MacMININEC Version 4.0

Documentation for MacMININEC Version 4.0

This program is shareware. If you find it useful, won't you please send me $15? I'll send you a copy of the lastest version, including a version compiled for the 68020/68881, which runs much faster.

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If this program is redistributed, it must be done so as a complete package, including documentation and any additional files that were in the archive.

Changes from previous version(s):

A bar graph display appears when calculating antenna currents, indicating how far along MacMININEC is solving the equations. At least you know it is doing something. A similar bar graph appears while the program is calculating radiation patterns.

Menus are dimmed when their selection is inappropriate. For example, you can't calculate currents until you have entered at least one element and one excitation. You can't use the **View** menu until you've calculated currents.

The three parameter windows have been made modal dialogs, You can only exit them by clicking on the OK button.

A check is made for entering an element with a zero radius. If one is found, it is replaced with a radius of 1.27 mm (my guess for an average piece of antenna wire). Be careful.

Some things have been moved around. The four menu selections for displaying radiation patterns have been moved to the **View** menu.

Some possible additions include: Seperate applications to produce antenna files for common multi-element antennas, such as Yagis, Log Periodics, etc; 3-D radiation patterns (if I can find a suitable graphics library); and simulation of real grounds.

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Requirements:

Works on any Mac with one megabyte or more of RAM. System 6 or greater.

If you register by sending in the $15 fee, you'll also receive a copy that has been compiled for the 68020/68881, which runs much faster.

System 7: MACMININEC is System 7 compatible.

File Menu:

Open...

When selected, the standard file dialog is presented, allowing a MacMININEC file to be opened. After opening, the three parameter windows are presented. Click on OK after each window.

Save

The current file is saved. You get a beep if you haven't yet selected a filename using the Save As... menu selection.

Save As...

The standard file dialog is presented, allowing the entry of the filename to save data.

Quit

Exits from MacMININEC. There is no warning if antenna parameters have been changed since the last save.

Edit Menu:

This menu is currently not used in MacMININEC.

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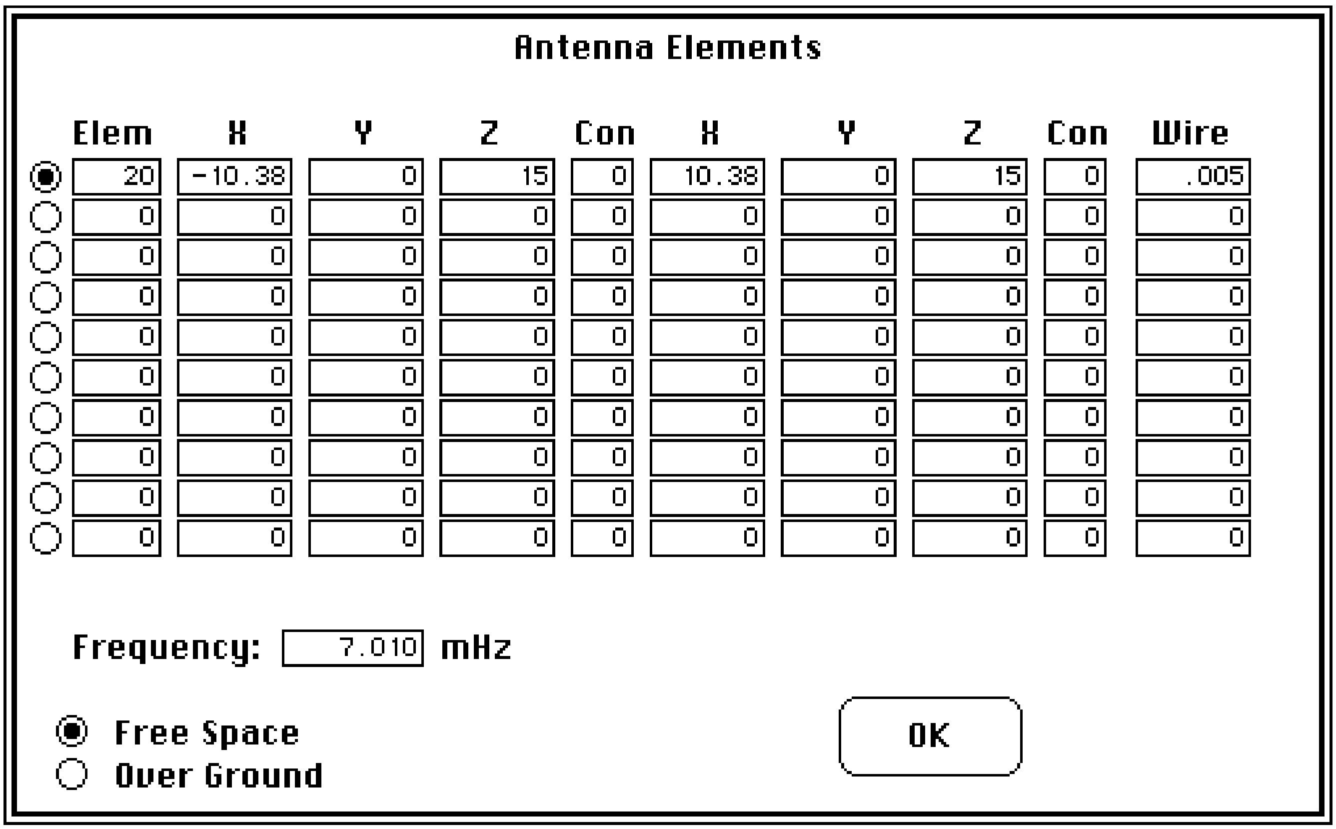
Parms Menu:

Elements...

Displays the Antenna Elements window.



This window contains the physical characteristics of each antenna element. Up to ten elements may be used in each antenna. A radio button at the left side of each line is used to activate a given element. This allows an element to be removed from analysis by turning the radio button off. The parameters for that element will still be kept, but will not be used. The button may be clicked again to activate that element.

The first value for each element tells MacMININEC into how many segments an element should be divided. The more segments, the more accuracy obtained when the antenna is analyzed. Of course, the more segments, the longer the analysis takes.

The next three values are the coordinates of the starting position for that particular element. The Z axis is the vertical axis, with zero being at ground level. All values are in meters

The next value is the type of connection. This is used when two or more elements are to be electrically connected at their intersection. 0 means no connection.

Next are the three coordinates of the ending position for the element, and the type of connection.

Last is the diameter of the element, in meters.

The frequency at the bottom of the window is the frequency at which the antenna will be analyzed, and is entered in megahertz (MHz).

The set of two radio buttons at the bottom of the window control whether or not a ground is simulated. If a ground is selected, it is considered to be an infinite conducting plane at a vertical (Z-axis) position of zero.

In this example, the antenna is composed of a wire 5mm (0.005m) in diameter, with one end at position (-10.38,0,15), and the other at (10.38,0,15). That is, a wire 20.76m long at a height of 15m. The test frequency is 7.010 Mhz, and a ground is not being simulated.

Note: It is not necessary to "center" an antenna at an XY position of (0,0), although it may conceptually make things easier.

