The Ten-Tec 1208 6 Meter Transverter

BY DOUG DeMAW*, W1FB

The 6 meter band offers an interesting opportunity to get started with non-FM VHF. Although a number of commercial HF transceivers include the 6 meter band at additional cost, a large number of older HF rigs do not accommodate the 6 meter enthusiast. Those who want to operate at 50 MHz without buying a 6 meter transceiver or an HF-band transceiver that includes the 6 meter band may use a transverter in combination with an existing HF transceiver to utilize the 50, 144, or 432 MHz frequencies. Ten-Tec wisely included a 6 meter transverter in its growing line of T-Kits. I was attracted to the No. 1208 transverter after reading about its features in the T-Kit catalog. I concluded that the 1208 merited a product review after observing the quality of the design and the excellent hardware used in the product. The heavy-duty metal cabinet is impressive by itself.

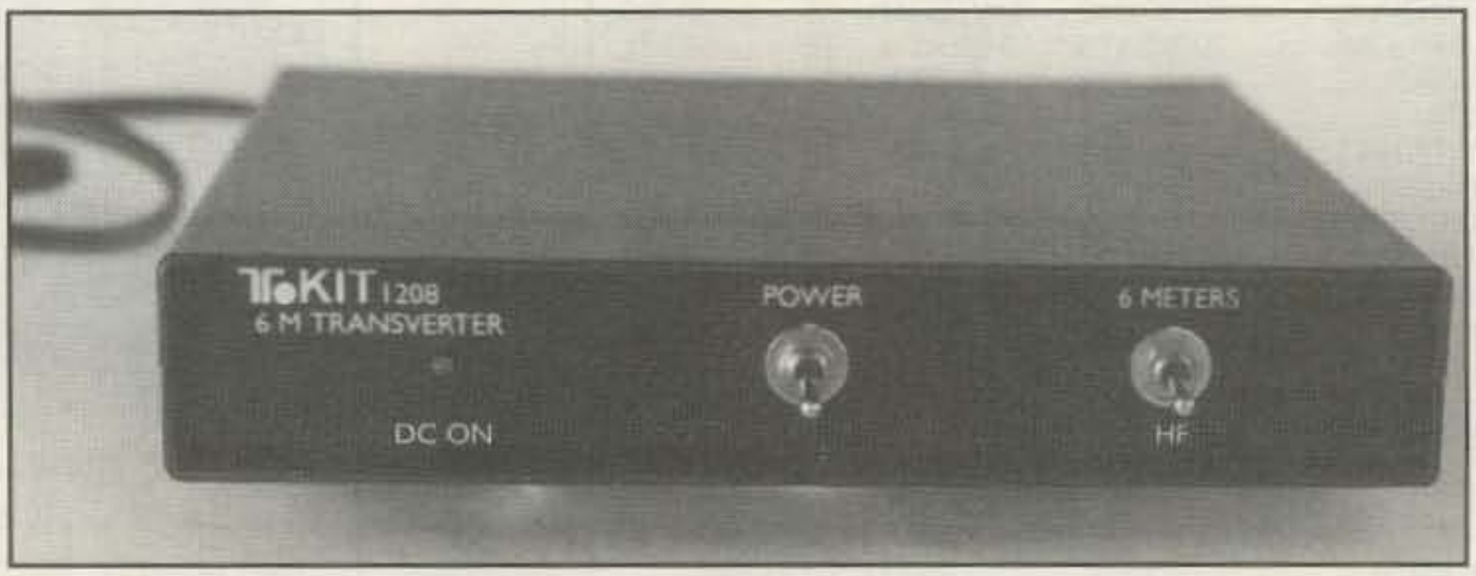

Photo A– The Ten-Tec 1208 six meter transverter.

Circuit Highlights

Fig. 1 is a hybrid diagram I drafted to illustrate the main points of the 1208 circuit. Q7 and Q8 provide the 36 MHz heterodyne frequency required for mixing with the 14 MHz HF transceiver energy to produce the 6 meter signal. A doubly balanced diode-ring mixer is used during transmit and receive to mix 36 MHz with 14 MHz on transmit, and 36 MHz with 50 MHz incoming signals during receive, to provide a tunable IF at 14 MHz.

