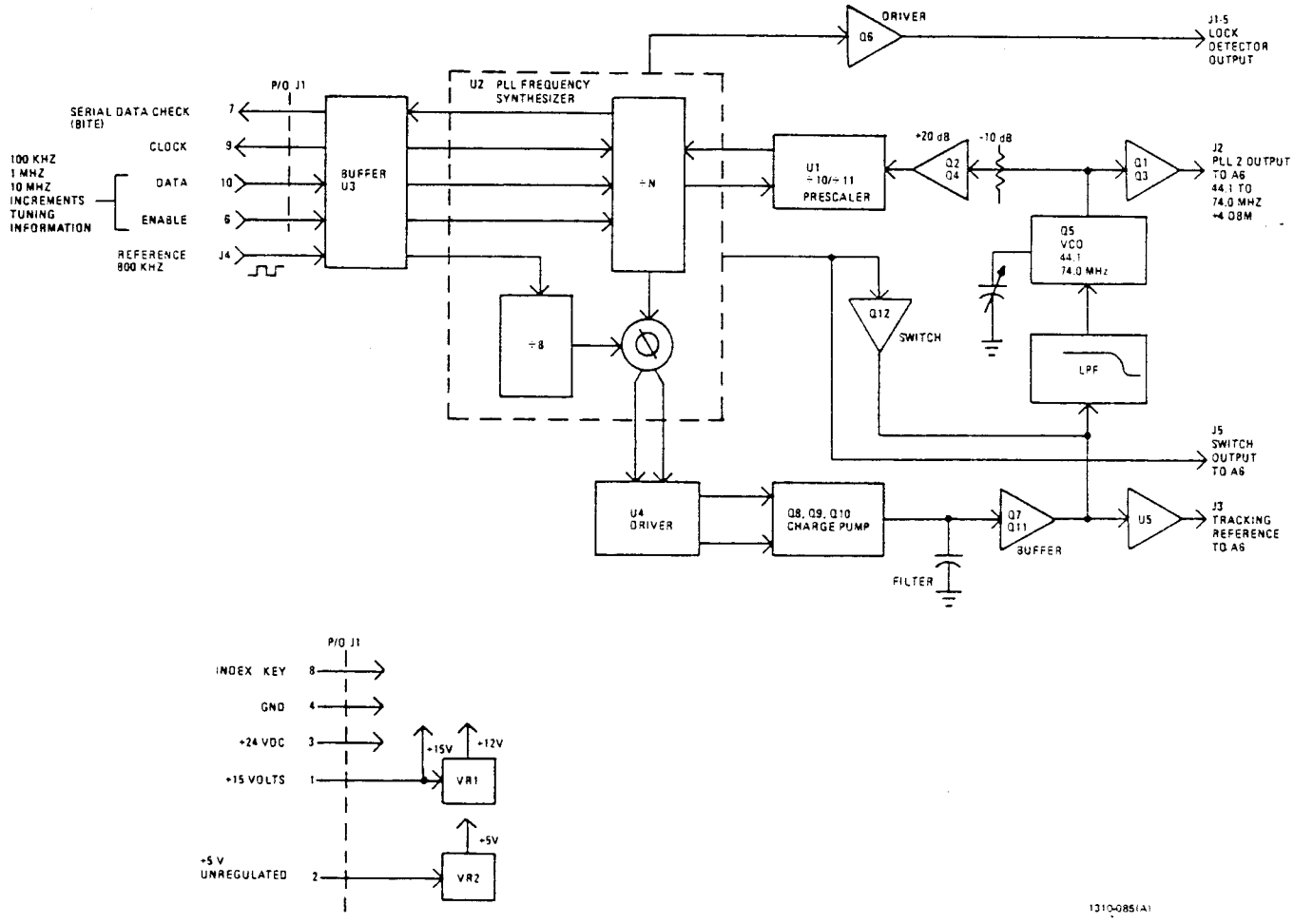
A7
PLL 2 ASSEMBLY



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PLL 2 ASSEMBLY A7

1. GENERAL DESCRIPTION

PLL 2 Assembly A7 is a single, phase locked loop synthesizer that ultimately provides the 100 kHz, 1 MHz, and 10 MHz tuning increments of the LO 1 signal used to produce the transmit frequency selected on the front panel. Figure 1 shows the location of PLL 2 Assembly A7 in the RF-1310 chassis.

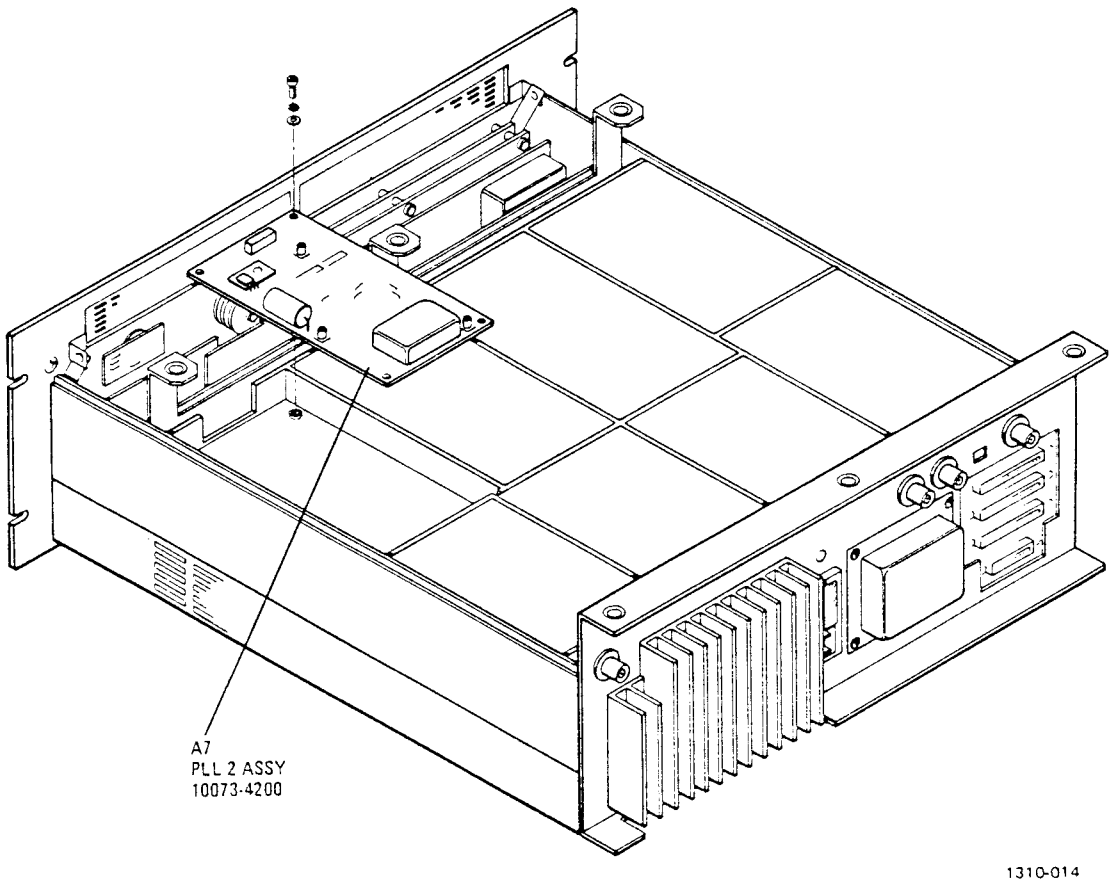


Figure 1. PLL 2 Assembly A7 Location

Frequency select input data is applied to the assembly in serial data form under Control Board Assembly A14 microprocessor control. The A7 output to PLL 1 Assembly A6 is a variable 44.1 to 74.0 MHz signal in 100 kHz controllable steps. The net result of A7 operation is to provide coarse tuning increments (100 kHz, 1 MHz, and 10 MHz) for LO 1 signal.

2. INTERFACE CONNECTIONS

Table 1 details the various input/output connections and other relevant data.

Table 1. PLL 2 Assembly Interface Connections

Connector	Function	Characteristics
J1-1	+ 15 Volts	Approximately 25 mA
J1-2	5 Volts Unregulated	Approximately 240 mA
J1-3	+ 24 Volts	Approximately 20 mA
J1-4	Ground	
J1-5	Lock Detector Output	5 Vdc = unlocked; 0 Vdc = locked
J1-6	Enable	+ going pulse = enabled
J1-7	Serial Data Check	P/O BITE Test, + 5 Vdc = ok
J1-8	Key	
J1-9	Clock	TTL, 750 kHz
J1-10	Data	Serial TTL
J2	PLL 2 (A7) Output	+ 4 dBm/50 ohms, 44.1 to 74.0 MHz
J3	PLL 2 Tracking Reference	3.5 to 19 Vdc
J4	800 kHz Reference Input	TTL
J5	Switch Output	+ 4 V for less than 2 MHz tune frequency 0 V for greater than or equal to 2 MHz tune frequency

3. CIRCUIT DESCRIPTION

NOTE

A7 operation is similar (in operation) to that of the general divide-by-N PLL and charge pump circuits described in section 4. A review of section 4 at this point would aid in the understanding of A7 assembly operation.

3.1 Reference Generation

The 800 kHz signal from Reference Generator Assembly A12 enters PLL 2 Assembly A7 at J4. This signal is applied via buffer U3 to a divide-by-eight counter internal to U2 to produce a 100 kHz reference signal. Since this has been derived ultimately from the RF-1310 crystal frequency standard via the A12 assembly, stable and accurate A7 operation is assured.

3.2 Divide-By-N Counter

Since the A7 assembly must generate a variable 44.1 to 74.0 MHz output frequency, a programmable counter has been designed into the VCO feedback path to the phase comparator. This counter consists of dual modulus divide-by-10/divide-by-11 prescaler U1 and a programmable counter internal to U2. Together, U1 and the programmable portion of U2 create a total division range of N = 441 to N = 740, where N is a function of the digits in the 10 MHz, 1 MHz, and 100 kHz positions of the frequency display.

