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

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# 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.
- 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 lmv, 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	luV	27.205 MHz	>2V @ ½ Volume
Q101 gate 1	10 <b>uV</b>	27.205 MHz	>2V @ ½ Volume
Q102 gate	30uV	7.8 MHz	72V @ ½ Volume
Q201 base	30uV	7.8 MHz	72V @ ½ Volume
Q202 base	100uV	7.8 MHz	72V @ ½ Volume
Q203	1000uV	7.8 MHz	72V @ 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)
В.	L902	(VCO buffer amp)
C.	T201	(IF AMP)
D.	T503, 502	(27 MHz filter)
E.	T501	(Interstage 27 KHz xfmr)
	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
$1 \mathrm{uV}$	1.69
10u <b>∀</b>	1.36
100uV	1.18
1000uV	1.00
10,000uV	0.85

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AM/LSB 5V

USB OV

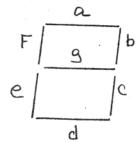
# MIXING SCHEME

		fvco	flo	fref	fif
		VCO	Local Osc.	Reference Osc,	Receive IF Freq.
transmit	nit	19.1625 MHz	7.8025 MHz	9.9987 MHz	N/A
AM receive	ve	19.1650 MHz	N/A	10,000 MHz	7.800 MHz
transmít	nit	19.1625 MHz	7.8025 MHz	9,9987 MHz	N/A
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frx - fvco = fif

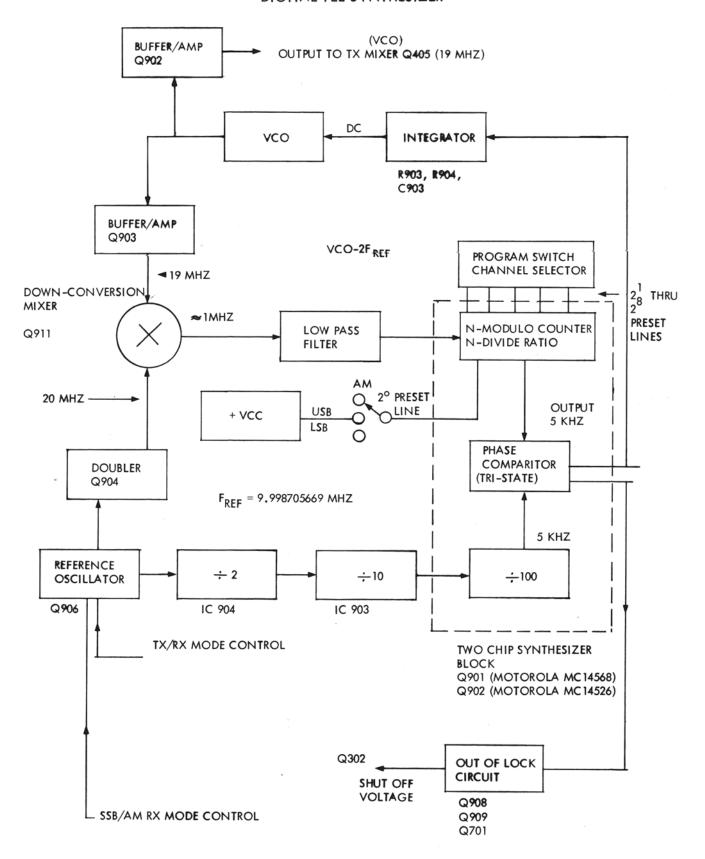
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CH  1
2       0       0       0       0       1       0         3       0       0       0       0       1       1         4       0       0       0       0       1       1       1         5       0       0       0       0       1       0       1       0       1         6       0       0       0       0       1       1       0       1         7       0       0       0       0       1       1       0       0         7       0       0       0       1       0       0       0       0       1       1       1         8       0       0       0       1       0
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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 1 21 0 1 0 0 0 0 1 22 0 1 0 0 0 0 1 23 0 1 0 0 0 1 1 24 0 1 0 0 1 0
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22 0 1 0 0 0 1 0 23 0 1 0 0 0 1 1 24 0 1 0 0 1 0 0
23 0 1 0 0 0 1 1 24 0 1 0 0 1 0 0
24 0 1 0 0 1 0 0
25 0 1 0 0 1 0 1
25 0 1 0 0 1 0 1 26 0 1 0 0 1 1 0
27 0 1 0 0 1 1 0
28 0 1 0 1 0 0 0
29 0 1 0 1 0 0 1
30 0 1 1 0 0 0 0
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32 0 1 1 0 0 1 0
33 0 1 1 0 0 1 1
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38
39 0 1 1 1 0 0 1 40 1 0 0 0 0 0 0