Output from the mixer is amplified at 50 MHz during transmit. Q9 and Q10 are low-level RF amplifiers. Q11 is the driver. Push-pull 2SC1971s (Q12 and Q13) operate as the linear final amplifier. The output transistors are rated conservatively. They should last a long time. Specified peak output power is 8 watts minimum. Each 2SC1971 is rated for 7 watts of output power at 175 MHz when using a +13.5 volt Vcc. Driving power for a single 2SC1971 is 0.6 watts. Driver transistor Q11 is also husky. The 2SC1970 will produce 1.3 watts of output power at 175 MHz with 0.12 watt of drive. These three transistors are properly heat-sinked to ensure safe operation.

A 7-element low-pass filter is included between the PA stage and the antenna to attenuate all harmonics by 55 dB or greater, referenced to peak output power.

There are no relays in the transverter. All T-R switching is done with PIN diodes and a 5-transistor electronic switching circuit which is not shown in fig. 1.

The receiving preamplifier, Q15, is protected by two diodes (D19 and D20) that conduct when positive voltage is applied to them in the transmit mode. A J310 JFET is used as a post mixer IF amplifier during receive. It boosts the 14 MHz IF signal from the mixer to assure ample overall receive gain. This transistor is not shown in fig. 1.

S1 is a front-panel switch that allows the user to select 6 meter or HF operation. The transverter is bypassed when S1 is set for HF operation. This manual switching circuit will safely accommodate up to 100 watts of RF power in the bypass mode. A second panel switch serves as a power ON/OFF selector in the +12 volt supply line. A red LED illuminates when the power is turned on.

Assembling The Transverter

I needed 12 hours to assemble and test the 1208 transverter. Assembly is tedious and requires that the builder pay close attention to the well-written assembly manual. There is an errata sheet that comes with the kit. I strongly advise that you make corrections to the basic manual before you start construction. I made an errata notation in the column where the book describes the installation of the mini T3 balun transformer. For reasons I cannot fathom, I ignored my own notation and failed to check the errata sheet during that step. The result was only milliwatts of output power from the tranverter at checkout. A call to Ten-Tec revealed that T3 was the most common cause for the power output problem. I read the errata sheet and learned that I had to remove the transformer and rotate it 90 degrees on the PC board. Suddenly I was getting 12 watts of output power! I am happy to say I made no other errors during assembly. Inexperienced builders may require a few more hours of assembly time to complete this project. However, even a beginner should be able to manage this kit. Circuit performance tests are suggested at various points as you assemble the kit. This makes it easier to locate wiring or assembly problems rather than when the entire circuit is tested at completion.

The double-sided PC board is loaded with components. A view of the top of the board, after assembly, is shown in photo B. The wiring between the front-panel bypass switch and the three SO-239 connectors on the rear panel is done with RG-174 coaxial cable. Two tie wraps are provided for bundling the RG-174 neatly.

I was impressed with the accuracy of the parts and hardware count. I had exactly the required number of components for the project. My bonus hardware "leftover" was one black 4-40 flathead screw.

It is a pleasure to find a product that uses Amphenol SO-239 coax fittings rather than RCA phono jacks for antenna connectors. There are three S0-239s on the rear of the transverter. No need for troublesome adapters when attaching RG-8 or RG-58 cable to the unit!

