My compliments to John, K5GD for heading up the antenna building sessions, and thanks to Ron, N5QV for providing the antenna comparison data. I wanted to share my experience with this project. First of all, I don't do well without a picture and it was hard for me to extrapolate a diagram from the construction sheet. Due to some hasty cutting of ladder line, I ended up with a J-pole that was a bit short. After lots of testing and tweaking, I gave up and started a second antenna following the author's advice from the original article in QST, to build and tune each section, one at a time. The first section consisting of a ¼ wave matching section for 2 mtrs (¾ on 440 MHz) and a ½ wavelength radiator for UHF (440 MHz).

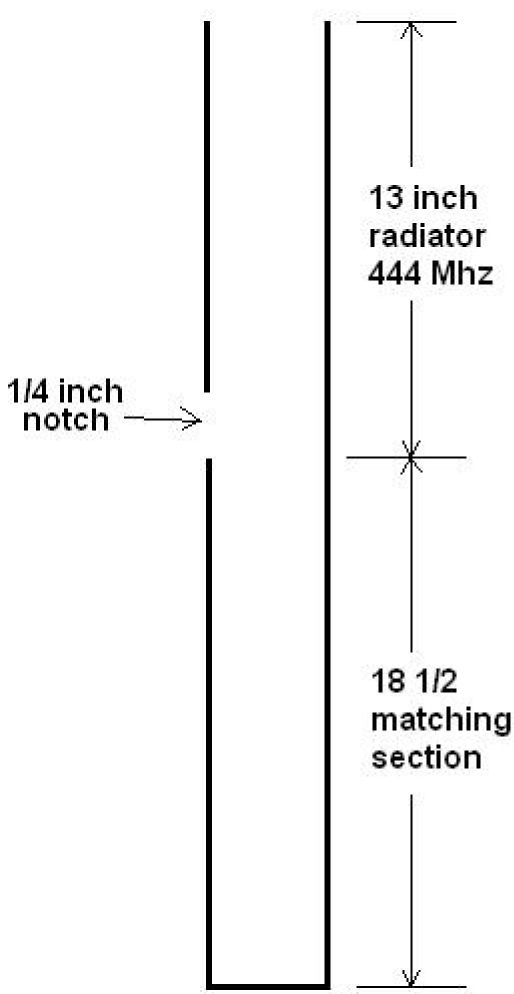


Figure 1

I used the formula $L = \frac{VF \times 2952}{f}$

L = ¼ wavelength in inches

VF = Velocity factor of the wire

(This varies for type of wire used).

f = Center frequency in Mhz.

(146 MHz and 444 MHz).

I didn't have an antenna analyzer that would work in the UHF band, so I used a dual band mobile rig on the 5 watt setting and Bird watt meter with a 5 watt slug to measure reflected power. During the initial measurements, I used a chart I found on the web to estimate VSWR. Then I plotted the results in an excel spreadsheet, ending up with a big old spike in the middle of the band. This turned out to be the radio jumping frequencies for automatic repeater offsets. Once I got rid of the offset, the picture looked a lot better. However, no matter what I did, the VSWR would not go below 2 to 1. Using data points every 5 MHz proved to be way too few, so I increased the number by going every

1 MHz in the 440 band. This gave a much smoother picture. I wasn't quite sure what affect the second conductor above the ¼ inch notch would have, so I did a little experimenting and just whacked it off. VSWR went immediately to 1.5 to 1. Theoretically it should have made the radiator look like a fat conductor effectively increasing bandwidth.

The next step was to build the ¼ wavelength coax stub. Its purpose in life is to isolate the top section of the antenna electrically during 440 operations. It should present high impedance and be invisible at 444 MHz. Be very careful trimming this part as 1/8 inch can make a very large difference at 444 MHz. I used a velocity factor of .78 for RG-8X. $L = \frac{.78 \times 2952}{444}$ for a length of 5.18 inches (Note: this is from the point where the shield is shorted to the center conductor to the end of the shield braid). Due to lots of experimenting back and forth, I ended up with a set of coax stubs in varying lengths and purposely cut some longer and others shorter than the calculated length. It was interesting how much these could affect the VSWR curve. Tests were made at 440 to 450 MHz adding just the coax stub and not the top section.

Finally it was time to add the top section. Here I just added a 20 inch piece of stranded 12 gauge copper wire cut intentionally long. This time tuning was done at 146 MHz for a center frequency in the 2 meter band, cutting 1/8 inch at a time and watching the VSWR drop. Once the VSWR dips and starts to rise again, you have cut off too much wire. No worries though, crimp and solder a round terminal lug on the end to make up for the lost length and give yourself a method to hang the antenna. You can also adjust the feed point up or down slightly for lowest VSWR.

