Product Review Column from *QST* Magazine

August 1980

Azden PCS-2000 2-Meter FM Transceiver

Heath Company Model SA-7010 Tri-Band Yagi

MFJ-484 Grandmaster Keyer

Product Review

Conducted By Paul K. Pagel,* N1FB

Azden PCS-2000 2-Meter FM Transceiver

What comes in a small package that can be made even smaller, has 12 push-button controls and a full 25 watts of output power? The Azden PCS-2000, a versatile and well-made 2-meter rig that's designed to satisfy the most demanding fm operator.

You say your subcompact car doesn't have enough knee room for a small bird, much less an underdash radio? The Azden's remote cable option cuts the size down to a miniscule 2-1/2 × 8 × 3-1/2 inches (64 × 203 × 89 mm). Want to call up a favorite repeater (or simplex) frequency without fiddling with the 12 buttons on the control panel? Just hit M1 CALL on the microphone. Want to find a vacant frequency? Turn the scan knob to V.

*Assistant Technical Editor, ARRL

The PCS-2000 can do all this, and more. It may take you a week or so to become familiar with its formidable list of features — as well as a few quirks. But once you've mastered them, you'll have a rig that will do just about everything except clear a busy repeater.

What doesn't it do? The list is short. It doesn't stay on frequency in the scan mode, for one thing. That problem is shared by all scanners, of course, but it's a bit annoying to find yourself 30 kHz up from where you thought you were — just as you're about to jump into a QSO. Perhaps someone will design a 3-second delay circuit to keep the rig on frequency until you really wish to move on. Once you've located a "busy" frequency by means of the scan function, you'll have to make it "permanent" by hitting the UP 10K (or DOWN 10K) button — twice. Then you punch the other button (DOWN or UP) to return to the repeater frequency. It's all accomplished in a matter of seconds, but takes some getting used to.

Another difficulty that can be overcome with some practice is the lack of backlighting for the push buttons. Trying to read them while driving at night is no easy task. For the sake of the rest of us on the highways, you may want to memorize the function of each button before attempting to operate at night.

Once you have the hang of it, operating the '2000 is a pleasure. Every control, both on the microphone and the control panel, is designed for ease of access. LEDs indicate frequency [the readout numbers are a full half inch (13 mm) high], signal strength, power output, which of the six memory frequencies is in use, and whether the memory mode is in use. The controls on the standard microphone are well placed — you're not likely to punch the wrong button while driving.

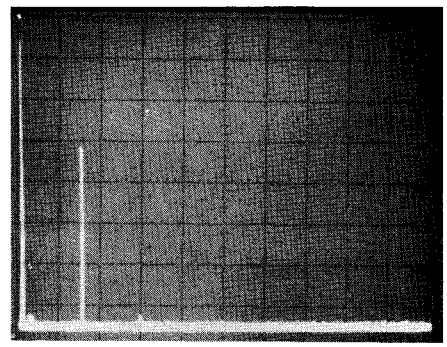
The standard microphone boasts six functions — PTT, call up memory 1, up 10 kHz, down 10 kHz, volume and squelch. It provides enough versatility to keep the user from having to deal with the multitude of switches and keyboard buttons on the control unit while operating mobile. About the only thing you can't do from the microphone is scan.

A brief summary of the steps needed to get the rig going provides an idea of what it can do. (1) Turn on power. (2) Set squelch and select high or low power. (3) Write in a memory frequency (let's say it's to be 146.88) by: pushing the M ADRS (memory address) button until the LED is on the first position; push the combination of MHz UP, 100K UP (or DOWN), and 10K UP (or DOWN) buttons to display 6.880 on the frequency readout; and push M WRITE. The

The Azden PCS-2000 2-meter fm transceiver. While a multitude of functions may be initiated from the front panel, the unit presents a neat and uncluttered appearance.

