	1k
R851	06-11077B15	47k
R852	06-11077B15	47k
R853	06-11077B45	820k
R854	06-11077A90	4.7k
R857	06-11077A98	10k
R858	06-11077A98	10k
R859	06-11077A98	10k
R860	06-11077A98	10k
R862	06-11077F95	11.0k 1%
R863	06-11077F91	10.0k 1%
R864	06-11077F20	1.82k 1%
R865	06-11077A98	10k
R866	06-11077A98	10k
R867	06-11077A98	10k
R868	06-11077A98	10k
R869	06-11077A98	10k
R870	06-11077A98	10k
R871	06-11077A98	10k
R872	06-11077A98	10k
R876	06-11077A98	10k
R877	06-11077B23	100k
R878	06-11077B23	100k
R879	06-11077B23	100k

R880	06-11077B15	47k
R883	06-11077A90	4.7k
R884	06-11077B15	47k
R887	06-11077A90	4.7k
R889	06-11077A68	560
R890	06-11077A98	10k
R891	06-11077A90	4.7k
R892	06-11077A98	10k
R893	06-11077A98	10k
R918	06-11077A98	10k
R919	06-11077A98	10k

Integrated circuits and modules (see note)

U401	51-02198J22	dual op-amp 4558 SOIC
U402	51-80942T01	regulator, 5V with reset
U451	51-02198J22	dual op-amp 4558 SOIC
U501	51-80147R01	audio power amp TDA1519A
U551	51-02198J22	dual op-amp 4558 SOIC
U552	51-02198J22	dual op-amp 4558 SOIC
U553	51-02198J22	dual op-amp 4558 SOIC
U601	51-02198J23	dual comparator 2903 SOIC
U602	51-02198J22	dual op-amp 4558 SOIC
U603	51-02198J22	dual op-amp 4558 SOIC
U651	51-02198J22	dual op-amp 4558 SOIC
U652	51-02198J22	dual op-amp 4558 SOIC
U653	51-80059M01	voltage-controlled attenuator
U801	51-13811G01	D/A converter 6 bit 6 channel
U802	51-80649B02	microcomputer MC68HC11E9

Voltage regulators (see note)

VR401	48-83461E40	zener diode 5.1V 1%
VR402	48-80140L06	zener diode 5.1V SOT
VR551	48-80140L15	zener diode 10V SOT
VR552	48-80140L15	zener diode 10V SOT
VR801	48-80948V01	zener diode 27V SOT
VR802	48-80948V01	zener diode 27V SOT
VR803		not used
VR804		not used
VR805		not used
VR807		not used
VR812	48-02245J30	silicon 3A 200V MURD320
VR813	48-80948V01	zener diode 27V SOT
VR814	48-80948V01	zener diode 27V SOT

Crystals

Y801	48-80173D09	7.776 MHz
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Non-referenced items

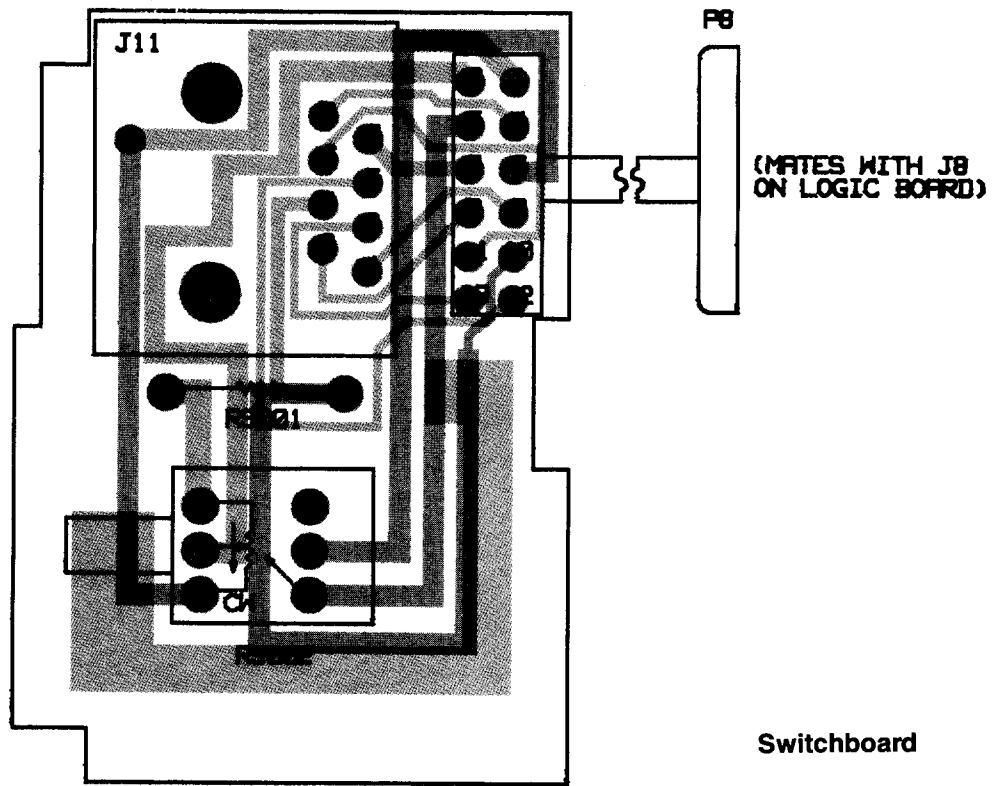
03-10943M04	screw M2.5 X 8 (2 used, for Q401 and Q452)
03-80271L01	screw (2 used for U501)
04-00136334	washer flat (2 used for U501)
14-83820M05	insulator (2 used, for Q401 and Q452)
26-80497B01	heatsink
01-80701Y58	connector assembly (mates with J3)

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

1/4/96

PL-951025-A

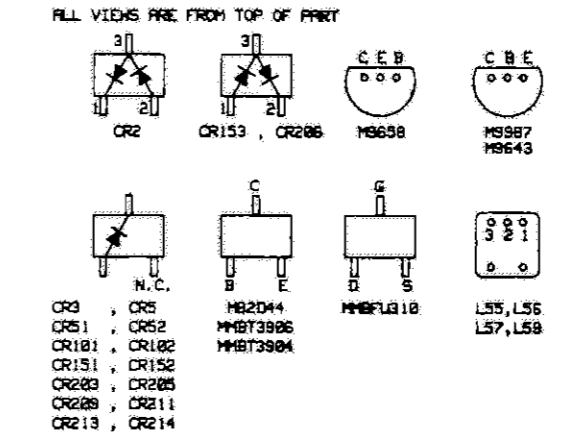
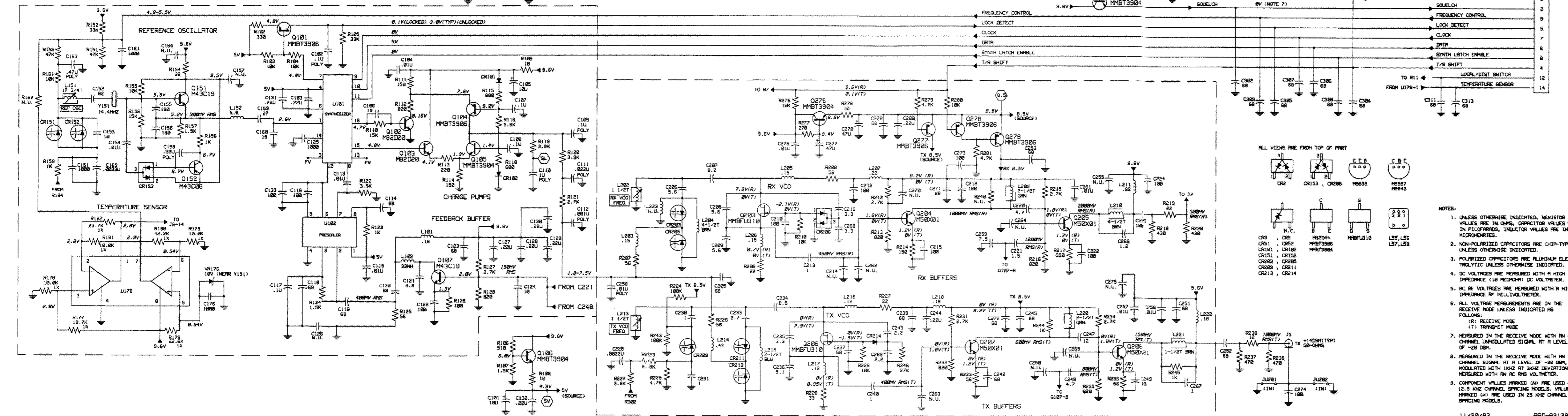
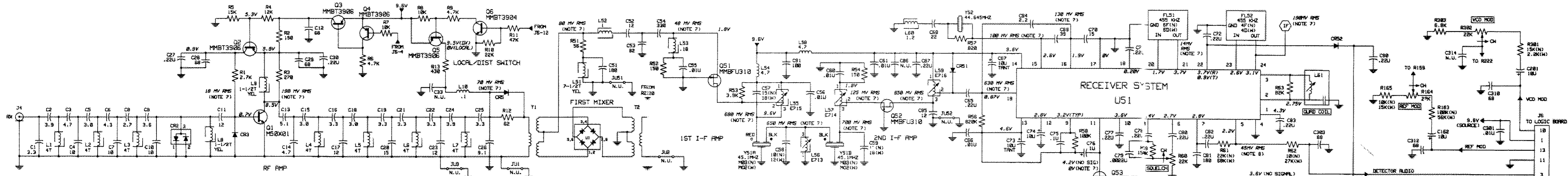
NEW



COMPONENT SIDE *
 SOLDER SIDE ●
 OVERLAY —

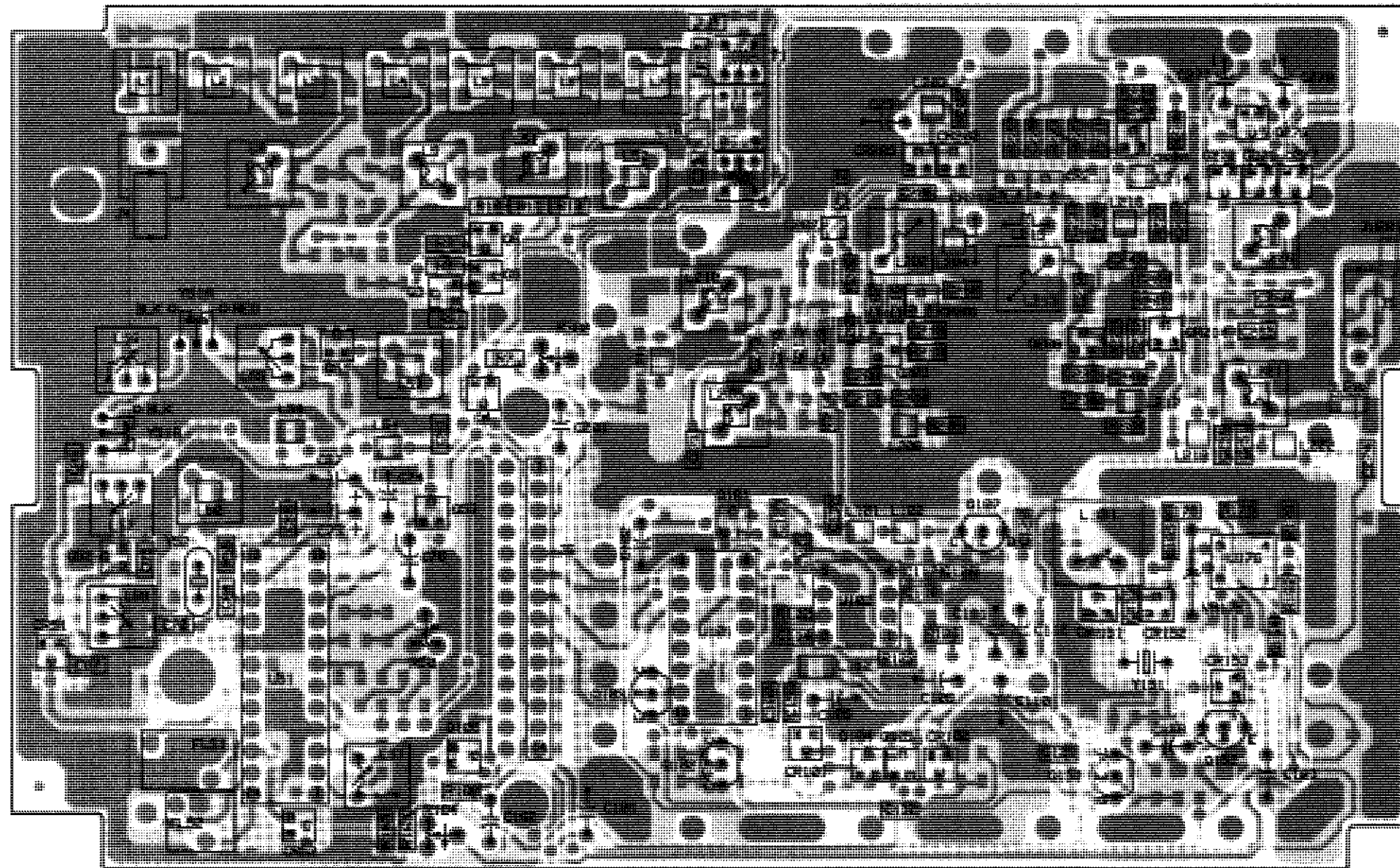
NEW

Circuit Board Details for HLN8071B
 Volume/Microphone Board



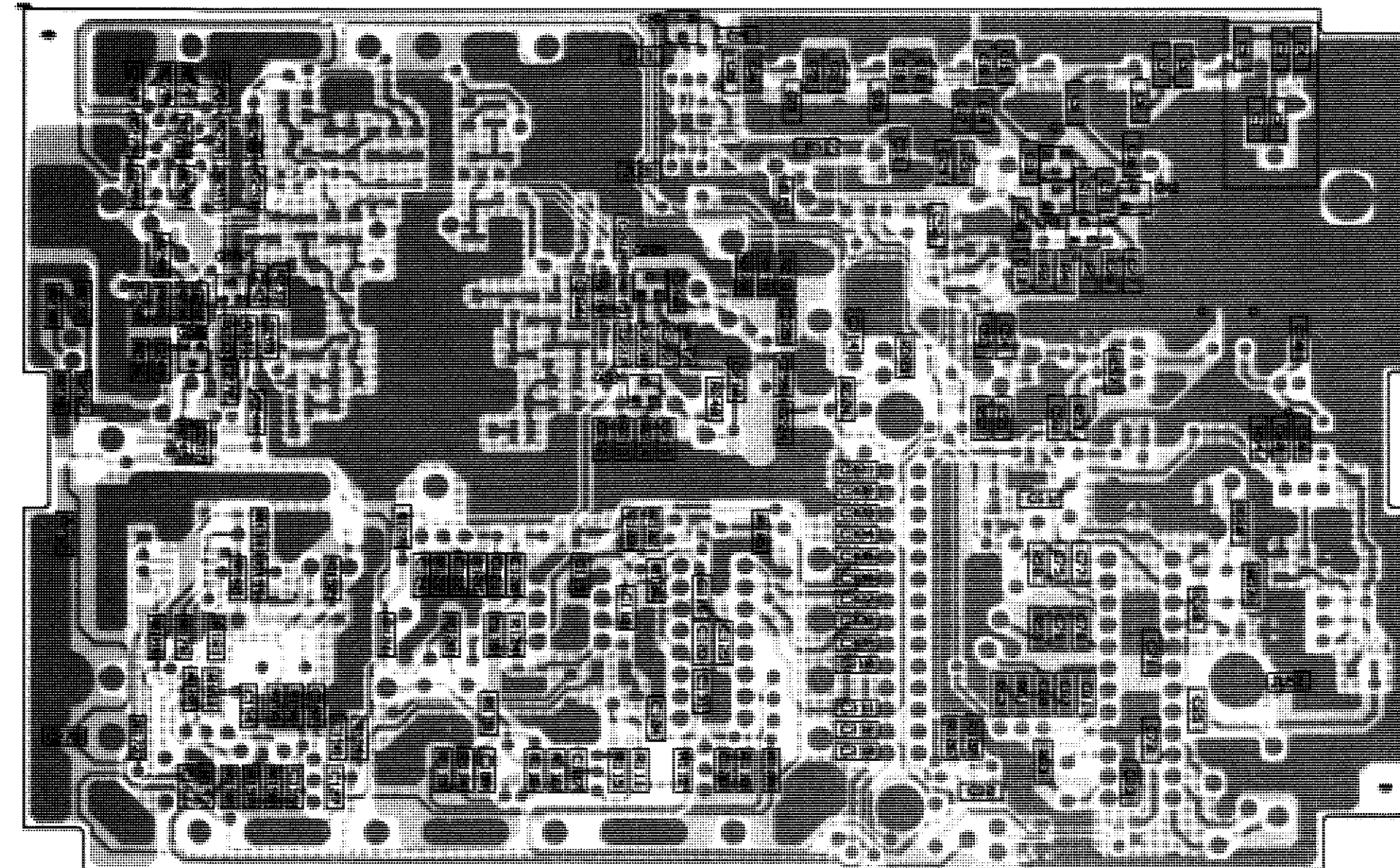
- NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
 2. NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 3. POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
 4. DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 5. AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 6. ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
(R) RECEIVE MODE
(T) TRANSMIT MODE
 7. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 8. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 1KHZ AT 30% DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
 9. COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODELS, VALUES MARKED (H) ARE USED IN 25 KHZ CHANNEL SPACING MODELS.

Schematic Diagram for HLE8263A and HLE8264A UHF RF Boards, 465-495 MHz



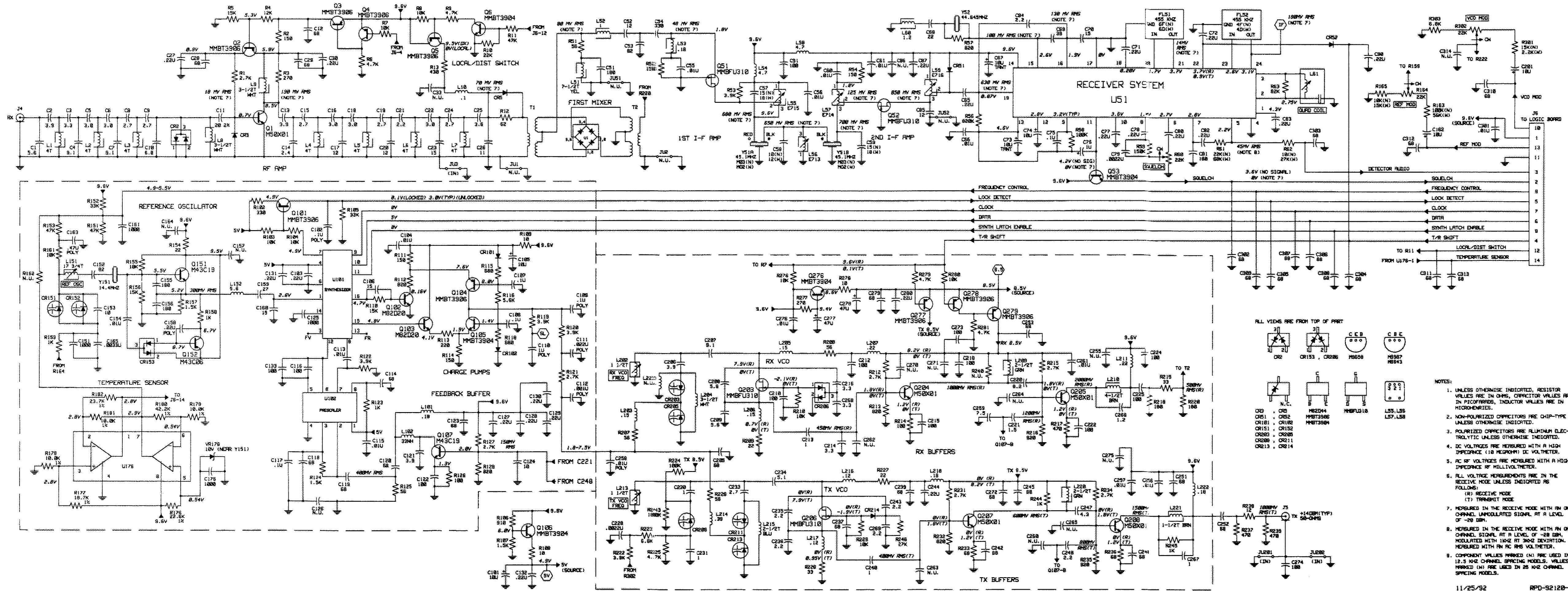
COMPONENT SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



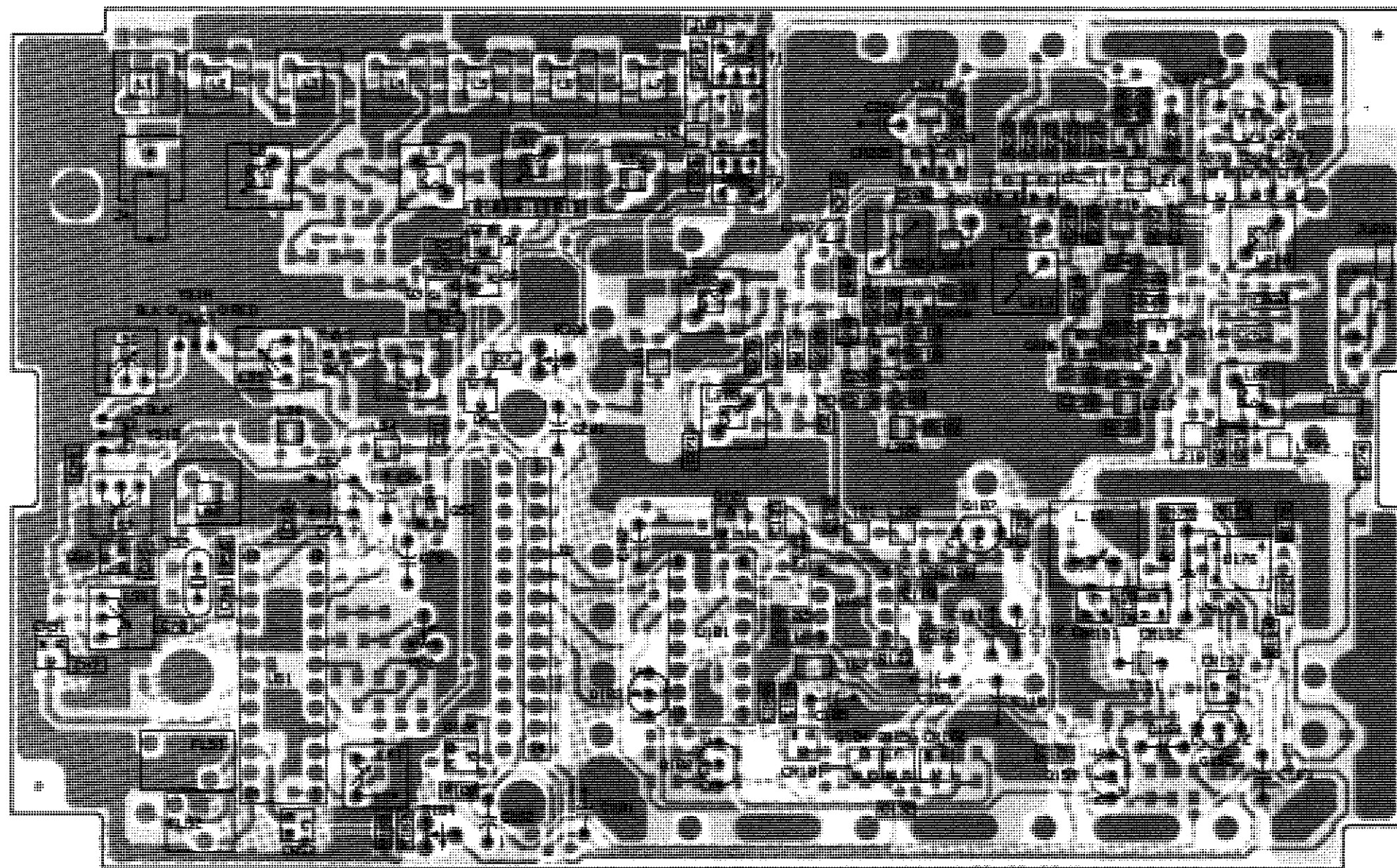
SOLDER SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



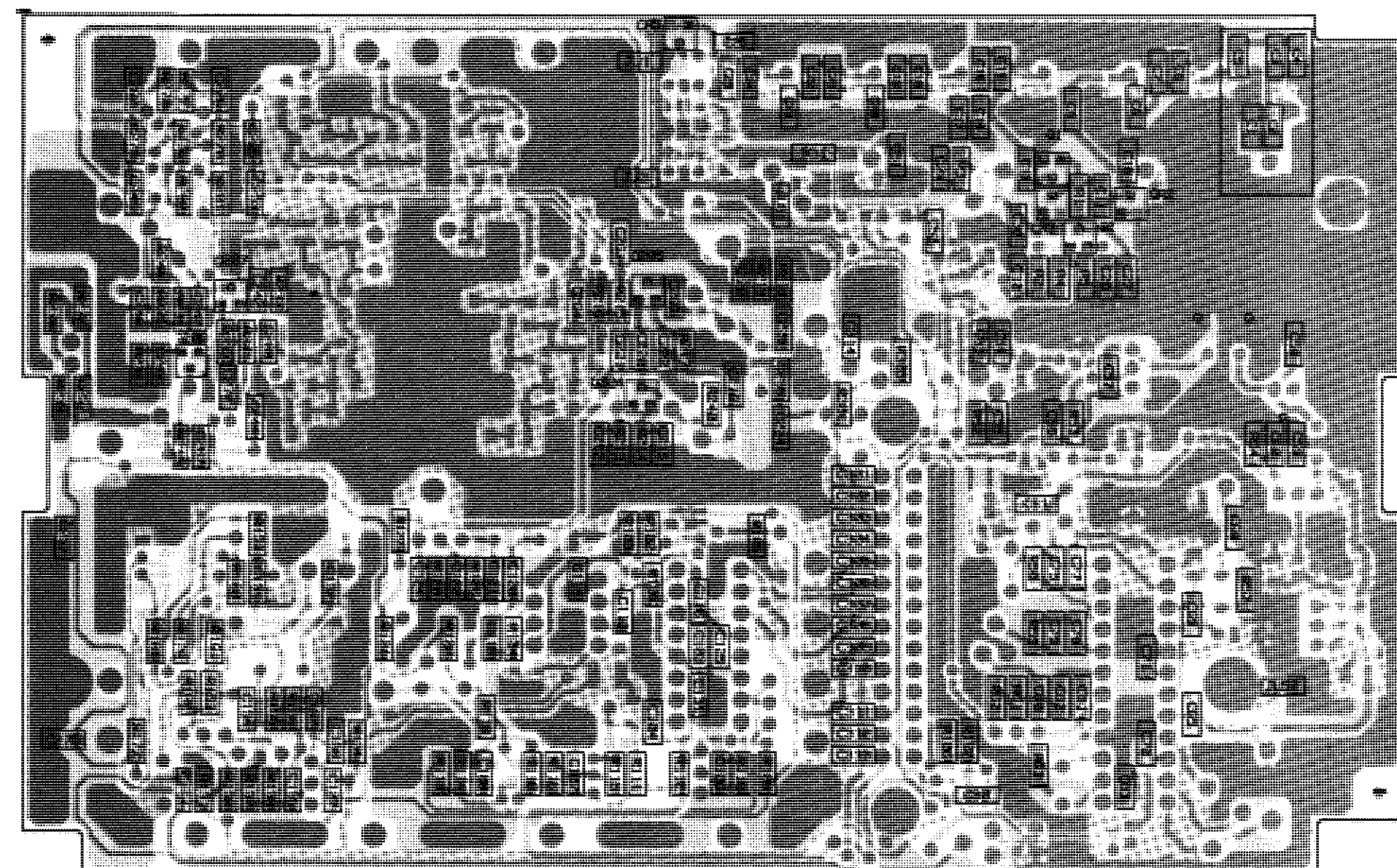
- ALL VIEWS ARE FROM TOP OF PART
- CR2
 CR153, CR286
 H6558
 H9567, H9543
 M82D44, MMBT3906, MMBT3904
 L55, L56, L57, L58
- NOTES:
 1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
 2. NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
 3. POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC UNLESS OTHERWISE INDICATED.
 4. DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
 5. AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
 6. ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
 (R) RECEIVE MODE
 (T) TRANSMIT MODE
 7. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF -20 DBM.
 8. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 10KHZ AT 30% DEVIATION, MEASURED WITH AN AC RMS VOLTMETER.
 9. COMPONENT VALUES MARKED (N) ARE USED IN 12.5 KHZ CHANNEL SPACING MODELS. VALUES MARKED (H) ARE USED IN 25 KHZ CHANNEL SPACING MODELS.

Schematic Diagram for HLE8227A and HLE8228A UHF RF Boards, 490-520 MHz



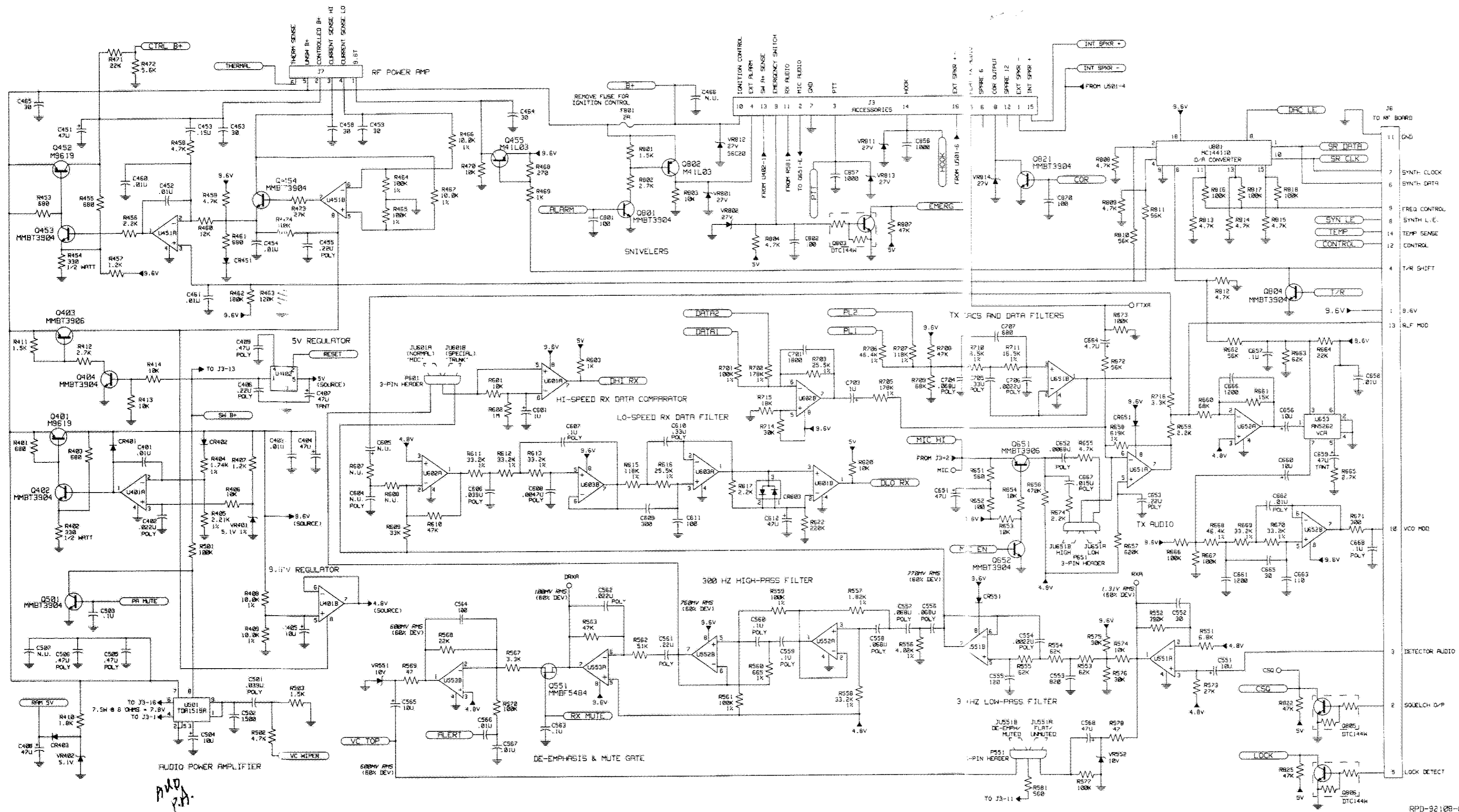
COMPONENT SIDE

COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----

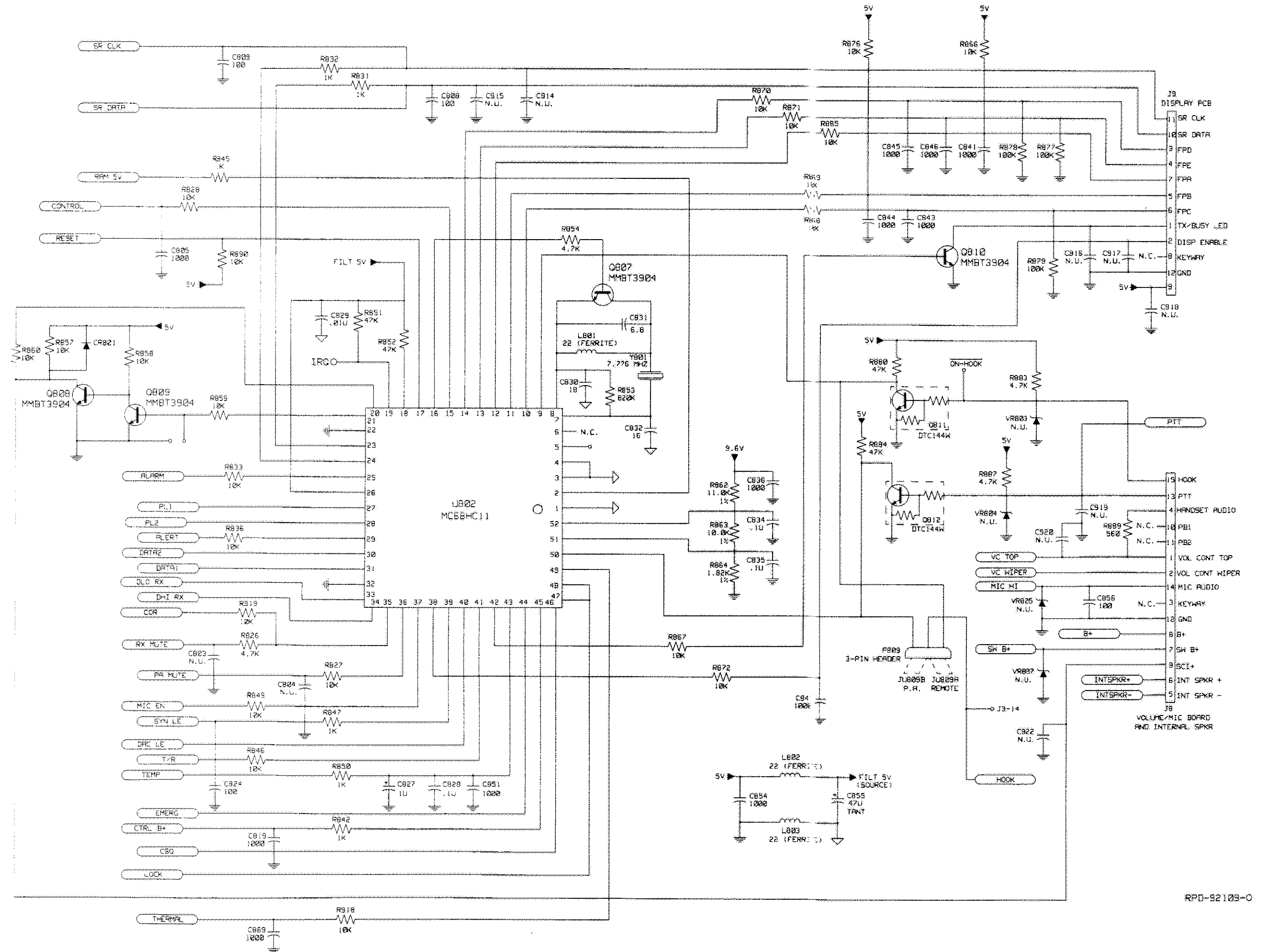


SOLDER SIDE

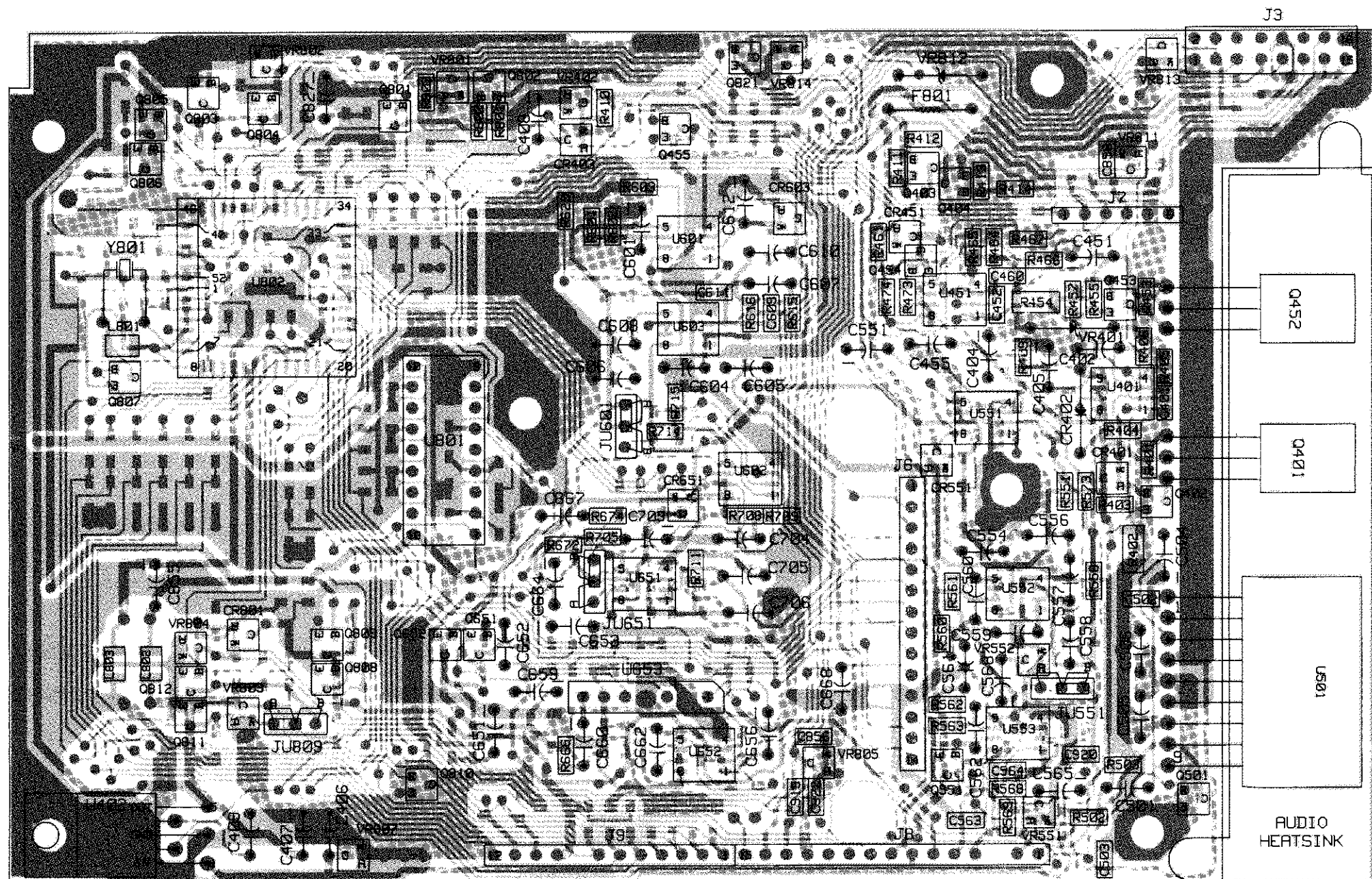
COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