Plotting all this data got old using a chart to look up VSWR each time. Here is a formula I found rooting around the web. Let Excel do the work ☺

$$VSWR = \frac{1 + \sqrt{Reflected\ Power/Forward\ Power}}{1 - \sqrt{Reflected\ Power/Forward\ Power}}$$

Excel formula cell C4 is the reflected PWR and cell $D$1 is the forward PWR.
=(1+SQRT(C4/$D$1))/(1-SQRT(C4/$D$1))

URL of the original article - http://www2.arrl.org/tis/info/pdf/0302038.pdf

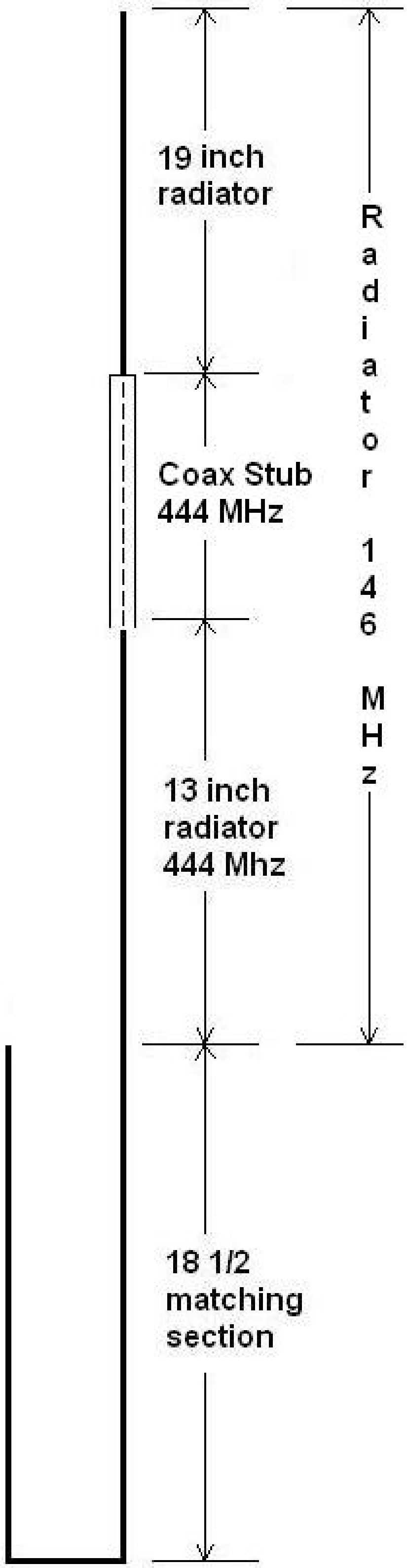


Figure 2

Below is an Excel chart plotting VSWR for 2 mtr and 440 operations. I compared the curves for a successfully built antenna with all ladder line and then my antenna variation with a single conductor radiating element. The all ladder line did prove to be more wide banded at 440 Mhz, but I achieved a slightly lower VSWR with the single conductor radiator design. Both worked equally well at 2 mtrs looking at the 2:1 VSWR. Mine was centered slightly higher in the band. Build two antennas and you will get two different VSWR plots. It takes patience and careful pruning to build one of these.

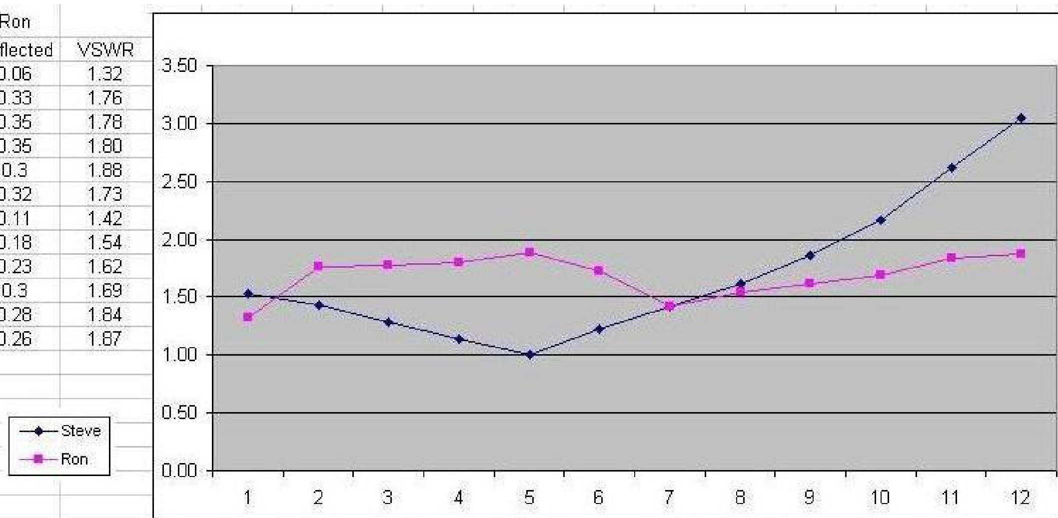
You may want to consider different types of coax for your stub and feedline because of power handling capabilities and line loss, but don't forget to use the correct velocity factor.

