



PHOTOFACT[®] with

CIRCUITRACE[®]

For Supplier Address See PHOTOFACT Index

NOTE

Repair or adjustment of transmitter circuits must be under supervision of a person with first-or second-class radiotelephone license.

(Refer to FCC Rules and Regulations Part 95, Subpart C & D.)

The frequency of the transmitter should be checked periodically with a secondary frequency standard to insure proper and legal operation.

Best results will be obtained when adjusting the final RF output circuit if the antenna normally used is connected and the chassis is as nearly in the cabinet as possible.

Connect either 50-ohm dummy load or the normally used antenna system.



MODEL L231

CRAIG MODEL L231

MANUFACTURER'S SPECIFICATIONS

GENERAL

Channels: 40 AM, 40 LSB and USB modes
Frequency Range: 26.965 to 27.405 MHz
Frequency Stability: $\pm 0.005\%$ from -30°C to $+50^{\circ}\text{C}$
Microphone: Dynamic with press-to-talk switch
Power Source: 13.8V DC $\pm$ Ground or 120V AC, 60Hz
Current Drain: Receive: DC 1.5A, AC 0.4A @ maximum audio output. DC 0.7A, AC 0.23A standby (no signal)
Transmit: AM full mode — DC 2.5A, AC 0.55A
SSB 12W P.E.P. — DC 3A, AC 0.67A
Meter: Illuminated. Indicates receiving signal strength, relative power output and SWR
Semiconductors: Transistors, 38; Diodes, 56; Integrated Circuits, 5; FET, 8 (PLL Circuit: Transistors, 9; Diodes, 4; Integrated Circuits, 2; FET, 1)
Size: W: 436 mm (17 1/16")
H: 130 mm (5 1/16")
D: 267 mm (10 1/2")
Weight: 7.5kg (16 1/2 lbs)

TRANSMITTER

RF Power Output: 4.0 Watts (AM)
SSB Suppressed Carrier: Peak Envelope Power Output 12 watts
Modulation Capability: 100%

Spurious Attenuation: 60 dB minimum
Output Impedance: 50 ohm
Filter Circuit: Crystal lattice 7.8 MHz filter
Carrier Suppression: 45 dB
Unwanted Sideband Suppression: 60 dB

RECEIVER

Sensitivity: AM: Better than $0.5\mu\text{V}$ for 10 dB (S+N)/N
SSB: Better than $0.18\mu\text{V}$ for 10dB (S+N)/N
Bandwidth: $\pm 2\text{ kHz}$ @ -6 dB
AGC: Change in audio output less than 12 dB from $10\mu\text{V}$ to 0.5 volts
Squelch: Adjustable. Threshold less than $0.5\mu\text{V}$
Tight more than $250\mu\text{V}$
10% at 3.5 watts output
Better than 60 dB @ 7.8 MHz
Distortion:
Image Rejection:
Adjacent Channel Rejection: Better than 60 dB @ $\pm 10\text{ kHz}$
IF Frequency: AM: 7.8 MHz
SSB: 7.8 MHz
AM: $\pm 800\text{ Hz}$
SSB: $\pm 800\text{ Hz}$
Clarifier Range: RF Parallel gate type
Noise Blanker:

P.A. SYSTEM

P.A. output: 3.5 watts

Courtesy of the Manufacturer

HOWARD W. SAMS & CO., INC. Indianapolis, Indiana 46206

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ALIGNMENT INSTRUCTIONS

CAUTION: Use isolation transformer or observe polarity when connecting test equipment. Maintain line voltage at 120V AC. Allow a 15-minute warm-up period.
Adjustments made with 13.8-volt DC input.
Connect low sides of test equipment to ground unless specified otherwise.
Connect 50-ohm dummy load or antenna before keying transmitter.
Connect Microphone.

Suggested Alignment Tools:

GC ELECTRONICS:

L3 thru L6, T1, T102 thru T104, T201 thru T206,
T301, T302, T303, L114, L404.....9440
L111, L108.....9300, 9302, 9304
L106, T101.....8728, 9304, 9089
C101A, C101B, C415.....5000, 8276, 9089

SYNTHESIZER ALIGNMENT

TEST EQUIPMENT	TRANSCIVER	ADJUST	REMARKS
Input of frequency counter to TP8 (IC2 Pin 3).	Ch. 19 AM Clarifier Midrange	L5	Adjust for 10.0000MHz.
Input of frequency counter to TP8 (IC2 Pin 3).	Ch. 19 USB Clarifier Midrange	L6	Adjust for 9.9987MHz.
Input of oscilloscope to TP7 (Q6 Gate 2).	Ch. 19	T1	Adjust for maximum RF (45mV p-p typical). (See Figure 1.)
Input of DC meter to TP6 (Junction of R13 & R16).	Ch. 1	L3	Adjust for 3.00 volts. Check for approximately 2.00 volts on channel 40.
Input of oscilloscope to TP9 (Junction of C11 and C140).	Ch. 19	L4	Adjust for maximum RF (300mV p-p typical). (See Figure 2.)
Input of oscilloscope to TP1 (Junction of C208 & C136).	Ch. 19	T104	Adjust for maximum RF (150mV p-p typical). (See Figure 3.)
Input of frequency counter to TP9 (Junction of C11 & C140).	Ch. 1 AM Clarifier Midrange		Check for 19.1650MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP9 (Junction of C11 & C140).	Ch. 1 LSB Clarifier Midrange		Check for 19.1625MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP9 (Junction of C11 & C140).	Ch. 1 USB Clarifier Midrange		Check for 19.1675MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP10 (IC2 Pin 2).	Ch. 1 AM Clarifier Midrange		Check for .8350MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP10 (IC2 Pin 2).	Ch. 1 LSB Clarifier Midrange		Check for .8349MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP10 (IC2 Pin 2).	Ch. 1 USB Clarifier Midrange		Check for .8299MHz. Check all channels. (See Truth Chart for correct frequencies.)
Input of frequency counter to TP4 (Q401 emitter).	Ch. 19 USB	L404	Adjust for 7.7975MHz.
Input of frequency counter to TP4 (Q401 emitter).	Ch. 19 LSB	C415	Adjust for 7.8025MHz.
Input of frequency counter to antenna input.	Ch. 19 AM XMT	R706	Adjust for 27.185MHz.

RECEIVER ALIGNMENT

Connect an AC VTVM or AF wattmeter across speaker voice coil.
Adjust volume control to obtain a suitable indication.
Set generator output low enough to prevent AGC limiting. Preset controls as follows, unless otherwise noted: RF Gain Maximum, Clarifier Midrange, Squelch MINIMUM, NB/ANL Off.

TEST EQUIPMENT	TRANSCIVER	ADJUST	REMARKS
Output of signal generator to TP11 (Q203 Gate 2). 7.8MHz, 1000Hz @ 30% modulation.	Ch. 19 AM	T206, T205, T204, T203	Adjust for maximum audio output.
Output of signal generator to antenna input. 27.185MHz, 1000Hz @ 30% modulation.	Ch. 19 AM	T202, T201	Adjust for maximum audio output. Readjust T203, T204, T205 and T206 for maximum.
Output of signal generator to antenna input. 27.185MHz, 1000Hz @ 30% modulation. Output 1uV. Input of oscilloscope to TP12 (Q302 Gate). Inject a 100pps, 1uSec pulse width signal at antenna input.	Ch. 19 AM NB/ANL NB	T301, T302, T303	Adjust for maximum pulse amplitude. (100mV peak typical). (See Figure 4.)

CRAIG MODEL L231

RECEIVER ADJUSTMENTS

Connect an AC VTVM or AF wattmeter across speaker voice coil.
Adjust volume control to obtain a suitable indication.
Preset controls as follows, unless otherwise noted: RF Gain Maximum, Clarifier Midrange, Squelch MINIMUM, NB/ANL Off.

TEST EQUIPMENT	TRANSCIVER	ADJUST	REMARKS
Output of signal generator to antenna input. 27.185MHz, 1000Hz @ 30% modulation. Output 1uV.	Ch. 19 AM Volume Maximum	R309	AGC Adjust for 2.00 volts rms (.5 watts) audio output.
Output of signal generator to antenna input. 27.185MHz, 1000Hz @ 30% modulation. Output 1000uV.	Ch. 19 AM Squelch Maximum	R315	SQUELCH RANGE Adjust so squelch just breaks.
Output of signal generator to antenna input. 27.185MHz, 1000Hz @ 30% modulation. Output 1000uV.	Ch. 19 AM	R229	AM "S" METER Adjust for 9 on S unit scale of meter.
Output of signal generator to antenna input. 27.186MHz, no modulation. Output 1000uV.	Ch. 19 USB	R240	SSB "S" METER Adjust for 9 on S unit scale of meter.

TRANSMITTER ALIGNMENT

Connect a 50-ohm, 25-watt dummy load to antenna connector.

NOTE: Be sure to check transmit frequency and power on all active channels after alignment of transmitter.

See page 4 for channel frequencies.

TEST EQUIPMENT	TRANSCIEVER	ADJUST	REMARKS
Input of RF wattmeter to antenna input.	Ch. 19 AM XMT	T103,T102, T101,L111, L109	Adjust for maximum RF output
Input of RF wattmeter to antenna input.	Ch. 19 AM XMT	L106	Adjust for 4.0 watts RF output maximum.
Input of spectrum analyzer or harmonic meter to antenna input A.	Ch. 19 AM XMT Antenna A	C101A	Adjust for MINIMUM at 54MHz (2nd harmonic).
Input of spectrum analyzer or harmonic meter to antenna input B.	Ch. 19 AM XMT Antenna B	C101B	Adjust for MINIMUM at 54MHz (2nd harmonic).
Input of oscilloscope and output of signal generator to TP13 (Q104 collector). 15.600MHz, no modulation.	Power Off	L114	Adjust for MINIMUM at response at 15.600MHz.

TRANSMITTER ADJUSTMENTS

Connect a 50-ohm, 25-watt dummy load to antenna connector.

NOTE: Be sure to check transmit frequency and power on all active channels after adjustment of transmitter.

See page 4 for channel frequencies.

TEST EQUIPMENT	TRANSCIEVER	ADJUST	REMARKS
Input of oscilloscope or RF wattmeter to antenna input. No modulation input.	Ch. 19 USB XMT	R414,R401	CARRIER BALANCE Adjust for MINIMUM RF output.
Input of RF wattmeter to antenna input. Inject a two-tone 20mV audio signal at mic input.	Ch. 19 USB XMT	R130	SSB ALC Adjust for 12.0 watts PEP RF output maximum.
Input of oscilloscope or modulation meter to antenna input. Inject a 1000Hz, 20mV audio signal at mic input.	Ch. 19 AM XMT	R605	AM AMC Adjust for 100% modulation maximum. (See Figure 5.)
Input of RF wattmeter to antenna input.	Ch. 19 AM XMT	R106	RF METER At 4.0 watts RF output adjust for 4 on RFO scale of meter.
	Ch. 19	R711	DIMMER Adjust for desired brilliance of channel display.

