



**Eighteen Sound
a AEB S.r.l. Company**

**Via dell'Industria 20
45025 Cavriago
Reggio Emilia
Italy**

Application Note #9:

Building an effective, high power, manifolded, Double 21", Band-Pass subwoofer.

Eighteen Sound Technical Department
March, 2010

PRELIMINARY

Rev. 0.1

Manifolded, Double 21" Band-Pass Subwoofer kit

- High performance 2 x 21" subwoofer system
- Multiple driver choice is possible:
 - 21NLW9000, for high power handling and lightweight box, neodymium magnet equipped.
 - 21LW1400 for cost effective solution equipped with ceramic magnet
 - Alternatively, 21NLW9600 could be a special option for highest efficiency, increased motor-strength and maximum impact.



•21NLW9000 woofer key features:

Neodymium magnet

5.3" interleaved sandwich voice coil (ISV)

Triple silicon spider (TSS)

1800W AES power handling

•21LW1400 woofer key features:

4" interleaved sandwich voice coil (ISV)

Double silicon spider (DSS)

Double demodulating rings (DDR)

1500W AES power handling

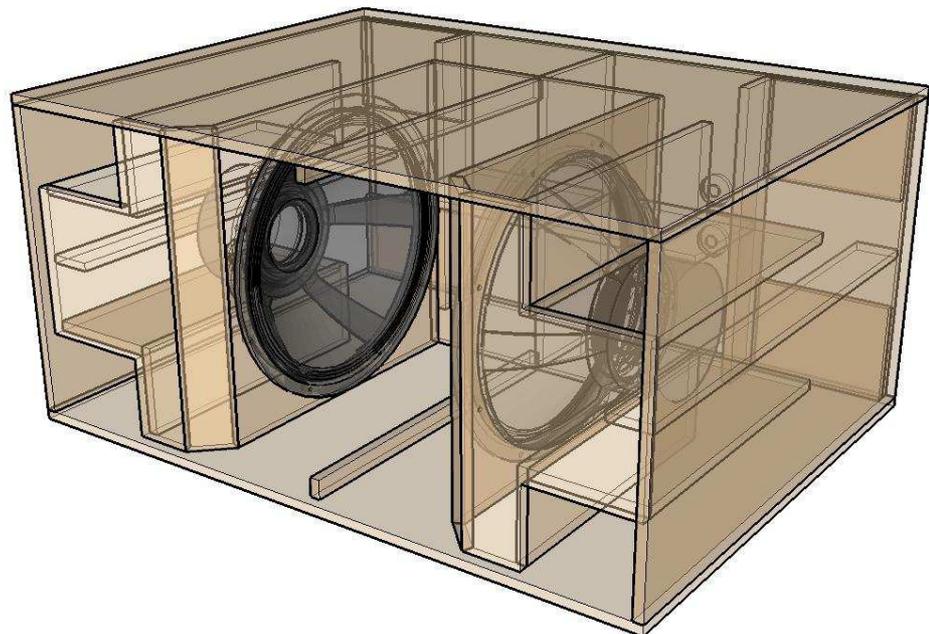
•21NLW9600 woofer key features:

Similar mechanic characteristics like

21NLW9000 model but with

augmented strength magnet for

an outstanding 43.5! Bl factor.



Manifolded, Double 21" Band-Pass Subwoofer kit

21NLW9000 Data



GENERAL SPECIFICATIONS

NOMINAL DIAMETER	533 mm (21 in)
RATED IMPEDANCE	8 ohms
AES POWER	1800W
PROGRAM POWER (1)	3600W
PEAK POWER (2)	10000W
SENSITIVITY (3)	96 dB
FREQUENCY RANGE (4)	24 - 1500 Hz
POWER COMPRESSION @ -10 DB (5)	0.7 dB
POWER COMPRESSION @ -3 DB	1.3 dB
POWER COMPRESSION @ FULL POWER	2.2 dB
MAX RECOMM. FREQUENCY	100 Hz
RECOMM. ENCLOSURE VOLUME	120 ÷ 500 lt. (4,24 ÷ 17,7 cuft)
MINIMUM IMPEDANCE	8,2 ohms at 25°C
MAX PEAK TO PEAK EXCURSION	70 mm (2,75 in)
VOICE COIL DIAMETER	135 mm (5,32 in)
VOICE COIL WINDING MATERIAL	copper
SUSPENSION	Triple roll, Polycotton
CONE	Straight Ribbed, Treated Paper

THIELE SMALL PARAMETERS (6)

Fs	29 Hz
Re	6 ohms
Sd	0,1662 sq.mt. (257,6 sq.in.)
Qms	9,32
Qes	0,36
Qts	0,34
Vas	304 lt. (10,4 cuft)
Mms	390 gr. (0,86 lb)
BL	34,5 Tm
Linear Mathematical Xmax (7)	±14 mm (±0,55 in)
Le (1kHz)	2,8 mH
Ref. Efficiency 1W@1m (half space)	95,0 dB

Manifolded, Double 21" Band-Pass Subwoofer kit

21LW1400 Data



GENERAL SPECIFICATIONS

NOMINAL DIAMETER	533 mm (21 in)
RATED IMPEDANCE	8 Ohm
AES POWER	1400 W
PROGRAM POWER (1)	1600 W
PEAK POWER (2)	7000 W
SENSITIVITY (3)	99 dB
FREQUENCY RANGE (4)	24 - 2000 Hz
POWER COMPRESSION @-10DB (5)	0,6 dB
POWER COMPRESSION @-3DB	1,5 dB
POWER COMPRESSION @FULL POWER	2,2 dB
MAX RECOMM. FREQUENCY	250 Hz
RECOMM. ENCLOSURE VOLUME	120 ÷ 500 lt. (4,24 ÷ 17,7 cuft)
MINIMUM IMPEDANCE	6,4 Ohm at 25°C
MAX PEAK TO PEAK EXCURSION	52 mm (2,05 in)
VOICE COIL DIAMETER	100 mm (4 in)
VOICE COIL WINDING MATERIAL	copper
SUSPENSION	Triple roll, Polycotton
CONE	Straight ribbed, Paper

THIELE SMALL PARAMETERS (6)

Fs	28 Hz
Re	5 Ohm
Sd	0,1662 sq.mt. (257,6 sq.in.)
Qms	9,32
Qes	0,242
Qts	0.235
Vas	385 lt. (13,6 cuft)
Mms	296 gr. (0,65 lb)
BL	33,5 Tm
Linear Mathematical Xmax (7)	± 9,5 mm (± 0,37 in)
Le (1kHz)	2,85 mH
Ref. Efficiency 1W@1m (half space)	98,0 dB

