

01-30-2019

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# Klipsch Horn Modeling with Various Drivers

A Klipsch K-horn cabinet has been previously modeled for:

- 1) Horn mouth size
- 2) Effective acoustic length

These two factors are held constant, while the Klipsch K-33 driver and other replacement drivers are modeled. Horn parameters are tweaked with the intent of improving the SPL response for each particular driver. It should be noted that 12 inch drivers are being investigated, since creating the initial horn folds should be easier with two drivers, with folds being similar to the Klipsch Jubilee.

# JBL 136A Driver - 16Hz

 **Hornresp - Input Parameters** — □ ×

File Tools Window Help

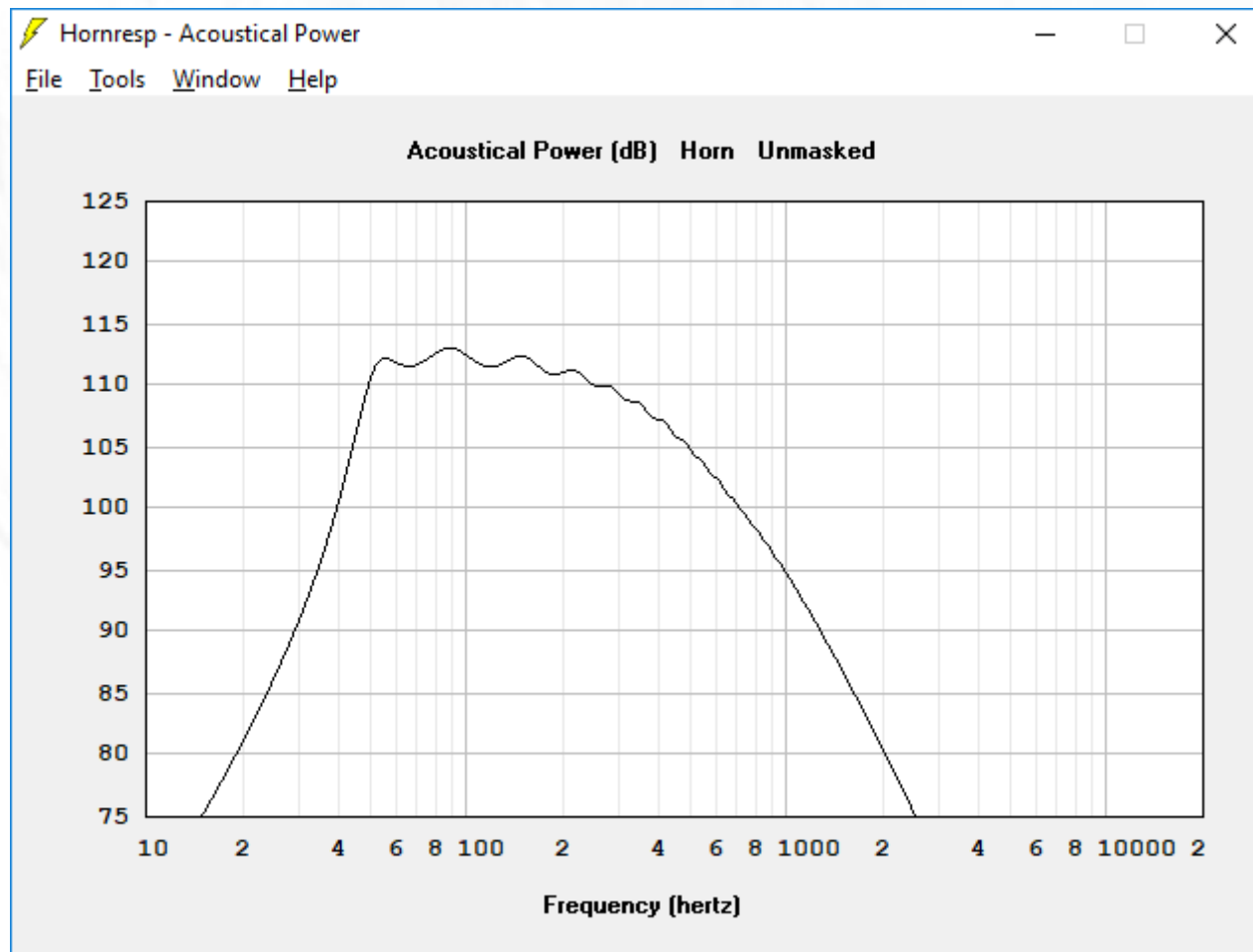
<b>Ang</b>	<input type="text" value="0.5 x Pi"/>	<b>Eg</b>	<input type="text" value="2.83"/>	<b>Rg</b>	<input type="text" value="0.00"/>	<b>Cir</b>	<input type="text" value="0.84"/>
<b>S1</b>	<input type="text" value="239.00"/>	<b>S2</b>	<input type="text" value="4056.00"/>	<b>Exp</b>	<input type="text" value="172.00"/>	<b>F12</b>	<input type="text" value="45.06"/>
<b>S2</b>	<input type="text" value="0.00"/>	<b>S3</b>	<input type="text" value="0.00"/>	<b>L23</b>	<input type="text" value="0.00"/>	<b>AT</b>	<input type="text" value="4.11"/>
<b>S3</b>	<input type="text" value="0.00"/>	<b>S4</b>	<input type="text" value="0.00"/>	<b>L34</b>	<input type="text" value="0.00"/>	<b>F34</b>	<input type="text" value="0.00"/>
<b>S4</b>	<input type="text" value="0.00"/>	<b>S5</b>	<input type="text" value="0.00"/>	<b>L45</b>	<input type="text" value="0.00"/>	<b>F45</b>	<input type="text" value="0.00"/>

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<b>Sd</b>	<input type="text" value="889.60"/>	<b>Cms</b>	<input type="text" value="6.52E-04"/>	<b>Mmd</b>	<input type="text" value="136.46"/>	<b>Re</b>	<input type="text" value="6.30"/>
<b>Bl</b>	<input type="text" value="21.00"/>	<b>Rms</b>	<input type="text" value="2.77"/>	<b>Le</b>	<input type="text" value="1.40"/>	<b>Nd</b>	<input type="text" value="1"/>
<b>Vrc</b>	<input type="text" value="20.00"/>	<b>Fr</b>	<input type="text" value="100.00"/>	<b>Vtc</b>	<input type="text" value="1000.00"/>	<b>CAUTION:</b>	
<b>Lrc</b>	<input type="text" value="16.00"/>	<b>Tal</b>	<input type="text" value="4.00"/>	<b>Atc</b>	<input type="text" value="883.00"/>	<b>Atc &lt; Sd</b>	

