SBE 27CB/A, 39CB 40CB Service Manual

SERVICE MANUAL

SBE 27 CB/A
Sidebander IV

SBE 39 CB
Sidebander V

SBE 40 CB
Console V

SBE, INC.
220 AIRPORT BLVD.
WATSONVILLE, CA 95076

RECEIVER

INITIAL SET-UP

Connect the unit to an appropriate 13.8VDC or 117VAC power source. Connect RF signal generator to the antenna jack and set to 27.205 MHz. Set the unit to channel 20. Turn the volume control full clockwise, the squelch control full counterclockwise, RF gain control full clockwise, scan switch to the OFF position and center clarifier. Connect 8 ohm load to external speaker jack, EXT SP, and connect AC voltmeter to 8 ohm load. (See Figure 5-?)

Step 1

Set the mode selector to AM. Adjust signal generator for 1.0uV output with 30% - 1 KHz modulation. Verify that at least 4VAC appear across the 8 ohm load.

Step 2

Increase signal generator output to 200uV. Rotate squelch control knob full clockwise. Receiver should squelch.

Step 3

Adjust signal generator for 100uV. S meter should read approximately S-9.

Step 4

Remove connection from external speaker jack if used. Adjust signal generator for 0.5uV output with no modulation. Set the mode selector to LSB. Rotate clarifier back and forth. Tone should be hear at one end of the clarifier.

Step 5

Repeat step 4 in USB.

Step 6

Rotate the squelch control slow clockwise. Check squelch meter to insure that meter is indicating proper squelch action.

Step 7

Adjust squelch control to mute background noise. Place scan switch to the on position and insure that the unit scans through all 40 channels.

NOISE BLANKER ALIGNMENT

1. Connect oscilloscope to junction anode D306 and cathode D308.

2. Inject 24.5 MHz RF signal at antenna connector. Peak L301, T302, and T303.

3. Inject RF signal 100 KHz above channel frequency (27.065 = 27.165). Null T301.

4. With signal generator still set at 100 KHz above channel frequency, and at a level of 1mv, connect a VOM to collector Q302 and adjust T304 for a null.

AM MODE

RECEIVE INJECTION VOLTAGES

INJECTION POINT	INJECTION LEVEL	FREQUENCY	AUDIO VOLTAGE
Antenna Jack	1uV	27.205 MHz	>2V @ ½ Volume
Q101 gate 1	10uV	27.205 MHz	>2V @ ½ Volume
Q102 gate	30uV	7.8 MHz	>2V @ ½ Volume
Q201 base	30uV	7.8 MHz	>2V @ ½ Volume
Q202 base	100uV	7.8 MHz	>2V @ ½ Volume
Q203	1000uV	7.8 MHz	>2V @ ½ Volume

TRANSMITTER ALIGNMENT PROCEDURE

INITIAL SET-UP

Connect unit with appropriate 13.8VDC or 117VAC power source. Turn on and select AM mode. Connect a suitable RF load to the antenna output terminals.

Step 1

Connect a DC voltmeter to TP1. Select channel 1 AM mode and adjust L901 for an observed voltage of 2.0 volts $\pm$ 0.1 volts.

Step 2

Connect a digital frequency counter to the 19 MHz output (C914). Select channel 20 AM receive mode and set the clarifier control to the 12:00 o'clock position. Adjust L905 for an observed frequency of 19.405 MHz.

Step 3

Maintaining the set up as in step 2, switch to USB receive mode and adjust L904 for an observed frequency of 19.4075 MHz.

Step 4

Maintaining the set up as in step 2, switch to AM mode and key the transmitter. Adjust VR801 for an observed frequency of 19.4025 MHz.

Step 5

Switch the digital frequency counter to the transmitter output. Connect an audio signal generator to the microphone input and inject a 1000 Hertz tone. Select channel 20, LSB mode and key the transmitter. Adjust CV701 for an observed frequency of 27.204 MHz.

Step 6

Maintaining the set up as in step 5, switch to USB and key the transmitter. Adjust L703 for an observed frequency of 27.206 MHz.

Step 7

After completing the steps outlined above, select channel 20, USB mode and connect either a watt meter or a peak reading RF voltmeter such as a Hewlett Packard HP-410B to the antenna output terminals.

Step 8

Disable the ALC system by rotating VR302.

Step 9

Connect an audio signal generator to the microphone input and inject a 1000 Hertz signal. Key the transmitter and adjust the audio level to produce approximately 15 watts PEP.

Step 10

Tune the following in sequence for maximum RF output, reducing the audio drive whenever the output power goes over 15 watts PEP.

A.	L801	(VCO output)
B.	L902	(VCO buffer amp)
C.	T201	(IF AMP)
D.	T503, 502	(27 MHz filter)
E.	T501	(Interstage 27 KHz xfmr)
F.	L507	(Interstage "T" network coil)
G.	L505	(Interstage "T" network coil)
H.	L502	(Output Z-matching coil)

Step 11

Repeat adjustments G and H once more to optimize the impedance match.

Step 12

Connect a two tone audio signal generator to the microphone input, setting the tones at 500 Hertz and 2400 Hertz with relative amplitudes set to produce a close-to-equal amplitude RF resultant.

Step 13

Key the transmitter and increase the audio composite level to the point where no further increase in power output is noted. Adjust ALC VR302 for a reading of 11-12 watts PEP (23.5-24.5 volts).

Step 14

Change to the AM mode and apply a 1 KHz tone to the mike input.

Step 15

With an oscilloscope attached to the antenna terminals, key the transmitter and observe the modulation envelope. Set the audio level for a 50% modulation.

Step 16

Increase the audio input by 20db (10 times the voltage).

Step 17

Adjust OML control VR803 for less than 100% modulation (no clipping of the envelope either on the positive or negative peaks). Adjust VR2 OML module output level for a 1db drop in modulation percentage.

Step 18

Using a spectrum analyzer or frequency selective voltmeter, sample the RF output at the second harmonic (=54 MHz) and adjust CV101 for a null of this spurious emission.

Step 19

Switch back to the USB or LSB mode and key the transmitter with the audio input grounded to prevent modulation.

Step 20

With a sensitive voltmeter or spectrum analyzer adjust VR701 and VR724 for minimum transmitted carrier.

Step 21

Using a spectrum analyzer, adjust L509 for minimum 19 MHz output.

AGC VOLTAGE VERSUS RF INPUT LEVEL MEASURED AT Q401 SOURCE

INPUT LEVEL @ ANTENNA JACK	AGC VOLTAGE
NC	1.85
1uV	1.69
10uV	1.36
100uV	1.18
1000uV	1.00
10,000uV	0.85

	MODE		f vco	flo	f ref	fif	
1 26.965	AM	TX	19.1625	7.8025	9.9987	N/A	
		RX	19.1650	N/A	10.0000	7.8000	
	USB	TX	19.1675	7.7975	9.9987	N/A	
		RX	19.1675	7.7975	9.9987	7.7975	
	LSB	TX	19.1625	7.8025	9.9987	N/A	
		RX	19.1625	7.8025	9.9987	7.8025	
2 26.975	AM	TX	19.1725	same as Channel 1			
		RX	19.1750				
	USB	TX	19.1775				
		RX	19.1775				
	LSB	TX	19.1725				
		RX	19.1725				
3 26.985	AM	TX	19.1825	same as Channel 1			
		RX	19.1850				
	USB	TX	19.1875				
		RX	19.1875				
	LSB	TX	19.1825				
		RX	19.1825				
4 27.005	AM	TX	19.2025	same as Channel 1			
		RX	19.2050				
	USB	TX	19.2075				
		RX	19.2075				
	LSB	TX	19.2025				
		RX	19.2025				
5 27.015	AM	TX	19.2125	same as Channel 1			
		RX	19.2150				
	USB	TX	19.2175				
		RX	19.2175				
	LSB	TX	19.2125				
		RX	19.2125				
6 27.025	AM	TX	19.2225	same as Channel 1			
		RX	19.2250				
	USB	TX	19.2275				
		RX	19.2275				
	LSB	TX	19.2225				
		RX	19.2225				
7 27.035	AM	TX	19.2325	same as Channel 1			
		RX	19.2350				
	USB	TX	19.2375				
		RX	19.2375				
	LSB	TX	19.2325				
		RX	19.2325				
8 27.055	AM	TX	19.2525	same as Channel 1			
		RX	19.2550				
	USB	TX	19.2575				
		RX	19.2575				
	LSB	TX	19.2525				
		RX	19.2525				

	MODE		f vco	flo	f ref	fif	
9 27.065	AM	TX	19.2625				
		RX	19.2650				
	USB	TX	19.2675				
		RX	19.2675				
	LSB	TX	19.2625	same as Channel 1			
		RX	19.2625				
10 27.075	AM	TX	19.2725				
		RX	19.2750				
	USB	TX	19.2775				
		RX	19.2775				
	LSB	TX	19.2725	same as Channel 1			
		RX	19.2725				
11 27.085	AM	TX	19.2825				
		RX	19.2850				
	USB	TX	19.2875				
		RX	19.2875				
	LSB	TX	19.2825	same as Channel 1			
		RX	19.2825				
12 27.105	AM	TX	19.3025				
		RX	19.3050				
	USB	TX	19.3075				
		RX	19.3075				
	LSB	TX	19.3025	same as Channel 1			
		RX	19.3025				
13 27.115	AM	TX	19.3125				
		RX	19.3150				
	USB	TX	19.3175				
		RX	19.3175				
	LSB	TX	19.3125	same as Channel 1			
		RX	19.3125				
14 27.125	AM	TX	19.3225				
		RX	19.3250				
	USB	TX	19.3275				
		RX	19.3275				
	LSB	TX	19.3225	same as Channel 1			
		RX	19.3225				
15 27.135	AM	TX	19.3325				
		RX	19.3350				
	USB	TX	19.3375				
		RX	19.3375				
	LSB	TX	19.3325	same as Channel 1			
		RX	19.3325				
16 27.155	AM	TX	19.3525				
		RX	19.3550				
	USB	TX	19.3575				
		RX	19.3575				
	LSB	TX	19.3525				
		RX	19.3525				

