6 Meter Loop

A 6 Meter Magnetic Bicycle Wheel?

I've been intrigued with the magnetic loop antenna for some time, but have always been leery of the narrow bandwidth. With the opening of the 6 meter band I was in need of a 6M antenna because my EFHW does not cover 6M. Since I only want to use FT8 on 6M this was the opportunity to build a 6M Magnetic loop for just one frequency. The adventure begins!

In need of a loop, I set out to find something suitable. I only had to travel one block before I found a bicycle set out for the metal recycler (me in this case). Now in possession of a 26" rim, which is only 22.5" diameter, it was time to cypher up some numbers. How hard could that be? Actually very easy.

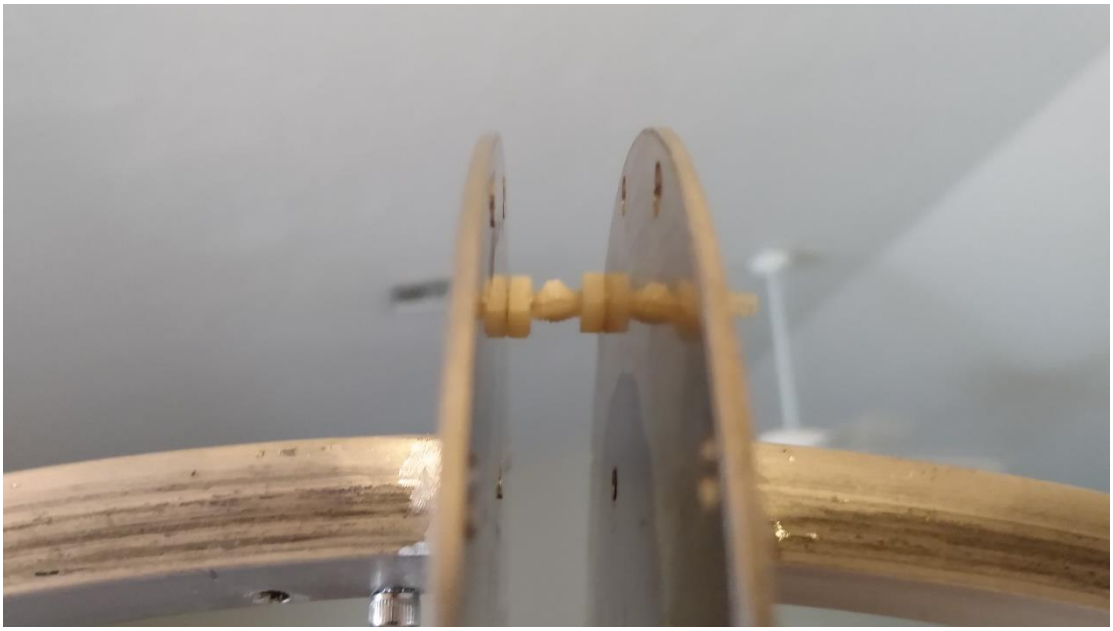
One simple online calculator was used to determine the amount of capacitance needed to tune the loop to the specific frequency (50.313 MHz). It said I needed 9 Pico farads, and the voltage at the capacitor for 100W would be 2005V rms! "DANGER-DANGER WILL ROBINSON." Another simple online parallel plate capacitor calculator gave me the distance between plates for plates of a specified area. Off to the junk box.

The junk box provided a round aluminum disk that was cut in half to use as the two plates. They were attached at split cut in the rim and a small nylon screw was used to separate them. The coupling loop is usually one fifth the diameter of the main loop so a piece of 14GA bare wire from a piece of Romex was wrapped around a big jar to form the loop. It is attached to a SO239 connector. The entire contraption is mounted atop a camera tripod using a coupling nut.

The beloved NanoVNA was used to tune the loop by adjusting the distance between the plates. The result was impressive as seen in the photo. Then the real learning started……

1.11 SWR at 50.310 MHz!

As I increased the power from 10W on my first transmission, the SWR started increasing and when I heard a small pop it went off the scale. I love that my radio protects itself from me. The antenna was in the next room. Lesson 1 – 1500 volts across a used, slightly dirty small nylon screw is enough to melt it….