**Comment**

# JBL 136A SPL



# Eminence Lab 12 Driver - 22Hz

 **Hornresp - Input Parameters** — □ ×

File Tools Window Help

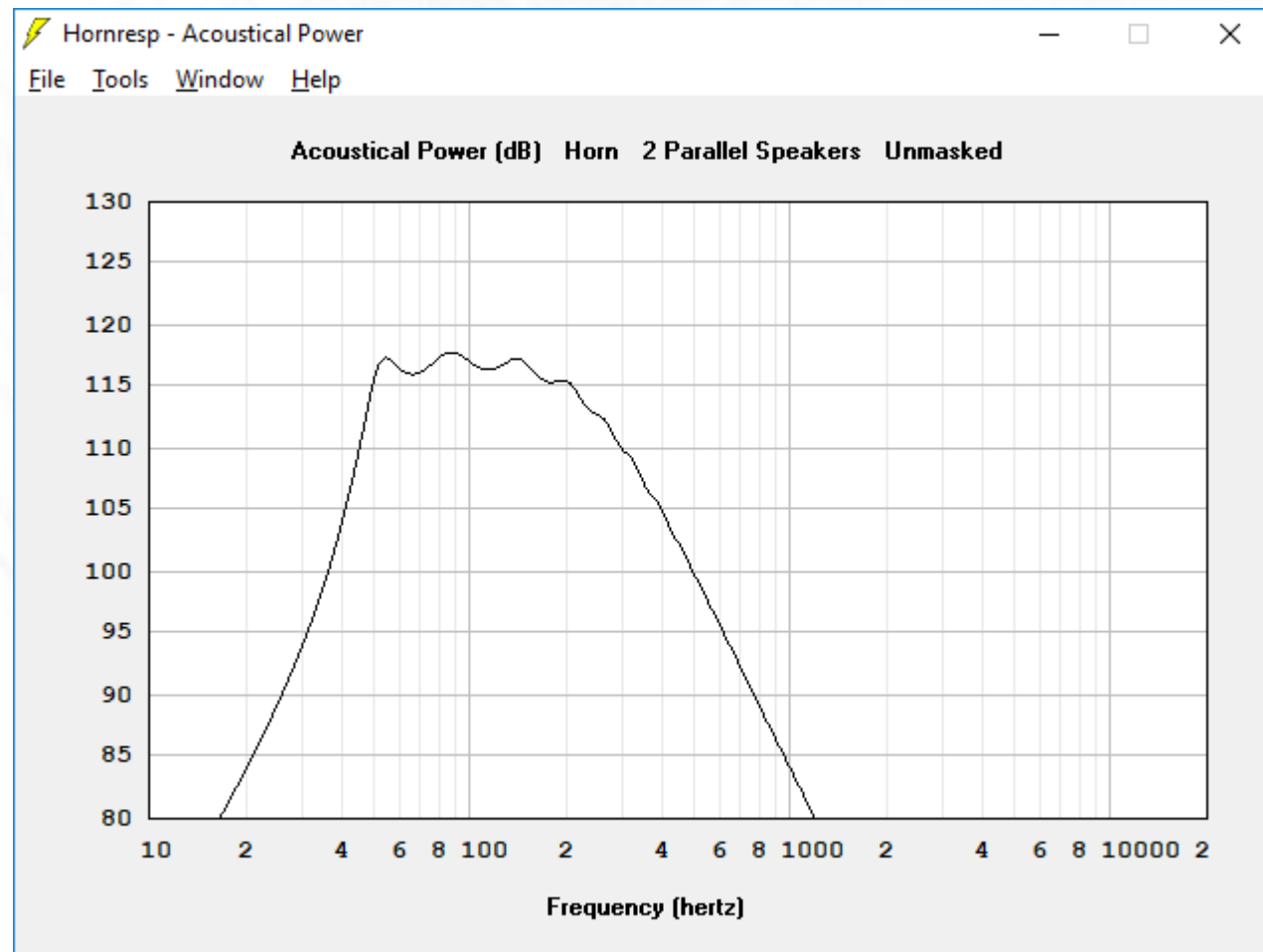
<b>Ang</b>	<input type="text" value="0.5 x Pi"/>	<b>Eg</b>	<input type="text" value="2.83"/>	<b>Rg</b>	<input type="text" value="0.00"/>	<b>Cir</b>	<input type="text" value="0.58"/>
<b>S1</b>	<input type="text" value="125.00"/>	<b>S2</b>	<input type="text" value="2025.00"/>	<b>Exp</b>	<input type="text" value="172.00"/>	<b>F12</b>	<input type="text" value="44.32"/>
<b>S2</b>	<input type="text" value="0.00"/>	<b>S3</b>	<input type="text" value="0.00"/>	<b>L23</b>	<input type="text" value="0.00"/>	<b>AT</b>	<input type="text" value="2.92"/>
<b>S3</b>	<input type="text" value="0.00"/>	<b>S4</b>	<input type="text" value="0.00"/>	<b>L34</b>	<input type="text" value="0.00"/>	<b>F34</b>	<input type="text" value="0.00"/>
<b>S4</b>	<input type="text" value="0.00"/>	<b>S5</b>	<input type="text" value="0.00"/>	<b>L45</b>	<input type="text" value="0.00"/>	<b>F45</b>	<input type="text" value="0.00"/>

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<b>Sd</b>	<input type="text" value="520.00"/>	<b>Cms</b>	<input type="text" value="3.24E-04"/>	<b>Mmd</b>	<input type="text" value="154.69"/>	<b>Re</b>	<input type="text" value="4.30"/>
<b>Bl</b>	<input type="text" value="15.00"/>	<b>Rms</b>	<input type="text" value="1.68"/>	<b>Le</b>	<input type="text" value="1.48"/>	<b>Nd</b>	<input type="text" value="1"/>
<b>Vrc</b>	<input type="text" value="8.00"/>	<b>Fr</b>	<input type="text" value="100.00"/>	<b>Vtc</b>	<input type="text" value="2170.00"/>		
<b>Lrc</b>	<input type="text" value="12.00"/>	<b>Tal</b>	<input type="text" value="4.00"/>	<b>Atc</b>	<input type="text" value="545.00"/>		

**Comment**

# Eminence Lab 12 SPL



# Caire HW321 Driver – 27Hz

 **Hornresp - Input Parameters** — □ ×

File Tools Window Help

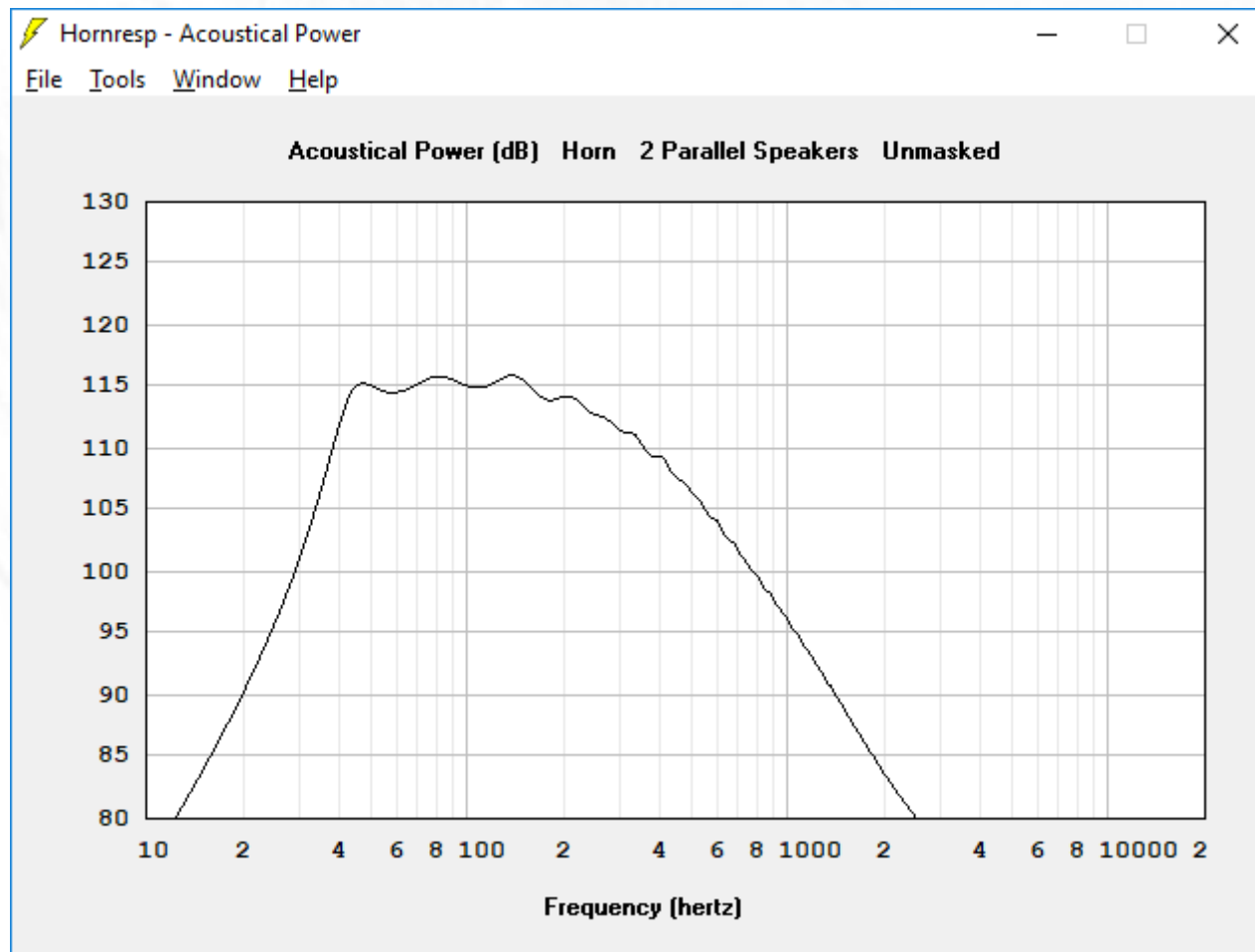
<b>Ang</b>	<input type="text" value="0.5 x Pi"/>	<b>Eg</b>	<input type="text" value="2.83"/>	<b>Rg</b>	<input type="text" value="0.00"/>	<b>Cir</b>	<input type="text" value="0.40"/>
<b>S1</b>	<input type="text" value="300.00"/>	<b>S2</b>	<input type="text" value="2025.00"/>	<b>Exp</b>	<input type="text" value="172.00"/>	<b>F12</b>	<input type="text" value="30.39"/>
<b>S2</b>	<input type="text" value="0.00"/>	<b>S3</b>	<input type="text" value="0.00"/>	<b>L23</b>	<input type="text" value="0.00"/>	<b>AT</b>	<input type="text" value="3.10"/>
<b>S3</b>	<input type="text" value="0.00"/>	<b>S4</b>	<input type="text" value="0.00"/>	<b>L34</b>	<input type="text" value="0.00"/>	<b>F34</b>	<input type="text" value="0.00"/>
<b>S4</b>	<input type="text" value="0.00"/>	<b>S5</b>	<input type="text" value="0.00"/>	<b>L45</b>	<input type="text" value="0.00"/>	<b>F45</b>	<input type="text" value="0.00"/>

