Home Theatre System Setbacks and Surprises

In case you decide to follow this project, I am able to offer some very candid insight into issues I have encountered during the development of this project.

Setbacks

1. Currently, Trace8 and TraceOutA16 sound cards from Marian do not work on Windows7 WASAPI system in Exclusive Mode.

Lack of support for Windows7 Exclusive Mode necessitates introduction of an audio buffering system, which in turn, introduces delays and increases latency. From the programming point of view, it's possibly easier to go back to MME audio engine, and accept 40-50ms increased latency. This may not necessarily be a bad idea, as newer 3D TVs have large video latency. I will revisit this issue later.

2. PC power supply noise getting into audio lines.

Turned out, that the culprit was the PC power supply (Thermaltake TT-450NLINH-1, PN W0276). The poor quality PSU has been replaced with Seasonic S12II-520W 80+Bronze PSU. Now, the noise level dropped by -15dB, restoring the original Delta1010LT specification for S/N.

3. Ground-loop problems.

Ground-loop issues are magnified in my system, because I use UE3 volume control as the "master" volume control. In this configuration, all audio power amplifiers do not have input attenuators, and therefore operate at maximum volume level at all time. Consequently, whatever signal comes out of the sound cards output, it will be amplified at full volume right away. This is why I paid so much attention to the ground loop issues, and S/N of the PC audio system. It's perhaps worth mentioning here, that you do not have to incorporate volume control this way, and there are other options. I just took the challenging path.

For example, one simple way of providing a volume control between the Delta1010LT outputs and your amplifier is a device (IR High Fidelity Remote Volume Controller Chip with LCD support) from http://www.tauntek.com/irvc2-ir-master-with-lcd-for-remote-volume-control.htm

Another excellent option is to by-pass the whole amplifier building problem and buy three JVC RX-5032 5x100W receivers from Ebay (around $150) and use them as 15-channel amplifier with remote control. Or buy them from Parts Express.

While building this system, I have encountered ground-loop problems between the pieces of equipment and also localized ground loops, within multi-channel amplifier. Initially, when using only two RCA audio cables connecting the sound card's output with the 10-channel amplifier, I could completely get rid of ground loop problem disconnecting ground wire from my amplifier's chassis. The whole system

would still be grounded via the PC power cord, but this was the only grounding point in the system. Now, all ground-loop problems magically disappeared. It was really quite an amazing improvement, and I reported these findings on the User's Group board some time ago. This is how the dual-channel subwoofer amplifier is connected to the PC – only two RCA lines.

However, after connecting all 10 output RCA cables from the two Delta1010LT sound cards, I found that ground loops have re-appeared again in the system. It took some time to analyse the issue and determine solution. Firstly, I have re-connected the mains power ground wire to the amplifier's chassis – to see if I can relay on a fixed, good quality ground point reference. Then I started experimenting with internal grounding around the amplifier's power supply (initially a star-type of grounding) and the location of each loudspeaker terminal ground point. For instance, I would keep the "hot" loudspeaker wire cable connected, and I would lift the ground wire inside the amplifier box, so I could connect it anywhere to the ground inside. After moving the loudspeaker grounds around, I have eventually found locations on the chassis, or "0Volt" power supply line, which completely eliminated the ground-loop buzz on some drivers, and on others, this technique minimized ground-loop induced buzz to a level so faint, that could only be realized when you put your ear right next to the speaker's cone. I had to repeat this process for all 10 amplifier modules, but the outcome was an excellent result I was looking for, and confirmed, that I can still use UE3 volume control as the "master" for the whole 12-channel amplifier system.

To close this issue - if you encounter problems described above, I would strongly advice, to also try the same grounding trial approach, but with the main's power ground disconnected from the amplifier's chassis. Your computer should still be grounded, therefore the whole system is still grounded vie the multiple RCA cables' shields, but the ground loops are not developed between the pieces of equipment.

4. Solder bridge on 100W/4ohm amplifier module.

Accidentally, I have created a solder bridge between base-emitter junction of Q10 (MJE340). The result was that amplifier was acting as a half-wave rectifier above 5Watt power output. The bridge looked like normal copper track, and therefore was very difficult to find. After I replaced a couple of suspicious parts, it did not fix the problem. Then I started to measure voltages across transistors' legs, and found 0Volt between BE junction of Q10. After the bridge was removed, that amplifier performed as per specification.

5. 100W/4ohm power amplifier module instabilities.