Manifolded, Double 21" Band-Pass Subwoofer kit

21NLW9600 Data



GENERAL SPECIFICATIONS

NOMINAL DIAMETER	533mm (21 in)
RATED IMPEDANCE	8 ohms
AES POWER	1800W
PROGRAM POWER (1)	3600W
PEAK POWER (2)	10000W
SENSITIVITY (3)	97 dB
FREQUENCY RANGE (4)	24 - 2000 Hz
POWER COMPRESSION @ -10 DB (5)	0.7 dB
POWER COMPRESSION @ -3 DB	1.3 dB
POWER COMPRESSION @ FULL POWER	2.2 dB
MAX RECOMM. FREQUENCY	100 Hz
RECOMM. ENCLOSURE VOLUME	120 ÷ 500 lt. (4,24 ÷ 17,7 cuft)
MINIMUM IMPEDANCE	8,2 ohms at 25°C
MAX PEAK TO PEAK EXCURSION	70 mm (2,75 in)
VOICE COIL DIAMETER	135 mm (5,32 in)
VOICE COIL WINDING MATERIAL	copper
SUSPENSION	Triple Roll, Polycotton
CONE	Straight Ribbed, Treated Paper

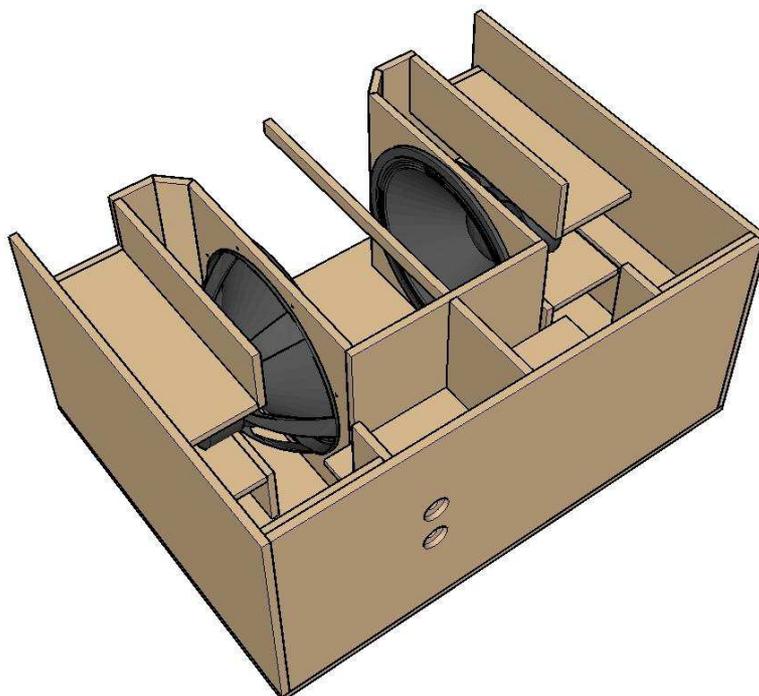
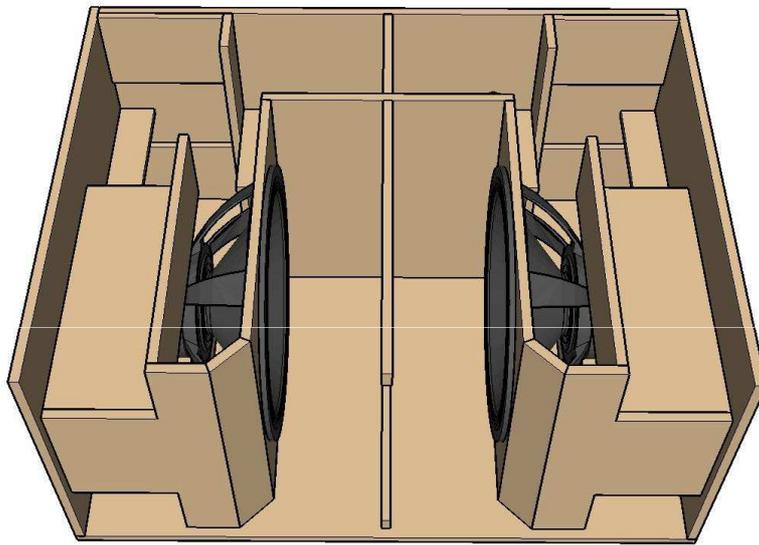
THIELE SMALL PARAMETERS (6)

Fs	29 Hz
Re	6 ohms
Sd	0,1662 sq.mt. (257,6 sq.in.)
Qms	9,32
Qes	0,23
Qts	0,22
Vas	304 lt. (10,4 cuft)
Mms	390 gr. (0,86 lb)
BL	43,5 Tm
Linear Mathematical Xmax (7)	±14 mm (±0,55 in)
Le (1kHz)	3 mH
Ref. Efficiency 1W@1m (half space)	97,0 dB

