RF Toolbox

Version 3.3.0   May 3, 2007

Hi, and thanks for giving RF Toolbox a try!

First things first... What is it?

RF Toolbox is a program that allows you to quickly design antennas, as well as perform many useful RF, electronics, and electrical calculations.

It is not an antenna analysis package (like MININEC) in that it doesn't determine how an antenna design performs. Instead, you select the type of antenna and the desired characteristics, and RF Toolbox gives you the suggested design for the described antenna.

Why? Well, it's a lot faster for one (I'd say by a factor of several hundred times). That's the big benefit.

You can design several types of antennas. These types include:

- Dipole
- Fat Dipole
- Yagi
- J-Pole
- Super J-Pole
- Log Periodic
- Cubic Quad
- Vertical (over a ground plane)
- Helical

You can't design an antenna of an arbitrary design. Of course, I hope to be adding many more types of antennas, in the future.

You can also perform the following additional calculations:

- LC calculations - by entering two of the following: L, C, frequency, the third is calculated.

• Coil design - by entering three of the following: L, diameter, length, number of turns, the fourth is calculated

• Transmission line loss - given the type of cable, length, and band, computes the loss in dB, also computes the additional loss caused by SWR.

• L Network - L matching network

• Pi Network - Pi matching network

• Impedance - Calculate the impedance of a capacitor or inductor at a given frequency

• Wire inductance - Calculate the inductance of a straight piece of wire

• Wire resistance - Calculate the resistance of a length of wire, as well as the voltage drop

• Transmission Line Calculator - Handles many transmission line related calculations, including SWR and impedance transformations.

• db Calculator - Convert between dB and voltage/power ratios.

• Resistor Color Code Calculator - Determine the color code for a resistor
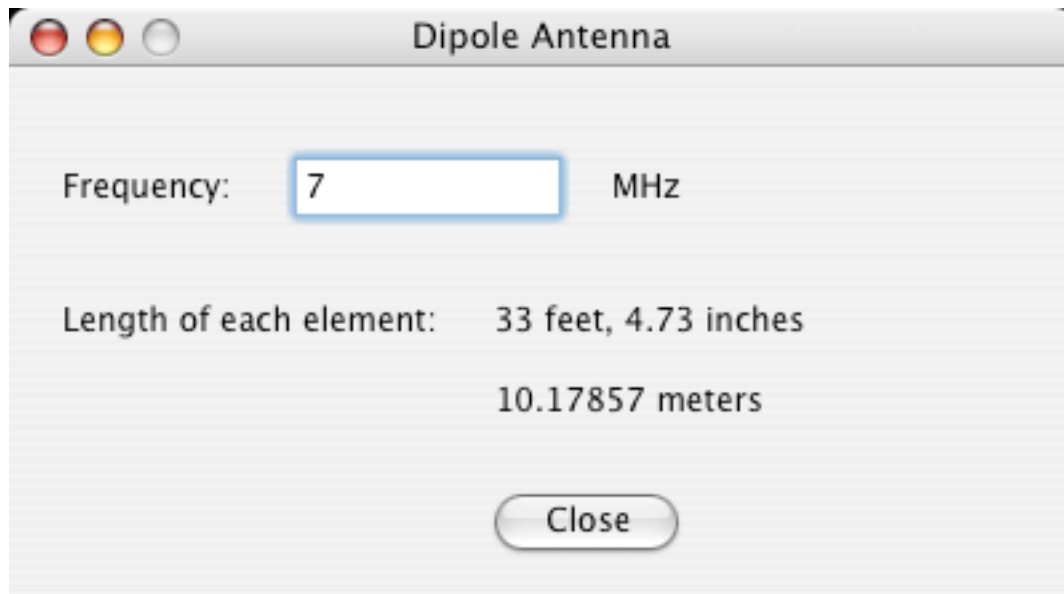
Use:

Just select the desired antenna type from the Antennas menu, or calculation type from the Tool menu, and fill in the requested information.

That's it! It's really that simple.

The following pages show the design window for each of the calculators, and give a brief description of how to use them.
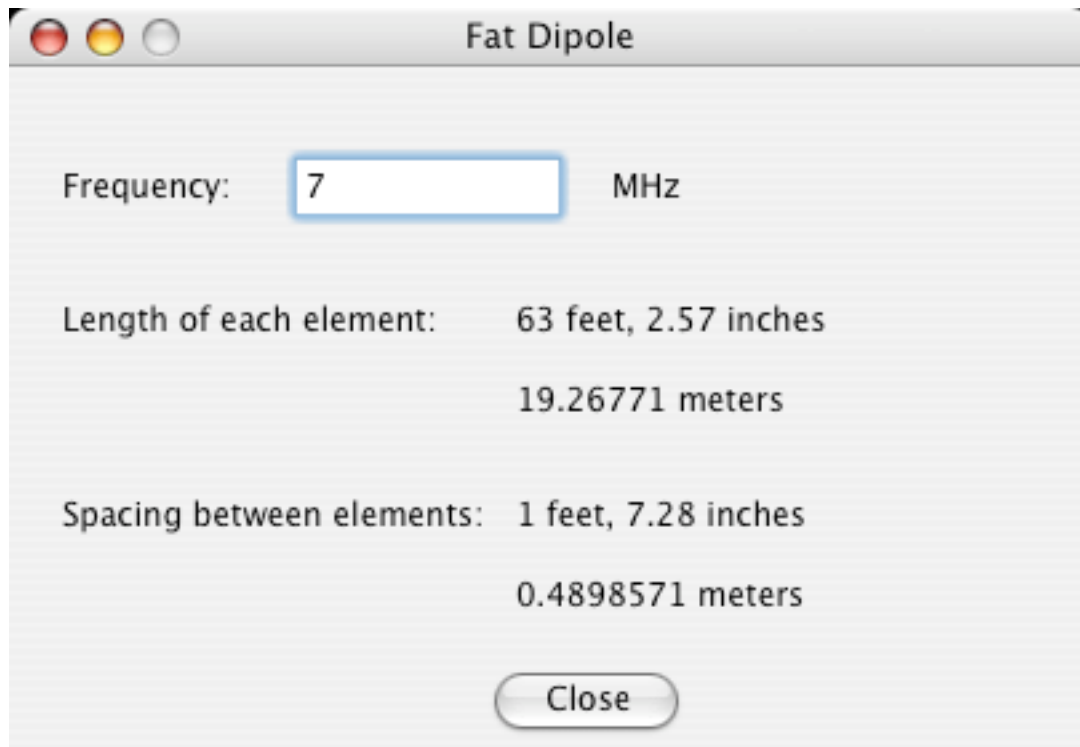
Dipole Antenna Calculator