	MODE		f vco	flo	f ref	fif	
17 27.165	AM	TX	19.3625				
		RX	19.3650				
	USB	TX	19.3675				
		RX	19.3675				
	LSB	TX	19.3625	same as Channel 1			
		RX	19.3625				
18 27.175	AM	TX	19.3725				
		RX	19.3750				
	USB	TX	19.3775				
		RX	19.3775				
	LSB	TX	19.3725	same as Channel 1			
		RX	19.3725				
19 27.185	AM	TX	19.3825				
		RX	19.3850				
	USB	TX	19.3875				
		RX	19.3875				
	LSB	TX	19.3825	same as Channel 1			
		RX	19.3825				
20 27.205	AM	TX	19.4025				
		RX	19.4050				
	USB	TX	19.4075				
		RX	19.4075				
	LSB	TX	19.4025	same as Channel 1			
		RX	19.4025				
21 27.215	AM	TX	19.4125				
		RX	19.4150				
	USB	TX	19.4175				
		RX	19.4175				
	LSB	TX	19.4125	same as Channel 1			
		RX	19.4125				
22 27.225	AM	TX	19.4225				
		RX	19.4250				
	USB	TX	19.4275				
		RX	19.4275				
	LSB	TX	19.4225	same as Channel 1			
		RX	19.4225				
23 27.255	AM	TX	19.4525				
		RX	19.4550				
	USB	TX	19.4575				
		RX	19.4575				
	LSB	TX	19.4525	same as Channel 1			
		RX	19.4525				
24 27.235	AM	TX	19.4325				
		RX	19.4350				
	USB	TX	19.4375				
		RX	19.4375				
	LSB	TX	19.4325	same as Channel 1			
		RX	19.4325				

	MODE		f vco	flo	f ref	fif	
25 27.245	AM	TX	19.4425				
		RX	19.4450				
	USB	TX	19.4475				
		RX	19.4475				
	LSB	TX	19.4425	same as Channel 1			
		RX	19.4425				
26 27.265	AM	TX	19.4625				
		RX	19.4650				
	USB	TX	19.4675				
		RX	19.4675				
	LSB	TX	19.4625	same as Channel 1			
		RX	19.4625				
27 27.275	AM	TX	19.4725				
		RX	19.4750				
	USB	TX	19.4775				
		RX	19.4775				
	LSB	TX	19.4725	same as Channel 1			
		RX	19.4725				
28 27.285	AM	TX	19.4825				
		RX	19.4850				
	USB	TX	19.4875				
		RX	19.4875				
	LSB	TX	19.4825	same as Channel 1			
		RX	19.4825				
29 27.295	AM	TX	19.4925				
		RX	19.4950				
	USB	TX	19.4975				
		RX	19.4975				
	LSB	TX	19.4925	same as Channel 1			
		RX	19.4925				
30 27.305	AM	TX	19.5025				
		RX	19.5050				
	USB	TX	19.5075				
		RX	19.5075				
	LSB	TX	19.5025	same as Channel 1			
		RX	19.5025				
31 27.315	AM	TX	19.5125				
		RX	19.5150				
	USB	TX	19.5175				
		RX	19.5175				
	LSB	TX	19.5125	same as Channel 1			
		RX	19.5125				
32 27.325	AM	TX	19.5225				
		RX	19.5250				
	USB	TX	19.5275				
		RX	19.5275				
	LSB	TX	19.5225	same as Channel 1			
		RX	19.5225				

	MODE		f vco	flo	f ref	fif	
33 27.335	AM	TX	19.5325				
		RX	19.5350				
	USB	TX	19.5375				
		RX	19.5375				
	LSB	TX	19.5325	same as Channel 1			
		RX	19.5325				
34 27.345	AM	TX	19.5425				
		RX	19.5450				
	USB	TX	19.5475				
		RX	19.5475				
	LSB	TX	19.5425	same as Channel 1			
		RX	19.5425				
35 27.355	AM	TX	19.5525				
		RX	19.5550				
	USB	TX	19.5575				
		RX	19.5575				
	LSB	TX	19.5525	same as Channel 1			
		RX	19.5525				
36 27.365	AM	TX	19.5625				
		RX	19.5650				
	USB	TX	19.5675				
		RX	19.5675				
	LSB	TX	19.5625	same as Channel 1			
		RX	19.5625				
37 27.375	AM	TX	19.5725				
		RX	19.5750				
	USB	TX	19.5775				
		RX	19.5775				
	LSB	TX	19.5725	same as Channel 1			
		RX	19.5725				
38 27.385	AM	TX	19.5825				
		RX	19.5850				
	USB	TX	19.5875				
		RX	19.5875				
	LSB	TX	19.5825	same as Channel 1			
		RX	19.5825				
39 27.395	AM	TX	19.5925				
		RX	19.5950				
	USB	TX	19.5975				
		RX	19.5975				
	LSB	TX	19.5925	same as Channel 1			
		RX	19.5925				
40 27.405	AM	TX	19.6025				
		RX	19.6050				
	USB	TX	19.6075				
		RX	19.6075				
	LSB	TX	19.6025	same as Channel 1			
		RX	19.6025				

MC14568 IC901					MC14526 IC902				
Pin #	4	5	6	7	2	14	11	5	
	P_4	P_3	P_2	P_1	P_4	P_3	P_2	P_1	N=
CH									
1	1	0	1	0	0	1	1	1	167
2	1	0	1	0	0	1	0	1	165
3	1	0	1	0	0	0	1	1	163
4	1	0	0	1	1	1	1	1	159
5	1	0	0	1	1	1	0	1	157
6	1	0	0	1	1	0	1	1	155
7	1	0	0	1	1	0	0	1	153
8	1	0	0	1	0	1	0	1	149
9	1	0	0	1	0	0	1	1	147
10	1	0	0	1	0	0	0	1	145
11	1	0	0	0	1	1	1	1	143
12	1	0	0	0	1	0	1	1	139
13	1	0	0	0	1	0	0	1	137
14	1	0	0	0	0	1	1	1	135
15	1	0	0	0	0	1	0	1	133
16	1	0	0	0	0	0	0	1	129
17	0	1	1	1	1	1	1	1	127
18	0	1	1	1	1	1	0	1	125
19	0	1	1	1	1	0	1	1	123
20	0	1	1	1	0	1	1	1	119
21	0	1	1	1	0	1	0	1	117
22	0	1	1	1	0	0	1	1	115
23	0	1	1	0	1	1	0	1	109
24	0	1	1	0	1	1	1	1	111
25	0	1	1	1	0	0	0	1	113
26	0	1	1	0	1	0	1	1	107
27	0	1	1	0	1	0	0	1	105
28	0	1	1	0	0	1	1	1	103
29	0	1	1	0	0	1	0	1	101
30	0	1	1	0	0	0	1	1	99
31	0	1	1	0	0	0	0	1	97
32	0	1	0	1	1	1	1	1	95
33	0	1	0	1	1	1	0	1	93
34	0	1	0	1	1	0	1	1	91
35	0	1	0	1	1	0	0	1	89
36	0	1	0	1	0	1	1	1	87
37	0	1	0	1	0	1	0	1	85
38	0	1	0	1	0	0	1	1	83
39	0	1	0	1	0	0	0	1	81
40	0	1	0	0	1	1	1	1	79

AM/LSB
5V

USB
0V

MIXING SCHEME

	fvco	flo	fref	fif
	VCO	Local Osc.	Reference Osc.	Receive IF Freq.
AM transmit	19.1625 MHz	7.8025 MHz	9.9987 MHz	N/A
AM receive	19.1650 MHz	N/A	10.000 MHz	7.800 MHz
LSB transmit	19.1625 MHz	7.8025 MHz	9.9987 MHz	N/A
LSB receive	19.1625 MHz	7.8025 MHz	9.9987 MHz	7.8025 MHz
USB transmit	19.1675 MHz	7.7975 MHz	9.9987 MHz	N/A
USB receive	19.1675 MHz	7.7975 MHz	9.9987 MHz	7.7975 MHz

frx - fvco = fif

fvco + flo = ftx

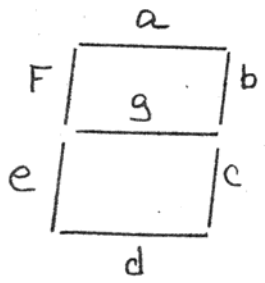
IC804

Pin #	17	18	19	20	21	22	23
	B_2	B_1	B_0	A_3	A_2	A_1	A_0
CH							
1	0	0	0	0	0	0	1
2	0	0	0	0	0	1	0
3	0	0	0	0	0	1	1
4	0	0	0	0	1	0	0
5	0	0	0	0	1	0	1
6	0	0	0	0	1	1	0
7	0	0	0	0	1	1	1
8	0	0	0	1	0	0	0
9	0	0	0	1	0	0	1
10	0	0	1	0	0	0	0
11	0	0	1	0	0	0	1
12	0	0	1	0	0	1	0
13	0	0	1	0	0	1	1
14	0	0	1	0	1	0	0
15	0	0	1	0	1	0	1
16	0	0	1	0	1	1	0
17	0	0	1	0	1	1	1
18	0	0	1	1	0	0	0
19	0	0	1	1	0	0	1
20	0	1	0	0	0	0	0
21	0	1	0	0	0	0	1
22	0	1	0	0	0	1	0
23	0	1	0	0	0	1	1
24	0	1	0	0	1	0	0
25	0	1	0	0	1	0	1
26	0	1	0	0	1	1	0
27	0	1	0	0	1	1	1
28	0	1	0	1	0	0	0
29	0	1	0	1	0	0	1
30	0	1	1	0	0	0	0
31	0	1	1	0	0	0	1
32	0	1	1	0	0	1	0
33	0	1	1	0	0	1	1
34	0	1	1	0	1	0	0
35	0	1	1	0	1	0	1
36	0	1	1	0	1	1	0
37	0	1	1	0	1	1	1
38	0	1	1	1	0	0	0
39	0	1	1	1	0	0	1
40	1	0	0	0	0	0	0