Manifolded, Double 21" Band-Pass Subwoofer kit

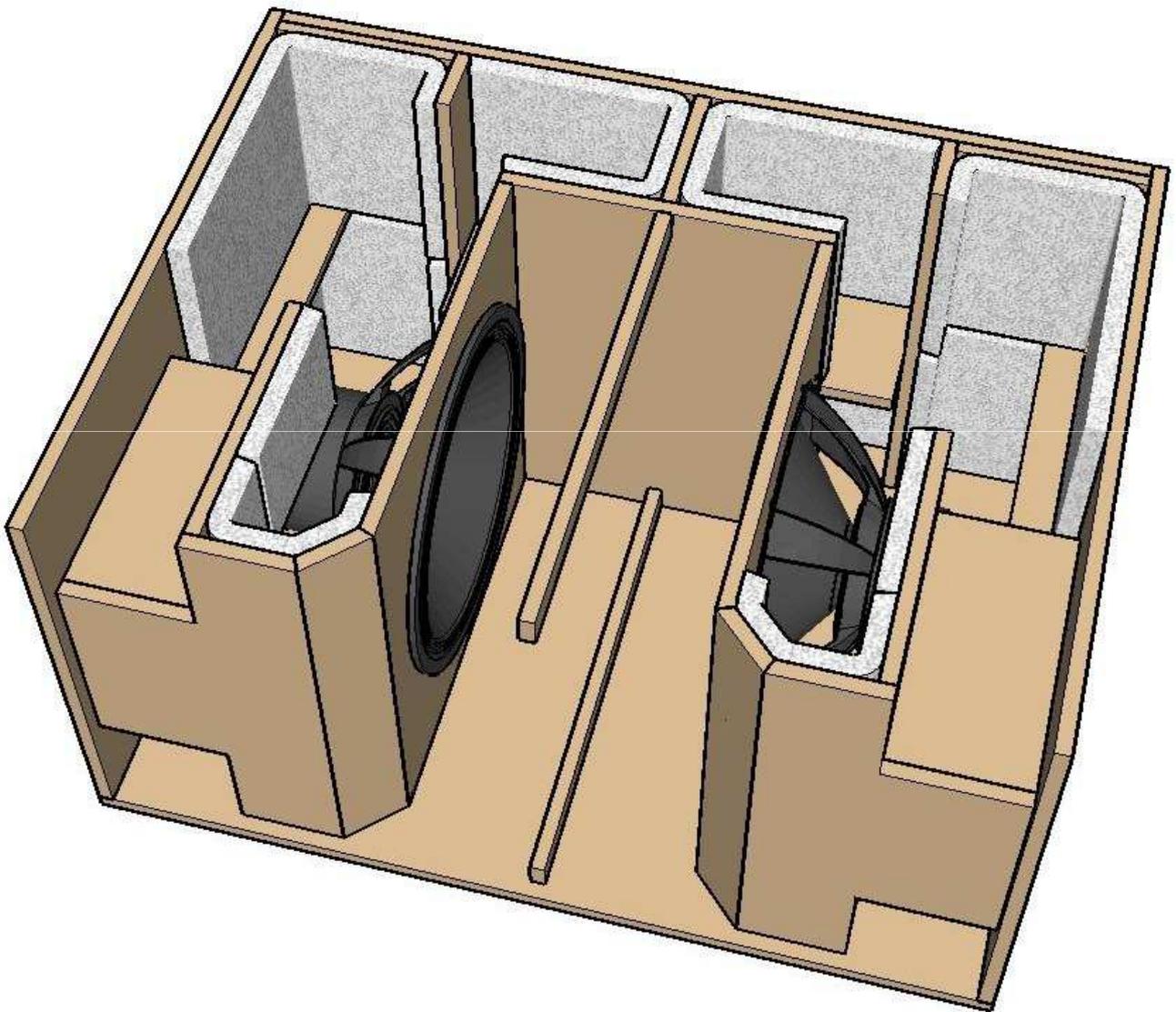
- The enclosure should be made of Baltic birch plywood (18mm thickness)
- Bolts are M6x35mm
- M6 T-Nuts are recommended
- Handling, rigging and connectors are user's choice
- It's recommended to well damping the cabinet interior
- You should see an example of the required dampening on the image on the next page
- An high density dampening material, such as Dacron or other synthetic fibers, is required for better performance

