HFp Antennas

The HFp System as an End-Fed Halfwave

An end-fed halfwave antenna can be a great performer. Because it is a resonant halfwave, it offers the largest capture area possible in a simple antenna. It does not require any radials. If it is vertically mounted, it provides a low angle of radiation in all directions, for DX operations. Its only drawback is that its feed impedance is quite high – up to several thousand Ohms – but that is easily dealt with.

Using components of both the HFp Vertical and the HFp Dipole, a vertically-polarized end-fed vertical can be set up fairly easily. The only extra piece of gear required is a matching unit to transform the high impedance of the antenna to the 50 Ohm impedance of the feedline. This can be as simple as an "L" circuit matcher, and, if you are reasonably adept, you can build one from the information provided here.

Basically, the HFp Vertical base is used as the bottom support for an assembly of elements which is configured for the band in use. The matching network is located at the base, and the coax is connected to the network.

Here are the element configurations for some of the bands tested. Others will be added as they are determined.

40M – covers 7.0 to 7.41 MHz (whip extended / whip collapsed)

base - 1 – 1 – 2-U – 1 – 2-U – 1 – 1 – guy – 1 – 1 – 1 - whip

30M – covers 9.56 to 10.35 MHz (whip extended / whip collapsed)

base - 2-U – 1 – 1 – 1 – 1 – 1 - guy - 1 – 2-D - whip

20M – covers 13.6 to 14.4 MHz (whip extended / whip collapsed)

base - 1 – 1 – 1 – 1 – 1 – 1 - guy - 2-U – 1 - whip

17M – covers 17.9 to 19.5 MHz (whip extended / whip collapsed)

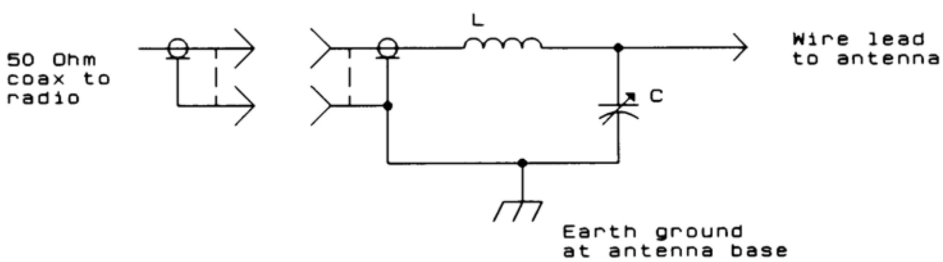
base - 1 – 1 – 1 – 1 – 1 – guy - 1 – 1 - whip

Initially, I thought that the element assembly should be symmetrical – that is the relative positions of the elements on each side of the center of the antenna should be identical. But, this restriction turned out to make it difficult to get resonance on some frequencies. So, I gave up on that, and just assembled them to get resonance. I don't know if the non-symmetrical assembly affects the radiation pattern of the antenna or not, but, in use it seemed to work fine. I had a QSO with Lithuania the first time out!

Obviously, these combinations of elements stand pretty tall (the 40M setup is almost 16 feet high!). That means guy lines are a must. But, the old guy line twisting problem becomes serious with this long an antenna. Because of the extra-long antenna, the guys should be attached high in the elements, for stability (suggested points are noted in the config charts). With this high a guy attachment point, it's just not practical to be able to unscrew the elements above the guy lines to adjust the whip. So, a new Inter-Element Connector was invented to allow the entire assembly of elements to be turned (and even removed at the base) without the guy lines twisting. Take a look at the Special IEC Note to see how this was done.

Another innovation sparked by the end-fed halfwave is the Guy Line Slider. This neat little device was inspired by Kevin, N7KKR. It allows easy tensioning of the guy lines by one person (another must-have when setting up the tall end-fed halfwave by yourself). (Note - Guy Line Sliders are included in all HFp-Vertical kits, but may be ordered separately, as spare parts.)