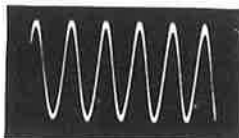


FIGURE 1

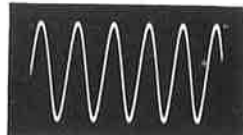


FIGURE 2

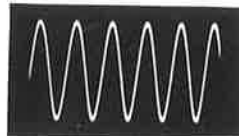


FIGURE 3

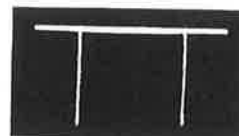


FIGURE 4

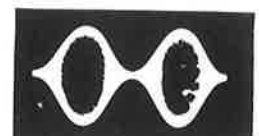
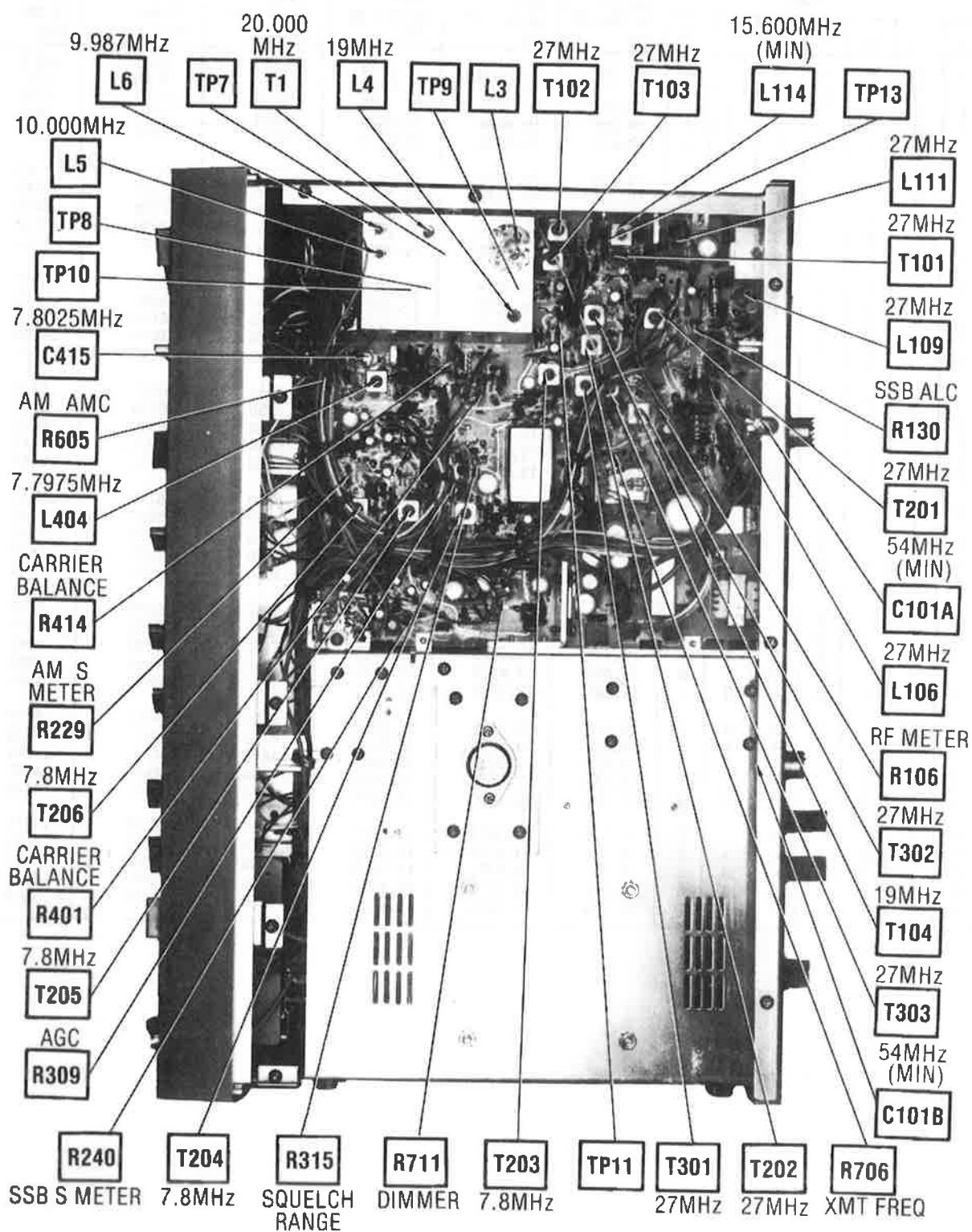


FIGURE 5

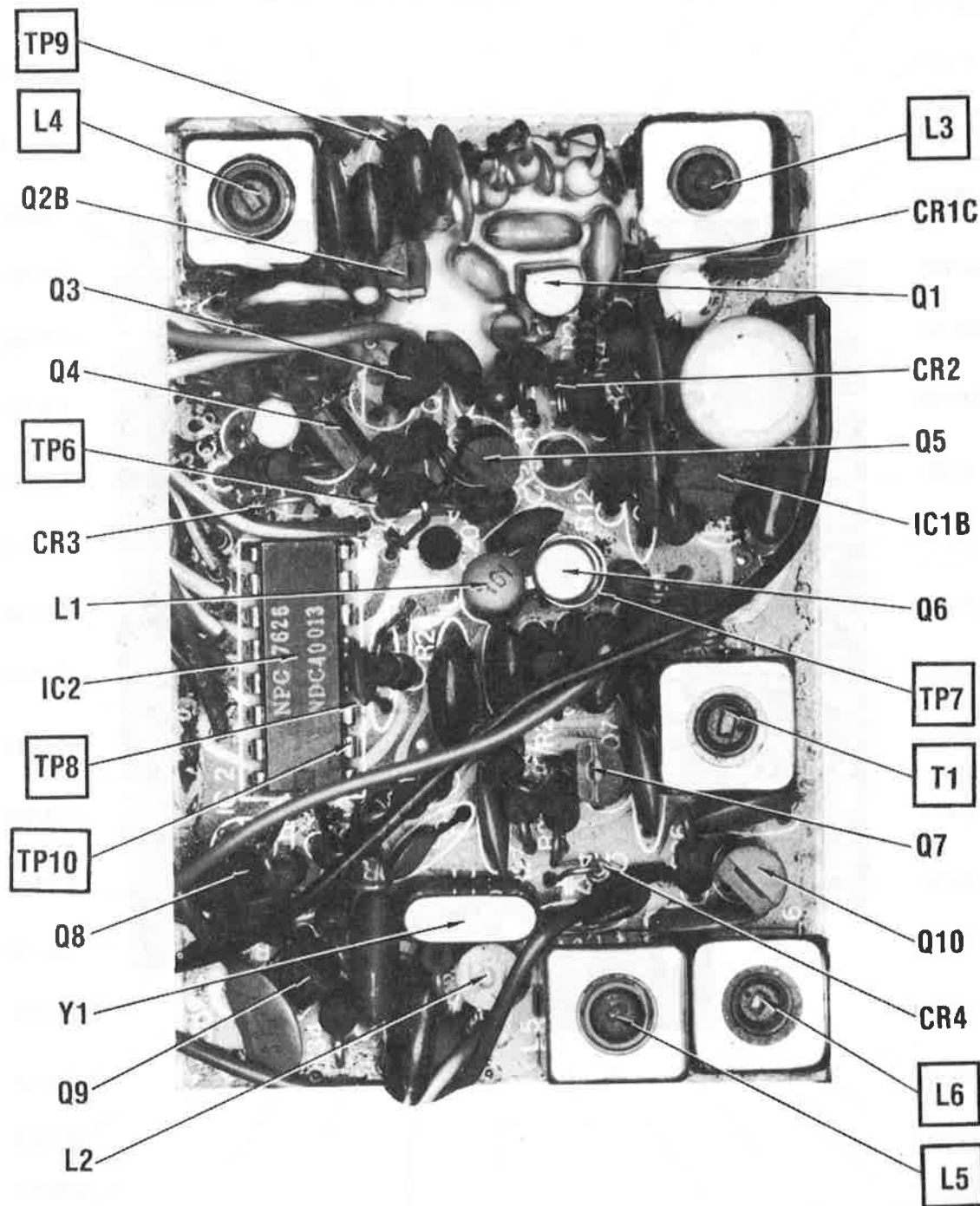
TRUTH CHART

TRUTH CHART														
CHANNEL	1 = 5.00 Volts 0 = 0 Volts							AM REC SYNTH OUTPUT IN MHz AT TP9	USB REC & XMT SYNTH OUTPUT IN MHz AT TP9	LSB REC & AM XMT SYNTH OUTPUT IN MHz AT TP9	AM DIVIDER INPUT IN MHz AT TP10	USB DIVIDER INPUT IN MHz AT TP10	LSB DIVIDER INPUT IN MHz AT TP10	
	IC2 PROGRAM DIVIDER													
	PINS													
	8	9	10	11	12	13	14							
1	1	0	1	0	0	1	1	19.165	19.1675	19.1625	.8350	.8299	.8349	
2	1	0	1	0	0	1	0	19.175	19.1775	19.1725	.8250	.8199	.8249	
3	1	0	1	0	0	0	1	19.185	19.1875	19.1825	.8150	.8099	.8149	
4	1	0	0	1	1	1	1	19.205	19.2075	19.2025	.7950	.7899	.7949	
5	1	0	0	1	1	1	0	19.215	19.2175	19.2125	.7850	.7799	.7849	
6	1	0	0	1	1	0	1	19.225	19.2275	19.2225	.7750	.7699	.7749	
7	1	0	0	1	1	0	0	19.235	19.2375	19.2325	.7650	.7599	.7649	
8	1	0	0	1	0	1	0	19.255	19.2575	19.2525	.7450	.7399	.7449	
9	1	0	0	1	0	0	1	19.265	19.2675	19.2625	.7350	.7299	.7349	
10	1	0	0	1	0	0	0	19.275	19.2775	19.2725	.7250	.7199	.7249	
11	1	0	0	0	1	1	1	19.285	19.2875	19.2825	.7150	.7099	.7149	
12	1	0	0	0	1	0	1	19.305	19.3075	19.3025	.6950	.6899	.6949	
13	1	0	0	0	1	0	0	19.315	19.3175	19.3125	.6850	.6799	.6849	
14	1	0	0	0	0	1	1	19.325	19.3275	19.3225	.6750	.6699	.6749	
15	1	0	0	0	0	1	0	19.335	19.3375	19.3325	.6650	.6599	.6649	
16	1	0	0	0	0	0	0	19.355	19.3575	19.3525	.6450	.6399	.6449	
17	0	1	1	1	1	1	1	19.365	19.3675	19.3625	.6350	.6299	.6349	
18	0	1	1	1	1	1	0	19.375	19.3775	19.3725	.6250	.6199	.6249	
19	0	1	1	1	1	0	1	19.385	19.3875	19.3825	.6150	.6099	.6149	
20	0	1	1	1	0	1	1	19.405	19.4075	19.4025	.5950	.5899	.5949	
21	0	1	1	1	0	1	0	19.415	19.4175	19.4125	.5850	.5799	.5849	
22	0	1	1	1	0	0	1	19.425	19.4275	19.4225	.5750	.5699	.5749	
23	0	1	1	0	1	1	0	19.455	19.4575	19.4525	.5450	.5399	.5449	
24	0	1	1	1	0	0	0	19.435	19.4375	19.4325	.5650	.5599	.5649	
25	0	1	1	0	1	1	1	19.445	19.4475	19.4425	.5550	.5499	.5549	
26	0	1	1	0	1	0	1	19.465	19.4675	19.4625	.5350	.5299	.5349	
27	0	1	1	0	1	0	0	19.475	19.4775	19.4725	.5250	.5199	.5249	
28	0	1	1	0	0	1	1	19.485	19.4875	19.4825	.5150	.5099	.5149	
29	0	1	1	0	0	1	0	19.495	19.4975	19.4925	.5050	.4999	.5049	
30	0	1	1	0	0	0	1	19.505	19.5075	19.5025	.4950	.4899	.4949	
31	0	1	1	0	0	0	0	19.515	19.5175	19.5125	.4850	.4799	.4849	
32	0	1	0	1	1	1	1	19.525	19.5275	19.5225	.4750	.4699	.4749	
33	0	1	0	1	1	1	0	19.535	19.5375	19.5325	.4650	.4599	.4649	
34	0	1	0	1	1	0	1	19.545	19.5475	19.5425	.4550	.4499	.4549	
35	0	1	0	1	1	0	0	19.555	19.5575	19.5525	.4450	.4399	.4449	
36	0	1	0	1	0	1	1	19.565	19.5675	19.5625	.4350	.4299	.4349	
37	0	1	0	1	0	1	0	19.575	19.5775	19.5725	.4250	.4199	.4249	
38	0	1	0	1	0	0	1	19.585	19.5875	19.5825	.4150	.4099	.4149	
39	0	1	0	1	0	0	0	19.595	19.5975	19.5925	.4050	.3999	.4049	
40	0	1	0	0	1	1	1	19.605	19.6075	19.6025	.3950	.3899	.3949	

