
Subject: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 12:48:49 GMT
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Here we go!

Crossovers are built

File Attachments

- 1) [P1030089.jpg](#), downloaded 9330 times
 - 2) [P1030090.jpg](#), downloaded 9194 times
-

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 13:04:54 GMT
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These are built on a 12" X 13" board.

I sort of mixed up on what I went \$\$\$ on and what I went cheaper

I used Meniscus Audio 14ga air core inducers so I splurged a bit with these

I used Dayton caps. I used the standard 250V Poly on the 20uf and 10uf and I used the better new Dayton precision grade 250V Poly on the 6.8 and .047.

On the resistors I used the Dayton Precision Audio Grade Resistor line

I probably should have stood up the .6mH Inducer up. I hope this won't be a problem.

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 17:48:10 GMT
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I thought I'd add my plan on these 4PI speakers. I'm going to build something similar to what a user Nicol1997 on this forum did on this thread
(http://audioroundtable.com/forum/index.php?t=msg&goto=61737&#msg_61737)

- I would use the same 4PI crossover exact to Wayne's plan.
- I would space the 290 horn from the woofer exact to the 4PI plan only center the horn.
- I would have the speaker stand 7" taller. I plan to use two 4" Ports at 9-1/4" length on ea speaker. These are at the bottom of the speaker. I plan to run a lower internal brace at the point where the bottom board would normally be on a to plan 4PI. I'm thinking to run the router on this brace to cut holes in a variety pattern.. some 2" and some 3"... To allow for sound down to below this brace where the ports will run. I'll have the ports run down in the lower chamber and stuff that with the R13 and then lay a layer of R13 on top of the lower brace. I have these in mind (This is the outer piece of the tube that has a taper and the tube would be cut to attach to this)-

I used these on a subwoofer and I like the look and they work well.

- speaker box - 7" taller. trim one inch in width (17-1/2" instead of 18-1/2"). Add 3/4" to the depth (15" instead of 14-1/4")
- Each speaker will have an upper brace which will be a criss cross of boards per speaker. Again, to the plan of a normal 4PI

I am planning to use Baltic Birch and I'm looking for the best grade I can get. Right now I have a line on 5' X 5' sheets. The speaker boxes are big and getting all the wood I'll need out of 2 sheets is a bit tight.... So I drew up some cut plans.

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Wed, 03 Oct 2012 18:14:04 GMT

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I'm not able to see some of your pictures. Looks like they're uploaded to a private area on the internet somewhere that you can see (probably because you're logged in) but the rest of us cannot see. I suggest uploading them as an attachment here, to make sure they are visible to everyone reading.

As for the mods, I'll have to make the standard disclaimer that if you don't measure the cabinet, you can't be sure the internal standing waves aren't going to make an anomaly in the lower midrange. So if you don't have the equipment and time to do acoustic measurements, then I would suggest sticking with the plans as shown, or with a mod that you know has been tested. Don't deviate blindly, even if what you plan to do appears to be a trivial change. It's just not worth it, to risk messing up the midrange when the plans as drawn are tested and optimized. We discussed this in the thread you linked above, so I think you understand.

Now that we're through with the "standard disclaimer", notice that I said "I would suggest sticking with the plans as shown, or with a mod that you know has been tested." Nick's mod has been tested, so if you go with his cabinet, you'll be good to go. You can center the tweeter but don't change the positions or sizes of the woofer or port(s). If you change position or size, you'll need to do some testing to verify the midrange.

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 20:56:47 GMT
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How do my crossovers look? Newbie... I'll try using something else to post update photos

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 21:22:38 GMT
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I hear ya Wayne... I'll have to think about going more with exactly what Nichol1997 did... I feel ok doing what he did as the outcome of his test looked pretty good and close to a spec 4PI build.

Here are the attachments I had.

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Wed, 03 Oct 2012 21:35:03 GMT
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I agree - Probably best to duplicate what Nick did, since we know that worked well. You can center the tweeter, but don't change the ports.

