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# ANTENNAS

The debate on PL259/SO239 coax connectors continues to generate comment. Bryan Young, GW6TYO, sent the following (edited) e-mail exchange between W8JIT and K7FR that he found on the Internet:

To K7FR from W8JIT, responding to "...allow 0.1dB for the connectors at each end or 0.2dB total"; "I keep seeing this thing about connector loss everywhere I look. It's become accepted as fact in our community, but it's folklore. Here's an example why. With 0.1dB loss per connector, power loss in a PL259/SO239 combo would be about 35 watts at 1500W. Loss is concentrated in the centre pin and dielectric of the SO239 section, in an area less than one half-inch long. The PL259 section has almost no loss or impedance bump when properly installed. 35W of connector heat (with a 1500W transmitter), when concentrated in the inside of the SO239, would quickly make the connector so hot it would be untouchable. In a few minutes [it would] melt the solder connection and dielectric. If you doubt this, turn on a 35W lamp for a few minutes and touch the glass. Now imagine how hot the glass would be if it was all within a quarter inch of the filament. At 30MHz, the loss caused by a 239/259 combo is totally unimportant. One foot of 9913 cable has much more loss. Tom, W8JIT."

"Back in senior year at Washington State University we had to do a project in the measurements lab. Since there were two hams in the lab we decided to measure losses in coax connectors. We set up a calorimeter and measured $I^2R$ losses from DC to 2GHz for a PL259/SO239 combo, with the output increased in 100 watt steps until we observed a sharp up turn in losses. The results from my lab notes are shown in **Table 1**... Before this experiment I was paranoid about my connectors. Since then I have only been concerned with the quality of the assembly and water ingress. Gary, K7FR."

**LOSSES MEASURED IN A PL259/SO239 CONNECTOR AT 1000 WATTS INTO A BIRD DUMMY LOAD** (SEE TEXT)

| f (MHz) | Loss (W) | dB |
|---|---|---|
| 0.1 | 1 | -0.00435 |
| 1 | 1.2 | -0.00521 |
| 10 | 1.3 | -0.00565 |
| 20 | 1.5 | -0.00652 |
| 30 | 1.8 | -0.00782 |
| 50 | 2.2 | -0.00957 |
| 100 | 2.6 | -0.01131 |
| 200 | 3.5 | -0.01523 |
| 400 | 7 | -0.03051 |
| 1000 | 15 | -0.06564 |
| 1500 | 28 | -0.12334 |
| 2000 | 100 | -0.45757* |

* CONNECTOR FAILED BEFORE CALORIMETER STABILISED

## LOADED VERTICALS

Des Vance, GI3XZM, while querying that the I5TGC antenna ['Antennas', *RadCom* April 2003] was a vertical dipole, was nevertheless inspired to try the following idea. All the lengths are given in imperial measurements (to convert feet to metres multiply by 0.3048 and inches to mm multiply by 25.4).

"I have often used a vertical about 5/16 or 1/3 wavelengths long, working against ground or elevated radials. A variable capacitor tunes out the extra length, giving 1/4-wave resonance and direct connection to coax. As is well known, this raises both the radiation resistance and the impedance (resistance) seen by the feeder. If the extra height arising from this arrangement is removed by using a top loading coil and capacity hat the radiation resistance is only slightly reduced. Could one optimise a vertical of limited height by 'stretching' the bottom until the maximum current point is half way up the permitted height and absorbing all the excess height in the top loading coil and capacity hat?

"Suppose one had a 20ft pole and wanted a vertical for 80 metres. Now we want the current maximum 10ft from the base so if we had a full 1/4-wave vertical, plus the 10ft, it would be, say, 66+10=76ft high which would resonate (with suitable earth) at about 3MHz. Suppose we top load the 20ft pole with inductance and capacitance until it resonates at 3MHz, then bring it up to 3.55MHz with a series capacitor we should have the current in the pole optimised.

"I thought I would see if this idea might be easily implemented. I found a length of alloy tube in my heap about 13ft long, stood it in a jam jar on the lawn and guyed it with plastic rope as shown in **Fig 3**. With a one-turn link, see **Fig 1**, and the GDO I found this arrangement resonant at about 15.7MHz." The variable capacitor is shorted out to measure the antenna's natural frequency. The loop is replaced with a coaxial socket when used with a transceiver and the capacitor adjusted for minimum SWR.

"Top loading was added and the resonant frequency fell to 10.8MHz. The five-turn helical coil shown in **Fig 2** was inserted (another stab in the dark) and the resonant frequency became 6.4MHz." The top loading frame was made by supporting three 5ft garden canes fixed in holes in 1.5 x 1.5 inch timber, chamfered to fit the 50mm alloy pole. It has an inductive centre section with five helical turns 6in to 30in diameter, approximately 23ft wire total, and a capacitive outer section, with three broken loops connected in parallel. By including the variable capacitor the system was easily tuned to 7MHz.

"Not having a transmitter in working order I could not try my 40m vertical in the standard way. Undaunted, I drove off in the car, listening to the ground wave from the GDO. With an FRG7 [receiver] beside me and a length of hook-up wire tied to a garden cane taped to the door pillar I got a fair signal about 3 miles (5km) away. Since the input to the GDO is less than 5mW the output, with no matching, could hardly have exceed 1 or 2mW." ◆

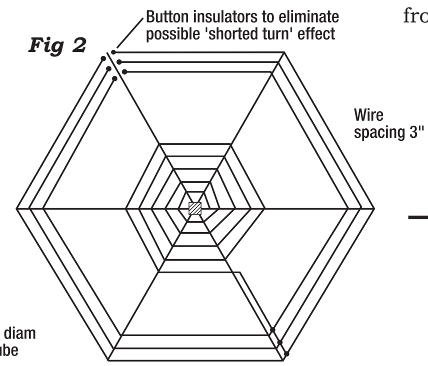


Fig 2

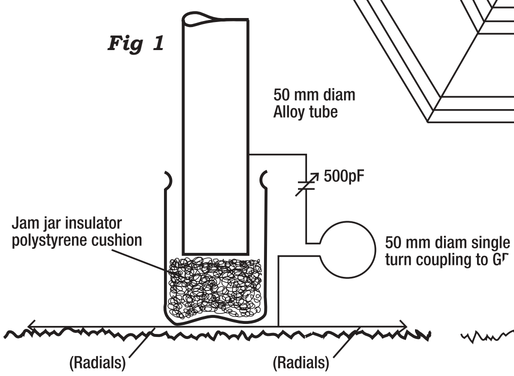


Fig 1

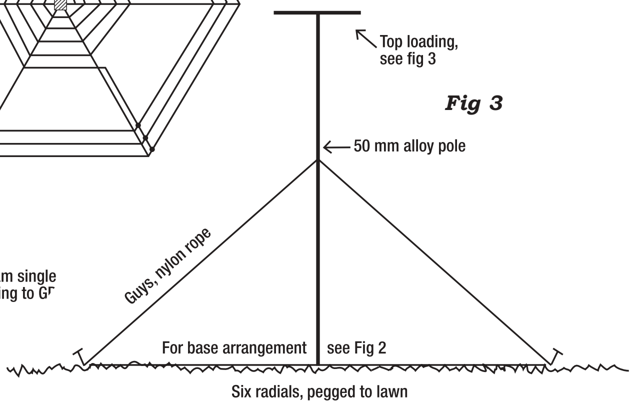


Fig 3

*Fig 1: Base insulator and feed method for coupling a GDO.*

*Fig 2: Top loading frame.*

*Fig 3: General view of the GI3XZM antenna. Six 22SWG radials of similar length are pegged out on the lawn.*