



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

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## 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)

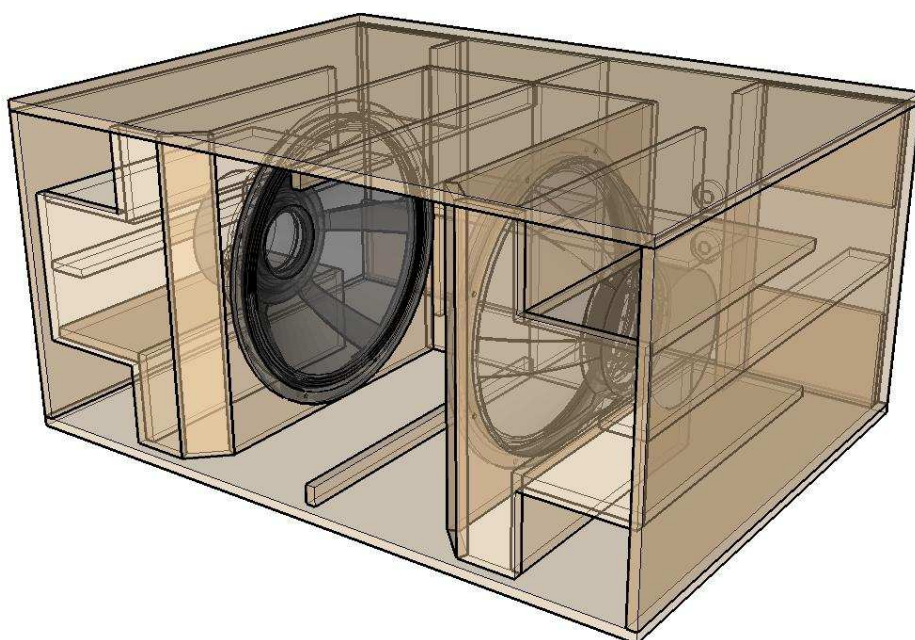
Double silicon spider (DSS)

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

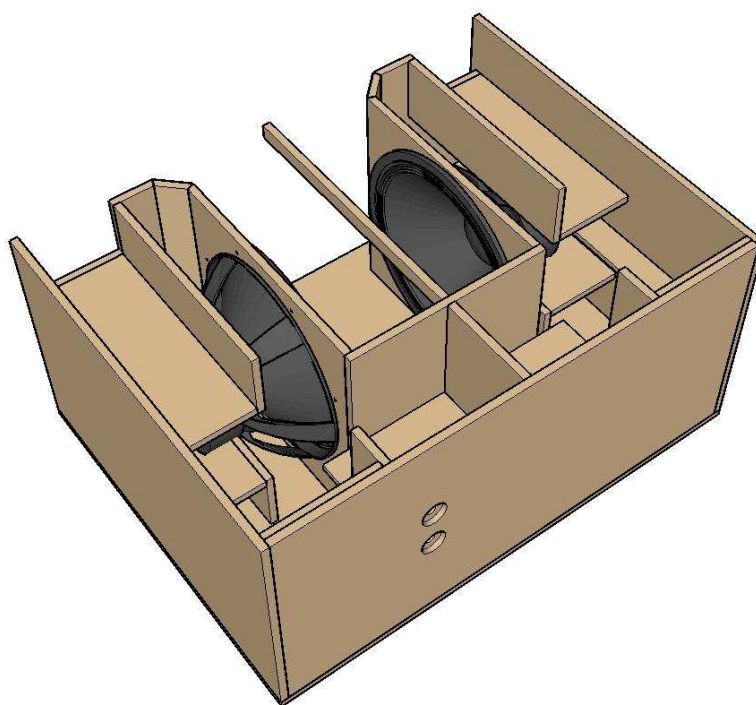
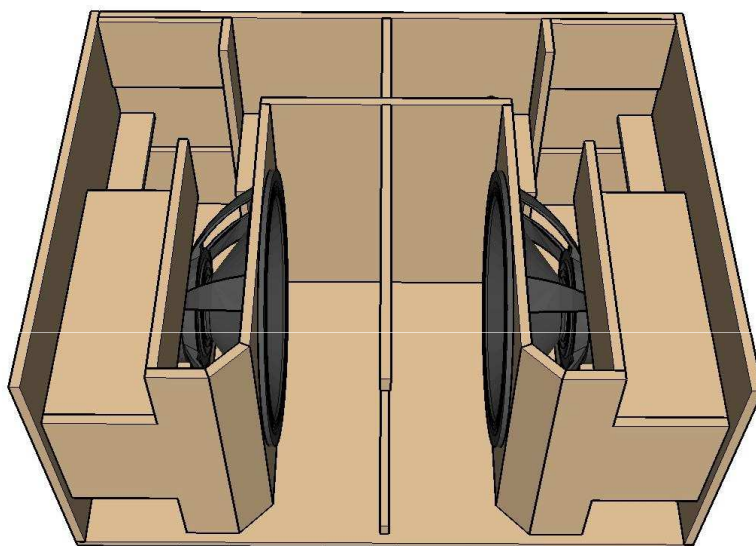
### THIELE SMALL PARAMETERS (6)