Schematic Diagram for HLN8074B
Masked Logic Board (2-Layer)
(Sheet 1 of 2)

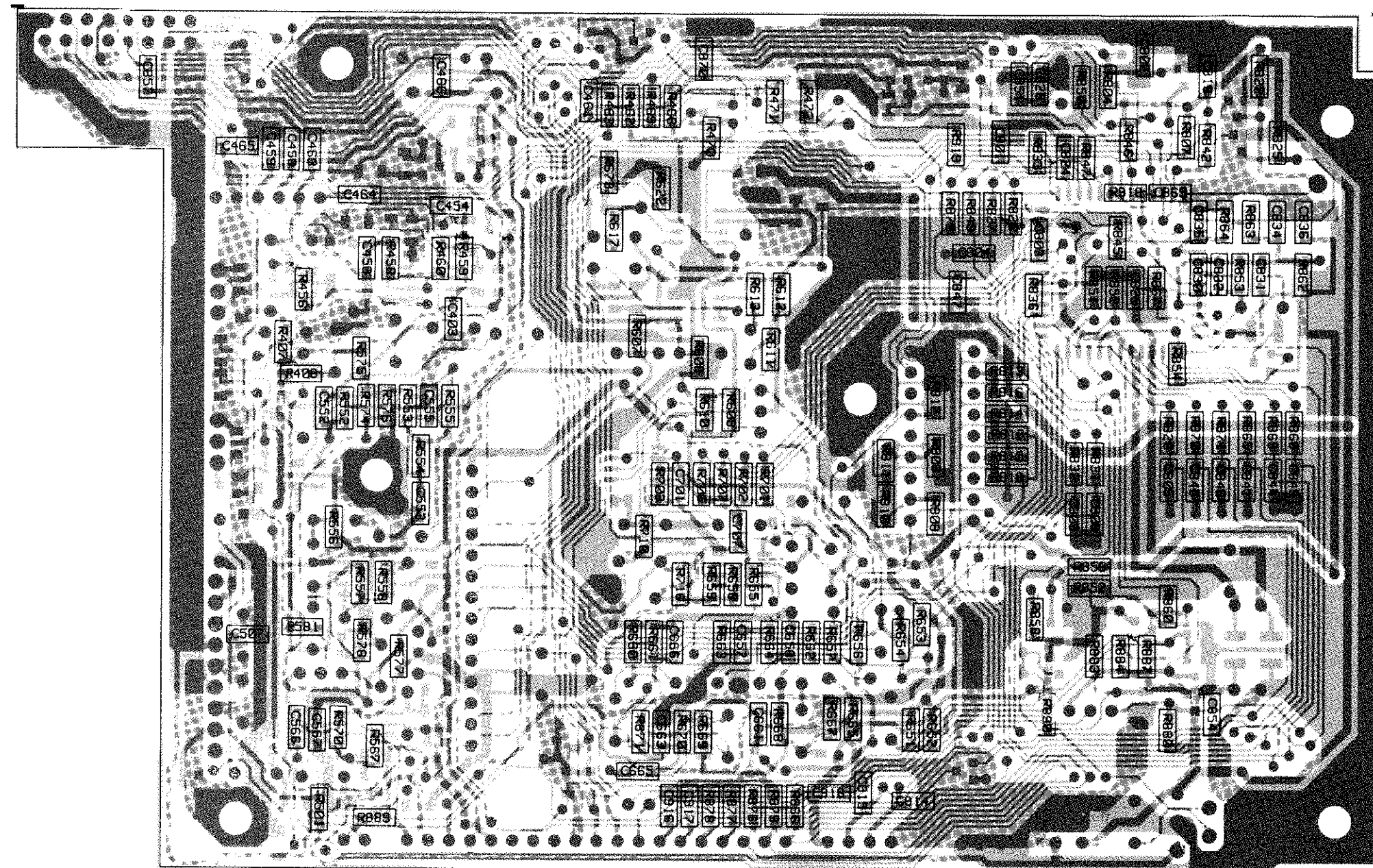


Schematic Diagram for HLN8074B
Masked Logic Board (2-Layer)
(Sheet 2 of 2)



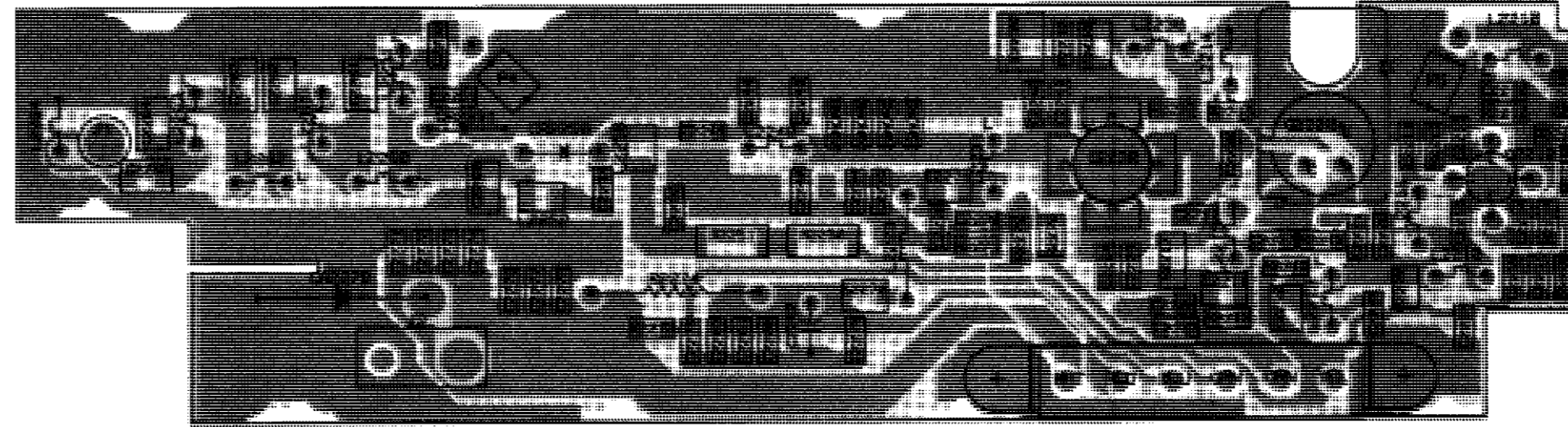
COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----

COMPONENT SIDE

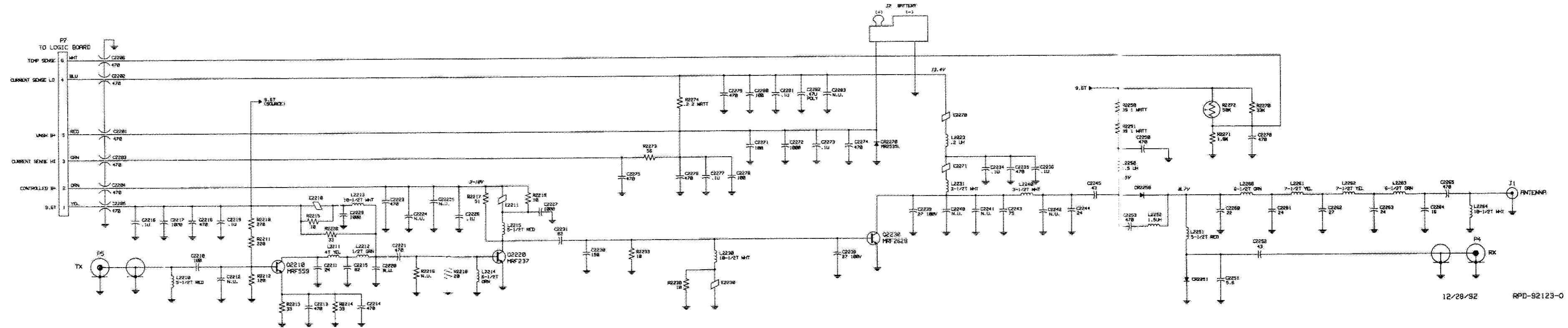


COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----

SOLDER SIDE



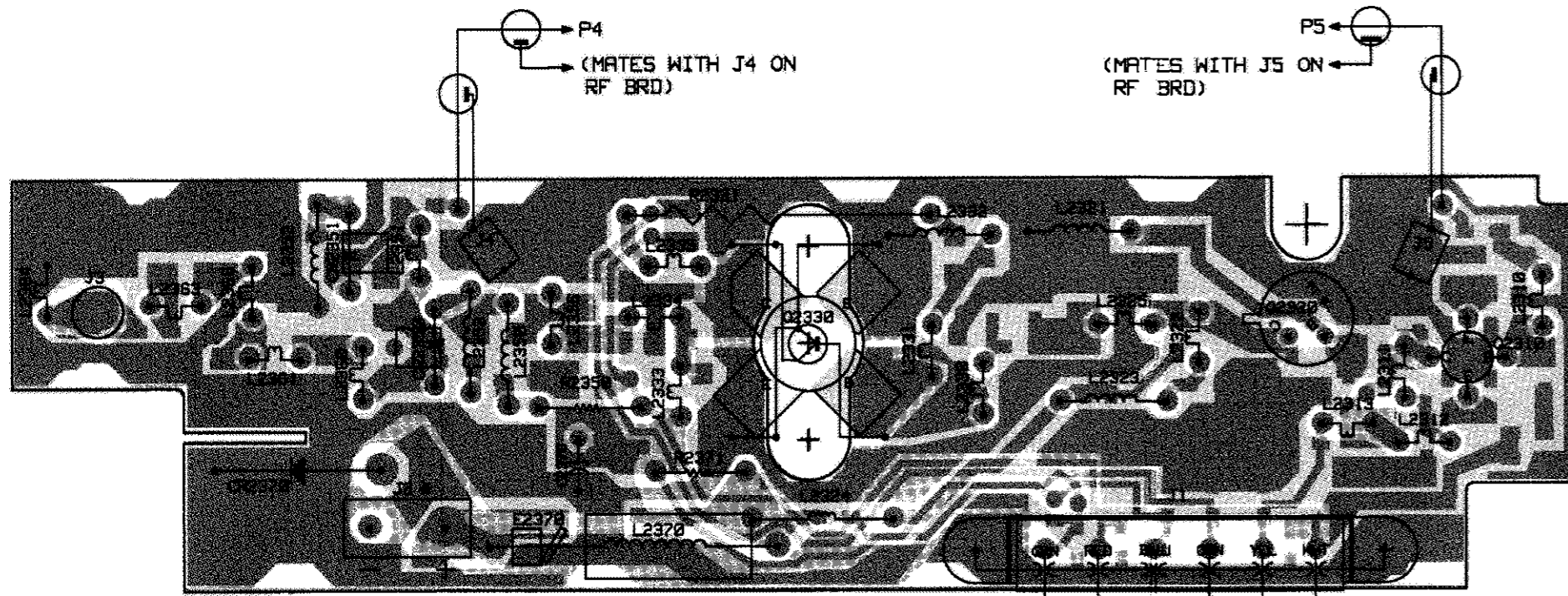
COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----



12/28/92 RPD-92123-0

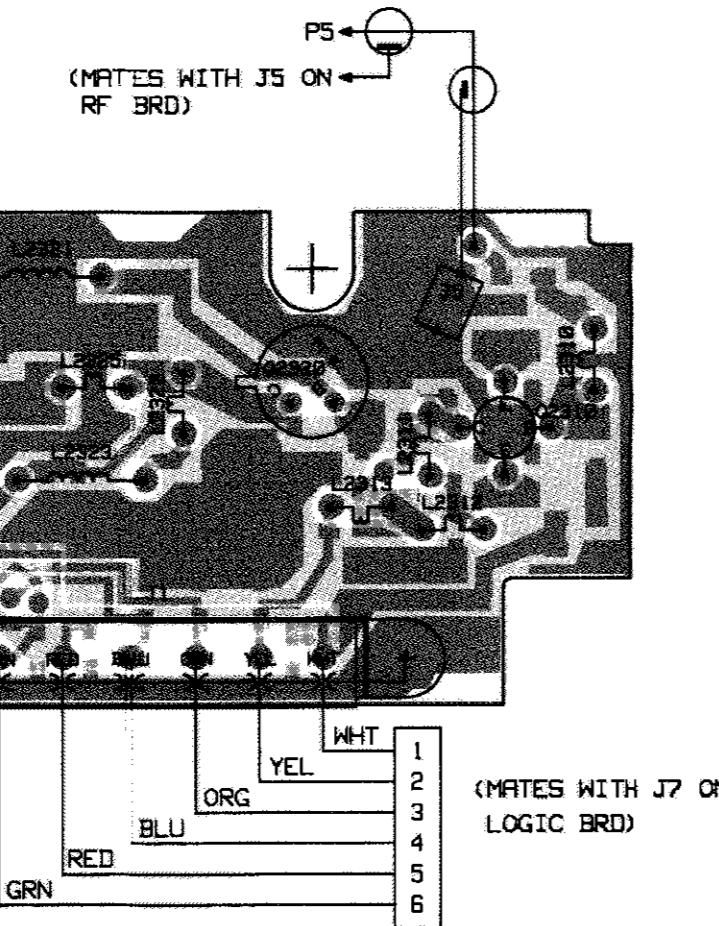
Circuit Board Details and Schematic for HLD8299A
 VHF Power Amplifier, 146-174 MHz, 1-10 Watts

COMPONENT SIDE

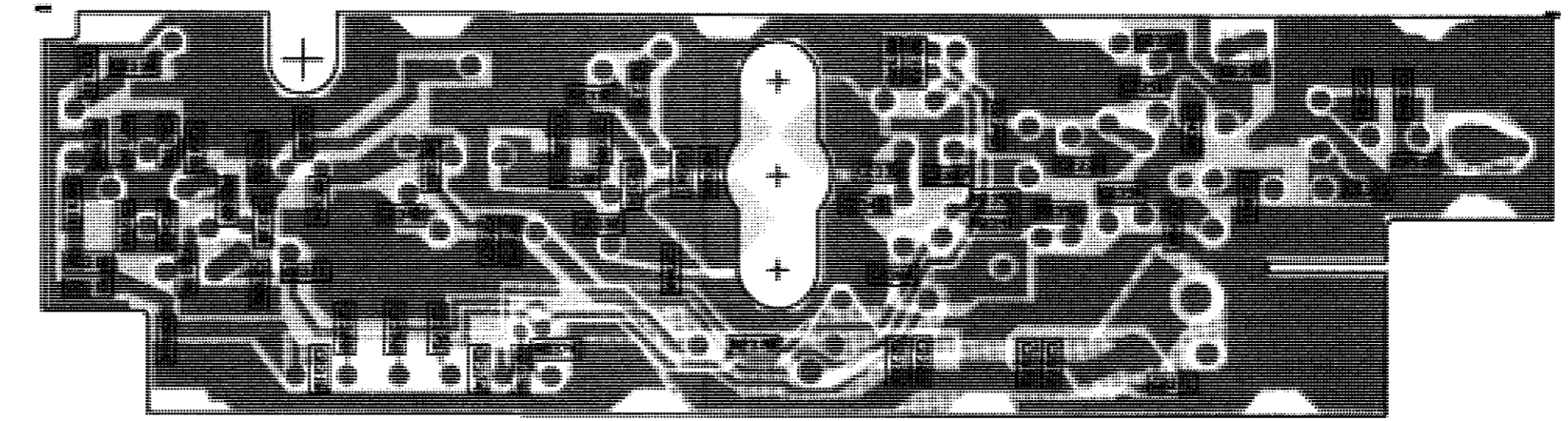


* INCLUDES INTERCAL FEEDTHRU CAPACITOR

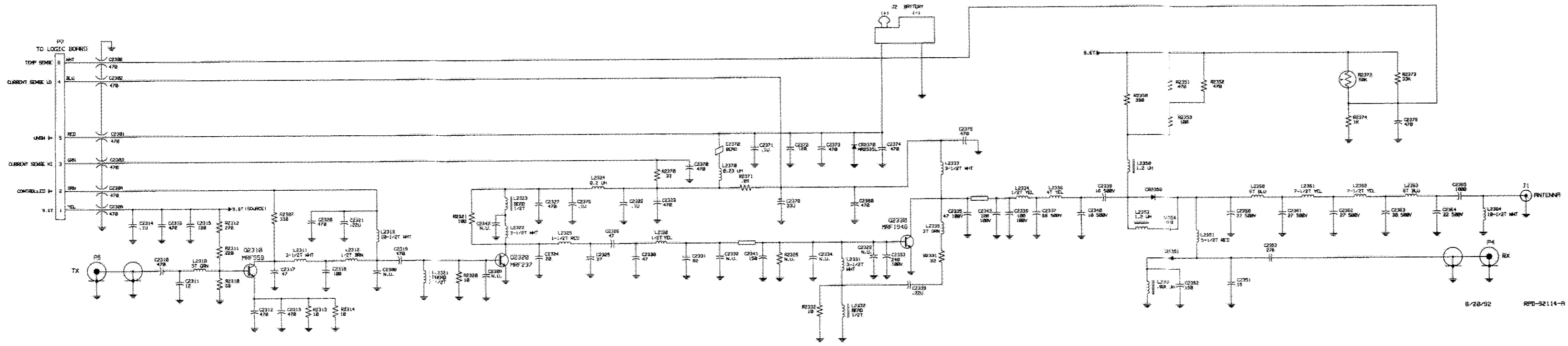
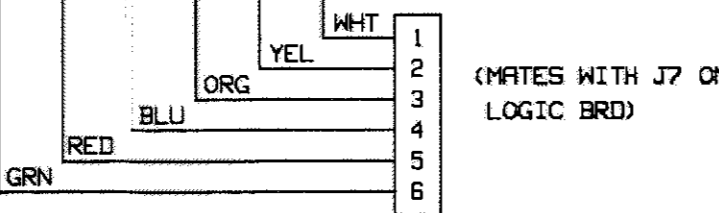
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SOLDER SIDE (Pink)
OVERLAY -----



SOLDER SIDE

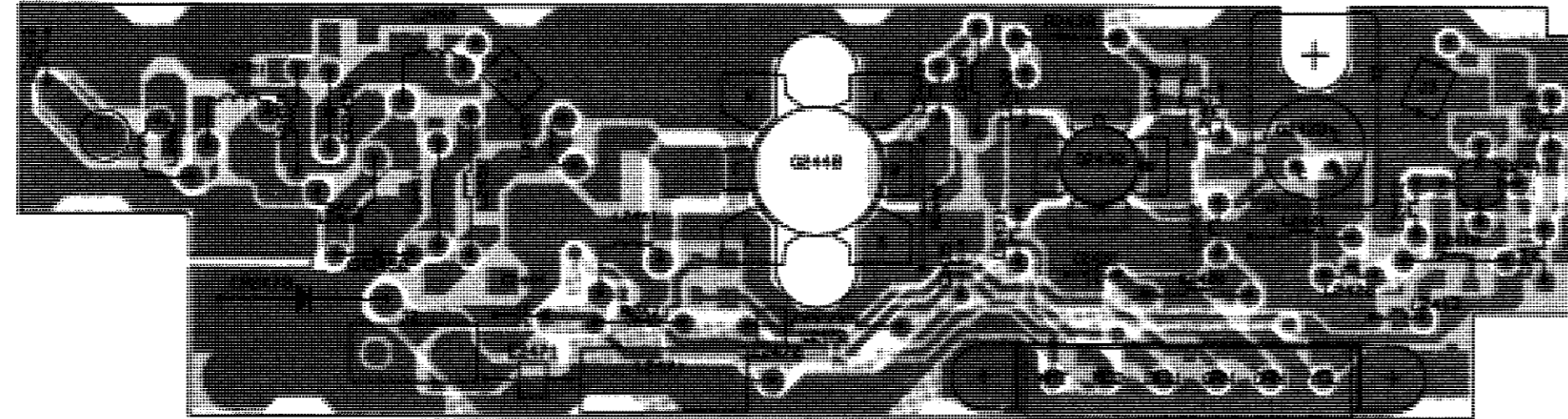


COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

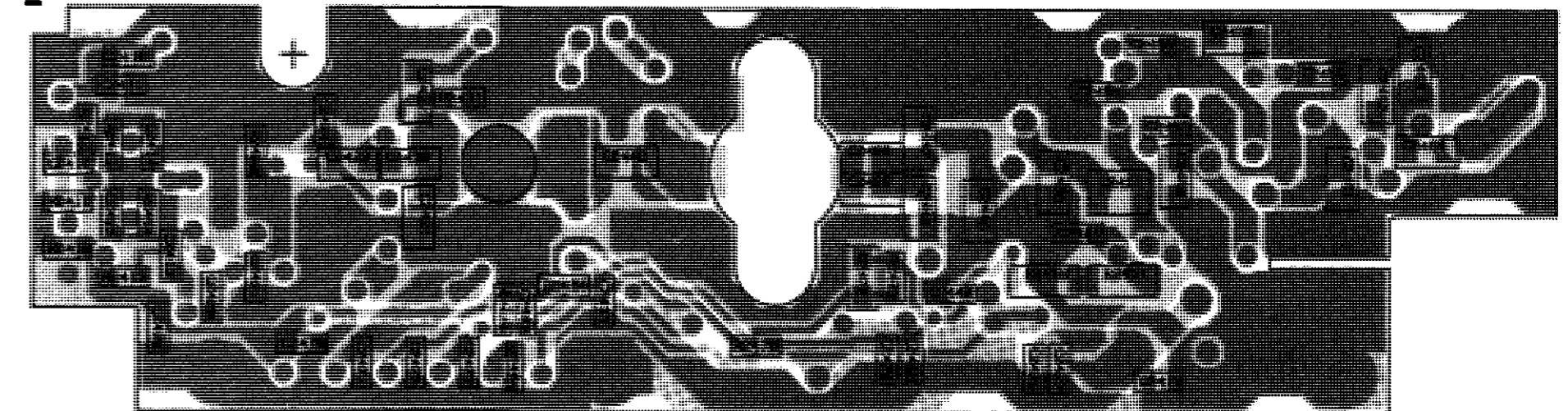


Circuit Board Details and Schematic for HLD8033A
VHF Power Amplifier, 146-174 MHz, 10-25 Watts

COMPONENT SIDE

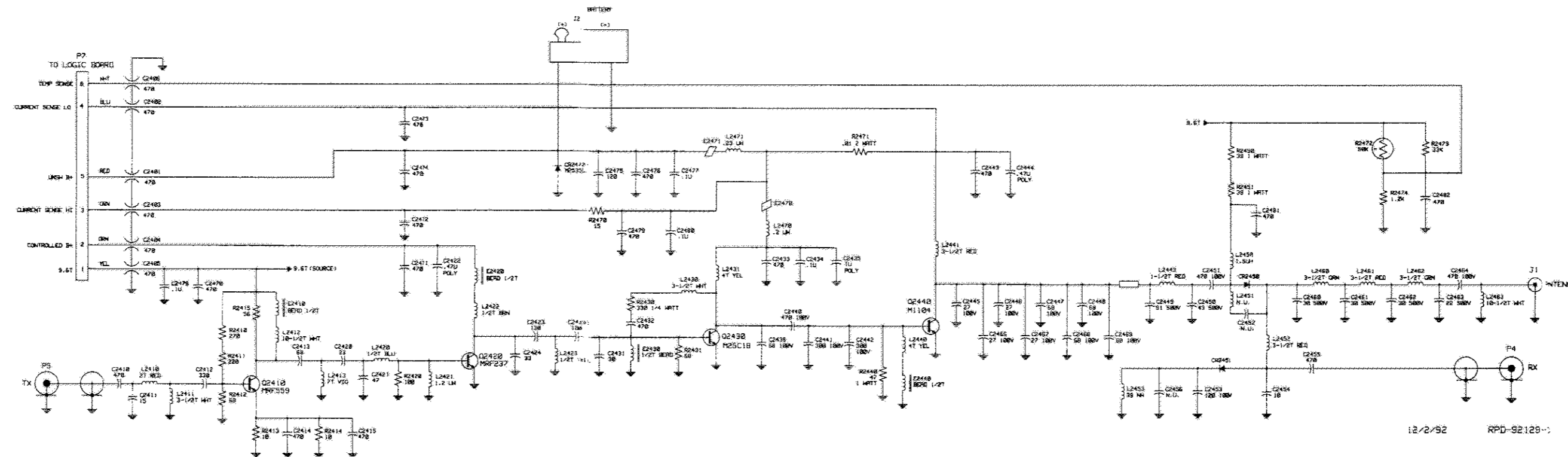


SOLDER SIDE



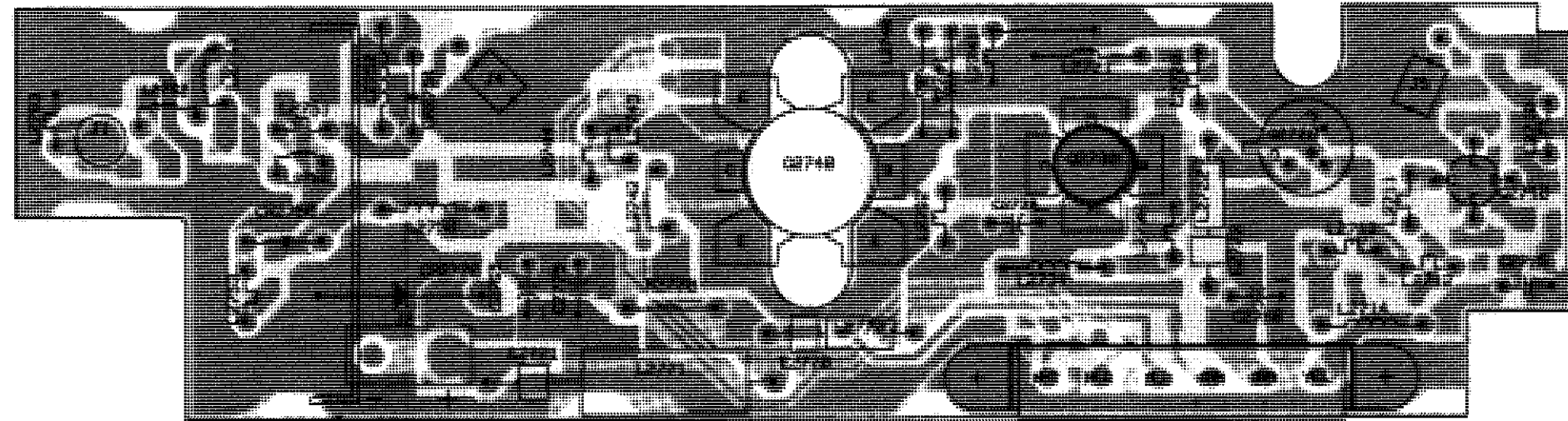
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

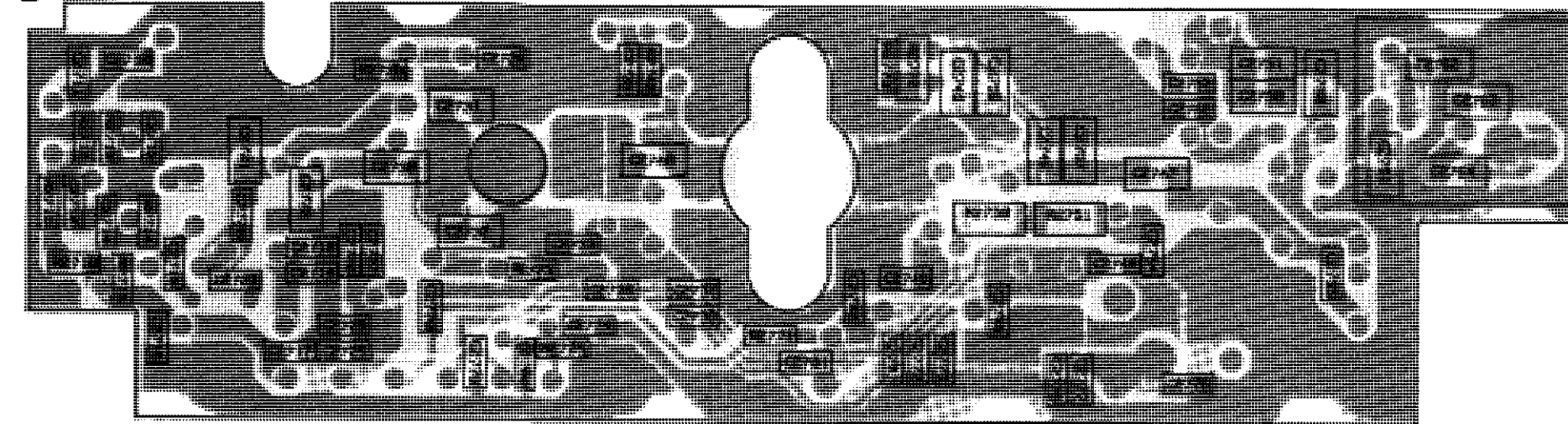


12/2/92 RPD-92129-1

COMPONENT SIDE

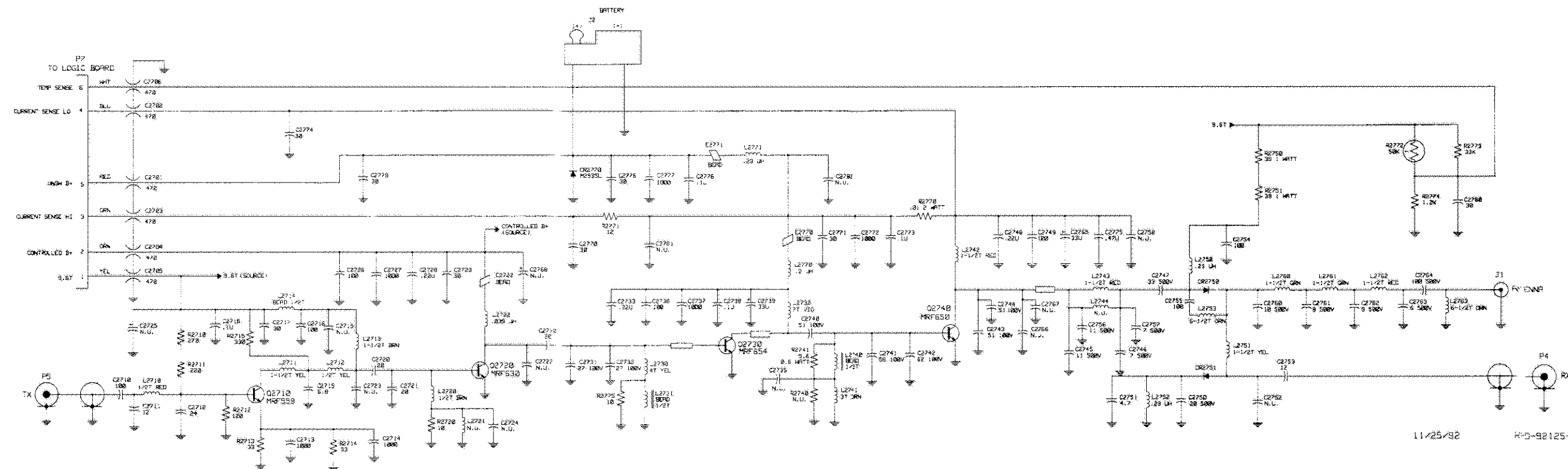


SOLDER SIDE



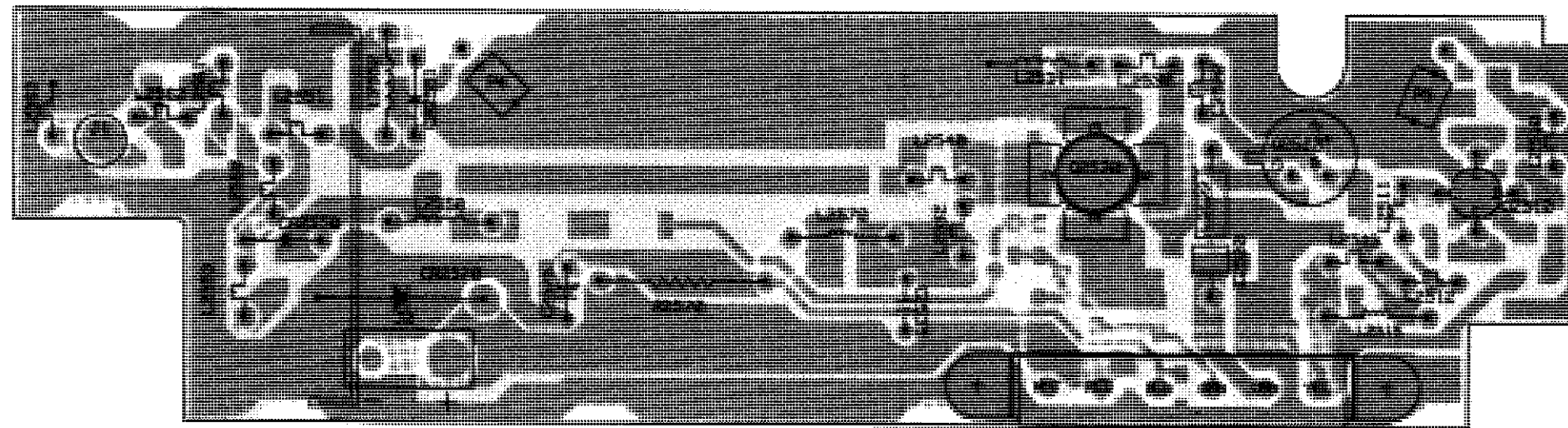
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

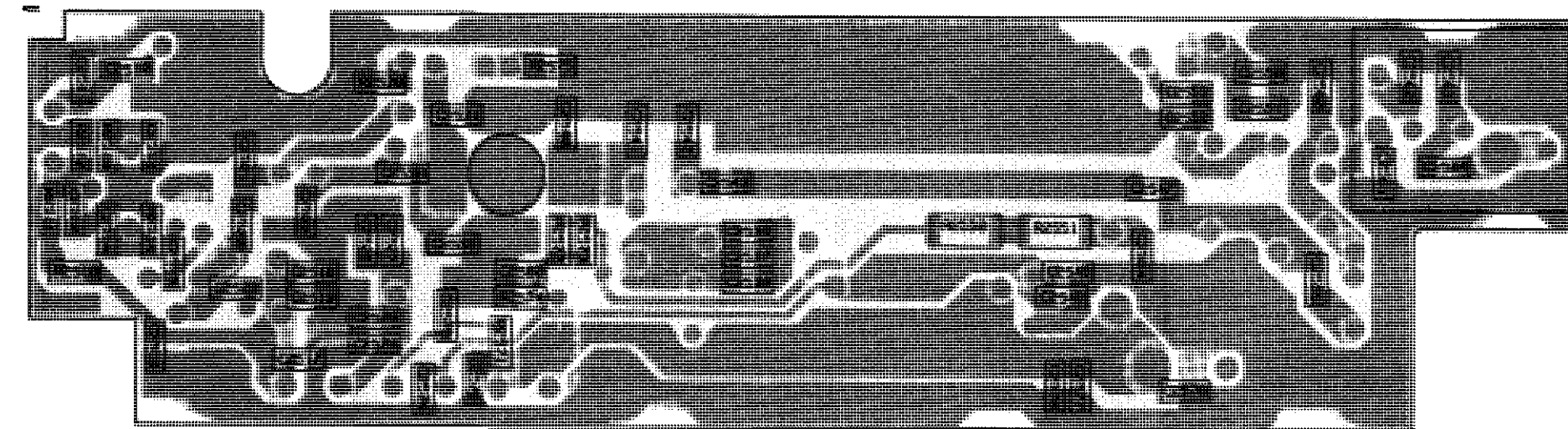


Circuit Board Details and Schematic for HLE8275A
UHF Power Amplifier, 403-433 MHz, 25-40 Watts

