

Sonatello

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Sonatello is a 3-way, floor-standing speaker system using all SB Acoustics drivers, the 8-inch SB23NRXS45-8 woofer, 5-inch coated paper-cone SB15NRX30-8 midrange, and 1-inch, dimple dome tweeter with neodymium magnet, SB29RDCN-C000-4.

The cabinet is 11 inches wide, 15 inches deep and 42.5 inches tall. In the cabinet's top 6 inches is an 11-liter sealed box for the midrange, and in the bottom 2 inches is the crossover compartment. In between is a volume of ~2.4 cubic feet containing a 58-inch long, 25:1 tapered transmission line for the woofer. The tweeter shares the woofer/TL section of the cabinet. The TL's terminus is on the rear panel about a foot above the cabinet bottom. Martin King's "Sections" MathCad-based worksheet (Version 2/09/08) was used to design and model the tapered TL, resulting in a modeled anechoic F3 of 30-31 Hz (with an overall system tuning frequency of ~26 Hz).

The cabinet uses ¾-inch MDF for the sides and top, on which was applied walnut and maple veneer. The back is birch-veneered, ¾-inch plywood chosen because the birch veneer closely resembles maple in coloring. The baffle is comprised of ¾-inch solid walnut and maple and backed by ½-inch MDF. Extensive bracing was used in the cabinet. For finishing, two coats of sanding sealer were first applied, followed by 5 coats of satin wipe-on, oil-based polyurethane, sanding after all but the last coat of polyurethane.



The primary goal for this design was to maximize system sensitivity by mounting the woofer near the bottom of the baffle to gain from floor-boundary reinforcement and minimize or eliminate baffle step compensation. Due to the location requirement of the woofer along the TL's length, the woofer's center ended up ~13" above the floor. After settling on that location, placing the midrange above the tweeter, instead of vice versa, would best accommodate several characteristics; CTC spacing between woofer and midrange, floor-bounce frequencies of the two drivers, baffle step frequency of ~415 Hz, and a likely crossover frequency around 400-500 Hz. Depending on which set of three slightly different T/S values are used to model the TL, the woofer's predicted sensitivity ended up in the range of 89.3 to 90.3 dB SPL (re: 2.83V/1meter).

Dan Neubecker designed the crossover. The vertical design axis is the midrange's center at 15 degrees off that horizontally. There are 5 inductors (1 Erse steel laminate and 4 Jantzen air-cores), 4 Mills resistors and 9 capacitors (3 Dayton Audio, 3 Jantzen CrossCap and 2 Jantzen Standard Z polypropylenes, plus 1 NPE). Corner

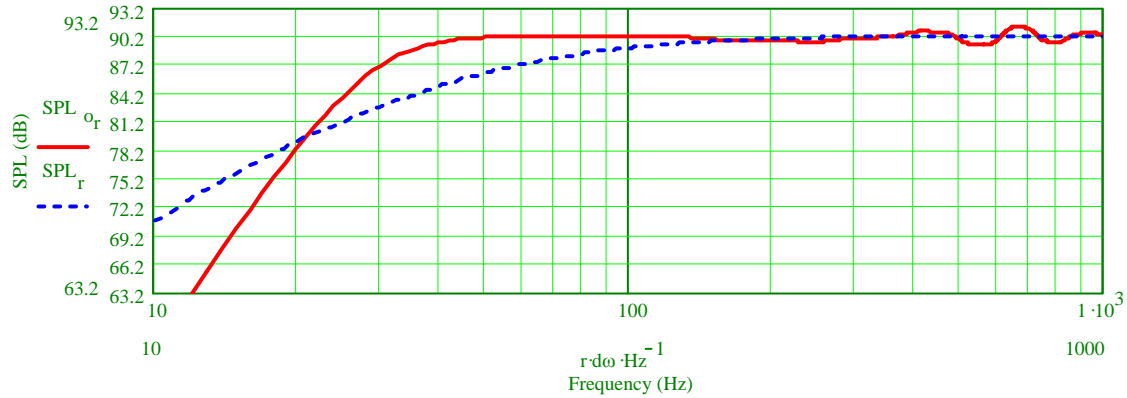
frequencies are ~370 and 2100 Hz. The woofer rolls off at slightly less than 2nd-order in the first octave above 370 Hz, increasing its rate higher up. Below 370 Hz the midrange initially rolls off also at a little less than 2nd-order but increases to more than 3rd-order below 100 Hz, while above 2.1 kHz it rolls off at a 4th-order rate. The tweeter's rolloff below 2.1 kHz is essentially 3rd-order. Impedance-wise the system's is 6 ohms or higher below 70 Hz, drops to generally 4 ohms from 100 Hz to 4 kHz, and increases to 8 ohms towards 20 kHz. Other than the impedance is 4 ohms over a broad range, this is not a difficult-to-drive amplifier load. The overall SPL versus frequency response is quite smooth with good phase characteristics. Actual system sensitivity using pink noise as the source, with a 2.8-volt input and measuring 1 meter away on the midrange's center, gave results of ~88 dB SPL, lower than expected but within experimental accuracies.

