
Subject: Adjusting the capacitor value on the tweeter attenuator

Posted by [Jerry Parker](#) on Sat, 16 Aug 2003 16:23:23 GMT

[View Forum Message](#) <> [Reply to Message](#)

Hey Wayne! Well Mitch and I finally finished building the 3pi's, and they sound good! (They don't look so good though, cause we didnt have time to finish them :-\) I did think that the psd2002 still had too much energy though. So what I did was make 2 foot sections of 16awg wire and pull them out of the port on the front. I cut off the old .47mfd capacitor and soldered the jumper wires to the old capacitor lead points. I had some film and foil .33mfd caps around, so i hooked them up instead. something really WIERD is occuring though. I disconnect the capacitor out of the loop, and it seems that it makes NO difference in the sound!!! :-(I find it hard to believe I made the same mistake on BOTH speakers, and it still sounds good, with just a little less midrange. Do you have any idea on what is occuring? I plan on ordering some .22mfd caps in the future to try those out too.

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Wayne Parham](#) on Sat, 16 Aug 2003 19:50:53 GMT

[View Forum Message](#) <> [Reply to Message](#)

Are the cables installed so that the components are nearest the crossover circuit board? I'm sure you have that part right. But I can sure hear the difference when capacitor C1 is removed, so something is up. Let's get together sometime soon and have a look at them. Maybe the cables assemblies are built wrong. I'll look over the ones in inventory too - They're built in batches, so if yours are wrong, probably a couple of others are too.

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Jerry Parker](#) on Sun, 17 Aug 2003 15:38:43 GMT

[View Forum Message](#) <> [Reply to Message](#)

Well, completely shorting the capacitor out of the loop, gives a 4dB increase in SPL according to my radioshack spl meter at around 2500hz. And I can definatly hear that. But disconnecting and reconnecting the .33mfd film and foil capacitor (or even the original .47mfd) does nothing at the same frequency of 2500hz. I would assume that it would be attenuating by around 10 to 12dB at this frequency, but it isnt doing anything? The thing is, it sounds relatively flat up to around 16khz or so even without the cap...

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Wayne Parham](#) on Sun, 17 Aug 2003 16:18:42 GMT

[View Forum Message](#) <> [Reply to Message](#)

As the capacitance of C1 is decreased, it does less and less as you might expect. And even without the capacitor, there is some top-octave compensation simply because the tweeter's voice coil is inductive and voltage division between the resistors and the voice coil tends to create a slightly positive slope in its response curve. But there is definitely more lift at 10kHz and 15kHz with a 0.47uF capacitor, and it is audible. I didn't look at my stock of cable assemblies this weekend, but I'd sure like to have a look at yours. It should be providing significant attenuation at 2.5kHz, and most of the attenuation should be removed at 15kHz. You can really hear the difference between such a cable assembly and a straight wire, so if that's not the case with yours, then something is wrong. If you'd like, we can get together this week and have a look. Or we can check it out at Phil's meeting

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Jerry Parker](#) on Sun, 17 Aug 2003 17:16:43 GMT

[View Forum Message](#) <> [Reply to Message](#)

Well, I pulled the tweeter compensation out of the speaker to examine. I noticed something odd though. There should be 2 values of resistors right? 16ohm and either 20 or 30ohm right? Well one (I didn't check the other) has one 20 ohm resistor, one 30ohm, and four 16 ohms (I'm using the 12dB attenuator). I thought there should only be 2 resistor values? I also notice that I get around a 2dB more of output in the ~2500hz range when I substitute the .47mfd for a 4.0mfd capacitor in the tweeter attenuator, but again, no audible or measureable difference when I use a .47 or .33 compared to the circuit being open.

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Jerry Parker](#) on Sun, 17 Aug 2003 18:37:21 GMT

[View Forum Message](#) <> [Reply to Message](#)

Hey Wayne, what about if I used my ohmmeter to measure the resistances between each resistor to make sure it's wired up right? I made a little diagram (I think it's right) of the way it looks the attenuator is wired. First we have two 16ohm resistors wired in series with each other. We then have another set of 16ohm resistors wired in series. These two sets are wired in parallel with the tweeter. Then, we have a 20ohm, 30ohm and a .33mfd cap wired in parallel with each other. This set is then wired in series with the tweeter. Is this correct?

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Wayne Parham](#) on Mon, 18 Aug 2003 03:06:52 GMT

[View Forum Message](#) <> [Reply to Message](#)

Even if the cable assembly were wired correctly (which we now see that it is), you may simply not notice the slight difference that the 0.47uF capacitor makes, and even less from a smaller part. There is some augmentation in the top octave just from the voice coil's inductive reactance rise at higher frequencies. This represents a few decibels over the top couple of octaves. Then there is an additional few decibels provided by capacitor C1. So the combined effects create the overall response curve.