The output of the divide-by-N counter will always attempt to equal the 100 kHz reference frequency at the Phase Comparator inputs, despite changes in the divide-by-N factor due to changing the 10 MHz, 1 MHz, and/or 100 kHz digits of the displayed frequency. The VCO frequency will change to accomplish this, in response to command signals generated by the phase comparator. The VCO frequency will always equal (N) (reference frequency), or (N) (100 kHz) = 44.1 MHz to 74.0 MHz. The exact value of N is determined by the digits in the 10 MHz, 1 MHz, and 100 kHz positions of the frequency display. This front panel selection causes Control Assembly A14 to generate a serial data code containing information pertaining to the values of the increments chosen. This code is applied synchronously with the 750 kHz system clock to U2 whenever the U2 enable line is gated open by A14. In general, N = (441 + XXX), where XXX are the digits in the 10 MHz, 1 MHz, and 100 kHz positions of the frequency display.

For example, tuning the RF-1310 to 15.789000 MHz would make N = (441 + 157) = 598. The VCO frequency will be (N) (Reference) = (598) (100 kHz) = 59.8 MHz.

Tuning the radio to 24.705000 MHz would result in a VCO output frequency of (441 + 247) (100 kHz) = 68.8 MHz. Note that increasing the tune frequency causes an increase in the A7 output frequency. The opposite will also be true.

3.3 Phase Comparator and Charge Pump Operation

Phase comparison of the 100 kHz reference and the 100 kHz divide-by-N counter VCO derived signal is accomplished by a phase comparator internal to U2. When these two signals are equal in frequency and phase, the buffered phase comparator outputs at TP2 and TP3 are essentially 5 Vdc. This 5-volt level holds charge pump transistors Q9 and Q10 on, and consequently, Q8 off. The voltage across C51 will be at a constant value, forcing buffers Q7 and Q11 to develop a stable voltage at TP1. This VCO control voltage holds the VCO frequency constant somewhere between 44.1 MHz and 74.0 MHz.

Assume that the VCO feedback signal at the divide-by-N counter output is suddenly less than the reference frequency, which is what happens at the instant the divide-by-N factor is increased. Since the two phase comparator inputs are no longer equal, the phase comparator will output a series of negative pulses at TP3. The pulse width of these pulses is a function of the difference in phase/frequency between the two inputs. Q10 turns on, and its decreasing collector voltage turns Q8 on. Q8 will start to pump charge into C51, raising its voltage. Buffer stage Q7 and Q11 will produce a corresponding increase at TP1 which forces the VCO to increase in frequency. The increasing VCO signal produces a corresponding frequency increase at the divide-by-N counter output, driving it towards the reference signal at 100 kHz. As the divide-by-N counter output approaches the reference frequency, the pulses at TP3 get narrower, until they are at an essentially constant + 5 Vdc level. Q10 and Q8 turn off, and the voltage rise across C51 stops at a new higher level, producing a stabilization of the VCO control voltage and the VCO frequency at a new higher value.

Assume that the VCO feedback signal is suddenly greater than the reference frequency, which is what occurs at the instant the divide-by-N factor is decreased. The phase comparator outputs a series of negative pulses at TP2. Q9 turns on, and starts drawing charge out of C51, dropping its voltage. A corresponding decrease in the VCO control voltage occurs, producing a decreasing VCO frequency. This causes the feedback VCO divide-by-N counter output to decrease, driving it towards the 100 kHz reference. As the divide-by-N counter output approaches the reference, the negative pulses at TP2 become narrower, until the signal becomes a 5 Vdc level. Q9 turns off, and stops any further decrease in the C51 voltage, the VCO control voltage, and therefore the VCO frequency. The VCO now generates a lower frequency.

Note that the VCO control voltage at Q7 and Q11 is sent to two places. They are the LPF and VCO on the A7 assembly and buffer stage U5. This second output is referred to as the Tracking Reference, and is routed through J3 for use on PLL 1 Assembly A6. It allows the A6 VCO to properly track the A7 VCO.

3.4 VCO Operation and Control

A charge pump circuit consisting of Q8-Q10 and associated components converts the two phase comparator pulse ouputs into an analog dc control voltage. Buffer stages Q7 and Q11 apply the VCO control voltage through a low pass filter (LPF) network to the varactor diode string in the VCO. The VCO itself is a JFET (Q5) Hartley oscillator stage whose frequency shifts as the capacitance of the varactor diodes change in response to changes in VCO control voltage. A VCO control voltage range of approximately 3.5 Vdc to 19.0 Vdc shifts the VCO from 44.1 MHz to 74.0 MHz.

The VCO output is fed to two separate amplifier stages. The first, Q4 and Q2, is a 20 dB amplifier which applies the VCO signal to the divide-by-10/divide-by-11 prescaler, U1. It is this signal which completes the feedback loop to the phase comparator. The second amplifier stage, Q3 and Q1, boosts the level to approximately 4 dBm and is called the PLL 2 output. This signal contains the 10 MHz, 1 MHz, and 100 kHz portions of the LO 1 signal, and is fed to PLL 1 Assembly A6 for further processing.

3.5 Noise Reduction Techniques

The noise characteristics of the VCO output are enhanced by the following two methods:

- Use of a sharp cutoff LPF network to filter noise off the VCO control voltage. This stage is located between charge pump buffer stage Q11 and the VCO input.

- Use of a circuit to make charge pump operation linear at exciter tune frequencies less than 2 MHz. Lower exciter tune frequencies require less VCO control voltage than higher exciter tune frequencies. At tune frequencies less than 2 MHz, the VCO control voltage required is so low that the charge pump enters a nonlinear mode of operation in an attempt to produce the output across C51 that is required. In order to correct this at frequencies less than 2 MHz, U2 outputs a 5 Vdc level which turns Q12 on. Q12, which is connected across the LPF input, reduces the control voltage level. The net result is that the charge pump is now "tricked" into forcing its output to increase the voltage across C51 required to produce the required VCO control voltage. In so doing, it pulls itself out of its nonlinear region. At frequencies greater than 2 MHz, Q12 is off and the charge pump functions normally. Note that this switch output from U2 is routed through J5 to the A6 assembly for similar purposes.

3.6 BITE Circuits

The A7 assembly contains two circuits for self-test evaluation.

- Lock detector Q6, whose output is 0 Vdc whenever the PLL is tracking properly. This line is constantly monitored by the A14 assembly. A front panel fault light will appear if the loop ever unlocks.

- Serial data check verifies that the tuning data from the A14 assembly has been received and properly translated into the correct divide-by-N factor. A serial data word is sent on the data line (J1 pin 10) and the U6 serial data check line is read back to the A14 assembly (J1 pin 7). If the word has been received and properly decoded, this line will pulse to + 5 Vdc. The serial data check occurs automatically, but only when the BITE self test is actuated.

4. MAINTENANCE

The following adjustments should not be performed as a routine maintenance procedure, but only when a failure indicates a definite need. Perform all tests with all connections in normal contact, unless otherwise specified.

4.1 VCO Frequency Adjustment

a. Connect equipment as shown in figure 2.

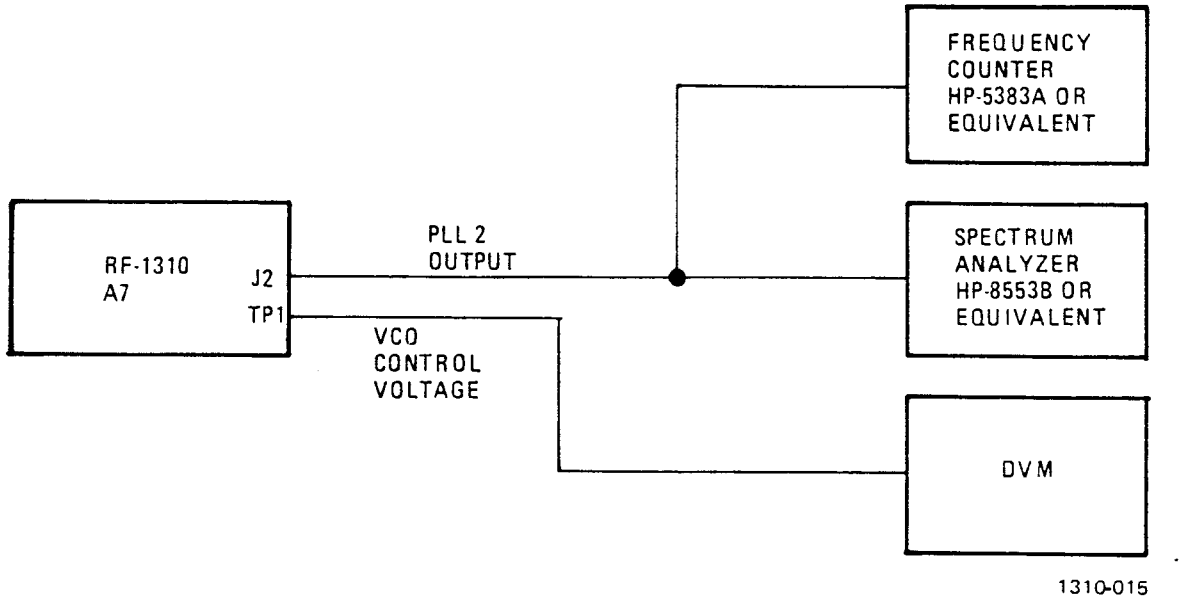


Figure 2. VCO Adjustment

b. Set RF-1310 frequency to 29.900000 MHz.

c. Adjust C15 for a nominal voltage of 16.5 - 19.0 Vdc at TP1. PLL 2 output at J2 should be 74.0 MHz, 4 dBm ± 3 dB. Check the exciter tune frequency against PLL II output frequencies listed in table 2. Output should remain at + 4 dBm ± 3 dB.

d. Check that the Tracking Reference Signal (J3) agrees within ± 1 Vdc to the control voltage at TP1 for the ranges listed in table 2.

Table 2. VCO Frequency Range

Exciter Tune Frequency, MHz	PLL 2 Output Frequency, MHz	Approximate TP1 Voltage, Vdc
29.900000	74.000000	19.0
15.000000	59.100000	10.0
00.000000	44.100000	3.5

e. Check that the switch output (J5) changes to approximately 4 Vdc when the exciter is tuned below 2.000000 MHz.

f. Fully reconnect the A7 assembly to the RF-1310 and initiate BITE test. Exciter should not fail at any test concerning the A7 assembly. These tests have verified the proper operation of the A7 assembly. Proceed to paragraph 4.2, Tracking Adjustment.

