

# RF Toolbox

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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.

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

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

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 Calculator - Calculate Required Series/Parallel Combinations
  - Resistor Color Code Calculator - Determine the color code for a resistor
  - Thermal Noise Calculator

- Pi Network Attenuator Calculator
- Tee Network Attenuator Calculator
- 555 Timer Oscillator Calculator
- RF Link Budget Calculator
- Skin Depth Calculator
- Gamma Match Calculator
- Zener Diode Calculator
- Parallel Line / Ladder Line Calculator
- Toroid Core Calculator

Use:

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

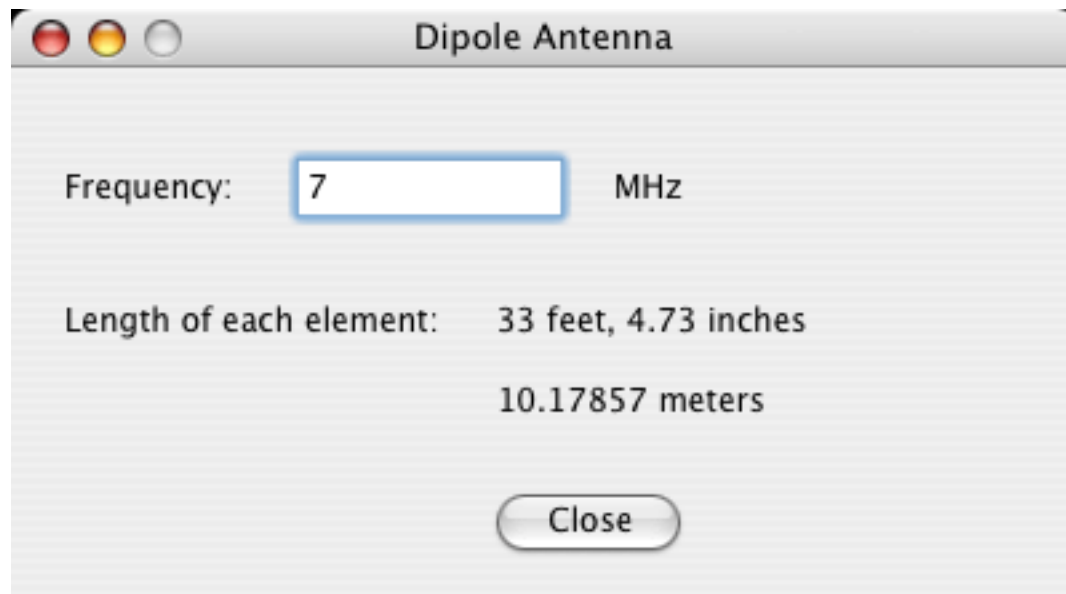
That's it! It's really that simple.

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

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



Dipole Antenna

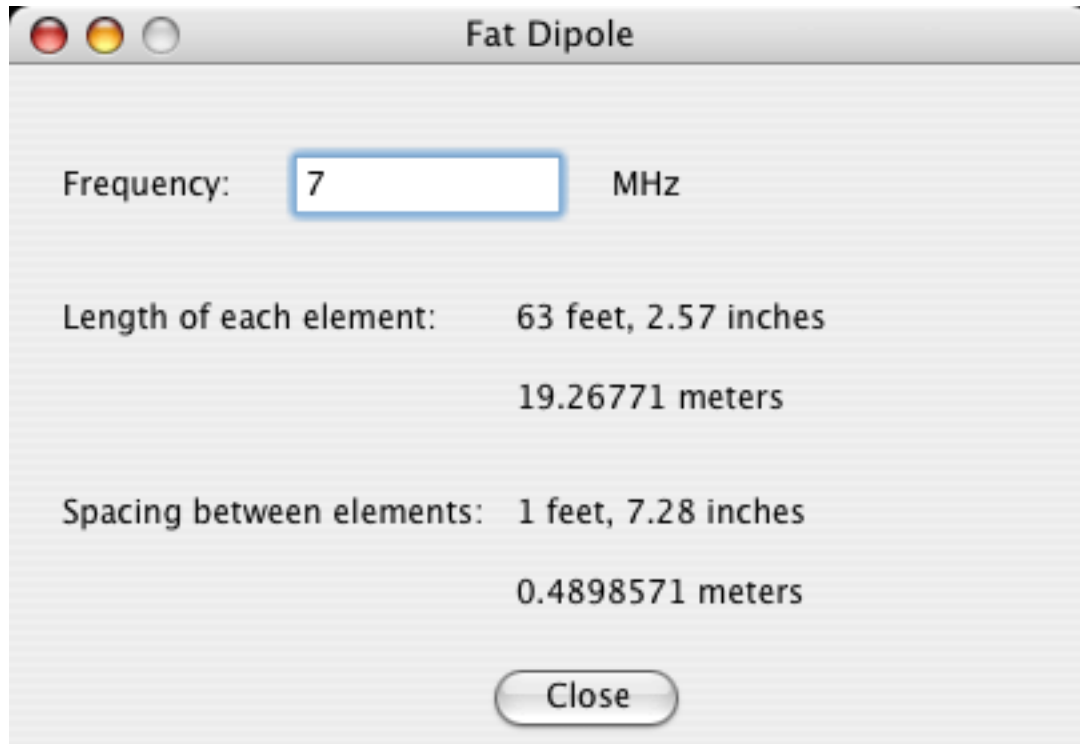
Frequency:  MHz

Length of each element: 33 feet, 4.73 inches  
10.17857 meters

Close

## Fat Dipole Antenna Calculator

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.



The image shows a screenshot of a software window titled "Fat Dipole". The window has a standard macOS-style title bar with three colored buttons (red, yellow, grey) on the left. The main content area is light grey and contains the following text and input fields:

- Frequency:** A text label followed by a text input field containing the number "7", and the unit "MHz" to the right.
- Length of each element:** A text label followed by two lines of output: "63 feet, 2.57 inches" and "19.26771 meters".
- Spacing between elements:** A text label followed by two lines of output: "1 feet, 7.28 inches" and "0.4898571 meters".
- Close:** A rounded rectangular button with the text "Close" inside.

## J Pole Antenna Calculator

The image shows a software window titled "J Pole Antenna". It features a text input field for "Frequency:" with the value "146" and the unit "MHz". Below the input field, a diagram of a J-pole antenna is shown. The diagram consists of a vertical mast, a horizontal base, and a shorter vertical arm. Dimensions are labeled for each part: the mast is "1.397 meters. 4 feet, 7.03 inches", the base is "0.07 meters. 0 feet, 2.78 inches", the arm is "0.465 meters. 1 feet, 6.34 inches", and the spacing between the mast and the arm is "0.089 meters. 0 feet, 3.52 inches". A "Close" button is located at the bottom of the window.

Component	Length (meters)	Length (feet, inches)
Mast	1.397	4 feet, 7.03 inches
Base	0.07	0 feet, 2.78 inches
Arm	0.465	1 feet, 6.34 inches
Spacing	0.089	0 feet, 3.52 inches

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

## Super J Pole Antenna Calculator

The screenshot shows a window titled "Super J Pole Antenna" with a frequency input of 146 MHz. The antenna diagram includes several dimension labels: "Phasing: 0.465 meters. 1 feet, 6.34 inches" for the top horizontal section, "0.931 meters. 3 feet, 0.68 inches" for the top vertical section, "Spacing: 0.027 meters. 0 feet, 1.1 inches" for the gap between the top horizontal section and the main vertical mast, "1.397 meters. 4 feet, 7.03 inches" for the main vertical mast, "Feed: 0.07 meters. 0 feet, 2.78 inches" for the bottom horizontal section, "0.465 meters. 1 feet, 6.34 inches" for the bottom vertical section, and "Spacing: 0.031 meters. 0 feet, 1.24 inches" for the gap between the bottom horizontal section and the bottom vertical section. A "Close" button is at the bottom.