Frequency: 7 MHz

Length of each element: 33 feet, 4.73 inches

10.17857 meters

Close

Enter in the desired resonant frequency in MHz, and the length of each element (side) is computed and displayed.
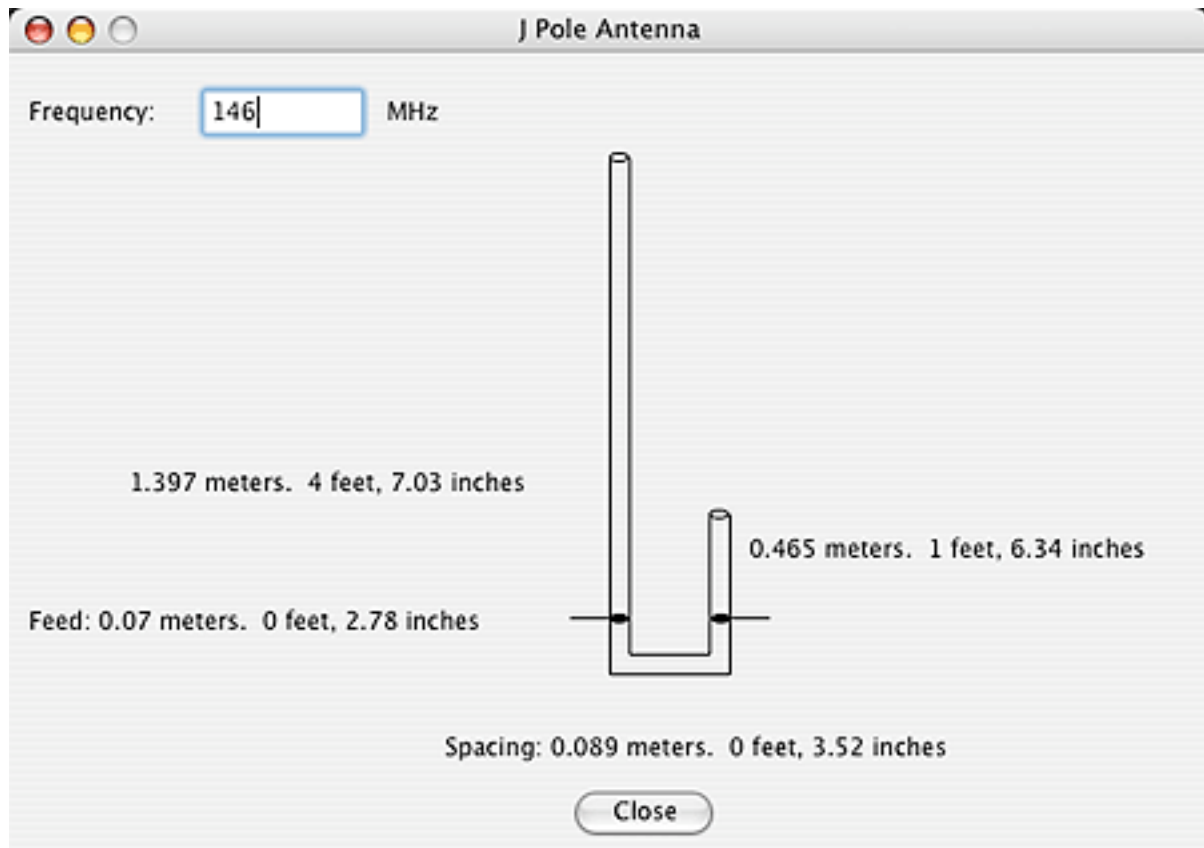
Fat Dipole Antenna Calculator

