

PURE SOUND

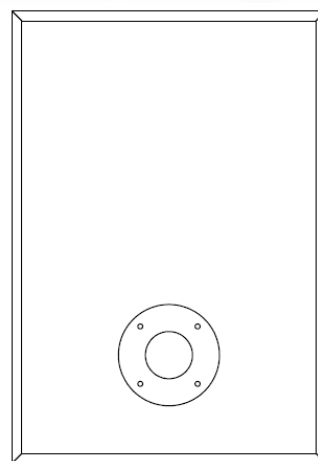
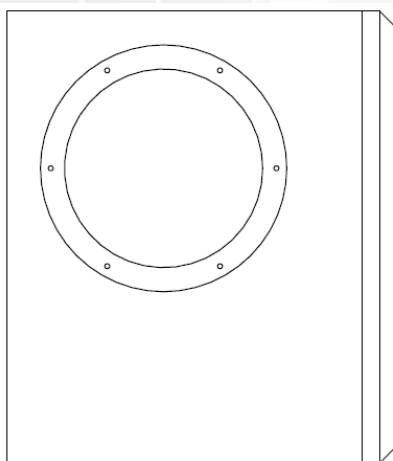
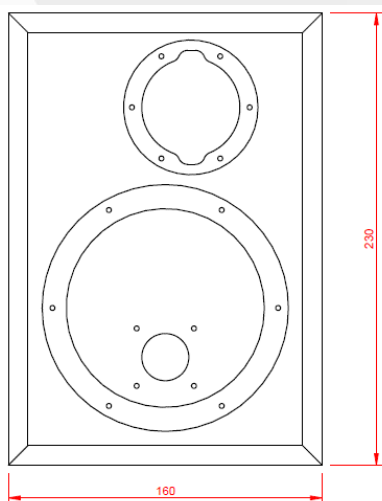
Building a Straight Wire
to the Soul of Music

SPK8 DEMO SPEAKER



KEY SPECIFICATIONS

Type	Passive, 2-way, Passive Radiator
Woofer	PTT4.0X04-NFC-01
Passive Radiator	2pcs PTT4.0PR-NF2-01
Tweeter	B25B-6
Crossover	~3kHz
Volume	~4.2L
Size	160x230x200mm



1 Description

SPK8 is intended as demonstration platform for the PTT4.0X04-NFC-01 transducer together with the PTT4.0PR-NF2-01 passive radiator.

The design is deliberately kept very simple: a small wooden box, traditionally shaped with a simple 10mm chamfer for management of edge diffraction, and a passive cross over at ~3kHz. Although extremely simple, with numerous possibilities for enhancement by the skilled speaker designer, the SPK8 design very successfully demonstrates the tremendous improvements in sound quality which is possible to achieve when using the long-stroke ultra-low-distortion PTT4.0X04 woofer from PURIFI Transducer Technology.



