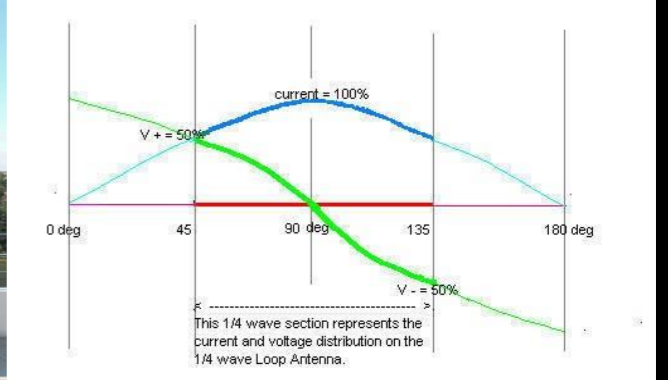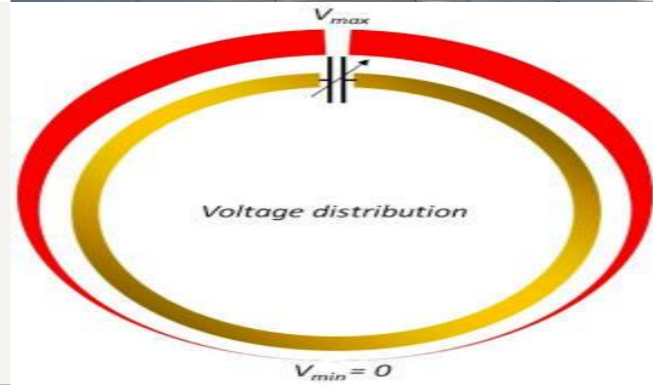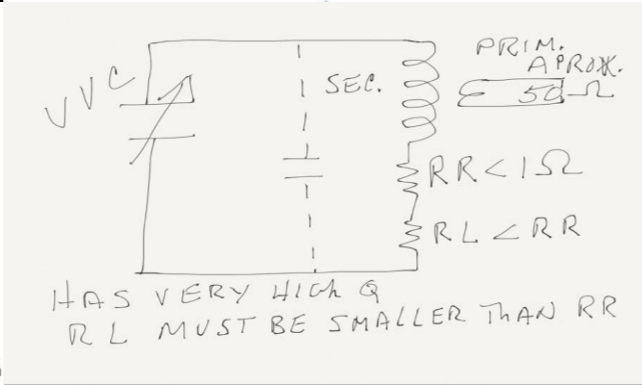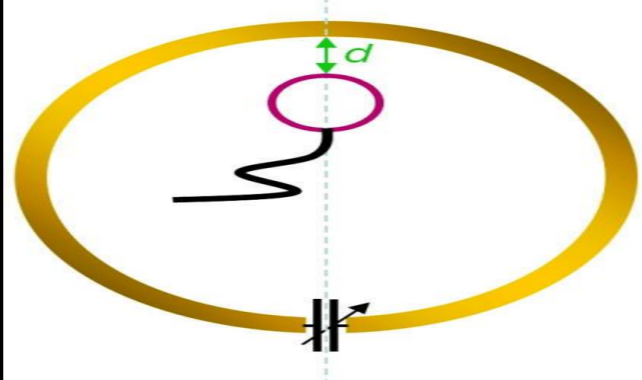# Magnetic Loop Antennas