4.2 Tracking Adjustment

a. Perform VCO adjustment found in paragraph 4.1.

b. Tune the RF-1310 to 29.99999 MHz.

c. Measure the VCO control voltage at TP1 on PLL 1 VCO Assembly A6A2. Note that TP1 is located under the VCO assembly cover. This voltage should be 16 to 19.0 Vdc on a properly aligned A6 assembly.

d. Measure PLL 2 Assembly A7 VCO control voltage at TP1, and adjust C15 for a voltage equal to that of the A6 PLL 1 VCO control voltage (step c).

e. Tune the exciter to 20 MHz, then 10 MHz, and then 2 MHz, measuring the VCO control voltages on both assemblies at each frequency. The two voltages should track each other at all times, and differ by no more than ± .5 Vdc. Test is now complete.

5. PARTS LIST, COMPONENT LOCATIONS, AND SCHEMATIC DIAGRAM

All replaceable components of the A7 assembly are listed in table 3. Component locations can be found in figure 3. Figure 4 is a schematic diagram of PLL 2 Assembly A7. (Cont.)

Table 3. PLL 2 Assembly A7 Parts List

Ref. Desig.	Part Number	Description
A7	10073-4200	PLL 2 ASSEMBLY
4	MP-0121	CLIP, MTG, SPRING STEEL
5	10073-7116	CAN RECT DEEP DRAWN
12	E70-0002-002	PAD MNT XSTR TO-5
C1	CK05BX103M	CAP .01UF 20% 100V CER
C2	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
C4	CK05BX103M	CAP .01UF 20% 100V CER
C5	CK05BX103M	CAP .01UF 20% 100V CER
C6	CK05BX103M	CAP .01UF 20% 100V CER
C7	M39014/02-1310	CAP .1UF 10% 100V CER-R
C8	CK05BX103M	CAP .01UF 20% 100V CER
C9	C26-0025-100	CAP 10UF 20% 25V TANT
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C11	M39014/02-1310	CAP .1UF 10% 100V CER-R
C12	C26-0025-100	CAP 10UF 20% 25V TANT
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	CK05BX103M	CAP .01UF 20% 100V CER
C15	C85-0001-002	CAPACITOR .8-10 PF

Table 3. PLL 2 Assembly A7 Parts List (Cont.)

Ref. Desig.	Part Number	Description
C16	CK05BX102M	CAP 1000PF 20% 200V CER
C17	CK05BX102M	CAP 1000PF 20% 200V CER
C18	C26-0025-100	CAP 10UF 20% 25V TANT
C19	M39014/02-1310	CAP .1UF 10% 100V CER-R
C20	C26-0025-100	CAP 10UF 20% 25V TANT
C21	M39014/02-1310	CAP .1UF 10% 100V CER-R
C22	M39014/02-1310	CAP .1UF 10% 100V CER-R
C23	C26-0025-100	CAP 10UF 20% 25V TANT
C24	M39014/02-1310	CAP .1UF 10% 100V CER-R
C25	CK05BX103M	CAP .01UF 20% 100V CER
C28	M39014/02-1310	CAP .1UF 10% 100V CER-R
C29	CK05BX103M	CAP .01UF 20% 100V CER
C30	CK05BX103M	CAP .01UF 20% 100V CER
C31	CK05BX102M	CAP 1000PF 20% 200V CER
C32	CK05BX103M	CAP .01UF 20% 100V CER
C33	M39014/02-1310	CAP .1UF 10% 100V CER-R
C34	CK05BX103M	CAP .01UF 20% 100V CER
C35	M39014/02-1310	CAP .1UF 10% 100V CER-R
C36	M39014/02-1310	CAP .1UF 10% 100V CER-R
C38	CM06FD472J03	CAP 4700PF 5% 500V MICA
C39	C-0912	CAPACITOR
C40	C-0912	CAPACITOR
C41	M39014/02-1310	CAP .1UF 10% 100V CER-R
C43	M39014/02-1310	CAP .1UF 10% 100V CER-R
C44	CM06FD242J03	CAP 2400PF 5% 500V MICA
C45	CM06FD242J03	CAP 2400PF 5% 500V MICA
C46	C25-0001-301	CAP 1.0UF 20% 20V TANT
C51	M39014/02-1310	CAP .1UF 10% 100V CER-R
C52	6628-0660	CAP 5600PF 5% 300V MICA
C53	M39014/02-1310	CAP .1UF 10% 100V CER-R
C54	C26-0035-470	CAP 47UF 20% 35V TANT
C55	C-8212	CAP 470UF 50V ELEC
C56	M39014/02-1310	CAP .1UF 10% 100V CER-R
C57	M39014/02-1310	CAP .1UF 10% 100V CER-R
C58	M39014/02-1310	CAP .1UF 10% 100V CER-R
C60	M39014/02-1310	CAP .1UF 10% 100V CER-R
C61	C26-0025-100	CAP 10UF 20% 25V TANT
C62	M39014/02-1310	CAP .1UF 10% 100V CER-R
C63	M39014/02-1310	CAP .1UF 10% 100V CER-R
C64	M39014/02-1310	CAP .1UF 10% 100V CER-R
C82	CM04ED390J03	CAP 39PF 5% 500V MICA
C83	CK05BX103M	CAP .01UF 20% 100V CER
CR1	10073-7118	VARACTOR 26.0 - 32.0pF
CR2	10073-7118	VARACTOR 26.0 - 32.0pF
CR3	10073-7118	VARACTOR 26.0 - 32.0pF

Table 3. PLL 2 Assembly A7 Parts List (Cont.)

Ref. Desig.	Part Number	Description
CR4	10073-7118	VARACTOR 26.0 - 32.0pF
CR5	10073-7118	VARACTOR 26.0 - 32.0pF
CR6	10073-7118	VARACTOR 26.0 - 32.0pF
CR7	10073-7118	VARACTOR 26.0 - 32.0pF
CR8	10073-7118	VARACTOR 26.0 - 32.0pF
CR9	10073-7118	VARACTOR 26.0 - 32.0pF
CR10	10073-7118	VARACTOR 26.0 - 32.0pF
CR11	10073-7118	VARACTOR 26.0 - 32.0pF
CR12	10073-7118	VARACTOR 26.0 - 32.0pF
CR13	1N6263	DIODE .40W 60V HOT CARR
CR14	1N3064	DIODE 75mA 75V SW
CR15	1N3064	DIODE 75mA 75V SW
J1	J46-0032-010	HEADER, 10 PIN DISCRETE
J2	J-0031	CONN SMB VERT PCB F
J3	J-0031	CONN SMB VERT PCB F
J4	J-0031	CONN SMB VERT PCB F
L1	MS75084-3	COIL 1.8UH 10% FXD RF
L2	MS75084-11	COIL 8.2UH 10% FXD RF
L3	L08-0001-001	CHOKE W B 50 MHZ
L4	L08-0001-001	CHOKE W B 50 MHZ
L5	MS90539-13	INDUCT MOLD 820 UH 5%
L6	MS90539-12	COIL 750UH 5% FXD RF
L7	L08-0001-001	CHOKE W B 50 MHZ
Q1	2N5109	XSTR RFPWR NPN TO-39
Q2	Q35-0003-000	XSTR U310 JFET HIGH GM
Q3	Q35-0003-000	XSTR U310 JFET HIGH GM
Q4	2N3563	XSTR SS/RF
Q5	Q35-0003-000	XSTR U310 JFET HIGH GM
Q6	2N2907	XSTR SS/GP PNP TO-18
Q7	Q60-0003-000	XSTR MOSFET
Q8	2N2907	XSTR SS/GP PNP TO-18
Q9	2N2222	XSTR SS/GP NPN TO-18
Q10	2N2222	XSTR SS/GP NPN TO-18
Q11	2N5088	XSTR SS/GP
Q12	2N2222	XSTR SS/GP NPN TO-18
R1	R65-0003-470	RES,47 5% 1/4W CAR FILM
R2	R65-0003-471	RES,470 5% 1/4W CAR FILM
R3	R65-0003-242	RES,2.4K 5% 1/4W CAR FILM
R4	R65-0003-470	RES,47 5% 1/4W CAR FILM
R5	R65-0003-100	RES,10 5% 1/4W CAR FILM
R6	R65-0003-152	RES,1.5K 5% 1/4W CAR FILM
R7	R65-0003-201	RES,200 5% 1/4W CAR FILM
R8	R65-0003-270	RES,27 5% 1/4W CAR FILM
R9	R65-0003-513	RES,51K 5% 1/4W CAR FILM
R10	R65-0003-201	RES,200 5% 1/4W CAR FILM

Table 3. PLL 2 Assembly A7 Parts List (Cont.)

Ref. Desig.	Part Number	Description
R11	R65-0003-510	RES,51 5% 1/4W CAR FILM
R12	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R13	R65-0003-151	RES,150 5% 1/4W CAR FILM
R14	R65-0003-680	RES,68 5% 1/4W CAR FILM
R15	R65-0003-101	RES,100 5% 1/4W CAR FILM
R16	R65-0003-152	RES,1.5K 5% 1/4W CAR FILM
R17	R65-0003-100	RES,10 5% 1/4W CAR FILM
R18	R65-0003-151	RES,150 5% 1/4W CAR FILM
R19	R65-0003-470	RES,47 5% 1/4W CAR FILM
R20	R65-0003-513	RES,51K 5% 1/4W CAR FILM
R21	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R22	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R23	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R24	R65-0003-201	RES,200 5% 1/4W CAR FILM
R25	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R26	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R27	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R28	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R29	R65-0003-479	RES,4.7 5% 1/4W CAR FILM
R31	R65-0003-279	RES,2.7 5% 1/4W CAR FILM
R32	RN55D6810F	RES,681.0 1% 1/8W MET FLM
R33	RN55D6810F	RES,681.0 1% 1/8W MET FLM
R34	RN55D1501F	RES,1500 1% 1/8W MET FLM
R35	RN55D2001F	RES,2000 1% 1/8W MET FLM
R36	RN55D6810F	RES,681.0 1% 1/8W MET FLM
R37	RN55D6810F	RES,681.0 1% 1/8W MET FLM
R38	RN55D1212F	RES,12.1K 1% 1/8W MET FLM
R39	R65-0003-121	RES,120 5% 1/4W CAR FILM
R40	R65-0003-101	RES,100 5% 1/4W CAR FILM
R41	R65-0003-182	RES,1.8K 5% 1/4W CAR FILM
R42	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R43	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R44	R65-0003-223	RES,22K 5% 1/4W CAR FILM
R45	R65-0003-473	RES,47K 5% 1/4W CAR FILM
R46	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R47	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R48	R65-0003-103	RES,10K 5% 1/4W CAR FILM
T1	10073-7014	TRANSFORMER, RF, FIXED
T2	10073-7014	TRANSFORMER, RF, FIXED
T3	10073-7002	TRANSFORMER, RF, FIXED
TP1	J-0071	TP PWB BRN TOP ACCS .080"
TP2	J-0066	TP PWB RED TOP ACCS .080"
TP3	J-0069	TP PWB ORN TOP ACCS .080"
TP4	J-0070	TP PWB YEL TOP ACCS .080"
TP5	J-0068	TP PWB GRN TOP ACCS .080"

Table 3. PLL 2 Assembly A7 Parts List (Cont.)

