Rx antennas at IV3PRK: the QDFA project

How a great Rx antenna array can be destroyed in a bad environment

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The Quad Delta Flag Array by Dr. Dallas Lankford

After reading all the very interesting documents published by <u>Dr. Dallas Lankford on this</u> <u>web site</u> and learnt some new ideas on receiving antennas, I began to study a new project for the summer season.

I found really enthusiastic the idea of an array of four Delta Flag antennas, which I was intended to install on top of my 120 m. long fence. I had already four fishing rods (left from the previous DHDL experiments) and they could be tied to the fence stakes without trouble to walking and grass mowing. These stakes, holding the plastic covered metallic net, are spaced 1.80 m. from each other and thus all the loops dimensions and distance are based on 1.80 m. multiples.

So my loops are triangles 4.50 m. high on a 10.80 m. base with 21.4 m. separation. This was the starting EZNEC model:



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A very nice lobe with an RDF of 11.3 and a gain of -30 dB, much better than with many other flag arrays, and thus a single preamplifier could be sufficient.

Than I tried a couple of different phasing delays and came out with a most desirable pattern to cover the Pacific area. My array is pointed to the northern direction, where the DX signals are generally skewed east or west of the aurora oval, and thus I don't want a sharp lobe, but the widest possible one, with a wide back null, without secondary lobes. So after changing the sources phase:



Adding in EZNEC model the nearby existing antennas

It should have been a very nice receiving system by reversing direction and also trying a broadside switching but, before going with the project and buying a lot of cable, I decided to investigate with EZNEC 5+ (which has 1.500 segments capability) the possible interactions with the nearby antennas and the fence itself. From a previous work I had already a map of my lot with all the needed XY antennas coordinates.

So I start by adding at first only the TX resonating tower at 35 m. distance, without the elevated radials.



Not a great harm: only a very small back lobe appears which reduces the F/B to 33 dB! Now let's add also the 4 elevated radials:



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As expected, now the pattern worsens, loosing a lot of front to back ratio, but the shape of the forward lobe could be still acceptable. (The blue trace shows the QDFA alone).

So let's add to the picture all the other receiving antennas (rotatable Flag and 6 Pennants) in the position they have actually on my lot.



We see that the Pennants, even very close to the new Delta array, do not add any further interaction and the pattern is pretty the same as without them. From the starting QDFA alone (blue trace) the F/B drops from 60 dB to 15 dB and RDF from 11.3 to 10.0.



Adding to EZNEC model the fence and other nearby metallic objects

At this point I added also in the model the surrounding telephone cable, a lighting pole and the fence itself. The metallic net is all plastic covered and apparently it should be insulated, like the three thick horizontal wires crossing the vertical stakes, which are driven in the concreted. So at first I modelled the whole fence without any ground connection



A very big model came out, with 372 wires and 1487 segments, but it revealed an absolute DISASTER: the pattern has been completely DESTROYEDthe array became omnidirectional without any elevation lobe !



I am not sure if such a miserable pattern would be real or mainly due to the model limits of NEC2 engine. I am also not sure about insulation, losses or ground connections of this kind of garden net fence, so I tried to model it also with some ground connections added.

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After grounding the fence the array pattern recovered its low angle shape, with a correct null at high angles, but the back lobe arose too much reducing further the F/B to a poor 7.5 dB. (In the following plots the blue trace represents the situation before adding the grounded fence).



Than I tried to move the fence 5 meters away:



Only a small improvement, so I moved it to 10 meters distance:



Uhm...no difference! I forgot to move also the telephone cable and the lighting pole. After moving them to 10 m. distance the pattern is almost like before. (Blue trace without fence)



And what happened by deleting all other antennas and keeping only the QDFA on top of the grounded fence? (Primary trace only fence and blue trace all together).



Not a great difference, so it is proven that most interaction is due to the fence and, if this is not grounded, it gets worse and totally destroying...so, definitely, I must give up with this project !

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