Component	Length (meters)	Length (feet, inches)
Top Vertical Element	0.931	3 feet, 0.68 inches
Top Horizontal Phasing Element	0.465	1 feet, 6.34 inches
Gap (Spacing)	0.027	0 feet, 1.1 inches
Main Vertical Mast	1.397	4 feet, 7.03 inches
Bottom Horizontal Feed Element	0.07	0 feet, 2.78 inches
Bottom Vertical Element	0.465	1 feet, 6.34 inches
Gap (Spacing)	0.031	0 feet, 1.24 inches

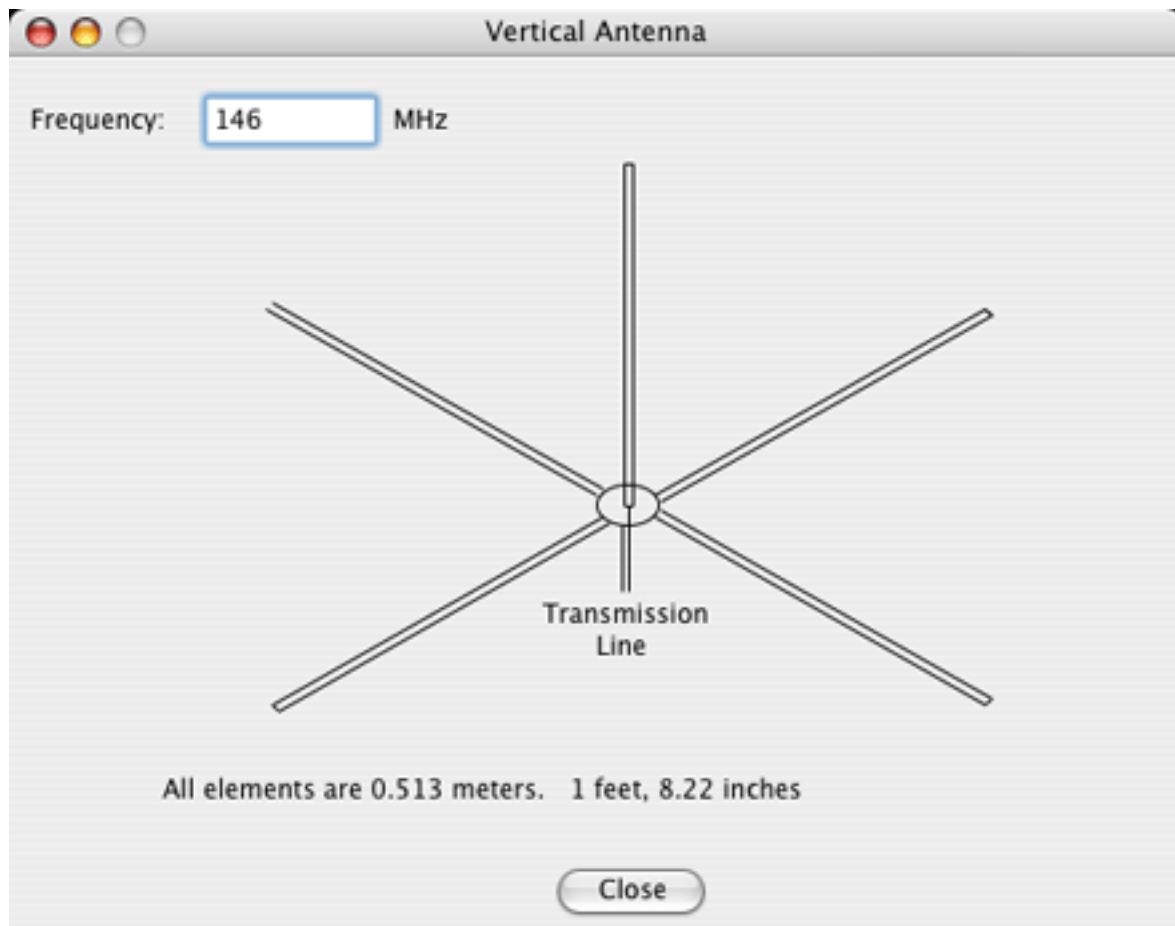
Enter in the desired operating frequency in MHz. The dimensions for the antenna elements are calculated and displayed.



## Vertical (Ground Plane) Antenna Calculator

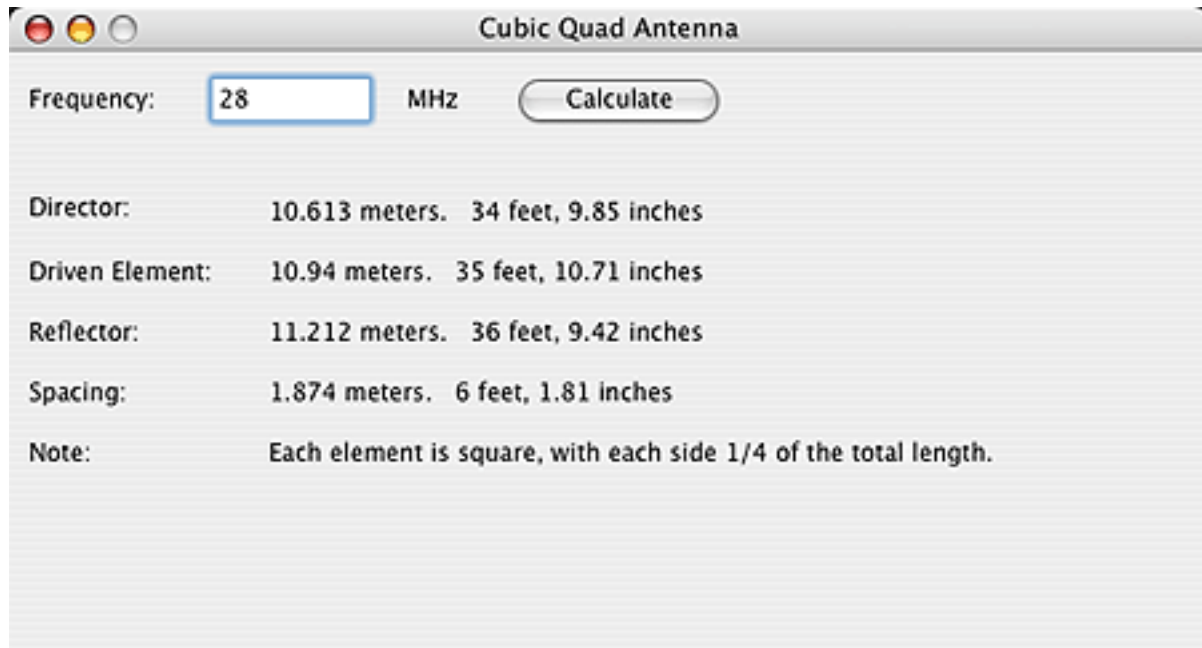
Enter in the desired operating frequency in MHz. The dimensions for the antenna elements are calculated and displayed. You can also change the type of antenna from the popup menu:

1/8 wavelength 1/4 wavelength 3/8 wavelength 1/2 wavelength 5/8 wavelength 3/4 wavelength 7/8 wavelength Full wavelength



