Rx antennas at IV3PRK: detuning the TX Antenna

Using the "sectionalizing tower" method by W8JI

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In the 1st part of my modeling study on the Flags upgrade, from the original standard rotatable one to the new "Waller Flag", it came out that, in any case, detuning the Tx antenna was an issue.

To see the detuning effect, and to recover the required patterns, it was sufficient to add a 90 degrees shorted line (high impedance) at the base of the Tx tower. But that was "modelling" and I have been unable to get it working in the realty, as mine is a shunt-fed "grounded" tower.

Once again a great help was found on W8JI site http://www.w8ji.com/detuning_towers.htm, but I could not get an idea of the capacitance values involved and where to start from.

Modeling with Eznec 5

One of the most useful features of the new EZNEC 5 is the possibility to insert objects, and thus transformers, L-networks or capacitors, in virtual segments wherever you want.

I added the 3 wires forming the detuning loop on the Tx antenna, inserted a capacitance in the lower one, and made a lot of runs tweaking for best values as seen in the far field plots from the receiving Flag.

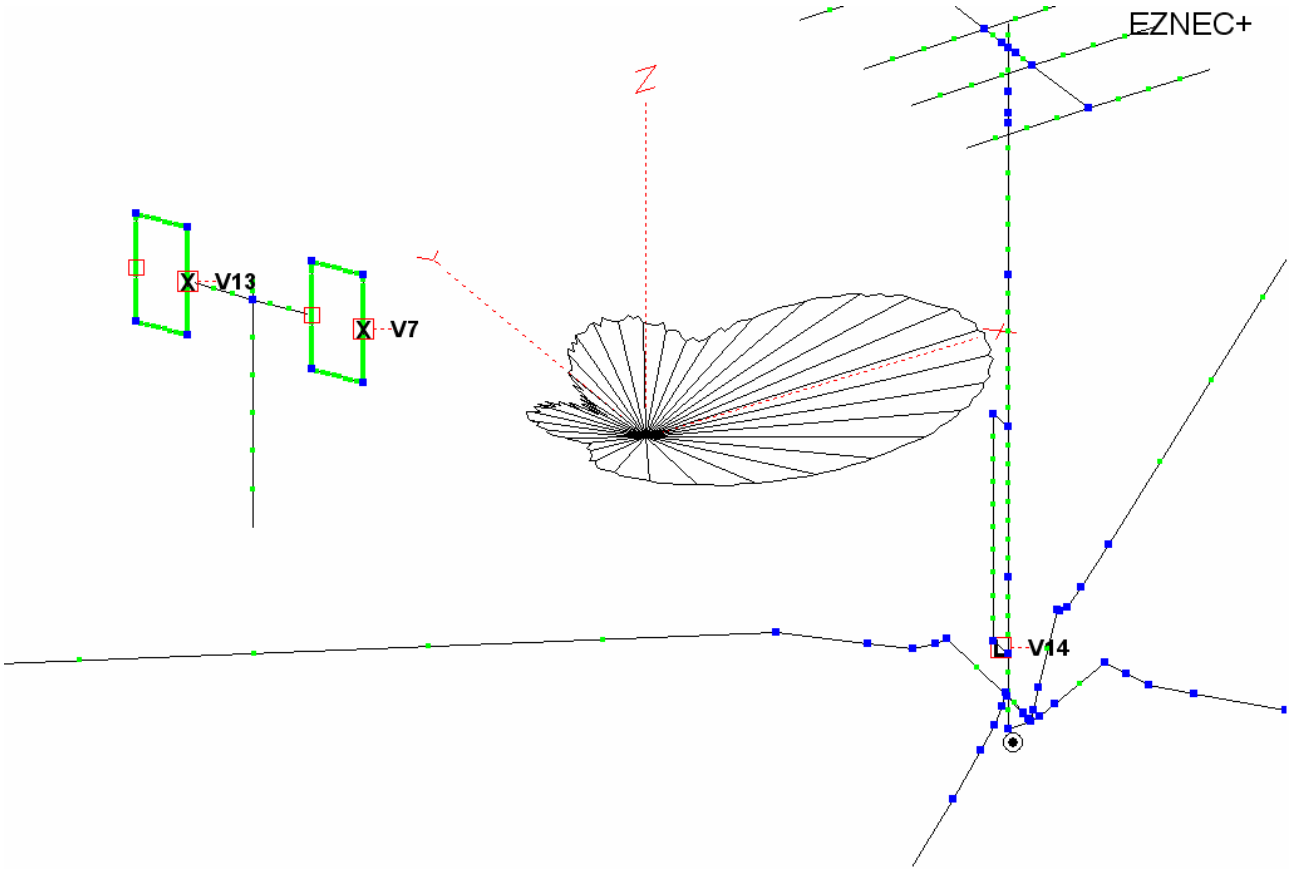
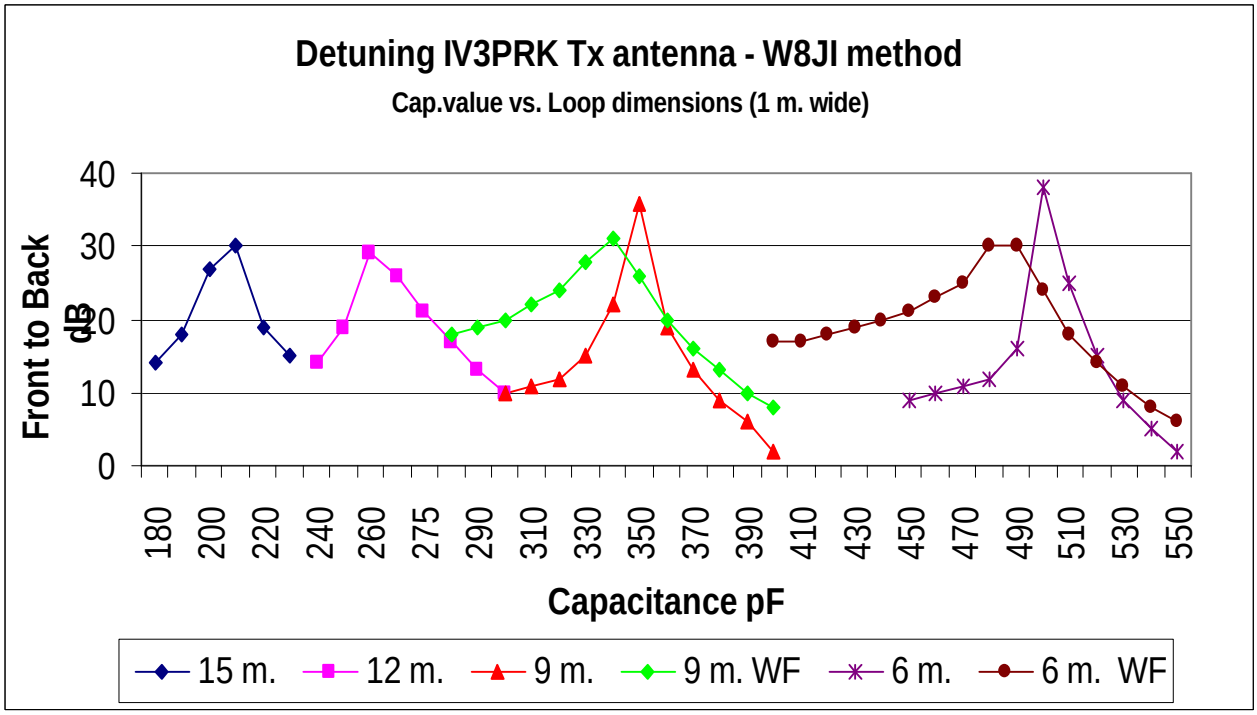