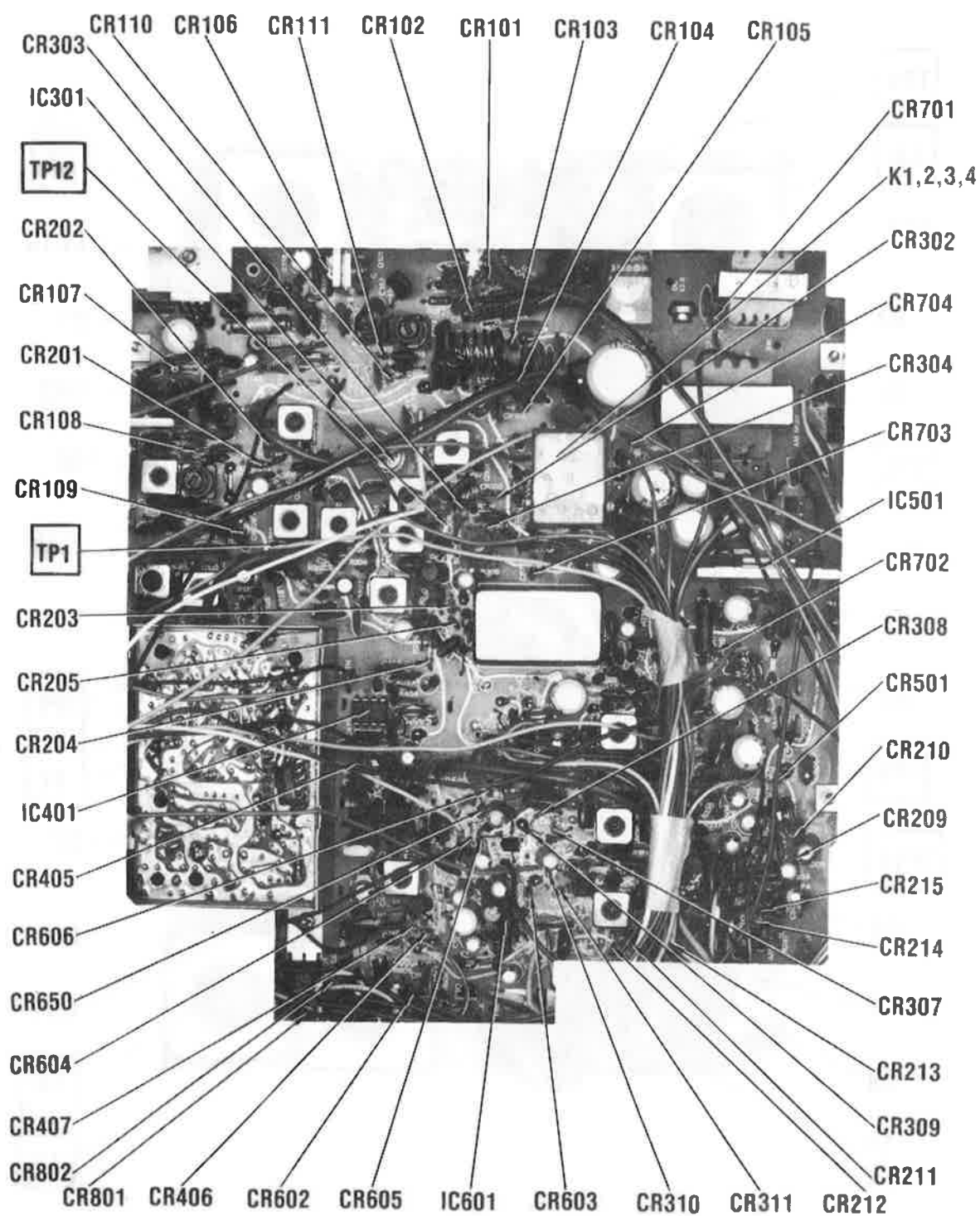
CRAIG MODEL L231



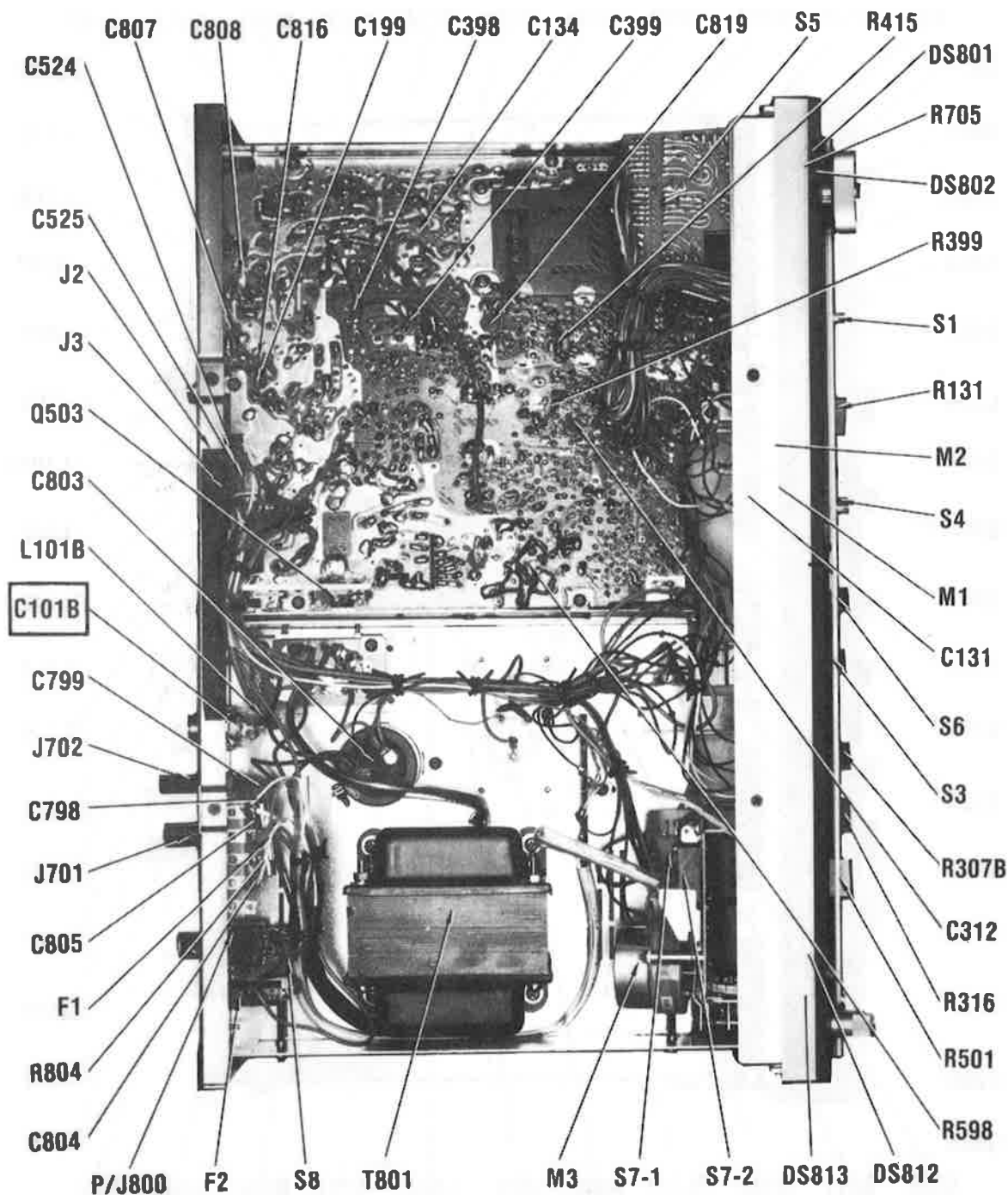
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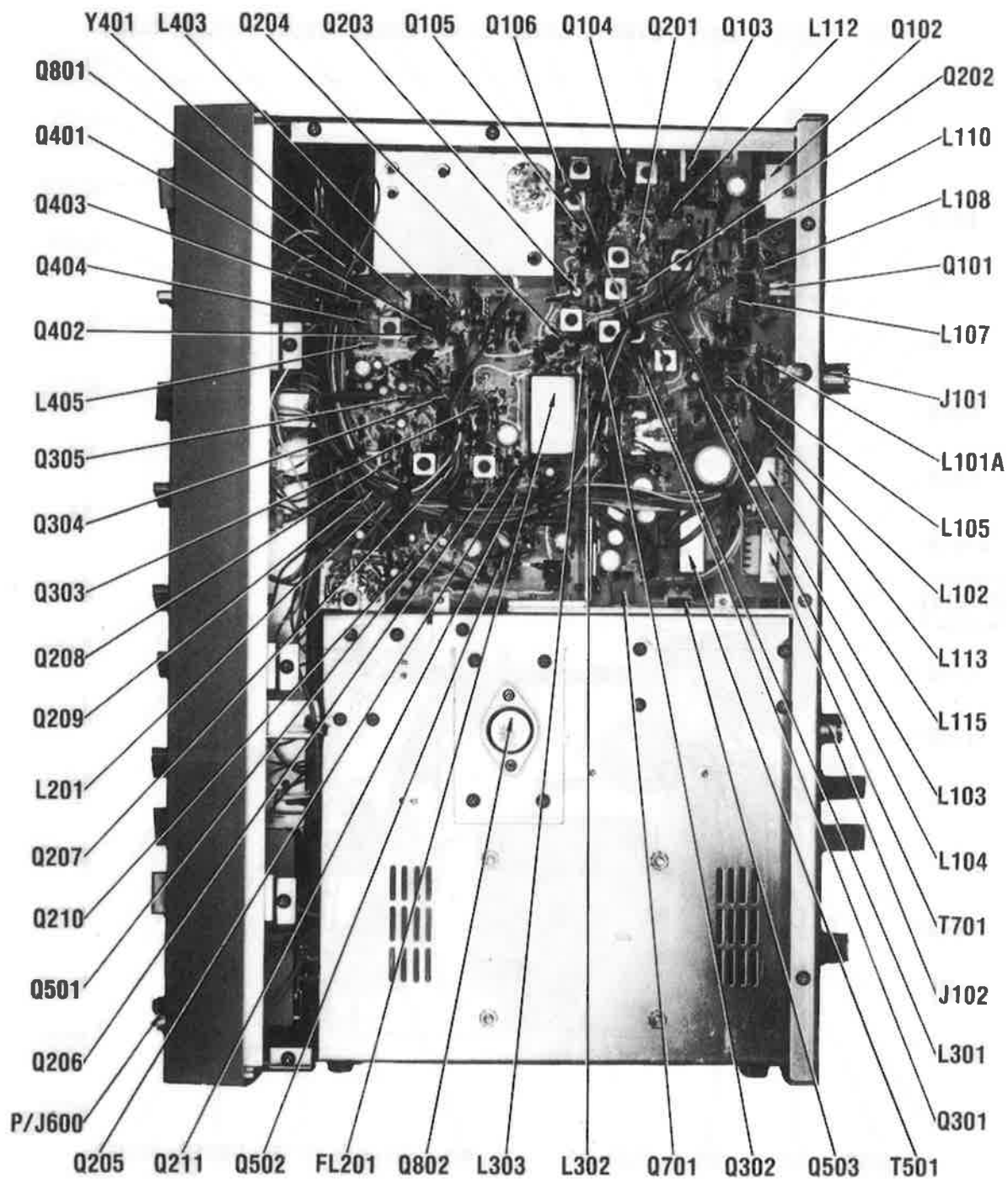
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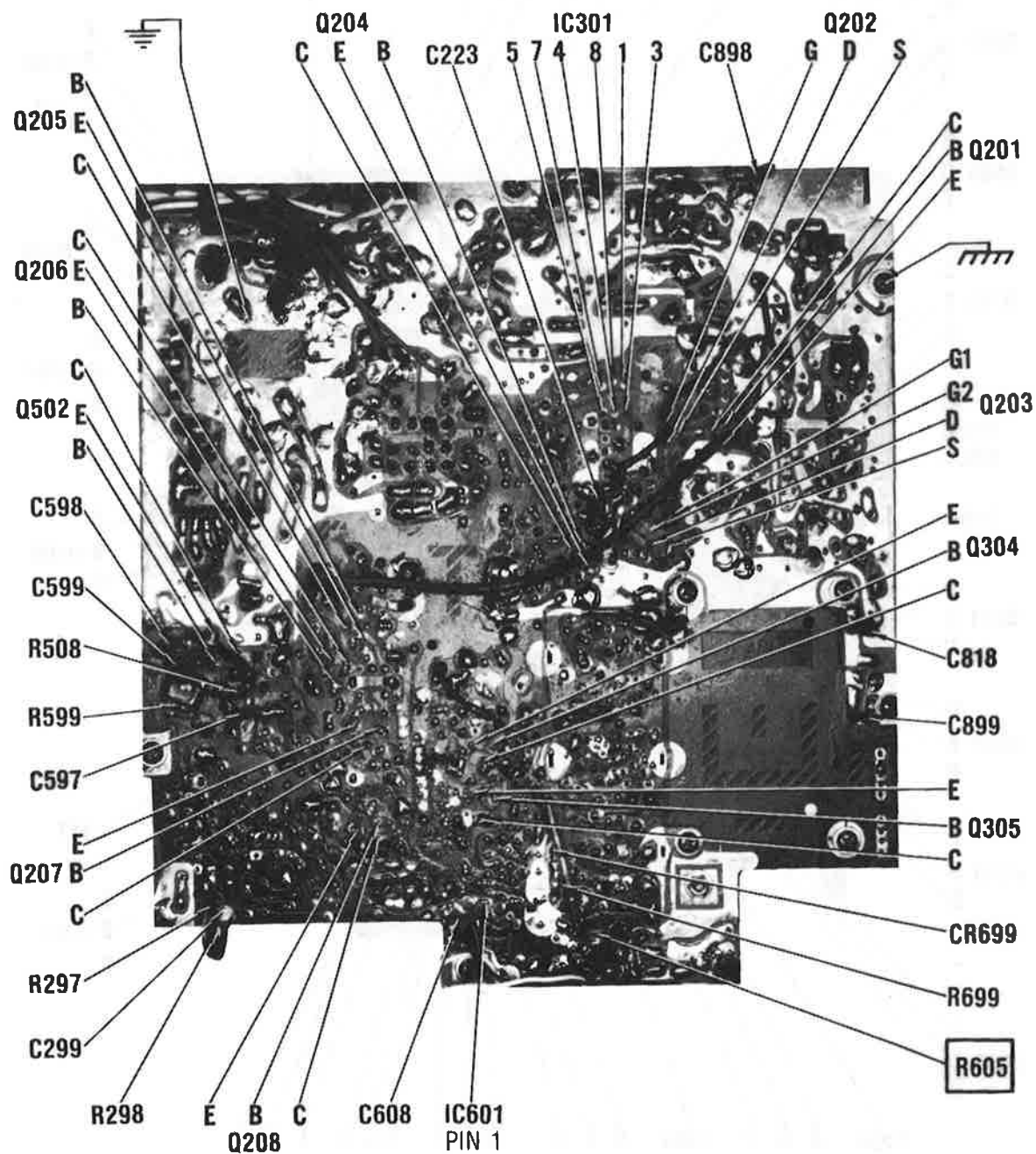
MAIN BOARD