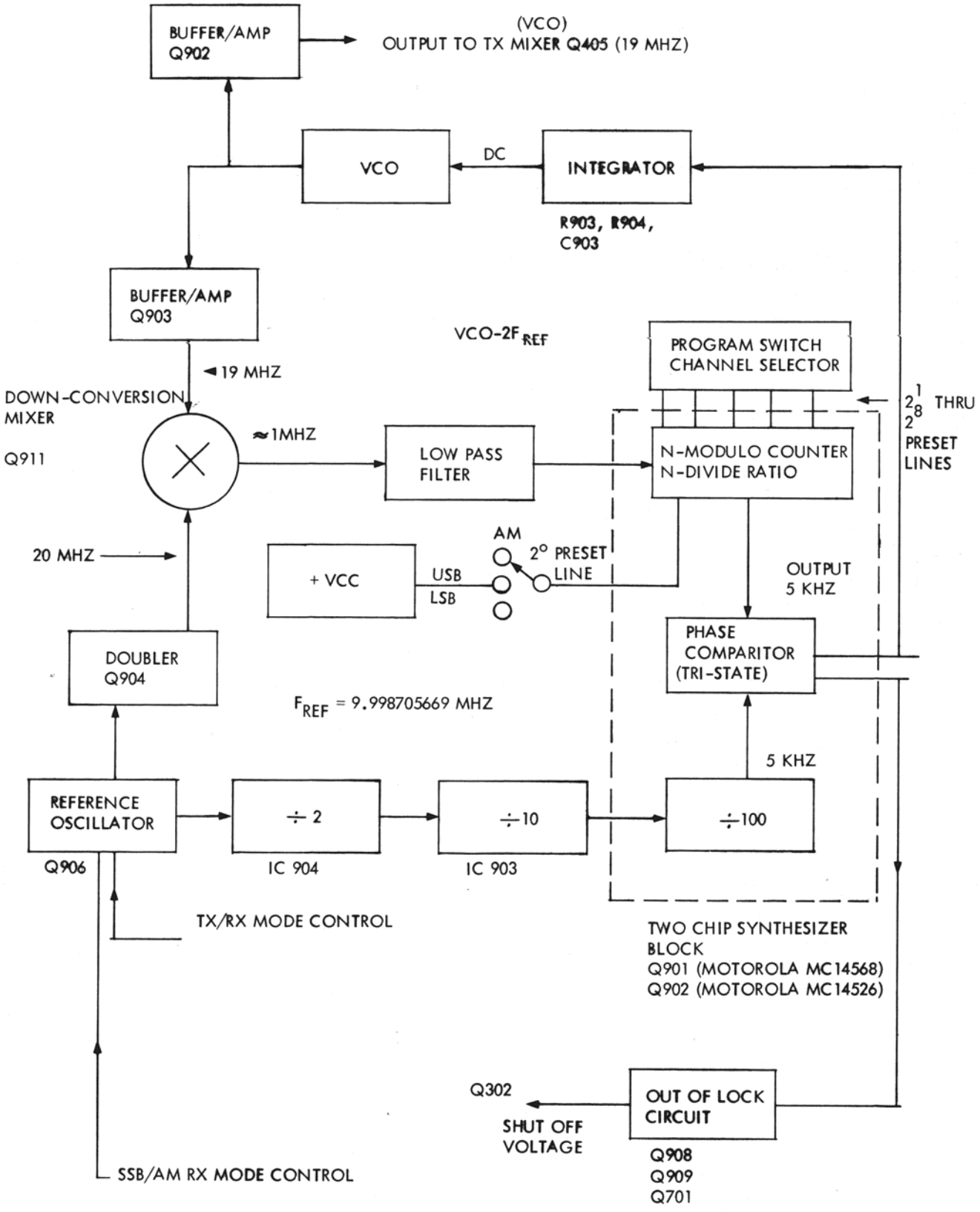
IC804-5

15	14	13	12	11	10	9
f	g	a	b	c	d	e

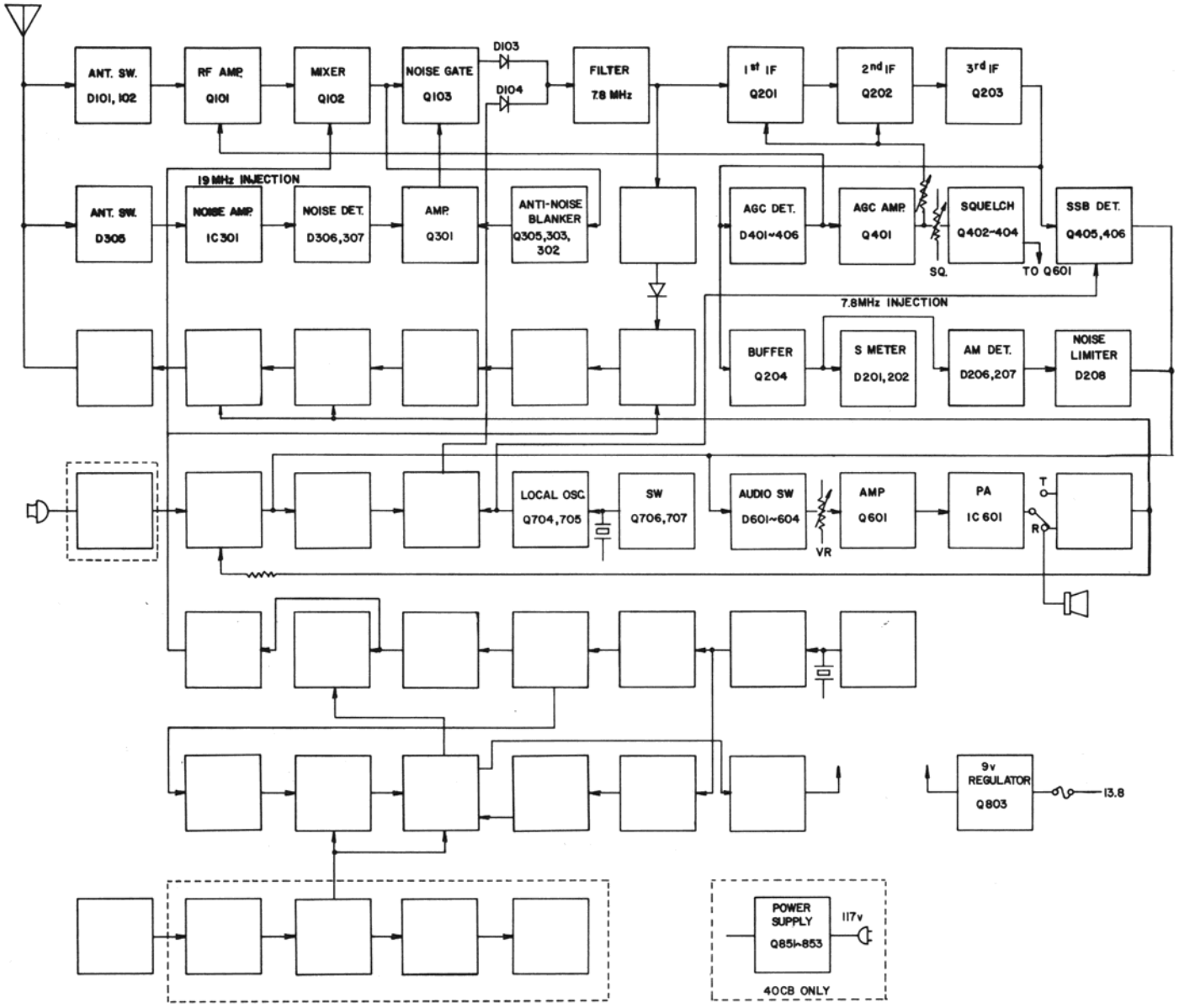
3 = 1 0 0 0 0 0 1



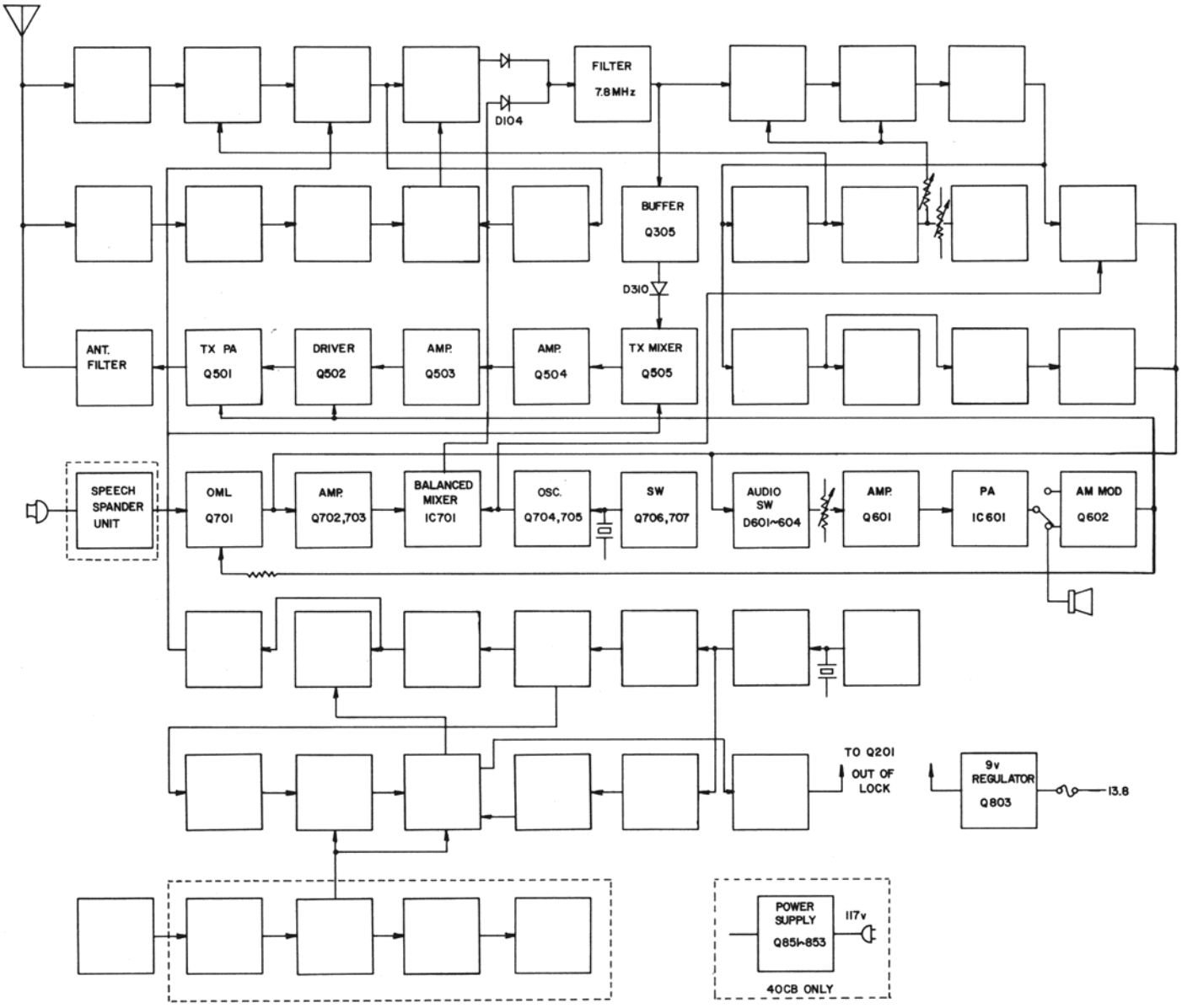
BLOCK DIAGRAM
DIGITAL PLL SYNTHESIZER



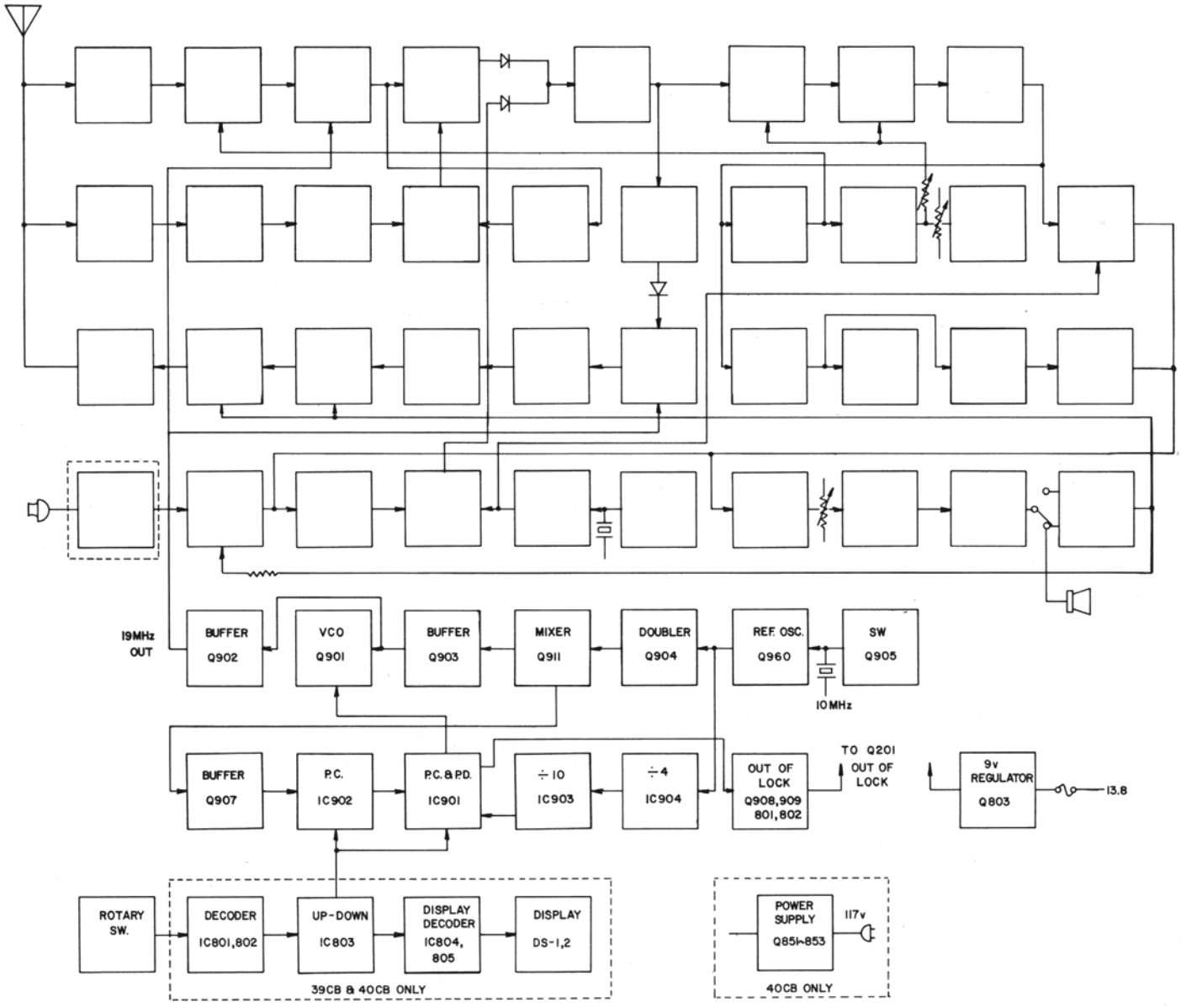
BLOCK DIAGRAM
RECEIVER SIGNAL FLOW



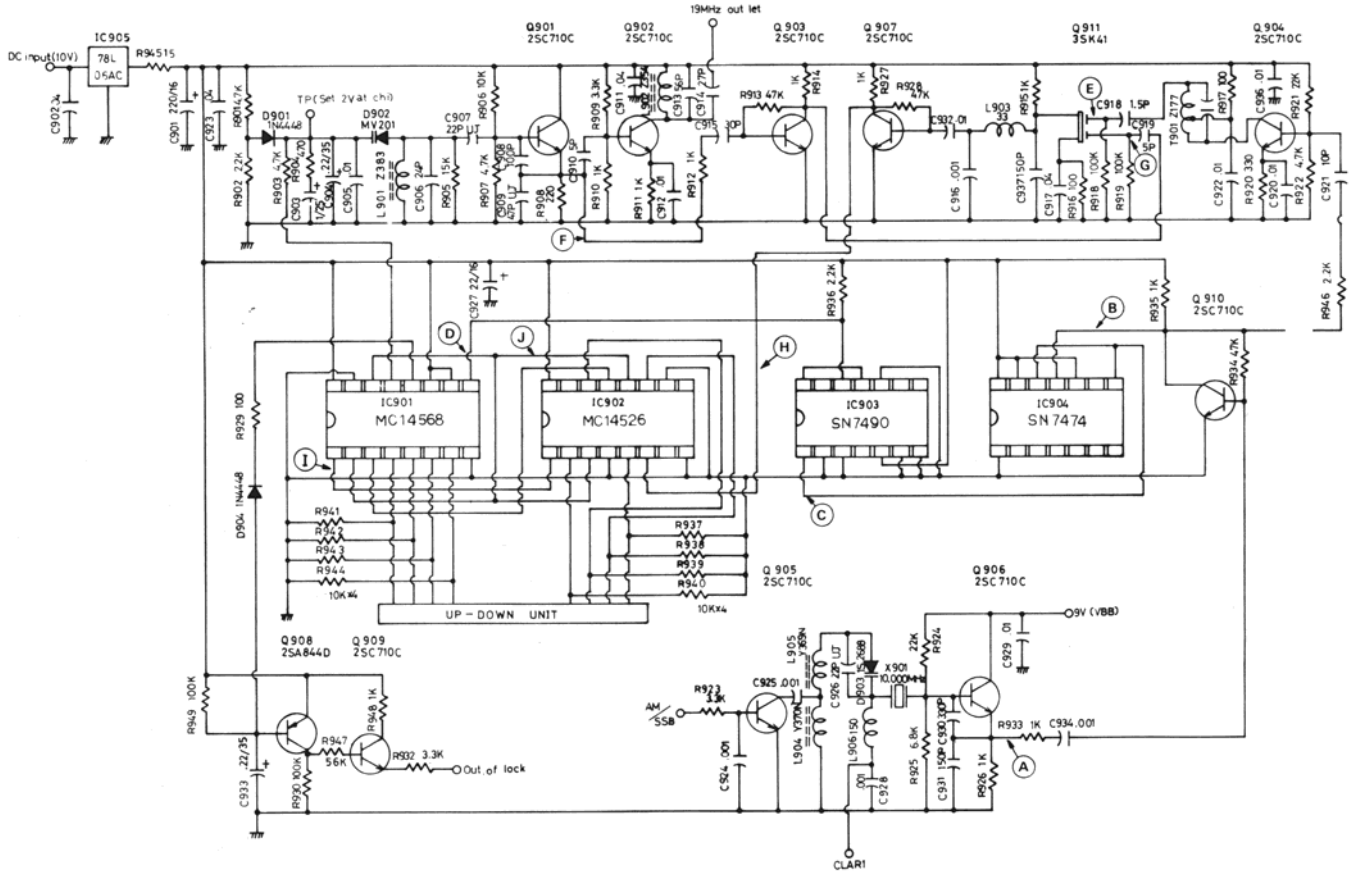
BLOCK DIAGRAM
TRANSMIT SIGNAL FLOW



BLOCK DIAGRAM
PLL SIGNAL FLOW

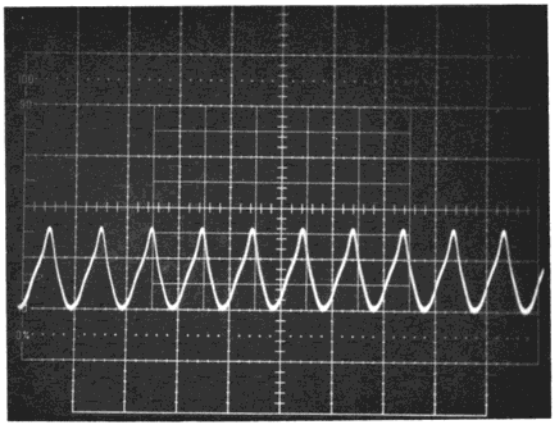


SYNTHESIZER SCHEMATIC