Feedline	Velocity Factor	Power 400 MHz	Loss 100'
RG-8X	.78	250	7.9
RG-58	.66	135	10.5
RG-174	.66	60	17.5
RG-8	.66	450	4.1
300 twin	.83		
450 ladder	.92		

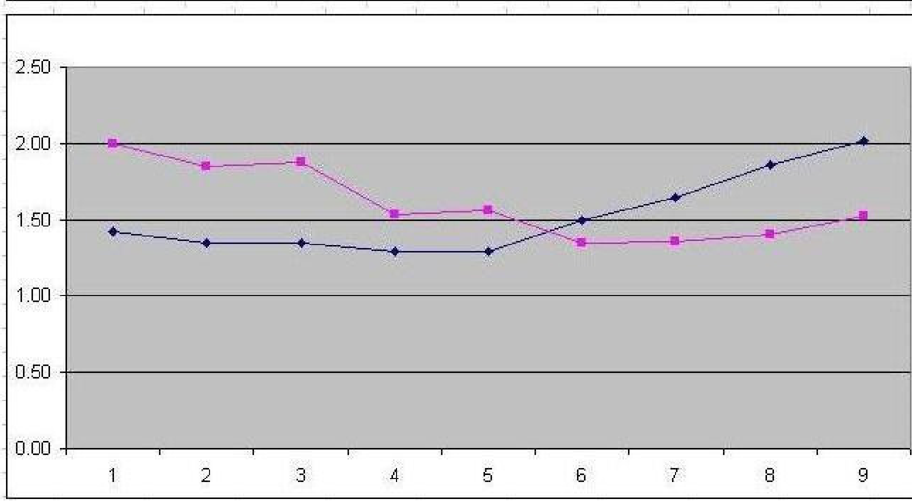
I used liquid tape and heat shrink to weather proof all bare connections.

73's and good luck building.
Steve, KM5HT

		Steve		Ron	
	Frequency	Reflected	VSWR	Reflected	VSWR
1	450	0.22	1.53	0.06	1.32
2	449	0.16	1.44	0.33	1.76
3	448	0.08	1.29	0.35	1.78
4	447	0.02	1.14	0.35	1.80
5	446	0	1.00	0.3	1.88
6	445	0.05	1.22	0.32	1.73
7	444	0.15	1.42	0.11	1.42
8	443	0.28	1.62	0.18	1.54
9	442	0.45	1.86	0.23	1.62
10	441	0.68	2.17	0.3	1.69
11	440	1	2.62	0.28	1.84
12	439	1.28	3.05	0.26	1.67



	Frequency	Reflected	VSWR	Ron's	VSWR
1	148	0.15	1.42	0.38	2.00
2	147.5	0.11	1.35	0.29	1.85
3	147	0.11	1.35	0.3	1.88
4	146.5	0.08	1.29	0.15	1.53
5	146	0.08	1.29	0.16	1.56
6	145.5	0.2	1.50	0.09	1.35
7	145	0.3	1.65	0.09	1.36
8	144.5	0.45	1.86	0.11	1.40
9	144	0.57	2.02	0.15	1.52