If you were to just have either of these two properties - voice coil inductance or bypass capacitance - you would still have rising response, just not as fast or as much. The amounts, of course, depend on the values. Capacitor C1 sets both the frequency where augmentation begins and the overall amount available, up to whatever attenuation the R1/R2 network provides.

Larger values of capacitance bring in augmentation sooner and it is made louder too. But as the capacitor value grows, augmentation begins at a lower frequency. As the C1 capacitance grows and bypass frequency drops, you get to a point where the R1/R2 network is completely bypassed and acts like it isn't even there at all.

Smaller capacitance values bring in compensation later, but also reduce the total amount of augmentation provided in the audio range. Below a certain capacitance value, the circuit acts as though there were no bypass capacitor. But even at this point, you still have an amount of HF rise set by the values of voice coil inductance and R1/R2.

All this to say that you might just not be hearing the difference. I've got a little circuit that I used in the "Crossover Electronics 101" seminar at the Midwest Audiofest. This circuit is the exact same as is used on your crossover, except that there is a switch to cut capacitor C1 in or out. There is also a switch that substitutes the R1/R2 network for a single series resistor that provides the same amount of overall attenuation. This allows a person to easily demonstrate the sound of each and to compare it with the response curves. Sort of like a picture being worth a thousand words, and a sound being worth a thousand pictures - at least where response graphs are concerned.

Anyway, the point is that while the removal of C1 is definitely audible, it is not a huge thing by itself. When the total network is removed, now that's a big change. Not just because of level-matching, but also the EQ provided by the network. And again, some of this is done by capacitor C1 and some of it is done by voltage division between voice-coil inductance and the attenuator resistors R1 and R2. This voltage division forms a filter, and the total filter function is provided by all these parts acting together.

So while you're experimenting, put a switch in the circuit to be able to switch C1 in and out of the circuit easily. That way you'll be able to make A/B comparisons immediately. When you do this, I think you'll be able to hear capacitor C1's participation in overall response. And try the system without a compensation cable at all, just so you get a feel for how that sounds. In my opinion, this part of the circuit is where you really set the character of the speaker. I think it's probably the most important part of the design. So your work on "voicing" the speaker with these components is very productive and interesting. It's a lot of fun, isn't it?!!

Wayne

P.S. If you want, you can borrow those little demonstration circuits from the seminar. Sounds like you'll be wanting to go a step beyond - To be able to switch in different values of R1, R2 and C1. But the circuits I have are already built, so that makes some of this easier. And they're really handy for being able to demonstrate the different influences of all these parts.

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Wayne Parham](#) on Mon, 18 Aug 2003 03:08:19 GMT

[View Forum Message](#) <> [Reply to Message](#)

Your circuit is wired correctly, except that the stock cable uses 0.47uF for C1. But as you've noticed, the difference is pretty slight between C1 values of 0.33uF and 0.47uF in a circuit having these particular values of R1 and R2.

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Jerry Parker](#) on Tue, 19 Aug 2003 14:43:48 GMT

[View Forum Message](#) <> [Reply to Message](#)

Hey Wayne. I did some measurements with the capacitor disconnected and connected again using 15.8khz and 16.5khz sine waves. With the Radio shack SPL meter, I was getting about a 2dB difference in output, which is inaudible I suppose to my ears :-). But then again there isn't much content that high in frequency in music anyways. Interestingly enough though, paralleling the .33 and .47uf caps gives me a 4dB gain over the capacitor out of the circuit. I dunno why that is, since parallel wiring should only allow more potential to pass, right? At any rate, if I want more output at those high frequencies, around say 15 to 17khz, I am going to have to buy a larger capacitor right? I also think I want to build a 16dB attenuator, as it is, the midrange is a bit too hot for my tastes, and with more attenuation, I will probably get a closer sound to what I am looking for. :-)

Subject: Re: Adjusting the capacitor value on the tweeter attenuator

Posted by [Wayne Parham](#) on Tue, 19 Aug 2003 17:42:50 GMT

[View Forum Message](#) <> [Reply to Message](#)

You're right that parallel connections for capacitors add their values, so having 0.33uF and 0.47uF

connected in this way gives you 0.8uF in-circuit. I'm not sure the Radio Shack meter would be very accurate above 10kHz, but I'm not surprised it would show a little more on the scale when the caps were connected in parallel. You might try the 15dB circuit and see if it is more to your liking, and you can always manipulate the values of R1, R2 and C1. But I personally wouldn't want to use much bypass capacitance with higher-value attenuators. Once you get past 10dB or so, I don't like bypassing as much of the attenuation in the top octave with PSD2002's, because they already have pretty strong output above 10kHz.
