



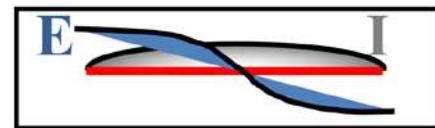
# The Radio Hotel - The Antenna - Part 7 by W5RH

## Antenna Shortening – Let’s Get Loaded with Coils and Hats

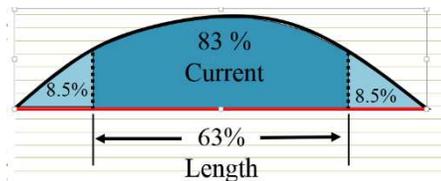
Sometimes an antenna is too long to fit the space we have available. Take an 80 meter dipole for instance: it is about 135 feet long. Stretched horizontally it is pretty darn long for some smaller city lots, but that is what it takes to get on 80 meters. Is there anything that can be done about the length? Sure, you can bend it around corners, you can bend the ends down toward the ground, you can zig zag it or you can load it. Load it? \*(See Note 1 for a great example) OK, but, just what is loading?

A dipole is typically ½ wavelength long, which is  $468/\text{MHz} = \text{length in feet}$ . But look at it another way, the dipole is 180 “electrical” degrees.. If we shorten it, the feed point will exhibit “Capacitive Reactance --  $X_c$ ” along with a reduced resistive value of the feedpoint. If we make it longer than ½ wl, the feedpoint exhibits Inductive Reactance -  $X_l$  along with an increased resistive feedpoint value. You can cancel the reactance by, judiciously, applying the opposite type of reactance. For example, if the antenna is short and exhibits capacitive reactance, you apply inductive reactance (a coil) along the element. If it exhibits inductive reactance (too long) you apply capacitive reactance (a hat) at the end of the element. Antennas that are short are far more popular than antennas that are too long, so we’ll use a short antenna as the limited space example.

Look at the current distribution on a standing wave antenna (Fig. 1) (I talked about standing wave antennas back in TRH # 3) The current distribution is sinusoidal, or close to it. The current is largest in the middle, so the radiation is strongest from the middle portion of the antenna. Hence, the “83/63 Rule” (Fig 2) which is “on a full size dipole, 83 percent radiation from a dipole is performed by 63 percent of the antenna length”. wanted to shorten the antenna it would be best to do it where the current is – at the ends. Some antennas do this by adding “capacitive hats” at the ends, but physically easier is placing coils in the higher current portions of We’ve all seen the “Bug Catcher” mobile antennas with their large coils way up the mast. This is a perfect example of coil loading. Without that up a significant amount of electrical degrees, that mobile antenna would long on 20 meters. A bit much for putting on a car.



Standing waves of voltage E and current I



antenna.  
of the  
So, if we  
not so strong  
element  
the element.  
about half  
coil making  
be 16 feet

Loading is a fairly straight forward concept once you get the basic rules principles down. My suggestion is that you have a look at some mobile articles or even read about the multi-band dipoles that some folks sell that use loading coils for making low band antennas shorter. Loading can all be calculated with the charts in the ARRL Antenna Handbook or you can model it in EZNEC. Just a few ways to get you up to speed with understanding loading.

So, that is it in a nutshell. Inductive loading – ‘Coils’, capacitive loading – ‘Hats’...the two well known methods to load an antenna. For alternate loading methods you can Google “Linear Loading” or even “CCD Antennas” for a couple of bazaar methods to load a wire. Have a look at a presentation “Practical Application of Loading Techniques” a PDF on the [www.BVARC.org](http://www.BVARC.org) Tech Articles page or read the 3 part treatise on loading in the BVARC 2004 January, May and September newsletters. It is tough to explain some things in one page and loading is one of those things.

\* Note 1 – The LKJ Wednesday Night Special – [www.BVARC.org](http://www.BVARC.org) Tech Articles

### Next time.... Getting All Choked up about Feeding and Matching

*The purpose of The Radio Hotel is to give you a practical kickstart into exploring the workings of antenna systems. It is a series, so go back and read the previous columns to get the whole picture, as one month relies on the previous month's information. Google the buzz words and find out what they mean. Read up on antenna system theory to see how it all works together. You will be glad you did.*



**Editor’s Note:** Due to the large amount of material for this issue of the BVARC Newsletter, some articles had to be started in the middle of the page and others required smaller font than usual. More than the normal liberties needed to be taken with reformatting.