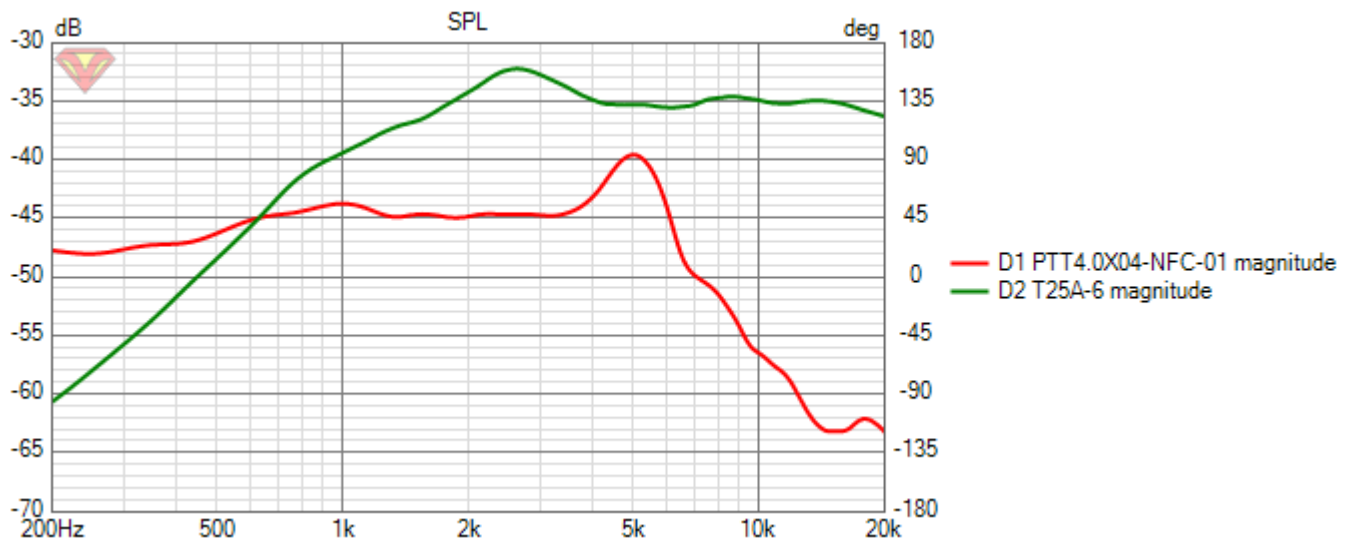
Figure 1 SPK8 Demonstration Speaker

2 Crossover

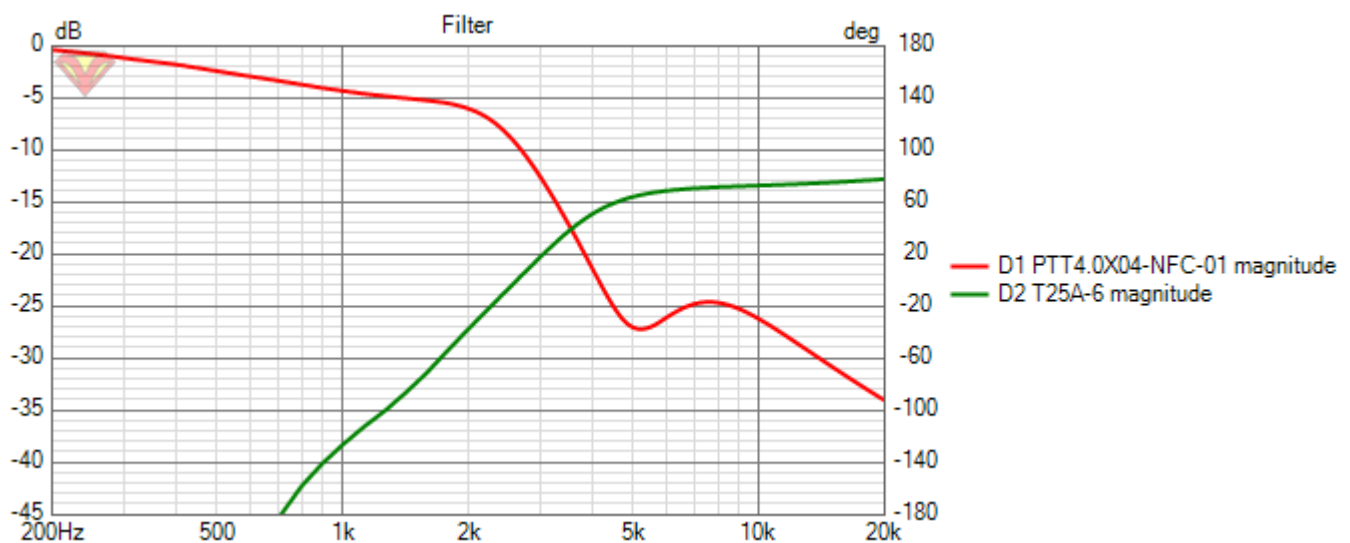
The PTT4.0X04-NFC-01 shows an extended frequency response with a small low Q peak at 5kHz that can be flattened with a series notch.

The small box formfactor gives a baffle step starting around 200Hz and peaking at 1500Hz. This can be compensated by lowering the inductor value in the 2nd order filter.

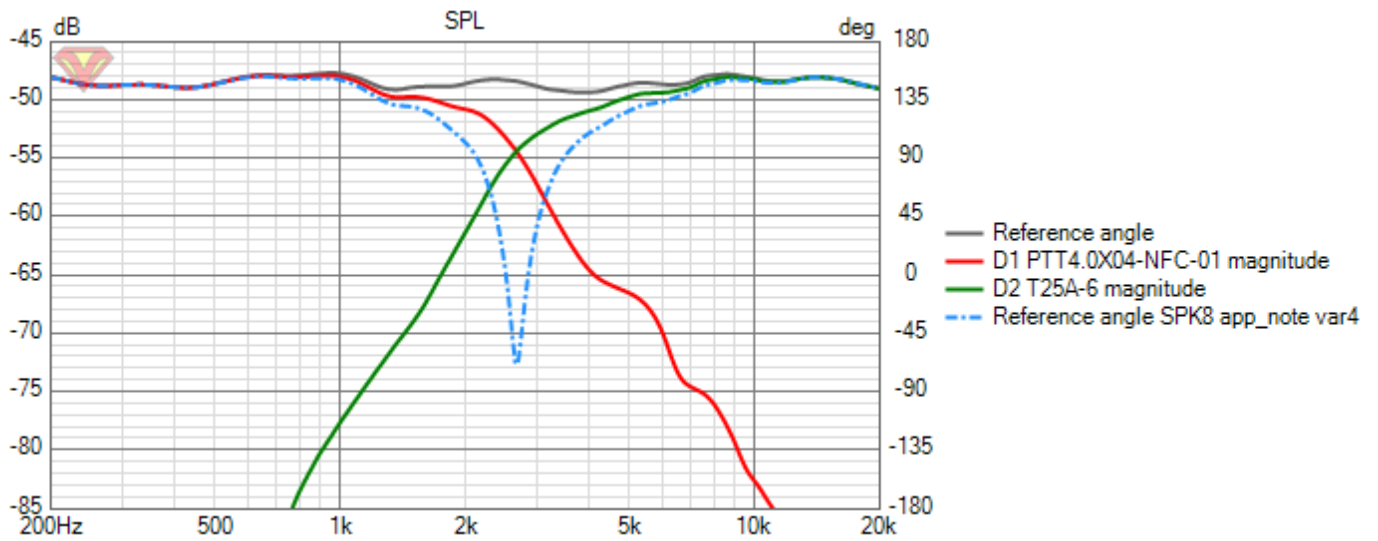
In the next figure the raw responses measured on tweeter axis in 50cm distance is shown. Gating is used so the response is only shown from 200Hz.



