Subject: 4 Pi revisited first impression
Posted by Arthur C on Thu, 29 Nov 2012 13:49:04 GMT
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4 pi speaker revisited, first impressions:

I have just finished this weekend my new pair of 4 pi speakers. My project isn't exactly the same as Wayne's design considering that in France, the Eminence H290 is not available and the JBL 2226H is really too expensive.

The horn chosen is the RCF H100 very popular in the DIY world and the woofer chosen is the Eminence Kappa 15A.

Considering the filter, I have maintained the principles of Wayne's filter with very minor modifications.

For the woofer, I have substituted a 25 microFarad capacitor and a 6.5 ohm resistor instead of 20 microFarad and 8 ohms (C5 and R3).

For the couple B&C DE 250 and RCF H100, I have operated some little modification in order to take into account that the frequency response of the H100 less attenuates the high frequencies as the H290.

Thus, I have substituted the 0.47 microFarad capacitor with a 0.33 microFarad (C1).

Considering that the RCF H100 horn creates a little peak around 2kHz, I have used a 4.8 microFarad (3.3+0.47) capacitor instead of the recommended 6.8 microFarad in Wayne's schematic (C2).

Concerning the size of the enclosure, some very slight modifications have been also done but with the same internal volume as the volume mentioned in Wayne's plan. Concerning the port, some modifications have been introduced. I have used a 10cm diameter port with 14 cm length. Frequency tuned around 35 Hz.

I just wondering about one point, in Wayne's schematic C4 is 10 micro. In accordance to my calculation it should be 20 micro. I haven't tried this substitution. Is someone able to explain me?

Listening impressions: the results are purely tremendous. All the spectrum is very well reproduced with very high dynamic and definition. With such kind of speaker you are far away from most of expensive product available. The dynamic even at very low volume is very good. The style of reproduction is very clear. You can hear everything. One could find that this type of speaker is not for classical music, that's wrong. On piano, you have all the definition and dynamic of the piano which is tremendously well respected without compression as one can feel when listening low efficiency speaker.

The Eminence Kappa 15 A has a very good ability to reproduce the mids with definition and dynamic and is not aggressive at all. The Eminence Kappa 15 A is very seriously made and very

well shaped with a very low price.

I was wondering about the frequency response in the low frequencies. Even if in the specifications the -3db is around 50/60Hz, there is no lack of bass. A 15" woofer reproduces low frequencies much more better than 6" or 8" woofer commonly installed in hifi speaker. You have real bass with power, definition and impact and less compression than 6" or 8" woofer.

Of course, the couple B&C DE 250 and RCH H100 gives you a definition that is very hard to find in hifi speaker even in very expensive brands. Moreover the distortion of DE 250 is far less than the common distortion of "regular" mid speaker.

In the same manner, if you wish to listen to music or movie sound tracks at high volume, this pair of speaker is made for you. The ability of the 15" to reproduce sound at high volume is unbeatable.

The listening has been made with a Luxman M 12 amp and a NAD Monitor Series preamp 1300.

To sum up, the 4 pi are very great for music lover want ever the music played. With the 4 pi you back to the golden age of Hifi with modern products. Don't forget that in the 50 until the 80's prestigious brands used very often large 15" woofer for their top level speakers. For marketing reasons 15" woofers have been abandoned by manufacturers.

Pictures will follow soon.

Arthur

Subject: Re: 4 Pi revisited first impression
Posted by Wayne Parham on Thu, 29 Nov 2012 16:10:02 GMT
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Thanks for posting here. As I read your post, I remembered the days about ten or twelve years ago when many people on this forum were "doing their own thing" like this, maybe as many as half of the builders deviating from the plans in one way or the other. It's refreshing to see that here again.

I tell so many people not to deviate from the plans if they don't have measurement equipment and time. And I think that's good advice, because there are a lot of "weekend warriors" that probably can't take the time to test and optimize a design if they make changes. But with modeling tools and measurement equipment, you can certainly do something like this and do it well. There are a lot of ways to get it "right" - not just one. Of course, there are a lot more ways to get it wrong too, but the point is if you have the time and know-how to dial it in, you can get there too.

Arthur C wrote on Thu, 29 November 2012 07:49The horn chosen is the RCF H100 very popular in the DIY world and the woofer chosen is the Eminence Kappa 15A.
At one time, there were a LOT of people here running the Kappa 15. I had considered using it too, because it is very similar to the Omega 15. But in the end, that's why I didn't use it - There

was no need to offer something so similar as an option.

