Product Review Column from *QST* Magazine

January 1984

Hustler 6-BTV Vertical Antenna

Mirage Communications D1010 430-450-MHz Amplifier

Trio-Kenwood Communications TS-930S HF Transceiver

Viewstar PT-2000A HF Linear Amplifier

Conducted By Paul K. Pagel,* N1FB

Trio-Kenwood Communications TS-930S HF Transceiver

Every major manufacturer of HF equipment has a feature-packed, state-of-the-art transceiver these days. Kenwood is no exception. The TS-930S is their show piece. This electronic marvel contains a 250-W-input, solid-state, broadband transmitter, a high-performance receiver (including general coverage), synthesized frequency control, a hefty power supply, a bevy of bells and whistles, and even an optional automatic antenna-matching network all in one box.

Describing each and every feature of the '930 would fill considerably more space than available here. Table 1 lists the front- and rear-panel controls and connectors. This review will highlight some of the unique features of the radio.

Frequency Control

The TS-930S employs a push-button bandswitch instead of the conventional rotary-type selector. There is a button for each band from 160 to 10 meters, including the WARC bands. Two push buttons located at the bottom of the bandswitch panel allow tuning up or down in 1-MHz steps to access the nonham frequencies covered by the general-coverage receiver.

Two VFOs are built into the '930. Both share a common synthesizer and are controlled by the main tuning knob. The VFO function switch has settings for transceive on VFO A or VFO B. Using one VFO for transmit and the other for receive is easily possible for split operation. The A=B switch brings the unused VFO to the frequency in use. The VFOs tune in 10-Hz steps, providing frequency transition almost as smooth as in radios with a crystal-controlled LO. The main tuning knob is weighted to give a smooth, high-quality feel.

One feature not standard on most HF rigs (not yet, anyway) is a memory. Up to eight frequencies on any combination of bands may be stored in the '930 memory. Storing a frequency in memory is as easy as tuning to the desired spot and pressing the MIN switch. The MR switch may be used to recall a frequency. The VFO/MEMO switch transfers frequency control from the VFO to the memory switch for selection among the preset channels. Three AA-size batteries in a compartment under the top cover back up the memory when power is disconnected. These memories may be used in a variety of ways. A traffic handler might store chosen net frequencies, while a DXer could program in several pileup frequencies and switch among them.

Contest operators may plug in their favorite frequency for each band before the fray begins so they can bandswitch directly to the active part of the band with a minimum of dial twirling.

Another unusual feature of the '930 is the digital display. Years ago, any digital display attracted attention. Now, they come in all shapes and sizes, and the '930's is white! A red pointer dial underneath the display digits tracks the progress up and down the band in 20-kHz increments. This display is wonderful to look at.

The two digits to the right of the main frequency display show the RIT offset in 100-Hz increments. The RIT range is an amazing ±9.9 kHz, and there is no conventional center off position. Instead, the RIT-CLEAR switch returns the offset to zero.

Receiver

The '930 uses a quadruple-conversion receiver

*Assistant Technical Editor

Table 1
TS-930S Controls and Connections

Front Panel
General
METER switch
POWER switch
DIMMER switch
SEND/REC switch
MODE switch
VOX switch

Frequency Control
BAND switch
1 MHz STEP switch
D.IAL LOCK switch
VFO FUNCTION switch
VFO A=B switch
TF-SET switch
VFO/MEMO switch
MEMORY CH switch
MIN memory write switch
MR memory recall switch

Transmitter
MICROPHONE gain control
CARRIER level control
FULL/SEMI CW break-in switch
PROCESSOR switch
PROCESSOR IN-OUT control
MONITOR switch
AUTO/THRU antenna tuner switch
MIC jack (8 pin)

Receiver
NB1 noise blanker 1 switch
NB LEVEL control
NB2 noise blanker 2 switch
RIT switch and control
RIT-CLEAR switch
NOTCH switch and control
AF TUNE switch and control
NAR/WIDE CW filter switch
AGC switch
PHONES jack (1/4-in phone)†
RF ATTENUATOR switch
AF gain control
RF gain control
CW VBT control
SSB SLOPE TUNE control
PITCH control

Top Panel
VOX GAIN control
ANTI VOX control
VOX DELAY control
CALIBRATOR switch

Rear Panel
ANTENNA connector (SO)-239)
GND ground terminal
RX. ANT output switch
TX. ANT jack (phono)
RX. VERTER connector (8-pin DIN)
REMOTE connector (7-pin DIN)
IF OUT jack (phono)
PHONE PATCH jacks (phono)
RTTY KEY jack (phono)
Power connector
EXT. SPEAKER jack (1/8-in phone)
CW. KEY jack (1/4-in phone)
FUSE 6A holder

†mm = in × 25.4.

