Antenna of the Month

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Square Loop (Squalo)

A popular and compact antenna for 6 and 2 m is the square loop, also called a squalo. Available commercially or easily built from copper tubing, it offers an omnidirectional pattern, horizontal polarization, and a good match to 50 ohms. In principle it could be built for any band but low VHF is where it's most popular and practical. It's a nice complement to a vertical, and also handy for a "quick look around" if you only have a Yagi. In this article, we'll look at a popular design for 6m, one that I built myself in a few hours when desperate for an antenna to join an ongoing June VHF contest (Fig.. 1).

Figure 1. My emergency 6 m squalo, made of refrigerator tubing and installed on a piece of conduit.

The squalo is basically a dipole (half wavelength of course) with the ends bent around until they nearly touch. This is not to be confused with other loop designs of various lengths that are in fact contiguous closed loops. An important factor in its design is that if we do nothing special, the impedance at the feedpoint would be very low, on the order of 10-15 ohms. So some form of matching device is required to transform that up to 50 ohms.

There are many ways to provide a match including transformers, transmission line matching sections, LC networks, gamma match, beta match, and others. In this case, we will follow the lead of the most common design for 6 m and use a modified beta match. A full description of how a beta match works is beyond the scope of this short note but is covered in detail in ARRL *Antenna Handbook*. It turns out that it's what amounts to a simple loop of wire placed across the feedpoint acts as a small inductor. This is also called a *hairpin* match. By adjusting the geometry of the antenna (chiefly its length), we force it to have a small effective capacitance at the feedpoint at the center of the desired band. When combined with our little inductor, they act like an *L network*. L networks in general are very useful in impedance transformation, and in this case it's configured to convert a lower to a higher impedance. It's just a matter of mechanical adjustment.

Figure 2 shows a good design from PA3EGH. Make it from half-inch copper tubing and fittings for best results, or bend it up from soft refrigerator tubing (kinked corners are ok). Coax attaches at the locations marked "feed point." You will need to come up with some kind of clamps to make the connections. There's a shorting strap that determines the length of the beta match loop. Adjust that carefully for lowest SWR. To change resonant frequency, either trim the ends of the antenna that go into the insulator, or try bending them apart. A piece of aluminum angle can be used to attach it to the mast, and it's pretty well balanced.

A common-mode choke is needed, as close as you can get to the feedpoint. Two turns through a mix 31 ferrite toroid, or a series of 5 or 6 beads or clamp-ons over the coax will work fine. This will prevent the outside of the coax from becoming part of the antenna and detuning it, along with conducting noise onto the antenna.

I ran some simulations in EZNEC with the antenna up 20 feet and the results are shown in Figs. 3 through 5. An SWR less than 2:1 is available over a 1 MHz bandwidth. Peak gain is about 1 dB less than a simple dipole in exchange for a more omnidirectional pattern. It's somewhat directional along the centerline of the antenna as shown in the azimuth pattern. For additional gain, two or more antennas can be stacked and fed via a phasing harness like the ones from M-Squared (m2inc.com). Overall, this is a simple and robust antenna that anyone can build.