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<b>Sd</b>	<input type="text" value="535.00"/>	<b>Cms</b>	<input type="text" value="5.02E-04"/>	<b>Mmd</b>	<input type="text" value="62.08"/>	<b>Re</b>	<input type="text" value="5.70"/>
<b>Bl</b>	<input type="text" value="13.20"/>	<b>Rms</b>	<input type="text" value="3.82"/>	<b>Le</b>	<input type="text" value="0.90"/>	<b>Nd</b>	<input type="text" value="1"/>
<b>Vrc</b>	<input type="text" value="25.00"/>	<b>Fr</b>	<input type="text" value="100.00"/>	<b>Vtc</b>	<input type="text" value="2170.00"/>		
<b>Lrc</b>	<input type="text" value="14.00"/>	<b>Tal</b>	<input type="text" value="4.00"/>	<b>Atc</b>	<input type="text" value="545.00"/>		


**Comment**

# Caire HW321 SPL





# Beyma 12BR70 Driver – 31Hz

 **Hornresp - Input Parameters** — □ ×

File Tools Window Help

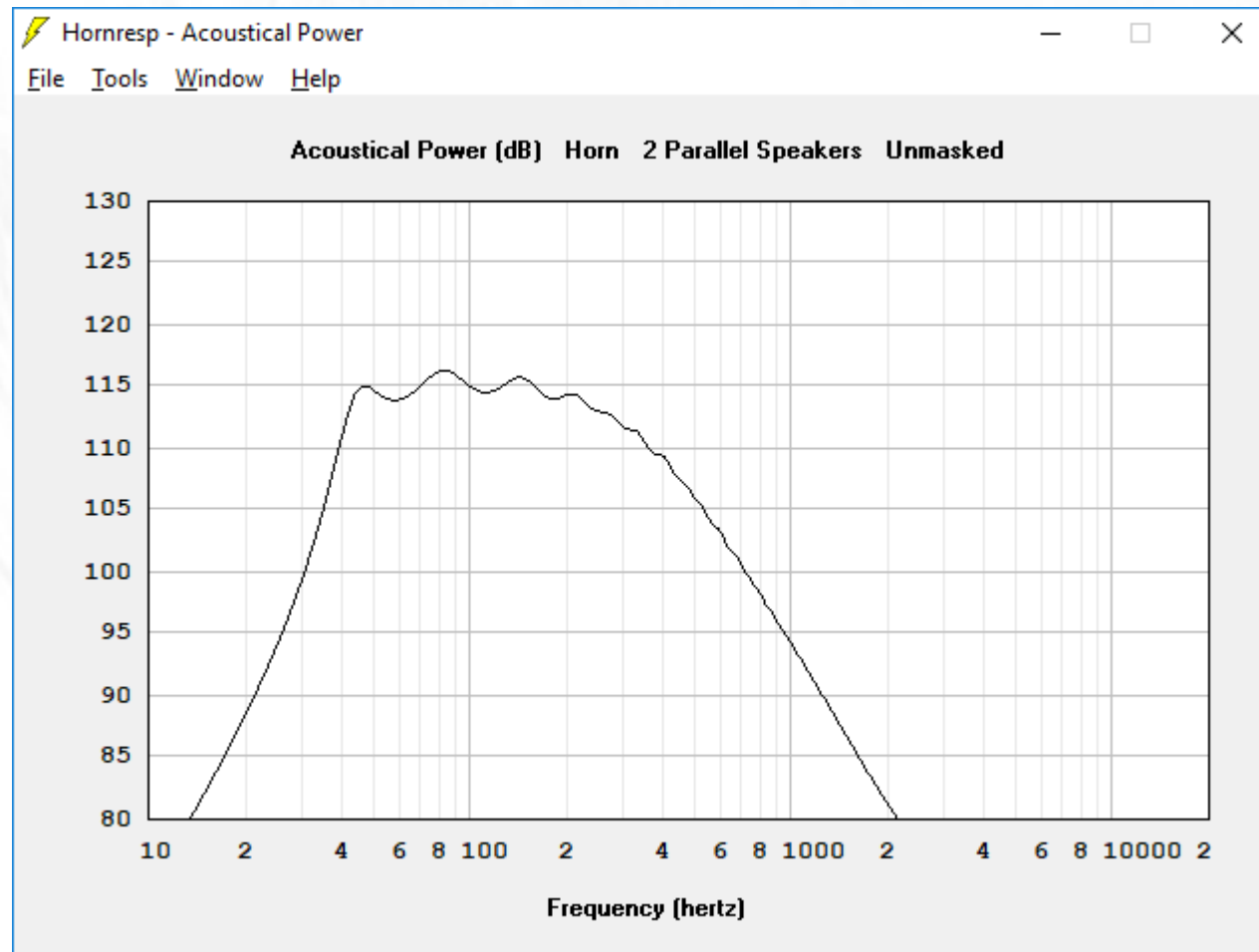
<b>Ang</b>	<input type="text" value="0.5 x Pi"/>	<b>Eg</b>	<input type="text" value="2.83"/>	<b>Rg</b>	<input type="text" value="0.00"/>	<b>Cir</b>	<input type="text" value="0.47"/>
<b>S1</b>	<input type="text" value="215.00"/>	<b>S2</b>	<input type="text" value="2025.00"/>	<b>Exp</b>	<input type="text" value="172.00"/>	<b>F12</b>	<input type="text" value="35.69"/>
<b>S2</b>	<input type="text" value="0.00"/>	<b>S3</b>	<input type="text" value="0.00"/>	<b>L23</b>	<input type="text" value="0.00"/>	<b>AT</b>	<input type="text" value="3.09"/>
<b>S3</b>	<input type="text" value="0.00"/>	<b>S4</b>	<input type="text" value="0.00"/>	<b>L34</b>	<input type="text" value="0.00"/>	<b>F34</b>	<input type="text" value="0.00"/>
<b>S4</b>	<input type="text" value="0.00"/>	<b>S5</b>	<input type="text" value="0.00"/>	<b>L45</b>	<input type="text" value="0.00"/>	<b>F45</b>	<input type="text" value="0.00"/>

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<b>Sd</b>	<input type="text" value="520.00"/>	<b>Cms</b>	<input type="text" value="3.68E-04"/>	<b>Mmd</b>	<input type="text" value="64.79"/>	<b>Re</b>	<input type="text" value="5.60"/>
<b>Bl</b>	<input type="text" value="12.10"/>	<b>Rms</b>	<input type="text" value="3.17"/>	<b>Le</b>	<input type="text" value="0.85"/>	<b>Nd</b>	<input type="text" value="1"/>
<b>Vrc</b>	<input type="text" value="22.00"/>	<b>Fr</b>	<input type="text" value="100.00"/>	<b>Vtc</b>	<input type="text" value="2170.00"/>		
<b>Lrc</b>	<input type="text" value="14.00"/>	<b>Tal</b>	<input type="text" value="4.00"/>	<b>Atc</b>	<input type="text" value="545.00"/>		

