A short antenna optimization tutorial using MMANA-GAL, Part 3

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In this section I want to describe the use which can be made of the "Associated" values which are in the middle column of the optimization table. At the most basic, one can force one of the lines in the optimization table to be stepped in the same way as one of the other lines in the table. By default the value is 0 for all lines, which indicates no association is to be used. If a value of 1 is placed in the association cell on line 2, you will notice that the default step and limit values disappear, which means that the values in line 1 are being used. So the values in this column are position values, in the sense that this term has been used elsewhere, to indicate a line in the table. But it gets better. One can use these position numbers as variables in simple algebraic functions. If I want line 2 to vary the opposite of line 1, I would place -1 in the association cell in line 2. The operators +,-,*,/ are recognized, and this part of the optimization engine acts like a simple spread sheet. An example is in order. Here is a link to a file to open with MMANA-GAL: a 12m and 17m 2 el quad with common feed. If you look at the view tab, you should see this:
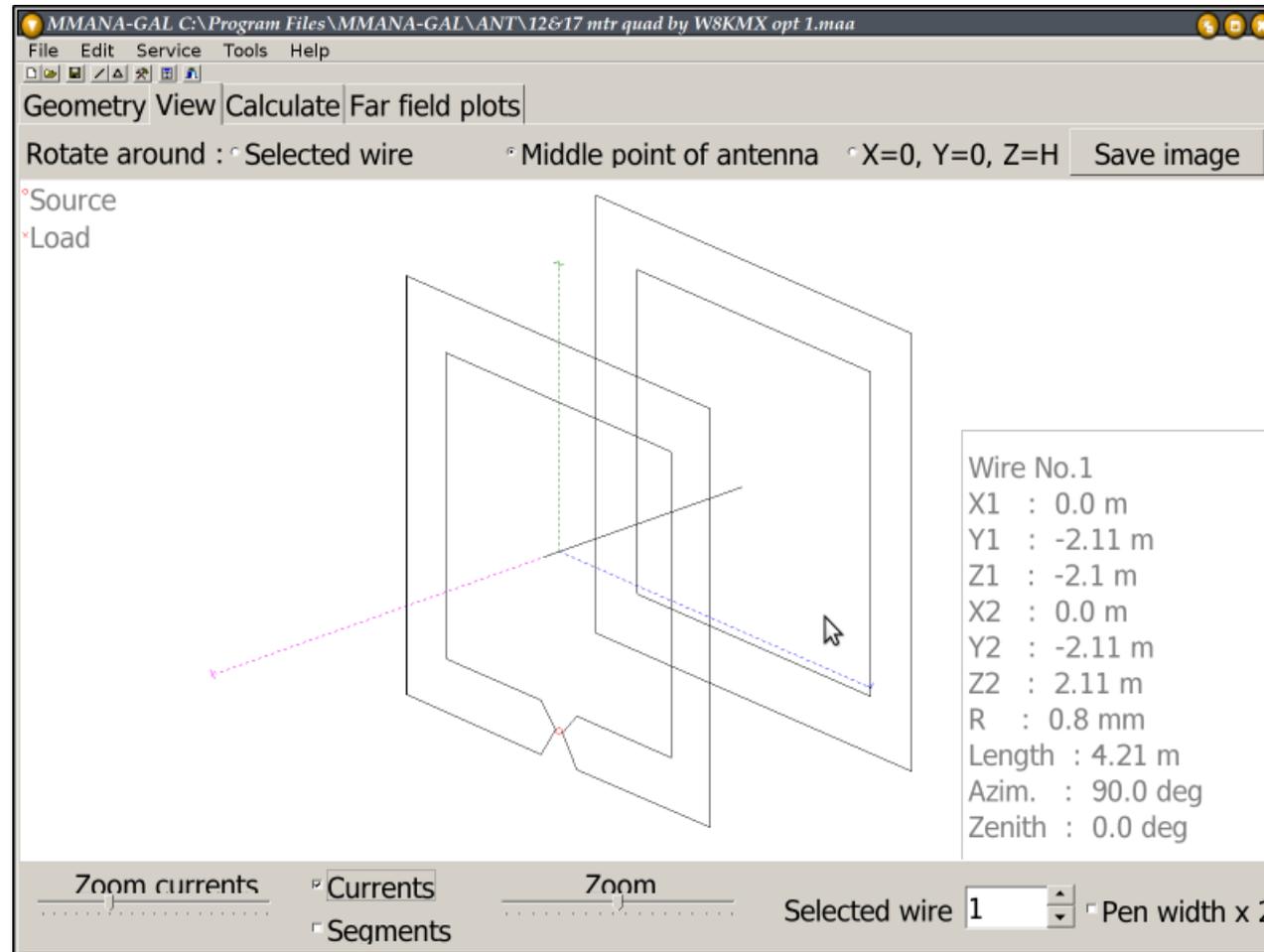
This dual band quad has a common feed point, and this presents a problem if we want to vary the side lengths of the driven element on one band only. We need to keep the feed point stationary, and this can't be done using the loop element type with the perimeter parameter. So we use the association variables to create the values to keep things in line. Here is what the optimization table looks like for working with the 17m elements:

