

Converting the 35 to 50 MHz Orion to 6 meters

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Revision 2 added notes to pictures

PROCEDURE:

This conversions covers

- #1 the VCO capacitor changes to obtain lock over temperature over the entire 6 meter ham band.
- #2. Tuning the receiver for best sensitivity in the 6 meter band only.
- #3. Tuning the Power amplifier for maximum power in the 6 meter band only.
- #4. Programming the radio using the DOS software using a plus 4 MHz SC file.

Make sure that your radio has revision E or higher mods and if not download this document at the orion group first. I suspect this is why my transmitter tuning was so easy and smooth.

http://f1.grp.yahooofs.com/v1/4KtkSy2En0B7F844Ff2PqyWUGdC76br337yw8IP1RKU_prQYpJm8bnOVXaeSz0TOK5oBw8L8Q5bXZVyrjL5ZtWyviA/Rework%20Procedure%20for%20P3-P4%20Low%20Band%20Orion%20Radio.pdf

DOCUMENTS REQUIRED:

LBI39138, ORION, 29-50 MHZ SYNTHESIZER/RECEIVER

<http://www.repeater-builder.com/ge/lbi-library/lbi-39138a.pdf>
<http://www.repeater-builder.com/ge/lbi-library/lbi-39138.pdf>

LBI39139, ORION, POWER AMPLIFIER BOARD.

<http://www.repeater-builder.com/ge/lbi-library/lbi-39138a.pdf>

<http://www.repeater-builder.com/ge/lbi-library/lbi-39139a.pdf>

<http://www.repeater-builder.com/ge/lbi-library/lbi-39139b.pdf>

I downloaded all documents just for reference but the last revisions should be sufficient.

Parts required:

2 X 0805 case chip capacitors from DIGIKEY:

ITEM 1. C285 on the transmit VCO: replace with 68pf

<http://search.digikey.com/scripts/DkSearch/dksus.dll?Selection>

And pick this part <http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=PCC680CGCT-ND>

68 pf chip capacitor.

ITEM 2. For C241 on the receive VCO replace it with a 82 pf capacitor

<http://search.digikey.com/scripts/DkSearch/dksus.dll?Selection>

and select this part 82 pf chip cap

<http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=PCC820CGCT-ND>

TOOLS REQUIRED:

1. DC voltmeter
2. Rf signal generator
3. 100 watt or more RF power meter.
4. #20 TORX bit
5. #10 TORX bit
6. solder iron
7. tweezers
8. Insulated tuning tool for spreading the transmitter and receiver inductors.
9. desolder wick.
10. Anti Static mat or anti static bag and anti static grounding strap.
11. 35 to 50 MHz plus 4 SC file.

GOTO YAHOO Orion group at <http://groups.yahoo.com/group/GE-Orion/files/>

And download file [35plus4.sc](#) 35-50 MHz plus 4 MHz Offset Orion/M-RK SC File

OPENING up the radio.

Use a good grounding strap to protect sensitive electronics at all times.

1. See figure 1, using the #20 torx bit loosen the 6 torx screws from the bottom plastic cover and set the cover aside.



Figure 1. bottom cover removal

2. See figure 2. remove the metallic shield over the Power amplifier board paying attention to the side that needs to be lifted away first as marked on the shield.



Figure 2. remove the Shield on the left side that is over the power amplifier board.

3. See figure 3 Using the #10 torx bit remove the 4 torx screws over the low pass filter cover in the upper left side of figure 3 below on the Power amplifier board and set this cover aside.



Figure 3. remove the cover at the upper TOP to access the low pass filter inductors.

4. Refer to figure 2 again which is shown below and remove the thin metallic shield from the receiver synthesizer board which is on the upper right and set this aside.



Figure 2, again remove the small cover over the receiver section on the upper right of the board.

