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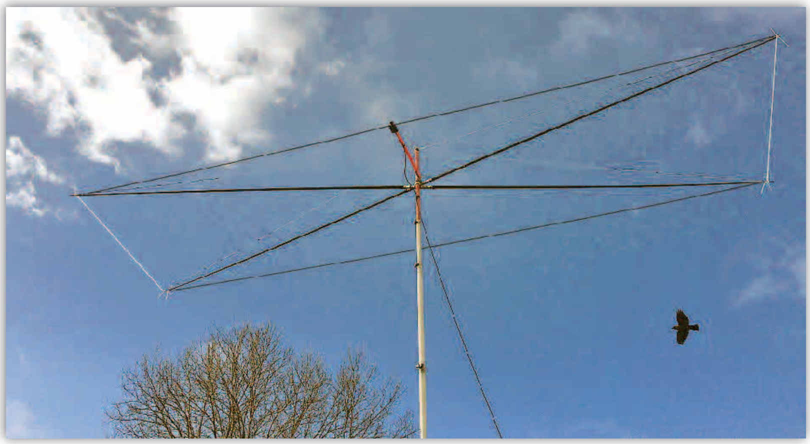
A Two-Element Yagi for 18 MHz

Martin Hedman, SMØDTK

I wanted a compact, directional antenna for DX work. A two-element Yagi is a good choice for obtaining both reasonable gain and front-to-back ratio in an antenna. Adding another element provides some more gain, and also makes the antenna bigger, heavier, and more vulnerable to wind loading. With this in mind, I decided to construct a two-element antenna based on the concept of my three-element Yagi antenna that appeared in the March 2010 issue of *QST*.[1] It attained its

[1]M. Hedman, SMØDTK, "The Mini Horse Antenna," *QST*, Mar. 2010, pp. 37 – 38.



Put together a compact directional antenna for 17 meters with fishing rods and bits of wire and string.