I'd say the H100 is pretty much the same as the older H290 horn with twice the vertical beamwidth. To be honest, I'd prefer a little less vertical, but other than that, it appears to be a good horn.

Arthur C wrote on Thu, 29 November 2012 07:49For the woofer, I have substituted a 25 microFarad capacitor and a 6.5 ohm resistor instead of 20 microFarad and 8 ohms (C5 and R3). That will give you a smidge less midwoofer peaking in the ~1200Hz region. But I'd consider it pretty much a non-change because Zobels are fairly wide tolerance networks. You can see this in the last couple of pages in my "Crossover Electronics 101" document. Because of the relaxed requirements of the Zobel values, I tend to pick components that are readily available with high-power dissipation capacity since Zobels take a beating.

Arthur C wrote on Thu, 29 November 2012 07:49For the couple B&C DE 250 and RCF H100, I have operated some little modification in order to take into account that the frequency response of the H100 less attenuates the high frequencies as the H290.

Thus, I have substituted the 0.47 microFarad capacitor with a 0.33 microFarad (C1).

Considering that the RCF H100 horn creates a little peak around 2kHz, I have used a 4.8 microFarad (3.3+0.47) capacitor instead of the recommended 6.8 microFarad in Wayne's schematic (C2).
I realize it would require a baffle change, but consider trying our H290C waveguide sometime. Shipping is not expensive, so many of our overseas customers buy this part alone (or this and a crossover) and source their drivers locally.

The H290C waveguide is as smooth as I've seen any horn be, and it provide a great coverage pattern with very little high-order modes. Its profile is oblate spheroidal, and its length/area ratio gives it good beamwidth and best-of-class smoothness of response.

Arthur C wrote on Thu, 29 November 2012 07:49Concerning the size of the enclosure, some very slight modifications have been also done but with the same internal volume as the volume mentioned in Wayne's plan. Concerning the port, some modifications have been introduced. I have used a 10cm diameter port with 14 cm length. Frequency tuned around 35 Hz.
Be sure to perform acoustic measurements to verify that you have not introduced midrange ripple between 100Hz and 200Hz. Standing waves inside the enclosure can cause midrange anomalies if the port falls on a pressure node.

Arthur C wrote on Thu, 29 November 2012 07:49I just wondering about one point, in Wayne's schematic C4 is 10 micro. In accordance to my calculation it should be 20 micro. I haven't tried this substitution. Is someone able to explain me ?
It measures better. When C4 is 20uF, the forward lobe is about 5° too low. The bottom null is around 30° below the forward centerline and the top null is about 20° above it.

By changing to a 10uF value C4, the nulls are more evenly spaced, +/- 25°. Depending on what you call the "centerline" - center of the box or midpoint between woofer and tweeter centerlines - it can even be considered to be slightly upward now, which I think is preferable to pointing slightly

downward.

The bottom line is substituting 10uF for 20uF in C4 creates a subtle shift in the position of the forward lobe, slight but I think worthwhile.

As an aside, this is one of those tiny details you'll never see with modeling tools. I suppose one day, computer simulations might get to a point where they would give this level of visibility - They're clearly improving compared to what was available in decades past. But progress is slow. It's hard to justify the R&D expense when there is such a small market for loudspeaker simulation tools, so it is almost exclusively in the realm of hobbyists. That's why what is out there is either too oversimplified to give any real visibility or too specialized on one aspect or another, incapable of modeling the loudspeaker as a complete system. And in either case, you really have to verify the mathematical models in the simulation programs closely before you trust them because there generally is no Q/A team for a hobbyist project.

Arthur C wrote on Thu, 29 November 2012 07:49I was wondering about the frequency response in the low frequencies. Even if in the specifications the -3db is around 50/60Hz, there is no lack of bass. A 15' woofer reproduces low frequencies much more better than 6 or 8' woofer commonly installed in hifi speaker. You have real bass with power, definition and impact and less compression than 6 or 8' woofer.
Yes, the bass response sounds subjectively much more full and powerful than the measurements indicate. I'm completely satisfied listening to speakers like these without subs, especially in large rooms or outdoors where room modes aren't a problem. But then again, the deepest bass really isn't there and you'll notice it when you add subs. This, combined with the fact that properly positioned subs will smooth room modes in the bass and even self-interferece notches in the lower midrange, makes me inclined to always run flanking subs with these speakers, and sometimes one or two more distant subs in rooms where lower frequency modes are noticeable.