My mag loop

Components

Copper tubing

VVC

Coupling

Also copper foil, aluminum

There are two physical distinctions to a mag loop

A small loop or (magnetic loop) with a size much smaller than a wavelength
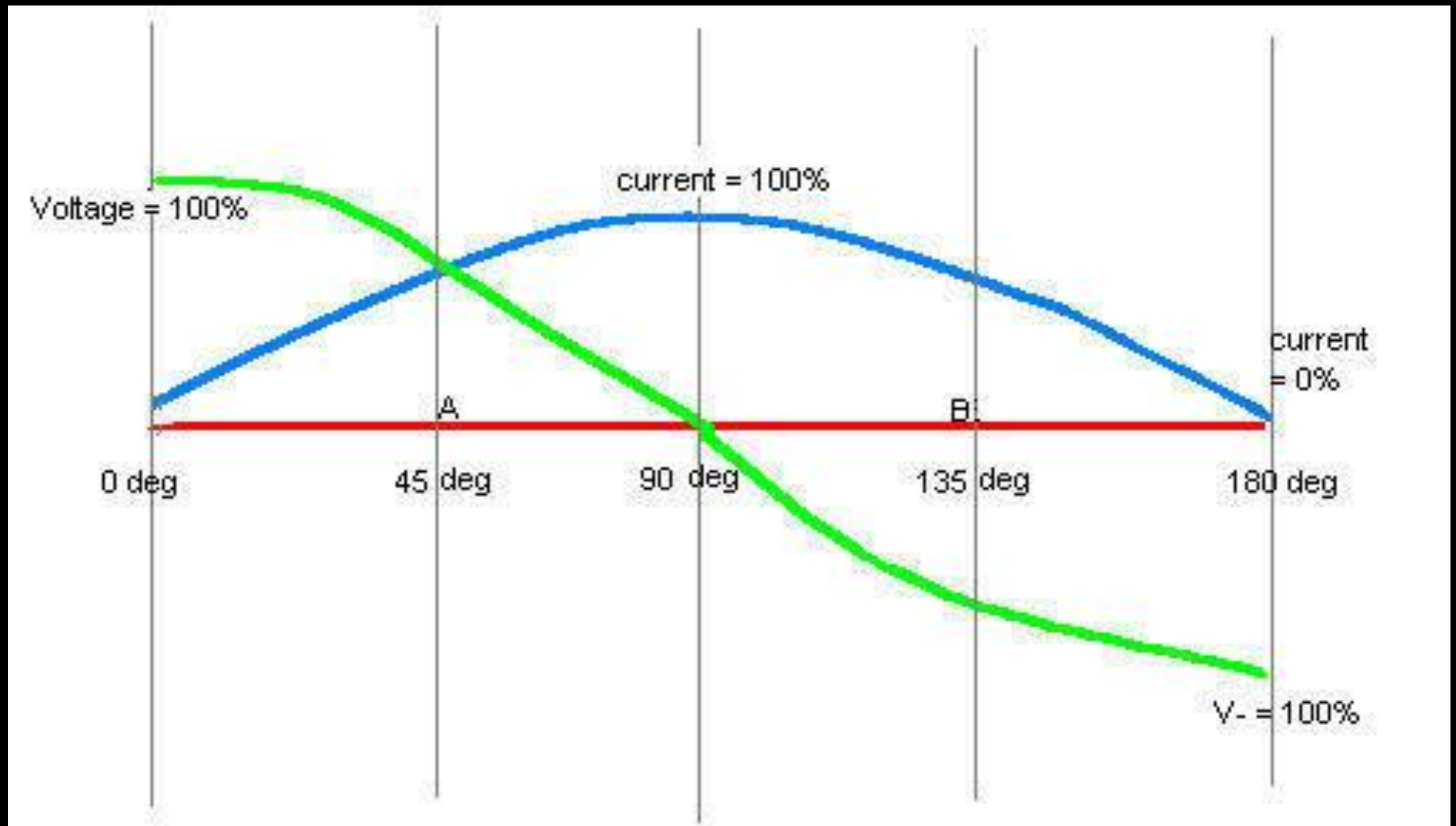
A Resonant loop with a circumference approximately equal to a wavelength

Key advantages to using a mag loop?

1.) A properly designed, constructed, small loop of nominal 1 meter (39.4in) in diameter will equal and often times out perform any antenna type except a tri-band beam on the 10/15/20m bands, and will at worse be within 1 S unit (6db) of an optimized mono-band 3 element beam that's mounted at an appropriate height in wavelengths above ground.

2.) The real practical advantage of the small loop is the loop's freedom dependence on a ground plane and earth (provided its mounted vertical instead of horizontal) for achieving efficient operation.