- Using the #10 torx bit remove the heavy shield over the synthesizer section by loosening the 13 TORX screws and then remove the smaller shield covering the receiver section and set these shields aside. Do not mix these 13 TORX screws up. Leave them in the cover so they don't get in the wrong locations.
- The result should be figure 4.



Figure 4. Receiver synthesizer covers and board removal.

- Next remove 3 more #10 TORX screws, one near the upper left in figure 4 and the other 2 holding down regulator tabs.

SYNTHESIZER modification: Open LBI39138, on look at page 9 upper right diagram for locations of C285 and C241 for comparison to the figures below.

1. See figure 5. Make sure your grounding strap is attached before removing the synthesizer board from the chassis.
2. Remove the coax connecting the synthesizer board to the power amplifier board by gently prying out at connectors J2 and J151.
3. Place the synthesizer/receiver board upside down on the anti-static mat or bag as shown in figure 5.



Figure 5. receiver/synthesizer board back side components. C285 is near the top just right of center and C241 is vertically in line with it but near the board center.

4. Remove capacitor C285 As shown below in figure 6 below.
5. Replace C285 on the transmit VCO with item 1 the 68 pf 0805 chip capacitor.
6. See LBI39138 page 9 right side assembly locator near the upper center and locate capacitor C285 also see figure 6 for the close up.