## Cubic Quad Antenna Calculator

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

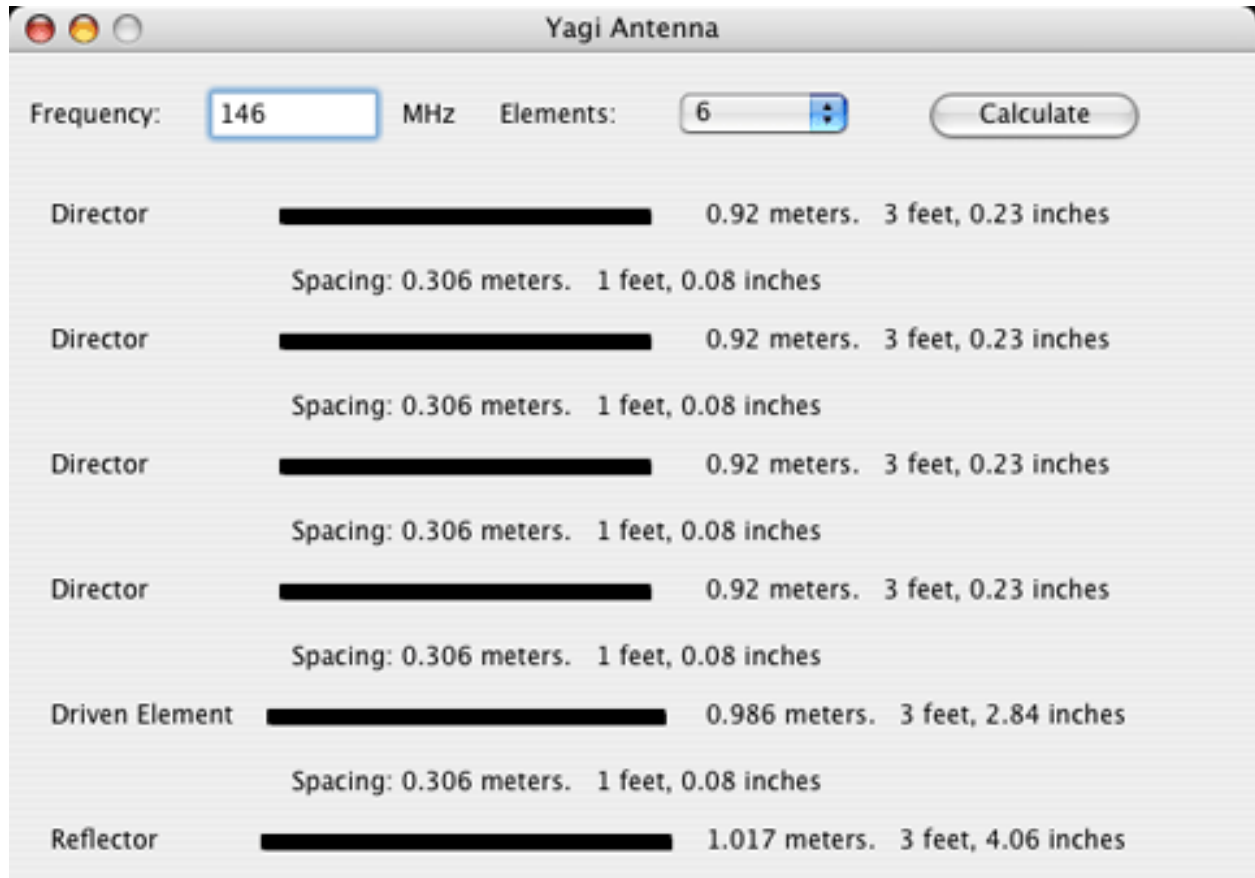


The image shows a screenshot of a software window titled "Cubic Quad Antenna". The window has a standard macOS-style title bar with red, yellow, and green window control buttons. Inside the window, there is a "Frequency:" label followed by a text input field containing the number "28". To the right of the input field is the unit "MHz", and further right is a "Calculate" button. Below the input section, the results are displayed in a list format:

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.

## Yagi Antenna Calculator

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



The screenshot shows a window titled "Yagi Antenna" with a light gray background. At the top, there are three standard macOS window control buttons (red, yellow, and gray). Below the title bar, the interface includes a "Frequency:" label followed by a text input field containing "146", the unit "MHz", an "Elements:" label followed by a spinner control set to "6", and a "Calculate" button. The main area of the window displays the calculated dimensions for a Yagi antenna with 6 elements. It lists four "Director" elements, one "Driven Element", and one "Reflector". Each element is represented by a black horizontal bar. To the right of each bar, its length is given in both meters and feet/inches. Below each element's length, the spacing between it and the next element is also provided in meters and feet/inches.

Element Type	Length (meters)	Length (feet, inches)	Spacing (meters)	Spacing (feet, inches)
Director	0.92	3 feet, 0.23 inches	0.306	1 foot, 0.08 inches
Director	0.92	3 feet, 0.23 inches	0.306	1 foot, 0.08 inches
Director	0.92	3 feet, 0.23 inches	0.306	1 foot, 0.08 inches
Director	0.92	3 feet, 0.23 inches	0.306	1 foot, 0.08 inches
Driven Element	0.986	3 feet, 2.84 inches	0.306	1 foot, 0.08 inches
Reflector	1.017	3 feet, 4.06 inches	-	-

## Long Yagi Design

This window allows you to design long Yagi antennas, up to 99 elements, using the DL6WU formula.

Select whether you would like to use mm or inches for dimensions. Enter in the frequency in MHz.

Select whether you want to specify the gain in dB, or the length of the antenna from the popup menu, then enter in that value.

Choose one of three boom types:

Metal with bonded (electrically attached) elements  
Metal with insulated elements

Non metallic

Enter in the diameter of the boom as well as the driven and parasitic elements.

Click Calculate, and the element information will be generated and displayed. You can print the results, or save them to a MININECPro format file for analysis.

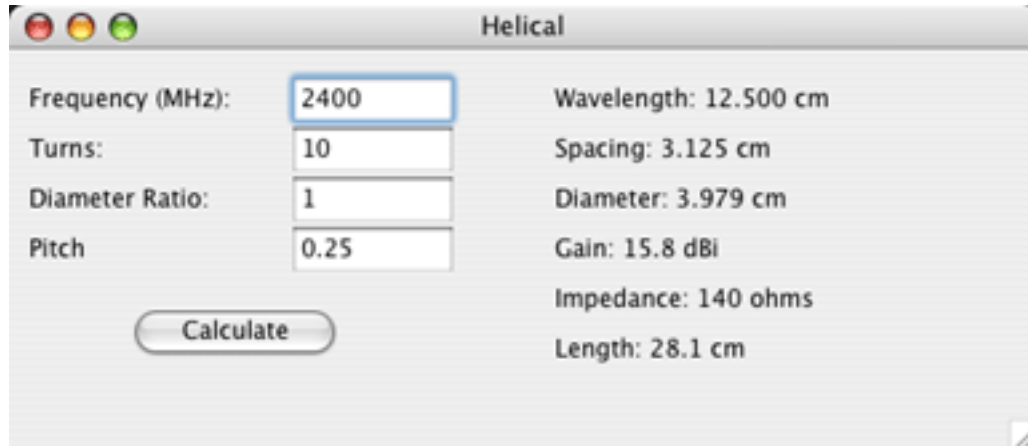
## Log Periodic Antenna Calculator

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.



The screenshot shows a window titled "Helical" with a light gray background. On the left, there are four input fields with labels: "Frequency (MHz):", "Turns:", "Diameter Ratio:", and "Pitch". The values entered are 2400, 10, 1, and 0.25 respectively. Below these is a "Calculate" button. On the right, there are six output labels: "Wavelength: 12.500 cm", "Spacing: 3.125 cm", "Diameter: 3.979 cm", "Gain: 15.8 dBi", "Impedance: 140 ohms", and "Length: 28.1 cm". The window has standard macOS window controls (red, yellow, green buttons) in the top left corner.

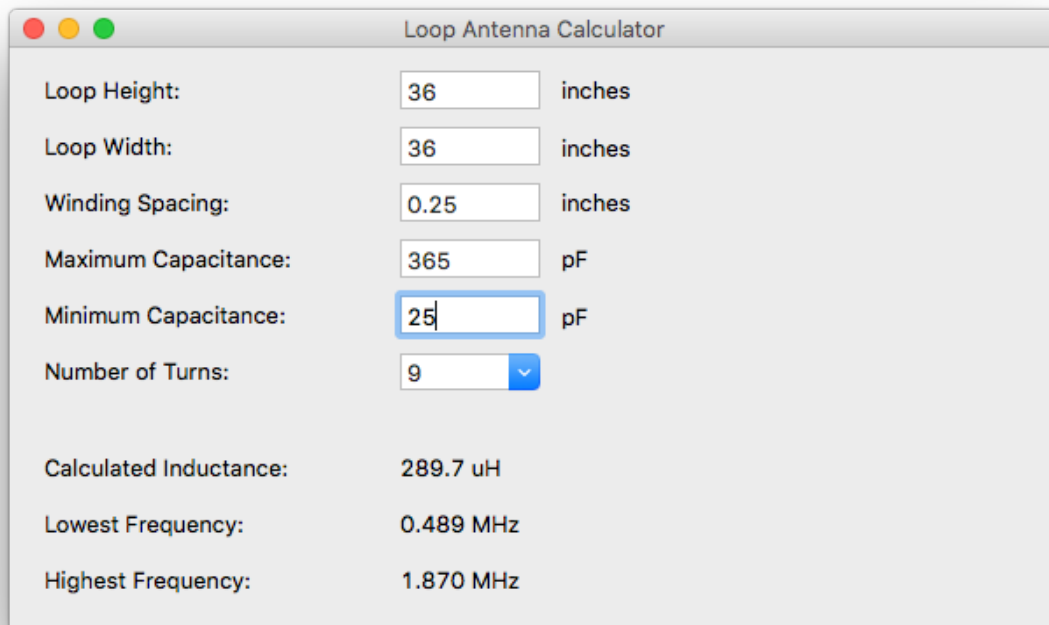
Input	Value	Output	Value
Frequency (MHz)	2400	Wavelength	12.500 cm
Turns	10	Spacing	3.125 cm
Diameter Ratio	1	Diameter	3.979 cm
Pitch	0.25	Gain	15.8 dBi
		Impedance	140 ohms
		Length	28.1 cm

## Loop Antenna Calculator

This is for calculating the frequency range of a square (box) loop antenna, with a parallel tuning capacitor.