3.) Can take up small space, back yard, balcony, attic, car, boat, airplane.
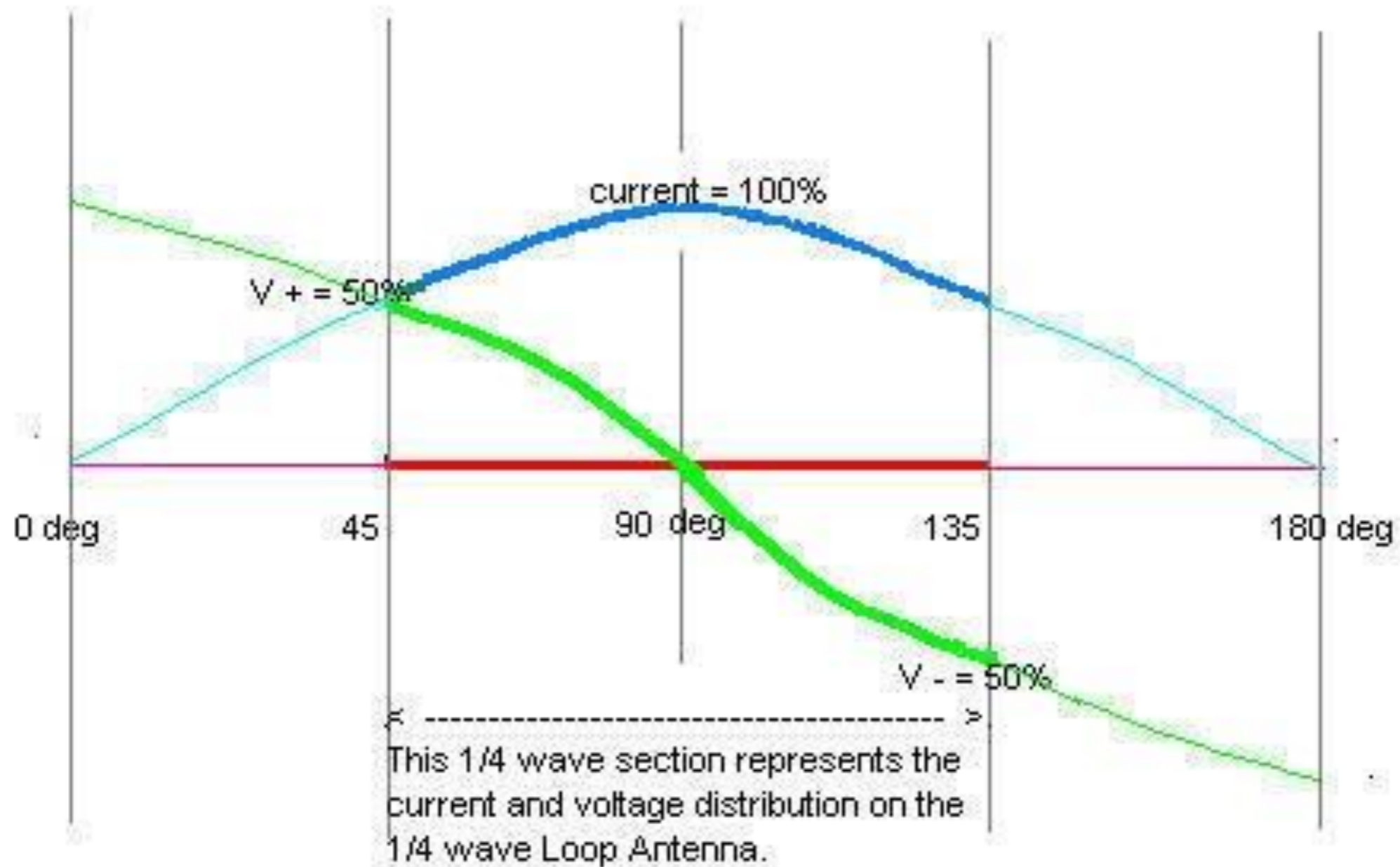
4.) close in noise rejection.

Basic electrical characteristics of a Magnetic loop

First: here is a conventional current and voltage distribution on the 1/2 wave dipole. It can be made to relate to the current and voltage nodes that exist on a 1/4 wave loop .

By taking the centre 1/4 wave section of the dipole as shown

current = 100%

V + = 50%

0 deg   45   90 deg   135   180 deg

V - = 50%

< --- >

This 1/4 wave section represents the current and voltage distribution on the 1/4 wave Loop Antenna.

Basic electrical characteristics (cont)

