CQ REVIEWS: BY JERRY HAGEN*, N6AV

The Butternut HF2V Vertical Antenna

I was glad to hear that Butternut Electronics was producing a 40 and 80 meter vertical which could also be loaded on 160 meters. With the sunspot plunge, a good signal on the low band will be a must during the next few years. As a satisfied user of one of the original HF5V Butternut 5 band verticals I hoped that the HV2V would have the same quality with improved performance on the low bands. Even with a fairly good radial system, my HF5V was not as competitive on 75 and 80 meters as it was on 40 meters and the other bands. The HF2V was designed to provide the improved performance desired during the sunspot minimum.

Concept And Specifications

To gain an understanding of the Butternut loading concept, reading the review of the HF5V antenna by John Schultz, W4FA, is essential. It was published in the April, 1982 issue of *CQ*[1]. John explains that the entire length of the Butternut HF5V is active on all bands, and that the antenna does not have the conventional traps used by most multiband verticals. This results in better bandwidth and excellent performance on all bands. The concept in the new HF2V is to improve the low band performance by increasing the length of the antenna from 26 to 32 feet and provide a way to top load the antenna for even greater efficiency. The antenna is designed with large aluminum inductor coils and ceramic capacitors which provide appropriate capacitive and inductive reactance which loads the antenna as a quarter wave on both 80 and 40 meters. The loading devices are *not* traps. The instructions are excellent and a brochure entitled *Notes on Grounding/Radial Systems* is also available and is well worth the effort to read. The power rating for the HF2V is 2 KW PEP or 1 KW CW (DC) input (which is assumed to be to the final amplifier) and the wind survival is 60 mph.

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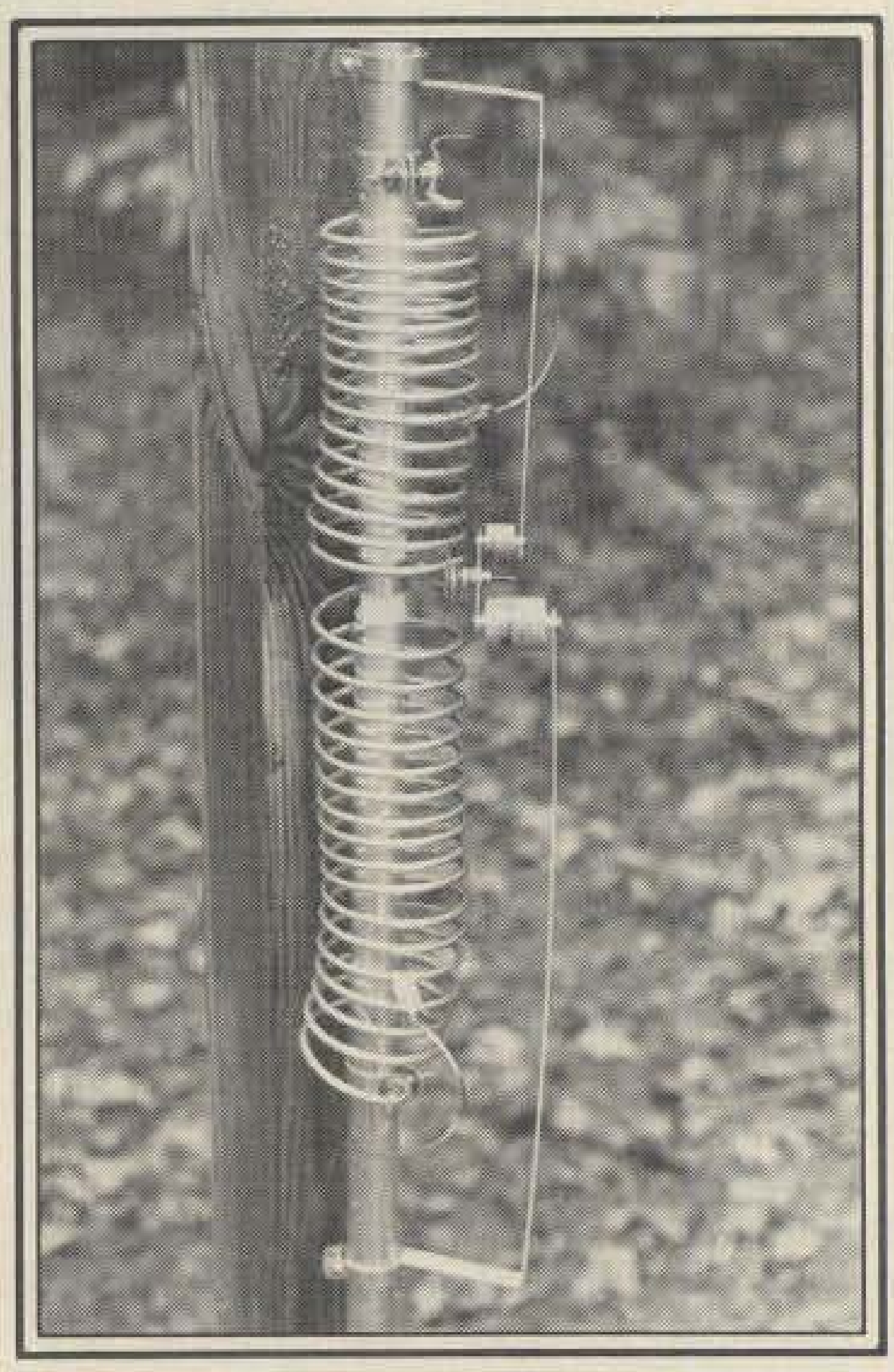
The base mounting coil. This raises the impedance up to 50 ohms.