**Comment**

# Beyma 12BR70 SPL



# Eminence BP122 Driver - 35Hz

 Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.48
S1	200.00	S2	2025.00	Exp	172.00	F12	36.84
S2	0.00	S3	0.00	L23	0.00	AT	3.07
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

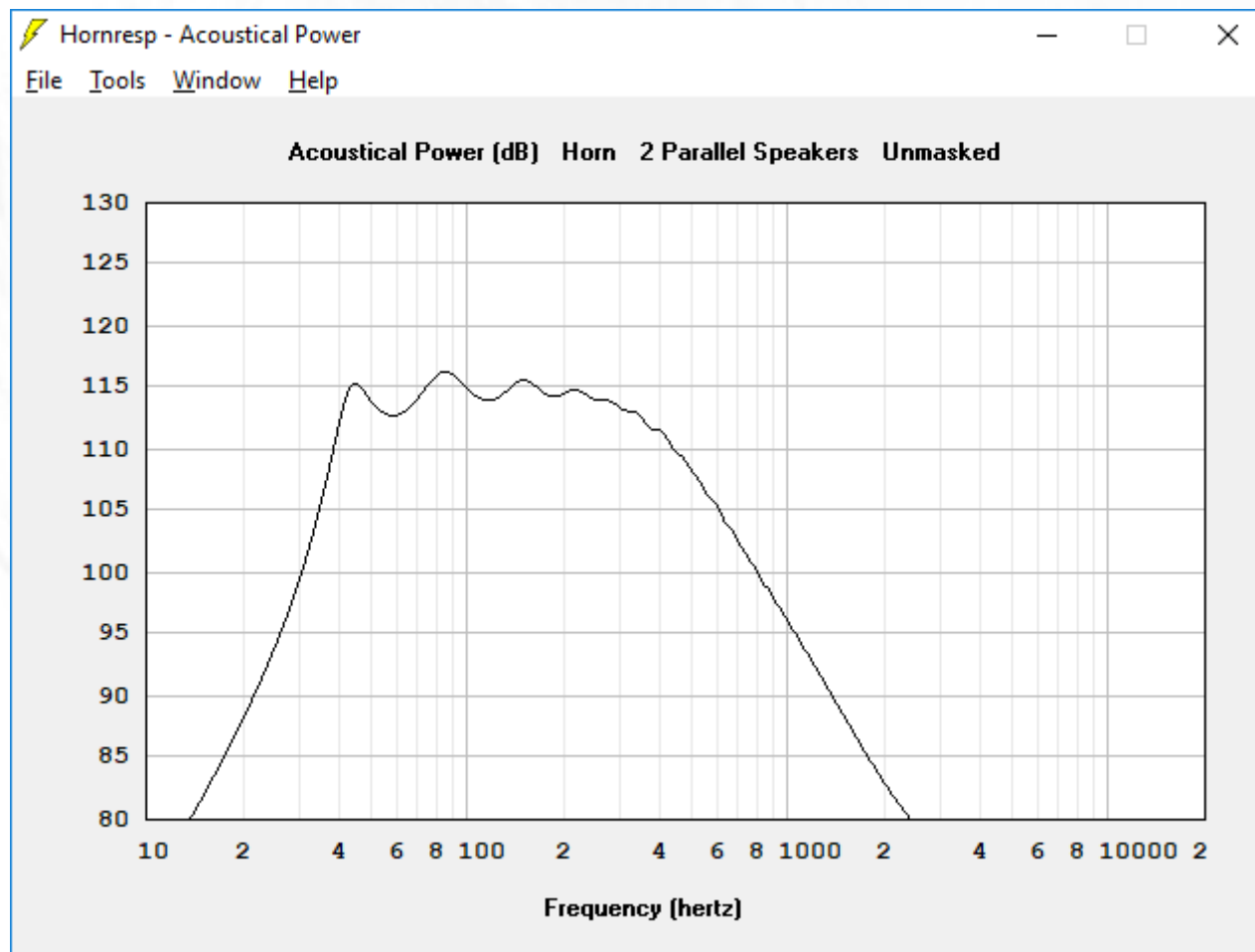
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Sd	532.00	Cms	3.90E-04	Mmd	45.95	Re	5.66
Bl	10.56	Rms	1.26	Le	0.84	Nd	1
Vrc	25.00	Fr	100.00	Vtc	2170.00		
Lrc	14.00	Tal	4.00	Atc	545.00		


Comment Eminence BP122 - 35Hz (1)

Previous Next Edit Add Delete Record 18 of 23 Calculate

# Eminence BP122 SPL



# Eminence Pro-12A Driver - 37Hz

 Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.44
S1	250.00	S2	2028.00	Exp	172.00	F12	33.32
S2	0.00	S3	0.00	L23	0.00	AT	3.11
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

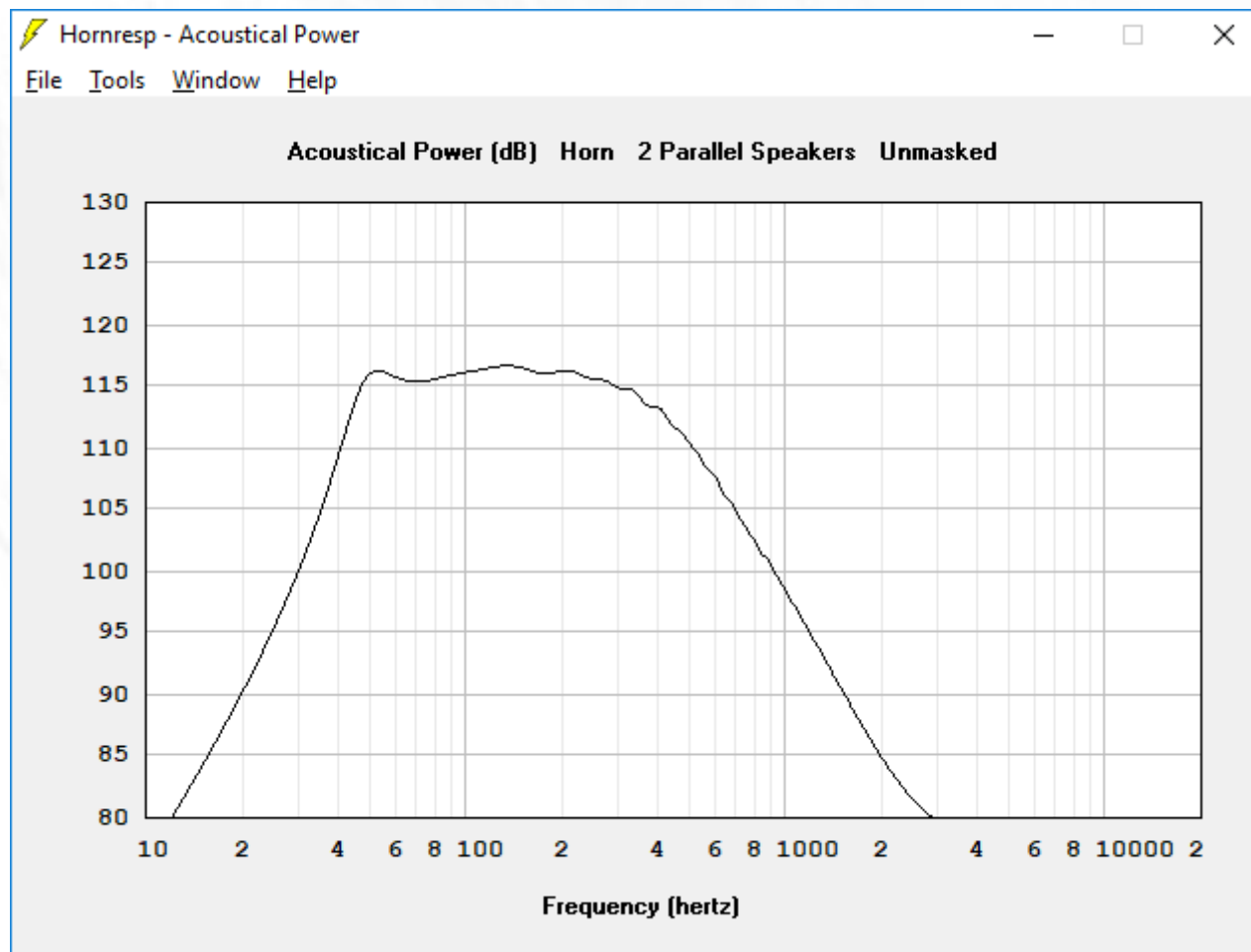
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Sd	520.00	Cms	3.16E-04	Mmd	51.72	Re	5.50
Bl	17.30	Rms	1.96	Le	1.20	Nd	1
Vrc	20.00	Fr	100.00	Vtc	2170.00		
Lrc	20.00	Tal	4.00	Atc	520.00		