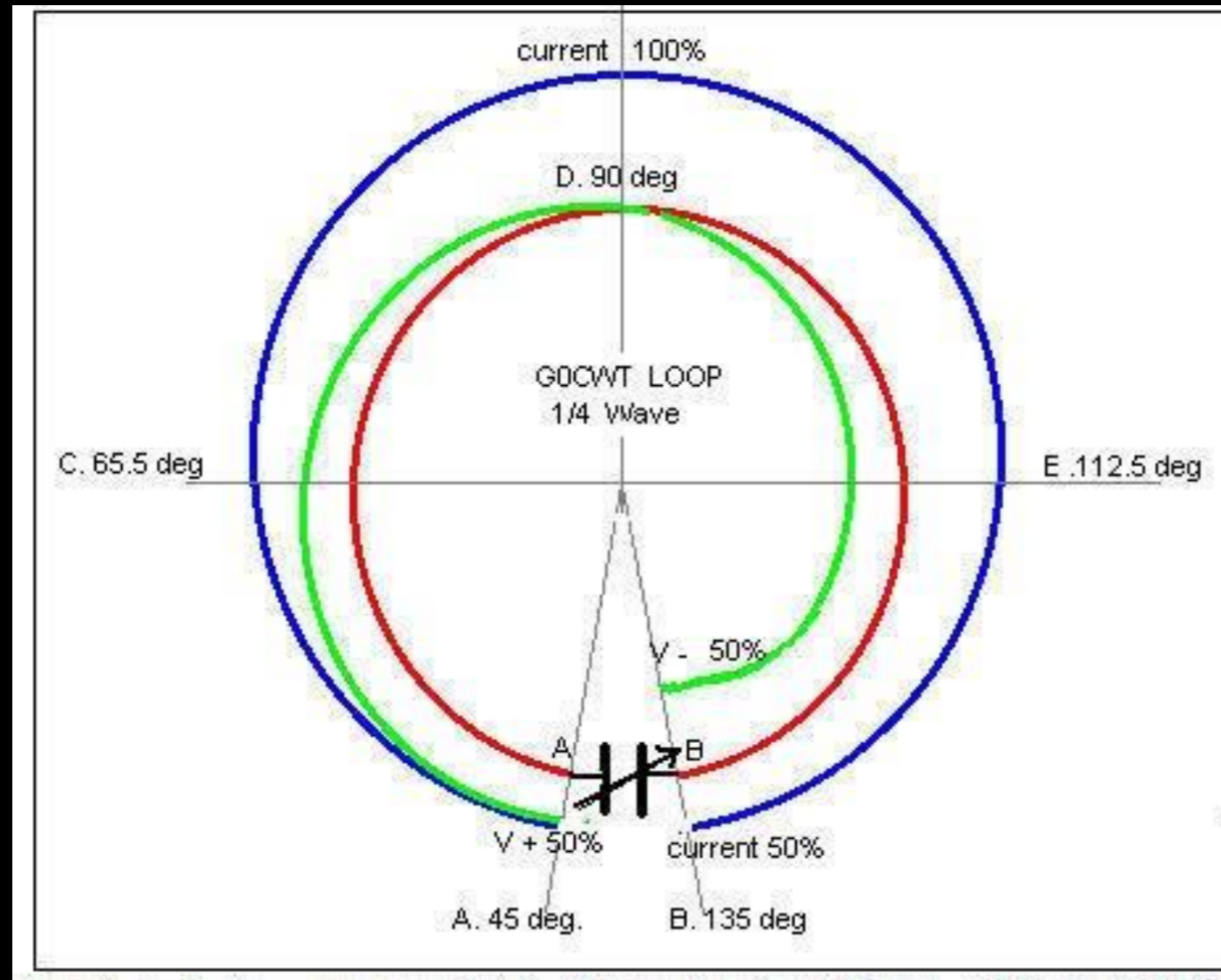**..... And bending to form a loop. The capacitance that existed between the end sections were removed. But if the loop is