Azden PCS-2000 2-Meter FM Transceiver

Manufacturer's claimed specifications (except where indicated)	*Measured in ARRL lab*
Frequency coverage: 144.000 to 148.995 MHz in 5-kHz steps.	
Power requirements: 13.8 V dc ±15% at 5.0 A transmit, 0.7 A receive.	
Output power: 25 W (high), 5 W (low).	27 W (high), 7 W (low).
Spurious emission: −60 dB or better.	−72 dB.
Microphone input impedance: 500 ohms, nominal.	
Antenna output impedance: 50 ohms, nominal.	
Sensitivity: 0.28 μV for 20 dB of quieting.	
Selectivity: ±6 kHz (−6 dB), ±15 kHz (−60 dB).	
Price class: $300 (without optional accessories).	
Manufacturer: Japan Piezo Company, Ltd., Tokyo, Japan.	
Importer: Amateur-Wholesale Electronics, 8817 S.W. 129th Terr., Miami, FL 33176.	
Dimensions (HWD): 2-1/2 × 8 × 11-1/4 in. (65 × 200 × 285 mm) including cabinet projections.	
Weight: 5.5 lbs (2.5 kg).	



ARRL lab spectral photograph of the output of the Azden PCS-2000 transceiver. Vertical divisions are 10 dB each; horizontal divisions, 100 MHz. The fundamental frequency at 144 MHz has been attenuated approximately 32 dB by means of a two-cavity notch filter in order to prevent overload distortion in the spectrum analyzer. The second harmonic is down approximately 72 dB. This photograph represents a worst-case test. The PCS-2000 complies with current FCC specifications regarding spectral purity.

other five memories are stored in a similar manner. (4) Push the ±600 SHIFT button until the LED comes on at the −600 mark. (5) Select internal (control panel) or external (microphone) VOL and SQUELCH. (6) Select preferred type of scan — vacant, busy or free. (7) Hit the PTT switch. (8) To change frequency, push either M SCAN (to scan the six memories you've selected) or one or more of the UP and DOWN buttons.

If it sounds complicated, it is — at least compared with a no-frills 2-meter rig. After looking through the 22-page instruction manual, you'll know all of the '2000's capabilities. If you're not satisfied with all this, you can order several options. Aside from the remote cable kit already mentioned ($30), you can add a Touch-Tone mic kit ($40) a base-station microphone with built-in amplifier, a MARS-CAP kit, ac power supply ($50) and external speaker.

"Convenient" is the most appropriate word for the PCS-2000. In describing the usefulness of the remote cable kit, for example, the manual suggests: "When using this transceive [*sic*] as a fixed station, you can perform QSO in bed while setting the main unit on a desk." What more could you ask from your 2-meter fm rig! — *Joel P. Kleinman, WA1ZUY*

Four memory positions are featured in the MFJ-484 Grandmaster keyer. At the user's option, these four memories can be bridged to accept a 100-character message.

MFJ-484 GRANDMASTER KEYER

It has been interesting to observe MFJ Enterprises, Inc. ascend from a tiny supplier of audio and R-C active filter modules to its present strong position in the amateur equipment manufacturing community. Not only has its product line expanded almost exponentially in the past 10 years, but the complexity of the products and the quality of the workmanship has increased. The '484 Grandmaster memory keyer is an example of Martin F. Jue's (MFJ) efforts to produce a quality line of amateur wares. Dollar for dollar, the '484 keyer seems to offer the cw enthusiast a handful of useful keyer options.

When I opened the keyer cabinet I fully expected to see the Curtis Electro Devices 8044 and 8047 keyer and memory ICs reposing on the circuit board, because the 8044 is used by MFJ and others in various models of keyers. But the interior view disclosed 19 ICs and seven bipolar transistors instead! Indeed, this appeared to be a "busy" circuit board! The packaging and circuit-board layout had that "sanitary" look that many of us appreciate.

MFJ-484 Features

The code speed is variable from 8 to 50 wpm. I was happy to observe that the speed did not "bunch up" over a small part of the adjustment range of the control, a condition which is characteristic of some commercial and homemade keyers.

The weight control, when set for normal operation, establishes a 1:3:1 dit/dah/space ratio. Clockwise rotation of the control initiates progressively more weighting.