● ● ○	Fat Dipole

Frequency: `7` MHz

Length of each element: 63 feet, 2.57 inches

19.26771 meters

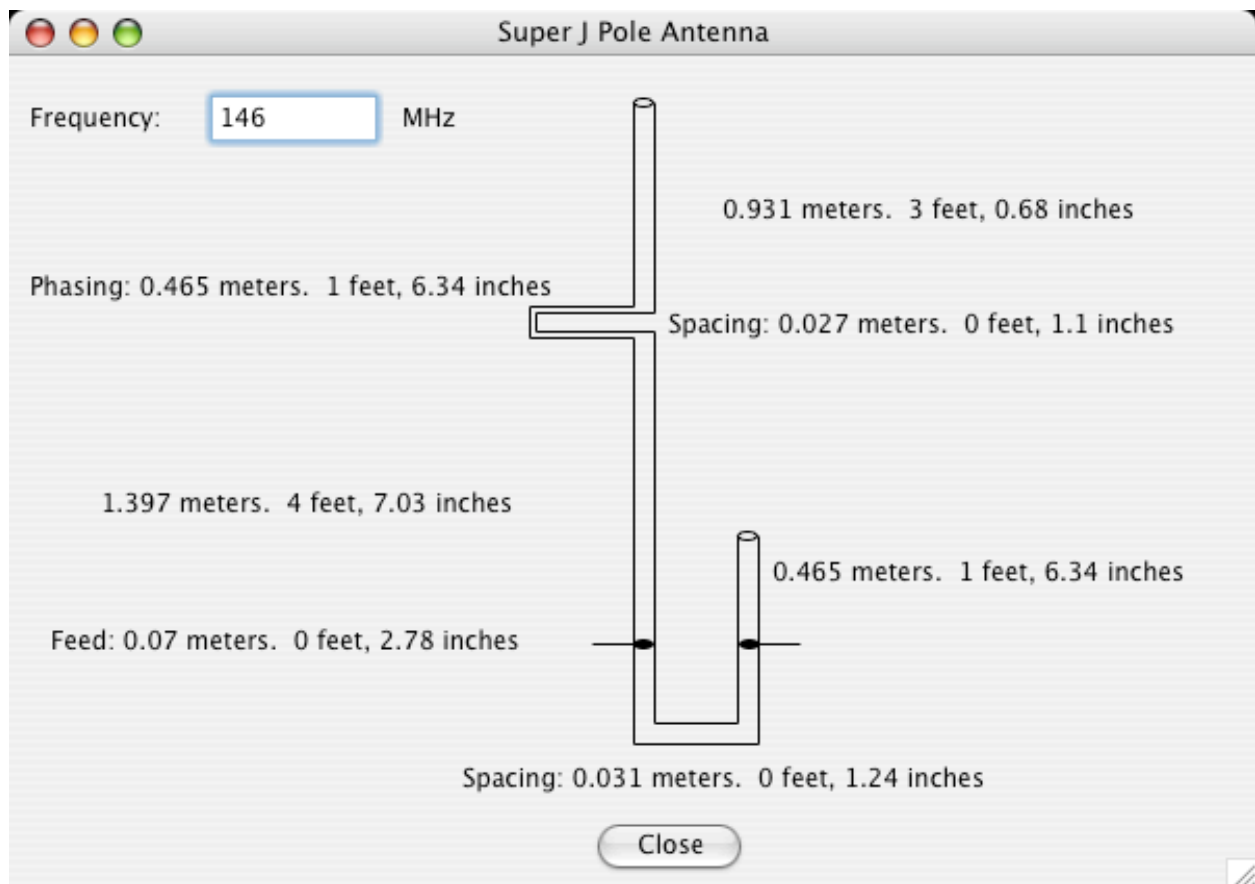Spacing between elements: 1 feet, 7.28 inches

0.4898571 meters

(Close)

Enter in the desired resonant frequency in MHz, and the length of each element (side) is computed and displayed, as well as the necessary spacing between each element.
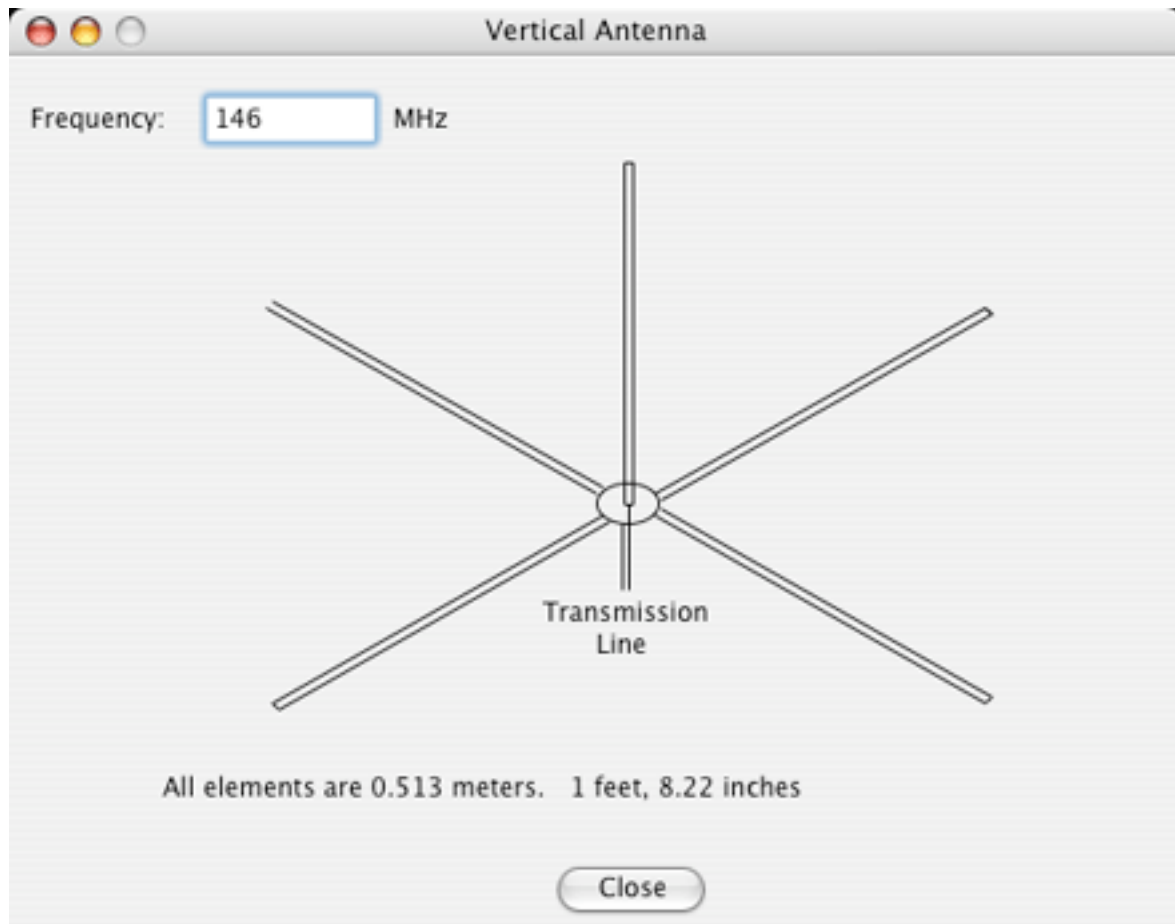
J Pole Antenna Calculator