Trio-Kenwood Communications TS-930S HF Transceiver, Serial No. 3070685

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency Coverage: Receive — 150 kHz to 29.9999 MHz; transmit — 1.8-2.0, 3.5-4.0, 7.0-7.3, 10.1-10.15, 14.0-14.35, 18.068-18.168, 21.0-21.45, 24.89-24.99, 28.0-29.7 MHz.	Receive — as specified; Transmit — 1.5-1.9999; 3.5-4.0; 7.0-7.4999; 10.0-10.4999; 14.0-14.4999; 18.0-18.4999; 21.0-21.4999; 24.5-25.0; 28.0-29.9999 MHz.
Modes of operation: CW, SSB, AM, FSK.	As specified.
kHz/turn of knob: Not specified.	10.
Frequency display: 6-digit fluorescent.	5/16-in high, white digits.
Frequency resolution: 100 Hz.	As specified.
Backlash: Not specified.	Nil.
S-meter sensitivity (μV for S9 reading): Not specified.	160 m, 155; 80 m, 160; 40 m, 160; 20 m, 160; 15 m, 190; 10 m, 165.
Transmitter power input: 250-W SSB/CW/FSK; 80 W AM.	Power output (measurements without AT-930 tuner in line/with AT-930 in line): 160 m, 110 W, 80 m, 115/105; 40 m, 120/105; 30 m, 120/107; 20 m, 120/110; 15 m, 120/105; 10 m, 115/100.
Harmonic suppression: Better than 40 dB.	50 dB (see Fig. 1).
Third-order IMD: Less than −31 dB.	−35 dB (see Fig. 2).
Spurious suppression: Better than 50 dB.	50 dB (see Fig.1).
Receiver sensitivity: (1.8-30 MHz) less than 0.25 μV for 10 dB S+N/N.	Receiver dynamics measured with optional 500-Hz CW filters installed:

	80 m	*20 m*
Noise floor (MDS) dBm:	−139	−139
Blocking DR (dB):	Noise limited.	Noise limited.
Two-tone 3rd-order IMD DR (dB):	87.5† (99.5)††	86.5 † (96.5)††
Third-order intercept (dBm):	−9.25† (5.75)††	−7.75† (10.25)††

Color: Two-tone gray.
Size (HWD): 5.6 × 14.75 × 13.8 in (141 × 374 × 350 mm).
Weight: 40.8 lb (18.5 kg).

†at 20-kHz spacing ††at 50-kHz spacing

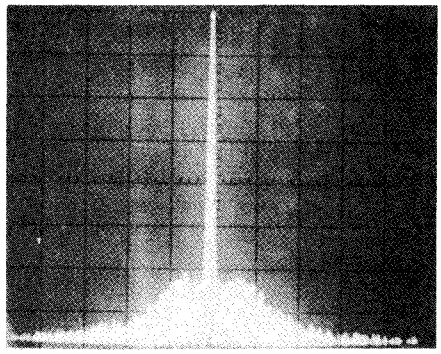


Fig. 3 — Spectral display of synthesizer noise about the carrier. Vertical divisions are each 10 dB; horizontal divisions are each 20 kHz. The TS-930S was being operated at rated input power on the 20-meter band.

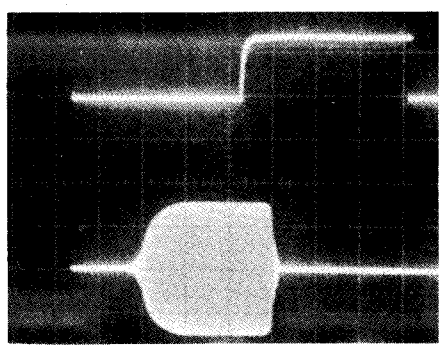


Fig. 4 — CW keying waveform of the TS-930S. Upper trace is the actual key closure; lower trace is the RF envelope. Each horizontal division is 5 ms.

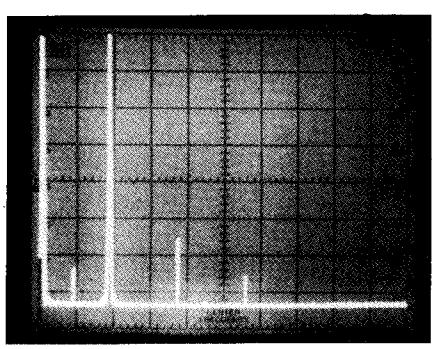


Fig. 1 — Worst-case spectral display of the Kenwood TS-930S. Vertical divisions are each 10 dB; horizontal divisions are each 1 MHz. Output power is approximately 100 W at a frequency of 1.8 MHz. All spurious emissions and harmonics are at least 50 dB below peak fundamental output. The TS-930S complies with current FCC specifications for spectral purity.

