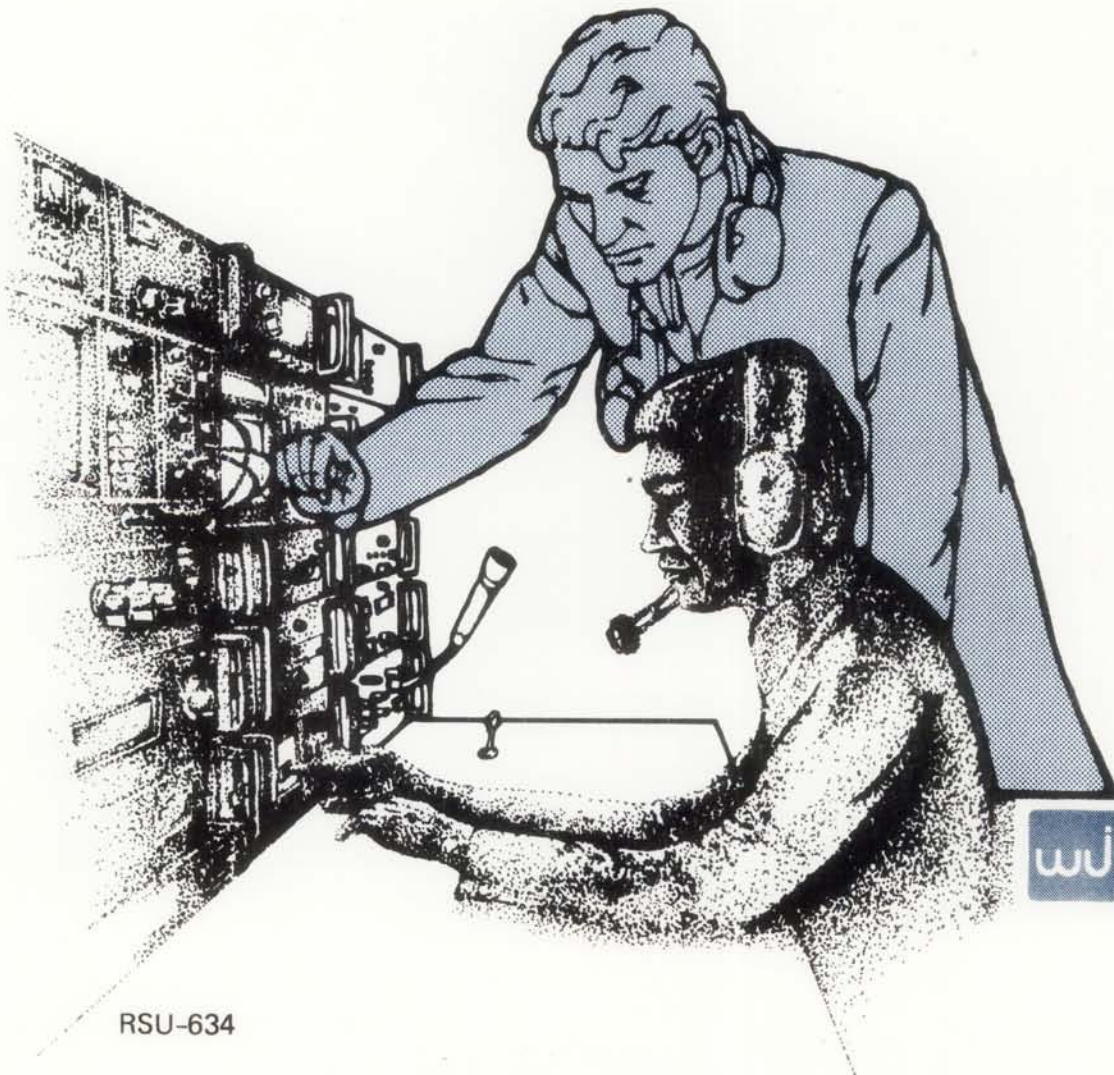


**Operation and Maintenance Manual for  
Tuning Units TU0145 1.0 - 4.5 GHz, TU0412 4.0 - 12.4 GHz,  
TU0112 1.0 - 12.4 GHz, Parts of the  
WJ-8969 Microwave Receiving System**

**Operation and Maintenance Manual for  
IF Demodulator/Control Unit, Part of the  
WJ-8969 Microwave Receiving System**



WATKINS-JOHNSON

1) Change Inventory blocks and LO

2) New cables:

- 660143-009
- 660143-011
- 660144-010
- 660143-010
- 659468-020
- 659468-021

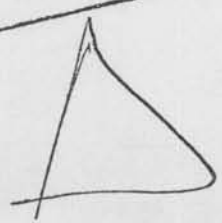
3) Move Power distribution wire wrap.

