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Kenwood TW-4000A 2-m/70-cm FM Dual Bander

Maggiore Electronic Laboratory Hi Pro MK I 2-m Repeater

Mirage Communications A1015 6-m Amplifier

Product Review

Conducted By Paul K. Pagel,* N1FB

Kenwood TW-4000A 2-m/70-cm FM Dual Bander

POWER ON. V. GO TEN GO, GO, GO.
POWER ON. V. FIVE POINT FIVE, FIVE, FIVE.

Egad! A talking radio! Kenwood's FM Dual Bander knows more Japanese than I do! (The voice-synthesizer option for the TW-4000A has Japanese and English vocabularies. A switch inside the rig selects the language. More on this later.)

The TW-4000A is Kenwood's latest high-tech VHF/UHF FM transceiver. The 25-W rig sports a liquid-crystal display panel that shows frequency, offset, memory channel, received-signal strength in S units and a relative-power-output bar graph that doubles as a modulation indicator when used in low-power transmissions. All function switches are backlit with a pleasant green.

Kenwood supplies an UP/DWN 16-button DTMF mike. The review unit is supplied with the optional VS-1 voice synthesizer and TU-4C programmable subaudible tone (CTCSS) encoder.

Ten memory channels store frequency and offset. Memory zero can be used to program those "oddball splits," and can be used for crossband (2-m/70-cm) operation. In the "Priority Watch" (PR.W) mode, the rig switches back to Channel 1 for one second of every 10, regardless of mode. Each time the priority channel is checked, the rig beeps. This priority channel watch is a "listen only" function. For example, you have your favorite 2-meter simplex frequency programmed as Channel 1, and you're waiting for a net to start. In the meantime, you are in a QSO through a 440-MHz repeater. Press the PR.W button, and every 10 seconds, the 2-meter simplex frequency will be checked. Press the PR.W key again to cancel the watch.

A programmable scanning feature adds to the versatility of the rig. This gives the operator freedom to choose the scanning sequence. In the Memory Recall (MR) scan mode, you can scan all memory channels, only the VHF channels or only the UHF channels. Any 1-MHz segment of a band can be searched in the VFO scan mode. The COM function is interesting — press the COM 8 or COM 9 key and then press the SCAN button. Memory Channels 8 and 9 are alternately scanned every five seconds, ignoring other channels. To stop the COM scan, press the COM-8 or COM-9 button, or key the microphone. This scan mode does not stop when a signal breaks the squelch. Scanning direction can be controlled by the UP/DOWN controls on the mike or front panel. Want to skip a memory channel during each scan? Press M.

The dual VFOs tune in 5- or 10-kHz steps (2 m) and 5- or 25-kHz steps (70 cm), selectable by the front panel F.S. (Frequency Step) switch. Tuning may be accomplished using the front panel VFO knob or the UP/DOWN mike buttons.

The CTCSS encoder option mounts inside the radio and is programmed with DIP switches. There are two independently programmable encoders, giving you one "reed" frequency for each band. (It looks like a simple matter to expand this by wiring some outboard toggle switches to each DIP switch.)

A spring-loaded "slide lock" mobile mounting bracket is furnished with the rig. I found this an excellent mounting scheme for those, like me, who are wary of "radio rip-off." Simply match the securing bosses to the slots on the bracket and slide the radio right in. It's much easier to remove and stow the radio with this bracket than it is with those wrap-around or thumb-screw type brackets.