Enter in the desired operating frequency in MHz. The dimensions for the antenna elements are calculated and displayed.
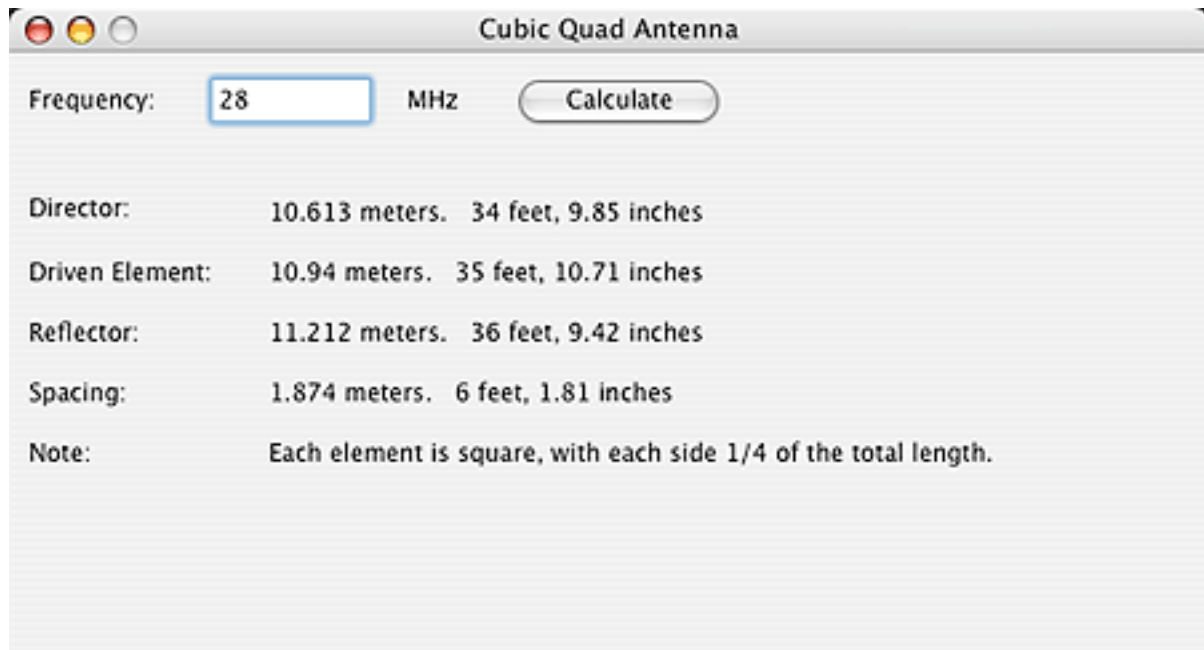
Super J Pole Antenna Calculator

Super J Pole Antenna

Frequency: 146 MHz

0.931 meters. 3 feet, 0.68 inches

Phasing: 0.465 meters. 1 feet, 6.34 inches

Spacing: 0.027 meters. 0 feet, 1.1 inches

1.397 meters. 4 feet, 7.03 inches

0.465 meters. 1 feet, 6.34 inches

Feed: 0.07 meters. 0 feet, 2.78 inches

Spacing: 0.031 meters. 0 feet, 1.24 inches

Close

Enter in the desired operating frequency in MHz. The dimensions for the antenna elements are calculated and displayed.

Vertical (Ground Plane) Antenna Calculator

Enter in the desired operating frequency in MHz. The dimensions for the antenna elements are calculated and displayed.

Cubic Quad Antenna Calculator

	Cubic Quad Antenna	
Frequency:	28	MHz	Calculate

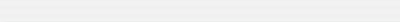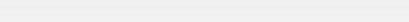|	
Director:	10.613 meters. 34 feet, 9.85 inches
Driven Element:	10.94 meters. 35 feet, 10.71 inches
Reflector:	11.212 meters. 36 feet, 9.42 inches
Spacing:	1.874 meters. 6 feet, 1.81 inches
Note:	Each element is square, with each side 1/4 of the total length.

Enter in the desired operating frequency in MHz. The dimensions and spacings for the antenna elements are calculated and displayed.