COMPONENT SIDE

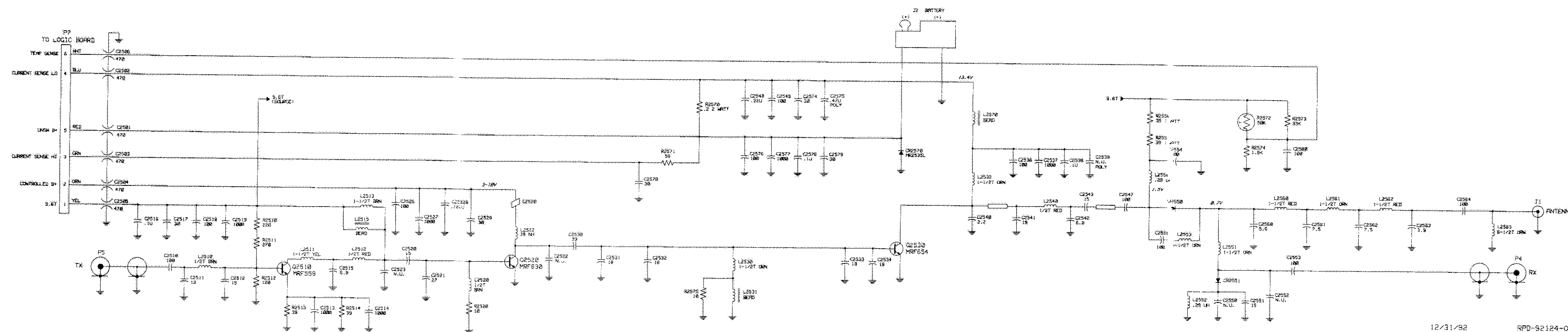


SOLDER SIDE

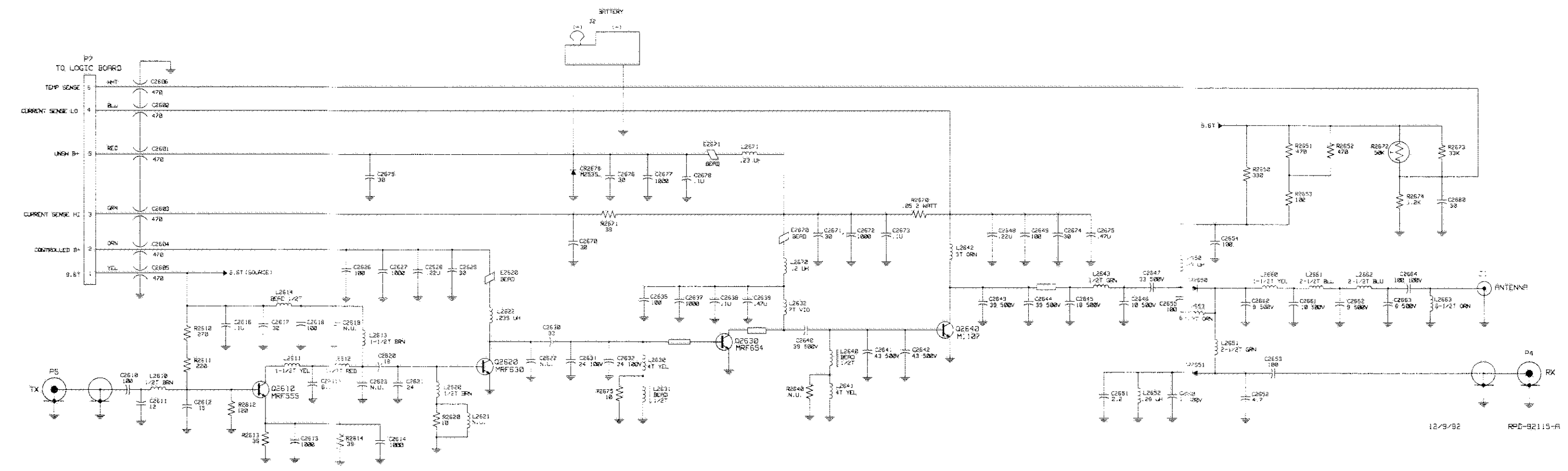
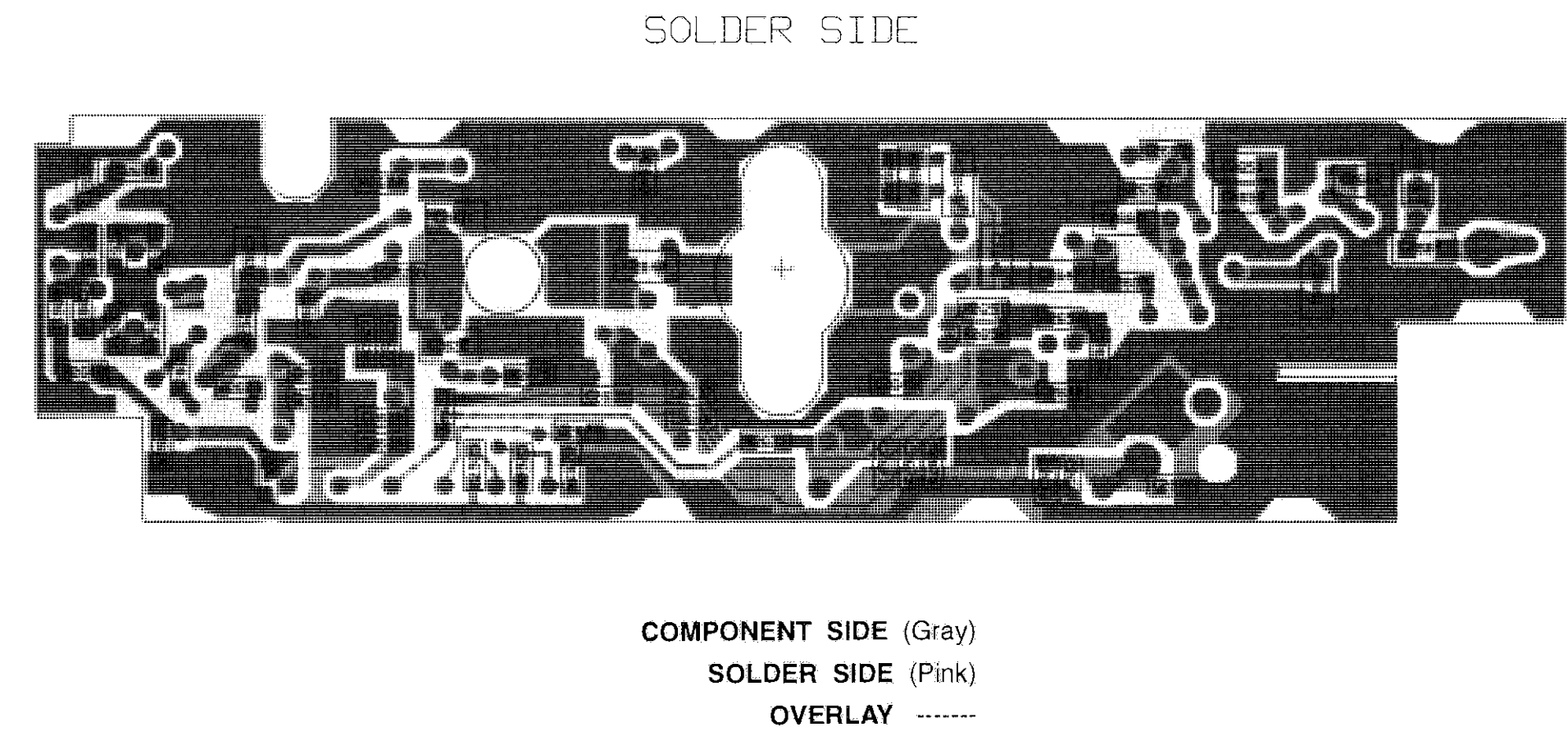
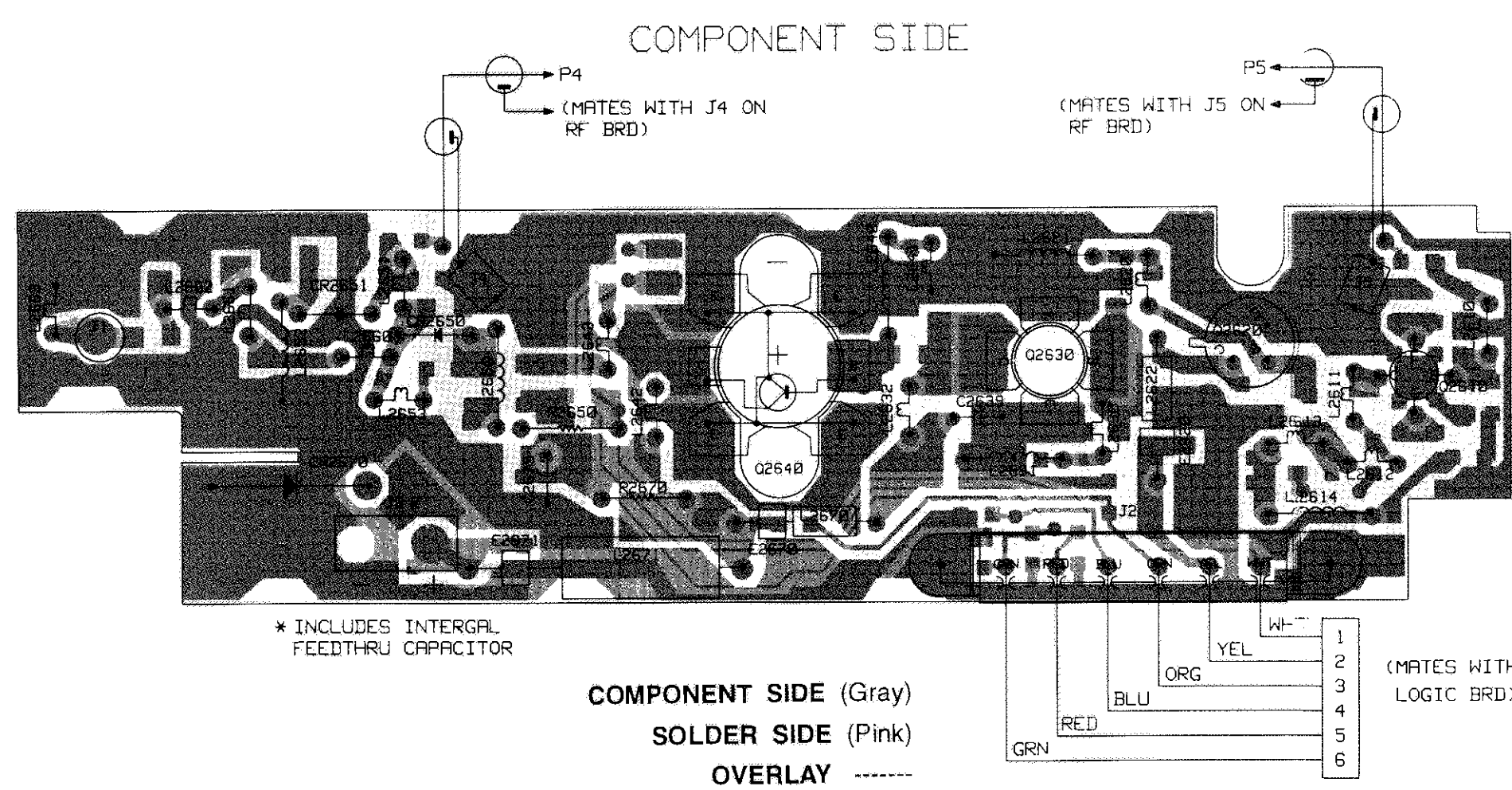


COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

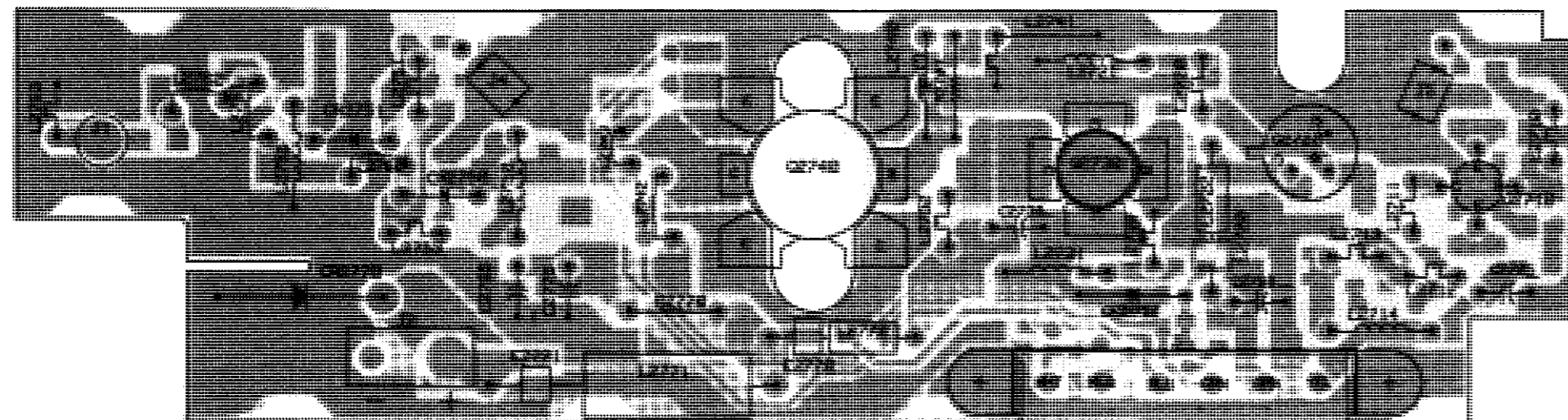


12/31/92 RPD-92124-0

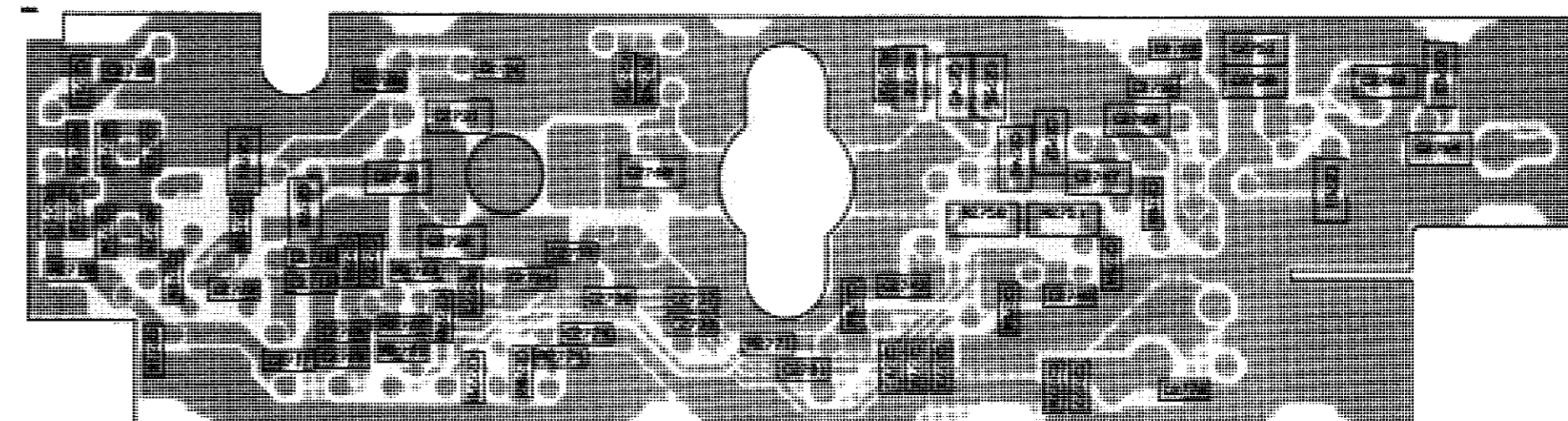


Circuit Board Details and Schematic for HLE8034A LHF Power Amplifier, 438-470 MHz, 10-25 Watts

COMPONENT SIDE

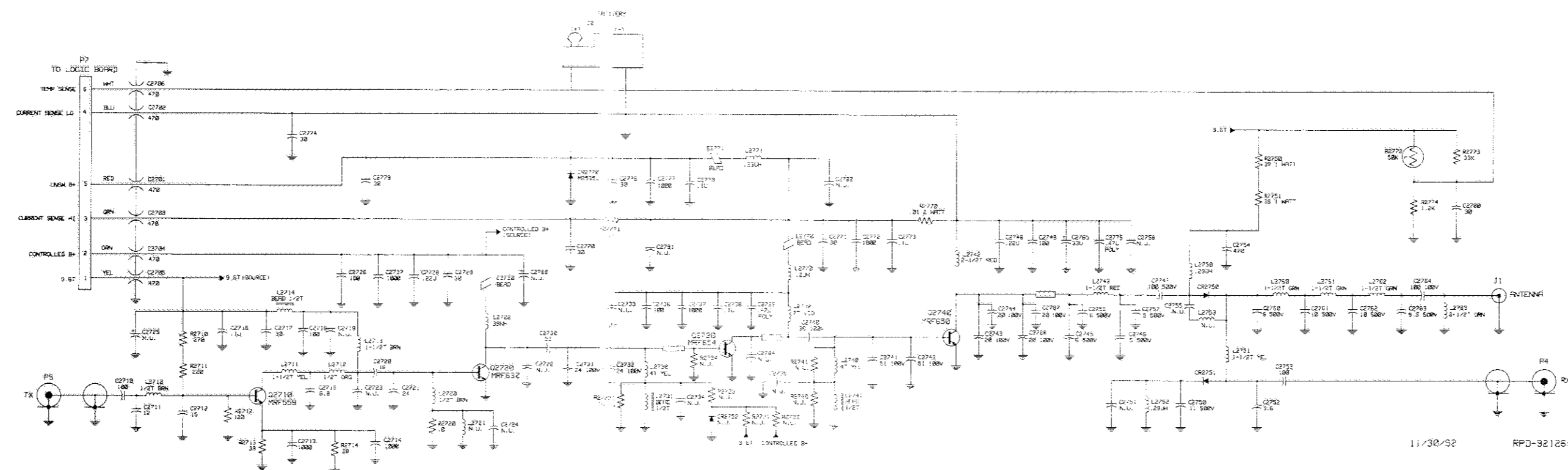


SOLDER SIDE



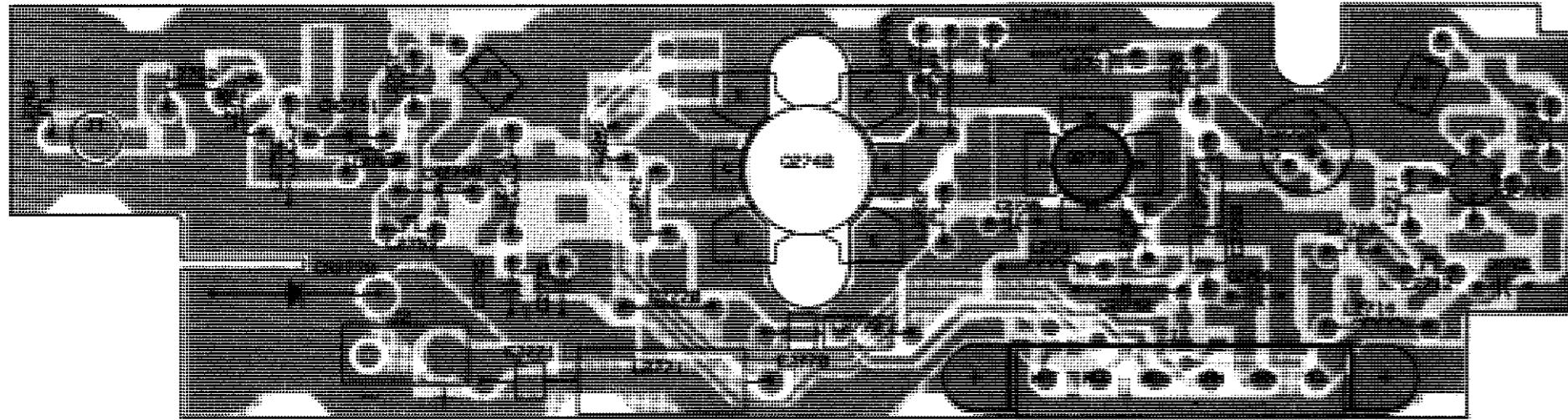
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

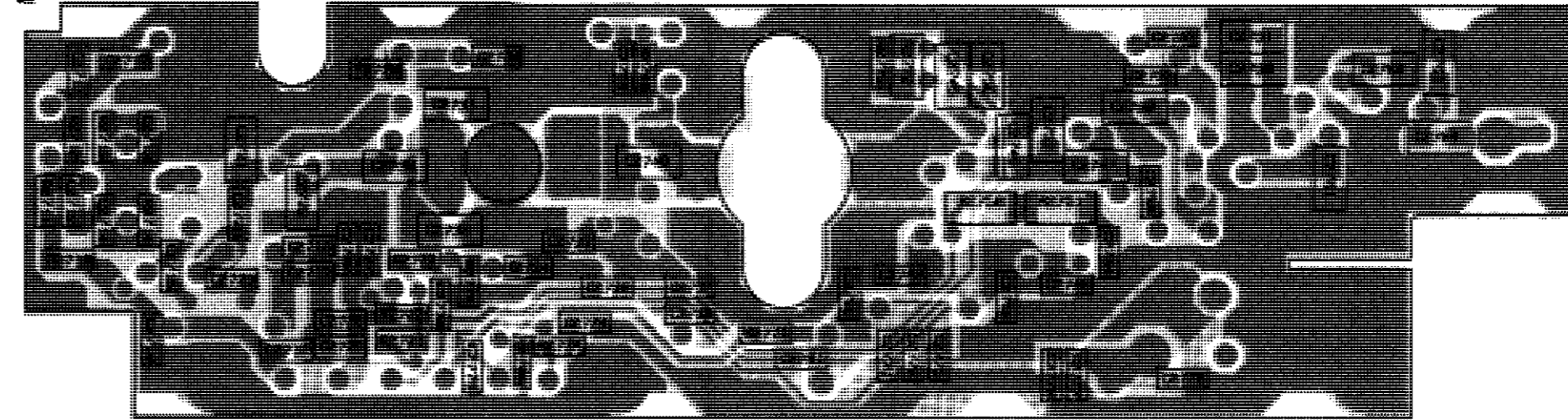


11/30/92 RPD-32126-0

COMPONENT SIDE

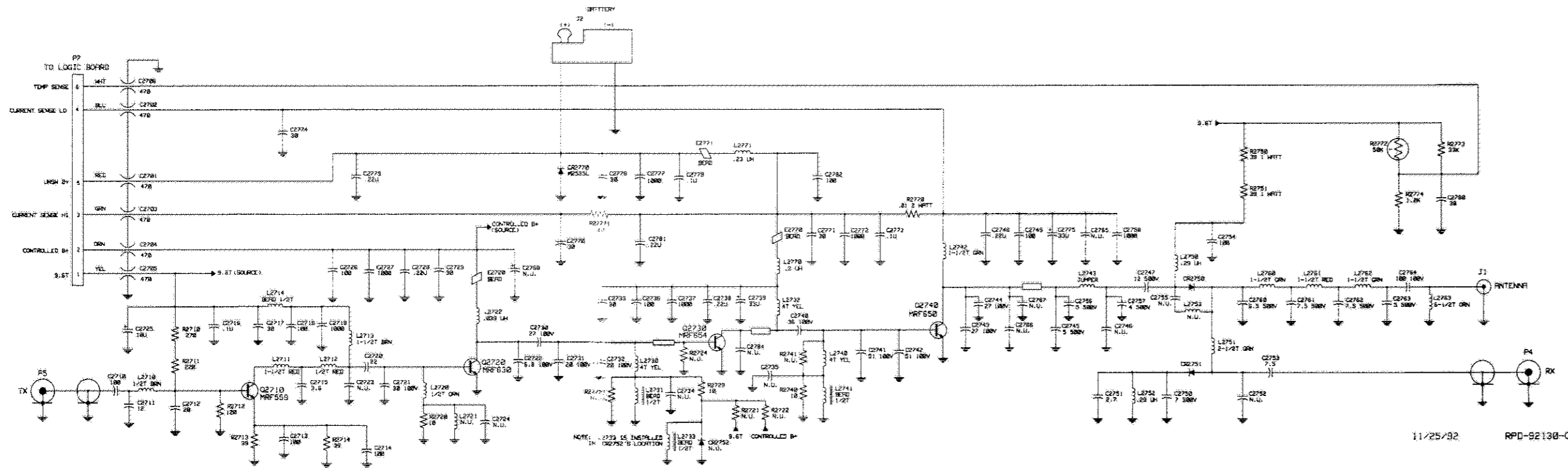


SOLDER SIDE



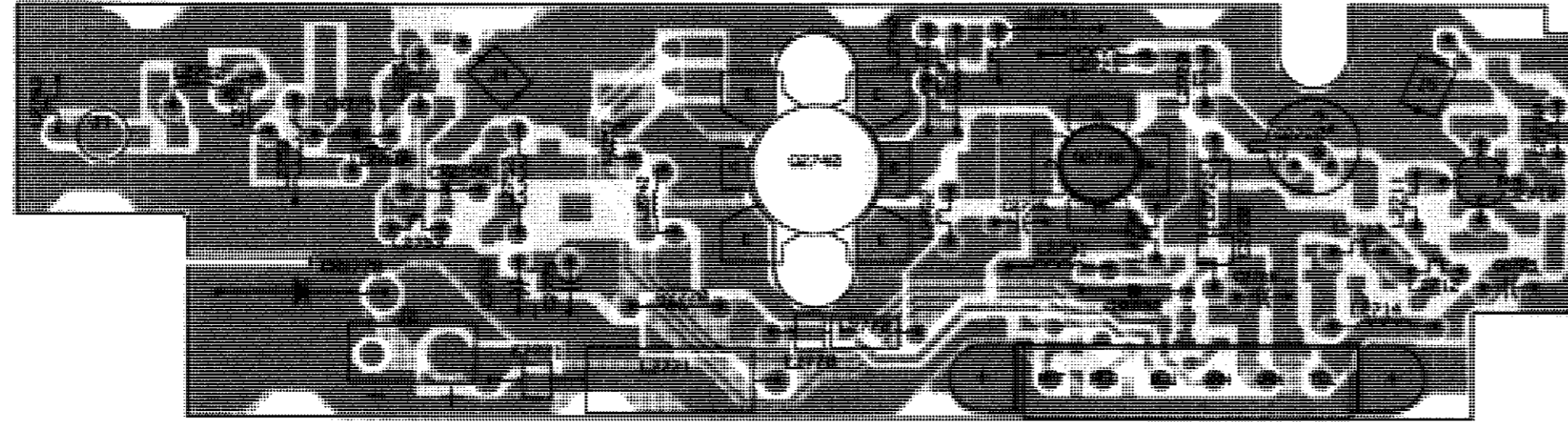
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

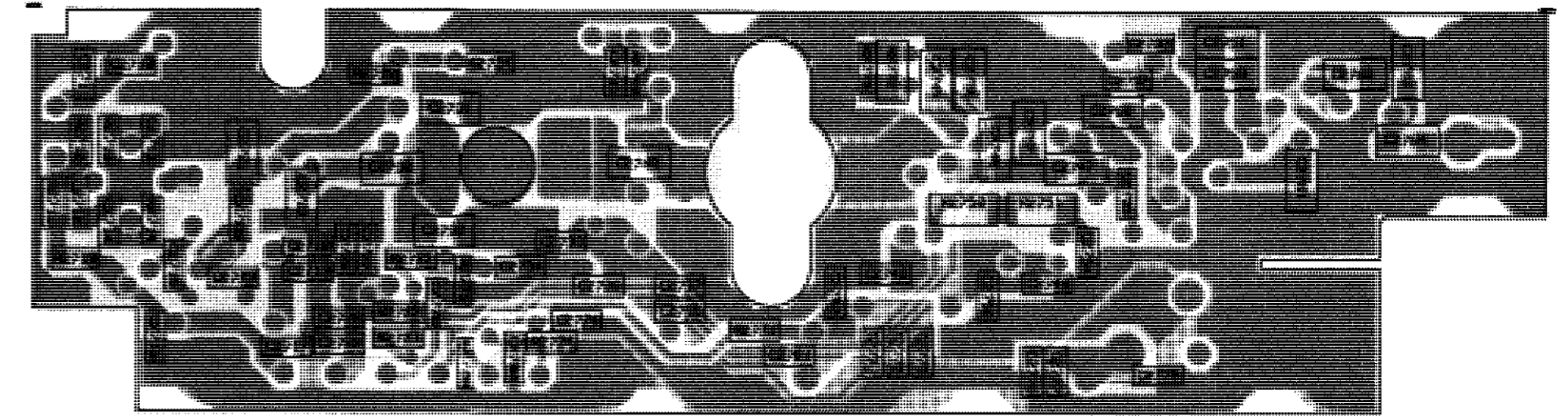


Circuit Board Details and Schematic for HLE8284A
UHF Power Amplifier, 465-495 MHz, 25-40 Watts

COMPONENT SIDE

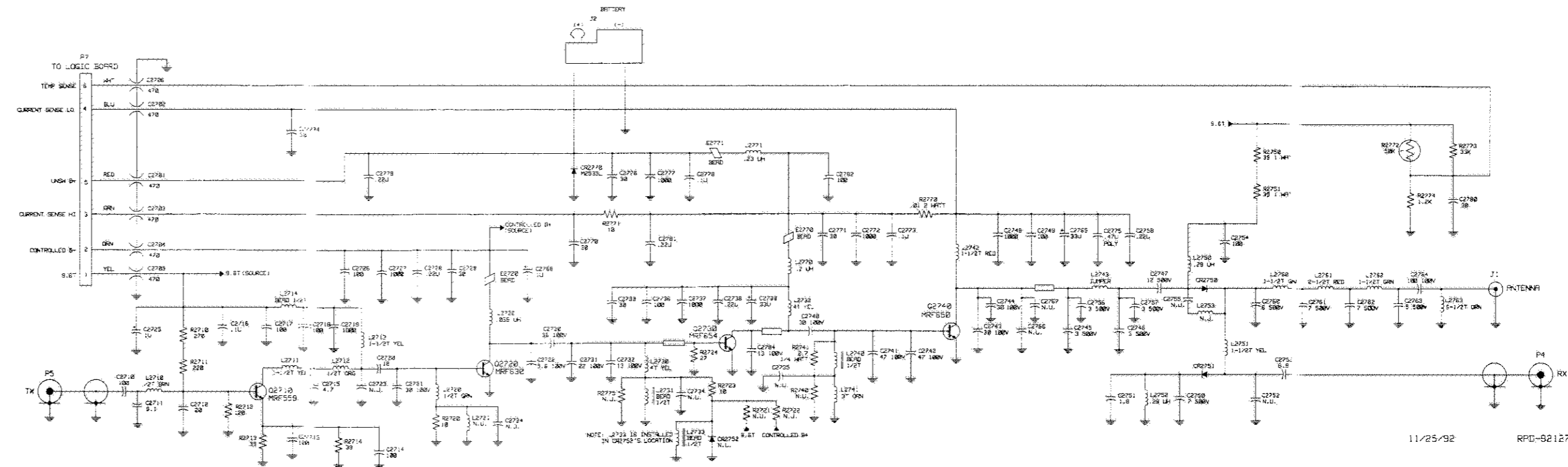


SOLDER SIDE



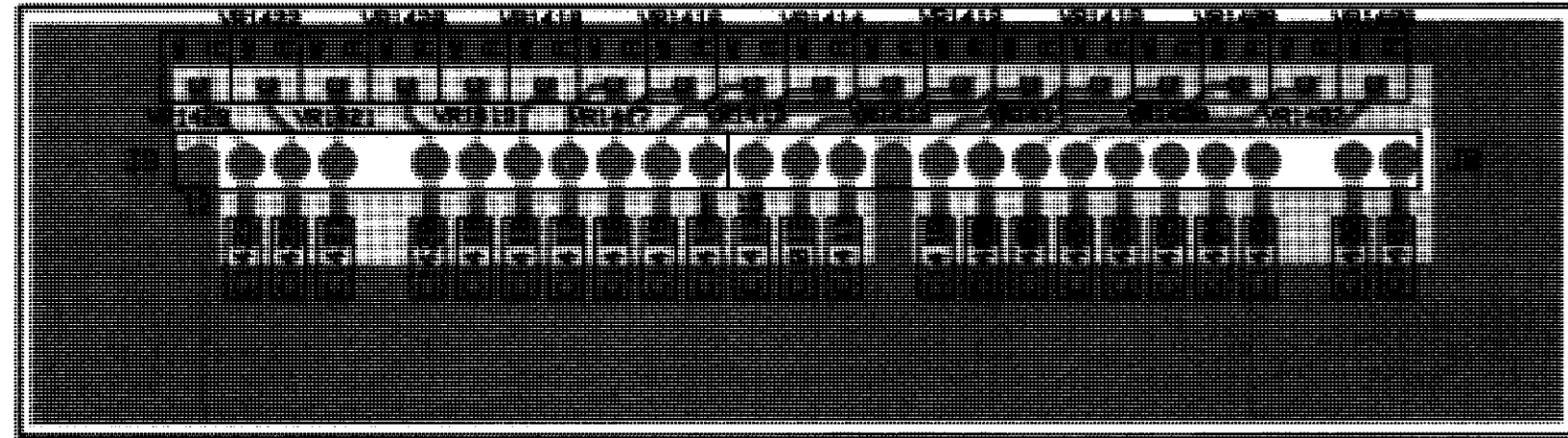
COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----