Enter in the loop height and width in inches, along with the maximum and minimum capacitance values of the variable tuning capacitor, and the number of turns.

The lowest and highest resonate frequencies will be calculated.



The screenshot shows a macOS-style window titled "Loop Antenna Calculator". It contains input fields for "Loop Height", "Loop Width", "Winding Spacing", "Maximum Capacitance", and "Minimum Capacitance", each followed by a unit label. The "Number of Turns" is a dropdown menu. Below these are three read-only output fields: "Calculated Inductance", "Lowest Frequency", and "Highest Frequency".

Parameter	Value	Unit
Loop Height:	36	inches
Loop Width:	36	inches
Winding Spacing:	0.25	inches
Maximum Capacitance:	365	pF
Minimum Capacitance:	25	pF
Number of Turns:	9	
Calculated Inductance:	289.7	uH
Lowest Frequency:	0.489	MHz
Highest Frequency:	1.870	MHz

## 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.

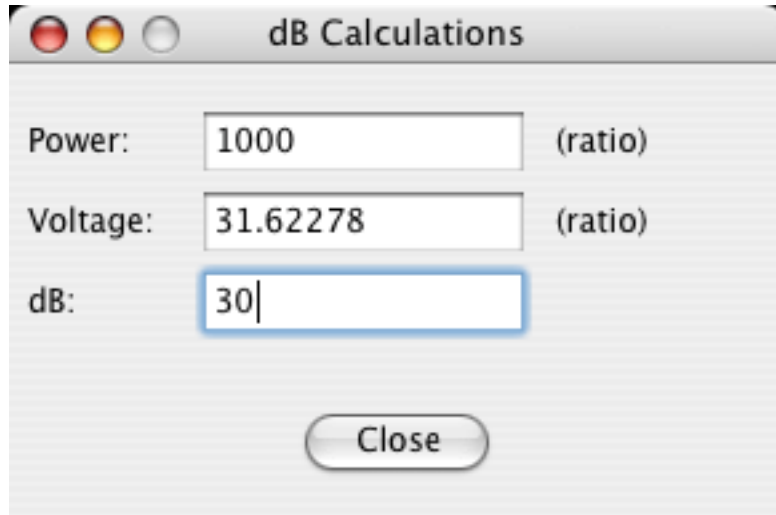
The screenshot shows a software window titled "Transmission Line Calculator". It contains several input fields and calculated results. The inputs are: Cable: Belden 9258 (RG-8X), Ohms: 50, VF: 0.78, Freq: 7 MHz, Band: 40m, Length: 50 ft, Load Resistance: 73, Impedance: 0. The results section shows: Matched Loss: 0.752 dB/100 ft, Attenuation: 0.376 dB, Electrical Length: 0.4602 wavelengths (165.68 degrees), SWR: 1.46, Attenuation due to SWR: 0.024 dB, Total Loss: 0.4 dB, Input Watts: 100, Cable Loss: 8.29W, SWR Loss: 0.51W, Power Out: 91.2W. A "Close" button is at the bottom.

	Input	Load
R	68.274 ohms	73.000 ohms
X	12.681 ohms	0.000 ohms
Z	69.442 ohms	73.000 ohms



## 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.

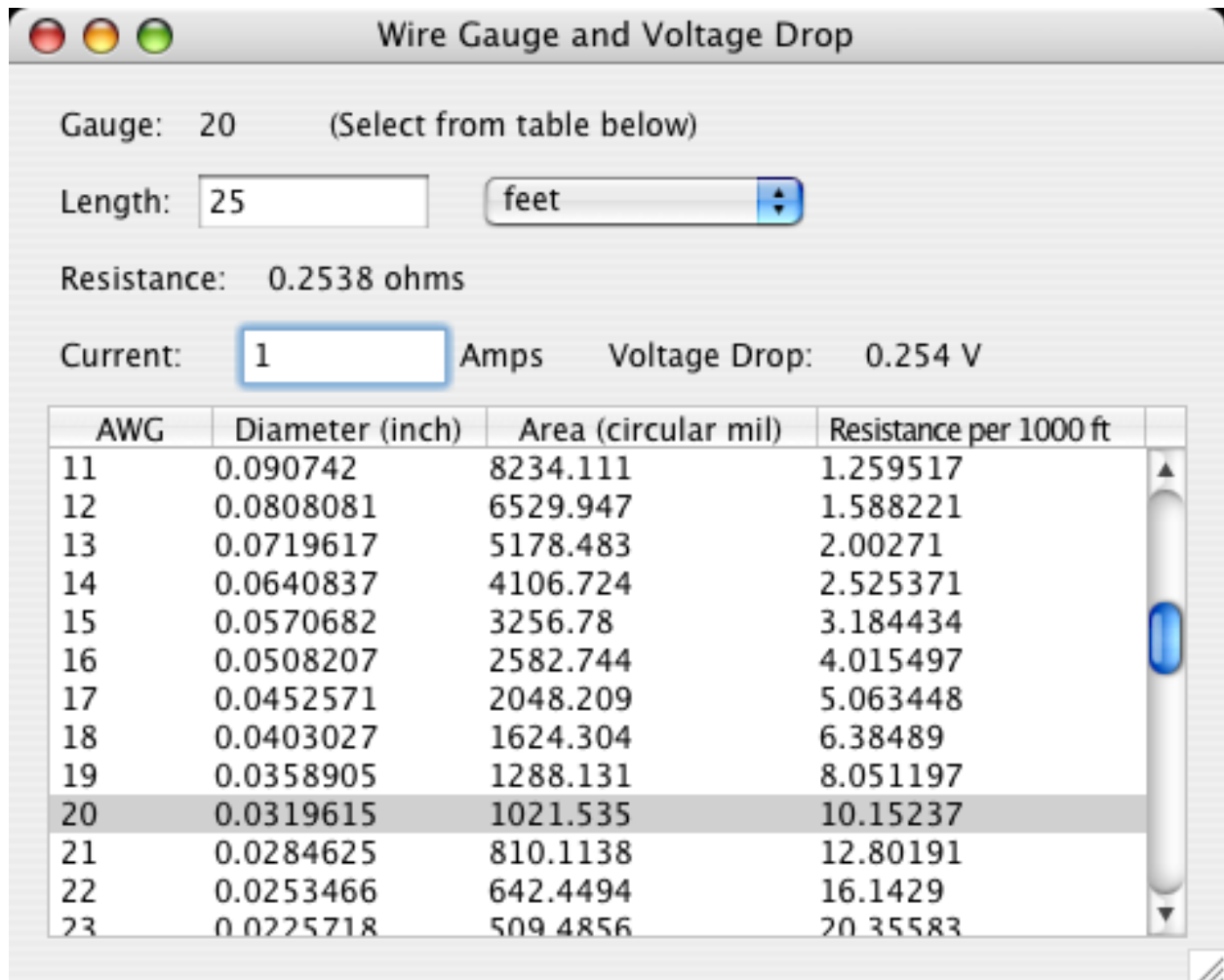


A screenshot of a macOS-style dialog box titled "dB Calculations". The dialog has a light gray background and a title bar with three window control buttons (red, yellow, and gray). It contains three input fields arranged vertically. The first field is labeled "Power:" and contains the value "1000", with the text "(ratio)" to its right. The second field is labeled "Voltage:" and contains the value "31.62278", with the text "(ratio)" to its right. The third field is labeled "dB:" and contains the value "30", which is highlighted with a blue selection box. At the bottom center of the dialog is a rounded rectangular button labeled "Close".

Field	Value	Unit
Power	1000	(ratio)
Voltage	31.62278	(ratio)
dB	30	

Close

## Wire Gauge and Voltage Drop Calculator



The image shows a software window titled "Wire Gauge and Voltage Drop". It contains several input fields and a table. The "Gauge" field is set to 20, with a note "(Select from table below)". The "Length" field is set to 25, and the unit is "feet". The "Resistance" field displays 0.2538 ohms. The "Current" field is set to 1, with the unit "Amps", and the "Voltage Drop" field displays 0.254 V. At the bottom, there is a table with 4 columns: AWG, Diameter (inch), Area (circular mil), and Resistance per 1000 ft. The table lists wire gauges from 11 to 23. The row for gauge 20 is highlighted.