The last item to consider is the matcher. A simple "L" match is all that's necessary to transform the high impedance of the antenna to 50 Ohms. A diagram of the "L" Match follows:



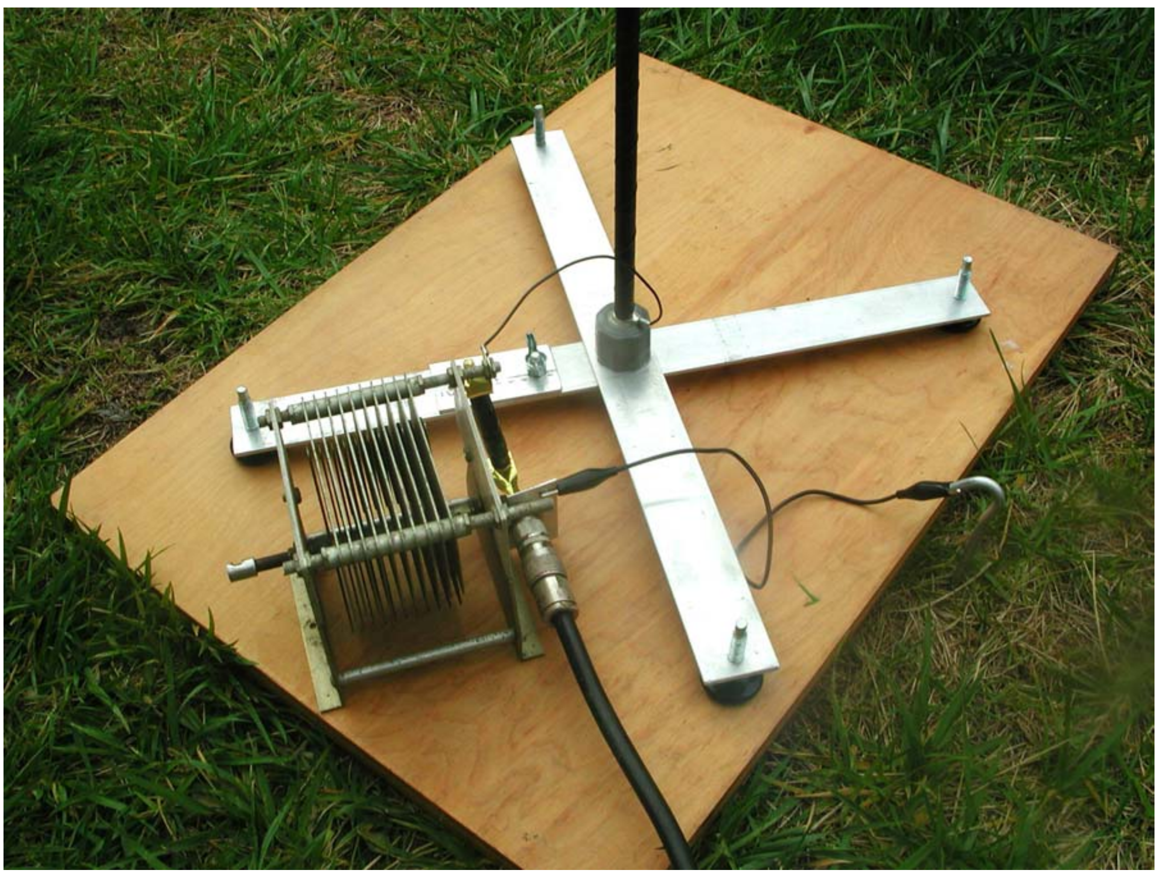
Band	L (uHy)	C (pF)
40	1.5	140
30	1.5	210
20	1.5	125
17	1.5	85

The chart in the schematic shows the values for L and C used to match the antenna to the coax for each band tested. A variable capacitor was used, to allow for fine adjustments. It was possible to get the SWR to under 1.1:1 for any frequency in each band, with 1.2:1 bandwidth of 300 KHz on 17 meters, a bit less on the lower bands. The value for L is not critical – you could be off by 100% and the matcher will still work – but the capacitor values will change, in proportion.