COMPONENT SIDE (Gray)
SOLDER SIDE (Pink)
OVERLAY -----



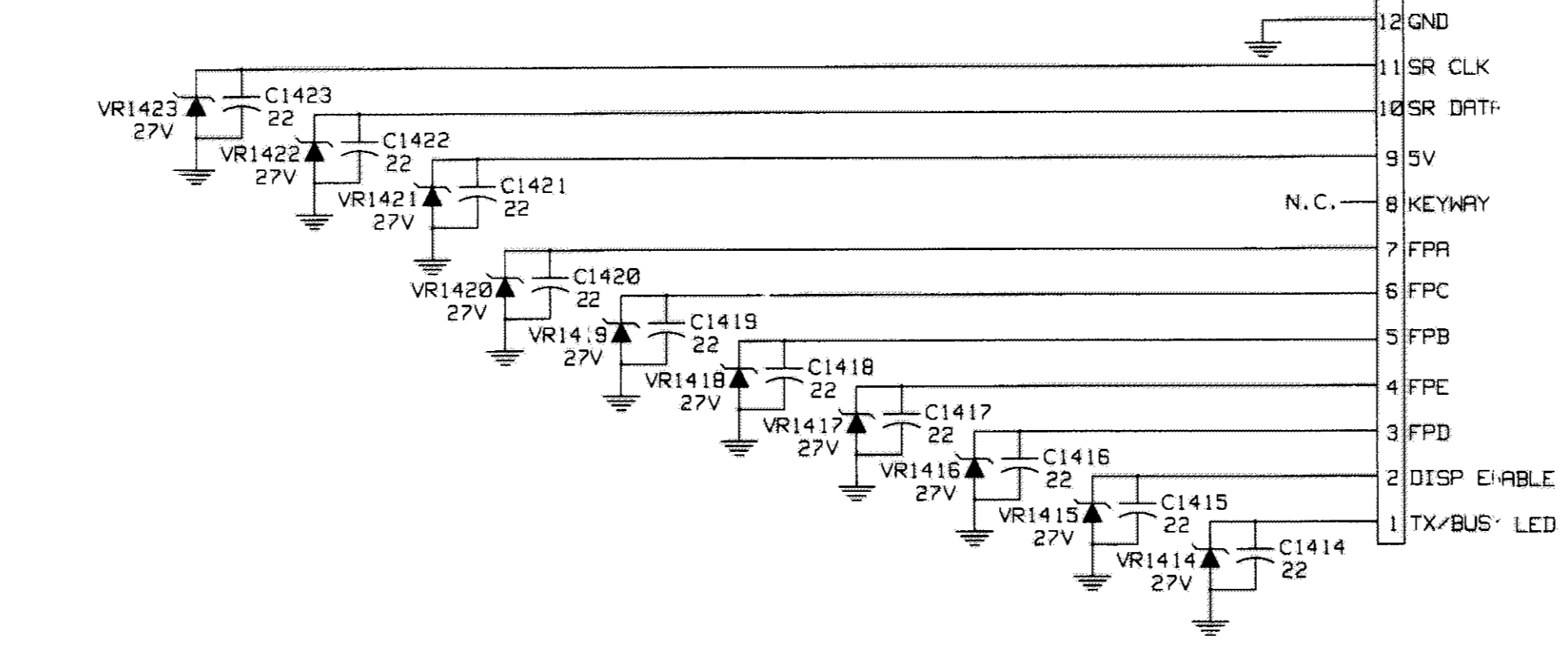
11/25/92 RPD-82127-0

COMPONENT SIDE

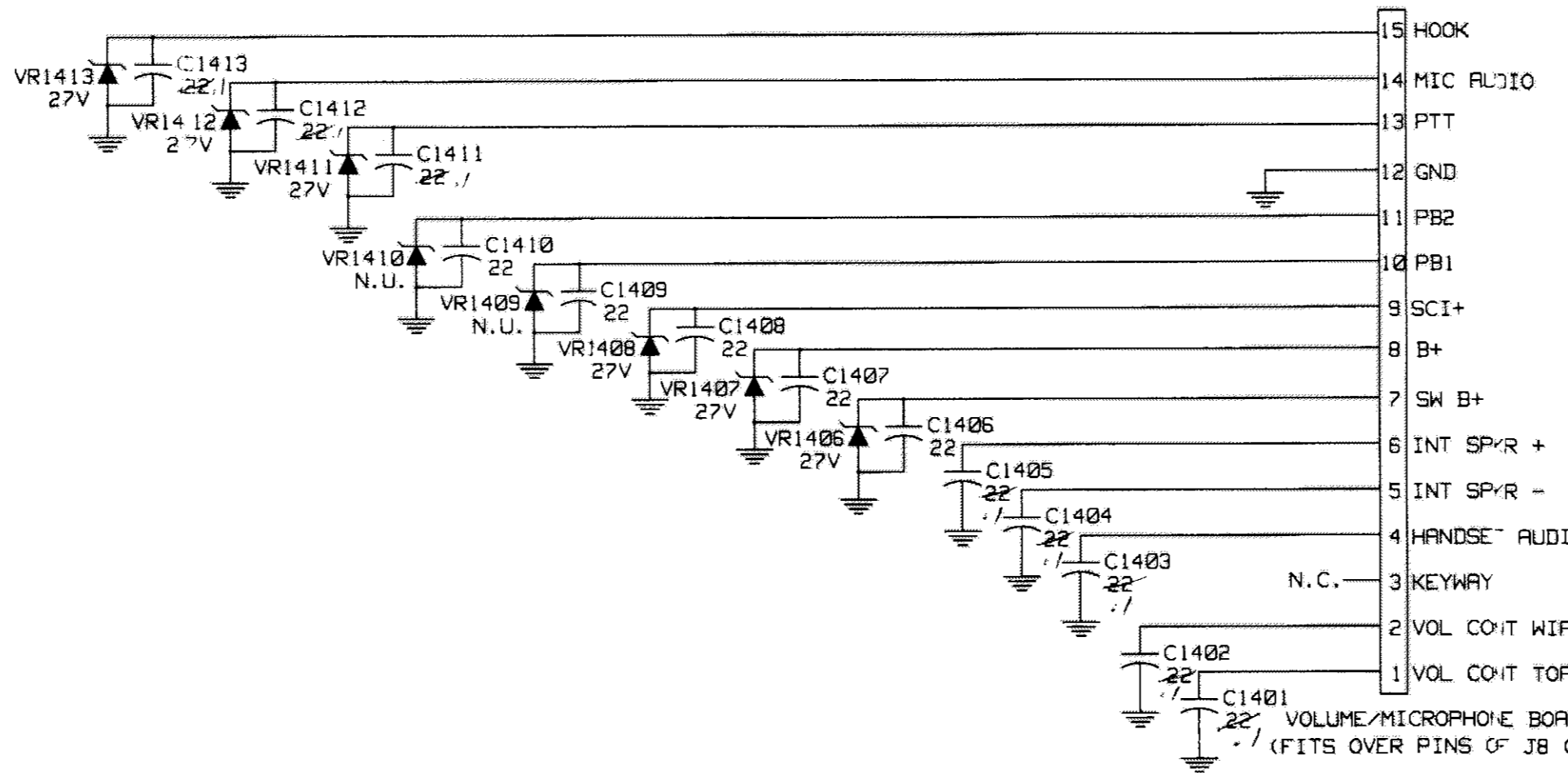


COMPONENT SIDE (Gray)
 SOLDER SIDE (Pink)
 OVERLAY -----

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



VOLUME/MICROPHONE BOARD & INT SPKR
 (FITS OVER PINS OF J8 ON LOGIC BOARD)



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)

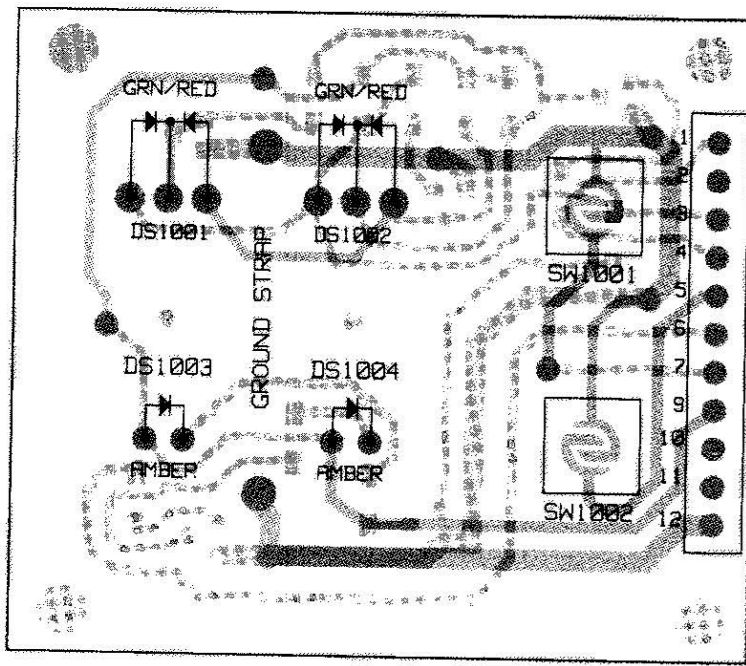
VR1406	48-80948V01	zener diode 27V SOT
VR1407	48-80948V01	zener diode 27V SOT
VR1408	48-80948V01	zener diode 27V SOT
VR1409		not used
VR1410		not used
VR1411	48-80948V01	zener diode 27V SOT
VR1412	48-80948V01	zener diode 27V SOT
VR1413	48-80948V01	zener diode 27V SOT
VR1414	48-80948V01	zener diode 27V 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.

3/12/92 PL-921014-O

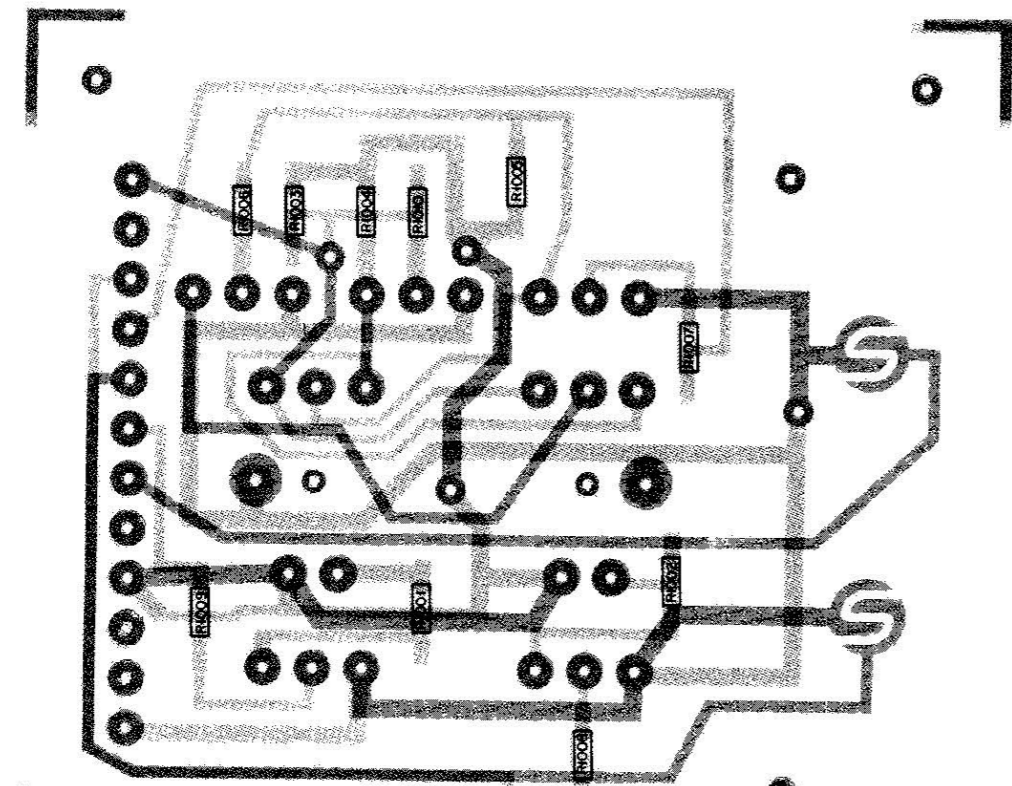
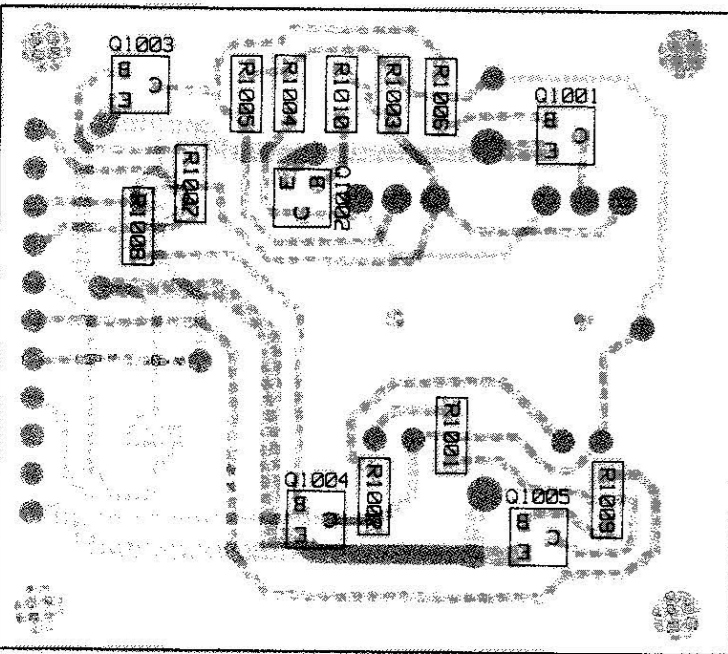
Circuit Board Detail, Schematic, and Parts List for
 Front Panel Filter Board (01-80704Y83)

COMPONENT SIDE

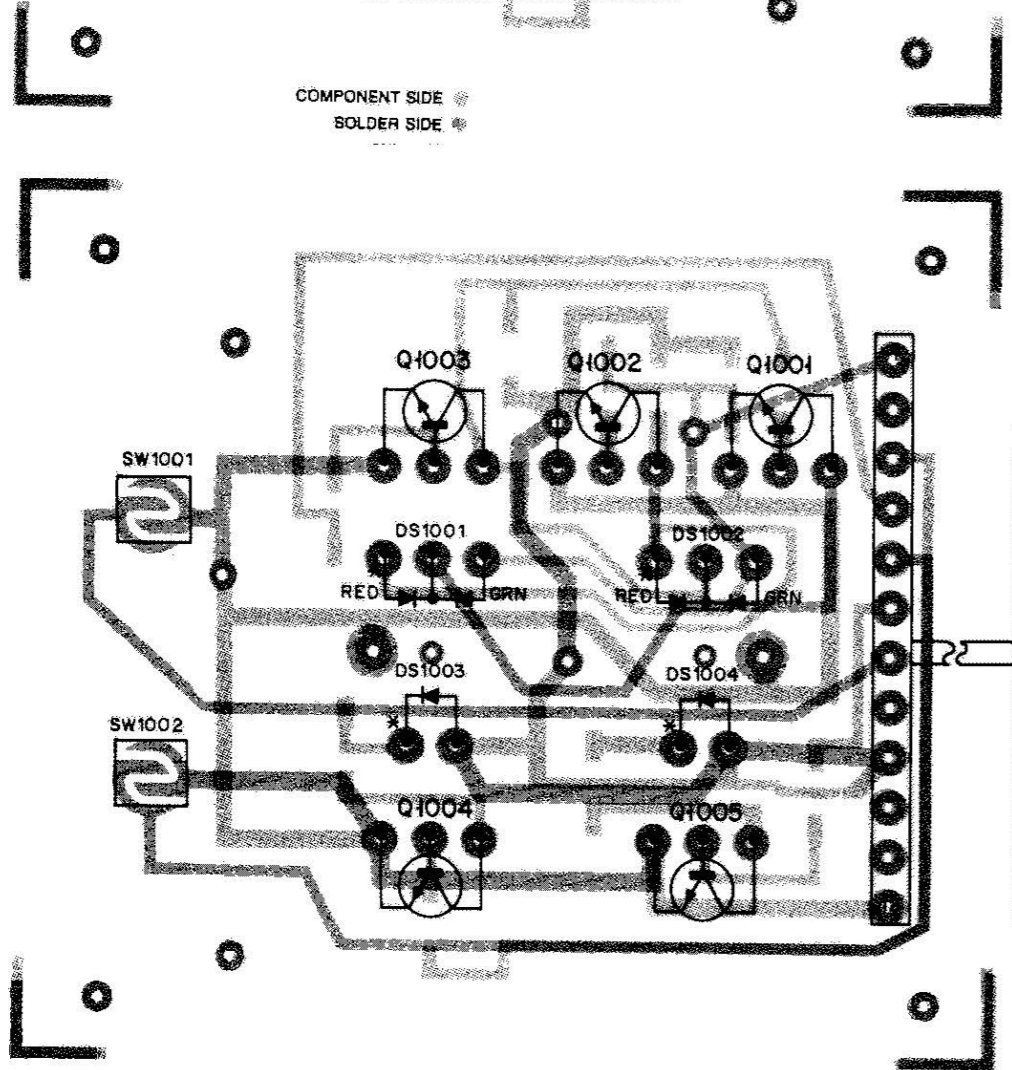


(MATES WITH J9 ON LOGIC BOARD)

SOLDER SIDE

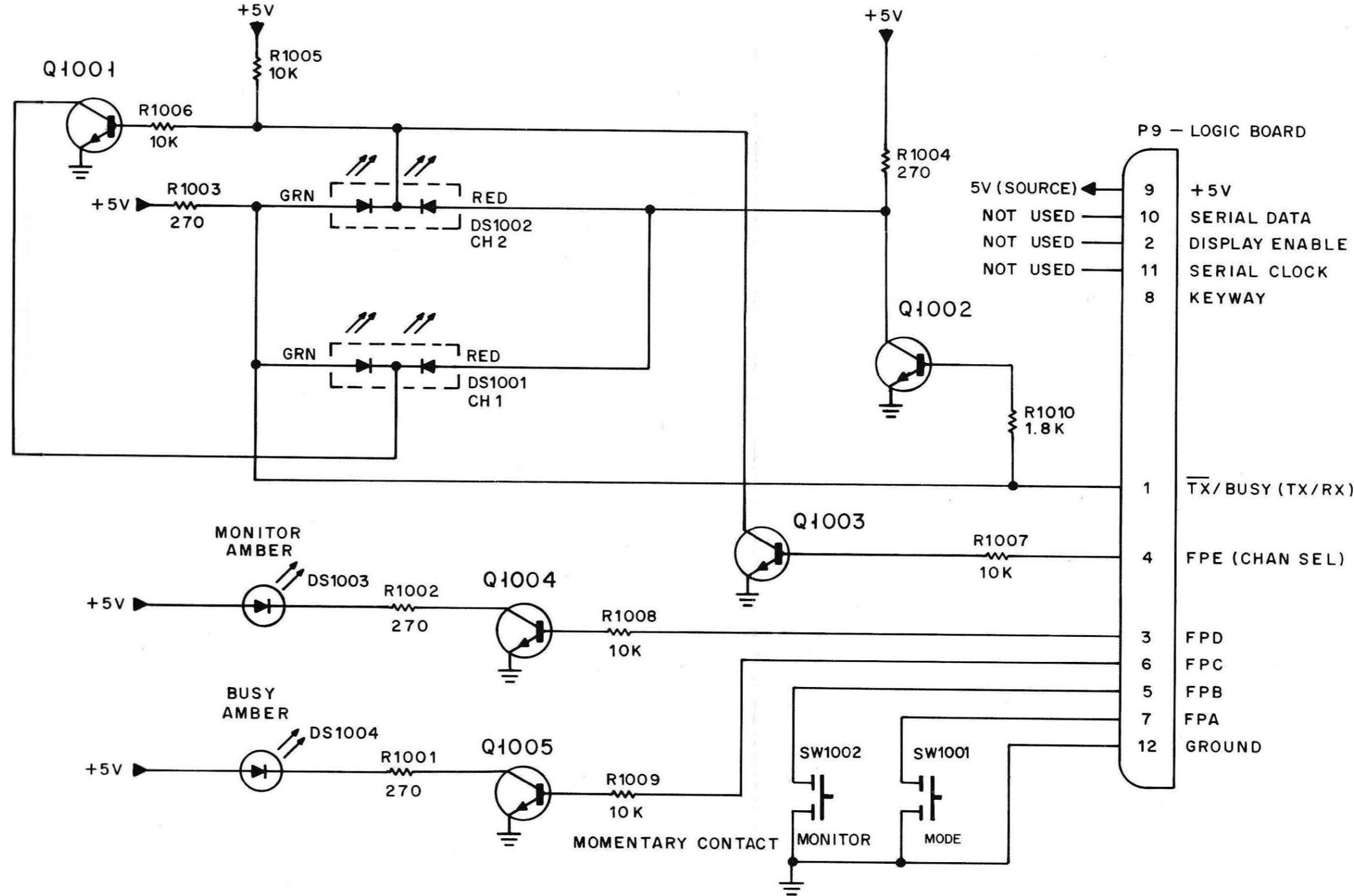


COMPONENT SIDE
SOLDER SIDE



COMPONENT SIDE
SOLDER SIDE
SHORTER LEAD
OVERLAY

SHOWN FROM COMPONENT SIDE



parts list

HLN8439A Display Board, 2 Frequency

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

Displays and Indicators

DS1001,2	48-80051M07	diode LED red/green
DS1003,4	48-80051M06	diode LED amber

Transistors (see note)

Q1001-5	48-80214G02	NPN, type MMBT3904
---------	-------------	--------------------

Resistors, chip, 5%, 1/10 watt

R1001-4	06-11077A60	270
R1005-9	06-11077A98	10k
R1010	06-11077A60	1.8k

Non-referenced items

01-80747T11	cable assembly (includes P9)
42-80052N01	ground strap
43-80279L01	spacer, LED

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

1/11/93

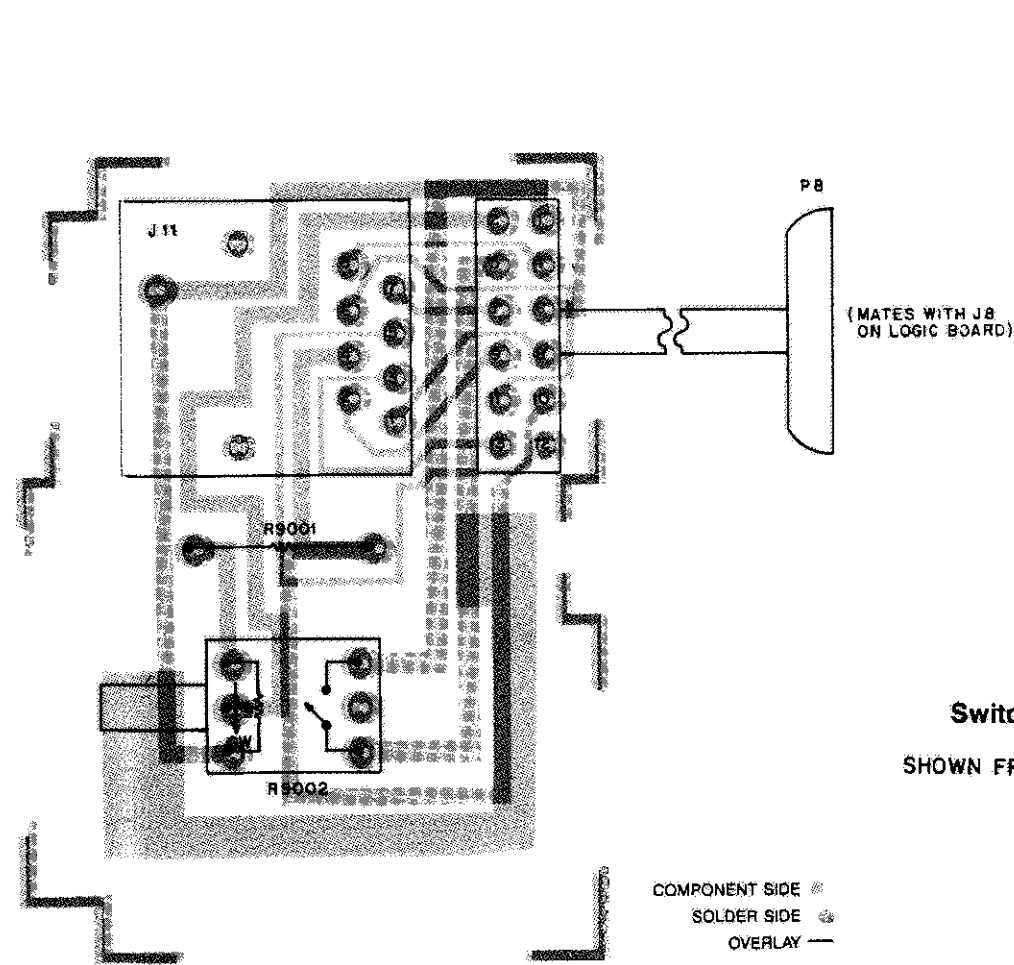
PL-921043-O

HLN8071A Volume/Microphone Board

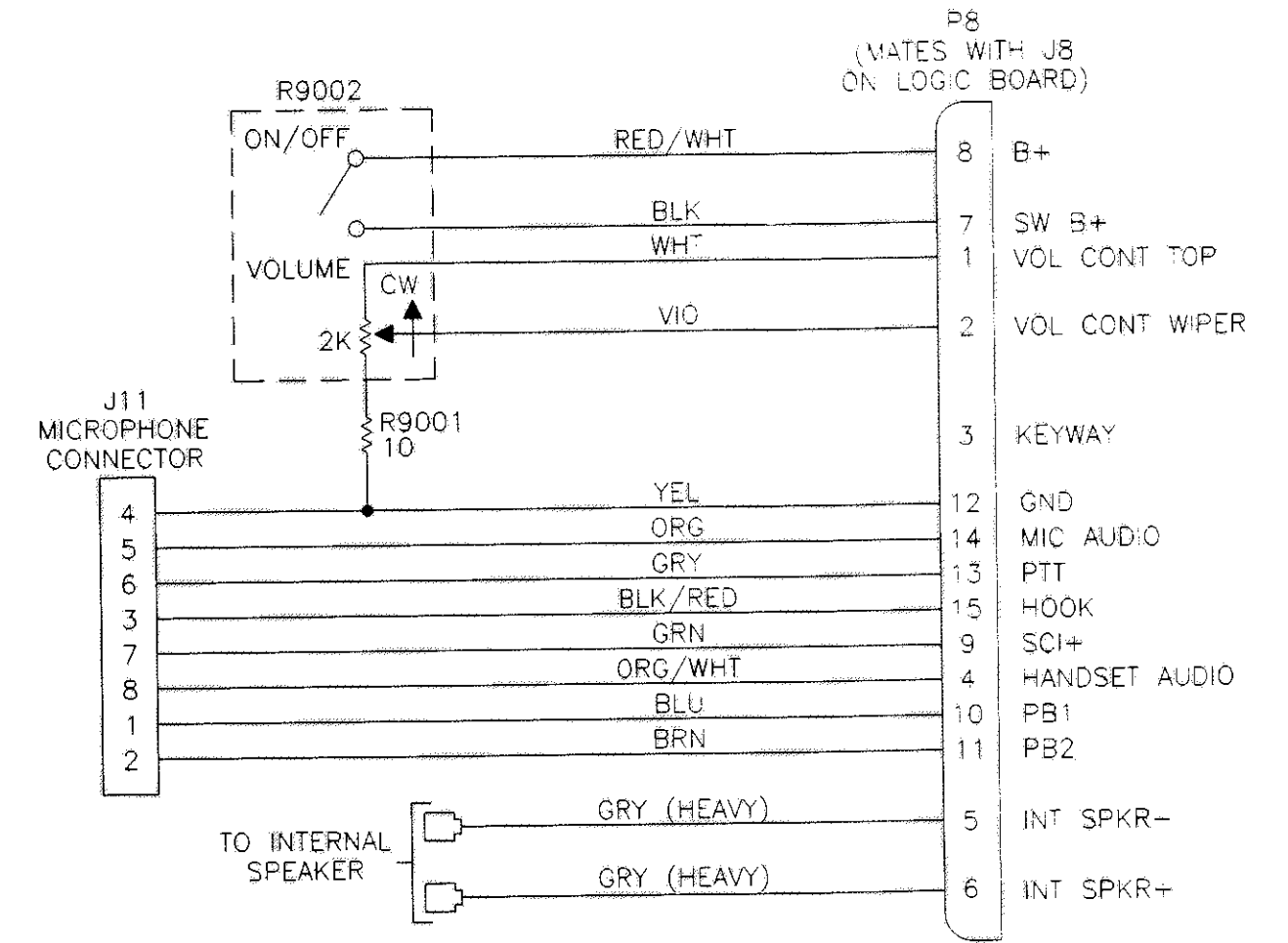
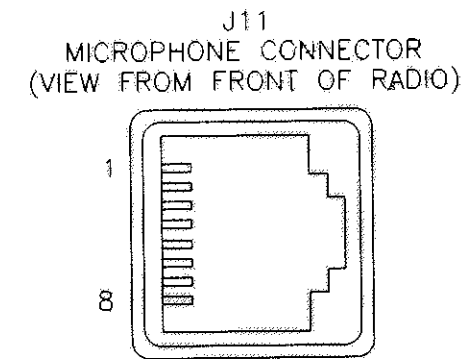
REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Receptacle, jack		
J11	09-80132M01	telephone type, 8 contact
Resistors		
R9001	06-11009A01	10 5% 1/4 watt
R9002	18-80140M01	2k VOLUME with switch
Non-referenced items		
	01-80614B01	cable assembly (includes P8)

3/12/92

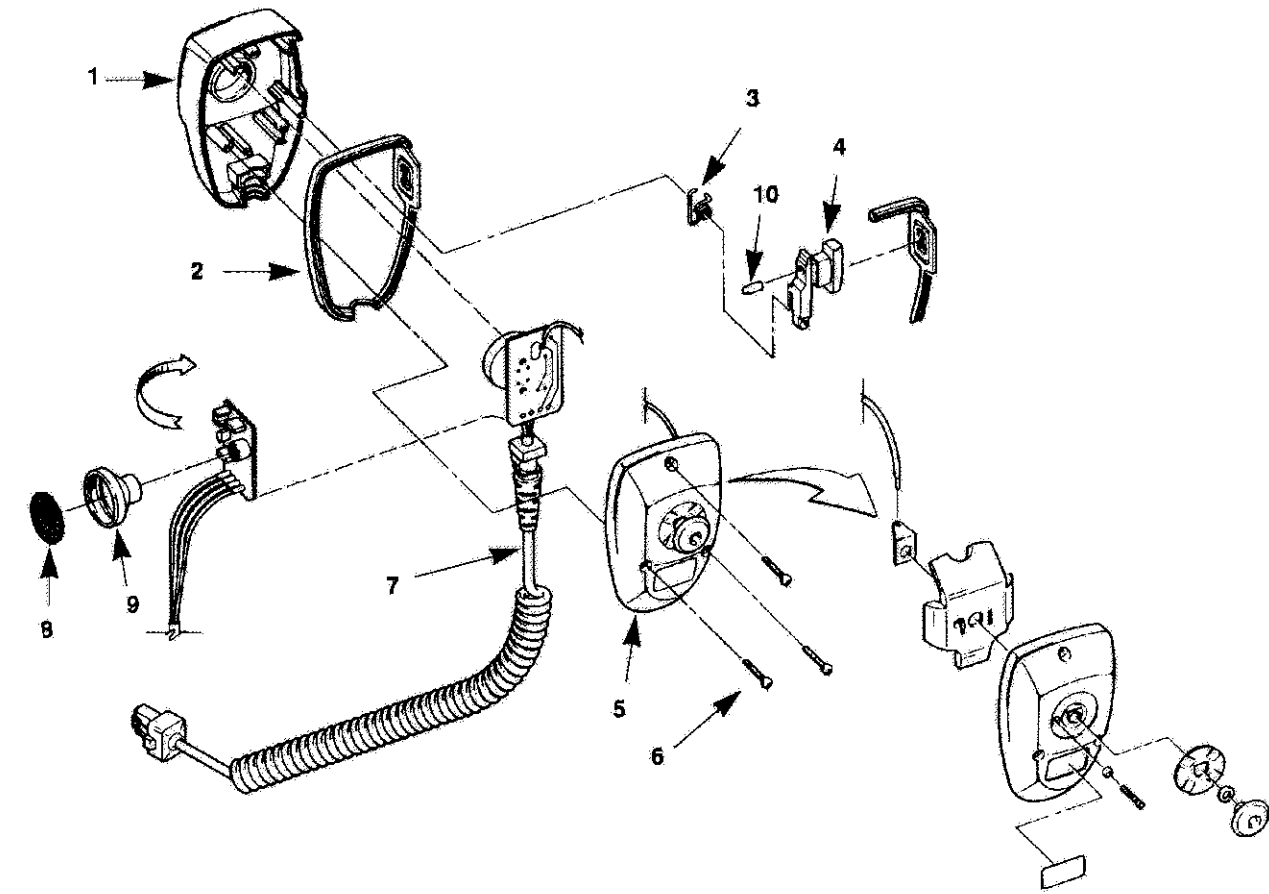
PL-921019-O



Switchboard
SHOWN FROM COMPONENT SIDE



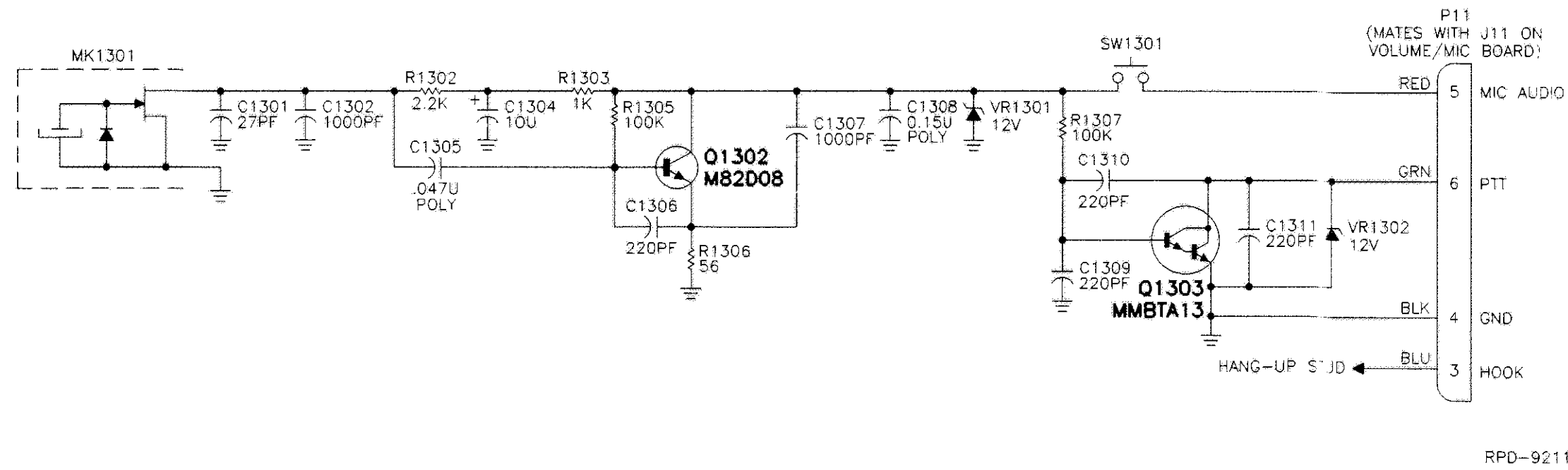
RPD-92116-0



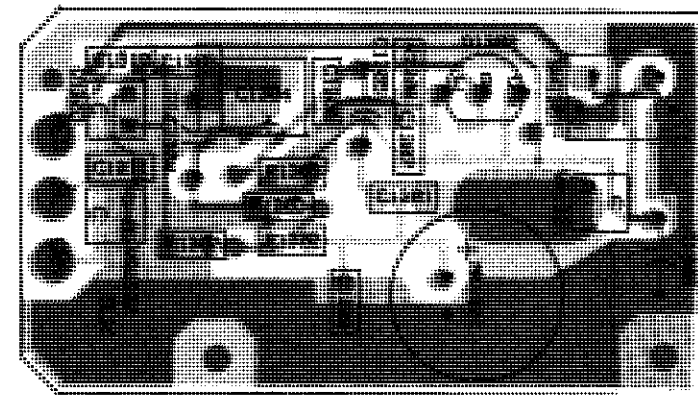
parts list

HMN3596A: MICROPHONE EXPLODED VIEW PARTS LIST (part of HMN3413A)

REF SYMBOL	MOTOROLA PART NUMBER	DESCRIPTION	QTY. USED
1	15-80566B02	FRONT HOUSING	1
2	32-80565B01	GASKET, MICROPHONE	1
3	41-80150R01	SPRING	1
4	38-80568B01	PTT BUTTON	1
5	01-80704Y99	REAR HOUSING RIVETED	1
6	03-11994A23	SCREWS 5-20 x 7/8	3
7	30-80978Z03	COIL CORD, MICROPHONE	1
8	35-80132R01	FELT, BAFFLE, MICROPHONE	1
9	05-80149R01	GROMMET, MIC.	1
10	75-80983Z02	RUBBER SPACER, SWITCH	1



RPD-92117-0



COMPONENT SIDE
SOLDER SIDE

SHOWN FROM COMPONENT SIDE

01-80704Y98 Microphone Board
(Used in HMN3596A Microphone)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip, 5%, 50V unless otherwise indicated		
C1301	21-13740B35	27 pF
C1302	21-13740B73	1000 pF
C1304	23-11049J27	tantalum 10 uF 10% 25V
C1305	08-11051A11	poly .047 uF 63V
C1306	21-13740B57	220 pF
C1307	21-13740B73	1000 pF
C1308	08-11051A14	poly .15 uF 63V
C1309	21-13740B57	220 pF
C1310	21-13740B57	220 pF
C1311	21-13740B57	220 pF

Microphone

MK1301	50-80258E04	cartridge electret
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Transistors (see note)

Q1302	48-80182D08	NPN; type M8208
Q1303	48-05128M19	NPN; type MMBTA13

Resistors, chip, 5%, 1/8 watt

R1302	06-11077A82	2.2k
R1303	06-11077A74	1k
R1305	06-11077B23	100k
R1306	06-11077A44	56
R1307	06-11077B23	100k

