

“Statements”

Design Goals / Driver Selection

Curt: Jim has asked me to design some crossovers for him back in 2004. Unfortunately at that time I was swamped with previous commitments. When he asked again after Iowa DIY 2006, I thought I saw a clear spot on my plate, and accepted. This design is the fruition of that commitment, and is a collaboration of Jim, who did the driver selection and enclosure design, Wayne Wendel, who graciously lent us his ears and sage opinions for the voicing of the design, and me, as the crossover guy.

Jim had some pretty ostentatious goals with this design: He made no secret he was looking to build a system that trumped the sound of his line arrays. (This of course put NO pressure on the crossover designer at all.) Jim chose the [Tang Band W4-1337SD](#) for the midrange. This driver appears to have a well designed motor and the phase plug and titanium cone made for a sexy looking driver. One of Jim's design requirements was the speaker be a true full range design. Knowing the capabilities of the Dayton RS225-8 from previous designs, they seemed the obvious choice to hold down the bottom end. The extended range of the W4-1337SA's enabled a high tweeter crossover point, and an easy cross to a ribbon tweeter. The [Fountek NeoCD3](#) seemed like a great choice. All the drivers exhibit high marks for value, which gives this design a high performance to cost ratio.

Jim: There were several criteria that were established for the project. The speaker has to be able to achieve high SPL's so it could be used for home theater as well as music. The design had to be extremely dynamic and detailed with a very large soundstage that would excel at recreating the original performance. Placement had to be flexible and not require positioning far away from walls. The top end had to have realistic reproduction of triangles and cymbals while extracting the ambiance of the recording venue. Last but not least, the bass had to be as close to full range as possible with a reasonable size cabinet and still fit into the budget allocated for the project. Finally, we wanted a design that was fairly efficient to minimize amp requirements and to be a 4 ohm or higher load for the amp. A W-M/T/M-W driver configuration was selected for its symmetrical lobbing characteristics, visual appeal and a configuration that could meet the criteria established for the project.

Not long after the 2006 Iowa DIY event, there was a lot of discussion about how nice the Visaton Ti100 sounded in the midrange. The Tangband W4-1337S stood out as a very similar driver design but with a few additional 'upscale features such as a Neo magnet assembly with copper sleeves and a curvilinear cone which smoothes frequency response. Once the W4 was selected as the midrange the design goals began to come into focus. The only tweeter considered for the project was the Fountek NeoCD3.0. It fit perfectly in the overall design goals and the extended frequency response of the W4 allowed the ribbon to be crossed at a high

enough frequency to minimize distortion. A perfect match! Bass drivers were then considered. There are many fine bass drivers but most are extremely expensive or are very inefficient. The Dayton Reference RS225 eight inch drivers stood out as the best low distortion driver at an affordable price that also would fit in a reasonable size cabinet. They are over achievers and produce deep high quality bass that is unexpected for a driver their size.

Enclosure Design

Jim: The cabinet had to be tall to accommodate the W-M/T/M-W format and place the ribbon at ear level. The (2) RS225 woofers dictated a 100 liter ported enclosure to achieve the design goals for bass extension. The actual cabinet worked out to be 55" tall with a 3" tall base and 2" spikes to allow breathing room for the down firing port for an overall height of 60". The cabinet measures 11 ½" wide x 16 ½" deep. The ribbon is located at 38" from the floor. The ribbon height should match the builders seated ear height and can be adjusted to whatever height needed. An open back/transmission line design was chosen for the mid range to eliminate the 'boxy' sound associated with closed cabinets and to open the mid range sound stage for greater realism.

Curt: Wayne and I both remarked that Jim had done a nice job on the enclosure design which has nice proportions and symmetry. The design appears massive without being overwhelming, and truly do make an imposing visual 'Statement'.. -Just don't plan on moving one by yourself. The woofers are vented into 100 liters and tuned to approximately 24 Hz. This tuning results in a roll off that emulates a 2nd order sealed response down to its f10 of 20 Hz, and models an f3 of 33 Hz. As an attempt to provide a less boxy, and more open, spacious sound, the mids are enclosed by individual transmission lines, with the terminus on the back of the enclosure. The enclosure itself is well designed and braced, utilizing multiple layers of MDF in appropriate locations. It easily passed Wayne's knuckle test. The base makes it very well balanced. My only suggestions to Jim on the enclosure design were changing the mid enclosures from sealed to transmission lines, and the bottom firing port.

Enclosure Assembly:

Jim: The enclosure assembly is rather conventional and consists of ¾" MDF throughout with an additional ½" MDF front baffle added for a total thickness of 1 ¼" for the front baffle. All drivers are flush mounted. The driver flange thickness is approximately ¼" for the RS225's and Fountek ribbon. The W4-1337SA flange thickness is 3/16". Actual driver dimensions are indicated in the cabinet layout. Depending on how you finish the cabinets (veneer or paint) you may want to add 1/16" to the driver diameter recess for additional clearance around the driver for paint build up. The actual cabinet is 55" x 11 ½" x 16 ½" with a ¾" round over on the front vertical edges. A 3" thick 14 ½" x 19 ½" base consisting of (4) ¾" MDF pieces glued together

