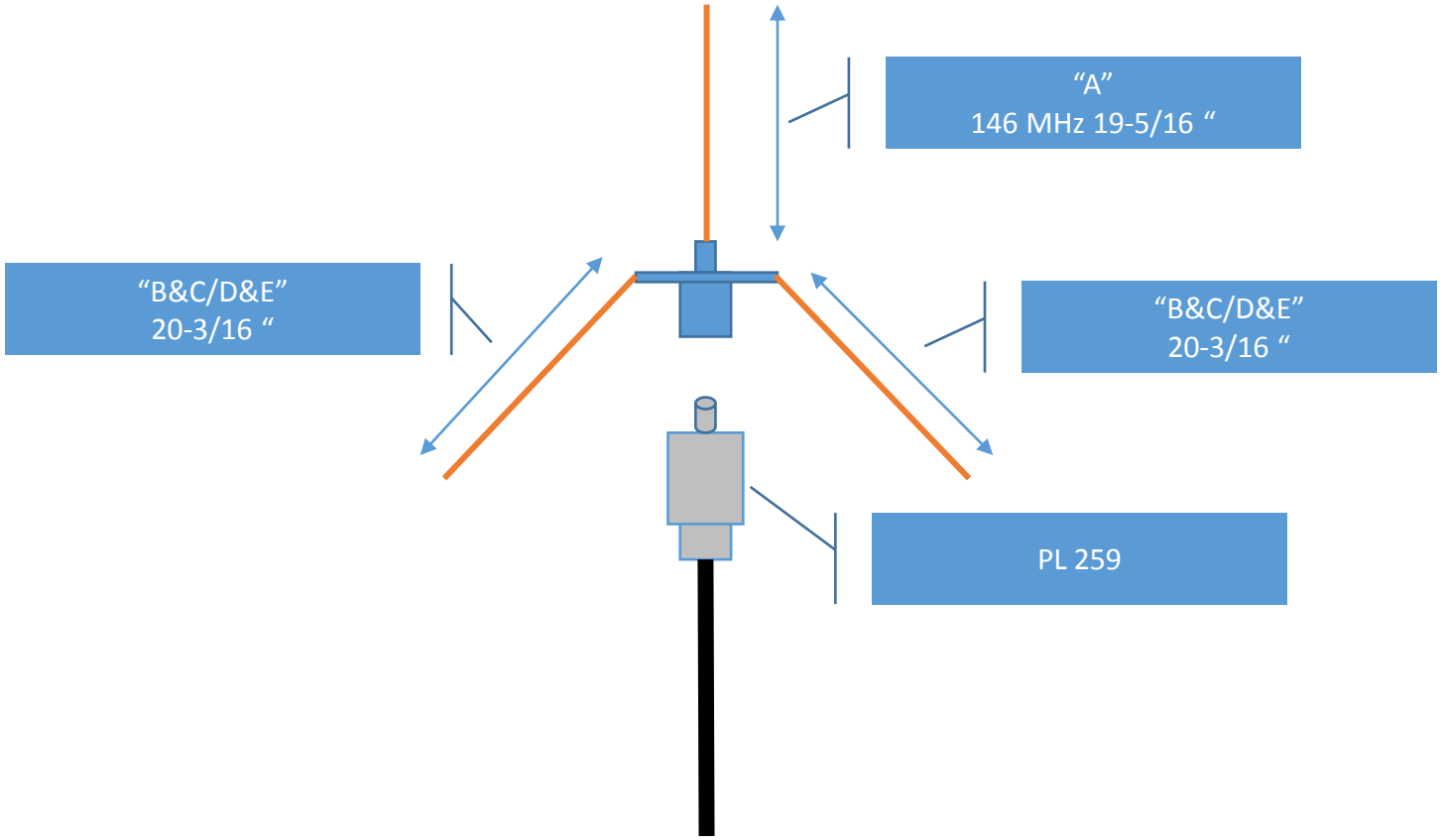
A Simple ¼ Wave Ground Plane



A Simple ¼ Wave Ground Plane Antenna

A fun project to build and learn how to tune antennas is a ¼ wave ground plane antenna using an SO239 connector; 12 gage solid copper wire or 36" brass or aluminum brazing rods ,4 each 10-12 gage automotive buss eyelet connectors.

