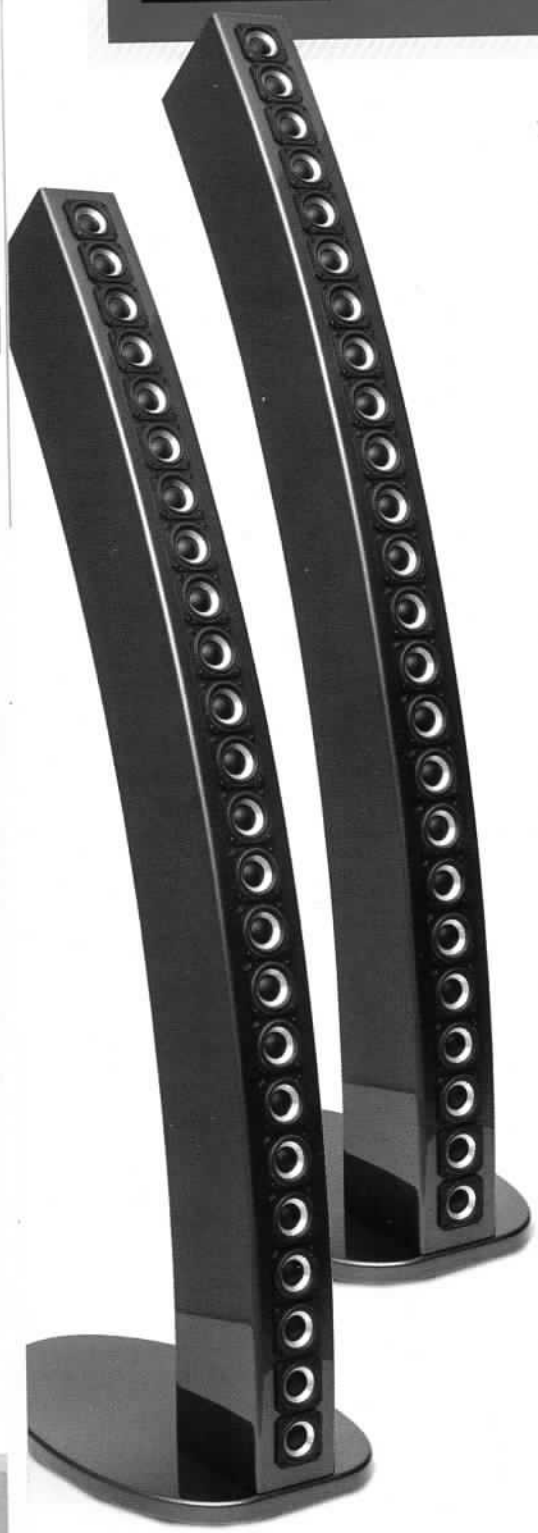
Modified CBT24

By: James G.



Design Goals

Nearly three years ago, I began an effort to build a line array with near full frequency range drivers. I spent several months auditioning the performance of small diameter, full-range drivers. The test configuration consisted of mounting pairs of these drivers on open back foam boards and then listening to music at my normal volume level. After months of listening I concluded that the SB Acoustics SB65WBAC25-4 (SBA65) drivers exhibited the best tonality and livability of the tested units.

Driver Selection

The SBA65 driver have a 65 mm (about 2.5") square polymer chassis, a geometrically furrowed aluminum cone, and a neodymium motor. The special cone features copper cap, low damping surround, and vented voice coil function to extend frequency response beyond 20 kHz with reduced distortion and compression. The nominal impedance is 4 ohms with sensitivity (2.83 V/1 m) of 83.5 dB. They have 5.3 mm of linear coil travel with a power handling of 20 watts. This driver in a half to one liter sealed enclosure has a calculated 3 dB down bass frequency below 140 Hz.