Kenwood TW-4000A 2-m/70-cm FM Dual Bander

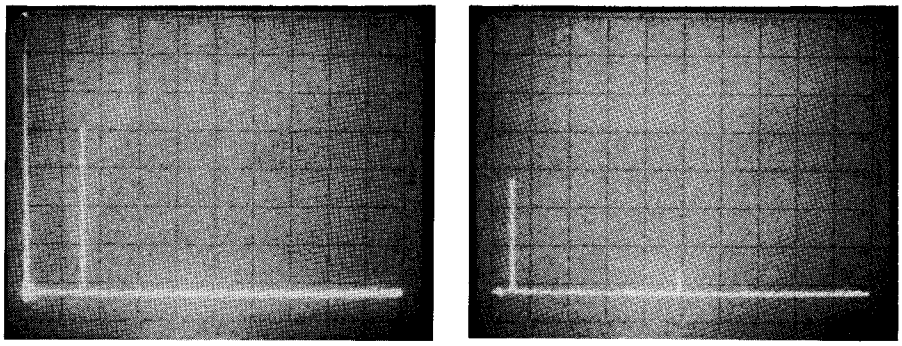
Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: VHF — 144.00-148.00 MHz; UHF — 440.00-450.00 MHz.	142-148.995. 440-449.975.
RF output power: 25-W HI (both bands); 5-W LOW (internally adjustable to about 10 W).	VHF: 25 W (HI), 1.7 W (LOW); UHF: 24 W (HI), 3.6 W (LOW).
Spurious requirements: Less than −60 dB.	See photograph.
Power requirements: 13.8-V dc ±15%.	
Current drain (at 13.8-V dc):	
Rx — 0.6 A with no signal;	570 mA
Tx — 7.5 A (HI), 3.3 A (LOW); approx. 2 μA for backup.	6.1 A VHF, 6.6 A UHF (HI); 2.6 A VHF, 2.8 A UHF (LO).
Receiver type: Dual-conversion superheterodyne; 1st IF — 30.865 MHz, 2nd IF — 455 kHz.	
Sensitivity: SINAD 12 dB less than 0.17 μV; S+N/N more than 30 dB at 0.63-μV input.	0.13 μV/12 dB SINAD, 0.76 μV/30 dB quieting (145.45 MHz); 0.15 μV/12 dB SINAD, 0.88 μV/30 quieting (443.5 MHz).
Audio power output (8-ohm load): More than 2.0 W, 10% THD.	1.9 W.
Size (HWD): 2.7 × 6.3 × 8.5 in (60 × 161 × 217 mm).	
Weight: 4.18 lb (2.0 kg).	
Color: Gray, silver, green.	

Operating Impressions

I used the TW-4000 as a mobile rig (with the MA-4000 dual-band mobile whip) and as a base station. Fortunately, I was able to operate the radio while on vacation in sunny Southern California, where 440 machines seem to be in abundance. I made quite a number of new friends while on the air.

The radio itself performed flawlessly, although the voice box developed a case of laryngitis. The voice synthesizer did not work properly when I first got the rig — the "woman" inside would only talk when the V.RCL (Voice Recall) button was depressed and held down. No automatic voice announcement was heard even with the bottom panel V.ON/OFF (Voice On/Off) switch ON. A trip to the Kenwood facility in Compton

*Assistant Technical Editor



(A) (B)

Fig. 1 — Worst-case spectral displays of the Kenwood TW-4000A. At A, the output power is approximately 28 W at a frequency of 146 MHz. The fundamental has been reduced in amplitude approximately 30 dB by means of notch cavities to prevent analyzer overload. At B, the output power is about 25 W at a frequency of 445 MHz. The fundamental has been reduced in amplitude approximately 42 dB by means of notch cavities to prevent analyzer overload. In both cases, vertical divisions are each 10 dB and horizontal divisions are each 100 MHz. The TW-4000A complies with current FCC specifications for spectral purity.

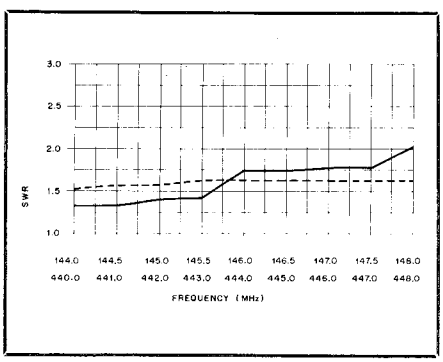


Fig. 2 — SWR curve for the Kenwood MA-4000 2-m/70-cm mobile antenna. Antenna was mag-mounted to the top center of a pickup truck cab. All measurements were taken with a Sola Basic Dielectric Directional RF wattmeter, Model 1000, 50 ohms. Solid line refers to 2 meters; dashed line to 70 cm.

revealed that a small jumper wire should have been cut when the VS-1 was installed. How embarrassing!

This solved the operational problem, but a few days later the voice became intermittent. So, back to Kenwood it went. An oscillator was replaced. Now the laryngitis is cured, and no malfunctions have reappeared. (A few QSOs with other '4000 users indicate that this problem is an isolated case.)