to remain resonant and also for the current maximum to stay at the centre portion of the wire, a variable capacitor is inserted between the ends of the loop.**
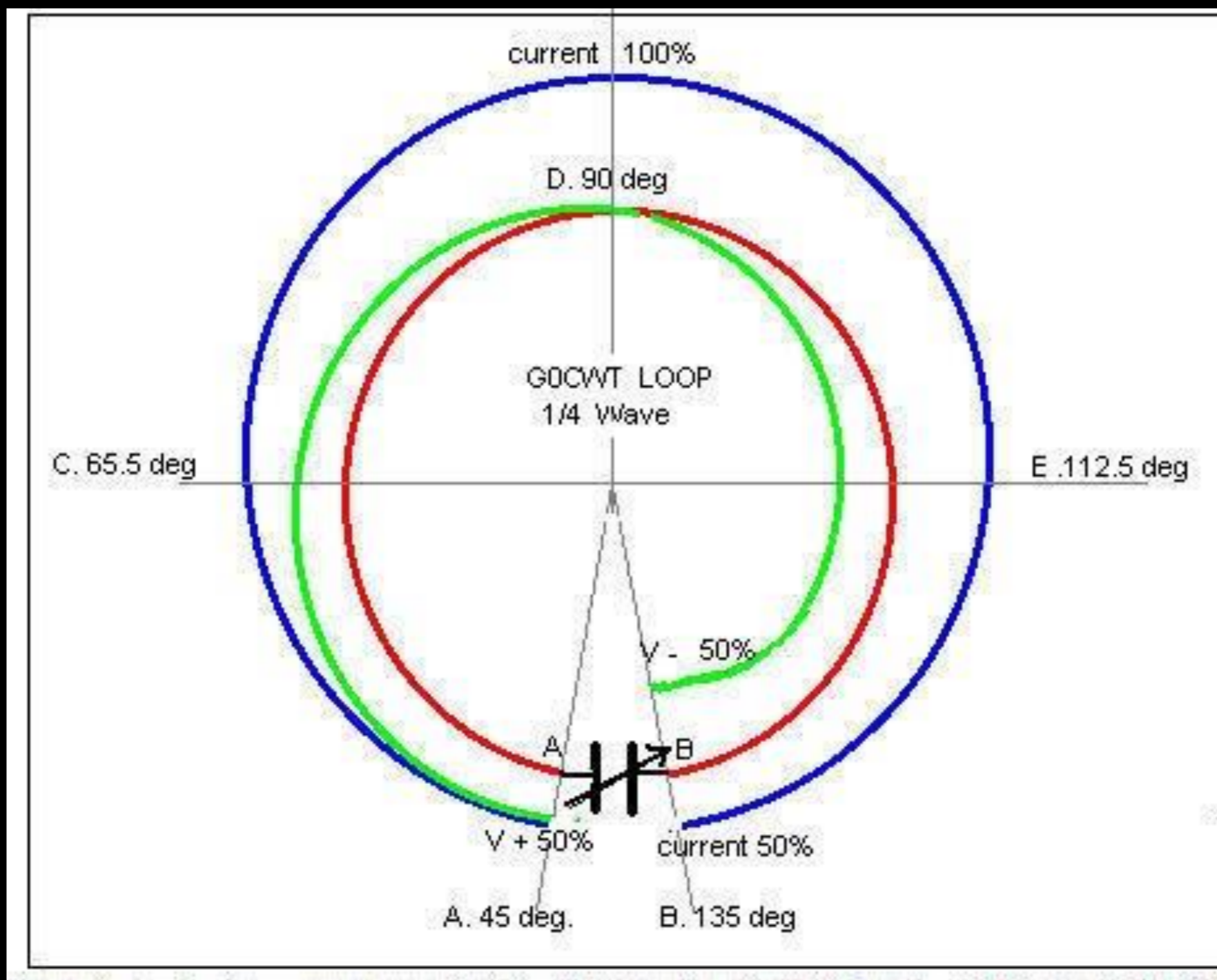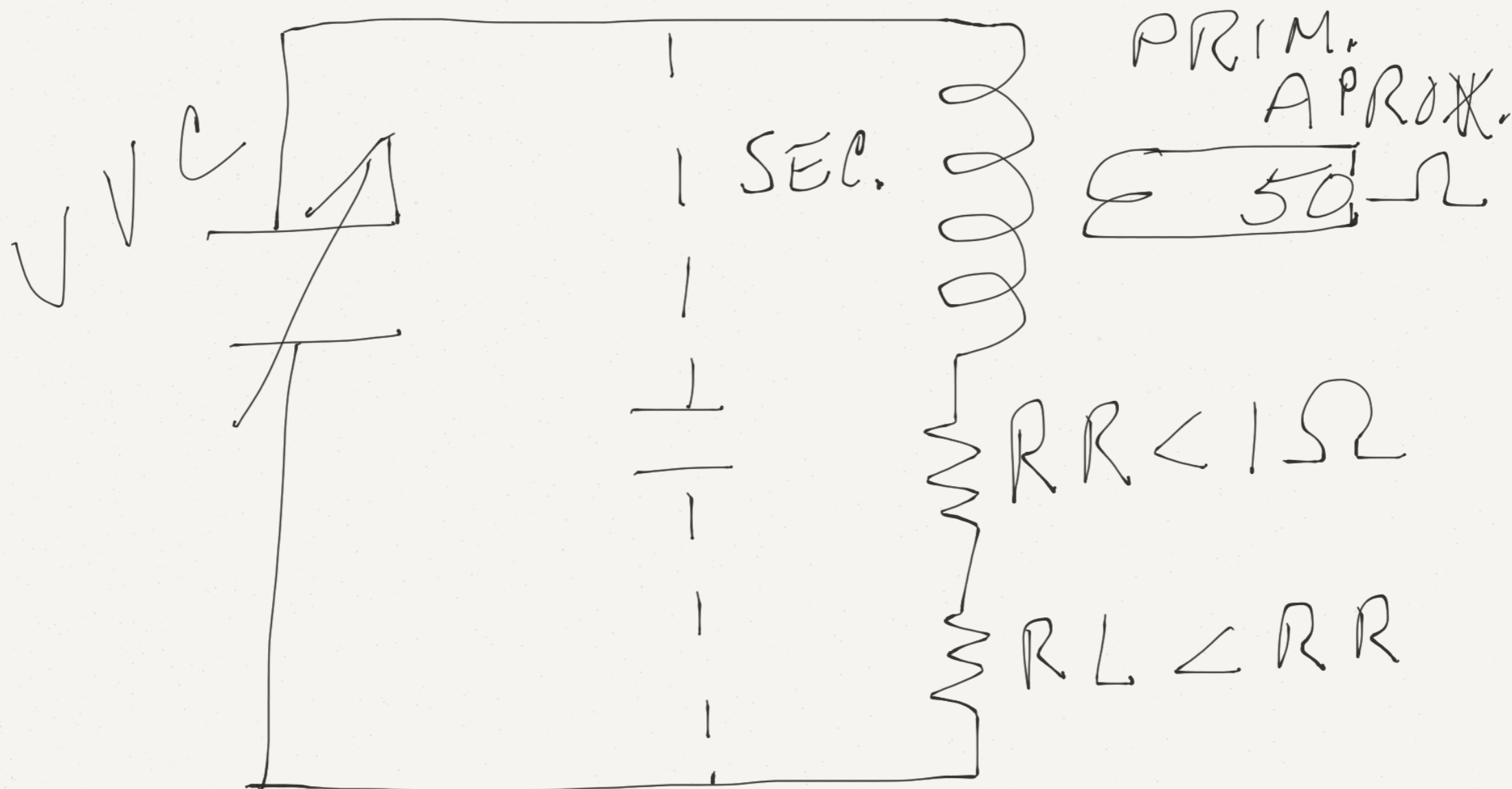
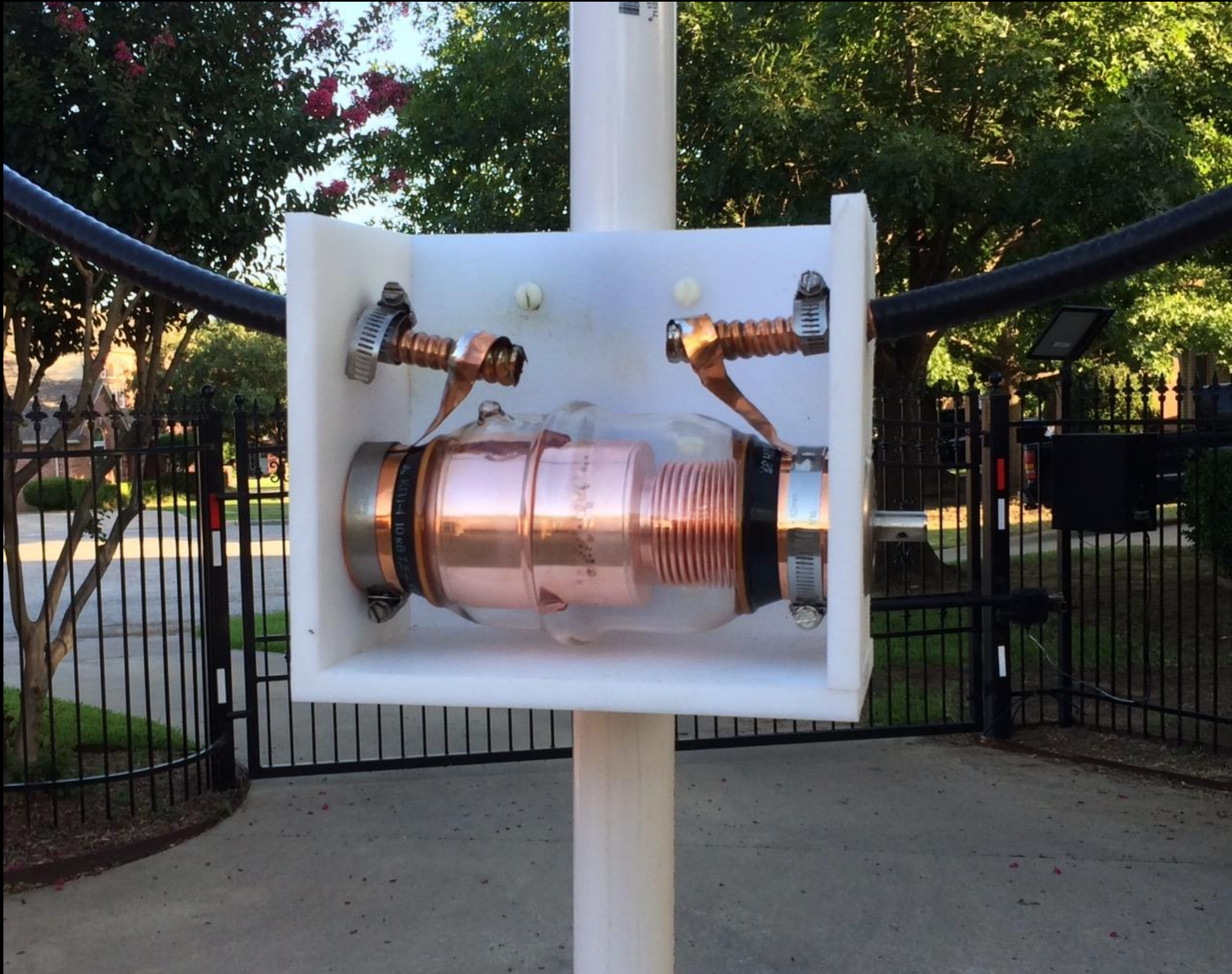# Basic electrical characteristics (cont)