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

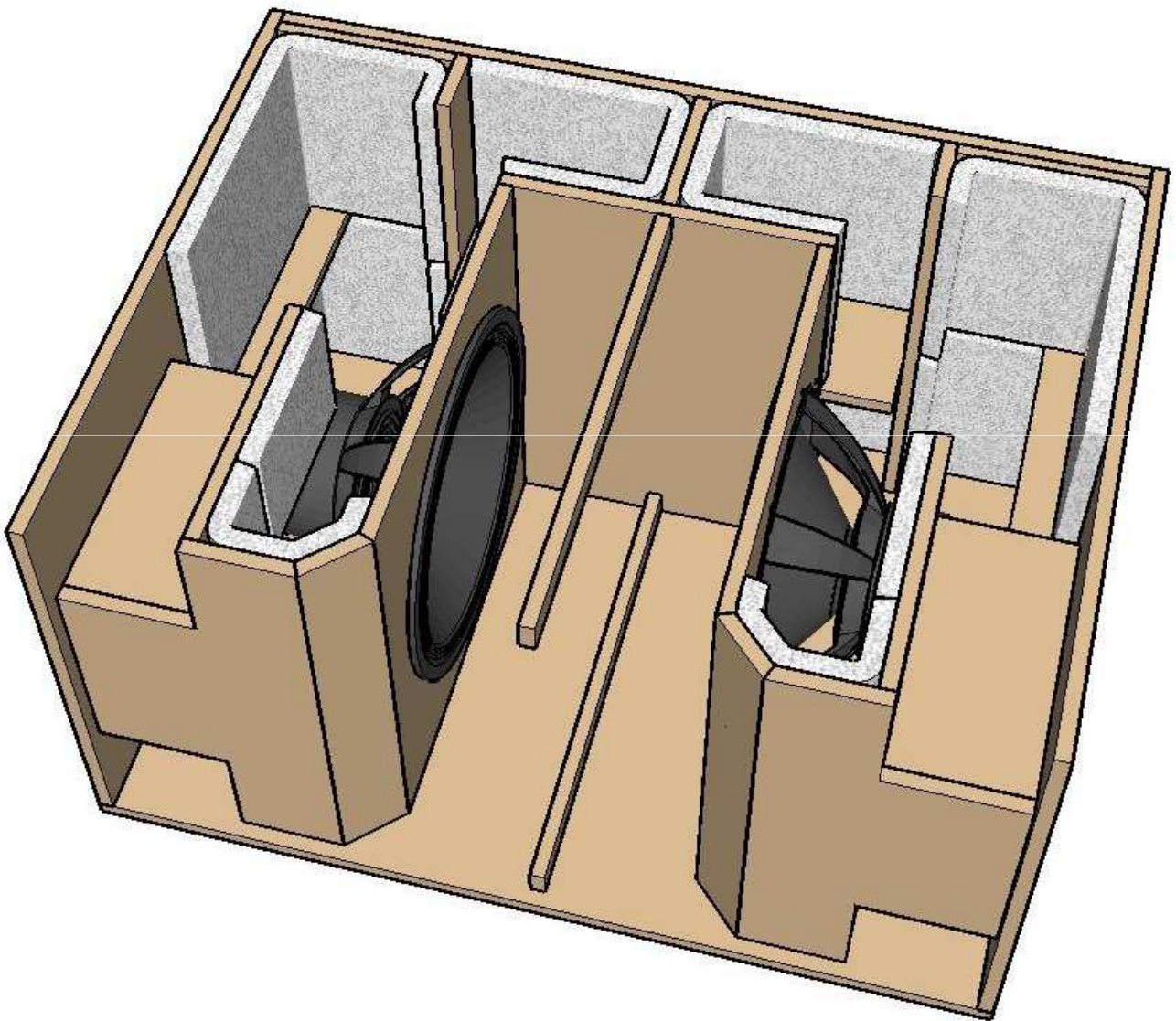


## Manifolded, Double 21" Band-Pass Subwoofer kit

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### Internal view and damping material

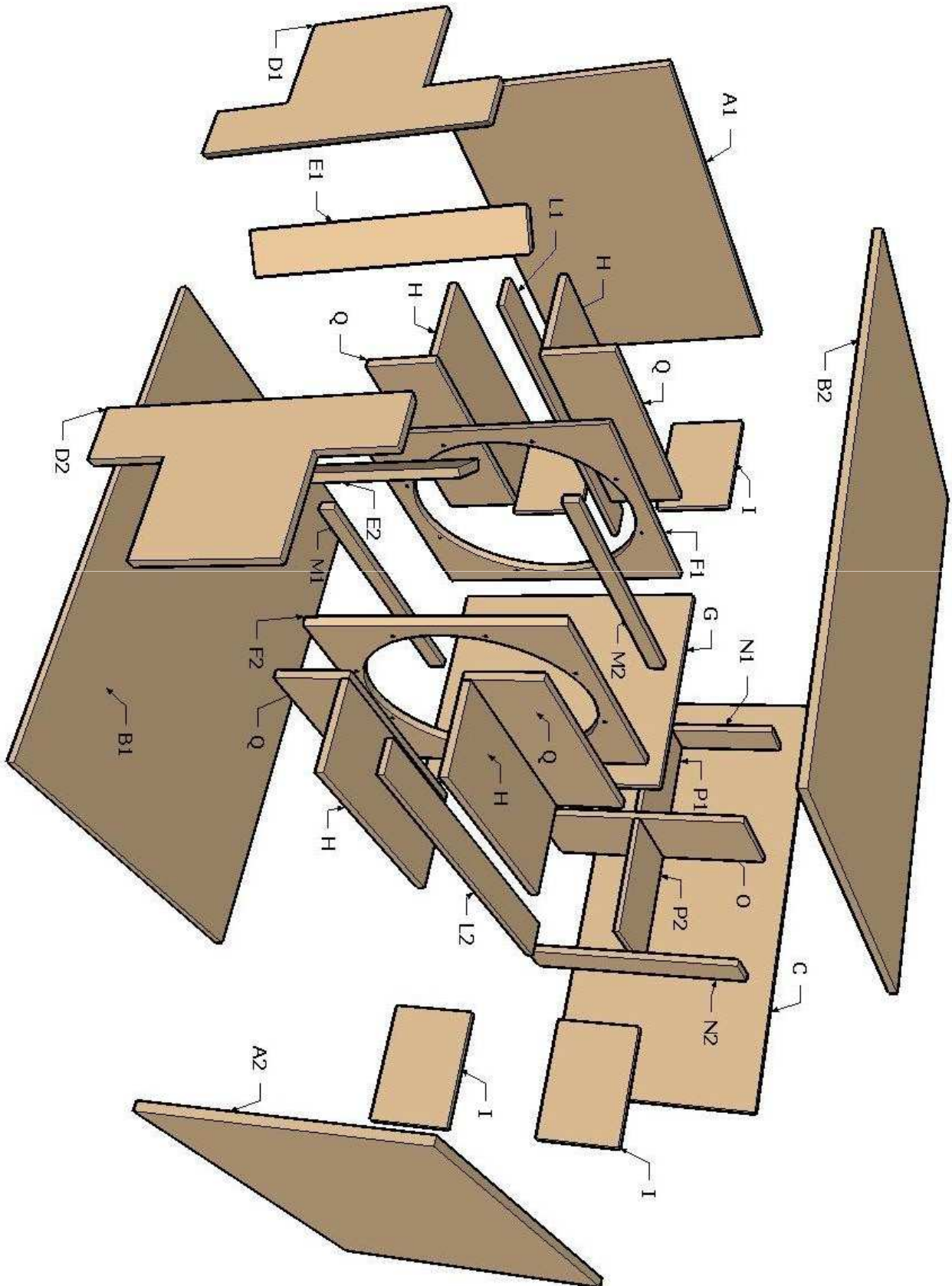
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# Manifolded, Double 21" Band-Pass Subwoofer kit



