Final Test Report 2-WMT Prepared By:DJ Puuri

Test Location: 2nd Floor Walker (Mcardle Theater)

Description of Testing Environment and Equipment:

All tests were preformed in fuzz measure on a Mac mini. A Behringer mic was placed 4' away from the baffle of the 2-WMT in between the tweeter and woofer at 0 degrees. The measurement from the floor to the center of the mic was 90". Speaker was sitting on a stand to insure the measurement from floor to point between tweeter and woofer measured 90". These distances were chosen due to that fact this is the intended distance and position ones ear will be located while using the 2-WMT.

A Fire wire solo interface was used to transfer signal. The input setting was set to half (12 o clock). The output setting was two clicks under half (10 o clock). A Rotel Amp was used to power speakers during testing.

:It should be noted the above measurements and all equipment mentioned was maintained thru out the testing phase for the 2-WMT.

Test Dates:

3/31/10- 4/25/10

Initial testing for the 2-WMT began on 3/31/10. A frequency response for both the woofer and tweeter were taken at this time. Figure 1.1 illustrates a full frequency response test preformed on the 6.5" Tang Band woofer.

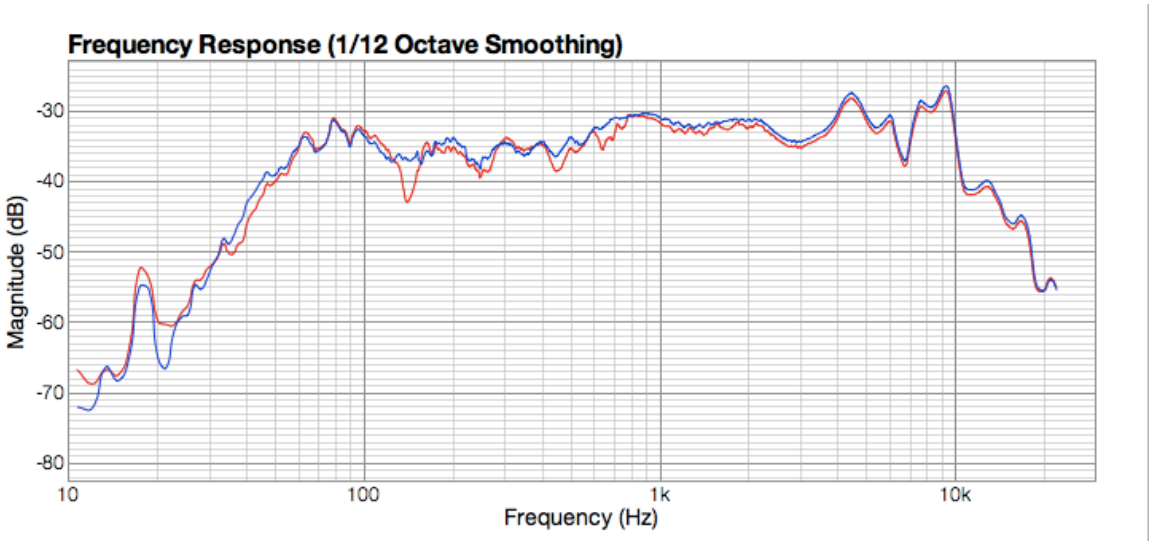


Fig 1.1

The red response is the initial woofer response. A sever dip in the response was evident at 150Hz followed by a series of smaller dips. To deal with these dips dampening material was experimentally placed inside the cabinet in various locations. The final response in fig 1.1 is in blue to obtain this result fiberglass dampening material was placed directly behind the woofer on the rear of the enclosure. A piece of fiberglass was also placed on the top interior and bottom interior of the enclosure. The dip evident at 150HZ is about 5dB less with the dampening material. Fiberglass was chosen due to its affordability. Black hole was experimented with on the top and bottom of enclosure. The results were not substantial enough to warrant the extra expense in this project.

Figure 1.2 Illustrates a difference in amplitude between the tweeter and woofer at 1500Hz. In order to compensate for this difference a pad was placed on the tweeter. Theoretical cross over design had suggested a 3dB pad. This was to be adjusted substantially. (A pad of 8dB was used) A cross over point of 1500Hz is crucial in this system. These are to be monitor speakers and keeping the cross over point bellow 2000Hz will help to insure clarity in the vocal consonant range.