Ref. Desig.	Part Number	Description
U1	165-0004-001	IC 12013 PLASTIC ECL
U2	170-0002-001	IC MC145156 PLASTIC CMOS
U3	101-0000-019	IC 4050B PLASTIC CMOS
U4	105-0000-000	IC 74LS00 PLASTIC TTL
U5	130-0018-000	IC 1458 OP AMP PLASTIC
VR1	112-0006-012	IC VR 78L12A + 12V .10A 4%
VR2	111-0001-001	IC VR 7805 + 5V 1.5A 4%
VR3	1N5236A	DIODE 7.5V 10% .5W ZENER

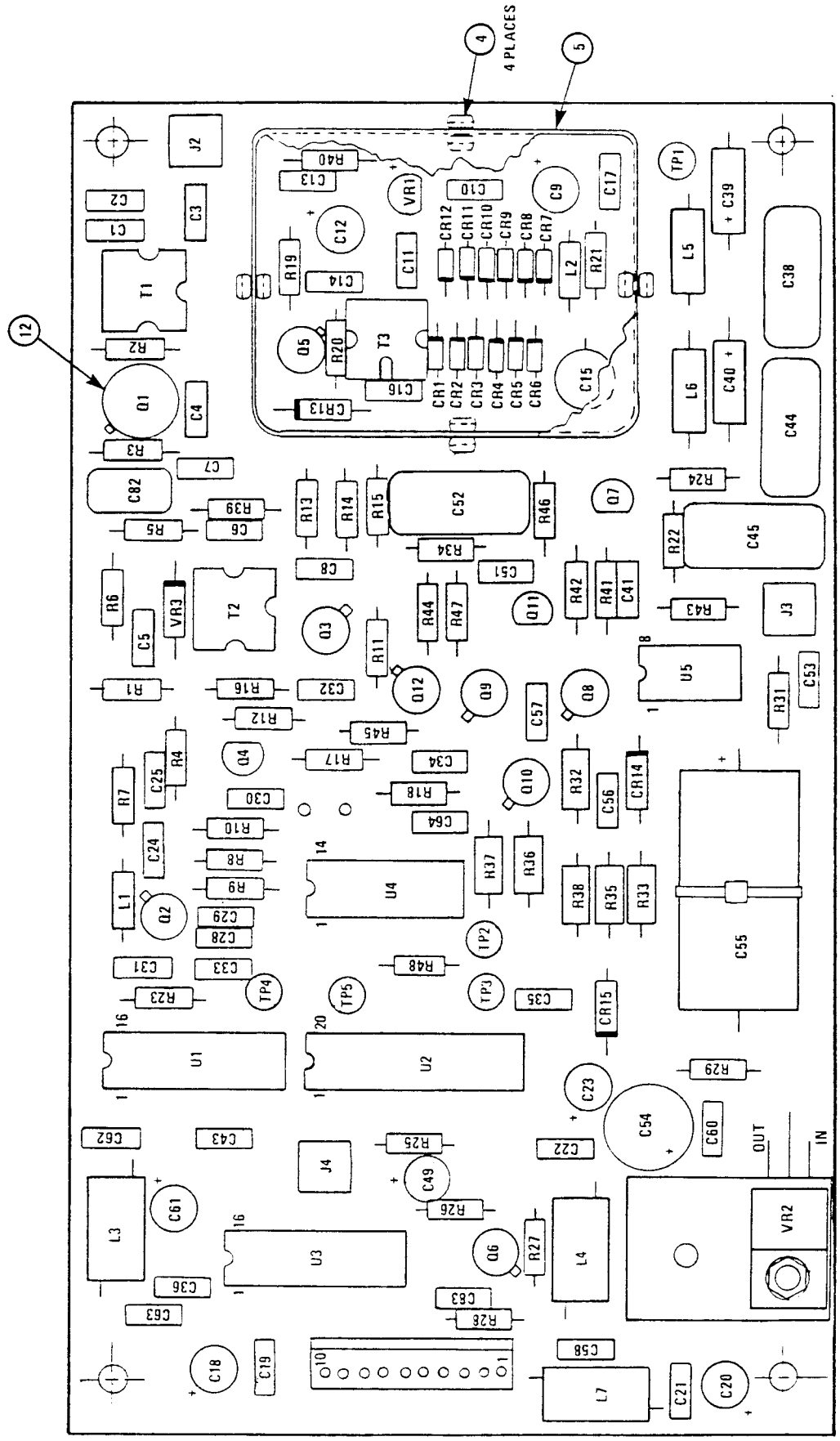
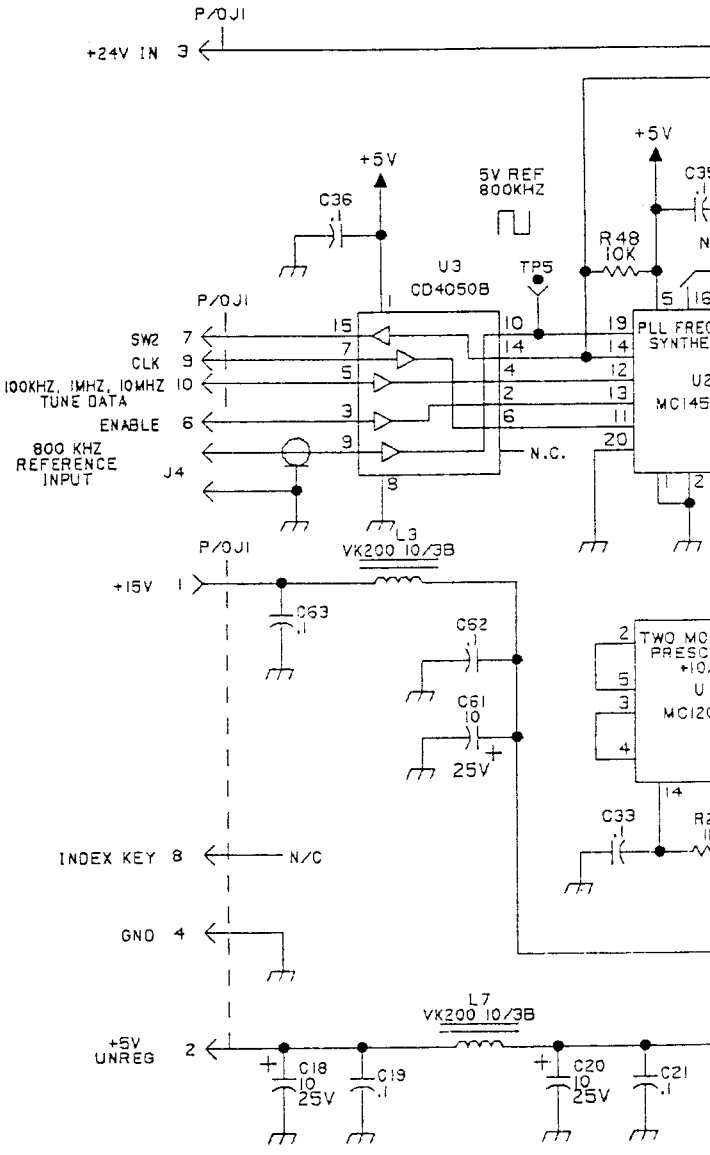


Figure 3. PLL 2 Assembly A7 Component Location Diagram (10073-4200)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. DIODES CR1-CR12 ARE KV3901.
5. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
6. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONL COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LI



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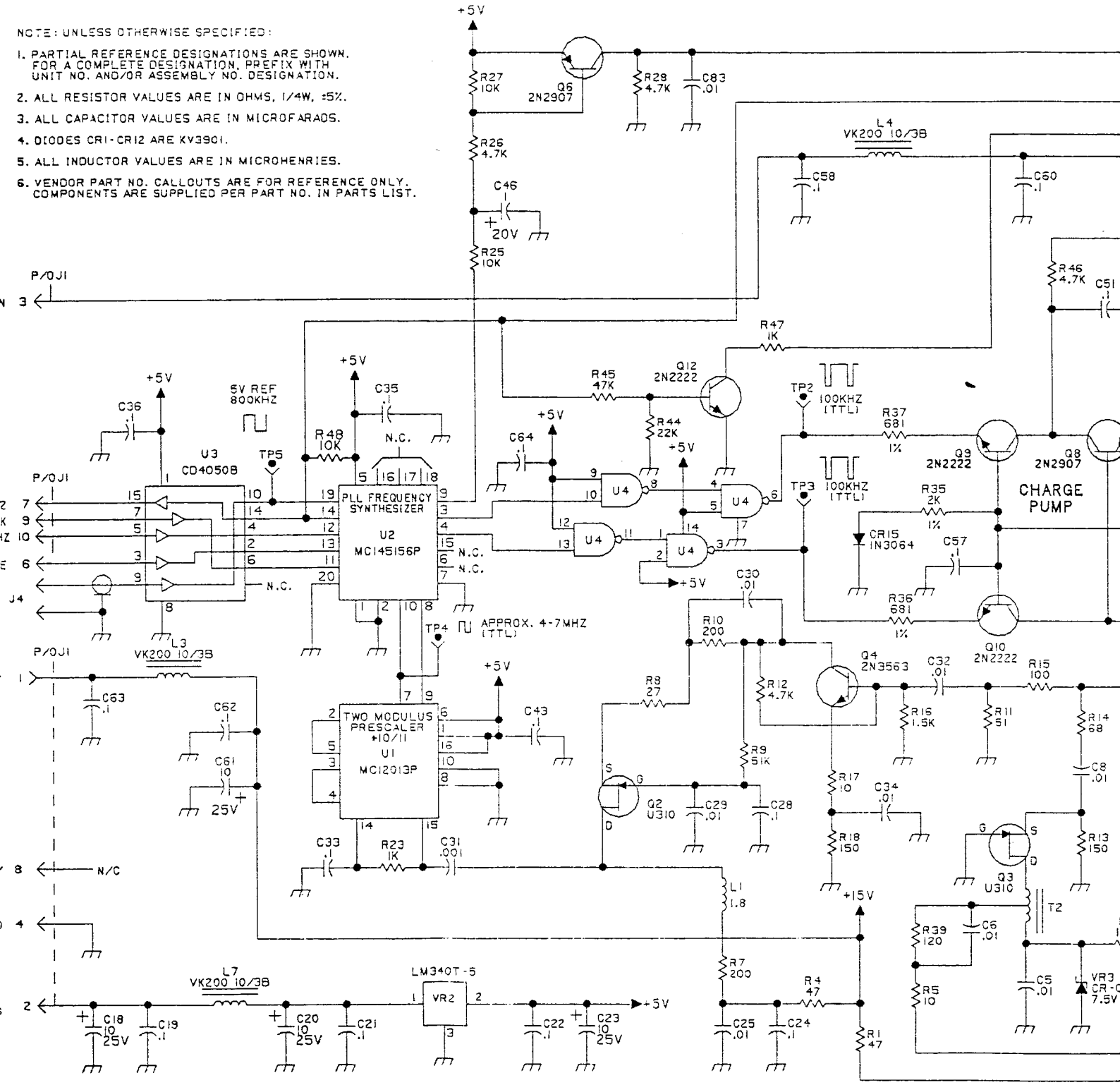
6. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.