Assembly And Installation

The antenna is shipped in a 4 × 4 × 66 inch cardboard box by UPS and consists of a base mounting section (1 ¼ " OD tubing) antenna bottom section with insulator (also 1 ¼ "), coil assembly (2 coils), capacitor assembly, base loading coil and 7 four foot aluminum tubing sections ranging from 1⅛" to ⅜" in diameter. Appropriate hardware was included, although screws and nuts to secure the shorting straps has been omitted from my particular package. The mounting and antenna base sections have been "double walled" to provide strength for unguyed installations. The instructions look complicated but the antenna is easy to assemble thanks to outstanding detail in easy-to-understand language. My only problem was that I skipped the part where Butternut advises assembly in the garage, and a piece from my socket wrench set fell into an area of rocks and gravel along the driveway and has not been retrieved as of this date! All the tubing slots and holes has been de-burred and matched perfectly. Within one hour the antenna was ready to erect.

Some care must be used in installing the base section so as not to damage the fiberglass insulating section. If the soil is hard clay such as in my local, it can require some effort to drive the section in, unless there has been some rain. My only critical comment on the mechanical design was that the wingnuts used to adjust the coils were a bit small, making them difficult to turn by hand. However, they are stainless which is a nice improvement over the HF5V. After assembly the antenna is easily lifted into the vertical plane and attached to the base insulator.



The HF2V loading coils and capacitor assembly. Note the shorting straps which are provided to tune the antenna.

Tuning

The tuning instructions are very complete and easy to follow. Prior to tuning it is necessary to install the 40 meter shorting clip to short out 7 turns of the top (40 meter) coil. The coils were then set as specified and tuning was initiated on 75 meters. The resonant point was close to