Internal view

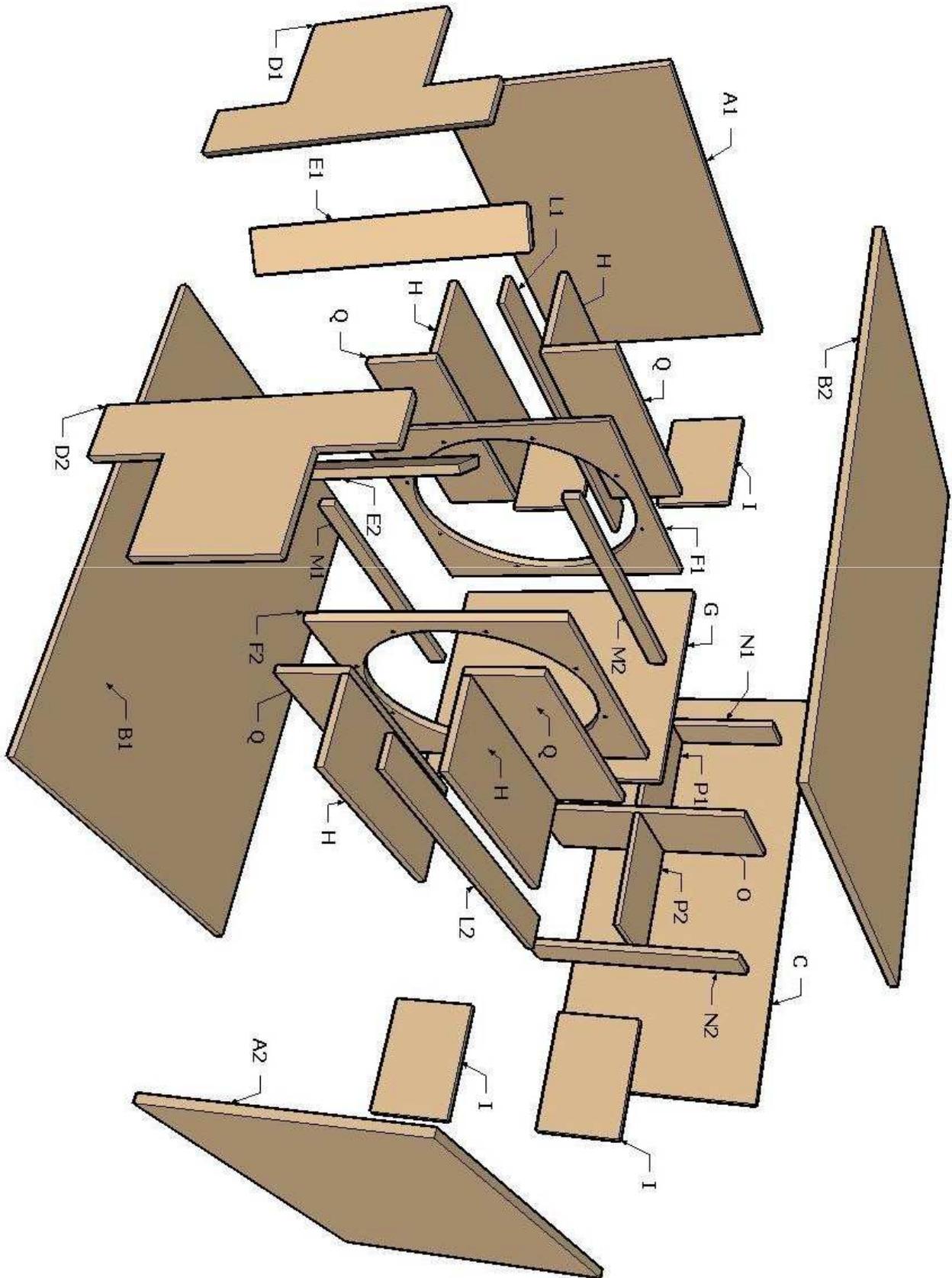


Manifolded, Double 21" Band-Pass Subwoofer kit

Internal view and damping material



Manifolded, Double 21" Band-Pass Subwoofer kit

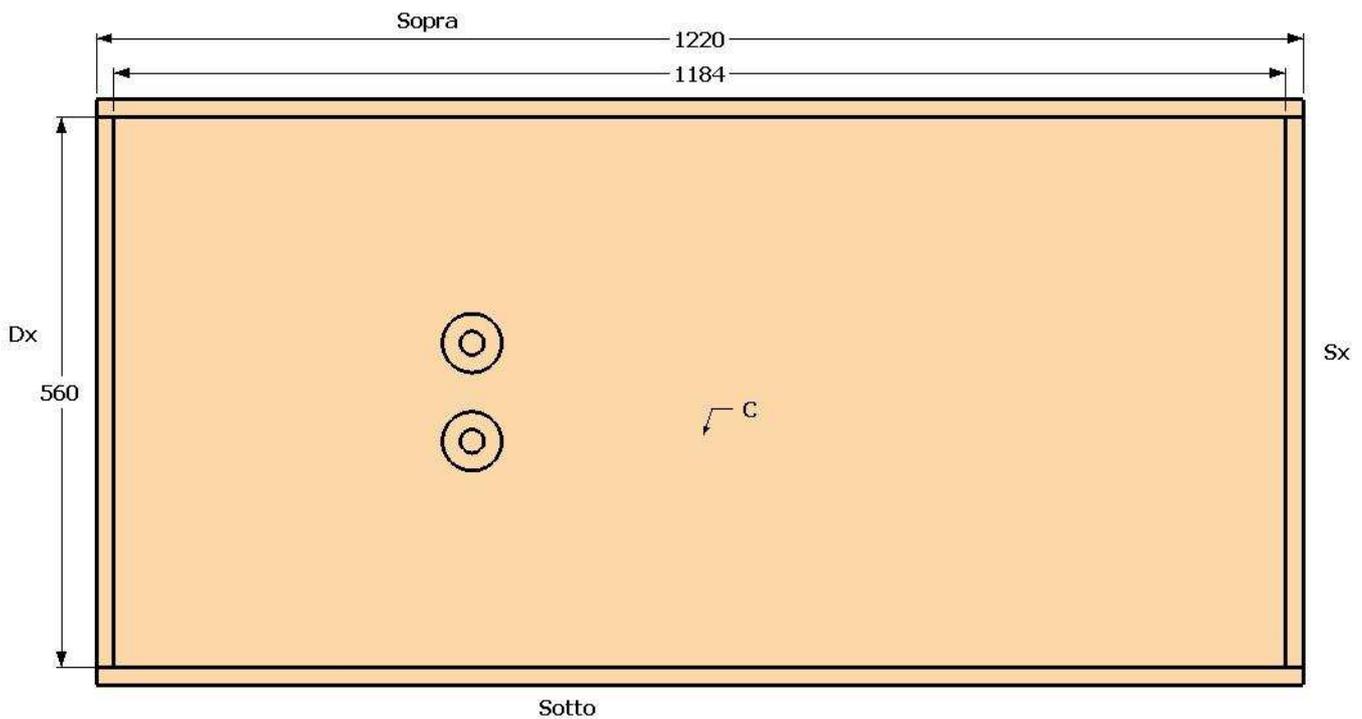
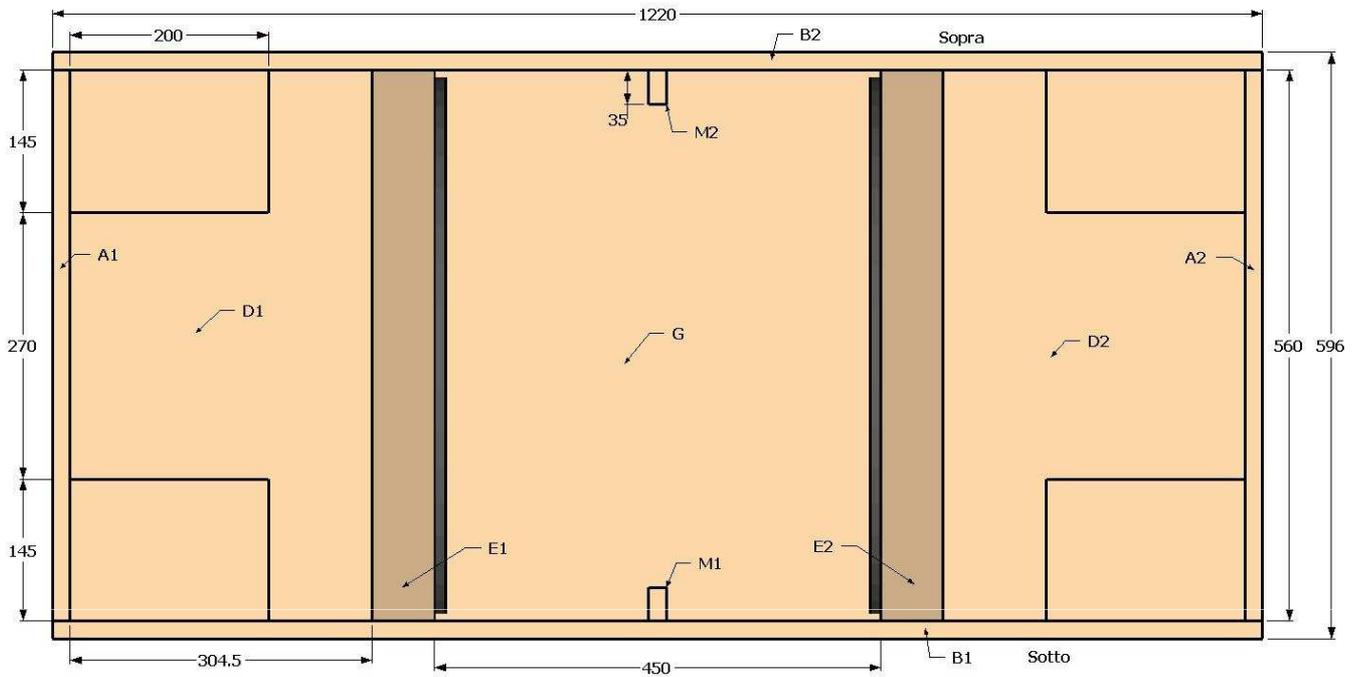