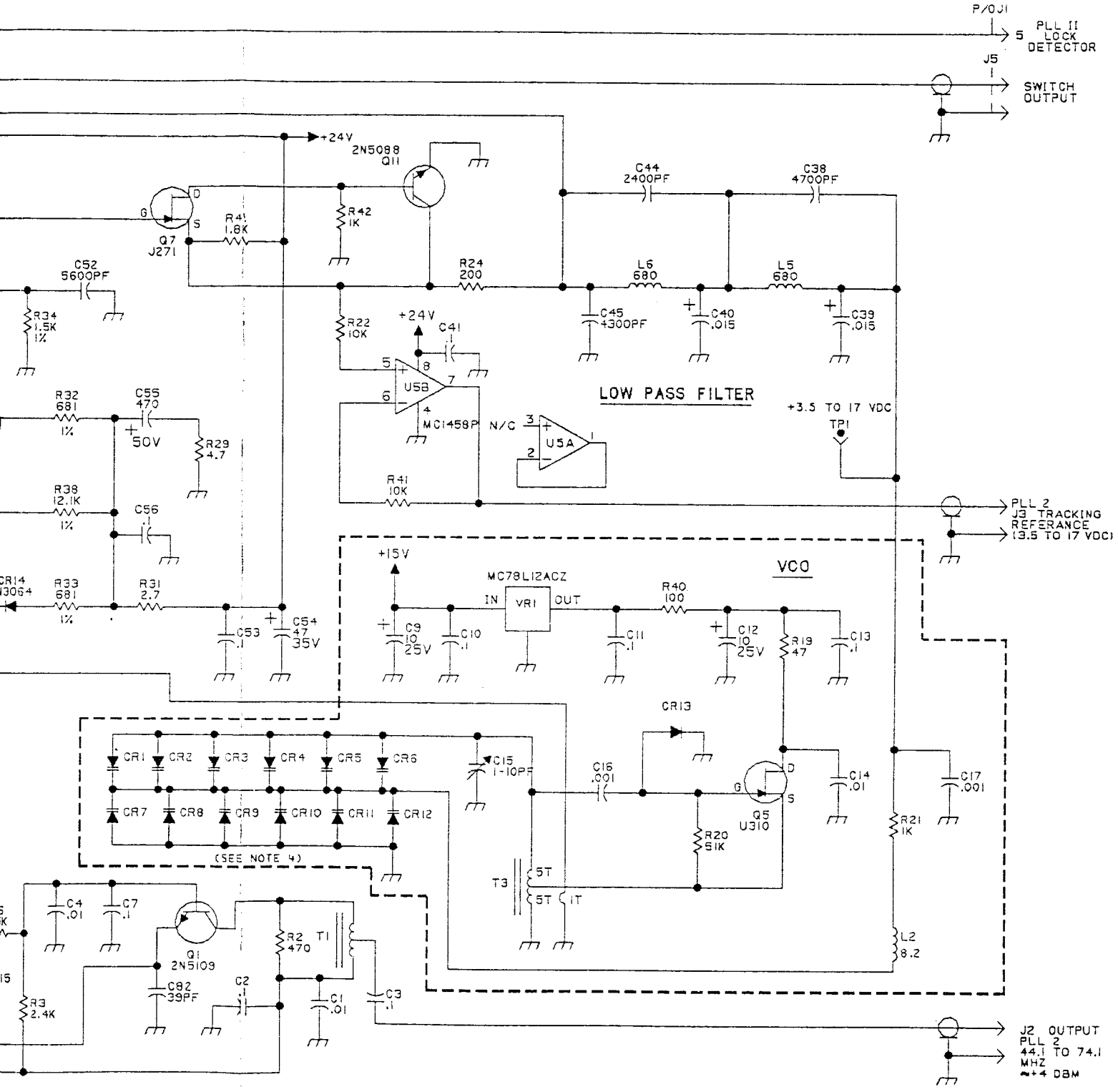


Figure 4. PLL 2 Assembly A7 Schematic Diagram (10073-4201 Rev. H)

amplifier Q2 applies a VCO control voltage to the varactor diode string in the VCO. Changing diode capacitance fine tunes JFET Hartley oscillator stage Q6. The total VCO frequency range is 35.45 to 36.45 MHz. A control voltage range of approximately 6.5 to 7.5 Vdc will tune the oscillator from 35.45 MHz to 36.45 MHz.

Clamp circuit Q7, Q8, and CR2-CR5 monitors the VCO control voltage level, and will prevent the control voltage from exceeding the approximate range of 5.5 to 8.5 Vdc. This "window" is necessary to prevent the VCO from running to the wrong side of the frequency conversion during the mixing process. This could cause the exciter to lock falsely at the wrong frequency, or not lock at all. For example, assume that the control voltage could rise high enough to force the VCO to 41 MHz. Combination of the 40.05 to 40.06 MHz signal at mixer U1 would produce a loop IF in the 1 MHz region instead of the required 3.61 to 4.61 MHz range. The clamp circuit would prevent this. CR4, CR5, and Q8 would conduct and clamp the level at 8.5 volts and prevent the VCO from "running away".

The VCO output is fed through amplifier stage Q9 and Q10 to function as a +7 dBm LO injection for U1, and to Q1, where a -2 dBm signal is passed through J1 to PLL 1 Assembly A6.

4.5 BITE Test Circuits

The A10 assembly contains two circuits for self-test evaluation. The circuits are:

- Lock detector Q15 whose output is 0 Vdc whenever the PLL is tracking properly. This line is constantly monitored by the A14 assembly. A front panel fault light will appear if the loop ever unlocks.

- Serial data check that verifies that the tune data from the A14 assembly has been received and properly translated into the correct divide-by-N factor. A serial data word is sent on the data line (J4 pin 10) and the U3 serial data check line is read back to the A14 assembly (J4 pin 7). If the word has been received and properly decoded, this line will pulse to +5 Vdc. The serial data check occurs automatically, but only when the exciter BITE self test is actuated.

5. MAINTENANCE

The following adjustments should not be made as part of a routine maintenance procedure, but only when a failure indicates a definite need. Perform all tests with all connections in normal contact, unless otherwise specified.

5.1 VCO Alignment

Perform the following procedure to align the VCO:

a. Connect equipment as shown in figure 2.

b. Set exciter frequency to 02.05050 MHz.

c. Monitor U1, pin 8, with an oscilloscope and adjust T3 for a maximum signal (should be approximately 1.2 Vpp).

d. Monitor U1 RF input at R44 with oscilloscope and adjust T4 for a maximum signal (should be approximately 1 Vpp).

e. Monitor J1 with spectrum analyzer at approximately 35 MHz. Adjust T2 for a maximum output (approximately -2 dBm).

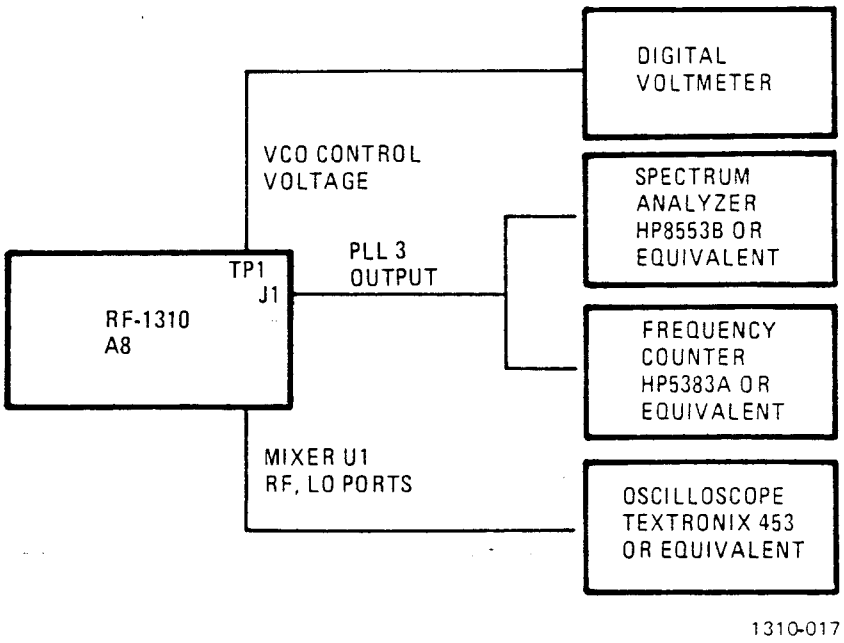


Figure 2. A8 VCO Alignment

f. Monitor TP1 with digital voltmeter (DVM). Adjust C11 for 7.0 Vdc. PLL 3 output and tune frequencies should agree with values listed in table 2.