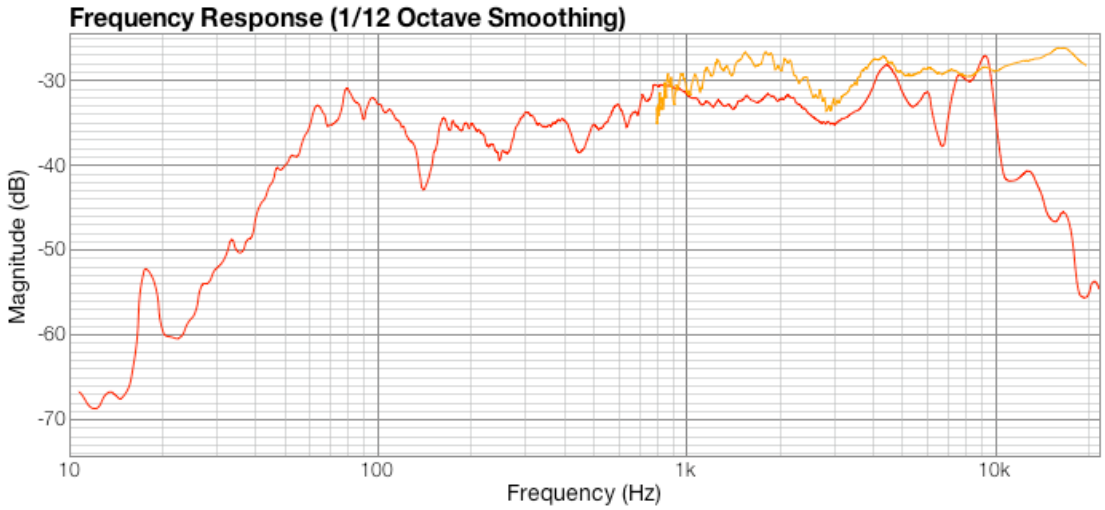


Fig 1.2

Numerous combinations of baffle step circuits (BSC) and pads were to be experimented with. This was done to align both the woofer and tweeter across the bandwidth. Making it possible to cross both over at 1500Hz. Figure 1.3 illustrates the difference incurred with in the woofer response with 2 different baffle step circuits. In this figure the tweeter has an 8dB pad on it. This is the red response starting at 800Hz running to 20K above -40dB. One can see clearly how the two red responses line up fairly smoothly across the bandwidth. The gold woofer response in fig 1.3 illustrates the woofer with a 10 dB pad (L=2.0,R=17ohm) on it. Both the

inductor and resistor were changed out a number of times to obtain the red woofer response. (L=.5,R=24ohm)

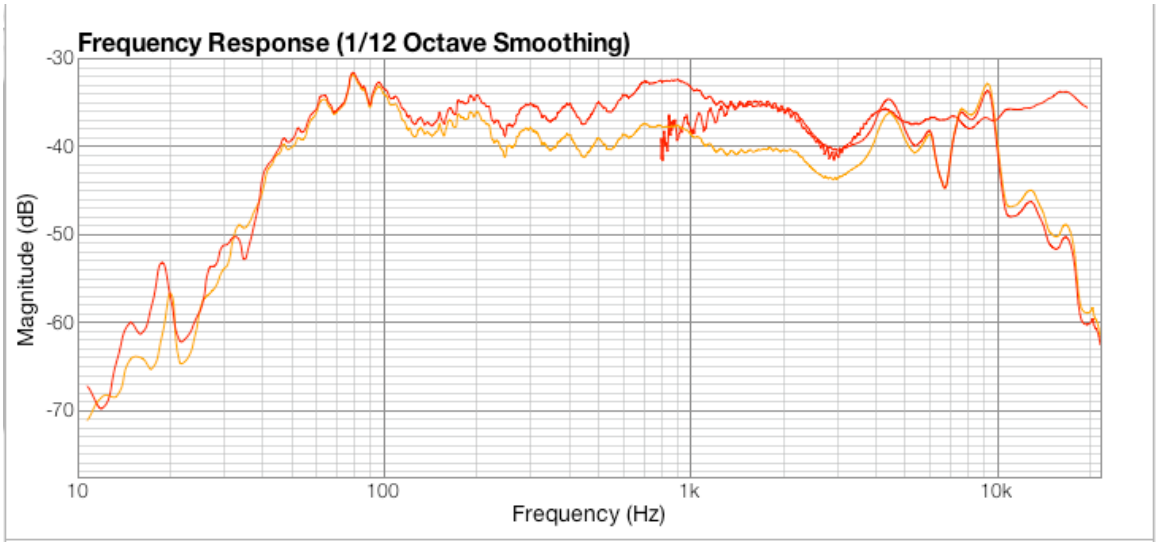


Fig 1.3

Once both the response aligned relatively smoothly across the bandwidth both a high pass and low pass filter were installed on their respective response. These filters were both placed at 1500Hz. See Figure 1.4

