SERVICE MANUAL

L T D

SOLID STATE CITIZENS BAND

SSB/AM TRANSCEIVERS

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BROWNING LABORATORIES, INC. - 1269 UNION AVENUE - LACONIA, N. H. 03246

1. SSB TRANSMITTER ALIGNMENT

LTD

1.1 SSB Exciter Alignment

A. Disconnect TP 4 and connect oscilloscope TP4-TP5.

B. Rotate the channel selector switch to Channel 11.

C. Set to mode selector switch on either upper or lower sidebands.

D. Connect an audio generator to the input terminals of the microphone connector. Inject the frequency of 1 KHz.

E. Adjust the audio generator output level to 3 millivolts.

F. Press the mike button and adjust transformers T1, T2, T3, T4 and T5 for maximum output.

G. Set T6 to the maximum position and rotate to 3 turns clockwise position.

TABLE I

Location	AF or RF Voltage	DC Voltage
Mike jack	3mV r.m.s. (1KHz)	
TP13	350mV r.m.s. (1KHz)	
TP1	0.6V P-P	
Q3, 4 Base		1.5V
Q3, 4 Emitter		0.9V
Q3, 4 Collector		6.7V
Q5 Base		0.65V
Q5 Collector		4.2V
TP3	0.38 P-P	

1.2 Transistors Bias Adjustment of Linear Amplifier

A. Connect a 50ohm Wattmeter to antenna jack.

B. Set the mode selector switch on either upper or lower sideband.

C. Connect a milliamp meter between L4 and +B (TP10).

D. Short the microphone input. Press the mike button and adjust R102 for 7 milliamp current indication.

1.3 Linear Amplifier Alignment

LTD

A. Set the mode selector switch on either upper or lower sideband.

B. Short TP11-TP12 and connect audio generator to the microphone input circuit. Inject the frequency of 1KHz.

C. Adjust the audio generator output level to 3 millivolts.

D. Press the mike button and adjust the transformer and coils T14, L2 and L5 for maximum power output. Power output should be more than 9 watts.

E. Disconnect TP11-TP12 and adjust R96 for 8 watts power output.

TABLE II

Location	RF Voltage	DC Voltage
Q16 Base		1.8V
Q16 Emitter		1.2V
Q16 Collector	10V P-P	10V
Q17 Base	1.2V P-P	
Q17 Collector	12.5V P-P	
Q20 Base	3.5V P-P	
Q20 Collector	30V P-P	
Ant. Jack	60V P-P	

1.4 Carrier Balance Alignment

A. Select either upper or lower sideband with the mode switch and short the microphone input circuit to ground.

B. Press the microphone button and adjust the R20 and C15 for minimum indication on the oscilloscope. Output voltage should be less than 0.6 volts P-P.

2. AM TRANSMITTER ALIGNMENT

LTD

SSB alignment should be performed before AM alignment

2.1 AM Transmitter alignment

A. Press the mike button and adjust R85 for 3.7 watts power output.

TABLE III

Location	RF Voltage	DC Voltage
Q16 Base		2.3V
Q16 Emitter		1.9V
Q16 Collector	8.5V P-P	9V
Q17 Base	1.5V P-P	
Q17 Collector	16V P-P	
Q20 Base	25V P-P	
Q20 Collector	30V P-P	10.5V
Ant. Jack	40V P-P	

2.2 Modulation performance check

A. Connect an oscilloscope across the 50 ohm dummy load.

B. Connect an audio generator to the microphone input circuit. Inject the frequency of 1KHz.

C. Adjust the audio generator output level 2 millivolts modulation should be approx. 100%.

TABLE IV

Location	AF Voltage
Mike jack	2mV
Q31 Base	2.5mV
Q32 Base	150mV
Q32 Collector	3V
Q34, 35 Collector	8V
TP10	5V

3. AM RECEIVER

LTD

3.1 AM Receiver performance check

A. Connect the RF signal generator to the antenna jack. Set the generator output at 0.5 microvolts. 1KHz 30% modulation.

B. Connect the 8 ohm load with an audio voltmeter to external speaker jack.

C. Rotate the volume control, RF-GAIN control to the maximum clockwise position and the squelch control to the maximum counter-clockwise position.

D. Set the channel selector switch to channel 11 and the signal generator to 27.085 MHz.

E. Audio output power should be more than 1 watt.

F. Adjust the volume control for 1w(or 0.775) volt indication on the audio voltmeter. Remove the modulating signal from the signal generator. Indication on the audio voltmeter should drop 10 db or more.

3.2 AM Receiver alignment

The following table is provided to aid the alignment of the AM receiver section.

TABLE V

Alignment	Generator Frequency & Output Level	Generator Connection	Adjustment	Connection	Adjust For
2nd IF Stage	455 KHz (10 uV)	TP7-TP6	T12, T13	EXT SP Jack	MAX
1st IF Stage	7.8 MHz (3 uV)	Base of Q9	T10, T11	EXT SP Jack	MAX
RF Stage	27 MHz (0.5 uV)	Ant.Jack	T7, T8, T9	EXT SP Jack	MAX

3.3 AM Receiver Transistor Voltage

TABLE VI

		Q7	Q8	Q9	Q10	Q11	Q12
Emitter	(Source)	1.8	1.8	7.2	0.1	0	1.1
Collector	(Drain)	1.7	8	1.1	3.4	1.8	7.5
Base	(Gate)	1.7	0.35	1.8	0.4	0.6	1.8

All voltages are measured with a 100K ohm voltmeter at no output of signal generator.

3.4 AM AGC Performance Check LTD

A. Connect the signal generator to the unit. Select channel 11 and adjust the signal generator for 0.5 microvolts output signal modulated to 30%.

B. Increase the signal generator output to 100 millivolts.

C. Adjust the volume control for 1 (or 0.775) volt indication on the audio voltmeter.

D. Reduce the signal generator to 10 microvolts. The audio voltmeter should not drop more than 6 db.

3.5 AM S Meter Alignment

A. Connect the unit as described in Step 3.4 and adjust the signal generator for 100 microvolts.

B. Adjust R67 for S9 indication.

3.6 Squelch performance check

A. Connect the unit as described in Step 3.1.

B. Rotate the squelch control until the signal has been just muted.

C. Advance the signal generator output level until the squelch is broken. It should take less than 0.5 microvolts increase on the signal generator output to break the squelch.

D. Rotate the squelch control to the maximum clockwise position. Advance the signal generator output. Adjust R160 to break the squelch between the output of 30 and 300 microvolts.

3.7 Squelch Troubleshooting

Table VII is to be used as an aid in locating and correcting the troubles in the squelch circuitry.

TABLE VII

Stage		Unsquelch	Full squelch
	F	0	0
Q36	C	0.7	0.06
	B	0.35	0.65
	E	0	0
Q37	C	0.03	6.5
	B	0.7	0.06

4. SSB RECEIVER

LTD

4.1 SSB Receiver Performance Check

A. Connect an RF signal generator to the antenna jack. Set the signal generator output level to 0.25 microvolts with no modulation.

B. Connect a 8 ohm load with an Audio voltmeter to external speaker jack.

C. Set the mode selector switch to upper sideband. Rotate the volume control, RF-GAIN Control to its maximum clockwise position and the squelch control to its maximum counterclockwise position.

D. Rotate channel selector switch to Channel 11.

E. Adjust the signal generator output frequency to the audio tone of approx. 1 KHz. Audio output power should be more than 1 watt.

F. Adjust the volume control for 1 (or 0.775) volt indication on the audio voltmeter.

G. Reduce the signal generator output. The indication on the audio voltmeter should drop 10 db or more.

TABLE VIII

LOCATION (terminal of IC1)	DC VOLTAGE
1	2
2	2
3	8
4	0
5	8
6	2
7	2

5. SYNTHESIZER

5.1 Synthesizer Performance Check

A. Connect a 50 ohm Wattmeter to the antenna jack.

B. Connect a frequency counter to the antenna jack.

C. Connect an audio generator set at 1 KHz to the microphone input.

D. Rotate the channel selector to Channel 1 and the mode switch to USB.

E. Press the mike button and increase the audio generator output until sufficient RF output is obtained to trigger the counter.