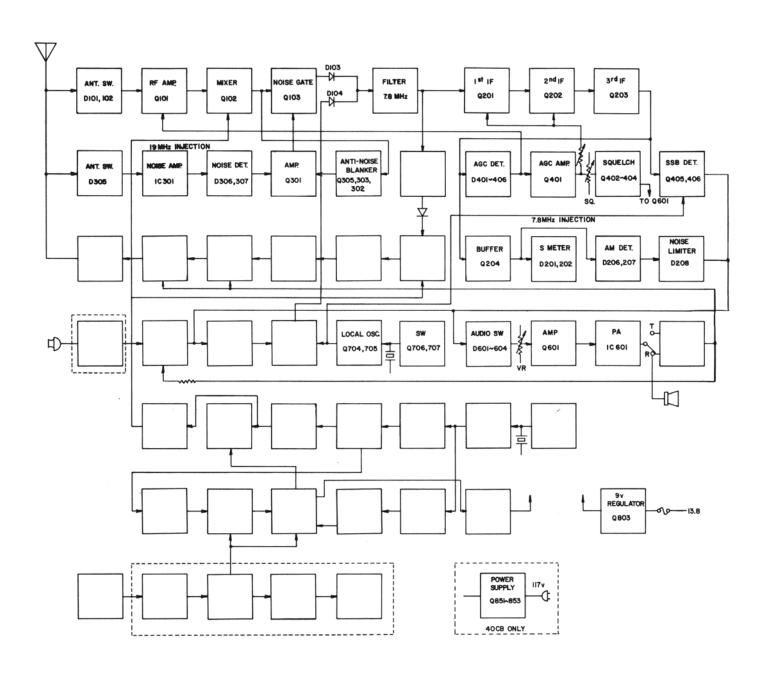


3 = 1 0 0 0 0 0 1

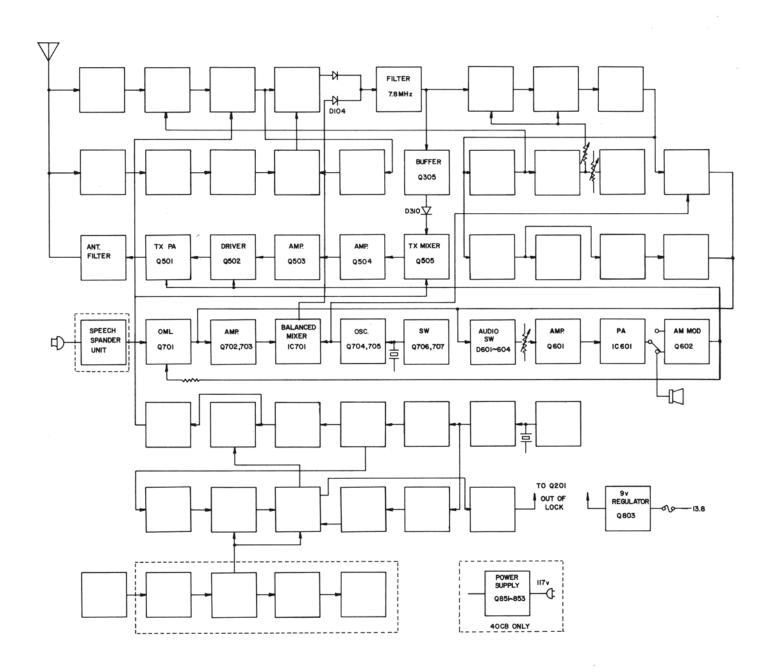
### BLOCK DIAGRAM DIGITAL PLL SYNTHESIZER