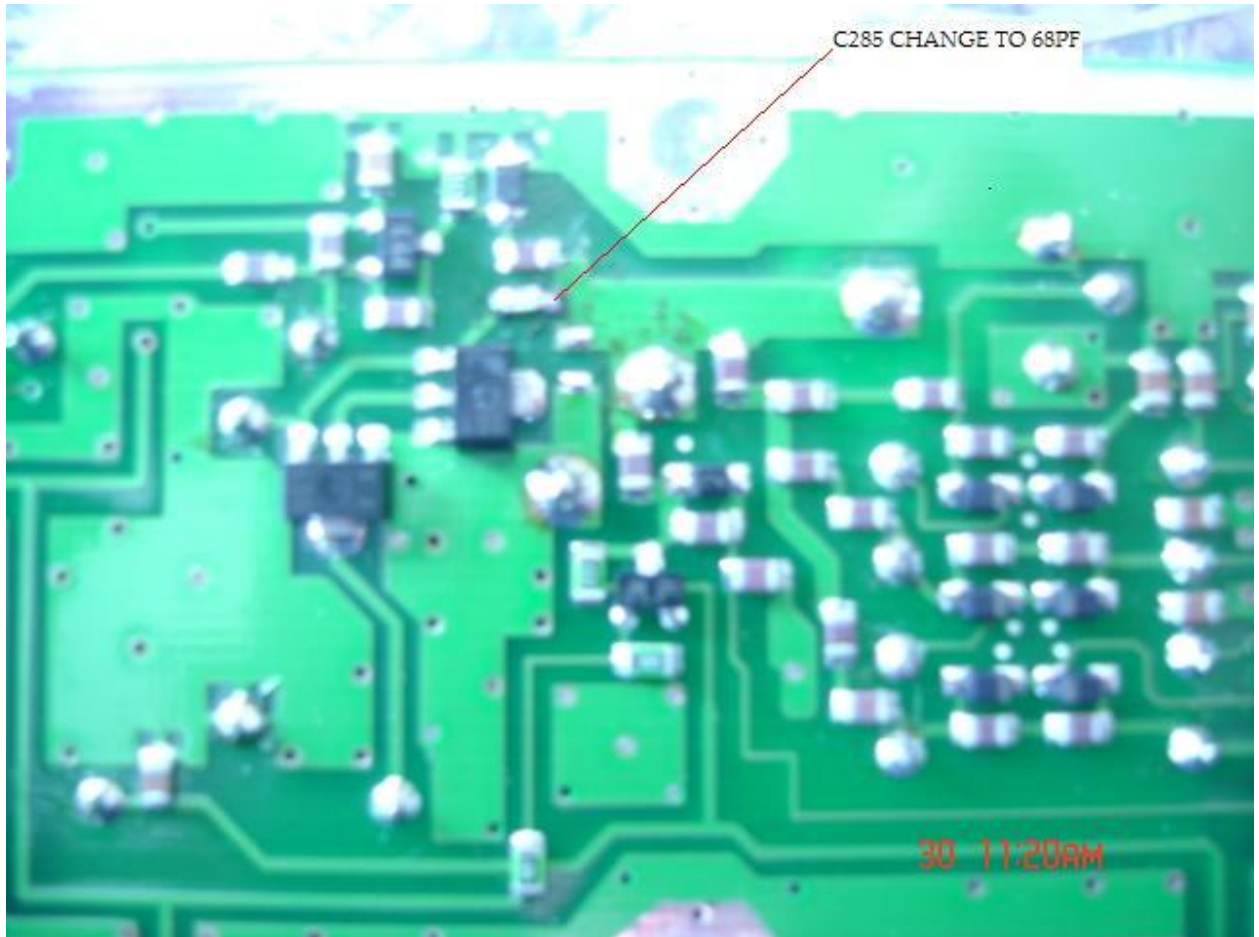


FIGURE 6. Location of C285 on the transmit VCO.

7. Looking lower down on the right side of the assembly locator near the center find capacitor C241 and remove this part.
8. Replace with item 2 the 82 pf chip capacitor. See figure 7 for a close up.

