FlexRadio Systems
Software Defined Radios

Engineering Change Order Procedure ECO-0009 for the SDR-100WPA – Revised December 21, 2004

Note: These modifications are only required on amplifiers shipped prior to December 1, 2004. All units shipped after that date will include the updates. PLEASE CHECK THE DOWNLOAD PAGE FOR THE LATEST VERSION OF THIS DOCUMENT.

Overview of Changes

This document outlines engineering changes to the SDR-100WPA in the following areas:

1. Improved directional coupler circuit values to correct SWR readings on the lower bands;
2. Higher value bypass capacitors in several locations to prevent amplifier instability; and
3. Replacement of the RF input balun transformer to improve driver stage balance for increased 2nd harmonic rejection.

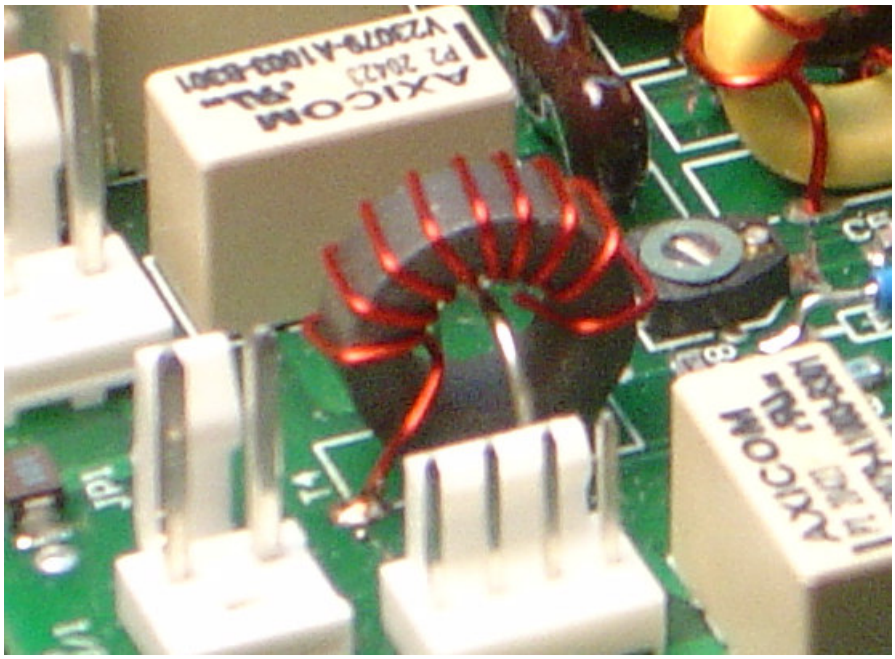
Please note that Items 2 and 3 may be necessary to meet the specifications for spurious content and are therefore required for proper operation. While these changes are best performed at the factory, FlexRadio Systems will offer the option of shipping the necessary parts to customers who are competent kit builders or experimenters. Customers should use this document to evaluate whether they would prefer to return the unit for factory upgrade or to request that the parts provided for their own installation.

The following sections outline the procedure for modifying the amplifier. Note that all steps can be performed from the top of the PCB without removing it from the heat sink.

The following items are included in the retrofit kit:

Quantity	Description
6	0.1uF 50V 1206 SMD Ceramic Chip Capacitors
1	0.33uF 50V Radial Monolithic Ceramic Capacitor
1	4.87K 0805 SMD Resistor
Approx. 8 in.	Twisted 26 AWG magnet wire

