QRP

Low Power Operation

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The Two-Fer

Mr. Webster describes a "classic" as being excellent; established; a standard; a model of its kind. This month we'll take a break from the charge controller to work on a simple spring classic: the Two-Fer. Yes, it was around for a while and it's been through several changes since its conception in the *QRP Quarterly*. The original Two-Fer came from Mike Michaels W3TS and John Collins KN1H. I had my hand in the first prototype PC boards and produced the first Two-Fer kits for Dayton. The kits sold out in a matter of minutes.

Several different versions have appeared in many articles. This is a modification of a modification, so to speak. Bryon Weaver WU2J did the modifying this time around. He changed out the FET used for the VXO and instead installed a common transistor. Notice that the output transistor has also been changed from the 2N3553 to an MRF476. This is a 5 watt RF transistor in the flat pak style. The circuit will produce 2 watts out on 14 MHz with 13 volts VCC.

New Keying Circuit

This time I changed the keying circuit around. Connecting the jumper to either the "A" or "B" connection on the PC board will determine how the oscillator will be keyed.

With the original Two-Fer, the oscillator ran all the time. The oscillator supplied the matching direct conversion receiver with the needed injection for the balanced mixer. The matching receiver for the Two-Fer was a real dog. Most builders of the Two-Fer simply did not build the receiver. Therefore, you had to remove the VCC from the crystal oscillator so you could hear the other station. Otherwise, the crystal's frequency would be heard in your receiver.

With this version of the Two-Fer, you can select how you want to run the crystal oscillator: continuous or keyed. The output of the VXO may be coupled to a direct conversion receiver by a small-value capacitor. Unless you are planning on using the oscillator to drive a direct conversion receiver mixer (as in the original version), then use the keyed oscillator configuration. This way you won't have to do any fancy VCC switching when going from transmit to receive.

A capacitor for coupling RF to a receiver mixer may be mounted on the PC board. If you don't plan on using this feature you may leave the capacitor out. But, by installing it, you have a dandy place to pick up the output from the VXO. I use a frequency counter for that digital readout feeling everyone is so used to.

If you have a sluggish crystal and keying the oscillator causes chirp, then simply configure the oscillator to run continuously. Of course, you'll need to remove the VCC during receive, but you won't be chirping CW anymore either!

Solid-State QSK

This version also has something new: a solid-state QSK system. By adding a small handful of parts we end up with a no-relay QSK. Best of all, you don't have to include this feature if you don't want to! You can use the T/R controller shown in an earlier "QRP" column to mute the receiver and control the antenna relay if you wish. The choice is up to you.

Construction is quick and easy with the PC board from FAR circuits. Of course, you could use just about any other method to build the circuit, including perf-board. The so called "ugly" construction would work fine, too.

Notice the use of a ferrite bead on the base lead of the transistor. This improves stability in the PA under certain conditions. In some models, I had no problem with the PA stages running away without the bead; using other transistors required installing the bead. In either case, mount the transistor as close to the board as possible.

Most of the parts can be picked up from your local Radio Shack. You should be able to build this transmitter for less than $20, even if you buy all the parts new. If you have a well-stuffed junk box, your total cost may be next to nothing. A junk box CB would be a good source for the final PA transistor and driver. In fact, I've used several different types of transis-