F. Check the DELTA control for maximum and minimum output frequency. This should be 26.966 MHz± approx. 800 Hz.

G. Check the remaining channels in the upper sideband mode. Keep in mind that the output frequency will appear 1 KHz higher than the actual assigned channel number since you are using a 1 KHz tone.

H. When checking output frequency when the mode switch is at LSB, the measured output frequency should be 1 KHz ± approx. 800 Hz, less than the assigned channel frequency.

5.2 Synthesizer alignment

A. Short between TP301 and ground (TP304) and connect the frequency counter between TP302 and TP304.

B. Set the channel selector switch on Channel 1 and mode selector switch to USB or LSB.

C. Adjust C320 for a frequency reading of 6,000 MHz.

D. Frequency adjustment for the remaining channels are listed in Table IX.

TABLE IX

Channel	Mode Switch	ADJUSTMENT	Frequency (MHz)
1	USB or LSB	C320	6,000
2	USB or LSB	C318	6,010
3	USB or LSB	C316	6,020
4	USB or LSB	C314	6,040

E. Disconnect TP301-TP304 and disconnect S16 main contact from PC board.

F. Set the channel selector switch in channel 1 and mode switch to USB or LSB

G. Adjust C312 for frequency reading of 15.965 MHz.

H. Frequency adjustment for the remaining channels are listed in Table X.

TABLE X

Channel	Mode Switch	Adjustment	Frequency (MHz)
1	USB or LSB	C312	15.965
5	USB or LSB	C310	16.015
9	USB or LSB	C308	16.065
13	USB or LSB	C306	16.115
17	USB or LSB	C304	16.165
21	USB or LSB	C302	16.215

I. Remove the frequency counter from TP302-TP304.

J. Connect the frequency counter between TP303 and TP304.

K. Set the mode selector switch on USB and delta tune control to its maximum clockwise position.

L. Adjust L301 for a frequency reading of 12.8023 MHz.

M. Set the mode selector switch on LSB and delta tune control to its maximum counter-clockwise position.

N. Adjust R327 for a frequency reading of 12.7977 MHz.

O. Set the mode selector switch on USB and delta tune control to its maximum counterclockwise position.

P. Adjust R325 for a frequency reading of 12.8007 MHz.

Q. Set the mode selector switch on LSB and delta tune control to its maximum clockwise position.

R. Adjust R323 for a frequency reading of 12.7993 MHz.

S. Connect S16 main contact to PC board and remove the frequency counter from TP303 - TP304.

T. Short between TP305 and TP304 and connect an oscilloscope to TP303 - TP304.

U. Tune the peak of T301 and T302 for maximum indication on the oscilloscope.

V. Remove the oscilloscope from TP303 - TP304 and discount TP305 - TP304.

W. Connect an oscilloscope to output of T305.

X. Tune the peak of T303, T304, and T305 for maximum indication on the oscilloscope.
A typical voltage reading should be 0.2 volts P-P.

5.3 Synthesizer Troubleshooting

A. Locating a problem in the synthesizer circuitry of the unit, use the measurement in Table XI.

TABLE XI

Location		RF Voltage (V P-P)
Q301	Base	2.4
Q302	Base	6.4
Q305	Emitter	2
T305	(Output)	0.2

B. If there were no synthesizer output on some channels, refer to Table XII to locate the defective crystal.

TABLE XII

LTD

		7 MHZ			12.8MHz			16 MHz						6 MHz			
		7.7985 MHz	7.8015 MHz	7.3450 MHz	12.7985 MHz±800 Hz	12.800 MHz±2.3 KHz	12.8015 MHz±800Hz	15.965 MHz	16.015 MHz	16.065 MHz	16.115 MHz	16.165 MHz	16.215 MHz	6.000 MHz	6.010 MHz	6.020 MHz	6.040 MHz
1 26.965 MHz	USB		o				o	o						o			
	LSB,AM-TX	o			o			o						o			
	AM-RX			o		o		o						o			
2 26.975 MHz	USB		o				o	o							o		
	LSB,AM-TX	o			o			o							o		
	AM-RX			o		o		o							o		
3 26.985 MHz	USB		o				o	o								o	
	LSB,AM-TX	o			o			o								o	
	AM-RX			o		o		o								o	
4 27.005 MHz	USB		o				o	o									o
	LSB,AM-TX	o			o			o									o
	AM-RX			o		o		o									o
5 27.015 MHz	USB		o				o		o					o			
	LSB,AM-TX	o			o				o					o			
	AM-RX			o		o			o					o			
6 27.025 MHz	USB		o				o		o						o		
	LSB,AM-TX	o			o				o						o		
	AM-RX			o		o			o						o		
7 27.035 MHz	USB		o				o		o							o	
	LSB,AM-TX	o			o				o							o	
	AM-RX			o		o			o							o	
8 27.055 MHz	USB		o				o		o								o
	LSB,AM-TX	o			o				o								o
	Am-RX			o		o			o								o

TABLE XII

LTD

		7 MHz			12.8 MHz			16 MHz						6 MHz			
		7.7985 MHz	7.8015 MHz	7.3450 MHz	12.7985 MHz±800Hz	12.800 MHz±2.3KHz	12.8015 MHz±800Hz	15.965 MHz	16.015 MHz	16.065 MHz	16.115 MHz	16.165 MHz	16.215 MHz	6.000 MHz	6.010 MHz	6.020 MHz	6.040 MHz
9	USB		o				o			o				o			
27.065 MHz	LSB, AM-TX	o			o					o				o			
	AM-RX			o		o				o				o			
10	USB		o				o			o					o		
27.075 MHz	LSB, AM-TX	o			o					o					o		
	AM-RX			o		o				o					o		
11	USB		o				o			o						o	
.085 MHz	LSB, AM-TX	o			o					o						o	
	AM-RX			o		o				o						o	
12	USB		o				o			o							o
27.105 MHz	LSB, AM-TX	o			o					o							o
	AM-RX			o		o				o							o
13	USB		o				o				o			o			
27.115 MHz	LSB, AM-TX	o			o						o			o			
	AM-TX			o		o					o			o			
14	USB		o				o				o				o		
27.125 MHz	LSB, AM-TX	o			o						o				o		
	AM-TX			o		o					o				o		
15	USB		o				o				o					o	
27.135 MHz	LSB, AM-TX	o			o						o					o	
	AM-TX			o		o					o					o	
16	USB		o				o				o						o
27.155 MHz	LSB, AM-TX	o			o						o						o
	AM-RX			o		o					o						o

TABLE XII

LTD

		7 MHz			12.8 MHz			16 MHz						6 MHz			
		7.7985 MHz	7.8015 MHz	7.3450 MHz	12.7985 MHz±800Hz	12.800 MHz±2.3KHz	12.8015 MHz±800Hz	15.965 MHz	16.015 MHz	16.065 MHz	16.115 MHz	16.165 MHz	16.215 MHz	6.000 MHz	6.010 MHz	6.020 MHz	6.040 MHz
17 27.165 MHz	USB		o			o						o		o			
	LSB, AM-TX	o			o							o		o			
	AM-RX			o		o						o		o			
18 27.175 MHz	USB		o			o						o			o		
	LSB, AM-TX	o			o							o			o		
	AM-RX			o		o						o			o		
19 27.185 MHz	USB		o			o						o				o	
	LSB, AM-TX	o			o							o				o	
	AM-RX			o		o						o				o	
20 27.205 MHz	USB		o			o						o					o
	LSB, AM-TX	o			o							o					o
	AM-RX			o		o						o					o
21 27.215 MHz	USB		o			o							o	o			
	LSB, AM-TX	o			o								o	o			
	AM-RX			o		o							o	o			
22 27.225 MHz	USB		o			o							o		o		
	LSB, AM-TX	o			o								o		o		
	AM-RX			o		o							o		o		
23 27.255 MHz	USB		o			o							o				o
	LSB, AM-TX	o			o								o				o
	AM-RX			o		o							o				o