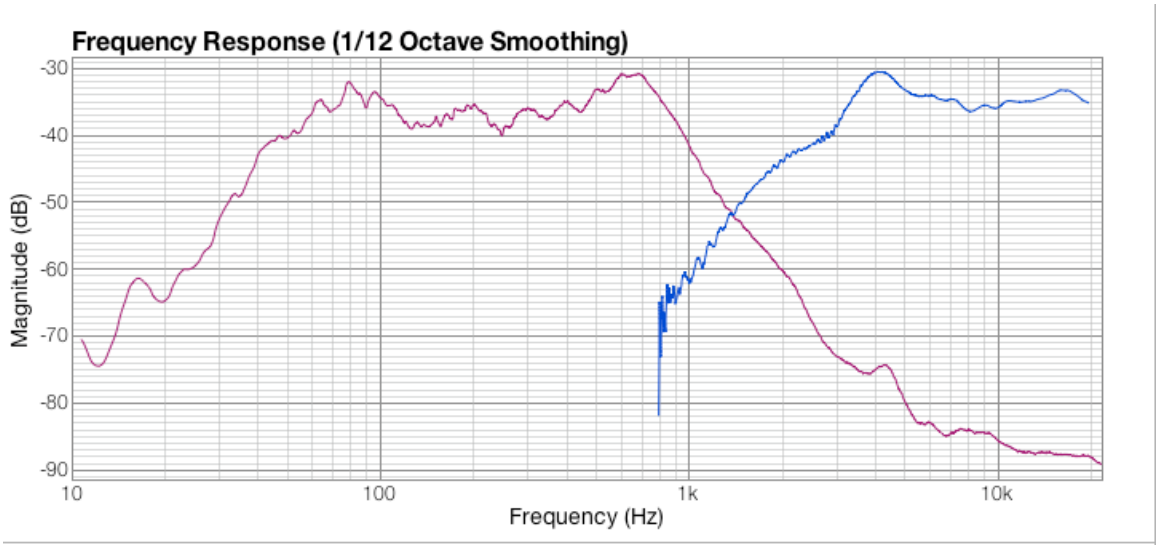


Fig 1.4

These filters were placed at 1500Hz this was part of a theoretical cross over design done prior to testing for this system. The two responses clearly cross over at 1500Hz in fig 1.4. They both roll off at 18dB/octave both of these conditions were intended. What was not intended was the substantial drop down to the cross over

point. This would cause a substantial dip in our overall frequency response at our cross over point. This would not make for a suitable response for the 2-WMT.

After careful consideration both the tweeter pad and BSC were place prior to their respective filters in the circuitry. This is illustrated in figure 1.5