Table 2. PLL 3 Output Range

Exciter Tune Frequency, MHz	PLL 3 Output Frequency, MHz	Approximate TP1 Voltage, Vdc
02.00000	36.450000	7.9
02.05050	35.944950	7.0
02.09999	35.450100	6.5

g. Fully reconnect the A8 assembly to the RF-1310 and initiate BITE self test. No failures should occur indicating an A8 assembly fault.

6. PARTS LIST, COMPONENT LOCATION, AND SCHEMATIC DIAGRAM

All components of the PLL 3 assembly are listed in table 3. Component locations are shown in figure 3. Figure 4 is the schematic diagram for PLL 3 Assembly A8.

Table 3. PLL 3 Assembly A8 Parts List

Ref. Desig.	Part Number	Description
A8	10073-4300	PLL 3 ASSEMBLY
3	10073-7116	CAN RECT DEEP DRAWN
4	MP-0121	CLIP, MTG, SPRING STEEL
5	10073-7106	HEATSINK PLATE
6	918-0237	SHIELD, COIL
13	E70-0002-002	PAD MNT XSTR TO-5
C1	M39014/02-1310	CAP .1UF 10% 100V CER-R
C2	CK05BX103M	CAP .01UF 20% 100V CER
C3	CK05BX103M	CAP .01UF 20% 100V CER
C4	CM04ED560J03	CAP 56PF 5% 500V MICA
C5	CK05BX103M	CAP .01UF 20% 100V CER
C6	C26-0025-100	CAP 10UF 20% 25V TANT
C7	M39014/02-1310	CAP .1UF 10% 100V CER-R
C8	CK06BX334K	CAP .33UF 10% 50V CER
C9	CK05BX273K	CAP .027UF 10% 50V CER
C10	C26-0025-339	CAP 3.3UF 20% 25V TANT
C11	C84-0003-008	CAP, VAR 3-15PF
C12	M39014/02-1310	CAP .1UF 10% 100V CER-R
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	CK05BX102M	CAP 1000PF 20% 200V CER
C15	CK05BX103M	CAP .01UF 20% 100V CER
C16	M39014/02-1310	CAP .1UF 10% 100V CER-R
C17	M39014/02-1310	CAP .1UF 10% 100V CER-R
C18	CK05BX103M	CAP .01UF 20% 100V CER
C19	CK05BX102M	CAP 1000PF 20% 200V CER
C20	C26-0025-100	CAP 10UF 20% 25V TANT
C21	CK05BX103M	CAP .01UF 20% 100V CER
C22	C26-0025-100	CAP 10UF 20% 25V TANT
C23	M39014/02-1310	CAP .1UF 10% 100V CER-R
C24	CM04ED470J03	CAP 47PF 5% 500V MICA
C25	M39014/02-1310	CAP .1UF 10% 100V CER-R
C26	M39014/02-1310	CAP .1UF 10% 100V CER-R
C27	CK05BX103M	CAP .01UF 20% 100V CER
C28	CK05BX103M	CAP .01UF 20% 100V CER
C29	C26-0016-151	CAP 150UF 20% 16V TANT
C30	CK05BX103M	CAP .01UF 20% 100V CER
C31	CK05BX103M	CAP .01UF 20% 100V CER
C32	C26-0025-339	CAP 3.3UF 20% 25V TANT
C33	M39014/02-1310	CAP .1UF 10% 100V CER-R
C34	CM04ED470J03	CAP 47PF 5% 500V MICA
C35	CK05BX103M	CAP .01UF 20% 100V CER
C36	C26-0025-100	CAP 10UF 20% 25V TANT
C37	M39014/02-1310	CAP .1UF 10% 100V CER-R
C38	M39014/02-1310	CAP .1UF 10% 100V CER-R

Table 3. PLL 3 Assembly A8 Parts List (Cont.)

Ref. Desig.	Part Number	Description
C39	M39014/02-1310	CAP .1UF 10% 100V CER-R
C40	M39014/02-1310	CAP .1UF 10% 100V CER-R
C41	M39014/02-1310	CAP .1UF 10% 100V CER-R
C42	CM04FD151J03	CAP 150PF 5% 500V MICA
C43	CM04FD151J03	CAP 150PF 5% 500V MICA
C44	CM04FC271J03	CAP 270PF 5% 300V MICA
C45	CM04FC301J03	CAP 300PF 5% 300V MICA
C46	CM04FC271J03	CAP 270PF 5% 300V MICA
C47	CM04FC271J03	CAP 270PF 5% 300V MICA
C48	CM04FD111J03	CAP 110PF 5% 500V MICA
C49	CM04CD120J03	CAP 12PF 5% 500V MICA
C50	M39014/02-1310	CAP .1UF 10% 100V CER-R
C51	CM04ED330J03	CAP 33PF 5% 500V MICA
C52	CM04FD151J03	CAP 150PF 5% 500V MICA
C53	CM04CD120J03	CAP 12PF 5% 500V MICA
C54	CK05BX103M	CAP .01UF 20% 100V CER
C55	CK05BX103M	CAP .01UF 20% 100V CER
C56	CM04ED470J03	CAP 47PF 5% 500V MICA
C57	CK05BX103M	CAP .01UF 20% 100V CER
C58	CM04ED390J03	CAP 39PF 5% 500V MICA
C59	CK05BX103M	CAP .01UF 20% 100V CER
C60	CK05BX103M	CAP .01UF 20% 100V CER
C61	M39014/02-1310	CAP .1UF 10% 100V CER-R
C62	C26-0025-470	CAP 47UF 20% 25V TANT
C63	C26-0025-470	CAP 47UF 20% 25V TANT
C64	M39014/02-1310	CAP .1UF 10% 100V CER-R
C65	M39014/02-1310	CAP .1UF 10% 100V CER-R
C66	M39014/02-1310	CAP .1UF 10% 100V CER-R
C67	M39014/02-1310	CAP .1UF 10% 100V CER-R
C68	M39014/02-1310	CAP .1UF 10% 100V CER-R
C69	C25-0001-301	CAP 1.0UF 20% 20V TANT
C70	CK05BX103M	CAP .01UF 20% 100V CER
C71	CK05BX103M	CAP .01UF 20% 100V CER
C72	CK05BX103M	CAP .01UF 20% 100V CER
CR1	1N6263	DIODE, HOT CARRIER
CR2	1N3064	DIODE 75mA 75V SW
CR3	1N3064	DIODE 75mA 75V SW
CR4	1N3064	DIODE 75mA 75V SW
CR5	1N3064	DIODE 75mA 75V SW
CR6	1N3064	DIODE 75mA 75V SW
CR7	10073-7118	VARACTOR 26.0 - 32.0pF
CR8	10073-7118	VARACTOR 26.0 - 32.0pF
CR9	10073-7118	VARACTOR 26.0 - 32.0pF
CR10	10073-7118	VARACTOR 26.0 - 32.0pF

Table 3. PLL 3 Assembly A8 Parts List (Cont.)

Ref. Desig.	Part Number	Description
CR11	10073-7118	VARACTOR 26.0 - 32.0pF
CR12	10073-7118	VARACTOR 26.0 - 32.0pF
CR13	10073-7118	VARACTOR 26.0 - 32.0pF
CR14	10073-7118	VARACTOR 26.0 - 32.0pF
CR15	10073-7118	VARACTOR 26.0 - 32.0pF
CR16	10073-7118	VARACTOR 26.0 - 32.0pF
J1	J-0031	CONN SMB VERT PCB F
J2	J-0031	CONN SMB VERT PCB F
J3	J-0031	CONN SMB VERT PCB F
J4	J46-0032-010	HEADER, 10 PIN DISCRETE
L1	MS75084-13	COIL 12UH 10% FXD RF
L2	MS75083-6	COIL .27UH 10% FXD RF
L3	MS75084-6	COIL 3.3UH 10% FXD RF
L4	MS75083-6	COIL .27UH 10% FXD RF
L5	L08-0001-001	CHOKE W B 50 MHZ
L6	MS18130-9	COIL 1.2UH 10% FXD RF
L7	MS18130-9	COIL 1.2UH 10% FXD RF
L8	MS18130-8	COIL 1.0UH 10% FXD RF
L9	L08-0001-001	CHOKE W B 50 MHZ
Q1	Q35-0003-000	XSTR U310 JFET HIGH GM
Q2	Q05-0001-000	XSTR JFET N-CH
Q3	2N2907	XSTR SS/GP PNP TO-18
Q4	2N2222	XSTR SS/GP NPN TO-18
Q5	2N2222	XSTR SS/GP NPN TO-18
Q6	Q35-0003-000	XSTR U310 JFET HIGH GM
Q7	2N2222	XSTR SS/GP NPN TO-18
Q8	2N2907	XSTR SS/GP PNP TO-18
Q9	Q35-0003-000	XSTR U310 JFET HIGH GM
Q10	2N5109	XSTR RFPWR NPN TO-39
Q11	Q-0153	XSTR SS/RF PN4258
Q12	2N2369	XSTR SS/RF NPN
Q13	2N2369	XSTR SS/RF NPN
Q14	Q35-0003-000	XSTR U310 JFET HIGH GM
Q15	2N2907	XSTR SS/GP PNP TO-18
R1	R65-0003-101	RES,100 5% 1/4W CAR FILM
R2	R65-0003-470	RES,47 5% 1/4W CAR FILM
R3	R65-0003-513	RES,51K 5% 1/4W CAR FILM
R4	R65-0003-101	RES,100 5% 1/4W CAR FILM
R5	R65-0003-102	RES,1.0K 5% 1/4W CAR FILM
R7	R65-0003-201	RES,200 5% 1/4W CAR FILM
R8	R65-0003-202	RES,2.0K 5% 1/4W CAR FILM
R9	RN55D1501F	RES,1500 1% 1/8W MET FLM
R10	RN55D1501F	RES,1500 1% 1/8W MET FLM
R11	RN55D1002F	RES,10.0K 1% 1/8W MET FLM

Table 3. PLL 3 Assembly A8 Parts List (Cont.)