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

Frequency: 14 MHz

Inductance: 45 uH    Calc Z    Z: 3958.403 ohms

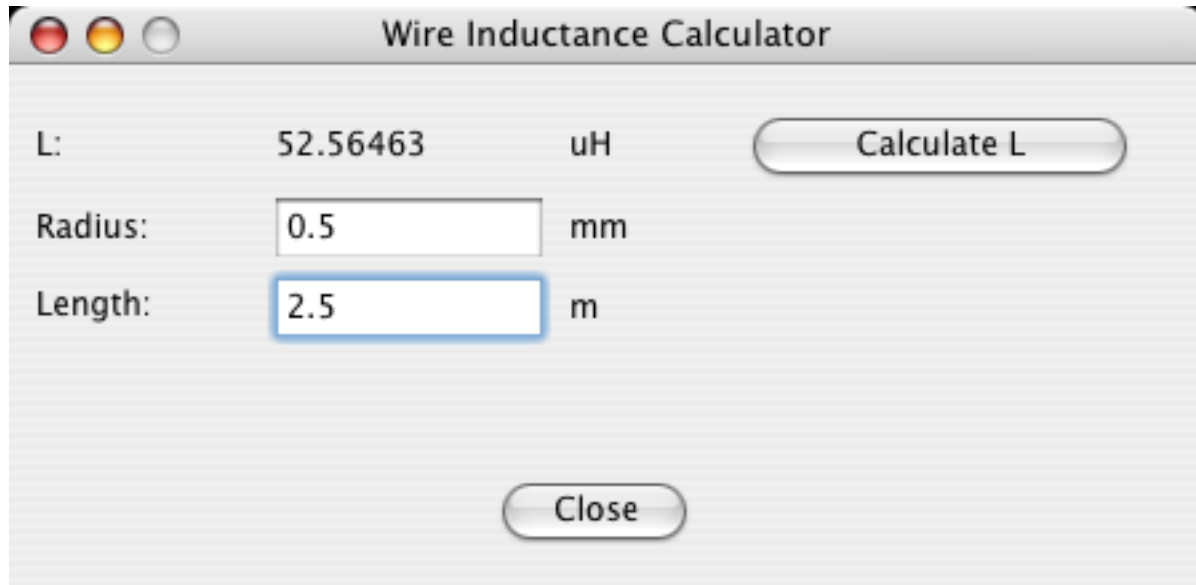
Capacitance: 20 pF    Calc Z    Z: 568.411 ohms

Close

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

Enter in a the radius (in millimeters) 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.

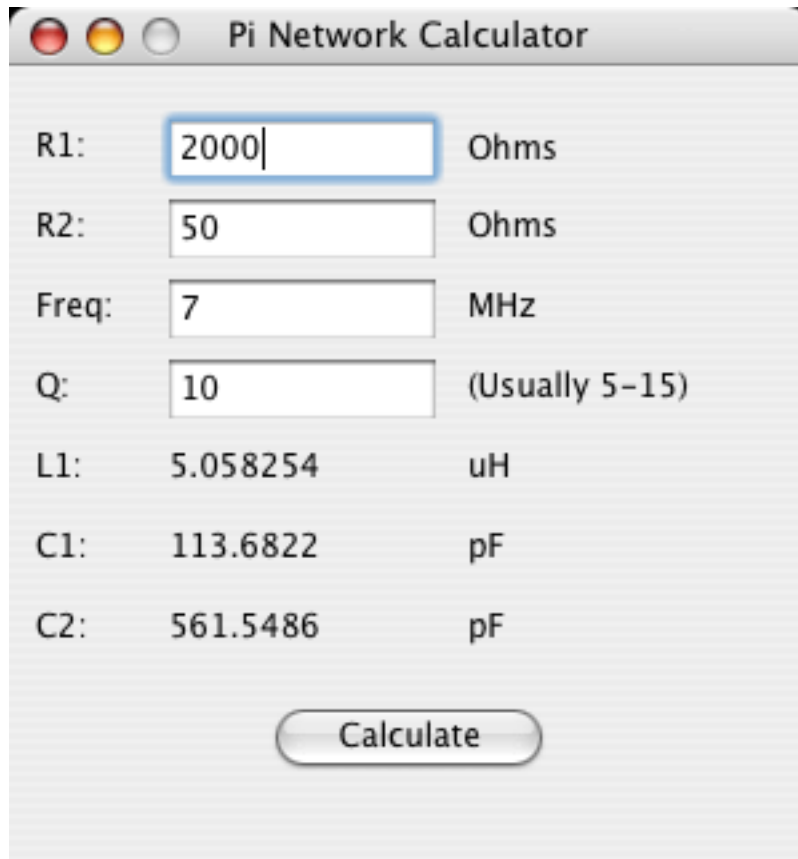


A screenshot of a macOS-style window titled "Wire Inductance Calculator". The window has a light gray background and rounded corners. At the top left are three window control buttons (red, yellow, and gray). The main content area contains the following elements:

- A label "L:" followed by the value "52.56463" and the unit "uH".
- A "Calculate L" button with a gradient and rounded corners.
- A "Radius:" label followed by a text input field containing "0.5" and the unit "mm".
- A "Length:" label followed by a text input field containing "2.5" and the unit "m". The "Length:" input field is highlighted with a blue border.
- A "Close" button with a gradient and rounded corners at the bottom center.

## Pi Network Calculator

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.



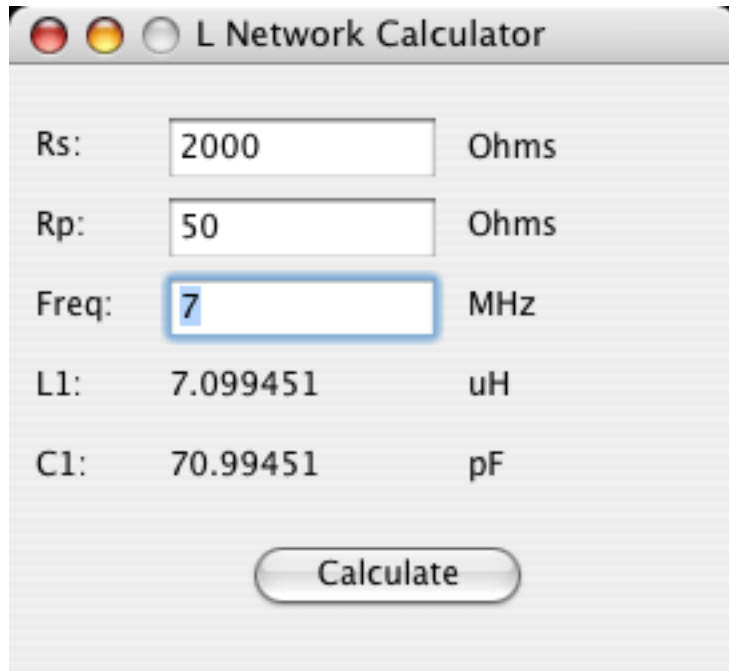
A screenshot of a software window titled "Pi Network Calculator". The window has a standard macOS-style title bar with red, yellow, and green window control buttons. The interface is light gray with a subtle grid. It contains several input fields and labels. The first four rows are for user input: "R1:" with a value of "2000" and unit "Ohms", "R2:" with a value of "50" and unit "Ohms", "Freq:" with a value of "7" and unit "MHz", and "Q:" with a value of "10" and a note "(Usually 5-15)". The next three rows show calculated results: "L1:" with value "5.058254" and unit "uH", "C1:" with value "113.6822" and unit "pF", and "C2:" with value "561.5486" and unit "pF". At the bottom center is a rounded rectangular button labeled "Calculate".