As for the pictures, what I see is, "Your client does not have permission to get URL". Can you save the images on your computer and then upload them here, as an attachment in your posts?

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Wed, 03 Oct 2012 22:52:11 GMT
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Google Images...

Lets try this!

Thanks again for any help/feedback. I totally understand the disclaimer as well.

File Attachments

- 1) [4PI_Face_Mod.jpg](#), downloaded 8455 times
 - 2) [5X5 sheetcuts_4PIMOD Page1.jpg](#), downloaded 8430 times
 - 3) [5X5 sheetcuts_4PIMOD Page2.jpg](#), downloaded 8447 times
-

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Wed, 03 Oct 2012 22:55:42 GMT

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There you go, excellent!

Just remember on those cut sheets that there will be some material loss from the cutting blade. But you have some room at the edges to make up for it, so I think you're good.

Looks like you're going to have some killer speakers before long!

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Wed, 03 Oct 2012 23:00:46 GMT

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Some really ugly crossovers

The .5 and 1.5 Inducer are close to one another... They are far enough away from the 1.0 that I'm not too worried about that.

I thought you just didn't want to "see" another Inducer looking thru the hole of an Inducer.. the .5 is close to the 1.0 but the 1.0 is a good 3in from the 1.5.

File Attachments

- 1) [P1030089.JPG](#), downloaded 8551 times
 - 2) [P1030090.JPG](#), downloaded 8579 times
-

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Thu, 04 Oct 2012 01:05:34 GMT

It's better if the coils are not in the same plane. Position them like this:

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Thu, 04 Oct 2012 12:24:26 GMT
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Wow! My crossovers are suddenly looking really ugly! Even more in comparison to what you have! Oh well.. The solder points are solid and it is to the schematic. I'll hide them in the speaker where nobody will know.

I stood up the .5 and left the 1.0 and 1.5 flat. the 1.0 and the 1.5 are about 4" from one another so I should be good. I say this from a "How To" write up on Parts Express for how to build a cross over. In this it is said the 3-4" in apart range is where the magnetic interference is no longer an issue.

Either way.. I could pull off the .5 inducer... I don't think I could pull off the 1.0 or 1.5. These 14ga are big and held down with lots of glue. I could hardly pull off the .5 ones.

I'll be building in a few weeks and I'll come back with updates.

This will be gradual.

PS - I would have purchased the parts from you Wayne but I got them some time ago.... When you were out of the Eminence horns and 2226 woofers. I was planning to build in the Summer/Early Fall but just too busy.

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Sat, 03 Nov 2012 14:26:42 GMT
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I was trying to wrap up the build yesterday on these bad boys. I had a bad JBL 2226H driver

Hooked it up and dead as a door nail... nothing. I purchased this back in July from Guitar Center and was able to talk them into a return. Lucky! I should have just been smart and waited to buy from Wayne when I was REALLY going to build. Summer too busy and these sat for months.

I had the one hooked up and it is spectacular. so vivid and robust. Not having the second is

killing me!

PS - woofer grill is a must.. 3 and 5 year olds in home. I tried with and without and the sound is excellent. My ears don't really notice a down fall with the grill so far.

Thanks for the help Wyane!!!

I don't have speaker measuring gear... My ears are happy and that is good enough for me!!!

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Sat, 03 Nov 2012 14:30:22 GMT
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PS

The wood is Marine Grade OKOUME that I got from a higher end wood supply shop.. This is used for Chris Craft Woodies (Nice Wood speed boats). I was going to buy baltic at 58.00 a sheet and explained to the guy the void free need. He said he sold this stuff to speaker builders and it is void free.. And has a Mahogany veneer that turned out well with some stain/poly.

The OKOUME is void free and was 129.00 a sheet. No veneer work is good as I suck at it.