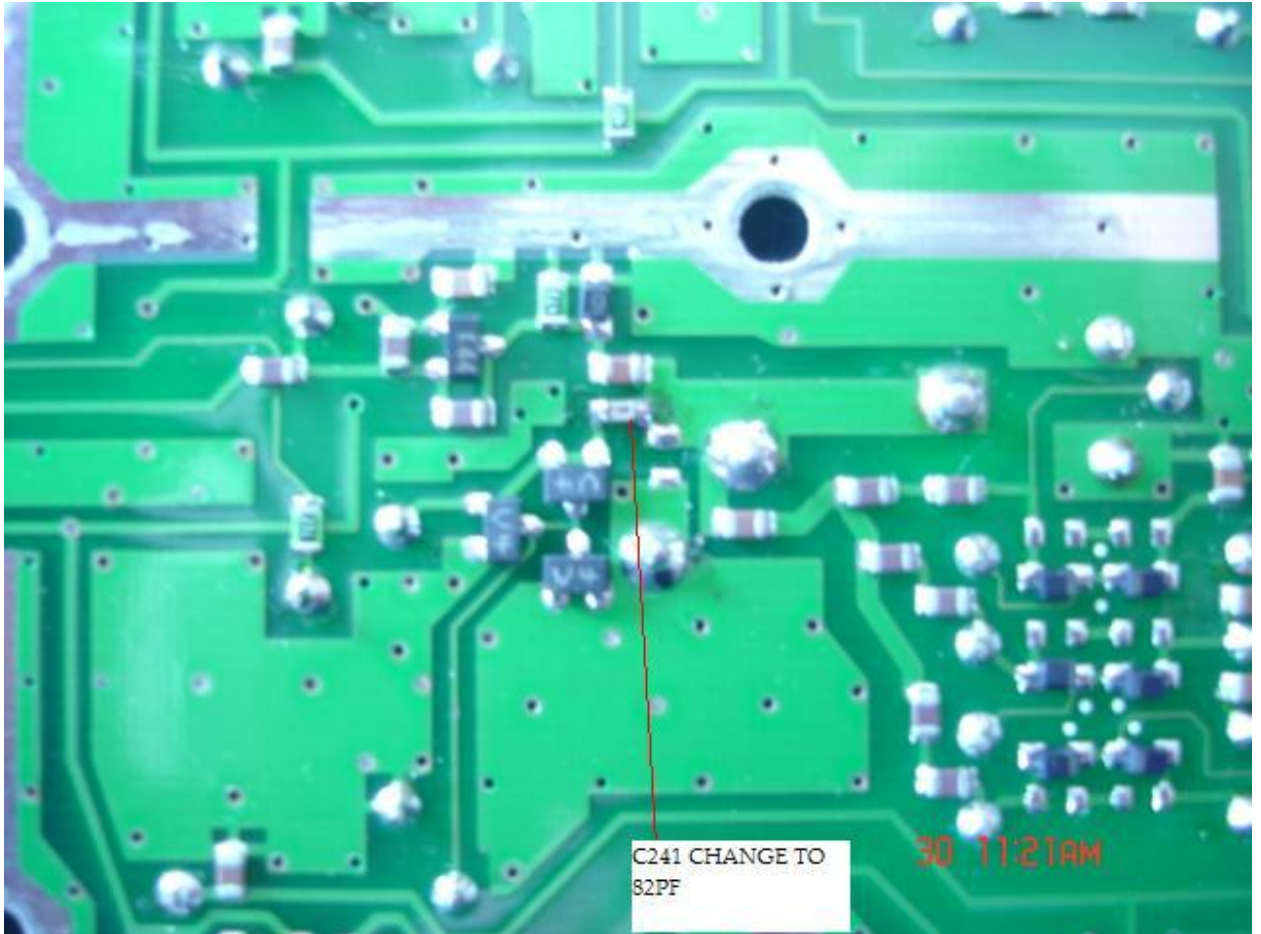


Figure 7. location of C241 on receive VCO.

9. Assemble the synthesizer back into the chassis being sure to place the printed wiring board into the chassis correctly and replace the 3 screws holding the 2 regulators and the single screw in the upper left corner of the receiver/synthesizer board.
10. Screw the heavy synthesizer cover back on but do not place the smaller shield over the receiver section at this time.
11. Connect the 2 small RF coax to the Power amplifier board.
12. The coax marked TX INJ goes to J151 on the receiver/synthesizer board and the coax marked P401 goes to J 2 on the receiver synthesizer board.

PROGRAM the radio.

Before proceeding you need to program the radio.

1. Set up your dos computers directories as follows.
2. C:\GE\CONV1\MRK
3. Place the downloaded [35plus4.sc](#) file in the C:\GE\CONV1\MRK directory.
4. Open up your Orion programming software and set everything to your liking on the control head etc. except for the 6 meter frequencies.
5. To enter correct 6 meter frequencies simply subtract 4 MHz from each desired 6 meter frequency.
6. For example 52.525 is entered as 48.525 in the programming software.
7. At this time please make up a simple 4 channel programming file with 47.000 MHz in channel 1 (this will become 51 MHz), 48 MHz in channel 2 (this will become 52 MHz). 49 MHz in channel 3 (this will become 53 MHz) and 49.99 MHz in channel 4 (this will become 53.99 MHz)
8. Once finished setting up your temporary radio file next connect your orion radio to a suitable 13.8 volts DC supply and connect the proper orion programming cable to your computer serial port and turn the ORION radio on.
9. Connect a good 100 watt or greater dummy load to the radio
10. Turn trimmer capacitors CV240 and CV280 fully counterclockwise
11. Call the programming software by typing the following at the C DOS prompt
12. MRK /sc 35plus4.sc Note: there is a space between the K and / and between the c and 35, so don't forget these.
13. Wait for the radio to complete programming.
14. Set the radio to channel 4 (53.99 MHz)
15. Using the Dc voltmeter connect the negative lead to any ground point on the radio chassis and connect the positive lead thru the hole marked TP201 so that it makes contact with TP201 on the VCO board. You may have to gently move the lead around to make good contact.
16. Note the volt meter reading in receive mode and adjust trimmer capacitor CV240 marked on the VCO cover for between 7.3 and 7.45 volts DC.
17. Key the microphone briefly, (Less than 10 seconds since the low pass filter isn't adjusted yet) and adjust capacitor CV280 for between 7.3 and 7.45 volts
18. Change the channel to Channel 1 and measure the receive control voltage and confirm that it is greater than 3.5 volts.
19. Key the mic and confirm that the transmit control voltage is greater than 3.5 volts.
20. If all is OK next we will adjust the receiver coils.