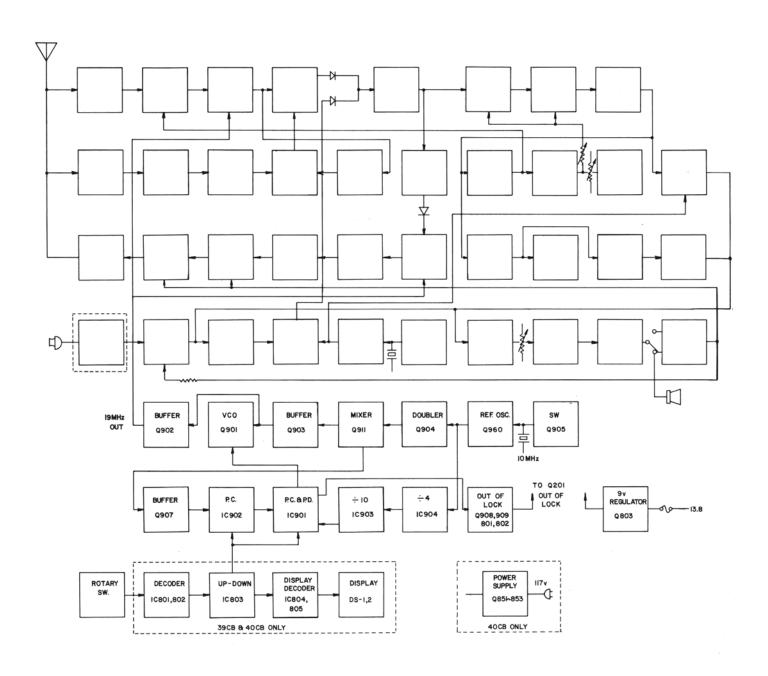
# BLOCK DIAGRAM RECEIVER SIGNAL FLOW



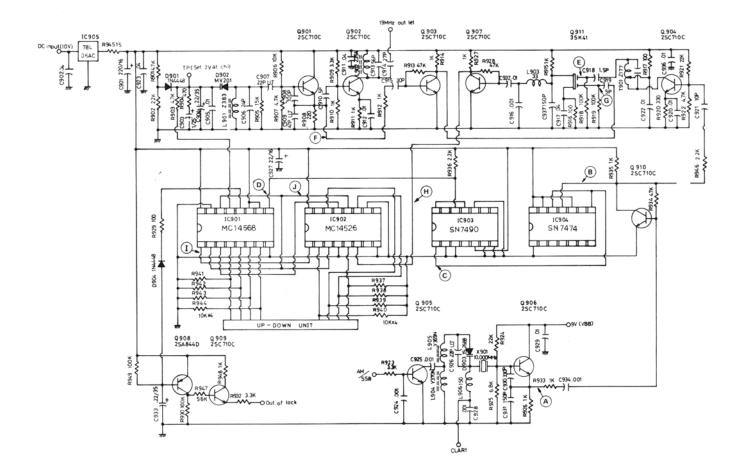
# BLOCK DIAGRAM TRANSMIT SIGNAL FLOW



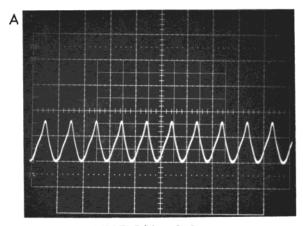
#### BLOCK DIAGRAM PLL SIGNAL FLOW



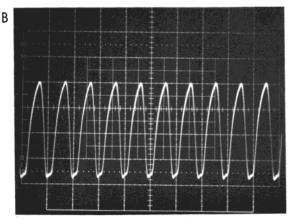
#### SYNTHESIZER SCHEMATIC



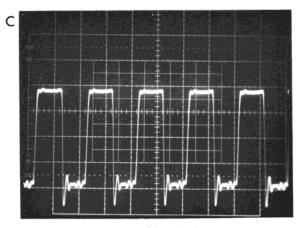
#### SYNTHESIZER WAVEFORMS



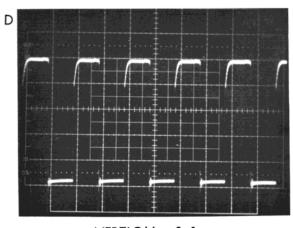
VERTICAL: 0.1vpc, HORIZONTAL: 0.1us, FREQ: 10.0 MHZ