4) Re-seat U wires from cap feed thru underneath Fan.

5) Remove WIRE TIE WIRE from 2<sup>nd</sup> L.O. / OR / WIRE A NEW HARNESS

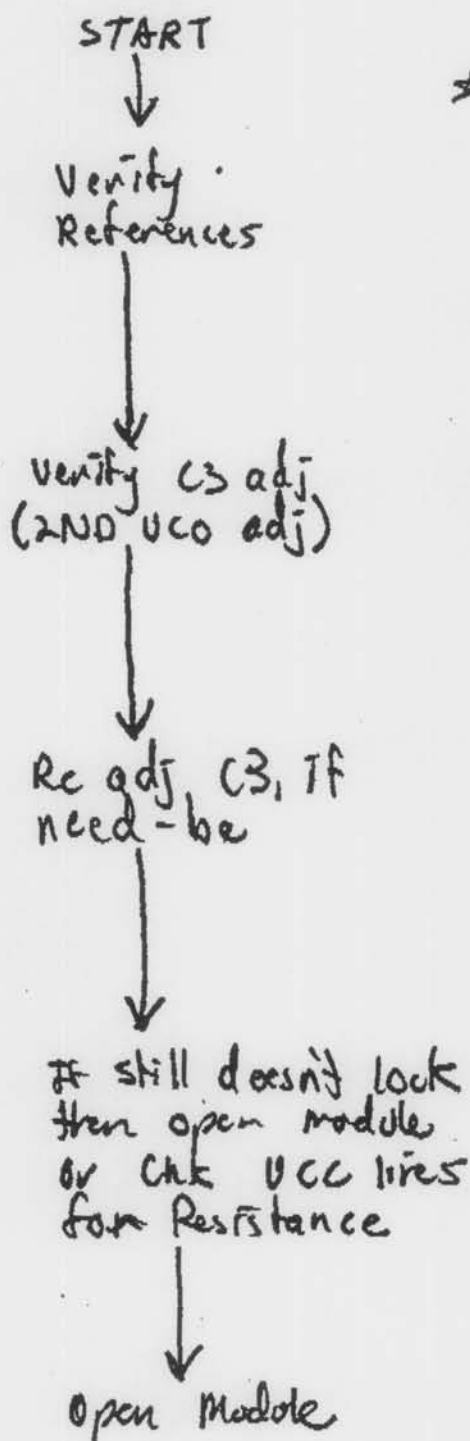
6) Change 1st LO Harness / Harness connection

7) NEW MOTHER BD. (see #6)



S/N 001 TO 010  
 TO UPDATED MECHANICAL  
 CONFIGURATION

## 2ND LO TROUBLESHOOTING



→ IS 2nd LO locked or is it lying?  
→ IS 2nd LO unlocked?

→ Check 10 MHz to J1  
★ If OK then check 1050 MHz  
power output at J4 (this checks 50  
MHz reference)

★ disconnect 50 MHz at J2 and  
check that 2ND VCO is being  
pulled down in frequency

★ make sure op-amp is railing  
negative.  
★ adj for 1060 MHz  
★ re-connect 50 MHz to J2

→ Page 1 item 1

★ Re-check 1050 MHz power level  
★ Check -11VDC to 2ND VCO CC  
★ Check lock level of 1st VCO  
TP1 on 659684-00X CUA (U2-7)  
★ Check signal (128-160 MHz)  
at E4 on 659870-00X CUA  
★ Check pulses to 2ND VCO  $\phi$  control  
IC (U2-6/9 on 659698-00X CC  
★

2ND LO TEST PROCEDURE:

1) wire check connector on 2nd LO, as follows:

10	9	8	7	6	5	4	3	2	1
NOT USED	NOT USED	0Ω	10kΩ	10kΩ	95kΩ	10kΩ	1.6MΩ	3.75kΩ	60Ω

2) Adj RIO on 659684-001 CUA for the following:

a) measure w/ DVM resistance from U2-15 to U3-3.

b) Place leads from DVM onto U2-16 to U3-2.

c) adj RIO for reading of item b) to same reading found in item a).

3) Before powering up module, spot check major components (ie: IC's, caps, etc.) and wiring inside module.

4) Power on unit and adj the 1050 MHz output as follows (J4):

a) Modulate the coil (L7) on 659702-001 CUA inductance by adjusting coil spread of inductor.

b) adj C6, C7 and C8 for max amplitude at J4 of 2nd LO.