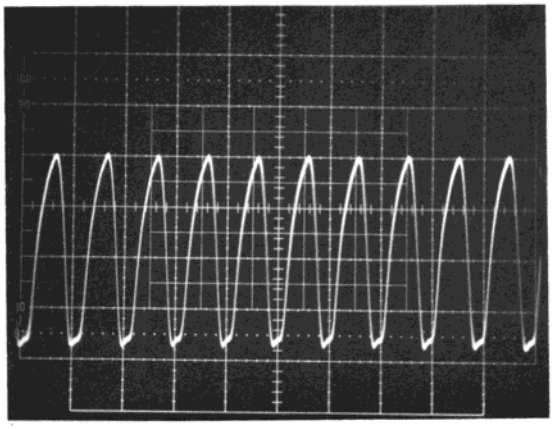
SYNTHESIZER WAVEFORMS

A



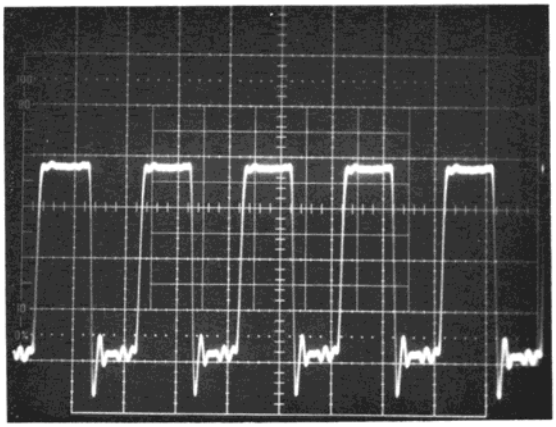
VERTICAL: 0.1vpc,
HORIZONTAL: 0.1us, FREQ: 10.0 MHZ

B



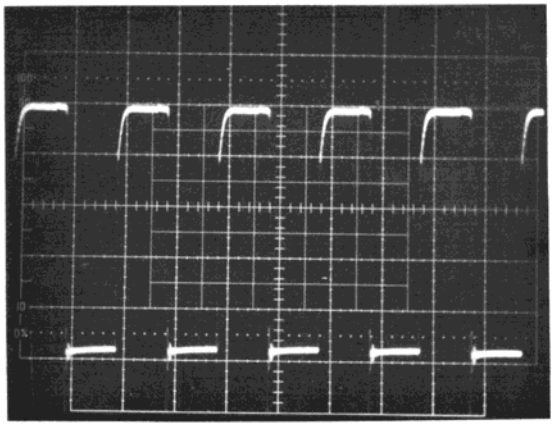
VERTICAL: 0.1vpc,
HORIZONTAL: 0.1us, FREQ: 10.0 MHZ

C



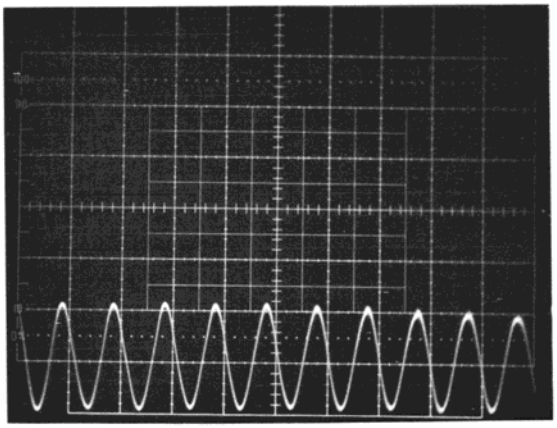
VERTICAL: 0.1vpc,
HORIZONTAL: 0.1us, FREQ: 5.0 MHZ

D



VERTICAL: 0.1vpc,
HORIZONTAL: 1.0us, FREQ: 500 KHZ

E



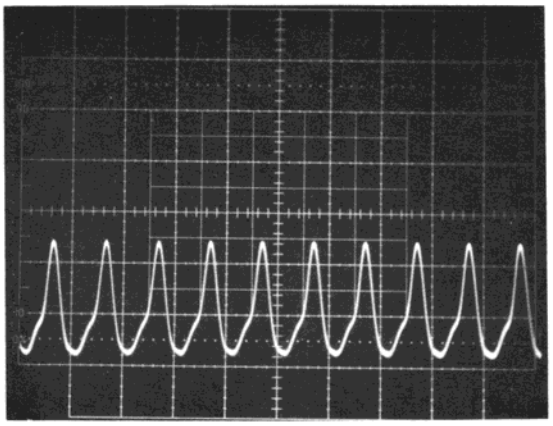