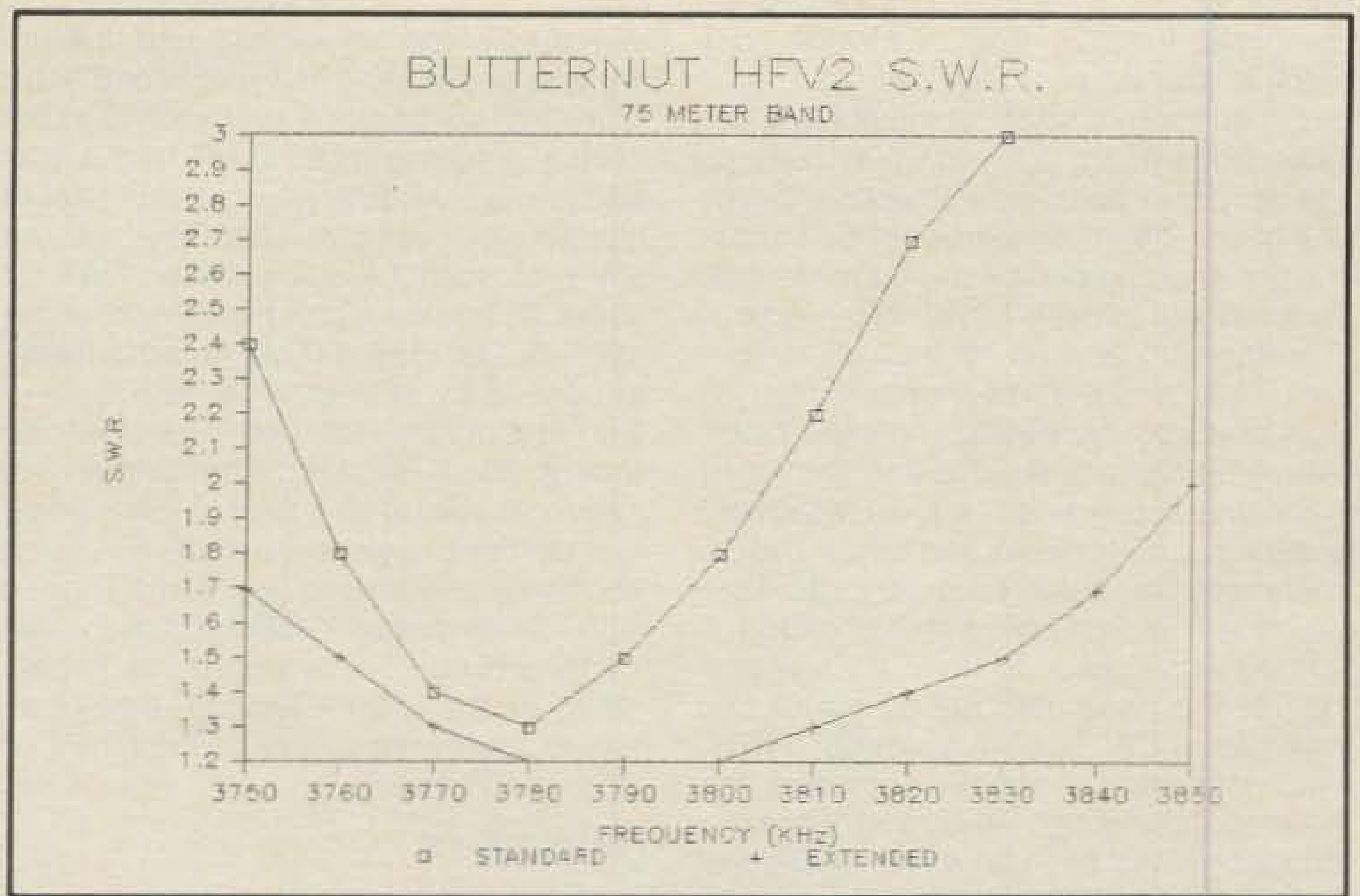


Fig. 1– SWR curve for the 75 meter band.