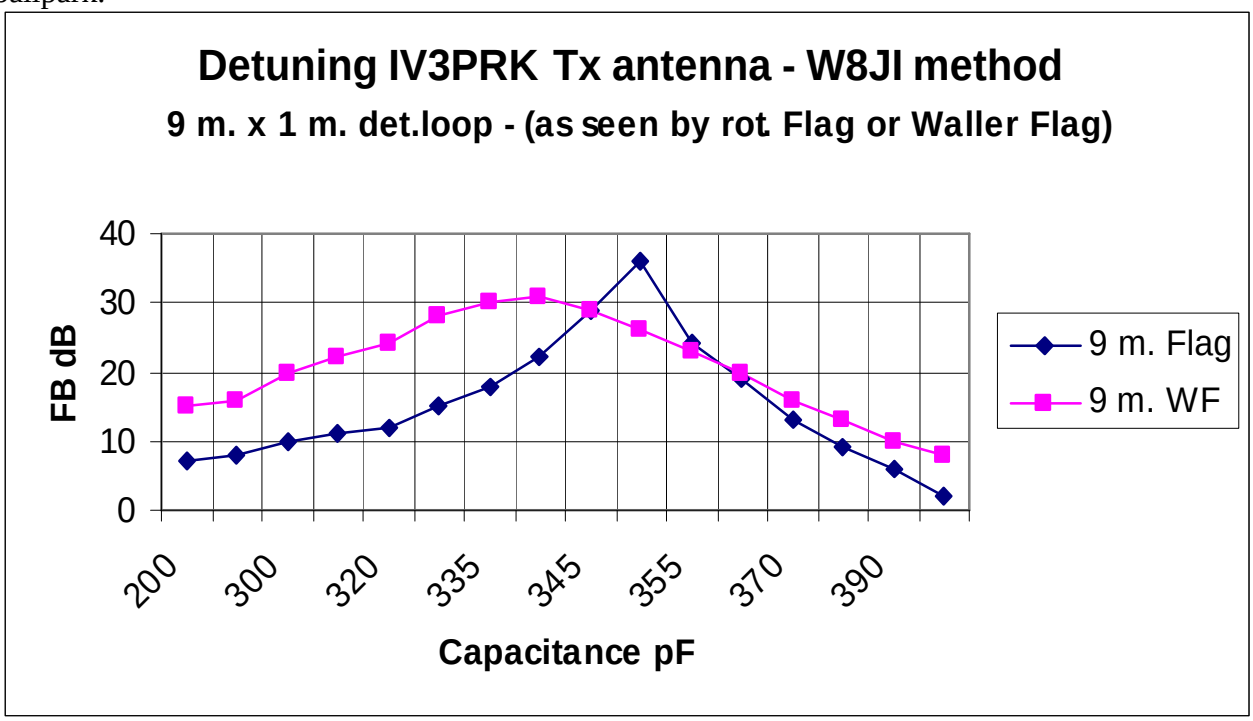
Fig.1: Eznec "View Antenna" snapshot showing the Waller Flag facing the Tx antenna (150 deg.) and the final correct pattern resulting after detuning : FB 30 dB – RDF 11.40 dB

I started looking for the best capacitance values for several sectionalizing areas. I kept the loop always 1 meter wide and varied the vertical wire length, both with the old Flag model and the new "WF" model.



The capacitance value increases as the detuning area decreases. My tower is 24 m. high (plus 5 m. mast) and I choose to use a 9 m. area section, put between 3 and 12 meters of the tower.

The bandwidth is very sharp and capacitor setting is going to be quite critical. There are also some small variations between the two receiving antennas and their directions, but we are in the ballpark.



The graphs show only the front to back variations, as the RDF is more stable, always above 11 dB, as detailed in the following table, and are less meaningful in this study.