Switch

SW1301	40-80164S01	momentary pushbutton
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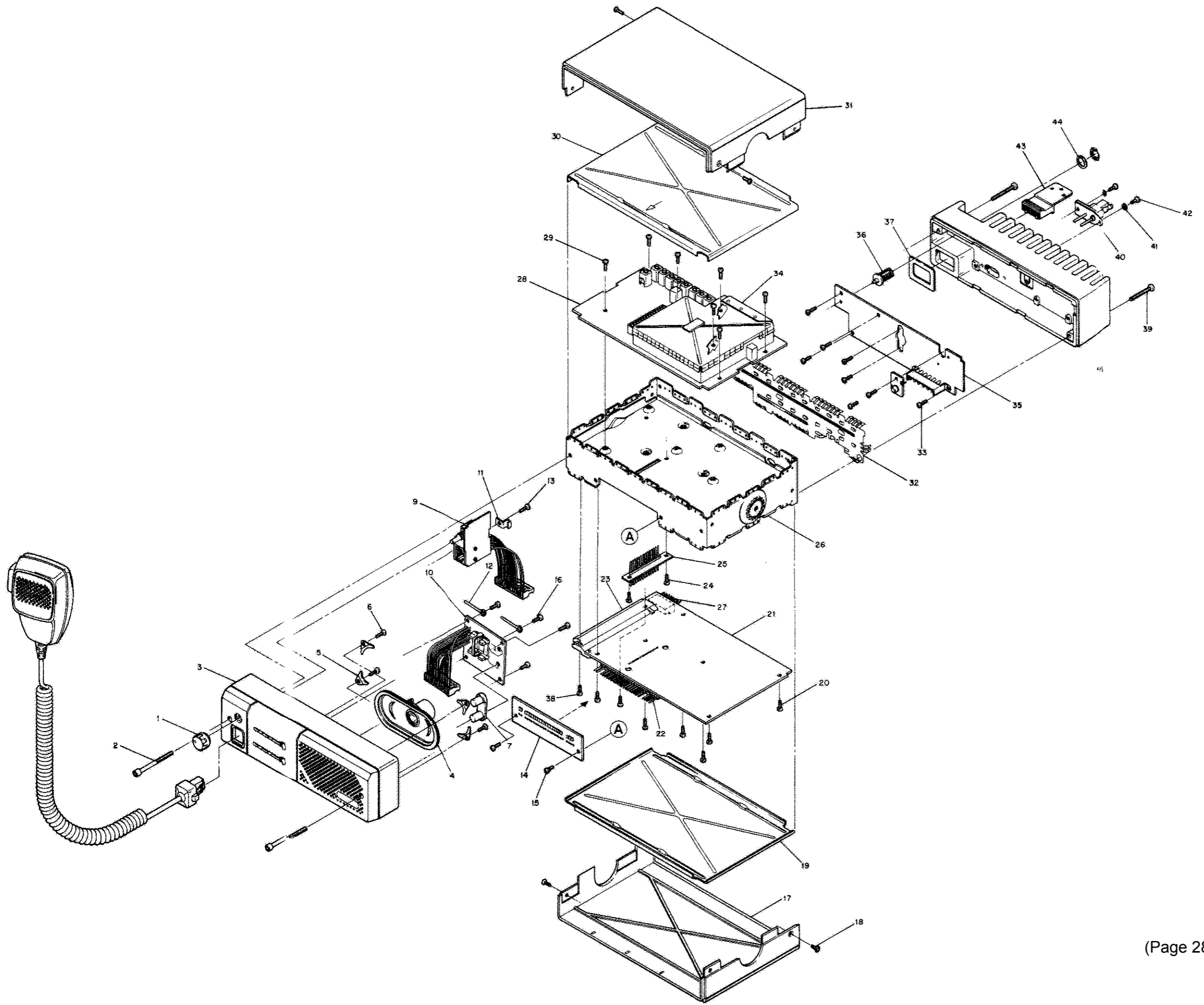
Voltage regulators (see note)

VR1301	48-80140L17	zener diode 12V 5% SOT
VR1302	48-80140L17	zener diode 12V 5% SOT

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

3/12/92

PL-921020-O



Parts List

M120 Mobile Radio Exploded View

PL-931018-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	36-80106M03	Knob, control
2	03-80270L01	Screw, M4 x .7 x 36 cap blk; 2 used
3	15-80518B02	Housing, front-panel, 2 frequency
4	50-80088D03	Speaker
5	42-80253L01	Bracket, speaker; 4 used
6	03-10945A11	Screw, M3 x 8 plastite; 4 used
7	75-80541C01	Keypad, elastomeric, 2 freq.
9	HLN8071A	Vol/Mic. PCB assembly
10	HLN8439A	Display PCB assembly, 2 frequency
11	07-80037M01	Bracket, PCB retainer
12	29-00129883	Lug; 2 used
13	03-10945A11	Screw, M3 x 8 plastite
14	01-80704Y83	Front Panel Filter PCB
15	03-10943M09	Screw, M3 x 6; 2 used
16	03-10945A11	Screw, M3 x 8 plastite; 4 used
17	15-80127L01	Cover, housing
18	03-10943R55	Screw, M3 x 8; 4 used
19	26-80498B01	Shield, chassis
20	03-10943M09	Screw, M3 x 6; 6 used
21	-----	Logic Board (see model chart)
22	28-80600B01	Connector, 27 pin, J8 & J9
23	26-80497B01	Heatsink, logic board
24	03-10943M09	Screw, M3 x 6; 2 used
25	01-80605B01	Feed-thru assembly, RF/Logic
26	27-80496B01	Chassis
27	28-80923V01	Connector, 16 pin
28	-----	RF Board (see model chart)
29	03-10943M09	Screw, M3 x 6; 7 used
30	26-80498B01	Shield, chassis
31	15-80127L01	Cover, housing
32	26-80223M07	Shield, PA
33	03-10943M10	Screw, M3 x 8; 8 used
34	26-80229L03	Shield, VCO
35	-----	(part of PA assembly)
36	09-80131M01	Antenna connector, mini UHF
37	32-80014N03	Gasket, accessory connector
38	03-10943M10	Screw, M3 x 8; 2 used
39	03-80271L01	Screw, M4 x 27; 2 used
40	09-80255E01	Power connector
41	04-05587G01	Washer, power connector
42	03-10943M11	Screw, M3 x 10; 2 used
43	01-80701Y58	Connector assembly
44	04-80943V01	Lock-washer, ant. conn.
45	26-80124L01	Heatsink, PA

(Page 28 is blank)

Exploded Mechanical View and Parts List
for M120 Mobile Radios

HLD8029A RF Board, 146-174 MHz, 12.5 kHz (N)
HLD8031A RF Board, 146-174 MHz, 25 kHz (W)

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

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

C1	21-13740B30	16 pF
C2	21-13740B38	36 pF
C3	21-13740B36	30 pF
C4	21-13740B30	16 pF
C5		not used
C6	21-13740B13	3.3 +/- .25 pF
C7	21-13740B13	3.3 +/- .25 pF
C8	21-13740B25	10 pF
C9	21-13740B37	33 pF
C10	21-13740B38	36 pF
C11	21-13740B33	22 pF
C12	21-13740B65	470 pF
C13	21-13740B32	20 pF
C14	21-13740B45	68 pF
C15	21-13740B43	56 pF
C16	21-13740B34	24 pF
C17	21-13740B42	51 pF
C18	21-13740B27	12 pF
C19	21-13740B65	470 pF
C20	21-11032B15	.22 uF +80/-20%
C21	21-11032B15	.22 uF +80/-20%
C22	21-13741B45	.01 uF
C23	21-13741B45	.01 uF
C51	21-13740B35	27 pF
C52	21-13740B35	27 pF
C53	21-13740B18	5.1 +/- .25 pF
C54	21-13740B47	82 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57	21-13740B29	15 pF
C58	21-13740B25	10 pF
C59	21-13740B29	15 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B29	15 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/- .25 pF
C85	21-13740B25	10 pF
C86		not used
C87	21-13741B45	.01 uF
C88	21-11032B15	.22 uF +80/-20%
C89		not used
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-13741B45	.01 uF
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112		not used
C113	21-13741B69	.1 uF
C114	21-13740B73	1000 pF
C115	21-13741B45	.01 uF
C116	21-13740B73	1000 pF
C117	21-13740B73	1000 pF
C118	21-13740B31	18 pF
C119	21-13740B73	1000 pF
C120	21-13740B73	1000 pF
C121	21-13740B29	15 pF
C122	21-13740B49	100 pF
C127		not used
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157	21-13741B45	.01 uF
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164	21-13741B69	.1 uF
C165	21-13740B73	1000 pF
C166	21-13740B49	100 pF
C167	21-13740B49	100 pF
C168	21-13740B49	100 pF
C169		not used
C176	21-13740B73	1000 pF
C177	21-13741B69	.1 uF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B73	1000 pF
C206	21-13740B27	12 pF
C207	21-13740B29	15 pF
C208	21-13740B27	12 pF
C209	21-13740B23	8.2 +/- .25 pF
C210	21-13740B73	1000 pF
C211	21-13740B73	1000 pF
C212	21-13740B73	1000 pF
C213	21-13740B19	5.6 +/- .25 pF
C214	21-13740B13	3.3 +/- .25 pF
C215	21-13740B73	1000 pF
C216	21-13740B47	82 pF
C217		not used
C218	21-13741B45	.01 uF
C219	21-13740B13	3.3 +/- .25 pF
C220	21-13740B73	1000 pF
C221	21-13740B05	1.5 +/- .25 pF
C222	21-13741B45	.01 uF
C223	21-13740B13	3.3 +/- .25 pF
C224	21-13740B73	1000 pF
C225	21-13740B73	1000 pF
C228	21-13740B80	2200 pF
C229	21-13740B05	1.5 +/- .25 pF
C230	21-13740B05	1.5 +/- .25 pF
C231	21-13740B38	36 pF
C232		not used
C233	21-13740B40	43 pF
C234	21-13740B29	15 pF
C235	21-13740B23	8.2 +/- .25 pF
C236	21-13740B23	8.2 +/- .25 pF
C237	21-13740B73	1000 pF
C238	21-13740B73	1000 pF
C239	21-13740B73	1000 pF
C240	21-13740B13	3.3 +/- .25 pF
C241	21-13740B19	5.6 +/- .25 pF
C242	21-13740B73	1000 pF
C243	21-13740B47	82 pF
C244		not used
C245	21-13740B73	1000 pF
C246	21-13740B25	10 pF
C247	21-13740B73	1000 pF
C248	21-13740B01	1 +/- .25 pF
C249	21-13741B45	.01 uF
C250	21-13740B17	4.7 +/- .25 pF

C251	21-13740B73	1000 pF
C252	21-13740B73	1000 pF
C253		not used
C256	21-13741B45	.01 uF
C258	08-11051A08	poly .015 uF 63V
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C301	21-13741B45	.01 uF
C302		not used
C303	21-13740B65	470 pF
C304		not used
C305		not used
C306		not used
C307		not used
C308		not used
C309		not used
C310		not used
C311		not used
C312		not used
C313		not used

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR202	48-80006E11	silicon varactor SOT
CR203	48-80006E11	silicon varactor SOT
CR204	48-80006E11	silicon varactor SOT
CR205	48-80006E11	silicon varactor SOT
CR206	48-80154K03	dual Schottky SOT
CR209	48-80006E10	silicon varactor SOT
CR210	48-80006E11	silicon varactor SOT
CR211	48-80006E11	silicon varactor SOT
CR212	48-80006E11	silicon varactor SOT
CR213	48-80006E11	silicon varactor SOT
CR214	48-80154K03	dual Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Coils

L1	24-62587E51	chip 68 nH 5%
L2	24-62587E51	chip 68 nH 5%
L3	24-62587E51	chip 68 nH 5%
L4	24-62587E51	chip 68 nH 5%
L5	24-62587E51	chip 68 nH 5%
L6	24-62587E51	chip 68 nH 5%
L7	24-62587E51	chip 68 nH 5%
L8	24-62587E69	chip 1.2 uH 5%
L10	24-62587E69	chip 1.2 uH 5%
L11	24-62587E51	chip 68 nH 5%
L51	24-62587E61	chip .47 uH 5%
L52	24-62587E61	chip .47 uH 5%
L53	24-62587E61	chip .47 uH 5%
L54	24-62587E76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587E76	chip 4.7 uH 5%

L59	24-80164M03	tunable .7 uH E716
L60	24-62587E69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587E69	chip 1.2 uH 5%
L102	24-62587E47	chip 33 nH 5%
L103	24-62587E76	chip 4.7 uH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M05	tunable 3-1/2 turns
L203	24-62587E69	chip 1.2 uH 5%
L204	24-62587E47	chip 33 nH 5%
L205	24-62587E69	chip 1.2 uH 5%
L206	24-62587E69	chip 1.2 uH 5%
L207	24-62587E69	chip 1.2 uH 5%
L208	24-62587E47	chip 33 nH 5%
L209	24-62587E56	chip .18 uH 5%
L210	24-62587E52	chip 82 nH 5%
L211	24-62587E69	chip 1.2 uH 5%
L213	24-80148M08	tunable 4-1/2 turns
L214	24-62587E69	chip 1.2 uH 5%
L215	24-62587E52	chip 82 nH 5%
L216	24-62587E69	chip 1.2 uH 5%
L217	24-62587E69	chip 1.2 uH 5%
L218	24-62587E69	chip 1.2 uH 5%
L219	24-62587E47	chip 33 nH 5%
L220	24-62587E56	chip .18 uH 5%
L221	24-62587E54	chip .12 uH 5%
L222	24-62587E69	chip 1.2 uH 5%
L301	24-84657R01	ferrite bead

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906
Q105	48-80214G02	NPN; type MMBT3904
Q106	48-80214G02	NPN; type MMBT3904
Q107	48-11043C19	NPN; type M43C19/M9658
Q151	48-11043C19	NPN; type M43C19/M9658
Q152	48-11043C06	PNP; type M43C06/M9643
Q203	48-05128M66	field effect; type MMBFU310
Q204	48-11043C19	NPN; type M43C19/M9658
Q205	48-11043C19	NPN; type M43C19/M9658
Q206	48-05128M66	field effect; type MMBFU310
Q207	48-11043C19	NPN; type M43C19/M9658
Q208	48-11043C19	NPN; type M43C19/M9658
Q276	48-80214G02	NPN; type MMBT3904
Q277	48-05128M67	PNP; type MMBT3906
Q278	48-05128M67	PNP; type MMBT3906
Q279	48-05128M67	PNP; type MMBT3906

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A30	15
R2		not used
R3		
R4	06-11077A66	470
R5	06-11077A84	2.7k
R6	06-11077A56	180
R7	06-11077A98	10k
R8	06-11077A96	8.2k
R9	06-11077A98	10k
R10	06-11077A90	4.7k
R11	06-11077B07	22k
R12	06-11077B15	47k
R13	06-11077A50	100
R15	06-11077A68	560
R51	06-11077A43	51
R52	06-11077A54	150
R53	06-11077A88	3.9k
R54	06-11077A54	150

R56	06-11077B45	820k				
R57	06-11077A72	820		R227	06-11077A44	56
R58	06-11077B23	100k		R228	06-11077A50	100
R59	06-11077B27	150k		R229	06-11077A84	2.7k
R60	18-05500L08	variable 22k		R230	06-11077A98	10k
R61(N)	06-11077B07	22k		R231	06-11077A84	2.7k
R61(W)	06-11077B19	68k		R232	06-11077A72	820
R62(N)	06-11077A26	10		R233	06-11077A50	100
R62(W)	06-11077B09	27k		R234	06-11077A84	2.7k
R63	06-11077B21	82k		R235	06-11077A72	820
R102	06-11077A62	330		R236	06-11077A42	47
R103	06-11077A98	10k		R237	06-11077A62	330
R104	06-11077A98	10k		R238	06-11077A32	18
R105	06-11077B11	33k		R239	06-11077A62	330
R106	06-11077A74	1k		R241	06-11077B23	100k
R107	06-11077A78	1.5k		R276	06-11077A98	10k
R108	06-11077A26	10		R277	06-11077A60	270
R109	06-11077A26	10		R278	06-11077A26	10
R110	06-11077B03	15k		R279	06-11077A90	4.7k
R111	06-11077A72	820		R280	06-11077A98	10k
R112	06-11077A86	3.3k		R281	06-11077A90	4.7k
R113	06-11077A74	1k		R301	06-11077A74	1k
R114	06-11077A72	820		R302	18-05500L08	variable 22k
R115	06-11077A70	680		R303	06-11077B01	12k
R116	06-11077A92	5.6k				
R118	06-11077A70	680				
R119	06-11077A90	4.7k				
R120	06-11077A88	3.9k				
R121	06-11077A88	3.9k				
R122	06-11077A43	51				
R123	06-11077A50	100				
R124	06-11077A84	2.7k				
R125	06-11077A72	820				
R151	06-11077B15	47k				
R152	06-11077B11	33k				
R153	06-11077B15	47k				
R154	06-11077A34	22				
R155	06-11077A98	10k				
R156	06-11077B03	15k				
R157	06-11077A78	1.5k				
R158	06-11077A74	1k				
R159	06-11077A74	1k				
R160		not used				
R161	06-11077A98	10k				
R162		not used				
R163(N)	06-11077B11	33k				
R163(W)	06-11077A50	100				
R164	18-05500L08	variable 22k				
R165(N)	06-11077A98	10k				
R165(W)	06-11077B03	15k				
R176	06-11077G26	22.6k 1%				
R177	06-11077G18	18.7k 1%				
R178	06-11077F91	10.0k 1%				
R179	06-11077F91	10.0k 1%				
R180	06-11077G52	42.2k 1%				
R181	06-11077F91	10.0k 1%				
R182	06-11077G28	23.7k 1%				
R207	06-11077A44	56				
R208	06-11077A44	56				
R209	06-11077A50	100				
R210	06-11077A84	2.7k				
R211	06-11077A98	10k				
R212	06-11077A84	2.7k				
R213	06-11077A72	820				
R214	06-11077A50	100				
R215	06-11077A84	2.7k				
R216	06-11077A72	820				
R217	06-11077A42	47				
R218	06-11077A54	150				
R219	06-11077A40	39				
R220	06-11077A54	150				
R222	06-11077A88	3.9k				
R223(N)	06-11077A92	5.6k				
R223(W)	06-11077A66	470				
R224	06-11077B23	100k				
R225(N)	06-11077A92	5.6k				
R225(W)	06-11077B01	12k				
R226	06-11077A44	56				

Transformers

T1	25-80163M02	balun
T2	25-80163M02	balun

Integrated circuits and modules (see note)

U1	48-80174R01	quad Schottky ring SOIC
U51	51-05479G05	receiver system
U101	51-84704M75	synthesizer
U102	51-84810F66	prescaler
U176	51-80932W01	dual op-amp

Voltage regulators (see note)

VR176	48-82256C11	zener diode 10V 5%
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Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (10 used)
26-80228L01	shield can (2 used, for J4 and J5)
26-80229L03	shield VCO frame
75-05295B02	insulator (for Y151)
75-05295B05	insulator (3 used, for Y51A/B, Y52)

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

12/14/92

PL-921009-A

RF 403-433 MHz

HLE8230A RF Board, 403-433 MHz, 12.5 kHz (N)
 HLE8229A RF Board, 403-433 MHz, 25 kHz (W)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C1	21-13740G27	8.2 +/-1 pF
C2	21-13740G27	8.2 +/-1 pF
C3	21-13740G17	3.9 +/-1 pF
C4	21-13740G30	11 pF 2%
C5	21-13740G21	5.6 +/-1 pF
C6	21-13740G19	4.7 +/-1 pF
C7	21-13740G27	8.2 +/-1 pF
C8	21-13740G17	3.9 +/-1 pF
C9	21-13740G21	5.6 +/-1 pF
C10	21-13740G27	8.2 +/-1 pF
C11	21-13740G32	13 pF 2%
C12	21-13740B45	68 pF
C13	21-13740G27	8.2 +/-1 pF
C14		not used
C15	21-13740G13	2.7 +/-1 pF
C16	21-13740G20	5.1 +/-1 pF
C17	21-13740G37	22 pF 2%
C18	21-13740G19	4.7 +/-1 pF
C19	21-13740G16	3.6 +/-1 pF
C20	21-13740G36	20 pF 2%
C21	21-13740G18	4.3 +/-1 pF
C22	21-13740G17	3.9 +/-1 pF
C23	21-13740G35	18 pF 2%
C24	21-13740G20	5.1 +/-1 pF
C25	21-13740G29	10 pF 2%
C26	21-13740G31	12 pF 2%
C27	21-11032B15	.22 uF +80/-20%
C28	21-13740B45	68 pF
C29		not used
C30	21-13740B35	27 pF
C33	21-13741B45	.01 uF
C51	21-13740B55	180 pF
C52	21-13740B27	12 pF
C53	21-13740B47	82 pF
C54	21-13740B61	330 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57(N)	21-13740B29	15 pF
C57(W)	21-13740B31	18 pF
C58(N)	21-13740B25	10 pF
C58(W)	21-13740B27	12 pF
C59(N)	21-13740B29	15 pF
C59(W)	21-13740B31	18 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B29	15 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/--.25 pF
C85	21-13740B25	10 pF
C86	21-11032B15	.22 uF +80/-20%
C87	21-11032B15	.22 uF +80/-20%
C90	21-13741B45	.01 uF
C91	21-13740B49	100 pF

C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-11032B15	.22 uF +80/-20%
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112	08-11051A01	poly .001 uF 63V
C113	21-13741B45	.01 uF
C114	21-13740B45	68 pF
C115	21-13741B45	.01 uF
C116	21-13740B49	100 pF
C117		not used
C118		not used
C119	21-13740B45	68 pF
C120	21-13740B45	68 pF
C121	21-13740B19	5.6 +/--.25 pF
C122	21-13740B49	100 pF
C123	21-13740B45	68 pF
C124	21-13740B25	10 pF
C125	21-13740B73	1000 pF
C126		not used
C127	21-11032B15	.22 uF +80/-20%
C128	21-11032B15	.22 uF +80/-20%
C129	21-11032B15	.22 uF +80/-20%
C130	21-11032B15	.22 uF +80/-20%
C131	21-11032B15	.22 uF +80/-20%
C132	21-11032B15	.22 uF +80/-20%
C133	21-13740B49	100 pF
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157		not used
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164	21-11032B15	.22 uF +80/-20%
C165	21-13741B33	.0033 uF
C176	21-13740B73	1000 pF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B49	100 pF
C206	21-13740B16	4.3 +/--.25 pF
C207	21-13740B19	5.6 +/--.25 pF
C208	21-13740B14	3.6 +/--.25 pF
C209	21-13740B14	3.6 +/--.25 pF
C210	21-13740B49	100 pF
C212	21-13740B49	100 pF
C213	21-13740B01	1 +/--.25 pF
C214	21-13740B13	3.3 +/--.25 pF
C215	21-13740B49	100 pF
C216	21-13740B13	3.3 +/--.25 pF
C218	21-13740B49	100 pF
C220	21-13740B25	10 pF
C221	21-13740B05	1.5 +/--.25 pF
C222	21-13740B49	100 pF
C224	21-13740B49	100 pF
C225	21-13740B49	100 pF
C228	21-13741B29	.0022 uF
C230	21-13740B05	1.5 +/--.25 pF
C231	21-13740B05	1.5 +/--.25 pF
C233	21-13740B18	5.1 +/--.25 pF
C234	21-13740B23	8.2 +/--.25 pF
C235	21-13740B22	7.5 +/--.25 pF
C236	21-13740B22	7.5 +/--.25 pF
C237	21-13740B49	100 pF
C239	21-13740B49	100 pF
C240	21-13740B05	1.5 +/--.25 pF
C242	21-13740B49	100 pF

C243	21-13740B13	3.3 +/- .25 pF
C244	21-11032B15	.22 uF +80/-20%
C245	21-13740B45	68 pF
C247	21-13740B23	8.2 +/- .25 pF
C248	21-13740B01	1 +/- .25 pF
C249	21-13740B49	100 pF
C251	21-13740B45	68 pF
C252	21-13740B49	100 pF
C253	21-13740B45	68 pF
C255		not used
C256	21-13741B45	.01 uF
C257		not used
C258	08-11051A07	poly .01 uF 63V
C259	21-13740B23	8.2 +/- .25 pF
C260		not used
C261	21-13741B45	.01 uF
C262		not used
C263	21-13740B19	5.6 +/- .25 pF
C264		not used
C265		not used
C266	21-13740B03	1.2 +/- .25 pF
C267	21-13740B01	1 +/- .25 pF
C268	21-13740B13	3.3 +/- .25 pF
C269	21-13740B09	2.2 +/- .25 pF
C270		not used
C271		not used
C272	21-13740B45	68 pF
C273		not used
C274	21-13740B49	100 pF
C275	21-13741B45	.01 uF
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C279	21-13740B45	68 pF
C280	21-11032B15	.22 uF +80/-20%
C301	21-13741B45	.01 uF
C302	21-13740B45	68 pF
C303	21-13740B45	68 pF
C304	21-13740B45	68 pF
C305	21-13740B45	68 pF
C306	21-13740B45	68 pF
C307	21-13740B45	68 pF
C308	21-13740B45	68 pF
C309	21-13740B45	68 pF
C310	21-13740B45	68 pF
C311	21-13740B45	68 pF
C312	21-13740B45	68 pF
C313	21-13740B45	68 pF
C314	21-13740B49	100 pF

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR3	48-80939T01	Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR203	48-84534N02	silicon varactor SOT
CR205	48-84534N02	silicon varactor SOT
CR206	48-80154K02	dual Schottky SOT
CR209	48-84534N02	silicon varactor SOT
CR211	48-84534N02	silicon varactor SOT
CR213	48-84534N02	silicon varactor SOT
CR214	48-80939T01	Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Jumpers

JU1	06-11077A01	jumper
JU2	06-11077A01	jumper
JU3	06-11077A01	jumper
JU51	06-11077A01	jumper
JU52	06-11077A01	jumper
JU201		not used
JU201		not used

Coils

L1	24-84562T04	4 turns airwound
L2	24-84562T04	4 turns airwound
L3	24-84562T04	4 turns airwound
L4	24-84562T04	4 turns airwound
L5	24-84562T04	4 turns airwound
L6	24-84562T04	4 turns airwound
L7	24-84562T04	4 turns airwound
L8	24-62587N42	chip 12 nH 5%
L9	24-62587N44	chip 18 nH 5%
L10	24-62587N54	chip .12 uH 5%
L51	24-11030B12	7-1/2 turns YEL
L52	24-62587N68	chip 1 uH 5%
L53	24-62587N56	chip .18 uH 5%
L54	24-62587N76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587N76	chip 4.7 uH 5%
L59	24-80164M03	tunable .7 uH E716
L60	24-62587N69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587N56	chip .18 uH 5%
L102	24-62587N47	chip 33 nH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M02	tunable 2-1/2 turns RED
L203	24-62587N55	chip .15 uH 5%
L204	24-11030A04	5 turns GRN
L205	24-62587N55	chip .15 uH 5%
L206	24-62587N55	chip .15 uH 5%
L207	24-62587N57	chip .22 uH 5%
L209	24-11030B05	2-1/2 turns GRN
L210	24-11030B08	4-1/2 turns BRN
L211	24-62587N57	chip .22 uH 5%
L213	24-80148M01	tunable 1-1/2 turns BRN
L214	24-62587N55	chip .15 uH 5%
L215	24-11030B08	4-1/2 turns BRN
L216	24-62587N55	chip .15 uH 5%
L217	24-62587N55	chip .15 uH 5%
L218	24-62587N57	chip .22 uH 5%
L220	24-11030B05	2-1/2 turns GRN
L221	24-11030B08	4-1/2 turns BRN
L222	24-62587N56	chip .18 uH 5%
L223		not used

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q3	48-05128M67	PNP; type MMBT3906
Q4	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906

Q105	48-80214G02	NPN; type MMBT3904	R158	06-11077A74	1k
Q106	48-80214G02	NPN; type MMBT3904	R159	06-11077A74	1k
Q107	48-11043C19	NPN; type M43C19/M9658	R161	06-11077A98	10k
Q151	48-11043C19	NPN; type M43C19/M9658	R162		not used
Q152	48-11043C06	PNP; type M43C06/M9643	R163(N)	06-11077B23	100k
Q203	48-05128M66	field effect; type MMBFU310	R163(W)	06-11077B17	56k
Q204	48-80950X01	NPN; type M50X01	R164	18-05500L08	variable 22k
Q205	48-80950X01	NPN; type M50X01	R165(N)	06-11077A98	10k
Q206	48-05128M66	field effect; type MMBFU310	R165(W)	06-11077B03	15k
Q207	48-80950X01	NPN; type M50X01	R176	06-11077G26	22.6k 1%
Q208	48-80950X01	NPN; type M50X01	R177	06-11077G18	18.7k 1%
Q276	48-80214G02	NPN; type MMBT3904	R178	06-11077F91	10.0k 1%
Q277	48-05128M67	PNP; type MMBT3906	R179	06-11077F91	10.0k 1%
Q278	48-05128M67	PNP; type MMBT3906	R180	06-11077G52	42.2k 1%
Q279	48-05128M67	PNP; type MMBT3906	R181	06-11077F91	10.0k 1%

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A84	2.7k	R207	06-11077A44	56
R2	06-11077A54	150	R208	06-11077A38	33
R3	06-11077A60	270	R209	06-11077A38	33
R4	06-11077B07	22k	R210	06-11077A98	10k
R5	06-11077A95	7.5k	R212	06-11077A84	2.7k
R6	06-11077A90	4.7k	R213	06-11077A72	820
R7	06-11077A98	10k	R214	06-11077A50	100
R8	06-11077A98	10k	R215	06-11077A84	2.7k
R9	06-11077A90	4.7k	R216	06-11077A72	820
R10	06-11077B07	22k	R217	06-11077A50	100
R11	06-11077B15	47k	R218	06-11077A53	130
R12	06-11077A45	62	R219	06-11077A41	43
R13	06-11077A65	430	R220	06-11077A53	130
R51	06-11077A44	56	R222	06-11077A88	3.9k
R52	06-11077A54	150	R223	06-11077A94	6.8k
R53	06-11077A88	3.9k	R224	06-11077B23	100k
R54	06-11077A54	150	R225	06-11077A88	3.9k
R56	06-11077B45	820k	R226	06-11077A44	56
R57	06-11077A72	820	R227	06-11077A38	33
R58	06-11077B23	100k	R228	06-11077A38	33
R59	06-11077B27	150k	R229	06-11077A98	10k
R60	18-05500L08	variable 22k	R231	06-11077A84	2.7k
R61(N)	06-11077B07	22k	R232	06-11077A72	820
R61(W)	06-11077B19	68k	R233	06-11077A50	100
R62(N)	06-11077A26	10	R234	06-11077A84	2.7k
R62(W)	06-11077B09	27k	R235	06-11077A72	820
R63	06-11077B21	82k	R236	06-11077A50	100
R102	06-11077A62	330	R237	06-11077A61	300
R103	06-11077A98	10k	R238	06-11077A32	18
R104	06-11077A98	10k	R239	06-11077A61	300
R105	06-11077B11	33k	R240		not used
R106	06-11077A73	910	R243	06-11077B23	100k
R107	06-11077A78	1.5k	R244	06-11077A74	1k
R108	06-11077A26	10	R245	06-11077A74	1k
R109	06-11077A26	10	R246	06-11077B09	27k
R110	06-11077B03	15k	R276	06-11077A98	10k
R111	06-11077A54	150	R277	06-11077A60	270
R112	06-11077A72	820	R278	06-11077A26	10
R113	06-11077A58	220	R279	06-11077A90	4.7k
R114	06-11077A54	150	R280	06-11077A98	10k
R115	06-11077A70	680	R281	06-11077A90	4.7k
R116	06-11077A92	5.6k	R301(N)	06-11077B03	15k
R118	06-11077A70	680	R301(W)	06-11077A82	2.2k
R119	06-11077A88	3.9k	R302	18-05500L08	variable 22k
R120	06-11077A88	3.9k	R303	06-11077A94	6.8k
R121	06-11077A84	2.7k			
R122	06-11077A88	3.9k	Transformers		
R123	06-11077A74	1k	T1	25-80163M02	balun
R124	06-11077A78	1.5k	T2	25-80163M02	balun
R125	06-11077A44	56			
R126	06-11077A50	100	Integrated circuits and modules (see note)		
R127	06-11077A84	2.7k	U1	48-80174R01	quad Schottky ring SOIC
R128	06-11077A72	820	U51	51-05479G05	receiver system
R151	06-11077B15	47k	U101	51-84704M75	synthesizer
R152	06-11077B11	33k	U102	51-83977M45	prescaler
R153	06-11077B15	47k	U176	51-80932W01	dual op-amp
R154	06-11077A34	22			
R155	06-11077A98	10k	Voltage regulators (see note)		
R156	06-11077B03	15k	VR176	48-82256C11	zener diode 10V 5%
R157	06-11077A78	1.5k			

Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (17 used)
26-80228L01	shield can (for J4)
26-80229L03	shield VCO frame
26-80256L02	shield image
42-80957X01	ground clip
75-05295B02	insulator (for Y151)
75-05295B07	insulator (3 used, for Y51A/B, Y52)

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

12/14/92

PL-921021-O

HLE8301A RF Board, 438-470 MHz, 12.5 kHz (N)
HLE8300A RF Board, 438-470 MHz, 25 kHz (W)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C1	21-13740G21	5.6 +/- .1 pF
C2	21-13740G18	4.3 +/- .1 pF
C3	21-13740G18	4.3 +/- .1 pF
C4	21-13740G33	15 pF 2%
C5	21-13740G18	4.3 +/- .1 pF
C6	21-13740G15	3.3 +/- .1 pF
C7	21-13740G26	9.1 +/- .1 pF
C8	21-13740G17	3.9 +/- .1 pF
C9	21-13740G17	3.9 +/- .1 pF
C10	21-13740G24	6.8 +/- .1 pF
C11	21-13740G29	10 pF 2%
C12	21-13740B45	68 pF
C13	21-13740G31	12 pF 2%
C14	21-13740G29	10 pF 2%
C15	21-13740G18	4.3 +/- .1 pF
C16	21-13740G15	3.3 +/- .1 pF
C17	21-13740G31	12 pF 2%
C18	21-13740G16	3.6 +/- .1 pF
C19	21-13740G16	3.6 +/- .1 pF
C20	21-13740G35	18 pF 2%
C21	21-13740G16	3.6 +/- .1 pF
C22	21-13740G16	3.6 +/- .1 pF
C23	21-13740G33	15 pF 2%
C24	21-13740G15	3.3 +/- .1 pF
C25	21-13740G19	4.7 +/- .1 pF
C26	21-13740G31	12 pF 2%
C27	21-11032B15	.22 uF +80/-20%
C28	21-13740B45	68 pF
C29		not used
C30	21-13740B34	24 pF
C33		not used
C51	21-13740B55	180 pF
C52	21-13740B27	12 pF
C53	21-13740B47	82 pF
C54	21-13740B61	330 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57(N)	21-13740B29	15 pF
C57(W)	21-13740B31	18 pF
C58(N)	21-13740B25	10 pF
C58(W)	21-13740B27	12 pF
C59(N)	21-13740B29	15 pF
C59(W)	21-13740B31	18 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B29	15 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/- .25 pF
C85	21-13740B25	10 pF
C86		not used
C87	21-11032B15	.22 uF +80/-20%
C90	21-11032B15	.22 uF +80/-20%
C91	21-13740B49	100 pF
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-11032B15	.22 uF +80/-20%
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112	08-11051A01	poly .001 uF 63V
C113	21-13741B45	.01 uF
C114	21-13740B45	68 pF
C115	21-13741B45	.01 uF
C116	21-13740B49	100 pF
C117	21-13741B69	.1 uF
C118	21-13740B45	68 pF
C119	21-13740B45	68 pF
C120	21-13740B45	68 pF
C121	21-13740B19	5.6 +/- .25 pF
C122	21-13740B49	100 pF
C123	21-13740B45	68 pF
C124	21-13740B25	10 pF
C125	21-13740B73	1000 pF
C126		not used
C127	21-11032B15	.22 uF +80/-20%
C128	21-11032B15	.22 uF +80/-20%
C129	21-11032B15	.22 uF +80/-20%
C130	21-11032B15	.22 uF +80/-20%
C131	21-11032B15	.22 uF +80/-20%
C132	21-11032B15	.22 uF +80/-20%
C133	21-13740B45	68 pF
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157		not used
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164		not used
C165	21-13741B33	.0033 uF
C176	21-13740B73	1000 pF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B45	68 pF
C206	21-13740B11	2.7 +/- .25 pF
C207	21-13740B21	6.8 +/- .25 pF
C208	21-13740B14	3.6 +/- .25 pF
C209	21-13740B09	2.2 +/- .25 pF
C210	21-13740B49	100 pF
C212	21-13740B49	100 pF
C213	21-13740B01	1 +/- .25 pF
C214	21-13740B13	3.3 +/- .25 pF
C215	21-13740B49	100 pF
C216	21-13740B09	2.2 +/- .25 pF
C218	21-13740B49	100 pF
C220	21-13740B23	8.2 +/- .25 pF
C221	21-13740B13	3.3 +/- .25 pF
C222	21-13740B49	100 pF
C224	21-13740B49	100 pF
C225	21-13740B49	100 pF
C228	21-13741B29	.0022 uF
C230	21-13740B01	1 +/- .25 pF
C231	21-13740B01	1 +/- .25 pF
C233	21-13740B17	4.7 +/- .25 pF
C234	21-13740B21	6.8 +/- .25 pF
C235	21-13740B17	4.7 +/- .25 pF
C236	21-13740B15	3.9 +/- .25 pF
C237	21-13740B45	68 pF
C239	21-13740B45	68 pF
C240	21-13740B01	1 +/- .25 pF
C242	21-13740B45	68 pF

C243	21-13740B09	2.2 +/- .25 pF
C244	21-11032B15	.22 uF +80/-20%
C245	21-13740B45	68 pF
C247	21-13740B32	20 pF
C248	21-13740B19	5.6 +/- .25 pF
C249	21-13740B45	68 pF
C251	21-13740B45	68 pF
C252	21-13740B45	68 pF
C253	21-13740B45	68 pF
C255		not used
C256	21-13741B45	.01 uF
C257	21-13741B45	.01 uF
C258	08-11051A07	poly .01 uF 63V
C259	21-13740B22	7.5 +/- .25 pF
C260		not used
C261	21-13741B45	.01 uF
C262		not used
C263	21-13740B19	5.6 +/- .25 pF
C264		not used
C265		not used
C266	21-13740B03	1.2 +/- .25 pF
C267	21-13740B01	1 +/- .25 pF
C268	21-13740B09	2.2 +/- .25 pF
C269	21-13740B09	2.2 +/- .25 pF
C270		not used
C271		not used
C272	21-13740B45	68 pF
C273	21-13740B49	100 pF
C274	21-13740B49	100 pF
C275		not used
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C279	21-13740B45	68 pF
C280	21-11032B15	.22 uF +80/-20%
C301	21-13741B45	.01 uF
C302	21-13740B45	68 pF
C303	21-13740B45	68 pF
C304	21-13740B45	68 pF
C305	21-13740B45	68 pF
C306	21-13740B45	68 pF
C307	21-13740B45	68 pF
C308	21-13740B45	68 pF
C309	21-13740B45	68 pF
C310	21-13740B45	68 pF
C311	21-13740B45	68 pF
C312	21-13740B45	68 pF
C313	21-13740B45	68 pF
C314	21-13740B49	100 pF