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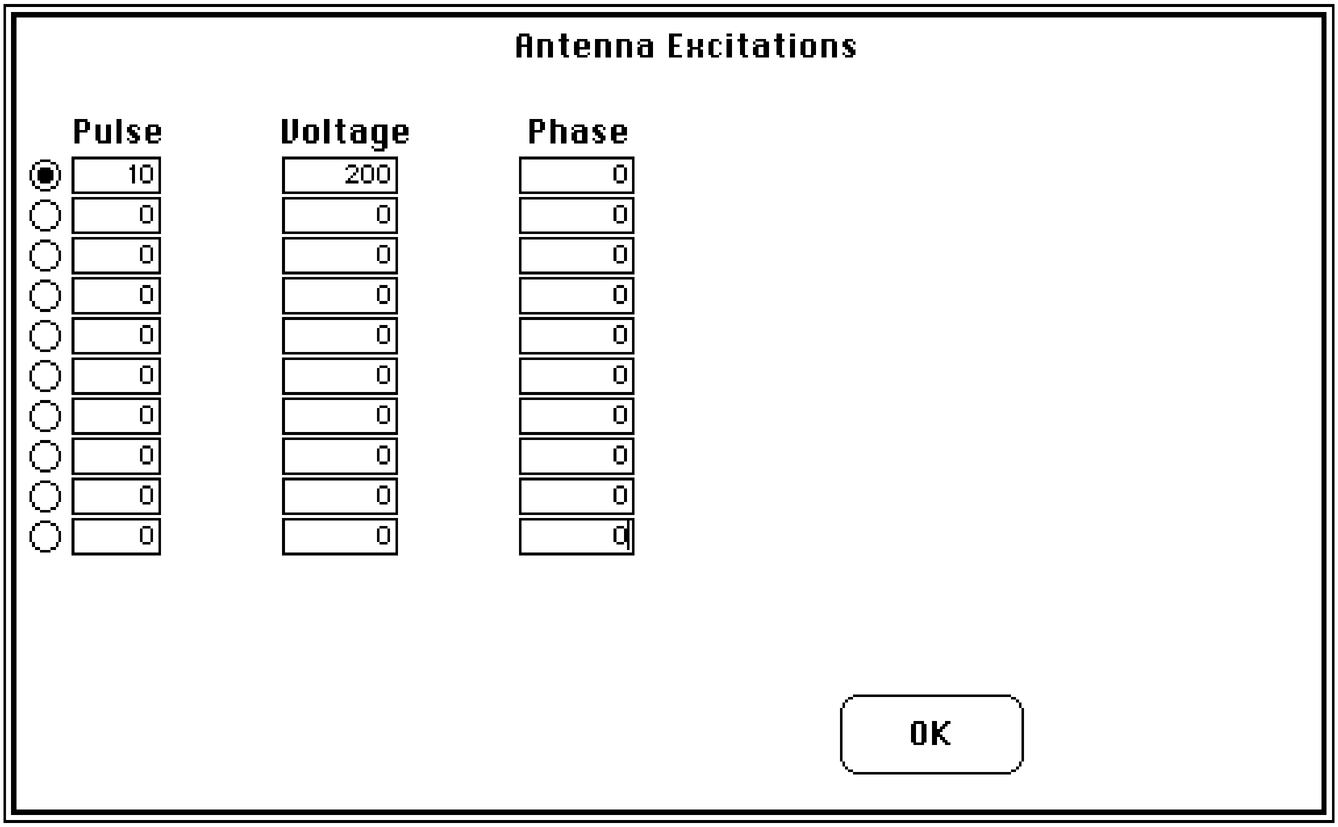
Excitations...

Displays the Antenna Excitations window.



This window contains the excitations applied to the antenna during analysis. A radio button at the extreme left of each line activates each excitation. An excitation may be removed from analysis by clicking the button to the off position, it is not necessary to reset the voltage to zero.

The pulse entry is the segment to which the excitation will be applied.

The voltage is the magnitude of the applied voltage, in volts.

The phase is the phase of the applied voltage, in degrees. This allows multiple excitations which are delayed in phase from each other to be applied to various parts of the antenna.

In this example, an excitation of 200 volts is being applied at segment 10. Checking the Elements window presented earlier, this is the center of the antenna. In this example, we are analyzing a dipole.