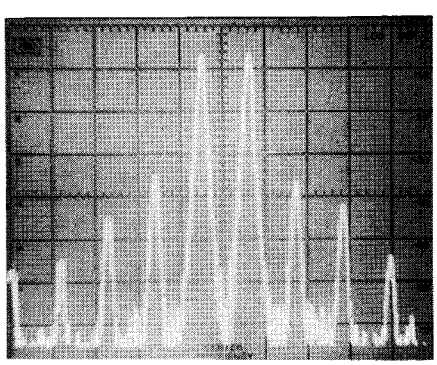


Fig. 2 — Spectral display of the TS-930S output during transmitter two-tone IMD test. Third-order products are 35 dB below PEP, and fifth-order products are 42 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 1 kHz. The transceiver was being operated at rated input power on the 20-meter band.

with the first IF at 44.93 MHz, the second at 8.83 MHz, the third at 455 kHz, and the fourth at 100 kHz. Signals enter the receiver through switched band-pass filters and are sent to paralleled JFET RF amplifiers. The first and second mixers are balanced, employing two more JFETs each. The third and fourth mixers use dual-gate MOSFETs. There are as many different approaches to the state-of-the-art high-dynamic-range receiver as there are rigs, and Kenwood has a winner here.

Not one but two noise blankers are included in the '930. The first, with a threshold control, is effective against pulse-type noise. The second is for pulses of a longer duration, such as those annoying "woodpecker" over-the-horizon radar pulses. The woodpecker blanker really helps. Use of the noise blankers noticeably degrades receiver performance under high-level signal conditions. Judicious use of the NB LEVEL and RF ATTenuator controls will get rid of the noise while keeping overload problems to a minimum.

An entire arsenal of QRM-fighting weaponry is available to the '930 operator. For CW operation, several optional filter combinations are available. The review '930 came with the YK-88C-1 500-Hz second IF filter and the YG-455C-1 500-Hz third IF filter installed. A front-panel NAR/WIDE switch offers selection of the narrow CW filters or the normal 2.7-kHz SSB filters.

The CW VBT control is a continuously variable bandwidth tuning control, which may be used to tighten up CW selectivity. Used with the wide (SSB) filters, the VBT varies the bandwidth from 2.7 kHz down to 600 Hz. With either or both CW filters installed, the VBT range is 500-150 Hz. VBT is especially handy for those times when the narrow filter is too much and the wide filter is not enough. In fact, the VBT works so well that a casual CW operator may never need the selectivity afforded by the optional filters.

In addition to IF filtering, the TS-930S incorporates an effective audio filter. The AF TUNE circuit controls a peak-type audio filter with an 800-Hz center frequency, adjustable ±400 Hz. This filter is useful for reducing unwanted signals and noise.

Yet another feature for the CW op is the PITCH control. The normal CW offset is 800 Hz. For those operators who prefer to listen to a higher (heaven forbid!) or lower note, the PITCH

control simultaneously shifts the IF passband, the received beat frequency *and* the sidetone pitch. This rig is a far cry from the days when CW was added as an afterthought!

Kenwood has not forgotten the SSB operator, either. The SSB SLOPE TUNE controls (HIGH CUT and LOW CUT) allow independent adjustment of the high and/or low frequency slopes of the IF passband. These controls help "cut" interference from stations higher or lower in frequency. In addition, the NOTCH filter (also useful on CW) helps cut SSB QRM.

Even the RF ATTenuator is worth mentioning. Instead of the usual fixed 20 dB or so value, the '930's attenuator is switchable — 10, 20 or 30 dB. This feature allows the operator to choose the right amount for conditions and is especially useful on the low bands.

Transmitter

Kenwood chose a pair of rugged Motorola MRF-422 transistors, each capable of dissipating 290 W, for the final amplifiers. The MRF-422s operate at 28-V dc, and the net result is a clean, cool-running transmitter. Output power is at least 100 W on all bands. The transmitter is broadband, and no tuning is required. SWR-protection circuitry reduces transmitter output if the load SWR is greater than about 2:1. Two quiet cooling fans, one for the final amplifier heat sink and one for the power supply, automatically activate when heat sink temperatures rise and shut off after the temperatures fall below a safe level.

The review TS-930S came with the optional AT-930 automatic antenna-matching network installed. This pi-network uses coils and two motor-driven variable capacitors. According to the manual, it is capable of matching antenna impedances from 20 to 150 ohms. The AT-930 works on all amateur bands except 160 meters. To use the tuner, simply place the AUTO/THRU switch in AUTO, set the mode switch to TUNE, and hit the SEND switch. After some motor whirring and buzzing as the tuner searches for the best match, the transceiver is ready for operation. Tuning ranges are preset for each band, so the automatic operation takes only a few seconds when using a resonant antenna. Just for fun, I tried matching my coax-fed full-size 160-meter inverted V on various bands. The AT-930 matched that antenna for use on each of the 80-10 meter amateur bands!

As mentioned in the receiver portion of this review, CW operation was a primary design consideration rather than an afterthought. The full break-in CW operation is just that — real QSK. The circuit uses CMOS logic to ensure proper sequencing and reed relays for silent operation. The receiver AGC recovers instantly, as it should, making QSK a joy to use.

For the RTTY operator, the '930 has FSK. On transmit, the modem output keying line may be connected directly to the RTTY KEY jack if the voltage on the line is 5-V dc or less. A keying relay must be used with older high-voltage equipment. For receive, the modem input signal may be derived from the PHONE PATCH OUT jack.

Operation

The TS-930S is a quality piece of equipment. All of the controls have a good feel — the variable controls are firm but smooth, and the switches are solid. The front panel is well thought out, making the rig exceptionally easy to use.