NOTE: Re-adj for maximum amplitude when cover is out.

5) Sweep 2nd VCO to check for comb spurs: (33)

short out V control (E1 on 659688-001 CCA)

Remember: If the cover is going to be put on, you need to short out and adjust C3 with the test cover on unit.

Adj C3 for an output of 1059 MHz  $\pm$  1 MHz at 33 of 2ND LO module

for first test (Pre-AT operation and test) disconnect wire at E1 on 659688-001 CCA and connect a 0-15VDC power supply,

and verify the following: 0VDC  $\approx$  1059 MHz  
15VDC  $\approx$  1070 - 1090 MHz

SET SPAN ON Spectrum Analyzer to 500 MHz and verify that no comb spurs come up.

If spurs come up, try one of the following on the 659688-001 CCA:

- factory select R11 to a different value, but watch Op-Amp voltage output levels. (see page 4 item d)
- hand select CR1 for the circuit.
- " " Q1 " " "
- " " CR1 and Q1 for the circuit
- Verify component values and CCA construction

PAGE 3

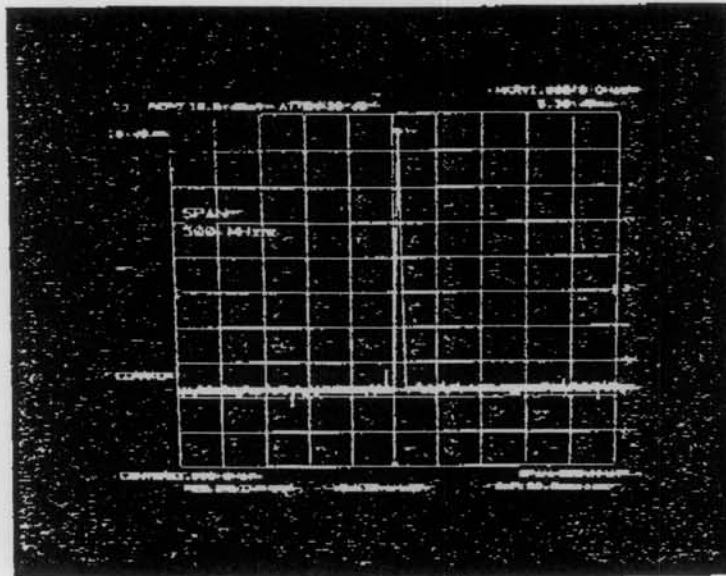
Courtesy of <http://BlackRadios.terryo.org>  
This photo shows the 2nd LO on the 2nd LO,  
with the proper output signal. Note the 1050 MHz  
bleeding through, at just below center frequency.

CENTER FREQ:  
1059.000 MHz

REF LEVEL:  
+10.00 dBm

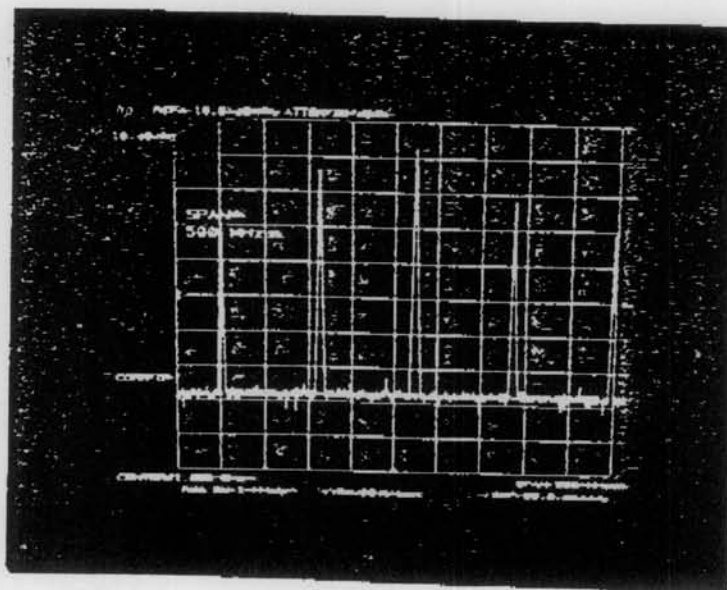
FREQ SPAN:  
500 MHz

AMPL. SCALE:  
10 dB/DIV



This photo shows the comb spurs generated  
by a 2nd LO and VCO. This is not acceptable  
if  $V_{control}$  is at or below +15VDC.

SAME  
AS  
ABOVE



6) 2nd LO Should now be ready for ATP.

