Extended Output from 4nec2 using GNUplot and MS Excel

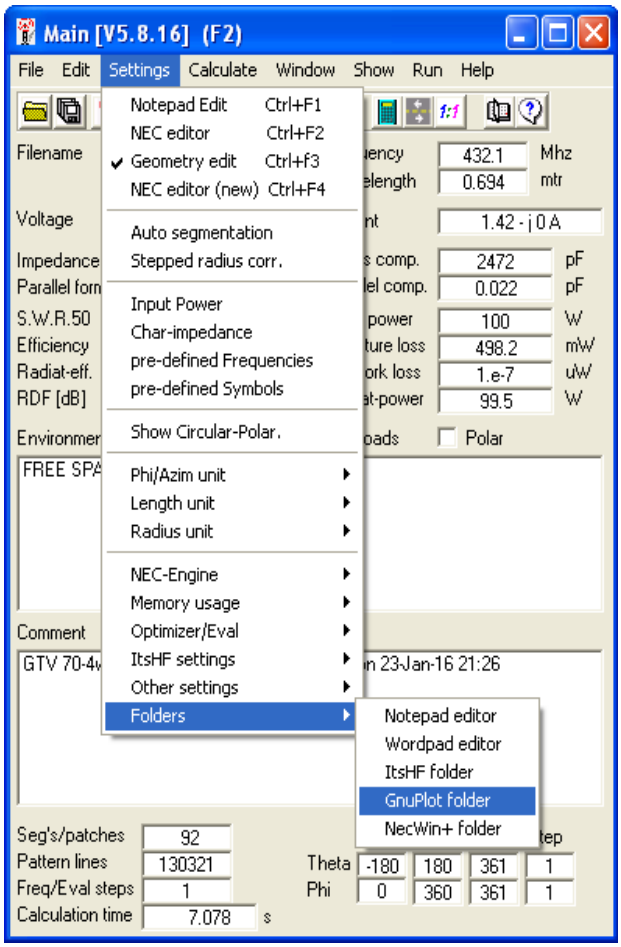
This paper describes how to transfer data sets from 4nec2 into 4NEC2_PLOT.xls where they are displayed for comparison and also some other antenna parameters are computed on the sheet.

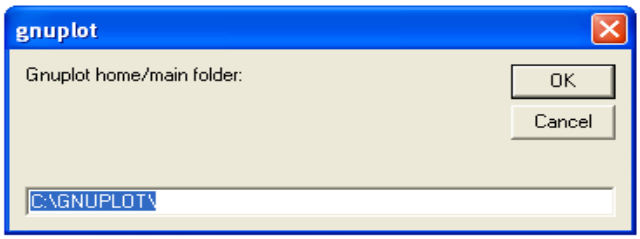
UR5EAZ: “In this project I have tried to expand the capabilities of 4nec2 software. Thus additional antenna parameters (both data files and graphs) are now available to the 4nec2 user.”

- Actual Power Gain
- Q-factor
- Antenna Absolute Impedance
- Mismatch Loss
- Return Loss
- Antenna Input Efficiency

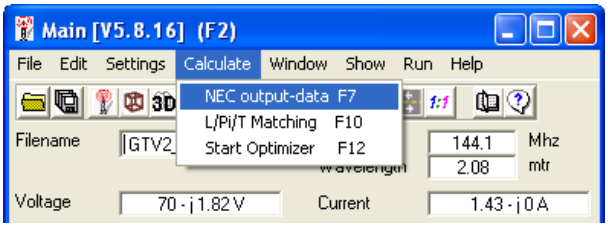
For this the free add-on GNUplot must be installed in you computer and 4nec2 has to know where to find it. GNUplot can be downloaded from Arie Voors 4nec2 website.

1. Installation and download of GNUplot. Download from http://www.qsl.net/4nec2/ and unpack the .zip file into a path of your choice. Then register it in 4nec2 as shown