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR3	48-80939T01	Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR203	48-84534N02	silicon varactor SOT
CR205	48-84534N02	silicon varactor SOT
CR206	48-80154K02	dual Schottky SOT
CR209	48-84534N02	silicon varactor SOT
CR211	48-84534N02	silicon varactor SOT
CR213	48-84534N02	silicon varactor SOT
CR214	48-80939T01	Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Jumpers

JU1	06-11077A01	jumper
JU2		not used
JU3		not used
JU51		not used
JU52		not used
JU201		not used
JU202		not used

Coils

L1	24-84562T04	4 turns airwound
L2	24-84562T04	4 turns airwound
L3	24-84562T04	4 turns airwound
L4	24-84562T04	4 turns airwound
L5	24-84562T04	4 turns airwound
L6	24-84562T04	4 turns airwound
L7	24-84562T04	4 turns airwound
L8	24-11030B04	1-1/2 turns YEL
L9	24-11030B04	1-1/2 turns YEL
L10	24-62587N54	chip .12 uH 5%
L51	24-11030B12	7-1/2 turns YEL
L52	24-62587N68	chip 1 uH 5%
L53	24-62587N56	chip .18 uH 5%
L54	24-62587N76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587N76	chip 4.7 uH 5%
L59	24-80164M03	tunable .7 uH E716
L60	24-62587N69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587N56	chip .18 uH 5%
L102	24-62587N47	chip 33 nH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M02	tunable 2-1/2 turns RED
L203	24-62587N55	chip .15 uH 5%
L204	24-11030B07	3-1/2 turns WHT
L205	24-62587N55	chip .15 uH 5%
L206	24-62587N55	chip .15 uH 5%
L207	24-62587N57	chip .22 uH 5%
L209	24-11030B05	2-1/2 turns GRN
L210	24-11030B08	4-1/2 turns BRN
L211	24-62587N57	chip .22 uH 5%
L213	24-80148M01	tunable 1-1/2 turns BRN
L214	24-62587N54	chip .12 uH 5%
L215	24-11030B08	4-1/2 turns BRN
L216	24-62587N54	chip .12 uH 5%
L217	24-62587N54	chip .12 uH 5%
L218	24-62587N56	chip .18 uH 5%
L220	24-11030B05	2-1/2 turns GRN
L221	24-11030B08	4-1/2 turns BRN
L222	24-62587N56	chip .18 uH 5%
L223		not used

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q3	48-05128M67	PNP; type MMBT3906
Q4	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906

Q105	48-80214G02	NPN; type MMBT3904
Q106	48-80214G02	NPN; type MMBT3904
Q107	48-11043C19	NPN; type M43C19/M9658
Q151	48-11043C19	NPN; type M43C19/M9658
Q152	48-11043C06	PNP; type M43C06/M9643
Q203	48-05128M66	field effect; type MMBFU310
Q204	48-80950X01	NPN; type M50X01
Q205	48-80950X01	NPN; type M50X01
Q206	48-05128M66	field effect; type MMBFU310
Q207	48-80950X01	NPN; type M50X01
Q208	48-80950X01	NPN; type M50X01
Q276	48-80214G02	NPN; type MMBT3904
Q277	48-05128M67	PNP; type MMBT3906
Q278	48-05128M67	PNP; type MMBT3906
Q279	48-05128M67	PNP; type MMBT3906

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A84	2.7k
R2	06-11077A54	150
R3	06-11077A60	270
R4	06-11077B01	12k
R5	06-11077B03	15k
R6	06-11077A90	4.7k
R7	06-11077A98	10k
R8	06-11077A98	10k
R9	06-11077A90	4.7k
R10	06-11077B07	22k
R11	06-11077B15	47k
R12	06-11077A45	62
R13	06-11077A65	430
R51	06-11077A44	56
R52	06-11077A54	150
R53	06-11077A88	3.9k
R54	06-11077A54	150
R56	06-11077B45	820k
R57	06-11077A72	820
R58	06-11077B23	100k
R59	06-11077B27	150k
R60	18-05500L08	variable 22k
R61(N)	06-11077B07	22k
R61(W)	06-11077B19	68k
R62(N)	06-11077A26	10
R62(W)	06-11077B09	27k
R63	06-11077B21	82k
R102	06-11077A62	330
R103	06-11077A98	10k
R104	06-11077A98	10k
R105	06-11077B11	33k
R106	06-11077A73	910
R107	06-11077A78	1.5k
R108	06-11077A26	10
R109	06-11077A26	10
R110	06-11077B03	15k
R111	06-11077A54	150
R112	06-11077A72	820
R113	06-11077A58	220
R114	06-11077A54	150
R115	06-11077A70	680
R116	06-11077A92	5.6k
R118	06-11077A70	680
R119	06-11077A88	3.9k
R120	06-11077A88	3.9k
R121	06-11077A84	2.7k
R122	06-11077A88	3.9k
R123	06-11077A74	1k
R124	06-11077A78	1.5k
R125	06-11077A44	56
R126	06-11077A50	100
R127	06-11077A84	2.7k
R128	06-11077A72	820
R151	06-11077B15	47k
R152	06-11077B11	33k
R153	06-11077B15	47k
R154	06-11077A34	22
R155	06-11077A98	10k
R156	06-11077B03	15k
R157	06-11077A78	1.5k

R158	06-11077A74	1k
R159	06-11077A74	1k
R161	06-11077A98	10k
R162		not used
R163(N)	06-11077B23	100k
R163(W)	06-11077B17	56k
R164	18-05500L08	variable 22k
R165(N)	06-11077A98	10k
R165(W)	06-11077B03	15k
R176	06-11077G26	22.6k 1%
R177	06-11077G18	18.7k 1%
R178	06-11077F91	10.0k 1%
R179	06-11077F91	10.0k 1%
R180	06-11077G52	42.2k 1%
R181	06-11077F91	10.0k 1%
R182	06-11077G28	23.7k 1%
R207	06-11077A44	56
R208	06-11077A44	56
R209	06-11077A34	22
R210	06-11077A98	10k
R212	06-11077A84	2.7k
R213	06-11077A72	820
R214	06-11077A50	100
R215	06-11077A84	2.7k
R216	06-11077A72	820
R217	06-11077A66	470
R218	06-11077A66	470
R219	06-11077A28	12
R220	06-11077A66	470
R222	06-11077A88	3.9k
R223	06-11077A94	6.8k
R224	06-11077B23	100k
R225	06-11077A90	4.7k
R226	06-11077A44	56
R227	06-11077A34	22
R228	06-11077A38	33
R229	06-11077A98	10k
R231	06-11077A84	2.7k
R232	06-11077A72	820
R233	06-11077A46	68
R234	06-11077A84	2.7k
R235	06-11077A72	820
R236	06-11077A46	68
R237	06-11077A58	220
R238	06-11077A34	22
R239	06-11077A58	220
R240		not used
R243	06-11077B23	100k
R244	06-11077A74	1k
R245	06-11077A74	1k
R246	06-11077B09	27k
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301(N)	06-11077B03	15k
R301(W)	06-11077A82	2.2k
R302	18-05500L08	variable 22k
R303	06-11077A94	6.8k

Transformers

T1	25-80163M02	balun
T2	25-80163M02	balun

Integrated circuits and modules (see note)

U1	48-80174R01	quad Schottky ring SOIC
U51	51-05479G05	receiver system
U101	51-84704M75	synthesizer
U102	51-83977M45	prescaler
U176	51-80932W01	dual op-amp

Voltage regulators (see note)

VR176	48-82256C11	zener diode 10V 5%
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Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (17 used)
26-80228L01	shield can (for J4)
26-80229L03	shield VCO frame
26-80256L02	shield image
42-80957X01	ground clip
75-05295B02	insulator (for Y151)
75-05295B07	insulator (3 used, for Y51A/B, Y52)

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

12/14/92

PL-921025-O

HLE8264A RF Board, 465-495 MHz, 12.5 kHz (N)
HLE8263A RF Board, 465-495 MHz, 25 kHz (W)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
C1	21-13740G15	3.3 +/- .1 pF
C2	21-13740G17	3.9 +/- .1 pF
C3	21-13740G19	4.7 +/- .1 pF
C4	21-13740G29	10 pF 2%
C5	21-13740G14	3.0 +/- .1 pF
C6	21-13740G18	4.3 +/- .1 pF
C7	21-13740G29	10 pF 2%
C8	21-13740G13	2.7 +/- .1 pF
C9	21-13740G16	3.6 +/- .1 pF
C10	21-13740G29	10 pF 2%
C11	21-13740G31	12 pF 2%
C12	21-13740B45	68 pF
C13	21-13740G20	5.1 +/- .1 pF
C14	21-13740G19	4.7 +/- .1 pF
C15	21-13740G14	3.0 +/- .1 pF
C16	21-13740G15	3.3 +/- .1 pF
C17	21-13740G31	12 pF 2%
C18	21-13740G14	3.0 +/- .1 pF
C19	21-13740G15	3.3 +/- .1 pF
C20	21-13740G33	15 pF 2%
C21	21-13740G15	3.3 +/- .1 pF
C22	21-13740G15	3.3 +/- .1 pF
C23	21-13740G31	12 pF 2%
C24	21-13740G17	3.9 +/- .1 pF
C25	21-13740G15	3.3 +/- .1 pF
C26	21-13740G28	9.1 +/- .1 pF
C27	21-11032B15	.22 uF +80/-20%
C28	21-13740B45	68 pF
C29	21-13740B45	68 pF
C30	21-11032B15	.22 uF +80/-20%
C33		not used
C51	21-13740B55	180 pF
C52	21-13740B27	12 pF
C53	21-13740B47	82 pF
C54	21-13740B61	330 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57(N)	21-13740B29	15 pF
C57(W)	21-13740B31	18 pF
C58(N)	21-13740B25	10 pF
C58(W)	21-13740B27	12 pF
C59(N)	21-13740B29	15 pF
C59(W)	21-13740B31	18 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B33	22 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/- .25 pF
C85	21-13740B27	12 pF
C86		not used
C87	21-11032B15	.22 uF +80/-20%
C90	21-11032B15	.22 uF +80/-20%
C91	21-13740B49	100 pF
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-11032B15	.22 uF +80/-20%
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112	08-11051A01	poly .001 uF 63V
C113	21-13741B45	.01 uF
C114	21-13740B45	68 pF
C115	21-13741B45	.01 uF
C116	21-13740B49	100 pF
C117	21-13741B69	.1 uF
C118	21-13740B45	68 pF
C119	21-13740B45	68 pF
C120	21-13740B45	68 pF
C121	21-13740B19	5.6 +/- .25 pF
C122	21-13740B49	100 pF
C123	21-13740B45	68 pF
C124	21-13740B25	10 pF
C125	21-13740B73	1000 pF
C126		not used
C127	21-11032B15	.22 uF +80/-20%
C128	21-11032B15	.22 uF +80/-20%
C129	21-11032B15	.22 uF +80/-20%
C130	21-11032B15	.22 uF +80/-20%
C131	21-11032B15	.22 uF +80/-20%
C132	21-11032B15	.22 uF +80/-20%
C133	21-13740B49	100 pF
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157		not used
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164		not used
C165	21-13741B33	.0033 uF
C176	21-13740B73	1000 pF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B45	68 pF
C206	21-13740B19	5.6 +/- .25 pF
C207	21-13740B23	8.2 +/- .25 pF
C208	21-13740B19	5.6 +/- .25 pF
C209	21-13740B19	5.6 +/- .25 pF
C210	21-13740B49	100 pF
C212	21-13740B49	100 pF
C213	21-13740B01	1 +/- .25 pF
C214		not used
C215	21-13740B49	100 pF
C216	21-13740B13	3.3 +/- .25 pF
C218	21-13740B49	100 pF
C220	21-13740B17	4.7 +/- .25 pF
C221	21-13740B05	1.5 +/- .25 pF
C222	21-13740B49	100 pF
C224	21-13740B49	100 pF
C225	21-13740B49	100 pF
C228	21-13741B29	.0022 uF
C230	21-13740B01	1 +/- .25 pF
C231	21-13740B01	1 +/- .25 pF
C233	21-13740B11	2.7 +/- .25 pF
C234	21-13740B21	6.8 +/- .25 pF
C235	21-13740B13	3.3 +/- .25 pF
C236	21-13740B18	5.1 +/- .25 pF
C237	21-13740B45	68 pF
C239	21-13740B45	68 pF
C240	21-13740B01	1 +/- .25 pF
C242	21-13740B45	68 pF

C243	21-13740B09	2.2 +/- .25 pF
C244	21-11032B15	.22 uF +80/-20%
C245	21-13740B45	68 pF
C247	21-13740B27	12 pF
C248	21-13740B17	4.7 +/- .25 pF
C249	21-13740B45	68 pF
C251	21-13740B45	68 pF
C252	21-13740B45	68 pF
C253	21-13740B45	68 pF
C255		not used
C256	21-13741B45	.01 uF
C257	21-13741B45	.01 uF
C258	08-11051A07	poly .01 uF 63V
C259	21-13740B22	7.5 +/- .25 pF
C260		not used
C261	21-13741B45	.01 uF
C262		not used
C263		not used
C264		not used
C265		not used
C266	21-13740B03	1.2 +/- .25 pF
C267	21-13740B01	1 +/- .25 pF
C268	21-13740B13	3.3 +/- .25 pF
C269	21-13740B09	2.2 +/- .25 pF
C270		not used
C271	21-13740B45	68 pF
C272	21-13740B45	68 pF
C273	21-13740B49	100 pF
C274	21-13740B49	100 pF
C275		not used
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C279	21-13740B45	68 pF
C280	21-11032B15	.22 uF +80/-20%
C301	21-13741B45	.01 uF
C302	21-13740B45	68 pF
C303	21-13740B45	68 pF
C304	21-13740B45	68 pF
C305	21-13740B45	68 pF
C306	21-13740B45	68 pF
C307	21-13740B45	68 pF
C308	21-13740B45	68 pF
C309	21-13740B45	68 pF
C310	21-13740B45	68 pF
C311	21-13740B45	68 pF
C312	21-13740B45	68 pF
C313	21-13740B45	68 pF
C314		not used

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR3	48-80939T01	Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR203	48-84534N02	silicon varactor SOT
CR205	48-84534N02	silicon varactor SOT
CR206	48-80154K02	dual Schottky SOT
CR209	48-84534N02	silicon varactor SOT
CR211	48-84534N02	silicon varactor SOT
CR213	48-84534N02	silicon varactor SOT
CR214	48-80939T01	Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Jumpers

JU1		not used
JU2		not used
JU3		not used
JU51		not used
JU52		not used
JU201	06-11077A01	jumper
JU202	06-11077A01	jumper

Coils

L1	24-84562T04	4 turns airwound
L2	24-84562T04	4 turns airwound
L3	24-84562T04	4 turns airwound
L4	24-84562T04	4 turns airwound
L5	24-84562T04	4 turns airwound
L6	24-84562T04	4 turns airwound
L7	24-84562T04	4 turns airwound
L8	24-11030B04	1-1/2 turns YEL
L9	24-11030B04	1-1/2 turns YEL
L10	24-62587N53	chip .1 uH 5%
L51	24-11030B12	7-1/2 turns YEL
L52	24-62587N68	chip 1 uH 5%
L53	24-62587N56	chip .18 uH 5%
L54	24-62587N76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587N76	chip 4.7 uH 5%
L59	24-80164M03	tunable .7 uH E716
L60	24-62587N69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587N56	chip .18 uH 5%
L102	24-62587N47	chip 33 nH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M01	tunable 1-1/2 turns BRN
L203	24-62587N55	chip .15 uH 5%
L204	24-11030B09	4-1/2 turns BRN
L205	24-62587N55	chip .15 uH 5%
L206	24-62587N55	chip .15 uH 5%
L207	24-62587N57	chip .22 uH 5%
L209	24-11030B05	2-1/2 turns GRN
L210	24-11030B08	4-1/2 turns BRN
L211	24-62587N57	chip .22 uH 5%
L213	24-80148M01	tunable 1-1/2 turns BRN
L214	24-62587N61	chip .47 uH 5%
L215	24-11030B06	2-1/2 turns BLU
L216	24-62587N54	chip .12 uH 5%
L217	24-62587N54	chip .12 uH 5%
L218	24-62587N56	chip .18 uH 5%
L220	24-11030B05	2-1/2 turns GRN
L221	24-11030B01	1-1/2 turns BRN
L222	24-62587N56	chip .18 uH 5%
L223		not used

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q3	48-05128M67	PNP; type MMBT3906
Q4	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906

Q105	48-80214G02	NPN; type MMBT3904
Q106	48-80214G02	NPN; type MMBT3904
Q107	48-11043C19	NPN; type M43C19/M9658
Q151	48-11043C19	NPN; type M43C19/M9658
Q152	48-11043C06	PNP; type M43C06/M9643
Q203	48-05128M66	field effect; type MMBFU310
Q204	48-80950X01	NPN; type M50X01
Q205	48-80950X01	NPN; type M50X01
Q206	48-05128M66	field effect; type MMBFU310
Q207	48-80950X01	NPN; type M50X01
Q208	48-80950X01	NPN; type M50X01
Q276	48-80214G02	NPN; type MMBT3904
Q277	48-05128M67	PNP; type MMBT3906
Q278	48-05128M67	PNP; type MMBT3906
Q279	48-05128M67	PNP; type MMBT3906

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A84	2.7k
R2	06-11077A54	150
R3	06-11077A60	270
R4	06-11077B01	12k
R5	06-11077B03	15k
R6	06-11077A90	4.7k
R7	06-11077A98	10k
R8	06-11077A98	10k
R9	06-11077A90	4.7k
R10	06-11077B07	22k
R11	06-11077B15	47k
R12	06-11077A45	62
R13	06-11077A65	430
R51	06-11077A44	56
R52	06-11077A54	150
R53	06-11077A88	3.9k
R54	06-11077A54	150
R56	06-11077B45	820k
R57	06-11077A72	820
R58	06-11077B23	100k
R59	06-11077B27	150k
R60	18-05500L08	variable 22k
R61(N)	06-11077B07	22k
R61(W)	06-11077B19	68k
R62(N)	06-11077A26	10
R62(W)	06-11077B09	27k
R63	06-11077B21	82k
R102	06-11077A62	330
R103	06-11077A98	10k
R104	06-11077A98	10k
R105	06-11077B11	33k
R106	06-11077A73	910
R107	06-11077A78	1.5k
R108	06-11077A26	10
R109	06-11077A26	10
R110	06-11077B03	15k
R111	06-11077A54	150
R112	06-11077A72	820
R113	06-11077A58	220
R114	06-11077A54	150
R115	06-11077A70	680
R116	06-11077A92	5.6k
R118	06-11077A70	680
R119	06-11077A88	3.9k
R120	06-11077A88	3.9k
R121	06-11077A84	2.7k
R122	06-11077A88	3.9k
R123	06-11077A74	1k
R124	06-11077A78	1.5k
R125	06-11077A44	56
R126	06-11077A50	100
R127	06-11077A84	2.7k
R128	06-11077A72	820
R151	06-11077B15	47k
R152	06-11077B11	33k
R153	06-11077B15	47k
R154	06-11077A34	22
R155	06-11077A98	10k
R156	06-11077B03	15k
R157	06-11077A78	1.5k

R158	06-11077A74	1k
R159	06-11077A74	1k
R161	06-11077A98	10k
R162		not used
R163(N)	06-11077B23	100k
R163(W)	06-11077B17	56k
R164	18-05500L08	variable 22k
R165(N)	06-11077A98	10k
R165(W)	06-11077B03	15k
R176	06-11077G26	22.6k 1%
R177	06-11077G18	18.7k 1%
R178	06-11077F91	10.0k 1%
R179	06-11077F91	10.0k 1%
R180	06-11077G52	42.2k 1%
R181	06-11077F91	10.0k 1%
R182	06-11077G28	23.7k 1%
R207	06-11077A44	56
R208	06-11077A44	56
R209	06-11077A34	22
R210	06-11077A98	10k
R212	06-11077A84	2.7k
R213	06-11077A72	820
R214	06-11077A54	150
R215	06-11077A84	2.7k
R216	06-11077A72	820
R217	06-11077A64	390
R218	06-11077A65	430
R219	06-11077A34	22
R220	06-11077A65	430
R222	06-11077A88	3.9k
R223	06-11077A94	6.8k
R224	06-11077B23	100k
R225	06-11077A90	4.7k
R226	06-11077A44	56
R227	06-11077A34	22
R228	06-11077A38	33
R229	06-11077A98	10k
R231	06-11077A84	2.7k
R232	06-11077A72	820
R233	06-11077A44	56
R234	06-11077A84	2.7k
R235	06-11077A72	820
R236	06-11077A44	56
R237	06-11077A66	470
R238	06-11077A28	12
R239	06-11077A66	470
R240		not used
R243	06-11077B23	100k
R244	06-11077A74	1k
R245	06-11077A74	1k
R246	06-11077B09	27k
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301(N)	06-11077B03	15k
R301(W)	06-11077A82	2.2k
R302	18-05500L08	variable 22k
R303	06-11077A94	6.8k

Transformers

T1	25-80163M02	balun
T2	25-80163M02	balun

Integrated circuits and modules (see note)

U1	48-80174R01	quad Schottky ring SOIC
U51	51-05479G05	receiver system
U101	51-84704M75	synthesizer
U102	51-83977M45	prescaler
U176	51-80932W01	dual op-amp

Voltage regulators (see note)

VR176	48-82256C11	zener diode 10V 5%
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Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (17 used)
26-80228L01	shield can (for J4)
26-80229L03	shield VCO frame
26-80256L02	shield image
42-80915V01	ground clip
42-80957X01	ground clip
75-05295B02	insulator (for Y151)
75-05295B07	insulator (3 used, for Y51A/B, Y52)

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

11/30/92

PL-921034-O

HLE8228A RF Board, 490-520 MHz, 12.5 kHz (N)
HLE8227A RF Board, 490-520 MHz, 25 kHz (W)

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C1	21-13740G21	5.6 +/- .1 pF
C2	21-13740G17	3.9 +/- .1 pF
C3	21-13740G15	3.3 +/- .1 pF
C4	21-13740G28	9.1 +/- .1 pF
C5	21-13740G14	3.0 +/- .1 pF
C6	21-13740G14	3.0 +/- .1 pF
C7	21-13740G28	9.1 +/- .1 pF
C8	21-13740G13	2.7 +/- .1 pF
C9	21-13740G13	2.7 +/- .1 pF
C10	21-13740G24	6.8 +/- .1 pF
C11	21-13740G36	20 pF 2%
C12	21-13740B45	68 pF
C13	21-13740G17	3.9 +/- .1 pF
C14	21-13740G12	2.4 +/- .1 pF
C15	21-13740G13	2.7 +/- .1 pF
C16	21-13740G14	3.0 +/- .1 pF
C17	21-13740G31	12 pF 2%
C18	21-13740G14	3.0 +/- .1 pF
C19	21-13740G13	2.7 +/- .1 pF
C20	21-13740G31	12 pF 2%
C21	21-13740G11	2.2 +/- .1 pF
C22	21-13740G14	3.0 +/- .1 pF
C23	21-13740G33	15 pF 2%
C24	21-13740G13	2.7 +/- .1 pF
C25	21-13740G16	3.6 +/- .1 pF
C26	21-13740G30	11 pF 2%
C27	21-11032B15	.22 uF +80/-20%
C28	21-13740B45	68 pF
C29	21-13740B45	68 pF
C30	21-11032B15	.22 uF +80/-20%
C33		not used
C51	21-13740B55	180 pF
C52	21-13740B27	12 pF
C53	21-13740B47	82 pF
C54	21-13740B61	330 pF
C55	21-13741B45	.01 uF
C56	21-13741B45	.01 uF
C57(N)	21-13740B29	15 pF
C57(W)	21-13740B31	18 pF
C58(N)	21-13740B25	10 pF
C58(W)	21-13740B27	12 pF
C59(N)	21-13740B29	15 pF
C59(W)	21-13740B31	18 pF
C60	21-13741B45	.01 uF
C61	21-13741B45	.01 uF
C65	21-11032B15	.22 uF +80/-20%
C66	21-13741B45	.01 uF
C67	23-13749C39	tantalum 10 uF 10% 20V
C68	21-13740B33	22 pF
C69	21-13740B39	39 pF
C70	21-13740B29	15 pF
C71	21-11032B15	.22 uF +80/-20%
C72	21-11032B15	.22 uF +80/-20%
C73	23-13749C39	tantalum 10 uF 10% 20V
C74	23-11048B13	lytic 10 uF 20% 16V
C75	21-13741B69	.1 uF
C76	23-11048B05	lytic 1 uF 20% 50V
C77	21-11032B15	.22 uF +80/-20%
C78	21-11032B15	.22 uF +80/-20%
C79	21-13741B29	.0022 uF
C80	21-11032B15	.22 uF +80/-20%
C81	21-13740B55	180 pF
C82	21-11032B15	.22 uF +80/-20%
C83	21-11032B15	.22 uF +80/-20%
C84	21-13740B09	2.2 +/- .25 pF
C85	21-13740B27	12 pF
C86		not used
C87	21-11032B15	.22 uF +80/-20%
C90	21-11032B15	.22 uF +80/-20%
C91	21-13740B49	100 pF
C101	23-11048B13	lytic 10 uF 20% 16V
C102	08-11051A13	poly .1 uF 63V
C103	21-11032B15	.22 uF +80/-20%
C104	21-13741B45	.01 uF
C105	23-11048B13	lytic 10 uF 20% 16V
C106	21-13740B29	15 pF
C107	21-13741B69	.1 uF
C108	21-13741B69	.1 uF
C109	08-11051A13	poly .1 uF 63V
C110	08-11051A19	poly 1 uF 63V
C111	08-11051A09	poly .022 uF 63V
C112	08-11051A01	poly .001 uF 63V
C113	21-13741B45	.01 uF
C114	21-13740B45	68 pF
C115	21-13741B45	.01 uF
C116	21-13740B49	100 pF
C117	21-13741B69	.1 uF
C118	21-13740B45	68 pF
C119	21-13740B45	68 pF
C120	21-13740B45	68 pF
C121	21-13740B15	3.9 +/- .25 pF
C122	21-13740B49	100 pF
C123	21-13740B45	68 pF
C124	21-13740B25	10 pF
C125	21-13740B73	1000 pF
C126		not used
C127	21-11032B15	.22 uF +80/-20%
C128	21-11032B15	.22 uF +80/-20%
C129	21-11032B15	.22 uF +80/-20%
C130	21-11032B15	.22 uF +80/-20%
C131	21-11032B15	.22 uF +80/-20%
C132	21-11032B15	.22 uF +80/-20%
C133	21-13740B49	100 pF
C151	21-13740B73	1000 pF
C152	21-13740B47	82 pF
C153	21-13740B25	10 pF
C154	21-13741B45	.01 uF
C155	21-13740B55	180 pF
C156	21-13740B55	180 pF
C157		not used
C158	08-11051A15	poly .22 uF 63V
C159	21-13740B35	27 pF
C160	21-13740B29	15 pF
C161	21-13740B73	1000 pF
C162	23-11048B13	lytic 10 uF 20% 16V
C163	08-11051A17	poly .47 uF 63V
C164		not used
C165	21-13741B33	.0033 uF
C176	21-13740B73	1000 pF
C201	23-11048B13	lytic 10 uF 20% 16V
C205	21-13740B45	68 pF
C206	21-13740B15	3.9 +/- .25 pF
C207	21-13740B24	9.1 +/- .25 pF
C208	21-13740B19	5.6 +/- .25 pF
C209	21-13740B19	5.6 +/- .25 pF
C210	21-13740B49	100 pF
C212	21-13740B49	100 pF
C213	21-13740B01	1 +/- .25 pF
C214	21-13740B13	3.3 +/- .25 pF
C215	21-13740B49	100 pF
C216	21-13740B13	3.3 +/- .25 pF
C218	21-13740B49	100 pF
C220	21-13740B23	8.2 +/- .25 pF
C221	21-13740B05	1.5 +/- .25 pF
C222	21-13740B49	100 pF
C224	21-13740B49	100 pF
C225	21-13740B49	100 pF
C228	21-13741B29	.0022 uF
C230	21-13740B01	1 +/- .25 pF
C231	21-13740B01	1 +/- .25 pF
C233	21-13740B11	2.7 +/- .25 pF
C234	21-13740B18	5.1 +/- .25 pF
C235	21-13740B09	2.2 +/- .25 pF
C236	21-13740B09	2.2 +/- .25 pF
C237	21-13740B45	68 pF
C239	21-13740B45	68 pF
C240	21-13740B01	1 +/- .25 pF
C242	21-13740B45	68 pF

C243	21-13740B09	2.2 +/- .25 pF
C244	21-11032B15	.22 uF +80/-20%
C245	21-13740B45	68 pF
C247	21-13740B16	4.3 +/- .25 pF
C248	21-13740B09	2.2 +/- .25 pF
C249	21-13740B45	68 pF
C251	21-13740B45	68 pF
C252	21-13740B45	68 pF
C253	21-13740B45	68 pF
C255		not used
C256	21-13741B45	.01 uF
C257	21-13741B45	.01 uF
C258	08-11051A07	poly .01 uF 63V
C259	21-13740B22	7.5 +/- .25 pF
C260		not used
C261	21-13741B45	.01 uF
C262		not used
C263		not used
C264		not used
C265		not used
C266	21-13740B03	1.2 +/- .25 pF
C267	21-13740B01	1 +/- .25 pF
C268	21-13740B13	3.3 +/- .25 pF
C269	21-13740B09	2.2 +/- .25 pF
C270		not used
C271		not used
C272	21-13740B45	68 pF
C273	21-13740B49	100 pF
C274	21-13740B49	100 pF
C275		not used
C276	21-13741B45	.01 uF
C277	23-11048B19	lytic 47 uF 20% 16V
C278	23-11048B19	lytic 47 uF 20% 16V
C279	21-13740B45	68 pF
C280	21-11032B15	.22 uF +80/-20%
C301	21-13741B45	.01 uF
C302	21-13740B45	68 pF
C303	21-13740B45	68 pF
C304	21-13740B45	68 pF
C305	21-13740B45	68 pF
C306	21-13740B45	68 pF
C307	21-13740B45	68 pF
C308	21-13740B45	68 pF
C309	21-13740B45	68 pF
C310	21-13740B45	68 pF
C311	21-13740B45	68 pF
C312	21-13740B45	68 pF
C313	21-13740B45	68 pF
C314		not used

Diodes (see note)

CR2	48-80154K03	dual Schottky SOT
CR3	48-80939T01	Schottky SOT
CR5	48-80142L01	silicon PIN SOT MMBV3401
CR51	48-05129M76	silicon SOT
CR52	48-05129M76	silicon SOT
CR101	48-05129M76	silicon SOT
CR102	48-05129M76	silicon SOT
CR151	48-80006E10	silicon varactor SOT
CR152	48-80006E10	silicon varactor SOT
CR153	48-84336R03	dual silicon SOT MMBD7000
CR203	48-84534N02	silicon varactor SOT
CR205	48-84534N02	silicon varactor SOT
CR206	48-80154K02	dual Schottky SOT
CR209	48-84534N02	silicon varactor SOT
CR211	48-84534N02	silicon varactor SOT
CR213	48-84534N02	silicon varactor SOT
CR214	48-80939T01	Schottky SOT

Filters

FL51(N)	91-80097D04	455 kHz 6F
FL51(W)	91-80097D06	455 kHz 6D
FL52(N)	91-80098D04	455 kHz 4F
FL52(W)	91-80098D06	455 kHz 4D

Connector, receptacle

J4	09-80135M01	coaxial (RX)
J5	09-80135M01	coaxial (TX)
J6	09-80130M03	14-pin, RF board

Jumpers

JU1		not used
JU2		not used
JU3	06-11077A01	jumper
JU51		not used
JU52		not used
JU201	06-11077A01	jumper
JU202	06-11077A01	jumper

Coils

L1	24-84562T04	4 turns airwound
L2	24-84562T04	4 turns airwound
L3	24-84562T04	4 turns airwound
L4	24-84562T04	4 turns airwound
L5	24-84562T04	4 turns airwound
L6	24-84562T04	4 turns airwound
L7	24-84562T04	4 turns airwound
L8	24-11030B07	3-1/2 turns WHT
L9	24-11030B07	3-1/2 turns WHT
L10	24-62587N53	chip .1 uH 5%
L51	24-11030B12	7-1/2 turns YEL
L52	24-62587N68	chip 1 uH 5%
L53	24-62587N56	chip .18 uH 5%
L54	24-62587N76	chip 4.7 uH 5%
L55	24-80164M02	tunable .7 uH E715
L56	24-80164M01	tunable .7 uH E713
L57	24-80164M04	tunable .7 uH E714
L58	24-62587N76	chip 4.7 uH 5%
L59	24-80164M03	tunable .7 uH E716
L60	24-62587N69	chip 1.2 uH 5%
L61	25-80000E01	tunable 455 kHz with cap
L101	24-62587N56	chip .18 uH 5%
L102	24-62587N47	chip 33 nH 5%
L151	24-80299D01	tunable 17-3/4 turns
L152	24-11087A35	chip 5.6 uH 10%
L202	24-80148M01	tunable 1-1/2 turns BRN
L203	24-62587N55	chip .15 uH 5%
L204	24-11030B07	3-1/2 turns WHT
L205	24-62587N55	chip .15 uH 5%
L206	24-62587N55	chip .15 uH 5%
L207	24-62587N57	chip .22 uH 5%
L209	24-11030B05	2-1/2 turns GRN
L210	24-11030B08	4-1/2 turns BRN
L211	24-62587N57	chip .22 uH 5%
L213	24-80148M01	tunable 1-1/2 turns BRN
L214	24-62587N60	chip .39 uH 5%
L215	24-11030B06	2-1/2 turns BLU
L216	24-62587N54	chip .12 uH 5%
L217	24-62587N54	chip .12 uH 5%
L218	24-62587N56	chip .18 uH 5%
L220	24-11030B05	2-1/2 turns GRN
L221	24-11030B01	1-1/2 turns BRN
L222	24-62587N56	chip .18 uH 5%
L223		not used

Transistors (see note)

Q1	48-80950X01	NPN; type M50X01
Q2	48-05128M67	PNP; type MMBT3906
Q3	48-05128M67	PNP; type MMBT3906
Q4	48-05128M67	PNP; type MMBT3906
Q5	48-05128M67	PNP; type MMBT3906
Q6	48-80214G02	NPN; type MMBT3904
Q51	48-05128M66	field effect; type MMBFU310
Q52	48-05128M66	field effect; type MMBFU310
Q53	48-80214G02	NPN; type MMBT3904
Q101	48-05128M67	PNP; type MMBT3906
Q102	48-80182D20	NPN; type M82D20/M9987
Q103	48-80182D20	NPN; type M82D20/M9987
Q104	48-05128M67	PNP; type MMBT3906

Q105	48-80214G02	NPN; type MMBT3904
Q106	48-80214G02	NPN; type MMBT3904
Q107	48-11043C19	NPN; type M43C19/M9658
Q151	48-11043C19	NPN; type M43C19/M9658
Q152	48-11043C06	PNP; type M43C06/M9643
Q203	48-05128M66	field effect; type MMBFU310
Q204	48-80950X01	NPN; type M50X01
Q205	48-80950X01	NPN; type M50X01
Q206	48-05128M66	field effect; type MMBFU310
Q207	48-80950X01	NPN; type M50X01
Q208	48-80950X01	NPN; type M50X01
Q276	48-80214G02	NPN; type MMBT3904
Q277	48-05128M67	PNP; type MMBT3906
Q278	48-05128M67	PNP; type MMBT3906
Q279	48-05128M67	PNP; type MMBT3906

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R1	06-11077A84	2.7k
R2	06-11077A54	150
R3	06-11077A60	270
R4	06-11077B01	12k
R5	06-11077B03	15k
R6	06-11077A90	4.7k
R7	06-11077A98	10k
R8	06-11077A98	10k
R9	06-11077A90	4.7k
R10	06-11077B07	22k
R11	06-11077B15	47k
R12	06-11077A45	62
R13	06-11077A65	430
R51	06-11077A44	56
R52	06-11077A54	150
R53	06-11077A88	3.9k
R54	06-11077A54	150
R56	06-11077B45	820k
R57	06-11077A72	820
R58	06-11077B23	100k
R59	06-11077B27	150k
R60	18-05500L08	variable 22k
R61(N)	06-11077B07	22k
R61(W)	06-11077B19	68k
R62(N)	06-11077A26	10
R62(W)	06-11077B09	27k
R63	06-11077B21	82k
R102	06-11077A62	330
R103	06-11077A98	10k
R104	06-11077A98	10k
R105	06-11077B11	33k
R106	06-11077A73	910
R107	06-11077A78	1.5k
R108	06-11077A26	10
R109	06-11077A26	10
R110	06-11077B03	15k
R111	06-11077A54	150
R112	06-11077A72	820
R113	06-11077A58	220
R114	06-11077A54	150
R115	06-11077A70	680
R116	06-11077A92	5.6k
R118	06-11077A70	680
R119	06-11077A88	3.9k
R120	06-11077A88	3.9k
R121	06-11077A84	2.7k
R122	06-11077A88	3.9k
R123	06-11077A74	1k
R124	06-11077A78	1.5k
R125	06-11077A44	56
R126	06-11077A50	100
R127	06-11077A84	2.7k
R128	06-11077A72	820
R151	06-11077B15	47k
R152	06-11077B11	33k
R153	06-11077B15	47k
R154	06-11077A34	22
R155	06-11077A98	10k
R156	06-11077B03	15k
R157	06-11077A78	1.5k