Directional Coupler Modifications

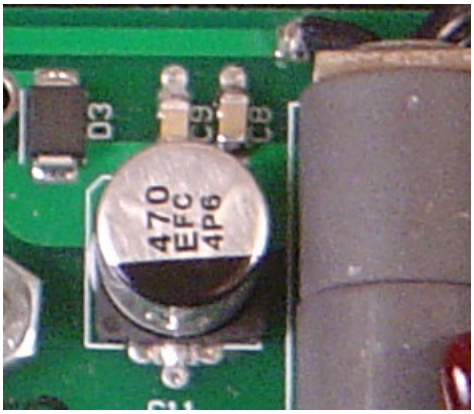


- Locate toroidial transformer T4.
- Carefully unsolder the lead nearest J5 from the PCB – use needle nose pliers to pull the lead gently while heating the lead and pad with a soldering iron.
- Remove 5 turns of wire from the toroid and re spread the turns evenly across the core.
- Cut and tin the wire for re soldering – note that heat from the soldering iron will dissolve the wire coating.
- Carefully heat the wire and pad while guiding into the hole with needle nose pliers.
- **Visually inspect the space under the PCB to make sure the lead is not shorted to the heat sink.**
- Use 2 small tipped soldering irons to simultaneously melt the solder on both ends of the 0805 chip resistor, R9 (located between the blue diodes, D1 and D2). When both sides have melted, flick the part off the pads with a tweezers like grip. Optionally, a single iron can be held on one end until the heat propagates to the other pad enough to melt it as well. The part can then be moved to the side with the single iron. The second method must be used with care, so as not to damage the circuit pads.
- With a pair of tweezers, locate a 4.87K 0805 SMD resistor at R9 and solder on both ends.
- Alignment of the directional coupler is covered in the SDR-100WPA Installation Guide. Be sure to download the most recent version from the website.

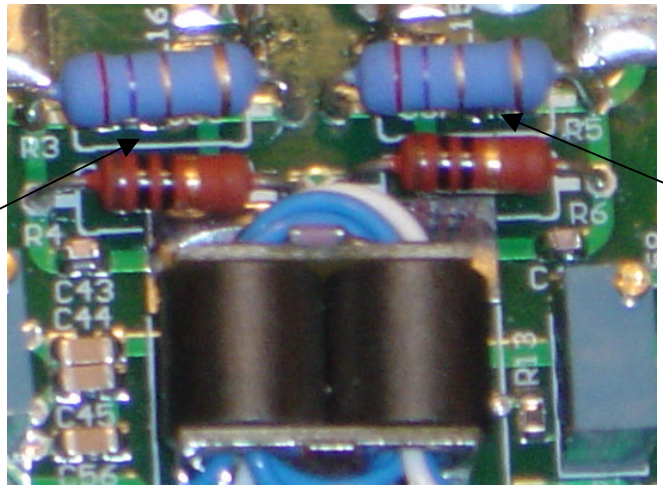
Capacitor Installation

- Six 0.1uF 1206 SMD capacitors are to be installed piggyback on top of the existing capacitors in locations:
  - C8 (located next to T1)

- C9 (located next to T1)

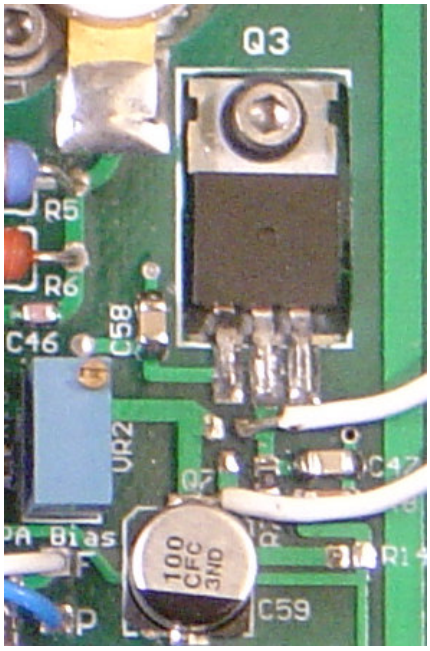


- C36 (located under R3)
- C37 (located under R5)