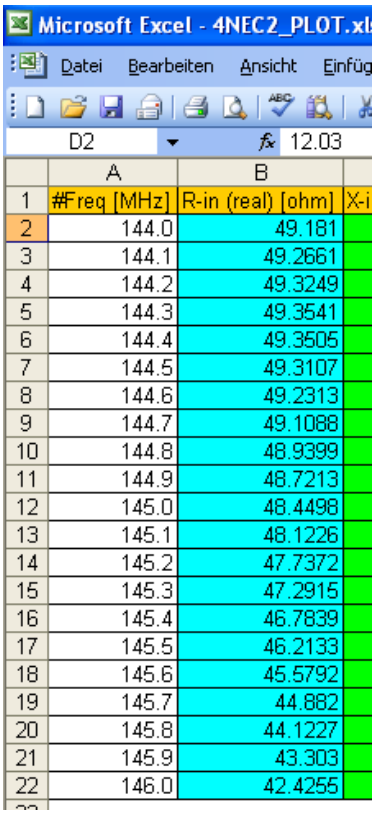


2. Run first antenna model calculation in 4nec2 by choosing “Calculate” > “NEC output-data F7” in the main windows menu



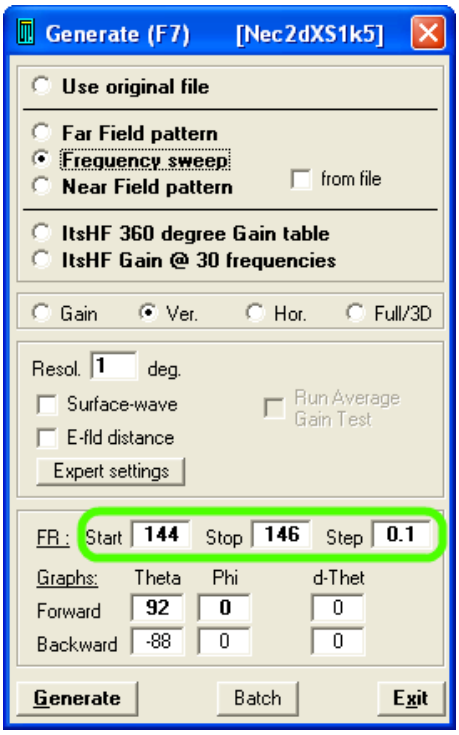
Now generate a simulation run using a frequency sweep start / stop marks and steps that match the MS Excels predefined range. See area highlighted in green

Note the Excels freq. scale



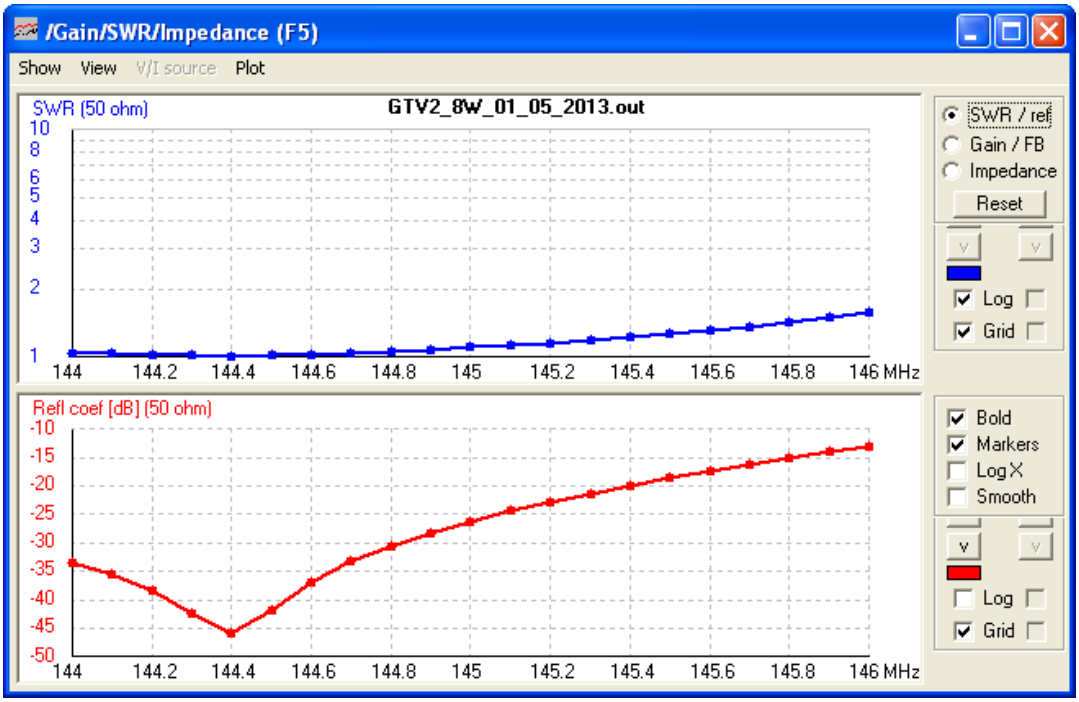
	A	B	
1	#Freq [MHz]	R-in (real) [ohm]	X-i
2	144.0	49.181	
3	144.1	49.2661	
4	144.2	49.3249	
5	144.3	49.3541	
6	144.4	49.3505	
7	144.5	49.3107	
8	144.6	49.2313	
9	144.7	49.1088	
10	144.8	48.9399	
11	144.9	48.7213	
12	145.0	48.4498	
13	145.1	48.1226	
14	145.2	47.7372	
15	145.3	47.2915	
16	145.4	46.7839	
17	145.5	46.2133	
18	145.6	45.5792	
19	145.7	44.882	
20	145.8	44.1227	
21	145.9	43.303	
22	146.0	42.4255	

