

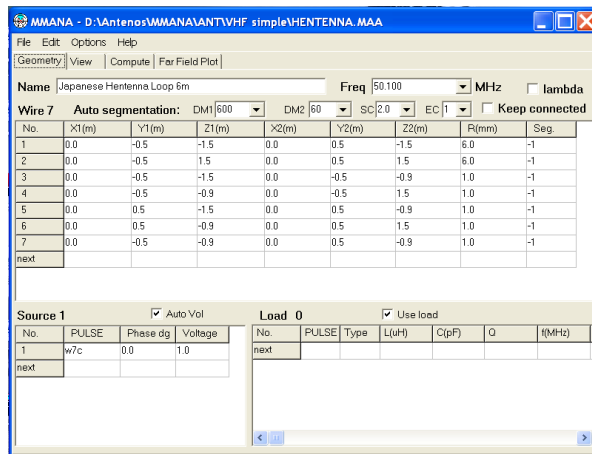
Simulation of antennas using MMANA program

Laboratory work

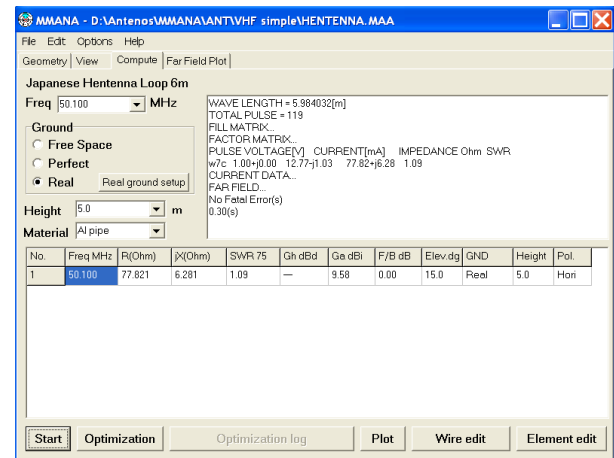
Aim of work: get acquainted with the modeling of wire antennas, learn to determine the basic parameters of antennas and change them.

Software: antenna analysis program MMANA
(<http://mmhamsoft.amateur-radio.ca/mmmana/index.htm>) is used.
This program consists of four main windows:

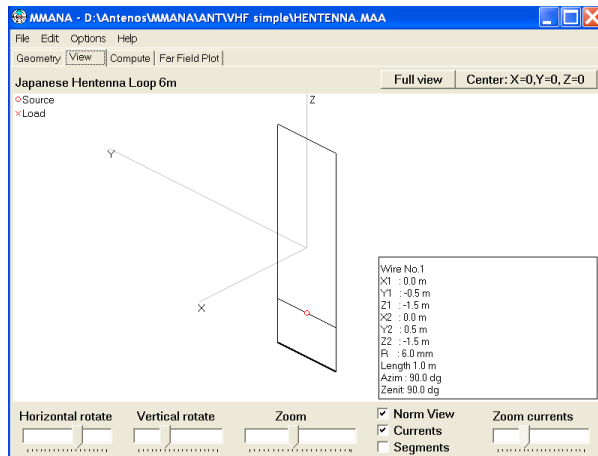
1. Antenna geometry



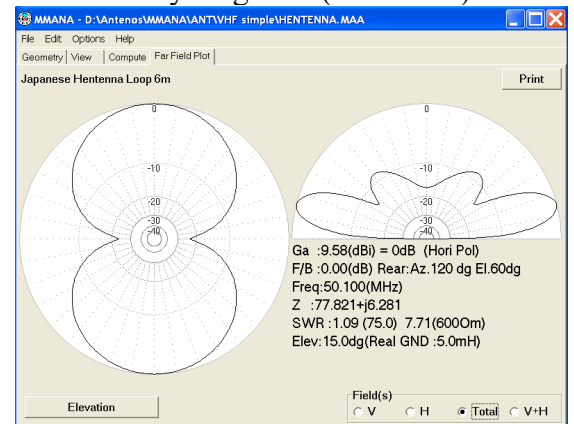
3. Calculation



2. Antenna view



4. Directivity diagramm (Far Fields)



Workflow

Part 1. Dipole modelling

1. Create a dipole model. In the Geometry window, enter the coordinates of both ends of one wire corresponding to the half-wavelength dipole length L. Ffrequency is.