Subject: Re: 4 PI by Andy
Posted by [zheka](#) on Sat, 03 Nov 2012 19:56:55 GMT
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mantha3 wrote on Sat, 03 November 2012 09:26\

PS - woofer grill is a must.. 3 and 5 year olds in home. I tried with and without and the sound is excellent. My ears don't really notice a down fall with the grill so far.

where did you buy the grill?

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Sat, 03 Nov 2012 21:39:13 GMT
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Parts Express

15" Peavy grill kit.

Respond if you have trouble finding it

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Sun, 04 Nov 2012 01:57:56 GMT

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Wow, that's an awesome looking build! Sorry you had trouble with the woofer, but I'm glad the place you bought them is supporting you.

At the time you started building, the 2226H woofers were unobtainium, and none of us knew when that would change. I'm glad they got that worked out and we have plentiful stock again. Sorry I didn't have 2226 woofers on the shelf when you started.

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Sun, 04 Nov 2012 22:14:36 GMT

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I got antsy seeing you and parts express out of stock on the 2226... I found some at Guitar Center and got them. If I had been patient and waited for stock to come back perhaps I'd have Stereo 4 PI right now. Patience is a virtue...

I did the same with the Eminence 290 horn.. Found a place in Canada that still had these and got em.. Patient I could have your new horns.

I decided I wanted these speakers and worried about the parts.

PS - I don't have measuring tools/software... So for now it is just my ears telling me things are awesome!

Thanks again. I hope to post a photo of a pair of these soon. With some luck I'll have a good audition of these this coming weekend

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Sat, 10 Nov 2012 13:49:00 GMT

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All in place for now.

Wayne,

Have you ever ran any subwoofer built with the 2242H driver by JBL?

I was thinking I'd try that driver on a sub.

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Sat, 10 Nov 2012 16:04:40 GMT

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Yes, I love that woofer. Also love the 2241. But my favorite is the 2245.

Put one of those woofers in a 10ft3 box tuned to 30Hz. It makes an awesome sub. Like this:

File Attachments

1) [fourPi_18_Subwoofer.gif](#), downloaded 10309 times

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Sat, 10 Nov 2012 17:04:42 GMT

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Nice!

Do you have any photos of one of these?

Subject: Re: 4 PI by Andy

Posted by [zheka](#) on Sat, 10 Nov 2012 19:55:35 GMT

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wow

10 cu.ft. box. that's half of my room .

Subject: Re: 4 PI by Andy

Posted by [zheka](#) on Sat, 10 Nov 2012 20:00:39 GMT

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Wayne,

What effect the scoop-like baffle has in this design?

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Sun, 11 Nov 2012 04:33:09 GMT

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There's nothing gained by the angled baffle, it's just a really cool looking box, in my opinion. Way back when I had Bill Martinelli making our cabinets, I asked him to build these subs as a plain-ol' 10ft3 box and this is what he came up with for me instead. I thought it looked awesome, so that's what we were doing for subs ten years ago.

When I started embracing the multisub approach, I needed smaller boxes and that really marked the end of the big 224x series subs. They are just too big to distribute several around the room, and too large for flanking subs, at least for most people. But if you can fit them in your decor, they're awesome.

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Sun, 11 Nov 2012 14:15:53 GMT

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I'm thinking of getting a 4645C THX Sub by JBL. This is a built sub that has the 2242H driver in it.

The prices for a 2242H are around 900 - \$1000

I called a place that has this 4645 for \$1,000. They have really good prices on this thing. I asked how it was not marked up much from just the raw driver and he said that JBL charges a lot for just the drivers.

Dimensions: 1010 mm x 674 mm x 450 mm

H x W x D 39¾ in x 26½ in x 17¾ in

So about 10.6 Ft3

Subject: Re: 4 PI by Andy

Posted by [Wayne Parham](#) on Sun, 11 Nov 2012 16:53:57 GMT

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That's an excellent sub. It has an EBS curve that gives a -3dB shelf below 100Hz that extends all the way out to 30Hz. And its efficient enough the shelf is around 93dB/W/M.