VERTICAL: 20 mvpc,
HORIZONTAL: 0.05us, FREQ: 20 MHZ

All waveforms taken with 10x1 probe scope vertical in DC mode with o ref line 1cm from bottom.

Radio controls as follows
Mode - AM Rx
Ch - 20
Clarifier - center

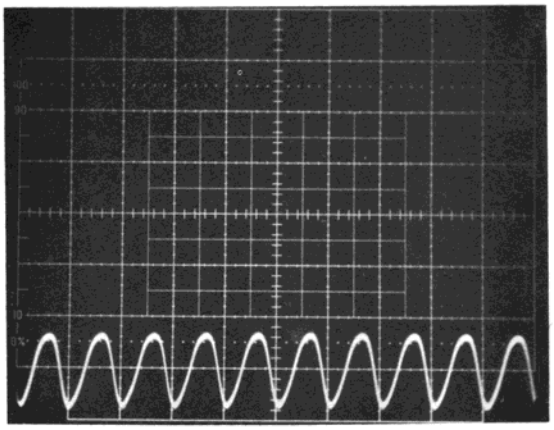
SYNTHESIZER WAVEFORMS

F



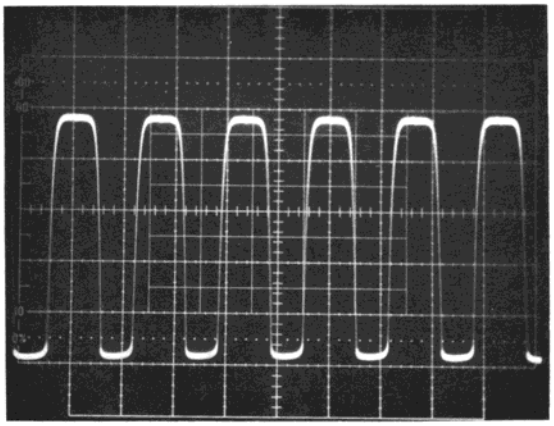
VERTICAL: 0.1vpc,
HORIZONTAL:0.05us,FREQ:19.405 MHZ

G



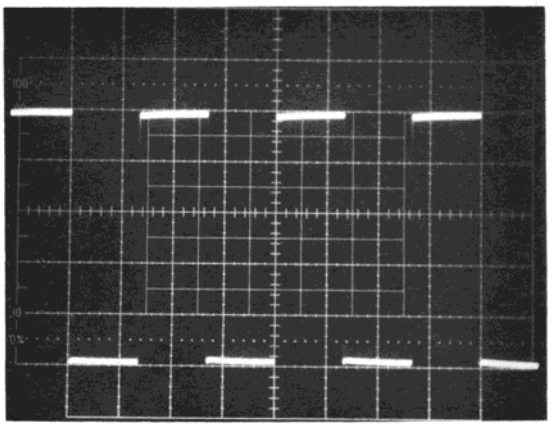
VERTICAL: 0.05 vpc,
HORIZONTAL:0.05us,FREQ:19.405 MHZ