There is a built-in sidetone oscillator and monitor speaker in the '484. The sidetone pitch can be adjusted from the front panel of the unit. Similarly, there is a sidetone volume control located on the front panel.

The memory features of the keyer permit the operator to place 25 characters into any of the four memory positions, A, B, C and D. Memories can be combined to provide up to three 50-character messages, or all four memories can be bridged to accommodate a 100-character message. By utilizing the memory-selector switch it is possible to choose between 12 individual 25-character messages. The switch has positions 1, 2, 3 and K. The K position is for combining the four memories when a 100-character message is required. Momentary push-button switches are located on the keyer front panel. They are used for addressing the four memories.

A memory-delay control is provided so that a message can be repeated automatically. The time delay between the repeat of the message is variable from 0 to 2 minutes. Automatic repeating will continue until the paddle is tapped, the reset button pushed or the delay control is deactivated. When the control is set fully counter-clockwise the delay is defeated to permit the message to be repeated instantly.

The RESET switch is used to stop the message. The same effect will be brought about

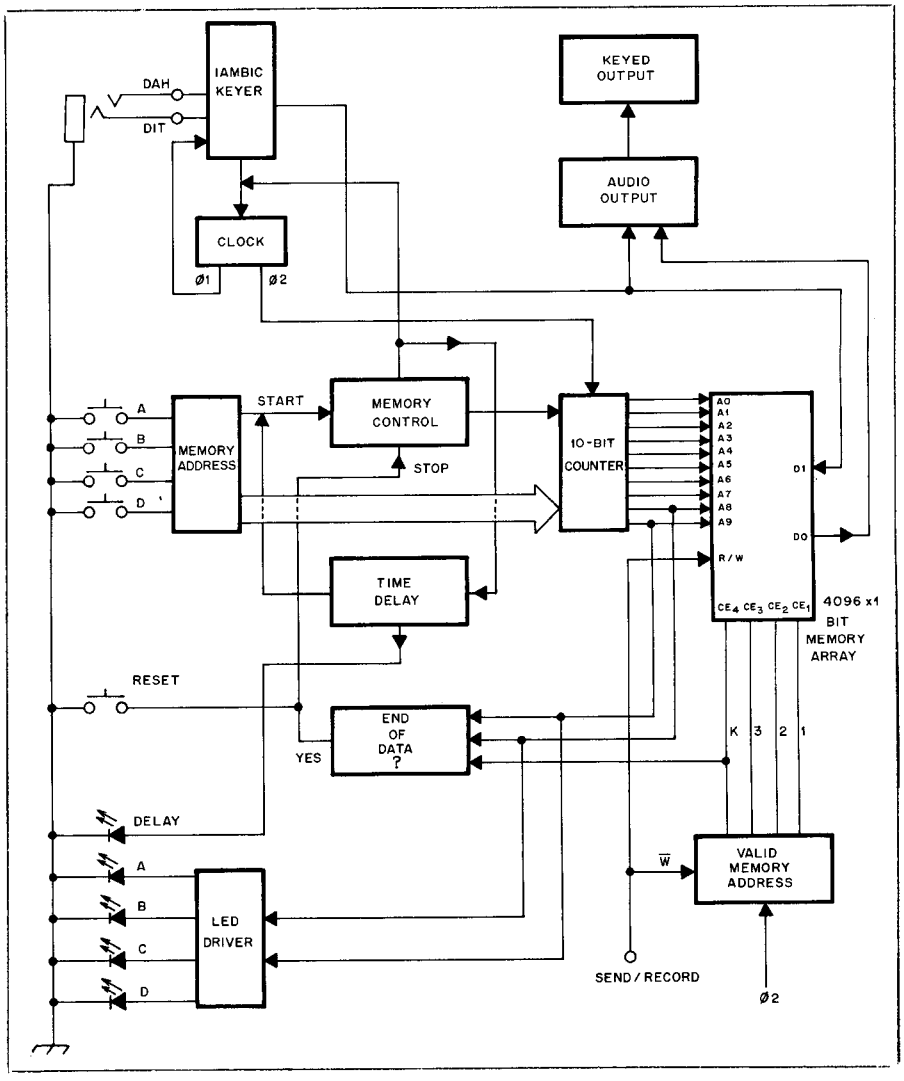


Fig. 1 — Block diagram of the MFJ-484 Grandmaster Memory Keyer.