Yagi Antenna Calculator

	Yagi Antenna	
Frequency: `146` MHz	Elements: `6`	Calculate

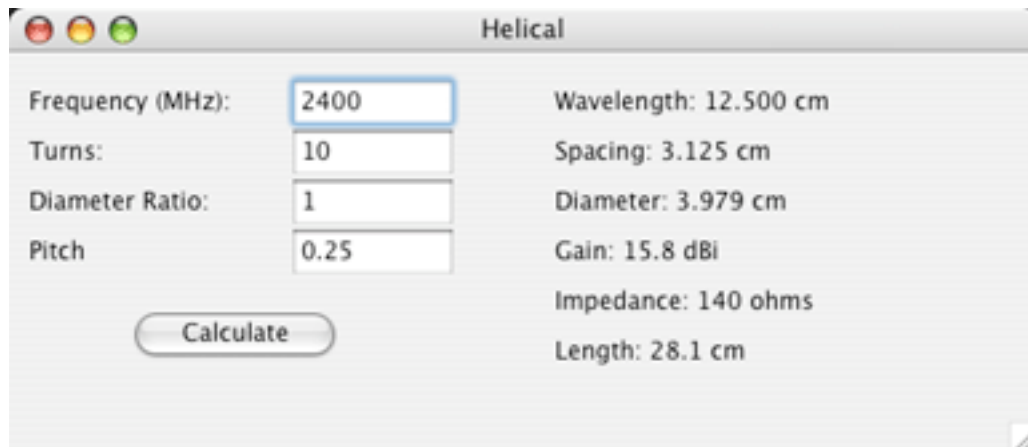|			
Director	▬▬▬▬▬▬	0.92 meters.	3 feet, 0.23 inches
	Spacing: 0.306 meters.	1 feet, 0.08 inches	
Director	▬▬▬▬▬▬	0.92 meters.	3 feet, 0.23 inches
	Spacing: 0.306 meters.	1 feet, 0.08 inches	
Director	▬▬▬▬▬▬	0.92 meters.	3 feet, 0.23 inches
	Spacing: 0.306 meters.	1 feet, 0.08 inches	
Director	▬▬▬▬▬▬	0.92 meters.	3 feet, 0.23 inches
	Spacing: 0.306 meters.	1 feet, 0.08 inches	
Driven Element	▬▬▬▬▬▬	0.986 meters.	3 feet, 2.84 inches
	Spacing: 0.306 meters.	1 feet, 0.08 inches	
Reflector	▬▬▬▬▬▬	1.017 meters.	3 feet, 4.06 inches

Enter in the desired operating frequency in MHz. The dimensions and spacings for the antenna elements are calculated and displayed.

Log Periodic Antenna Calculator

```
○○○                    Log Periodic Antenna
                    [ Design    Gain Graph ]

Low Frequency:   [30]    MHz  Bandwidth:    1.666667   Zo:              475.8        ohm

High Frequency:  [50]    MHz  Elements:     9          Feeder Spacing:  0 feet, 3.31 inches

Sigma:           [.15]        Boom Length:  26 feet, 1.64 inches

Tau:             [.88]        Feeder Dia:   [0.125]    inch         ( Calculate )

Resistance:      [300]        Shortest Dia: [0.125]    inch         [ English  ▼ ]

          Length                    Diameter                    Spacing
   16 feet, 4.85 inches        0.34 inches           4 feet, 11.05 inches
   14 feet, 5.22 inches        0.3 inches            4 feet, 3.96 inches
   12 feet, 8.44 inches        0.26 inches           3 feet, 9.73 inches
   11 feet, 2.14 inches        0.23 inches           3 feet, 4.24 inches
   9 feet, 10.05 inches        0.2 inches            2 feet, 11.41 inches
   8 feet, 7.88 inches         0.18 inches           2 feet, 7.16 inches
   7 feet, 7.41 inches         0.16 inches           2 feet, 3.42 inches
   6 feet, 8.44 inches         0.14 inches           2 feet, 0.13 inches
   5 feet, 10.79 inches        0.12 inches
```

Enter in the frequency range as well as the sigma and tau design parameters (look at the Gain Graph in the window for suggested values), and the design resistance, as well as the diameter of the feeder and shortest elements. Click on the calculate button, and the lengths, diameters, and spacings for each element will be computed and displayed.

Helical Antenna Calculator

Enter in the desired frequency in MHz, and the number of turns. You can leave the diameter ratio and pitch at the default values, or edit them. Click the calculate button, and the antenna parameters are computed.

Transmission   Line   Calculator
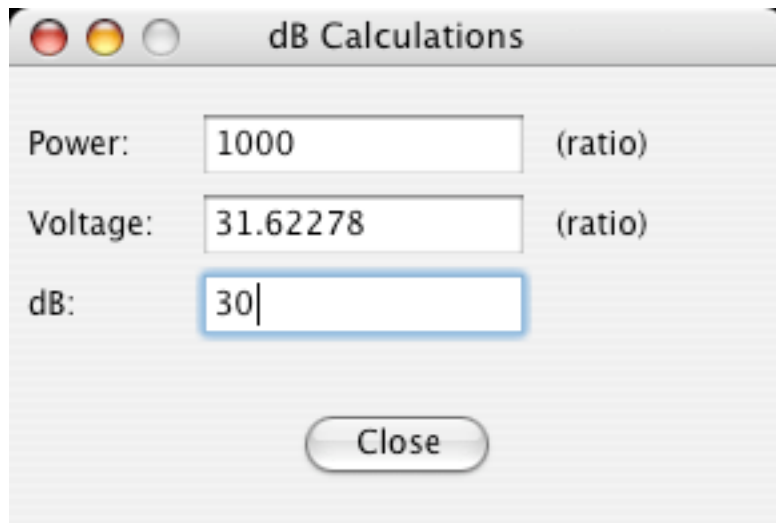
This calculator may be used to compute the losses caused by the transmission line (coax or open wire), as well as the SWR from a mismatched load, and the power loss. Select the cable type from the popup menu, as well as the length and operating frequency. Enter in the impedance of the load (antenna). The SWR is calculated, as well as the losses in the cable, both matched and due to the SWR. You can also enter in the transmitter power, and the lost and output power are calculated and displayed.

db Calculator

This calculator is used to convert between dB (decibels) and both power and voltage ratios. Type a number into any of the fields, and the values for the other two fields will be automatically computed.