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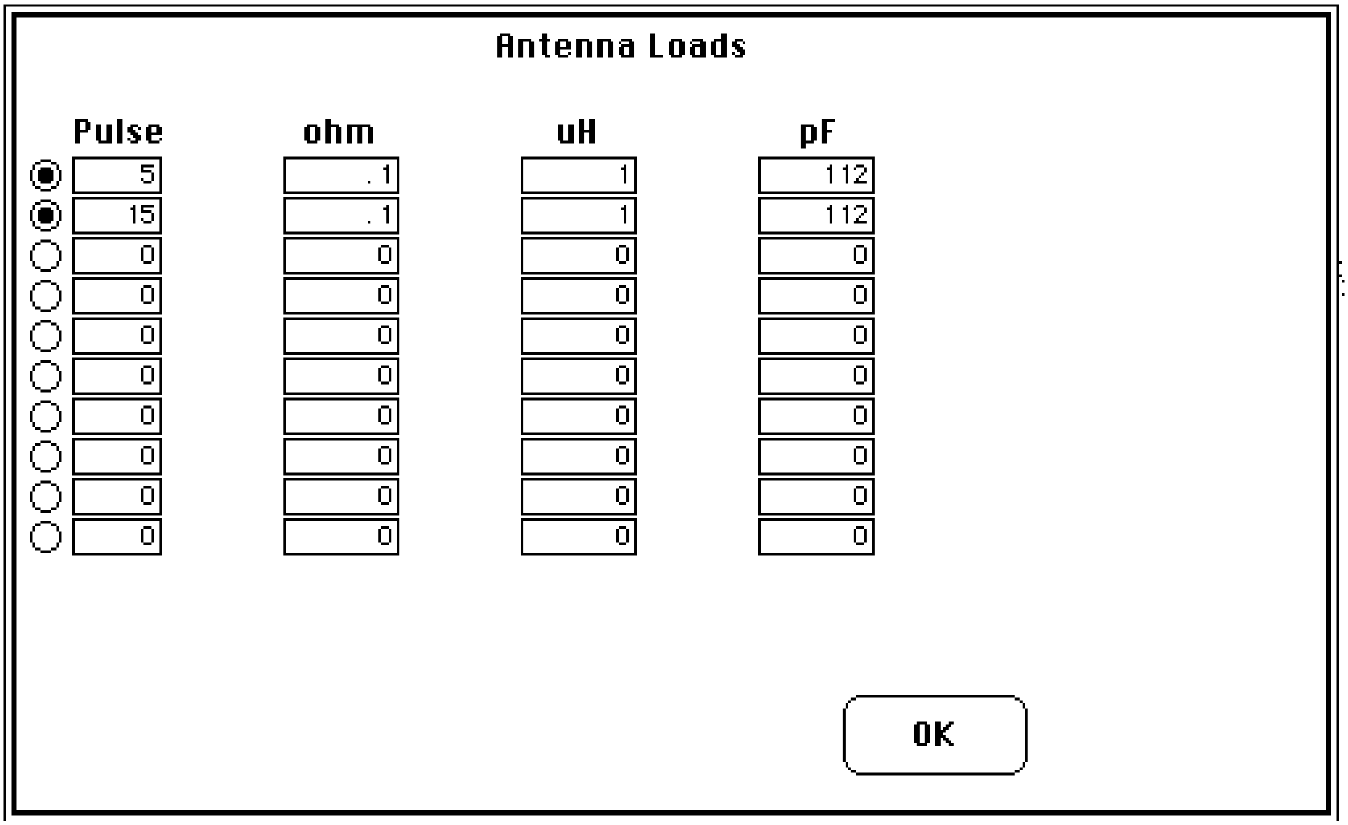
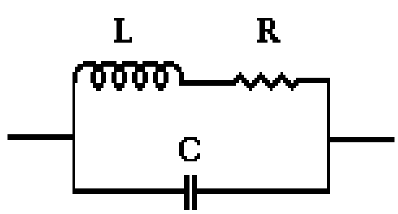
Loads...

Displays the Antenna Loads window.



This window contains any loads which are part of the antenna. A load is considered to be an RLC circuit of the following type:



The resistance, R, is entered in ohms, the capacitance, C, in picofarads (pF), and the inductance, L, in microhenries (uH). At analysis time, the LRC circuit is converted to a R+jX impedance at the analysis frequency. Loads are very useful for simulating constructions such as traps. To prevent problems during analysis, set the resistance to a low value, but not zero.

In this example, the load is constructed with a 112 pF capacitor in parallel with a 1 uH inductor and a 0.1 ohm resistor. It is a trap with a reasonant frequency at 15.039 MHz.

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Calculate Menu:

Note: This menu is dimmed until there there is at least one antenna element, and at least one excitation. (Otherwise there would be nothing to calculate!)

Geometry...

When selected, MacMININEC will read the values in the Antenna Elements window, and build a table of the segments making up the antenna. This table may be viewed using the View Geometry menu selection.

Currents...

When selected, MacMININEC will analyze the antenna. It will insert any loads at the desired segments, and apply excitations. When finished, the current and impedance at each excitation segment can be viewed using the View Currents and View Impedances menu selections.

A bar graph is displayed which indicates how far along MacMININEC is in calculating the currents.

Note: It can take quite a while to perform the calculations for a complex antenna, especially if you have a 68000 Mac. If you are going to play around with a lot of changes, it is best to use a small number of segments until you want to do final analysis. Start with a given number of segments, and then vary the number. You can determine how few segments you can get away with, yet still have reasonable answers. Then increase the number of segments for the final analysis.