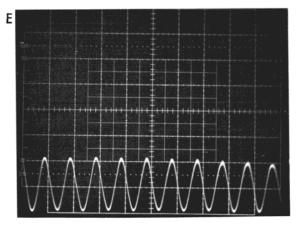
VERTICAL: 0.1vpc, HORIZONTAL: 0.1us, FREQ: 10.0 MHZ



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



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

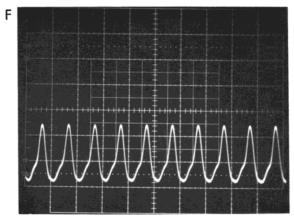


VERTICAL: 20 mvpc, HORIZONTAL: 0.05us, FREQ: 20 MHZ

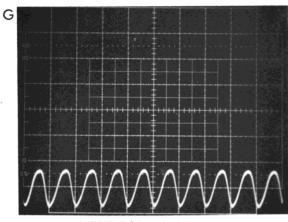
All waveforms taken with 10x1 probe scope vertical in DC mode with o ref line 1cm from bottom.

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

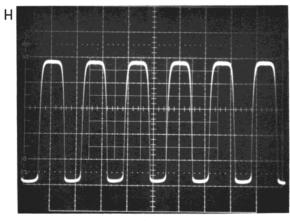
#### SYNTHESIZER WAVEFORMS



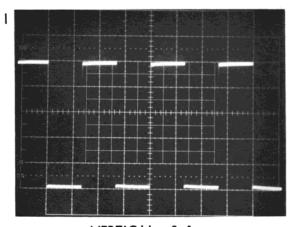
VERTICAL: 0.1vpc, HORIZONTAL:0.05us, FREQ:19.405 MHZ



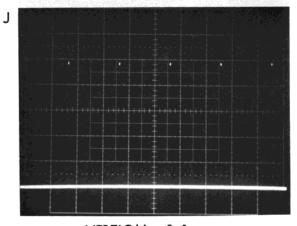
VERTICAL: 0.05 vpc, HORIZONTAL:0.05us, FREQ:19.405 MHZ