Exploded view

PRELIMINARY

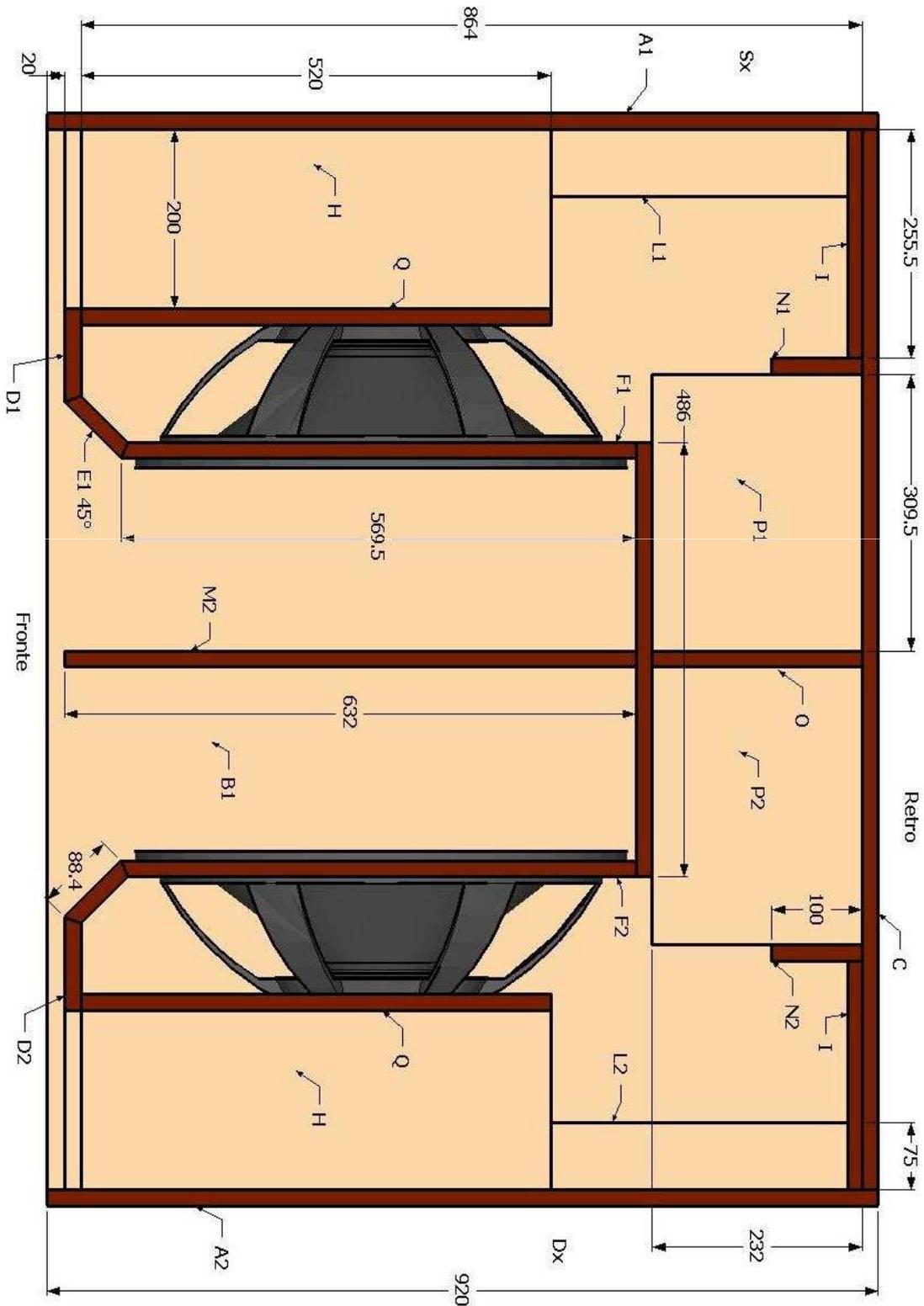
Manifolded, Double 21" Band-Pass Subwoofer kit

Front-Rear view



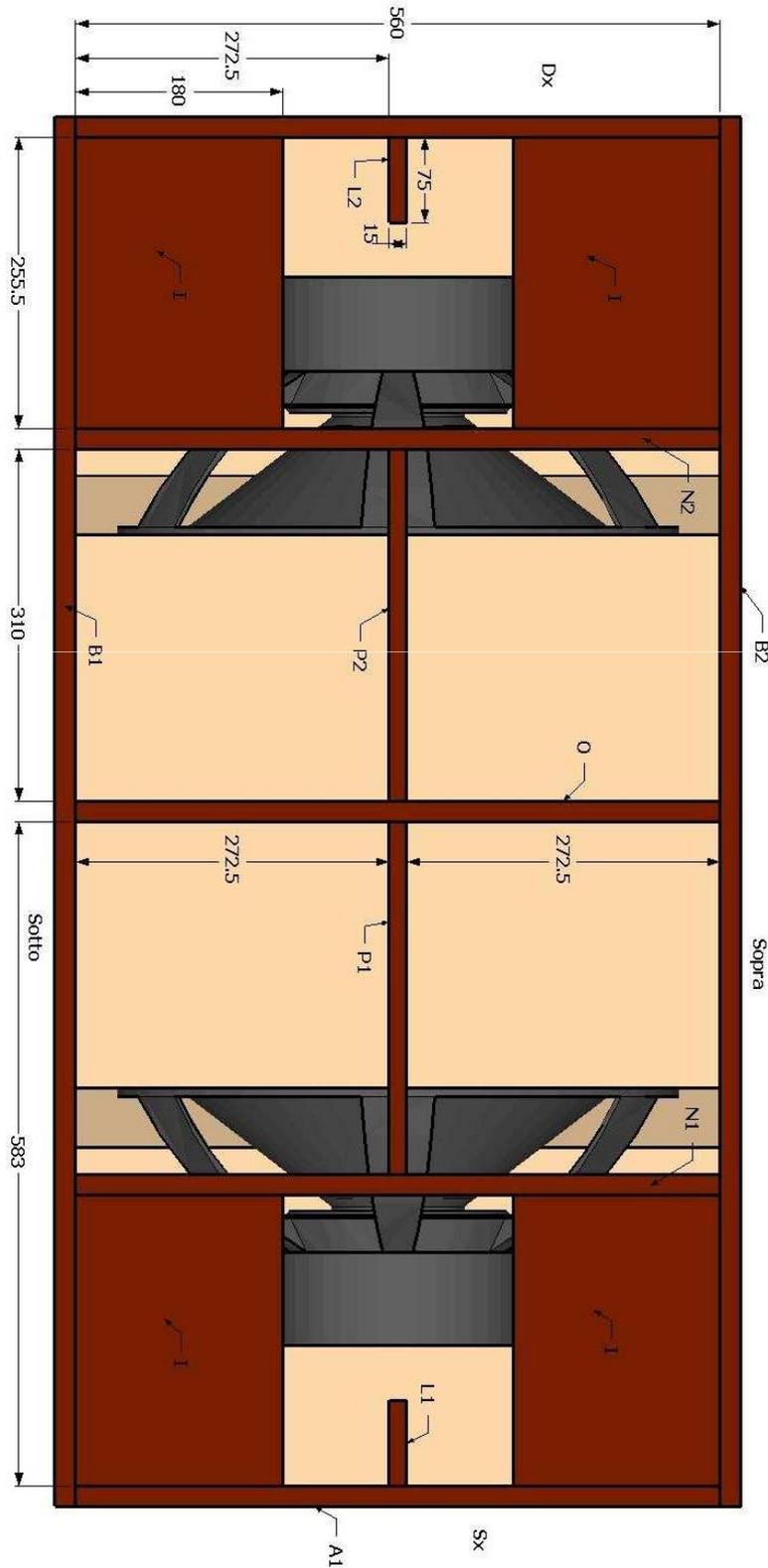
Manifolded, Double 21" Band-Pass Subwoofer kit