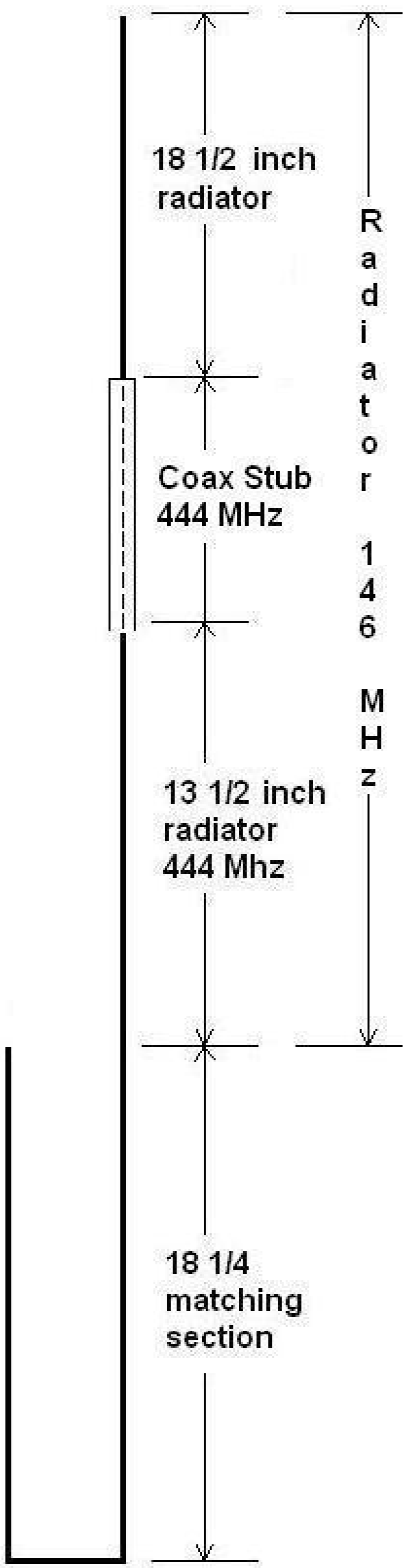


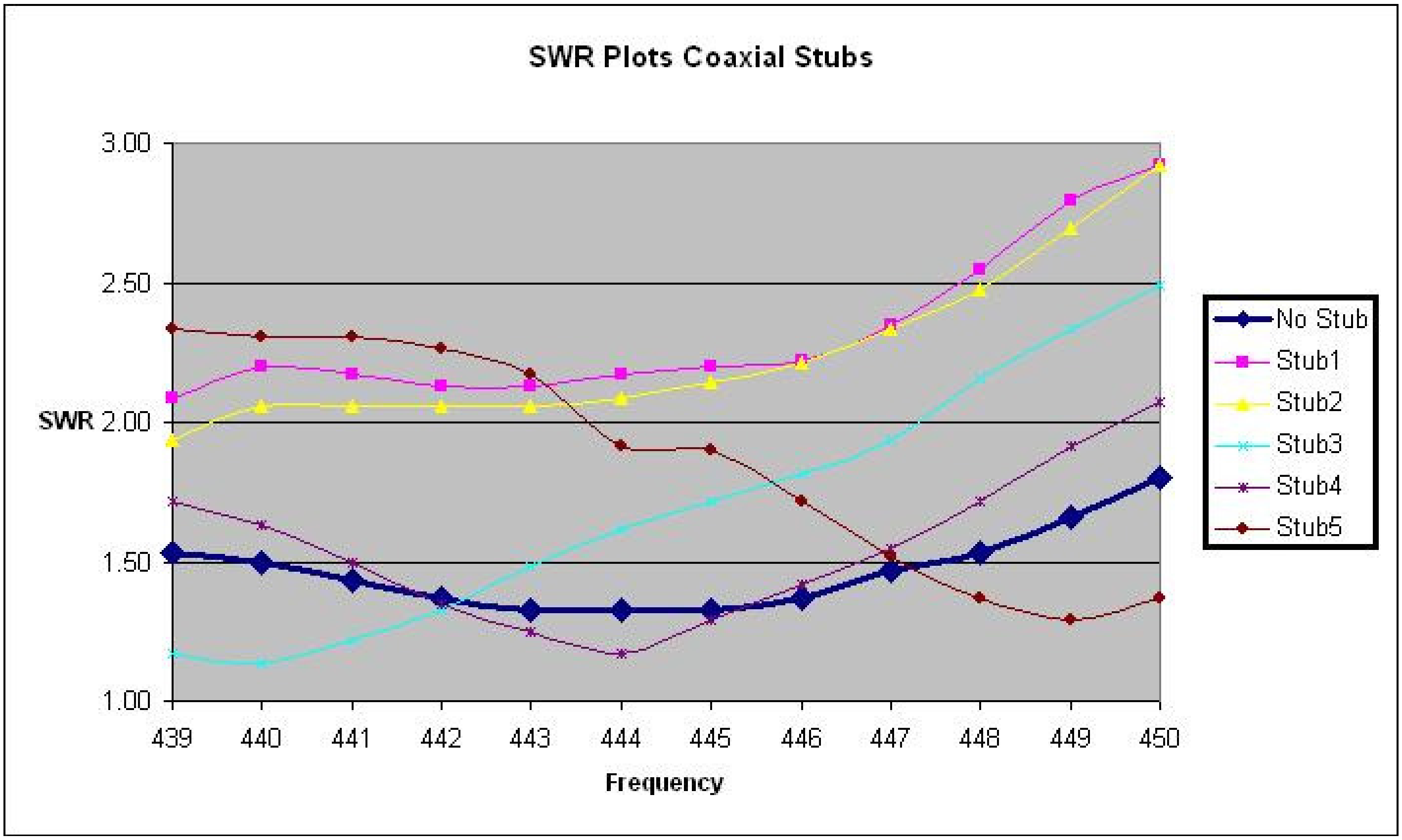
Figure 2

Revision: I still found myself with a piece of John's ladder line from the first antenna laying around. I couldn't just throw it away, so I decided to experiment a little more. This piece had the matching section cut at 18 ¼ inches, but the 444 MHz radiator was a bit short. I cut off the second conductor above the ¼ inch notch again, and extended the radiator. It's length ended up at 13 ½ inches, a bit longer than antenna 2. The coax stub was the same length and the upper part of 146 radiator was a bit shorter. The resulting SWR curves were an improvement over the last antenna. Lower SWR and more wide banded. I may just have to go back and do a bit more tweaking on the previous antennas.

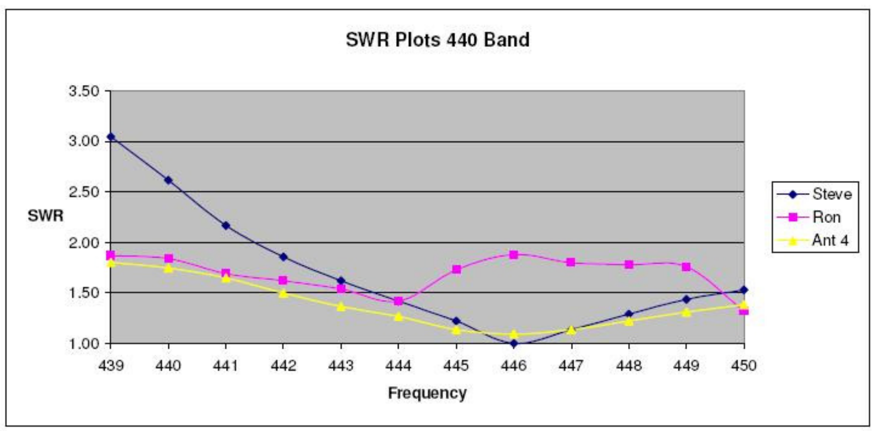
I also included the SWR plots using the different length coax stubs. I found that to be an interesting picture as well.