(Last revision date: 4 October 2010)

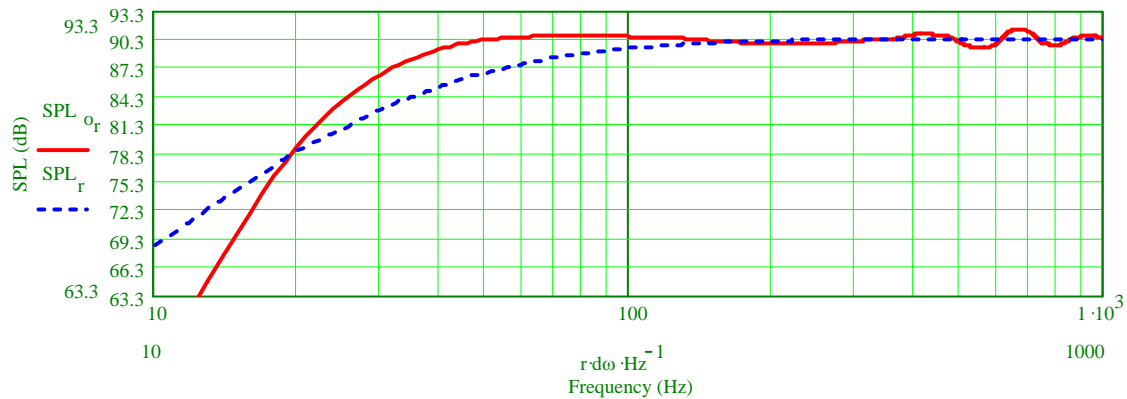
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Predicted low-frequency responses for the 58-inch-long, 25:1 tapered TL using SB Acoustics driver SB23NRXS45-8, modeled with three different sets of T/S values

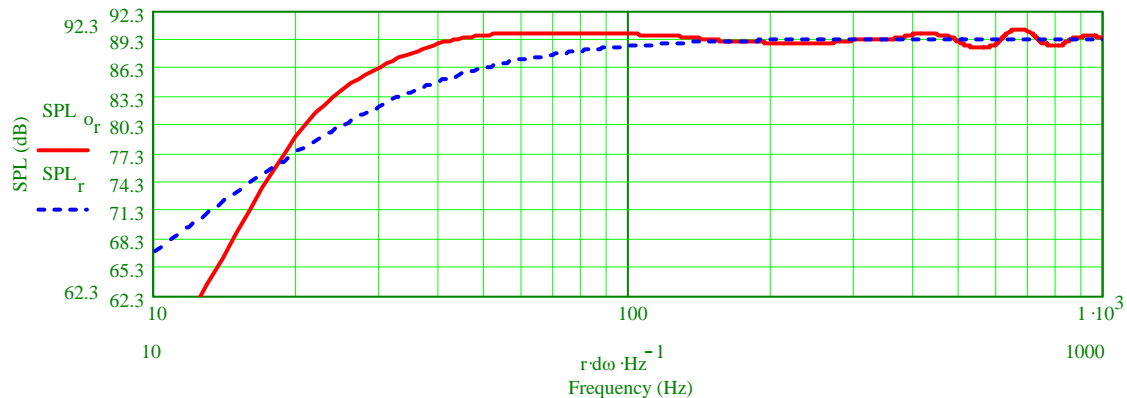
Using T/S values as published by SB Acoustics