Comment Eminence Pro-12A - 37Hz

Show previous record

# Eminence Pro-12A SPL



# Eminence 3012 Driver - 37Hz

 Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.47
S1	215.00	S2	2025.00	Exp	172.00	F12	35.69
S2	0.00	S3	0.00	L23	0.00	AT	3.09
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

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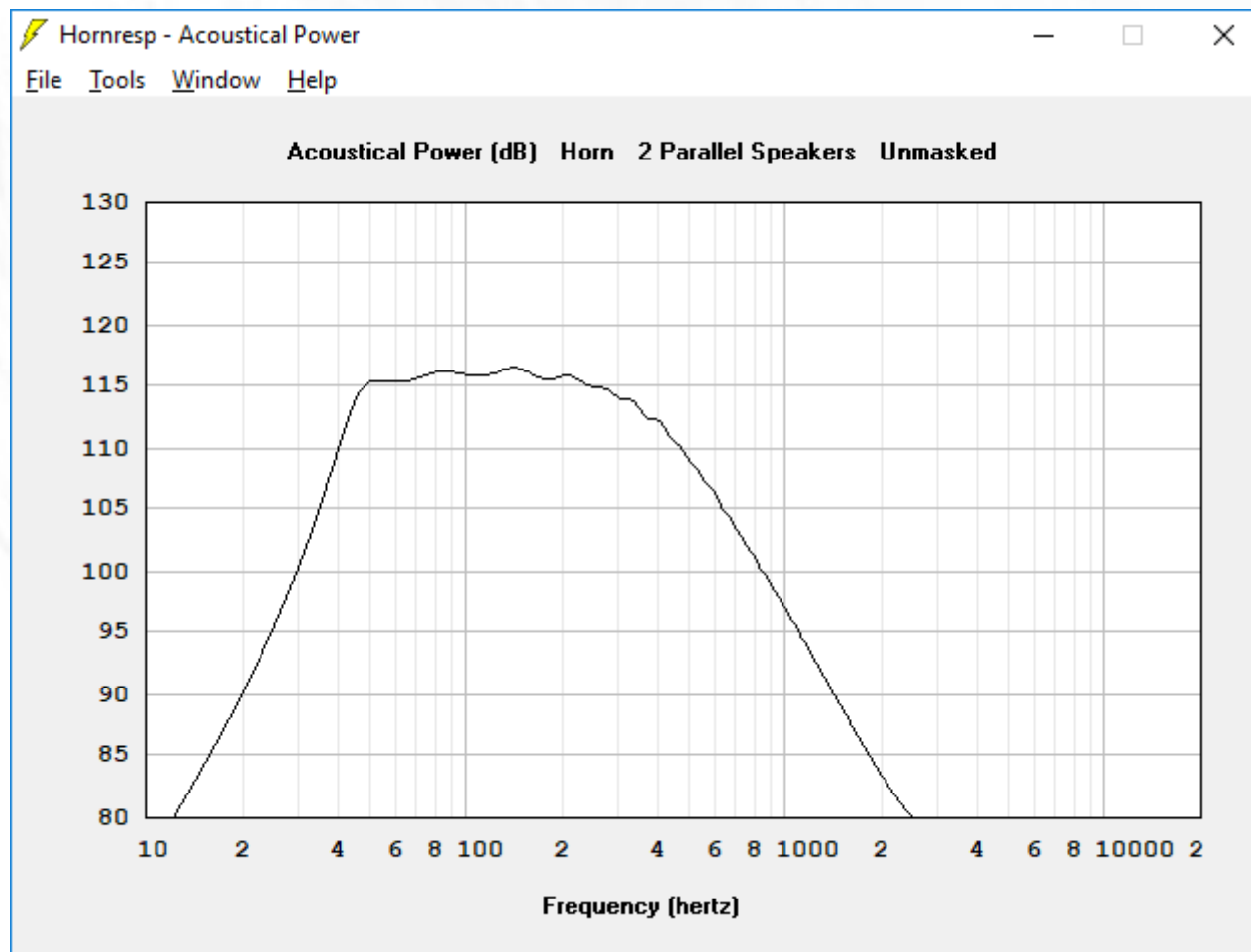
Sd	545.00	Cms	2.55E-04	Mmd	65.23	Re	5.60
Bl	16.70	Rms	2.43	Le	0.98	Nd	1
Vrc	22.00	Fr	100.00	Vtc	2170.00		
Lrc	14.00	Tal	4.00	Atc	545.00		

Comment Eminence 3012 - 37Hz

Previous Next Edit Add Delete Record 14 of 23 Calculate


Show next record

# Eminence 3012 SPL





# Eminence Kappa 15C Driver – 31Hz

 Hornresp - Input Parameters

File Tools Window Help

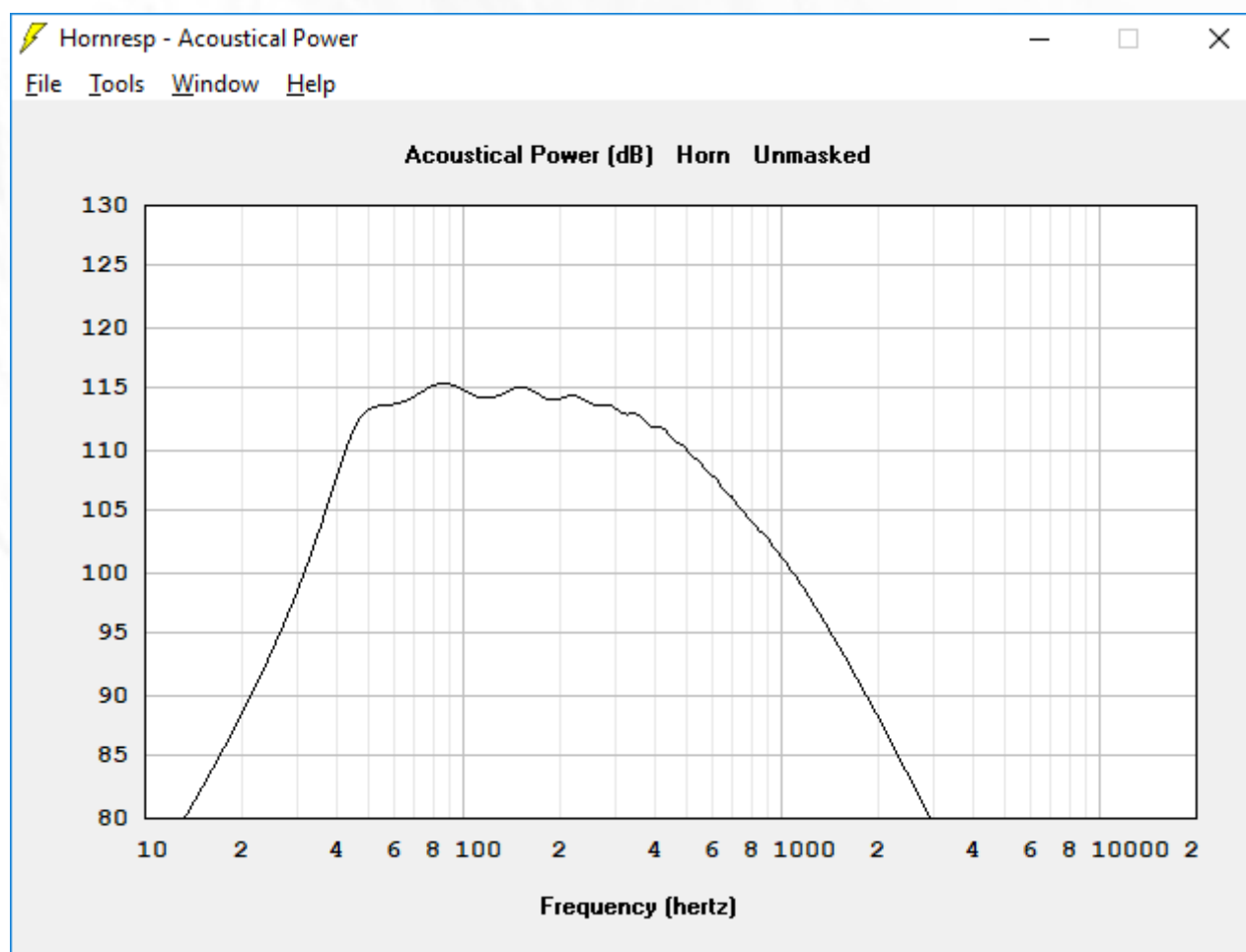
Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.77
S1	300.00	S2	4050.00	Exp	172.00	F12	41.42
S2	0.00	S3	0.00	L23	0.00	AT	4.23
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