CHASSIS-TOP

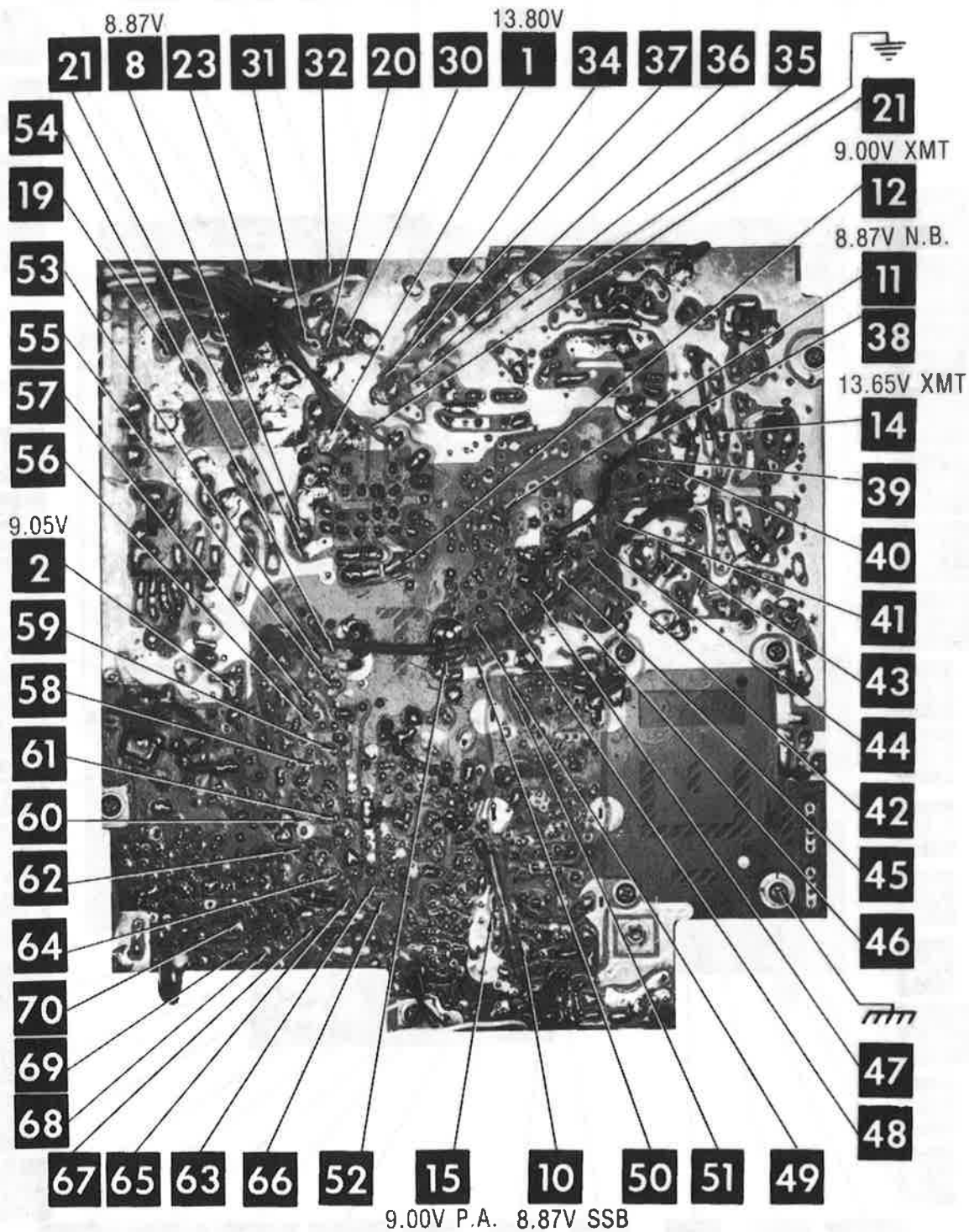


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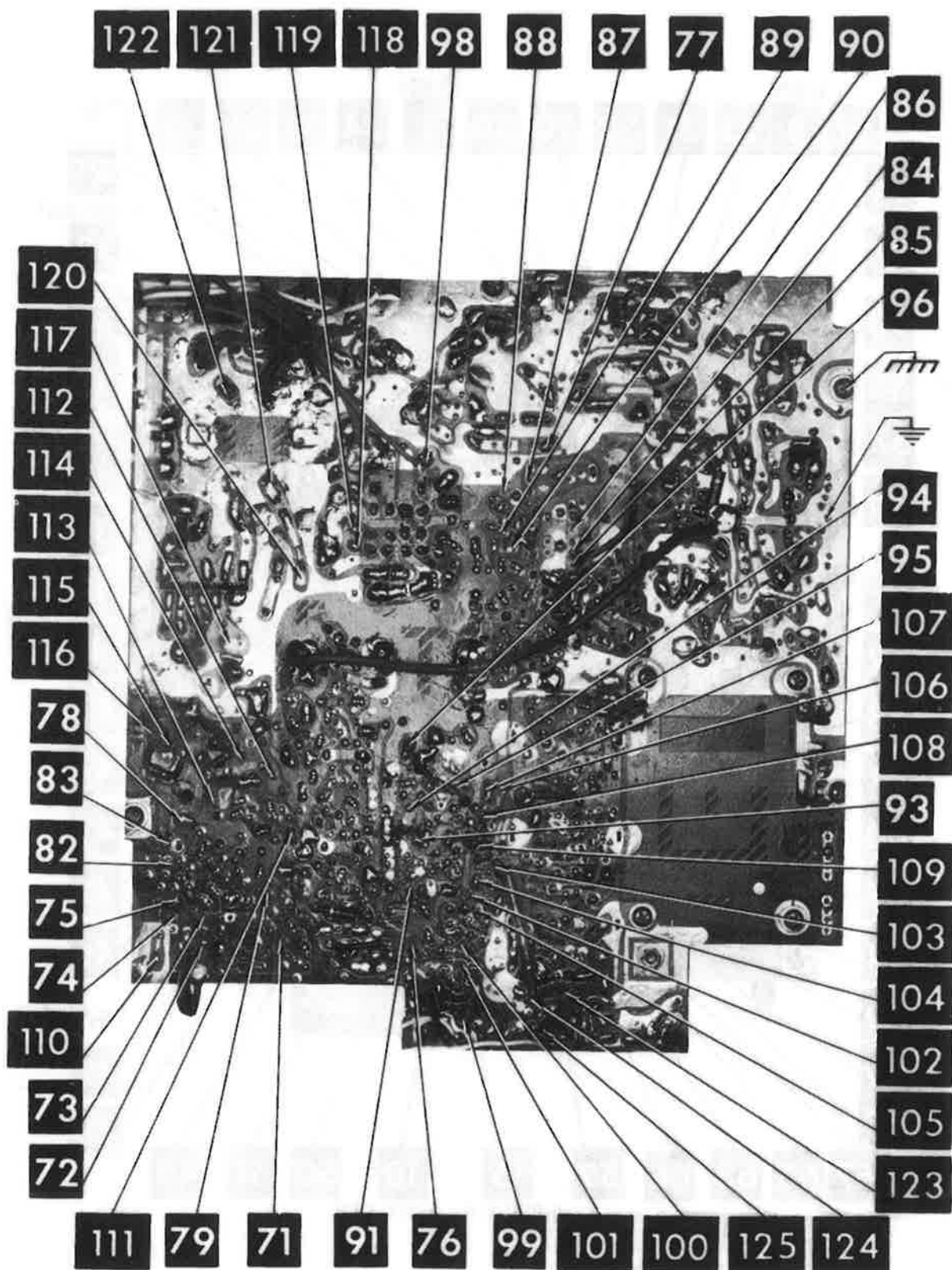
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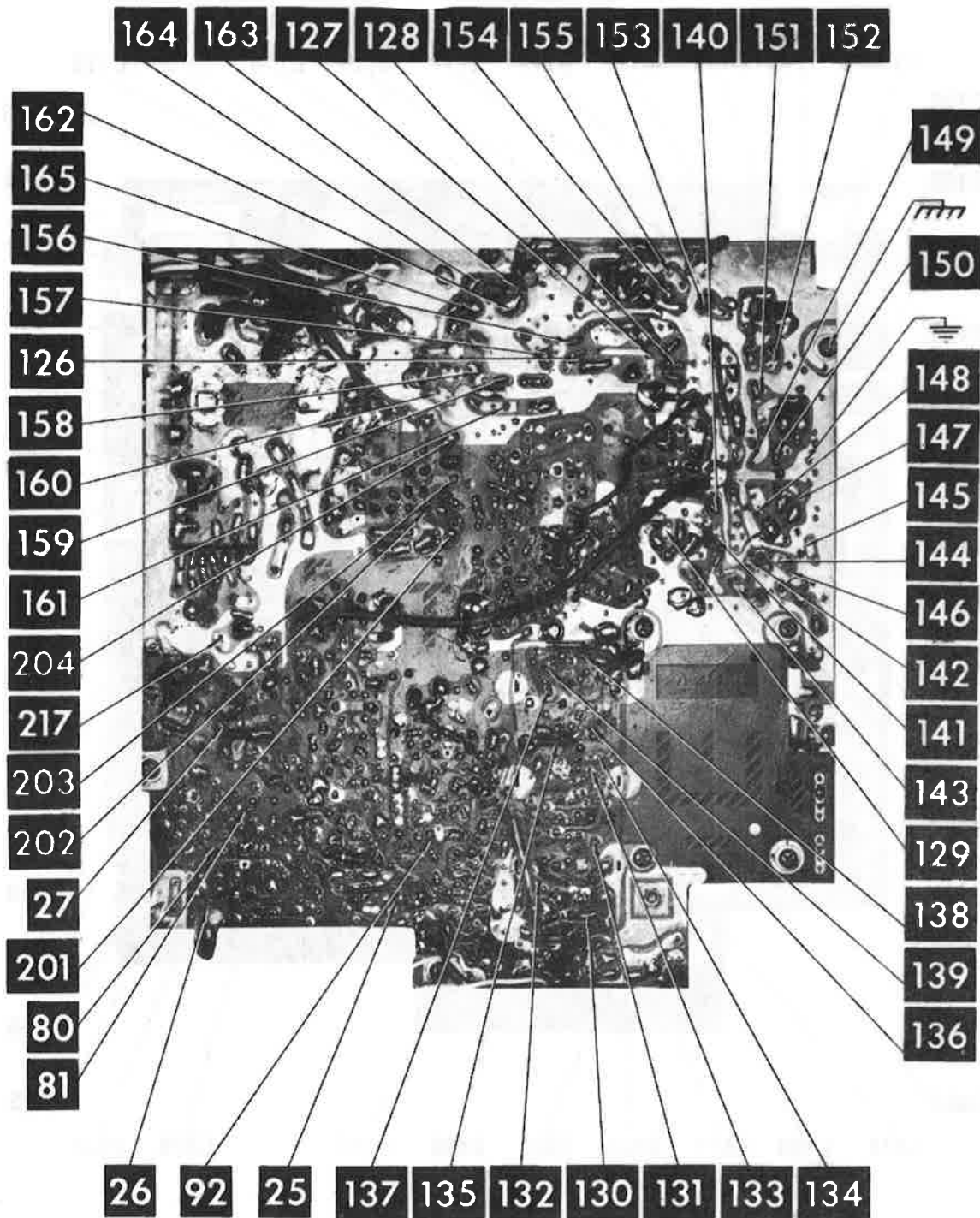