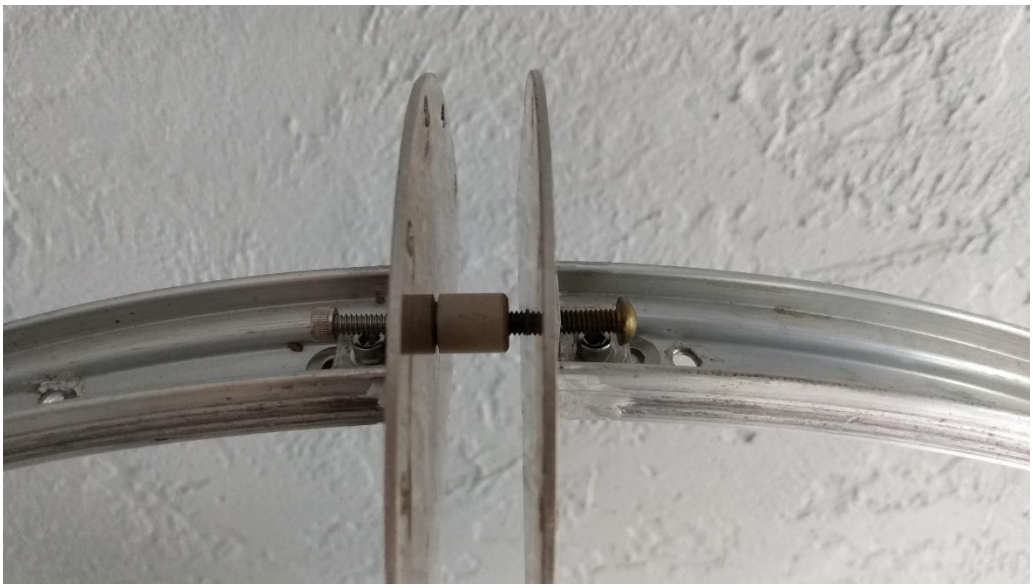
Meltdown

A better method of separating the plates was undertaken. Along the way I learned Lesson 2 – the plates cannot shift side to side which causes the capacitance to change. The final solution was to use a ceramic standoff between the plates. It is attached to one side by the stainless steel screw. The brass screw on the other side is threaded through the plate and the end is a in an indentation on the standoff. Adjusting the brass screw pushes the plates apart while the indentation keeps them aligned.

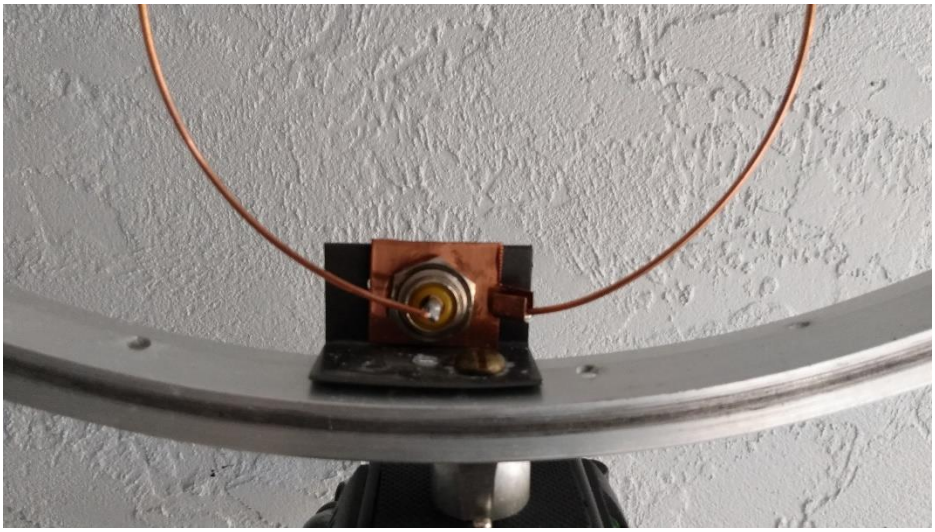
Does it work? YES. With the antenna inside my house, using 50 watts, I made my first two contacts to Virginia and Belize. The band was pretty dead at the time. I moved the antenna outside and had no problems operating it at 100 watts. There was a brief opening to the Northeastern states and several contacts were made. Construction is robust enough that all the moving around did not de-tune it.