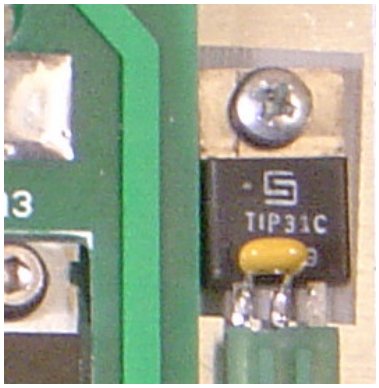


- Note that C36 is located under R3 and C37 is located under R5. On most units, it may be possible to bend R3 and R5 over so that the capacitors can be installed without removing the resistors. If necessary, a single lead on each resistor may be unsoldered to allow clearance for capacitor installation.

- C47 (located near Q3)
- C58 (located near Q3)



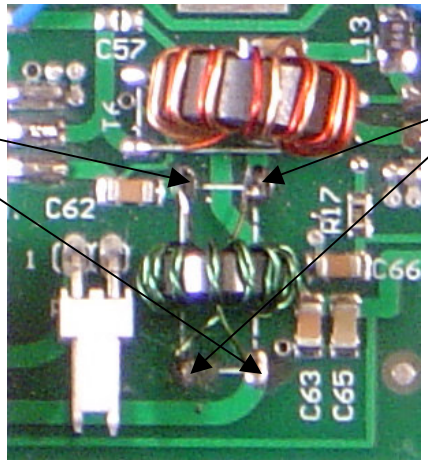
- With a fine tipped soldering iron, tin one end of each capacitor currently located on the PCB. The solder should lap slightly over the top metal edge of the capacitor.
- Use tweezers to hold the piggyback capacitors on top of the existing capacitors.
- Melt the solder on the end so that it flows up onto the top capacitor.
- Next flow solder onto the other end of the part.
- Inspect both ends to make sure they are properly soldered.
- Disconnect the 3-pin connector from the TIP31C transistor located on the heat sink just outside of the PCB.
- Install the 0.33uF monolithic capacitor across the Base to Collector pins (see photo below) of the TIP31C transistor. The base pin is closest to the PCB and the Collector pin is in the center. Inspect to make sure that adjacent pins are not shorted after installation. Replace the connector after capacitor installation.



Input Balun Transformer Replacement

- Locate 8-turn balun transformer, T7 located near the RF input connector.
- Unsolder each wire carefully by heating the wire and pad while pulling up gently on the wire with a pair of needle nose pliers.
- Remove the wire from the core and save the core for the next step. The old wire may be discarded.
- Wind the twisted wires onto the core using exactly 12 turns. Use the same method you use when winding non-twisted wires, covering about 85% of the core. Start with about 1 inch (25.4 mm) of wire through the core. Each pass through the center of the core counts as a turn.
- After winding the 12 turns, cut the leads to approximately ½ inch (12.7mm) and untwist the wires to the core. Tin the leads by applying a soldering iron and solder directly to the wires. Do not solder together.
- Replace T7 with the 12-turn balun transformer as follows:
  - The new transformer will be installed perpendicular to the silk screen outline
  - The toroid is installed perpendicular to the silk screen shown on the PCB. Install the leads from one side of the toroid, nearest to T6, keeping the leads short as practical. For proper connection, see photo for T7 installation. Please note comments on the photo. Using an ohmmeter determine continuity of the windings.
  - **For proper operation, the output connections must be inverted from the input connections (see photo below). Verify with an Ohmmeter that the diagonal leads of the transformer are connected. That is, the lead nearest the RF input connector must have continuity with the lead nearest R17.**
  - Solder the leads of T7 nearest T6 first, followed by those nearest the PCB edge. Use needle nose pliers to gently guide the leads into the hole while heating the pad/lead.

Must have continuity between these points



Must have continuity between these points

- **Visually inspect the space under the PCB to make sure the leads are not shorted to the heat sink.**

Final Checkout and Alignment

Perform the procedure in the Amplifier Test Procedure section in the v1.2 or later version SDR-100WPA Installation Guide.