Top Section



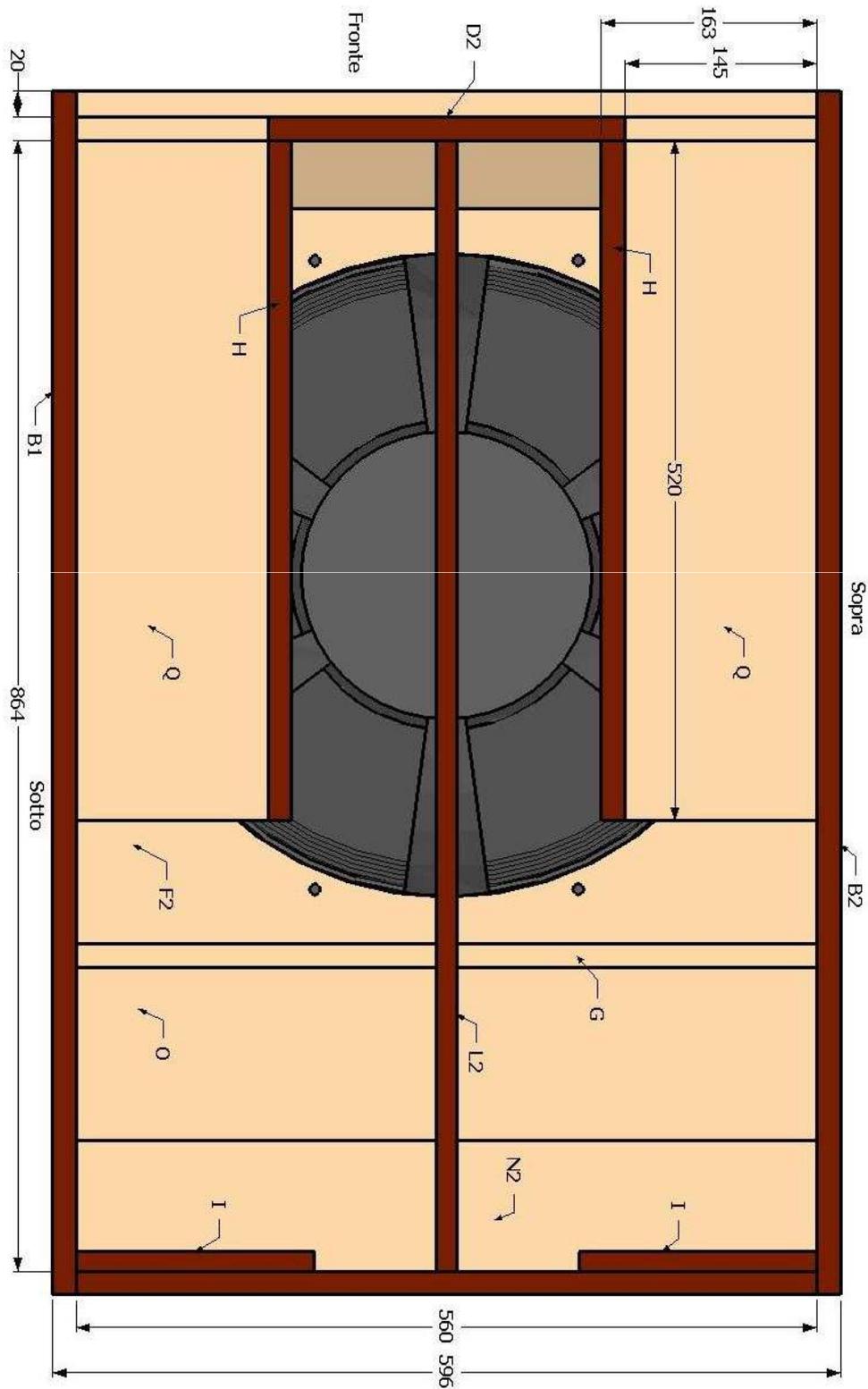
Manifolded, Double 21" Band-Pass Subwoofer kit