- a) Install test cover, with all the screws in place.
- b) Check and re-adjust 1050 MHz power level at J4 on 2nd LO. Only do procedure 4 b) here. Adjustment of COMV(L1) on 1050 CCA should not be required.
- c) Short out V control to 2nd VCO (a hole is provided in Test Cover for 2nd LO), and adj 2nd VCO for 1059 MHz when V control (E5 on 659698-001 CCA is grounded).
- d) ATP module, and measure phase noise and Voltage output of U4 G on 659698-001 CCA, a hole is provided for this on Test cover for 2nd LO.

approx voltage levels:

Terminal	Output Frequency	Voltage Range
SF 000 (TUNER 6000 MHz)	1062.000 MHz	No less than 2.0V No more than 6.0V
SF 500 (TUNER 5999 MHz)	1062.500 MHz	No less than 2.1V No more than 8.0V
SF 999	1062.999 MHz	No less than 3.0V No more than 8.5V

NOTE: SF 999 (1062.999 MHz) is only used on Tuners with doubled yigs (above 12 GHz Tuners, i.e. 1.18 GHz or 12.18 GHz Tuners) standard, half rack tuners use only SF000 + SF5 (1062.000 to 1062.500).

2ND LO PROBLEMS:

1) C3 on 659688-001 CCA out of adj:

a) see "Quick and Easy" notes.

b) Do steps 6a-c) on 2ND LO TEST PROCEDURE.

2) 1050 MHz CCA out of Adj/Broke:  
with cover on @ J4:

- a) -35 dBm to -43 dBm = OK
- 50 dBm to -55 dBm = Bad Phase noise
- 55 dBm to -75 dBm = 2nd VCO Unlocked

b) +5VPC on 1050 CCA is shorted to Gnd.

3) CRI and/or BI on 659688-001 CCA are degraded/Broke causing comb spurs, or non linear tuning:

a) Do step 5 on 2ND LO TEST PROCEDURE (Pg

b) Replace 659688-001 CCA with a known good one

4) 1st VCO output is Bad: (measured at E4 of 659870-001)

OK



CF = 128 - 164 MHz  
 SPAN = 10 MHz  
 RF Probe on E4 of 659684-001  
 REF LVL ≈ -20 dBm.



NG

5) 2nd VCO doesn't lock, and does this @ J3 output

2ND VCO  
TUNED  
BELOW



CF = 1062 MHz  
 SPAN = 10 MHz  
 REF LVL = +5 dBm



2ND VCO  
TUNED  
ABOVE

Replace U3+  
ON  
659688-001



## "QUICK AND EASY" ADJ OF 2ND LO'S 2ND VCO

This procedure, in most cases, if not always, will allow the adjustment, to proper specs, of the 2ND LO's and VCO (659688-001 CCA) without removal from Toner (would have to remove YIG MODULE A2) and not require removal of 2ND LO cover. If 2ND LO has absolutely no output, this won't help.

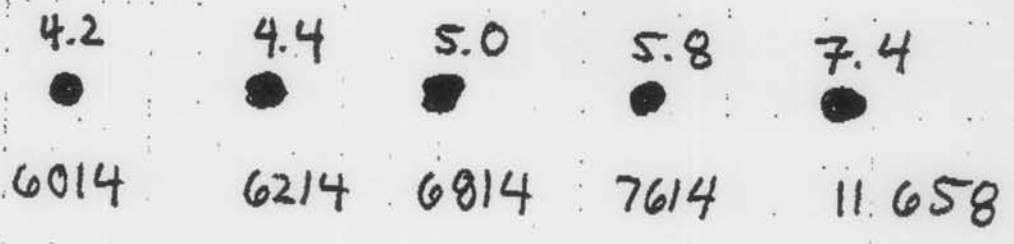
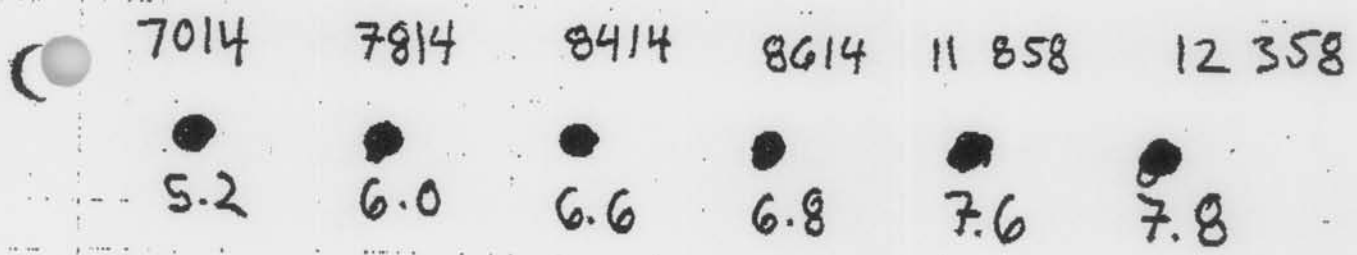
- 1) Remove 50 MHz from J2 on 2ND LO module.
- 2) Observe that signal on output J3, is approx 1059 MHz,  $\pm$  5 to 10 MHz. If not, Op Amp U4 on 659698-001 CCA may not be going to a negative output (which it needs to, for this adjustment procedure), this 2ND LO has not been modified to latest revision, OR something else is wrong.
- 3) With 50 MHz still disconnected from 2ND LO, adjust C3 on 659688-001 CCA for an output of 1059 MHz  $\pm$  1 MHz at J3 of 2ND LO.
- 4) Re-connect 50 MHz to 2ND LO J2 and observe signal for locking and phase noise performance. Check for comb spurs.

