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Butternut HF2V HF vertical antenna

Although the Butternut HF2V vertical has been around for many years, it has never been reviewed in *RadCom*. Peter Hart puts this right with this review, carried out over a period of 10 months.

Now owned by Bencher Inc, the Butternut multiband HF vertical antennas are popular and long established designs which have acquired a good reputation for performance. The two-band HF2V and six-band HF6V-X antennas have been available now for over 20 years. The nine-band HF9V-X is by comparison a relative newcomer.

In 1990 I installed the HF6V-X at my home QTH (see my review in March 1991 *RadCom* pp66 – 68) and used it consistently for 14 years. This antenna covers all bands from 80 to 10m with the optional 12m and 17m extension which I had also fitted. On bands 14MHz and upwards I used it primarily as the back-up antenna to my beam but on 80, 40 and 30m it was my only antenna. All credit to the HF6V-X, it performed very competitively on these bands giving me over 300 DXCC countries on 40m and over 250 countries on both 80 and 30m during this period. I fitted one set of guys above the loading coils and reliability overall was generally good. During the 14 years I had one mechanical failure when the tubing snapped above the guying point during a particularly severe gale, I needed to replace capacitors on three occasions and the fibreglass insulators required periodic cleaning. However, eventually the insulators were wearing more and more, and the tubing components were becoming quite corroded so early last year I decided to replace the antenna. Not really requiring coverage of the higher bands for this antenna, I decided to install the longer HF2V where coverage is limited to the lower bands.

The HF2V is essentially a base loaded quarter-wave vertical antenna covering the 80m and 40m bands. Additional resonators are available to extend coverage to the 160m and 30m bands.

DESCRIPTION

The HF2V comprises a single vertical radiator 32ft in length with a feedpoint at the base. Eight 4ft lengths of tubing are used tapering from 1.25in at the base to 3/8in at the top. Each tubing length slides inside the adjacent piece and is secured with a bolt and nut. A resonator assembly 4ft up from the base comprising two inductors and one door-knob capacitor brings the antenna into resonance on the 80m and 40m bands. A shunt inductor across the feedpoint improves the VSWR at resonance on 80m and also provides a DC path to ground which eliminates any static charge build-up in stormy conditions. The antenna is rated at 2kW PEP and can be used in either a ground mounted or an elevated mounting position. A 2ft mounting post is provided which can be fixed into the ground or used for mast attachment.

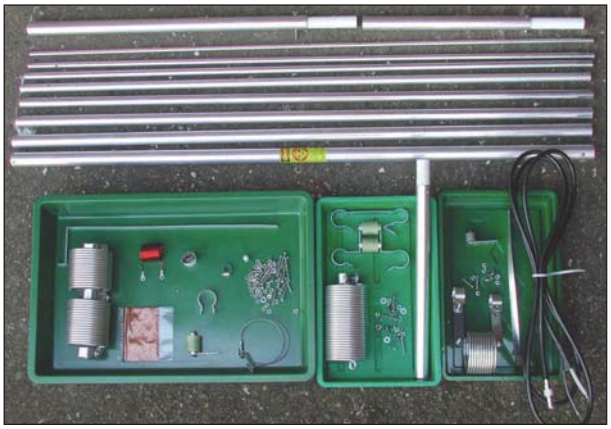
For use on 160m an additional resonator is available (TBR-160-S) which comprises an inductor and shunt capacitor and is mounted at the base feedpoint of the antenna. This introduces extra series inductance for resonating on 160m and a capacitive bypass for the higher bands. On 160m the power rating is reduced to 1kW PEP / 500W CW.

A 30m resonator is also available (30MRK) and both this and the 160m resonator can be fitted at the same time to cover four bands. The 30m resonator comprises a further inductor-capacitor combination which shunts the 40m inductor and provides a resonance on both bands. The power rating on 30m is limited to 300W. The antenna is somewhat longer than a quarter wavelength on this band and the feed impedance rather higher than 50Ω. A matching transformer comprising an 11ft length of RG-11/U 75Ω coaxial cable is provided. This is connected in series between the antenna feed terminals and the main 50Ω transmission line and has a minimal effect on the lower bands.