Ref. Desig.	Part Number	Description
R12	R65-0003-202	RES,2.0K 5% 1/4W CAR FILM
R13	RN55D3321F	RES,3320 1% 1/8W MET FLM
R14	RN55D1621F	RES,1620 1% 1/8W MET FLM
R15	RN55D2211F	RES,2210 1% 1/8W MET FLM
R16	RN55D2211F	RES,2210 1% 1/8W MET FLM
R17	R65-0003-330	RES,33 5% 1/4W CAR FILM
R18	R65-0003-121	RES,120 5% 1/4W CAR FILM
R19	R65-0003-360	RES,36 5% 1/4W CAR FILM
R20	R65-0003-201	RES,200 5% 1/4W CAR FILM
R21	R65-0003-392	RES,3.9K 5% 1/4W CAR FILM
R22	R65-0003-392	RES,3.9K 5% 1/4W CAR FILM
R23	R65-0003-470	RES,47 5% 1/4W CAR FILM
R24	R65-0003-242	RES,2.4K 5% 1/4W CAR FILM
R25	R65-0003-681	RES,680 5% 1/4W CAR FILM
R26	R65-0003-182	RES,1.8K 5% 1/4W CAR FILM
R27	R65-0003-471	RES,470 5% 1/4W CAR FILM
R28	R65-0003-330	RES,33 5% 1/4W CAR FILM
R29	R65-0003-101	RES,100 5% 1/4W CAR FILM
R30	R65-0003-271	RES,270 5% 1/4W CAR FILM
R31	R65-0003-820	RES,82 5% 1/4W CAR FILM
R32	R65-0003-391	RES,390 5% 1/4W CAR FILM
R33	R65-0003-561	RES,560 5% 1/4W CAR FILM
R34	R65-0003-330	RES,33 5% 1/4W CAR FILM
R35	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R36	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R37	R65-0003-471	RES,470 5% 1/4W CAR FILM
R39	R65-0003-750	RES,75 5% 1/4W CAR FILM
R40	R65-0003-101	RES,100 5% 1/4W CAR FILM
R41	R65-0003-101	RES,100 5% 1/4W CAR FILM
R42	R65-0003-101	RES,100 5% 1/4W CAR FILM
R43	R65-0003-750	RES,75 5% 1/4W CAR FILM
R44	R65-0003-101	RES,100 5% 1/4W CAR FILM
R45	R65-0003-101	RES,100 5% 1/4W CAR FILM
R46	R65-0003-111	RES,110 5% 1/4W CAR FILM
R47	R65-0003-471	RES,470 5% 1/4W CAR FILM
R48	R65-0003-470	RES,47 5% 1/4W CAR FILM
R49	R65-0003-242	RES,2.4K 5% 1/4W CAR FILM
R50	R65-0003-182	RES,1.8K 5% 1/4W CAR FILM
R51	R65-0003-681	RES,680 5% 1/4W CAR FILM
R52	R65-0003-201	RES,200 5% 1/4W CAR FILM
R53	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R54	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R55	R65-0003-472	RES,4.7K 5% 1/4W CAR FILM
R56	R65-0003-103	RES,10K 5% 1/4W CAR FILM

Table 3. PLL 3 Assembly A8 Parts List (Cont.)

Ref. Desig.	Part Number	Description
R58	R65-0003-103	RES,10K 5% 1/4W CAR FILM
R59	R65-0003-101	RES,100 5% 1/4W CAR FILM
R60	R65-0003-560	RES,56 5% 1/4W CAR FILM
T1	10073-7004	TRANSFORMER, RF, FIXED
T2	10073-7011	TRANSFORMER, RF, VARIABLE
T3	10073-7011	TRANSFORMER, RF, VARIABLE
T4	10073-7011	TRANSFORMER, RF, VARIABLE
TP1	J-0071	TP PWB BRN TOP ACCS .080"
TP2	J-0066	TP PWB RED TOP ACCS .080"
TP3	J-0069	TP PWB ORN TOP ACCS .080"
TP4	J-0070	TP PWB YEL TOP ACCS .080"
TP5	J-0068	TP PWB GRN TOP ACCS .080"
TP6	J-0072	TP PWB BLU TOP ACCS .080"
U1	I51-0003-003	MIXER DB 50mW 500MHZ
U2	I01-0000-019	IC 4050B PLASTIC CMOS
U3	I70-0002-001	IC MC145156 PLASTIC CMOS
U4	I05-0000-090	IC 74LS90 PLASTIC TTL
U5	I05-0000-000	IC 74LS00 PLASTIC TTL
VR1	I12-0005-012	IC VR 78L12 + 12V .10A 10
VR2	I11-0001-001	IC VR 7805 + 5V 1.5A 4%
VR3	1N5236A	DIODE 7.5V 10% .5W ZENER
VR4	1N5236A	DIODE 7.5V 10% .5W ZENER

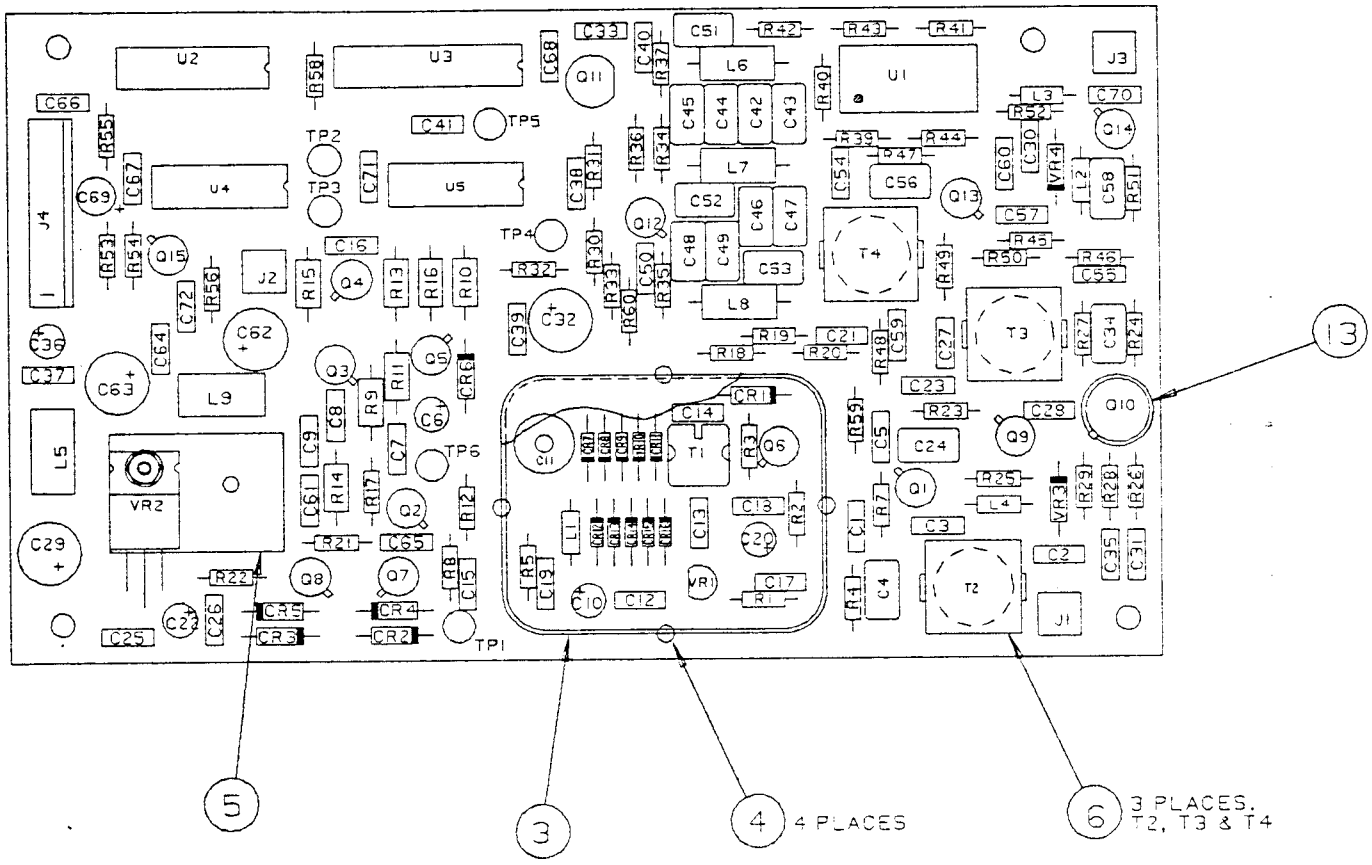
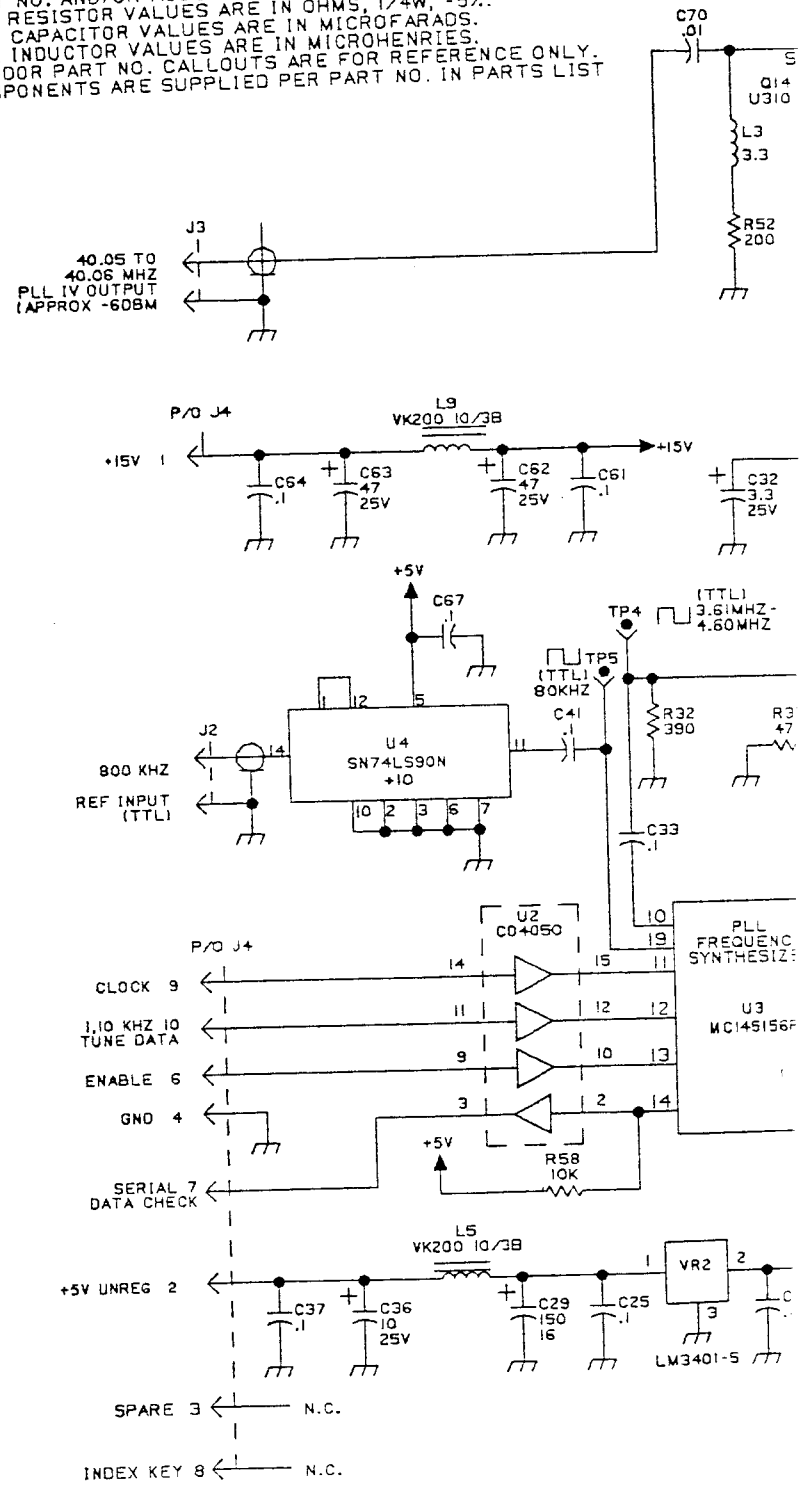


