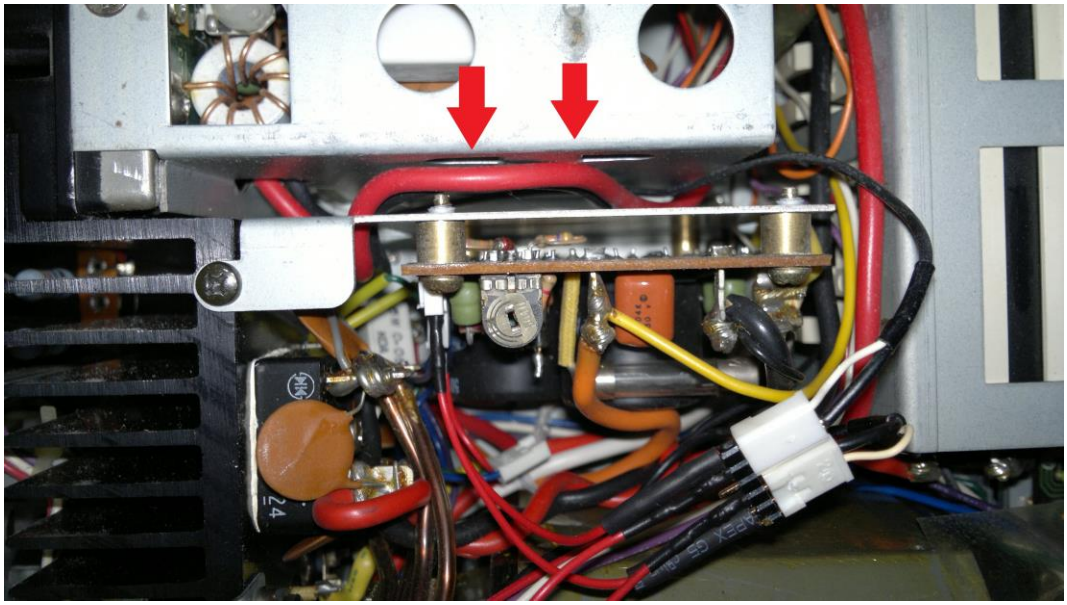
SECTION 1: Preliminary Testing and Diagnosis

Whether this is your radio and it worked previously, or it's new to you, I recommend from experience that you follow the steps that I've outlined below.

Preliminary. Unplug the radio and remove the top cover.

Disconnect the PA Power. Locate the heavy red and black wires that connect to the RF power amplifier and unplug them. Pull them up so that you can access them for testing. The photo below shows their location. The black ground lead to the PA may be tucked underneath the red positive one. Move the wires from the power supply out of the way. Leave the PA disconnected for the duration of your testing. This radio had jumper wires for the fan hookups on the AVR board that your radio won't have.



Inspection. Carefully examine and even smell the power supply section for burned areas or signs of obvious arcing. Do this even if the radio was showing signs of life (receiver made noise or even worked, dial lights came on, and so forth) before you started working on it.

Quick Tests. If the radio seemed to work but it failed to produce output, locate the heavy red power lead that led to the PA. Leave the PA disconnected for all testing.

POWER SUPPLY (PS). Connect the positive lead of a DMM to that lead and the ground lead to the chassis. Plug the radio back in and turn it on. Your meter should show a voltage of 28 volts, or something very close. If it DOES, then the power supply is probably good, and you can use it for testing the signal unit. If it shows nothing or it's something high like 40 volts, then it has failed, and you will have to use a separate power source if you wish to test the Signal Unit. See "Powering Your TS-930S with an External Power Supply" in the Appendix. This Compendium does not address repairing and reusing the OEM power supply because the old supply is obsolete and may pose a serious threat to your radio.

POWER AMPLIFIER (PA). Connect the two heavy main power leads coming from your PA to your DMM so that the **black** negative PA lead is connected to the positive **red** DMM probe, and the **red** PA power lead is connected to the **black** DMM probe. Set the DMM to DIODE test. The meter should display a reading that resembles what you would get if you were testing a silicon diode: a forward voltage ranging from 0.510V to 0.580V. This reading will vary from one PA to another, but the above numbers will be close. NOW, reverse your leads so that the **blac**k DMM lead is connected to the **black** PA lead, and the **red** goes to the **red** lead. Your meter should read either "OL" (Over Limit) or something high, like 2.8 – 3.0 volts. If the forward reading is higher than 0.620, both of your drivers may be "open", but that's rare. If one is open, the other is usually shorted.

