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Line Configuration : Near End Closed.
Offset Driver.
Far End Open.

Unit and Constant Definition

cycle := 2 · π · rad

Hz := cycle · sec⁻¹

Air Density : ρ := 1.21 · kg · m⁻³

Speed of Sound : c := 342 · m · sec⁻¹



User Input (Edit This Section and Input all of the Parameters for the System to be Analyzed)

Driver Thiele / Small Parameters : Focal 8V 4412 Average Driver in Final TL Enclosure

$f_d := 127.0 \cdot \text{Hz}$

$V_{ad} := 1.29 \cdot \text{liter}$

$R_e := 7.8 \cdot \Omega$

$Q_{ed} := 0.98$

$L_{vc} := 0.03 \cdot \text{mH}$

$Q_{md} := 4.00$

$Bl := 2.98 \cdot \frac{\text{newton}}{\text{amp}}$

$Q_{td} := \left(\frac{1}{Q_{ed}} + \frac{1}{Q_{md}} \right)^{-1}$

$S_d := 28.27 \cdot \text{cm}^2$

$Q_{td} = 0.787$

Enclosure Geometry Definition

Reference : Derivation and Correlation of a Viscous Damping Model Used in the Design of a Transmission Line Loudspeaker System
by Martin J. King, 3/04/01

The following dimension were derived from "Figure 18 : Cabinet Construction Details and Dimensions (inches)" of the referenced article. This is the most accurate model for the Focal 8V 4412 two-way transmission line enclosure. All of the required input data has been entered below directly into the Geometry Definition section of the worksheet. No variable definitions have been used to describe the enclosure geometry.

Transmission Line Definition (0 lb/ft³ < D < 1 lb/ft³)

n_closed := 4 (n_closed > 1)

n_open := 9 (n_open > 1)

Geometry Definition

Closed End of Transmission Line (Driver ---> Closed End)

| Section Length | Initial Area | Final Area | Stuffing Density |
|-----------------------------------|---------------------------------|---------------------------------|---|
| $L_{c_0} := 0.79 \cdot \text{in}$ | $S_{c_{0,0}} := 3.71 \cdot S_d$ | $S_{c_{0,1}} := 3.71 \cdot S_d$ | $D_{c_0} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{c_1} := 0.79 \cdot \text{in}$ | $S_{c_{1,0}} := 3.71 \cdot S_d$ | $S_{c_{1,1}} := 3.71 \cdot S_d$ | $D_{c_1} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{c_2} := 0.79 \cdot \text{in}$ | $S_{c_{2,0}} := 3.71 \cdot S_d$ | $S_{c_{2,1}} := 3.71 \cdot S_d$ | $D_{c_2} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{c_3} := 0.79 \cdot \text{in}$ | $S_{c_{3,0}} := 3.71 \cdot S_d$ | $S_{c_{3,1}} := 3.71 \cdot S_d$ | $D_{c_3} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{c_4} := 0.79 \cdot \text{in}$ | $S_{c_{4,0}} := 3.71 \cdot S_d$ | $S_{c_{4,1}} := 3.71 \cdot S_d$ | $D_{c_4} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |

Open End of Transmission Line (Driver ---> Open End)