Programming the radio is surprisingly simple, once you get the hang of it. Simply press the M.CH (Memory Channel) button, which selects the channel number, dial in the desired frequency with either VFO, select the offset using the OFFSET switch and, finally, press M. A beep tells you that the radio will remember your channel selection. A built-in lithium battery backs up the memories, even when the radio is disconnected from the power source.

With the optional VS-1 voice synthesizer, you're never alone. "She" announces "power on" when the rig is powered up. (Interestingly, "power on" is "power on" in Japanese.) Any change in control settings makes her talk.

When the VFO frequency is changed, she says, "V" (for VHF) or "U" (for UHF), followed by the last four digits of the VFO setting. Using the example at the beginning of this review, the VHF frequency is 145.555 MHz. Memory channel number, frequency offset and VFO in use are also announced. Kenwood has thoughtfully provided a control on the voice module to adjust the voice level, as well as a switch (V.ON/OFF) to turn the automatic voice announcement off. When the V.ON switch is OFF, the front panel V.RCL (Voice Recall) button can be used to hear the voice on command. ("Power on" is announced regardless of either switch setting.) I noticed that after a few days of use, the novelty of the voice wore off, and I preferred to hear it only on demand.

On-the-air reports indicate that the transmitted audio is constantly crisp and clear, and 25 W of RF power helps in fringe areas. The compactness of the radio does not adversely affect the ease of operating the front-panel controls; however, the tone-pad mike, with its small rubber buttons, is a bit hard to use. My fingers aren't particularly large, but punching the little rubber keys seemed difficult while mobile. Similarly, I found it hard to keep my fingers off the UP/DWN buttons while holding the mike. At best, this spoils reception; at worst, you can "swish" the VFO while transmitting. A dial-lock feature seems to be needed here. But, after a short period of use, you'll learn to keep your fingers away from the buttons.

The priority-watch function is nice, but it can be annoying sometimes. If you are in QSO, the rig jumps to Channel 1, almost always at the wrong moment. I found that the best time to use the PR.W is when you're listening to the radio on a "dead" night.

The antenna connectors on the rear panel are SO-239s. I thought it a bit strange and felt a bit disappointed that type of connector is used at the 440-MHz port. I expected to see a BNC or N connector there so there could be absolutely no question which port is which. Kenwood does provide UHF and VHF labels, which don't stick very well, to mark the antenna cables.

I had the opportunity to get some operating impressions from Kitty Hevener, WB8TDA, ARRL Handicapped Program Coordinator. Kitty is particularly concerned about a radio's operating ease for physically handicapped individuals. She felt that the TW-4000's small push-button controls would be difficult for persons with limited fine-motor skills to manipulate. On the plus side, Kitty felt that the voice synthesizer and the detents on the VFO knob (the setscrew hole and bevel) would enhance a visually impaired person's ability to locate specific frequencies.

Final Comments

The '4000 is an awesome rig. Everyone is first fascinated by the green glow of the front-panel controls. Then they smile when the radio talks! Kenwood is on the right track for what the mobile operator wants. After getting used to the radio's quirks, I had no problem reaching for the right controls while operating mobile at night.

Owners of this radio have two rigs in one little box. Using the MA-4000 dual-band antenna, there is but a single spike sticking out of the car. And, by adding the VS-1 voice module, you'll never be alone. Who knows? Maybe more hams will become familiar with the Japanese language by using the radio with the module switched to the JA position!

Price classes: TW-4000A, $600; VS-1 voice synthesizer, $40; TU-4C two-frequency programmable CTCSS encoder, $40; MA-4000 dual-band antenna, $45. Contact the Trio-Kenwood Corp., 1111 West Walnut St., Compton, CA 90220, for more information. — *Wayne T. Yoshida, KH6WZ/W1*

MAGGIORE ELECTRONIC LABORATORY HI PRO MK I 2-m REPEATER

☐ This is W1OD listening ... cccssh. If this sounds familiar, you've probably experienced 2-meter FM. Because of the low price of synthesized gear available for this mode, many HF operators have stepped up to the 144-MHz band. Many choices are available to the FM enthusiast, and repeater clubs have sprung up everywhere.