Table 1: The Waller Flag - tweaking detuning capacitance on Tx antenna for best pattern and F/B

File	Detuning Cap. pF	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	200	-56,14	20	82	85	**15**	-66,96	**10,82**
wires 71 segments 276	250	-55,96	20	82	85	**16**	-66,90	**10,94**
Detuned with W8JI	280	-55,81	20	82	83	**18**	-66,84	**11,03**
tower sectionalizing method	290	-55,75	20	82	83	**19**	-66,82	**11,07**
from 3 to 12 m. 1 m. dist. => 9 m.	300	-55,68	20	88	84	**20**	-66,80	**11,12**
wire diam. (top - vert.side - bottom):	310	-55,59	20	88	83	**22**	-66,77	**11,18**
25 mm. 3 mm. 3 mm.	320	-55,51	20	88	83	**24**	-66,75	**11,24**
	328	-55,44	20	88	82	**27**	-66,73	**11,29**
Beaming 90 deg.	329	-55,43	20	88	82	**28**	-66,73	**11,30**
	330	-55,42	20	88	82	**28**	-66,73	**11,31**
	331	-55,42	20	88	82	**28**	-66,73	**11,31**
	332	-55,41	20	88	82	**29**	-66,72	**11,31**
	333	-55,40	20	88	82	**29**	-66,72	**11,32**
	334	-55,39	20	88	82	**30**	-66,72	**11,33**
	335	-55,38	20	88	82	**30**	-66,72	**11,34**
	336	-55,37	20	88	82	**30**	-66,72	**11,35**
	337	-55,37	20	88	81	**31**	-66,72	**11,35**
	338	-55,36	20	88	81	**31**	-66,72	**11,36**
	339	-55,35	20	88	81	**31**	-66,72	**11,37**
	340	-55,35	20	88	81	**31**	-66,71	**11,36**
	341	-55,34	20	88	81	**31**	-66,71	**11,37**
	342	-55,33	20	88	81	**30**	-66,71	**11,38**
	343	-55,33	20	88	81	**30**	-66,71	**11,38**
	344	-55,32	20	88	81	**30**	-66,71	**11,39**
	345	-55,32	20	88	81	**29**	-66,72	**11,40**
	346	-55,31	20	88	81	**28**	-66,72	**11,41**
	347	-55,31	20	88	81	**28**	-66,72	**11,41**
	348	-55,30	20	88	81	**27**	-66,72	**11,42**
	349	-55,30	20	88	81	**27**	-66,72	**11,42**
	350	-55,30	20	88	81	**26**	-66,72	**11,42**
	355	-55,29	20	88	82	**23**	-66,73	**11,44**
	360	-55,30	20	94	81	**20**	-66,76	**11,46**
	370	-55,39	20	94	80	**16**	-66,76	**11,37**
	380	-55,68	22	96	78	**13**	-67,06	**11,38**
	390	-56,23	20	98	74	**10**	-67,35	**11,12**
	400	-57,05	20	98	72	**8**	-67,78	**10,73**

Now let's see what happens by varying the width of the detuning area:

- Reducing the width from 100 cm. to 60 cm. we must increase the capacitance to 390 pF
- Increasing the width to 120 cm., we must reduce the capacitance to 320 pF.

Actually the detuning section is a closed loop which represents a parallel tuned circuit, with an high impedance at resonance, which splits the tower and causes it to "electrically vanish". But that part of the tower itself is the 4th side of the loop, with a large diameter.

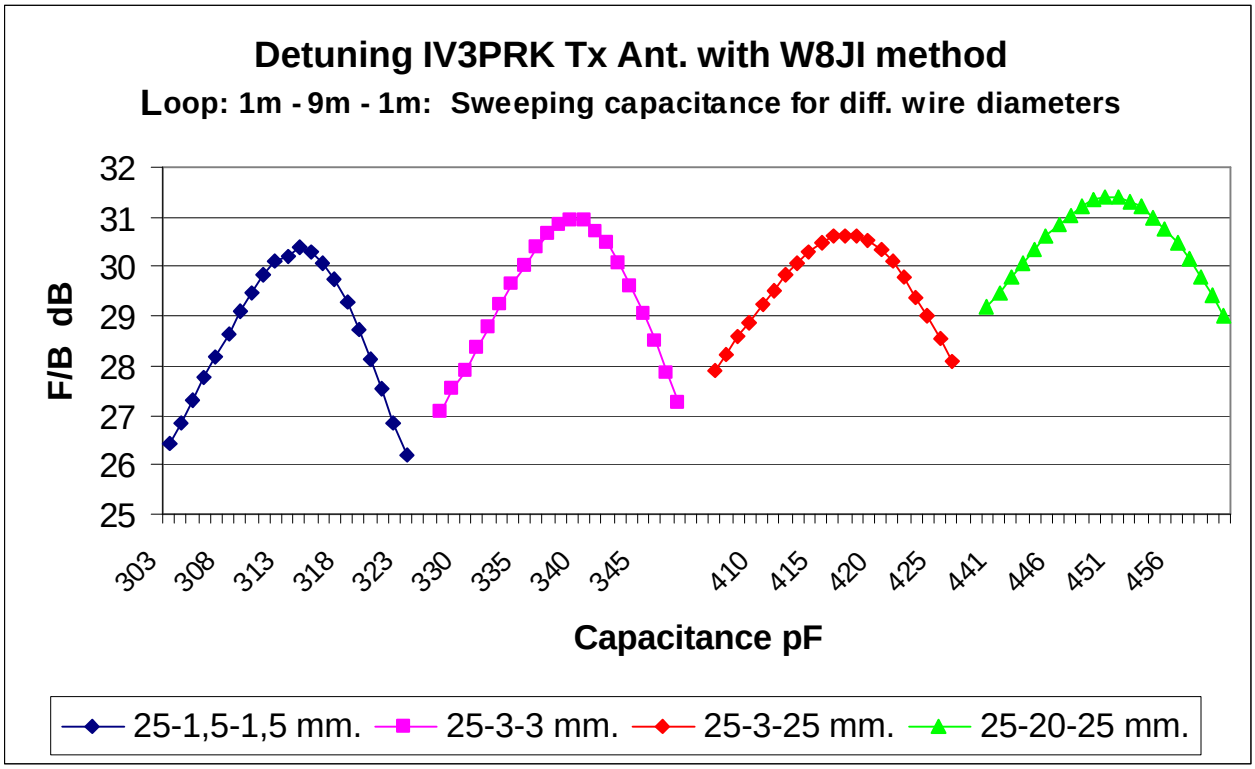
My tower is a triangular, self supporting one, tapering from 130 cm. at the base, to 70 cm. at the top, and the leg tubes are 110 to 90 mm. diameter in the bottom part. Some years ago, in order to design the shunt-feeding system, I calculated an equivalent wire diameter for each tower section and always used them instead of the complex real wires structure. No way to change that side of the loop, but how far could it be if my equivalent wire diameter is wrong? In the next table the tower legs have been reduced at half diameter.

