Subject: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by positron on Fri, 21 Jan 2022 21:44:18 GMT
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Hi Gents,

I finally found the AES article covering RIAA equalization by Stanley Lipshitz I lost many moons ago. According to the article, there is a problem with correct RIAA equalization design in phono stages. (I am wondering about recording as well.)

No need for math etc, the introduction and references 1-18 at the end of the article give a sense of the scope of the problem. Who knows who is really following the true RIAA curve to this day?

https://forums.melaudia.net/attachment.php?aid=1301

Interestingly, the computer program I used for designing the RIAA in my test phono stage was up to 0,7 db off in the highs and 0,3 db off in the bass. After correcting the problems, a definite sonic improvement. Of course I had to reset the TT tracking, rake angle, anti skate etc.

For those who diy, here is a website whose calculator is based on Stanley Lipshitz's design equations.

http://www.mh-audio.nl/Calculators/CalculateRIAA.html

cheers

pos

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by Strum Drum on Sun, 23 Jan 2022 01:22:50 GMT
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What's the reason behind the inaccuracies, though? I read the article and couldn't find the reason that so many models are like this. I saw this bit, - "These errors are due in part to the perpetuation in print of incorrect formulas for the design of the RIAA equalization networks commonly employed." However, I don't understand why it was an issue in the first place. I'm not an engineer, but I just assumed there was a standard that everyone followed.

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by positron on Sun, 23 Jan 2022 05:27:25 GMT
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Strum Drum wrote on Sat, 22 January 2022 19:22What's the reason behind the inaccuracies, though? I read the article and couldn't find the reason that so many models are like this. I saw

this bit, - "These errors are due in part to the perpetuation in print of incorrect formulas for the design of the RIAA equalization networks commonly employed." However, I don't understand why it was an issue in the first place. I'm not an engineer, but I just assumed there was a standard that everyone followed.
What Stanley is stating is that the design equations used by the designers/engineers are not correct. It is one thing to calculate a single pole complex math problem, but when multiple poles are needed, very complex math is needed. The designers/engineers did not understand how to perform the correct math.

I surmised that there are equations in general, standard reference, use that are incorrect and were simply copied by many designers/engineers.

Hope this helps. Cheers.

pos

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by Strum Drum on Sun, 23 Jan 2022 20:36:09 GMT
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Thank you, positron, for explaining the situation in simple terms. You would make a great teacher. I'm just so surprised that they messed up the math. It does seem complicated, though. Well, honestly, it goes over my head. Thanks for the share. It was an interesting read.

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by gofar99 on Mon, 24 Jan 2022 02:21:15 GMT
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Hi, I have found the various sets of formulas to be more or less close. They don't tell the whole story as the compliance with RIAA requires the output of the preamp to be right, not necessarily any individual stage. I use a 1% accurate inverse network with a very accurate signal generator. Then measure the output as a Bode plot on a calibrated scope with a suitable load. Doing it this way compensates for changes the actual circuit (not the EQ) usually causes. A qualifier is that with tube gear (all mine is) the brand, lot number and individual tubes will vary. It is unpredictable. When I hand select the tubes (same lot etc) it is possible to get matching within 0.5db when first installed. After 6 months or so the matching is not likely to be quite that good. I only use passive eq and no NFB in designs, if you use NFB you can get a slightly better long term result. IMO is that NFB is a double edged sword. Yes the numbers can be better, but I always hear some subtle changes in the presentation. Possibly it is just me, but I avoid NFB when ever I can.

Anyhow the site for calculations is a good one and I have used some calculations they had for speaker crossovers and box volumes.

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by positron on Mon, 24 Jan 2022 15:36:22 GMT
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gofar99 wrote on Sun, 23 January 2022 20:21Hi, I have found the various sets of formulas to be more or less close. They don't tell the whole story as the compliance with RIAA requires the output of the preamp to be right, not necessarily any individual stage. I use a 1% accurate inverse network with a very accurate signal generator. Then measure the output as a Bode plot on a calibrated scope with a suitable load. Doing it this way compensates for changes the actual circuit (not the EQ) usually causes. A qualifier is that with tube gear (all mine is) the brand, lot number and individual tubes will vary. It is unpredictable. When I hand select the tubes (same lot etc) it is possible to get matching within 0.5db when first installed. After 6 months or so the matching is not likely to be quite that good. I only use passive eq and no NFB in designs, if you use NFB you can get a slightly better long term result. IMO is that NFB is a double edged sword. Yes the numbers can be better, but I always hear some subtle changes in the presentation. Possibly it is just me, but I avoid NFB when ever I can.

Anyhow the site for calculations is a good one and I have used some calculations they had for speaker crossovers and box volumes.

If I understand you correctly, the actual accuracy of the rest of the system also needs to be investigated. With that in mind, I don't seen any reason not to start with the RIAA network as it costs very little.

I have tried different tubes and the specs seem to stay close. I try to use the best tube manufacturer possible. Sourcing from a cathode follower would definitely keep deviation in milli db range.