MFJ-484 Keyer

Claimed Specifications

Size (HWD): 2 × 8 × 6 inches (51 × 203 × 152 mm).
Power requirements: External 12-15 volts dc or 117-volt ac adaptor.
Keying characteristics: Dot and dash memories, adjustable weight control, sidetone and sidetone monitor.
Memory feature: Up to 12 each 25-character messages. Bridge the memories for up to three 50-character messages or combine memories A, B, C and D for 100-character message. Message delay and message-repeat features included. Memory-saver battery provision included also.
Keying modes: Up to −300 volts at 10 mA max., or up to +300 volts at 100 mA max.
Color: Eggshell and brown.
Price class: $140.
Manufacturer: MFJ Enterprises, Inc., Box 494, Mississippi State, MS 39762. Toll free no. is 800-647-1800.

if the paddle is tapped during a transmitted-message period. LED indicators show the state of the memories. They illuminate when the memories are addressed and become extinguished when the memories are full or have been fully utilized during a message period. The LEDs also enable the operator to know which memory is in service. A fifth LED will light during activation of the time-delay feature.

There is provision in the '484 keyer for a memory-saver battery (9 V). If the 117-volt ac service is interrupted, the battery is switched into the circuit automatically. If the keyer sidetone is not used during the power-outage period, the battery will provide approximately three hours of service before it is depleted. Longer periods of operation can be had by connecting an external battery of higher capacity to the battery jack on the rear of the keyer.

The keyer comes with a 117-volt ac adaptor. This unit plugs into the rear of the keyer. It can be connected to the '484 at all times, and can be attached while an external dc supply is connected to the keyer. With this arrangement, the dc supply will take over when the operating voltage from the ac adaptor vanishes: A 12- to 15-volt dc supply is recommended by the manufacturer.

Other Features

A squeeze key or conventional paddle can be used with the MFJ-484, since the circuit permits iambic keying. Grid-block or positive-voltage keying can be accommodated by this keyer. Damage to the keyer will not result if the wrong keying mode is chosen by the operator. The two outputs are protected from this kind of potential damage. A maximum voltage of −300 at 10 mA is the limit for grid-block keying. Direct keying of positive voltage can be done at levels up to +300 volts at 100 mA maximum.

Practical Considerations

I have used the '484 keyer for several weeks on a daily basis at W1FB. Operation took place on 80 through 10 meters at the 1-kW dc input level. End-fed and coaxial-fed antennas were used without rf energy affecting the keyer, the memory circuit or the sidetone operation. It appears to be rf-tight, provided shielded cables are used between the paddle and the keyer, and between the keyer and the transmitter.

The only difficulty experienced with the product occurred when it was first tried: The paddle jack was wired in reverse (dots and dashes reversed). The two appropriate wires on the jack were reversed and all was as it should be! — *Doug DeMaw, W1FB*

HEATH COMPANY MODEL SA-7010 TRI-BAND YAGI

Pictures can, at times, tell more than words. This may be true when describing a hardware item like the Heath SA-7010 4-element tri-band Yagi for 20, 15 and 10 meters. The purchaser is usually interested in two things when buying a beam antenna — performance, and the structural properties of the system. This review contains photographs of the key structural points to be discussed. It should be easy for the reader to form his or her own conclusions after inspecting the close-up views of Heath's new antenna. Performance data are included for those who want to compare our published results with the specifications of other brands and models of similar antennas.

The SA-7010 is advertised as a 4-element antenna. This does not mean that four elements are used during operation on any one band. Rather, there are three elements in service at a given time. The fourth element is a separate reflector for the 10-meter band. The designer included the extra element in order to obtain optimum spacing of the elements during 10-meter operation. A trap type of reflector is used during operation on 15 and 20 meters; the 10-meter reflector is full size, and has no traps.