There must be active amateurs on Kenwood's design staff because the transceiver has so many subtle useful touches. Most of the receiver bells and whistles really do work in reducing QRM when pulling out weak signals. Rear-panel jacks make connecting an outboard receiver, an external preamp or a different receive antenna (e.g., a Beverage for the low bands) a snap. The speech processor is easy to set up and, properly adjusted, sounds good. Unlike some other solid-state rigs, the transmitter has enough power to drive almost any amplifier to its limit, even on 10 meters. The panel meter even functions as an accurate wattmeter and direct-reading SWR meter. Accessory connectors on the rear panel allow attachment of an array of transverters, phone patches, monitor scopes and other accessory items. This rig has just about everything an active ham could want.

Although receiver dynamics testing in the ARRL lab was somewhat limited by reciprocal mixing noise, at no time during my on-the-air evaluation did I experience phase-noise problems. Even during high-signal-level conditions on the low end of 40 meters, I could not detect any phase noise. I used the transceiver during several contests, on CW and SSB, and the receiver delivered outstanding performance.

I do have two complaints about the '930. Synthesizer switching transients can be heard when tuning the band at a moderate-to-fast rate. These "pops" seem like built-in QRN and are especially annoying when tuning a dying band during a contest looking for very weak signals. The other complaint only comes into play when using the '930 as an IF for VHF and UHF transverters. The advent of transceivers found manufacturers generating CW by injecting a tone into the microphone amplifier circuit, normally in the USB mode. During CW reception, a narrow band-pass filter is usually added to reduce the IF bandwidth. For some reason, Kenwood has chosen LSB for CW generation in the '930S after years of using USB. While this does not affect CW-to-CW QSOs, this presents some problems on the bands above 144 MHz, where CW-to-USB QSOs are common.

All things considered, Kenwood has done an outstanding job with the TS-930S, and anyone considering the purchase of a state-of-the-art rig should audition one. Manufacturer: Trio-Kenwood Communications, 1111 West Walnut St., Compton, CA 90220. Price class: TS-930S with AT-930 antenna tuner, $1800, YK-88C-1 filter, $70; YG-455C-1 filter, $100. — *Mark Wilson, AA2Z*

MIRAGE COMMUNICATIONS D1010 430-450-MHz AMPLIFIER

☐ This solid-state amplifier is designed to operate with as little as 300-mW input to a maximum of 15 W. Such a wide range of input levels provides flexibility so that most any hand-held transceiver, homemade exciter or multimode rig can be used as a driver.

The D1010 operates as a linear amplifier in the CW, SSB, FM and ATV modes. Two front panel switches control all operation: One is the POWER ON/OFF switch, while the FM/SSB switch selects the T-R relay time delay. A hole on the side of the amplifier allows access to a control whose adjustment sets the delay time required when operating SSB. The built-in antenna relay is RF actuated so the amplifier can be used with a transceiver. A rear-panel jack is provided for separate amplifier keying to eliminate relay noise when VOX operation is not used. Grounding this point will key the antenna relay.

The only other front-panel items are two LEDs. One indicates the antenna relay is energized during transmit; the other LED lights when power is applied. If this light should go out during operation, it indicates an overheating condition, and the amplifier will be disabled until

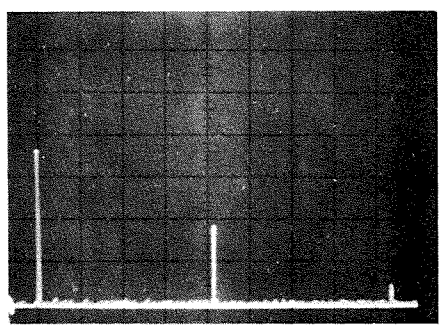
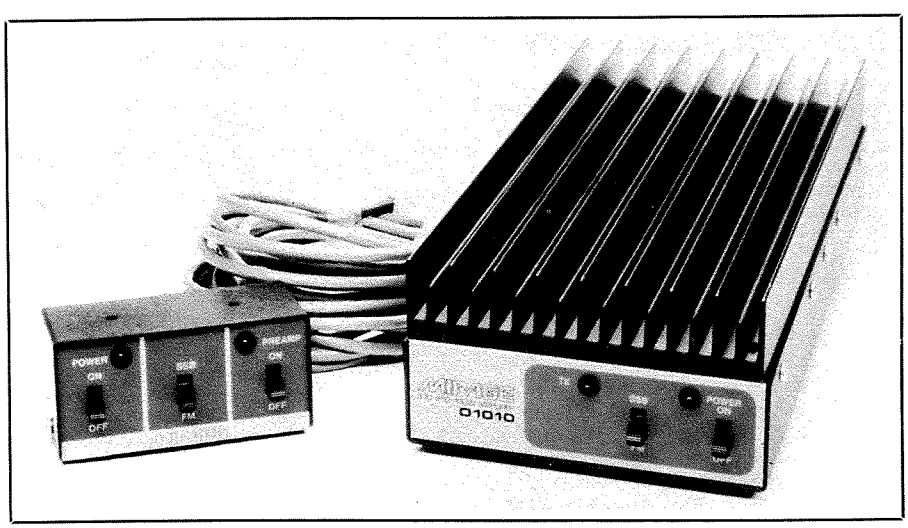


Fig. 5 — Worst-case spectral display of the Mirage D1010 amplifier. Vertical divisions are each 10 dB; horizontal divisions are each 100 MHz. Output power is approximately 100 W at a frequency of 432 MHz. The fundamental (pip at the left of the photo) has been reduced in amplitude approximately 32 dB by means of notch cavities; this prevents analyzer overload. All harmonics and spurious emissions are at least 50 dB below peak fundamental output.



