Antenna of the Month

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Fan (Parallel) Dipole

Those who must live with simple wire antennas are always searching for a way to get as many bands as possible with a single feedpoint. We've looked at things like off-center fed dipoles which may work ok though it has issues with common-mode current and some unpredictability as to what bands may actually work, plus the fact that a tuner is mandatory. And then there's the G5RV which may be ok in some situations, and also some fairly nutty end-fed wires that leave many users rather dissatisfied. But I'm quite convinced that the most compromise-free choice is the fan, or parallel, dipole, which is simply a set of dipoles cut for different bands, all connected to a common feedpoint (Fig. 1).

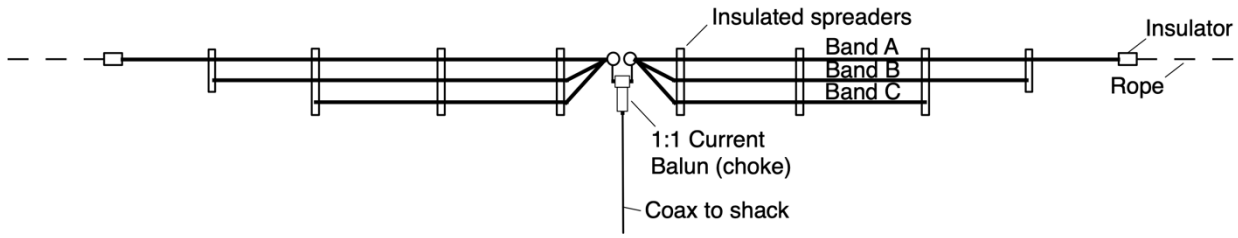

Figure 1. Plan for a basic fan, or parallel, dipole.

Advantages and Disadvantages

The main advantage of a fan dipole is that it's… a plain old dipole. That means it's balanced so you don't have to battle with excessive common-mode current on the feedline as you would on an off-center fed design. It's also highly predictable when it comes to the radiation pattern, which is primarily driven by how high you install it. Finally, it's impedance at resonance on all selected bands typically will be in our very friendly range of about 50 to 75 ohms without the need for any transformers or odd feedlines, again height-dependent.

The main drawback is that you can't realistically expect to access more than about four bands on a single fan. There are several reasons for this. First, the various lengths of wire do interact and an overly-complicated array becomes very difficult to tune. Second, the SWR bandwidth may be slightly reduced on some bands. Third, certain band combinations are not recommended because they may produce an undesirable feedpoint impedance. An example would be where the frequencies are rather close (12 and 10m).

Here are some common combinations which you may also find in commercial products such as those from Alpha Delta:

- 80, 40, 20, 15 (via third harmonic of 40) using 3 dipoles
- 40, 30, 20, 15 (via third harmonic of 40) using 3 dipoles
- 40, 20, 15 (via third harmonic of 40), 10 using 3 dipoles

Construction

Most commonly we hang the shorter wires under the longest one via insulating spacers. Spacing between wires really isn't critical. A few inches is acceptable and commonly used. The longest wire needs to be the strongest and is firmly anchored and tensioned at each end. Spacers can be made of things like small PVC pipe, acrylic, or Lexan strips with holes for each wire. With close spacing, the higher frequency dipoles tend to be longer than expected (10-15%), so be sure to start out with excess wire to trim off. Also, the SWR bandwidth on those higher bands is reduced somewhat. If you want lots of separation, run each wire to a separate tie point. Some comparative data is presented in Ref. 1.

You can potentially add all kinds of dipole enhancements including loading coils or bent ends to shorten things up, inverted-vee format, or my famous third-harmonic capacity hat that was discussed in a recent Antenna of the Month article (Fig. 2). Traps are possible but tuning such a contraption could be frustrating.