H



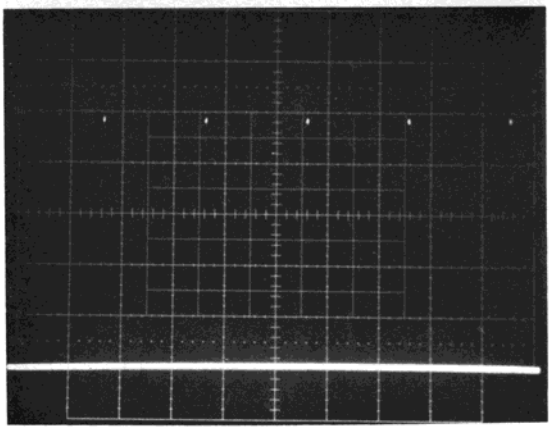
VERTICAL: 0.1vpc,
HORIZONTAL: 1.0us, FREQ: 595 KHZ

I



VERTICAL: 0.1vpc,
HORIZONTAL: 10.0us, FREQ: 35 KHZ

J

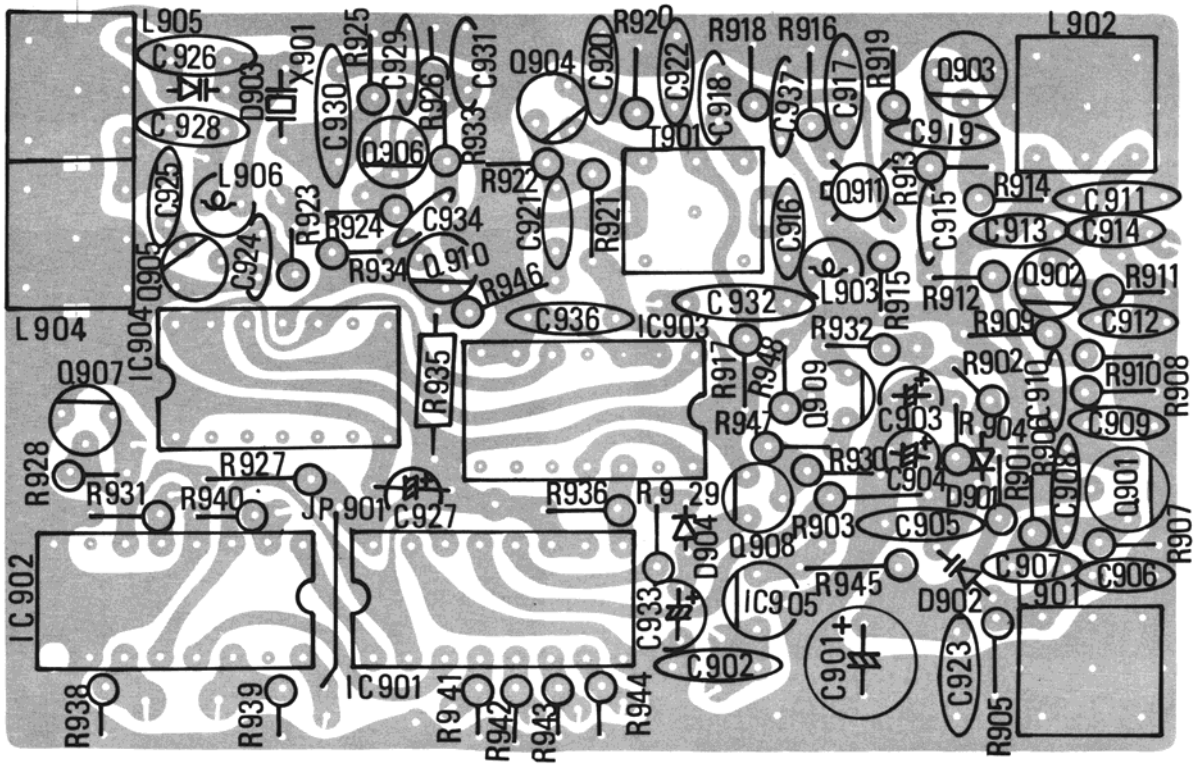


VERTICAL: 0.1vpc,
HORIZONTAL: 0.1ms, FREQ: 5 KHZ

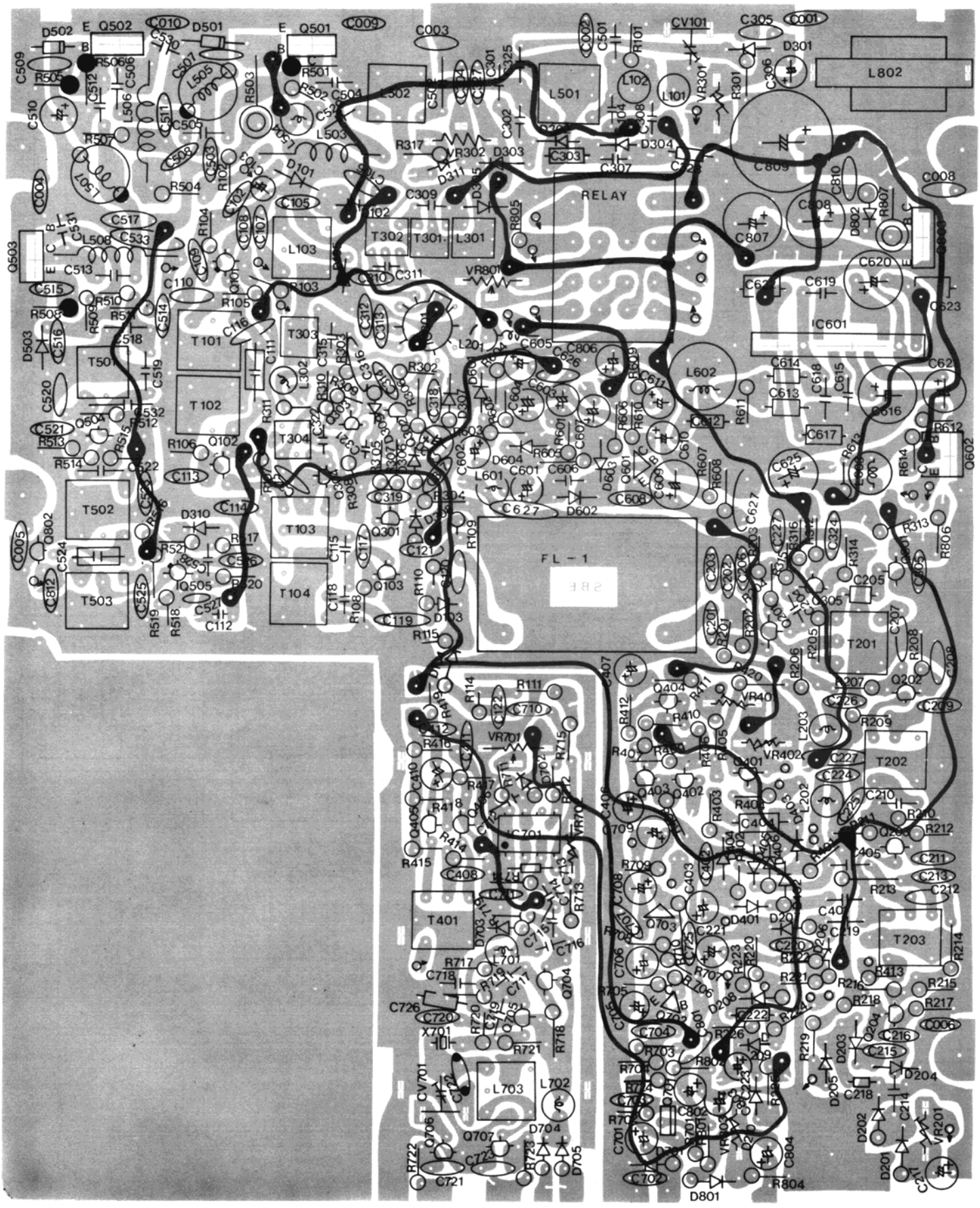
All waveforms taken with 10x1 probe scope vertical in DC mode with o ref line 1cm from bottom.