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

## 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.



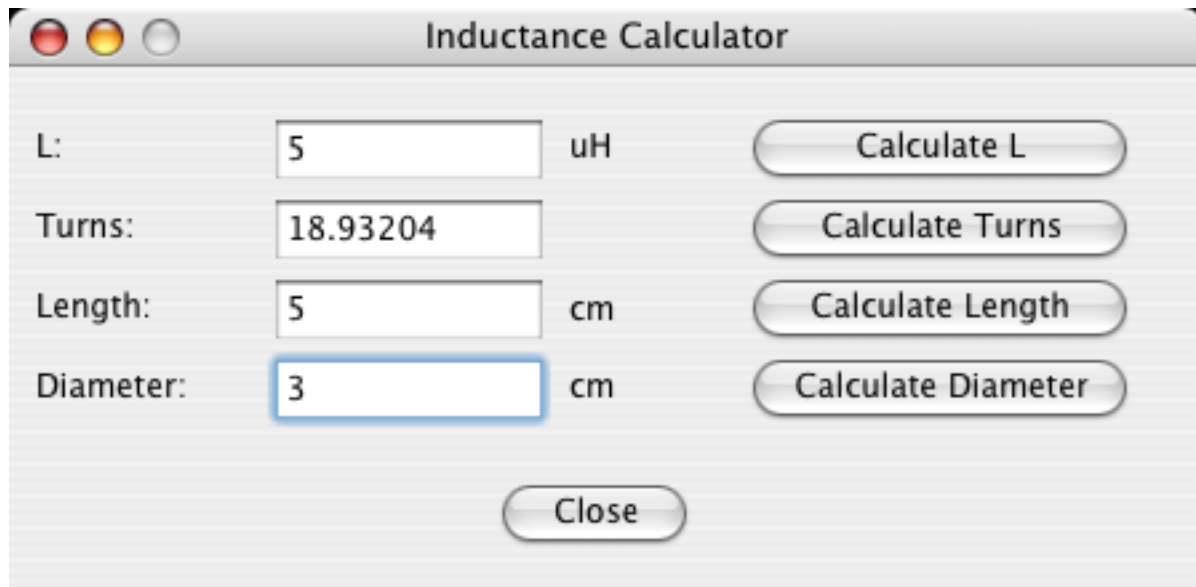
The image shows a screenshot of a software window titled "L Network Calculator". The window has a standard macOS-style title bar with three colored buttons (red, yellow, grey) on the left. The main area of the window contains five rows of input fields and labels. The first three rows are for input: "Rs:" with a text box containing "2000" and the label "Ohms" to its right; "Rp:" with a text box containing "50" and the label "Ohms" to its right; and "Freq:" with a text box containing "7" and the label "MHz" to its right. The last two rows show calculated values: "L1:" with the value "7.099451" and the label "uH" to its right; and "C1:" with the value "70.99451" and the label "pF" to its right. At the bottom center of the window is a rounded rectangular button labeled "Calculate".

Rs:	<input type="text" value="2000"/>	Ohms
Rp:	<input type="text" value="50"/>	Ohms
Freq:	<input type="text" value="7"/>	MHz
L1:	7.099451	uH
C1:	70.99451	pF

Calculate

## 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.



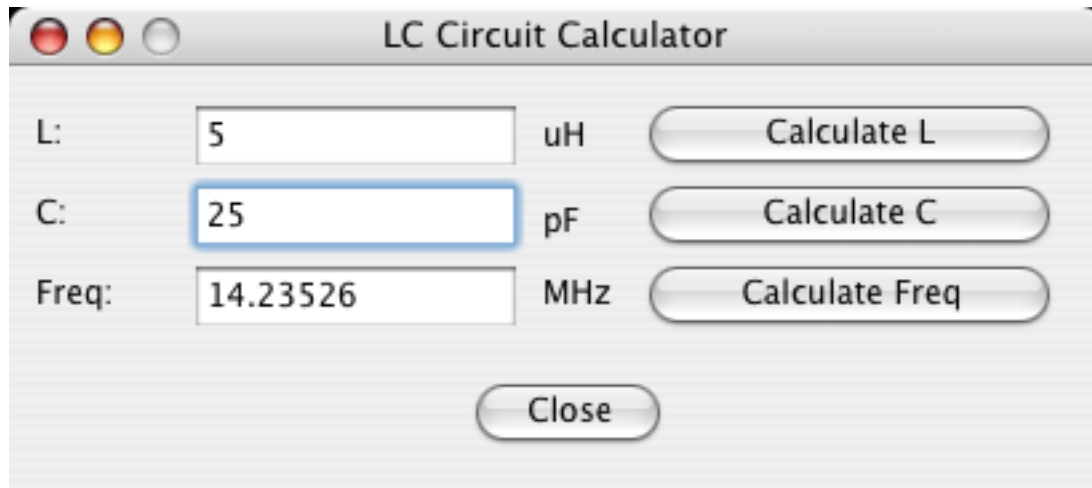
The image shows a window titled "Inductance Calculator" with a standard macOS-style title bar (red, yellow, and green buttons). The window contains four input fields, each with a label, a value, and a unit. To the right of each input field is a corresponding "Calculate" button. The inputs are: L: 5 uH, Turns: 18.93204, Length: 5 cm, and Diameter: 3 cm. The "Diameter" input field is highlighted with a blue border. At the bottom center of the window is a "Close" button.

Field	Value	Unit	Calculate Button
L:	5	uH	Calculate L
Turns:	18.93204		Calculate Turns
Length:	5	cm	Calculate Length
Diameter:	3	cm	Calculate Diameter

Close

## LC Circuit Calculator

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



The image shows a screenshot of a software application window titled "LC Circuit Calculator". The window has a standard macOS-style title bar with red, yellow, and green window control buttons. The interface is organized into three rows, each representing a different parameter of an LC circuit:

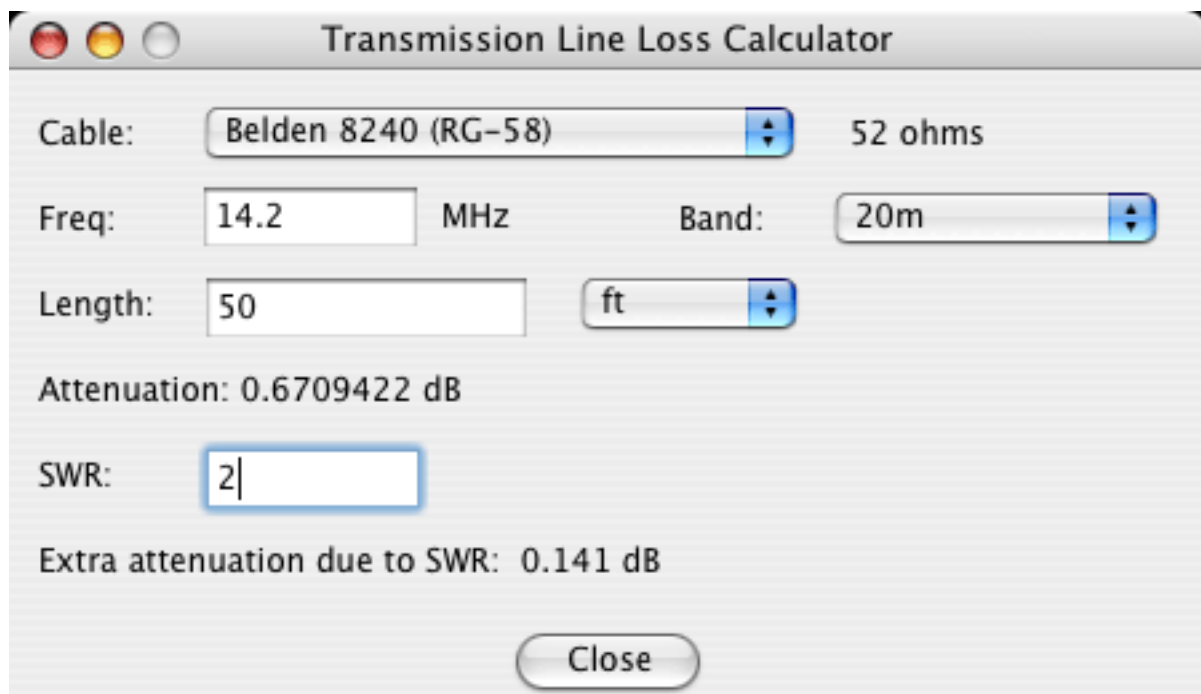
- Row 1:** The label "L:" is followed by a text input field containing the value "5". To the right of the field is the unit "uH". Further right is a button labeled "Calculate L".
- Row 2:** The label "C:" is followed by a text input field containing the value "25". To the right of the field is the unit "pF". Further right is a button labeled "Calculate C". The input field for "C" is highlighted with a blue border, indicating it is the active field.
- Row 3:** The label "Freq:" is followed by a text input field containing the value "14.23526". To the right of the field is the unit "MHz". Further right is a button labeled "Calculate Freq".