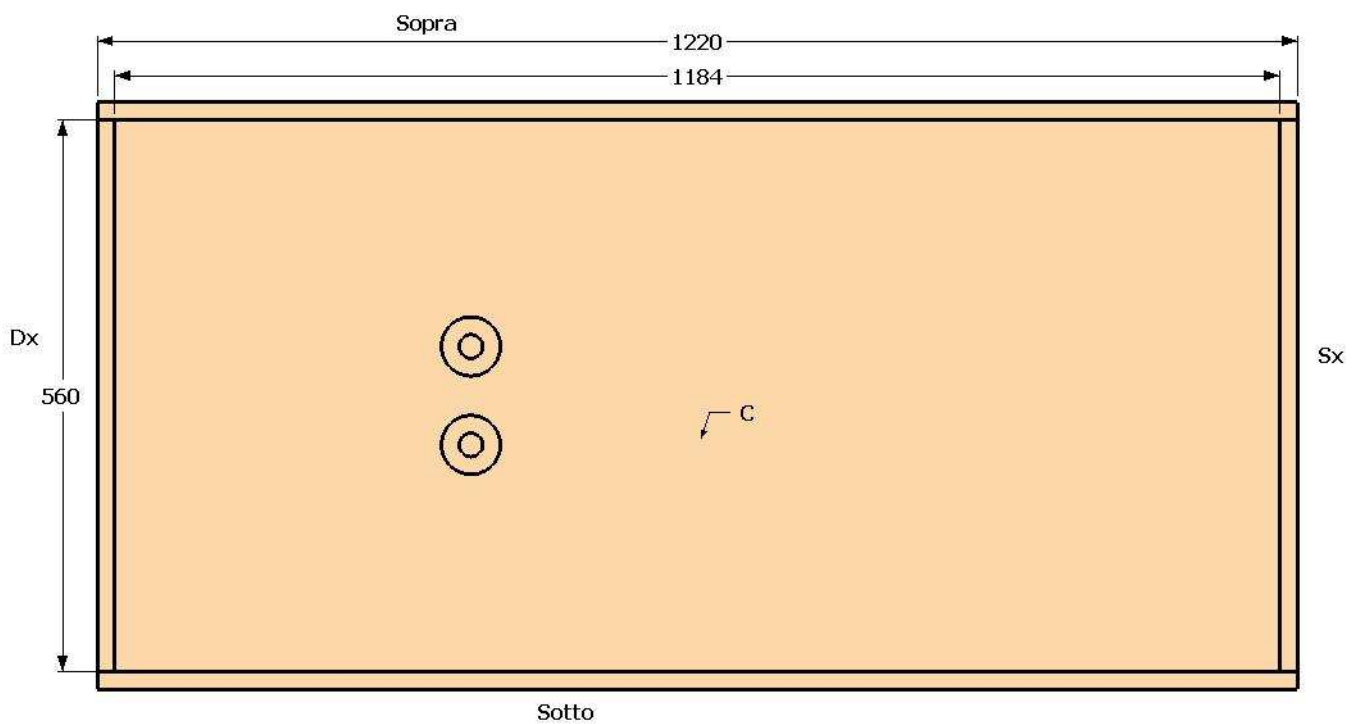
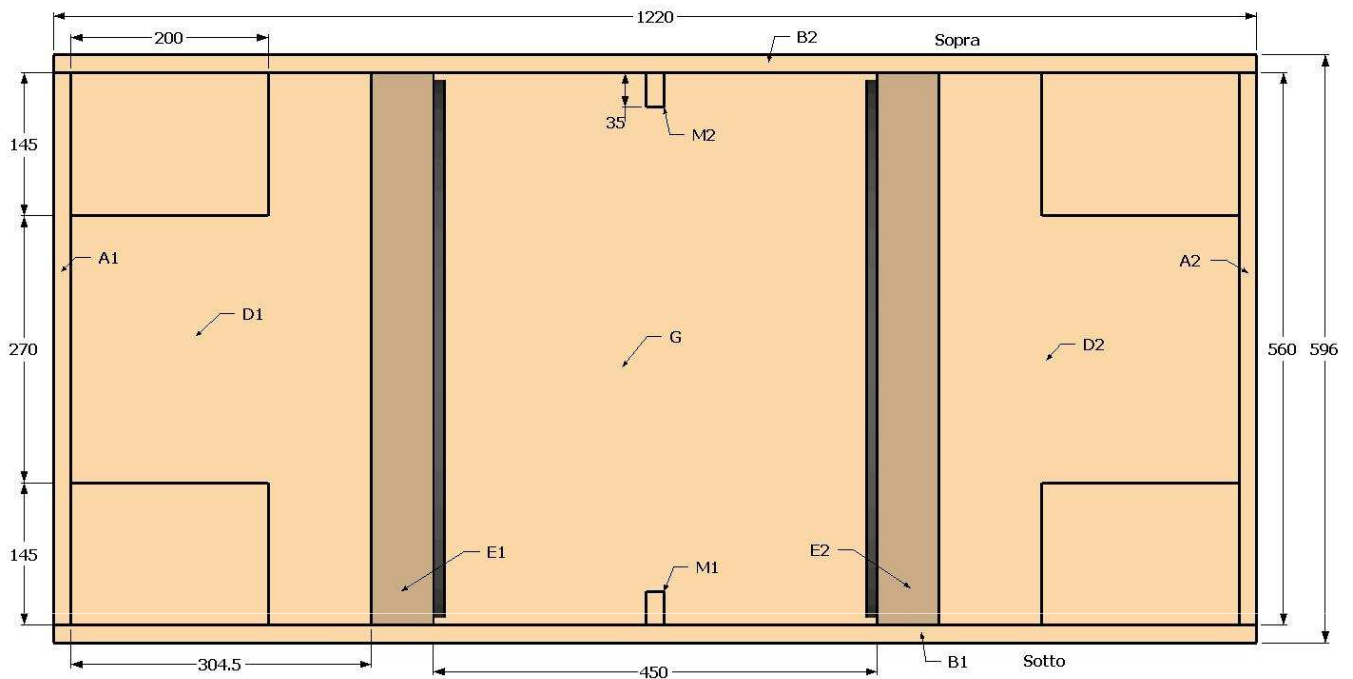
**Exploded view**