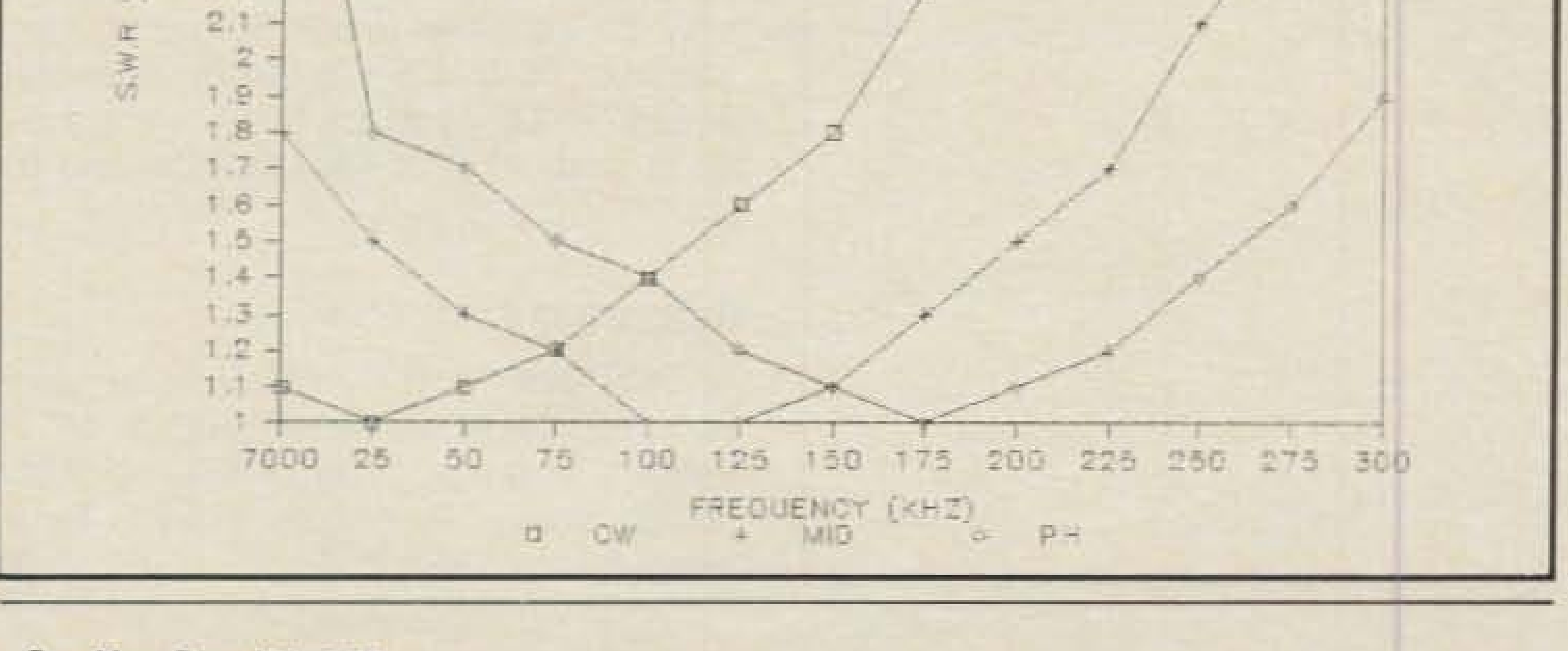
3750 kHz but the SWR was over 2.0:1 (the instructions had stated this would probably happen). It was the necessary to adjust the base matching coil (15 turns of #12 enameled copper wire 1⅛" in diameter, and 3 inches long) for the best SWR. As the installation had 27 radials, less inductance was required. It was necessary to cut several turns off of the coil as suggested by the instructions. The SWR curve is shown in fig. 1 and the 2.0:1 points are approximately 60 kHz as specified by the manufacturer.

As the HF2V is nearly a full quarter-wave length on 40 meters, tuning is not as critical as on 75 meters. The resonant point seemed to be way below the band so it was necessary to change the tap to short out eight turns rather than seven. By adjusting the 40 meter coil it is possible to set the antenna to favor portions of the band as shown in fig. 2. The CQ WW Phone Contest was at hand and I chose the phone setting for initial operation. During the contest the vertical performed well with all continents being worked on 40 meters (including Mellish Reef - VK9MR) and a number of European contacts on 75 meters.

Top Loading

One excellent feature of the HF2V is that top-loading[2] may be added to increase the 75/80 meter bandwidth and efficiency without severely affecting 40 meter operation. The Butternut instructions provide a full page on the subject, plus a diagram and bandwidth specifications for adding 4 twelve foot top-loading wires to the vertical. With this arrangement the bandwidth increases to 100 kHz on 75/80 meters and to 25 kHz on 160

Fig. 2– SWR curve for the 40 meter band.