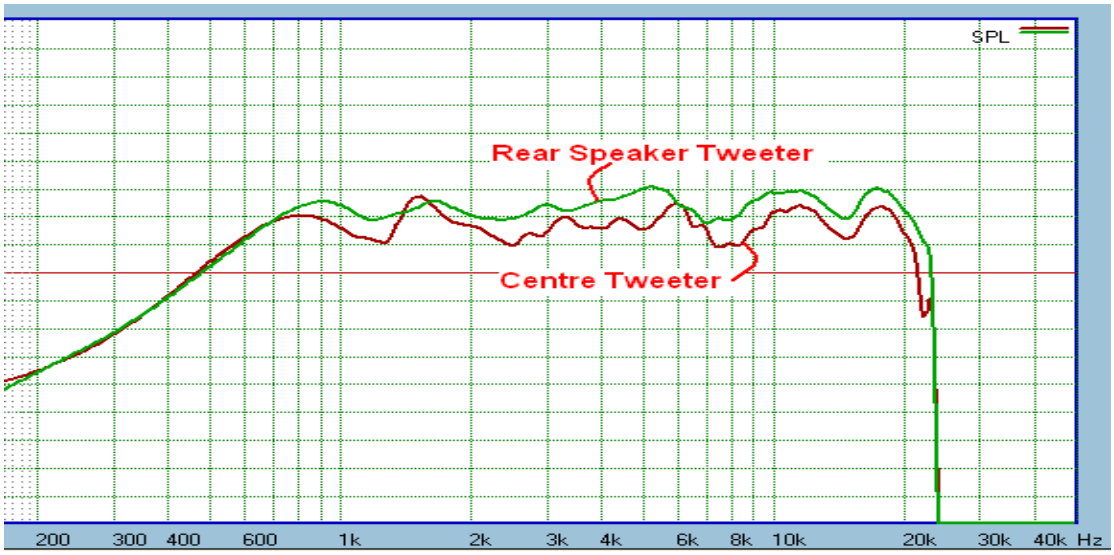
The original amplifier incorporates cascade stage consisting of Q8 and Q7, where Q8 operates in "grounded base" configuration. Such design, as claimed by the inventors, has improved linearity, gain and bandwidth. Perhaps even too much of a good thing?. However, I have found, that such combination leads to high frequency instabilities. The amplifier would heat-up and start to oscillate, after which even removal of the input signal would not extinguish the oscillations, and the amplifier

would continue to oscillate and heat up. Modified circuit with the Q4 (current source) and Q5 removed and replaced by fixed resistors, and the cascade stage replaced by a standard common-emitter configuration of Q8 has reduced the OL gain and fixed this problem.

Modified amplifier works very well and, when used with supply voltage of +/- 41V and appropriate heat-sink, will deliver 72Vpp voltage at the onset of clipping (measured on the bench). This equals to 25.5Vrms and therefore it is 160W into 4 ohms. However, with the gain of 5.6 and maximum sound card output of 10Vpp, the power output is set to 100W into 4 ohms. The design goal has been achieved.

6. Centre Channel Tweeter is possibly out-of-spec again?.

Rear loudspeakers and centre channel loudspeaker have the same tweeters. However, the centre channel tweeter has significantly more irregular frequency response, is 3dB less efficient, and drops off about 1kHz sooner then than the rear tweeters. I do not know what the problem is. Still, UE3 has managed to equalize this driver, but front and rear channels are equalized somewhat better.



I am looking at the possibility of replacing this tweeter. It seems to be also distorting the sound during playback. If the driver is non-linear, the HBT will have difficulties equalizing it. This is second tweeter, that I am forced to replace. The first one, had air pressure coming through magnet assembly into the cavity behind the dome. When woofer increased pressure inside the box, the dome of the tweeter was being pushed out of the assembly – shocker!.

In the final version of the centre loudspeaker, the faulty Vifa D25 tweeter was replaced by Dayton RS28F-4 tweeter.

Surprises

1. Removal of Input -10dB attenuators.

Having conducted listening tests with eliminated ground loops and amplifier gains adjusted as explained in the project documentation, I am satisfied, that the system is quiet enough and transparent, even with UE3 volume slider adjusted to 0dB (or unity gain), and CD player paused. Consequently, UE3 volume control becomes system's master volume control.

2. Time alignment of two Delta1010LT sound cards.

Synchronization is achieved via Word Clock mechanism built into the sound cards.

However, the final time-aligning mechanism for the two Delta1010LT sound cards turned out to be a software solution. This is really a good news, as the time alignment is performed automatically for each audio session, and does not require user's intervention. Occasionally, when Windows7 audio engine is unable to align the sound cards correctly one after another, you may need to stop and re-start the UE3 system.

3. Remote Control issue solved.

I have implemented (as a future software improvement), Volume, Mute/UnMute, Subwoofer control and Play/Stop control buttons in the keyboard. The keyboard is 2.4GHz wireless, so it serves as an excellent remote control device – remote control problem for UE solved. I can control the sound from next room.

4. Maximum undistorted acoustic output.

I have been quite pleasantly surprised about how loud and powerful the UE system is. This feature has exceeded my expectations by far, and it looks like my calculations of THX level included some decent margin. Well, it's also possible, that I have not used all the headroom for HBT equalization, and therefore, I have good margins for broadband SPL increase.

I am quite convinced, that you could easily employ 40W/channel amplifiers (MA1240 from Parts Express) and still get very respectable SPL levels in your AV room.