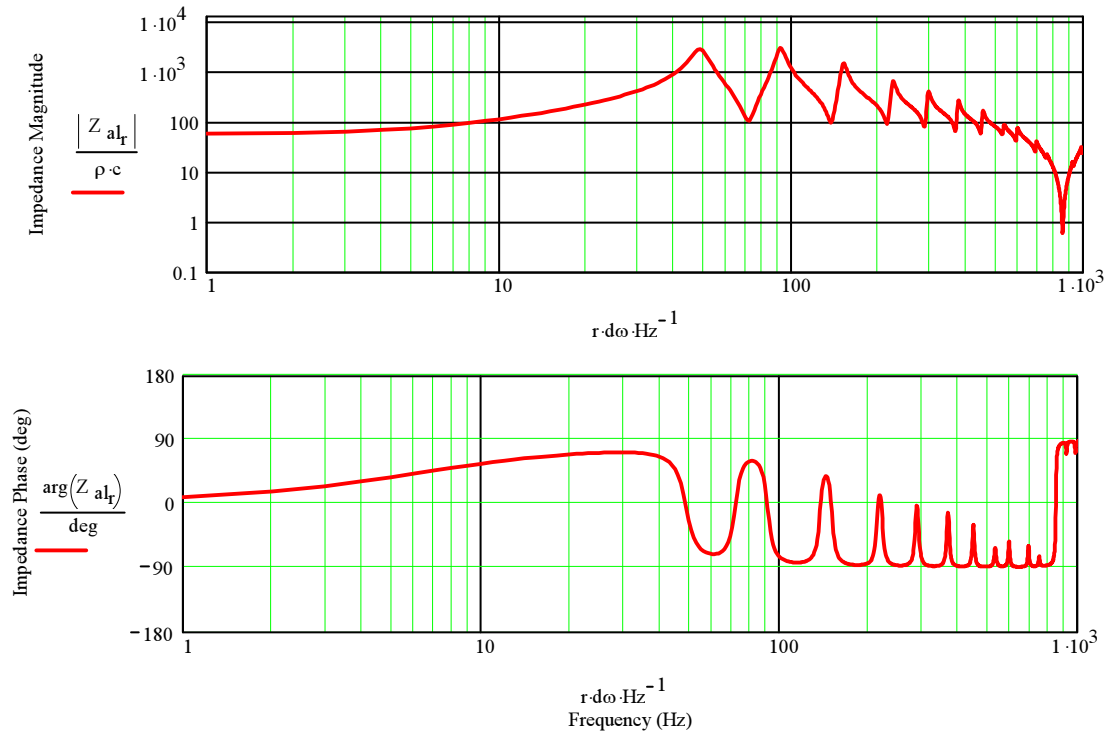
| Section Length | Initial Area | Final Area | Stuffing Density |
|------------------------------------|---------------------------------|---------------------------------|---|
| $L_{o_0} := 8.66 \cdot \text{in}$ | $S_{o_{0,0}} := 0.74 \cdot S_d$ | $S_{o_{0,1}} := 0.74 \cdot S_d$ | $D_{o_0} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_1} := 5.91 \cdot \text{in}$ | $S_{o_{1,0}} := 0.93 \cdot S_d$ | $S_{o_{1,1}} := 0.93 \cdot S_d$ | $D_{o_1} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_2} := 5.91 \cdot \text{in}$ | $S_{o_{2,0}} := 1.11 \cdot S_d$ | $S_{o_{2,1}} := 1.11 \cdot S_d$ | $D_{o_2} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_3} := 7.87 \cdot \text{in}$ | $S_{o_{3,0}} := 1.49 \cdot S_d$ | $S_{o_{3,1}} := 1.49 \cdot S_d$ | $D_{o_3} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_4} := 7.87 \cdot \text{in}$ | $S_{o_{4,0}} := 1.86 \cdot S_d$ | $S_{o_{4,1}} := 1.86 \cdot S_d$ | $D_{o_4} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_5} := 11.02 \cdot \text{in}$ | $S_{o_{5,0}} := 2.41 \cdot S_d$ | $S_{o_{5,1}} := 2.41 \cdot S_d$ | $D_{o_5} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_6} := 10.73 \cdot \text{in}$ | $S_{o_{6,0}} := 3.34 \cdot S_d$ | $S_{o_{6,1}} := 3.34 \cdot S_d$ | $D_{o_6} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_7} := 13.78 \cdot \text{in}$ | $S_{o_{7,0}} := 5.01 \cdot S_d$ | $S_{o_{7,1}} := 5.01 \cdot S_d$ | $D_{o_7} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_8} := 13.0 \cdot \text{in}$ | $S_{o_{8,0}} := 7.43 \cdot S_d$ | $S_{o_{8,1}} := 7.43 \cdot S_d$ | $D_{o_8} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |
| $L_{o_9} := 0.78 \cdot \text{in}$ | $S_{o_{9,0}} := 1.0 \cdot S_d$ | $S_{o_{9,1}} := 1.0 \cdot S_d$ | $D_{o_9} := 0.0 \cdot \text{lb} \cdot \text{ft}^{-3}$ |