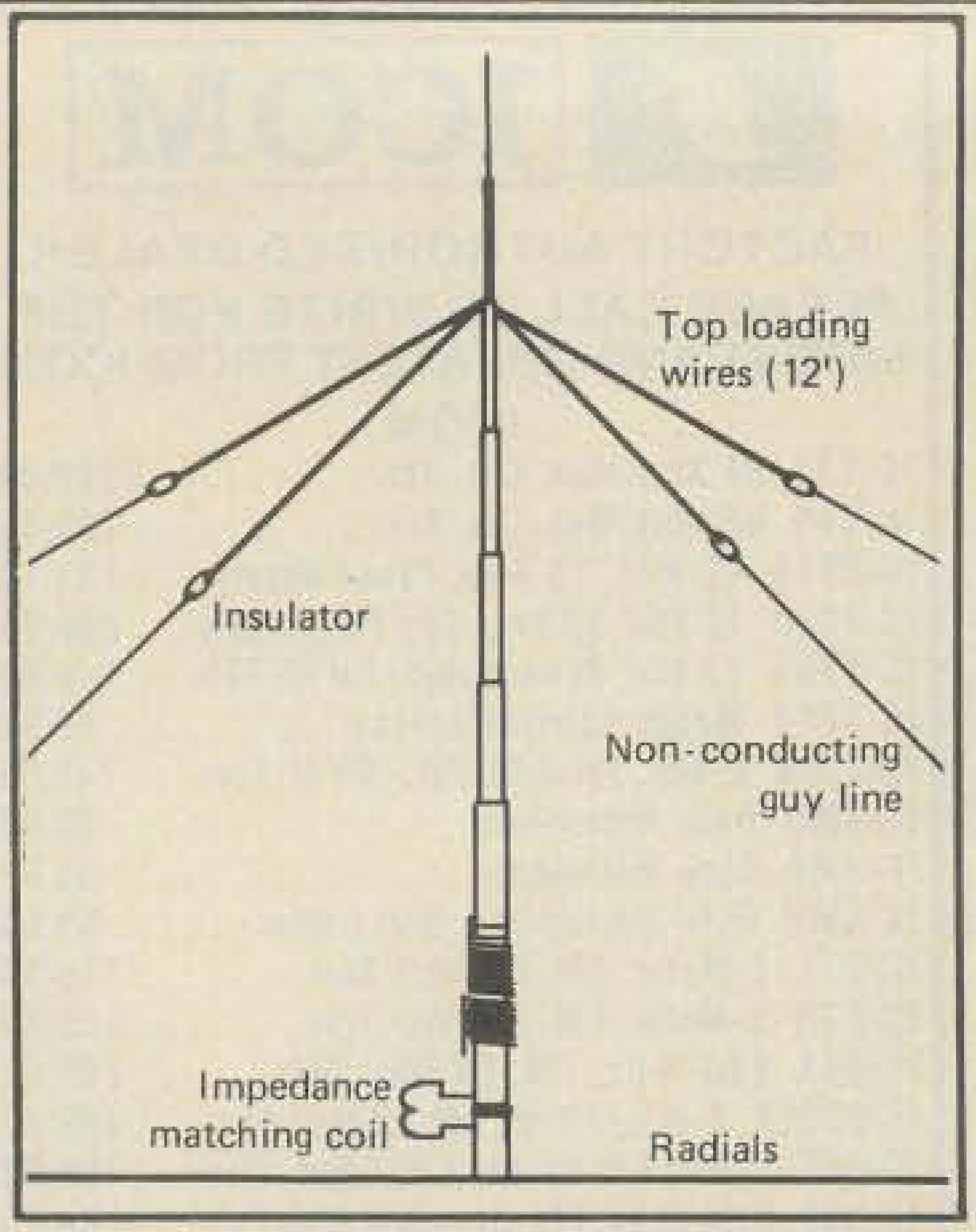


Fig. 3– The HF2V top-loaded installation.

meters (when the appropriate loading coil is used). From reading the instructions it was surmized that top-loading would have some effect on 40 meter operation which I found to be true. Fig. 3 shows the top loading suggested by Butternut.