.. and adjust 4nec2 to it



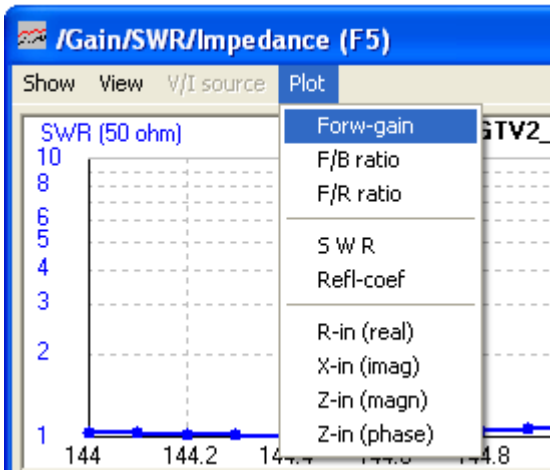
Of coarse the MS Excels freq. scale can also be adjusted, likewise to a 2 decades span in the 70 cm band (432.0 / 432.1 etc.) and dressing 4nec2s “Generate” input with “Start” = 432.0 MHz, “Stop” = 434.0 MHz, “Step” = 0.1 MHz

Click the “Generate” button now and 4nec2 naturally produces the SVWR / Reflection Coefficient [dB] (= Return Loss) chart