Start by cutting the "A" section of the wire to 20" giving yourself trimming room for tuning to the center frequency desired. Now cut four lengths of wire 20 3/16" for ground radial "B-D". Solder the "A" section of wire into the center of the SO239 connector making sure you do not ground it to the outer SO239 casing. Now solder the B-D radials into the wire receiving end of a eyelet connector. Now connect the radials to the SO239 connector mounting holes using either solder or 4-40 hardware. Turn down each ground radial to a 45° angle with approximately 2 1/4 " distance between each radial connection point b-c, c-d, d-e, e-b. centered.

There are a number of different ways to mount this to a mass and I prefer taking 1" Schedule 40 PVC in a 2 ½ ' section. I use a 1' end cap and drill a hole large enough to receive the SO239 with your PL259 attached. You can then epoxy or RTV your antenna into this hole just enough the secure and seal it to prevent water from getting into the coaxial cable. RTV around the "A" section base where soldered to the SO239 Center pin to again weather seal against water intrusion into the coaxial cable.

You are now ready to disconnect the PL259 connector from the antenna and feed it though the center of the 1" 2&1/2' section of PVC pipe. Reconnect this to the SO239 connector and secure the end cap on the end of the pipe. Now secure this to you mass using U bolt clamps of duct tape. You are now ready to begin tuning your antenna.

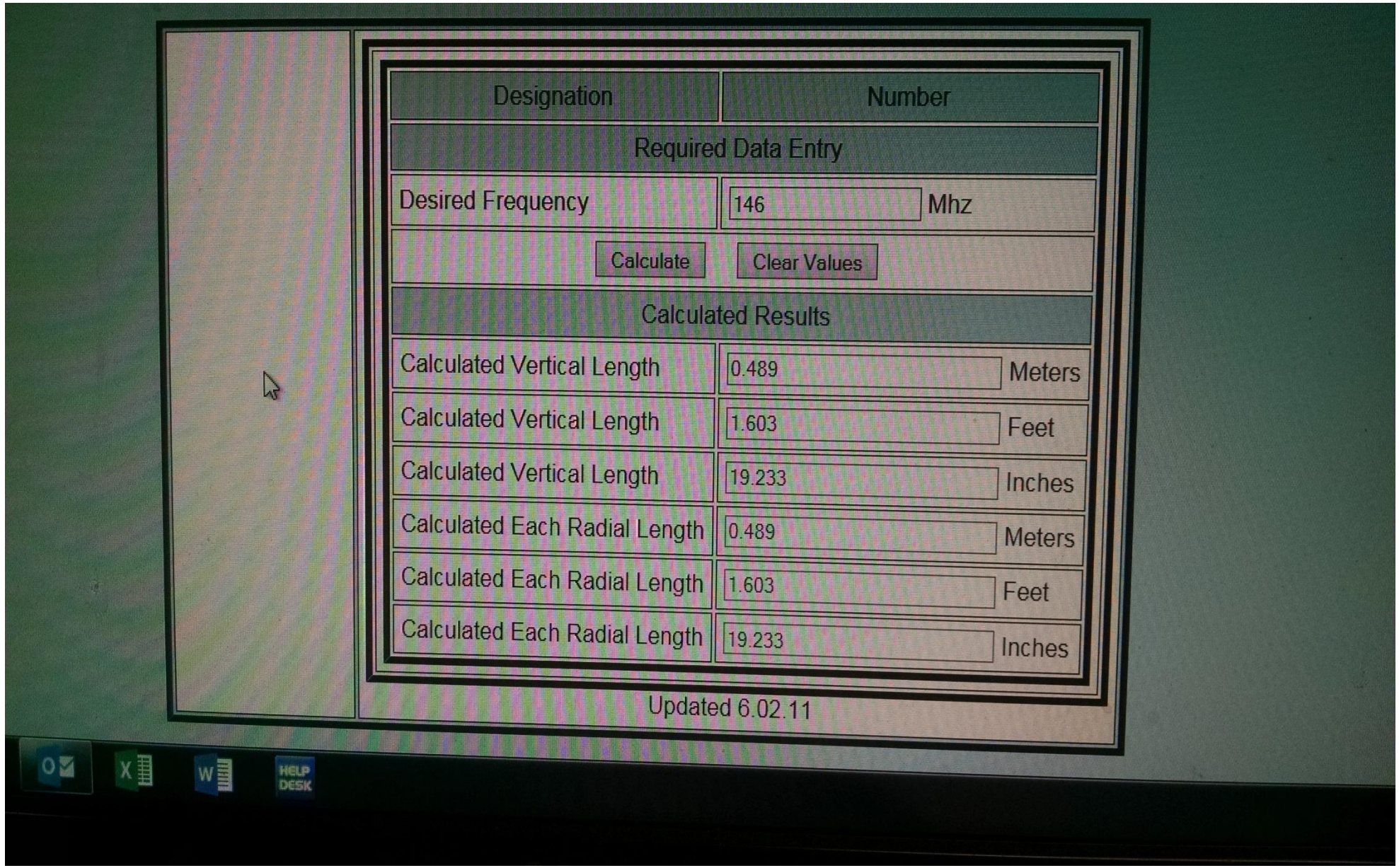
Determine your desired Center Frequency and observe your Antenna Analyzer's Advanced setting Resonate Frequency . Set your frequency to the desired center frequency and cut 1/8 " off the end of your "A" section observing the analyzer readings R = [ ]; X = [ ] values. At Center Frequency 146.0 MHz an R= -47-54 will result in X= 0 and a SWR of 1.0. Continue to trim 1/8" at a time off the "A" section until you have a length of about 19 5/16 " resonate frequency X=0 or as close as you can get. Now advance to return loss and reflection co-efficiency and observe you reading. An RL = (-)29-30 and reflective co-efficiency = (-)0.03 gives you an 1.0 SWR and a 99% efficiency to you antenna. You can adjust your frequency up and down the band getting a great idea how this antenna will perform on frequencies from 144.0 Mhz thru 148.0 Mhz.