One element universal to 2-meter FM operation is the repeater. The Maggiore Hi Pro MK I is a unit that should be considered by the first-time repeater group that wants to start off right, or for the group interested in upgrading their machine to first-class status without a "3-kilobuck" price tag.

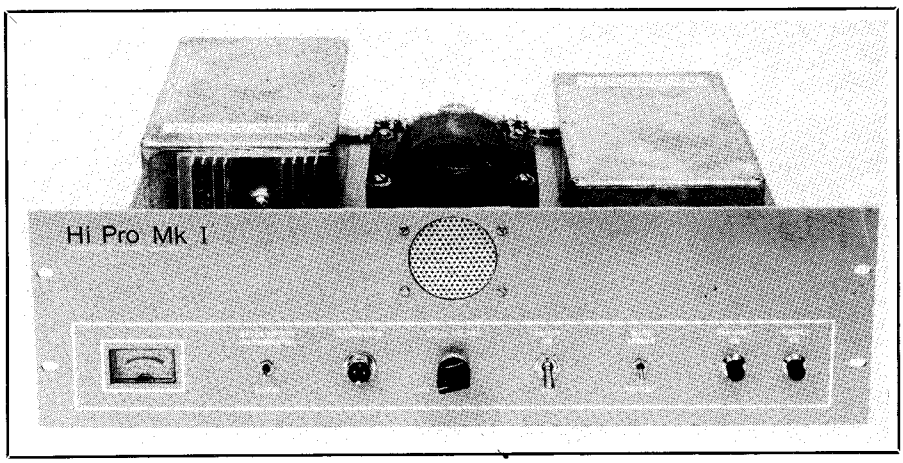
Mechanical Details

Mechanically, the Hi Pro is quite a rugged machine. The transmitter/power amplifier and receiver circuit boards are mounted atop the chassis in heavy-duty, cast-aluminum boxes for mechanical protection and electrical shielding. Shielding is important in repeater operation: without it, receiver desensitization becomes a problem, limiting repeater coverage.

The remaining components are contained on the underside of the heavy-duty chassis, of suitable size for convenient mounting in a standard 19-inch rack.[1] The organization of the components and cable harnesses is neat — there's plenty of room to install custom circuits for your machine. The review unit is a "bare-bones" unit, consisting of a receiver, transmitter/power amplifier and power supply. A built-in ac-operated power supply makes installation of the MK I a "plug-in and go" operation. Connections for external power (such as a 12-V battery for emergency power) and control are made via a terminal strip at the chassis rear.

A built-in 2½ × 1½-inch speaker may be used to monitor local audio. Audio level through this

[1]mm = in × 25.4.



Maggiore Electronic Laboratory Hi Pro MK I, Serial No. PO51176F

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Receiver sensitivity: 0.35 μV for 20-dB quieting.	0.30 μV for 20-dB quieting.
Audio output power: 2 W at less than 8% THD.	1 W at 10% THD.
Squelch sensitivity: Not specified.	0.46 μV (min.). 2.3 μV (max.).
Transmitter power output: 25 W min.	25 W.
Color: Gray.	
Size: (HWD) 5.5 × 18 × 12 in.†	
Weight: 15 lb.	

†mm = in × 25.4; kg = lb × 0.454.

speaker is varied by a panel-mounted control. Three switches on the front panel control POWER ON/OFF, S-METER/DISC. and SIMPLEX/REPEAT. The latter control is handy for turning off the transmitter while adjusting the antenna system.

The Receiver

The receiver is contained in a 2-1/4 × 4-5/8 × 7-1/4-inch (HWD) cast-aluminum box. It is a crystal-controlled, dual-conversion superheterodyne, and uses a third-overtone (44-MHz) crystal to determine the operating frequency. A 3N204 is used in the front end, allowing the receiver to boast a 12-dB SINAD sensitivity of 0.32 μV. A 150-μV signal is required to register S9 on the meter.

The Transmitter

The MK1 transmitter is contained on two PC boards: one for the exciter, and another for the power amplifier. Both boards are housed in a sturdy 3¼ × 4½ × 7½-inch (HWD) cast-aluminum box.