5.4 Carrier Oscillator Alignment LTD

A. Connect the frequency counter to TP1-TP2.

B. Set the mode selector switch to upper sideband

C. Adjust C4 for the output frequency of 7,801.500 KHz.

D. Set the mode selector switch to lower sideband.

E. Adjust C2 for the output frequency of 7,798.500 KHz.

TABLE XIII

LOCATION	RF VOLTAGE
Q2 Base	0.5V P-P
TP1	0.6V P-P

6. SIGNAL FLOW

AM RECEIVE SIGNAL FLOW

Q6	RF Gain Control	27 MHz
Q7	AGC	27 MHz
Q8	RF Amp.	27 MHz
IC2	Noise Blanker	27 MHz, 7.8 MHz
Synthesizer	1st LO.	34.8 MHz
Q9	1st Mixer	7.8 MHz
Q15	2nd LO.	7.3 MHz
Q10	2nd Mixer	455 KHz
Q11,12	IF Amp.	455 KHz
CD24	Detector	Audio
CD25	A.N.L.	Audio
Q30,31,32,34,35	Audio Amp.	Audio
CD25	S Meter Det.	DC
Q36,37	Squelch Amp.	DC
Q33	Bias	DC

SSB RECEIVE SIGNAL FLOW

LTD

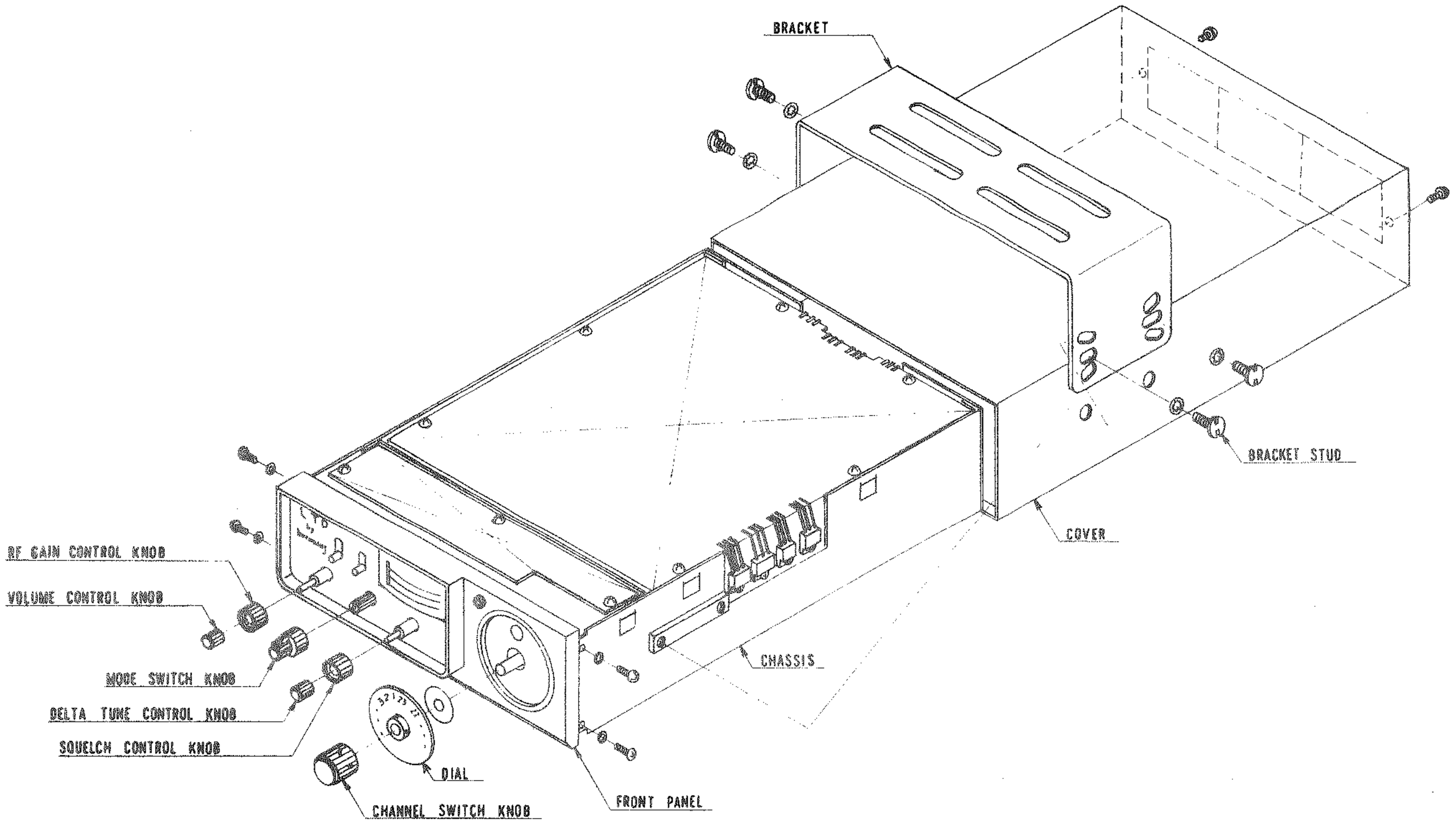
Q6	RF Amp.	27 MHz
Q7	AGC	27 MHz
Q8	RF Gain Control	27 MHz
IC2	Noise Blanker	27 MHz, 7.8 MHz
Synthesizer	lst LO.	34.8 MHz
Q9	lst Mixer	7.8 MHz
Ul	Filter	7.8 MHz
lCl	IF Amp.	7.8 MHz
CD8,9,10,11	Balanced Demodulator	Audio
Ql	USB and LSB 2nd LO.	7.8 MHz
Q2	Buffer Amp.	7.8 MHz
Q30,31,32,34,35	Audio Amp.	Audio
Q26,27	AGC Amp.	Audio
Q28,29	AGC Amp.	DC
CD43,44	AGC Det.	DC
CD40,41	S Meter Det.	DC
Q36,37	Squelch Amp.	DC
Q33	Bias	DC