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# Manifolded, Double 21" Band-Pass Subwoofer kit

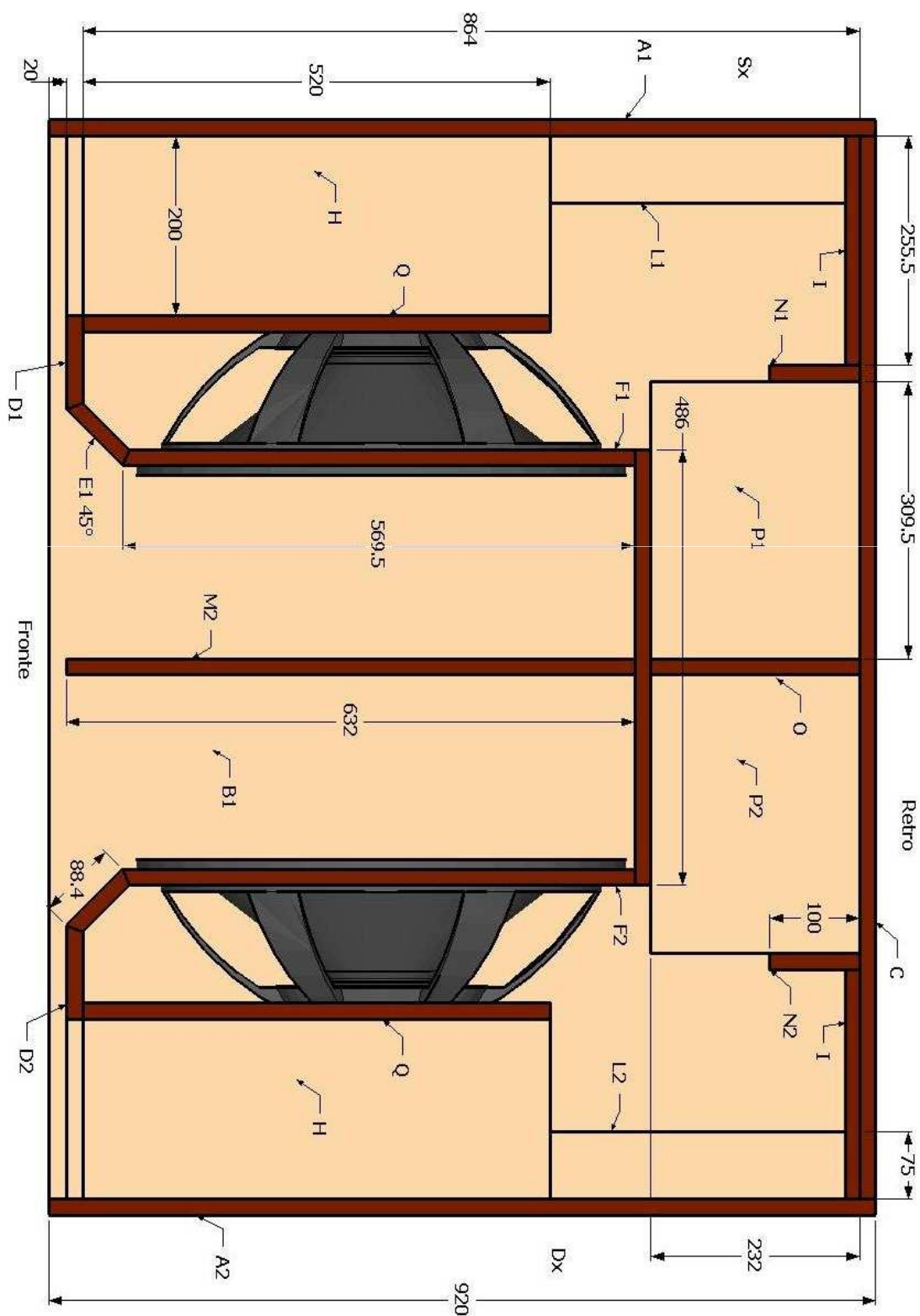
## Front-Rear view



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## Manifolded, Double 21" Band-Pass Subwoofer kit