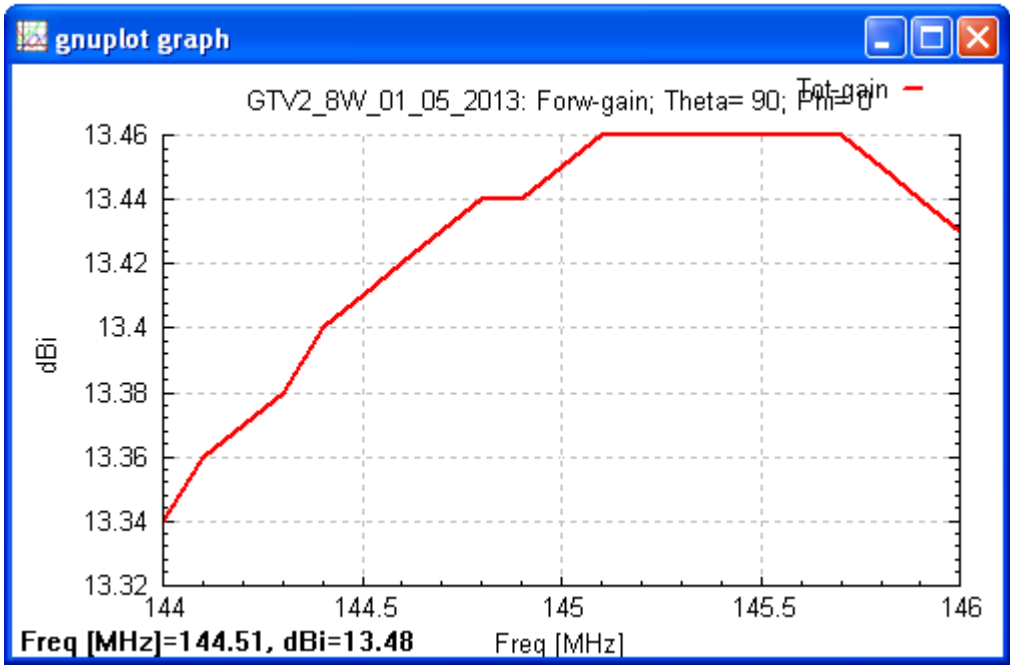


3. Producing the GNUplot chart and its file holding the data to print the chart line

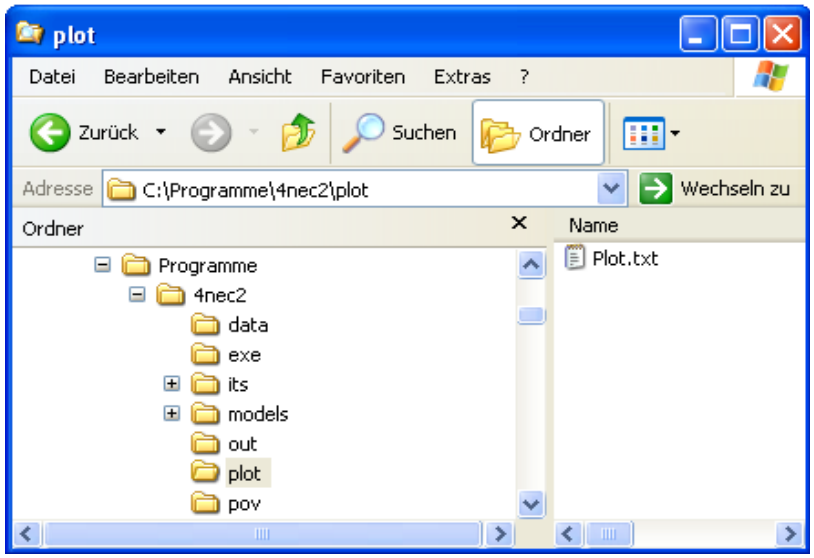
Sort “Plot” > “Forw.-gain” from this windows menu



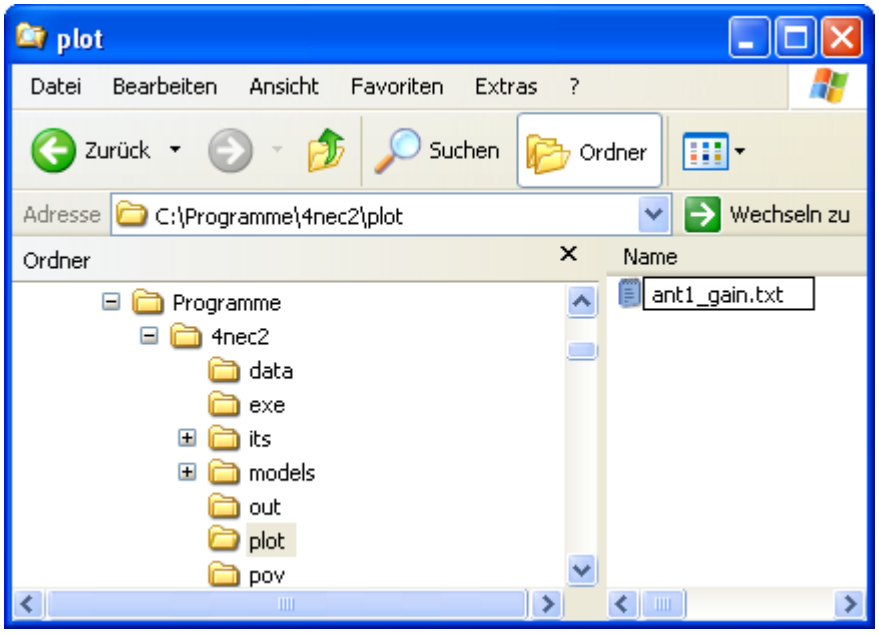
Now the add-on GNUplot comes to life and produces a chart holding the forward gain of the antenna model. See the “gnuplot graph” window.



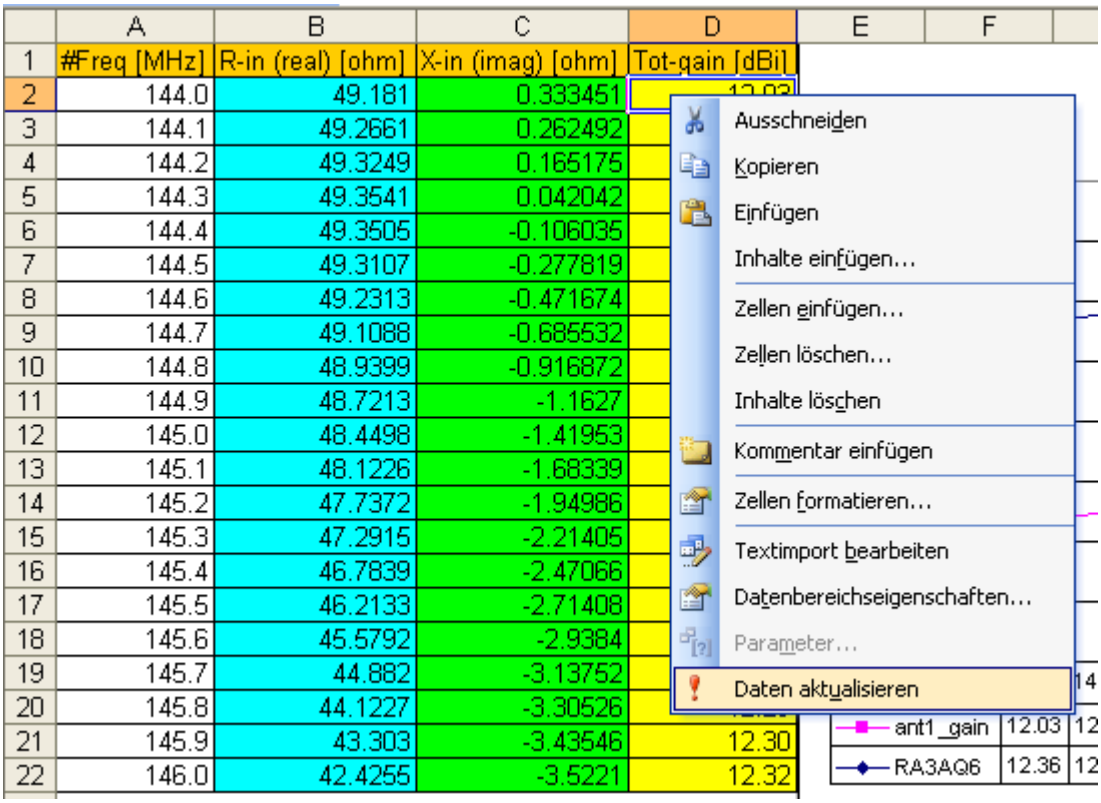
For drawing the chart line by GNUplot the 4nec2 prints the associated data set into a file into the "plot" folder in the root of the 4nec2 program installation. This file is (i) always related to the current GNUplot graph window, and (ii) always automatically named "Plot.txt". Because GNUplot needs to know where to find its data set.