Table 2: The Waller Flag - tweaking detuning capacitance on Tx antenna for best pattern and F/B

File	Detuning Cap. pF	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	300	-55,45	20	88	82	**28**	-66,75	**11,30**
from 3 to 12 m. 1 m. dist. => 9 m.	305	-55,43	20	88	81	**29**	-66,74	**11,31**
wire diam. (top - vert.side - bottom):	310	-55,40	20	88	81	**30**	-66,74	**11,34**
25 mm. 3 mm. 3 mm.	315	-55,38	20	88	81	**30**	-66,73	**11,35**
reduced diameter tower wires:	320	-55,36	20	88	81	**30**	-66,73	**11,37**
600>300mm. 500>250mm 400>200mm	325	-55,34	20	88	81	**30**	-66,72	**11,38**
	330	-55,32	20	88	81	**28**	-66,72	**11,40**

Nothing to worry; the capacitance should be reduced only by about 20 pF as actually the loop is made broader (the distance in Eznec is centre to centre of wires) and the bandwidth improves a little bit.

But what happens with different wire diameters on the other side of the detuning loop?



The graph reports the 20 top readings for every case and definitely the best results are achieved with the larger wires. The capacitor needs to be increased from 340 to 450 pF and the loop, entirely in aluminium tubes (25, 20 and 25 mm. diameter), becomes a solid connected structure as recommended by W8JI.

Table 3: The Waller Flag - tweaking detuning capacitance on Tx antenna for best pattern and F/B - Changed wire diameters

File	Detuning Cap. pF	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	440	-55,40	20	88	81	**29,19**	-66,71	**11,31**
wires 71 segments 276	441	-55,39	20	88	81	**29,49**	-66,71	**11,32**
Detuned with W8JI	442	-55,38	20	88	81	**29,81**	-66,71	**11,33**
tower sectionalizing method	443	-55,38	20	88	81	**30,08**	-66,71	**11,33**
from 3 to 12 m. 1 m. dist. => 9 m.	444	-55,37	20	88	81	**30,36**	-66,71	**11,34**
wire diam. (top - vert.side - bottom):	445	-55,37	20	88	81	**30,62**	-66,71	**11,34**
25 mm. 20 mm. 25 mm.	446	-55,36	20	88	81	**30,87**	-66,71	**11,35**
	447	-55,36	20	88	81	**31,03**	-66,70	**11,34**
Beaming 90 deg.	448	-55,35	20	88	81	**31,22**	-66,70	**11,35**
	449	-55,35	20	88	81	**31,35**	-66,70	**11,35**
	450	**-55,34**	**20**	**88**	**81**	31,39	**-66,70**	11,36
	451	-55,34	20	88	81	**31,38**	-66,70	**11,36**
	452	-55,33	20	88	81	**31,32**	-66,70	**11,37**
	453	-55,33	20	88	81	**31,20**	-66,70	**11,37**
	454	-55,32	20	88	81	**31,00**	-66,70	**11,38**
	455	-55,32	20	88	81	**30,75**	-66,70	**11,38**
	456	-55,31	20	88	81	**30,48**	-66,70	**11,39**
	457	-55,31	20	88	81	**30,14**	-66,70	**11,39**
	458	-55,31	20	88	81	**29,79**	-66,70	**11,39**
	459	-55,30	20	88	81	**29,41**	-66,69	**11,39**
	460	-55,30	20	88	81	**29,00**	-66,69	**11,39**

The green area above 30 dB of front to back is wider and thus my choice is 450 pF of capacitance. I keep that value, and with such model let's turn the Waller Flag and see how are the patterns in the other directions.

As tabulated in the following table 4, the results are not very satisfying. Although the lobe recovers its shape in every direction, with a general RDF improvement, the desired front to back does not reach anywhere the value of 30 dB like in the starting 90 degrees beaming.

Table 4: The Waller Flag - rotating Rx antenna wires in 30 deg. steps

File	Rotating direction	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	270	-55,62	22	274	80	**26**	-67,18	**11,56**
wires 71 segments 276	300	-55,08	22	304	83	**28**	-66,41	**11,33**
Detuned with W8JI	330	-54,94	20	330	84	**26**	-66,10	**11,16**
tower sectionalizing method	360	-55,24	22	0	82	**22**	-66,60	**11,36**
loop dimensions: 1m.wide - 9 m.high	30	-55,78	20	30	81	**23**	-67,24	**11,46**
wire diam. (top - vert.side - bottom):	60	-55,86	22	60	83	**19**	-67,16	**11,30**
25 mm. 20 mm. 25 mm.	90	-55,35	20	88	81	**31**	-66,71	**11,36**
Detuning capacitor = 450 pF	120	-55,32	22	116	88	**18**	-66,30	**10,98**
	150	-55,51	22	152	91	**14**	-66,06	**10,55**
	180	-55,46	20	180	86	**17**	-66,48	**11,02**
	210	-55,70	20	218	81	**25**	-67,15	**11,45**
	240	-56,07	20	244	79	**22**	-67,54	**11,47**
	270	-55,62	22	274	80	**26**	-67,18	**11,56**

Anyway if we compare the results of table 4 with the mess of table 5, taken without any detuning trick, we see that's not bad and we are on the right way.