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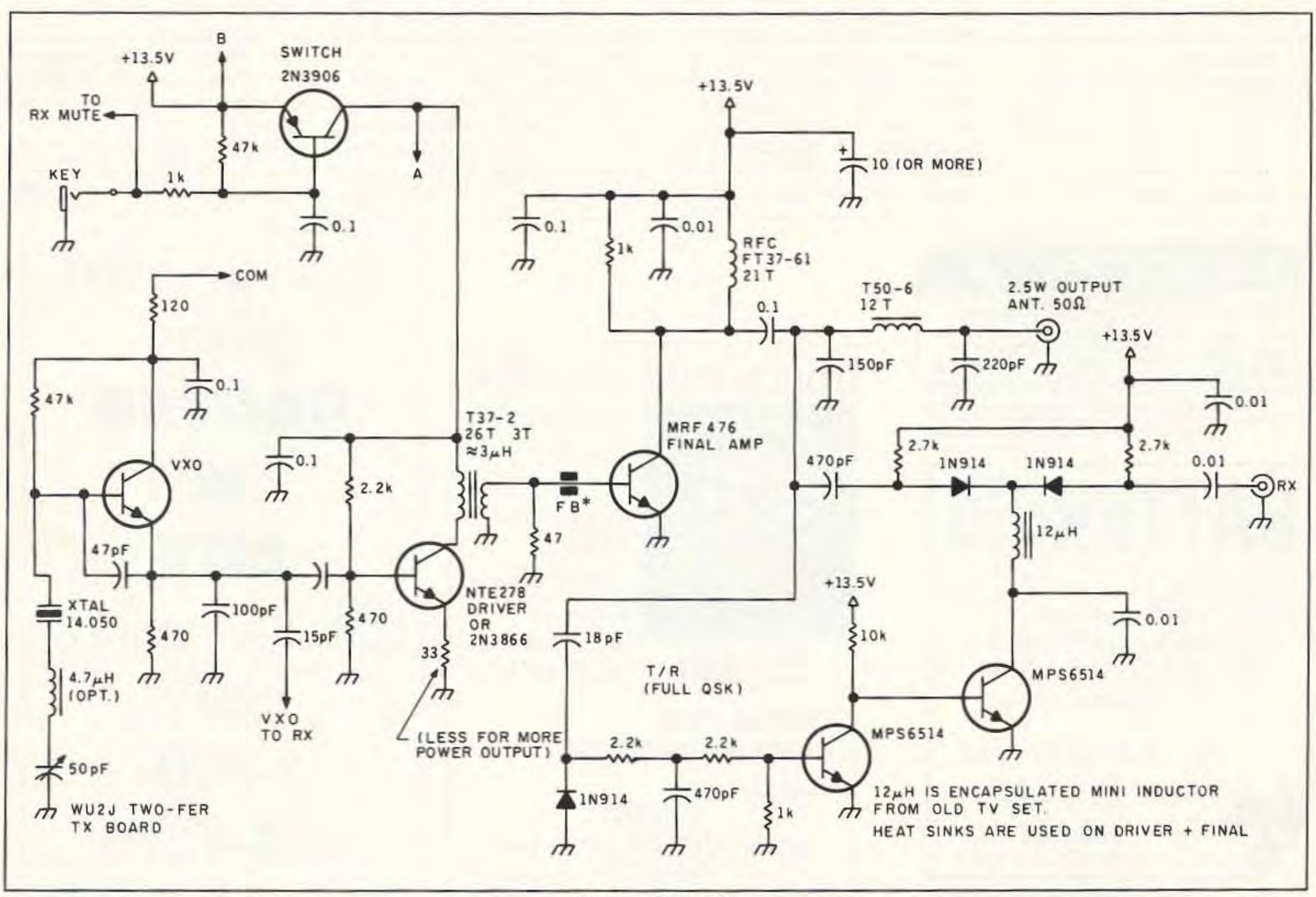

Figure 1. Schematic.

tors in the final stage and all seem to work just fine. Some transistors I tested: 2N3553, 2N3866, MRF479, and the C1909. I used a 2N3866 for the driver with good results, too. A small TO-220 style heat sink keeps the MRF476 from overheating. It runs a tad warm, but not hot to the touch.

Depending on the crystal you use, you may not need the 4.7 uH choke in series with the VXO capacitor. In fact, one of the rocks I have in the junk box would not oscillate with the choke in place. If you can (and if you can find one), use a double-bearing variable capacitor for the VXO. That will last a lot longer than a cheaper version, and will give you a much smoother tuning action, too.

Check out the circuit by first building the switch and the oscillator. Verify operation by listening to the crystal's frequency on a receiver, or use a frequency counter. Don't install the final PA transistor yet. Build the driver stage and test for output in that stage. If you have an RF probe, check for gain in the driver stage to that from the oscillator. An oscilloscope would be an ideal tool to check for gain in this stage.

If everything checks out, then install the PA transistor. Monitor the transmitter's current and, with the output going into a dummy load, key the rig. You should see about 2 watts of RF with 13 volts DC applied. My version demanded 360 mA from the power supply.

With the rig still connected to the dummy load, verify the operation of the VXO by listening to your signal on the receiver. Your frequency counter would be helpful here so you know exactly how much spread your crystal combination produces.

The values for the output filter are for the 20 meter band. I put one of these rigs on my favorite band, 30 meters, by changing the output filter. I did not change the driver transformer at all. The rig works just fine on 30 meters as well as on the 20 meter band. I did not use the QSK feature as I use my T/R controller instead. I see no reason why one could not put this rig on any other band, with the exception of 10 meters, by changing the values of the output filter.