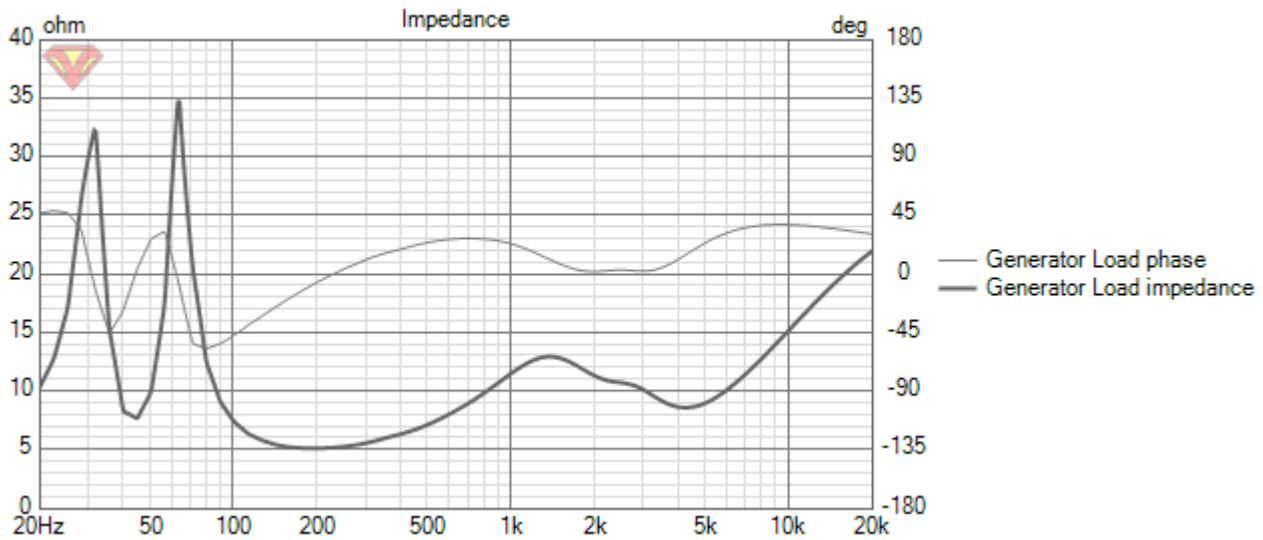
The resulting transfer function of the filter, a -6db slope to handle the baffle step, a low q notch at the 5kHz peak and then the 2nd and 3rd order electrical low/high pass functions to get the wanted 4th order acoustic filter functions



The next figure shows the resulting acoustical responses together with summed and summed with tweeter inversed. This shows a nice 20db dip at the cross-over frequency at 2.8kHz.



The amplifier load never dips below 50ohm and should not present any issues for a modern amplifier.



The tweeter section is on purpose kept with a series resistor as last element to approach current drive of the tweeter.

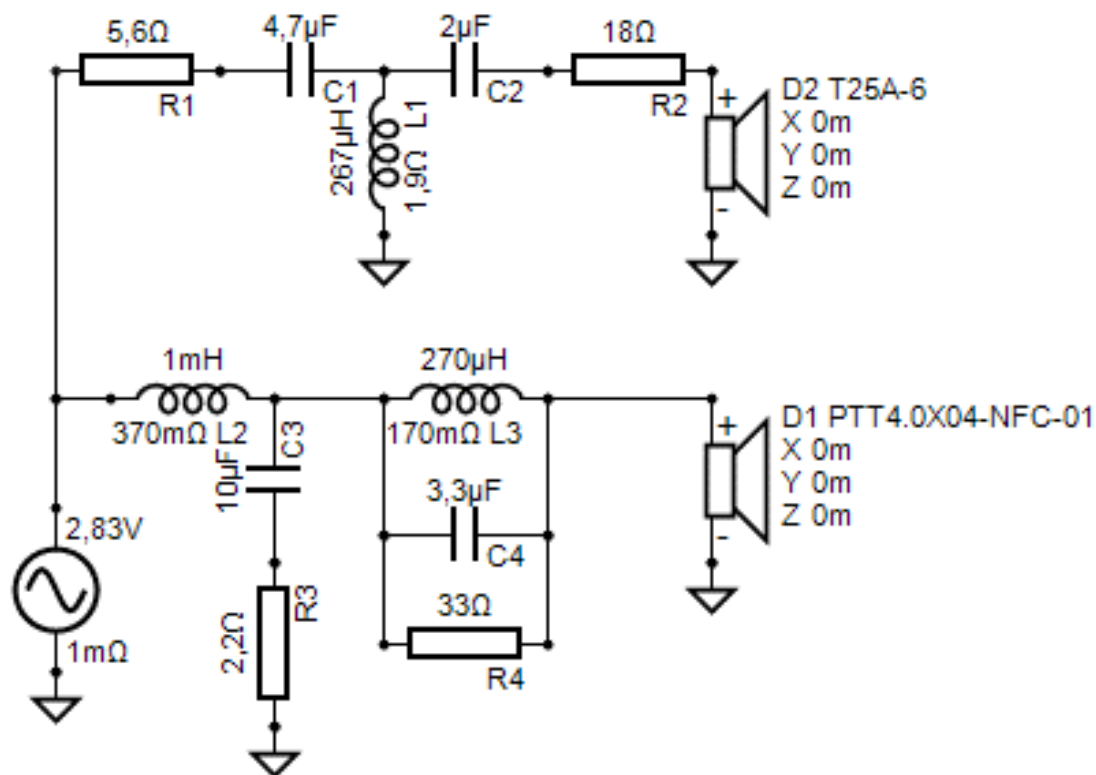


Figure 2 SPK8 Crossover Schematic

Due to the extremely low distortion of PTT4.0X04-NFC-01 it is VERY important to choose good crossover filter components. Inductors must be air-core type, also the proposed Resistors are non-magnetic

		Type	part number
Inductors			
L1	267μH	Air Coil	267μH, 0.3mmØ 1.9Ω ¹⁾
L2	1mH	Wax Coil	1mH, 16AWG 0.37Ω ²⁾
L3	270μH	Wax Coil	270μH, 16AWG 170mΩ ²⁾
Capacitors			
C1	4.7μF	Cross Cap	4.7μF
C2	2μF	Cross Cap	2μF
C3	10μF	Cross Cap	10μF
C4	3.3μF	Cross Cap	3.3μF
Resistors			
R1	5.6Ω	SBC 7W	5.6Ω 5%
R2	18Ω	SBC 11W	18Ω 5%
R3	2.2Ω	SBC 7W	2.2Ω 5%
R4	33Ω	SBC 7W	22Ω 5%