Figure 3. PLL 3 Assembly A8 Component Location Diagram (10073-4300)

NOTE:UNLESS OTHERWISE SPECIFIED:
1.PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR A COMPLETE DESIGNATION, PREFIX WITH
UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2.ALL RESISTOR VALUES ARE IN OHMS, 1/4W, -5%.
3.ALL CAPACITOR VALUES ARE IN MICROFARADS.
4.ALL INDUCTOR VALUES ARE IN MICROHENRIES.
5.VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY.
COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST



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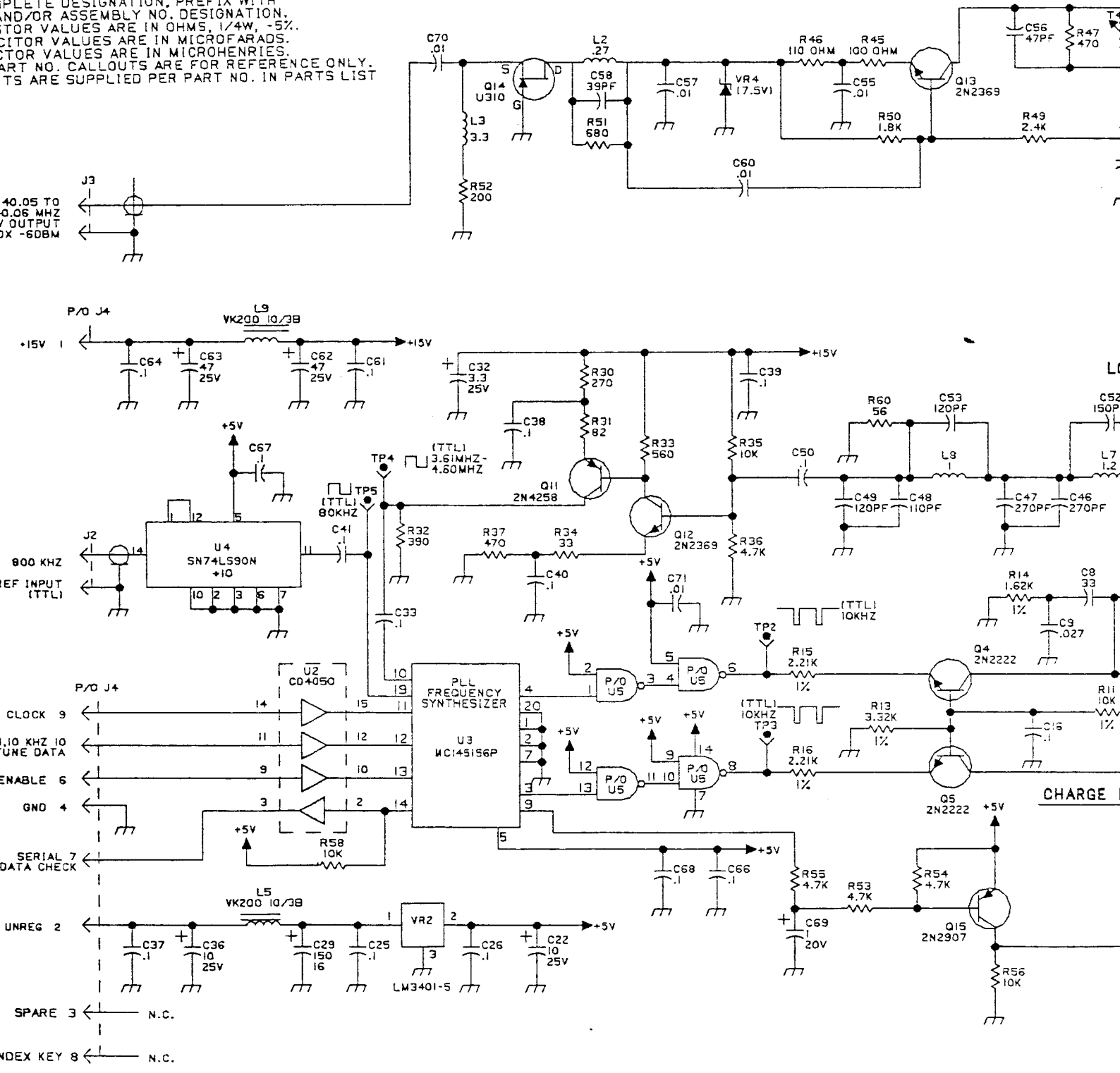

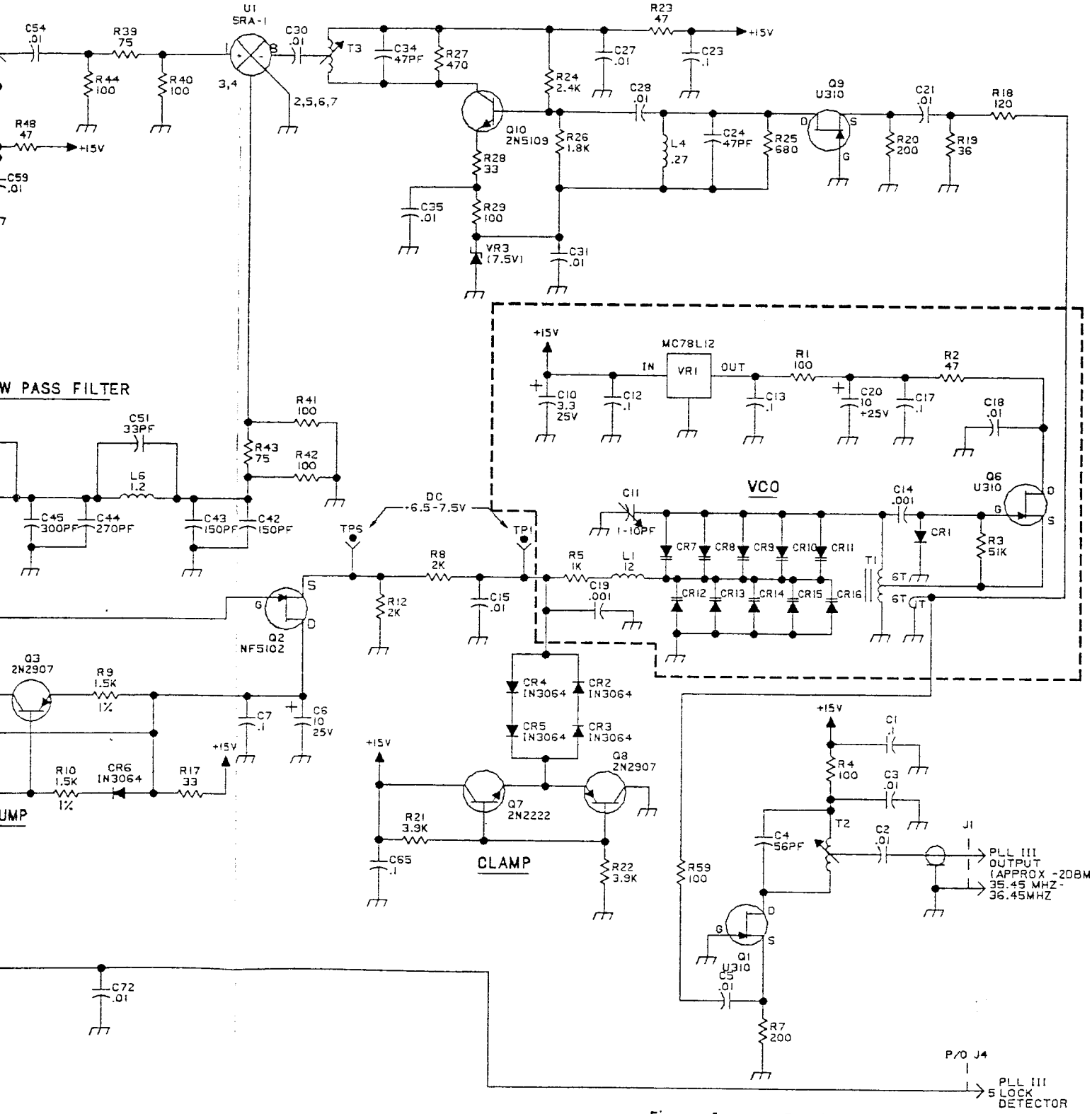

Figure 4. PLL 3 Assembly A8 Schematic Diagram (10073-4301 Rev. F)