### NOTE:

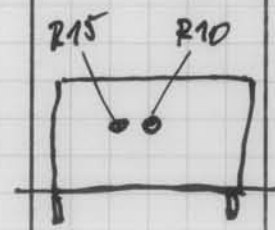
This procedure does not allow you to check the Op-Amp (U4-6 on 659698-001 CCA). For this reason, the above procedure is not recommended, unless absolutely no alternative is available.

1.0 - 12.4 and 1.0 - 18.0 TUNERS

MARKET	RF XXXXX IFC XXXXX	J7 (IF) RESULT	YIG LO FREQ
4.2	6014		4050
4.4	6214		4250
5.0	6814		4850
5.2	7014-		5050
5.8	7614		5650
6.0	7814		5850
6.6	8414		6450
6.8	8614		6650
7.4	11658		7250
7.6	11858		7450
7.8	12358		7950



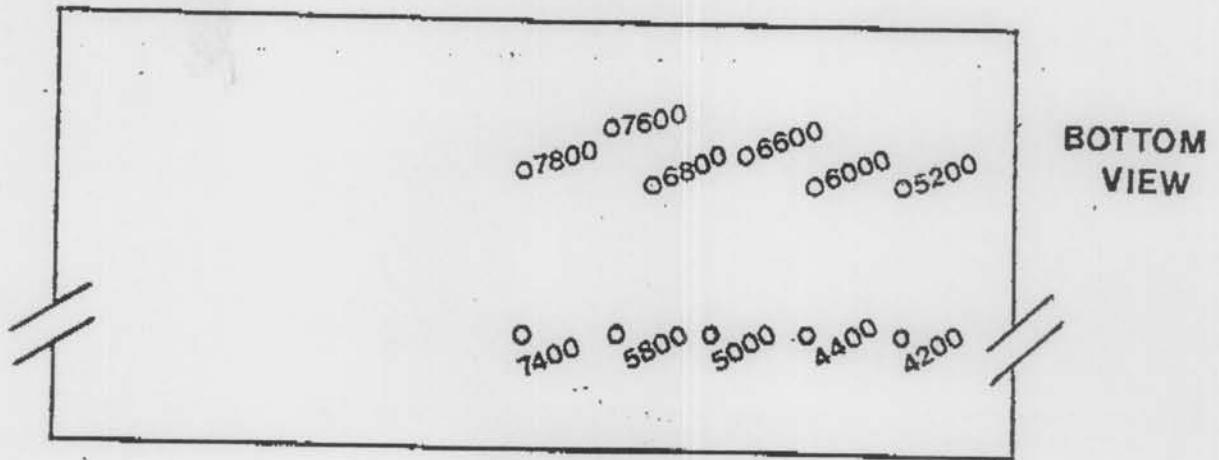