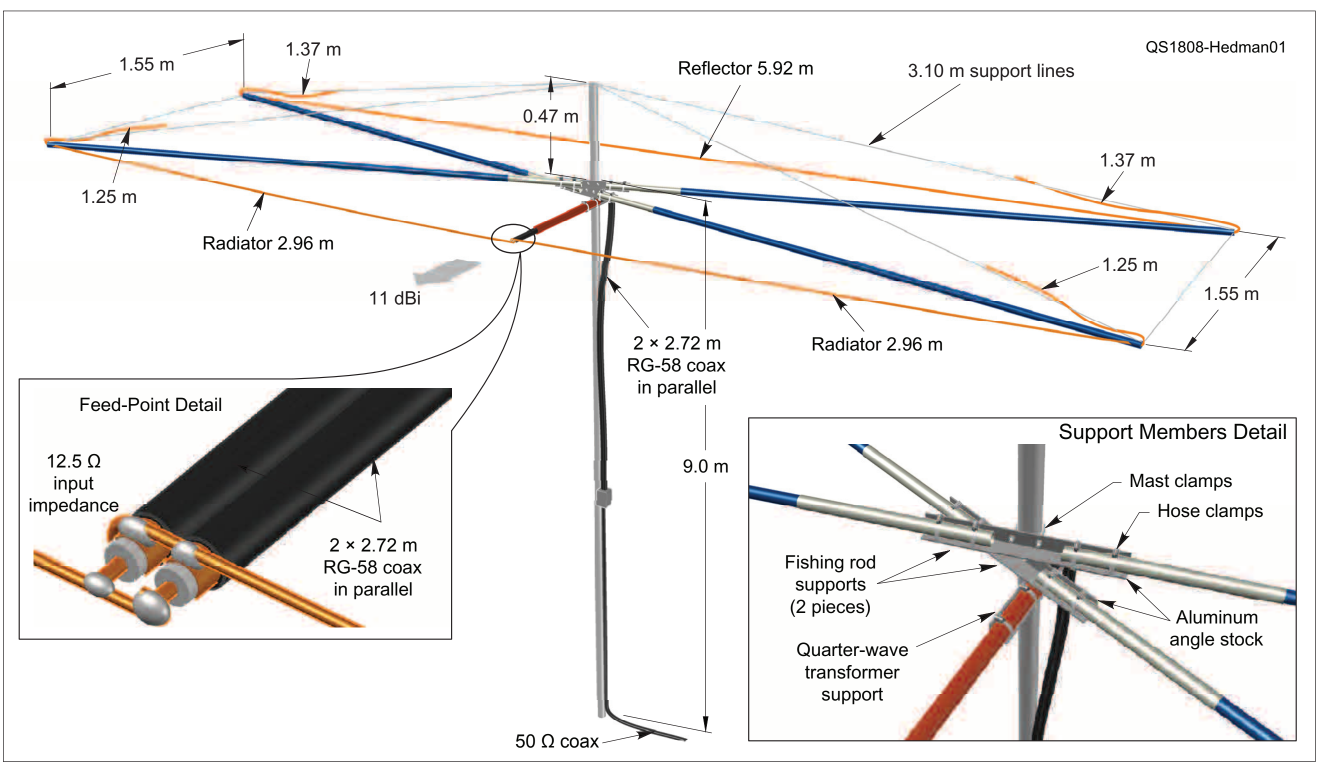


Figure 1 — Four 3-meter fishing rods serve as the antenna's structural frame, which is held in registration by tension in the nonconductive horizontal support lines and the radiator and reflector. These extend to the fishing rod tips and are then folded back and secured to the upper support lines, that are in turn secured to the apex of the mast, 0.47 meters above the plane of the structural frame.

reduced size by end loading the driven element and folding back the parasitic elements.

Design

Using the antenna analysis tool *4nec2*, I set out to create a new mini-version of my three-element Yagi antenna. For a Yagi, the distance between a driven element and a director is usually 0.1 wavelength (λ), and between a driven element and a reflector is 0.2 λ. To keep the antenna small, I therefore tried an antenna with a driven element and a director. This solution did not work as expected, so my second try was an antenna with a driven element and a reflector. Still, I wanted a narrow distance between the two elements. After many attempts, I finally ended up with the configuration shown in Figure 1.

Construction

As shown in Figure 1, the driven element and reflector are formed of 1-millimeter (#18 AWG) insulated wire. If you use a different wire diameter, the lengths of the elements must be modified. The distance between the driven element and the reflector is less than 0.1 λ, which makes the antenna really "tight," so an element length variation of 1 centimeter will change the resonance frequency by 40 kHz. Note that the driven element and reflector are folded back sharply and attached to the support lines that maintain the horizontal alignment of the fishing rods forming the antenna framework.

The framework is comprised of four 3-meter fishing rods that are secured by hose clamps to two sections of aluminum angle metal, which are in turn clamped to a 0.47-meter mast extension. The antenna is mounted atop a 9-meter mast.

Assemble the antenna by adjusting the fishing rod positions so that the tip-to-tip lengths are 5.92 meters on the long side with a front-to-back spacing of 1.55 meters at the ends. Secure the front-to-back spacing with fixed lengths of non-conductive support line. Support the four tips from drooping with nonconductive lines attached between the tips and the top of the 0.47-meter mast extension.

The reflector is an 8.66-meter length of wire strung between two tips on the long side, with 1.37-meter lengths folded back and attached to the vertical support lines at each end.