Tuning the receiver:

See figure 8 and figure 9 For receiver tuning points.



Figure 8, Receiver tuning L402 and L403.



Figure 9, receiver tuning inductors L408 and L409.

1. First remove the microphone from the control head.
2. Connect a good 3kHz deviation 1Khz tone FM modulated RF generator to the radio using suitable connectors/ adapters to the rear TNC female connector.
3. Set the generator to 53.99 MHz and set the control head channel to channel 4.
4. Adjust the generator RF level for a fair to weak signal.
5. Refer to figure 8 and 9 and slightly spread the turns on inductors L402 and L403 in figure 8 and L408 and L409 in figure 9 for at least .25 uv or less.
6. Set the control head to channel 1 (51 MHz) and make any required small adjustments to L402, 403, 408 and 409 for best sensitivity.
7. Change back and forth between channels 1 thru 4, each time resetting the RF generator to 51, 52 53 and 53.99 MHz so that the sensitivity is as flat as possible on all 4 channels.
8. I was able to achieve better than .225 uv across all of 6 meters on 2 radios that I converted.

Tuning the transmitter

NOTE: I didn't notice any differences between tuning of the 60 and 110 watt models I swept and measured the low pass filter insertion loss on 2 radios, a 60 and a 110 watt models using a HP8753C network analyzer after filter tuning and the response was < 1 dB loss up to 54 MHz. Also remember to only Key the transmitter for 15 seconds or less for each step below until proper tuning is achieved. I did not need to replace any chip capacitors in either transmitter filter.