Structural Details

A view of the assembled and operational SA-7010 is shown at the beginning of this review. It is installed at W1FB on a 50-foot (15-m) Rohn 25 tower. The director is in the foreground. Four traps are used in director, as is the case with the driven element. The rear element has ony two traps. It is the 15- and 20-meter reflector.

Figs. 2 and 3 illustrate the ruggedness of the mounting hardware for the boom-to-element unions (Fig. 2) and the boom-to-mast junction (Fig. 3). The latter consists of rugged aluminum castings which contain groove-type teeth for secure clamping of the boom to the mast.

Dimensions for the assembled antenna are 16 × 34 feet (4.9 × 10.4 meters). The boom is formed by joining two sections of 2-inch (51-mm) OD aluminum tubing. Each of the elements with traps contain graduated-size aluminum tubing [1-1/4, 1-1/8 and 7/16 inch (32, 29 and 11 mm) OD sections] to permit tapering of the elements. This ensures structural soundness while reducing the overall weight of the system. The 10-meter reflector contains sections of 7/8, 5/8 and 7/16 inch (22, 16 and 11 mm) tubing.

A check of the balance point of the assembled beam showed it to be exactly at the mast-to-boom clamping site. This is important in the interest of reduced stress on the mounting hardware. Conductive grease is provided with the kit for use where the tubing sections are joined. This prevents corrosion and subsequent resistive electrical joints.

I was not highly impressed with the element-clamp bolts which are used to lock the

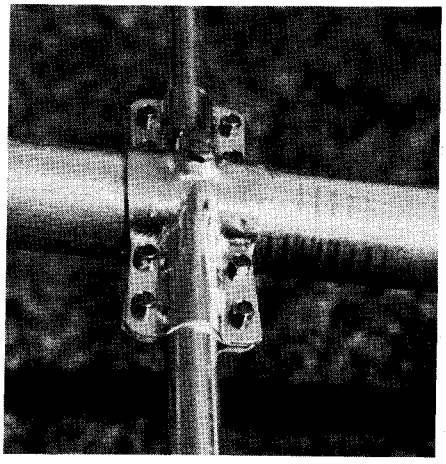
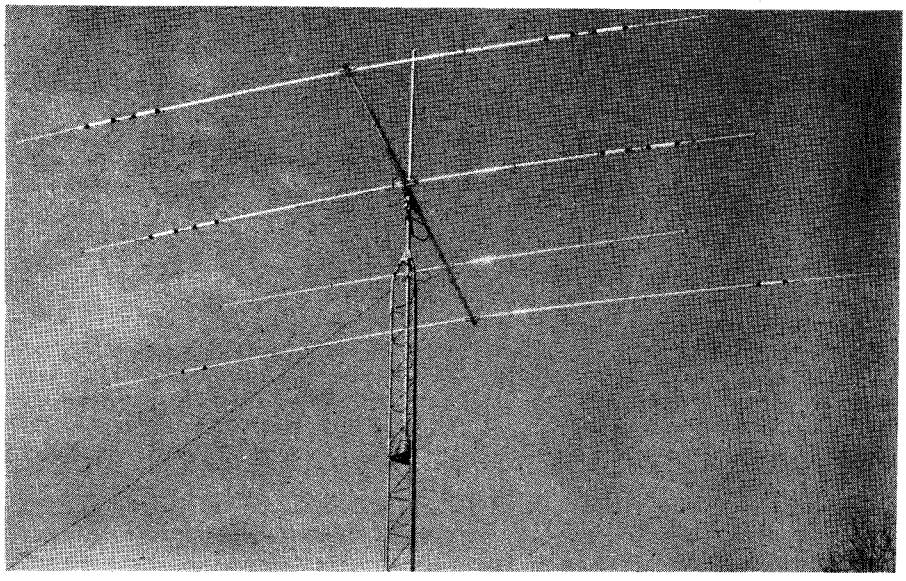


Fig. 2 — Closeup view of the element-to-boom clamps of the triband Yagi.



The Heath SA-7010 tri-band Yagi assembled and operational.