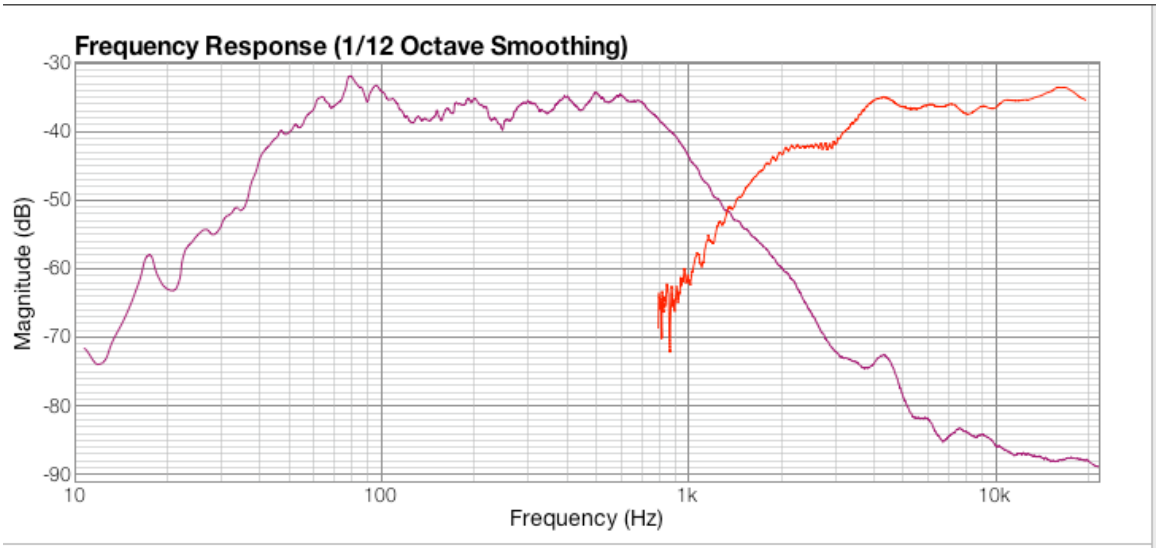


Fig 1.5

The responses cross over at virtually the same point as figure 1.4. However both the woofer and tweeter responses illustrate a slight drop. The woofer in fig 1.4 had a bit of a bump at about 650Hz this in no longer evident in fig 1.5. The tweeter also shows a bump at 4K in fig1.4. Once again fig 1.5 illustrates a moderate improvement. It was concluded that at this time both the BSC and tweeter pad would stay prior their respective circuits. The pad on tweeter would later be moved post filter.

After examining the two responses for some time a new approach was established. A 1st order Butterworth circuit would be used on the tweeter set at 1500Hz. The woofer would continue to have a 3rd order Butterworth circuit on it. It would be set at 1000Hz. This was done with the intention of summing the two responses smoothly from 1K to 2K. The results can be viewed in figure 1.6. Notice how a full frequency sweep was run on the tweeter response. This was done in order to see if the roll off on the tweeter was substantial enough. As can be seen the 1st order filter on the tweeter is enough. By the time the tweeter and the woofer responses cross the tweeters response has dropped enough to ensure minimal interference with the woofer response. Figure 1.7 shows both woofer and tweeter response and how they sum across the bandwidth. This would be the cross over for the 2-WMT. Figure 1.7 shows the final frequency response for the 2-WMT. Slight discrepancy can be seen from 150Hz down between fig1.6 and fig1.7. This is due to experimental dampening material placement. At the time of the time of the final test (fig 1.7) the bottom of the enclosure along with top and rear was treated with dampener. In fig 1.6 a small piece of dampener was placed on top and bottom and back of the enclosure. The amount of dampener present in fig 1.7 is much greater.