As my installation was attached to a 10 foot high 4″ × 4″ post left over from a 75 meter vertical, I decided to replace the four foot section of ⅞″ tubing with a 12 foot length making the vertical 40 feet. This extension was used instead of top loading. With the bottom 10 feet secured to the post, the antenna is self supporting and no guy lines are needed. The tuning procedure was begun by shorting out 3 turns of the 80 meter loading coil as the inductance needed would be decreased. My guess was lucky and there was a nice SWR null at 3850 kHz. The coil compression was adjusted to place the null at 3800 kHz and a SWR curve was plotted as shown in fig. 1. The 70 kHz of 1.5:1 SWR is exactly what was desired.

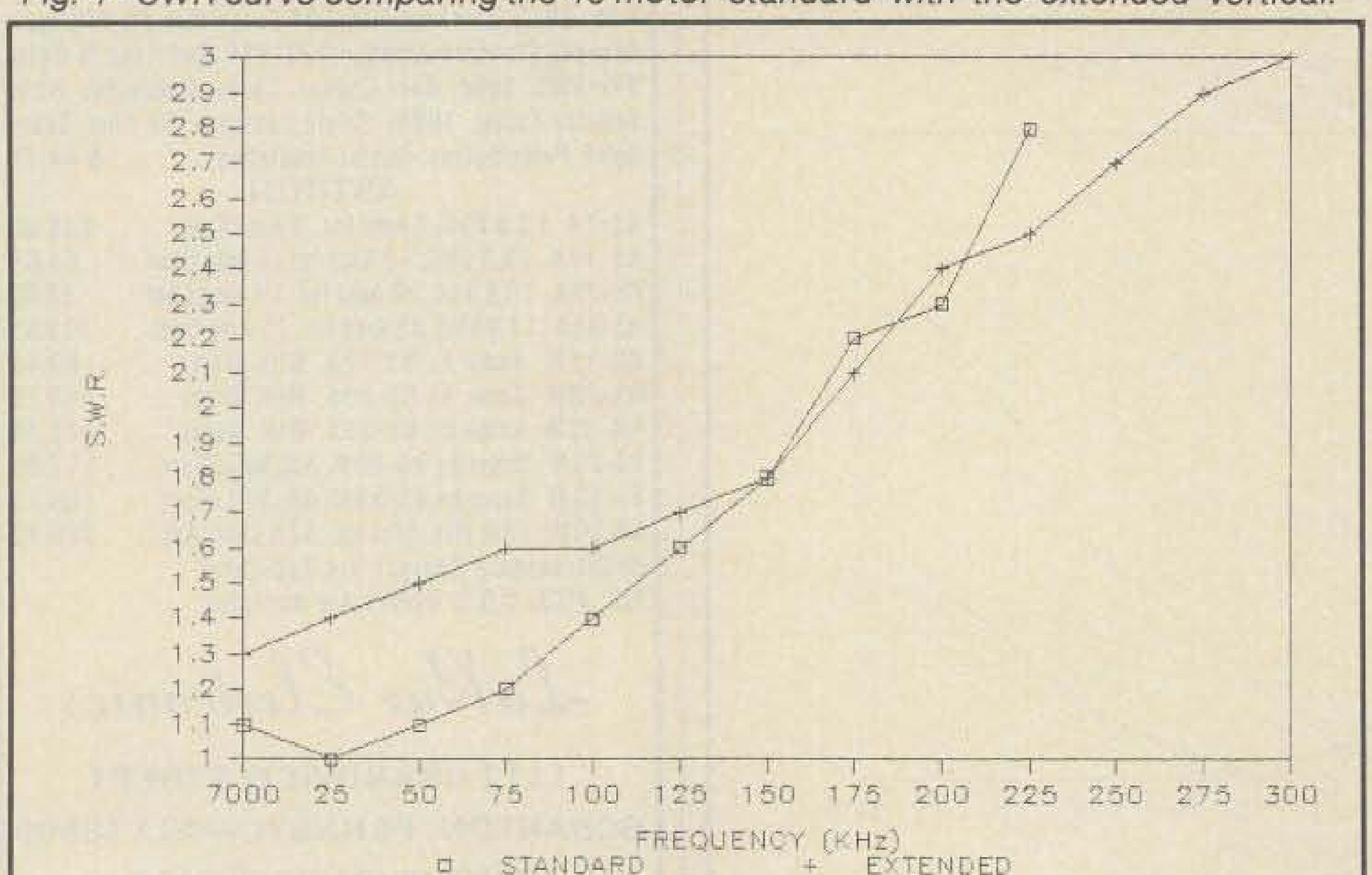
On 40 meters the best initial SWR obtained was about 2.2:1 at 70001 kHz so the resonant point was obviously below the band. This was corrected by changing the shorting clip on the 40 meter coil to short out eleven turns. After experimenting with several settings on 40 meters, I realized that the increased length was probably increasing the impedance above 50 ohms and exhibiting the broad band characteristics of a ⅝ wave vertical antenna. I also noted that when the 75 meter coil was adjusted for 80 meters the 40 meter resonant point also changed. A setting was chosen to favor the CW portion of the band with the 80 meter coil also set for CW. To obtain a better SWR it was necessary to slightly compress the base matching coil which degraded the 80 meter SWR slightly. A comparison of the un-modified vertical vs extended vertical SWR on 40 meters is shown in fig. 4.