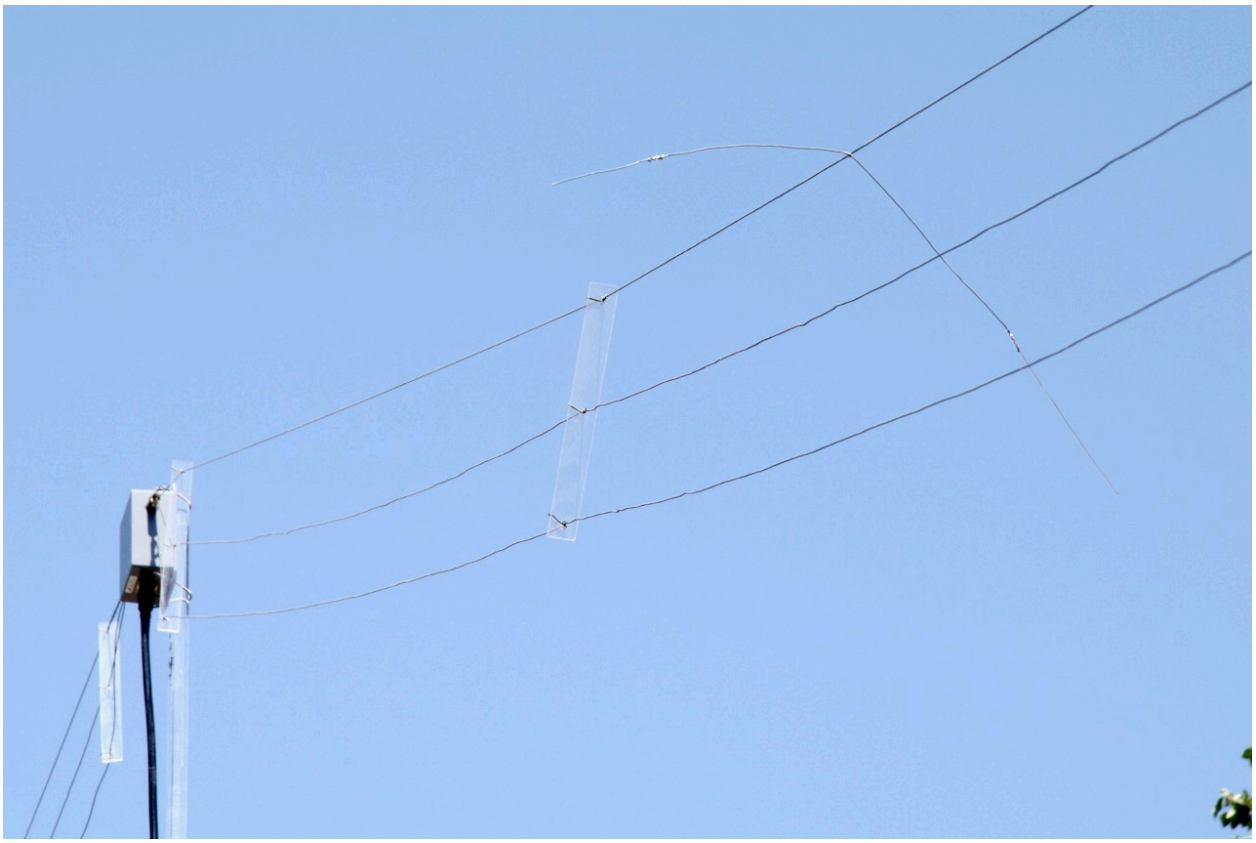

Figure 2. Closeup of my backyard fan dipole (40/30/20/15m) with a 15m hat. Wire is Teflon-insulated 20 ga. Spreaders are 1/8-inch acrylic strips about an inch wide. It's been up for 12 years.

At the feedpoint, always use a good common-mode choke. K9YC [Ref 2] has all the design information if you want to make one that is fully optimized to reduce receive noise and improve the radiation pattern.