At the bottom center of the window is a button labeled "Close".



## 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.



The image shows a screenshot of a software window titled "Transmission Line Loss Calculator". The window has a standard macOS-style title bar with red, yellow, and green window control buttons. The interface includes several input fields and dropdown menus. The "Cable" field is a dropdown menu showing "Belden 8240 (RG-58)" with a value of "52 ohms" displayed to its right. The "Freq:" field contains the value "14.2" followed by the unit "MHz". The "Band:" field is a dropdown menu showing "20m". The "Length:" field contains the value "50" followed by a unit dropdown menu showing "ft". Below these inputs, the calculated "Attenuation: 0.6709422 dB" is displayed. The "SWR:" field contains the value "2". Below this, the calculated "Extra attenuation due to SWR: 0.141 dB" is displayed. At the bottom center of the window is a "Close" button.

Parameter	Value
Cable	Belden 8240 (RG-58)
Impedance	52 ohms
Freq	14.2 MHz
Band	20m
Length	50 ft
Attenuation	0.6709422 dB
SWR	2
Extra attenuation due to SWR	0.141 dB

## 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.

Transmission Line Calculator

Cable: Belden 9913 (RG-8) Ohms: 50 VF: 0.89

Freq: 7 MHz Band: 160m

Matched Loss: 0.323 dB/100 ft

Length: 100 ft Attenuation: 0.323 dB

Electrical Length Modulo 1/2 Wavelength  
0 1/4 1/2 0.8067 wavelengths 290.41 °

Load Resistance: 73 Reactance: 0 ☒ Load ☐ Input

	Input	Load
R	37.509 ohms	73.000 ohms
X	8.775 ohms	0.000 ohms
Z	37.765 ohms	73.000 ohms
SWR	1.42	1.46

SWR: 1.46 Attenuation due to SWR: 0.021 dB Total Loss: 0.344 dB

Input Watts: 100 Cable Loss: 7.18W SWR Loss: 0.45W Power Out: 92.38W

Close

## Resistor Color Code Calculator

The image shows a software window titled "Resistor Calculator". It has two sections for calculating resistor color codes.

**4 Band Code Section:**

- Resistance: A dropdown menu showing "4.7K" with a unit of "ohms".
- Tolerance: A dropdown menu showing "10%".
- Below the dropdowns, the text "470 2" is displayed.
- To the right is a diagram of a 4-band resistor with the following color bands from left to right: Yellow, Violet, Red, and Silver.
- Below the resistor diagram, the color names are listed in a grid:

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

**5 Band Code Section:**

- Resistance: A text input field containing "47000".
- Tolerance: A dropdown menu showing "2%".
- To the right is a diagram of a 5-band resistor with the following color bands from left to right: Yellow, Violet, Black, Red, and Red.
- Below the resistor diagram, the color names are listed in a grid:

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 color code 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.

## Resistor Calculator

The resistor calculator allows you to perform four calculations:

1. Display the values for a resistor series.
2. Find the nearest resistor to a specified value.
3. Find the nearest series combination of resistors to a specified value.
4. Find the nearest parallel combination of resistors to a specified value.

For each of these, you can select which resistor series to use: E6, E12, E24, E48, E96, and S192

Select the series to use by clicking on the series, multiple series can be selected.

## Butterworth and Chebyshev Low and High Pass Filter Design

This window allows you to design a filter. You have two sets of choices, either low or high pass, and either Butterworth or Chebyshev.

A low pass filter attenuates frequencies above the cutoff frequency, while a high pass filter attenuates frequencies below the cutoff frequency.

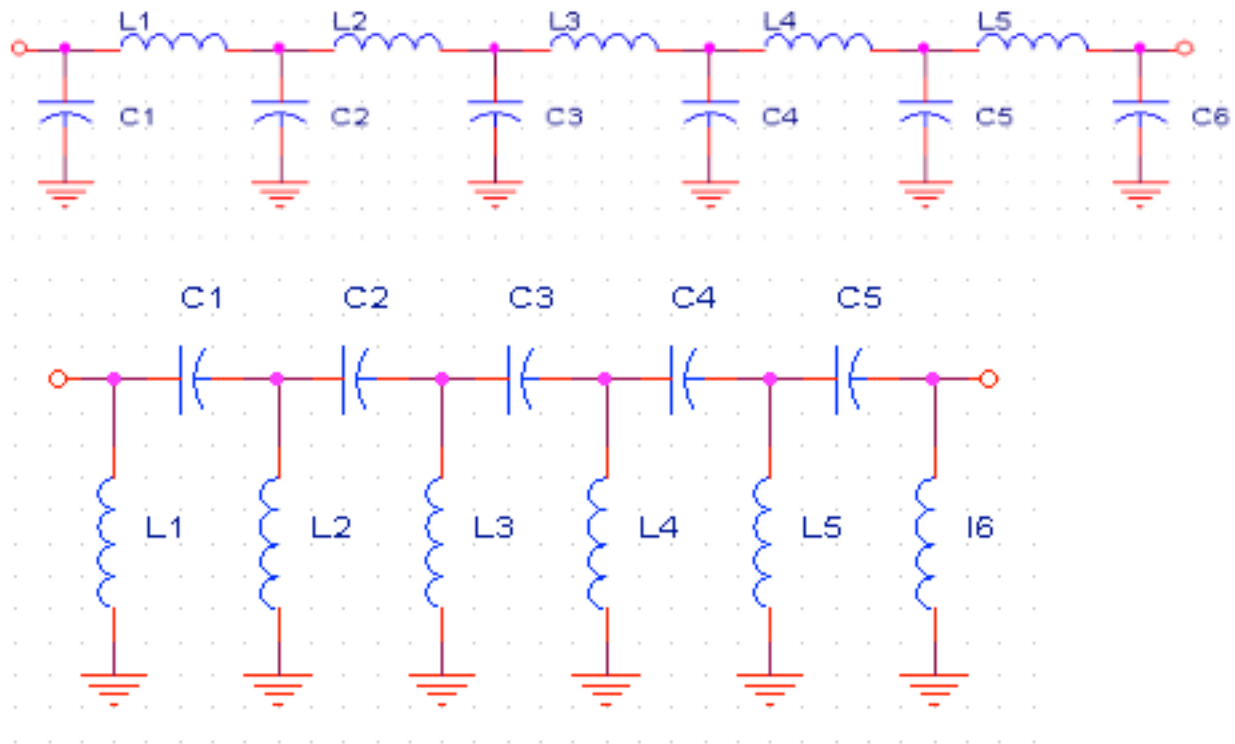
A Butterworth filter has a flat response in the passband and a constant 20 dB per decade attenuation for each pole of the circuit (equal to the order). The attenuation is -3 dB at the cutoff frequency.

A Chebyshev filter has a sharper rate of attenuation than a Butterworth filter, at the expense of ripple in the passband. You specify the amount of ripple allowed in the Ripple box, in dB. Chebyshev filters must have an odd order.

Low Pass Filter:

High Pass Filter:

Enter in the cutoff frequency, impedance, and number of components (order) of the filter, select the unit types and filter type, and click on the



Calculate button. The component values will be displayed. You can change the units for inductance and capacitance, and the values will adjust, accordingly.

## RF Link Budget Calculator

This window allows you to perform calculations related to an RF link. You can calculate the required transmitter power, gain margin, or maximum distance, based on two of these parameters as well the frequency, transmit and receive antenna gains, cable losses, and receiver sensitivity.

To use the calculator, select the units (miles or km) as well as which parameter you wish to calculate. Then enter in the other parameters, the calculation will update as you enter each parameter.



## Skin Depth Calculator

Enter in the frequency in MHz, the Resistivity in micro-ohm per cm, and the Relative Permeability. Click Calculate, and the skin depth in both micrometers and microinches will be calculated.

At the bottom of the window is a table of Resistivity and Relative

Permeability values for common metals.

## Gamma Match Calculator

This allows you to calculate the performance of a gamma match, which is typically used to transform the impedance of a yagi or other antenna to match the impedance of the transmission line connected to it.

The gamma match consists of a short rod which is parallel to the driven element. The length of the rod, as well as the spacing and relative diameters of the rod and driven element determine the impedance transformation. By entering in these dimensions, as well as the input impedance of the antenna, the input impedance of the gamma match can be determined.