You can us this design for UHF VHF application dual band and tri band by simply cutting additional "A" sections to the desired ¼ wave length and soldering them to the center pin 180° from each other at 45° from the center "A" section.

Enjoy this project:

Theodore B Cochran

N6TBC


Designation
Number
Required Data Entry
Desired Frequency
146
Mhz
Calculate
Clear Values
Calculated Results
Calculated Vertical Length
0.489
Meters
Calculated Vertical Length
1.603
Feet
Calculated Vertical Length
19.233
Inches
Calculated Each Radial Length
0.489
Meters
Calculated Each Radial Length
1.603
Feet
Calculated Each Radial Length
19.233
Inches
Updated 6.02.11
HELP DESK

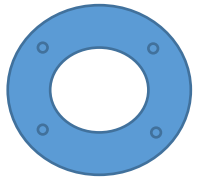
Parts list:

Home Depot

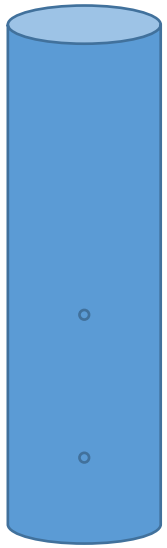
10 ‘ 12 ga bare copper wire (20 cents per foot)	total cost	$2.00
1” X 2’ Schedule 40 PVC pipe Home Depot precut		$2.13
1” schedule 40 end cap unthreaded 61 cents each	2 each	$1.22
¼” wing nut 4 pack		$1.18
¼” x 3 /1/2” hex head bolt 2 ea @ 24 cents		$.48
1 SO239 Connector		$ 5.95 - 9.95 each
Total cost		$12.96

A 25 pack of #8 3/8“ self taping screws cost about $3.00

SO239



1” PVC end cap
With top ground down flat
and hole for SO239 connector
drilled into center