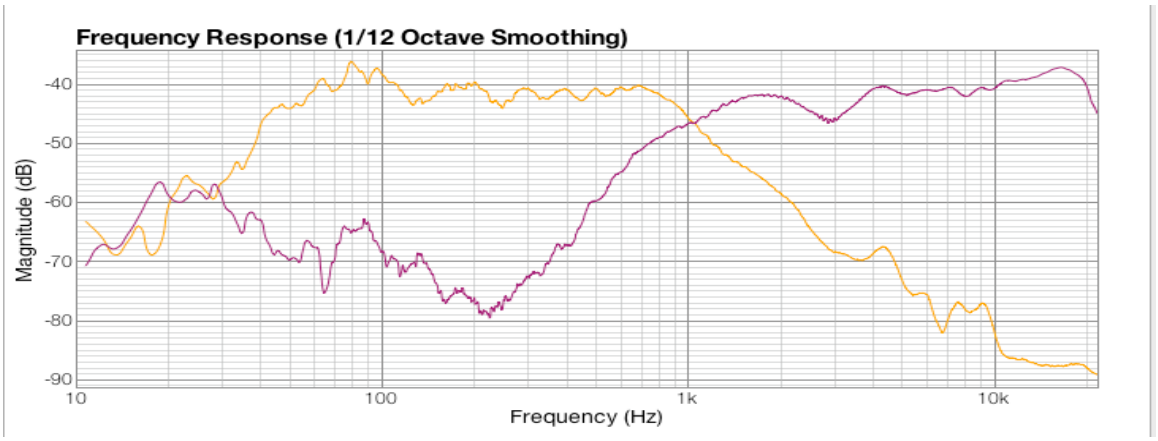


Fig 1.6

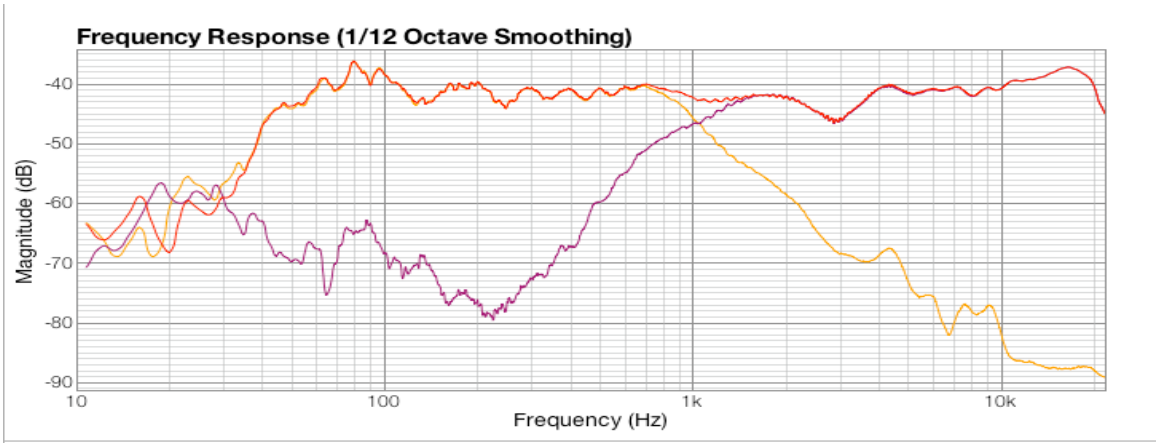


Fig 1.7 Frequency response of

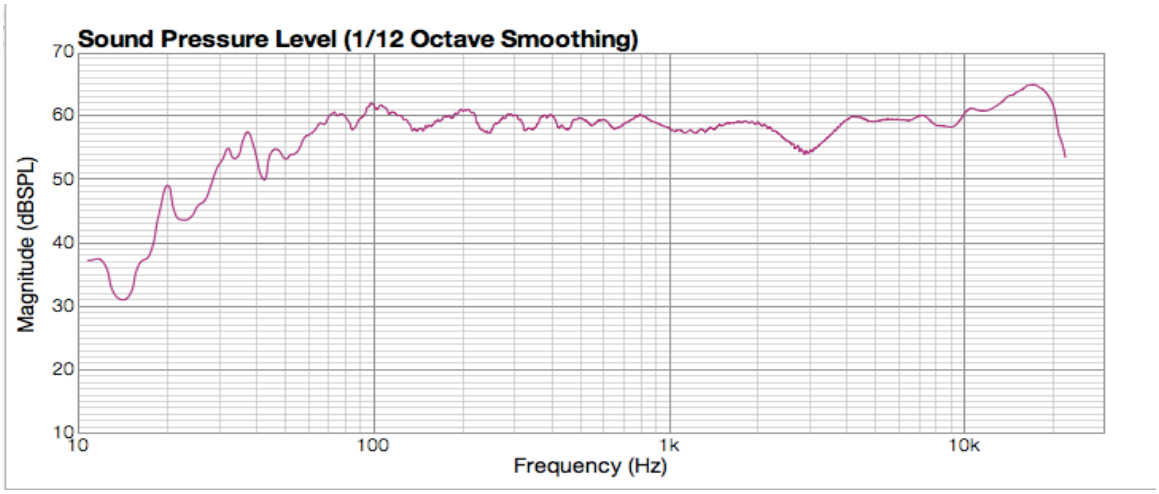


Fig 1.8 Final Frequency Response of system: Dampener and Port tuning can account for smoothing out of response from 150Hz down

After the cross over was worked out an initial listening test was held with about 8 different people. All of the participants have had experience in system design and construction. The response was well enough to warrant moving on to port tuning. This was done in a different fashion for this system. The reason being due to equipment failure at the time of testing a proper impedance test could not be run. So to tune the port the mic from the front was placed directly out from the port in the rear of the cabinet. Placed exactly half of half the distance away from the cabinet that it was in the front. In this case the mic was 4' away in front. So when placed in rear behind the port. It is placed 1' away. The reason this being done was the response taken from the port could easily be minimized by 6dB aligning it with our full system response for evaluation. So for every halving of the distance there is a 3db decrease. Results from this testing can be viewed bellow in figure 1.9