A heavy-duty, fused power cable is

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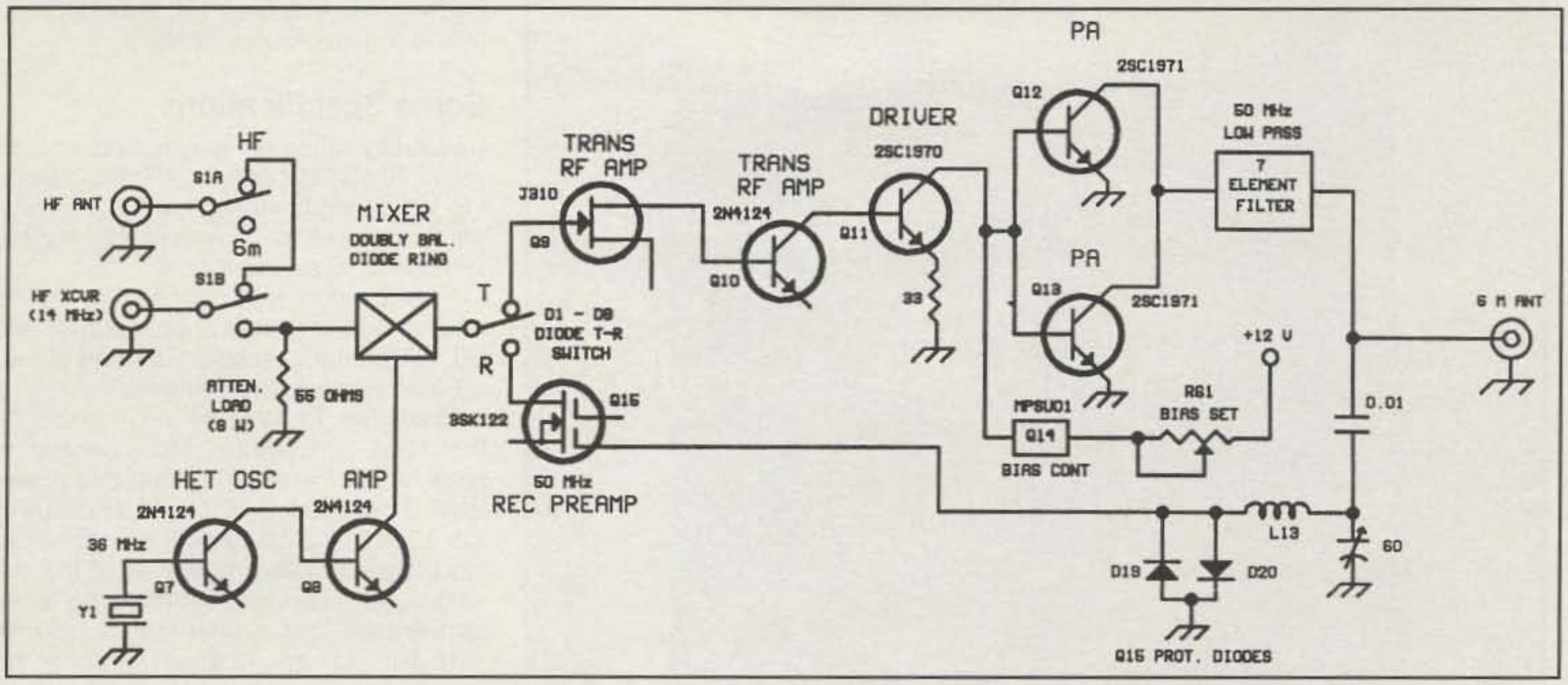

Fig. 1– Hybrid diagram of the basic 1208 transverter to illustrate how it functions. The 5-transistor T-R switching circuit has been ommitted, as has the post mixer 14 MHz receive amplifier.

included with the kit. It is used for powering the 1208 from an outboard +12 to +13.5 volt, 4 amp regulated DC supply.

Tune-up and Operation

Step No. 1 is to align the converter portion of the transverter. I used a 14 MHz receiver and a URM-25 signal generator during alignment. If you don't have access to a signal generator that covers the 6 meter band, you may use another HF transmitter as the signal source by selecting an HF frequency that is harmonically related to 6 meters. For example, the fifth harmonic of 10.105 MHz falls at 50.525 MHz. If your HF transmitter does not cover the 30 meter band, you may use the seventh harmonic of 7.150 MHz in the 40 meter band. This will be heard at 50.05 MHz. Adjust the level of the test signal until you hear it in the receiver to which the 1208 is attached. The manual indicates which coils and trimmers to adjust for peak signal response.