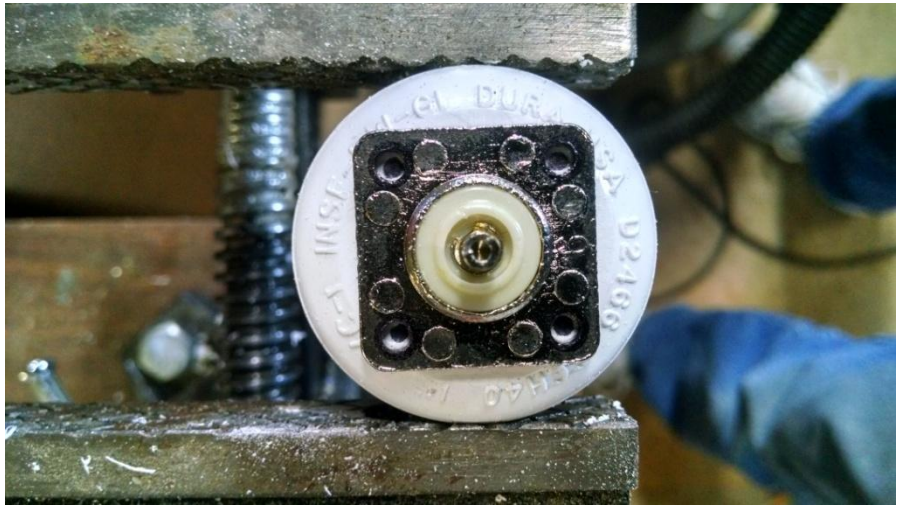


1” Schedule 40 PVC pipe 2’-3’ in length
with 5/16th holes drilled for mounting or use clamps
large enough to incorporate the mast and PVC pipe

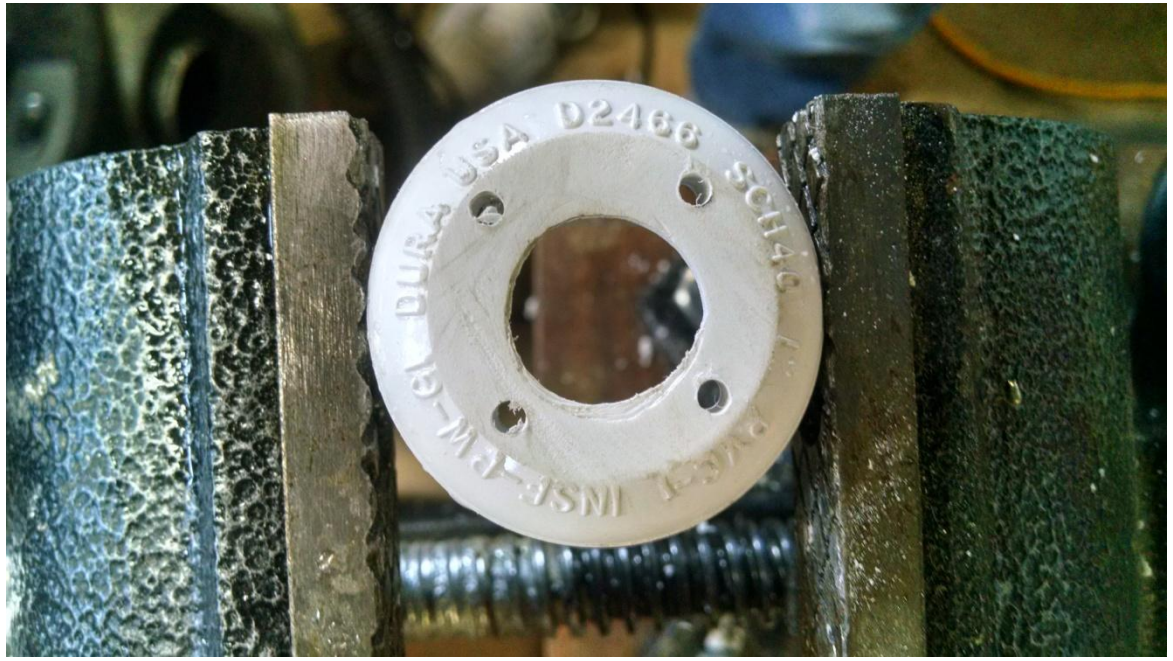
Take a 1” Schedule 40 unthreaded End Cap and grind the top as flat as you can on a 6 or 8” bench grinder. Once this is completed that it will allow the SO239 connector to sit squarely on the top. Now put the cap sideways in a vise and cut cap down to about 1/2” along the side. This allows enough space to freely connect the PL259 cable connector to the SO239 connector and fit snugly over and securely to the 1” diameter 2’ in length section of Schedule 40 PVC pipe used for mounting you antenna to a mast. Next insert the SO239 connector into the hole and mark the mounting holes locations with a marker. Remove the connector and with the drill.. drill out the mounting hole locations making the holes a little smaller than self taping screws if used or the same size as the 4 40 hardware being used. Mount the antenna to the cap and secure with mounting hardware.