Mirage Communications D1010 430-450 MHz Amplifier, Serial No. 762-1081

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 430-450 MHz.	Confirmed.
Modes of operation: FM, SSB, CW, ATV.	Confirmed (not used on ATV).
Power ratings: Input, 300 mW to 15 W; output, 100 W or more for 10-W input.	10 W output with 300 mW input; 110 W output with 15 W input.
Dc power requirements: 13.6 V at 20 A (nominal).	Confirmed.
Fuse: 35 A (internally mounted).	Confirmed.
Size (HWD): 3 × 5½ × 12 inches.†	
Weight: 5 lbs.	
Price class: D1010 (N connectors), $329; D1010 (UHF connectors), $319; RC-1, $25. Available from Mirage Communications Equipment, Inc., P.O. Box 1393, Gilroy, CA 95020.	

†mm = in × 25.4; m = ft × 0.3048; kg = lb × 0.454.

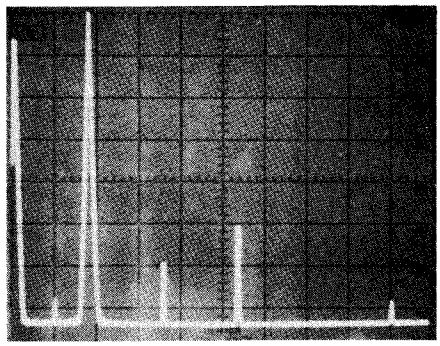


Fig. 6 — Worst-case spectral display of the Viewstar PT-2000A amplifier. Vertical divisions are each 10 dB; horizontal divisions are each 1 MHz. Output power is approximately 600 W at 160 meters. All harmonics and spurious emissions are at least 55 dB below peak fundamental output. The PT-2000A complies with current FCC specifications for spectral purity.

the temperature reaches 140° F. A built-in thermostat turns off all power when the heat sink temperature reaches 170° F. The amplifier must be located where air can circulate over the heat sink.

Rear panel RF input and output connectors are type N or UHF (your choice). The remote keying jack is a phono connector, and a six-pin Molex connector is provided for use of the RC-1 Remote Control Head. Amplifier power is applied through a two-conductor pigtail of no. 6 stranded wire.

This amplifier performed without any problems over a long period of contest and satellite operation. Operating through the new OSCAR 10 satellite proved that the 100-W output was more than adequate when used with a 10-dB-gain circularly polarized antenna with switchable sense (LHCP and RHCP). This seemed to be just the right amount of power because of line losses in a 50-foot run of 10-year-old coax. I measured 50 W at the antenna feedpoint which netted the AMSAT maximum recommended of 500-W ERP.

The amplifier was used for terrestrial operation from the home station and while mobile. When operating mobile, the amplifier was installed in the engine compartment, near the battery, at a point where there is adequate ventilation (mounting brackets are supplied with the amplifier). The RC-1 Remote Control Head made this kind of installation convenient for mobile as well as fixed operation. At home, I placed the amplifier in an attic location, along with the power supply, so the feed line losses could be held to a minimum while using a roof-mounted tower/antenna combination. In this installation, an attic fan was used during summer operation and the amplifier was located near the eave intake vent for maximum cooling. Though I did not attempt it, this amplifier could conceivably be installed in a weatherproof box near the antenna. A receiving converter, a preamplifier and a switching relay could also be installed in the weatherproof box. This would help eliminate any line losses.

Mirage has a five-year limited warranty on materials or workmanship (except power transistors) from date of purchase, for the original owner. The RF power transistors are warranted for one year. — *Bernie Glassmeyer, W9KDR*

VIEWSTAR PT-2000A HF LINEAR AMPLIFIER

☐ The PT2000A is a deluxe HF amplifier featuring 1.8- to 30-MHz coverage, a 2.3-kW SSB power-input rating, a CCS (CW, SSTV, RTTY) 1.3-kW power-input rating and a pi-L output network for good harmonic suppression.