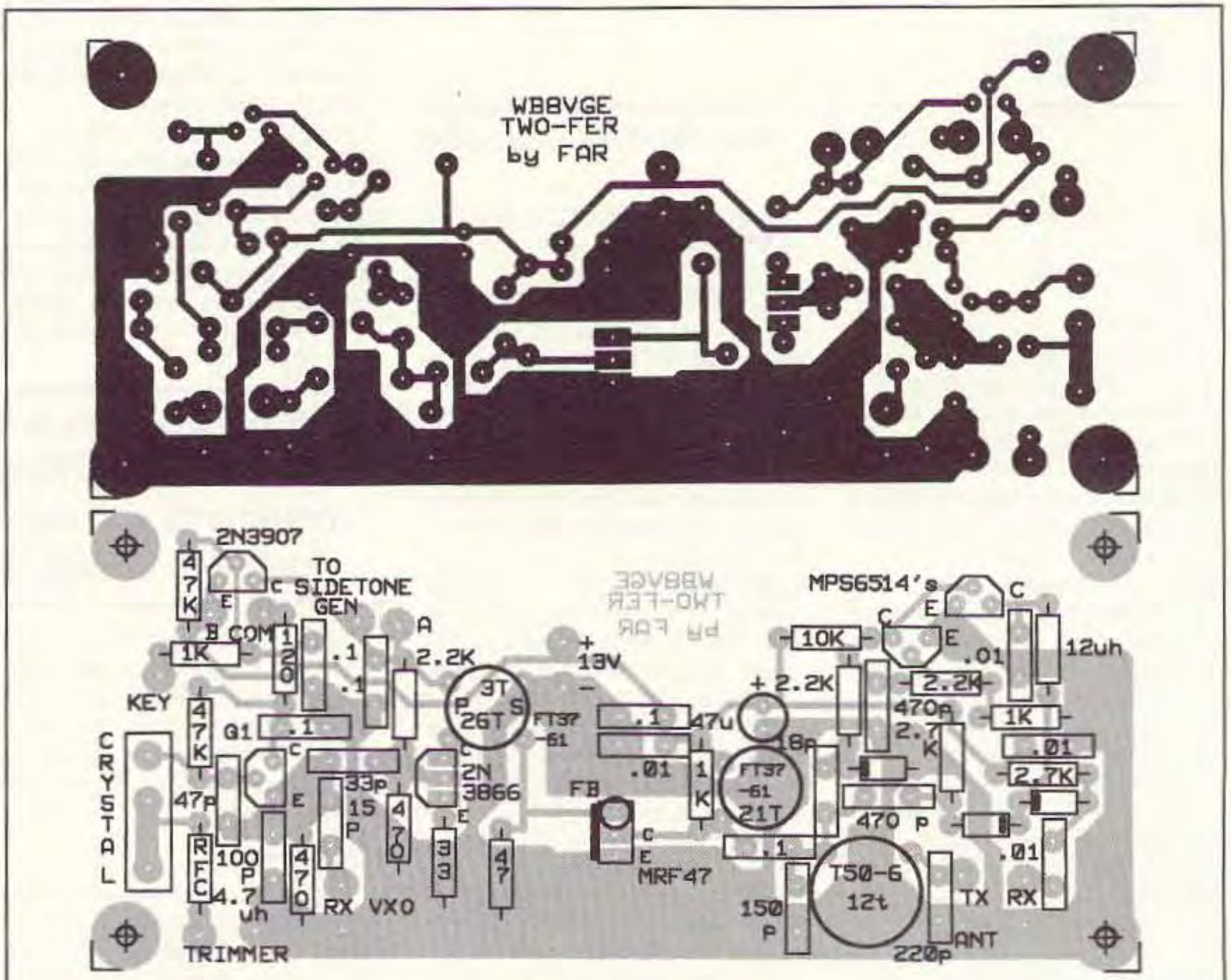

Figure 2. PC board and parts placement.

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Even though this is simple project, some of the parts may be hard to come by. KA7QJY Components at P.O. Box 3893, Logan UT 84323 has everything you need to get this rig up and running. Send him a large SASE for his part price lists. Of course, a PC board for the project is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. PC boards are $4.50 plus $1.50 S & H.

For something as simple as a handful of transistors, the Two-Fer in all its different varieties remains a popular project for beginners and old-timers alike.

Next month we'll get back to our charge controller project and put those power MOSFETs to work. 73