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



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

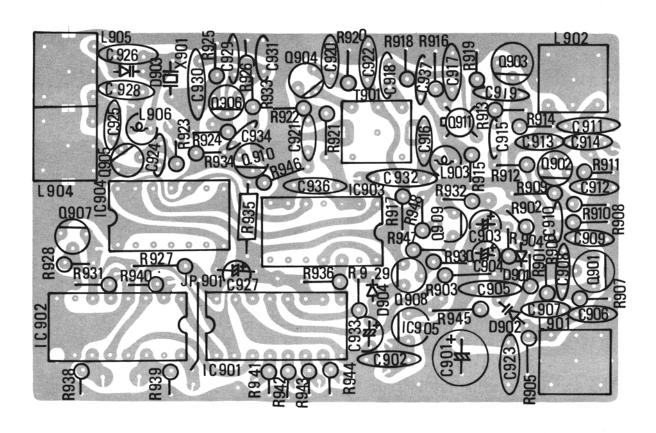


VERTICAL: 0.1vpc, HORIZONTAL: 0.1ms, FREQ: 5 KHZ

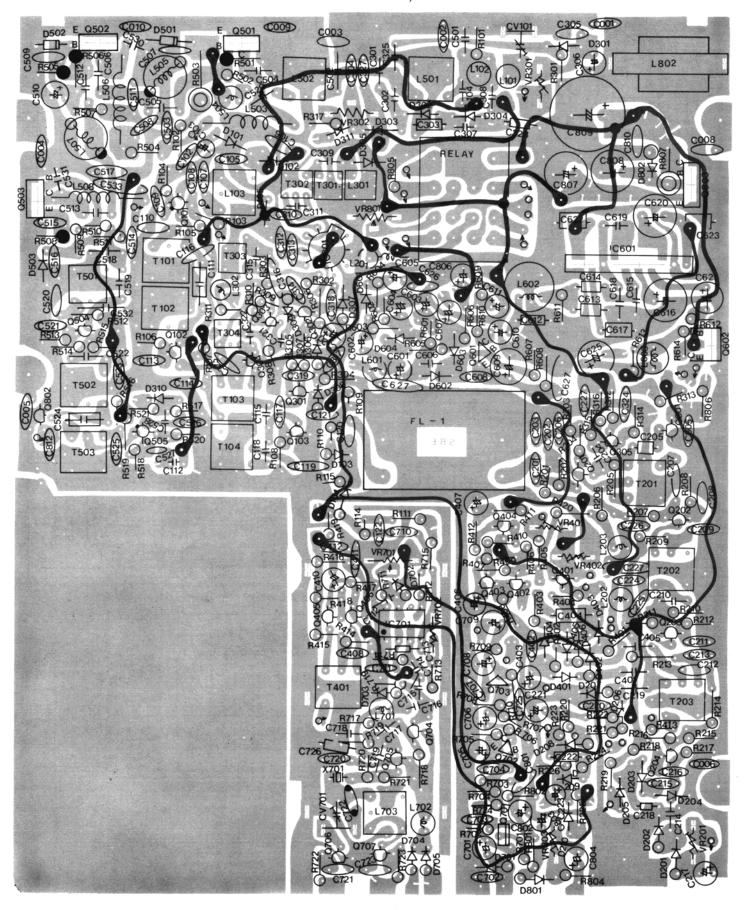
All waveforms taken with 10x1 probe scope vertical in DC mode with o ref line 1cm from bottom.