Table 5: The Waller Flag - rotating Rx antenna wires in 30 deg. steps - BEFORE DETUNING

File	Rotating direction	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03	270	- 56,77	20	272	74	**15**	- 68,38	**11,61**
wires 67 - segm. 264	300	- 54,22	22	304	86	**19**	- 65,30	**11,08**
WF 12 m.l ength, 12 m.high	330	- 53,73	20	330	89	**17**	- 64,49	**10,76**
2 loops (4,27 x 2,00 m.) 5 m. sep.	360	- 55,58	22	0	79	**23**	- 67,12	**11,54**
Xfmr: 600/100 ohms	30	- 58,43	20	22	78	**8**	- 68,60	**10,17**
RL1= 580 - RL2 = 600	60	- 58,32	20	62	83	**7**	- 68,21	**9,89**
TL1 100 ohm to front loop = 4,00 m.	90	- 56,47	20	82	84	**13**	- 67,12	**10,65**
TL2 to rear loop 180 deg.rev = 4,25m.	120	- 55,73	24	98	121	**5**	- 63,74	**8,01**
Added the wires of:	150	- 56,10	24	168	188	**3**	- 62,93	**6,83**
Tx antenna at a distance of 28 m.	180	- 56,12	20	194	94	**9**	- 65,60	**9,48**
and abt 140 degrees, with top loading	210	- 57,41	20	218	77	**12**	- 68,52	**11,11**
yagi, 28 m. high, and 4 elev. radials	240	- 58,68	20	232	79	**7**	- 68,61	**9,93**
without detuning	270	- 56,73	22	274	73	**16**	- 68,33	**11,60**

So I took the worst case of 150 deg. of beaming direction and swept the capacitance until I reached the best value of 475 pF, as in the next table 6.

Table 6: The Waller Flag - tweaking detuning capacitance on Tx antenna for best pattern and F/B - Changed beam direction

File	Detuning Cap. pF	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	450	-55,51	22	152	91	**14**	-66,06	**10,55**
wires 71 segments 276	460	-55,59	22	152	89	**17**	-66,49	**10,90**
Detuned with W8JI	470	-55,71	22	152	83	**26**	-66,96	**11,25**
tower sectionalizing method	471	-55,73	20	148	83	**27**	-67,00	**11,27**
loop dimensions: 1m.wide - 9 m.high	472	-55,74	20	148	83	**28**	-67,05	**11,31**
wire diam. (top - vert.side - bottom):	473	-55,76	20	148	82	**29,86**	-67,10	**11,34**
25 mm. 20 mm. 25 mm.	474	-55,78	20	148	82	**31,29**	-67,15	**11,37**
Beaming 150 degrees	475	-55,80	20	148	82	**32,23**	-67,20	**11,40**
	476	-55,81	20	148	82	**32,10**	-67,25	**11,44**
	477	-55,84	20	148	82	**30,90**	-67,29	**11,45**
	478	-55,86	22	148	81	**29**	-67,34	**11,48**
	479	-55,88	22	148	81	**27**	-67,39	**11,51**
	480	-55,90	22	148	80	**26**	-67,43	**11,53**

In the following fig. 2 we see the horizontal and vertical patterns of the Waller Flag taken at 150 degrees - in the direction of the Tx antenna - before detuning (primary red trace) and the superimposed plots with detuning at 450 pF (blue trace) and the final set at 475 pF (green trace): there is a great improvement!

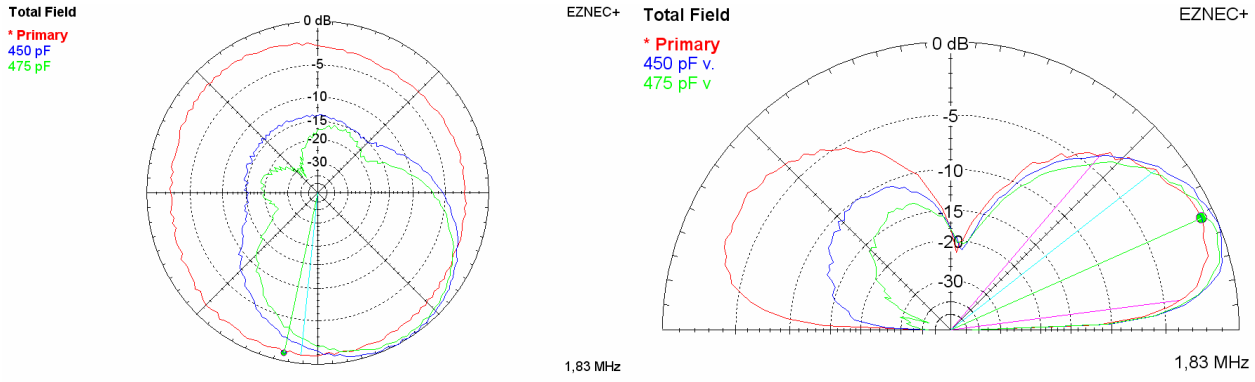


Fig.2: Azimuth and elevation plots of the Waller Flag at 150 degrees (facing the Tx antenna)

Now let's turn again the Waller Flag to verify if that best capacitance value, found for the worst direction, will behave as desired also in the other bearings.

Table 7: The Waller Flag - rotating Rx antenna wires in 30 deg. steps - FINAL DETUNING Tx antenna setup

File	Rotating direction	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d3 (+Tx ant.4 rad)	270	-55,42	20	272	81	**29**	-66,86	**11,44**
wires 71 segments 276	300	-55,37	22	304	81	**32**	-66,84	**11,47**
Detuned with W8JI	330	-55,33	20	330	80	**27**	-66,69	**11,36**
tower sectionalizing method	360	-55,29	20	4	81	**22**	-66,60	**11,31**
loop dimensions: 1m.wide - 9 m.high	30	-55,23	22	30	82	**22**	-66,53	**11,30**
wire diam. (top - vert.side - bottom):	60	-55,21	22	60	85	**27**	-66,50	**11,29**
25 mm. 20 mm. 25 mm.	90	-55,27	20	88	82	**23**	-66,72	**11,45**
Detuning capacitor = 475 pF	120	-55,49	22	122	81	**28**	-67,03	**11,54**
	150	-55,80	20	148	82	**32**	-67,20	**11,40**
	180	-55,53	20	180	82	**21**	-66,90	**11,37**
	210	-55,36	22	208	82	**23**	-66,79	**11,43**
	240	-55,43	22	242	82	**25**	-66,77	**11,34**
	270	-55,44	20	272	81	**29**	-66,86	**11,42**