## Top Section



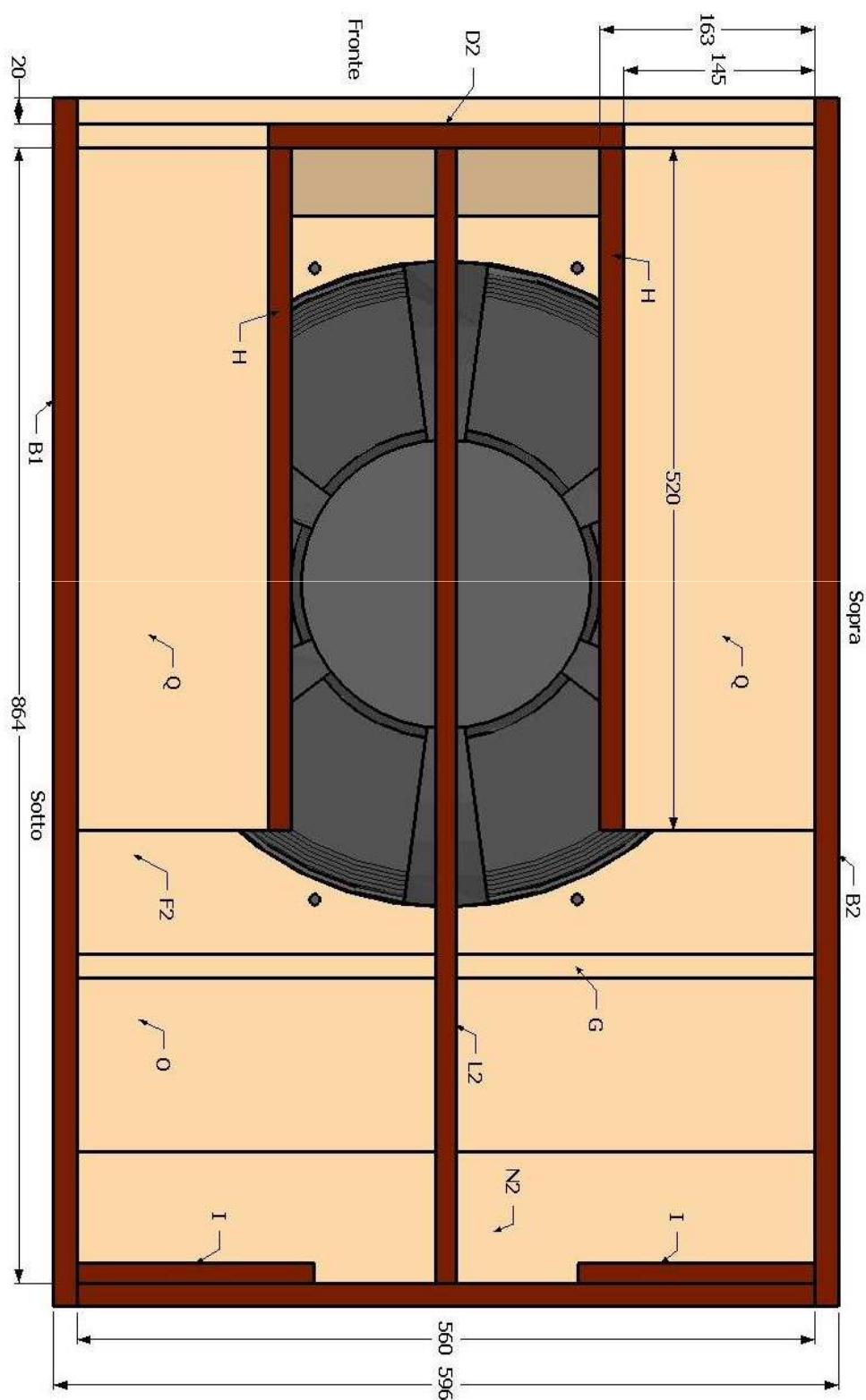
# PRELIMINARY

## Manifolded, Double 21" Band-Pass Subwoofer kit



# Manifolded, Double 21" Band-Pass Subwoofer kit

## Side Section

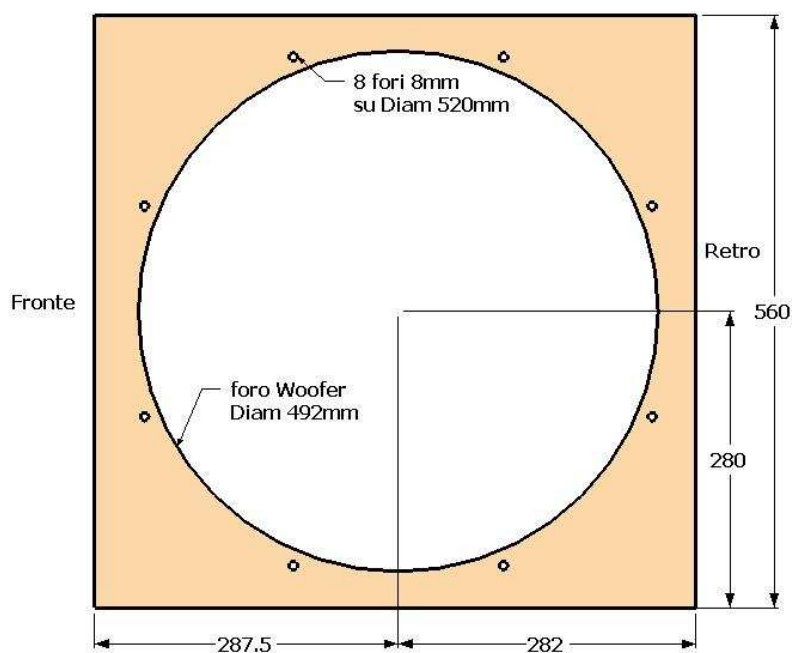
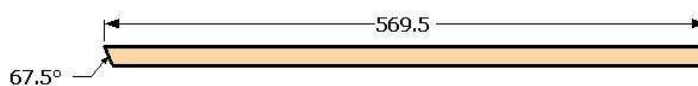
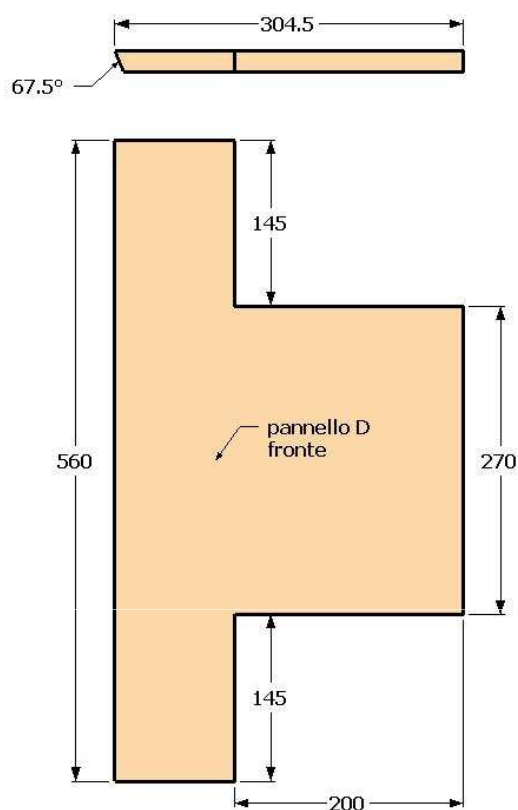


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# Manifolded, Double 21" Band-Pass Subwoofer kit