1. See figures 10 thru 12 for transmitter tuning.

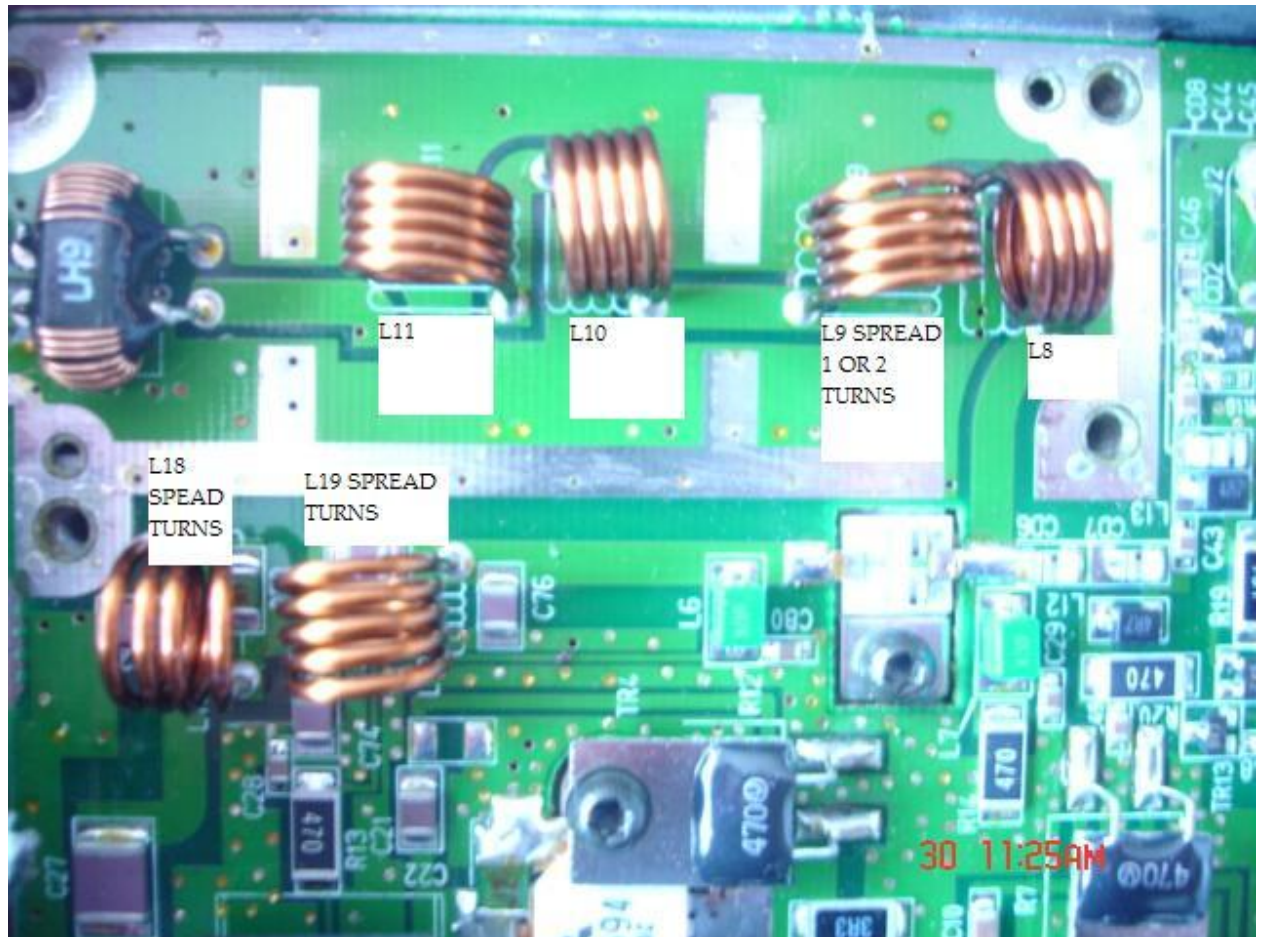


FIGURE 10. transmitter tuning. L18 and L19 lower left. L8 thru L11 upper center.