Radio controls as follows
Mode - AM Rx
Ch - 20
Clarifier - center

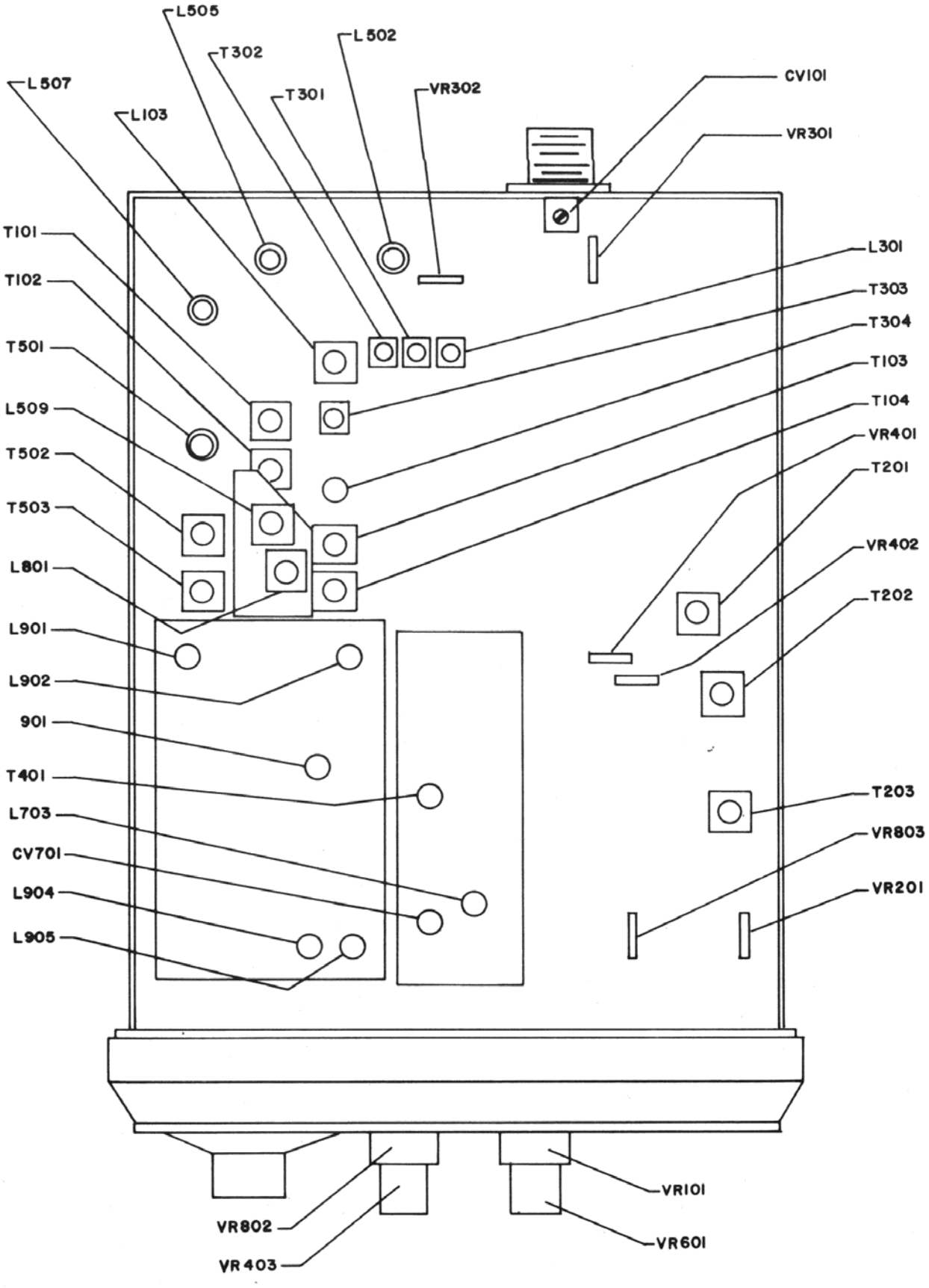
COMPONENT LAYOUT
PLL BOARD



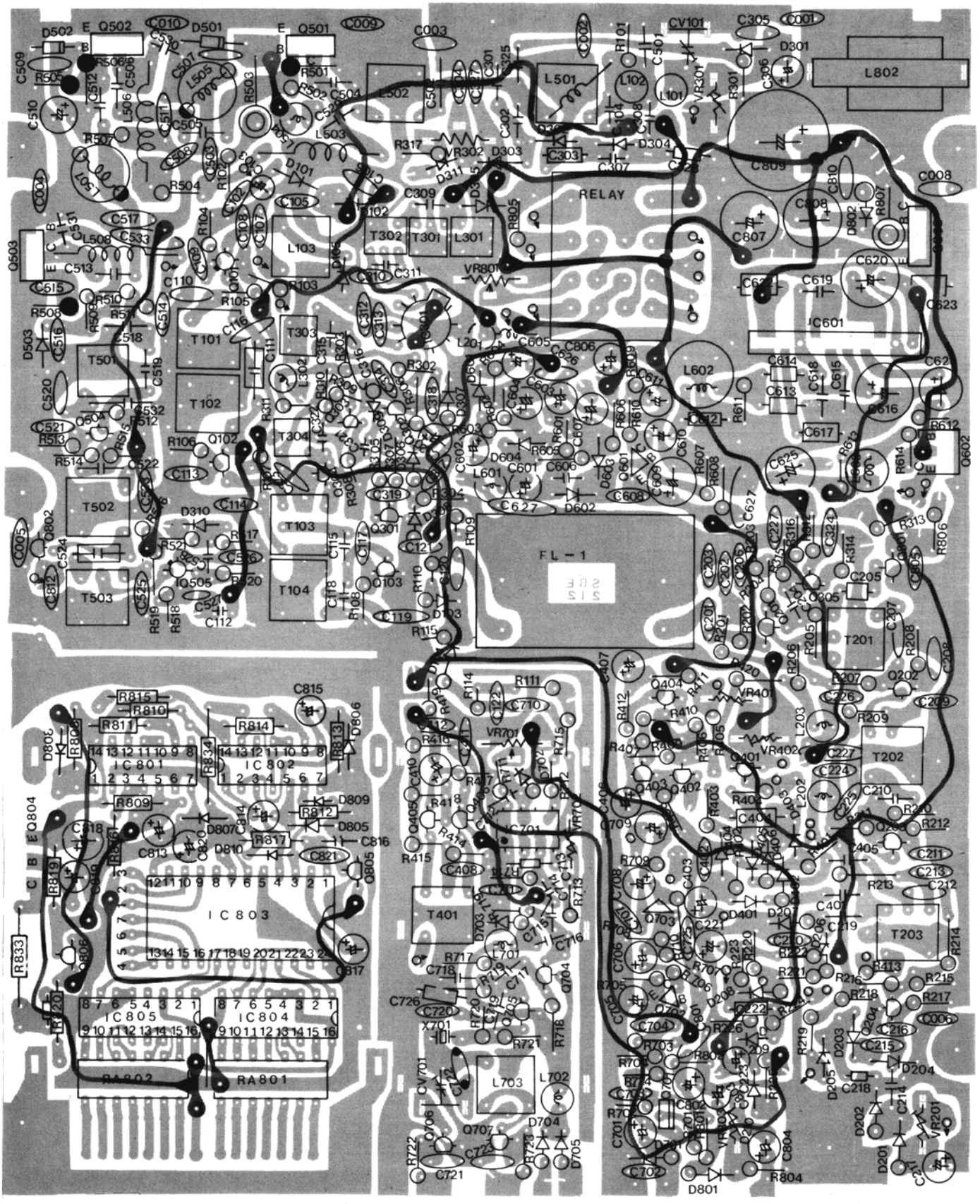
COMPONENT LAYOUT
SBE-27CB/A



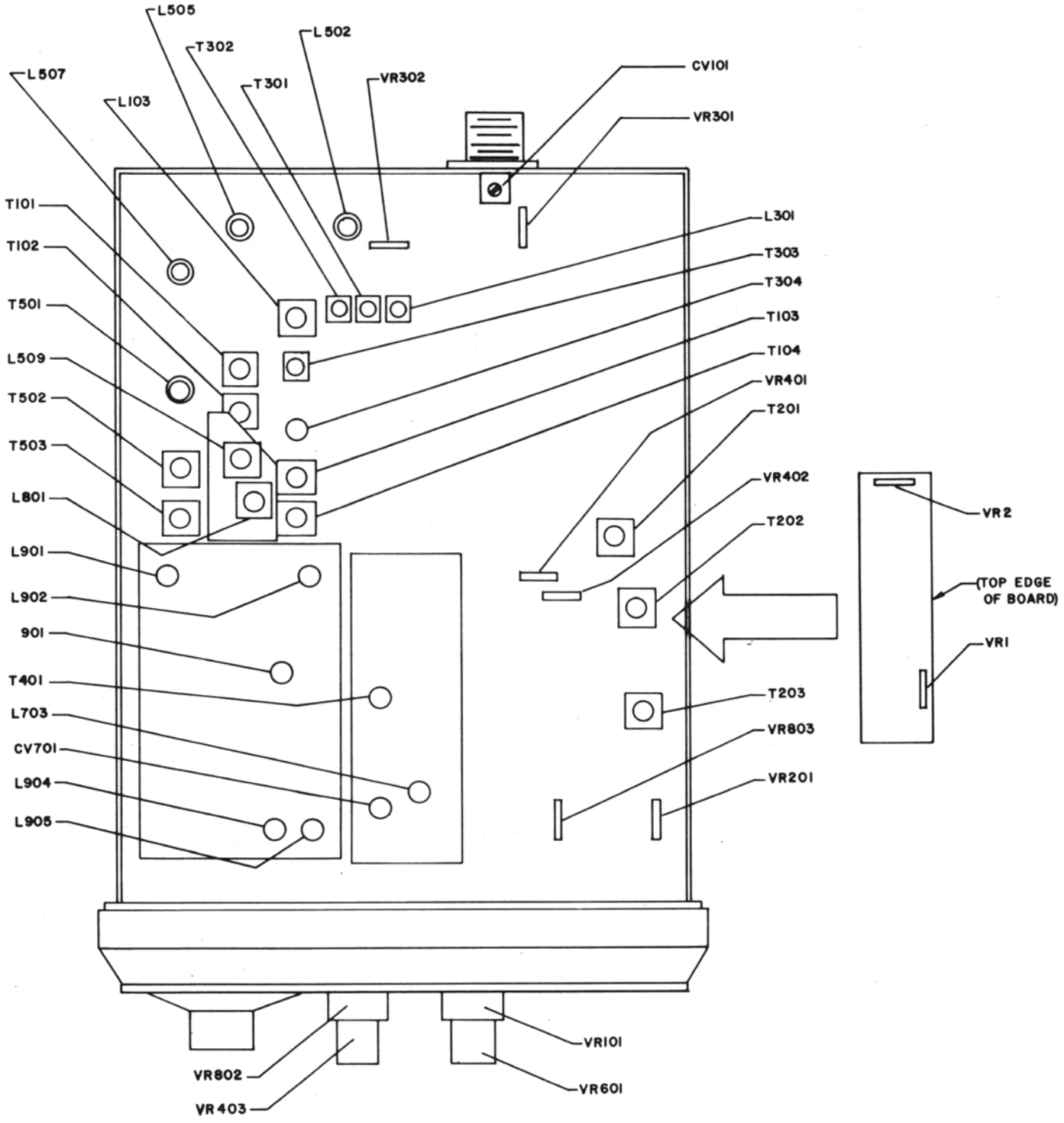
COMPONENT ALIGNMENT LOCATION



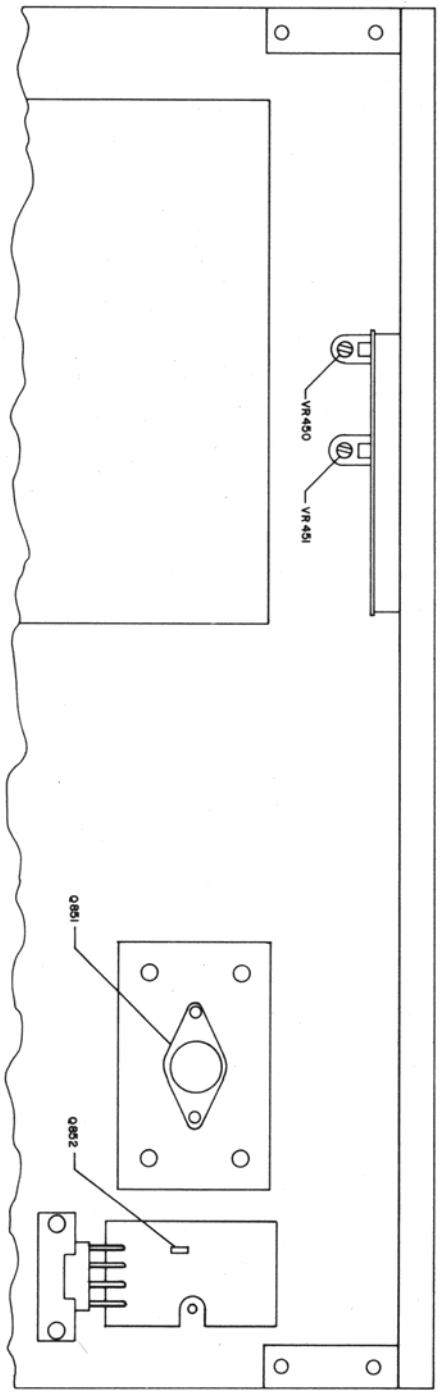
COMPONENT LAYOUT
SBE-39CB



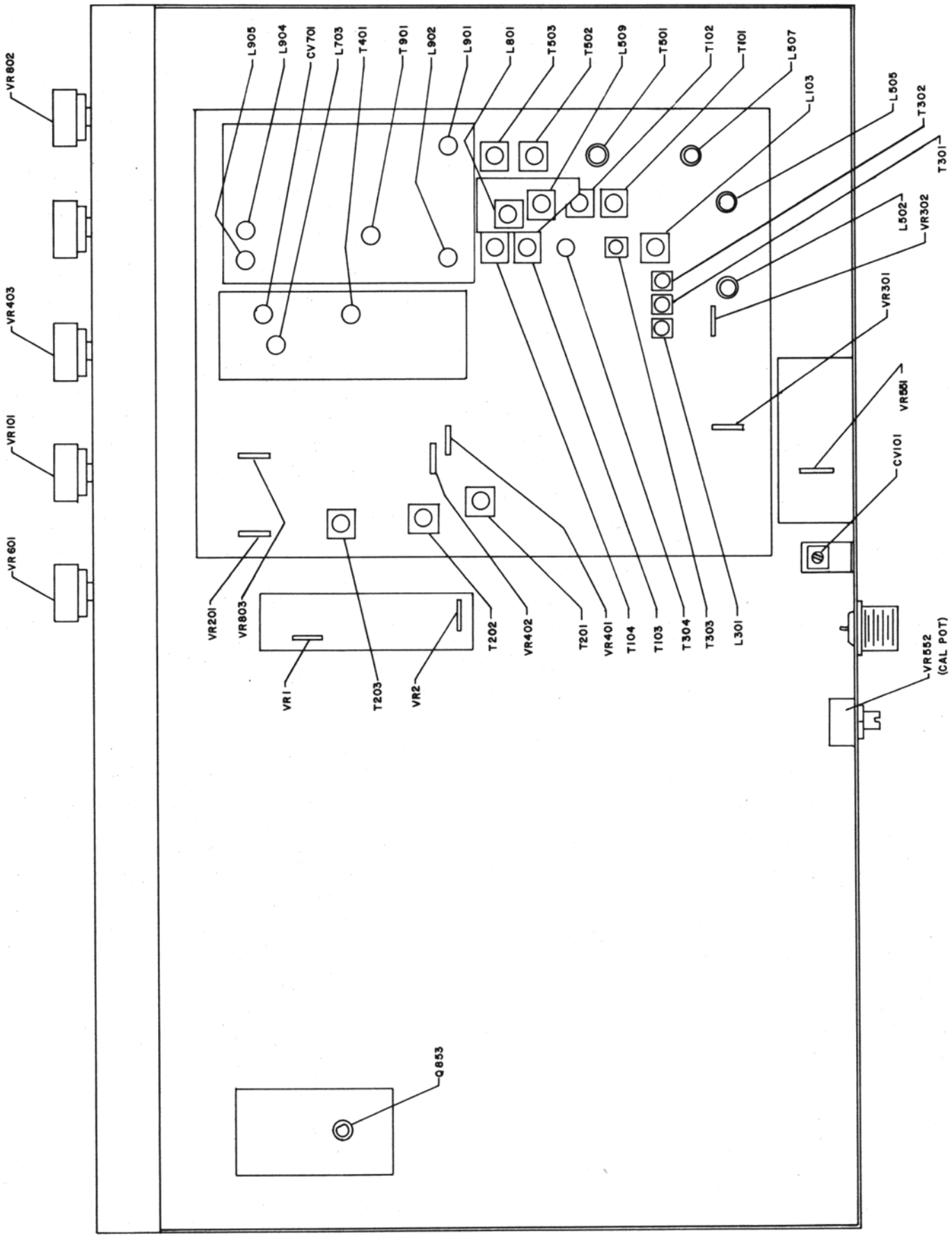