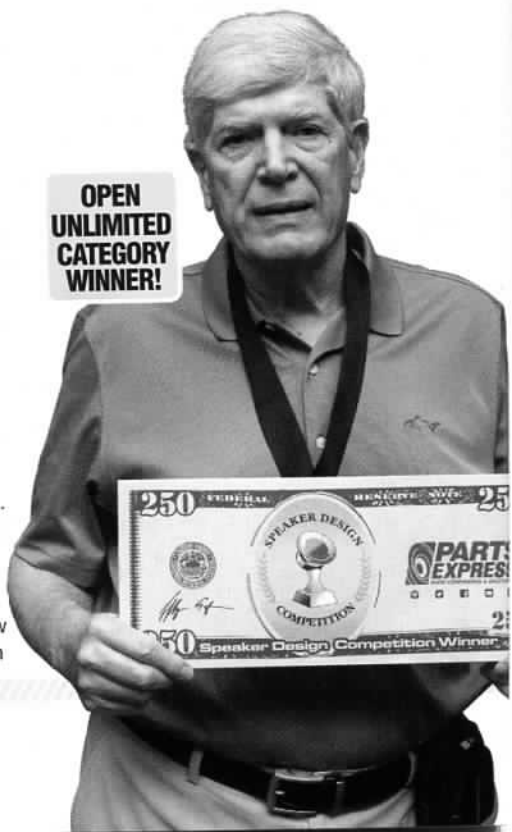
Once committed to the new project, I first envisioned a straight line array for my project. But soon after I started, Don Keele Jr, the Constant Beamwidth Transducer inventor, and Parts Express introduced their CBT24/Epique product. I have been a student of Don's work on CBTs for several years so I was familiar with his efforts. Later I heard Don's new arrays and also solicited Rick Craig's impression of the CBT24. At the 2017 Midwest Audiofest in Dayton, OH I met with Don to discuss options for my new project. We discussed various CBTs including his new dipolar research version. Don also provided information about his CBT24 design.

Thus, I decided that a Modified CBT24 version with the SBA65s would be my new project. While useful, Don's CBT24 design uses 16 ohms drivers vs. the 4 ohms SB65 units, so modification of the internal weighting network would be necessary for my Modified CBT24 arrays. Furthermore, Don's CBT24 enclosures are implemented without internal bracing so cabinet rigidity improvements were needed for my design. For transportability, I wanted an easily removable baseplate. As the Modified CBT24 design has evolved, the only holdover parameters from Don's design are the 36 degrees arc angle and the overall array height of 61".

Enclosure Design

The enclosures for the Modified CBT tower were constructed from half inch thick MDF. The front (baffle) and rear panels are curved over the side panels to realize the enclosed volume. The external measurements are 4.5" wide by 7.25" deep with a tower height of 61". Drivers are spaced on 2.625 inches center-to-center dimensions.

To construct the enclosures I asked Kevin Kendrick to convert my 2-D baffle/



panel Visio drawings into solid models for numerical control fabrication. Seven rectangular braces add rigidity inside each cabinet. An internal U-shaped metal nut plate strengthens the bottom of the enclosure, yet permits the one inch thick baseplate to be affixed to the tower assembly with 4 large screws. Later, Steve Fishe used his automotive painting expertise on the new cabinets. The Nebula Gray Pearl color is stunning.

Although the Modified CBT24 towers cover the full frequency range above the high pass crossover point, the 24 drivers are divided into parallel banks of 12, 6 and 6 drivers from bottom to top. The 12 drivers are series/ parallel connected to produce their full output while next 6 produce 3 dB less output. The top 6 drivers are further attenuated with a resistor divider network so that their output is 9 dB below the group of 12. This connection approximates a Legendre weighting scheme. The overall input impedance is 4 ohms.

Enclosure Assembly

Many small parts and pieces were needed to complete the assembly. Some 192 screws and more than 100 crimp connections were required to mount and connect the 48 drivers. More than 100 feet of 16 gauge wire was needed for the cable assemblies. Three separate wiring cables connect between the external binding post terminals near the bottom of the arrays to each driver bank inside the box. These color coded cables and the driver connection pins were assembled to scale outside the enclosure and then pulled through the cabinet into position. As many three-way connections were needed for the weighting networks inside the cabinets, a common 3M Scotchlok connector was modified from a 1 to 2 way connection to be a 1 to 3 connection by hand drilling out the through wire stop. Acousta Stuf sound absorbing material fills the enclosed volume of the cabinets.