Wire Gauge and Voltage Drop Calculator

	Wire Gauge and Voltage Drop	

Gauge: 20   (Select from table below)

Length: 25   feet
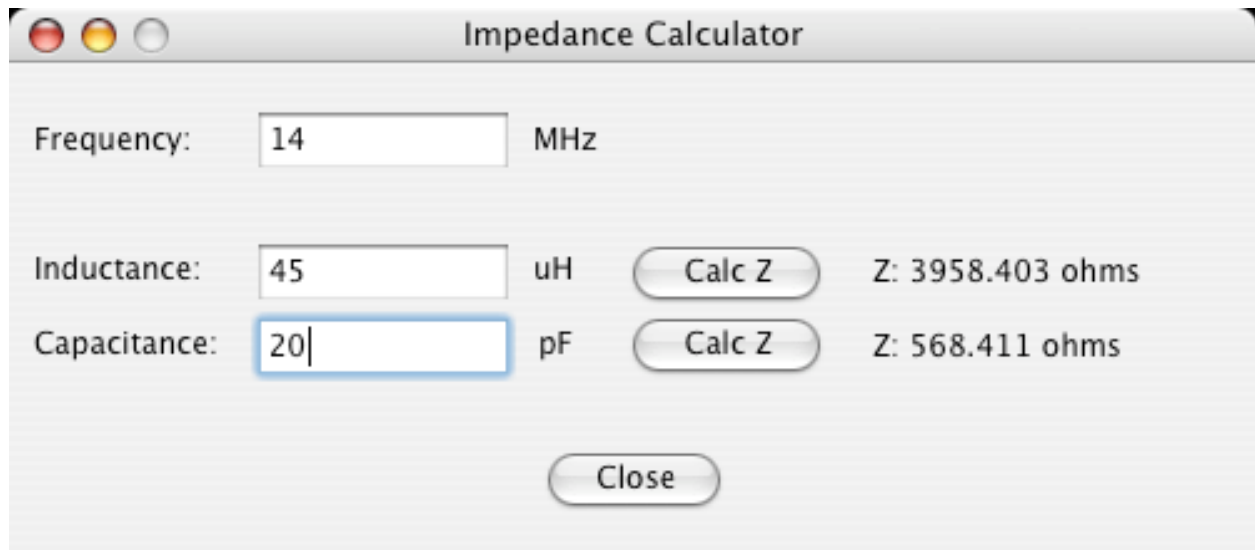
Resistance: 0.2538 ohms

Current: 1   Amps   Voltage Drop: 0.254 V

AWG	Diameter (inch)	Area (circular mil)	Resistance per 1000 ft
11	0.090742	8234.111	1.259517
12	0.0808081	6529.947	1.588221
13	0.0719617	5178.483	2.00271
14	0.0640837	4106.724	2.525371
15	0.0570682	3256.78	3.184434
16	0.0508207	2582.744	4.015497
17	0.0452571	2048.209	5.063448
18	0.0403027	1624.304	6.38489
19	0.0358905	1288.131	8.051197
20	0.0319615	1021.535	10.15237
21	0.0284625	810.1138	12.80191
22	0.0253466	642.4494	16.1429
23	0.0225718	509.4856	20.35583

Select a wire gauge from the list at the bottom of the window (which also contains useful information about each gauge). Enter in the length of the wire, and the resistance will be displayed. Enter in the current, and the voltage drop will be displayed.

Impedance   Calculator

Enter in a frequency in MHz, and either an inductance in uH or a capacitance in pF (or both), click on the Calc Z button, and the impedance in ohms will be calculated.
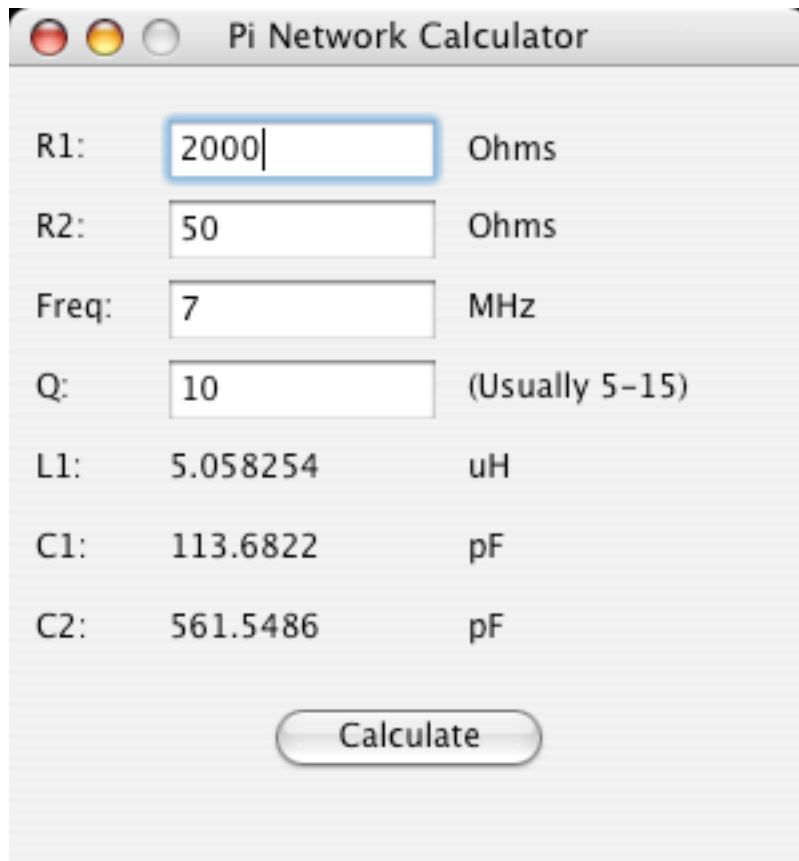
Wire   Inductance   Calculator