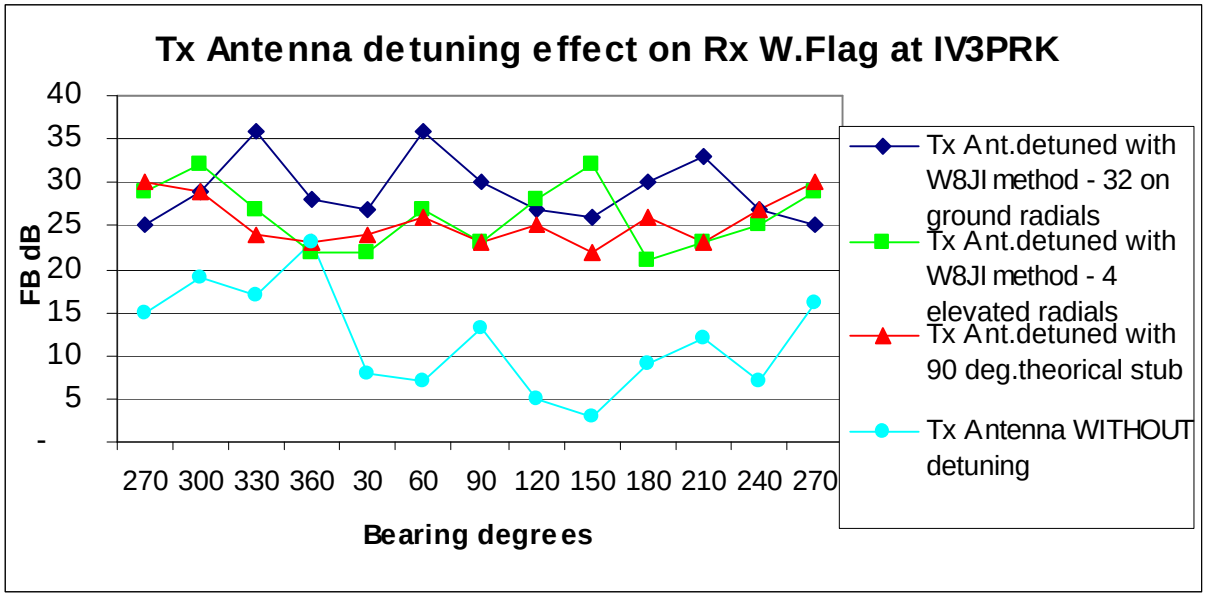
That's satisfactory: the front to back ratio is everywhere above 20 dB and the RDF almost stable between 11.30 and 11.50 dB.

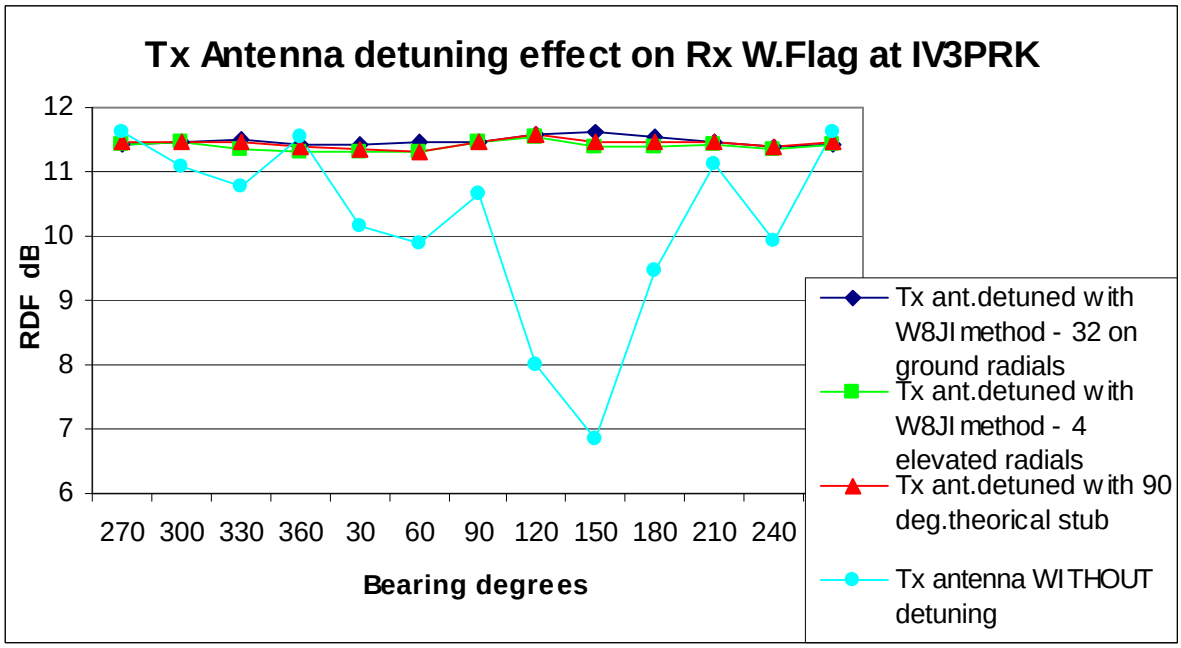
At last I wanted to see also if any improvement could be achieved by substituting the 4 elevated radials with 32 on ground radials. Remember that the elevated radials were so destructive on my Pennants that every effort in tower detuning had no effect unless changing the ground system. The tabulated results of Eznec modeling are in the following table.

Table 8: The Waller Flag - rotating Rx antenna wires in 30 deg. steps - Tx tower detuned with "on ground radial system"

File	Rotating direction	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLFlag_03d4 (+Tx ant. 32 radials)	270	- 55,44	24	270	81	**25**	- 66,86	**11,42**
wires 168 segments 513	300	- 55,52	22	304	81	**29**	- 66,99	**11,47**
Detuned with W8JI	330	- 55,53	20	330	79	**36**	- 67,02	**11,49**
tower sectionalizing method	360	- 55,48	22	0	82	**28**	- 66,91	**11,43**
loop dimensions: 1m.wide - 9 m.high	30	- 55,33	22	30	81	**27**	- 66,77	**11,44**
wire diam. (top - vert.side - bottom):	60	- 55,21	22	60	83	**36**	- 66,66	**11,45**
25 mm. 20 mm. 25 mm.	90	- 55,38	20	88	80	**30**	- 66,86	**11,48**
Detuning capacitor = 475 pF	120	- 55,65	22	122	80	**27**	- 67,23	**11,58**
	150	- 55,69	22	148	79	**26**	- 67,29	**11,60**
Substituted the 4 elevated radials	180	- 55,43	20	180	79	**30**	- 66,96	**11,53**
with 32 on ground radial system	210	- 55,18	22	208	82	**33**	- 66,63	**11,45**
	240	- 55,30	22	232	82	**27**	- 66,69	**11,39**
	270	- 55,45	24	270	81	**25**	- 66,88	**11,43**

The following last two graphs compare the same Rx antenna under different detuning situations and ground systems on the Tx antenna, which is at a 28 meters distance in the 150 deg. direction. The first one shows the Front to Back and the second the RDF parameter.