DURA
SCH40
PVC-T
NSF-PW-6


DURA
SCH40
NSF-PW-6

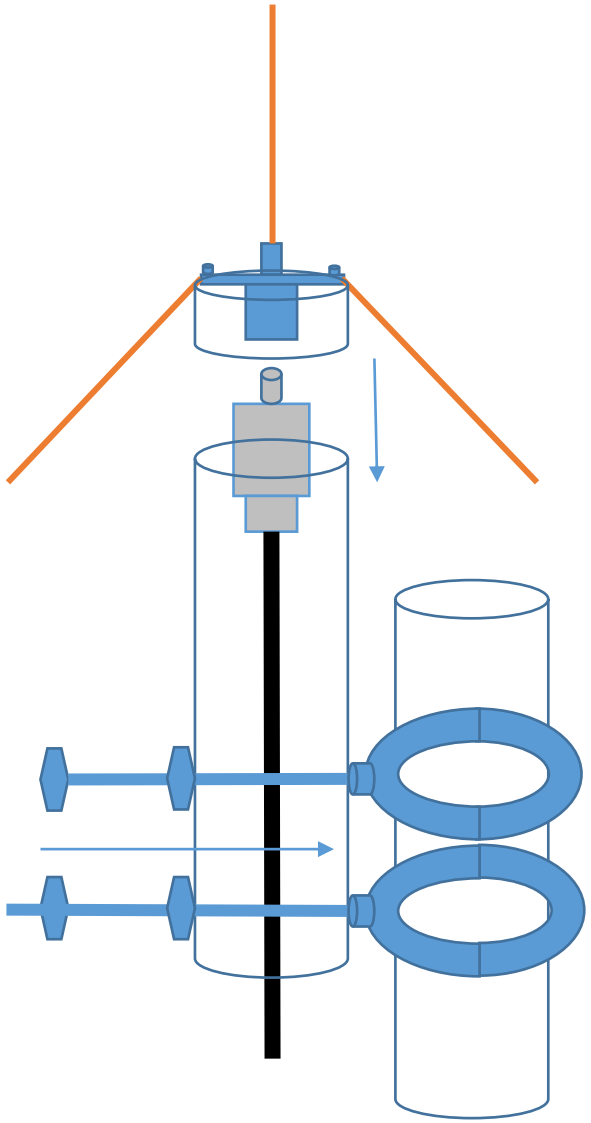



DURA USA D2466 SCH40


DURA USA D2466 SCH40


GUTTER SCREWS
EVERBILT
HEX HEAD PHILLIPS
#8 x 3/8 in
STAINLESS
25 PK
WHITE


1
2
FT & IN
INCHES



1 ½” ground clamps to mast

Here we will connect the PL239 to the SO239 and insert the PVC pipe into the cap. This give you a weather tight seal preventing water intrusion into the coaxial cable connector. You are now ready to mount to your mast using 1 ½ “ ground clamps, U-bolts 4 – 6” hose clamps or duct tape. If using grounding clamps you will need 2 each ¼” wing nuts as adjustments when mounting pipe to the clamps.