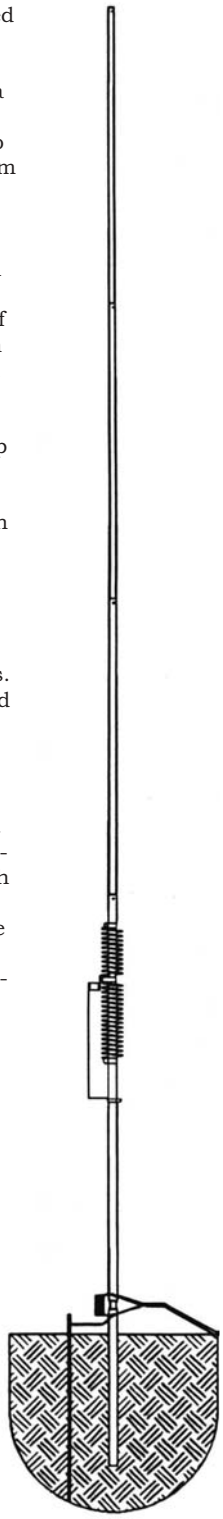
An essential part of any quarter-wave resonant vertical antenna system is a ground or radial system. On 80m and even more so on 160m the physical length of the antenna is considerably less than one quarter-wavelength. The radiation resistance will be very low on these bands and the efficiency of the antenna highly influenced by the quality of the ground or radials. For mounting in an elevated position several quarter-wave resonant radials should be used. For ground mounting a network of wires on the ground or slightly buried should be used, as many as can be arranged. Time and effort spent on laying down an effective radial system will be amply repaid by improved results on 160m and 80m, probably not so critical for 40m and 30m.

The HF2V has an unguyed wind survival rating of 60MPH (96KPH). It tends to bend rather alarmingly in high winds and I have fitted one set of four guys about 10ft up from the base. Guying much higher than this is not recommended and can result in bowing of the antenna and failure. From experience of the HF6V-X, wear of the fibreglass insulators will occur over time and reducing movement here by guying will lengthen the life of the antenna.

The bandwidth on 160m and 80m is very narrow and it is not possible to cover both CW and SSB sectors of 80m without retuning. The overall efficiency and bandwidth on these



The full kit of parts, including 30m (right tray) and 160m (centre tray).



Right: Line drawing of the Butternut HF2V (without added 160m or 30m resonators).

Left: Close-up of the 40m (top) and 80m loading coils.

Right: The 160m adaptor fitted.

Far right: The 30m resonator fitted.

bands can be improved by attaching top loading wires about three quarters of the way up the antenna and sloping down towards the ground. These cannot be used with the 30m resonator and should be limited in length to 12ft for satisfactory 40m operation. Longer wires can be used, eg 25ft, for improved 160m and 80m performance but 40m operation is sacrificed. I did not fit top loading wires on my antenna. Butternut provides a top loading wire kit (TLK) if required.

ASSEMBLY AND INSTALLATION

The HF2V antenna is supplied compactly packed in a box just over 4ft long and about 5in square with a shipping weight of 13lb (5.9kg). All tubing parts, straps and clamps are made from aluminium and all mounting hardware, bolts, nuts and washers are stainless steel or plated. Assembly is straightforward and accurately described in the instruction booklet. A small packet of anti-seize / anti-oxide compound ('Butter-It's-Not!') is provided for lightly lubricating tubing joins and clamps and some waterproof sealing tape for the feeder cable connections. A few spare bolts, nuts and washers were provided and overall unpacking, checking and assembly took under an hour.

I ground mounted the antenna and provided one set of guys. 12 radials were used deployed around the antenna and varying in length from about 15ft to about 80ft. 16SWG hard-drawn copper wire was used for the radials and these were buried just below the ground.