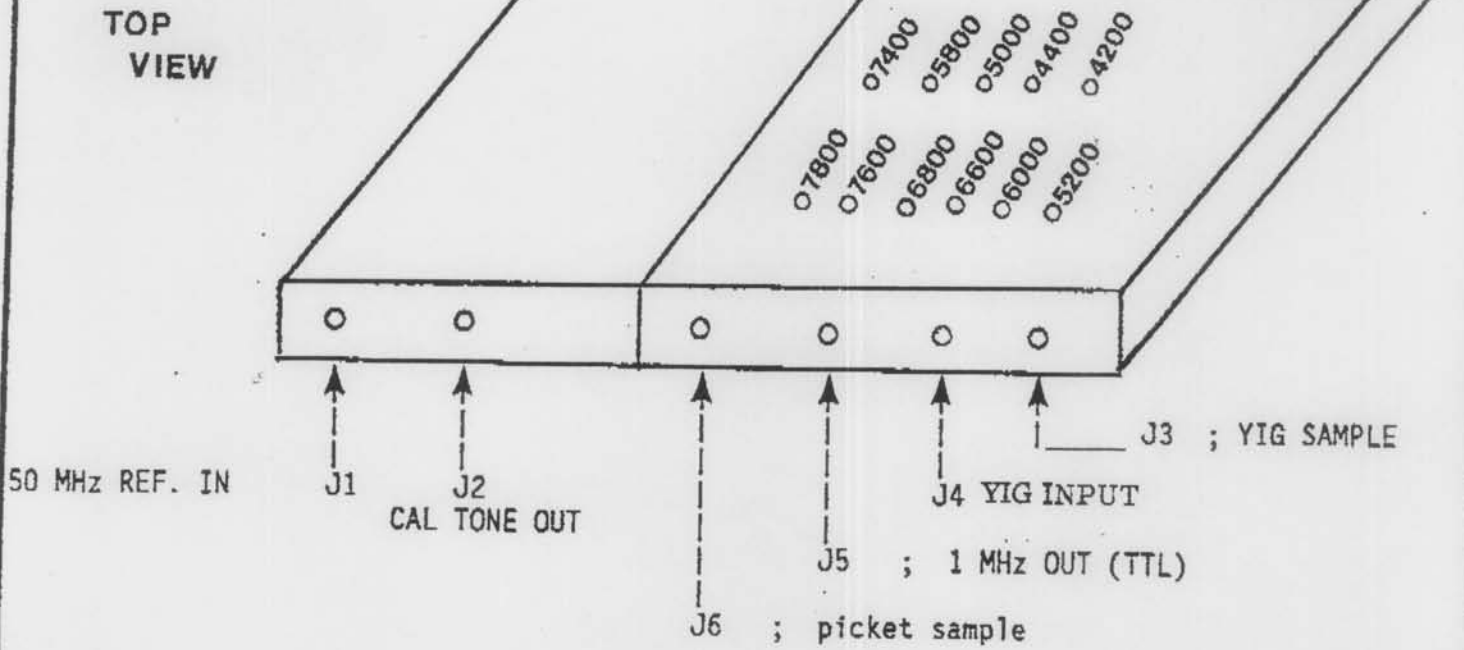
TUNED	1. LO	1. IF	2. LO	3. LO	IF	$\Sigma$ 3+2. LO
1.000	5.409	4.409	3186,75	1062,25	160	4249
2.000	6.409	↓	↓	↓		
2.999	7.408	↓	↓	↓		
3.000	4.965	1.965	3187,5	1062,5	160	4250
4.000	5.965	↓	↓	↓		
5.000	6.965	↓	↓	↓		
5.999	7.964	↓	↓	↓		
6.000	4.036 *	1.964	3186	1062	160	4248
7.000	5.036 <sup>OFFSET</sup> <sub>R10</sub>	↓	↓	↓		
8.000	6.036	↓	↓	↓		
8.999	7.035	↓	↓	↓		
9.000	4.592	4.408	3.186	1062	160	4248
10.000	5.592	↓	↓	↓		
11.000	6.592	↓	↓	↓		
12.000	7.592	↓	↓	↓		
12.400	7.992 *	↓	↓	↓		



