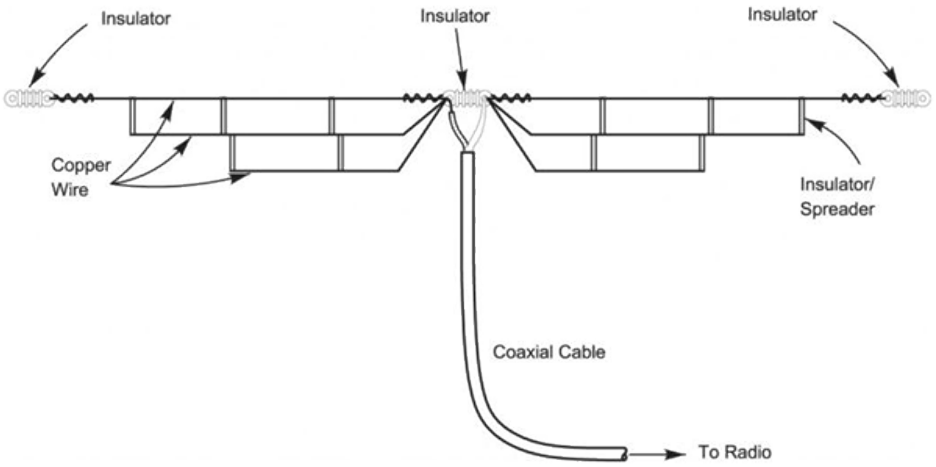
Multiband Parallel Dipoles

Walt – W5ALT

This antenna consists of several dipoles joined at the center with a common feed point. The dipoles are normally held apart by spacers at the ends. The operating theory of the performance of this type of antenna is that only one of the dipoles is resonant on any ham band. The other dipoles have minimal effect on the resonant one.

To see the effect of putting dipoles in parallel with a common feed, I will start with a 40m dipole arranged in an inverted-V and then add smaller dipoles for other bands to see what effect they have on the radiation pattern and impedance of the dipole. All cases are modeled using Multi-NEC with the NEC-3 calculation engine.

In all modeling cases #16 copper wire is used with the center of the antenna at 30 feet above ground with the 40m dipole ends 10 feet above ground. In all cases, a real ground is used in the calculation.



40m Inverted V

Modeling a 40m inverted V is fairly simple and there are no major surprises. At 7.1 MHz, the resonant length of each leg turns out to be about 33.1 ft and the impedance is 56.8 ohms, nearly exactly the expected 50 ohms. Since the antenna is relatively close to ground, the gain is about 4.5 dBi straight up. This would qualify as a "cloud warmer".

Adding a 30m Dipole

Adding a 30m dipole with each leg 24.0 ft long and recalculating shows that at 7.1 MHz the impedance has changed to 52.8 -j 0.6 which gives an SWR less than 1.1. We can make a slight adjustment to the lengths of both the dipoles to bring back resonance on both bands, but it's probably not worth the effort. Interestingly, the 30m radiation pattern shows a lobe at 58 deg, so the height above ground on 30m is helping out. It is not quite a cloud warmer on this band.

Adding a 20m Dipole

Adding a 20m dipole with each leg 17.2 ft long and recalculating shows that at 7.1 MHz the impedance has changed to 50.8 +j 0.2 which gives an excellent match. On 30m, the impedance is 51.1 +j 4.1 which is still quite good. On 20m, the impedance is 45.4 - j0.1, resonant and good impedance for a 50 ohm feedline. On 20m, the radiation pattern shows a lobe at 37 degrees and is starting to be high enough for long distance contacts.

Summary

It does appear that a parallel dipole antenna has minimal interaction between the individual dipoles. Although there is some interaction, it is small and has a minimal effect on both input impedance and radiation pattern.

It is interesting to compare the element lengths given by the modeling program at resonance. A common formula used to estimate the length of a dipole leg is L = 234/F, where L is in feet and F in MHz.

The lengths given at resonance in this exercise turn out to be slightly different. For the 40m element, each leg is represented by 235.2/F, while both the 30m and 20m elements are 242.6/F at resonance.

Building a parallel dipole antenna

First, the way to build and trim such an antenna is indeed the method recommended by the old timers: trim the longest one first, then the second longest, etc. The effects of interaction between the elements will not cause enough problems to worry about.

Second, cut the elements a little longer than estimated from standard formula. It appears that, except for the longest dipole, the others need to be a few percent longer to resonate. This is probably due to additional capacitance caused by coupling to the other dipoles.

Third, as for all types of dipoles, do not expect a low radiation angle unless you get the antenna significantly above ground (in terms of wave length). Since this is a balanced antenna, the use of a balun is recommended for feeding with 50 ohm coax.

Alpha Delta DX-EE
4-band parallel dipole antenna

Steve Ford – WB8IMY

I am personally fond of non-resonant HF antennas that I load with my trusty antenna tuners. Sometimes, you may want an antenna that simply works without the additional hassle and expense of adding a tuner in the line. In other words, you want an antenna that allows you to just attach a length of coax and go.

The DX-EE consists of three wire dipoles in parallel. The top wire, which serves as the 40/20-meter radiator, is the longest at 40 feet. That is about 26 feet short of a half wavelength for 40 meters. The length is reduced by using inductive loading on both legs. This compromise works, although it also narrows the 40-meter SWR bandwidth considerably.

The center section of the DX-EE at a height of 25 feet.

The remaining dipoles are full-size half wavelengths on 15 meters and 10 meters. They are separated from each other by plastic insulators. Using an antenna tuner, 30-meters, 17-meters, and 12 meters can also be used making this a 7-band antenna.

The DX-EE uses inductive loading on the 40/20 meter wires to reduce the overall length to just 40 feet.

On 40 meters, the 2:1 SWR bandwidth extended from 7.000 to 7.080 Mhz with the lowest SWR being 1.7:1. On 20 meters, the bandwidth was more generous ranging from 14.000 to 1.228 Mhz with the lowest SWR at 1.6:1. The results on 15 meters were similar to 40 meters with a range of 21.000 to 21.100 Mhz. Ten meters was the broadest of all with a 2:1 SWR bandwidth extending from 28.000 all the way to 28.400 Mhz with the lowest dip at 1.2:1.

Additional note - K5IJB

This parallel dipole antenna can also be used on 6-meters as a 5/8-wave dipole using an ATU. According to Ronald Holtz (NN4RH), the 6-meter 5/8-wave dipole is just a bit longer than a 1/2-wave dipole for 15 meters with the radiation pattern virtually identical. It has a narrow bandwidth with an impedance close to 100 ohms.

Ron claims that the 6-meter 5/8-wavelength dipole has about the highest gain possible (almost 10dBi) for a wire dipole with a two-lobe pattern. 6-meter 5/8-wave length is 23.5 feet at 50.313 Mhz. 15-meter 1/2-wave length is 22.2 feet at 21.074 Mhz.

I have used the DX-EE parallel dipole antenna for several years on 40-10 at 20-feet and 35-feet height with SSB, CW, and digital modes. It is consistently used on 6-meters FT8 running 50 watts with excellent results as an inverted-V at 20-feet.