Theoretically the current never drops to zero and the voltage never rises to maximum, as is typical in a 1/2 wave dipole drawing.. If there was no voltage present then there would not be any current.

PRIM.
APROX.

$\mathcal{E} = 50\ \Omega$

$RR < 1\ \Omega$

$RL < RR$

HAS VERY HIGH Q
RL MUST BE SMALLER THAN RR

Connection to capacitor is critical

The skin effect refers to the electron distribution that radiates. Current density of Electrons do not go much below a few millimeters below the surface of the conductor.

A Mag Loop can be double helical

A Mag Loop can be circular

A Mag Loop can be octagon
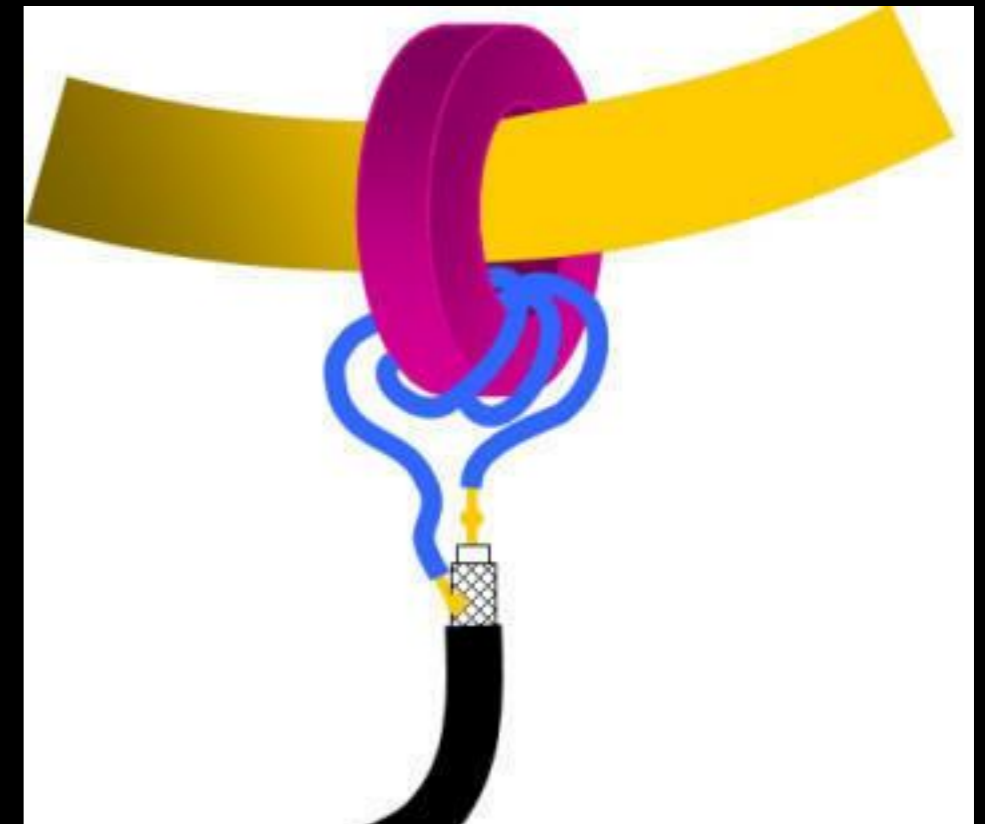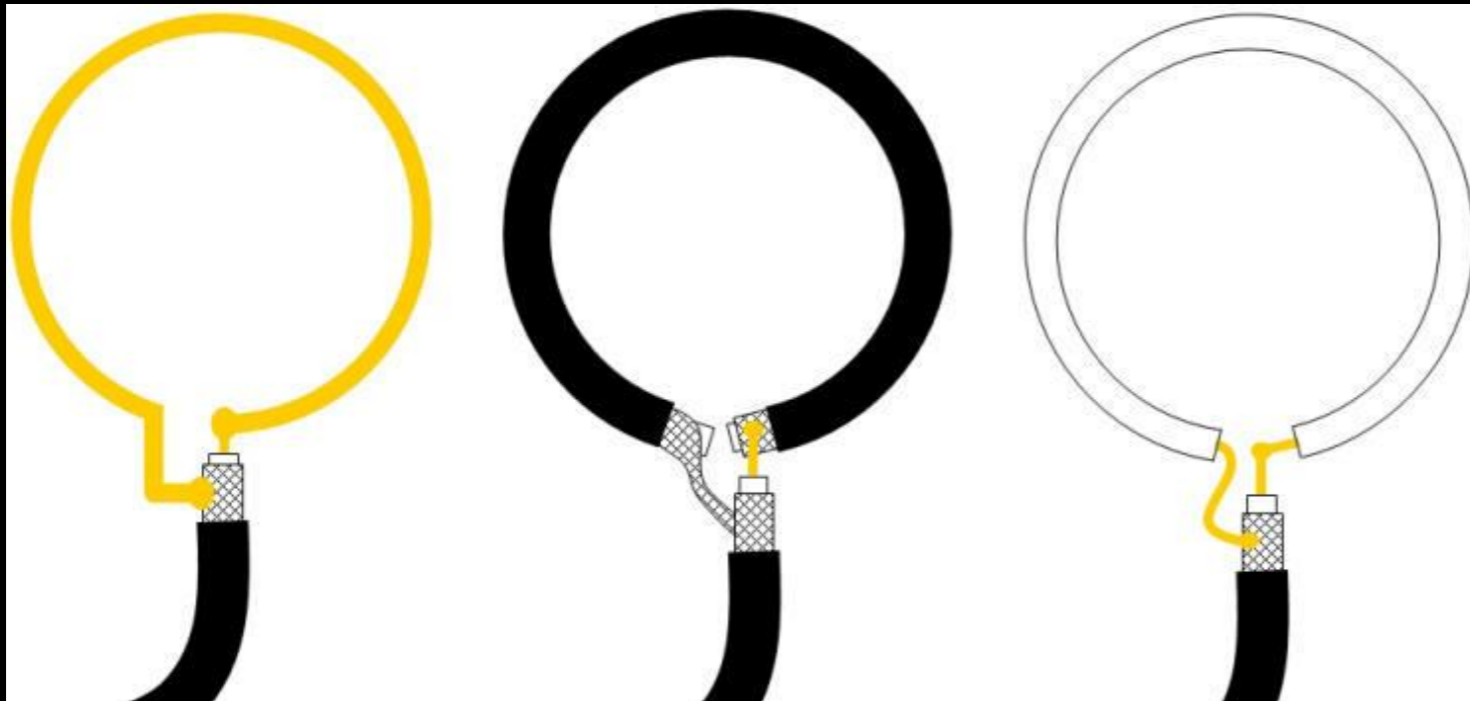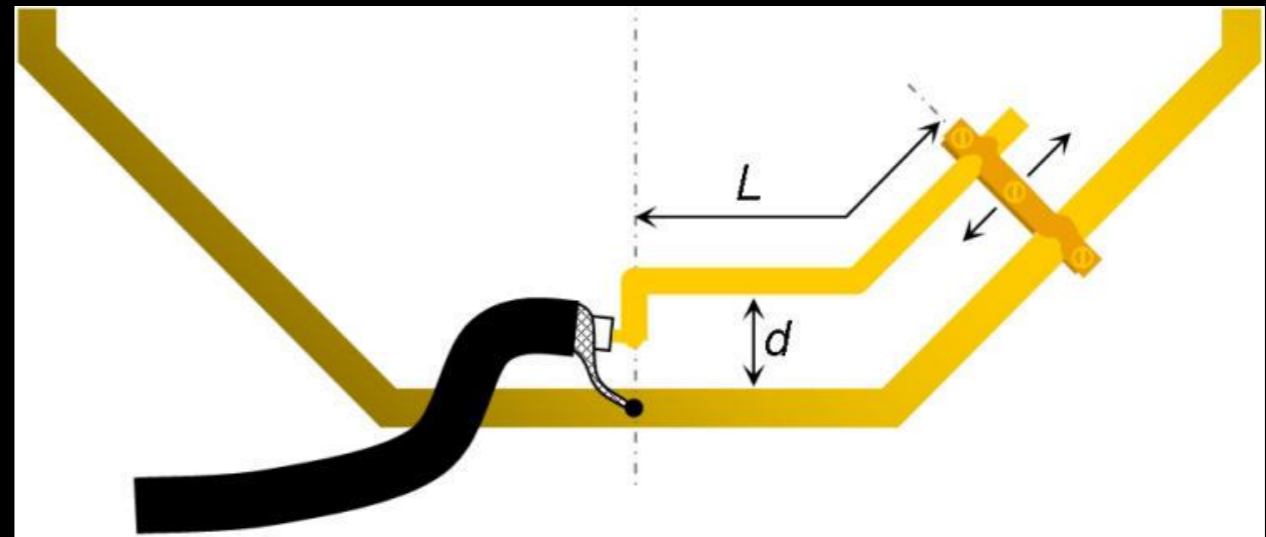
160 - 80 - 40m loop