WJ-8969 MICROWAVE RECEIVER

A4A4 1ST LO SYNTHESIZER PICKET TEST OUTPUT J6

IFC-FREQUENCY tuned to MHz	PICKET GHz	IFC-FREQUENCY tuned to MHz	PICKET GHz
1000 - 1090	5,2	6000 - 6063	4,2
1091 - 1290	5,8	6064 - 6263	4,4
1291 - 1490	6,0	6264 - 6463	4,2
1491 - 1690	5,8	6464 - 6663	4,4
1691 - 1890	6,0	6664 - 6863	5,0
1891 - 2090	6,6	6864 - 7063	5,2
2091 - 2290	6,8	7064 - 7263	5,0
2291 - 2490	6,6	7264 - 7463	5,2
2491 - 2690	6,8	7464 - 7663	5,8
2691 - 2890	7,4	7664 - 7863	6,0
2891 - 2999	7,6	7864 - 8063	5,8
3000 - 3134	5,2	8064 - 8263	6,0
3135 - 3334	5,0	8264 - 8463	6,6
3335 - 3534	5,2	8464 - 8663	6,8
3535 - 3734	5,8	8664 - 8863	6,6
3735 - 3934	6,0	8864 - 8999	6,8
3935 - 4134	5,8	9000 - 9107	4,4
4135 - 4334	6,0	9108 - 9307	5,0
4335 - 4534	6,6	9308 - 9507	5,2
4535 - 4734	6,8	9508 - 9707	5,0
4735 - 4934	6,6	9708 - 9907	5,2
4935 - 5134	6,8	9908 - 10107	5,8
5135 - 5334	7,4	10108 - 10307	6,0
5335 - 5534	7,6	10308 - 10507	5,8
5535 - 5734	7,4	10508 - 10707	6,0
5735 - 5934	7,6	10708 - 10907	6,6
5935 - 5999	7,8	10908 - 11107	6,8
		11108 - 11307	6,6
		11308 - 11507	6,8
		11508 - 11707	7,4
		11708 - 11907	7,6
		11908 - 12107	7,4
		12108 - 12307	7,6
		12308 - 12400	7,8



- (1) Screw on top adjusts center of cavity resonance; primarily adjusts picket power.
- (2) Bottom adjustment changes diode bias; affects both picket power & relative spur levels.

ADJUST FOR  $> 17dB$  OF SUPPRESSION OF FUNDAMENTAL PICKET TO STORAGE SPUR

Figure 2. 1st L.O. Synthesizer Screw Adjustment Locations



WATKINS-JOHNSON COMPANY  
2525 NORTH FIRST STREET  
SAN JOSE, CALIFORNIA 95131

CODE IDENT

14482

DIV

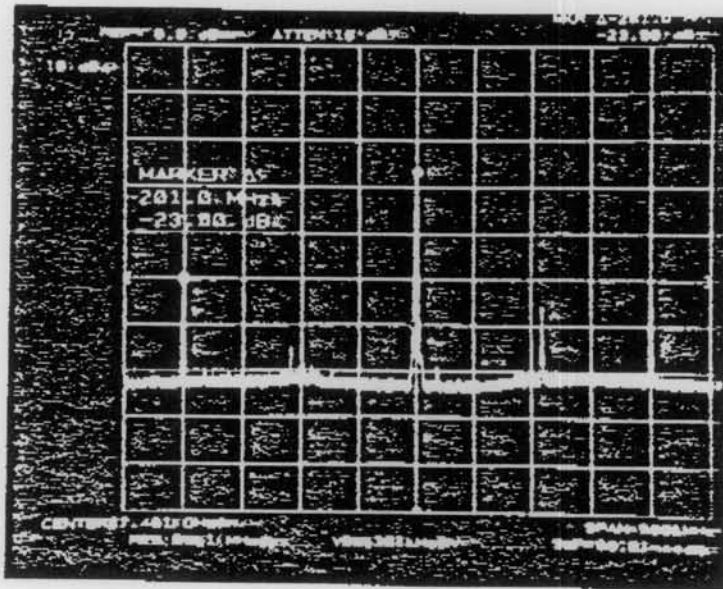
NO.

199642

SHEET

8

1st L.O. Synthesizer 7.4 GHz PICKET  
CENTER FREQUENCY 7.4 GHz POWER LEVEL -23 dBm  
DELTA -200 MHz at -23 dB DOWN  
7.510 MHz SPUR IS INTERMOD FROM YIG L.O.



1st L.O. SYNTHESIZER 5.2 GHz PICKET  
CENTER FREQUENCY 5.2 GHz POWER LEVEL -23 dBm  
DELTA +200 MHz at -22 dB DOWN  
5.375 MHz IS YIG L.O.