On the Inside

What separates one amplifier from another? Many would agree that the power supply and the cooling system are two important factors. The '2000A uses a heavy-duty (30 lb) plate transformer and voltage-doubler circuit to produce 2900 V in the SSB mode and 2300 V in the CW (or CCS) mode.[1] A pair of Eimac 3-500Z zero-bias triodes provide amplification, and they are cooled by a plenum cooling system consisting of a squirrel-cage blower, air-system sockets and Viewstar-designed chimneys.[2]

With a large number of transceivers today using solid-state final amplifiers, the input SWR of an external power amplifier has become increasingly important. The Viewstar unit uses pi input networks on each band, and has a worst-case input SWR of 1.7:1 (see data table) — most transceivers should drive the amplifier with no difficulty. A toroid core is used in the output matching network to provide the required inductance for 1.8-MHz operation; this reduces the overall size of the output tank.

[1]kg = lb × 0.454.

[2]Plenum: a condition in which the pressure of the air in an enclosed space is greater than that of the outside air pressure.

External Controls and Connectors

The front-panel layout is simple yet functional; the TUNE and LOAD controls drive their respective capacitors through smooth vernier mechanisms with two large knob skirts indicating relative position on a 0-100 scale. WARC-band markings are included on the BAND switch, which has five positions (U.S. model). Other front-panel controls and indicators include a STANDBY/OPERATE switch, which allows bypassing the amplifier, metering of high voltage (1-4 kV), grid current (0-400 mA), plate current (0-1 A), forward power (0-2 kW) and reflected power (0-200 W); and two panel lamps that indicate OPERATE or STANDBY conditions.

An uncluttered rear panel has jacks for RF IN and RF OUT (SO-239), ANT RELAY and ALC (phono), AC INPUT (CEE-22) and a standard

Viewstar Model PT-2000A HF Linear Amplifier, Serial No. 2000-8249-5048

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Modes of operation: SSB, CW, AM, RTTY, ATV	As specified.
Total frequency coverage (MHz): 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18, 21-21.45, (24 and 28-29.7 on non-U.S. models).	As specified (not tested at 10.1, 18, 24 or 28 MHz).
Drive power: 75-100 W nominal.	For 1-kW input: 160 m, 54 W; 80 m, 73 W; 40 m, 68 W; 20 m, 69 W; 15 m, 58 W;
Output power: Not specified.	At 1-kW input: 160 m, 600 W; 80 m, 660 W; 40 m, 680 W; 20 m, 680 W; 15 m, 640 W;
Efficiency: 60% nominal.	At 1-kW input: 160 m, 54.6%; 80 m, 58.7%; 40 m, 61.2%; 20 m, 61.0%; 15 m, 58.2%;
Input SWR: Less than 1.5:1.	160 m, 1.70:1; 80 m, 1.38:1; 40 m, 1.00:1; 20 m, 1.45:1; 15 m, 1.70:1.
Harmonic and spurious suppression: 50 dB.	Worst case: −55 dB (see photo).
Third-order IMD suppression: −33 dB.	
Maximum ac line input power: 115 V/15 A or 230 V/8 A.	Confirmed.
Weight: 70 lbs.†	
Dimensions: 8½ × 17 × 18 in.	
Color: Two-tone gray.	

†mm = in × 25.4; kg = lb × 0.454.

two-pin ac jack for an optional Muffin® fan.[3] Also on the rear panel are holders for the AC MAIN and ZENER (for cathode overcurrent protection) fuses.

Mechanical Details

Total PT-2000A weight is 70 pounds! The chassis and cabinet are constructed of heavy-gauge aluminum. Picking up the end of the cabinet opposite the power transformer does not bend the cabinet at all. (Try that test with other amplifiers.) The sides and top are a single shell that is bolted to the main chassis by no less than *33* screws, but the tight cabinet should help prevent TVI. Removal of the cabinet shell activates a safety interlock switch that disconnects primary power from the amplifier.

On-the-Air Tests

During the review period, I used the amplifier in conjunction with an ICOM IC-740 HF transceiver.[4] Apartment living dictates 117-V ac power, so the '2000A was rewired for low-voltage operation (it comes factory wired for 234 V). (Luckily, my apartment has 30-A circuit breakers and heavy-gauge wiring — the line-voltage drop at 1-kW input is less than 2 V.) You will appreciate the power-transformer terminal block and wire-lug terminations; they really simplify the rewiring.

Viewstar suggests adding an optional Muffin fan if continuous-duty operation is anticipated; the review unit included this fan. After many hours of CW contest operation, the unit remained cool, except for a small area on the top of the cabinet, directly above the tube chimneys.

My apartment building has a CATV system that employs 300-ohm ribbon cable for distribution. Braced for a large dose of TVI when the amplifier was activated, I was pleasantly surprised! Not one complaint of interference, except from my roommate, who noticed a little crosshatching on Channel 3 while I ran a "gallon" on 15-meter SSB.

"Final" Thoughts

The PT-2000A is certainly a "deluxe-class" amplifier. Some readers may not like the choice of the older 3-500Z triodes as the active devices; they would prefer a single ceramic-metal tube, such as the Eimac 8877. I agree with Viewstar — the 3-500Z is a low-cost, rugged tube that simplifies mechanical construction. What else can I say about the amplifier? Anyone who is looking for heavy-duty kilowatt "shoes" should take a close look at the '2000A. (During the preparation of this review, Viewstar announced the availability of the PT-2500A. According to the manufacturer, this improved model is capable of providing the 1500-W output level now permitted by FCC regulations).