Rear Section

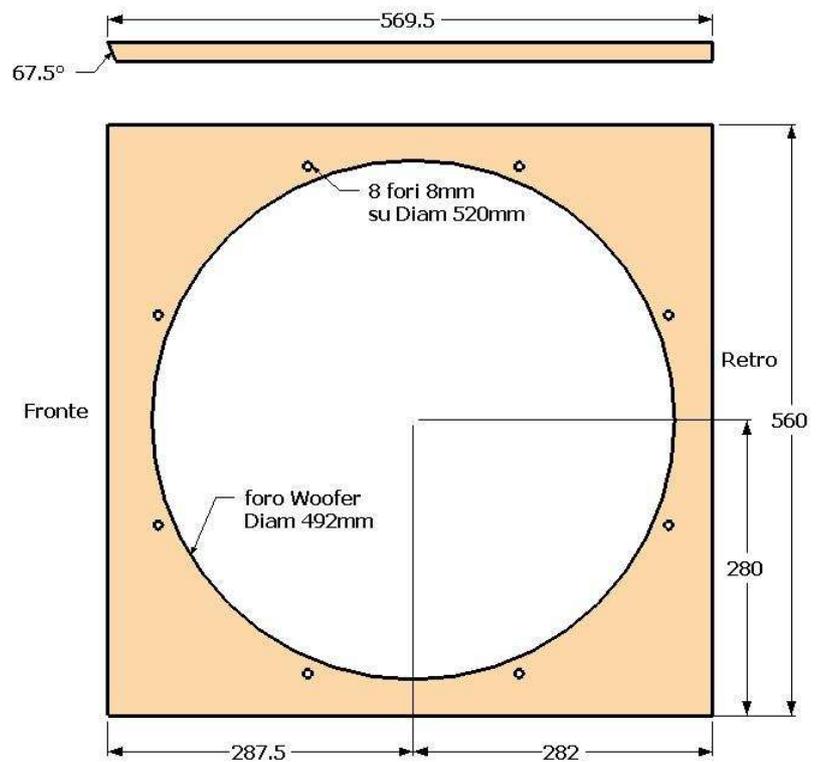
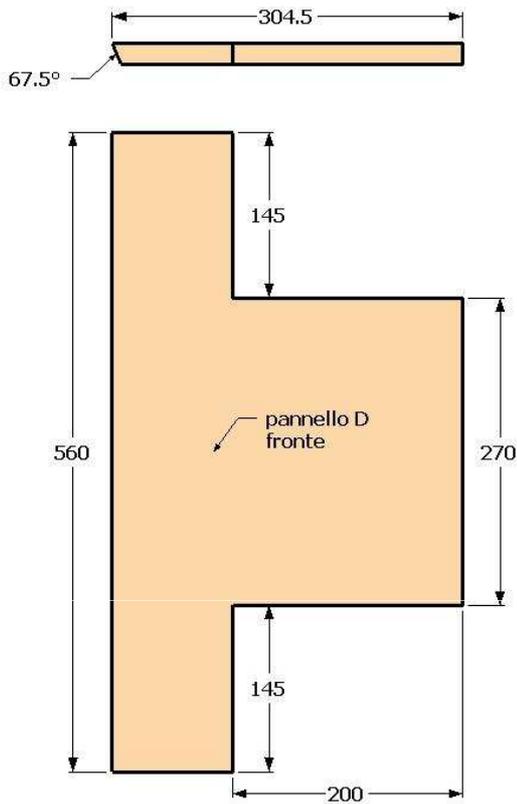


Manifolded, Double 21" Band-Pass Subwoofer kit

Side Section



Details: part D and F





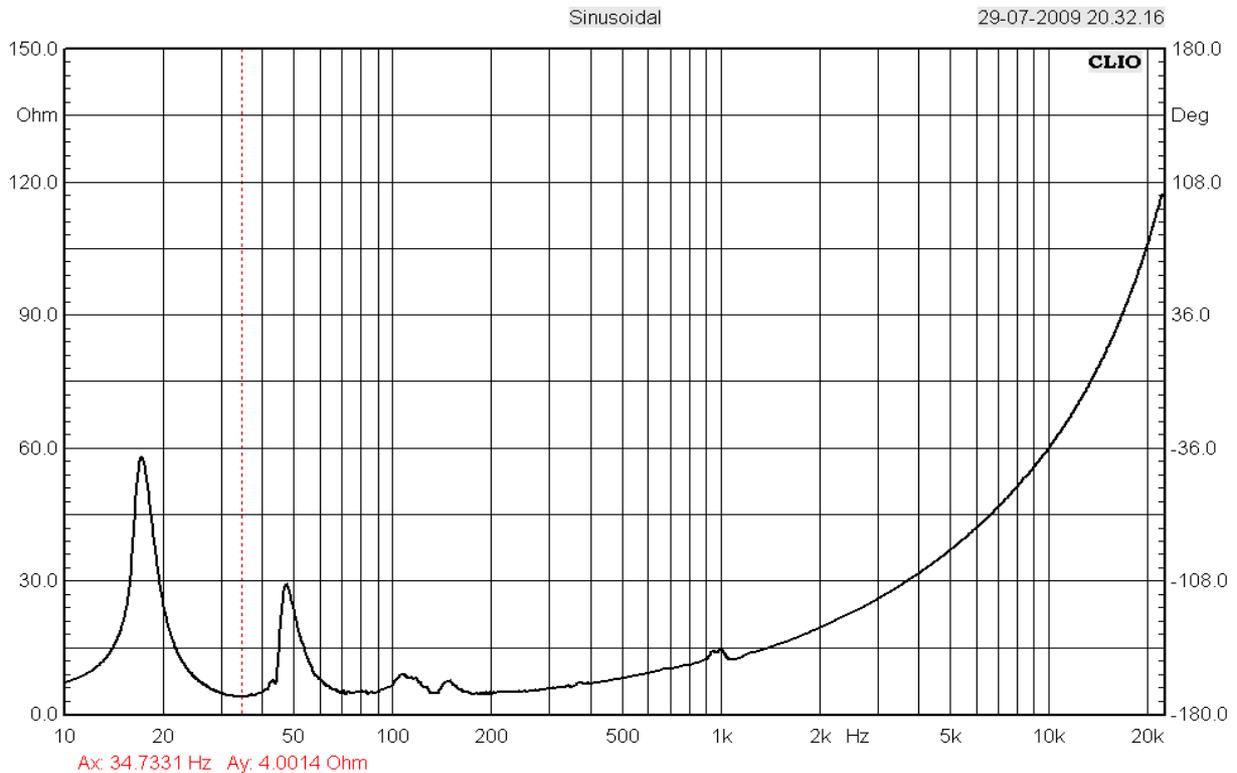
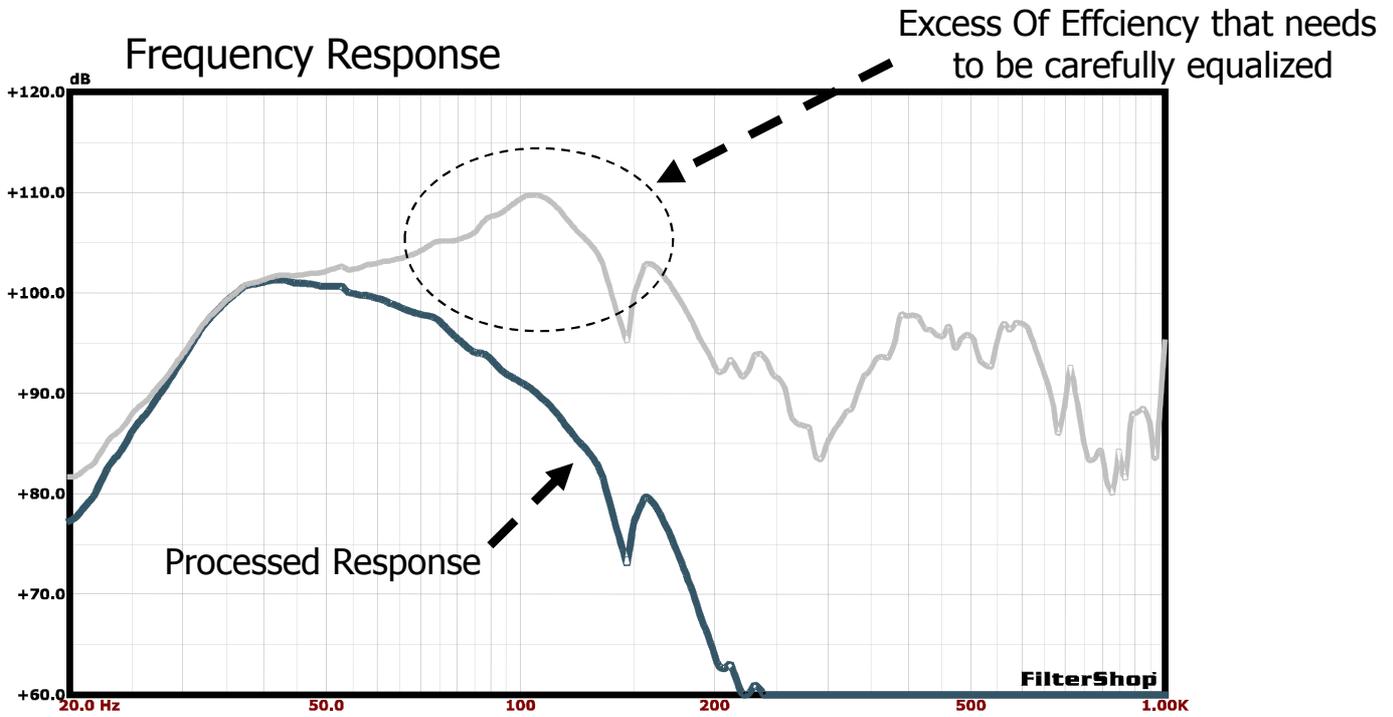
Manifolded, Double 21" Band-Pass Subwoofer kit