AM TRANSMIT SIGNAL FLOW

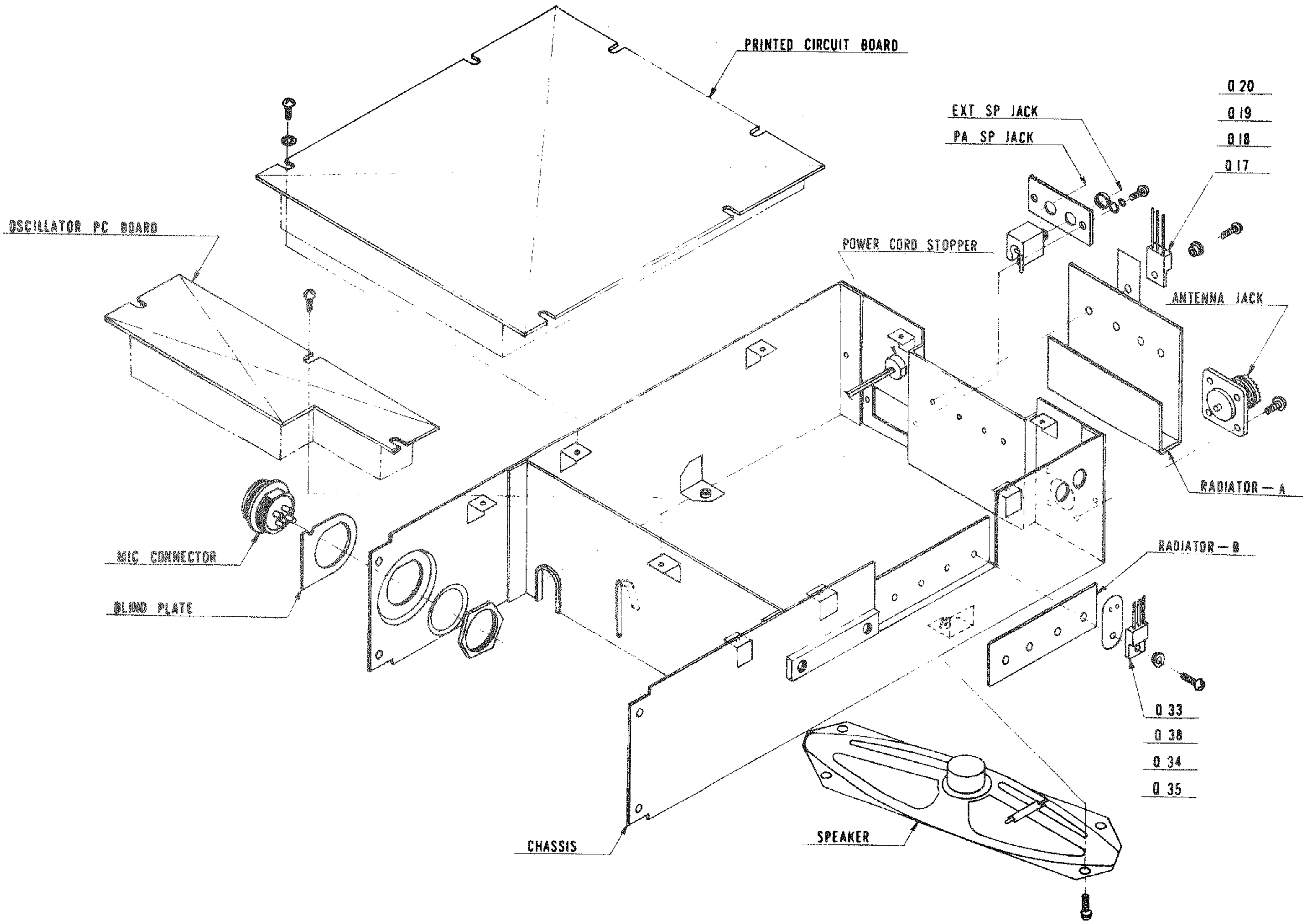
Q1	Carrier OSC	7.8 MHz
Q2	Buffer Amp.	7.8 MHz
Synthesizer	Local OSC	34.8 MHz
Q3, 4	Mixer	27 MHz
Q5	RF Amp.	27 MHz
Q16	RF Amp.	27 MHz
Q17	RF Driver	27 MHz
Q20	Final Amp.	27 MHz
Q18	Bias	DC
CD36	Lamp Detector	DC
Q21	Lamp Amp.	DC
Q23	Mod AGC	Audio
Q24,31,32	Audio Amp.	Audio
Q34,35	Modulator	Audio

SSB TRANSMIT SIGNAL FLOW

Q23	ALC Gate	Audio
Q24,25	Audio Amp	Audio
Q1	USB and LSB Carrier OSC.	7.8 MHz
Q2	Buffer Amp.	7.8 MHz
CD8,9,10,11	Balanced Modulator	7.8 MHz
U1	Filter	7.8 MHz
Synthesizer	Local, OSC	34.8 MHz
Q3, 4	Mixer	27 MHz
Q5	RF Amp	27 MHz
Q16	RF Amp	27 MHz
Q17	Driver	27 MHz
Q20	Final Amp.	27 MHz
Q18,19	Bias	DC
CD35	AGC Det.	DC
CD36	Lamp Det.	DC
Q21	Lamp Amp.	DC