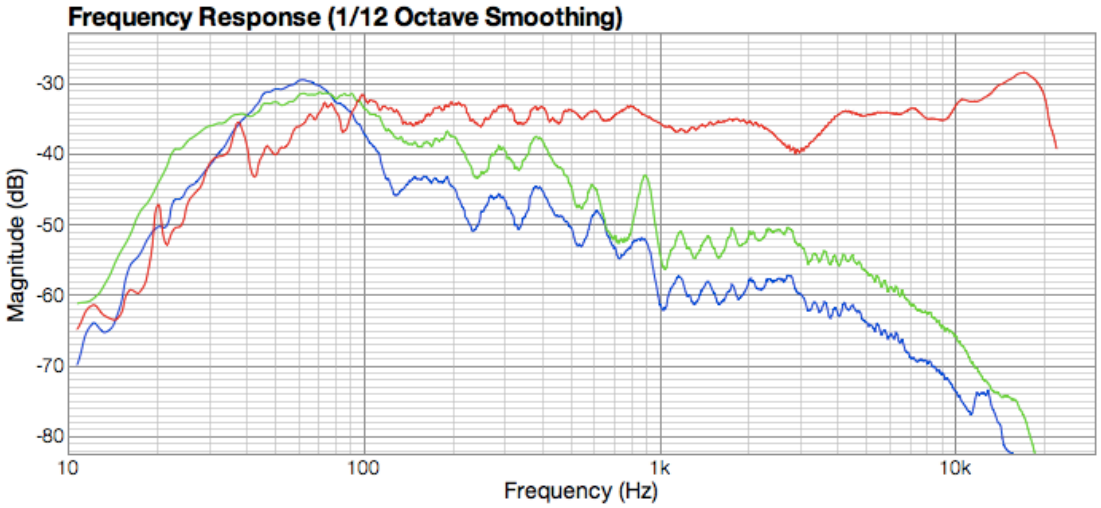
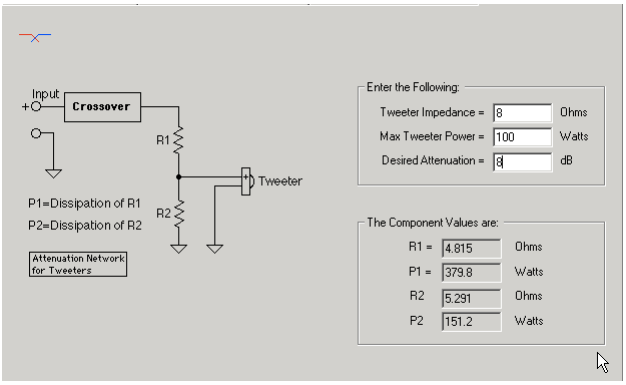


Figure 1.9

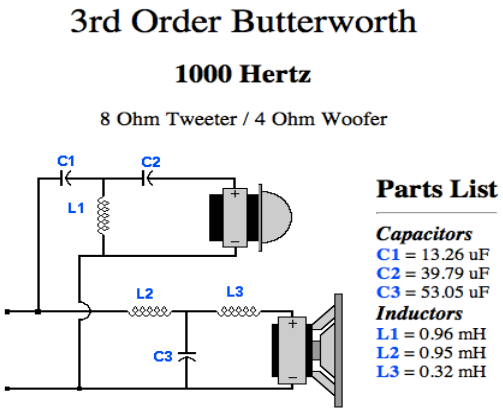
The blue illustrates the response of a port size calculated with a port calculator. These dimensions were 2" diameter 4" length port. A very narrow bandwidth bump centered a round 60Hz is evident. Some experimentation led to the green and final port response for the 2-WMT. To get this response a 2" diameter 6" long port was installed. The bottom of the cabinet was then stuffed loosely with fiberglass about 12" up.

This concluded the tuning phase for the 2-WMT.

Final Cross Over for 2-WMT

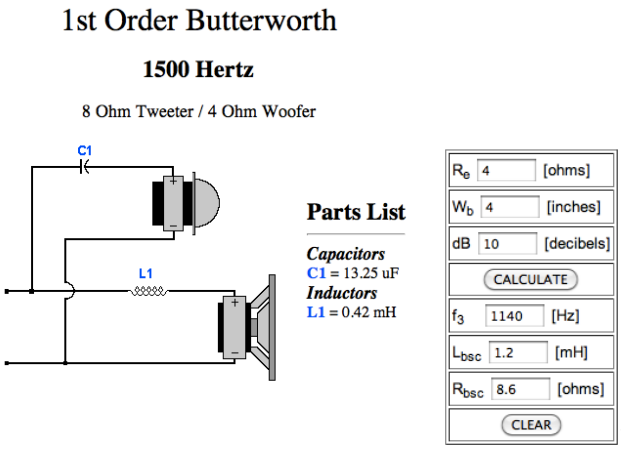


Tweeter Attenuation



Woofer Cross Over

Tweeter Cross Over



Baffle Step Circuit

In the third order schematic only woofer was used. In the 1st order schematic only the tweeter circuit was used. BSC was placed before low pass filter. While tweeter attenuation is placed post high pass filter.