Tuning of the antenna is accomplished using a VSWR indicator in the 50Ω feedline and is fully described in the instructions. In general, the lowest frequency band is adjusted first and then progressively each higher band in turn. Some slight interaction occurs but tuning rapidly converges to the optimum condition. Tuning involves sliding clamps up or down to compress or expand the appropriate inductor and achieve the lowest VSWR at the desired frequency. The tuning point is quite critical and you must decide on a centre frequency on 160m and 80m.

The shunt inductor across the feedpoint lowers the VSWR on 80m and is adjusted to give the lowest compromise VSWR on the 80m and 40m bands. A low loss radial / ground system will result in a higher VSWR at the feedpoint and narrower bandwidth but this is more than compensated by the greater efficiency of the overall antenna system.

PRACTICAL RESULTS

With the antenna connected through a short length of 50Ω cable measurements were made of the input VSWR and summarised in the following tables for the various combinations of HF2V and its various band extensions. Where the 30m resonator was fitted the feedline matching transformer was also fitted. On 40m, the tuning point was optimised and centred within the band edges 7.0 to 7.2MHz.

The measured results for the HF2V alone and no band extensions are shown in **Table 1**.

The measured results with the 30m resonator added are shown in **Table 2**. Adding the 30m band extension makes little difference to the 80 and 40m bands.

Fitting the 160m resonator results in a significant lowering of the bandwidth on 80m and tuning is extremely critical. The setting of the shunt feedpoint inductor is very much a compromise and is only needed with good ground systems. Results are shown in **Table 3**.

Table 4 shows the measurements with both the 30m and 160m resonators added. Again the shunt inductor was very much a compromise.

I have used the HF2V now for around 10 months. The performance on 30m and 40m is most competitive and similar to my experience with the HF6V-X. On 80m, comparisons with a low dipole were quite interesting. The dipole was some 1 to 2 S-points better for distances up to 2000 – 3000 miles but at greater distances the vertical was noticeably superior. This is a typical characteristic of a vertical antenna. Although the bandwidth on 80m is low, the extra 6ft in antenna length compared with the HF6V-X yields a significant increase in bandwidth over the shorter antenna.

On 160m, the bandwidth is very sharp and performance very dependent on the ground / radial system. With my set-up the antenna did not perform as well as longer wire antennas which I have used but this is perhaps only to be expected considering its small size. However, I made plenty of European QSOs, USA and further afield – including JT1CO in Mongolia on the first call. I am sure that the top loading wires would help considerably on this band. The antenna has survived a number of storms and gales without any problems.

Table 1: HF2V

	80	40
Min VSWR	1.2	1.2
Bandwidth 2:1 VSWR	70kHz	400kHz
Bandwidth 3:1 VSWR	150kHz	920kHz
VSWR at band edges	-	1.5

Table 2: HF2V + 30m

	80	40	30
Min VSWR	1.35	1.2	1.55
Bandwidth 2:1 VSWR	70kHz	360kHz	430kHz
Bandwidth 3:1 VSWR	150kHz	770kHz	1.1MHz
VSWR at band edges	-	1.6	1.55

Table 3: HF2V + 160m

	160	80	40
Min VSWR	1.25	1.2	1.1
Bandwidth 2:1 VSWR	11kHz	47kHz	400kHz
Bandwidth 3:1 VSWR	22kHz	96kHz	870kHz
VSWR at band edges	-	-	1.5

Table 4: HF2V + 160m and 30m

	160	80	40	30
Min VSWR	1.2	1.3	1.5	1.5
Bandwidth 2:1 VSWR	11kHz	43kHz	280kHz	500kHz
Bandwidth 3:1 VSWR	22kHz	93kHz	620kHz	1.3MHz
VSWR at band edges	-	-	1.7	1.55

CONCLUSIONS

The HF2V is an effective and reliable DX antenna for the 80m and 40m bands with a long established track record. With the 30m and 160m additions it is the only multiband vertical antenna currently available which covers these four bands. Priced at around £230 the HF2V is relatively good value although the additional band resonators and other accessories are a little more pricey. Bencher / Butternut products are available in the UK from Waters and Stanton PLC. ♦