COMPONENT ALIGNMENT LOCATION



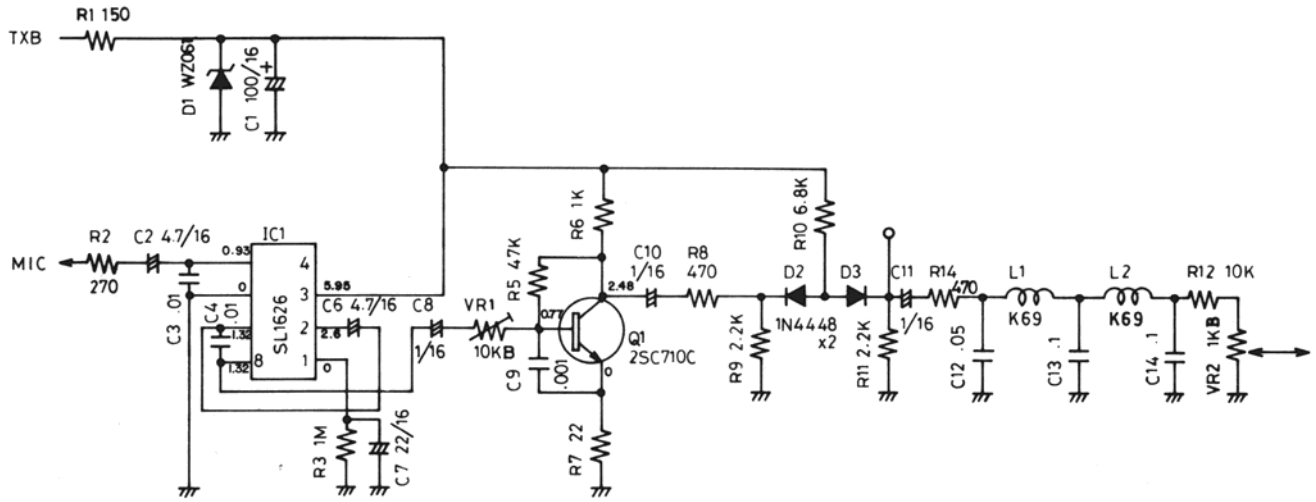
COMPONENT ALIGNMENT LOCATION
TOP VIEW SBE-40CB



COMPONENT LAYOUT LOCATION
BOTTOM VIEW SBE-40CB

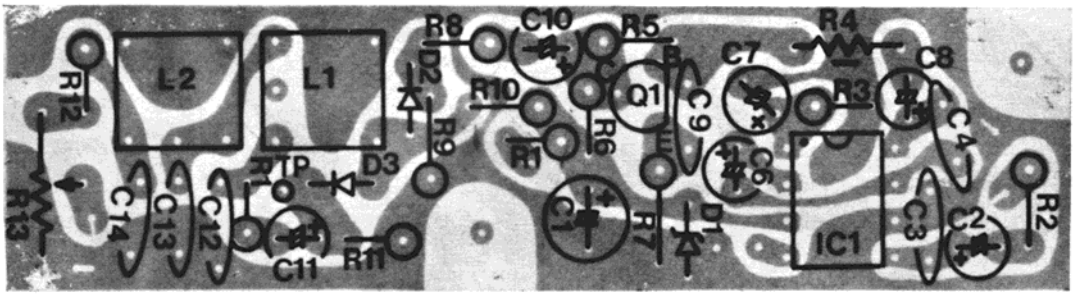


SPEECH SPANDER SCHEMATIC



HIGHEST NO.	VACANT
R14	R4
VR2	R13
C14	C5
Q1	
D3	
IC-1	

SPEECH SPANDER COMPONENT LOCATION



UP-DOWN UNIT
SCHEMATIC