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Thu, 15 Nov 2012 01:59:11 GMT

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- 1) [P1030180.jpg](#), downloaded 5230 times
 - 2) [P1030164.jpg](#), downloaded 5224 times
 - 3) [P1030163.jpg](#), downloaded 5185 times
-

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Fri, 07 Dec 2012 14:28:39 GMT

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I've been listening to these for a bit over a month now... Unreal. Never going to build another set of speakers again. A second subwoofer is all I'm thinking. Just following up after some time listening. I have been running On Demand high def movies thru these.. Then on High Def I've to the Palladia channel and have done about 8 or so different concerts.. It is like you are at the concert.

I put the older speaker on the other night... In the photos these are sitting on the new 4PI. These are Troels Gravesen Classic 3 way speakers that are nice. They can't keep up with these 4PIs. I think I'm the second to build with the taller mod. I don't have any tools/software to measure. I don't think I'll invest in this. My ears are as happy as ever. My wife loves these too.

Subject: Re: 4 PI by Andy
Posted by [zheka](#) on Fri, 07 Dec 2012 14:49:57 GMT
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mantha3 wrote on Fri, 07 December 2012 08:28 I've been listening to these for a bit over a month now... Unreal. Never going to build another set of speakers again. A second subwoofer is all I'm thinking. Just following up after some time listening. I have been running On Demand high def movies thru these.. Then on High Def I've to the Palladia channel and have done about 8 or so different concerts.. It is like you are at the concert.

I put the older speaker on the other night... In the photos these are sitting on the new 4PI. These are Troels Gravesen Classic 3 way speakers that are nice. They can't keep up with these 4PIs. I think I'm the second to build with the taller mod. I don't have any tools/software to measure. I don't think I'll invest in this. My ears are as happy as ever. My wife loves these too.

I can relate, absolutely. Have you tried toeing them in? Wayne suggests 45 degrees. It makes huge difference in my room. all three front seats are well within the sweet spot.

Subject: Re: 4 PI by Andy
Posted by [zheka](#) on Sun, 20 Jan 2013 15:25:36 GMT
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Wayne,

Do you use any damping material in your subwoofer boxes?

thank you.

Wayne Parham wrote on Sat, 10 November 2012 10:04
Yes, I love that woofer. Also love the 2241. But my favorite is the 2245.

Put one of those woofers in a 10ft3 box tuned to 30Hz. It makes an awesome sub. Like this:

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Sun, 20 Jan 2013 19:01:01 GMT
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Damping material is not needed in traditional subs run outdoors, distributed subs in a multisub

arrangement, or pretty much any subwoofer that is acoustically small. But that's a key: The subwoofer cabinet must be acoustically small, which means the low-pass frequency must be low enough that internal standing waves do not develop in the passband.

Otherwise the rules change.

If you run a big box like the one you posted as a flanking sub, then it will receive some lower midrange frequencies, and at certain frequencies, standing waves will develop inside. So I would put insulation in a big box like that, if I were running it as a flanking sub. And I wouldn't just line the walls, I'd also span the cross-section. In fact, I'd measure the finished product and make sure it was clean in the lower midrange, to even determine whether or not it was suitable as a flanking sub.

That's the whole reason we take such care with our mains, the ones that are physically large. The reason is standing waves develop in the lower midrange, and at those frequencies, the insulation inside is unable to effectively damp the standing wave nodes. So we do careful analysis to make sure the driver and port don't fall on a pressure node and we also put insulation inside that spans the cross-section. That's a more effective location for midrange attenuation - Bass goes right through but lower midrange is damped more effectively.

A physically small sub, something like a 20" square box, cannot develop standing waves below 300Hz. So it's completely safe to run as a flanking sub. You can easily run it up to the Schroeder frequency without having any internal standing waves.