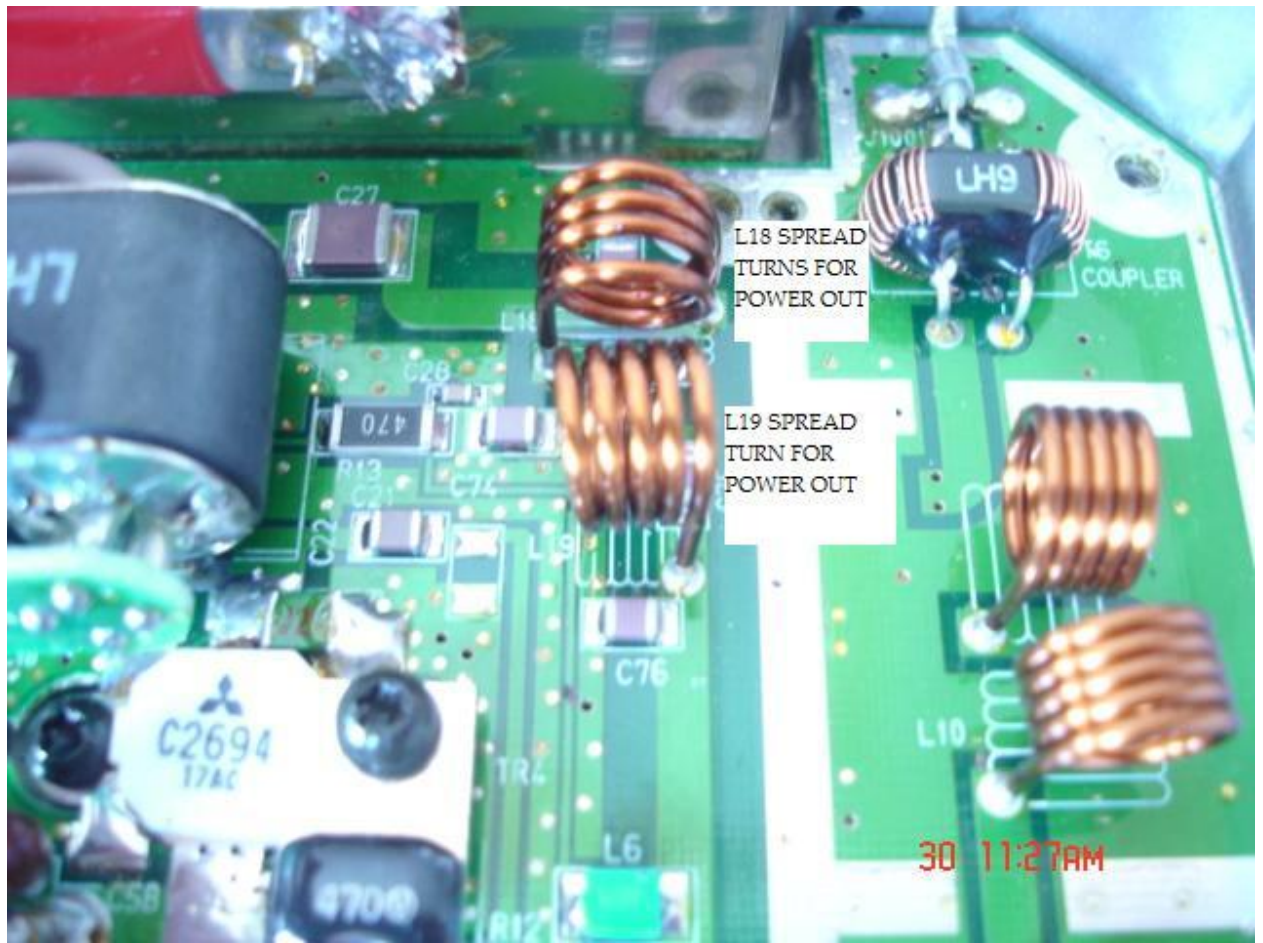


Figure 11. Inductors L18 and L19 upper center. L10 and L11 to the right.