NEVER TOUCH AN ANTENNA LIKE THIS WHILE TRANSMITTING! EXTREMELY HIGH VOLTAGES ARE PRESENT. Even at 1 watt there will be 200 volts rms across the capacitor.

But wait! There's more! Avoid disappointment and future regret! This article including links to the calculators used, and additional information will be posted to the Elmer section of the club website.



The final plate separator



The coupling loop

6M bicycle wheel mag loop antenna

Extra section for website:

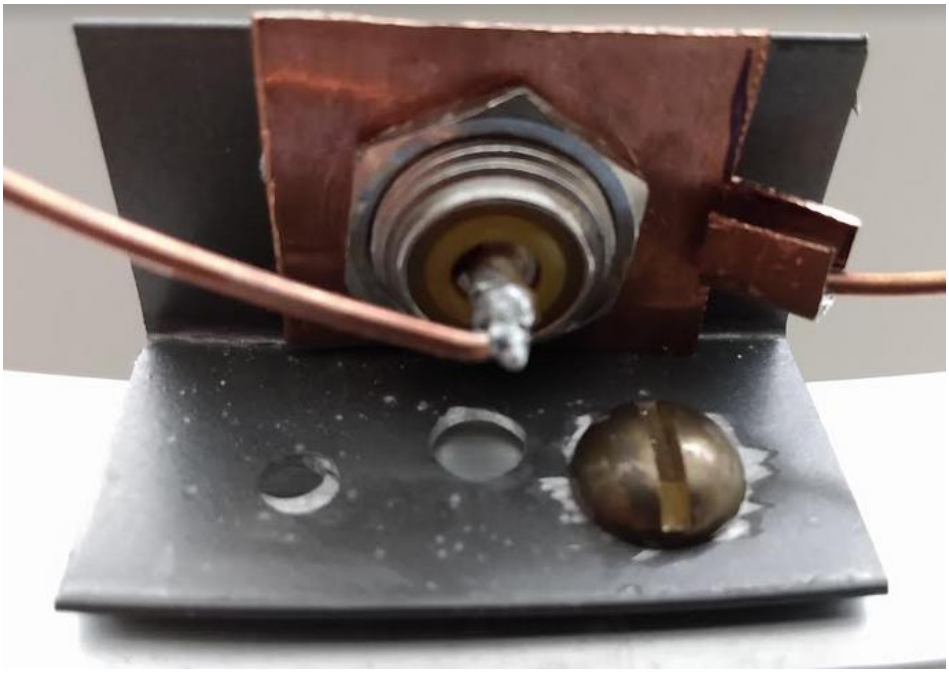
Loop Antenna calculator

https://www.66pacific.com/calculators/small-transmitting-loop-antenna-calculator.aspx