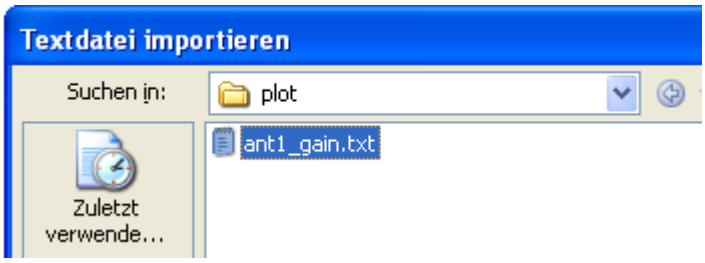


4. Renaming the GNUplot graphs “Plot.txt” into a meaningful name easy to recap for recognition when reading it into the MS Excel.



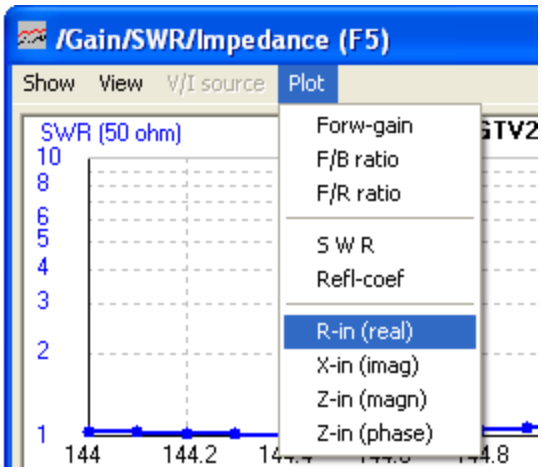
Lets name it “ant1_gain.txt”. Now we can take to the MS Excel, mark the yellow cells and click right mouse button, opt “Refresh Data” and select the “ant1_gain.txt” file.