Price class of the PT-2000A is $1495. For more information, contact Viewstar, Inc., 1690 Walden Ave., Buffalo, NY 14225, or 705 Progress Ave., Scarborough, ON M1H 2X1, Canada. — *Gerry Hull, VE1CER/W1*

[3]This specification outlines the use of a three-wire (grounded) ac connector with rectangular pins. It's the type you see on new electronic test equipment, computer hardware, and so on. (P. Rinaldo, "Microphone and Power Connector Standards," *QEX*, Sept. 1982).

[4]The ICOM IC-740 HF Transceiver, "Product Review, *QST*, Sept. 1983, p. 39.

HUSTLER 6-BTV VERTICAL ANTENNA

☐ One week after the 6-BTV was ordered from Hustler, a 6-foot-long box of aluminum and small parts arrived. A check of the package contents and a review of the instructions assured me this would be an easy job. The assembly instructions are clear, and there are no difficult procedures involved. Following the manufacturer's suggested measurements exactly, I had the antenna ready for mounting one hour later.

The antenna-raising weather was perfect — cold and rainy. I drove a 5-foot mast 42 inches into the earth and installed a 10-foot ground rod next to the mast. Placement and removal of the 23-foot antenna is not difficult. The radiating element slips over, and is clamped to, a heavy-walled stub that projects from the mount.

Hustler suggests connecting the coaxial cable to the antenna mount directly. It is better to make a short lead with one end fastened to the antenna mount and a connector at the other. This allows convenient removal of the antenna mount even when the cable is buried. Hustler also recommends a shield choke (10 turns, 6-inch-diameter) at each end of the transmission line. This choke prevents RF currents on the outside of the shield from affecting the SWR and radiation pattern. Each choke requires 15 feet of cable.

I adjusted the antenna for minimum SWR on each band from 10 through 80 meters. After spending several hours adjusting the antenna, I found it still wasn't resonant on the 30-meter band. A 20-inch tube below the 20-meter trap was too short, and the 24-inch tube above the trap too long, for proper adjustment. When the tube positions were reversed, the situation

Table 2
Hustler 6-BTV SWR Measurements

Frequency	*SWR*	*Frequency*	*SWR*
3.500	3.74	21.000	1.71
3.525	2.34	21.050	1.71
3.550	1.34	21.100	1.72
3.575	1.53	21.150	1.72
3.600	2.59	21.200	1.71
3.625	4.75	21.250	1.73
3.650	6.72	21.300	1.84
		21.350	1.97
Frequency	*SWR*	21.400	2.11
7.000	1.77	21.450	2.11
7.050	1.48		
7.100	1.22	*Frequency*	*SWR*
7.150	1.51	28.000	2.18
7.200	1.68	28.100	2.14
7.250	2.40	28.200	1.96
7.300	3.04	28.300	1.96
		28.400	1.94
Frequency	*SWR*	28.500	1.92
10.100	1.40	28.600	1.92
10.150	1.69	28.700	1.94
		28.800	1.91
Frequency	*SWR*	28.900	1.91
14.000	1.43	29.000	2.04
14.050	1.43	29.100	2.02
14.100	1.42	29.200	1.98
14.150	1.53	29.300	2.01
14.200	1.83	29.400	2.05
14.250	2.01	29.500	2.05
14.300	2.37	29.600	2.08
14.350	2.72	29.700	2.20

improved. Measurements with a calibrated wattmeter still yielded an SWR of 3.5:1 at 10.15 MHz and 2.5:1 at 10.1 MHz. This poor SWR performance merited a call to the manufacturer. I was informed that their test unit works fine, but the 20-inch tube is required between the 20- and 30-meter traps; this confirmed my experience and that there is an error in the assembly instructions.

Conditions at my site require a tube even shorter than 20 inches above the 20-meter trap. A 4-inch piece was cut from the 20-inch tube to obtain the 30-meter SWR curve shown in Table 2. Further shortening of the 20/30-meter and 30/40-meter tubes would result in better SWR readings, but those shown suit my needs as a CW operator. All antenna sections, except the 15/20-meter tube, were shortened to their minimum length as a result of tuning.

Bad experience in my youth with a vertical antenna made me curious about this one. I decided to experiment without radials to see if they were necessary at my location. Hustler states that the efficiency of the ground system can be judged by comparing the resonant antenna length to the nominal lengths given for assembly. If the antenna is shorter after adjustment, ground conductivity is better than average. The adjusted length of my antenna is short, so radials are not required. Radials will be installed only if the SWR increases as the soil dries. As spring and summer passed, the SWR was still low, and no radials needed.

Operation

My misgivings about vertical antennas were soon dispelled. The first contact with the new antenna was 4Z4QE (on 20-meter SSB with 100-W output). For Field Day, I transported the 6-BTV, in three pieces, to a lake in New Hampshire. Installation and disassembly each required 15 minutes. At the Field Day site, the 6-BTV was above 12 inches of water on the east shore of the lake. The ground plane was excellent for a minimum of 10 wavelengths to the north, west and south; reports of strong signals were received from California, Texas and Colorado.