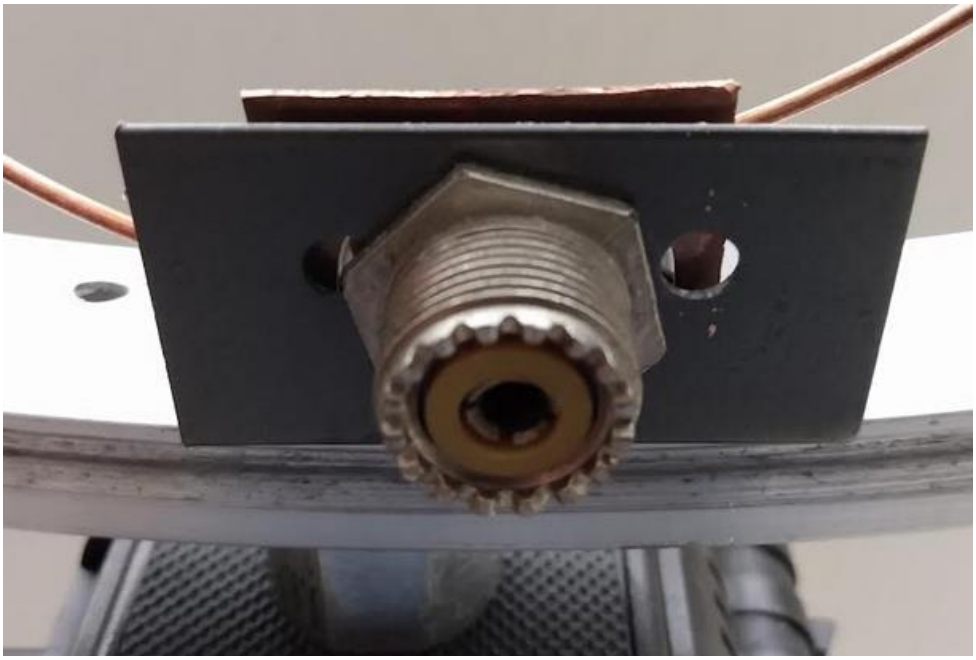
Parallel plate capacitor calculator

https://www.daycounter.com/Calculators/Plate-Capacitor-Calculator.phtml

Additional detail photos

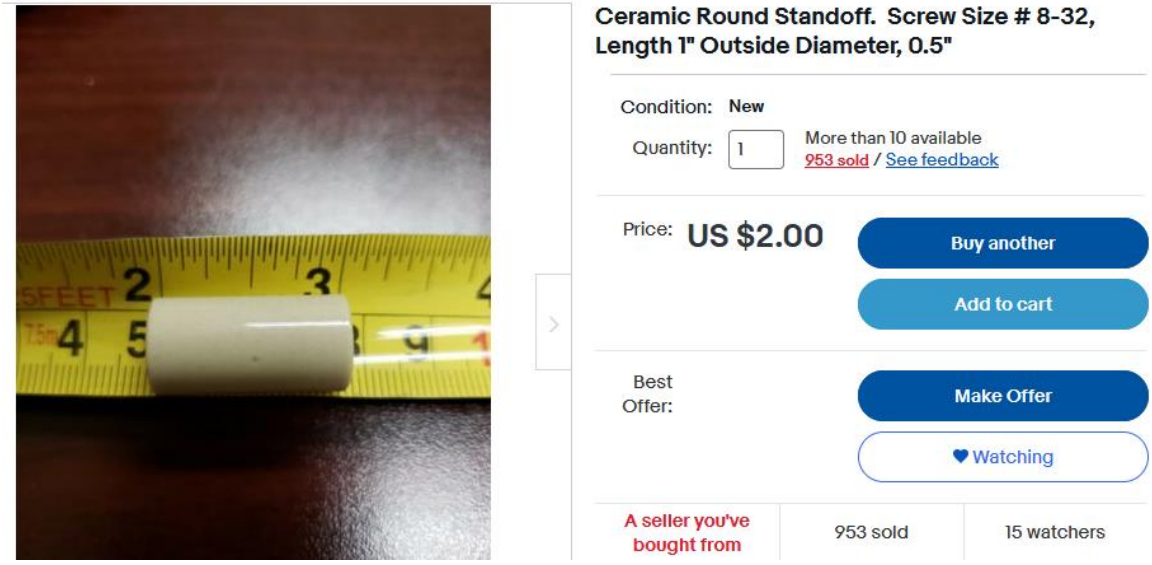


The mounting angle for the SO239 is an aluminum clip for lanai enclosures available at Lowes & Home Depot. The copper is a piece of flattened water pipe. The brass mounting screw goes through the tire tube stem hole in the rim.



The capacitor plates are attached to the rim with a small piece of aluminum angle. The angle is soldered to the capacitor plate using some aluminum soldering sticks a friend gave me. A washer wedged under the angle adjusts the tilt of the capacitor plate so they are more parallel to each other. The number 6 screw seen threads into the ceramic spacer (not seen).

The brass number 8 screw is in a threaded hole through the angle and plate so it can screw in and out to adjust the distance between the plates. The end is in a slight indentation on the end of the ceramic insulator to keep the plates in alignment.



Ceramic insulators are available on eBay. The one I used was cut from an old radio part in the scrap box. The ceramic can be cut using a Dremel tool with a diamond cutting disk. I bought a couple of the ones shown to have on hand. This was a great price compared to others on eBay.