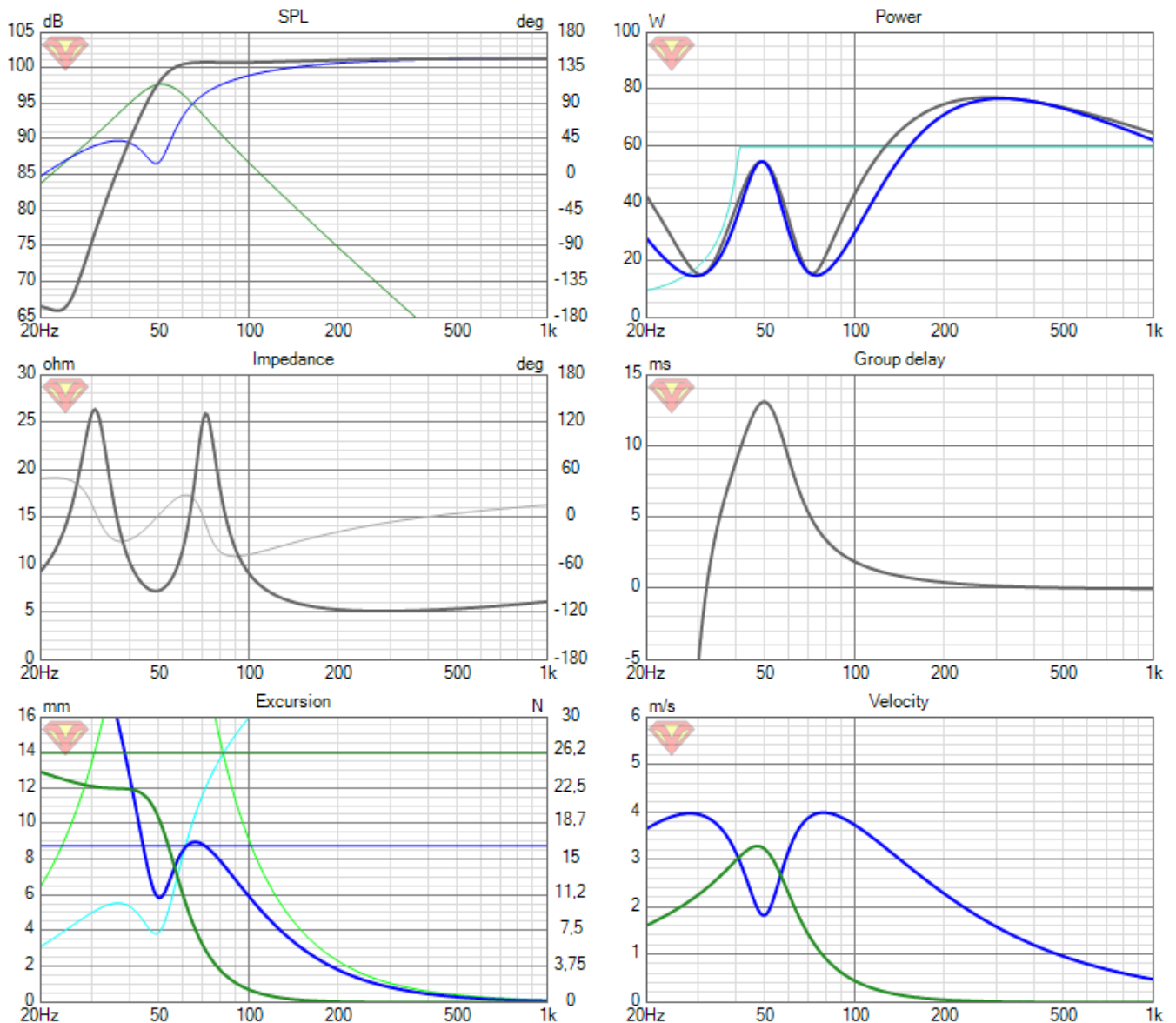
1) The DC resistance of inductor L1 is 1.9Ω. In case of other inductor is used, add a series resistor to keep combined DC series resistance as close as possible.

2) Higher DCR can influence bass performance.

3 Passive Radiator Box Modelling

The T/S parameters of the driver and passive radiator are entered in the enclosure modelling function of A 4.2litre box with the PTT4.0X04-NFC-01 and 2pcs PTT4.0PR gives an impressive Fb of 50Hz, lots of bass response for such a small box. The PTT4.0PR are placed on opposite sides to cancel the vibrations.

The extreme 8.8mm Xmax of the PTT4.0X04 enables more than 100db SPL before hitting the limits.



The modelling tool can easily show what happens if a larger or smaller box is used, a 3litre version could also be interesting – then a 10g mass is needed of the PR's

4 Cabinet and Damping

The cabinet is constructed of 15mm birch plywood with a 19mm front baffle made of black MDF.

This small cabinet do not need any bracing.

Remember to chamfer the woofer cut-out internally to allow for large air movements.

The cabinet is stuffed with cotton/fibre damping material: 85% Cotton, 15% Polyester. 370g/m². Approximately 60g of the material is placed behind the driver and another.

The crossover can be placed on the bag-plate, bottom-plate or externally.

The back plate is showed recessed and can as such be screw mounted. The remaining joints are glued.

The drawings show connections to SPK8 via a 4-wire SpeakON NL4MPR connector, this allows for bi-wiring all the way to the drivers.