Total Length of the Transmission Line

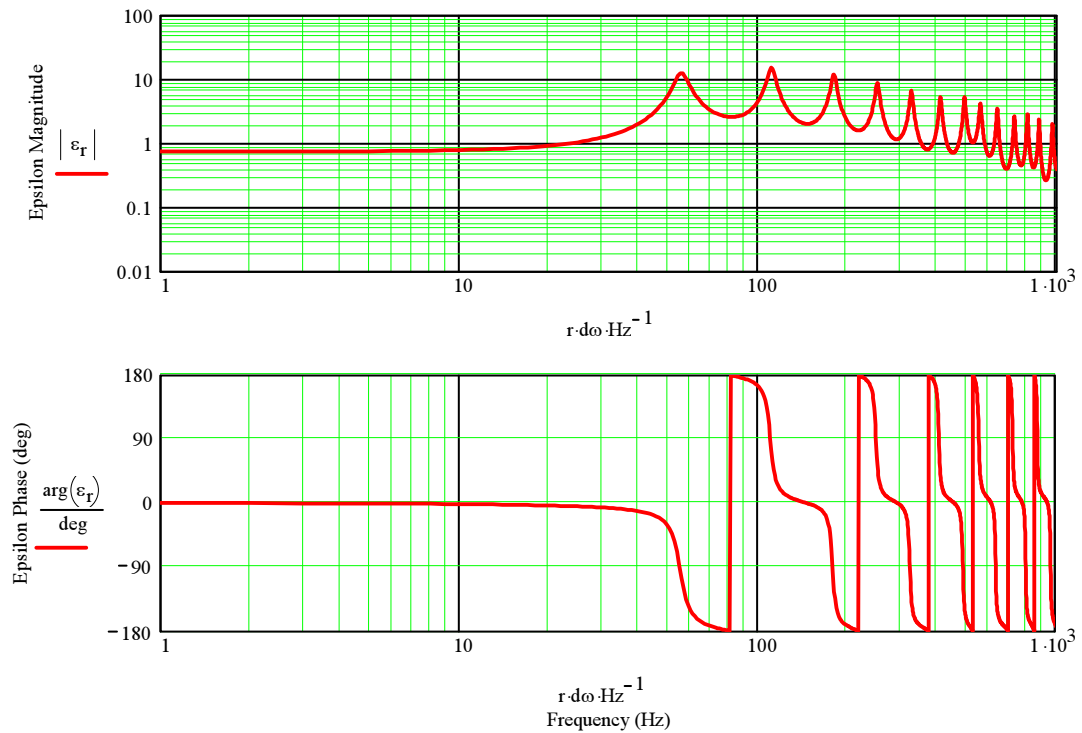
$$\sum_{i=0}^{n_closed} L_{c_i} + \sum_{i=0}^{n_open} L_{o_i} = 89.480 \cdot \text{in}$$



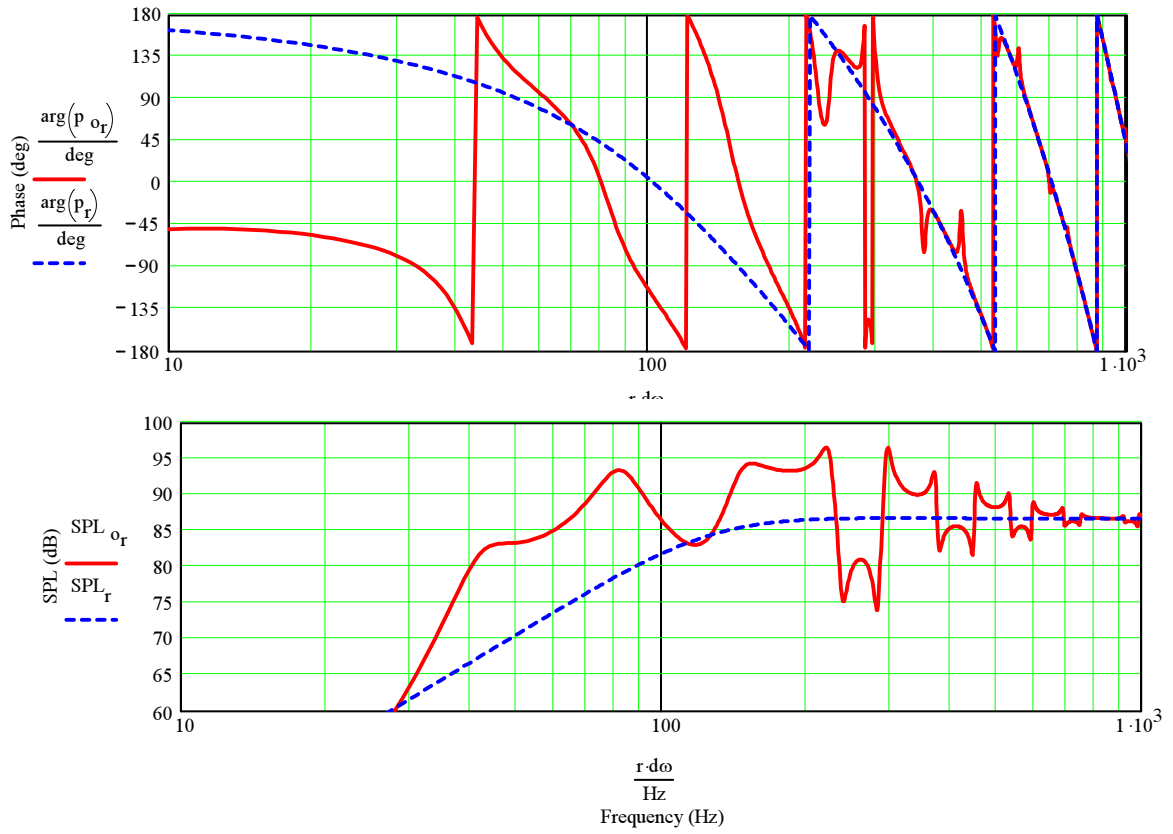
Resulting Acoustic Impedance for the Transmission Line



