

## A 42m Horizontal Wire Loop Antenna for 10m, 15m, 20m and 40m.

by Andrew Barron ZL3DW. (June 2004)

It's cheap, effective and almost invisible!

I needed an antenna, which would maximise my enjoyment of the HF ham bands, while keeping my wife and neighbours happy. My wife has an acute dislike of guyed masts and large Yagi arrays in the back yard of our suburban section. So I needed an antenna that did not require high masts, but offered acceptable performance on several bands.

After extensive Internet research, I decided to give a horizontal loop a try. The result was very successful, I have an antenna that cost almost nothing, was easy to erect, works well on 4 HF bands and is almost invisible to my wife and the neighbours. The antenna performance has exceeded all expectations, especially as it is only about 3m off the ground. I have worked 112 countries on it, using 100W SSB or 50W PSK and its performance is better than a commercial trap wire dipole at a similar height, or a home made ground based bottom loaded vertical with radials. <Got a Yagi now though ;-)>

The antenna is made of hard drawn 1.2mm copper wire and is approx 42m long. It is arranged as a square or rectangular horizontal loop about 10m per side. The sides do not need to be equal or even parallel, but keep the shape as close to a square as possible, as this will give the best bandwidth and radiation pattern. The loop is fed in the North corner with a 4:1 balun in a plastic weatherproof box. I used stainless steel bolts to connect the balun through the box to the antenna, and put a type N connector chassis on the transceiver port. The coax feed is 50 ohm RG213, to the antenna tuner in the shack. Because the antenna does not produce a 50 Ohm match, an antenna tuner **must** be used for transmit operation. I would love to know what the impedance of the antenna actually is, as the 4:1 balun may not be the best matching option. In fact I am pretty sure the antenna was better on 10m with no balun at all. The antenna has a wide bandwidth so the tuner can be "set and forget" on all bands except 40m where each frequency of operation will need the tuner adjusted

The antenna tunes, 10m (28-29MHz), 20m, 15m (mine has a sharp 50 Ohm Return Loss null in this band <really 200 Ohm plus the balun>), and 40m. The WARC bands will tune, but the antenna becomes a non-resonant random wire with very poor performance. The antenna will not tune on 80m.

The article on Cebik.com indicates that the antenna will have significant gain over a dipole on all bands. The radiation pattern should be 4 lobes through the antenna corners on 40m (1 wavelength loop), with more lobes on the other bands.

The overall wire length of 42m will need to be adjusted to centre the antenna in the ham bands, but it is not super critical and if it is OK on 20m, it will also be OK on the other three bands. The wire length may be different if non copper or a different wire size is used, or at different height above ground, the

higher the better. The easiest way to adjust the length is with a commercial (Return Loss) sweep set, but assuming you don't have one lying around in the shack, you can get an idea by comparing SWR (without the tuner) at the top and bottom of the 20m band. i.e. adjust the antenna length so that best SWR is in the middle of the band. Note the SWR, without the tuner, will always be high as the antenna is not 200 Ohms, (50 Ohms through the balun), but it should be lowest in the centre of the band. Use low power to avoid damage to your transceiver, and QRM.

