The Radio Hotel Designing a Coil-Loaded (short) Dipole

by Rick Hiller W5RH

This is part 1 of a 2 part "cook book" article on designing (part 1) and building (part 2) a shortened and coil-loaded dipole antenna. Although you can apply this technique to most any frequency, it is most applicable for 80 meters where a halfwave dipole length for mid-band (3.7 MHz) is 125 feet. Typically, too long for most of city lot back yards.

By shortening a dipole, you run into a few characteristic changes. As you shorten it, the feed Z's resistance, R, decreases. But, the feed Z's capacitance reactance, xC, increases, hence we use xL, inductive reactance (coils), to cancel the xC. Making the antenna resonant again. Also, they become slightly less efficient and the operational (3:1 SWR) bandwidth decreases. But….. it is "wire in the air". Right where we want it.

The "coil loaded" example below is a design for 3910 KHz – for the BVARC Rag Chew Net.

Note: This design method is fully explained in QST Sept 1974 by Gerald Hall page 23-25 or in the ARRL Antenna Handbooks 1974 thru to the 2003/2005 editions – Chapters on Antennas for Restricted Space or Low Frequency Antennas.

Design Steps : Determining the loading coil values (reference the graphics below)

-- Calculate the length of a full size ½ wl dipole 468 / FMHz 468 / 3.910 = 119.7 feet

-- Measure the space you have to hang the dipole – between 2 trees or 2 poles, etc. My yard space = 62 feet

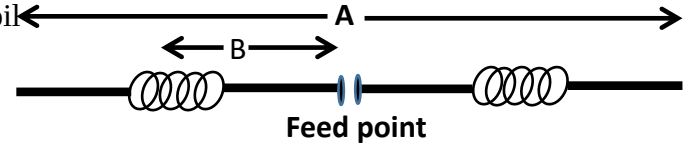
-- Calculate the percentage of reduction. Space available vs. a Full size dipole. 62'/119.5' = .50 or 50%

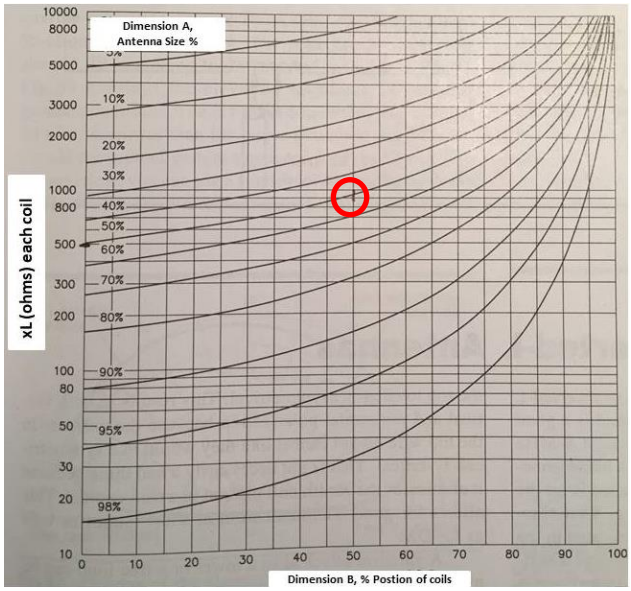
-- *Note: Best / practical placement for the coils is about 50% out each side.*

-- Use the diagram and graph to figure the xL value required for each coil

A= 50% size with a B=50% coil location means 950 xL in each coil – the circled value on the graph.

-- Convert xL to L xL= 2π F L then L = xL / 2π F or L = 950 / 6.28 x 3.910 x 10^6 L = 38.6 uH each coil

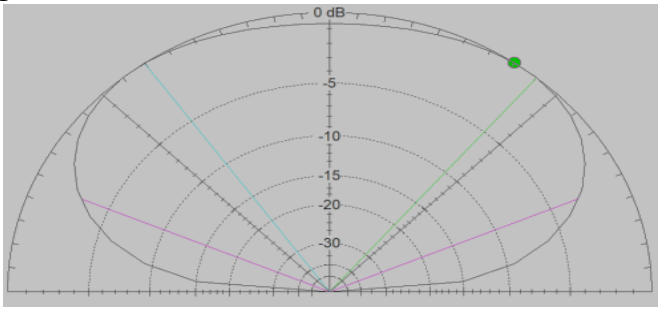




Note: We'll build the 38.6 uH coils in Part 2.

Remember, height above ground influences the Feed Z. EZNEC modeling of the short, resonant antenna at different heights shows varying values of feed Z:
Deployed at 25'- 8 ohm at 35'- 21 ohms at 50'- 25 ohms

I know with these feedpoint values the SWR seen on the transmission line will be as much as 6:1, but an analysis with TL Details shows that at 3.9 MHz, even 100' of RG8X has a total loss of less than 1 dB. Just install a tuner at the shack end to ensure your xcvr sees about 50 ohms to maintain full 100 watt output. See the typical radiation pattern – below, right.



Find p*ractical references on the BVARC Tech pages:*

K5LJ's ***Shortened Dipole Study for BVARC's RC Net***

http://bvarc.org/Tech/ShortenedDipole.pdf

The *(K5)***LKJ Wednesday Night Special Antenna***

http://www.bvarc.org/Tech/LKJ_Wednesday_Night_Special.pdf

Build it. Part 2. Next month. Enjoy your hobby. 73,W5RH