Heath SA-7010 Claimed Specifications

Weight: 40 pounds (18 kg).
Impedance: 50 ohms.
Maximum rf power input: 1 kW.
VSWR (at resonance): Less than 1.5:1. (See Fig. 4 for ARRL lab measurement.)
Turning radius: 17.4 feet (5.3 meters).
Surface area: 5.4 square feet (0.5 square meters)
Maximum wind survival: 80 mi/hr (128.7 km/hr).
Price class: $200.
Manufacturer: Heath Company, Benton Harbor, MI 49022.

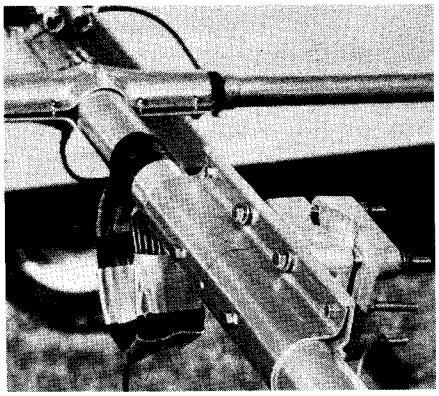


Fig. 3 — A cast-aluminum clamp offers a strong union between the 2-inch OD boom and the mast.

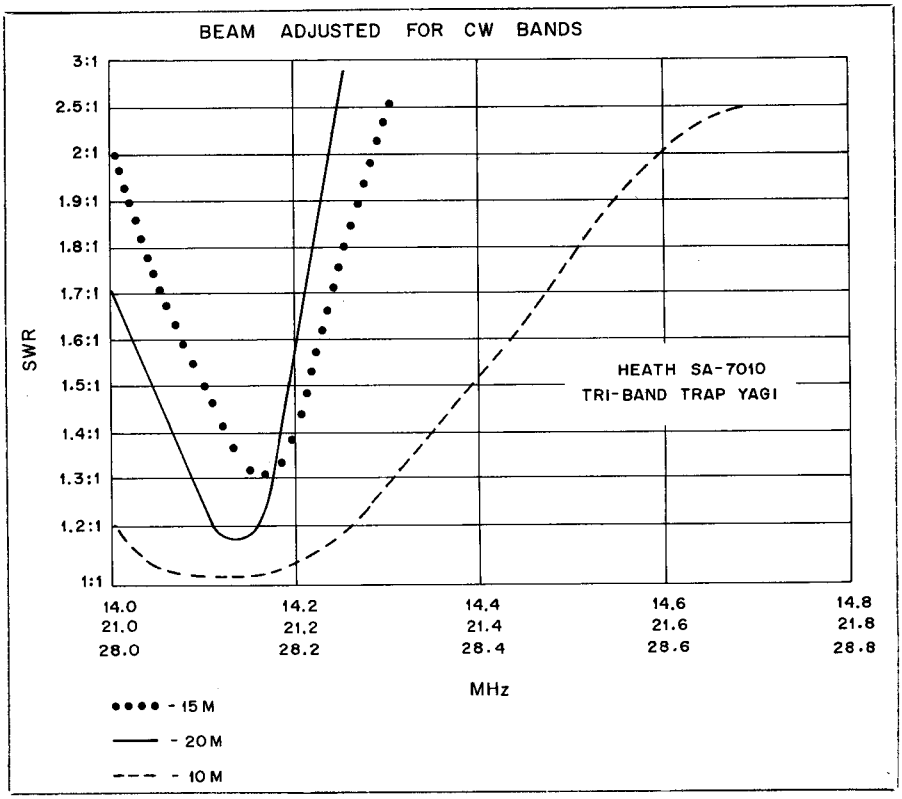


Fig. 4 — SWR curves for the 20-, 15- and 10-meter bands with the elements adjusted for cw operation. Dimensions are those specified in the instruction manual. Tests were performed with the beam at 50 feet on an unguyed tower.