DISASSEMBLY — A



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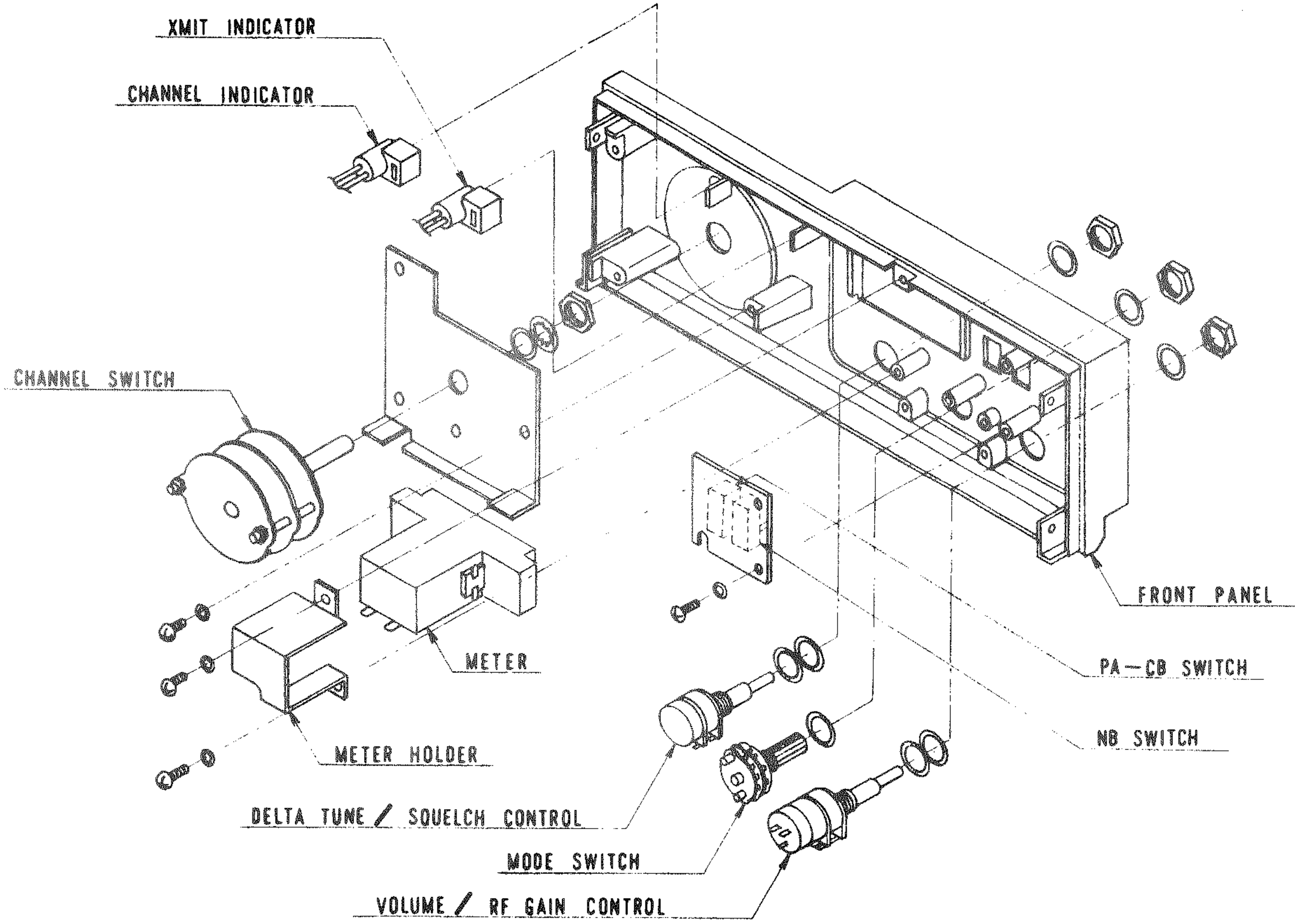
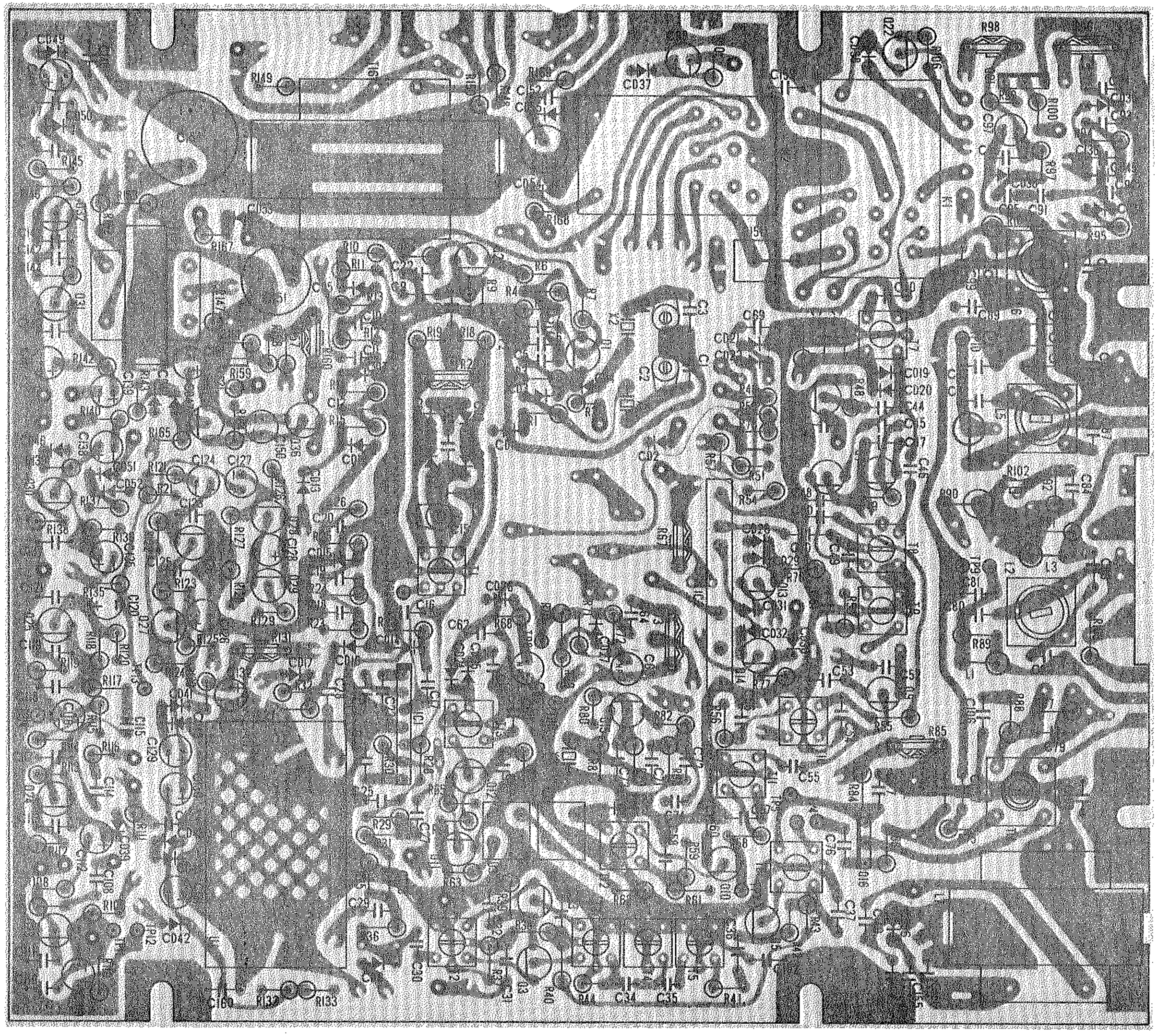
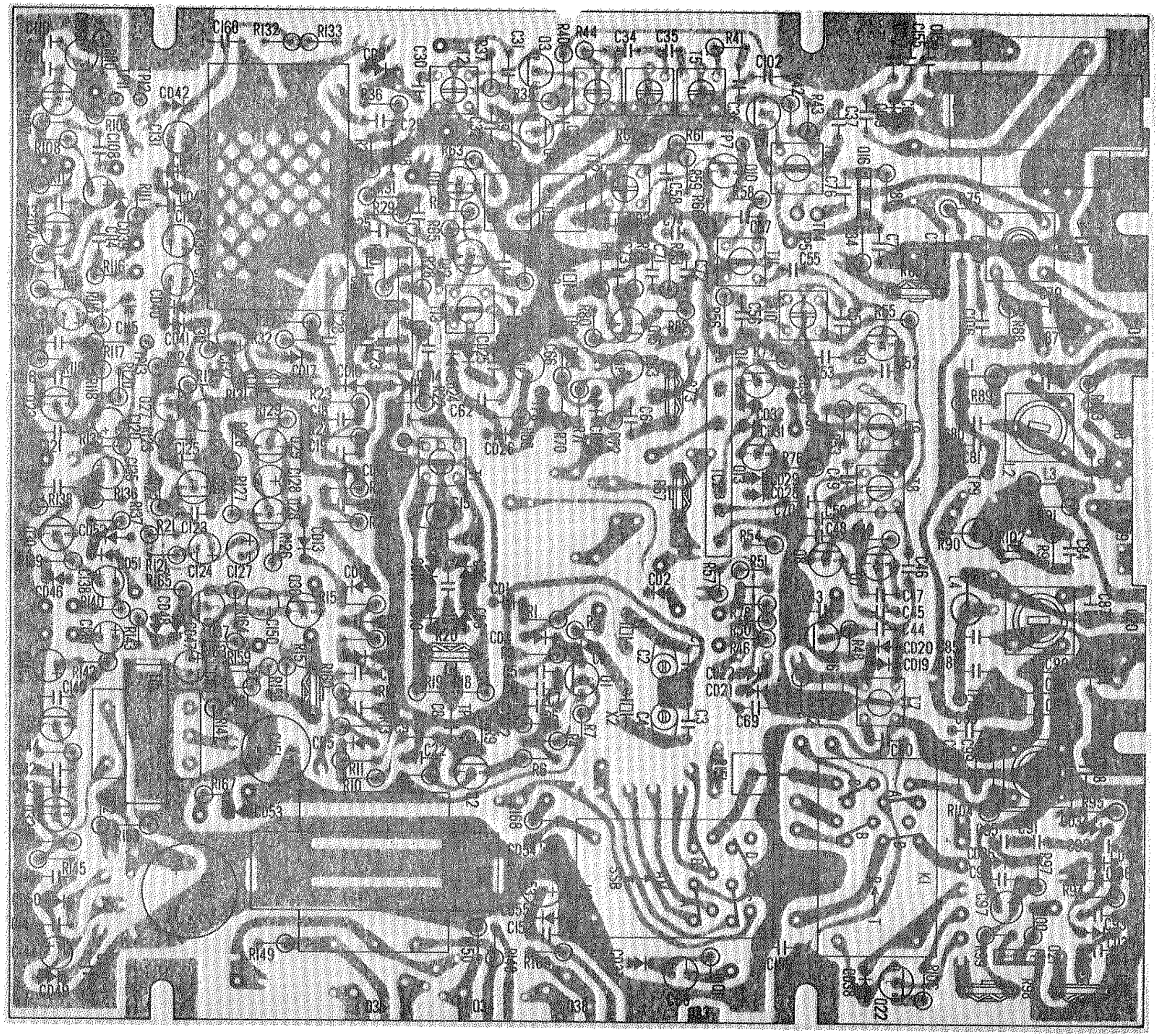