To cover the lowest frequency range for the Modified CBT24 a subwoofer was needed. I used the Eminence Lab12 driver inside a 2 cubic feet sealed box. The Dayton Audio SPA250 subwoofer plate amplifier with bass boost was used to power the woofer.

For my system a Marantz NR1602 receiver amplifies the tower arrays and crosses over to the sub. Thus, the receiver and subwoofer are used in a 2.1 way configuration. The subwoofer signal from the receiver provides the plate amplifier input. The receiver settings establish the crossover frequency at 120 Hz. In my listening room the Audyssey MultEQ auto calibration capability of the receiver is activated to equalize the system. Eight measurements are made in the room to complete the equalization.

Conclusion

How do the Modified CBT24 arrays sound? At the 2018 Midwest Audiofest Speaker Design Competition, judges, commented on their huge and engaging sound, nice vocals, and good detail. Two judges commented about the 'nice execution of a CBT'.

In my large living room (23 feet wide by 32 feet long with the ceiling peaking at 18 feet apex) the Modified CBT24 arrays sound outstanding with no audible reflections from the ceiling. I notice that the radiated sound is uniform across the sound stage (a benefit of constant beamwidth concept) while the sound volume level is nearly constant from front to rear of the listening room. The arrays are dynamic with sounds ranging from a single vocalist to a full orchestra.

About the Designer

After completion of his engineering studies, Jim Griffin had a 30 year work career at Texas Instruments in Dallas. After retirement he and his wife moved back to their native Tennessee.

Additional details and information on the Modified CBT24 project are available at:

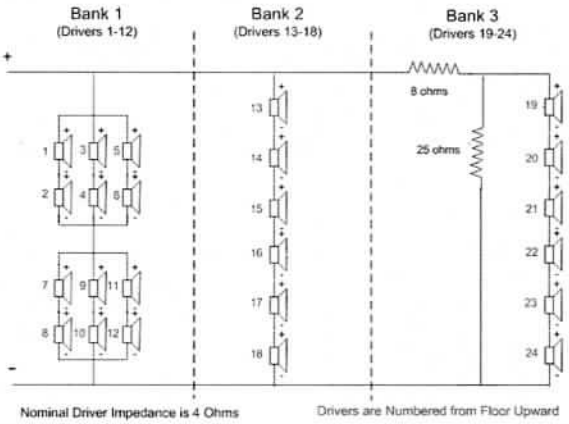
1. Google 'Jim's New CBT Arrays' dated October 11, 2017 or direct link is:

http://techtalk.parts-express.com/forum/tech-talk-forum/1348662-jim-s-new-cbt-arrays

2. Google 'My New Line Array. It's a Modified CBT24' dated October 11, 2017 or direct link is:

http://www.diyaudio.com/forums/full-range/313352-line-array-modified-cbt24.html

Modified CBT24 Weighting Network



Project Parts List:

Part #	Description	Qty
-	SB Acoustics SB65WBAC25-4	48
290-570	Eminence Labs 12" Woofer	1
300-803	Dayton Audio SPA250 Subwoofer Amplifier	1
091-1247	Dayton Audio Binding Posts (Pair)	2
091-602	Dayton Audio Binding Post Plate	2
260-840	#6- 3/4" Wood Screws (10 per pack)	2
100-072	16 AWG Hook-up Wire	6 colors
095-286	Crimp Connectors (50 per pack)	1
095-287	Crimp Connectors (50 per pack)	1
082-100	3M Scotchlok Connectors (50 per Pack)	1
005-072	Mills 12W Resistor	4
005-47	Mills 47W Resistor	4
260-330	Acousta Stuff	1