The exciter is crystal-controlled, and uses a fundamental-cut 12-MHz crystal for frequency control. A tripler and two doublers are used after the oscillator to generate the 2-meter signal. Exciter output is 4W.

Final amplification is achieved by a single MRF240 operated class C. This circuit, when driven with the 4-W exciter output, generates approximately 25 W of RF output. Adequate heat sinks provide for continuous operation at ambient temperatures below 90° F. The manufacturer recommends fan cooling at temperatures above this level.

Alignment

Receiver and transmitter alignment is straightforward, and should present no difficulty to most users with access to a modest test bench. An FM signal generator and a VTVM are necessary for proper alignment. A purist might find an audio-distortion analyzer helpful in achieving maximum SINAD sensitivity.

Transmitter alignment requires a wattmeter, a frequency counter, a dummy load and a VTVM. After the oscillator is on frequency, certain exciter-board test points are monitored with the VTVM while adjustments are made. To align the final amplifier board, adjust the output LOAD and TUNE controls for maximum power output with minimum driver collector current.

In all cases, the manual clearly calls out each alignment procedure. Pictorial views of each circuit board, with all components clearly labeled, make alignment a simple task.

Operation

The Hi Pro MK I repeater has been in use at W1AW/R for several months, and few problems have been noticed. Our repeater site is atop Cedar Mountain in Newington, on the roof of a hospital. This is a heavily populated site, with several low-band VHF and two UHF transmitters at the same location. Antenna separation is less than 20 feet, providing a severe test of IMD performance. One of the VHF repeaters happens to be separated from our receiver input frequency by 11.155 MHz, the frequency of the second local oscillator. This resulted in a spurious response, and some squelch-breaking interference whenever the local ambulance company had a call! A ¼-wave stub with an antiresonant circuit (an approximate 25-dB notch) was sufficient to totally eliminate the interference.

The transmitter is also rugged. At one point during testing, some receiver desensing was noticed, and the transmitted signal sounded weaker than normal. This situation lasted for two weeks before a trip to the site could be arranged. Someone had detuned the duplexer transmit cavities, and the transmitter was operating into a 5:1 SWR for two weeks! The damage? None! A tribute to a well-designed transmitter.

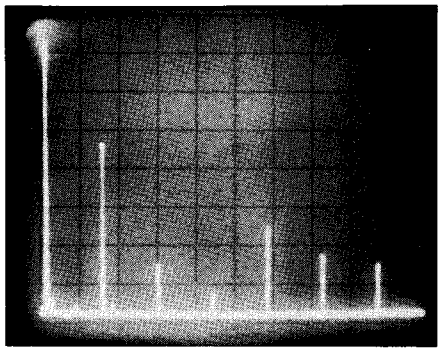


Fig. 3 — Worst-case spectral output of the Hi Pro MK I repeater before the final amplifier board was tightened down. Under these conditions, the transmitter does not meet present FCC spectral purity requirements. Horizontal divisions are each 100 MHz; vertical divisions are each 10 dB. The fundamental has been reduced in amplitude approximately 34 dB by means of notch cavities; this prevents analyzer overload. Power output was approximately 23 W at a frequency of 145.45 MHz.

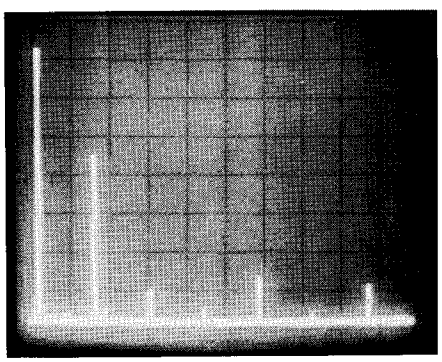


Fig. 4 — Spectral output of the MK I repeater after the final amplifier board was tightened down (see text). Horizontal divisions are each 100 MHz; vertical divisions are each 10 dB. The fundamental has been reduced in amplitude by 35 dB to prevent analyzer overload. Power output was approximately 23 W at a frequency of 145.45 MHz.

Some Comments

Two Maggiore units were tested during the review period. The first unit (s/n PO51176F) was obtained by the ARRL directly from the manufacturer. Another unit, procured from an outside source, was tested to verify specifications. As received, the second unit did not meet present FCC spectral-purity requirements: All spurious emissions must be 60 dB below the carrier. Fig. 3 shows the fourth harmonic reduced only 55 dB.