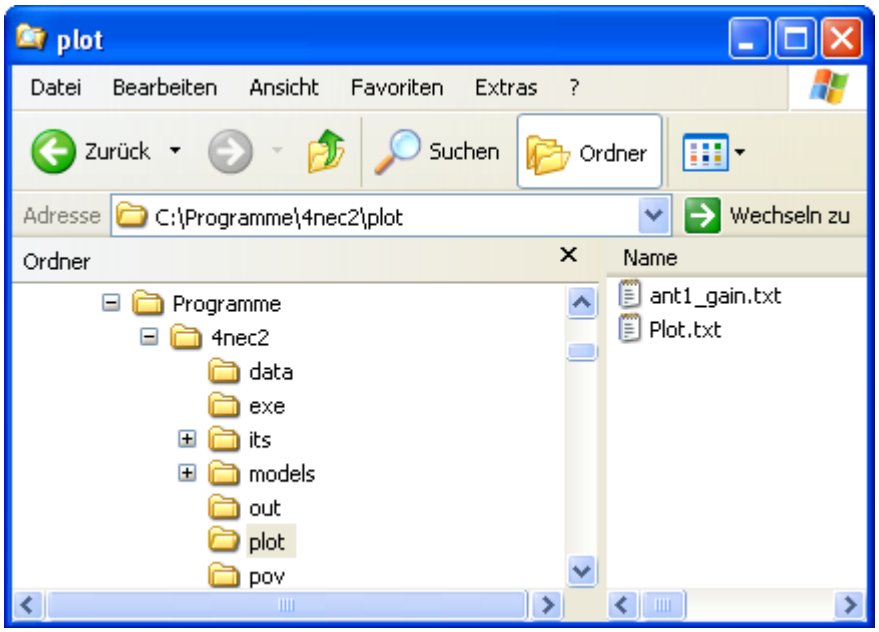


4. Next parameter, R

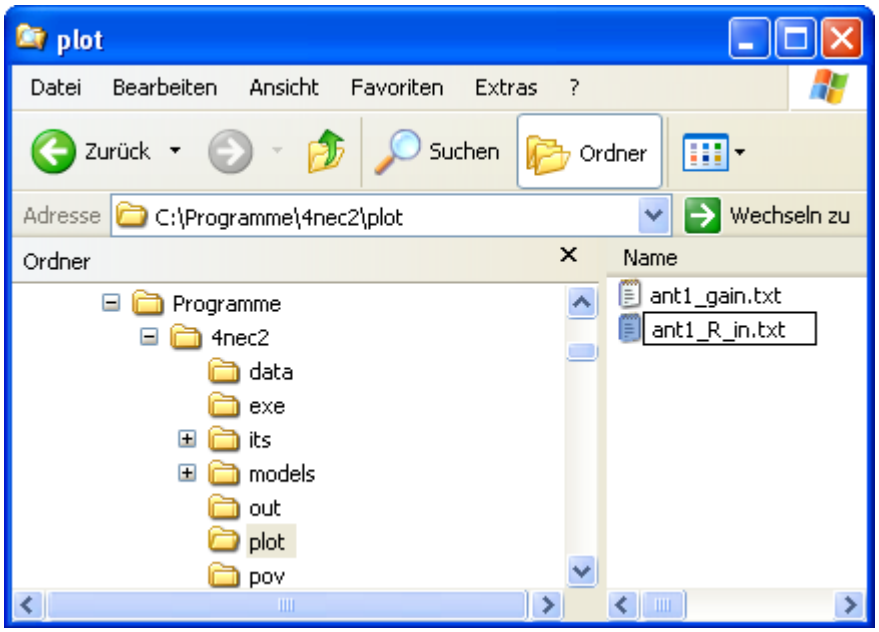
Returning to our Gain/SWR/ Impedance chart window we opt for “R-in(real) and 4nec2 reloads the same procedure but this time printing the real part of the impedance numbers into a new the now current “Plot.txt” file



So that we find a newer, other “Plot.txt” file in the “plot” folder in 4nec2’s root

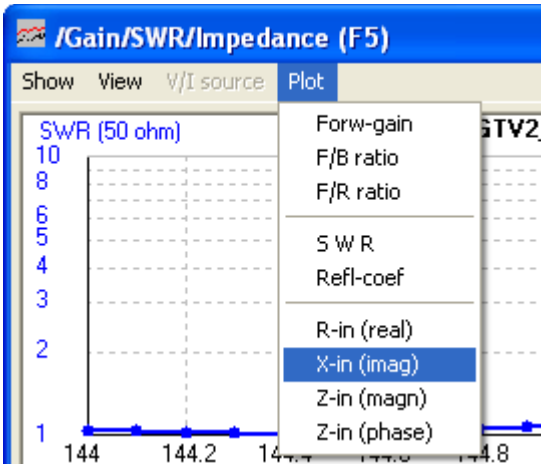


We repeat renaming the current “Plot.txt” into a meaningful name like for example “ant1_R_in.txt”.

