FlexRadio Systems
Software Defined Radios

ECO-027 Rev A SDR-100WPA FET Bias Setting – 8/31/05

The SDR-100WPA, 100 Watt amplifier module is shipped in all SDR-ASM/TRA 100 Watt model radios as well as an upgrade option for existing SDR-ASM/TR 1 Watt models. The amplifier uses a push-pull pair of IRF510 FETs in the driver stage followed by a push-pull pair of 2SC2879 bipolar transistors in the final stage. 100W radios and amplifier modules shipped before July 15, 2005, had the FET bias set to either 30mA per transistor or 50mA per transistor. Recent experiments have shown that IMD distortion at the lower bias levels may result in low level distortion on SSB transmissions. Before and after recordings demonstrate that this distortion is no longer audible when the FET bias is set to 100mA per transistor. IMD products as displayed on a spectrum analyzer are reduced as well. **Note that the following is a completely optional modification to the transmitter's bias adjustment. Also, all radios shipped on or after July 15, 2005 include the 100mA bias settings.**

Equipment Required

1. Multi meter capable of reading current with 1mA (0.001A) resolution. The resolution is required in order to precisely balance the current between the two FETS. This balance is needed to prevent excessive harmonic output from the amplifier.
2. Small flat blade screwdriver for adjusting potentiometers.
3. Phillips screwdriver for removing the top cover.

Adjustment Procedure

Note that the 100W amplifier is located on the right hand side of the chassis with the front panel facing the viewer. It has six banks of yellow/red toroidial inductors located toward the rear panel.

In this procedure, the bias for the two IRF510 driver FETs will be first turned off by turning their respective potentiometers counterclockwise until the bias voltage is below the cutoff threshold. The bias voltage will then be increased by clockwise rotation of the potentiometers until each of the two transistors has an idle current of 100mA for a total of 200mA. The two 2SC287l final transistors will be left at their combined bias of 400mA as set at the factory.

The adjustment procedure is as follows:

1. Remove and save the four, self-taping screws and washers that fasten the top cover of the radio.
2. If the radio has an Automatic Tuning Unit (ATU) installed, remove its four mounting screws and unplug the three cables going from it to the amplifier. The ATU is mounted on four standoffs above the amplifier module. *Note that the ATU must be reinstalled before transmitting but is not required for the bias adjustment.*

3. Install a digital multi meter capable of reading 1mA resolution in the positive power supply lead going to the radio. The total current drain for this test will be less than 1.5A. ***Do not transmit during this test using any constant carrier mode such as CW, AM, or FM.***
4. Refer to the partial component placement drawing on the next page for the location of potentiometers VR1 (Q4 Bias) and VR6 (Q5 Bias) that will be used to adjust the quiescent bias current for the two respective FET drivers.
5. Disconnect the microphone if installed.
6. Place the radio in SSB mode on the PowerSDR console.
7. Turn on the SDR-1000 hardware and PowerSDR software.
8. Press the MOX button and watch the measured supply current in mA as the following adjustments are made.
9. Turn VR1 counterclockwise until the current stops going down. It is not necessary to continue turning it down after the current stops decreasing. At this point the bias voltage is low enough that the FET is turned off.
10. Turn VR6 counterclockwise until the current stops going down.
11. Write down the supply current at this point. This will be the reference current for setting the first FET's bias. The baseline current measurement with VR1 and VR6 turned down will be on the order of 1.250A unless the DEMI144-28FRS is installed. In that case the base line current will be higher.
12. Note that the 2SC2879 finals are already biased for a combined total of 400mA and are not to be adjusted in this procedure. Their bias current is included in the baseline measurement. If the bias to the finals were turned all the way down, the baseline current will be in the range of 850mA.
13. Add 100mA to the base current and write down the new Q4 bias target current. For example if the base current is 1.233A, the target for the adjustment of VR1 will be 1.333A.
14. Adjust VR1 clockwise until the current starts rising. It may take quite a few turns before any current increase is seen. When the current starts to rise, slowly adjust the pot until the target current value is reached. ***Be careful not to significantly overshoot the target current. The gain slope of the IRF510 is very steep; therefore the bias current could reach excessive levels if the controls are set too high. With reasonable care in adjustment this should not be difficult to perform.***
15. Add 100mA to the previous target current and write the new value down as the Q5 bias target current. Continuing the example above, the target for adjustment of VR6 would be 1.433A.
16. Adjust VR6 slowly clockwise until the new Q5 bias target is achieved. Try to match the current between the two FETs within about 2mA (i.e. 1.433A +/- 1mA in the example) in order to achieve proper balance.
17. If for some reason VR2 is accidentally adjusted, the same procedure can be used to set the bias to the final transistors. To do so turn VR2 fully counterclockwise until the current stops decreasing. Write down the current value and add 400mA to the base current to calculate the target value for VR2. All amplifiers have been set at the factory to 400mA for the pair of final transistors.
18. Turn the MOX button off when adjustments have been completed.

19. Reinstall the ATU if required and install the top cover.

20. Complete the PA calibration procedure as defined in the SDR-1000 Operating Manual since the gain values will have changed with the new bias settings.