telescoping sections of tubing. They might be considered one of the two weak points in the system; during assembly, two of the clamp bolts broke before the tension was sufficient to lock the tubing sections together. Most of the clamp bolts are bowed somewhat when the torque on them is ample to hold the element sections together. This is complicated by the application of the conductive grease, which allows the tubing sections to slip inside one another unless high torque is applied to the bolts. In fact, a few days after the beam was erected, a bolt snapped on the reflector and down came the end of the element, plus one trap! The practical cure is to replace the kit clamps with stainless-steel hose clamps. Perhaps the manufacturer will consider this as a production change in the future![1]

Electrical Aspects

This antenna can be tuned for the phone or cw portions of the three bands. The bandwidth will not allow full coverage of each band without substantial SWR at one extreme of the frequency spread. The review model was tuned for the cw segments. The resultant SWR curves were obtained with the antenna in place on the tower (Fig. 4). On 15 and 20 meters, the lowest SWR occurs quite high in the cw parts of the bands. In my opinion, it would be much better to provide adjustment dimensions which would allow the SWR to "bottom out" at 14.050 and 21.050 MHz. This is especially important because the highest cw activity is found in the bottom 50 kHz of each band. It can be seen from the curves that the SWR is fairly high in the lower portions of the bands, except on 10 meters. These curves were obtained after tuning the beam in accordance with the instruction book.

[1]The Heath Company has informed the ARRL lab that new clamps are being tested and will be available in the future.

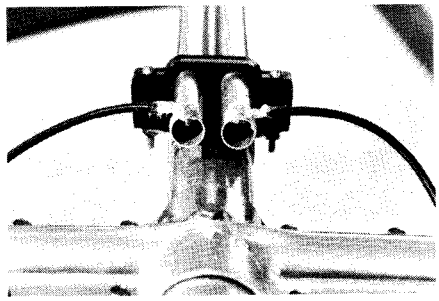


Fig. 5 — This view of the beta-match tubing shows 8-32 nuts and screws holding the driven-element connection wires in place on the matching section (see text).

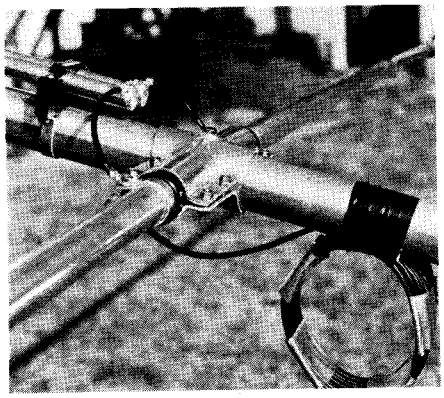


Fig. 6 — Details of the beta match, driven element and coaxial rf decoupling choke after assembly of the beam was completed. Plastic inserts insulate the halves of the driven element from the boom. The beta match provides a dc return for lightning protection.

Impedance matching (50 ohms) is accomplished with a beta match. The beta match tubes are mounted "piggy back" style on the boom, as shown in Fig. 5. This is where the second weak spot was observed. The manufacturer supplies two sheet-metal screws for use in attaching the driven element jumpers to the matching section. In order to obtain good tension at this important electrical junction, I replaced the screws with no. 8-32 bolts and nuts: The screw holes in the beta match tubes stripped before there was sufficient tension to hold the jumper wires in place. Noncorrosive weatherproof sealant was added after the bolts were in place.

Fig. 6 shows details of the decoupling choke which is fashioned from RG-58A/U coaxial cable. It contains 11 turns of coax. The ID is 6 inches (150 mm).

Performance

It took eight hours to sort, assemble and adjust the antenna. Installation on the tower required some 30 minutes (courtesy of W1VD). The reviewer is entirely satisfied with the antenna, structurally and electrically, now that the two mechanical weak points have been resolved. It received its first significant test during the ARRL DX Contest early in 1980. Of the first 30 "pileups" encountered, W1FB was acknowledged on the initial try in all but three instances. It took two attempts to break two of the pileups and four tries to nail down the third. (Dc input to the transmitter was 1 kW.) Overall performance is markedly better than with the previous low-cost triband trap Yagi that was on the tower. — *Doug DeMaw, W1FB*