Wire Inductance Calculator

L: 52.56463   uH   Calculate L

Radius: 0.5   mm

Length: 2.5   m

Close

Enter in a the radius (in milimeters) and length (in meters) of a piece of straight wire, click the Calculate L button, and the inductance (in uH) will be computed and displayed.
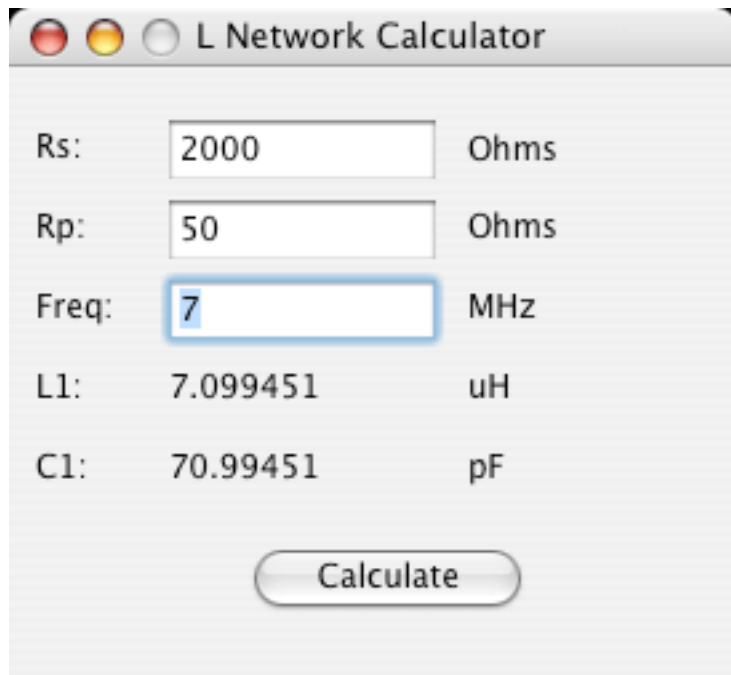
Pi Network Calculator

```
●  ●  ○      Pi Network Calculator

 R1:      2000|            Ohms

 R2:      50               Ohms

 Freq:    7                MHz

 Q:       10               (Usually 5-15)

 L1:      5.058254         uH

 C1:      113.6822         pF

 C2:      561.5486         pF

                ( Calculate )
```

The inductor and two capacitor values for a Pi Network can be quickly and easily calculated. Enter in the input and output impedance, as well as the operating frequency and desired Q, and click the calculate button.
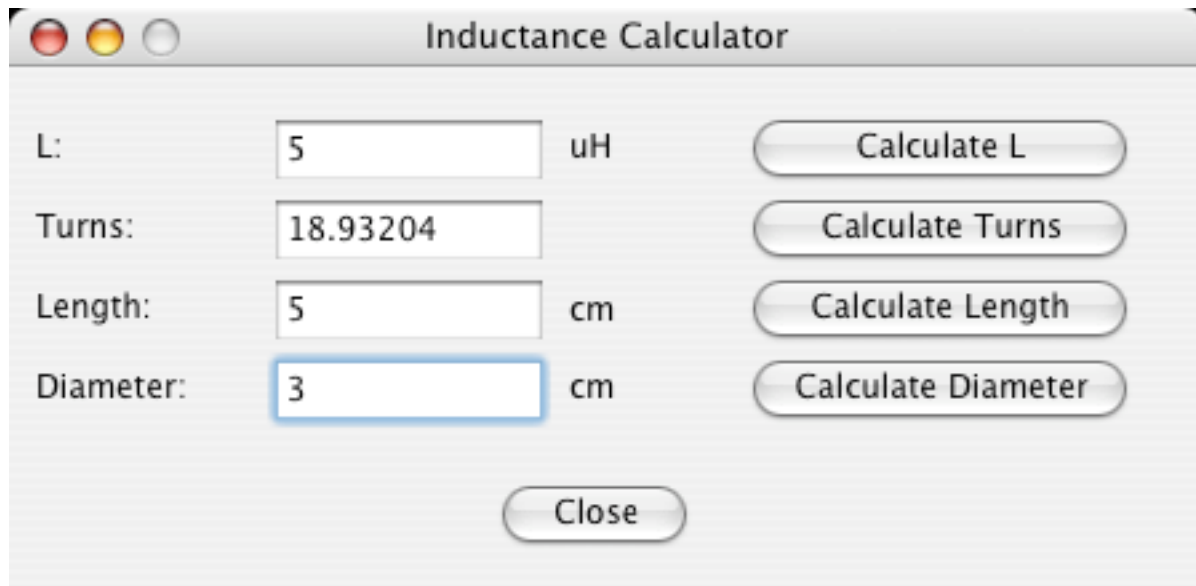
L Network Calculator

The inductor and capacitor values for an L Network can be quickly and easily calculated. Enter in the input and output impedance, as well as the operating frequency and desired Q, and click the calculate button.