R158	06-11077A74	1k
R159	06-11077A74	1k
R161	06-11077A98	10k
R162		not used
R163(N)	06-11077B23	100k
R163(W)	06-11077B17	56k
R164	18-05500L08	variable 22k
R165(N)	06-11077A98	10k
R165(W)	06-11077B03	15k
R176	06-11077G26	22.6k 1%
R177	06-11077G18	18.7k 1%
R178	06-11077F91	10.0k 1%
R179	06-11077F91	10.0k 1%
R180	06-11077G52	42.2k 1%
R181	06-11077F91	10.0k 1%
R182	06-11077G28	23.7k 1%
R207	06-11077A44	56
R208	06-11077A44	56
R209	06-11077A34	22
R210	06-11077A98	10k
R212	06-11077A84	2.7k
R213	06-11077A72	820
R214	06-11077A50	100
R215	06-11077A84	2.7k
R216	06-11077A72	820
R217	06-11077A66	470
R218	06-11077A56	180
R219	06-11077A38	33
R220	06-11077A56	180
R222	06-11077A88	3.9k
R223	06-11077A94	6.8k
R224	06-11077B23	100k
R225	06-11077A90	4.7k
R226	06-11077A44	56
R227	06-11077A34	22
R228	06-11077A38	33
R229	06-11077A98	10k
R231	06-11077A84	2.7k
R232	06-11077A72	820
R233	06-11077A46	68
R234	06-11077A84	2.7k
R235	06-11077A72	820
R236	06-11077A46	68
R237	06-11077A66	470
R238	06-11077A28	12
R239	06-11077A66	470
R240		not used
R243	06-11077B23	100k
R244	06-11077A74	1k
R245	06-11077A74	1k
R246	06-11077B09	27k
R276	06-11077A98	10k
R277	06-11077A60	270
R278	06-11077A26	10
R279	06-11077A90	4.7k
R280	06-11077A98	10k
R281	06-11077A90	4.7k
R301(N)	06-11077B03	15k
R301(W)	06-11077A82	2.2k
R302	18-05500L08	variable 22k
R303	06-11077A94	6.8k

Transformers

T1	25-80163M02	balun
T2	25-80163M02	balun

Integrated circuits and modules (see note)

U1	48-80174R01	quad Schottky ring SOIC
U51	51-05479G05	receiver system
U101	51-84704M75	synthesizer
U102	51-83977M45	prescaler
U176	51-80932W01	dual op-amp

Voltage regulators (see note)

VR176	48-82256C11	zener diode 10V 5%
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Crystals

Y51(N)	91-80022M03	filter 45.1 MHz 12.5 kHz
Y51(W)	91-80022M02	filter 45.1 MHz 25 kHz
Y52	48-80008K02	44.645 MHz
Y151	48-80174D05	14.4 MHz

Non-referenced items

26-80097M01	shield coil can (for L151)
26-80098M01	shield coil can (17 used)
26-80228L01	shield can (for J4)
26-80229L03	shield VCO frame
26-80256L02	shield image
42-80915V01	ground clip (2 used)
42-80957X01	ground clip
75-05295B02	insulator (for Y151)
75-05295B07	insulator (3 used, for Y51A/B, Y52)

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

11/25/92

PL-921022-O

2-LAYER LOGIC

HLN8074B Logic Board 2-Layer Masked

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C401	21-13741B45	.01 uF
C402	08-11051A09	poly .022 uF 63V
C403	21-13741B45	.01 uF
C404	23-11048B19	lytic 47 uF 20% 16V
C405	23-11048B13	lytic 10 uF 20% 16V
C406	08-11051A15	poly .22 uF 63V
C407	23-11013A56	tantalum 47 uF 20% 6V
C408	23-11048B19	lytic 47 uF 20% 16V
C409	08-11051A17	poly .47 uF 63V
C451	23-11048B19	lytic 47 uF 20% 16V
C452	21-13741B45	.01 uF
C453	21-11032B14	.15 uF + 80/-20%
C454	21-13741B45	.01 uF
C455	08-11051A15	poly .22 uF 63V
C458	21-13740B36	30 pF
C459	21-13740B36	30 pF
C460	21-13741B45	.01 uF
C461	21-13741B45	.01 uF
C463	21-13740B36	30 pF
C464	21-13740B36	30 pF
C465	21-13740B36	30 pF
C466		not used
C501	08-11051A22	poly .039 uF 63V
C502	21-13740B76	1500 pF
C503	21-13741B69	.1 uF
C504	23-11048B13	lytic 10 uF 20% 16V
C505	08-11051A17	poly .47 uF 63V
C506	08-11051A17	poly .47 uF 63V
C507		not used
C551	23-11048B13	lytic 10 uF 20% 16V
C552	21-13740B36	30 pF
C553	21-13740B71	820 pF
C554	08-11051A03	poly .0022 uF 63V
C555	21-13740B51	120 pF
C556	08-11051A12	poly .068 uF 63V
C557	08-11051A12	poly .068 uF 63V
C558	08-11051A12	poly .068 uF 63V
C559	08-11051A13	poly .1 uF 63V
C560	08-11051A13	poly .1 uF 63V
C561	08-11051A15	poly .22 uF 63V
C562	08-11051A09	poly .022 uF 63V
C563	21-13741B69	.1 uF
C564	21-13740B49	100 pF
C565	23-11048B13	lytic 10 uF 20% 16V
C566	21-13741B45	.01 uF
C567	21-13741B45	.01 uF
C568	23-11048B19	lytic 47 uF 20% 16V
C601	23-11048B05	lytic 1 uF 20% 50V
C604		not used
C605		not used
C606	08-11051A22	poly .039 uF 63V
C607	08-11051A13	poly .1 uF 63V
C608	08-11051A05	poly .0047 uF 63V
C609	21-13740B60	300 pF
C610	08-11051A16	poly .33 uF 63V
C611	21-13740B49	100 pF
C612	23-11048B19	lytic 47 uF 20% 16V
C651	23-11048B19	lytic 47 uF 20% 16V
C652	08-11051A06	poly .0068 uF 63V
C653	08-11051A15	poly .22 uF 63V
C656	23-11048B13	lytic 10 uF 20% 16V
C657	21-13741B69	.1 uF
C658	21-13741B45	.01 uF
C659	23-11013A56	tantalum 47 uF 20% 6V
C660	23-11048B13	lytic 10 uF 20% 16V
C661	21-13740B74	1200 pF
C662	08-11051A07	poly .01 uF 63V
C663	21-13740B50	110 pF
C664	23-11048B09	lytic 4.7 uF 20% 35V
C665	21-13740B36	30 pF

C666	21-13740B74	1200 pF
C667	08-11051A08	poly .015 uF 63V
C668	08-11051A13	poly .1 uF 63V
C701	21-13740B78	1800 pF
C703	23-11048B05	lytic 1 uF 20% 50V
C704	08-11051A12	poly .068 uF 63V
C705	08-11051A16	poly .33 uF 63V
C706	08-11051A03	poly .0022 uF 63V
C707	21-13740B69	680 pF
C801	21-13740B49	100 pF
C802	21-13740B49	100 pF
C803		not used
C804		not used
C805	21-13740B73	1000 pF
C808	21-13740B49	100 pF
C809	21-13740B49	100 pF
C819	21-13740B73	1000 pF
C824	21-13740B49	100 pF
C827	23-11048B05	lytic 1 uF 20% 50V
C828	21-13741B69	.1 uF
C829	21-13741B45	.01 uF
C830	21-13740B31	18pF
C831	21-13740B21	6.8 +/- .25 pF
C832	21-13740B30	16 pF
C834	21-13741B69	.1 uF
C835	21-13741B69	.1 uF
C836	21-13740B73	1000 pF
C841	21-13740B73	1000 pF
C843	21-13740B73	1000 pF
C844	21-13740B73	1000 pF
C845	21-13740B73	1000 pF
C846	21-13740B73	1000 pF
C847	21-13740B73	1000 pF
C851	21-13740B73	1000 pF
C854	21-13740B73	1000 pF
C855	23-11013A56	tantalum 47 uF 20% 6V
C856	21-13740B49	100 pF
C857	21-13740B73	1000 pF
C858	21-13740B73	1000 pF
C869	21-13740B73	1000 pF
C870	21-13740B49	100 pF
C914		not used
C915		not used
C916		not used
C917		not used
C918		not used
C919		not used
C920		not used
C922		not used

Diodes (see note)

CR401	48-05129M76	silicon SOT
CR402	48-83654H02	silicon
CR403	48-05129M76	silicon SOT
CR451	48-05129M76	silicon SOT
CR551	48-05129M76	silicon SOT
CR603	48-84336R03	dual silicon SOT MMBD7000
CR651	48-05129M76	silicon SOT
CR801	48-05129M76	silicon SOT

Fuse

F801	65-05214E04	2 amp axial lead
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Connector, receptacle

J3	28-80923V01	16-pin, accessories
J6	09-80130M03	14-pin, RF board
J7	28-80128M03	6 pin, RF power amplifier
J8	28-80600B01	27-pin, includes J8 and J9

Jumpers

JU551	09-80601B01	push-on jumper, 2-pin
JU601	09-80601B01	push-on jumper, 2-pin
JU651	09-80601B01	push-on jumper, 2-pin
JU809	09-80601B01	push-on jumper, 2-pin

Coils

L801	24-11087A42	chip 22 uH ferrite
L802	24-11087A42	chip 22 uH ferrite
L803	24-11087A42	chip 22 uH ferrite

Connector, Plug

P551	28-80002R03	3-pin header
P601	28-80002R03	3-pin header
P651	28-80002R03	3-pin header
P809	28-80002R03	3-pin header

Transistors (see note)

Q401	48-00869619	PNP, type M9619
Q402	48-80214G02	NPN; type MMBT3904
Q403	48-05128M67	PNP; type MMBT3906
Q404	48-80214G02	NPN; type MMBT3904
Q452	48-00869619	PNP, type M9619
Q453	48-80214G02	NPN; type MMBT3904
Q454	48-80214G02	NPN; type MMBT3904
Q455	48-80141L03	PNP, type M41L03
Q501	48-80214G02	NPN; type MMBT3904
Q551	48-80949V01	field effect; type MMBF5484
Q651	48-05128M67	PNP; type MMBT3906
Q652	48-80214G02	NPN; type MMBT3904
Q801	48-80214G02	NPN; type MMBT3904
Q802	48-80141L03	PNP, type M41L03
Q803	48-80947V01	digital NPN; type DTC144W
Q804	48-80214G02	NPN; type MMBT3904
Q805	48-80947V01	digital NPN; type DTC144W
Q806	48-80947V01	digital NPN; type DTC144W
Q807	48-80214G02	NPN; type MMBT3904
Q808	48-80214G02	NPN; type MMBT3904
Q809	48-80214G02	NPN; type MMBT3904
Q810	48-80214G02	NPN; type MMBT3904
Q811	48-80947V01	digital NPN; type DTC144W
Q812	48-80947V01	digital NPN; type DTC144W
Q821	48-80214G02	NPN; type MMBT3904

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R401	06-11077A70	680
R402	06-80195M37	330 1/2 watt
R403	06-11077A70	680
R404	06-11077F18	1.74k 1%
R405	06-11077F28	2.21k 1%
R406	06-11077A98	10k
R407	06-11077A76	1.2k
R408	06-11077F91	10.0k 1%
R409	06-11077F91	10.0k 1%
R410	06-11077A80	1.8k
R411	06-11077A78	1.5k
R412	06-11077A84	2.7k
R413	06-11077A98	10k
R414	06-11077A98	10k
R453	06-11077A70	680
R454	06-80195M37	330 1/2 watt
R455	06-11077A70	680
R456	06-11077A82	2.2k
R457	06-11077A76	1.2k
R458	06-11077A90	4.7k
R459	06-11077A90	4.7k
R460	06-11077B01	12k
R461	06-11077A70	680
R462	06-11077B29	180k
R463	06-11077B25	120k
R464	06-11077G88	100k 1%
R465	06-11077G88	100k 1%
R466	06-11077F91	10.0k 1%
R467	06-11077F91	10.0k 1%
R468	06-11077A60	270
R469	06-11077A74	1k
R470	06-11077A98	10k
R471	06-11077B07	22k
R472	06-11077A92	5.6k
R473	06-11077B09	27k

R474	06-11077A98	10k
R501	06-11077B23	100k
R502	06-11077A90	4.7k
R503	06-11077A78	1.5k
R551	06-11077A94	6.8k
R552	06-11077B37	390k
R553	06-11077B18	62k
R554	06-11077B18	62k
R555	06-11077B18	62k
R556	06-11077F53	4.02k 1%
R557	06-11077F20	1.82k 1%
R558	06-11077G42	33.2k 1%
R559	06-11077G88	100k 1%
R560	06-11077E77	665 1%
R561	06-11077G88	100k 1%
R562	06-11077B16	51k
R563	06-11077B15	47k
R567	06-11077A86	3.3k
R568	06-11077B07	22k
R569	06-11077A42	47
R570	06-11077B23	100k
R573	06-11077B09	27k
R574	06-11077A98	10k
R575	06-11077B10	30k
R576	06-11077B10	30k
R577	06-11077B23	100k
R578	06-11077A42	47
R581	06-11077A68	560
R601	06-11077A98	10k
R602	06-11077B47	1 meg
R603	06-11077A74	1k
R607		not used
R608		not used
R609	06-11077B11	33k
R610	06-11077B15	47k
R611	06-11077G42	33.2k 1%
R612	06-11077G42	33.2k 1%
R613	06-11077G42	33.2k 1%
R615	06-11077G95	118k 1%
R616	06-11077G31	25.5k 1%
R617	06-11077A82	2.2k
R620	06-11077A98	10k
R622	06-11077B31	220k
R651	06-11077A68	560
R652	06-11077A50	100
R653	06-11077A98	10k
R654	06-11077A98	10k
R655	06-11077A90	4.7k
R656	06-11077B39	470k
R657	06-11077B42	620k
R658	06-11077H65	619k 1%
R659	06-11077A82	2.2k
R660	06-11077B19	68k
R661	06-11077B03	15k
R662	06-11077B17	56k
R663	06-11077B18	62k
R664	06-11077B07	22k
R665	06-11077A84	2.7k
R666	06-11077B23	100k
R667	06-11077B23	100k
R668	06-11077G56	46.4k 1%
R669	06-11077G42	33.2k 1%
R670	06-11077G42	33.2k 1%
R671	06-11077A61	300
R672	06-11077B17	56k
R673	06-11077B23	100k
R674	06-11077A82	2.2k
R701	06-11077G88	100k 1%
R702	06-11077H13	178k 1%
R703	06-11077G31	25.5k 1%
R705	06-11077H13	178k 1%
R706	06-11077G56	46.4k 1%
R707	06-11077G95	118k 1%
R708	06-11077B15	47k
R709	06-11077B19	68k
R710	06-11077G13	16.5k 1%
R711	06-11077G13	16.5k 1%
R714	06-11077B10	30k

2-LAYER LOGIC

R715	06-11077B05	18k
R716	06-11077A86	3.3k
R801	06-11077A78	1.5k
R802	06-11077A84	2.7k
R803	06-11077A98	10k
R804	06-11077A90	4.7k
R807	06-11077B15	47k
R808	06-11077A90	4.7k
R809	06-11077A90	4.7k
R810	06-11077B17	56k
R811	06-11077B17	56k
R812	06-11077A90	4.7k
R813	06-11077A90	4.7k
R814	06-11077A90	4.7k
R815	06-11077A90	4.7k
R816	06-11077B23	100k
R817	06-11077B23	100k
R818	06-11077B23	100k
R822	06-11077B15	47k
R825	06-11077B15	47k
R826	06-11077A90	4.7k
R827	06-11077A98	10k
R828	06-11077A98	10k
R831	06-11077A74	1k
R832	06-11077A74	1k
R833	06-11077A98	10k
R836	06-11077A98	10k
R842	06-11077A74	1k
R845	06-11077A74	1k
R846	06-11077A98	10k
R847	06-11077A74	1k
R849	06-11077A98	10k
R850	06-11077A74	1k
R851	06-11077B15	47k
R852	06-11077B15	47k
R853	06-11077B45	820k
R854	06-11077A90	4.7k
R857	06-11077A98	10k
R858	06-11077A98	10k
R859	06-11077A98	10k
R860	06-11077A98	10k
R862	06-11077F95	11.0k 1%
R863	06-11077F91	10.0k 1%
R864	06-11077F20	1.82k 1%
R865	06-11077A98	10k
R866	06-11077A98	10k
R867	06-11077A98	10k
R868	06-11077A98	10k
R869	06-11077A98	10k
R870	06-11077A98	10k
R871	06-11077A98	10k
R872	06-11077A98	10k
R876	06-11077A98	10k
R877	06-11077B23	100k
R878	06-11077B23	100k
R879	06-11077B23	100k
R880	06-11077B15	47k
R883	06-11077A90	4.7k
R884	06-11077B15	47k
R887	06-11077A90	4.7k
R889	06-11077A68	560
R890	06-11077A98	10k
R918	06-11077A98	10k
R919	06-11077A98	10k

Integrated circuits and modules (see note)

U401	51-02198J22	dual op-amp 4558 SOIC
U402	51-80942T01	regulator, 5V with reset
U451	51-02198J22	dual op-amp 4558 SOIC
U501	51-80147R01	audio power amp TDA1519A
U551	51-02198J22	dual op-amp 4558 SOIC
U552	51-02198J22	dual op-amp 4558 SOIC
U553	51-02198J22	dual op-amp 4558 SOIC
U601	51-02198J23	dual comparator 2903 SOIC
U602	51-02198J22	dual op-amp 4558 SOIC
U603	51-02198J22	dual op-amp 4558 SOIC
U651	51-02198J22	dual op-amp 4558 SOIC

U652	51-02198J22	dual op-amp 4558 SOIC
U653	51-80059M01	voltage-controlled attenuator
U801	51-80135C10	D/A converter MC144110
U802	51-80649B02	microcomputer MC68HC11E9

Voltage regulators (see note)

VR401	48-83461E40	zener diode 5.1V 1%
VR402	48-80140L06	zener diode 5.1V SOT
VR551	48-80140L15	zener diode 10V SOT
VR552	48-80140L15	zener diode 10V SOT
VR801	48-80948V01	zener diode 27V SOT
VR802	48-80948V01	zener diode 27V SOT
VR803		not used
VR804		not used
VR805		not used
VR807		not used
VR811	48-80948V01	zener diode 27V SOT
VR812	48-82256C20	zener diode 27V
VR813	48-80948V01	zener diode 27V SOT
VR814	48-80948V01	zener diode 27V SOT

Crystals

Y801	48-80173D09	7.776 MHz
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Non-referenced items

03-10943M04	screw M2.5 X 8 (2 used, for Q401 and Q452)
03-80271L01	screw (2 used for U501)
04-00136334	washer flat (2 used for U501)
14-83820M05	insulator (2 used, for Q401 and Q452)
26-80497B01	heatsink
01-80701Y58	connector assembly (mates with J3)
09-82071K09	14 pin socket (2 used for U804)
26-80123M02	logic shield frame

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

6/17/93

PL-921011-A

HLD8299A PA Board, 146-174 MHz, 1-10 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2210	21-13740B49	100 pF
C2211	21-13740B34	24 pF
C2212		not used
C2213	21-13740B65	470 pF
C2214	21-13740B65	470 pF
C2215	21-13740B47	82 pF
C2216	21-13741B69	.1 uF
C2217	21-13740B73	1000 pF
C2218	21-13740B65	470 pF
C2219	21-13741B69	.1 uF
C2220		not used
C2221	21-13740B65	470 pF
C2223	21-13740B65	470 pF
C2224		not used
C2225		not used
C2226	21-13741B69	.1 uF
C2227	21-13740B65	470 pF
C2229	21-13740B73	1000 pF
C2230	21-13740B53	150 pF
C2231	21-13740B47	82 pF
C2234	21-13741B69	.1 uF
C2235	21-13740B65	470 pF
C2236	21-13741B69	.1 uF
C2240		not used
C2241		not used
C2242		not used
C2243	21-13740B46	75 pF
C2244	21-13740B34	24 pF
C2245	21-13740B40	43 pF
C2250	21-13740B65	470 pF
C2251	21-13740B19	5.6 +/- .25 pF
C2252	21-13740B40	43 pF
C2253	21-13740B65	470 pF
C2260	21-13740B33	22 pF
C2261	21-13740B34	24 pF
C2262	21-13740B35	27 pF
C2263	21-13740B34	24 pF
C2264	21-13740B30	16 pF
C2265	21-13740B65	470 pF
C2270	21-13740B65	470 pF
C2271	21-13740B49	100 pF
C2272	21-13740B73	1000 pF
C2273	21-13741B69	.1 uF
C2274	21-13740B65	470 pF
C2275	21-13740B65	470 pF
C2276	21-13740B65	470 pF
C2277	21-13741B69	.1 uF
C2278	21-13740B49	100 pF
C2279	21-13740B65	470 pF
C2280	21-13740B49	100 pF
C2281	21-13741B69	.1 uF
C2282	08-11051A17	poly .47 uF 63V
C2283		not used

Diodes (see note)

CR2250	48-80010E01	PIN UM9401
CR2251	48-80010E01	PIN UM9401
CR2270	48-80236E07	transient suppressor diode

Ferrite Beads

E2210	24-84657R01	ferrite bead
E2211	24-84657R01	ferrite bead
E2230	24-84657R01	ferrite bead
E2270	24-84657R01	ferrite bead
E2271	24-84657R01	ferrite bead

Coils

L2210	24-11030B10	5-1/2 turn RED
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L2211	24-11030A03	4 turns YEL
L2212	24-11030E05	1/2 turn GRN
L2213	24-11030B15	10-1/2 turns WHT
L2214	24-11030B11	6-1/2 turns ORN
L2215	24-11030B10	5-1/2 turns RED
L2223	24-82723H46	.2 uH
L2230	24-11030B15	10-1/2 turns WHT
L2231	24-11030B07	3-1/2 turns WHT
L2240	24-11030B07	3-1/2 turns WHT
L2250	24-11087B28	chip 1.5 uH
L2251	24-11030B10	5-1/2 turns RED
L2252	24-11087B28	chip 1.5 uH
L2260	24-11030B11	6-1/2 turns ORN
L2261	24-11030B12	7-1/2 turns YEL
L2262	24-11030B12	7-1/2 turns YEL
L2263	24-11030B11	6-1/2 turns ORN
L2264	24-11030B15	10-1/2 turns WHT

Transistors (see note)

Q2210	48-82233P39	NPN; type MRF559
Q2220	48-80225C23	NPN; type MRF237

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2210	06-11077A60	270
R2211	06-11077A58	220
R2212	06-11077A52	120
R2213	06-11077A38	33
R2214	06-11077A40	39
R2215	06-11077A26	10
R2216		not used
R2217	06-11077A43	51
R2218	06-11077A33	20
R2219	06-11077A26	10
R2220	06-11077A38	33
R2230	06-11077A26	10
R2233	06-11077A26	10
R2250	06-80194M15	39 1 watt
R2251	06-80194M15	39 1 watt
R2270	06-11077B11	33k
R2271	06-11077A80	1.8k
R2272	06-05621T02	thermistor 50k
R2273	06-11077A44	56
R2274	06-11086D01	0.2 2 watt

Non-referenced items

26-80158L01	heat sink (for Q2220)
29-80014A03	clip coax terminal (2 used)

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

1/7/93

PL-921028-O

PA 146-174 MHz (1-10W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Non-referenced items

01-80556B01		6-wire cable assembly (includes P7)
01-80634B01		feedthru bracket assembly (includes C2201 through C2206, 470 pF feedthru capacitors, 6 used)

HLN8274A PA Hardware Kt, 146-174 MHz, 1-10 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip

C2238	21-11078B25	27 pF 100V
C2239	21-11078B25	27 pF 100V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2230	48-80225C18	NPN; type MRF2628
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Non-referenced items

02-00007003		nut 8-32x5/16x1/8 (for J1)
03-10943M10		screw M3x.5x8 (6 used)
03-10943M11		screw M3x.5x10 (2 used for J2)
04-00131974		washer (2 used for J2)
04-05587G01		washer nylon (for J2)
04-80943V01		lockwasher (for J1)
26-80124L01		heat sink
26-80223M07		PA shield
32-80014N03		gasket, accessory connector
42-80520B01		ground clip, pc board (2 used)

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

1/7/93

PL-921029-O

HLD8033A PA Board, 146-174 MHz, 10-25 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2308		not used
C2309		not used
C2310	21-13740B65	470 pF
C2311	21-13740B27	12 pF
C2312	21-13740B65	470 pF
C2313	21-13740B65	470 pF
C2314	21-13741B69	.1 uF
C2315	21-13740B51	120 pF
C2316	21-13740B65	470 pF
C2317	21-13740B41	47 pF
C2318	21-13740B49	100 pF
C2319	21-13740B65	470 pF
C2320	21-13740B65	470 pF
C2321	21-11032B15	.22 uF +80/-20%
C2322	21-13741B69	.1 uF
C2323	21-13740B65	470 pF
C2324	21-13740B32	20 pF
C2325	21-13740B35	27 pF
C2326	21-13740B41	47 pF
C2327	21-13740B65	470 pF
C2330	21-13740B41	47 pF
C2331	21-13740B47	82 pF
C2332		not used
C2334		not used
C2336	21-80060M43	100 pF 100V
C2337	21-80060M39	68 pF 500V
C2338	21-80060M25	18 pF 500V
C2339	21-11032B15	.22 uF +80/-20%
C2340	21-80060M19	10 pF 500V
C2341	21-13740B53	150 pF
C2342		not used
C2343	21-80060M43	100 pF 100V
C2351	21-13740B29	15 pF
C2352	21-13740B53	150 pF
C2353	21-13740B59	270 pF
C2354	21-13740B65	470 pF
C2360	21-80060M29	27 pF 500V
C2361	21-80060M29	27 pF 500V
C2362	21-80060M29	27 pF 500V
C2363	21-80060M30	30 pF 500V
C2364	21-80060M27	22 pF 500V
C2365	21-13740B73	1000 pF
C2370	21-13740B65	470 pF
C2371	21-13741B69	.1 uF
C2372	21-13740B51	120 pF
C2373	21-13740B65	470 pF
C2374	21-13740B65	470 pF
C2375	21-13740B65	470 pF
C2376	21-13741B69	.1 uF
C2378	23-11048A17	lytic 33 uF 20% 25V
C2379	21-13740B65	470 pF
C2380	21-13740B65	470 pF

Diodes (see note)

CR2350	48-80010E01	silicon PIN UM9401
CR2351	48-80010E01	silicon PIN UM9401
CR2370	48-80236E07	transient suppressor diode

Ferrite Beads

E2370	76-83960B01	ferrite bead 1/2 turn
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Coils

L2310	24-11030A04	5 turns GRN
L2311	24-11030B07	3-1/2 turns WHT
L2312	24-11030E01	1/2 turn BRN
L2313	24-11030B15	10-1/2 turns WHT
L2321	24-80036A01	ferrite bead 1/2 turn
L2322	24-11030B07	3-1/2 turns WHT

L2323	24-80036A01	ferrite bead 1/2 turn
L2324	24-82723H46	.2 uH
L2325	24-11030B02	1-1/2 turns RED
L2330	24-11030E04	1/2 turn YEL
L2331	24-11030B07	3-1/2 turn WHT
L2332	24-80036A01	ferrite bead 1/2 turn
L2333	24-11030B07	3-1/2 turns WHT
L2334	24-11030E04	1/2 turn YEL
L2335	24-11030A02	3 turns ORG
L2336	24-11030A03	4 turns YEL
L2350	24-82723H49	1.2 uH
L2351	24-11030B10	5-1/2 turns RED
L2352	24-82723H44	.039 uH
L2353	24-82723H49	1.2 uH
L2360	24-11030A05	6 turns BLU
L2361	24-11030B12	7-1/2 turns YEL
L2362	24-11030B12	7-1/2 turns YEL
L2363	24-11030A05	6 turns BLU
L2364	24-11030B15	10-1/2 turns WHT
L2370	24-84346A02	.23 uH

Transistors (see note)

Q2310	48-82233P39	NPN; type 33P39
Q2320	48-80225C23	NPN; type MRF237

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2307	06-11077A62	330
R2310	06-11077A46	68
R2311	06-11077A58	220
R2312	06-11077A60	270
R2313	06-11077A26	10
R2314	06-11077A26	10
R2320	06-11077A26	10
R2321	06-11077A50	100
R2329		not used
R2331	06-80279M01	metal film 82 3 watt
R2332	06-11077A26	10
R2350	06-11009A39	390 1/4 watt
R2351	06-11077A66	470
R2352	06-11077A66	470
R2353	06-11077A50	100
R2370	06-11077A38	33
R2371	06-80147M01	metal plate .05 2 watt
R2372	06-05621T02	thermistor 50k
R2373	06-11077B11	33k
R2374	06-11077A74	1k

Non-referenced items

26-80158L01	heat sink (for Q2320)
26-80275M01	heat sink, diode (2 used for CR2350 and CR2351)
29-80014A03	clip coax terminal (2 used)

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

8/20/92

PL-921015-A

PA 146-174 MHz (10-25W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2301 through C2306, 470 pF feedthru capacitors, 6 used)

HLN8069A PA Hardware Kit, VHF 25 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip		
C2329		not used
C2333	21-11078B52	240 pF 100V
C2335	21-11078B34	47 pF 100V
Connector, receptacle		
J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)
Connector, plug		
P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug
Transistors		
Q2330	48-80225C22	NPN; type MRF1946
Non-referenced items		
	02-00007003	nut 8-32x5/16x1/8 (for J1)
	03-10943M10	screw M3x.5x8 (8 used)
	03-10943M11	screw M3x.5x10 (2 used for J2)
	04-00131974	washer (2 used for J2)
	04-05587G01	washer nylon (for J2)
	04-80943V01	lockwasher (for J1)
	26-80124L01	heat sink
	26-80223M07	PA shield
	32-80014N03	gasket, accessory connector
	38-80014N01	plug button
	42-80281L01	ground clip (2 used for Q2330)
	42-80520B01	ground clip, pc board (2 used)

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

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PL-921016-A

HLD8287A PA Board, 146-174 MHz, 25-45 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2410	21-13740B65	470 pF
C2411	21-13740B29	15 pF
C2412	21-13740B61	330 pF
C2413	21-13740B45	68 pF
C2414	21-13740B65	470 pF
C2415	21-13740B65	470 pF
C2420	21-13740B37	33 pF
C2421	21-13740B41	47 pF
C2422	08-11051A17	poly .47 uF 63V
C2423	21-13740B52	130 pF
C2424	21-13740B37	33 pF
C2430	21-13740B49	100 pF
C2431	21-13740B36	30 pF
C2432	21-13740B65	470 pF
C2433	21-13740B65	470 pF
C2434	21-13741B69	.1 uF
C2435	08-11051A19	poly 1 uF 63V
C2440	21-11078B59	470 pF 100V
C2443	21-13740B65	470 pF
C2444	08-11051A17	poly .47 uF 63V
C2447	21-11078B38	68 pF 100V
C2448	21-11078B38	68 pF 100V
C2449	21-80060M42	91 pF 500V
C2450	21-80060M34	43 pF 500V
C2451	21-11078B59	470 pF 100V
C2452		not used
C2453	21-11078B44	120 pF 100V
C2454	21-13740B25	10 pF
C2455	21-13740B65	470 pF
C2456		not used
C2460	21-80060M30	30 pF 500V
C2461	21-80060M30	30 pF 500V
C2462	21-80060M30	30 pF 500V
C2463	21-80060M27	22 pF 500V
C2464	21-11078B59	470 pF 100V
C2468	21-11078B38	68 pF 100V
C2469	21-11078B38	68 pF 100V
C2470	21-13740B65	470 pF
C2471	21-13740B65	470 pF
C2472	21-13740B65	470 pF
C2473	21-13740B65	470 pF
C2474	21-13740B65	470 pF
C2475	21-13740B51	120 pF
C2476	21-13740B65	470 pF
C2477	21-13741B69	.1 uF
C2478	21-13741B69	.1 uF
C2479	21-13740B65	470 pF
C2480	21-13741B69	.1 uF
C2481	21-13740B65	470 pF
C2482	21-13740B65	470 pF

Diodes (see note)

CR2450	48-80010E01	silicon PIN
CR2451	48-80010E01	silicon PIN
CR2470	48-80236E07	transient suppressor diode

Ferrite Beads

E2410	24-80036A01	ferrite bead 1/2 turn
E2420	24-80036A01	ferrite bead 1/2 turn
E2430	24-80036A01	ferrite bead 1/2 turn
E2440	24-80036A01	ferrite bead 1/2 turn
E2470	76-83960B01	ferrite bead 1/2 turn
E2471	76-83960B01	ferrite bead 1/2 turn

Coils

L2410	24-11030A01	2 turns RED
L2411	24-11030B07	3-1/2 turns WHT
L2412	24-11030B15	10-1/2 turns WHT

L2413	24-11030A06	7 turns VIO
L2420	24-11030E06	1/2 turn BLU
L2421	24-82723H49	1.2 uH
L2422	24-11030E01	1/2 turn BRN
L2423	24-11030E04	1/2 turn YEL
L2430	24-11030B07	3-1/2 turns WHT
L2431	24-11030D03	4 turns YEL
L2440	24-11030D03	4 turns YEL
L2441	24-80908T25	3-1/2 turns RED
L2443	24-80908T09	1-1/2 turns RED
L2450	24-82835G25	1.5 uH 5%
L2451		not used
L2452	24-80908T23	3-1/2 turns RED
L2453	24-82723H44	39 nH
L2460	24-80908T22	3-1/2 turns GRN
L2461	24-80908T23	3-1/2 turns RED
L2462	24-80908T22	3-1/2 turns GRN
L2463	24-11030B15	10-1/2 turns WHT
L2470	24-82723H46	.2 uH
L2471	24-84346A02	.23 uH

Transistors (see note)

Q2410	48-82233P39	NPN; type MRF559
Q2420	48-80225C23	NPN; type MRF237

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2410	06-11077A60	270
R2411	06-11077A58	220
R2412	06-11077A46	68
R2413	06-11077A26	10
R2414	06-11077A26	10
R2415	06-11077A44	56
R2420	06-11077A50	100
R2430	06-11009C37	330 1/4 watt FCF
R2431	06-11077A46	68
R2440	06-11086A27	47 1 watt FMO
R2450	06-80194M15	39 1 watt
R2451	06-80194M15	39 1 watt
R2470	06-11077A30	15
R2471	06-80147M02	metal plate .01 10% 2 watt
R2472	06-05621T02	thermistor 50k
R2473	06-11077B11	33k
R2474	06-11077A76	1.2k

Non-referenced items

26-80158L01	heat sink (for Q2420)
26-80275M01	heat sink (2 used for CR2450 and CR2451)
29-80014A03	clip coax terminal (2 used)

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

12/2/92

PL-921035-O

PA 146-174 MHz (25-45W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2401 through C2406, 470 pF feedthru capacitors, 6 used)

HLN8289A PA Hardware Kit, 146-174 MHz, 25-45 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip		
C2436	21-11078B38	68 pF 100V
C2441	21-11078B54	300 pF 100V
C2442	21-11078B54	300 pF 100V
C2445	21-11078B25	27 pF 100V
C2446	21-11078B25	27 pF 100V
C2466	21-11078B25	27 pF 100V
C2467	21-11078B25	27 pF 100V
Connector, receptacle		
J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)
Connector, plug		
P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug
Transistors		
Q2430	48-80225C18	NPN; type MRF2628
Q2440	48-84411L04	NPN; type M1104
Non-referenced items		
	02-00007003	nut 8-32x5/16x1/8 (for J1)
	03-10943M10	screw M3x.5x8 (8 used)
	03-10943M11	screw M3x.5x10 (2 used for J2)
	04-00131974	washer (2 used for J2)
	04-05587G01	washer nylon (for J2)
	04-80943V01	lockwasher (for J1)
	26-80124L01	heat sink
	26-80223M07	PA shield
	32-80014N03	gasket, accessory connector
	42-80281L01	ground clip (2 used for Q2440)
	42-80520B01	ground clip, pc board (2 used)