---

Sd	856.00	Cms	3.16E-04	Mmd	68.99	Re	3.68
Bl	14.70	Rms	1.60	Le	0.88	Nd	1
Vrc	40.00	Fr	100.00	Vtc	856.00		
Lrc	20.00	Tal	4.00	Atc	856.00		

Comment Eminence Kappa 15C

# Eminence Kappa 15C SPL



# Klipsch K-33 Model - 36Hz

Note that the horn shape is not stock.

**Hornresp - Input Parameters**

File Tools Window Help

Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.70
S1	239.00	S2	1500.00	Con	100.00	F12	0.00
S2	1500.00	S3	4056.10	Exp	72.00	F23	37.82
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

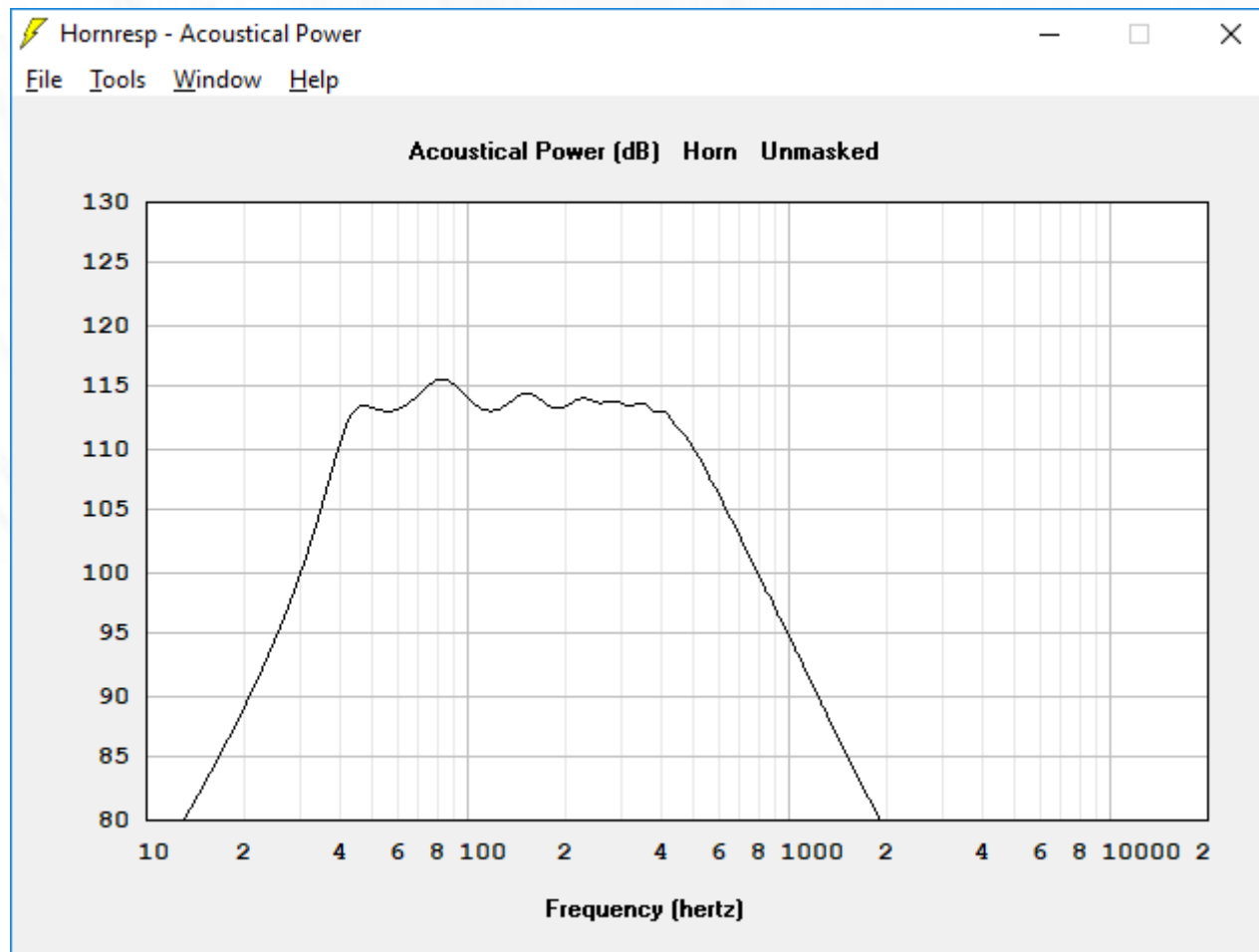
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Sd	889.60	Cms	2.68E-04	Mmd	64.33	Re	3.39
Bl	11.93	Rms	2.33	Le	0.96	Nd	1
Vrc	50.00	Fr	100.00	Vtc	3200.00	<b>CAUTION:</b>	
Lrc	16.00	Tal	4.00	Atc	856.00	<b>Atc &lt; Sd</b>	

Comment Klipsch K-33 Parameters

Previous Next Edit Add Delete Record 11 of 23 Calculate

This is the widest bandwidth of all the drivers modeled.