But even if we just increase a single cabinet dimension to three feet, now we have standing wave modes below 200Hz. This is getting down into the lower midrange, and it can adversely affect response if the pressure node lies where the driver and/or port are.

Lots of DIYers build cabinets using T/S box modelers and forget about internal standing waves. The Helmholtz frequency may be right and response below 100Hz is perfect, but the lower midrange can develop a 3dB to 6dB peak somewhere. They won't even know it unless they measure, and even then, sometimes they mis-identify the cause, thinking it's an outside reflection or even baffle diffraction.

Of course, reflection anomalies from nearest boundaries do fall in this frequency band too. But they tend to be most noticeable as notches, not peaks. And you won't see them in an outdoor measurement, in any case.

So anyway, all that to say be careful of internal standing waves in a physically large cabinet. Large cabinets are preferable, in my opinion, because they improve bass response (Hoffman's Iron Law) and because they give ample baffle area, keeping baffle diffraction at a low enough frequency it is masked by the room (and mitigated with flanking subs). But physically large boxes take more diligence to optimize, because the designer must always be mindful of internal standing waves.

Subject: Re: 4 PI by Andy

Posted by [zheka](#) on Sun, 20 Jan 2013 19:41:41 GMT

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Thank you very much.

The box I am working on is also 10ft³. The longest side is about 36" internal. It would not be used as true flanking sub but it may be low passed as high as 120Hz. If standing waves indeed form in this case, they would come from the harmonics, not main content

Would you recommend using damping material for such a box? If so, what material is effective at such low frequencies? Is there a downside to damping subwoofers if it's not really needed?

Thank you.

Wayne Parham wrote on Sun, 20 January 2013 13:01

Damping material is not needed in traditional subs run outdoors, distributed subs in a multisub arrangement, or pretty much any subwoofer that is acoustically small. But that's a key: The subwoofer cabinet must be acoustically small, which means the low-pass frequency must be low enough that internal standing waves do not develop in the passband.

Otherwise the rules change.

If you run a big box like the one you posted as a flanking sub, then it will receive some lower midrange frequencies, and at certain frequencies, standing waves will develop inside. So I would put insulation in a big box like that, if I were running it as a flanking sub. And I wouldn't just line the walls, I'd also span the cross-section. In fact, I'd measure the finished product and make sure it was clean in the lower midrange, to even determine whether or not it was suitable as a flanking sub.

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Lots of DIYers build cabinets using T/S box modelers and forget about internal standing waves. The Helmholtz frequency may be right and response below 100Hz is perfect, but the lower

midrange can develop a 3dB to 6dB peak somewhere. They won't even know it unless they measure, and even then, sometimes they mis-identify the cause, thinking it's an outside reflection or even baffle diffraction.

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Subject: Re: 4 PI by Andy
Posted by [zheka](#) on Sun, 20 Jan 2013 20:01:24 GMT
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And somewhat related question

What's the lowest acceptable first resonant frequency for such a sub in your opinion?

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Sun, 20 Jan 2013 23:11:19 GMT
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There is no downside to lining the cabinet walls with acoustic damping material. I've had best luck with R13 insulation. So feel free to add it.

If you're concerned with midrange, you can also install a sheet that spans the cross-section. It seems to work best at midrange frequencies when the cross-section sheet is between woofer and port.

But if you're going to use it as a prosound sub, I would probably discourage the cross-section sheet because there's a lot of air moving at full tilt. A prosound sub should be purpose oriented, and big boxes with big ports should be used without anything impeding airflow between them.

A box with 36" internal dimension will have a standing wave at 180Hz. It will have others too, but the longest dimension sets the lowest axial mode. So that's the one to watch.

I wouldn't be comfortable using that as a flanking sub unless I measured it and knew it wasn't making any artifacts all the way up to 200Hz.