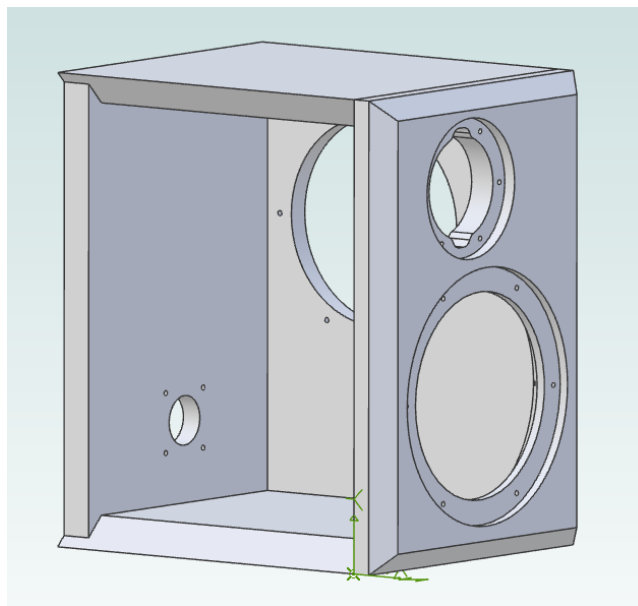


Table 1 Cabinet, cut-away view

Refer to drawings section for all dimensions.

5 Measurements

Measurement equipment and setup: Clio 12, 50cm microphone distance, gated measurement (valid down to 200Hz)

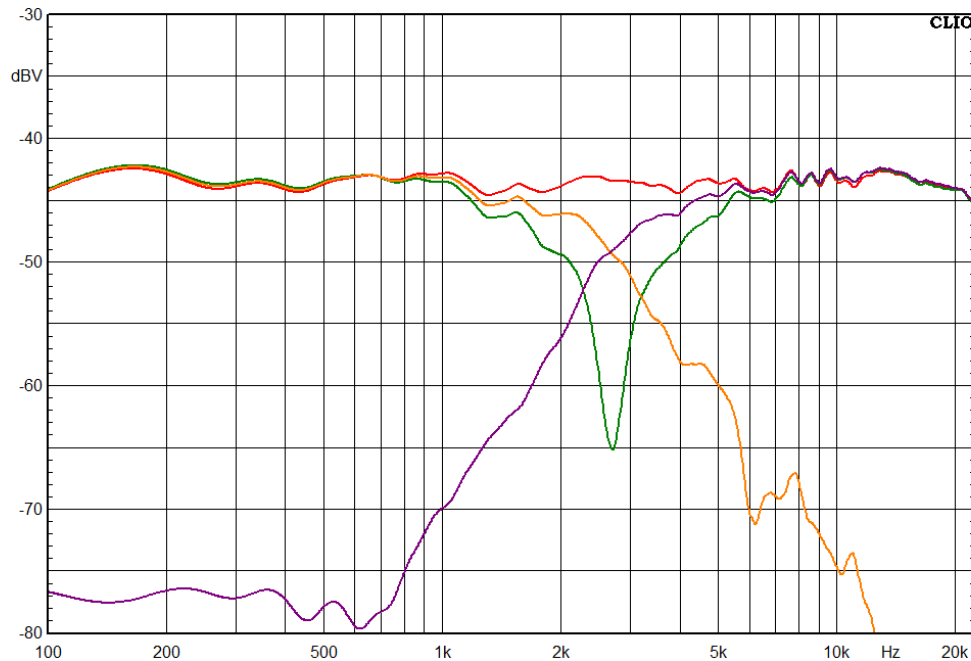


Figure 3 SPL, On-axis SPL @ 50cm (with gating). Normal RED, Inverted Phase, Green, Woofer Yellow, and Tweeter Magenta

Notice a nice flat response – there is a wide area where the woofer and tweeter is in phase, and well behaved slopes.

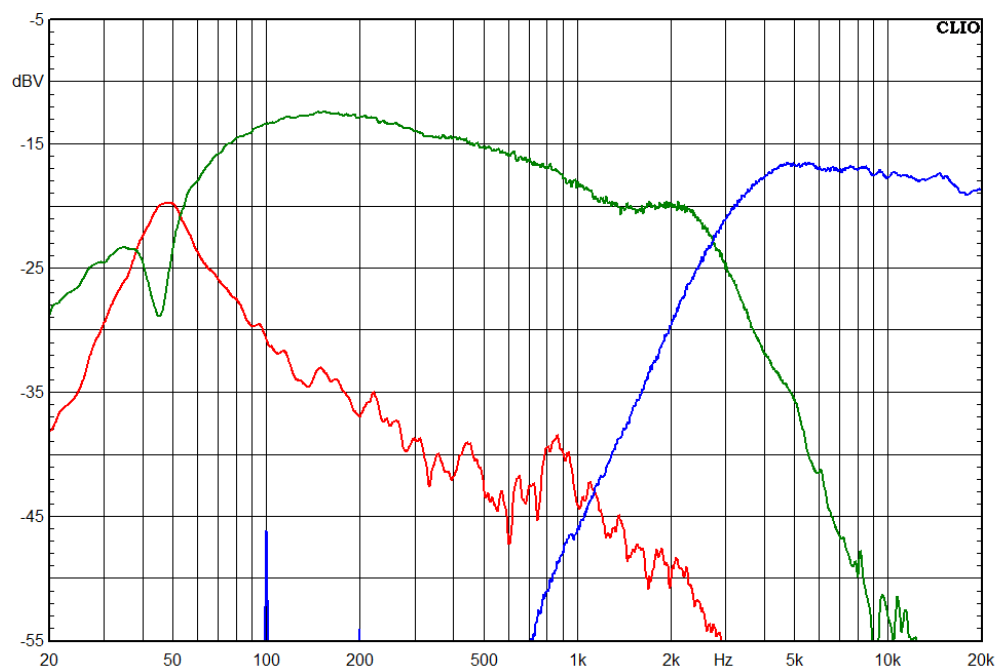


Figure 4 SPL, Nearfield, woofer green, tweeter blue and PR red

PR: resonance just below 50Hz. Nice roll off with just a little box resonance peak at 850Hz, but its so far down it doesn't show in the summed response.