Using T/S values as measured by Meniscus Audio



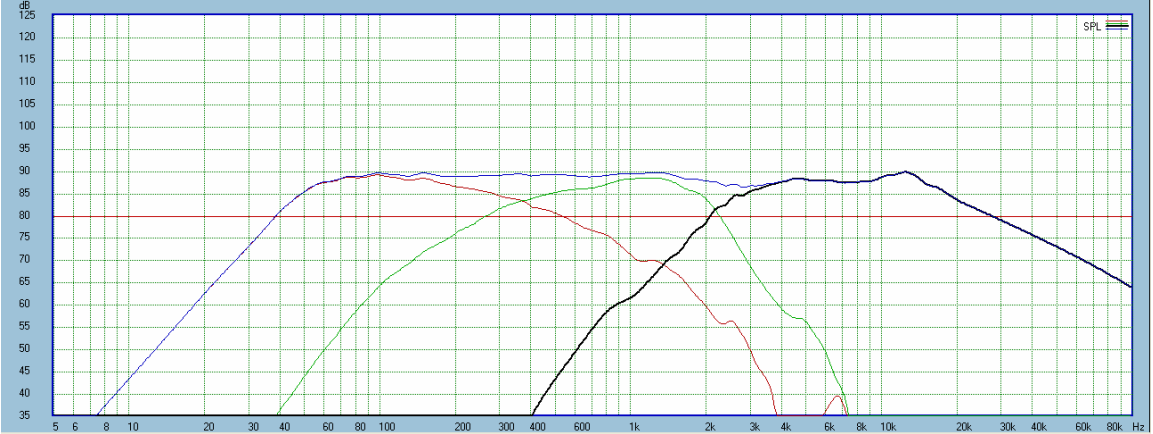
Using T/S values as measured by John Krutke (Zaph Audio)



All of the above indicate the expected response with a 2.83-volt input to the driver and with 0.22 ohms resistance added in series with the driver. The first half of the line was stuffed at a density of 0.85 lb/cu.ft.

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System and individual driver SPL vs. Frequency responses via crossover