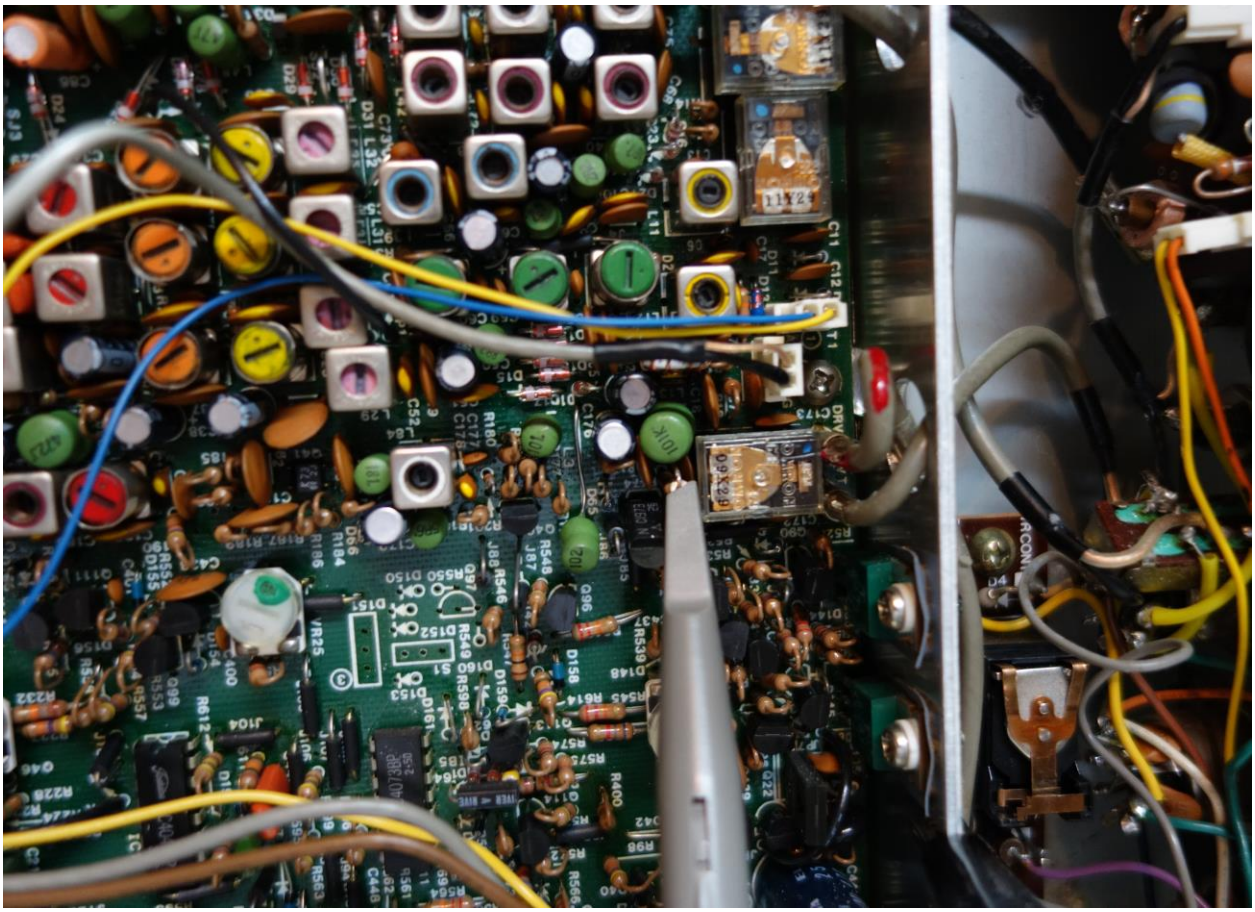
Preliminary Testing and Diagnosis (Cont)

PA (Continued). If you get something else, like a dead short or a low reading when you reversed the meter leads, then your PA is almost certainly damaged. This is not necessarily disastrous, but at this point, you can count on replacing both the power supply and some parts in the PA. If everything else in the rig is OK, restoring these two items will cost between $200 and $350 total if you do the work yourself. This is a small amount considering what you will have when you are finished. But before you invest that money, I would move on to the Signal Unit (below).

SIGNAL UNIT (SU). Another section that should be tested is the Signal Unit. There are few things more disheartening than investing several hundred dollars or more in a radio only to discover that it still has a serious and expensive problem that renders the rig both unusable and basically worthless for resale. I know several HAMs who performed the above work, only to find that they still had zero, or close to zero output.