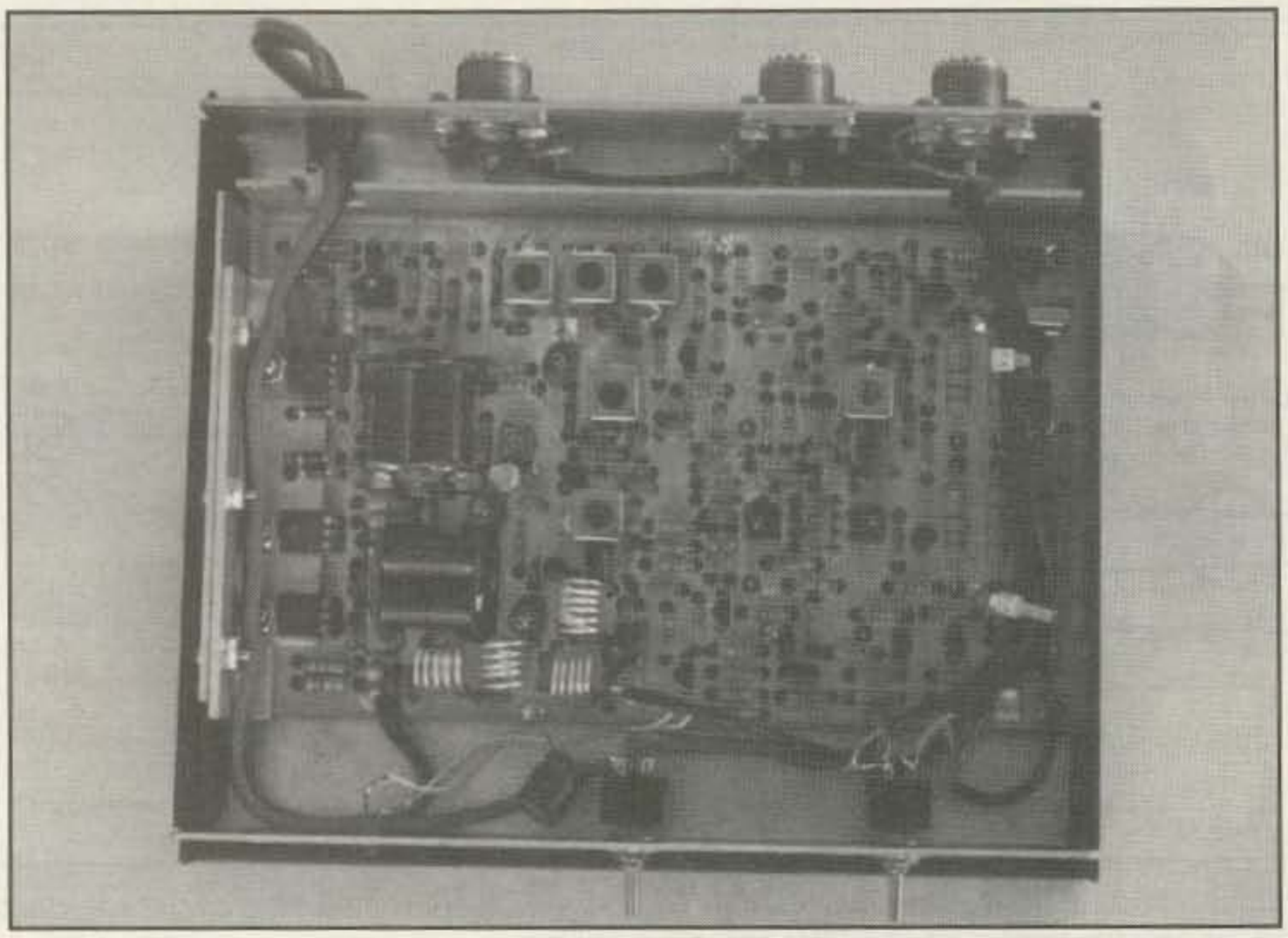

Photo B– Interior of the 1208 6 meter transverter showing the high-density circuit and clean layout. Three SO-239 coax connectors are used in lieu of the usual RCA phono jacks found in kits and certain small equipment.