for stability is attached with four 4" deck screws. There is a 9" circle cut out of the bottom 3 panels to allow room for a 3" x 4" (plus flares) down firing port to breathe. I wanted a down firing port but a rear firing one could be installed more easily without any performance penalty. The base sits on 2" spikes for an overall speaker height of 60". That positions the center of the ribbon at a seated ear height of about 38". If your ear height varies from 38" the drivers can be moved up or down slightly on the front baffle to accommodate your needs as long as the driver spacing remains the same. The base could also be adjusted for more flexibility if needed. The mid driver transmission line enclosures provide bracing for the upper and middle of the cabinet plus I added (2) 1 3/4" x 16 1/4" side braces on each side of the transmission line enclosure to tie the mid enclosures to the cabinet side walls. I then added a shelf brace, with the center cut out, a few inches below the bottom RS225 to strengthen that area with an additional 5" x 10" brace against the back of the enclosure behind each RS225 for extra bracing. The RS225 driver cutouts are rounded over with a 3/4" round over bit on the inside of the front baffle. However, the mids require extra attention to eliminate any tunneling effect. I used a 45 degree router bit to scallop the edges back as much as possible except where the driver mounting screws are located. A saber saw could also be used to accomplish this task. Pretty doesn't count, but function does, so either method will work. The corresponding opening in the back panel for the mid transmission line openings can either be a 5" circle or a 5" square as shown in the cabinet drawing. I'd also like to add many thanks to Brian Walters for the superb cabinet drawing. Excellent work! I lined the cabinet walls in the RS225 enclosure with 2" wedge foam. If you can find it, Owen Corning 703 fiberglass would also work great and offer more absorption of the driver back waves. The transmission line enclosures are lined with 1" foam with the foam held back about 1 1/2" or scalloped from the back of the W4 drivers.

Crossover design

Curt: Wayne and I had numerous listening sessions, and tried many iterations of the current crossover in our quest to optimize the resultant sound and driver integration. From the opinions of Jim and others that have heard the Statements, it appears it was worth all the effort:

I took advantage of the W4-1337SA's wide bandwidth to have the midrange passband cover almost the entire 'intelligence band'. This also allowed the ribbon to be crossed in its optimum passband. As I believe that simpler is often better, the crossover is something of a minimalist circuit. The woofer low pass, and midrange high pass filters are at roughly 350 Hz, and are 2nd order LR acoustic. The woofer network is about as simple as it gets, composed of only a single inductor and capacitor. The midrange network is probably the most complicated, but still only contains 8 elements. C2011 is the high pass filter, L2021 and C2041 and R2041 make up the low pass filter. C2021 and R2022 react with L2021 to provide a notch filter to smooth the driver response in the stop band. R2051 and R2061 are simple attenuation. The mid low pass filter initially emulates a 3rd order BW filter at about 3700 Hz. The tweeter network consists of a 2nd order high pass electrical filter, C3011 and L3021, which provide an acoustic 3rd order BW transfer function. R3041 and R3051 are an attenuator.

The impedance curve is fairly benign, with the minima of about 4.5 ohms, and a max impedance phase variation of 30 degrees. This will represent an easy load for most amplifiers, including tube amplifiers capable of 4 ohm loads.

Note that in the phase plot, while the woofer and mid driver phase 'track' well over their crossover range, the mid and tweeter are in phase quadrature for better power response. Also note that due to the 2nd order woofer/mid slopes, the midrange drivers are connected with reversed polarity.

Listening Impressions by Jim Holtz

Imaging and presentation: Since the Statements are a quasi transmission line/open back/di-pole design or whatever terminology you want to hang on them, there is a lot of rear energy coming out of the mids from the holes I cut. So, call it what you like, the imaging is superb. Very large and atmospheric sounding with huge amounts of detail. Performers begin at the rear of the speakers and go back in layers from there creating a very deep soundstage. Actually the soundstage has an almost 'near field listening' sound to it with the soundstage going beyond the speakers frequently. No 'head in the vice' sweet spot either. The speakers disappear as they should.

Treble: Cymbals sound like cymbals and the sound of triangles float in the air. Love or hate ribbons but they do a better job of realistically reproducing the highs to my ears than any other type of tweeter. The highs are open and airy with great off axis dispersion.

Mid range: Here's where the Statements really shine. The W4's are ultra clear and detailed. It's almost eerie when you 1st listen. My line arrays have been the most detailed speakers I've ever heard until now. The Statements now are my new standard. The W4 Titanium cones simply allow you to hear every nuance in the recording. Everything from the performer licking their lips to shifts in where they're standing are audible. Obviously it takes really good recordings to hear these things but the Statements are up to the task. Tonal balance is exceptional. Very, very real sounding to my ears. Some of the thoughts that crossed my mind as I listened were smooth and refined sounding.

Vocals: WOW! Vocals are simply stunning! Both male and female vocals are super smooth and textured with perfect tonality to my ears. I think Curt used the word seductive describing vocals and I agree completely.

Dynamics: This was a super surprise to me. I've been spoiled with the dynamics of my line arrays and have had doubts that a point source speaker could ever come close to the level they provide. The Statements are so darn close in this regard that I don't feel anything is missing. It is another WOW experience.

Bass: The bass capability of dual RS225's in a well tuned ported enclosure are well known. Very deep, tight bass that is extremely clean is what you hear. F3 came out about 30 Hz so there nothing missing in the music I listen to. If you're in to pipe organ a sub might be necessary but other than that, bass is abundant and the kind of clean tight bass that allows you to hear the string vibrations of an acoustic bass yet still have enough kick down low to feel the bass hit your chest when appropriate.

Summary: If you are in love with detail and realism like I am, the Statements fill the bill. People have been asking how I compared them to the RS 3-ways. IMHO, the Statements are your next project. J The W4's easily exceed the clarity and detail of the RS drivers, or dare I say, Seas Excels, and offer a very transparent sound quality. Bass is comparable to the RS 3-ways of course. Treble, well, I love ribbons so it's a hands down winner in that respect for me.