IMPEDANCE MATCH DOCUMENTATION


```
octave
 19.7055780      161590.8753896     328877.4285826
      2                15                  16

 40.1057288      2587.1740786       648071.9826312
      3                9                   17

 79.0306568      5098.1760644       1318986.8961987
      4                10                  18

 160.8469483     10376.0501977      2599139.9183829
      5                11                  19

 316.9582089     20446.6066658      5289893.0760982
      6                12                  20

 645.0884089     41613.9055332      10424040.0702156
      7                13                  21

 1271.1839969    82002.6061993      21215501.7136245
      8                14                  22
```
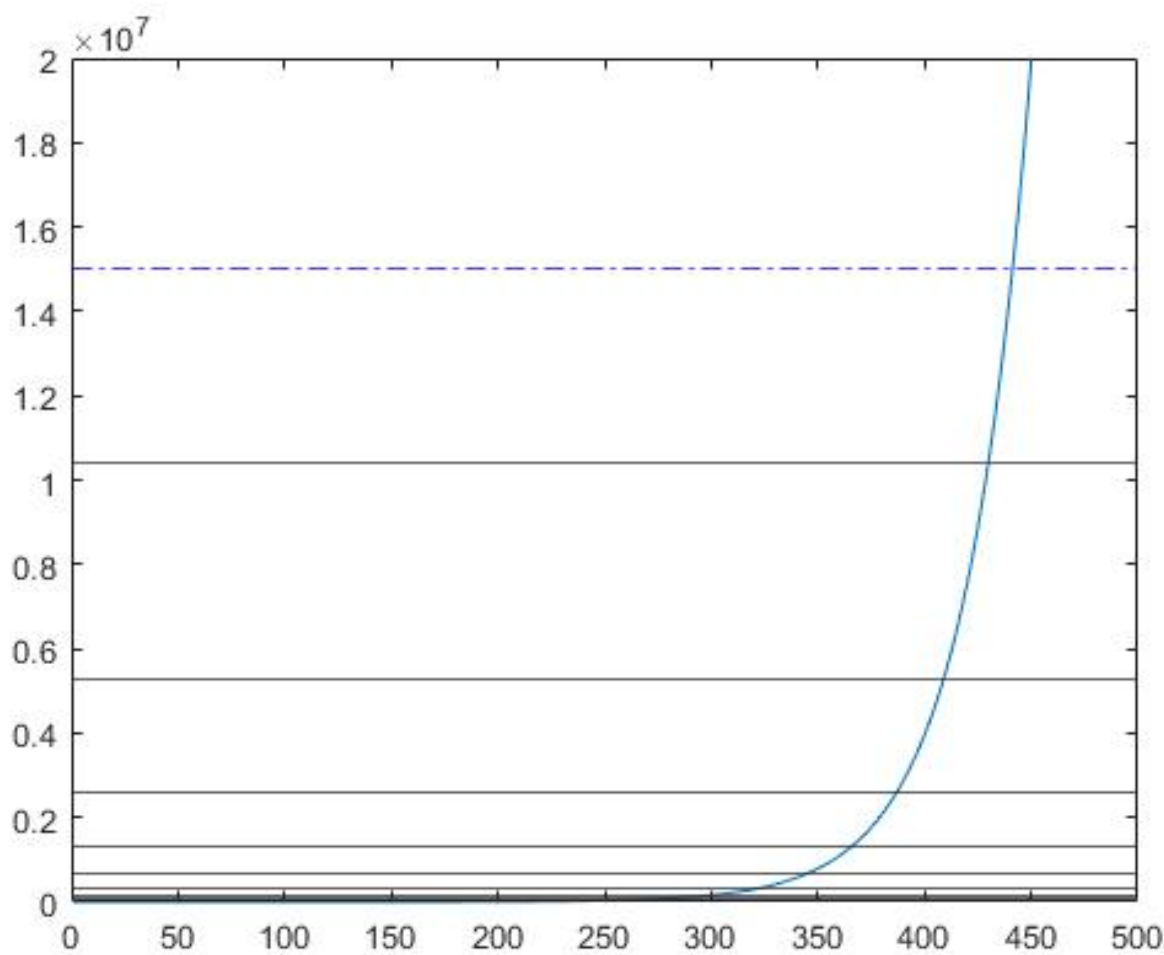
```matlab
numfreq = 500;
y = logspace(1,8,numfreq);
stopFreq = y(numfreq);
startFreq = y(1);
a = double(startFreq);
c = 1;
figure(4);
plot(y);
xlim([0 numfreq]);
ylim([0 20000000]);