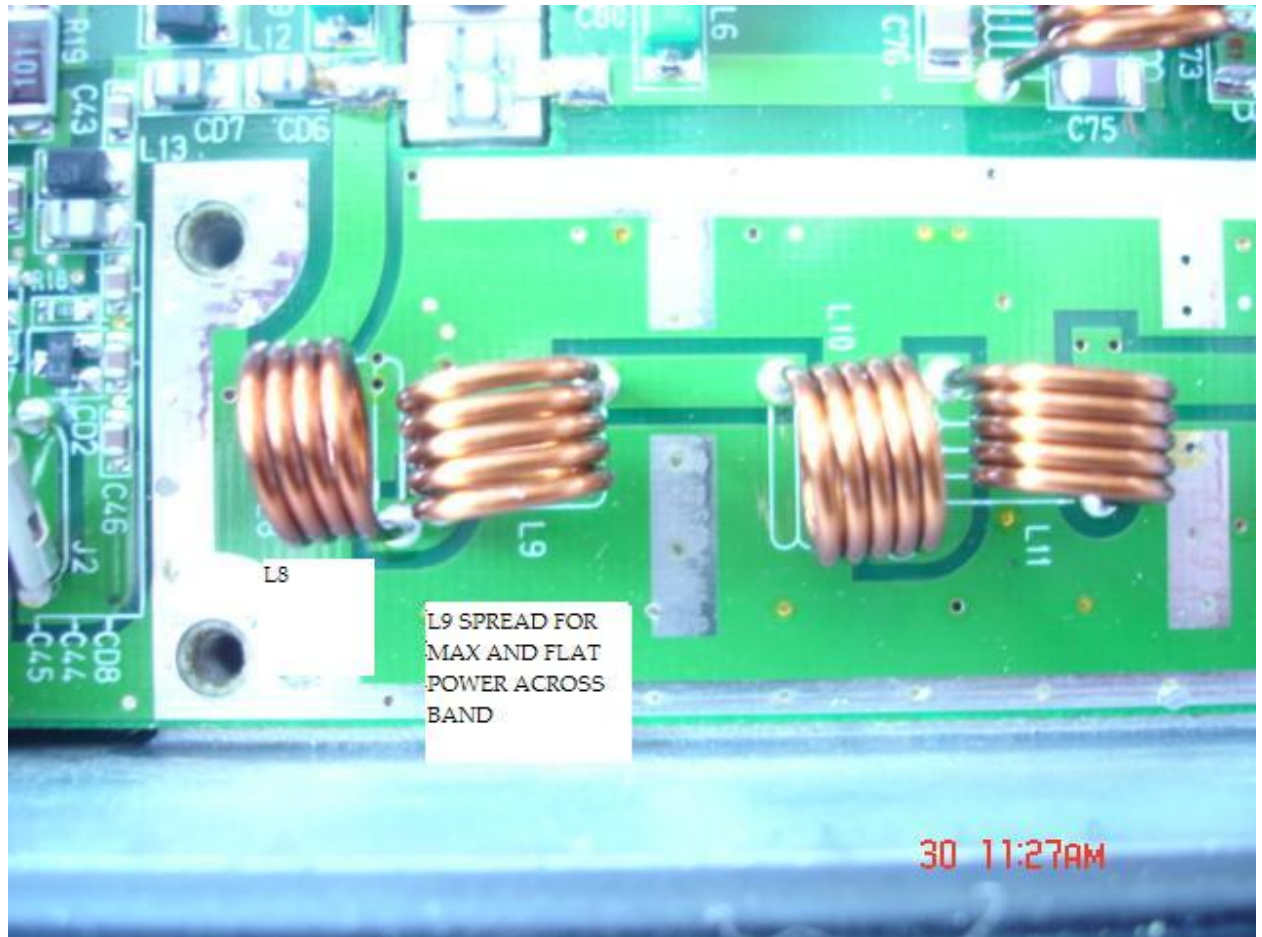


Figure 12. Final output low pass filter inductor L8 thru L11.

2. Connect the microphone and make sure that the RF power meter and a proper dummy load are connected to the antenna port.
3. Set the control head to channel 1, 51 MHz and key the radio.
4. Spread Inductors L18, L19 and L9 for any increase in output power.
5. Unkey the radio and set to channel 2, 52 MHz.
6. Key the radio and spread inductors L18, L19 and L9 if required for at least 60 watts or 110 watts depending on your radio model.
7. Unkey the radio and set to channel 3, 53 MHz.
8. Key the radio and adjust L18, L19 and L9 if required for proper power output.
9. Unkey the radio and set to channel 4, 53.99 Mhz
10. Key the radio and adjust L18, L19 and L9 for proper RF output power.
11. NOTE: I did not have to change any capacitors in the filters of the transmitter but you may need to adjust the other inductors, L8, L10 and L11 in the final output low pass filter to achieve proper output power.
12. If you cannot obtain proper and flat output power up to 53.99 MHz then it will be required to make small adjustments to L18, L19 and L8 thru L11 by stepping up from channels 1 thru channel 4 until the power is as flat as possible.

SETTING up your final channels.

- 1.** Once the radio is properly aligned go back and set up a radio file with all your desired channels making sure to set frequencies offset by -4 Mhz in the actual frequency entry screen.
- 2.** Follow the steps in the section ***PROGRAM the radio to get the proper frequencies programmed in.***

DISCLAIMER:

The standard disclaimer applies. I am not responsible for any damages etc if you endeavor to follow this procedure.

Also if anyone has any additions or comments to add as to tuning etc. please contact me and I will update this document.

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