CRAIG MODEL L231

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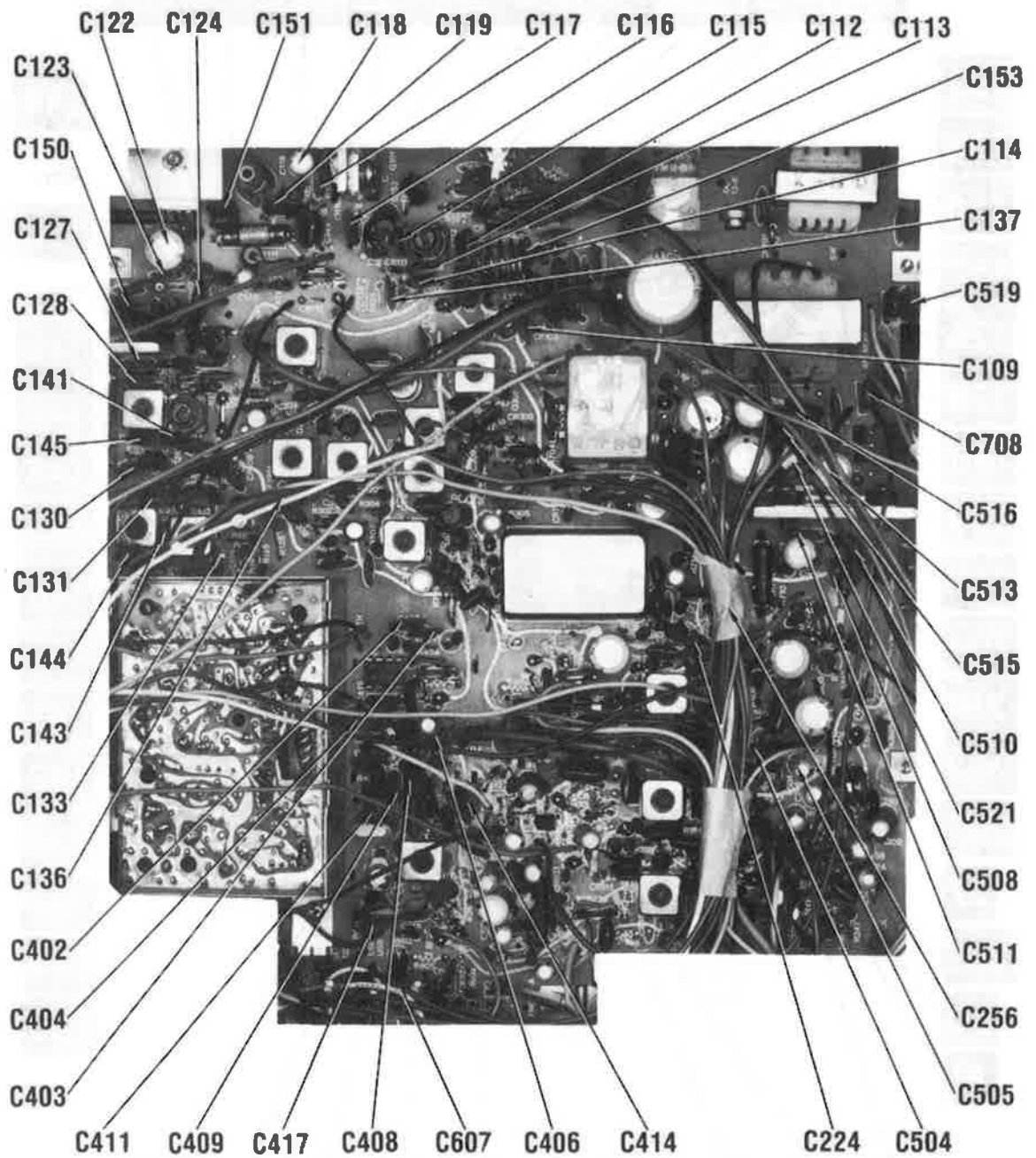


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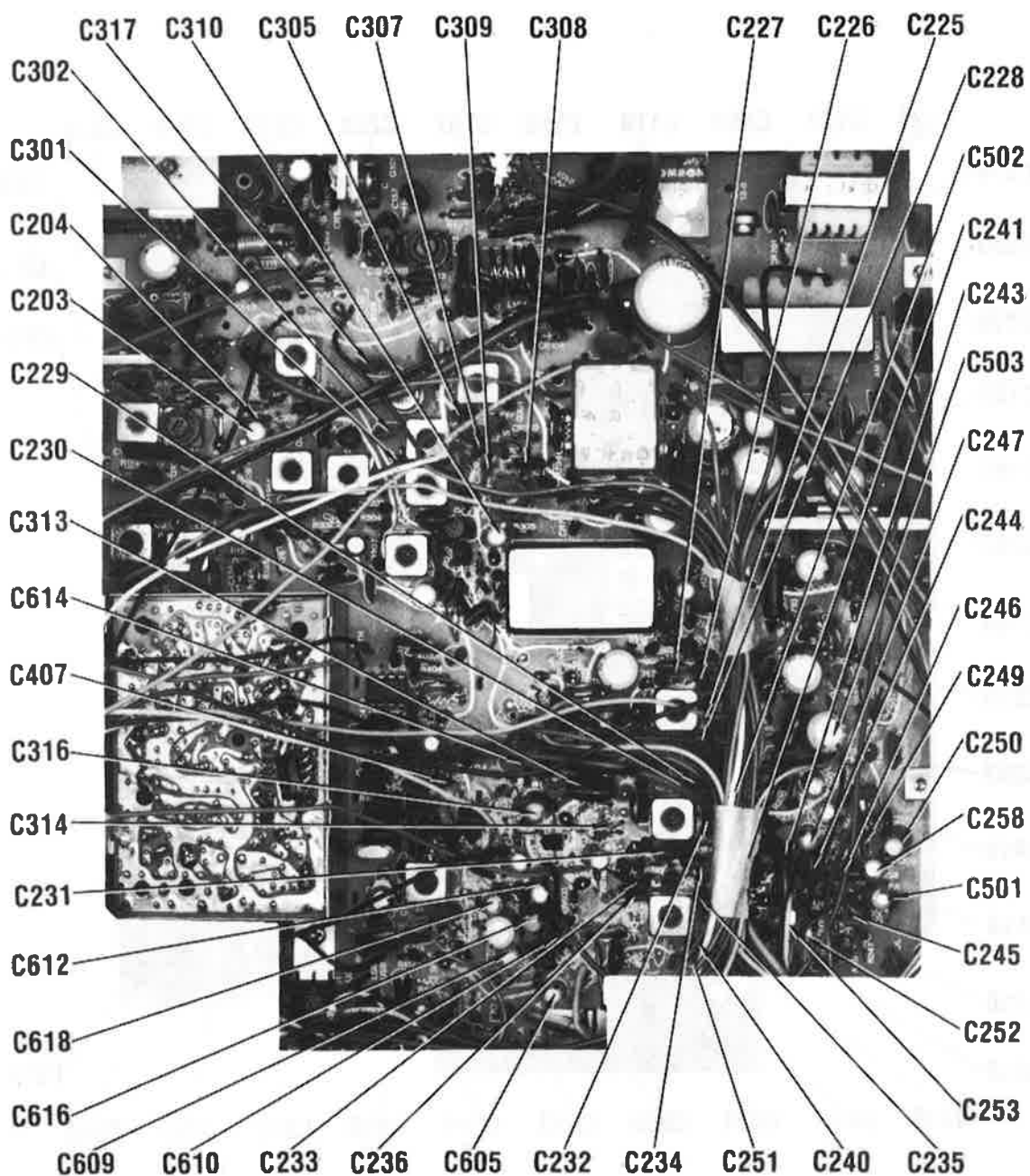