The final comments are:

- Detuning the transmitting tower is a must: unless that, the Flag is working as it should only on a few directions on the opposite side
- With the W8JI tower sectionalizing method it is possible to achieve the same results as with the theoretical 90 degrees high impedance stub: FB at least of 20 dB and RDF above 11.30 dB – even with the 4 elevated radials.
- With an on ground radial system it is possible to get a further little general improvement – FB at least over 25 dB (some bearings are better, but some are worse) and RDF stable above 11.40 dB.

Anyway I don't think that these latter small improvements are worth the trouble of the on ground radials, at least as far as I can work all the DX stations I can hear.

Now let's see also which is the effect of this detuning setup on the original W7IUV Flag:

Table 9: Single W7IUV Flag - rotating Rx antenna wires in 30 deg. steps - FINAL DETUNING Tx antenna setup

File	Rotating direction	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLAG_03d4 (+Tx ant.4 rad)	270	-30,28	28	270	147	**23**	-38,21	**7,93**
wires 69 segments 289	300	-30,21	30	300	149	**25**	-38,09	**7,88**
Detuned with W8JI	330	-30,10	30	330	150	**26**	-37,95	**7,85**
tower sectionalizing method	360	-30,35	28	0	149	**23**	-38,20	**7,85**
loop dimensions: 1m.wide - 9 m.high	30	-30,38	28	32	148	**23**	-38,26	**7,88**
wire diam. (top - vert.side - bottom):	60	-30,28	28	62	148	**26**	-38,16	**7,88**
25 mm. 20 mm. 25 mm.	90	-30,11	28	90	147	**33**	-37,99	**7,88**
Detuning capacitor = 475 pF	120	-29,99	28	120	145	**34**	-37,92	**7,93**
	150	-30,07	28	146	146	**30**	-38,00	**7,93**
	180	-30,36	28	174	151	**26**	-38,20	**7,84**
	210	-30,55	28	208	154	**22**	-38,37	**7,82**
	240	-30,44	28	242	149	**21**	-38,36	**7,92**
	270	-30,28	28	270	147	**23**	-38,21	**7,93**

Not bad, even if the peaking FB could have been achieved with a slightly less capacitance as shown in the following table!

Table 10: Single W7IUV rotatable Flag - tweaking for the highest possible FB

File	Detuning Cap. pF	gain	TO angle	Bearing	BW	FB	Avg.gain	RDF
FLAG_03d4 (+Tx ant.4 rad)	468	-30,16	28	88	150	**31**	-37,97	**7,81**
wires 69 segments 289	469	-30,15	28	88	149	**32**	-37,97	**7,82**
Detuned with W8JI	470	-30,14	28	90	149	**35**	-37,98	**7,84**
tower sectionalizing method	471	-30,13	28	90	148	**36**	-37,98	**7,85**
loop dimensions: 1m.wide - 9 m.high	472	-30,13	28	90	148	**36**	-37,99	**7,86**
wire diam. (top - vert.side - bottom):	473	-30,12	28	90	147	**35**	-37,99	**7,87**
25 mm. 20 mm. 25 mm.	474	-30,11	28	90	147	**33**	-38,00	**7,89**
	475	-30,10	28	92	146	**32**	-38,00	**7,90**
	476	-30,10	28	94	146	**31**	-38,01	**7,91**
	477	-30,09	28	94	145	**29**	-38,02	**7,93**

The detuning loop in the realty and the hardware work

So now let's go on with the detuning work on the "real" antenna.

The detuning loop will be in aluminium tube bolted to the tower as sketched in Fig.3.

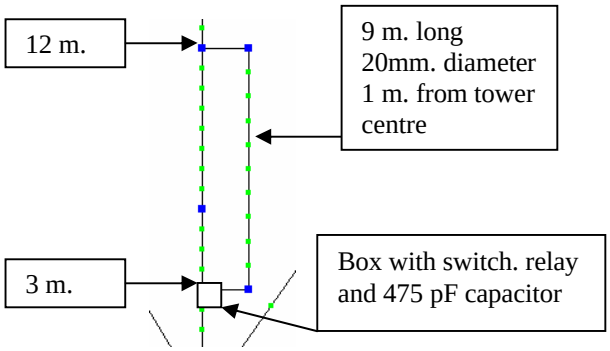


Fig.3: Sketch of the W8JI detuning loop

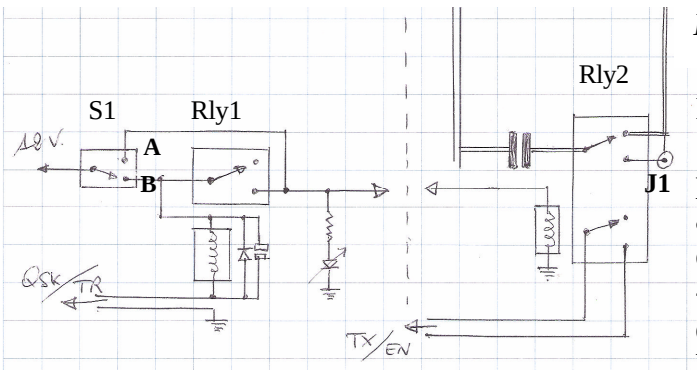


Fig.4: detuning switching circuit

In Fig. 4 the switching circuit:
- when S1 is in (A), Rly2 on the tower is permanently energized and thus NO detuning and no effect during Tx; an analyzer on J1 can be used to tune for minimum impedance;
- when S1 is in (B), Rly2 is open and the detuning loop activated; when the Tx is keyed, the QSK/TR control closes Rly1 and this closes Rly2; the Tx antenna gets normally matched and a closure to ground through TX/EN lets the Orion transmit.