The goal is to produce a gamma match input impedance with a real component equal to the characteristic impedance of the transmission line (typically 52 or 75 ohms). There will also be a reactive component, this is cancelled by putting a capacitor in series with the connection to the center conductor of the coax, RF ToolBox converts the impedance to a capacitance for the design frequency.

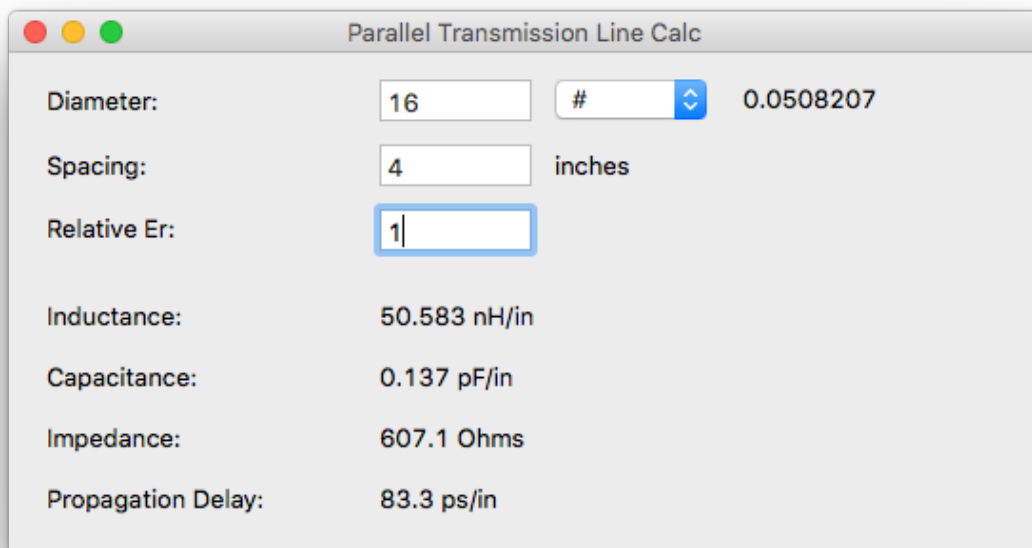
## Parallel Transmission Line / Ladder Line Calculator

This tool calculates the impedance of a parallel wire / ladder line style transmission line, as well as the line's inductance, capacitance, and propagation delay per inch or meter.

From the popup menu, select the units for the wire diameter, either inches, mm, or wire gauge. If wire gauge is selected, then the units for the spacing will be inches, otherwise it will be whichever units were selected for the gauge.

Enter in the wire spacing, along with the Relative dielectric constant ( $\epsilon_r$ ) which is 1 for free space.

The various values will be computed as you make changes to any of the inputs.



A screenshot of a macOS-style window titled "Parallel Transmission Line Calc". The window contains input fields for Diameter, Spacing, and Relative  $\epsilon_r$ , and output fields for Inductance, Capacitance, Impedance, and Propagation Delay. The Diameter input is set to 16 with a unit dropdown menu showing "#". The Spacing input is set to 4 with a unit dropdown menu showing "inches". The Relative  $\epsilon_r$  input is set to 1. The output fields show: Inductance: 50.583 nH/in, Capacitance: 0.137 pF/in, Impedance: 607.1 Ohms, and Propagation Delay: 83.3 ps/in.

Input	Value	Unit
Diameter	16	#
Spacing	4	inches
Relative $\epsilon_r$	1	

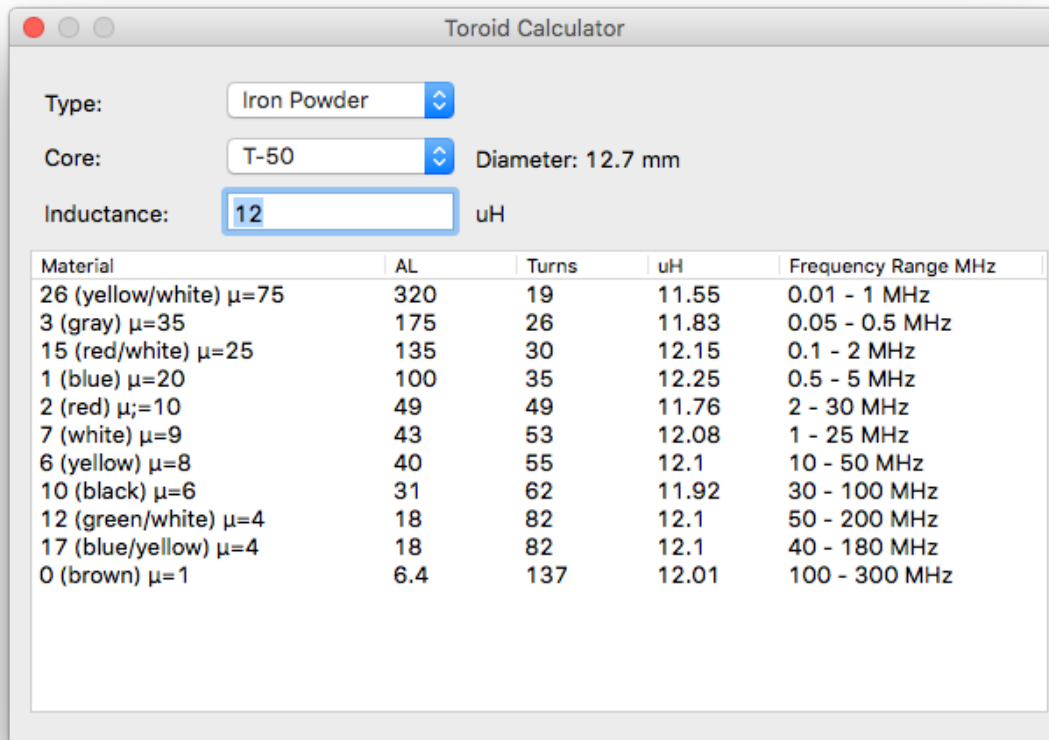
  

Output	Value
Inductance	50.583 nH/in
Capacitance	0.137 pF/in
Impedance	607.1 Ohms
Propagation Delay	83.3 ps/in

## Toroid Core Calculator

This tool calculates the number of turns required for a particular inductance on many commonly available iron powder and ferrite toroid cores.

Select the type of material, and then the core size, and enter in the desired inductance. The calculator will compute the number of turns required for more materials available in that size. The nearest integer number of turns will be displayed, along with the actual inductance for that number.



Material	AL	Turns	uH	Frequency Range MHz
26 (yellow/white) $\mu=75$	320	19	11.55	0.01 - 1 MHz
3 (gray) $\mu=35$	175	26	11.83	0.05 - 0.5 MHz
15 (red/white) $\mu=25$	135	30	12.15	0.1 - 2 MHz
1 (blue) $\mu=20$	100	35	12.25	0.5 - 5 MHz
2 (red) $\mu_r=10$	49	49	11.76	2 - 30 MHz
7 (white) $\mu=9$	43	53	12.08	1 - 25 MHz
6 (yellow) $\mu=8$	40	55	12.1	10 - 50 MHz
10 (black) $\mu=6$	31	62	11.92	30 - 100 MHz
12 (green/white) $\mu=4$	18	82	12.1	50 - 200 MHz
17 (blue/yellow) $\mu=4$	18	82	12.1	40 - 180 MHz
0 (brown) $\mu=1$	6.4	137	12.01	100 - 300 MHz

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## Revision History

5.2.0:

Updated to 64 bit application for macOS.

Added Toroid Core Calculator

5.0.0:

Added Parallel Wire / Ladder Line Calculator.

Several bug fixes and user interface improvements.

4.0.0:

Added a tool selection window.

Several bug fixes and user interface improvements.

3.9.0:

Added Skin Depth Calculator.

Corrected a bug with the input impedance in the Transmission Line Calc.

3.7.0:

Added Long Yagi Antenna Design.

Added Gamma Match Calculator

3.6.0:

Added RF Link Budget Calculator.

3.5.0:

Added Tee Attenuation Calculator.

Added Zener Diode Calculator.

Added 555 Timer Oscillator Calculator.

Added Thermal Noise Calculator.

Added PI Attenuation Calculator.



3.4.0:

Added Butterworth and Chebyshev Low and High Pass Filter Design.

Fixed a bug with the wire inductance calculator.

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 resistance 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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