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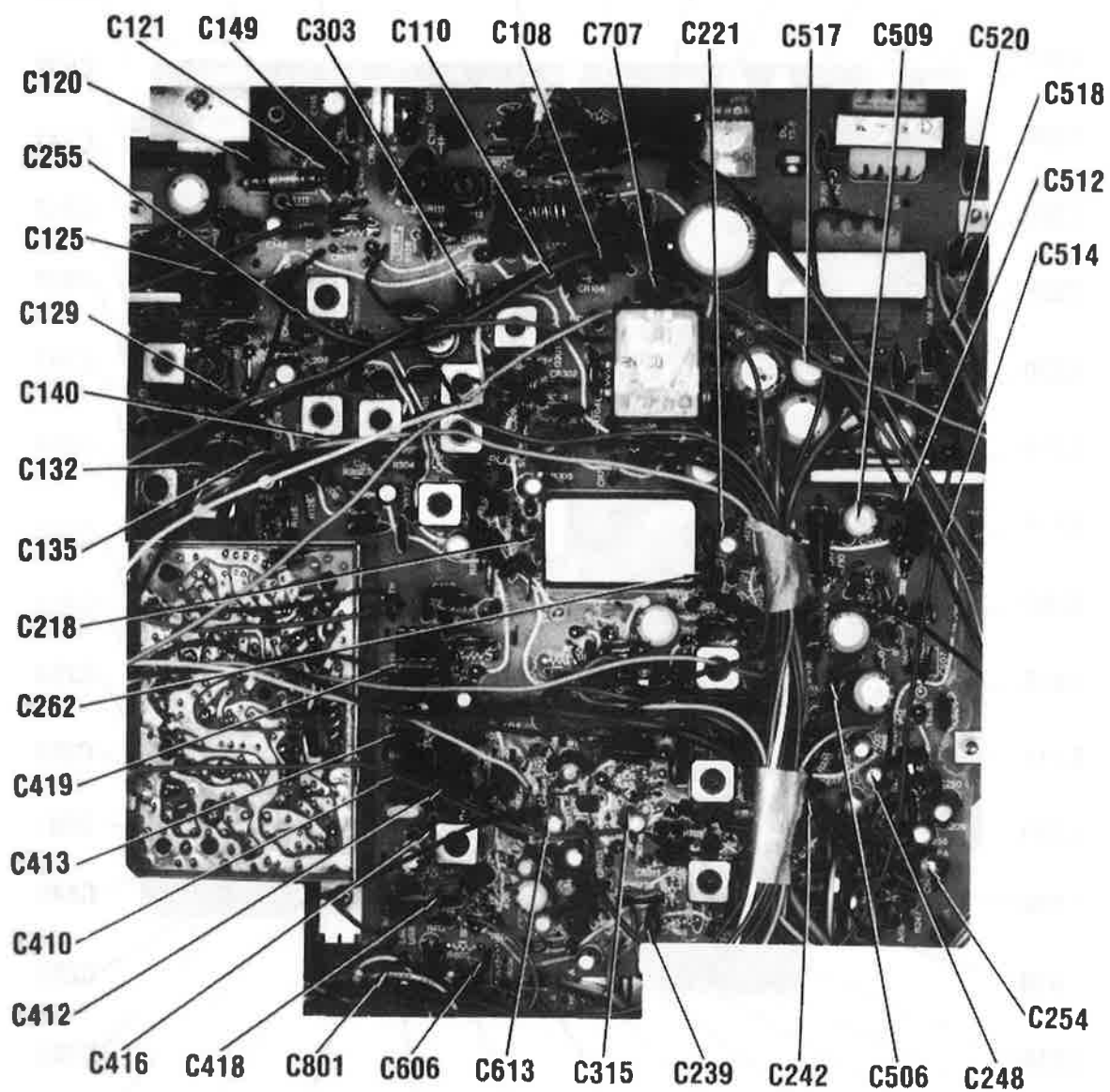
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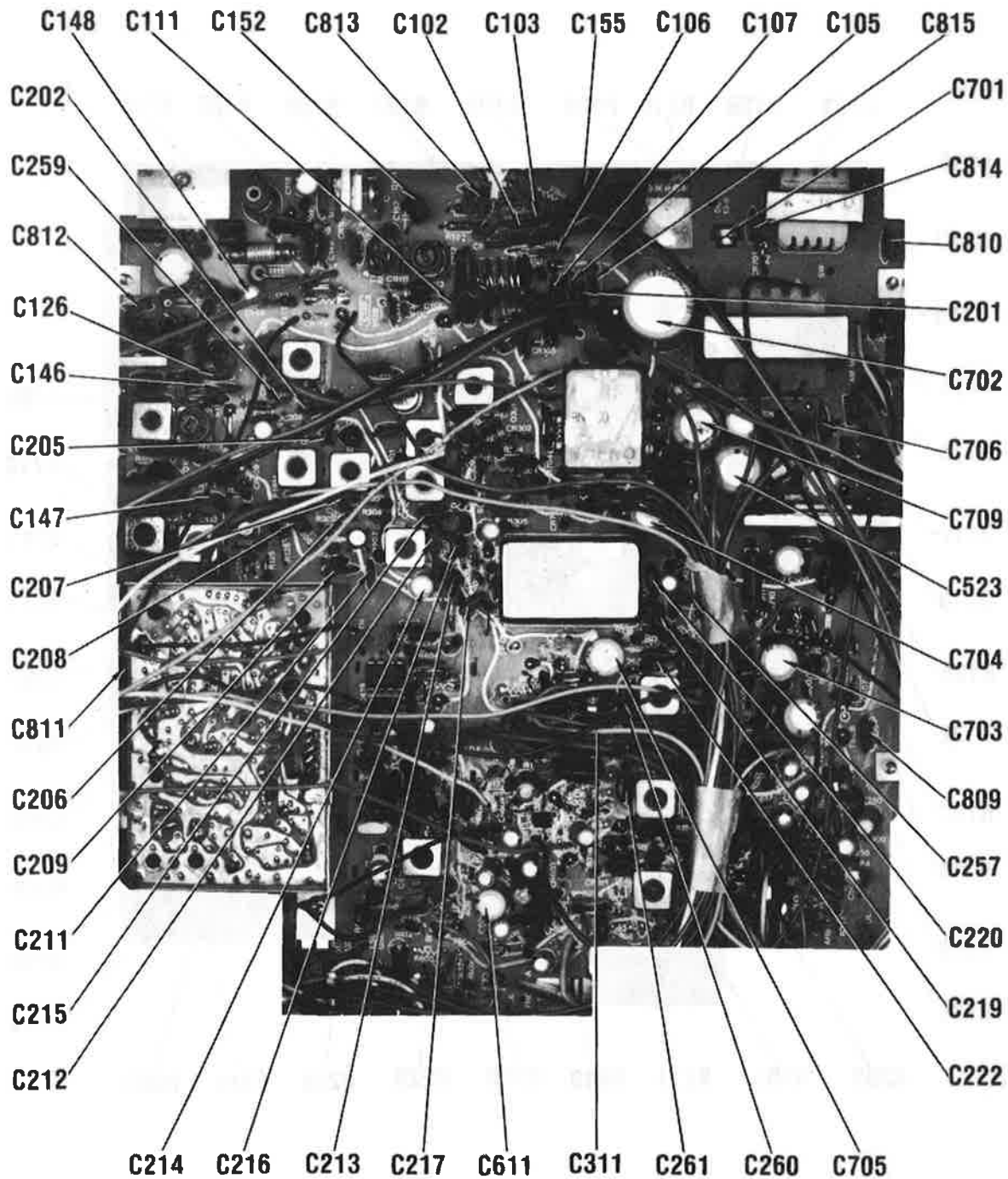
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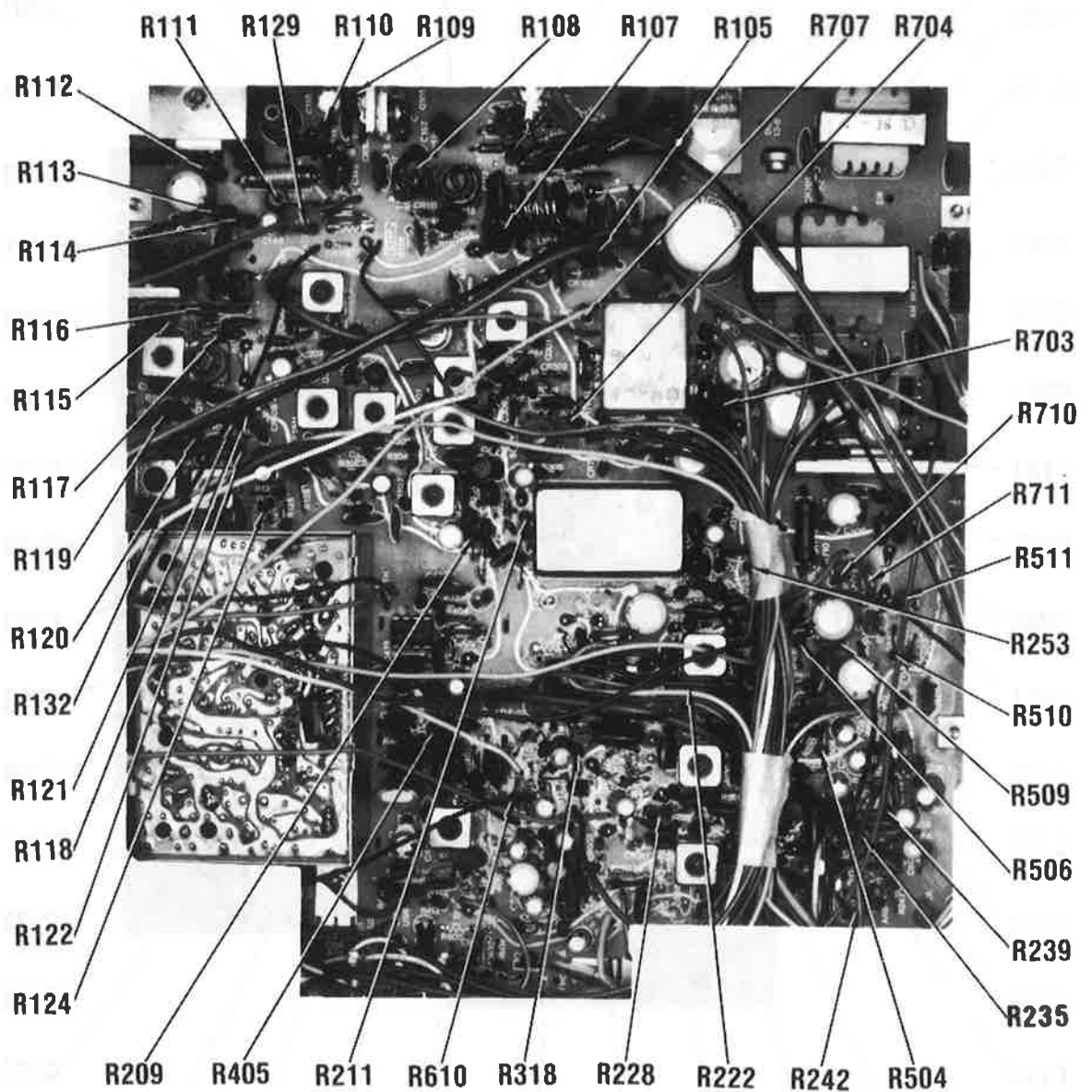
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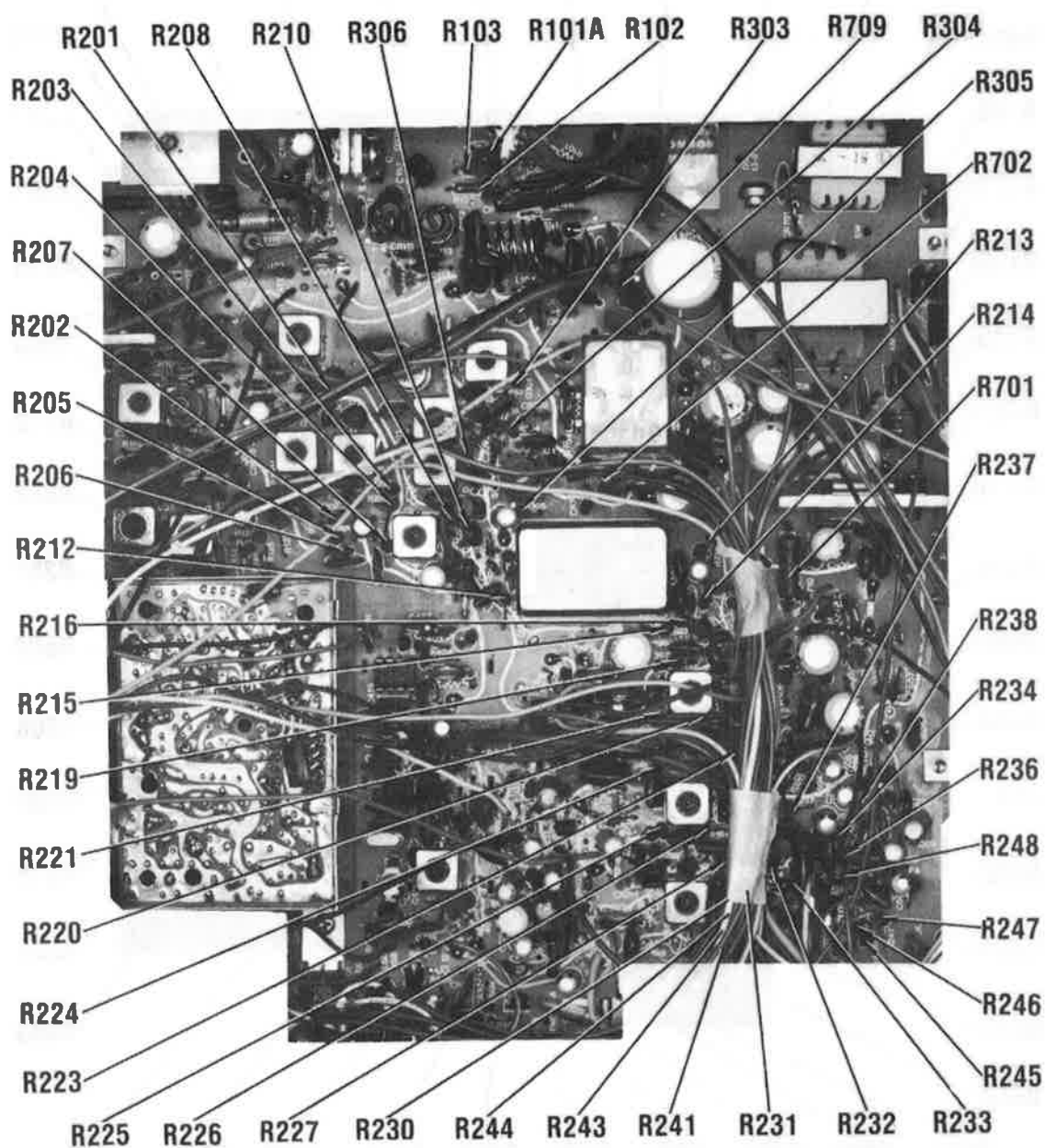
MA IN BOARD