Optimization

Rate of evaluation

☐ No goal set (simple sweep)   [Advanced]   [Band setting]

Gain   F/B   Elev   jX   SWR   Match   Current

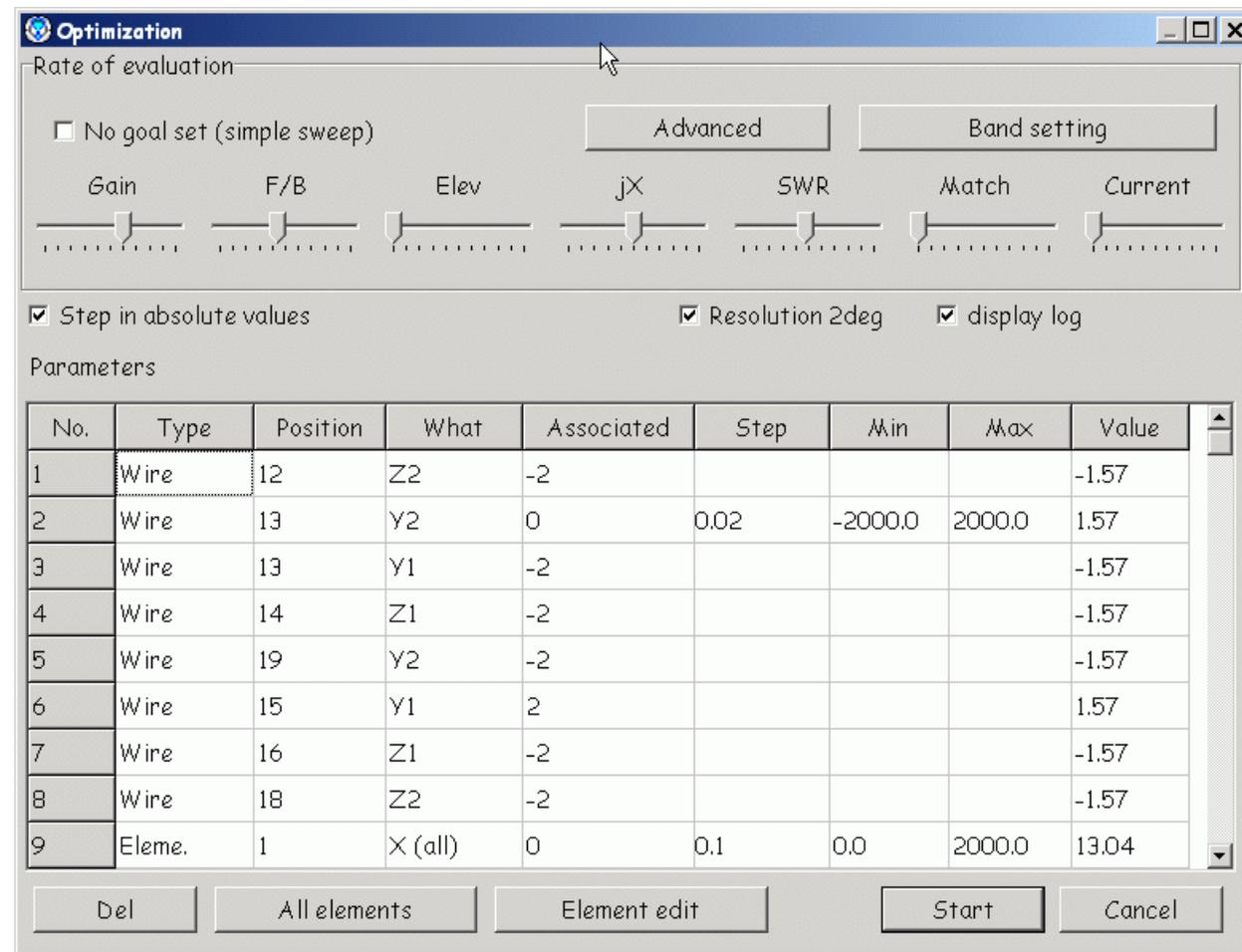☑ Step in absolute values   ☑ Resolution 2deg   ☑ display log