The input following the passive network needs capacitance (including Miller capacitance) to be included in the network, and resistance to be high for accurate bass reproduction. Some include a pole at very low frequencies, but personally I don't include such a pole.

Hope this helps the diyers as it costs virtually nothing to get the RIAA correct.

I agree, I also do not use negative feedback type.

Stanley also addresses other poles, especially high frequency pole around 50khz. A recording RIAA emphasis network and associated circuitry cannot indefinitely increase gain as the frequency rises, so a high frequency pole exists. I have found that if I create a super high frequency pole as well, I notice a sonic difference. I am not sure it is worth it. Very interesting to investigate though.

cheers
pos

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by gofar99 on Wed, 26 Jan 2022 02:44:42 GMT

Hi Good thoughts, but my experience is somewhat different. I find that tubes from one company do not always match characteristics with those from another. Several parameters can differ, Mu, Rp, residual noise and MillerC. Rp is the thing that seems most often different. I have not found Miller capacitance to be much of an issue although in builds with very high input impedance of the second stage it might contribute some. The formulas I use include that impedance in the calculations and compensate for it. One issue I have with some common formulas is that they don't address Rp well. Rp is necessarily included in the resistance feeding most RIAA passive networks. It is unfortunate that many of the formulas don't clearly indicate that it does and I am sure many builders have wondered why their preamps don't sound quite right. Generally I specify the tube type (not just like 12AX7, but if it actually is a 7025, ECC type or something else including the brand) to minimize errors on diy builds. And not to get too far off course some tubes sound different. A classic example of a type I use is the 5751. Most sound similar with one exception the JJ 5751 is way different. In the end I test all my builds on a scope and use my ears to verify that the sound is as I think it should be. In the end the ears are what matters.

Subject: Re: Wide Spread RIAA Phono Stage Inaccuracies by Manufacturers
Posted by positron on Thu, 27 Jan 2022 23:32:03 GMT

If I may Gofar, I think I can help with a closer, more accurate, and long term stability/success. I agree, no negative feeback loops, except for a very small amount of current feedback from the cathode resistor to give biasing etc (in my design). You may wish to use separate biasing technique, but that also has considerations.

The miller capacitance's effects depend upon the RIAA design. Using higher capacitance in the network (lower value resistors), the Miller capacitance will have negligible effects. If using a lower capacitance designed network (often seen with 12Axxx or even 6sn7 tubes), the miller capacitance will have more effect on the RIAA curve. So changing tubes with different Rps and miller capacitance will affect the RIAA more. Just a matter of how you wish to design and feel comfortable with.

A second point, I generally use a low Rp tube, and high R1, so the RIAA variance is small when changing out tubes. A low Rp tube will also give me a factor of 5 or 7 times less RIAA change than using a high Rp tube and high R1.
Very general figures.

When using 12XXX type tubes with generally high Rp, the margin of design is also quite slim "balance" when considering moderate+ deviations from RIAA. Thus using a cathode follower to the RIAA network is generally an advantage for RIAA stability. However, every added stage generally deteriorates the musical quality.

It is true that all the stages should be accurate in a system, but RIAA is one place to start that is inexpensive for those with a TT. One can also compare their phono system to that of digital.

Following that, one can then judge component auditions more accurately in one's home.

Working in a university Lab for a while, a scope is not accurate enough for a close accurate measurement imo. A quick, accurate, somewhat easy way to design an accurate RIAA netowrk, is to plug in a proper value of R1 resistor (which includes Rp and RL values) at this site, which uses Stanley Lipshitz's equations. I found it works wonderfully. (Personally, I use a Tektronix capacitance/resistance meter, but there are other accurate meters one can purchase to check values.)

http://www.mh-audio.nl/Calculators/CalculateRIAA.html

Using this site allows me to be withing 0,1db initial, and it stays quite close as the tube ages due to R1 resistor being much larger than Rp/RL.
As mentioned earlier, I agree that no negative feedback if possible.

Cheers and continued good fortune tweaking your system.

pos

positron wrote on Mon, 24 January 2022 09:36gofar99 wrote on Sun, 23 January 2022 20:21Hi, I have found the various sets of formulas to be more or less close. They don't tell the whole story as the compliance with RIAA requires the output of the preamp to be right, not necessarily any individual stage. I use a 1% accurate inverse network with a very accurate signal generator. Then measure the output as a Bode plot on a calibrated scope with a suitable load. Doing it this way compensates for changes the actual circuit (not the EQ) usually causes. A qualifier is that with tube gear (all mine is) the brand, lot number and individual tubes will vary. It is unpredictable. When I hand select the tubes (same lot etc) it is possible to get matching within 0.5db when first installed. After 6 months or so the matching is not likely to be quite that good. I only use passive eq and no NFB in designs, if you use NFB you can get a slightly better long term result. IMO is that NFB is a double edged sword. Yes the numbers can be better, but I always hear some subtle changes in the presentation. Possibly it is just me, but I avoid NFB when ever I can.

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