$$f = 350 \text{ MHz}$$

$$R = 2.5 \text{ mm}$$

divide the wavelength $\lambda = c / f$ in half ($L = \lambda / 2$) and the Y coordinates of the antenna ends will be $-L / 2$ and $L / 2$:

	X1(m)	Y1(m)	Z1(m)	X2(m)	Y2(m)	Z2(m)	R(mm)	Seg
Initial	0	-0.21425	0	0	0.21425	0	2.5	-1
Optimized	0	-0.20120	0	0	0.20120	0	2.5	-1

Enter the antenna cable radius R specified, select automatic cable segmentation (Seg = -1).

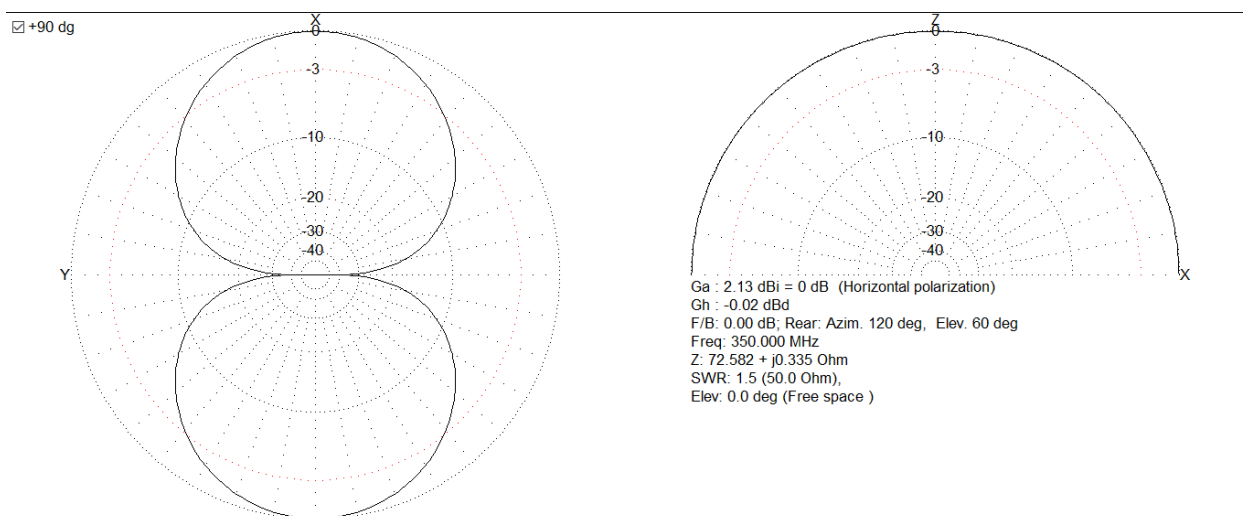
2. In the middle of the cable, turn on the Source by typing W1C in the PULSE box.
3. View the image of the created model in the View window. Check that the cable length corresponds to the calculated one.
4. In the Compute window, set the antenna modeling in Free Space and calculate its parameters (Start).
5. Write down the obtained value of the input impedance Z_{in} ($R + jX$)

and by changing the length of the antenna (symmetrically lengthening or shortening the conductor) find its resonant length when the reactive part is close 0:

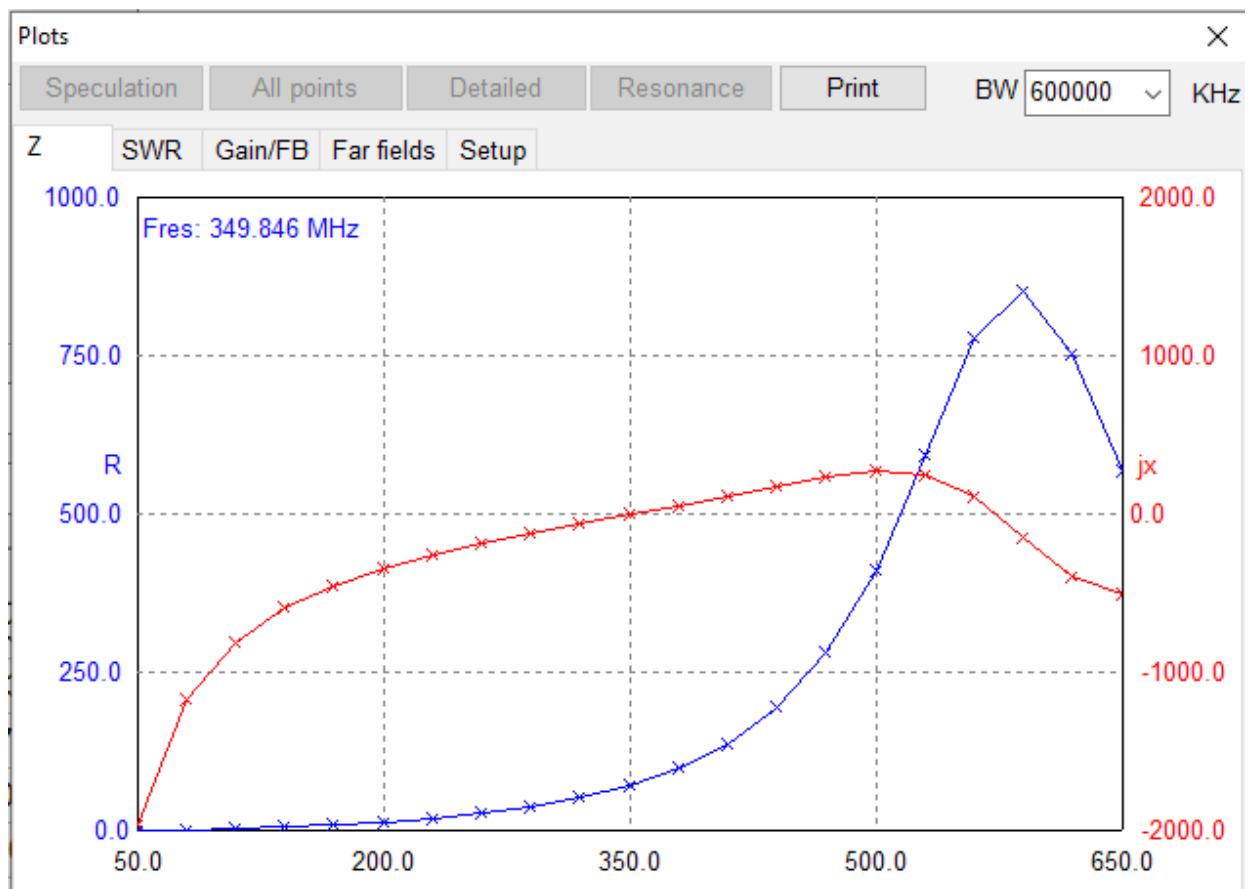
$$L_{rez} = 0.402 \text{ m}$$

$$Z = 72.58 + j0.33$$

6. In the Far field plot window, copy the Paint dipole direction diagram. The chart can also be saved via File-Save Far Fields. These charts can then be opened in the program via File-Open Far Fields or Tools-Compare.



7. Investigate the dipole Z_{in} frequency range $\sim 0.1f \dots 2-2.5f$. To do this, select the Plot button in the Compute window and select or enter the appropriate bandwidth (BW) in the window that appears. Click All points and you will get the R and X curves in the Z window. These curves can be displayed in detail by clicking on the Detailed and Set window and selecting a larger number of added points. Copy the resulting dependencies, move them to Paint, and save.



8. Extend the dipole to $L = \lambda$. Calculate its directional diagram, copy it. Compare with the half-wave dipole diagram. What gain G is obtained by extending the antenna in this way?