160 Meter Operation

After several weeks of using the HF2V I was anxious to try "top band" operation, so the 160 meter coil was ordered (TBR-160-S). The unit consists of a large coil (similiar to the 80 meter coil), two 200 PF ceramic capacitors, and a bracket to attach the unit to the base of the HF2V. The instructions state that the coil provides inductive reactance in series with the feedpoint to load the antenna, and that the coil produces capacitive reactance on 80 and 40 meters that raised the resonance point about 300 kHz on those bands. The instructions warn that 160 meter bandwidth is limited to 15–35 kHz and that the SWR will probably not be much less than 2:1 without affecting the other bands.

The coil was assembled and installed in less than an hour with the instructions again being excellent. The coil was set as specified in the instructions and the tuning was begun. The first try yielded a terrible SWR so the coil was stretched about 1 inch resulting in an SWR of 2.5:1 at 1800 kHz. Another half inch stretch placed resonance at 1815 kHz with an SWR of 1.8:1. A satisfactory SWR of about 2.4:1 was obtained from about 1808 kHz to 1833 kHz. As noted in the instructions it was then necessary to lower the resonant point on both 80 and 40 meters by about 300 kHz. After adding two 135 foot radials (for a total of 29) the final coil taps points were: 40 meters - 9 turns shorted and 80 meters - 2 turns shorted with the extended (loaded) antenna set for the CW portions of each band. The addition of the 160 meter coil has not affected the performance of the HF2V on 80 and 40 meters.

Fig. 4– SWR curve comparing the 40 meter standard with the extended vertical.



Performance

After several months of operation, results seem to be excellent. Several good contacts have been made over the 40 meter long path and coverage of the USA and Caribbean have also been good. The length extension has helped to make the HF2V a very competitive antenna on 80 and 75 meters where Europeans and the Pacific have been worked. On 160 meters, the West Coast, Canada, and the Caribbean were worked easily during the CQ WW CW Contest with 100 watts output.

The only disadvantage to using the antenna is that it does not cover both the 75 and 80 meter portions of the band without readjusting the coil, however other verticals do not even *have* the adjustment feature.

Conclusions

The HF2V vertical is an outstanding product with its main feature being versatility. It could be used as a primary antenna for 80 and 40 meters and can also operate on 160, 30 and 20 meters with available add-on kits. It could be used as an efficient 160 and 80 meter vertical with top-loading for those who have some other type of 40 meter antenna. It can be top-loaded in several different ways to fit the constraints of the operating location. The price range if the HF2V is $110 to $125 which compares favorably with other verticals. The HF2V vertical appears to meet or exceed all specifications of the manufacturer. Information may be obtained from Butternut Electronics, 405 E. Market Street, Lockhart, Texas 78644. If you are considering a low band vertical, this may be the one for you!

References

[1]CQ Reviews, The HF5V Vertical, John Schultz, W4FA, *CQ*, April 1982, p. 44.

[2]Top Loading, The ARRL Antenna Hand Book, American Radio Relay League Inc., 1980, p. 61.