Tuning and Typical SWR

A good antenna analyzer is highly recommended when tuning. Begin with the lowest frequency band first and work progressively to the highest frequency band. Expect to go through all the bands at least twice to walk them in to desired resonant frequencies. I prefer to fold the ends of wires back on themselves and twist them when tuning. That way, it's easy to "add" wire if needed. Figure 3 shows the SWR of my 40/30/20/15m installation. SWR bandwidth (2:1) was at least 200 kHz on each band. I ran it for many years at 500 W and even though it's quite low (only 15 ft up!) it was effective enough and trouble-free for my DXing and casual contesting activity in an HOA community.

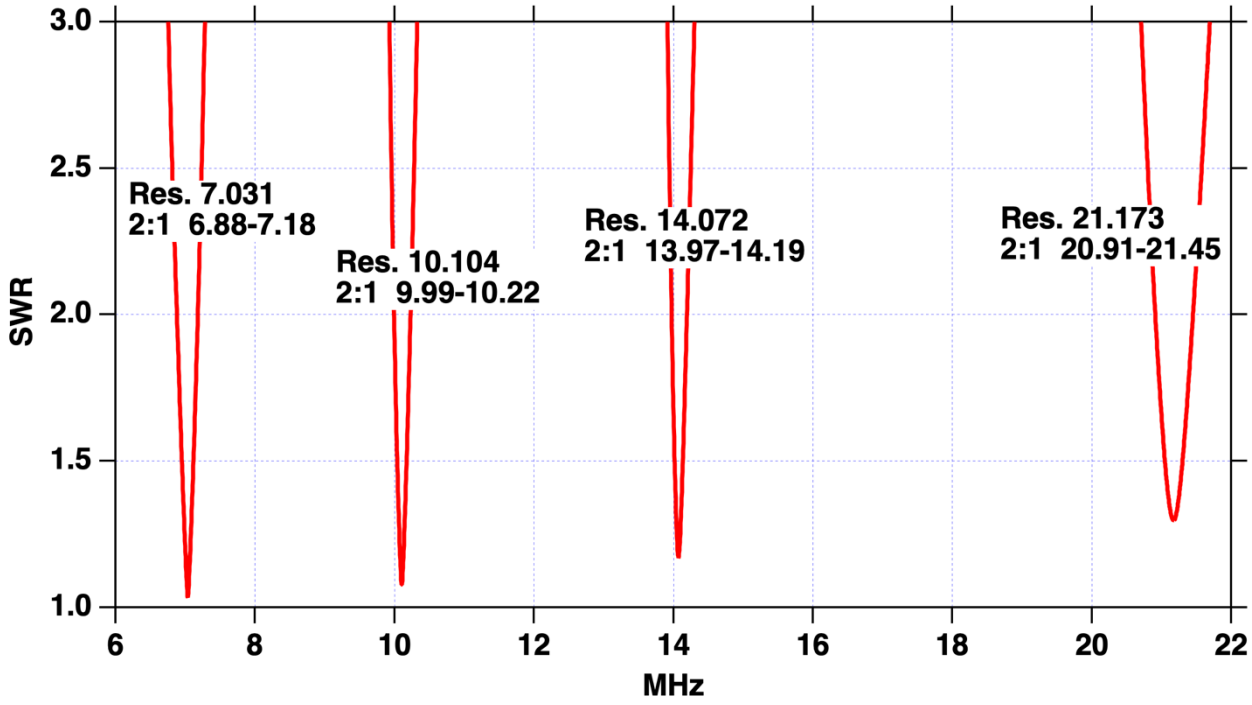

Figure 3. SWR of my 40/30/20/15m fan dipole showing 50-ohm 2:1 SWR bandwidths.

References

1. L. B. Cebik, W4RNL, "My Top Five Backyard Multi-Band Wire HF Antennas." http://on5au.be/content/fdim/fdim9.pdf

2. Jim Brown, K9YC, "A New Choke Cookbook for the 160-10m Bands." http://k9yc.com/2018Cookbook.pdf