Coil Inductance Calculator
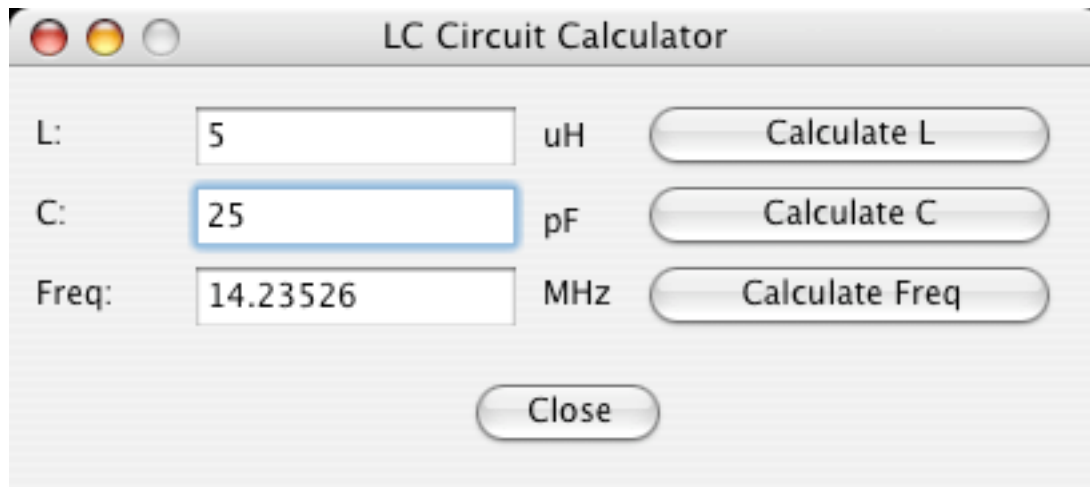
Enter in values for three of the four fields (inductance, turns, length, diameter), and click on the Calculate button for the fourth value, and it will be computed and displayed.

LC Circuit Calculator

This calculates resonant values for the LC circuit. Enter in two of the three values (inductance, capacitance, reasonant frequency), click the appropriate calculate button, and the third value is computed and displayed.

Transmission Line Loss Calculator

Select the cable type from the popup menu, enter in the length and frequency (or select a band from the popup menu), and the cable attenuation in dB is computed. Enter in the Standing Wave Ratio (SWR) and the extra attenuation due to the SWR is also computed and displayed.

Transmission Line Calculator

This calculator allows you to compute several parameters for a transmission line installation. Select the cable type from the popup menu. The impedance and velocity factor are automatically set, you can change them if you wish. Then select the frequency, either directly in MHz, or by selecting the appropriate ham band. Enter the length of the cable run, and select the units of feet or meters. The attenuation and electrical length are computed. Enter the load resistance and reactance and check the Load radio button, or enter the values as seen at the input end of the cable and select the Input radio button. The Input and Load resistance, reactance, impedance, and SWR are calculated, as well as the extra loss due to SWR. Enter the input power in watts, and the loss in watts is also calculated.

Resistor   Calculator

Resistor Calculator

4 Band Code

| 4.7K | ⬍ | ohms |

| 10% | ⬍ | tolerance |

470 2

```
Y   V   R       S
E   I   E       I
L   O   D       L
L   L           V
O   E           E
W   T           R
```

5 Band Code

| 47|000 |

| 2% | ⬍ | tolerance |

```
Y   V   B   R   R
E   I   L   E   E
L   O   A   D   D
L   L   C
O   E   K
W   T
```

The resistor calculator allows you to determine the color code for both 4 and 5 band resistors. For 4 band resistors, select the resistance and tolerance from the popup menus. For 5 band resistors, type in the resistance in ohms, and select the tolerance from the popup menu.

The resistor color codes are displayed, along with the name of each color under the band, since some colors may be difficult to distinguish.

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If you find RF Toolbox useful, please buy your copy, the price is only $19.99. This will help encourage the development of future versions of this program.

Please also write me with your comments and suggestions, and any bugs you may find.

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Westminster, MD 21158

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If you have any questions, comments, suggestions, or bug reports, please email them to me at:

info@blackcatsystems.com

My snail mail address for directly sending your registration fees (please use email for any questions you want answered) is:

Chris Smolinski, N3JLY
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4708 Trail Court
Westminster, MD 21158 USA

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Thanks again for giving RF Toolbox a try.

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Westminster, MD 21158

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Please make sure you include your email address when you order online. That way we can send the registration code to you. If you do not send us a valid email address, we have no way to send you the code.

Revision History

3.3.0:
Added resistor color code calculator.

3.2.0:
Added helical antenna calculations.

3.1.0:
Added Transmission Line calculator.
Added dB calculator.

3.0.0:
Changed name to RF Toolbox
Added impedance calculator.
Added wire inductance calculator.
Added wire resitance calculator.

2.0.1:
Fixed a calculation error in the inductor design tool.
Fixed a calculation error in Yagi antenna design

2.0.0:
Complete re-write, also first OSX and Windows versions.

1.4.0:
Added L and Pi network calculations

1.3.0:
Added transmission line loss calculator

1.2.1:
Fixed bug in Cubic Quad design

1.2.0:
Added Cubic Quad antenna
Fixed bug in Log Periodic display

1.1.0:
Bug fix. Bug caused heap errors on some systems resulting in System Error

33.

1.0.0:
Initial release

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