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

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PL-921036-O

HLE8275A PA Board, 403-433 MHz, 25/40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2710	21-13740B49	100 pF
C2711	21-13740B27	12 pF
C2712	21-13740B34	24 pF
C2713	21-13740B73	1000 pF
C2714	21-13740B73	1000 pF
C2715	21-13740B21	6.8 +/- .25 pF
C2716	21-13741B69	.1 uF
C2717	21-13740B36	30 pF
C2718	21-13740B49	100 pF
C2719		not used
C2720	21-13740B32	20 pF
C2721	21-13740B32	20 pF
C2722		not used
C2723		not used
C2724		not used
C2725		not used
C2726	21-13740B49	100 pF
C2727	21-13740B73	1000 pF
C2728	21-11032B15	.22 uF +80/-20%
C2729	21-13740B36	30 pF
C2730	21-13740B32	20 pF
C2731	21-11078B25	27 pF 100V
C2732	21-11078B25	27 pF 100V
C2733	21-11032B15	.22 uF +80/-20%
C2735		not used
C2736	21-13740B49	100 pF
C2737	21-13740B73	1000 pF
C2738	21-13741B69	.1 uF
C2739	23-11048A17	lytic 33 uF 20% 25V
C2740	21-11078B35	51 pF 100V
C2745	21-80060M20	11 pF 500V
C2746	21-80060M13	7 +/- .25 pF 500V
C2747	21-80060M31	33 pF 500V
C2748	21-11032B15	.22 uF +80/-20%
C2749	21-13740B49	100 pF
C2750	21-80060M26	20 pF 500V
C2751	21-13740B17	4.7 +/- .25 pF
C2752		not used
C2753	21-13740B27	12 pF
C2754	21-13740B49	100 pF
C2755	21-13740B49	100 pF
C2756	21-80060M20	11 pF 500V
C2757	21-80060M13	7 +/- .25 pF 500V
C2758		not used
C2760	21-80060M19	10 pF 500V
C2761	21-80060M15	8 +/- .25 pF 500V
C2762	21-80060M17	9 +/- .25 pF 500V
C2763	21-80060M11	6 +/- .25 pF 500V
C2764	21-80060M43	100 pF 100V
C2765	23-11048A17	lytic 33 uF 20% 25V
C2768		not used
C2770	21-13740B36	30 pF
C2771	21-13740B36	30 pF
C2772	21-13740B73	1000 pF
C2773	21-13741B69	.1 uF
C2774	21-13740B36	30 pF
C2775	08-11051A17	poly .47 uF 63V
C2776	21-13740B36	30 pF
C2777	21-13740B73	1000 pF
C2778	21-13741B69	.1 uF
C2779	21-13740B36	30 pF
C2780	21-13740B36	30 pF
C2781		not used
C2782		not used

Diodes (see note)

CR2750	48-80010E01	silicon PIN UM9401
CR2751	48-80010E01	silicon PIN UM9401
CR2770	48-80236E07	transient suppressor diode

Ferrite Beads

E2722	76-83960B01	ferrite bead 1/2 turn
E2770	76-83960B01	ferrite bead 1/2 turn
E2771	76-83960B01	ferrite bead 1/2 turn

Coils

L2710	24-11030E02	1/2 turn RED
L2711	24-11030B04	1-1/2 turns YEL
L2712	24-11030E04	1/2 turn YEL
L2713	24-11030B01	1-1/2 turns BRN
L2714	24-80036A01	ferrite bead 1/2 turn
L2720	24-11030E01	1/2 turn BRN
L2721		not used
L2722	24-82723H44	.039 uH
L2730	24-11030A03	4 turns YEL
L2731	24-80036A01	ferrite bead 1/2 turn
L2732	24-11030A06	7 turns VIO
L2740	24-80036A01	ferrite bead 1/2 turn
L2741	24-11030A02	3 turns ORN
L2742	24-80908T11	1-1/2 turns RED
L2743	24-80908T01	1-1/2 turns RED
L2744		not used
L2750	24-82723H40	.29 uH
L2751	24-11030B04	1-1/2 turns YEL
L2752	24-82723H40	.29 uH
L2753	24-11030B11	6-1/2 turns ORN
L2760	24-80908T08	1-1/2 turns GRN
L2761	24-80908T10	1-1/2 turns GRN
L2762	24-80908T11	1-1/2 turns RED
L2763	24-11030B11	6-1/2 turns ORN
L2770	24-82723H46	.2 uH
L2771	24-84346A02	.23 uH

Transistors (see note)

Q2710	48-82233P39	NPN; type MRF559
Q2720	48-80225C09	NPN; type MRF630

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2710	06-11077A60	270
R2711	06-11077A58	220
R2712	06-11077A52	120
R2713	06-11077A38	33
R2714	06-11077A38	33
R2715	06-11077A62	330
R2720	06-11077A26	10
R2740		not used
R2741	06-02369M10	metal film 5.6 0.6 watt
R2750	06-80194M15	39 1 watt
R2751	06-80194M15	39 1 watt
R2770	06-80147M02	metal plate .01 10% 2 watt
R2771	06-11077A28	12
R2772	06-05621T02	thermistor 50k
R2773	06-11077B11	33k
R2774	06-11077A76	1.2k
R2775	06-11077A26	10

Non-referenced items

26-80158L01	heat sink (for Q2720)
26-80275M01	heat sink (2 used for CR2750 and CR2751)
29-80014A03	clip coax terminal (2 used)

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

11/25/92

PL-921030-0

PA 403-433 MHz (25/40W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Non-referenced items

01-80556B01	6-wire cable assembly (includes P7)
01-80634B01	feedthru bracket assembly (includes C2701 through C2706, 470 pF feedthru capacitors, 6 used)

HLN8277A PA Hardware Kit, 403-433 MHz, 25/40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitors, chip

C2741	21-11078B36	56 pF 100V
C2742	21-11078B37	62 pF 100V
C2743	21-11078B35	51 pF 100V
C2744	21-11078B35	51 pF 100V
C2766		not used
C2767		not used

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2730	48-80225C19	NPN; type MRF654
Q2740	48-80225C24	NPN; type MRF650

Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L03	heat sink
26-80223M07	PA shield
26-80514C01	filter shield
26-80551C01	antenna connector shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2740)

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

11/25/92

PL-921031-O

HLE8267A PA Board, 438-470 MHz, 1-10 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2510	21-13740B49	100 pF
C2511	21-13740B27	12 pF
C2512	21-13740B29	15 pF
C2513	21-13740B73	1000 pF
C2514	21-13740B73	1000 pF
C2515	21-13740B21	6.8 +/- .25 pF
C2516	21-13741B69	.1 uF
C2517	21-13740B36	30 pF
C2518	21-13740B49	100 pF
C2519	21-13740B73	1000 pF
C2520	21-13740B29	15 pF
C2521	21-13740B35	27 pF
C2522		not used
C2523		not used
C2526	21-13740B49	100 pF
C2527	21-13740B73	1000 pF
C2528	21-11032B15	.22 uF +80/-20%
C2529	21-13740B36	30 pF
C2530	21-13740B37	33 pF
C2531	21-13740B31	18 pF
C2532	21-13740B31	18 pF
C2536	21-13740B49	100 pF
C2537	21-13740B73	1000 pF
C2538	21-13741B69	.1 uF
C2539		not used
C2540	21-13740B09	2.2 +/- .25 pF
C2541	21-13740B31	18 pF
C2542	21-13740B21	6.8 +/- .25 pF
C2543	21-13740B29	15 pF
C2547	21-13740B49	100 pF
C2548	21-11032B15	.22 uF +80/-20%
C2549	21-13740B49	100 pF
C2550		not used
C2551	21-13740B29	15 pF
C2552		not used
C2553	21-13740B49	100 pF
C2554	21-13740B49	100 pF
C2555	21-13740B49	100 pF
C2560	21-13740B19	5.6 +/- .25 pF
C2561	21-13740B22	7.5 +/- .25 pF
C2562	21-13740B22	7.5 +/- .25 pF
C2563	21-13740B15	3.9 +/- .25 pF
C2564	21-13740B49	100 pF
C2570	21-13740B36	30 pF
C2574	21-13740B36	30 pF
C2575	08-11051A17	poly .47 uF 63V
C2576	21-13740B49	100 pF
C2577	21-13740B73	1000 pF
C2578	21-13741B69	.1 uF
C2579	21-13740B36	30 pF
C2580	21-13740B49	100 pF

Diodes (see note)

CR2550	48-80010E01	silicon PIN UM9401
CR2551	48-80010E01	silicon PIN UM9401
CR2570	48-80236E07	transient suppressor diode

Ferrite Beads

E2520	24-84657R01	ferrite bead
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Coils

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
L2550	24-82723H40	.29 uH
L2551	24-11030B03	1-1/2 turns ORN
L2552	24-82723H40	.29 uH
L2553	24-11030B11	6-1/2 turns ORN
L2560	24-11030B02	1-1/2 turns RED
L2561	24-11030B03	1-1/2 turns ORN
L2562	24-11030B02	1-1/2 turns RED
L2563	24-11030B11	6-1/2 turns ORN
L2570	24-80036A01	ferrite bead 1/2 turn

Transistors (see note)

Q2510	48-82233P39	NPN; type MRF559
Q2520	48-80225C09	NPN; type MRF630
Q2530	48-80225C19	NPN; type MRF654

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2510	06-11077A58	220
R2511	06-11077A60	270
R2512	06-11077A52	120
R2513	06-11077A40	39
R2514	06-11077A40	39
R2520	06-11077A26	10
R2550	06-80194M15	39 1 watt
R2551	06-80194M15	39 1 watt
R2570	06-11086D01	0.2 2 watt FMO
R2571	06-11077A44	56
R2572	06-05621T02	thermistor 50k
R2573	06-11077B11	33k
R2574	06-11077A80	1.8k
R2575	06-11077A26	10

Non-referenced items

26-80158L01	heat sink (for Q2520)
29-80014A03	clip coax terminal (2 used)

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

12/31/92

PL-921026-O

PA 438-470 MHz (1-10W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2501 through C2506, 470 pF feedthru capacitors, 6 used)

HLN8268A PA Hardware Kit, 438-470 MHz, 1-10 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip, 5%, 50V		
C2533	21-13740B31	18 pF
C2534	21-13740B31	18 pF
Connector, receptacle		
J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)
Connector, plug		
P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug
Non-referenced items		
	02-00007003	nut 8-32x5/16x1/8 (for J1)
	03-10943M10	screw M3x.5x8 (6 used)
	03-10943M11	screw M3x.5x10 (2 used for J2)
	04-00131974	washer (2 used for J2)
	04-05587G01	washer nylon (for J2)
	04-80943V01	lockwasher (for J1)
	26-80124L01	heat sink
	26-80223M07	PA shield
	26-80514C01	filter shield
	26-80551C01	antenna connector shield
	32-80014N03	gasket, accessory connector

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

12/31/92

PL-921027-O

HLE8034A PA Board, 438-470 MHz, 10-25 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2610	21-13740B49	100 pF
C2611	21-13740B27	12 pF
C2612	21-13740B29	15 pF
C2613	21-13740B73	1000 pF
C2614	21-13740B73	1000 pF
C2615	21-13740B21	6.8 +/- .25 pF
C2616	21-13741B69	.1 uF
C2617	21-13740B36	30 pF
C2618	21-13740B49	100 pF
C2619		not used
C2620	21-13740B31	18 pF
C2621	21-13740B34	24 pF
C2622		not used
C2623		not used
C2626	21-13740B49	100 pF
C2627	21-13740B73	1000 pF
C2628	21-11032B15	.22 uF +80/-20%
C2629	21-13740B36	30 pF
C2630	21-13740B37	33 pF
C2631	21-11078B23	24 pF 100V
C2632	21-11078B23	24 pF 100V
C2636	21-13740B49	100 pF
C2637	21-13740B73	1000 pF
C2638	21-13741B69	.1 uF
C2639	08-11051A17	poly .47 uF 63V
C2640	21-80060M33	39 pF 500V
C2645	21-80060M25	18 pF 500V
C2646	21-80060M19	10 pF 500V
C2647	21-80060M31	33 pF 500V
C2648	21-11032B15	.22 uF +80/-20%
C2649	21-13740B49	100 pF
C2650	21-80060M20	11 pF 500V
C2651	21-13740B09	2.2 +/- .25 pF
C2652	21-13740B17	4.7 +/- .25 pF
C2653	21-13740B49	100 pF
C2654	21-13740B49	100 pF
C2655	21-13740B49	100 pF
C2660	21-80060M17	9 +/- .5 pF 500V
C2661	21-80060M19	10 pF 500V
C2662	21-80060M17	9 +/- .5 pF 500V
C2663	21-80060M11	6 +/- .5 pF 500V
C2664	21-80060M43	100 pF 500V
C2670	21-13740B36	30 pF
C2671	21-13740B36	30 pF
C2672	21-13740B73	1000 pF
C2673	21-13741B69	.1 uF
C2674	21-13740B36	30 pF
C2675	08-11051A17	.47 uF 63V
C2676	21-13740B36	30 pF
C2677	21-13740B73	1000 pF
C2678	21-13741B69	.1 uF
C2679	21-13740B36	30 pF
C2680	21-13740B36	30 pF

Diodes (see note)

CR2650	48-80010E01	silicon PIN
CR2651	48-80010E01	silicon PIN
CR2670	48-80236E07	transient suppressor diode

Ferrite Beads

E2620	76-83960B01	ferrite bead 1/2 turn
E2670	76-83960B01	ferrite bead 1/2 turn
E2671	76-83960B01	ferrite bead 1/2 turn

Coils

L2610	24-11030E01	1/2 turn BRN
L2611	24-11030B04	1-1/2 turns YEL
L2612	24-11030E03	1/2 turn ORN

L2613	24-11030B01	1-1/2 turns BRN
L2614	24-80036A01	ferrite bead 1/2 turn
L2620	24-11030E01	1/2 turn BRN
L2621		not used
L2622	24-82723H44	.039 uH
L2630	24-11030A03	4 turns YEL
L2631	24-80036A01	ferrite bead 1/2 turn
L2632	24-80030A06	7 turns VIO
L2640	24-80036A01	ferrite bead 1/2 turn
L2641	24-11030A03	4 turns YEL
L2642	24-11030A02	3 turns ORG
L2643	24-11030E05	1/2 turn GRN
L2650	24-82723H40	.29 uH
L2651	24-11030B05	2 1/2 turns GRN
L2652	24-82723H40	.29 uH
L2653	24-11030B11	6-1/2 turns ORN
L2660	24-11030B04	1-1/2 turns YEL
L2661	24-11030B06	2-1/2 turns BLU
L2662	24-11030B06	2-1/2 turns BLU
L2663	24-11030B11	6-1/2 turns ORN
L2670	24-82723H46	.2 uH
L2671	24-84346A02	.23 uH

Transistors (see note)

Q2610	48-82233P39	NPN; type MRF559
Q2620	48-80225C09	NPN; type MRF630

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2610	06-11077A60	270
R2611	06-11077A58	220
R2612	06-11077A52	120
R2613	06-11077A40	39
R2614	06-11077A40	39
R2620	06-11077A26	10
R2640		not used
R2650	06-11009A39	390 1/4 watt
R2651	06-11077A66	470
R2652	06-11077A66	470
R2653	06-11077A50	100
R2670	06-80147M01	metal plate .05 10% 2 watt
R2671	06-11077A40	39
R2672	06-05621T02	thermistor 50k
R2673	06-11077B11	33k
R2674	06-11077A76	1.2k
R2675	06-11077A26	10

Non-referenced items

26-80158L01	heat sink (for Q2620)
29-80014A03	clip coax terminal (2 used)

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

8/20/92

PL-921017-A

PA 438-470 MHz (10-25W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2601 through C2606, 470 pF feedthru capacitors, 6 used)

HLN8068A PA Hardware Kit, 438-470 MHz, 10-25 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip		
C2641	21-80060M34	43 pF 500V
C2642	21-80060M34	43 pF 500V
C2643	21-80060M33	39 pF 500V
C2644	21-80060M33	39 pF 500V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2630	48-80225C19	NPN; type MRF654
Q2640	48-84411L07	NPN; type M1107

Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2640)
42-80520B01	ground clip, pc board (2 used)

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

8/20/92

PL-921018-A

HLE8271A PA Board, 438-470 MHz, 25-40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2710	21-13740B49	100 pF
C2711	21-13740B27	12 pF
C2712	21-13740B29	15 pF
C2713	21-13740B73	1000 pF
C2714	21-13740B73	1000 pF
C2715	21-13740B21	6.8 +/- .25 pF
C2716	21-13741B69	.1 uF
C2717	21-13740B36	30 pF
C2718	21-13740B49	100 pF
C2719		not used
C2720	21-13740B31	18 pF
C2721	21-13740B34	24 pF
C2722		not used
C2723		not used
C2724		not used
C2725		not used
C2726	21-13740B49	100 pF
C2727	21-13740B73	1000 pF
C2728	21-11032B15	.22 uF +80/-20%
C2729	21-13740B36	30 pF
C2730	21-13740B37	33 pF
C2731	21-11078B23	24 pF 100V
C2732	21-11078B23	24 pF 100V
C2733		not used
C2734		not used
C2735		not used
C2736	21-13740B49	100 pF
C2737	21-13740B73	1000 pF
C2738	21-13741B69	.1 uF
C2739	08-11051A17	poly .47 uF 63V
C2740	21-11078B31	36 pF 100V
C2745	21-80060M11	6 +/- .25 pF 500V
C2746	21-80060M09	5 +/- .25 pF 500V
C2747	21-80060M43	100 pF 500V
C2748	21-11032B15	.22 uF +80/-20%
C2749	21-13740B49	100 pF
C2750	21-80060M20	11 pF 500V
C2751		not used
C2752	21-13740B19	5.6 +/- .25 pF
C2753	21-13740B49	100 pF
C2754	21-13740B65	470 pF
C2755		not used
C2756	21-80060M11	6 +/- .25 pF 500V
C2757	21-80060M09	5 +/- .25 pF 500V
C2758		not used
C2760	21-80060M15	8 +/- .25 pF 500V
C2761	21-80060M19	10 pF 500V
C2762	21-80060M19	10 pF 500V
C2763	21-80060M10	5.5 +/- .25 pF 500V
C2764	21-80060M43	100 pF 100V
C2765	23-11048A17	lytic 35 uF 20% 25V
C2768		not used
C2770	21-13740B36	30 pF
C2771	21-13740B36	30 pF
C2772	21-13740B73	1000 pF
C2773	21-13741B69	.1 uF
C2774	21-13740B36	30 pF
C2775	08-11051A17	poly .47 uF 63V
C2776	21-13740B36	30 pF
C2777	21-13740B73	1000 pF
C2778	21-13741B69	.1 uF
C2779	21-13740B36	30 pF
C2780	21-13740B36	30 pF
C2781		not used
C2782		not used

Diodes (see note)

CR2750	48-80010E01	silicon PIN UM9401
CR2751	48-80010E01	silicon PIN UM9401
CR2752		not used

CR2770 48-80236E07 transient suppressor diode

Ferrite Beads

E2720	76-83960B01	ferrite bead 1/2 turn
E2770	76-83960B01	ferrite bead 1/2 turn
E2771	76-83960B01	ferrite bead 1/2 turn

Coils

L2710	24-11030E01	1/2 turn BRN
L2711	24-11030B04	1-1/2 turns YEL
L2712	24-11030E03	1/2 turn ORN
L2713	24-11030B01	1-1/2 turns BRN
L2714	24-80036A01	ferrite bead 1/2 turn
L2720	24-11030E01	1/2 turn BRN
L2721		not used
L2722	24-82723H44	39 nH
L2730	24-11030D03	4 turns YEL
L2731	24-80036A01	ferrite bead 1/2 turn
L2732	24-11030A06	7 turns VIO
L2740	24-11030D03	4 turns YEL
L2741	24-80036A01	ferrite bead 1/2 turn
L2742	24-80908T17	2-1/2 turns RED
L2743	24-80908T01	1-1/2 turns RED
L2750	24-82723H40	.29 uH
L2751	24-11030B04	1-1/2 turns YEL
L2752	24-82723H40	.29 uH
L2753		not used
L2760	24-80908T06	1-1/2 turns GRN
L2761	24-80908T10	1-1/2 turns GRN
L2762	24-80908T10	1-1/2 turns GRN
L2763	24-11030B11	6-1/2 turns ORN
L2770	24-82723H46	.2 uH
L2771	24-84346A02	.23 uH

Transistors (see note)

Q2710	48-82233P39	NPN; type MRF559
Q2720	48-80225C09	NPN; type MRF630

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2710	06-11077A60	270
R2711	06-11077A58	220
R2712	06-11077A52	120
R2713	06-11077A40	39
R2714	06-11077A40	39
R2720	06-11077A26	10
R2721		not used
R2722		not used
R2723		not used
R2740		not used
R2741		not used
R2750	06-80194M15	39 1 watt
R2751	06-80194M15	39 1 watt
R2770	06-80147M02	metal plate .01 10% 2 watt
R2771	06-11077A28	12
R2772	06-05621T02	thermistor 50k
R2773	06-11077B11	33k
R2774	06-11077A76	1.2k
R2775		not used

Non-referenced items

26-80158L01	heat sink (for Q2720)
26-80275M01	heat sink (2 used for CR2750 and CR2751)
29-80014A03	clip coax terminal (2 used)

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

9/14/92

PL-921032-O

PA 438-470 MHz (25/40W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Non-referenced items

01-80556B01	6-wire cable assembly (includes P7)
01-80634B01	feedthru bracket assembly (includes C2701 through C2706, 470 pF feedthru capacitors, 6 used)

HLN8272A PA Hardware Kit, 438-470 MHz, 25-40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitors, chip

C2741	21-11078B35	51 pF 100V
C2742	21-11078B35	51 pF 100V
C2743	21-11078B21	20 pF 100V
C2744	21-11078B21	20 pF 100V
C2766	21-11078B21	20 pF 100V
C2767	21-11078B21	20 pF 100V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2730	48-80225C19	NPN; type MRF654
Q2740	48-80225C24	NPN; type MRF650

Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2740)
42-80520B01	ground clip, pc board (2 used)

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

9/14/92

PL-921033-O

PA 438-470 MHz (25/40W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Non-referenced items

01-80556B01	6-wire cable assembly (includes P7)
01-80634B01	feedthru bracket assembly (includes C2701 through C2706, 470 pF feedthru capacitors, 6 used)

HLN8272A PA Hardware Kit, 438-470 MHz, 25-40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitors, chip

C2741	21-11078B35	51 pF 100V
C2742	21-11078B35	51 pF 100V
C2743	21-11078B21	20 pF 100V
C2744	21-11078B21	20 pF 100V
C2766	21-11078B21	20 pF 100V
C2767	21-11078B21	20 pF 100V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2730	48-80225C19	NPN; type MRF654
Q2740	48-80225C24	NPN; type MRF650

Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2740)
42-80520B01	ground clip, pc board (2 used)

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

9/14/92

PL-921033-O

HLE8284A PA Board, 465-495 MHz, 25/40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2710	21-13740B49	100 pF
C2711	21-13740B27	12 pF
C2712	21-13740B32	20 pF
C2713	21-13740B49	100 pF
C2714	21-13740B49	100 pF
C2715	21-13740B14	3.6 +/- .25 pF
C2716	21-13741B69	.1 uF
C2717	21-13740B36	30 pF
C2718	21-13740B49	100 pF
C2719	21-13740B73	1000 pF
C2720	21-13740B33	22 pF
C2721	21-11078B27	30 pF 100V
C2722	21-11078B09	6.8 +/- .25 pF 100V
C2723		not used
C2724		not used
C2725	23-11048B13	lytic 10 uF 20% 16V
C2726	21-13740B49	100 pF
C2727	21-13740B73	1000 pF
C2728	21-11032B15	.22 uF +80/-20%
C2729	21-13740B36	30 pF
C2730	21-11078B25	27 pF 100V
C2731	21-11078B21	20 pF 100V
C2732	21-11078B21	20 pF 100V
C2733	21-13740B36	30 pF
C2734		not used
C2735		not used
C2736	21-13740B49	100 pF
C2737	21-13740B73	1000 pF
C2738	21-11032B15	.22 uF +80/-20%
C2739	23-11048A17	lytic 33 uF 20% 25V
C2740	21-11078B31	36 pF 100V
C2745	21-80060M09	5 +/- .25 pF 500V
C2746		not used
C2747	21-80060M21	12 pF 500V
C2748	21-11032B15	.22 uF +80/-20%
C2749	21-13740B49	100 pF
C2750	21-80060M13	7 +/- .25 pF 500V
C2751	21-13740B11	2.7 +/- .25 pF
C2752		not used
C2753	21-13740B22	7.5 +/- .25 pF
C2754	21-13740B49	100 pF
C2755		not used
C2756	21-80060M09	5 +/- .25 pF 500V
C2757	21-80060M07	4 +/- .25 pF 500V
C2758	21-13740B73	1000 pF
C2760	21-80060M12	6.5 +/- .25 pF 500V
C2761	21-80060M14	7.5 +/- .25 pF 500V
C2762	21-80060M14	7.5 +/- .25 pF 500V
C2763	21-80060M09	5 +/- .25 pF 500V
C2764	21-80060M43	100 pF 100V
C2765		not used
C2768		not used
C2770	21-13740B36	30 pF
C2771	21-13740B36	30 pF
C2772	21-13740B73	1000 pF
C2773	21-13741B69	.1 uF
C2774	21-13740B36	30 pF
C2775	23-11048A17	lytic 33 uF 20% 25V
C2776	21-13740B36	30 pF
C2777	21-13740B73	1000 pF
C2778	21-13741B69	.1 uF
C2779	21-11032B15	.22 uF +80/-20%
C2780	21-13740B36	30 pF
C2781	21-11032B15	.22 uF +80/-20%
C2782	21-13740B49	100 pF

Diodes (see note)

CR2750	48-80010E01	silicon PIN UM9401
CR2751	48-80010E01	silicon PIN UM9401
CR2752		not used

CR2770 48-80236E07 transient suppressor diode

Ferrite Beads

E2720	76-83960B01	ferrite bead 1/2 turn
E2770	76-83960B01	ferrite bead 1/2 turn
E2771	76-83960B01	ferrite bead 1/2 turn

Coils

L2710	24-11030E01	1/2 turn BRN
L2711	24-11030B02	1-1/2 turns RED
L2712	24-11030E02	1/2 turn RED
L2713	24-11030B01	1-1/2 turns BRN
L2714	24-80036A01	ferrite bead 1/2 turn
L2720	24-11030E03	1/2 turn ORN
L2721		not used
L2722	24-82723H44	39 nH
L2730	24-11030A03	4 turns YEL
L2731	24-80036A01	ferrite bead 1/2 turn
L2732	24-11030A03	4 turns YEL
L2733	24-80036A01	ferrite bead 1/2 turn
L2740	24-11030A03	4 turns YEL
L2741	24-80036A01	ferrite bead 1/2 turn
L2742	24-80908T12	1-1/2 turns GRN jumper
L2743		
L2750	24-82723H40	.29 uH
L2751	24-11030B05	2-1/2 turns GRN
L2752	24-82723H40	.29 uH
L2753		not used
L2760	24-80908T08	1-1/2 turns GRN
L2761	24-80908T09	1-1/2 turns RED
L2762	24-80908T08	1-1/2 turns GRN
L2763	24-11030B11	6-1/2 turns ORN
L2770	24-82723H46	.2 uH
L2771	24-84346A02	.23 uH

Transistors (see note)

Q2710	48-82233P39	NPN; type MRF559
Q2720	48-80225C09	NPN; type MRF630

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2710	06-11077A60	270
R2711	06-11077A58	220
R2712	06-11077A52	120
R2713	06-11077A40	39
R2714	06-11077A40	39
R2720	06-11077A26	10
R2721		not used
R2722		not used
R2723	06-11077A26	10
R2740	06-11077A26	10
R2741		not used
R2750	06-80194M15	39 1 watt
R2751	06-80194M15	39 1 watt
R2770	06-80147M02	metal plate .01 10% 2 watt
R2771	06-11077A26	10
R2772	06-05621T02	thermistor 50k
R2773	06-11077B11	33k
R2774	06-11077A76	1.2k
R2775		not used

Non-referenced items

26-80158L01	heat sink (for Q2720)
26-80275M01	heat sink (2 used for CR2750 and CR2751)
29-80014A03	clip coax terminal (2 used)

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

11/25/92

PL-921037-O

PA 465-495 MHz (25/40W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Non-referenced items		
	01-80556B01	6-wire cable assembly (includes P7)
	01-80634B01	feedthru bracket assembly (includes C2701 through C2706, 470 pF feedthru capacitors, 6 used)

HLN8286A PA Hardware Kt, 465-495 MHz, 25/40 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
Capacitors, chip		
C2741	21-11078B35	51 pF 100V
C2742	21-11078B35	51 pF 100V
C2743	21-11078B25	27 pF 100V
C2744	21-11078B25	27 pF 100V
C2766		not used
C2767		not used
C2784		

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2730	48-80225C19	NPN; type MRF654
Q2740	48-80225C24	NPN; type MRF650

Resistor, chip, 5%, 1/10 watt

R2724		not used
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Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2740)
42-80520B01	ground clip, pc board (2 used)
42-80915V01	ground clip, pc board

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

11/25/92

PL-921038-O

HLE8269A PA Board, 490-520 MHz, 25/35 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitor, chip, 5%, 50V unless otherwise indicated.

C2710	21-13740B49	100 pF
C2711	21-13740B24	9.1 +/- .25 pF
C2712	21-13740B32	20 pF
C2713	21-13740B49	100 pF
C2714	21-13740B49	100 pF
C2715	21-13740B17	4.7 +/- .25 pF
C2716	21-13741B69	.1 uF
C2717	21-13740B49	100 pF
C2718	21-13740B49	100 pF
C2719	21-13740B73	1000 pF
C2720	21-13740B31	18 pF
C2721	21-11078B27	30 pF 100V
C2722	21-11078B07	5.6 +/- .25 pF 100V
C2723		not used
C2724		not used
C2725	23-11048B05	lytic 1 uF 20% 50V
C2726	21-13740B49	100 pF
C2727	21-13740B73	1000 pF
C2728	21-11032B15	.22 uF +80/-20%
C2729	21-13740B36	30 pF
C2730	21-11078B31	36 pF 100V
C2731	21-11078B22	22 pF 100V
C2732	21-11078B16	13 pF 100V
C2733	21-13740B36	30 pF
C2734		not used
C2735		not used
C2736	21-13740B49	100 pF
C2737	21-13740B73	1000 pF
C2738	21-11032B15	.22 uF +80/-20%
C2739	23-11048A17	lytic 33 uF 20% 25V
C2740	21-11078B27	30 pF 100V
C2745	21-80060M05	3 +/- .25 pF 500V
C2746	21-80060M05	3 +/- .25 pF 500V
C2747	21-80060M21	12 pF 500V
C2748	21-13740B73	1000 pF
C2749	21-13740B49	100 pF
C2750	21-80060M13	7 +/- .25 pF 500V
C2751	21-13740B07	1.8 +/- .25 pF
C2752		not used
C2753	21-13740B21	6.8 +/- .25 pF
C2754	21-13740B49	100 pF
C2755		not used
C2756	21-80060M05	3 +/- .25 pF 500V
C2757	21-80060M05	3 +/- .25 pF 500V
C2758	21-11032B15	.22 uF +80/-20%
C2760	21-80060M11	6 +/- .25 pF 500V
C2761	21-80060M13	7 +/- .25 pF 500V
C2762	21-80060M13	7 +/- .25 pF 500V
C2763	21-80060M09	5 +/- .25 pF 500V
C2764	21-80060M43	100 pF 100V
C2765	23-11048A17	lytic 33 uF 20% 25V
C2768	23-11048B05	lytic 1 uF 20% 50V
C2770	21-13740B36	30 pF
C2771	21-13740B36	30 pF
C2772	21-13740B73	1000 pF
C2773	21-13741B69	.1 uF
C2774	21-13740B36	30 pF
C2775	08-11051A17	poly .47 uF 63V
C2776	21-13740B36	30 pF
C2777	21-13740B73	1000 pF
C2778	21-13741B69	.1 uF
C2779	21-11032B15	.22 uF +80/-20%
C2780	21-13740B36	30 pF
C2781	21-11032B15	.22 uF +80/-20%
C2782	21-13740B49	100 pF

Diodes (see note)

CR2750	48-80010E01	silicon PIN UM9401
CR2751	48-80010E01	silicon PIN UM9401
CR2752		not used

CR2770 48-80236E07 transient suppressor diode

Ferrite Beads

E2720	76-83960B01	ferrite bead 1/2 turn
E2770	76-83960B01	ferrite bead 1/2 turn
E2771	76-83960B01	ferrite bead 1/2 turn

Coils

L2710	24-11030E01	1/2 turn BRN
L2711	24-11030B04	1-1/2 turns YEL
L2712	24-11030E03	1/2 turn ORN
L2713	24-11030B04	1-1/2 turns YEL
L2714	24-80036A01	ferrite bead 1/2 turn
L2720	24-11030E05	1/2 turn GRN
L2721		not used
L2722	24-82723H44	.039 uH
L2730	24-11030A03	4 turns YEL
L2731	24-80036A01	ferrite bead 1/2 turn
L2732	24-11030A03	4 turns YEL
L2733	24-80036A01	ferrite bead 1/2 turn
L2740	24-80036A01	ferrite bead 1/2 turn
L2741	24-11030A02	3 turns ORN
L2742	24-80908T11	1-1/2 turns RED
L2743		jumper wire
L2750	24-82723H40	.29 uH
L2751	24-11030B04	1-1/2 turns YEL
L2752	24-82723H40	.29 uH
L2753		not used
L2760	24-80908T08	1-1/2 turns GRN
L2761	24-80908T09	1-1/2 turns RED
L2762	24-80908T08	1-1/2 turns GRN
L2763	24-11030B11	6-1/2 turns ORN
L2770	24-82723H46	.2 uH
L2771	24-84346A02	.23 uH

Transistors (see note)

Q2710	48-82233P39	NPN; type MRF559
Q2720	48-80225C09	NPN; type MRF630

Resistors, chip, 5%, 1/10 watt, unless otherwise indicated.

R2710	06-11077A60	270
R2711	06-11077A58	220
R2712	06-11077A52	120
R2713	06-11077A40	39
R2714	06-11077A40	39
R2720	06-11077A26	10
R2721		not used
R2722		not used
R2723	06-11077A26	10
R2740		not used
R2741	06-11009B26	2.7 1/4 watt FCF
R2750	06-80194M15	39 1 watt
R2751	06-80194M15	39 1 watt
R2770	06-80147M02	metal plate .01 10% 2 watt
R2771	06-11077A26	10
R2772	06-05621T02	thermistor 50k
R2773	06-11077B11	33k
R2774	06-11077A76	1.2k
R2775		not used

Non-referenced items

26-80158L01	heat sink (for Q2720)
26-80275M01	heat sink (2 used for CR2750 and CR2751)
29-80014A03	clip coax terminal (2 used)

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

11/25/92

PL-921023-O

PA 490-520 MHz (25/35W)

01-80704Y64 Feedthru Bracket and Cable Assembly

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Non-referenced items

01-80556B01	6-wire cable assembly (includes P7)
01-80634B01	feedthru bracket assembly (includes C2701 through C2706, 470 pF feedthru capacitors, 6 used)

HLN8270A PA Hardware Kit, 490-520 MHz, 25/35 Watt

REFERENCE NUMBER	MOTOROLA PART NO.	DESCRIPTION
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Capacitors, chip

C2741	21-11078B34	47 pF 100V
C2742	21-11078B34	47 pF 100V
C2743	21-11078B27	30 pF 100V
C2744	21-11078B27	30 pF 100V
C2766		not used
C2767		not used
C2784	21-11078B16	13 pF 100V

Connector, receptacle

J1	09-80131M01	mini UHF coax
J2	09-80255E01	power (includes feedthru)

Connector, plug

P4	30-80138M08	coaxial cable 200 mm with plug
P5	30-80138M07	coaxial cable 150 mm with plug

Transistors

Q2730	48-80225C19	NPN; type MRF654
Q2740	48-80225C24	NPN; type MRF650

Resistor, chip, 5%, 1/10 watt

R2724	06-11077A36	27
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Non-referenced items

02-00007003	nut 8-32x5/16x1/8 (for J1)
03-10943M10	screw M3x.5x8 (8 used)
03-10943M11	screw M3x.5x10 (2 used for J2)
04-00131974	washer (2 used for J2)
04-05587G01	washer nylon (for J2)
04-80943V01	lockwasher (for J1)
26-80124L01	heat sink
26-80223M07	PA shield
32-80014N03	gasket, accessory connector
42-80281L01	ground clip (2 used for Q2740)
42-80520B01	ground clip, pc board (2 used)
42-80915V01	ground clip, pc board

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

GENERAL:

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

INSTRUCTION MANUAL AFFECTED:

6880902Z98-O

M120 Service Manual

REVISION DETAILS:

1. Effective January, 1996, a new 2-Layer Masked Logic Board (HLN8074E) with improved EMC performance has replaced the older version (HLN8074D). This supplement contains a new circuit board detail, schematic, and parts list, necessary for servicing these radios. Please refer to the attached pages and place them into your manual.
2. The following components have changed on the Front Panel Filter Board 01-80704Y83: C1401 through C1405 and C1411 through C1413 have changed from 21-13740B33 (22 pF) to 21-13741B45 (0.1 uF).
3. A new Volume/Microphone Board (HLN8071B) has replaced the older version (HLN8071A). Please refer to the attached page and place it into your manual.

ATTACHMENTS

Schematic Diagram for HLN8074E Masked Logic Board (2-Layer) (Sheet 1 of 2)	Page 3 ✓
Schematic Diagram for HLN8074E Masked Logic Board (2-Layer) (Sheet 2 of 2)	Page 4 ✓
Circuit Board Details for HLN8074E Masked Logic Board (2-Layer)	Page 5 ✓
Parts List for HLN8074E Masked Logic Board (2-Layer)	Page 7 ✓
Circuit Board Detail for HLN8071B Volume/Microphone Board	Page 10 ✓

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