After some head scratching, the lab technician performing the tests noticed that the no. 4-40 screws used to mount the power-amplifier board to the transmitter cabinet were not fastened down — the nuts had never been installed. Installation of two nuts with lockwashers cured the problem. The spectral purity now meets present FCC specifications, as shown in Fig. 4. Results of the laboratory testing are given in the accompanying table.

Thanks to International Crystal Mfg. Co., 10

North Lee, Oklahoma City, OK 73102 for supplying crystals for the review repeater. Their assistance is appreciated.

The Maggiore Hi Pro MK I is available from Maggiore Electronic Laboratory, 845 Westtown Rd., West Chester, PA 19380. Price class: $1325. — *Michael B. Kaczynski, W1OD*

MIRAGE COMMUNICATIONS A1015 6-m AMPLIFIER

☐ Six-meter power amplifiers are few and far between these days. Declining interest in the band has caused manufacturers to devote their efforts to more lucrative bands, such as 2 meters. Mirage, a well-known manufacturer of VHF and UHF equipment, recently introduced a product to warm the hearts of 6-meter devotees. The A1015, a "brick" amplifier delivering 150-W output for 10-W input, is ideal for the operator with one of the 10-W solid-state rigs so popular these days.

The A1015 is a linear amplifier. It features a built-in preamplifier for the receiver, and the preamp is automatically switched out of the line during transmit. A remote-control head, model RC-1, is available should the amplifier be mounted away from the operating position. Although the review unit is not equipped with this option, it is especially attractive for mobile installations.

Two switches, POWER ON and PREAMP ON, adorn the front panel. The preamp may be switched on and off independently of the POWER ON switch — that control might be better labeled POWER AMPLIFIER ON. The rear panel holds two SO-239 coax connectors for input and output, a phono jack for TR control, a six-pin connector for the RC-1 and two leads for dc power.

The keying circuit in the A1015 is a bit different from that found in the run-of-the-mill brick. This rig does *not* incorporate an RF-sensing keying circuit. It *must* be hard-wired to key along with the station transceiver. The instruction manual is very explicit in warning that the key line must be hooked up before operating the amplifier. You may switch the A1015 into transmit by applying +5- to +15-V dc to the phono jack, or by shorting across it; the choice is yours. The amplifier comes wired for the +5- to +15-V option.

Changing to the shorting mode involves removing the top cover and moving a soldered jumper wire to a different pad on the PC board. My installation required this change, which was performed in about 15 minutes. Although some operators will miss the convenience of automatic RF-sensed antenna changeover, I find the TR delays inherent in most amplifiers employing that method of keying to be annoying. I much prefer to key the amplifier directly.

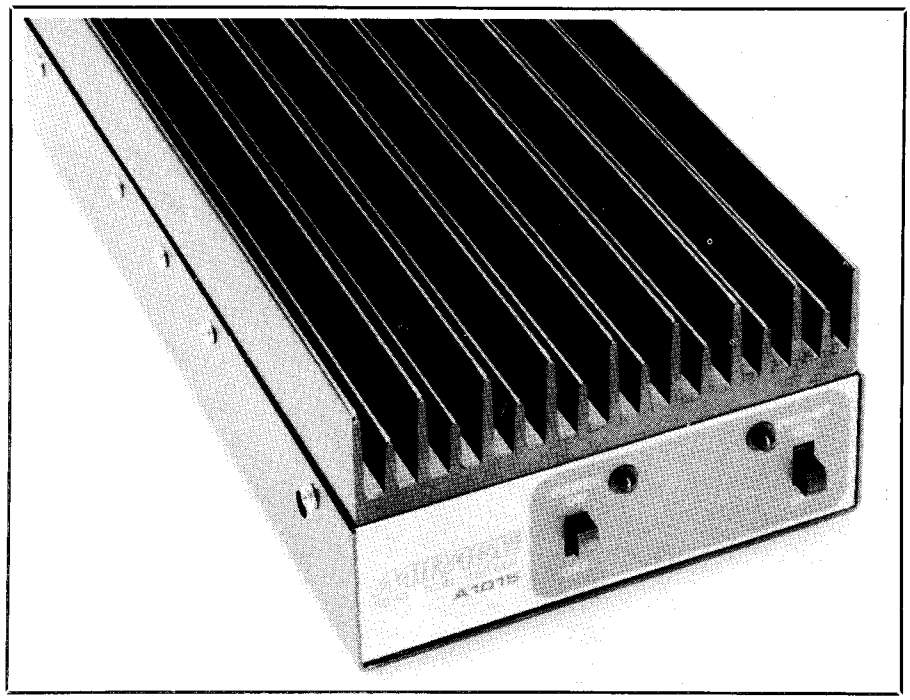
The A1015 employs a pair of MRF492 transistors in the power-amplifier section and a U309 in the receiver preamp. All components are mounted on a PC board, which is mounted directly on the heat sink that forms the entire top of the amplifier. A built-in thermostat turns off the A1015 if the heat sink temperature exceeds 170° F. High SWR will not damage the rig, and a 35-A fuse mounted internally on the PC board offers further protection.