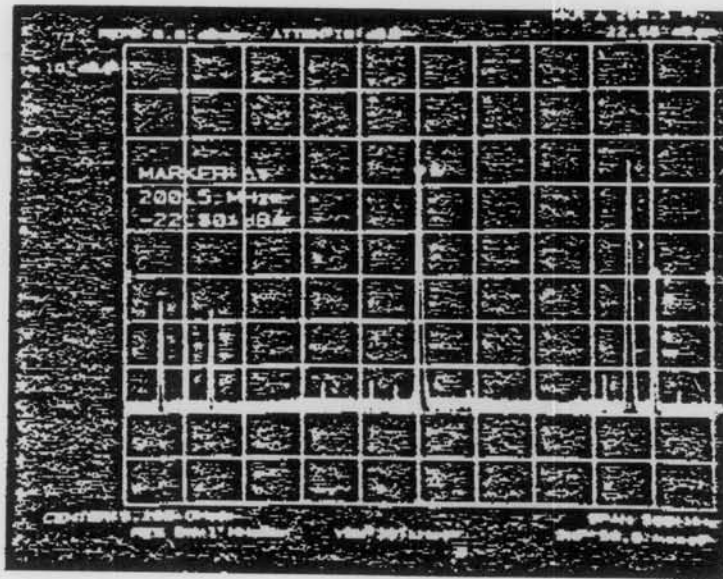
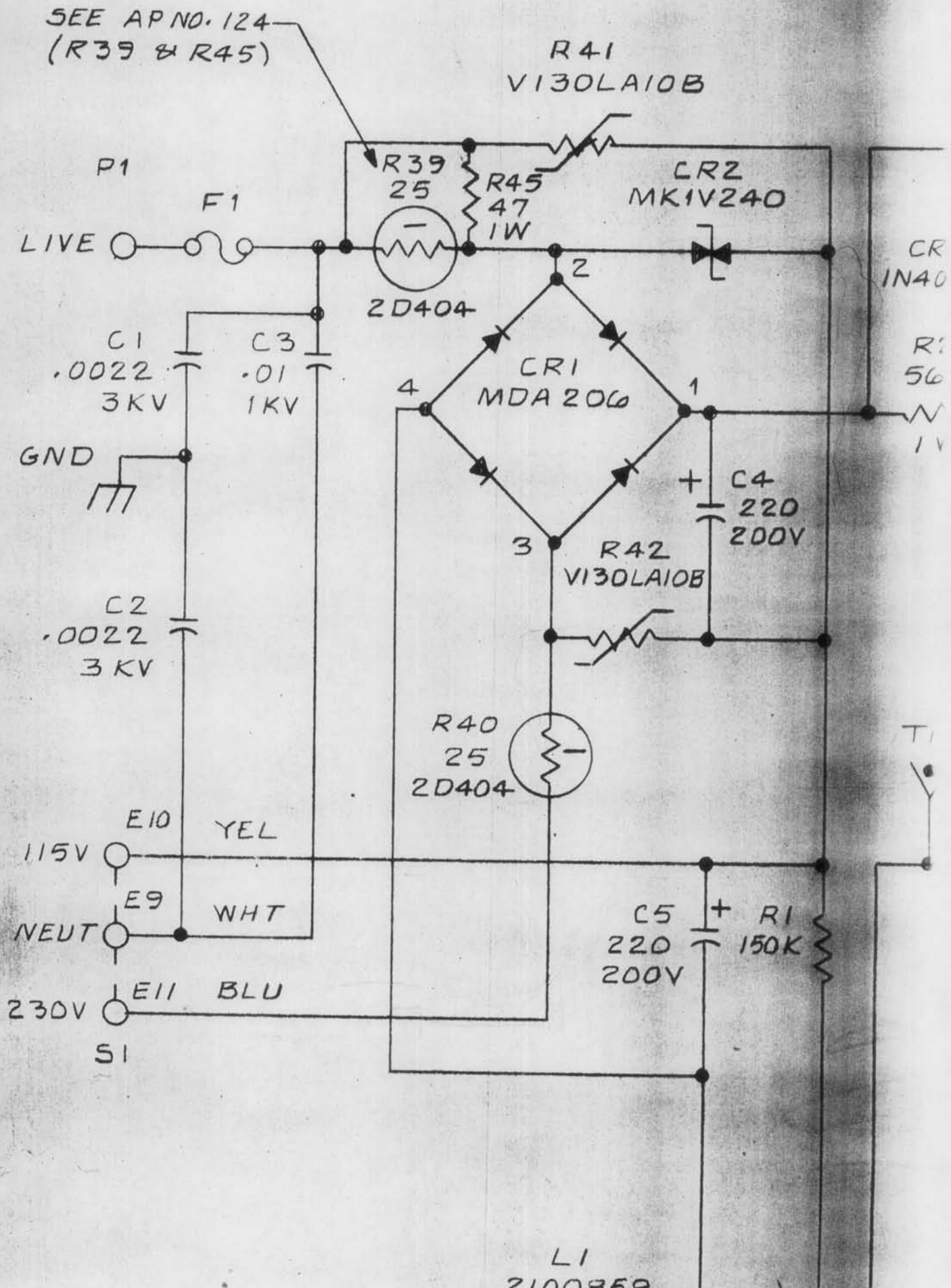


Figure 3. 1st L.O. Synthesizer Picket Representation







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