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View Menu:

Note: This menu is dimmed until currents have been calculated. It displays information for the last calculated currents. If you edit any of the parameters, you must re-calculate the current before choosing anything from the **view** menu.

Geometry...

When selected, MacMININEC will put up a window showing all segments (pulses) making up the antenna. It is necessary to first calculate the antenna's geometry.

In this example, the first thirteen segments of the antenna are displayed. The scroll bar may be used to scroll through the segments. The location (X,Y,Z) of the center of the segment is given, along with the type of connection at each end, and the diameter of the segment.

Click on the OK button to exit from this window.

Pulse	X	Y	Z	Conn1	Conn2	Radius
1	-9.342	0	15	0	1	.005
2	-8.304	0	15	1	1	.005
3	-7.266	0	15	1	1	.005
4	-6.228	0	15	1	1	.005
5	-5.19	0	15	1	1	.005
6	-4.152	0	15	1	1	.005
7	-3.114	0	15	1	1	.005
8	-2.076	0	15	1	1	.005
9	-1.038	0	15	1	1	.005
10	0	0	15	1	1	.005
11	1.038	0	15	1	1	.005
12	2.075999	0	15	1	1	.005
13	3.114	0	15	1	1	.005

OK

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Currents...

When selected, MacMININEC will put up a window showing the current through each segment making up the antenna. It is first necessary to calculate the antenna's currents.

In this example, the first thirteen segments of the antenna are displayed. The scroll bar may be used to scroll through the segments. The real and imaginary components (A+jB), along with the magnitude of each current is given,

Click on the OK button to exit from this window.

Pulse	Real	Imaginary	Magnitude
1	.2664929	-.2614548	.3733324
2	.504629	-.4895206	.7030511
3	.7260027	-.6959162	1.005674
4	.9296656	-.8798279	1.27999
5	1.114572	-1.04031	1.524636
6	1.244001	-1.142951	1.689342
7	1.349109	-1.217067	1.816961
8	1.426028	-1.258971	1.902252
9	1.472886	-1.266288	1.94239
10	1.488622	-1.232786	1.932811
11	1.472885	-1.266287	1.942389
12	1.426027	-1.25897	1.902251
13	1.349108	-1.217066	1.81696

OK

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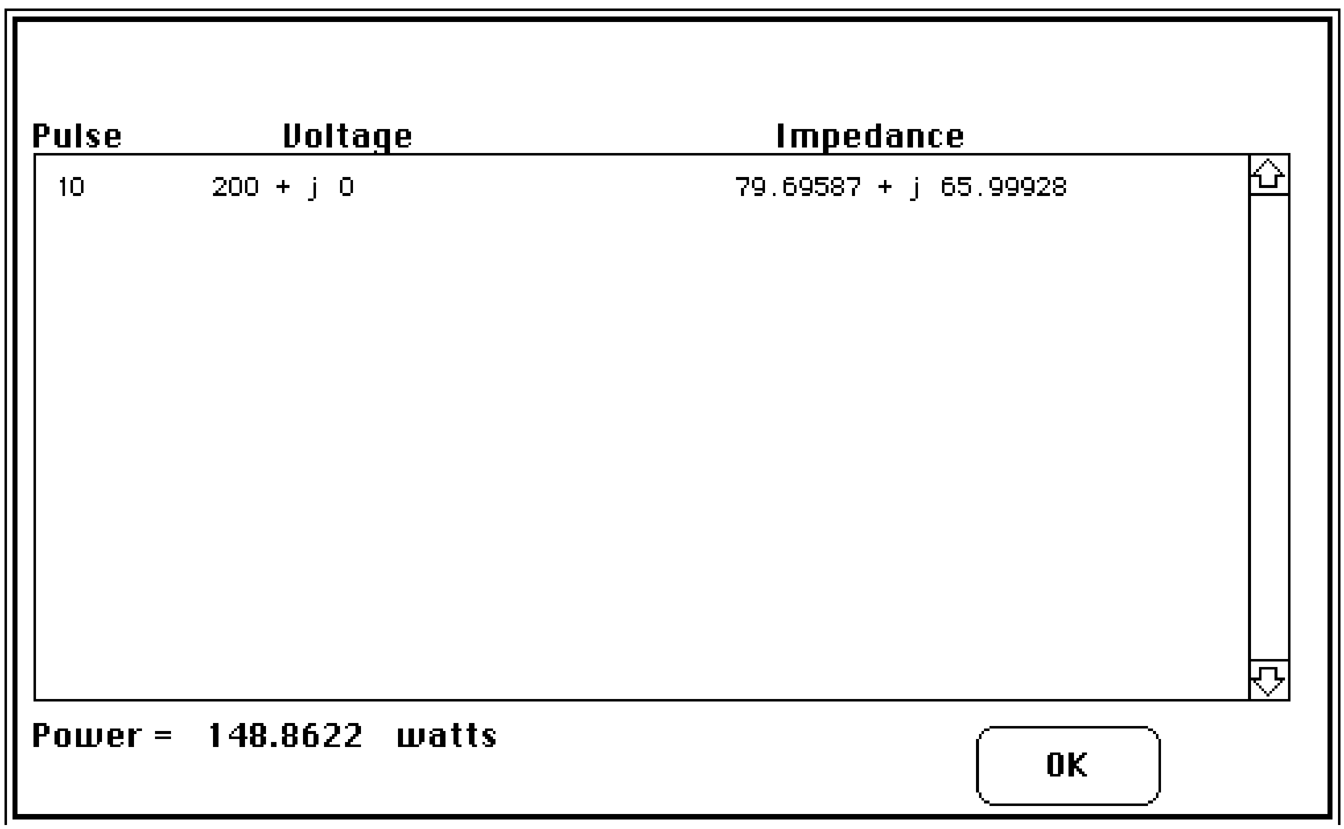
Impedances...