There are a couple simple tests that can determine if the signal board is OK, but they require 24-28 volts to power the radio. If the original power supply tested OK, then the rest is easy. If not, go to "Powering your 930S with an external Power Supply" in the Appendix.

1. Remove the bottom cover of the rig. This is more of a hassle than the top, because you no longer will have a handle for moving the radio around.
2. Locate the Antenna connector on the signal unit. The picture below should help. There are two connectors side-by-side, next to the TRANSMIT relay, RL-3. The upper connector leads to the PA. This is my test bed radio, so I installed a longer cable and marked it with a red laundry pen.



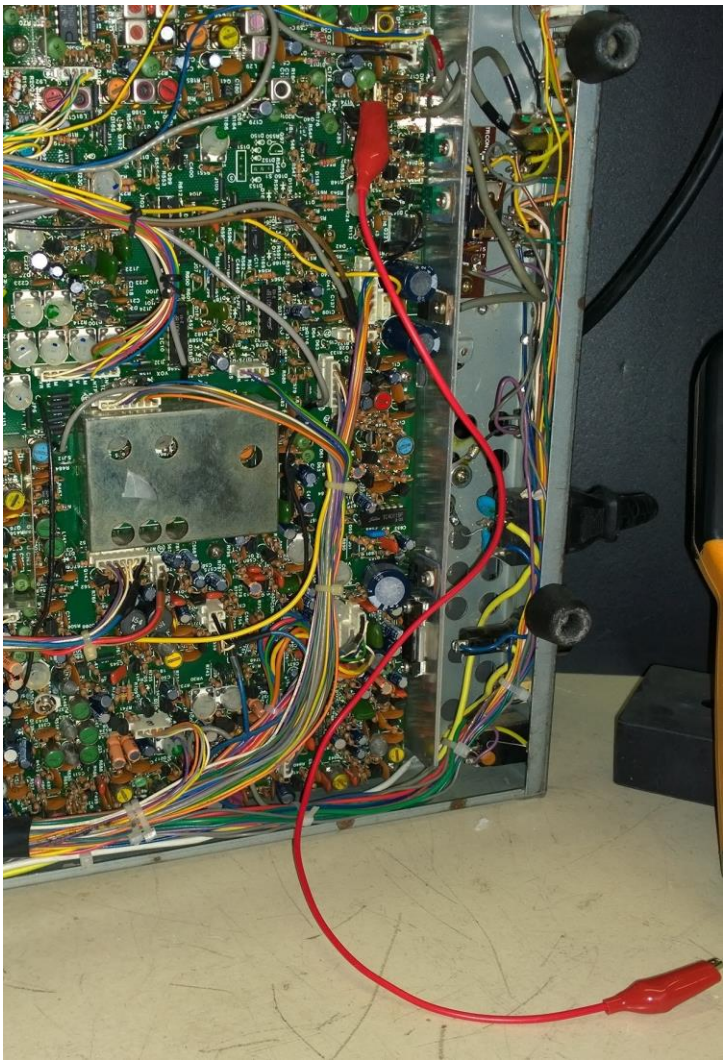
Note that I already have a probe attached to a **major** SU test point, R174, located just behind the transmit relay.

Quick & Easy SU tests.

Panel meter test. Connect a known good microphone to the radio. Set the METER switch to COMP, and turn on the PROCessor. Now speak into the mike while adjusting the Processor controls. If the Signal Unit is good, the panel meter will sweep up and down with your voice. Mine will easily peg to the right. If yours does the same, your SU is probably fine. But if you want to err on the side of caution, read on.

The "second radio" test. [1]

1. Carefully scrape some of the paint from the long, exposed lead of R174. I use a sharp Exacto knife.
2. Connect a piece of wire to R174. An alligator test jumper like the one shown below works great, as does a J-hook scope probe. Leave the ground lead on the probe free. The position of the wire isn't critical, just don't short the end to ground.



3. Set your 930S to some convenient frequency within the HAM bands, like 14.200 MHz and tune another radio in your shack or even a basic shortwave radio to the same frequency.

4. Now set your 930S to TUNE and listen for the carrier in the second rig. Better yet, connect a good mike to the rig, set it to USB or AM, and listen for your voice. Mine works perfectly through the second rig. In fact, it works without any wire. If yours does too, there's a 99.5% chance that your SU is good. Want more proof? Read on!

Note: 1. If your radios are close together this test will work without the wire. However, the wire yields much better results.