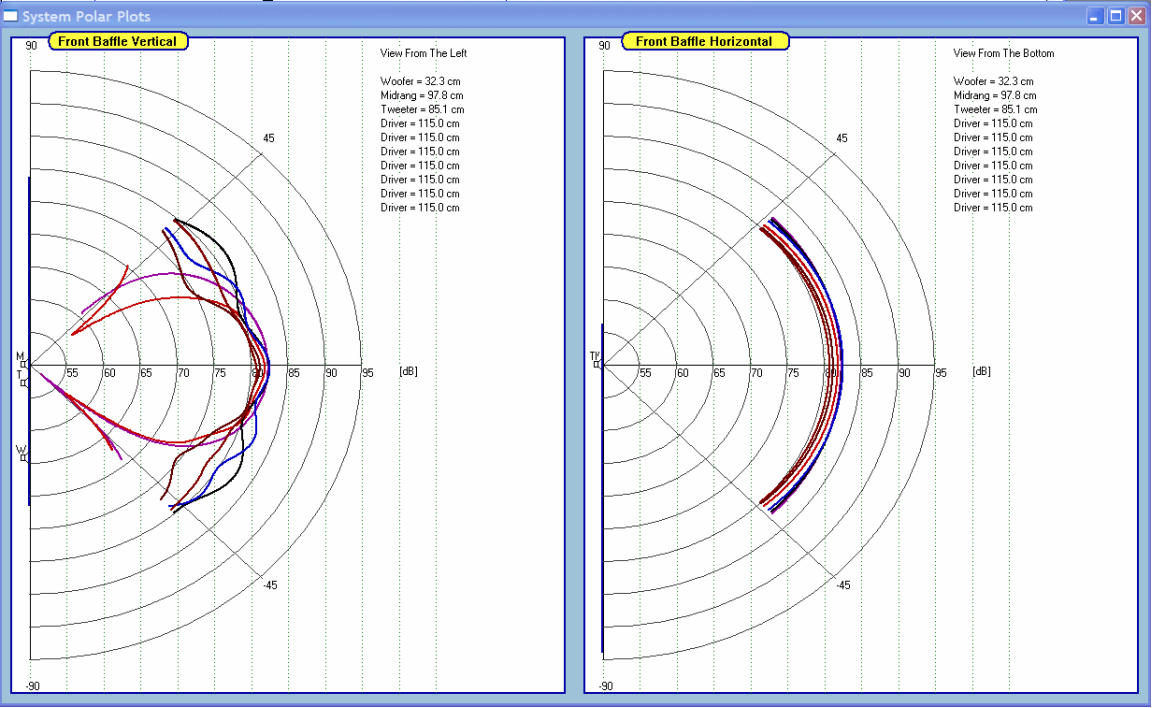


Impedance Magnitude and Phase



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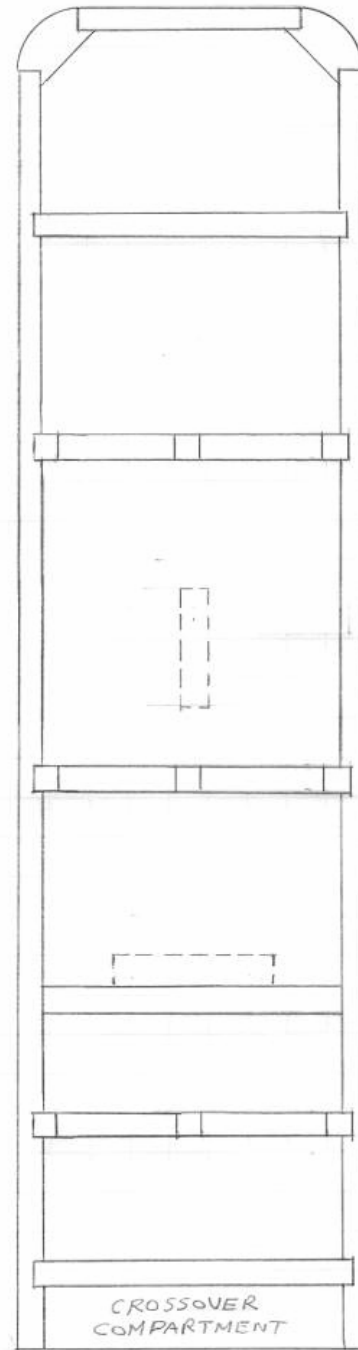
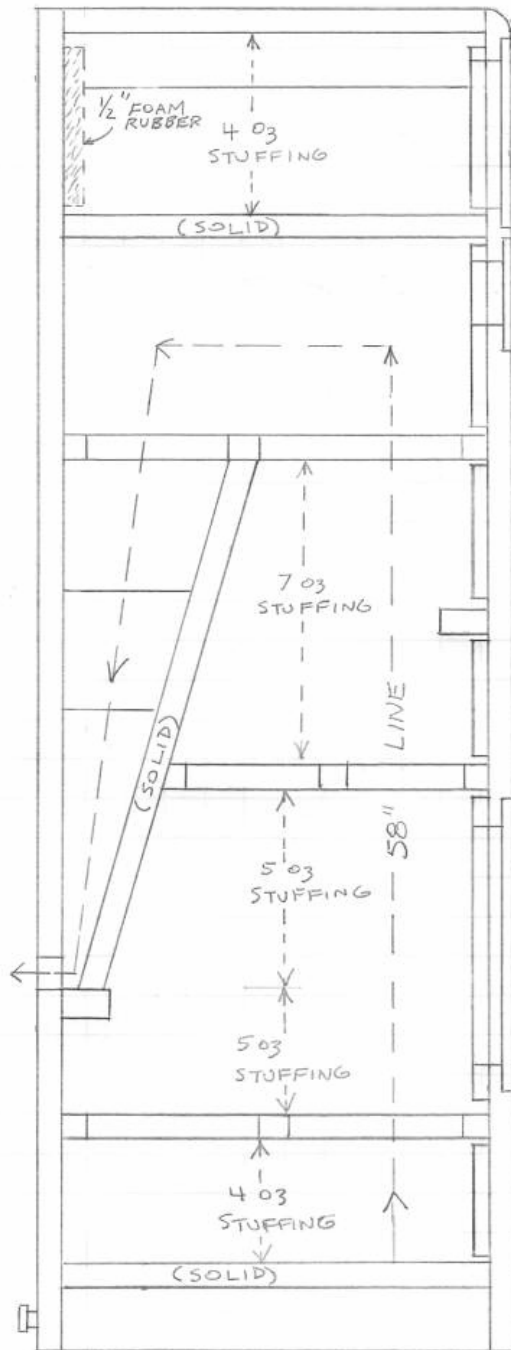
Polar Responses

