# Antenna Workshop

John Heys G3BDQ, brings you yet another use for the ubiquitous Slinky toy. This time it's a 7MHz antenna with the elements helically wound.

Back in in the November 2001 and November 2003 issues of *Practical Wireless* you'll find my two articles on antennas featuring the helix coils sold as Slinky toys. The antennas described in those articles were only used indoors so, in the summer of 2004, I decided to make and thoroughly test an externally mounted Slinky dipole for the 7MHz band. It's straight and about half sized at only 10m (approx 33ft) long.

Building and testing the new antenna with these new ideas has proved to be an interesting and useful exercise. Earlier tests had demonstrated that a helix antenna made with the Slinky needed a 'wire' length about 70% greater than that needed for a conventional half wave antenna. A Slinky coil when purchased consists of 87 turns, each being 218mm long (a total length of 18.97m).

I had discovered that the complete Slinky had a half wave resonance slightly below 14MHz, so by using a pair of these coils, you'd then have the basis of a 7MHz half wave dipole. So, I got to work, a dipole was made, fed with good quality double screened 75Ω impedance TV coaxial cable and temporarily erected in the garden, just three to four metres above ground.

Slinky Dipole at dusk

## Analyser Check

A check with my antenna analyser revealed that the dipole was, as expected, resonant below 7MHz. Instead of the usual 'cut and try' method to bring the antenna up onto the band, I made up a couple of shorting leads, each with 'crocodile' clips at their ends. (Using these I could short-out some of the turns at the end of each dipole leg).

After a few excursions in and out of the house, I'd found that by shorting seven turns at the end of each leg, I'd achieved resonance within the 7MHz band. This condition was made permanent by pulling turns together in a link of three and and one of four turns. Each of the bunches was bound with thin copper wire before soldering them with a heavy duty iron (my trusty and long lived 1946 Solon job!).

I found that there was perfect resonance in the middle of the 7MHz band where the s.w.r. (in 75Ω feeder) turned out to have the ideal 1:1 ratio. However, when making up the antenna, you should try to make each dipole leg a mirror image of its partner. The completed antenna, which had a total length (not wire length) of 10m was then hoisted to its operating height of around 12m. The s.w.r. at the lower band edge was 1.1:1 as it was also at 7.1MHz. At 7.2MHz the s.w.r. had risen to only 1.5:1. (This broadband characteristic meant that the antenna could connect straight into the transceiver without an a.t.u.).

I was hoping that the antenna would also show resonance on 21MHz, its third harmonic, but sadly the s.w.r. was close to 3:1 over the whole 21MHz band. Despite the problems, by using an a.t.u. I did have some DX QSOs on this band, but conditions by that time had deteriorated a lot from the sunspot maximum.

## Wobbly Slinky

A Slinky just supported at its two ends presents a horrible sight, looking like a very wobbly 'U' shape. The answer to this 'sag' is to use a catenary support line. so, I employed a length of strong nylon cord, which I threaded through the helix coil.

At the antenna centre the catenary cord went through a couple of holes close to the top of the centre dipole connector (see Fig. 1). This connector and the insulators used beyond the dipole ends were made with Polypropylene. This is a whitish plastic material that's lightweight, easily cut, drilled or filed, has superb insulating properties and sheds water like the proverbial 'duck's back'.

The inner ends of the each dipole leg thread through the centre 'T' and connect to the coaxial cable feeder. Before threading the catenary cord, I'd tied large knots at about 1.5m intervals (**Fig. 1**). Close to each knot I employed black cable ties to tightly clamp the Slinky coils to the catenary. This minimises any movements of the coils along the cord and it also helps to relieve any tension at the centre connector or at the antenna ends.

Should the antenna be exposed to sunlight over a long period, it would be best to use two cable ties at each tie point, one on top of the other. Then should the ultra violet (u.v.) light disintegrate the top cable tie, there will remain an almost perfect tie to continue its work.

Black nylon cable ties were also used to clamp the coaxial

feeder to the centre 'T'. You can obtain a good supply of Polypropylene from kitchen cutting boards, to be found at most hardware stores and supermarkets. (Go on, swipe that old kitchen board and treat the XYL to a new one!).

## Balanced Devices

Half-wave dipoles are balanced devices, which do not operate correctly when fed by an unbalanced feeder,such as coaxial cable. One solution to overcome the imbalance, is to wind some of the upper section of coaxial cable into a coil. This makes an r.f. choke current balun, but adds considerable weight to the feeder.

Personally, I prefer to use baluns made up from 'clamp on' ferrite cores. These are lightweight, small and impervious to weather conditions. A feeder imbalance can give rise to r.f. radiation from the feeder itself. It can make the antenna's radiation pattern 'squint' and even cause TVI.

I've found that by using a current balun, the antenna's s.w.r. is improved. Before the dipole finally goes aloft a thorough weatherproofing of the coaxial cable ends must be carried out. A liberal coating of a silicone rubber plumbing sealant is, I've found, very effective.