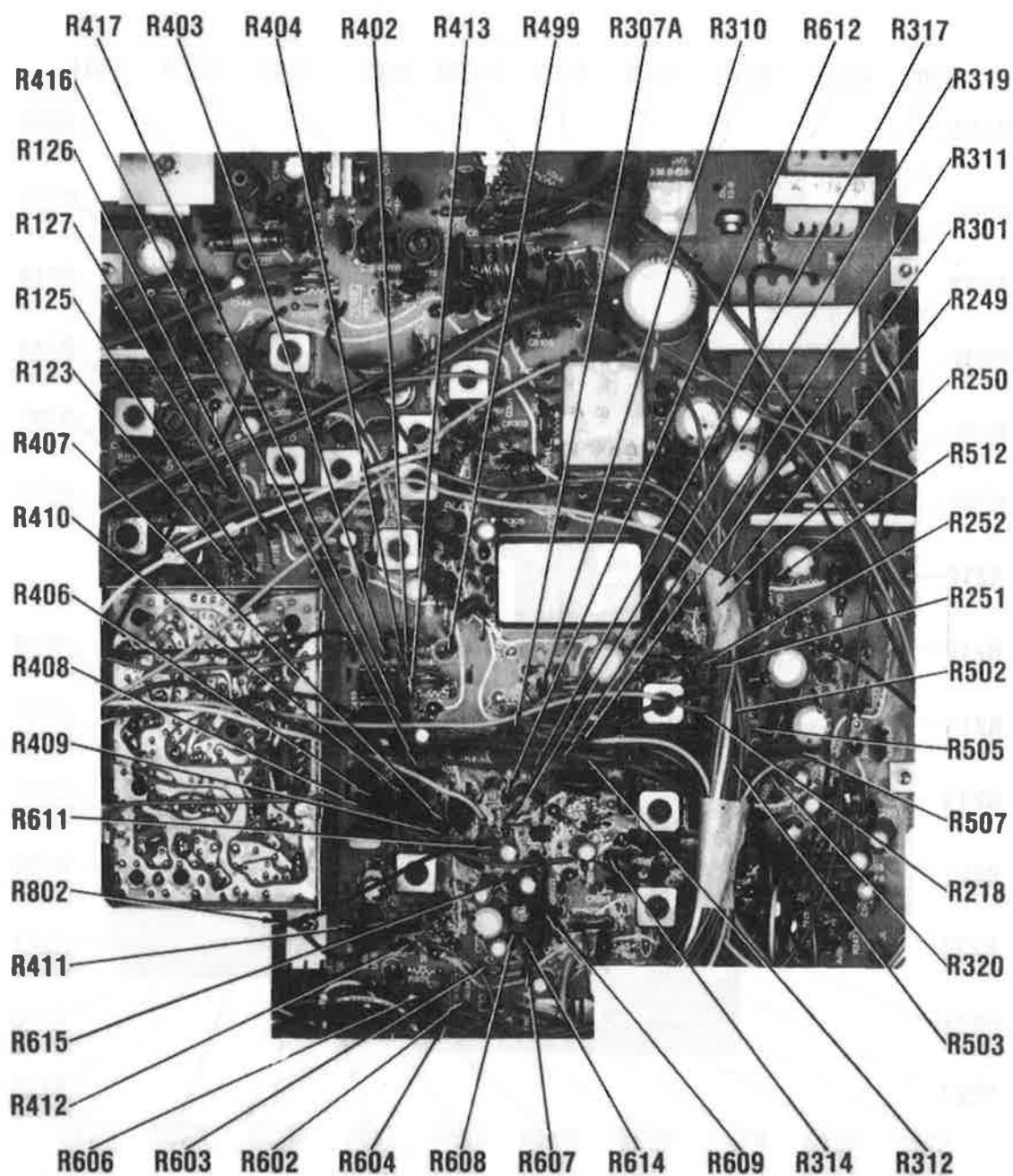
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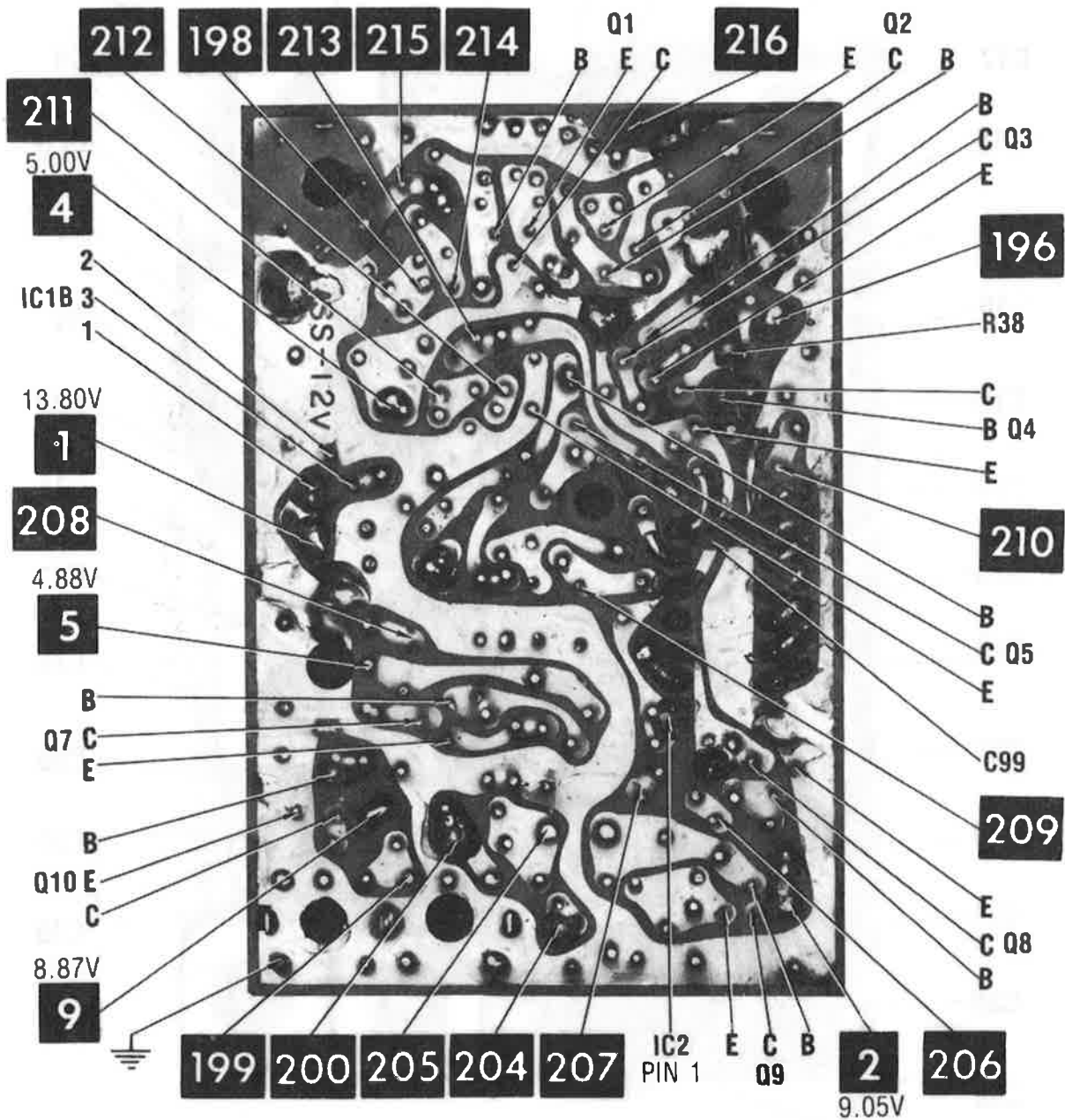
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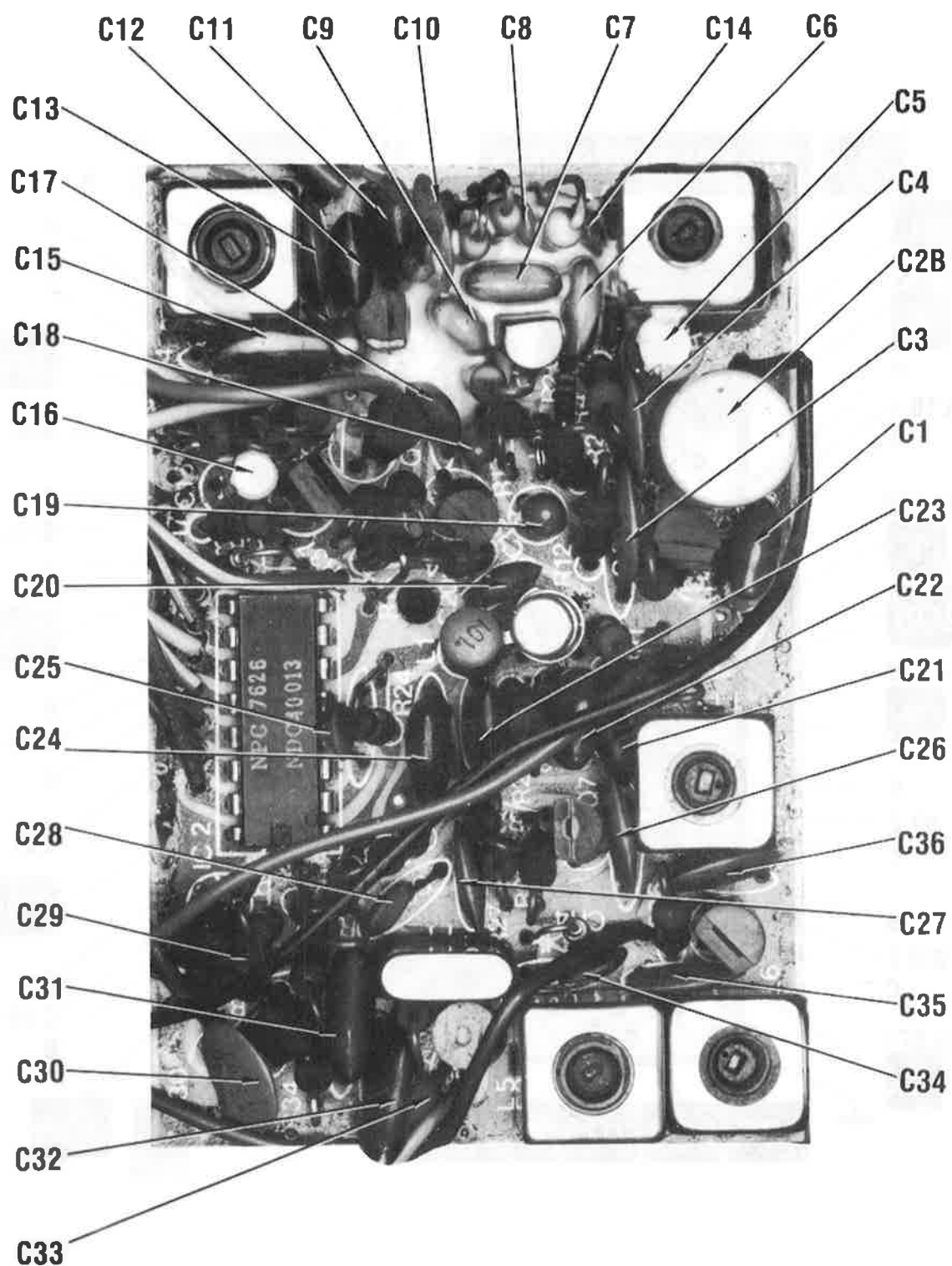
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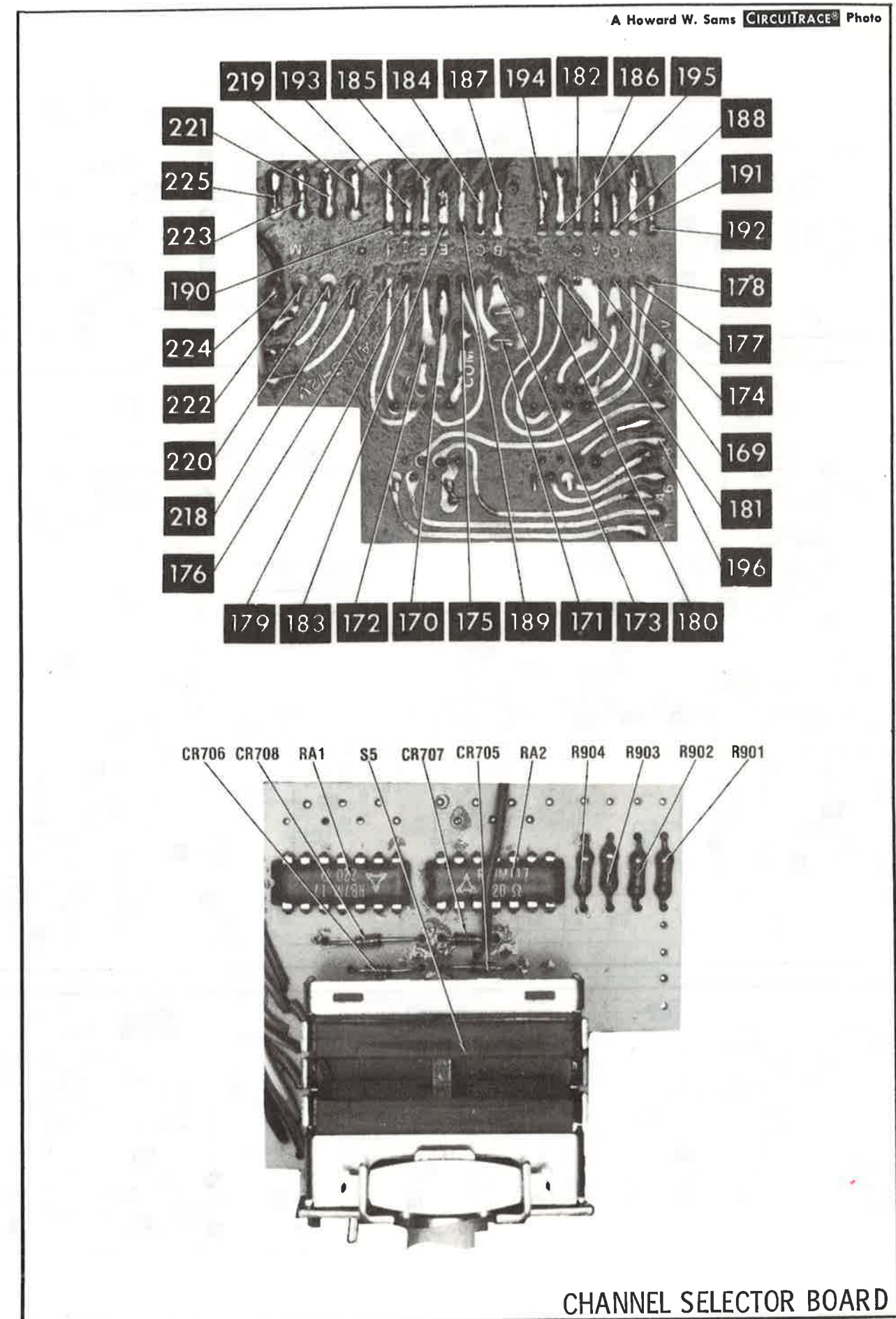
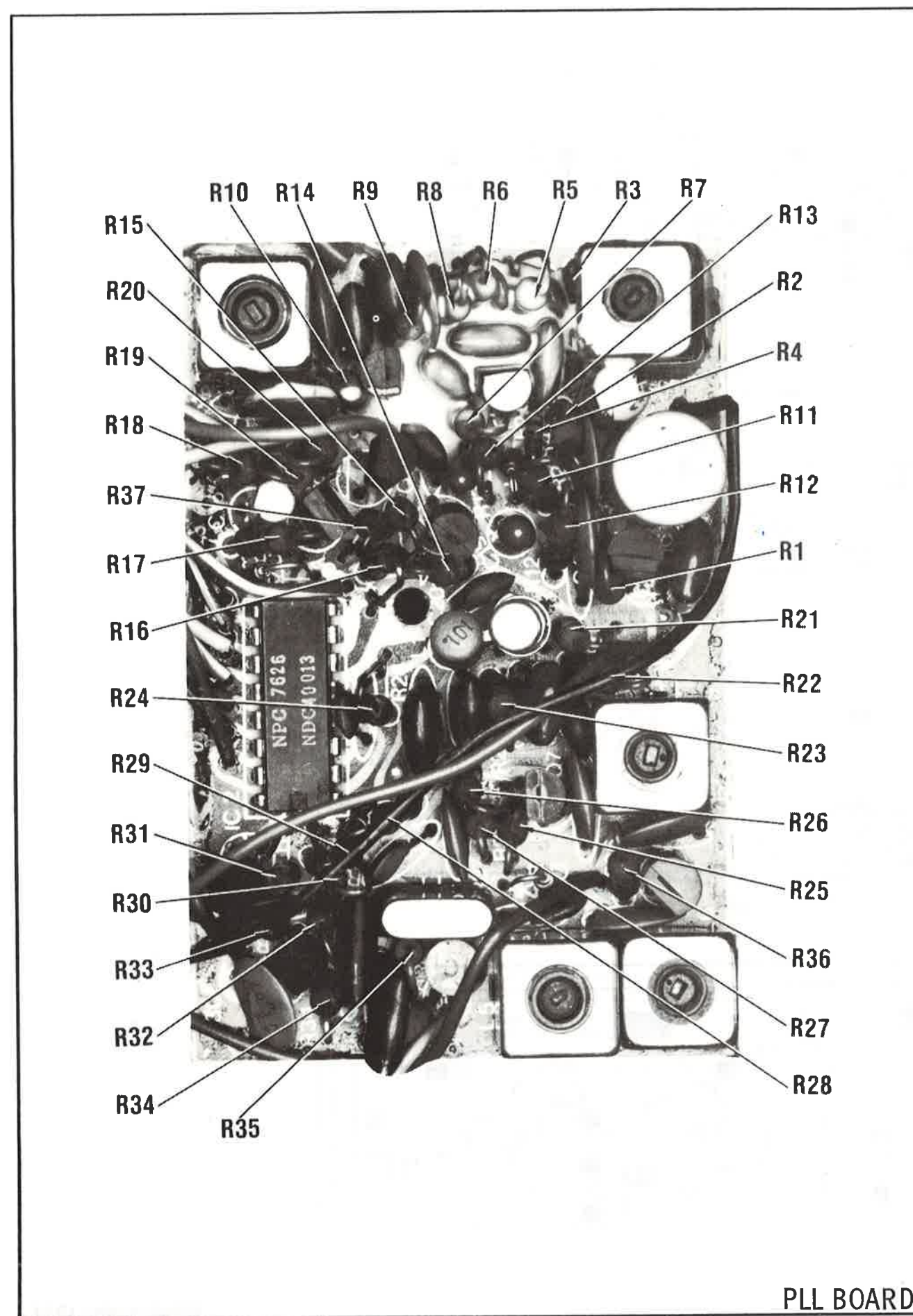
MAIN BOARD