yline(15*10^6,'-.b');

while a <= 15000000

a = a*2;
[val,idx]=min(abs(y-a));
minVal=y(idx);


fprintf('%.7f\n',minVal)

yline(minVal);

c = c+1;
disp(c);

end
```
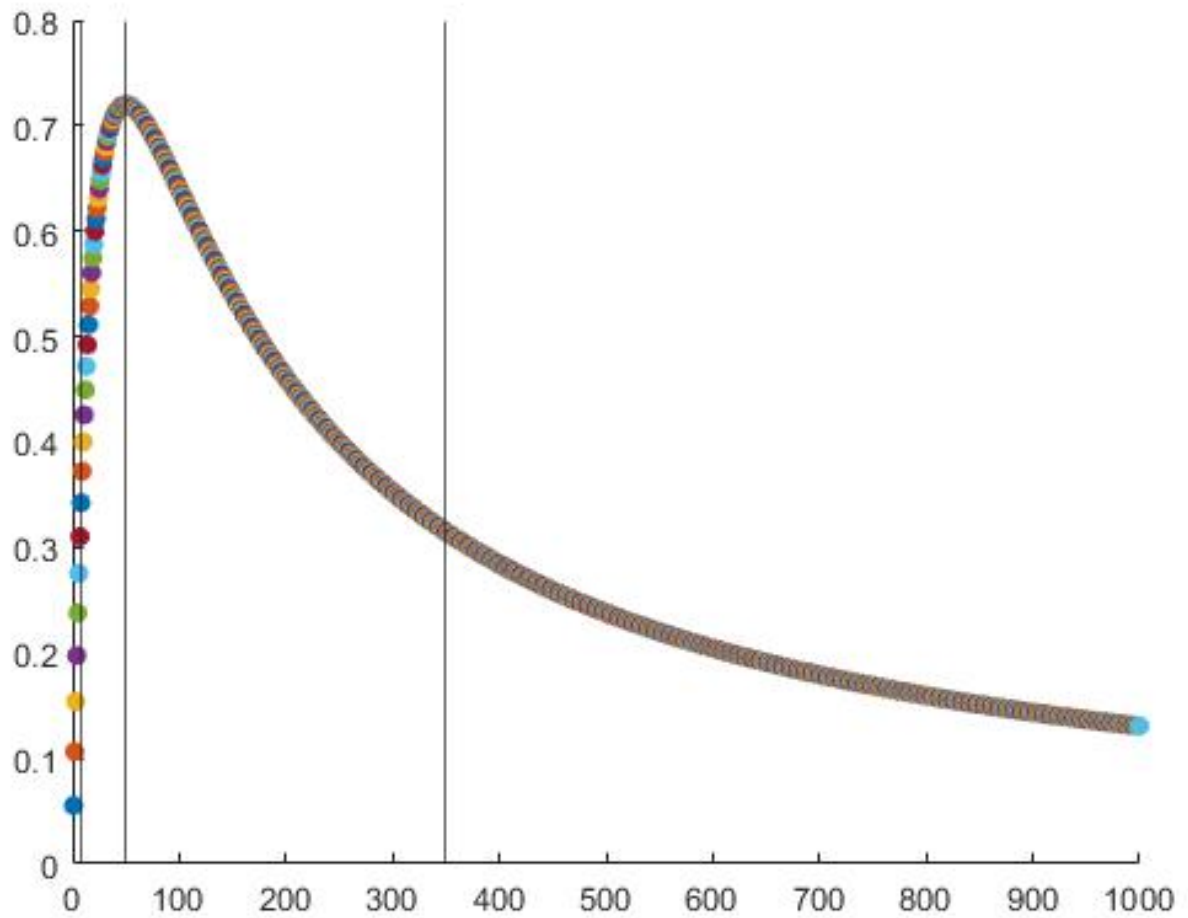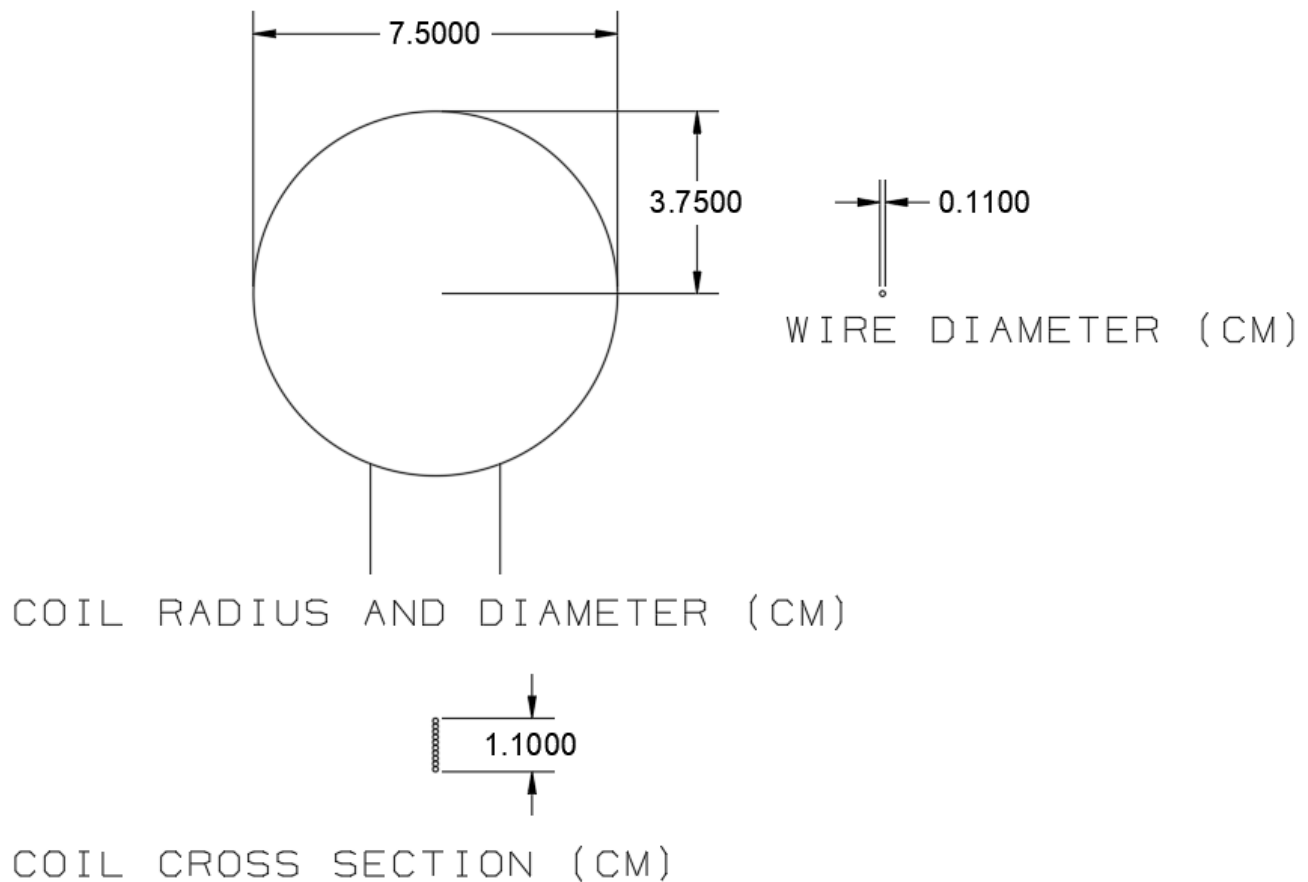
```
Vs = 12;
Zs = 50;
Zl = 0;
PL = 0;
figure(2);
scatter(Zl,PL,'filled');
x = [];
for c = 1:1000
Zl = Zl+1;
PL = (((Vs)/(Zs+Zl))^2)*Zl;
disp(PL);
scatter(Zl,PL,'filled');
hold on
x = [x, PL];
end
xline(50);
xline(7);
xline(350);
[M,I] = max(x)
```