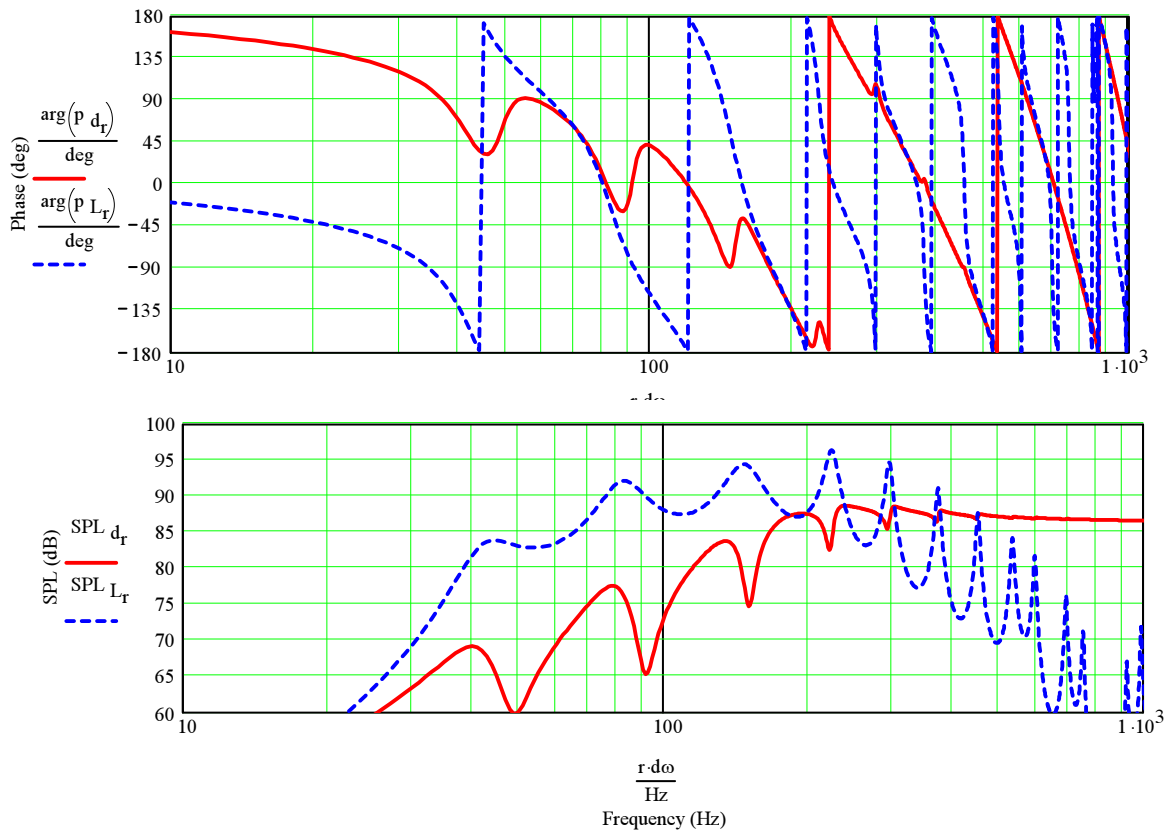
Velocity at the Terminus of the Transmission Line for a 1 m/sec Driver Excitation