## Details: part D and F





## **Manifolded, Double 21" Band-Pass Subwoofer kit**

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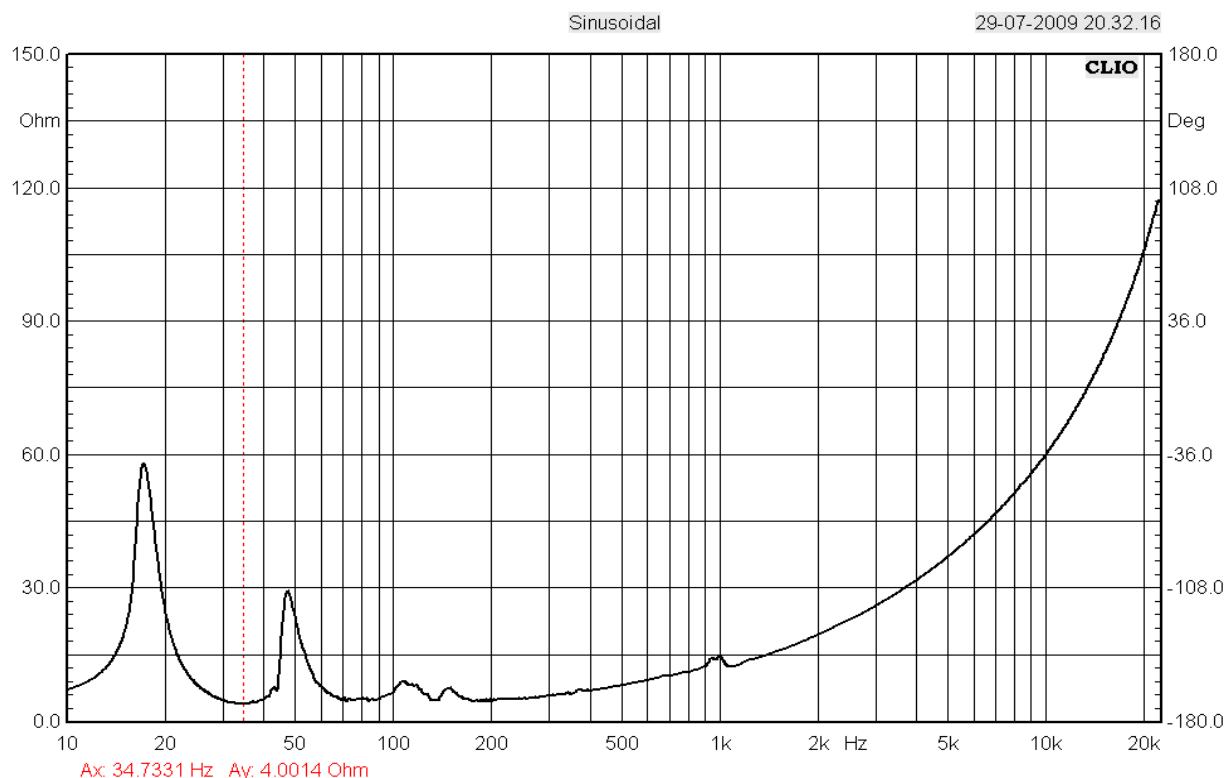
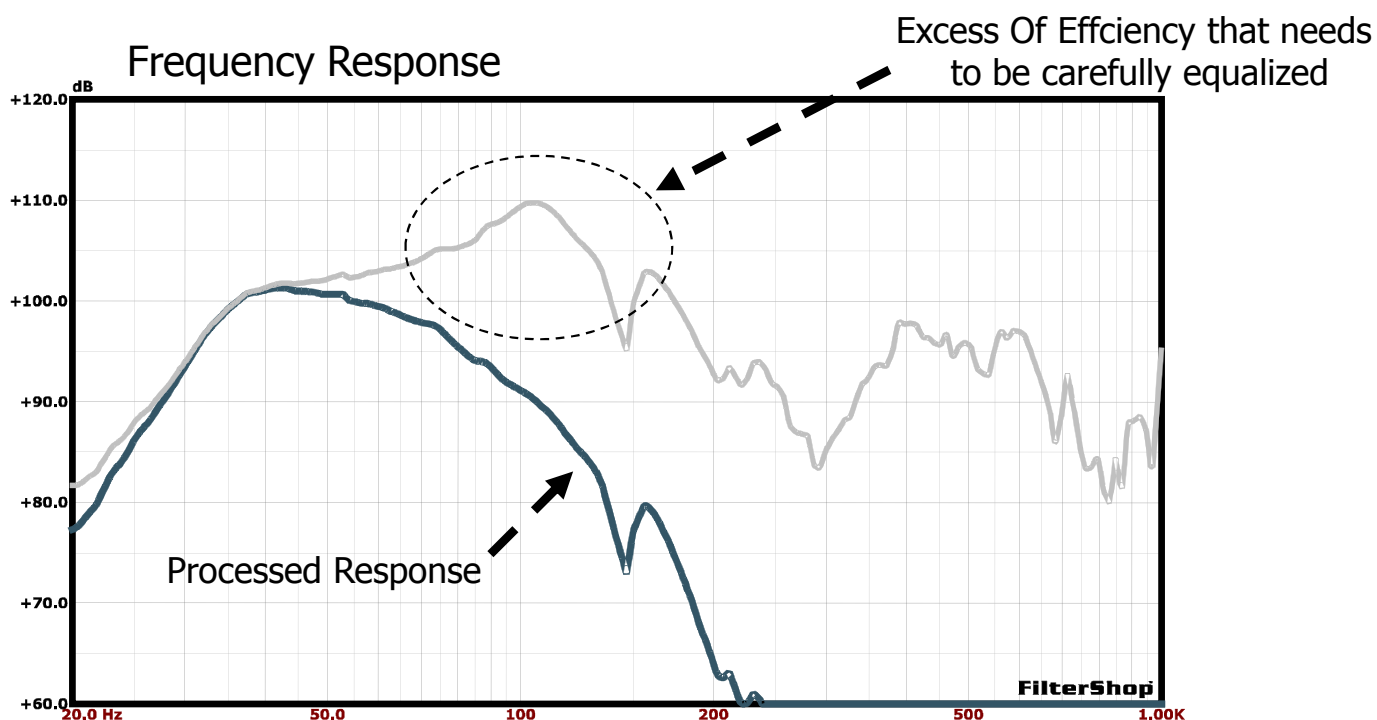
# **System Measurements and Suggested Settings