And that's really the issue here - I'm not saying standing waves will create response anomalies, I'm saying they might. If signals are presented to a woofer in a cabinet with at least one 36" dimension, then standing waves will exist inside the cabinet. If the woofer or port sits on a pressure node, then those standing waves will cause a response peak. So you would probably want to make sure the port and woofer are positioned in such a way that response is good. That's what we do when designing the mains too, or at least, that's what I do. It's why I tell people to be careful when contemplating baffle changes and mods.

This is basically a measurement thing. Measure the box and look for ripple above 150Hz. If you don't see any, then there's nothing to worry about. If you do see ripple, then you can either change the baffle and put the port and/or woofer in a different location, or you can limit the frequency range, and don't send signals at or above the anomalous range. Low-pass it below the frequency where it gets wonky.

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Thu, 18 Apr 2013 18:01:49 GMT
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I finally got a Subwoofer built using the 2242h 18" driver. Love it!

I'd 100% support anyone in going this route. I'd love to go with 2 but the room is an issue... that and the \$\$\$\$.

File Attachments

1) [speakers.jpg](#), downloaded 5203 times

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Thu, 18 Apr 2013 23:36:31 GMT
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Those speakers look fantastic!

But - yeah - I know what you mean about the size of those big-box 10ft3 monster subs. They start getting intrusive when you consider using them in multiples. That's why I designed a smaller cabinet when I started doing multisubs.

placement. It provides excellent extension and smooth response, but it isn't as efficient the larger cabinets like you have. That's the trade-off for their smaller size.

Subject: Re: 4 PI by Andy

Posted by [mantha3](#) on Fri, 19 Apr 2013 00:55:11 GMT

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I used Marine Grade Okoume on the build like my 4PI. This is basically good baltic birch type void free wood.. Nice Mahogany veneer... I suck at veneer... I have two layers of 3/4" for the face..

The face I cut the port smaller then the actual port... Then ran a flush cut router so the actual hole of the wood is perfect with the port as the port drove the flush cut router bit. The port was put into a recessed hole on the back of the baffle.. Then I ran some L brackets and some worm gear HVAC brackets.. Covered all in some PL adhesive.. Strong to hold that fat 10lb port

Before Braces:

Braces:

File Attachments

1)	sub1.jpg	, downloaded 5218 times
2)	sub2.jpg	, downloaded 5037 times
3)	sub3.jpg	, downloaded 5040 times
4)	sub4.jpg	, downloaded 5202 times
5)	sub5.jpg	, downloaded 5022 times
6)	sub6.jpg	, downloaded 5179 times

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Fri, 19 Apr 2013 00:58:07 GMT
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1) [speakers.jpg](#), downloaded 5309 times

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Fri, 19 Apr 2013 05:02:44 GMT
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Impressive system, and nice finish work, they look great!

I've always loved the JBL 2242 driver. I think my favorite all time direct radiating sub is a JBL 2245 in a 10ft3 box tuned to 30Hz. The 2241 and 2242 are very similar, and louder too. So kudos to you on that!

Subject: Re: 4 PI by Andy
Posted by [mantha3](#) on Fri, 19 Apr 2013 16:57:57 GMT
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I was looking into the 2245 VS the 2242 and went with the 2242... I think the 2242 in a 10 cu ft box goes a tad bit lower... Both options you can't go wrong with.

Subject: Re: 4 PI by Andy
Posted by [Wayne Parham](#) on Fri, 19 Apr 2013 17:56:06 GMT
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mantha3 wrote on Fri, 19 April 2013 11:57 I was looking into the 2245 VS the 2242 and went with the 2242... I think the 2242 in a 10 cu ft box goes a tad bit lower... Both options you can't go wrong with.

Both the 2241 and 2242 develop EBS alignments in large boxes. The 2245 doesn't have the shelf, and is as loud at 30Hz as it is at 100Hz. But the 2241 and 2242 are louder in the midbass.

And the 2245 isn't available anymore anyway. As you said, they're all great subs.