Conclusion

I have two minor complaints about the 6-BTV. First, assembly of a purchased antenna should not require cutting of aluminum tubes. Second, the nuts and bolts should be stainless steel; after only four months, there is visible corrosion on these parts. Performance of the 6-BTV is satisfactory and compares well with my inverted V. The V was slightly directional, but a lower angle of radiation seems to give the vertical antenna a small advantage for DX work. The 6-BTV requires no band switching and little tuning. Bandwidth is adequate to cover all bands except 80 meters, where only 90 kHz is usable without a Transmatch. The 6-BTV is available from Hustler, Inc., 3275 N. B Ave., Kissimee, FL 32741. Price class: $140. — *Bob Schetgen, KU7G*

Strays

BORN-AGAIN HAM

☐ A chance encounter a while ago with a magazine article about Amateur Radio carried me back in memory to Chicago where, as a boy, I sat mesmerized in front of a "cat's whisker" and a piece of galena listening to dots and dashes from ships on Lake Michigan and a few hams nearby. Back to mind also came that day in 1920 when, as a freshman in high school, I passed the "government exam" and was issued the call letters 9APH.

Then I remembered the various rigs I had built, from a Ford coil to a 1-kW "rock crusher." The crashing noise of its rotary spark gap could be heard all over the neighborhood! And I thought about the advent of CW and about my very first phone contact in 1923, when the carbon grains in my microphone overheated and stuck together. For me, it was the greatest of hobbies, but things like getting married and raising a family took precedence. Then came 20 years producing motion pictures, 25 more years as a cattle rancher and, ultimately, retirement.

After all these years, I met a ham through the ARRL who helped me get a Novice ticket and then, a few months later, my General class license. Back "pounding the brass" in 1982, I felt like Rip Van Winkle. If Rip found changes when he awoke, you can imagine what I found after being off the air for almost 60 years! — *Burt Depue, N7EJY, Wickenburg, Arizona*

NAVY HONORS THREE RADIO AMATEURS POSTHUMOUSLY

☐ On the occasion of the 60th anniversary of the Naval Research Laboratory in Washington, DC, ceremonies were held on October 19, 1983. Among the guests was Secretary of the Navy John F. Lehman, Jr., who addressed the more than 400 people who attended. Of particular interest was the recognition of three pioneer members of the NRL staff who made many contributions as scientists to Naval electronics, radar and communications systems. Significantly, all were radio amateurs, and this point was recognized by the speakers.

Dr. Louis A. Gebhard, ex-8AG (1896-1981), was employed by the Laboratory from 1923 until his death. Dr. A. Hoyt Taylor, ex-9YN (1879-1961), and Leo C. Young, W3WV (1891-1981), are credited as discoverers of the radar effect, which set the stage for developments that changed the course of history during World War II. The three first met as young men communicating with one another from their homes via Amateur Radio in different parts of the country. It was their mutual interest in propagation effects, developed in the course of their Amateur Radio activities, that led to their friendship and, later, to their joining the group that founded the NRL in 1923. Each of the three later received the Presidential Certificate of Merit from President Truman.

Other speakers at the ceremony included Rear Admiral Leland S. Kollmorgan, USN, Chief of Naval Research; Dr. Timothy Coffey, Director of Research at NRL; and Dr. Robert A. Frosch, Vice President of General Motors Corporation. Also speaking was Captain John A. McMorris II, USN, Commanding Officer of the Laboratory, who added a special welcome to the radio amateurs and representatives of ARRL. Three streets in the Naval Research Laboratory compound were renamed, one for each of the three honored scientists. — *Vic Clark, W4KFC*

SKIERS HAVE NET

☐ A worldwide net for advanced and would-be advanced powdered-snow skiers has been established. Net control is David Arnold, KA1CPL, a trustee of the U.S. Ski Team. New participants are welcome. Contact KA1CPL, 309 Musterfield Rd., Concord, MA 01742, tel. 617-369-4548.

QST congratulates...

☐ Technical Advisor Richard K. Olsen, N6NR, on being appointed as an Adjunct Professor of Business by the Board of Directors at La Jolla University of California for his outstanding experience and performance in the business community.

☐ Tennessee Section Emergency Coordinator Melvin L. Chandler, K4TKQ, on receiving the 1983 Union Carbide Corporation Nuclear Division Community Service Award.

New Products

MOTOROLA MOC8100 OPTOCOUPLER

☐ An optocoupler (optoisolator) capable of operating with an input current of only 1 mA (most optoisolators require a 10-mA level) is being produced by Motorola. The MOC8100 consists of a gallium-arsenide LED coupled to a sensitive silicon phototransistor contained in the standard six-pin DIP. It has a guaranteed minimum current transfer ratio of 50%, and is capable of being driven directly from low-level logic and telecommunications circuits. The device has an isolation rating of 7500 V. These units are available from authorized Motorola distributors, and are priced at $1.20 each in quantities of 100-999. — *Paul K. Pagel, N1FB*