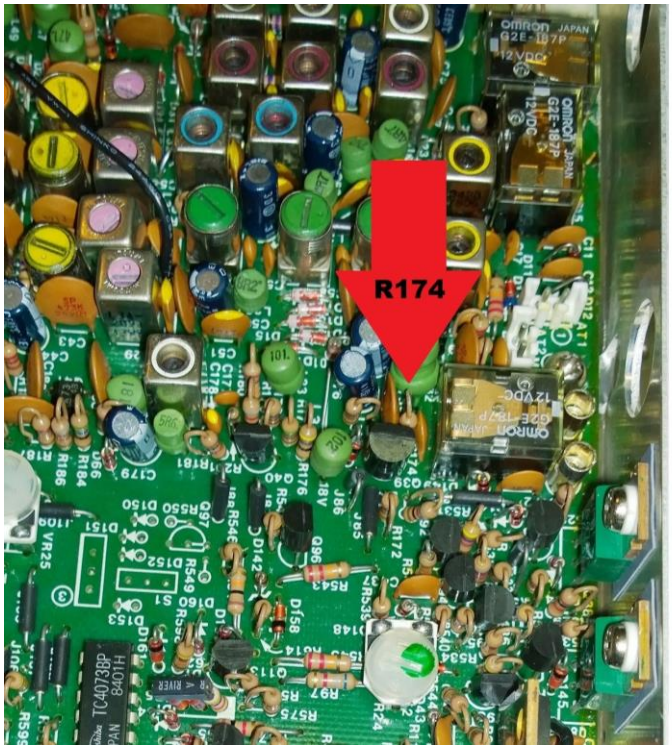
Junk-Box RF Probe and Frequency Meter. Two “quick & dirty” ways to make sure your SU is working are shown below. One uses a DMM with frequency measuring capabilities, and the other is a homemade junk box RF probe.

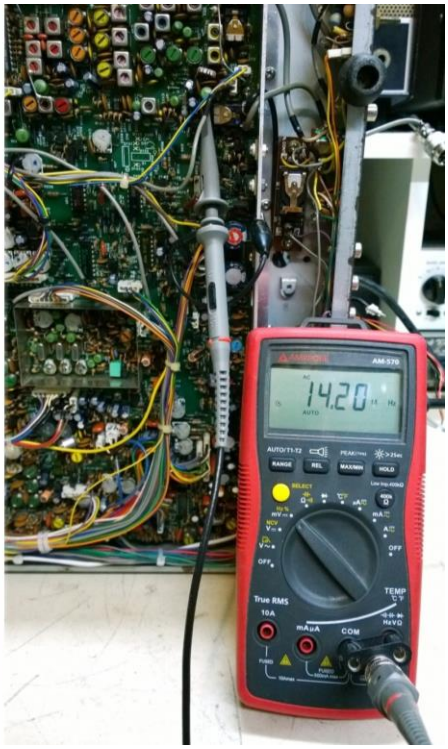
DMM: A meter that measures up to 20MHz is ideal, but if yours only reads to 5 or 10 MHz you can still use it. You just must use a lower band. If yours measures to 10MHz, then use 40M, maybe around 7.2 MHz

Basically you have two options: You can connect the leads from your meter to the cable that feeds RF into the PA, or you can put the rig up on its side and connect to the wire part of resistor R174, which is just to the left of relay RL-3 next to the DRV/XTR output terminals. I would try the RF cable first. If you don’t get a signal there, then I would check at R174 to make sure RL-3 hasn’t failed.

Connect your leads to the end of the RF cable to the PA input as shown below. Just don’t bend the little center pin. The cable shown below is black instead of gray because on this radio I replaced the original with a longer one that I made.