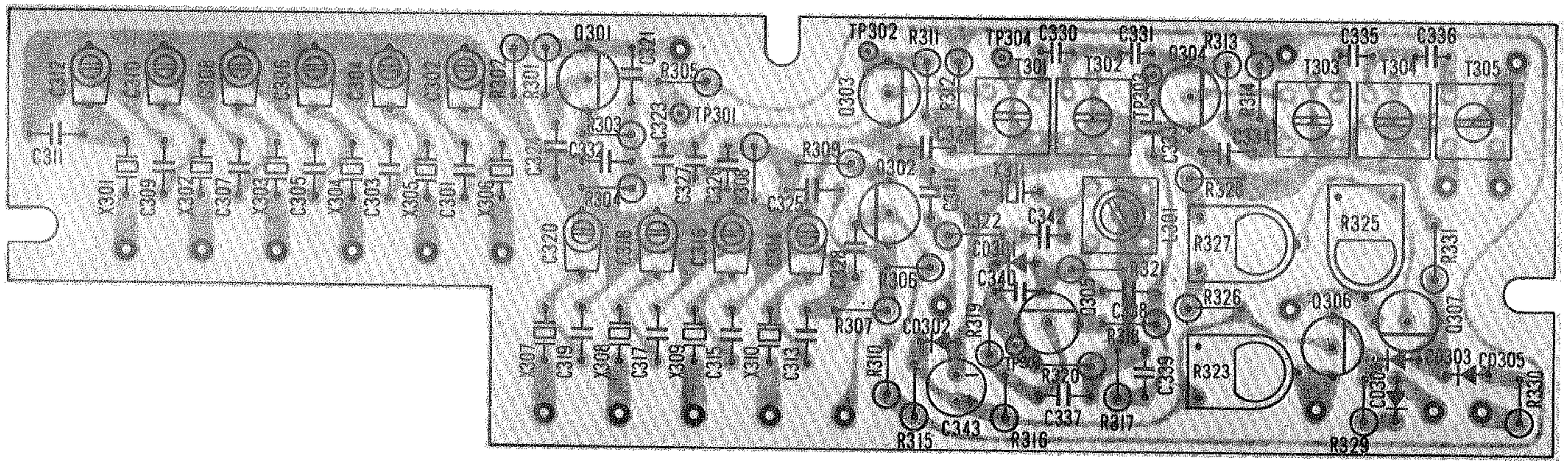
DISASSEMBLY — C



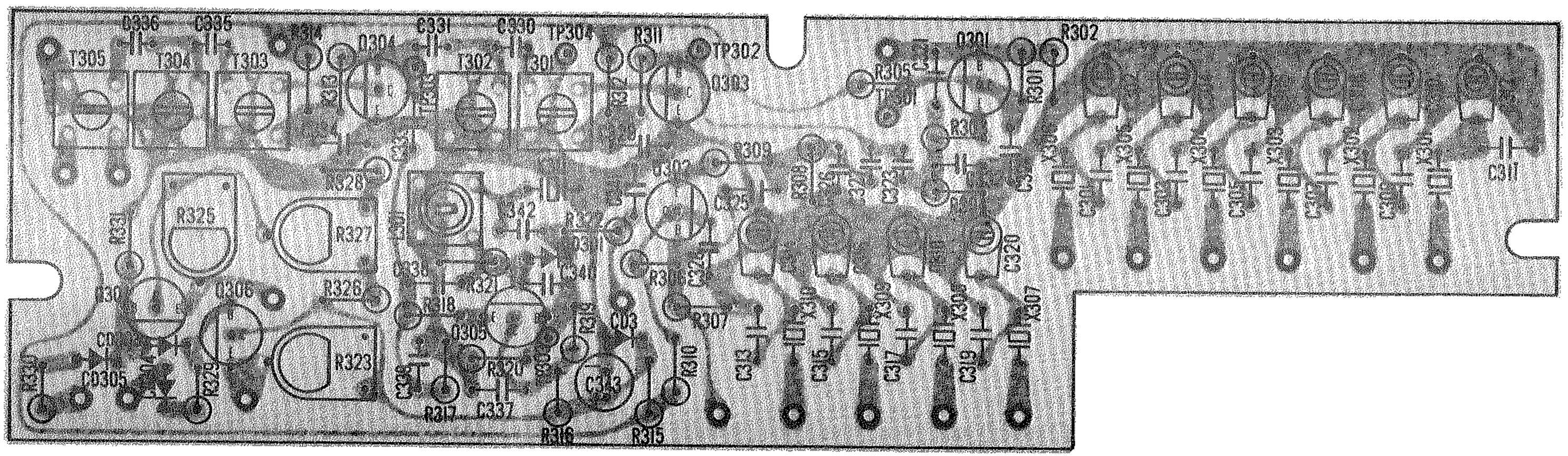
CIRCUIT BOARD DIAGRAM TOP VIEW



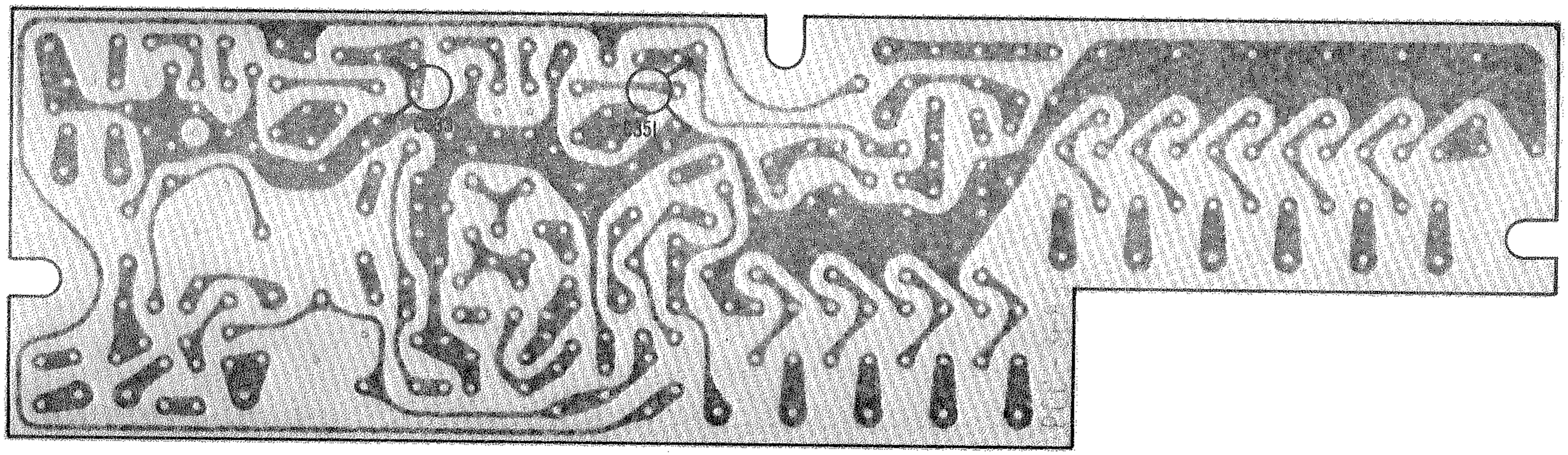
CIRCUIT BOARD DIAGRAM BOTTOM VIEW



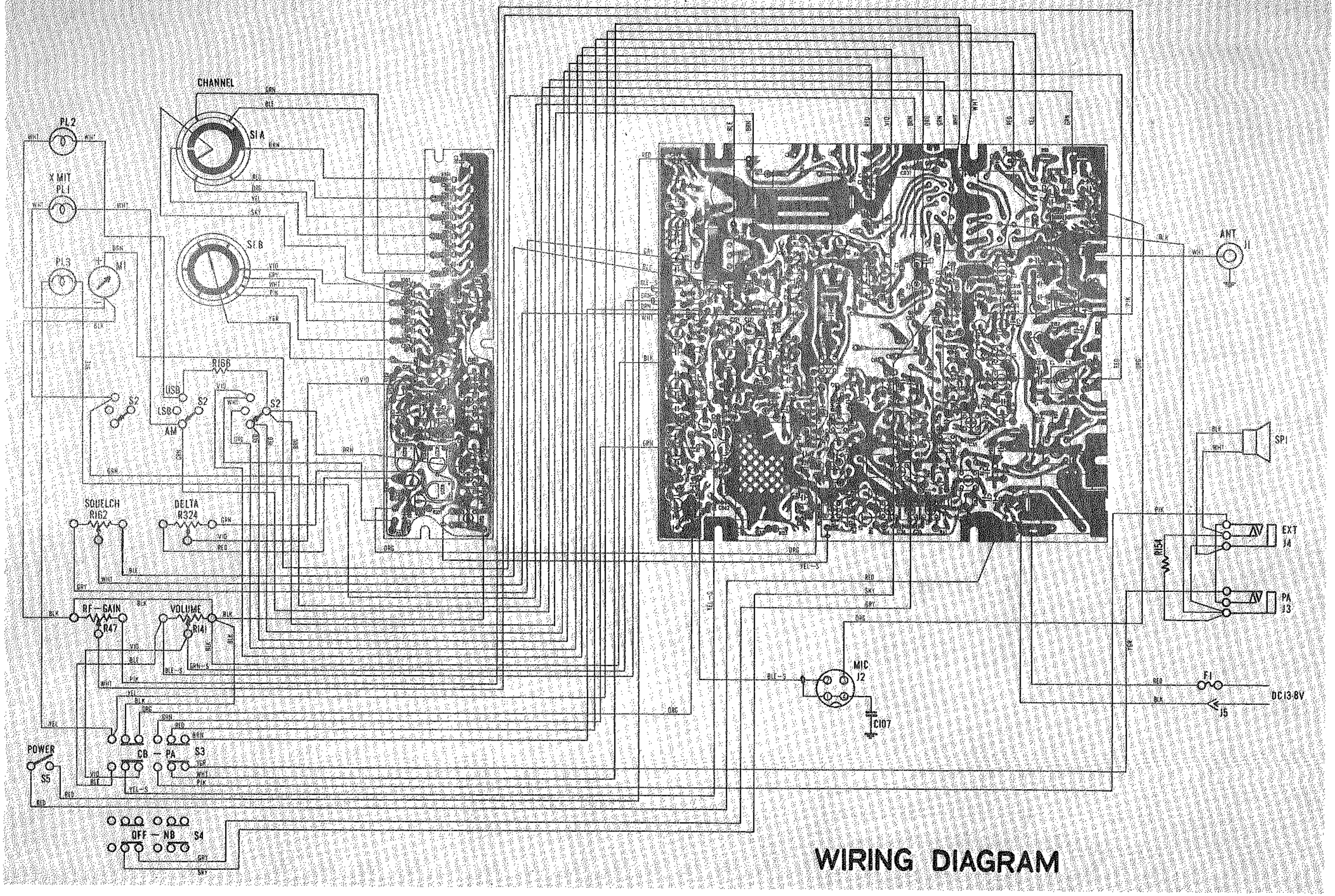
CIRCUIT BOARD DIAGRAM TOP VIEW



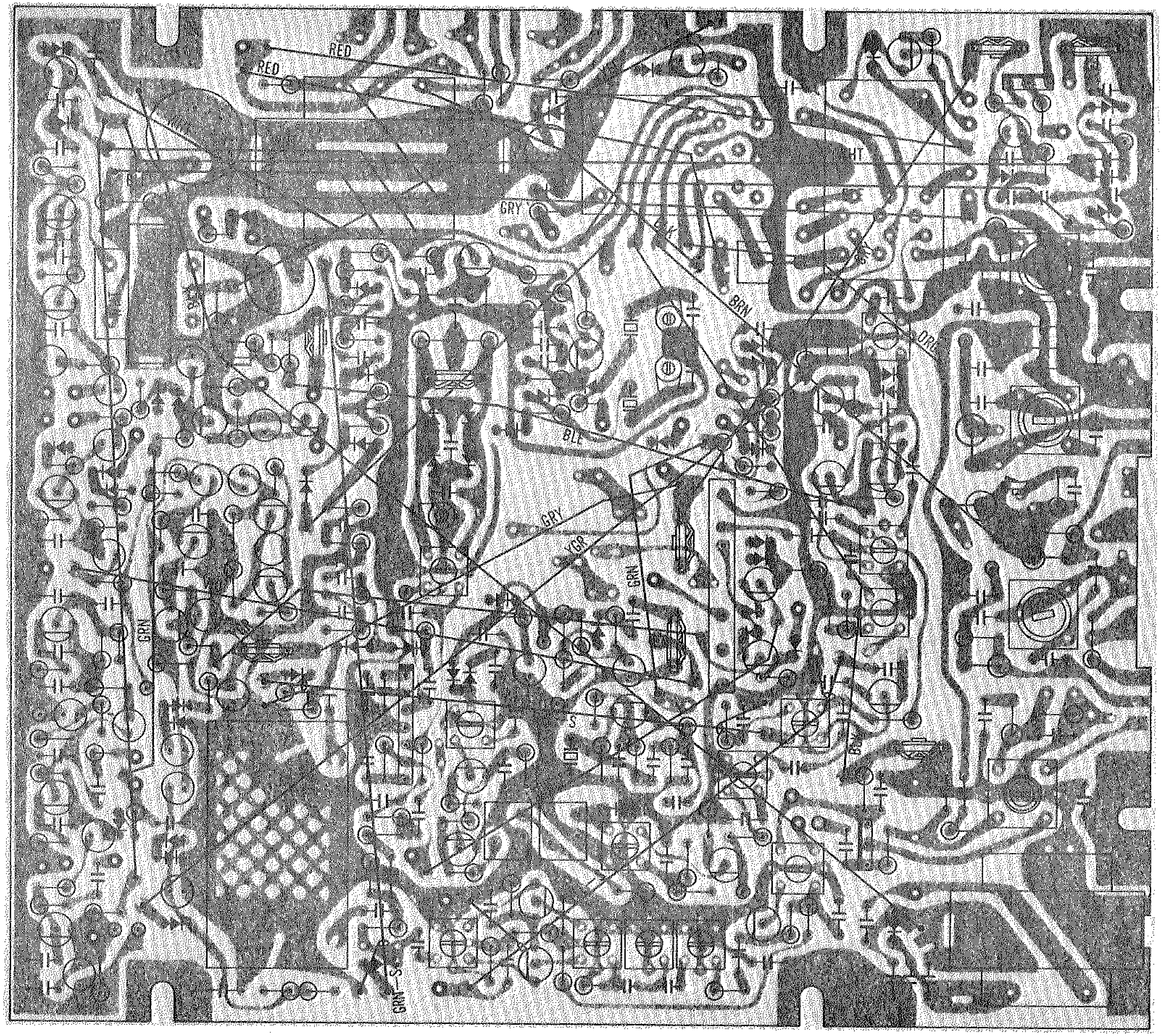
CIRCUIT BOARD DIAGRAM BOTTOM VIEW



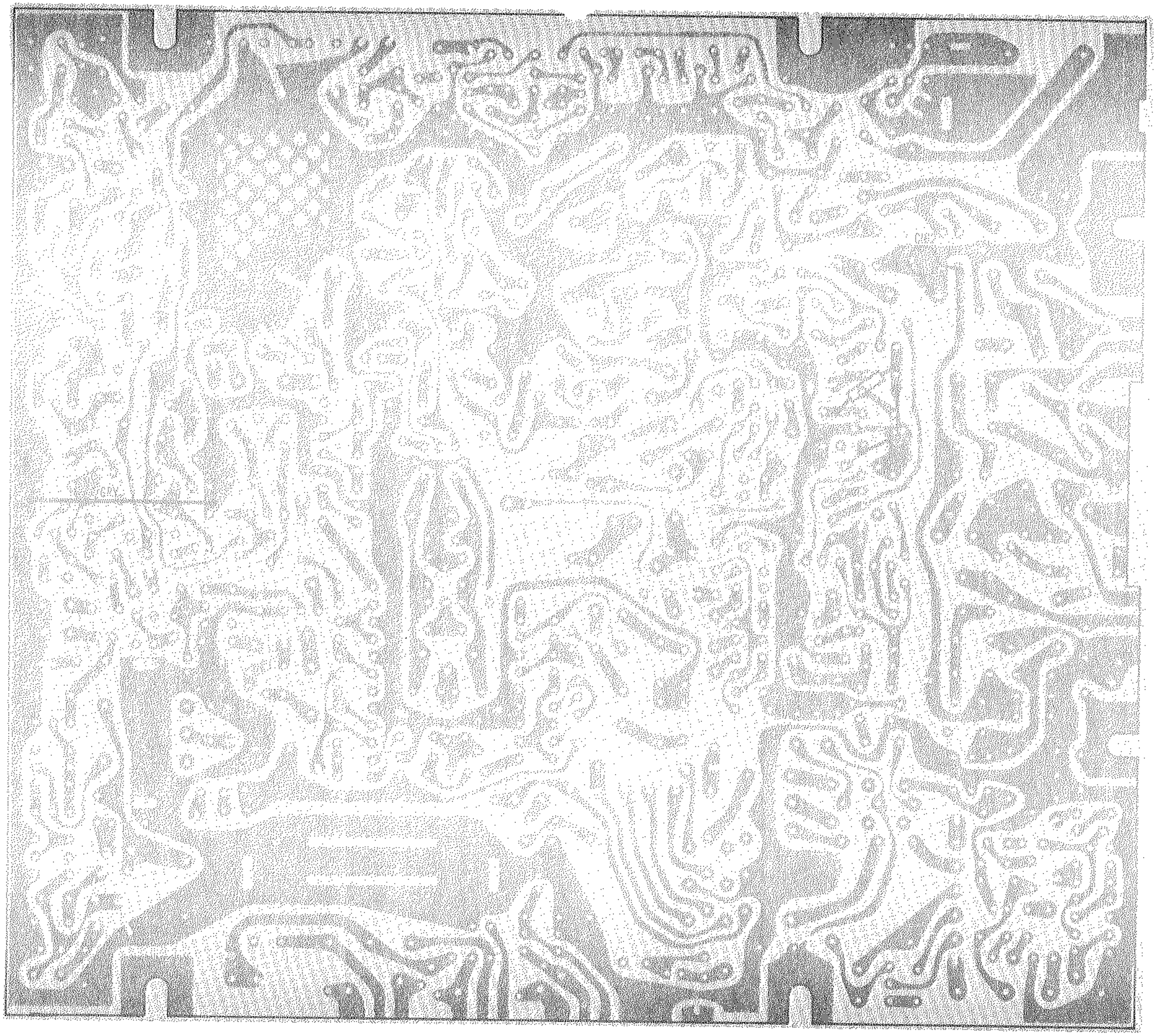