Fig.5: IV3PRK installing the detuning loop

In Fig.5 the top of the detuning loop is fixed at the 12 meter level of the transmitting tower.
On the other side is the gamma rod, tapped at the 20 m. level.
Fig.6 shows the 15 x 20 cm. plastic box containing an old surplus BC455 capacitor and a switching RF relay. In the NO position the capacitor is connected to the loop and thus detuning. Closing the relays, the loop opens and is connected to a coaxial plug for the analyzer. The second way contacts close a ground return which lets the transceiver go into transmission.

Fig.6: the detuning capacitor box

Fig.7: The full tower detuning loop

Fig.7 shows the full detuning loop bolted to the tower and the AEA CIA Analyzer connected for minimum impedance search.
The capacitance required to reach that minimum resulted 550 pF, something more than the value in the Eznec model (probably due to an error in the wire simplification of the big structure of the tower).

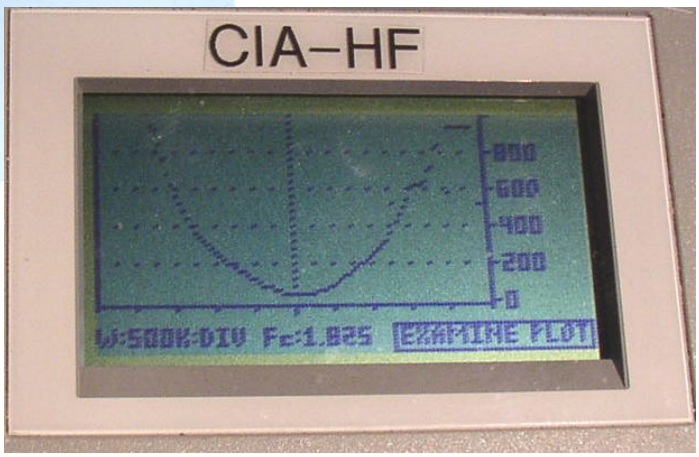


Fig.8: Impedance curve centered on 1.825 MHz

The Tx antenna is detuned when in the loop we have the highest current, which acts like a trap, splitting the tower. The bottom section (3 meters) is isolated from the section above the loop and thus, no more resonating, the Tx tower vanishes on 160 meters.

Maximum current occurs at minimum impedance and that is shown in the snapshot of Fig.8.

Of course transmission must be inhibited when the tower is detuned as the SWR jumps high as expected. I use an open frame RF 12V relay controlled by the KD9SV Front-End Saver, but for QSK or VOX operation a vacuum relay is necessary.

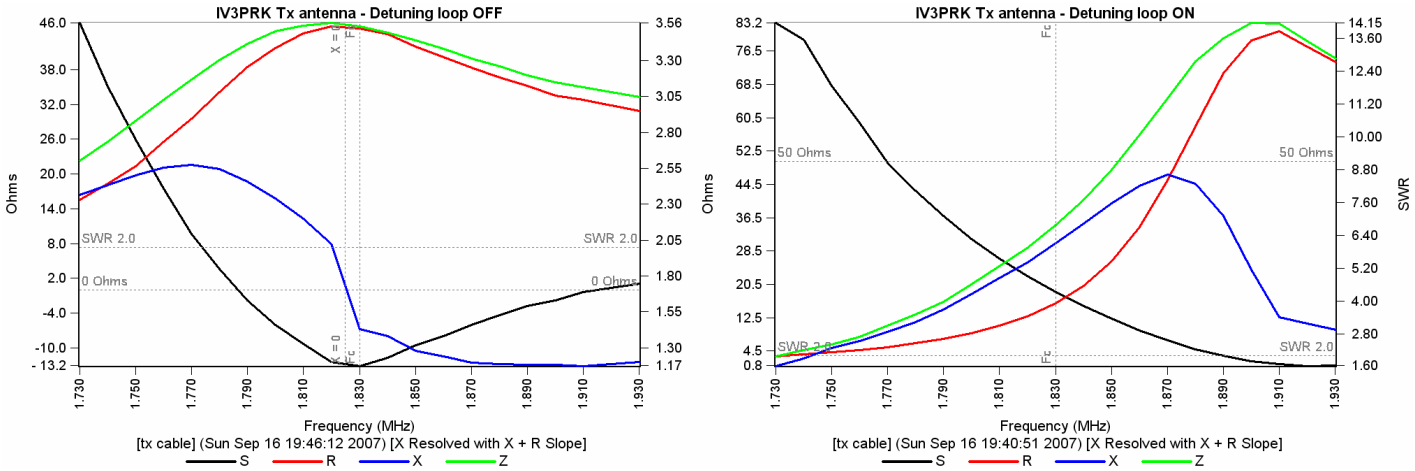


Fig.9: Analyzer readings on the TX cable vs. switching the detuning loop on and off

On the air test

Thanks to the big activity of 3B7C in the last week, I could perform a lot of tests on the air. My receiving antenna is still the original rotatable Flag and bearing to 3B7 is 135 degrees, with the Tx antenna almost in the same direction, at 150 deg., ideal for this test.

In every occasion their signal improves from 1 to 2 S-units by switching the detuning loop on.

Even more meaningful is listening on the pile-up frequency: the western European signals on the back (F,G,DL,ON,PA) lose 4 to 5 s-units with detuning, while the south-eastern ones (SV,YU,4X) gain by 2 to 3 s-units. The Flag pattern recovered completely its shape !

Amazing when I heard a French Little Pistol cqing on the 3B7 frequency with a 579 signal, covering the Dxpedition. With the detuning loop switched on, 3B7C came up to S7 and the F station went down in the mud, disappeared.

I should have done before, but now I am ready to go on with my program and upgrade the original W7IUV Flag into the new Waller Flag design.

September 2007

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