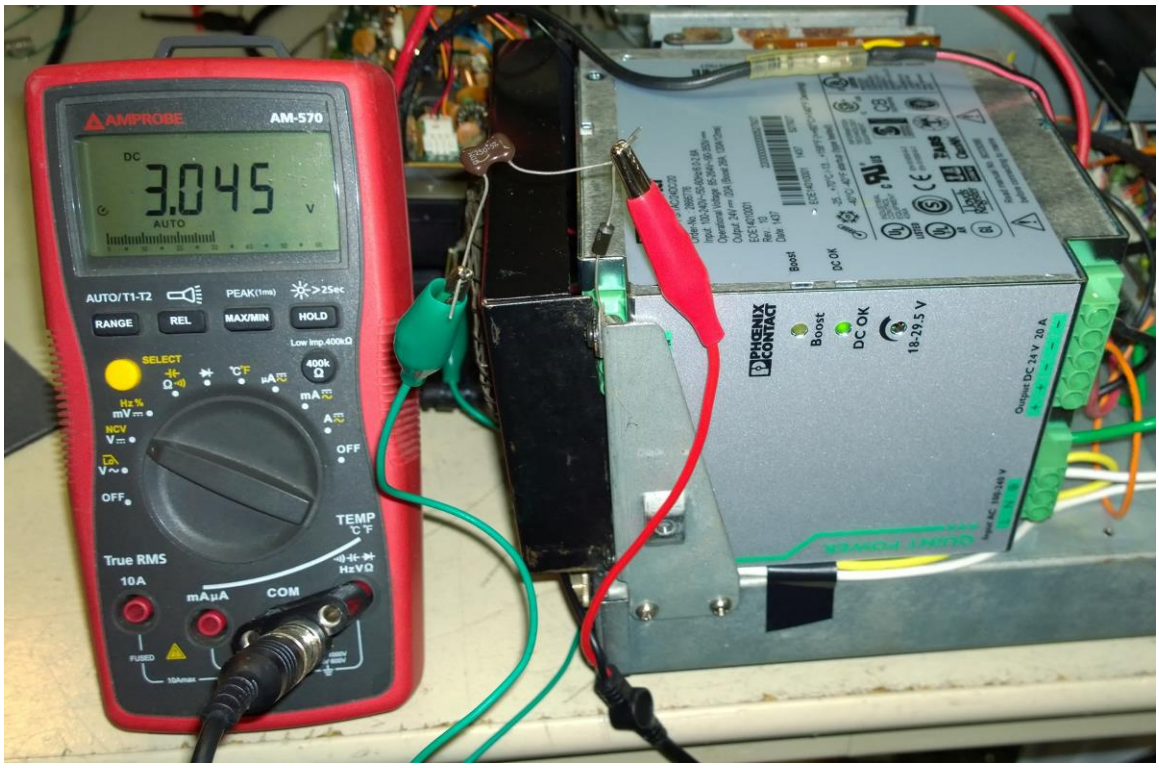
The same test is shown below but using R174 with my rig set at 14.200 MHz. I’ve connected a scope probe here, but a J-hook works too. To use the resistor, you will have to scrape some paint from the wire lead shown above (arrow). I would use an Exacto knife and work slowly, carefully shaving along the axis of the wire.



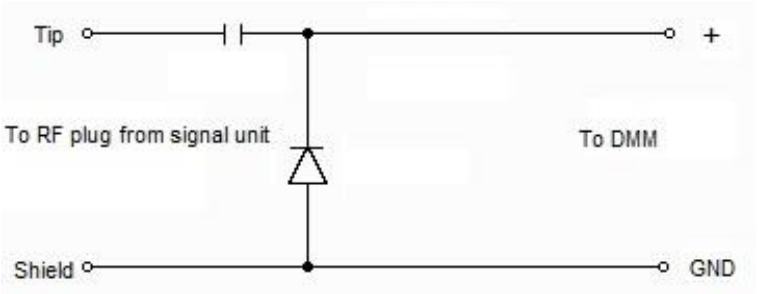


TEST: Set your rig to TUNE with the CARRIER control at zero. Push the SEND button and slowly turn the CARRIER control clockwise. If your Signal Unit is working properly your meter should display the frequency by the time your control is at the 4 or 5 position. Before you are fully clockwise, it certainly should. If it's not, carefully check your connections. Try it both ways if necessary. Most DMMs require between 0.250 and 0.400 RF volts to produce a frequency reading, which will produce a power output from a working PA of 35-50 watts.

Quick & Dirty RF probe: If you have some diodes lying around your shack and a non-electrolytic capacitor, you can literally make a "one-minute" RF probe. I won't be as accurate as a commercially made one, but it will do in a pinch.



The above rig is just a germanium or silicon diode, combined with a 250pF capacitor. Other values will work also.



The cathode end of the diode is simply pinned between the fan housing and the rig's frame, and the capacitor is hooked to the center pin of the RF cable with a jumper cable. The red alligator clip lead goes to the meter plus terminal, and the black is clipped to the RF cable plug barrel just like it was in the previous test. Set your DMM to DC volts. At full TUNE, the meter shows a little over 3 RF volts, using a silicon diode. A germanium will give a little higher reading. By contrast, my meter with a Fluke 85 RF probe shows 2.5 RF volts. As you back down the Carrier control, you will see the voltage drop down all the way to zero. If you've reversed the diode, the readings will show a minus sign.

If you get the results shown above, your Signal Unit is probably OK. If the SU does not appear to be working, see **Section 5: The Signal Unit.**