Woofer: Notch at Box resonance just below 50Hz. Gradually sloping from 200hz to 1500Hz to compensate for baffle step gain. 4th order roll off at cross over frequency 2.8kHz. Peak at 5kHz is compensated by the series notch.

Tweeter: Just a nice high pass filter without any peaking.

Figure 5 SPL, -30-deg Off-axis SPL @ 1m, normal response, and inverted phase to check alignment between woofer and tweeter

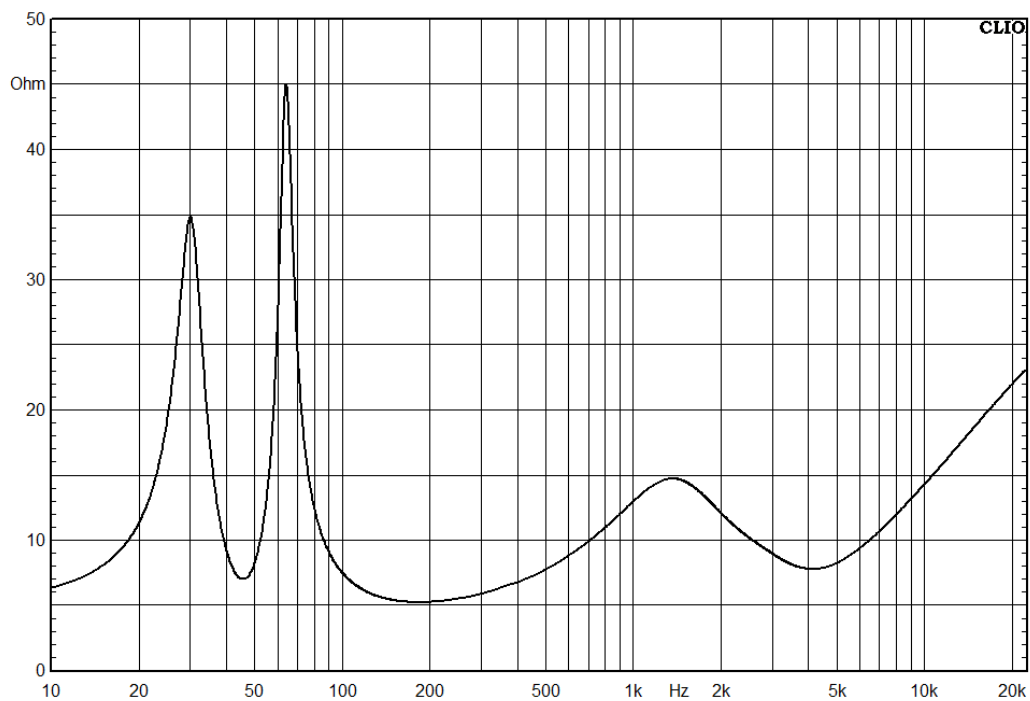
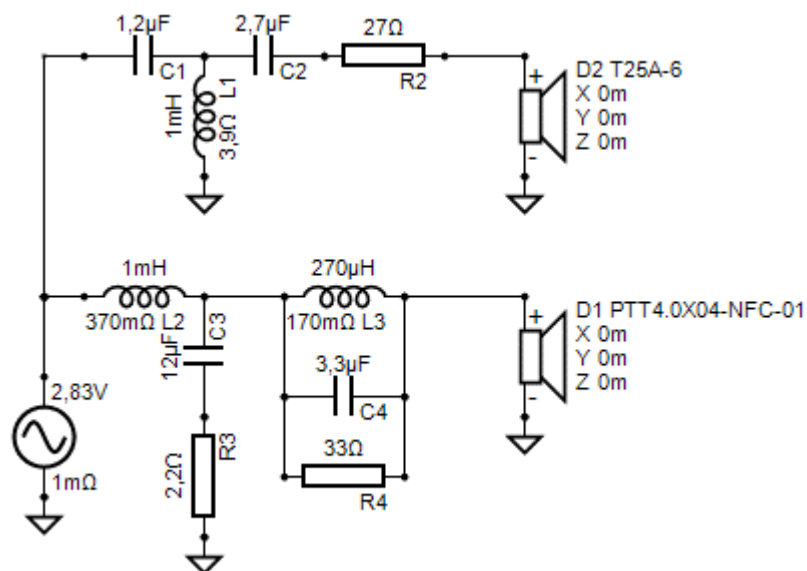


Figure 6 Impedance

6 Filter options

The filter can be made even simpler:



Attenuation of the tweeter can simply be adjusted to personal preference by changing R2 a couple of ohm's up or down.

If more bass is admirable then increasing the series inductor L2, to 1.2mH, and R2 to 33Ω tilts the response