The frequency of the heterodyne oscillator should be checked and adjusted, as required. An accurate frequency counter is the best device for calibrating the 36 MHz oscillator. Connect the counter to test point TP5 on the PC board. Adjust C22 for a reading of 36.000 MHz. The range of the calibration trimmer for my unit would not allow the frequency to be shifted to exactly 36.000 MHz. The best result I could obtain was a reading of 36.000823 MHz. Variations in crystal characteristics can account for some units being incapable of "dead on" adjustment. Crystal aging with operating time will often require recalibration of the oscillator. The user should be aware that 36.000823 is entirely acceptable for amateur work on 6 meters. Factually, I struggled to find this one picky fault in the 1208 transverter!

The builder must set the idling current for the final amplifier. This is done while monitoring the overall current taken by the transverter in the transmit mode, but without RF drive applied. Trim pot R61 is adjusted for a DC current increase of 200 mA.

The final setup requires peaking the tuned circuits for the transmitter portion of the 1208. This calls for a plastic hex tuning tool. Output from the transverter is fed to an SWR indicator and a 50 ohm dummy antenna. The specified circuits are tweaked for maximum RF power output. I was amazed to observe an unmodulated carrier output of 12 watts (TS-570D in the AM mode at 5 watts) while using a 13.5 volt DC supply. This nicely exceeds the 8 watts minimum power output rating set by Ten-Tec. A current of approximately 3.8 amps is drawn at peak output power during transmit. A modest 170 mA of DC current is required during receive.

Some Specifications

Receiving sensitivity is specified as 0.15 µV for 10 dB SNR @ a 2.4 kHz bandwidth. I found during my tests that a 0.1 µV signal from my URM-25 was plainly audible when I tuned across it.

Feedthrough from 20 meters during receive on 6 meters is approximately –75 dB. HF antenna isolation is rated at –60 dB (not measured by reviewer).

Maximum 14 MHz RF drive power to the 1208 is 5 watts. The operator is responsible for ensuring that this power level is not exceeded. The input circuit of the 1208 has a 55 ohm, 8 watt resistive load that dissipates nearly all of the driving power. Two other attenuating resistors ensure that approximately 30 mW (–15 dBm) of transmit energy reaches the mixer. Care must be taken to never exceed 5 watts of 14 MHz driving power. Excessive drive can quickly damage the transverter and its internal resistive load.

The dimensions of the assembled unit are $1\frac{5}{16}$"H × $7\frac{1}{4}$"W × $6\frac{1}{8}$"D. The 1208 weighs 2.5 pounds. The thick-wall aluminum case is painted black. The lettering is in white.

Final Comments

Coverage of the 6 meter band is accomplished by tuning the HF transceiver from 14.000 to 14.350 MHz. Therefore, 50.000 MHz coincides with 14.000 MHz and 50.350 MHz falls at 14.350 MHz. This indicates that a relatively small portion of the 6 meter band is covered with the 1208. If the tunable IF had been 28 MHz, there would have been greater coverage of 6 meters. However, using 28 MHz as a tunable IF would cause some spurious responses to be transmitted.

I was pleasantly surprised on July 5, 1997 when I gave my callsign on the 50.2 MHz SSB calling frequency at 1555Z and was answered by N8OMS in Arkansas. I received an S9 signal report from the barefoot 1208 tranverter. The antenna was (shame on me) a 160 meter inverted V at 70 feet with 450 ohm ladder-line feeders. A homemade 6 meter Transmatch/SWR indicator was used at the station end of the antenna.

I found the instruction/assembly manual to be clearly written and complete. The price class of the 1208 transverter is a mere $95. Frankly, I am unable to understand how Ten-Tec can offer this quality kit for so little. I consider it the bargain of the century.

The manufacturer is Ten-Tec, Inc., 1185 Dolly Parton Parkway, Sevierville, TN 37862-3710. To order call 1-800-833-7373 or e-mail to <sales@tentec.com>. A kit catalog is available on request. ■