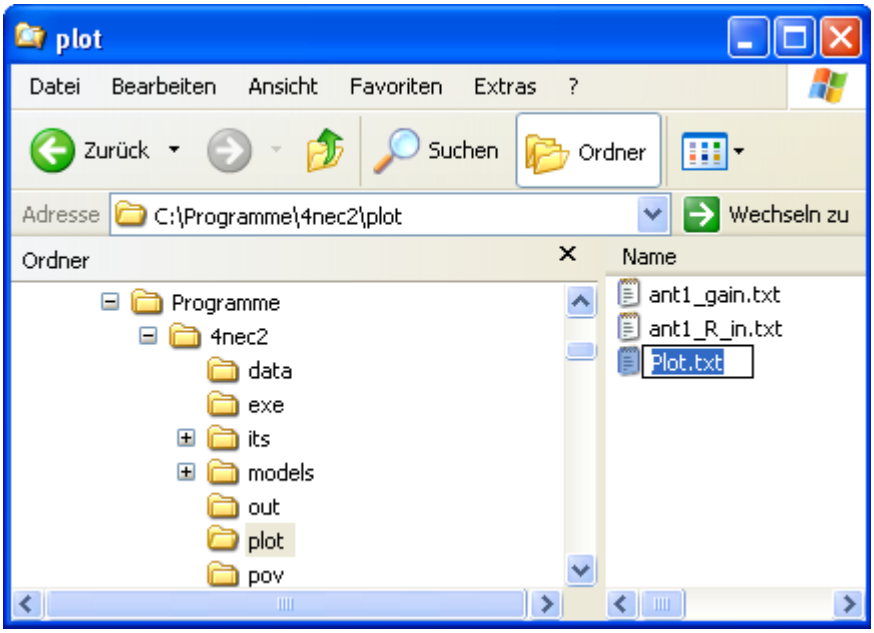


5. Next parameter, X

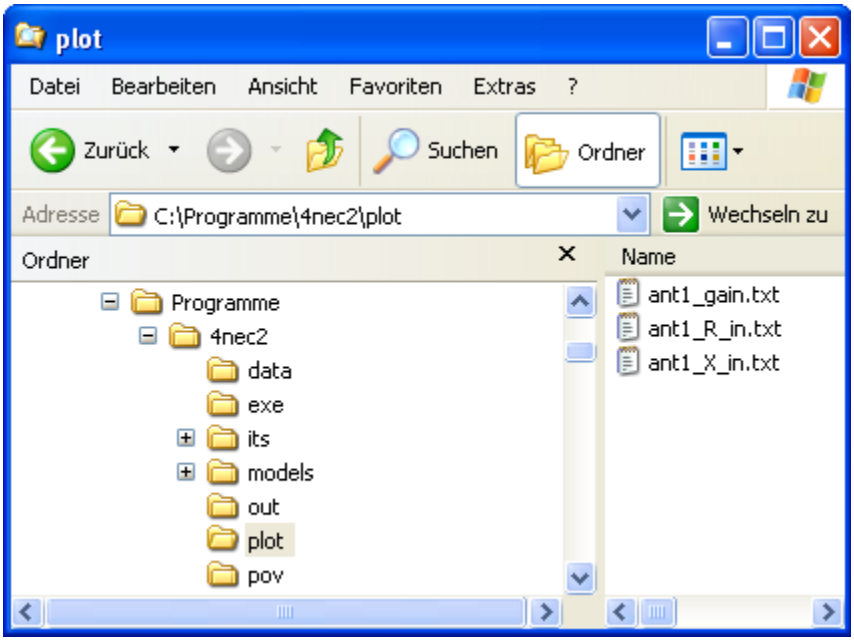
Now we repeat these steps opting for “X-in(imag)” to get a hold on the imaginary part of Z



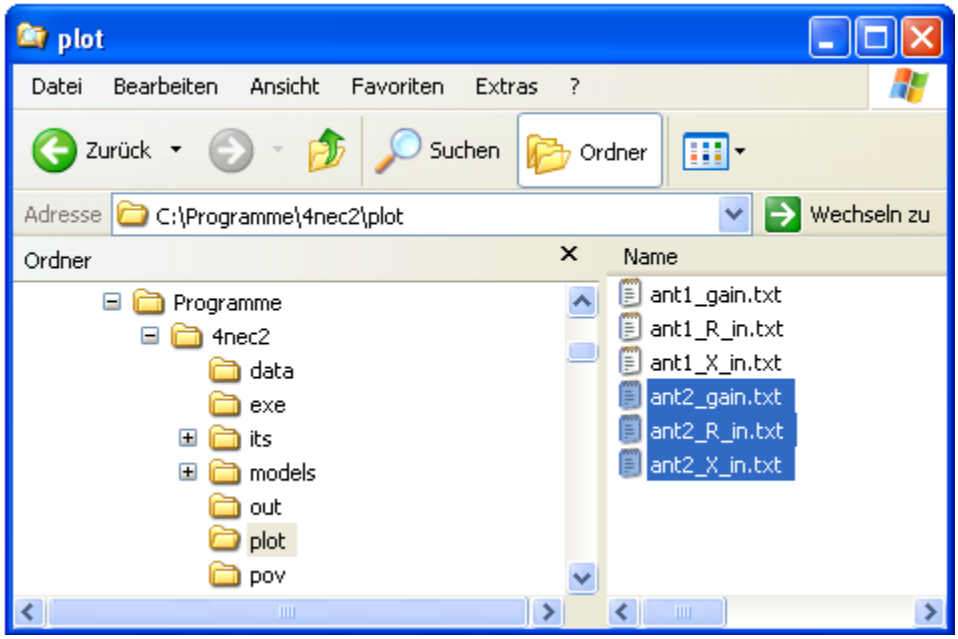
Yet again this new, current “Plot.txt” file is renamed, for example in “ant1_X_in.txt”.