Calculations

```
      |-------- 7.5000 --------|
```

3.7500

0.1100

WIRE DIAMETER (CM)

COIL RADIUS AND DIAMETER (CM)

1.1000

COIL CROSS SECTION (CM)

Final Coil Inductance: 50.469 uH

Transformer 1
Boundaries: ~%43.75 ---- %100 ---- ~%43.75
Primary Impedance: 7Ω   50Ω   350Ω
Transformer 1 Frequency Range: 160.84Hz   1277.17Hz   5.098Khz

Inductor Impedance Formula: Xl = 2ΠfL
f = frequency
L = Coil Inductance

Coil Impedance at 160.84 Hz: 2Π(160.84)(50.469*10^-6) = .05097748Ω

Impedance Matching Formula: (Primary Turns/Secondary Turns) =
sqrt(Primary Impedance/Secondary Impednace)

(100/Secondary Turns) = sqrt(7Ω / .05097748Ω)
Secondary Turns: 9
Final Turn Ratio 100:9

```
(100/90) = sqrt( 50Ω / Secondary Impedance)
Secondary Impedance: 2.853
Coil Frequency at Specific Impedance: 0.405 = 2Πf(50.469*10^-6)
Coil Frequency at Specific Impedance: 1277.17Hz

(100/90) = sqrt( 350Ω / Secondary Impedance)
Secondary Impedance: 2.835
Coil Frequency at Specific Impedance: Ω2.835 = 2Πf(50.469*10^-6)
Coil Frequency at Specific Impedance: 8.94 Khz

Normalized based on octave allocations: 5.098 Khz
Secondary Impedance at 5.098 Khz: 1.61578Ω
Primary Impedance at 5.098Khz: Ω199.469
Power Transfer at Primary Impedance: 64%
```

Transformer 2
```
Boundaries:                        ~%43.75 ---- %100 ---- ~%43.75
Primary Impedance:                    7Ω          50Ω        350Ω
Transformer 1 Frequency Range:     5.098Khz    36.32Khz   328.7Khz

Inductor Impedance Formula: Xl = 2ΠfL
f = frequency
L = Coil Inductance

Coil Impedance at 5.098Khz Hz: 2Π(5098)(50.469*10^-6) = 1.61578Ω
Impedance Matching Formula: (Primary Turns/Secondary Turns) =
sqrt(Primary Impedance/Secondary Impednace)

(100/Secondary Turns) = sqrt( 7Ω / 1.61578Ω )
Secondary Turns: 48
Final Turn Ratio 100:48

(100/90) = sqrt( 50Ω / Secondary Impedance)
Secondary Impedance: 11.52Ω
Coil Frequency at Specific Impedance: 11.52Ω = 2Πf(50.469*10^-6)
Coil Frequency at Specific Impedance: 36.3215 Khz

(100/90) = sqrt( 350Ω / Secondary Impedance)
Secondary Impedance: 80.64Ω
Coil Frequency at Specific Impedance: 80.64Ω = 2Πf(50.469*10^-6)
Coil Frequency at Specific Impedance: 254.299824 Khz

Normalized based on octave allocations: 328.7Khz
Secondary Impedance at 328.7 Khz: 104.17Ω
Primary Impedance at 5.098Khz: 452.126Ω
Power Transfer at Primary Impedance: 35.27%
```

Transformer 3

```
Boundaries:                         ~%43.75 ---- %100 ---- ~%43.75
Primary Impedance:                    7Ω          50Ω         350Ω
Transformer 1 Frequency Range:    328.7Khz    2.397 Mhz
```

Inductor Impedance Formula: Xl = 2ΠfL
f = frequency
L = Coil Inductance

Coil Impedance at 328.7 Khz: 2Π(328.7Khz)(50.469*10^-6) = 104.17Ω
Impedance Matching Formula: (Primary Turns/Secondary Turns) =
sqrt(Primary Impedance/Secondary Impedance)

(100/Secondary Turns) = sqrt(7Ω / 104.17Ω)
Secondary Turns: 48
Final Turn Ratio 10:39

(100/90) = sqrt(50Ω / Secondary Impedance)
Secondary Impedance:760.5Ω
Coil Frequency at Specific Impedance: 760.5Ω = 2Πf(50.469*10^-6)
Coil Frequency at Specific Impedance: 2.398 Mhz

Coil Impedance for a Frequency of 21.215Mhz: 6723.9Ω = 2Π(2398251)
(50.469*10^-6)
Primary Impedance: 442.07
Power Delivery at this Impedance: %36.51

Lower Bound	Upper Bound	Span		Turn Ratio	~43.75% Max Power	100% Max Power	~43.75% Max Power
160.84Hz	316.95Hz	156.110Hz					
316.95Hz	645.08Hz	328.130Hz					
645.08Hz	1.271KHz	615.920Hz	Transformer 1	100:9	160.84 Hz	1277.17 Hz	5.098 Khz (64%)
1.271KHz	2.587KHz	1.3160KHz					
2.587KHz	5.098KHz	2.511KHz					
5.098KHz	10.376KHz	5.278KHz					
10.376KHz	20.446KHz	10.070KHz					
20.446KHz	41.613KHz	21.1670KHz					
41.613KHz	82.002KHz	40.389KHz	Transformer 2	100:48	5.098 Khz	36.3285 Khz	328.877 Khz (35.27%)
82.002KHz	161.590KHz	79.588KHz					
161.590KHz	328.877KHz	167.287KHz					
328.877KHz	648.071KHz	319.194KHz					
648.071KHz	1.328MHz	680.0KHz					
1.328MHz	2.599MHz	1.271MHz					
2.599MHz	5.289MHz	2.690MHz	Transformer 3	10:39	328.877 Khz	2.39721 Mhz	21.215MHz (36.51%)
5.289MHz	10.424MHz	5.135MHz					
10.424MHz	21.215MHz	10.791MHz					