## Results Compared

One of my antennas is a long wire, around 80m long, that' grounded at its far end. This is used as a kind of standard to compare with other new or experimental antennas. There's provision for instant antenna switching, and to my surprise, I found that the signal strengths in and out when using the short (half normal length) dipole were normally within, plus or minus, an 'S' point of the signal strengths on the long wire. This was of course, when operating on the 7MHz band and when contacting British and other European countries.

The DX contacts I made after nightfall were always easier on the long wire with its inherent design gain and very low angles of radiation. Despite this, I did have QSOs with North America, the Middle East and the Antipodes. There have been several times here on the Sussex coast when the winds have reached gale force, but the Slinky dipole has remained unscratched and intact.

Antennas made with the Slinky helix coils all exhibit a low *Q* or wide-band characteristic. No doubt this is largely use to the inherent ohmic resistance of the metals used in the helix construction.

On the plus side, though, this wide band characteristic removes the need for an a.t.u. on the 7MHz band. My long wire antenna is always tuned by an a.t.u. and this needs a 'tweak' when moving frequency over the bands. Many Amateurs that I know have a very limited garden area, and for them, dipoles for the 7MHz band and below, must have dropped ends; one or more 'dog-leg' bends, folding back; or lossy loading coils.

This Slinky antenna design should be ideal for those with space problems and if the 75Ω coaxial cable is replaced with open wire or commercial 'ladder-line' of 300 or 450Ω impedance the use of an a.t.u. would allow effective working over a wide range of frequencies, certainly on 7MHz and any h.f. band higher than this. **PW**

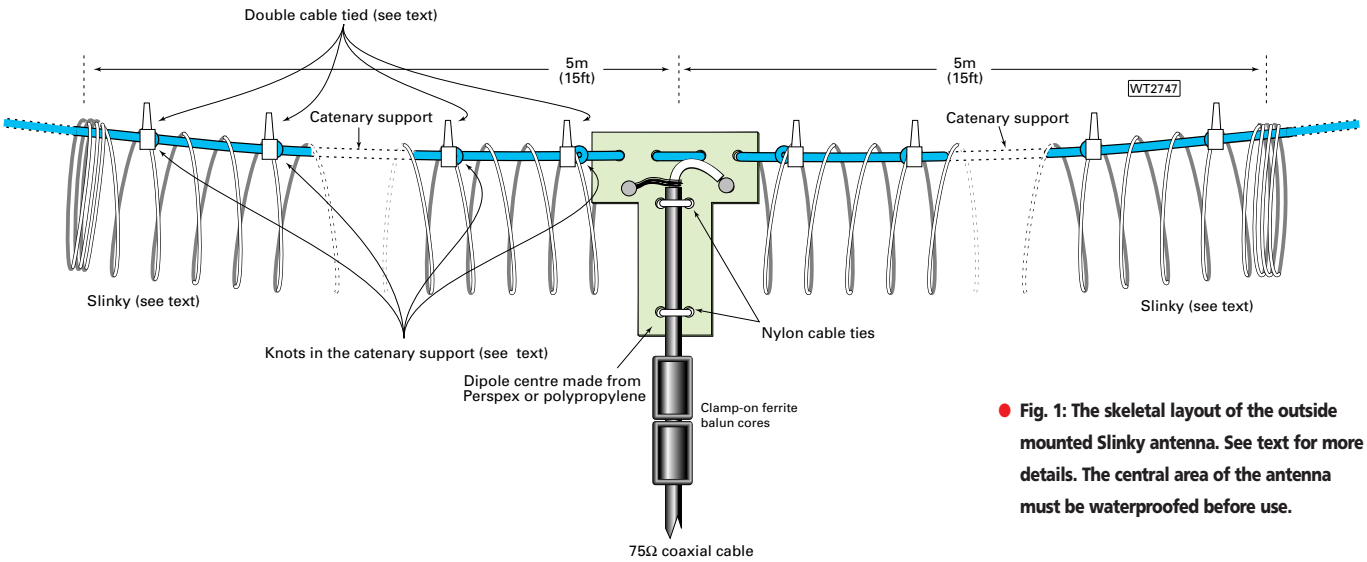


**Fig. 1: The skeletal layout of the outside mounted Slinky antenna. See text for more details. The central area of the antenna must be waterproofed before use.**

## An Introduction to 'Springy'

In some places it may be difficult to find a shop which sells the Slinky toy, but there is another helix toy named Springy. This closely resembles Slinky and has the following vital statistics: diameter 70mm, number of coil turns is 77, a total conductor length almost 17m (55.6ft).

There is also a Mini-Springy. This has a diameter of 35mm and has 98 turns. Both of the Springy toys have a very shiny surface. This is a thin insulating layer and must be rubbed or filed away before soldering. The antenna I have described will need a short length of wire at each end of the 7MHz dipole if the large Springies are used.

The Springy toys are much cheaper than the original Slinky but can only be purchased by Mail Order. The supplier has a fixed charge for carriage and packing may be found at **Tobar Ltd., St. Margaret, Harleston, Norfolk**, E-mail: **tobar@ukonline.co.uk**