When selected, MacMININEC will put up a window showing the voltage and impedance at every segment where an excitation has been applied. It is necessary to first calculate the antenna's currents.

In this example, the voltage at segment 10 is displayed as 200 + j0, along with an impedance of 79.69587 + j65.99928 ohms.

Along with this information, the total power into the antenna is displayed, in this example 148.8622 watts.

Click on the OK button to exit from this window.



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H Horizontal Patterns...

When selected, MacMININEC will prompt for the zenith. It will then calculate and display the horizontal pattern for horizontally polarized radiation.

H Vertical Patterns...

Calculates and displays the vertical pattern for horizontally polarized waves.

V Horizontal Patterns...

Calculates and displays the horizontal pattern for vertically polarized waves.

V Vertical Patterns...

Calculates and displays the vertical pattern for vertically polarized waves.

Use H Horizontal Patterns and H Vertical Patterns for horizontally polarized antennas. Use V Horizontal Patterns and V Vertical Patterns for vertically polarized antennas.

The following example is the horizontal pattern of the horizontally polarized radiation for a half wave dipole in free space. The figure-eight pattern is evident. In this example, the antenna was divided into 20 segments.

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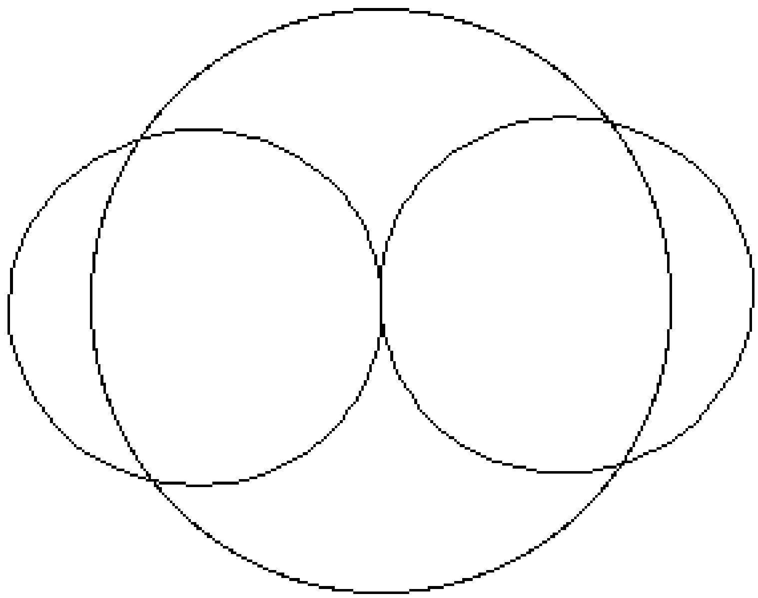
Horizontal Maximum = 2.128781 dB at 90 degrees