The radiator is comprised of two lengths of 4.21-meter wire connected

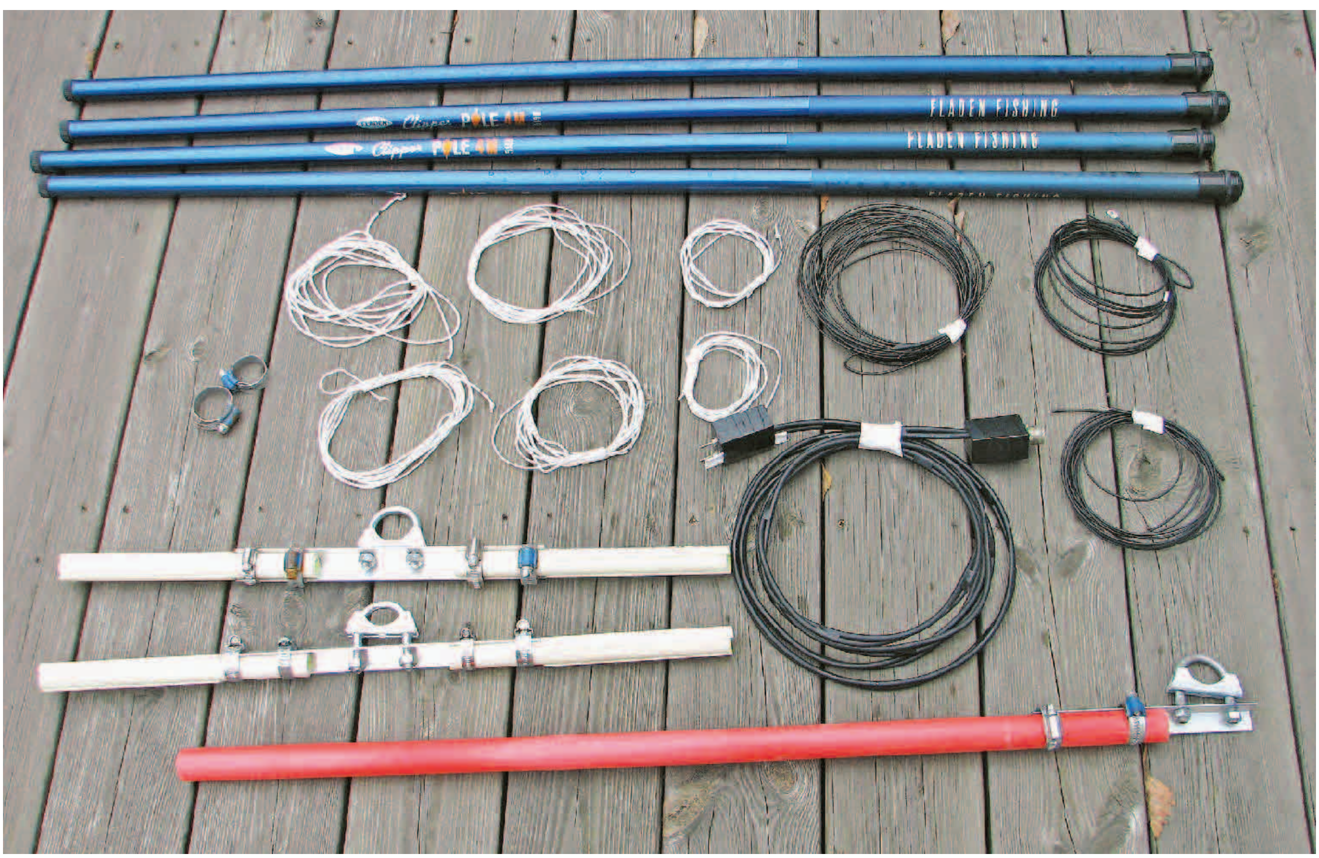


Figure 2 — The parts of the antenna: four 3-meter telescoping fishing rods, six coils of nonconductive support line, one 8.66-meter coil of 1-millimeter (#18 AWG) insulated wire for the reflector, two 4.21-meter coils of 1-millimeter (#18 AWG) insulated wire for the radiator, a quarter-wave transformer formed by a pair of parallel-connected 2.72-meter lengths of RG-58, two aluminum angle sections for mounting the fishing rods to the antenna mast, and a feed-point support (pink rod).

between the quarter-wave transformer at the center and the fishing rod tips opposite the reflector with 1.25 meters of wire folded back at each tip and secured to the tip's vertical support line, as shown in Figure 1. The feed point and coax that forms the quarter-wave transformer are supported by a fiberglass pole attached perpendicularly to the mast extension. Figure 2 shows the individual components of the antenna prior to assembly.