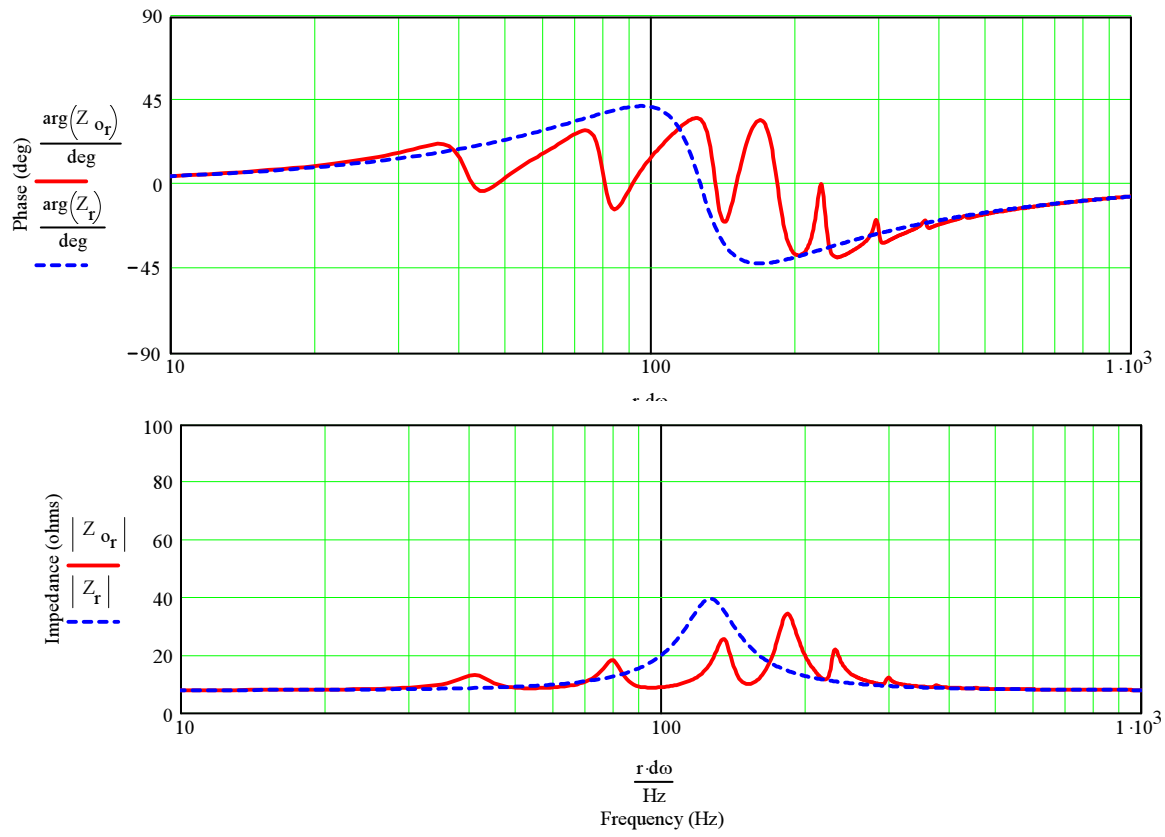
Far Field Transmission Line System and Infinite Baffle Sound Pressure Level Responses



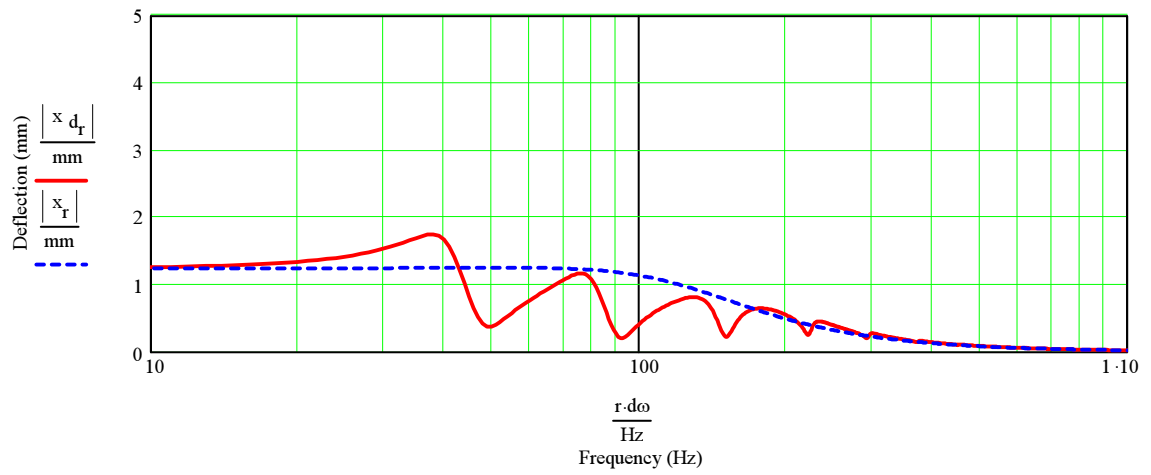
Woofer and Terminus Far Field Sound Pressure Level Responses



Transmission Line System and Infinite Baffle Impedance



Woofer Displacement



System Time Response for an Impulse Input