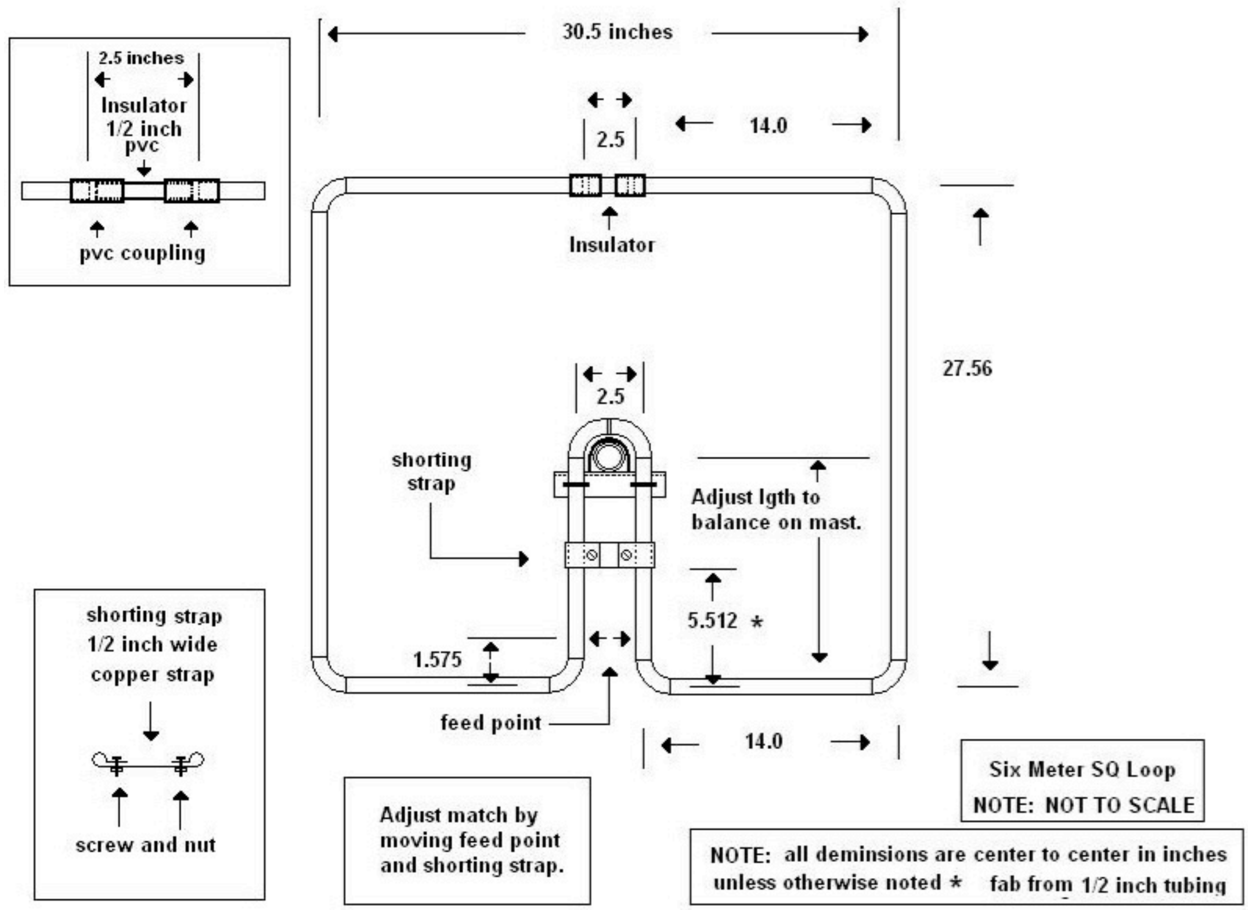

Figure 2. Design for a 6 m squalo by PA3EGH. https://www.pa3egh.nl/homemade/antenna/

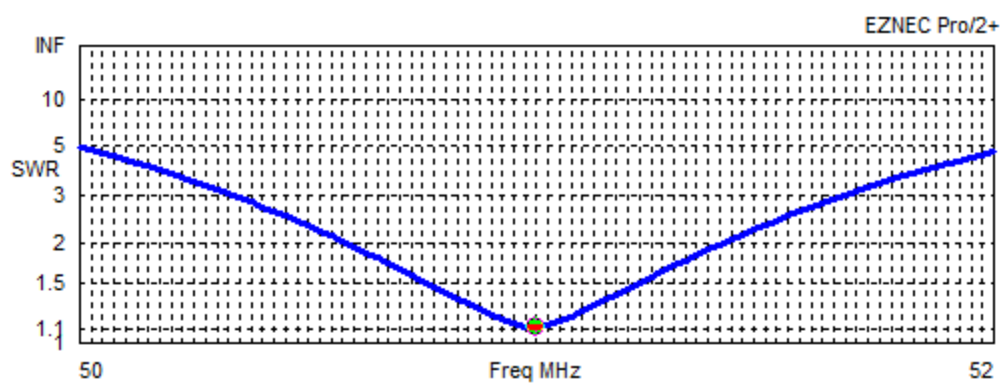

Figure 3. SWR when optimized for 51 MHz.

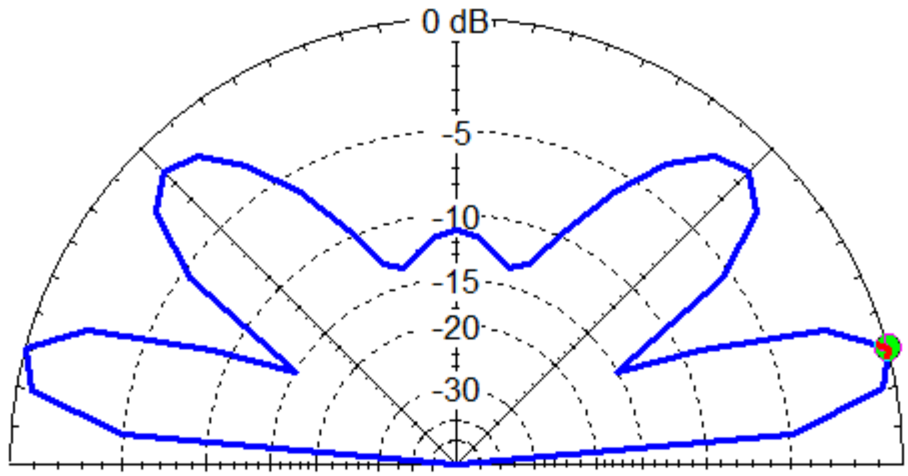

Figure 4. Pattern in elevation along centerline with the antenna at 20 ft .Outer ring is 6.75 dBi.

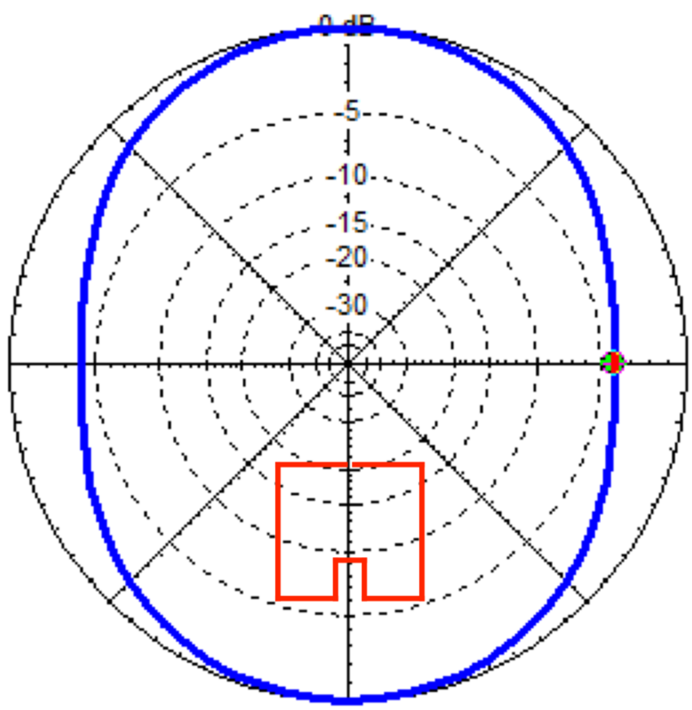

Figure 4. Pattern in azimuth at an elevation of 15 degrees. Outer ring is 6.75 dBi.