The matching impedance of the driven element is low, so I used a quarter-wave transformer to match the antenna to 50 Ω coax cable. The transformer consists of two 2.72-meter lengths of RG-58 connected in parallel. You can feed the antenna directly using a 50 Ω cable and an antenna tuner.

Performance

Figure 3 presents an overall summary of the antenna's performance. The SWR (blue line) is okay for a narrow band like 18 MHz. The gain (red line) is best obtained at the bottom of the band, while the best front-to-back ratio (green line) is obtained at the top of the band, based on simulations over real ground.

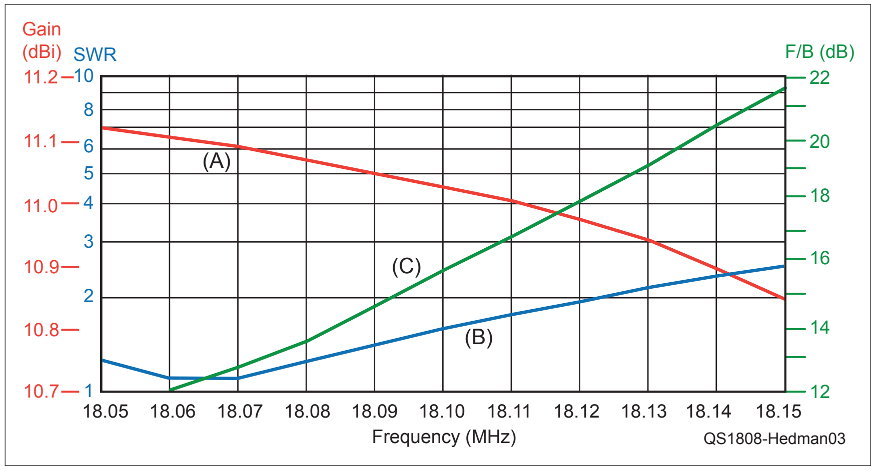


Figure 3 — Plot of three antenna parameters across the 17-meter band: (A) gain in red; (B) SWR in blue, and (C) front-to-back ratio in green.

This two-element version of my 2010 three-element antenna is lighter and more compact while maintaining good gain and front-to-back ratio, and is constructed from readily available, inexpensive components. Good luck in building the antenna for 18 MHz or another band. If you would like an NEC data file to start off the project, please contact me at **sm0dtk@icloud.com**.

Photos by the author.

Martin Hedman, SMØDTK, has been a licensed Amateur Radio operator since 1965. He enjoys building radio equipment, especially antennas. Martin also enjoys low-power DX and has worked all DX entities using low power with his homemade antennas. He is now retired following a career as a telecommunication engineer. Martin lives in western Sweden, just north of Gothenburg. You can contact him at **sm0dtk@icloud.com.**

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New Products

Coaxial Cable Crimp Connector Tools from DX Engineering

The Coaxial Cable Prep Tool Kit for Crimp Connectors (DXE-UT-KIT-CC1) from DX Engineering includes tools needed to prepare coaxial cable ends for RF crimp connectors. The kit includes four coaxial cable strippers, grippers for 8X and 213-size coaxial cables, 10 replacement blades, side cutter braid trimmers, Channellock cable cutters, and a custom carrying case. The hinged strippers allow users to insert a length of coaxial cable against an internal stop, close the tool, and rotate it to cut the cable to the correct measurement. The strippers will prepare 400MAX, 8U, 213U, LMR-400, 8X, and LMR-240-size cables for installation of crimp-style PL-259, type N, and BNC connectors. These tools are designed to prepare cables only for DX Engineering and Amphenol crimp connectors. DX Engineering also offers the Ultra-Crimp 2 Crimp Connector Kit (DXE-UT-KIT-CRMP2) that crimps 0.405-inch and 0.240-inch families of connectors, as well as three sizes of Anderson Powerpoles. Price: DXE-UT-KIT-CC1, $249.95; DXE-UT-KIT-CRMP2, $174.95. For more information, visit **www.dxengineering.com**.