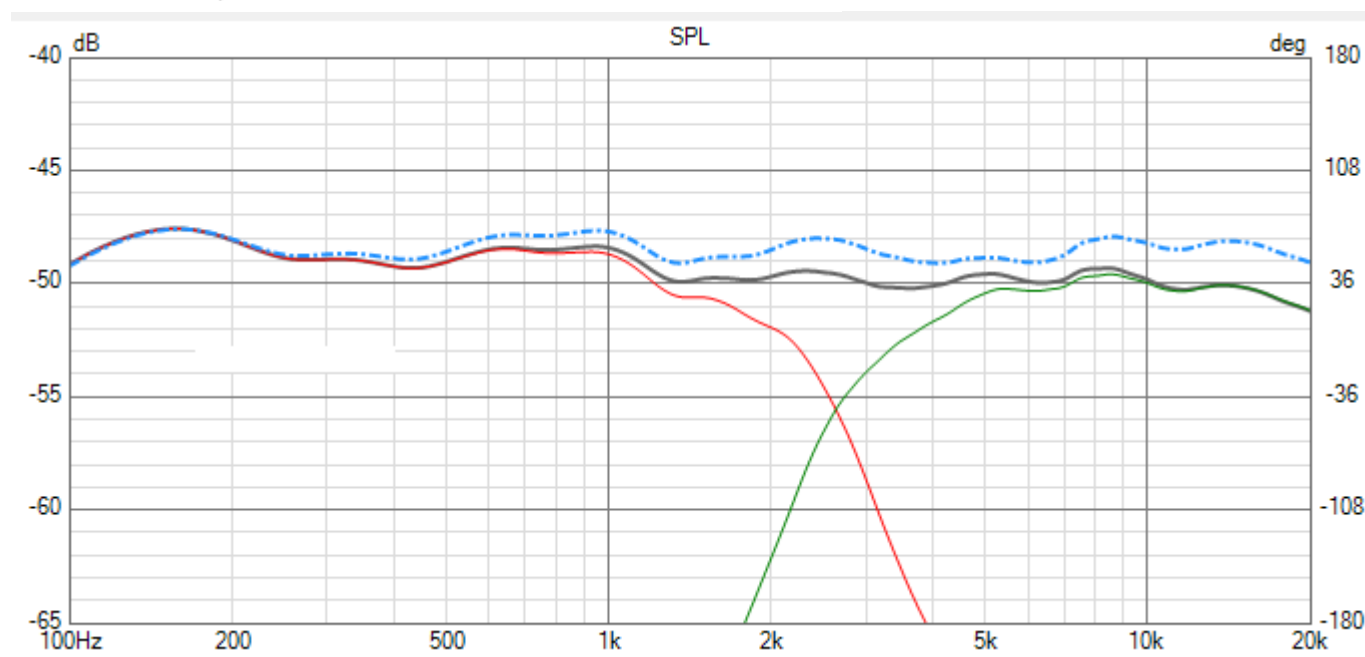


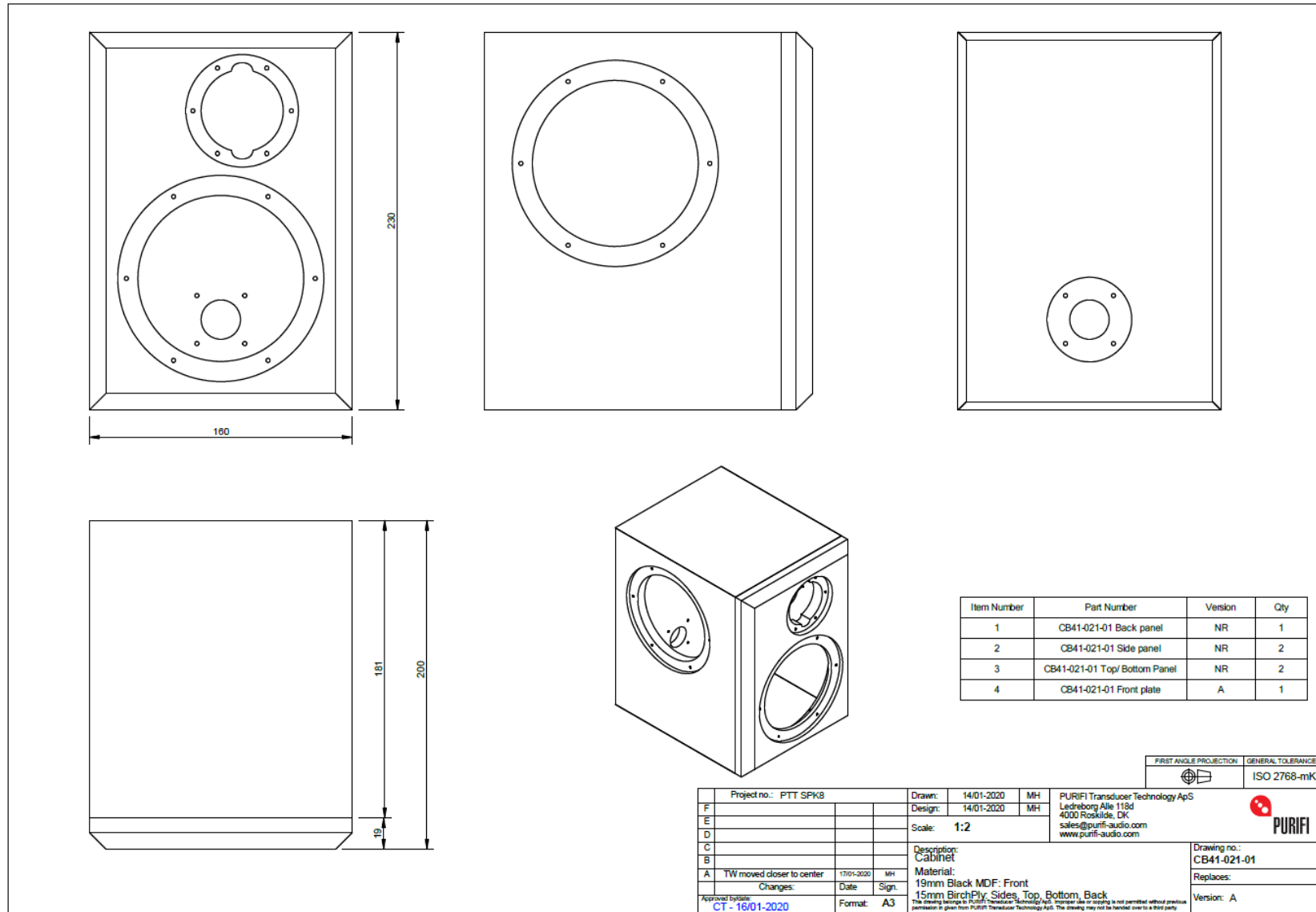
Figure 7 Response with increased inductance and damping of tweeter