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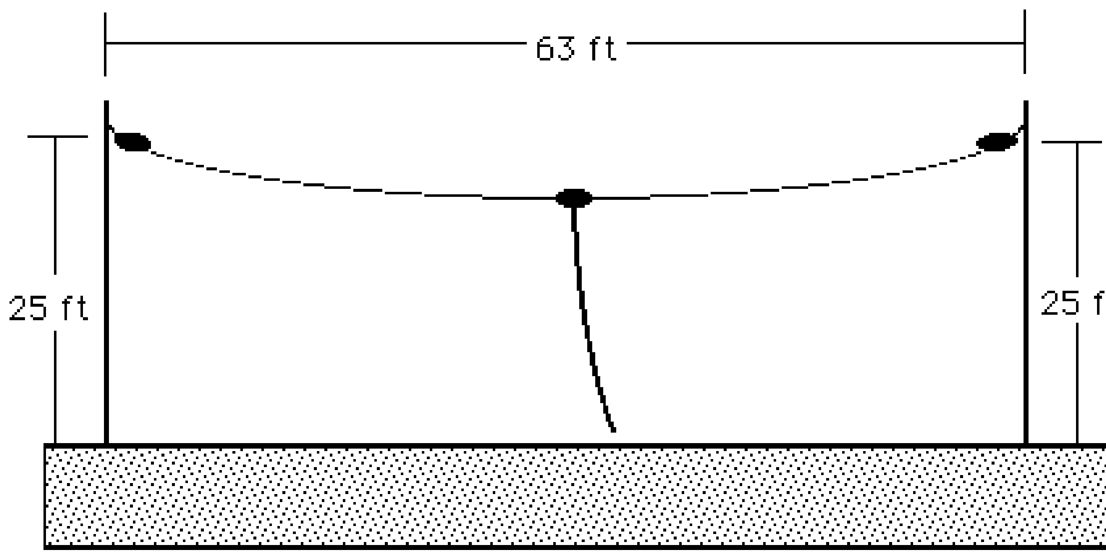
Antenna analysis example:

Here's an example of how to use MacMININEC. Let's analyze a typical HF dipole, as shown below:



The antenna is 63 feet (19.2 meters) long, and 25 feet (7.62 meters) high. Ignore the sag in the antenna. The antenna is center fed. We want to analyize the antenna at 7.4 MHz. Let's pick 20 segments for the analysis (we could use more for better results, or fewer for a faster analysis). While it isn't necessary, we'll center the antenna above the origin (0,0,0). Our one element will run from (-9.6, 0, 7.62) to (9.6, 0, 7.62). In this first analysis, we'll ignore ground effects. Selecting 20 segments will give us 19 pulses. Since the antenna is center fed, the excitation should be located at pulse 10. The voltage of the excitation does not matter in this case, nor the phase.

The next page shows what the Antenna Elements and Antenna Excitations windows should look like after you've entered the data. After entering this information, the **Calculate** menu will no longer be dimmed, and you can calculate the currents.

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Antenna Elements

Elem	X	Y	Z	Con	X	Y	Z	Con	Wire
20	-9.6	0	7.62	0	9.6	0	7.62	0	.0013
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	

Frequency: 7.4 mHz

(•) Free Space
( ) Over Ground

OK

Antenna Excitations

Pulse	Voltage	Phase
10	100	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

OK

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After the currents have been calculated (which may take a minute or two on a 68000 Mac), the results will be displayed:

```
                *** SOURCE DATA ***
PULSE  10  VOLTAGE = ( 100 , 0 J)
CURRENT = ( 1.162129 , .6332506 J)
IMPEDANCE = ( 66.3486 ,-36.15372 J)
POWER =  58.10647  WATTS
```

This tells us that the excitation was at pulse 10, and was 100 volts, with zero phase. The current is given, as is the impedance (the antenna seems to be a little too short). The radiated power is also given.