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

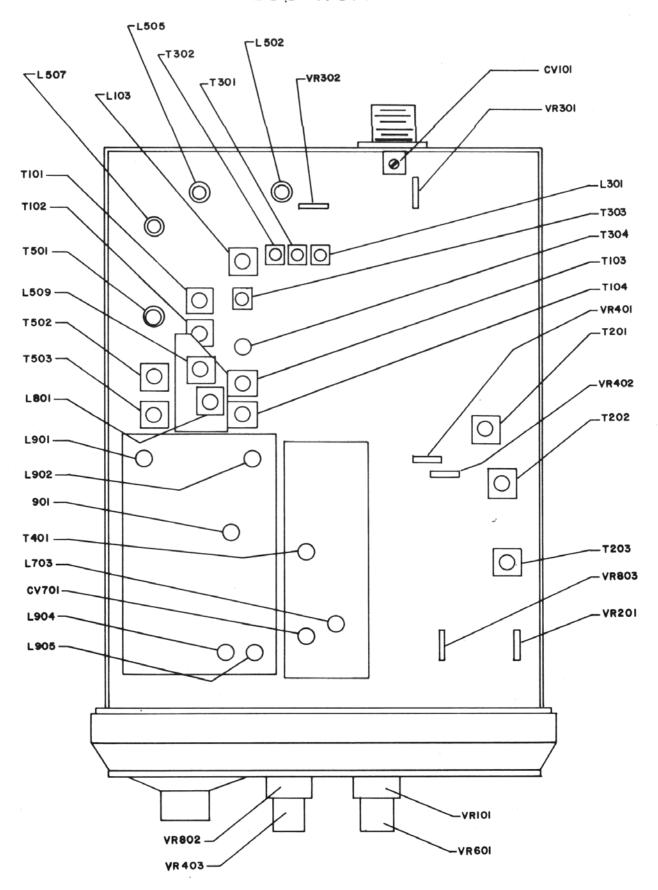
# COMPONENT LAYOUT PLL BOARD



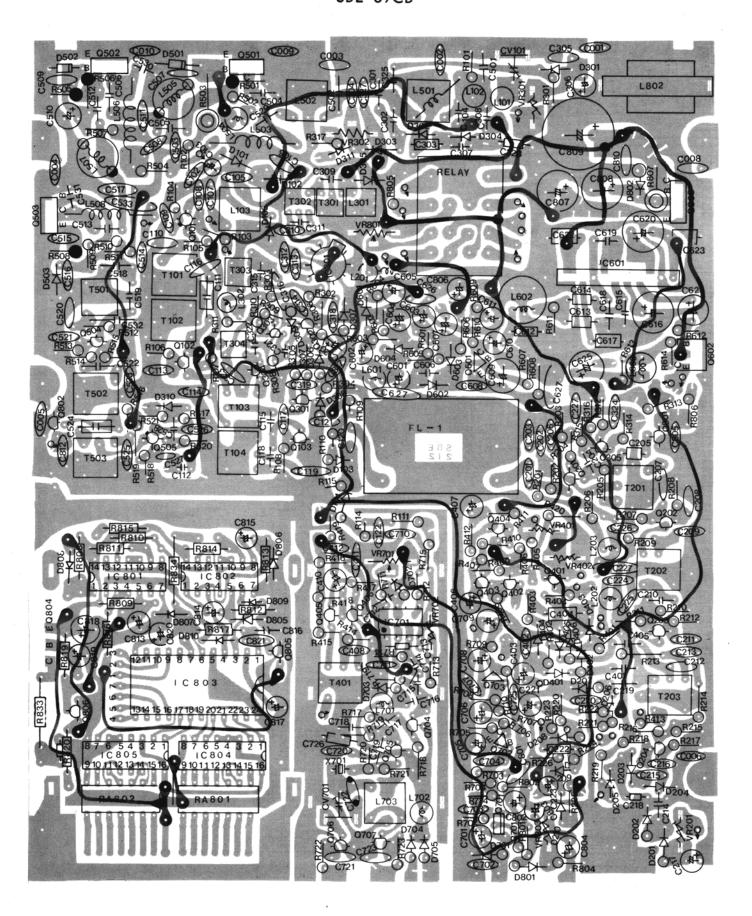
# COMPONENT LAYOUT SBE-27CB/A



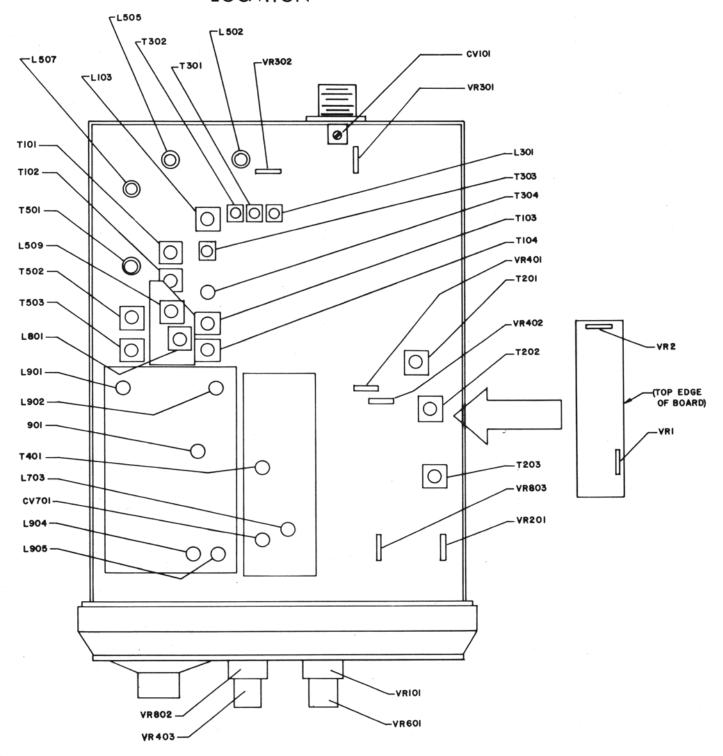
# COMPONENT ALIGNMENT LOCATION



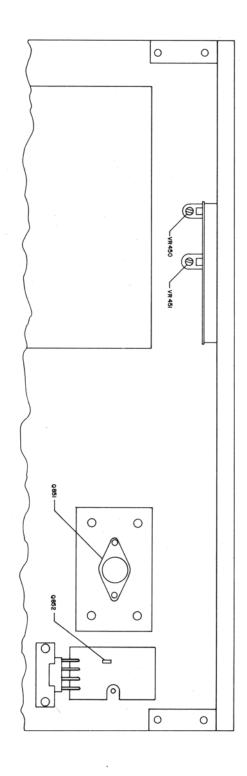
# COMPONENT LAYOUT SBE-39CB



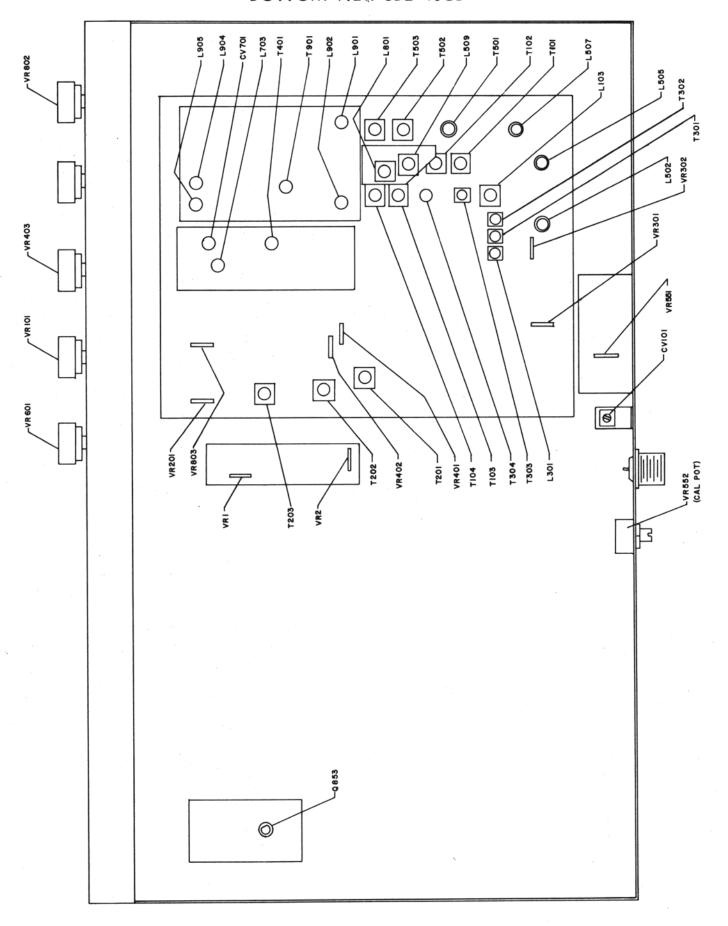