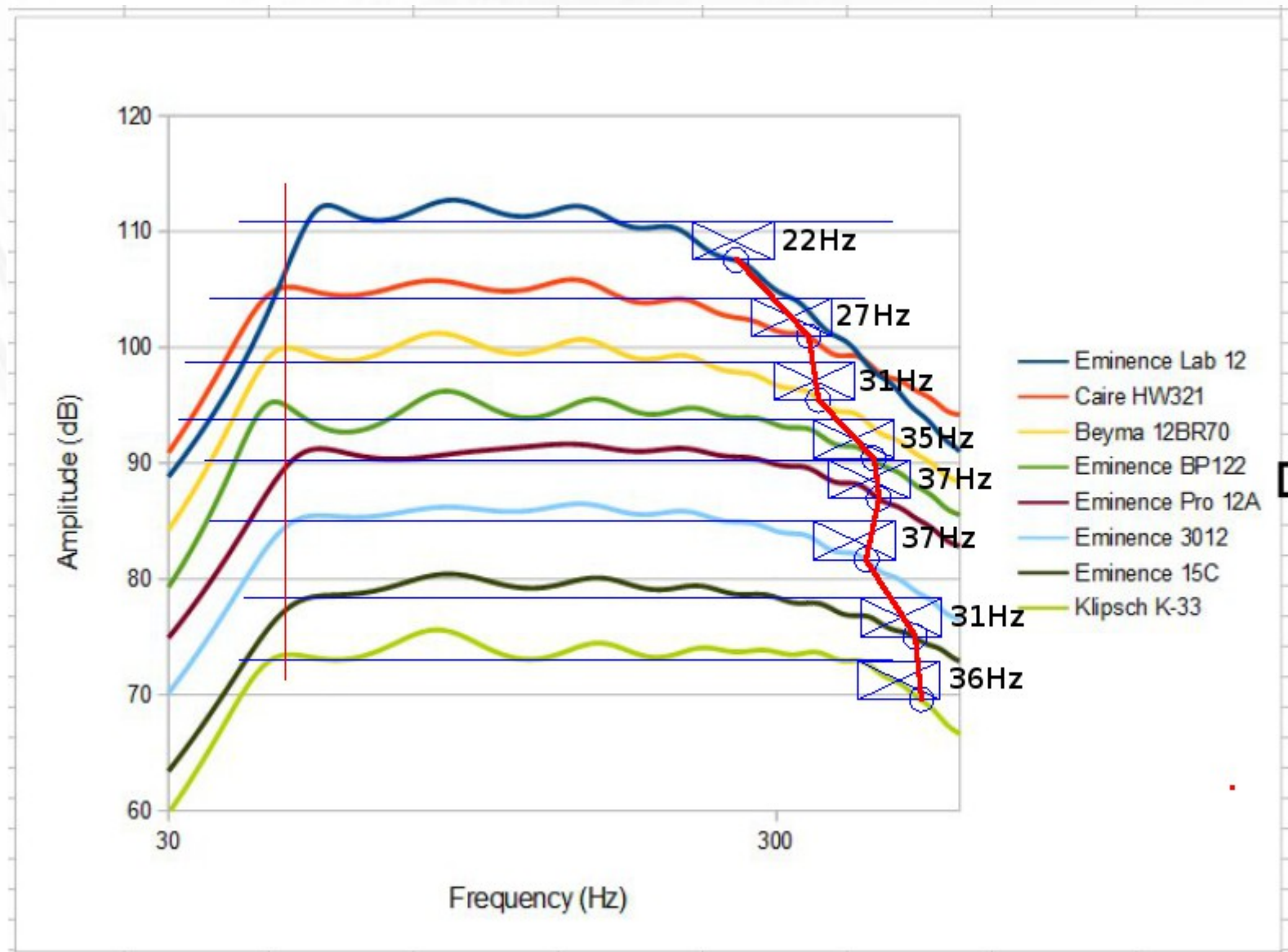
# K-Horn Driver Analysis Summary

There appears to be a small range of “ $f_s$ ” that allows a driver to meet a frequency range of 40 to 400 Hz while using a truncated horn mouth size. After modeling many drivers, it is also apparent that Klipsch has done an outstanding job in developing the K-33 woofer. There is not much else that can be done to improve the design based on the evidence shown here.

Speaking of “ $f_s$ ”, it appears that the best driver is one that has a resonance close to 35 or 36 Hz, maybe 37. Obviously other driver parameters are also important in extending the useful operating range, but these are outside the scope of this study.


The graph on the next page shows the -3dB point for each plot SPL curve, indicated by a blue box and circle. As the driver “ $f_s$ ” gets closer to 36, the upper frequency range is extended for the majority of drivers. Note that each curve shows the driver “ $f_s$ ” next to the -3dB point.

# K-Horn Driver Analysis



# Electro Voice 15L Driver

Note that yellow cells are guesses on my part  
The EV spec sheet does not list these values

 Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.64
S1	239.00	S2	239.00	Par	3.81	F12	0.00
S2	239.00	S3	511.60	Con	4.50	F23	0.00
S3	511.60	S4	4056.10	Exp	164.00	F34	34.56
S4	0.00	S5	0.00	L45	0.00	F45	0.00

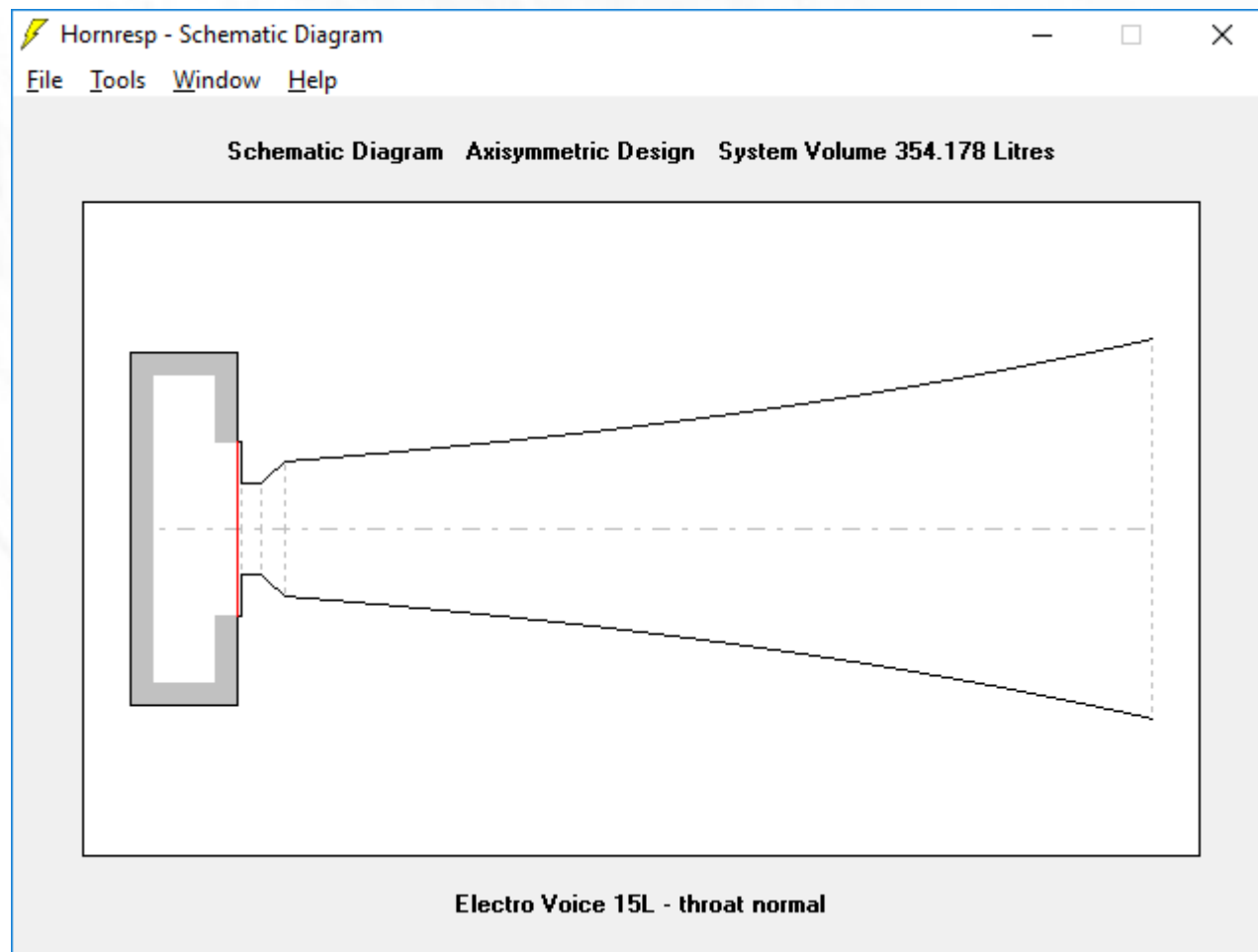
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Sd	856.00	Cms	2.34E-04	Mmd	44.16	Re	6.50
Bl	14.00	Rms	3.19	Le	0.90	Nd	1
Vrc	70.00	Fr	100.00	Vtc	856.00		
Lrc	20.00	Tal	4.00	Atc	856.00		