PLL BOARD

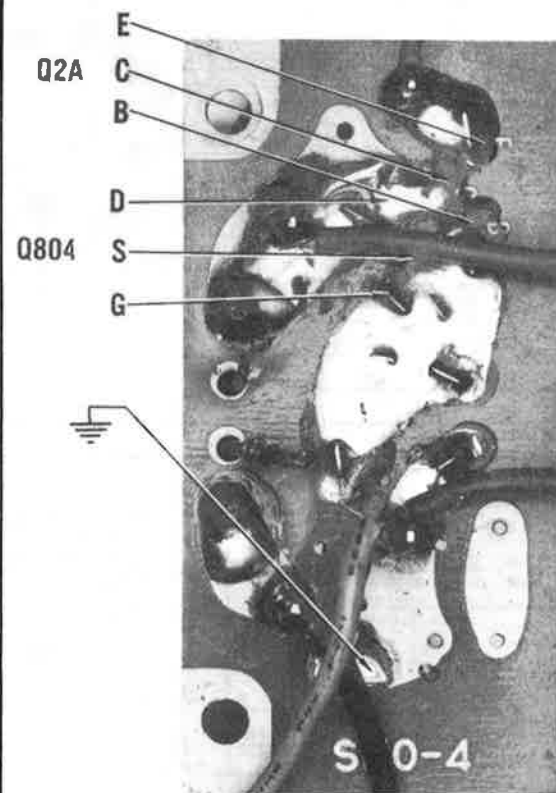
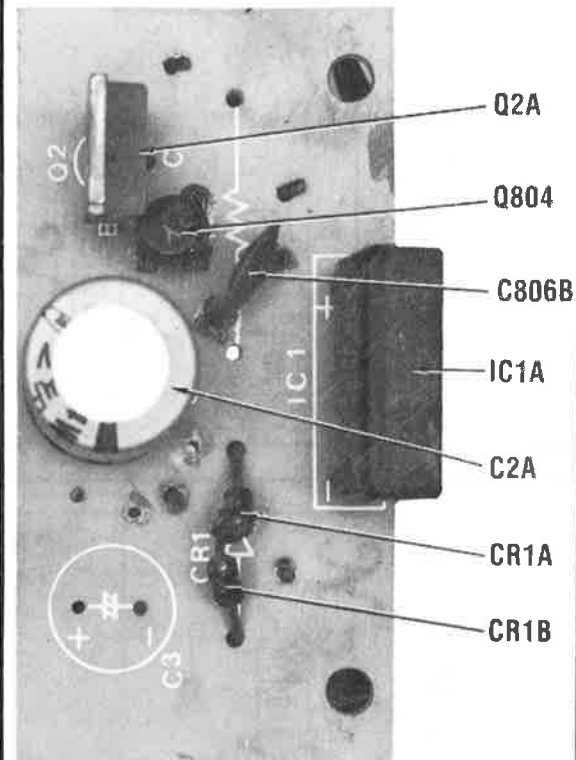


PLL BOARD

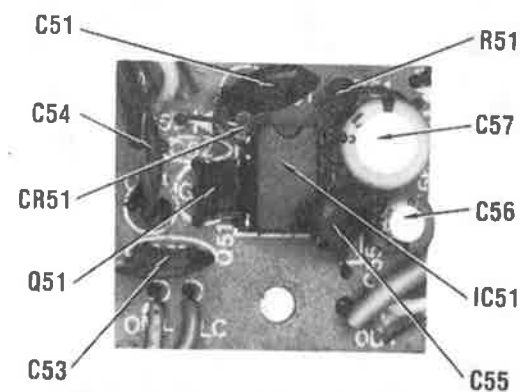
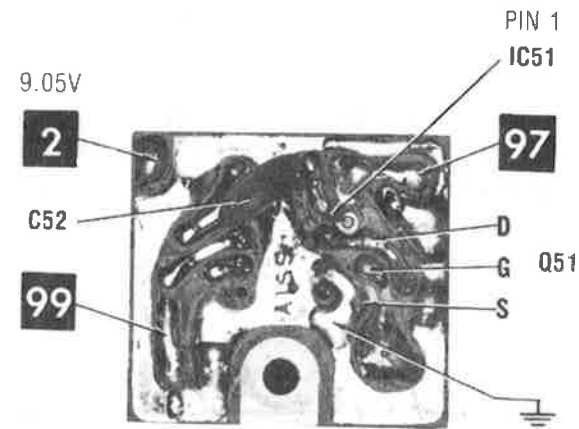




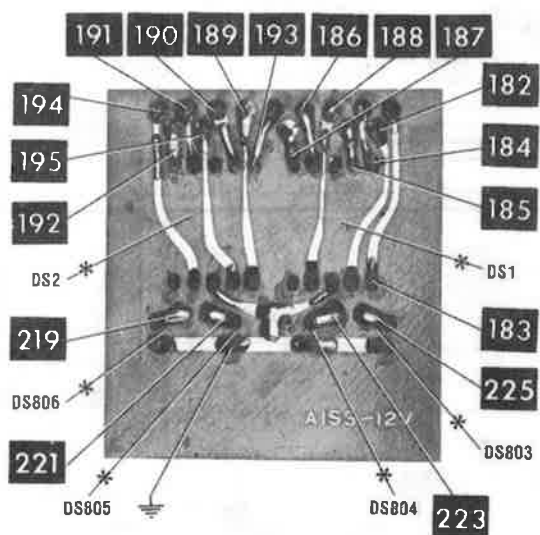
CHANNEL SELECTOR BOARD



POWER SUPPLY BOARD

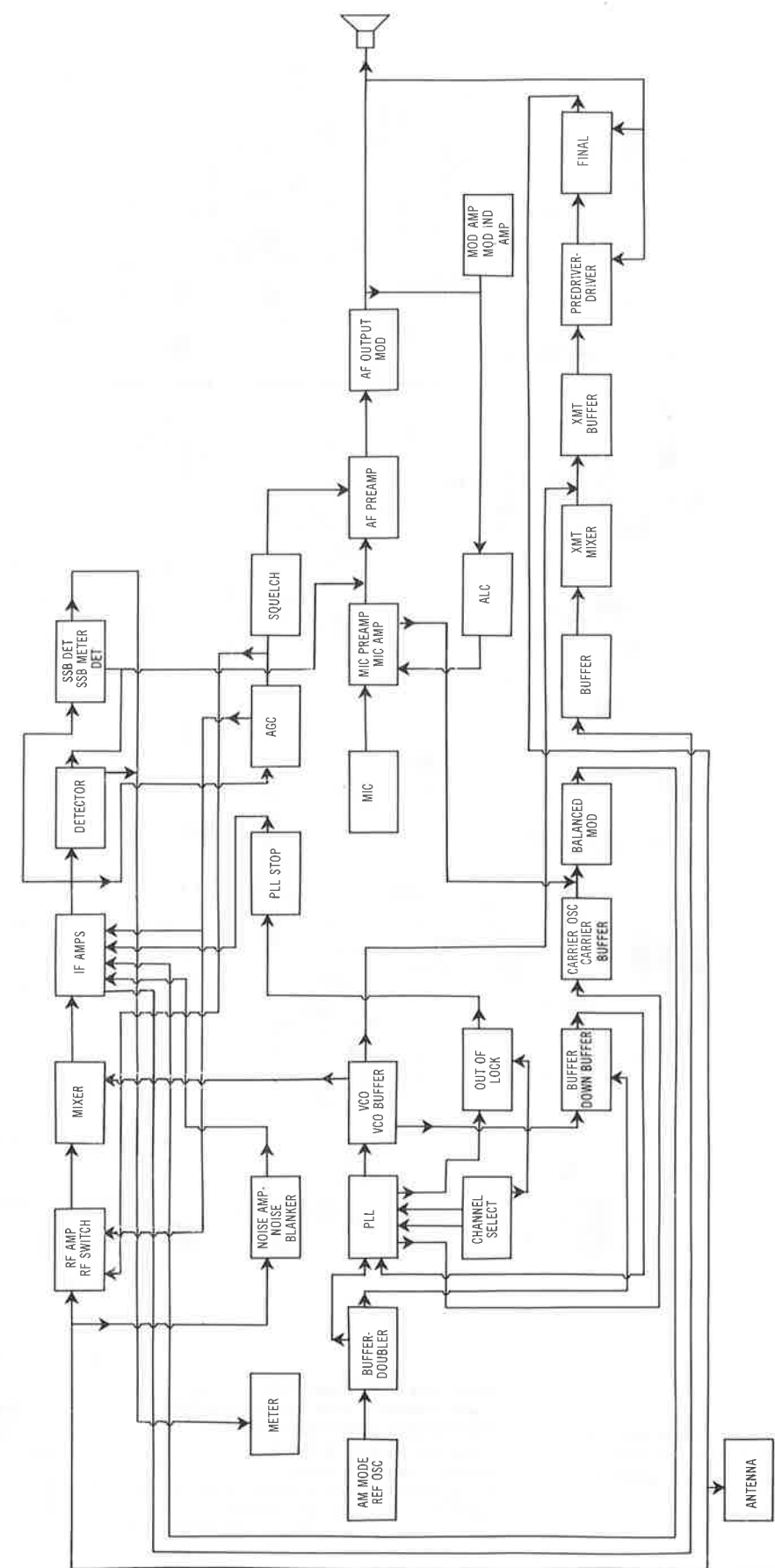


MIC AMP BOARD



* LOCATED ON BOTTOM OF BOARD

CHANNEL READOUT BOARD



BLOCK DIAGRAM

- * Circuitry not used in some versions.
- - - Circuitry used in some versions.
- ⊗ Nominal value ∇ Common tie point
- ⊥ Ground
- ▭ Chassis
- ⊙ See parts list

A PHOTOFAC STANDARD NOTATION SCHEMATIC
WITH **CIRCUITRACE**

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Waveforms and Voltages taken in Channel 19
with switching in receive unless noted.
Item numbers in rectangles appear in the
alignment/adjustment instructions.
Supply voltage maintained as shown at input.
Voltages measured with digital meter, no signal.
Controls adjusted for normal operation.
Terminal identification may not be found on unit.
Resistors are 1/2W or less, 5% unless noted.
Value in () used in some versions.
Arrow head(s) at coils and transformers
indicates accessibility of tuning slug(s).