# COMPONENT ALIGNMENT LOCATION



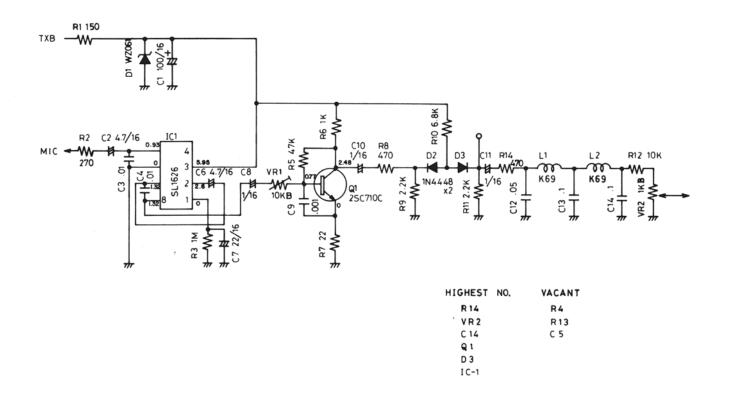
# COMPONENT ALIGNMENT LOCATION TOP VIEW SBE-40CB



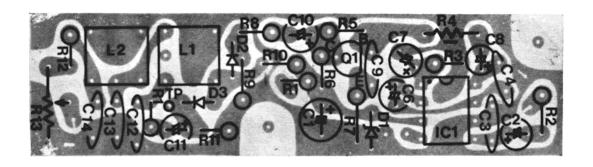
# COMPONENT LAYOUT LOCATION BOTTOM VIEW SBE-40CB



#### SPEECH SPANDER SCHEMATIC



#### SPEECH SPANDER COMPONENT LOCATION



# UP-DOWN UNIT SCHEMATIC