CIRCUIT BOARD DIAGRAM BOTTOM VIEW



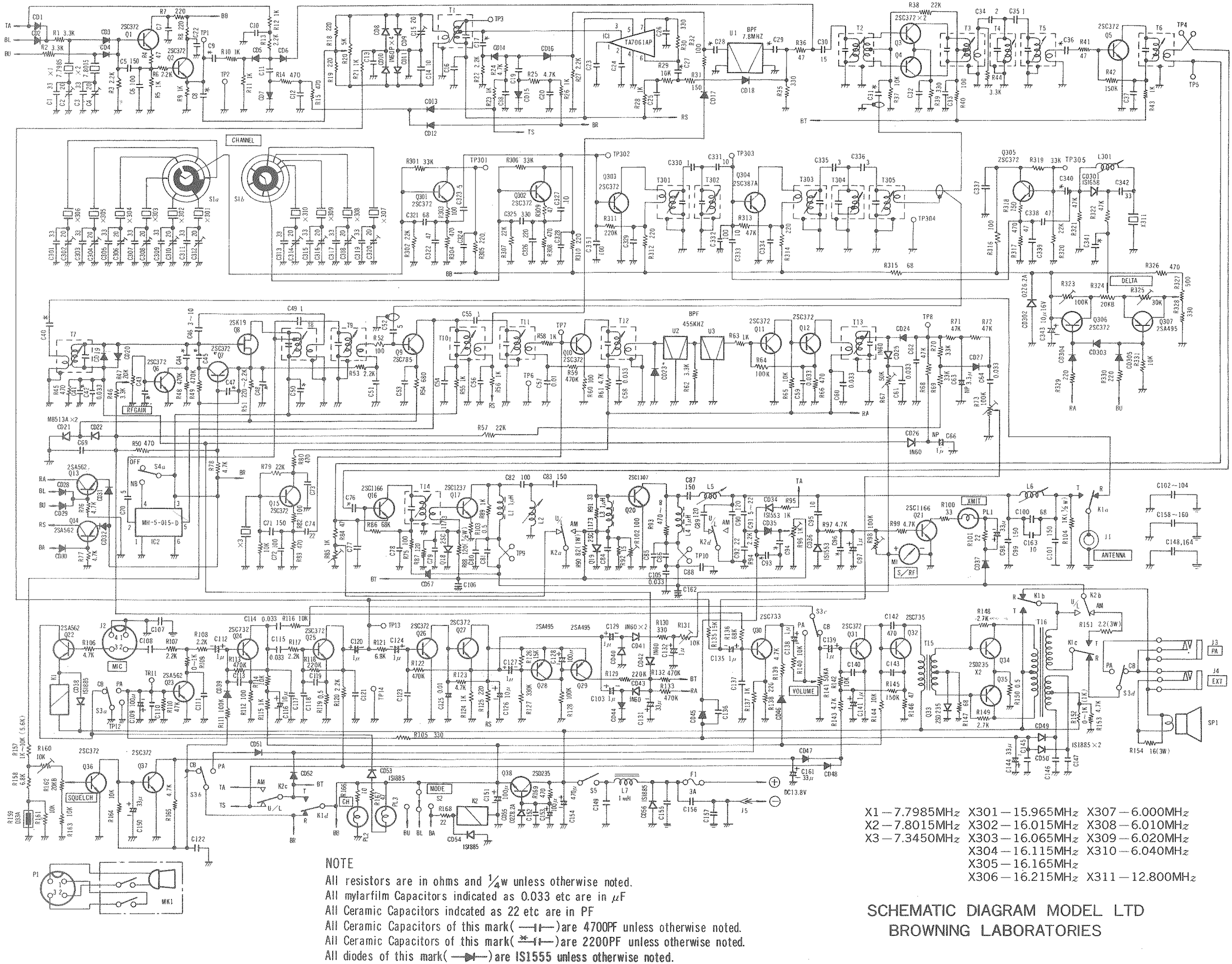
WIRING DIAGRAM



CIRCUIT BOARD WIRING DIAGRAM



CIRCUIT BOARD DIAGRAM BOTTOM VIEW



X1 — 7.7985MHz X301 — 15.965MHz X307 — 6.000MHz
X2 — 7.8015MHz X302 — 16.015MHz X308 — 6.010MHz
X3 — 7.3450MHz X303 — 16.065MHz X309 — 6.020MHz
X304 — 16.115MHz X310 — 6.040MHz
X305 — 16.165MHz
X306 — 16.215MHz X311 — 12.800MHz

NOTE

All resistors are in ohms and 1/4w unless otherwise noted.
All mylarfilm Capacitors indicated as 0.033 etc are in μF
All Ceramic Capacitors indcated as 22 etc are in PF
All Ceramic Capacitors of this mark(—⊣⊢—)are 4700PF unless otherwise noted.
All Ceramic Capacitors of this mark(—*⊣⊢—)are 2200PF unless otherwise noted.
All diodes of this mark(—▶|—) are IS1555 unless otherwise noted.

SCHEMATIC DIAGRAM MODEL LTD
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