Mirage recommends use of no. 8 wire between the A1015 and the power supply. This is sound advice in view of the 20-A current requirement. In my installation, I connected the short no. 10 wires from the brick directly to the power supply. The rest of my installation consists of a Yaesu FT-726R transceiver and a 3-element Yagi at 105 feet fed with about 140 feet of RG-213 coaxial cable.

Day-to-day 6-meter activity is light, even in New England, so I was fortunate to find a small aurora in progress the first night I used the amplifier. A few CQs yielded QSOs with stations in Quebec and western New York. The A1015 seemed to give me a big enough signal to work the aurora; all of the stations I called came back with good reports. The 150 W was plenty for groundwave operation around New England and south into New Jersey and Pennsylvania. It wasn't quite enough for successful scatter operation with my antenna, however. The receive preamp is effective, and its use allowed me to hear several stations that were marginal copy with it turned off.

The A1015 performed flawlessly during the six-week review period. Even during extended operation it became only warm, never hot, to the touch. It did just what a brick is supposed to do — sit quietly (except for the muted sound of clicking relays) and produce power. The instruction manual is informative and clear. Demonstrating extreme faith in their products, Mirage offers a five-year warranty on the A1015 (except for the power transistors, which are warranted for one year). This amplifier is worth considering if you want to upgrade your 10-W 6-meter station.

Price class: $280. Manufacturer: Mirage Communications Equipment, Inc., P.O. Box 1393, Gilroy, CA 95020. — *Mark Wilson, AA2Z*



Mirage Communications A1015 6-Meter Amplifier, Serial No. 165-484

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 50 to 52 MHz.	As specified.
Power output: 150 W or more with 10-W input.	153 W with 10-W input.
Receive preamp: 10-dB gain with 1.5-dB (±0.5 dB) noise figure.	10 dB with 2-dB noise figure.
Power requirement: 13.6-V dc at 18-22 A.	13.6-V dc at 20 A.
Input SWR: Not specified.	1.3 to 1 at 50.1 MHz.
Size (HWD): 3 × 5½ × 12 in†	
Weight: 5 lb.	

†mm = in × 25.4; kg = lb × 0.454.

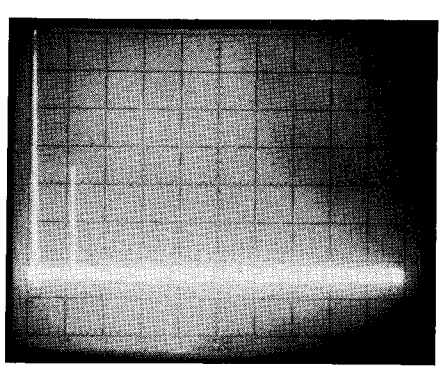


Fig. 5 — Worst-case spectral display of the Mirage A1015 amplifier. Vertical divisions are each 10 dB; horizontal divisions are each 50 MHz. Output power is approximately 125 W at 50.1 MHz. The fundamental (pip at the left of the photo) has been reduced in amplitude approximately 35 dB by means of a notch filter to prevent spectrum analyzer overload. All harmonics and spurious emissions are at least 60 dB below peak fundamental output. The A1015 complies with current FCC specifications for spectral purity.