Parameters

No.	Type	Position	What	Associated	Step	Min	Max	Value
1	Wire	1	Z2	2				2.11
2	Wire	2	Y2	0	0.01	-2000.0	2000.0	2.11
3	Wire	2	Y1	-2				-2.11
4	Wire	3	Z1	2				2.11
5	Wire	7	Y2	-2				-2.11
6	Wire	4	Y1	2				2.11
7	Wire	5	Z1	-2				-2.11
8	Wire	6	Z2	-2				-2.11
9	Eleme.	2	X (all)	0	0.1	0.0	2000.0	17.6

[Del]   [All elements]   [Element edit]   [Start]   [Cancel]

To review, the Type column refers to the physical item in the model that is varied, the Position column refers the where that item is defined, back on the geometry page, or on the element table (Ctrl-E). The What column indicates what part of the Type is varied (end point, spacing, etc.) The Associated column refers to line numbers in *this* optimization table. The step and limits columns show how fast and how far the values are varied. The Value column shows what the value for each line is now. If you want to save this table, along with the optimization results, go to File > Save Optimization log (*.mao) You can then go back and restore this information with File > Open Optimization log (*.mao).

What you see is that the end point Y2 of Wire 2, in line 2, which is the upper horizontal wire of the loop, is used as the reference, and all the other end points in the driven element's wires are dependant upon it. Since the loop is a square, all the end points have the same values, but some are moved directly as Y2, and some are moved in the opposite sign. Assuming you have entered the table above, you can hit Cancel, and come back to it later. Go to the Geometry tab and select 18.080 MHz for the frequency. Now back to the Calculate tab, click the Optimization button, and hit Start. Go quickly back to the View screen and watch as the outer loops are varied, looking for the best fit the the goal. The end points move as a group, and the feed point stays put. If you have a fast computer, this can be over in a flash. You can try setting the step size to a smaller value to see more iterations if need be.

Here is the table for optimizing the 12m elements:

Optimization

Rate of evaluation

☐ No goal set (simple sweep)   [Advanced]   [Band setting]

| Gain | F/B | Elev | jX | SWR | Match | Current |

☑ Step in absolute values   ☑ Resolution 2deg   ☑ display log

Parameters

No.	Type	Position	What	Associated	Step	Min	Max	Value
1	Wire	12	Z2	-2				-1.57
2	Wire	13	Y2	0	0.02	-2000.0	2000.0	1.57
3	Wire	13	Y1	-2				-1.57
4	Wire	14	Z1	-2				-1.57
5	Wire	19	Y2	-2				-1.57
6	Wire	15	Y1	2				1.57
7	Wire	16	Z1	-2				-1.57
8	Wire	18	Z2	-2				-1.57
9	Eleme.	1	X (all)	0	0.1	0.0	2000.0	13.04

[Del]   [All elements]   [Element edit]   [Start]   [Cancel]

This uses the same idea as before, now working on the inner elements. If you play with these settings, you need to first go to the Geometry tab and set the frequency to 24.94 MHz. Only slight interaction was noted between these two bands, so only a couple of iterations was needed to get the model to settle down. One thing you might notice is that I have not set any reasonable limits on the model, i.e. the software has just entered default Min and Max. With those settings you may see some strange results, such as a reflector turning into a director, or just increasing to a very large size. Again, a little playing with models will quickly help to make better guesses as to how things will turn out.

On to Part 4

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