Closeup of left speaker and its flanking sub

Subject: Re: 4 Pi revisited first impression
Posted by openbaffled on Thu, 29 Nov 2012 19:43:35 GMT
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Great post Arthur. Thanks for sharing your build, especially your evaluation of the sound quality.

I'm disappointed with my current speakers. I like to listen to piano at lower volume, but there is no weight to the sound. They don't energize a room the way a real piano does.

I've been following the Internet threads on the Pi, EconoWave and Seos horn speakers. I would

like to try them someday.

I wish there was an easy way to demo a 4 Pi in my home.

Subject: Re: 4 Pi revisited first impression
Posted by Arthur C on Fri, 30 Nov 2012 14:28:38 GMT
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Firstly I would like to thanks Wayne very much for his response, his clarifications and all his work and the dissemination of its work.

Concerning the C4 capacitor as Wayne mentioned I maintain the 10 micro F capacitor instead of a 20 micro as I had calculated.

Concerning the RCH H100 horn. Following Wayne's precisions and explanations, I am going to plan a change and thus, substitute the RCF H100 with the recommended H290C. The RCF H100 works very well and gives me all satisfaction. But, and in order to reach directly a top quality result, its seams to me more successful to adopt Waynes configuration directly rather that to continue to try top optimize Wayne crossover to the RCF H100. I have read to much threads on forum in which was reported the great difficulty to perfectly fine tune the crossover of a compression driver and its horns (ie : there is now nearly for 3/4 decades that some DIY are fine tuning the compression driver and the horns of their Altec A 7 VOT). For the 3 and 4 Pi's spekers. Waynes has kindly done the job with a great success.

For those that may be interested, I wanted to give some explanation concerning my choice of the 15' woofer.

Choice of the 15' woofer. The tricky point is that the 15' shall be able to reproduce accurately mids. As Waynes mentioned the 15' JBL 2226 H is really the top of 15' pro driver. Unfortunately and especially for the DIYers out of US, these driver is very expensive.
That's the reason why Wayne has proposed a substitute the Eminence Omega Pro 15 A.
One my side I have chosen the Eminence Kappa 15A for 3 reasons. (i) Datas are quite close to the Omega's one, (ii) I have been able to hear this woofer in a DIY configuration, (iii) and I have been able to purchase it new for a ridiculous price (around 75 USD/ speaker). This woofer is very well made with a large magnet and sounds really good.
I have been advised by Mr. Samuel Corde from B. Corde, very well known retailer in France and appreciated in the DIY French world, that the Beyma SM 115N is very good. He uses this speaker and the SM 115K in its pro speakers which works very very well for pro application.

Concerning the pictures. The battery of my camera was out of order yesterday. I will upload them this evening or on Saturday.

I will keep you posted.

Arthur.

Subject: Re: 4 Pi revisited first impression
Posted by Arthur C on Fri, 30 Nov 2012 21:17:32 GMT
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As mentioned in my last post, please find below the attached files with the pictures:

File Attachments
1) DSC02865.JPG, downloaded 11502 times
2) DSC02871.JPG, downloaded 11006 times
3) DSC02872.JPG, downloaded 10918 times
4) DSC02867.JPG, downloaded 11093 times
5) DSC02869.JPG, downloaded 11243 times

Subject: Re: 4 Pi revisited first impression
Posted by Wayne Parham on Fri, 30 Nov 2012 21:41:59 GMT
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Those are very nice looking speakers, Arthur!

Kind of remind me of Geddes Summas. I'll bet they sound really good!

But I do think you'll like the version with the H290C better. It provides a better pattern, with a taller forward lobe (thanks to closer driver spacing) and less output at large off-axis vertical angles, so less celing slap.

Subject: Re: 4 Pi revisited first impression
Posted by Arthur C on Sat, 01 Dec 2012 14:45:42 GMT
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I am currently listening some CD very hard to reproduce accurately. Chopin 24 Préludes Opus 28 and some sonatas from Beethoven "Quasi una Fantasia". These types of recording, Piano solos, are tremendously difficult to be reproduce accurately. The dynamic is generally too high for "regular" speakers and the dynamic is generally completely compressed.
With Wayne's 4 Pi, the results are amazing, fantastic ... If you have any doubt with 4 pi's, do not hesitate. Wayne's 4 Pi are for everyone who loves music. Sell you current speakers and adopt 4 pis rather than spending time and money.
On my NAD monitor series 1300 preamp, there is an integrated parametric tone control. I have a little boost the bass +6 db at 50 HZ. The result is wonderful.