Slinkies as Antennas

Many amateurs have at some stage experimented by using ‘Slinkies’ as antennas. Often with varying degrees of success.

I performed some experiments with a ‘Springy’ which is the most common version found in the UK.

http://www.hawkin.com/ search for ‘Springy’

This comprises of approx 75 turns of flat steel strip wound so that it has an outside diameter of about 70mm. The strip is about 0.5mm thick and about 1.5mm wide.

My original interest was for use as a portable antenna. I have a 9m glass fibre fishing pole which I was using as a multiband vertical with a 9m vertical wire attached to a 4:1 balun at the base fed from an LDG-Z11pro Autotuner.

Although this gave good results on the HF bands I wished to also operate on 80m so I was looking for something which would be electrically longer than the 9m wire, which could be supported in the same way but would still be easy to deploy. The ‘Springy’ seemed to be a good option.

The first tests involved stretching the ‘Springy’ to various lengths by securing it to the top section of the pole, with the pole running through the centre of the ‘Springy’ The mast was then extended section by section and whilst I measured the it’s natural resonant frequencies.

The following table shows the fundamental and other resonant frequencies with the ‘Springy’ stretched to different lengths.

Length	F1 - MHz	F2 - MHz	F3 - MHz	F4 - MHz	F5 - MHz
1 section 1.3m	3.4	7.1	24.5	39.2	51.1
2 section 2.3m	2.9 - 3.8	7.8 - 7.9	24.2 - 24.6	39.9 - 40.5	52.7 - 53.4
3 section 3.3m	3 - 3.7	7.5 - 7.7	23.3 - 23.8	39.2 - 39.8	53 - 53.7
4 section 4.3m	3 - 3.5	7.2 - 7.6	22.4 - 22.9	37.8 - 38.4	51 - 52.3
5 section 5.3m	3 - 3.4	6.9 - 7.2	21.6 - 22.2	36.4 - 37.1	50
6 section 6.3m	3 - 3.3	6.4 - 6.8	20.9 - 21.4	35.1 - 35.2	48
7 section 7.3m	2.8 - 3.2	6.1 - 6.5	20 - 20.3	28.8 - 29.8	43 -44
8 section 8.3m	2.8 - 3.1	5.9 - 6.3	19.4 - 19.9	28.4 - 29.1	42 - 42.5

The green blocks show useful resonances in various amateur bands.

Some variation in the actual resonant frequencies occurred as the ‘Springy’ moved around in the wind. This was particularly noticeable at the lower frequencies where the impedance was almost constantly changing. This was due to changes in inductance and capacitive coupling between the closely spaced turns. This effect reduced as the ‘Springy’ was stretched and so the turns were held steady under progressively greater tension.

The next test was to compare the field strength of transmissions first using the 9m wire and Balun / Autotuner and then using the ‘Springy’ stretched to the same length.

To make the measurements I used a remote controlled Icom PCR-1000 and Datong active antenna located about 2 miles away from the transmitter site. I also used a spectrum analyser and short vertical antenna about 30m away from the transmit antenna in order to try and verify the results.

Frequency MHz	1.92	3.62	7.06	10.1	14.14	18.11	21.115	24.94	28.55	50.165
Springy (Local Spectrum Analyser) level in dBm	-48	-55	-35	-39	-38	-50	-33	-40	-30	-45
9m Vertical (Local Spectrum Analyser) level in dBm	-50	-44	-33	-38	-37	-40	-40	-36	-30	-50
Springy gain relative to vertical dB	2	-11	-2	-1	-1	-10	7	-4	0	5
Springy (Remote receiver) level in dBm	-103	-72	-78	-87	-75	-84	-88	-85	-94	-110
9m Vertical (Remote receiver) level in dBm	-105	-70	-76	-85	-72	-82	-82	-80	-91	-110
Springy gain relative to vertical dB	2	-2	-2	-2	-3	-2	-6	-5	-3	0

In most cases the ‘Springy’ provides much worse performance than the vertical wire. The results obtained with the local spectrum analyser should be treated with some suspicion, as nearby objects and cables can produce large variations in the RF field strength. Measurements made with the receiver at some distance are a much better indicator of the actual performance.

Note that the longer electrical length of the ‘Springy’ makes a big difference on 1.9MHz, but the losses become greater as the frequency increases. I believe the ‘Springy’ figures at 50MHz are better due to the 9m wire being over 5/8 wavelength resulting in a very high angle radiation. The ‘Springy’ may only be radiating from the first few turns, producing a lower angle of radiation.

As can be seen the general trend is that the ‘Springy’ is about 2 or 3 dB worse than a straight wire. The other problem is that the ‘Springy’ moves around a lot and so the impedance is constantly varying. I had hoped that it would be possible to stretch the ‘Springy’ to achieve a good match without using an Autotuner. But this was not possible unless the ‘Springy’ was held perfectly still.

So the high losses of the steel ‘Springy’ and its mechanical instability don’t seem to make it particularly useful for antenna construction. I certainly wouldn’t use it in place of a wire dipole, unless I had really bad space restrictions.

I also would not recommend using one as a loading coil, as resistive losses are too high. I tested one for use in an ATU and measured 3dB loss across just ten turns.

However, other versions are available which are manufactured from less lossy materials (or are plated) and which may be more mechanically stable. But so far I have not had an opportunity to experiment with these.

Martin Ehrenfried - G8JNJ 21/05/2008 V2.3