System Measurements and Suggested Settings with 21NLW9000

PRELIMINARY

Manifolded, Double 21" Band-Pass Subwoofer kit

Unfiltered Frequency Response, 2.83V/1m and relative Input Impedance Curve with 21NLW9000

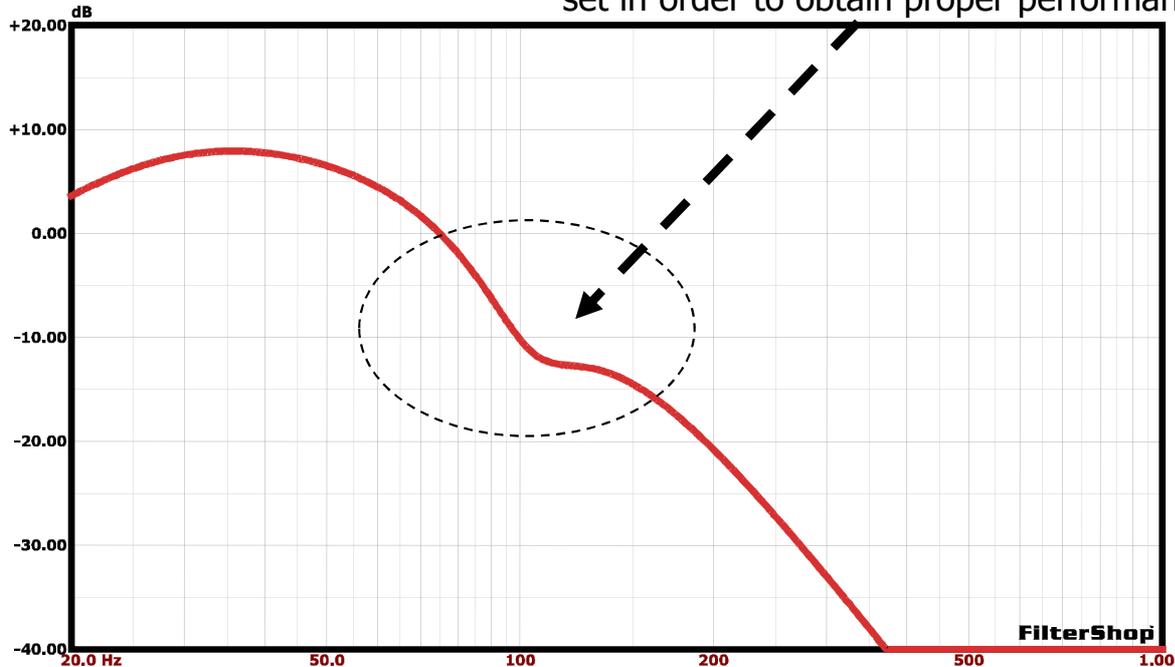


CH A Ohm Resolution 1/48 Octave Unsmoothed 48kHz Delay [ms] 0.000 Dist Rise [dB] 30.00

File: impedance direct 18 9600 rodaggio piu damp2.sini

Processing Guidelines and Processor Response with 21NLW9000

The equalization filter Eq2 must be carefully set in order to obtain proper performances



Necessary Processor Settings with 21NLW9000 Loudspeaker

High pass: Butterworth **2nd** order, 12dB/Oct @ 25 Hz

Parametric EQ **Eq1:** F= 33 Hz - Gain= 2dB - Q= 0.8

Eq2: F= 105 Hz - Gain= -12 dB - Q= 3

Low pass: Linkwitz-Riley **4th** order, 24dB/Oct @ 95 Hz

Polarity: Positive (+)

Limiter: @ +13dBu, 100ms Atk. Time, X4 Release Time

Output Gain: + 8dB

Processing Parameters Referred to **XTA DP224/DP226/DP448** Processors

Required Amplifier for proper driving, approx.: 2500W @ 8 Ohm, 5000W @ 4 Ohm with Gain 32dB

Gain and Limiter Values need to be properly adjusted if different gain amplifier is being used

Processing Guidelines and Processor Response with 21NLW900

Processed Subwoofer Response



Processed Subwoofer Response with Target Response Matching



Published by Eighteen Sound®. Copyright © 2010. All rights reserved.
Any effort of placing this design into manufacturing is strictly prohibited.