with 21NLW9000**

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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

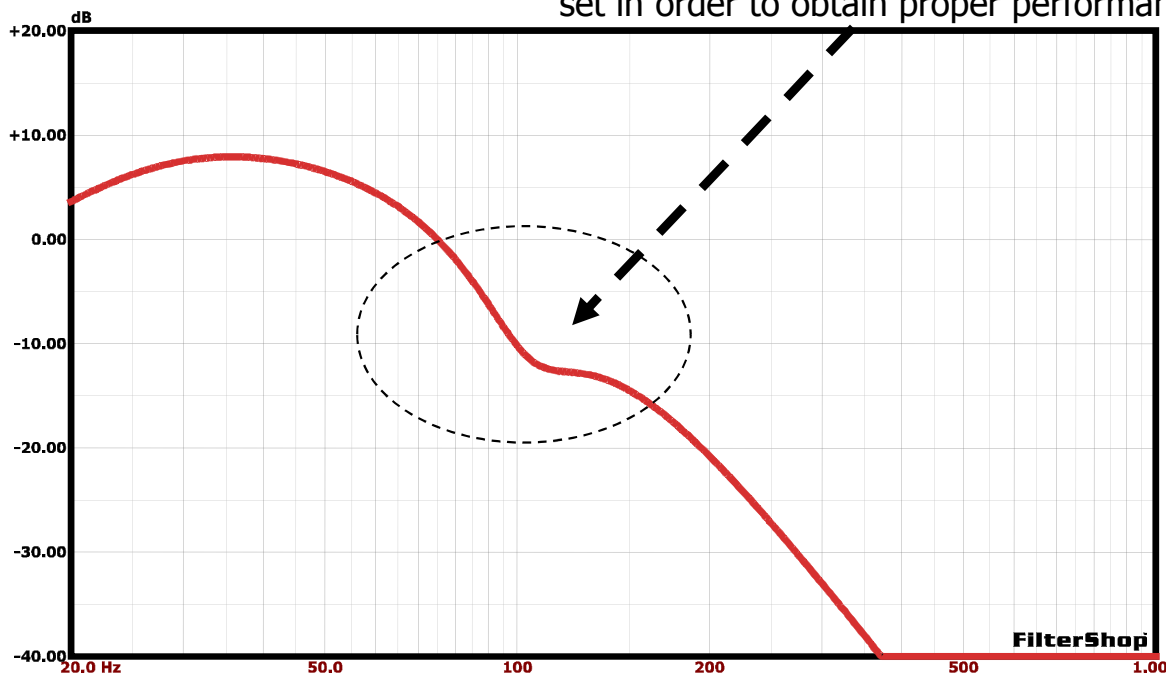
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# Manifolded, Double 21" Band-Pass Subwoofer kit