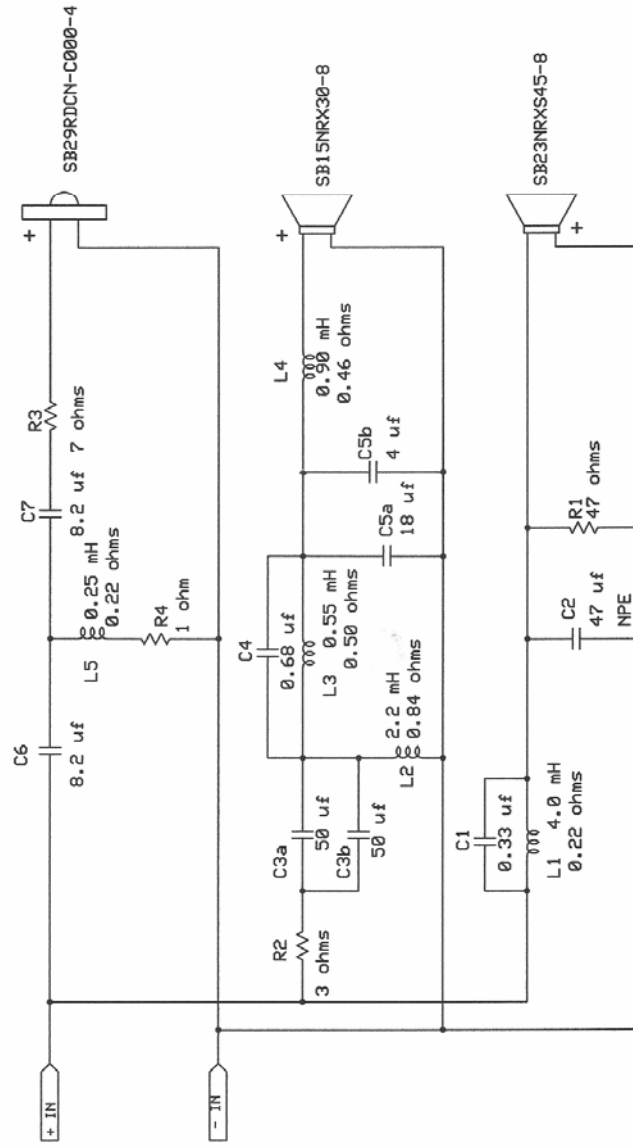


Acoustic Phase



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Cabinet designed and built by Paul Kittinger
Crossover designed by Dan Neubecker

L1--Erse Steel Laminate
L2, L4 & L5--Jantzen 18-gage air core
L3--Jantzen 20-gage air core
R1 thru R4--Mills, 12W
All capacitors except C2 are Polypropylene
Jantzen CrossCap: C1, C4 & C5a
Dayton Audio: C3a, C3b & C5b
Jantzen Std. Z: C6 & C7

Sonatello: 3-Way TL-Based Speaker		
Crossover Schematic		
Builder:	Rev 4.1	Page 1 of 1
Paul Kittinger	12 September 2018	