Tuning the capacitor - air or vacuum variable

Types of capacitor control

1. Manual
2. DC motor
3. Stepper motor

Some examples of coupling to loop

Conclusion

Mag loops, when properly constructed, rival the best antennas in the 40 thru 10m bands, except beams at full wavelength above ground.

They take up very little space for the 40, thru 10 m bands.

160 and 80m loops take up less real estate - the performance general exceeds that achievable from a dipole at less than optimum height from ground. This is a common site limitation of most HF antennas.

And making and operation one is a whole lot of fun !!!

Reference material

A must read before any link below:
Excellent site showing coupling diagrams and use of different material. A must read
http://www.nonstopsystems.com/radio/frank_radio_antenna_magloop.htm

Videos showing current and voltage points in a small loop
http://www.g0cwt.co.uk/magloops/new_page_5.htm

Couplings and animated current and voltage graphs
http://www.g0cwt.co.uk/magloops/new_page_3.htm

Shows plate construction and car mounting
http://www.laud.no/la6nca/loop/

Octagon Mag loop calculator - works fairly well for circle loops. Use spreadsheet for better results.
http://www.66pacific.com/calculators/small_tx_loop_calc.aspx

Copper construction, air variable caps, servo control
http://www.k5td.com/Loop_Antenna.html

A way of controlling a dc motor by using a smaller toy motor
http://www.qsl.net/7n3wvm/DC_mot_control.html

Reference Material (cont.)

Good info on an EH antenna
http://eh-antenna.skyserver.net/index.html

K8NDS - Rick. Pioneer of the helical fractal design
http://www.qrz.com/db/K8NDS

A Zmatch idea. http://users.tpg.com.au/ldbutler/HFTXLoop.htm

Skin depth discussion
http://www.w8ji.com/magnetic_receiving_loops.htm

Building a large 160 / 80m loop
http://www.pa0kv.nl/content/hamradio.html

Excellent work on Mag loops included here
http://qrz.com/db/K4HKX

Loop calculator in excel
http://www.aa5tb.com/aa5tb_loop_v1.22a.xls