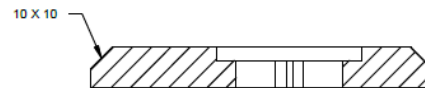
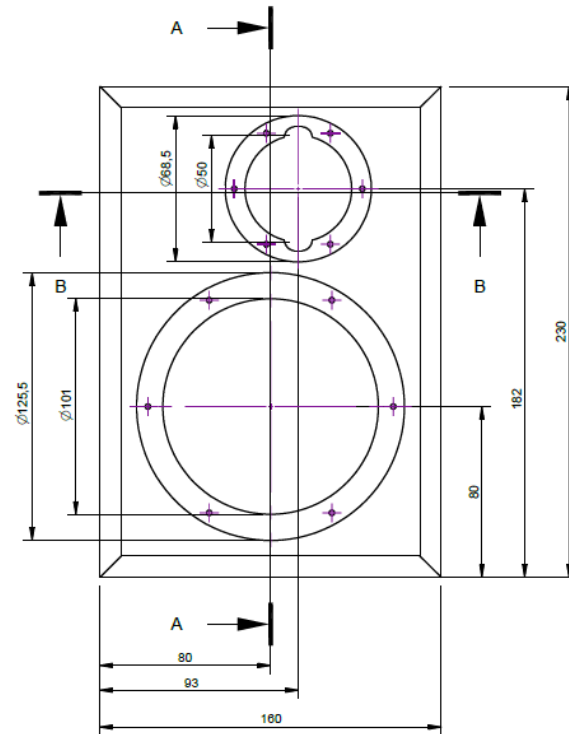
7 Tools

Tool	Link	Description
VituixCAD	kimmosaunisto.net	Box and cross-over modeling
Clio 12	www.audiomatica.com	Electrical and acoustic measurements systems
Earthworks M30BX	earthworksaudio.com	Measuring microphone

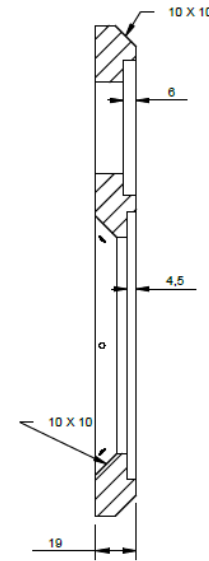
8 Revision History

Rev	Date	Description	ID
0.10	2022-2-17	Initial draft	KNM

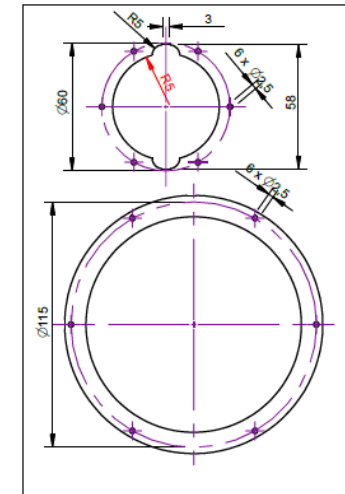




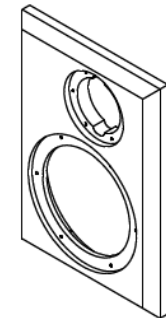
Section B-B





Section A-A

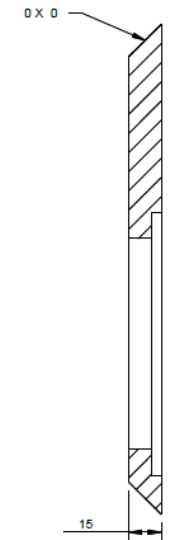
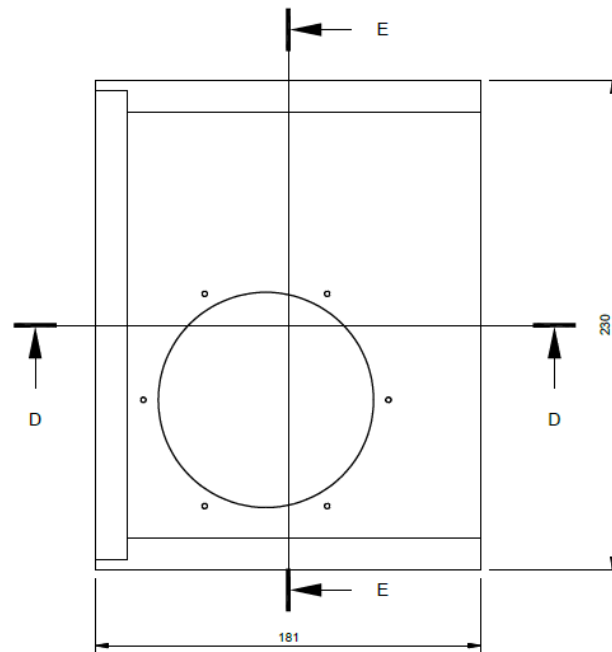


From behind



FIRST ANGLE PROJECTION	GENERAL TOLERANCES
	ISO 2768-mK

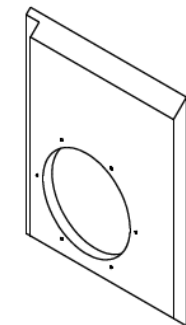
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F		Design: 14/01-2020	MH			
E		Scale: 1:2				
D		Description: Cabinet Front Panel 19mm Black MDF				Drawing no.: CB41-021-01 Front Plate
C						
B		Changes: A TW moved closer to center				Replaces:
A						
Approved by: CT - 16/01-2020		Date: 17/01-2020 Sign: MH		Version: A		
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Section E-E



Section D-D



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F			Design: 14/01-2020	MH			
E			Scale: 1:2		Description: Cabinet Side Panel 15mm Birch Plywood	Drawing no.: CB41-021-01 Side Panel	
D							
C							
B							
A							
Changes:		Date	Sign.	Replaces:			
Approved by: CT - 16/01-2020		Format: A3			Version: NR		

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