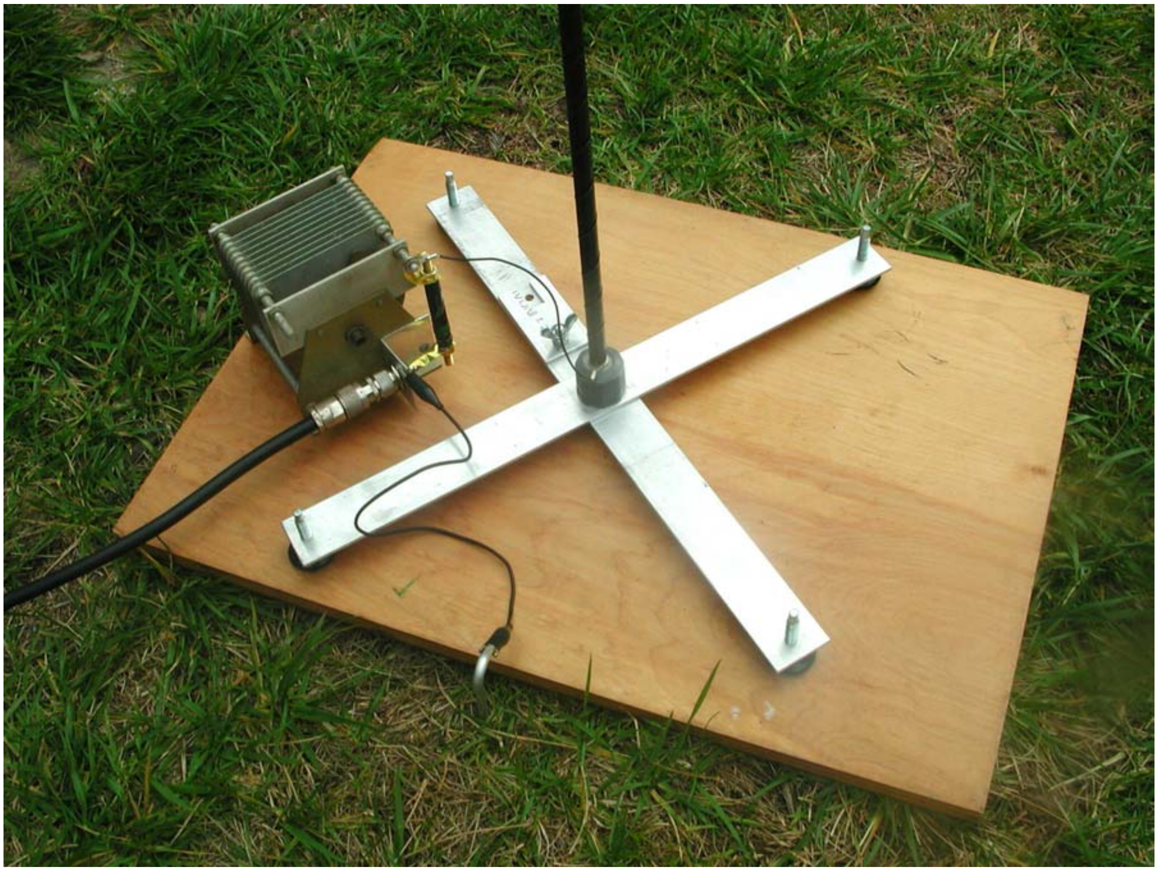
The earth ground shown at the antenna base is an important item. Without it, RF will flow back on the outside of the coax, and may detract from the antenna's performance. I used one of the aluminum guy stakes, pushed into the ground, with a clip lead connecting the stake to the matcher.

A word about power levels – at low levels, up to 20 watts or so, a small broadcast-band variable capacitor may be used in the matcher. If you want to run 50 to 100 watts, then the capacitor must be able to withstand 500 to 1000 volts across its plates without arcing. This means one of the wider-spaced air variable units, such as I used, or, if you have Bill Gates' kind of money, a vacuum-variable capacitor. This is because, at higher power levels, the peak RF voltage at the feed point of the antenna can get right up there.

Here are a couple of pictures of my matcher set up at the base of the antenna. It ain't beautiful, but it works! I'm sure you can come up with a box to put yours in, and, maybe even provide a knob (I turned mine with pliers…).



The coil (L) is the little tubular vertical thing at the end of the coax connector. It connects to the top of the capacitor, and then by a small wire to the base of the antenna. You can see the guy stake, and the clip lead connecting the outside of the coax and one side of the capacitor to ground. I set the antenna base on a piece of wood so that the grass wouldn't get into the capacitor plates.



When adjusting the antenna and the matcher, you will find that there is a bit of interaction between the two units, and it will take a couple of adjustments if you want to get the SWR down to its lowest at the target frequency. This means taking the antenna down, moving the whip in or out a bit to move the resonant frequency, re-installing the antenna, and then some radio or analyzer tests while adjusting the capacitor for best SWR.

With our laboratory-quality HP Network Analyzer, I was able to get the match to a 30-35dB null for any frequency in the tested bands (that's better than 1.07:1). In practice, because the SWR is typically under 1.2:1 for a fairly broad frequency range, you can easily be operational without too much fuss. I would start with the whip at half-length, and the capacitor near its suggested setting, and use an Antenna Meter or the HFp radio tuning method to see where to go from there. Chances are that the initial setting will work just fine for you.

Have Fun!

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