Comment Electro Voice 15L - throat normal



# Stock K-Horn Throat – EV 15L

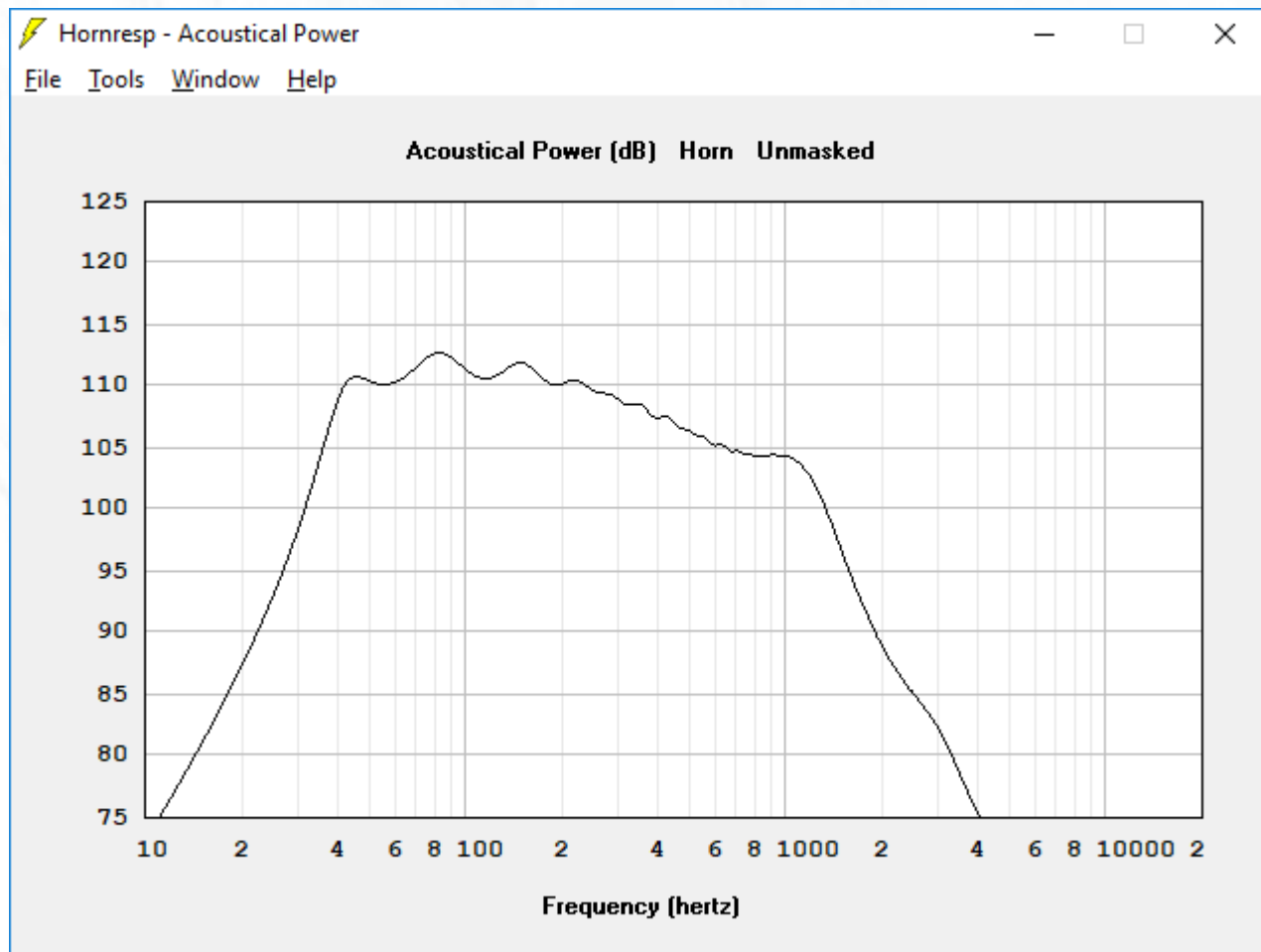




## EV 15L SPL


Notice the lower efficiency ( $\sim 110\text{dB}$ )

Low frequency cutoff is impressively close to 45Hz



# EV 15L Driver

## Same driver parameter guesses apply

 Hornresp - Input Parameters

File Tools Window Help

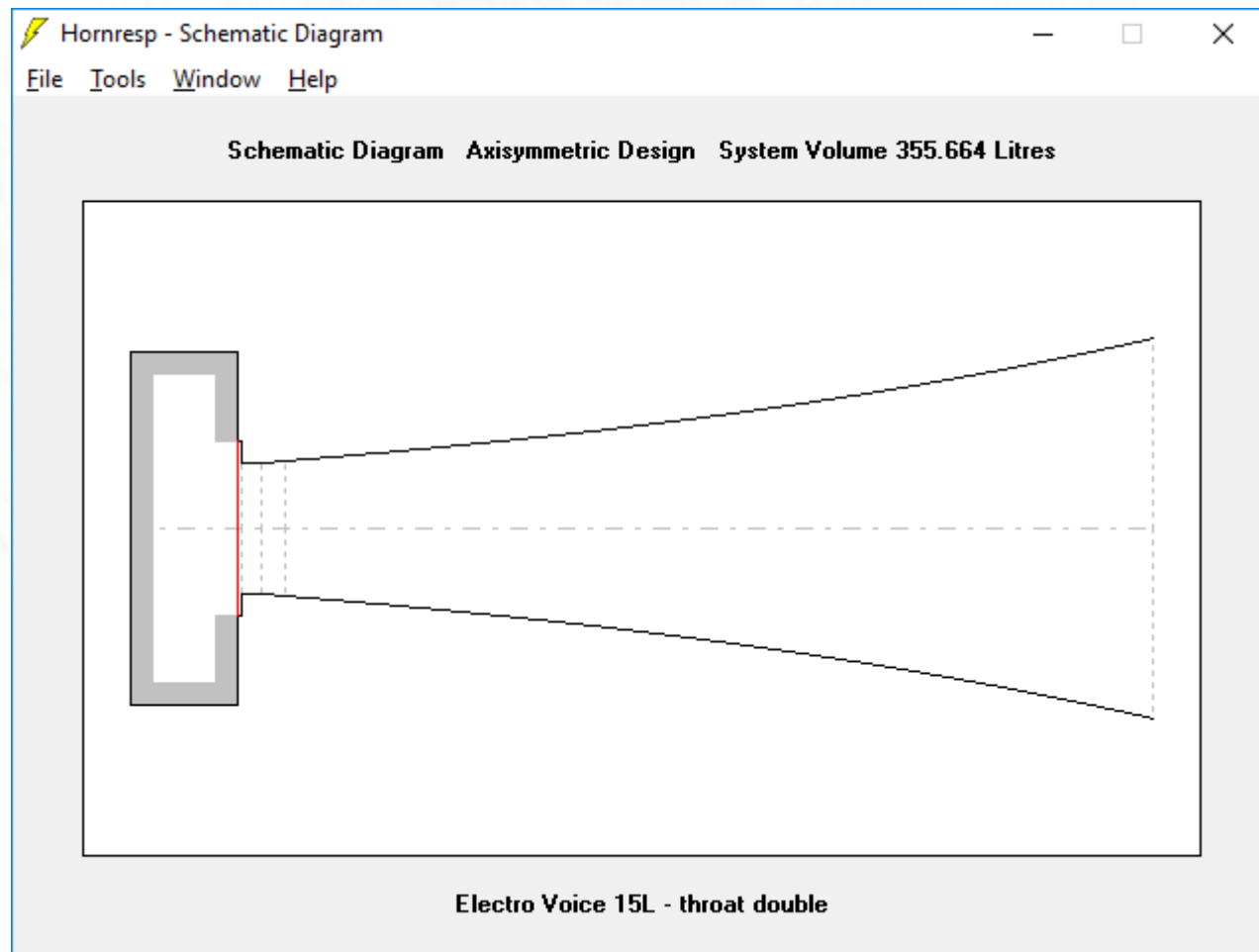
Ang	0.5 x Pi	Eg	2.83	Rg	0.00	Cir	0.64
S1	478.00	S2	478.00	Par	3.81	F12	0.00
S2	478.00	S3	511.60	Con	4.50	F23	0.00
S3	511.60	S4	4056.10	Exp	164.00	F34	34.56
S4	0.00	S5	0.00	L45	0.00	F45	0.00

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Sd	856.00	Cms	2.34E-04	Mmd	44.16	Re	6.50
Bl	14.00	Rms	3.19	Le	0.90	Nd	1
Vrc	70.00	Fr	100.00	Vtc	856.00		
Lrc	20.00	Tal	4.00	Atc	856.00		

Comment Electro Voice 15L - throat double

# Double K-Horn Throat Size



# EV 15L Driver

## Same lower efficiency (~110dB)