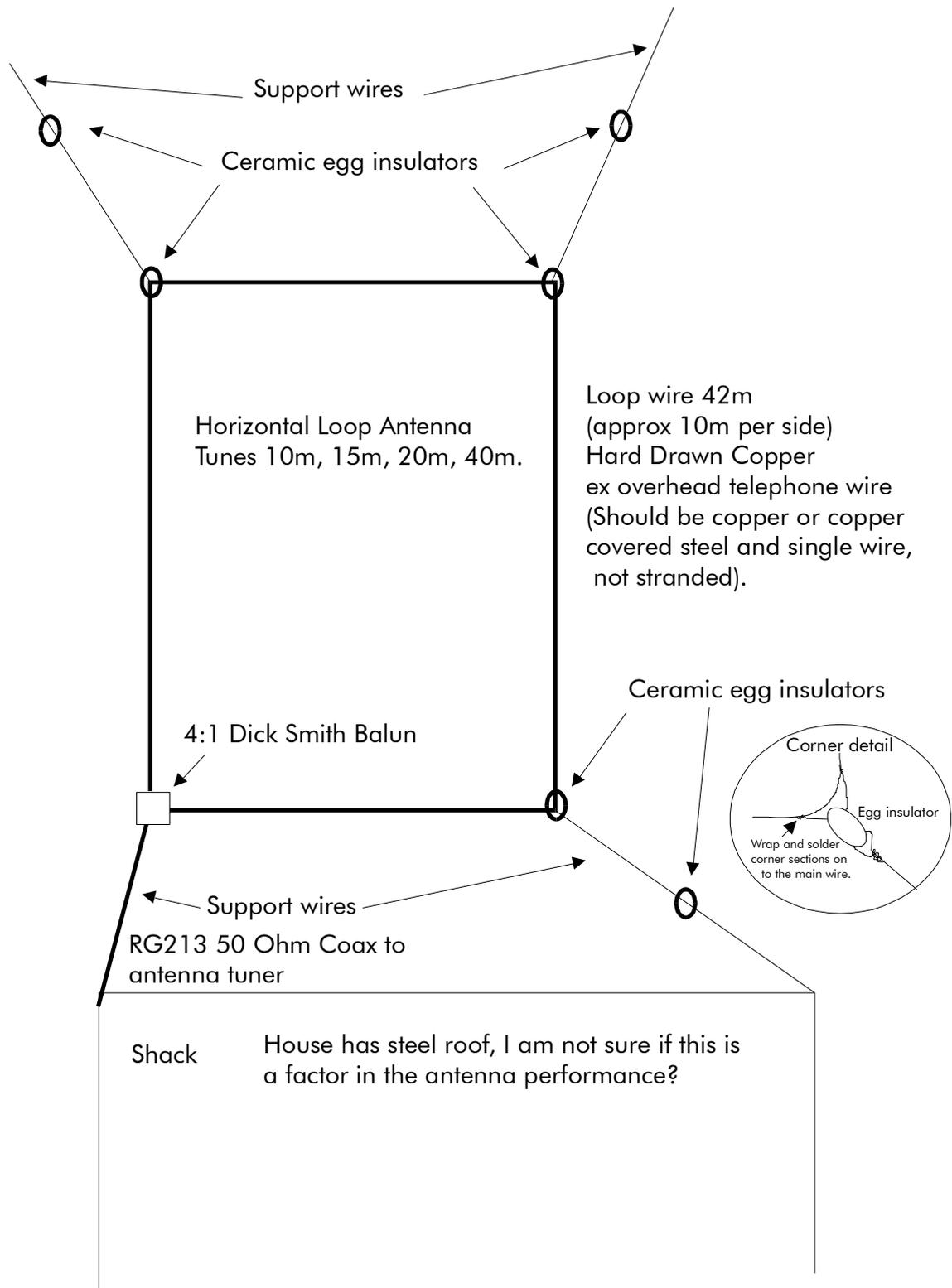
I am not sure if the black plastic egg insulators are OK for TX use. Better to get glass or ceramic eggs if possible. Cebik.com says stranded wire is NOT GOOD for wire antennas, use copper or copper covered steel wire if possible.

I would like to try nesting a smaller loop inside the main loop, possibly on the WARC bands, or 10m, <never got round to it>. This would probably lower the feed point impedance and may improve performance. An 84m loop would work on 80m as well as the other bands, but I don't have room on my section.

I believe that this antenna will out perform many other wire antennas at similar heights. Unlike wire dipole designs, it offers multiband operation with no traps. It has wide bandwidth near resonance so generally the tuner can be set once to cover the whole band. As it is more than one wavelength on 20, 15 and 10m it has gain over a dipole on these bands. Most importantly it is cheap, easy to construct and can be erected in an afternoon. I hope you give one a go, I would be very interested to hear if it is better than other antennas you have used.

By the way, <http://www.cebik.com/radio.html> has a LOT of very interesting articles on antenna designs, particularly wire antennas.

73 Andrew Barron ZL3DW.



This antenna has exceeded all expectations, especially as it is only about 3m off the ground I have worked 91 countries on it and its performance is better than a commercial trap wire dipole (at a similar height) or a ground based bottom loaded vertical with radials.

The antenna is extremely easy to build, costs almost nothing, and has performed very well for me. I would be very pleased to hear reports from anyone who builds it.