And there we are, the set of little plot files we need for the MS Excel for the first antenna model is complete.



5. Second antenna : Now repeat all steps to create the set of files for the other antennas analysis



6. Feed the 4NEC2_PLOT.xls MS Excel with all the data files created

In any order download these text files.
To perform this:

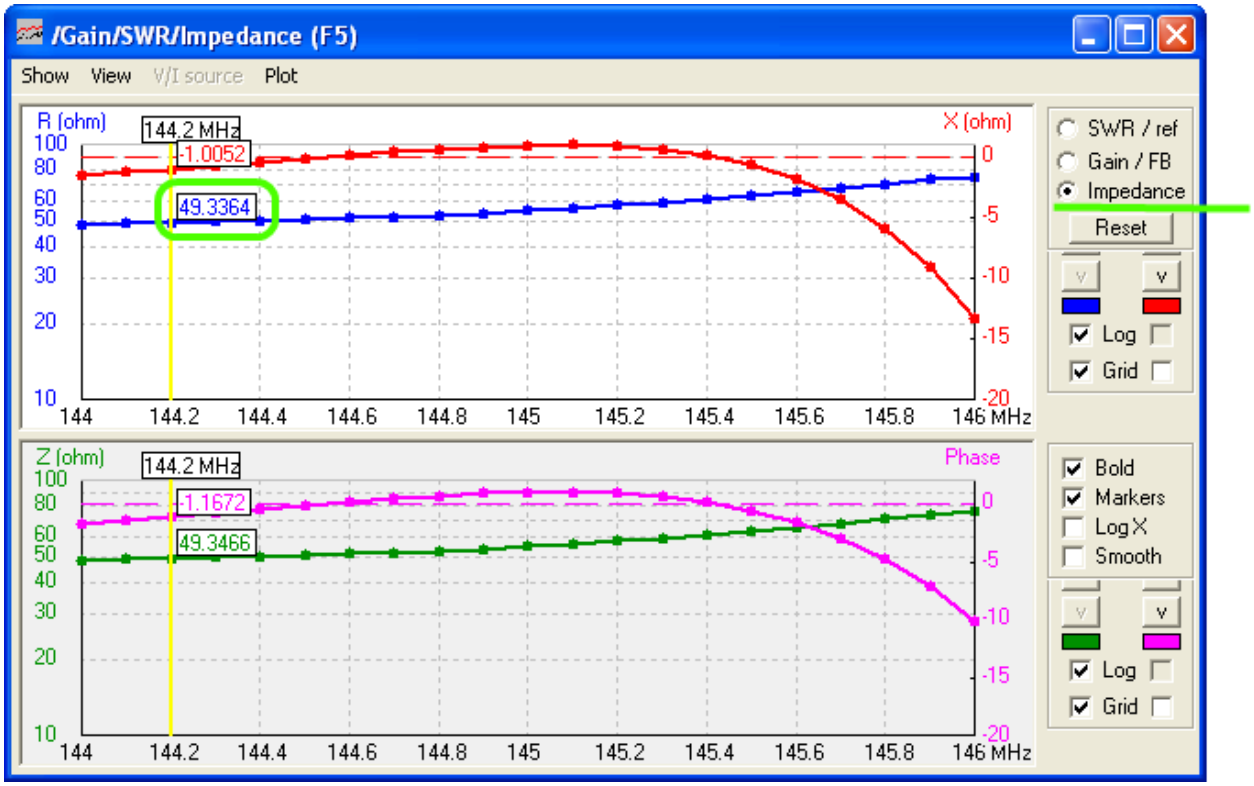
(i) For “ant1_gian” mark the yellow cells, click right mouse button, opt “Refresh Data” and select the “ant1_gain.txt” file

(ii) For “ant1_R_in” mark the blue cells, click right mouse button, opt “Refresh Data” and select the “ant1_R_in.txt” file

(iii) For “ant1_X_in” mark the green cells, click right mouse button, opt “Refresh Data” and select the “ant1_X_in.txt” file

7. Assign a name to the antenna #1 model and specify Zo for the model in the MS Excel.

The MS Excel needs a number for Zo at designated operating frequency for this antenna to compute data for some of te charts given from this in combination with the data tables for R_in. Z_in and gain. We read Zo from 4nec2s main window.



8. Now we repeat the whole procedure for the antenna #2 model.

If you want to analyse and display just one antenna and not going for a comparison of two antennas you simply delete the other (second) antennas data so that these cells are empty.