## 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

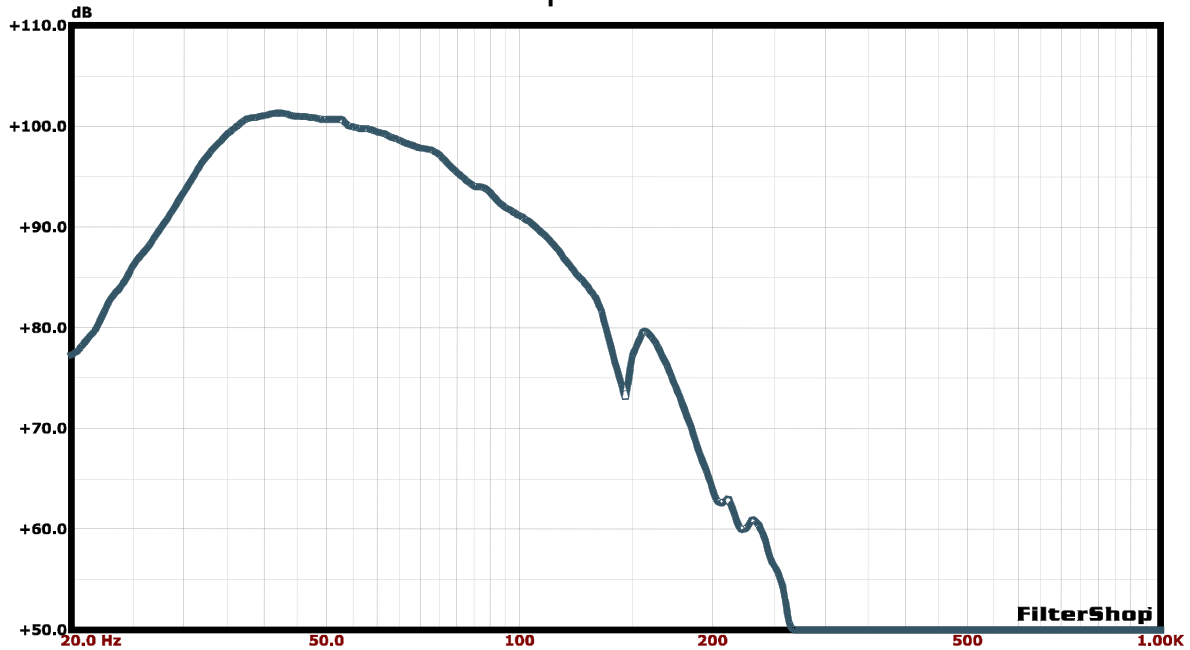
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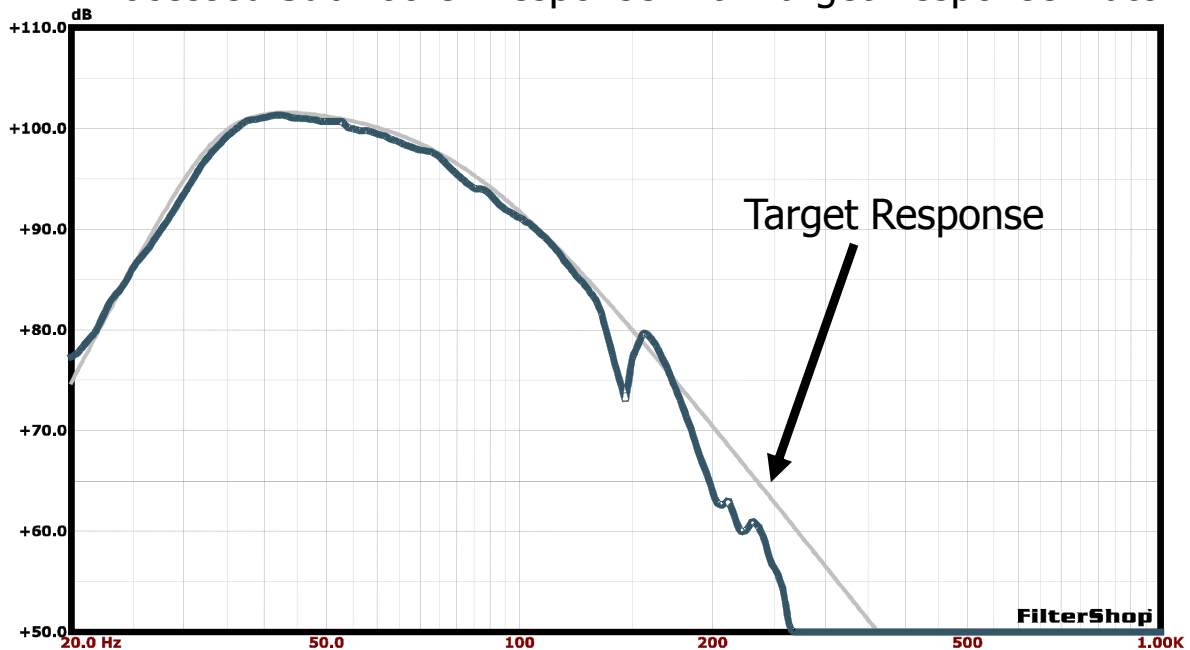
# Manifolded, Double 21" Band-Pass Subwoofer kit

## Processing Guidelines and Processor Response with 21NLW900

Processed Subwoofer Response



Processed Subwoofer Response with Target Response Matching



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