Note: Antenna 4 was built from parts of antenna 1. It might be interesting to experiment some more with the length of the matching section to see what kind of results can be obtained.

73 Steve, KM5HT



Forward Power			5		4.5	
	Steve		Ron		Ant 4	
Frequency	Reflected	VSWR	Reflected	VSWR	Reflected	VSWR
450	0.22	1.53	0.06	1.32	0.13	1.38
449	0.16	1.44	0.33	1.76	0.09	1.31
448	0.08	1.29	0.35	1.78	0.05	1.22
447	0.02	1.14	0.35	1.80	0.02	1.14
446	0	1.00	0.3	1.88	0.01	1.09
445	0.05	1.22	0.32	1.73	0.02	1.14
444	0.15	1.42	0.11	1.42	0.07	1.27
443	0.28	1.62	0.18	1.54	0.12	1.37
442	0.45	1.86	0.23	1.62	0.2	1.50
441	0.68	2.17	0.3	1.69	0.3	1.65
440	1	2.62	0.28	1.84	0.37	1.75
439	1.28	3.05	0.26	1.87	0.41	1.80



Forward Power			5		5	
Frequency	Reflected	VSWR	Ron's	VSWR	Reflected	VSWR
148	0.15	1.42	0.38	2.00	0.29	1.63
147.5	0.11	1.35	0.29	1.85	0.18	1.47
147	0.11	1.35	0.3	1.88	0.09	1.31
146.5	0.08	1.29	0.15	1.53	0.02	1.14
146	0.08	1.29	0.16	1.56	0.03	1.17
145.5	0.2	1.50	0.09	1.35	0.09	1.31
145	0.3	1.65	0.09	1.36	0.2	1.50
144.5	0.45	1.86	0.11	1.40	0.35	1.72
144	0.57	2.02	0.15	1.52	0.51	1.94