

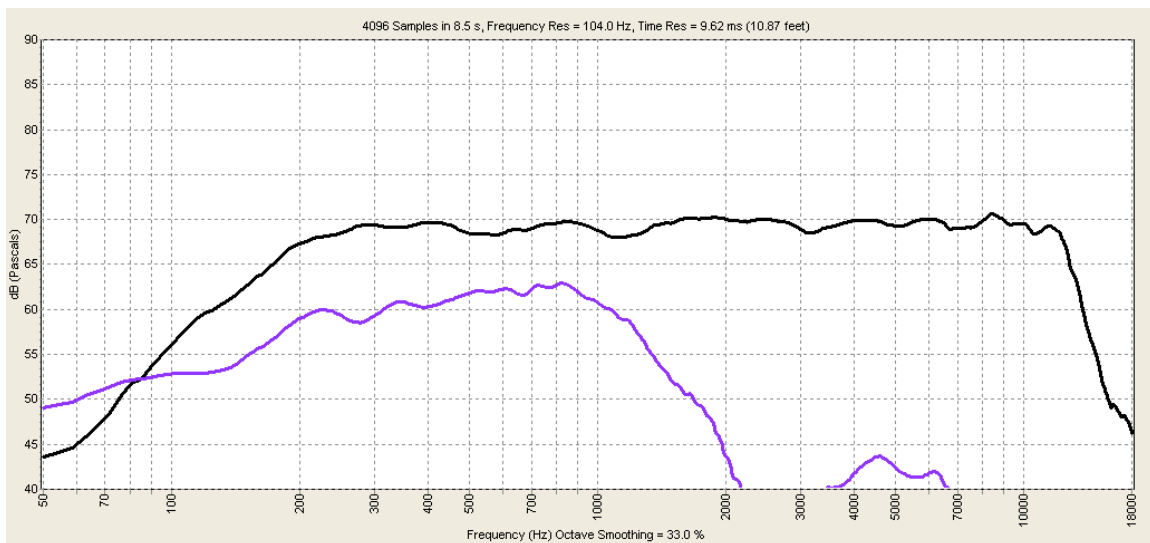
Are Your Loudspeakers Broke?

by Curt Taipale

When was the last time that you listened analytically to your loudspeakers? I mean really, truly listened to them!?!

The reason that I ask is because easily eighty percent of the church loudspeaker systems that I am invited to evaluate and re-voice ("tune", "EQ", "optimize") has something seriously wrong with them – something that the church sound techs and pastoral staff are totally unaware of.

Sometimes the church sound tech might be suspicious that things don't quite sound right, but they just can't pin their finger on what it is, let alone which loudspeaker has the problem. Often they say that they haven't had time to sort it out. And the reality is that most don't own the test gear to help them dig deeper into the problem.



Think there might be a problem here? The relatively "flat" black trace is the frequency response at a main seating section. The purple trace is the frequency response of the same model of loudspeaker aiming at the adjacent seating area. Those seated in the house left section receive a good quality sound, yet those seated just across the aisle hear no high frequencies at all.

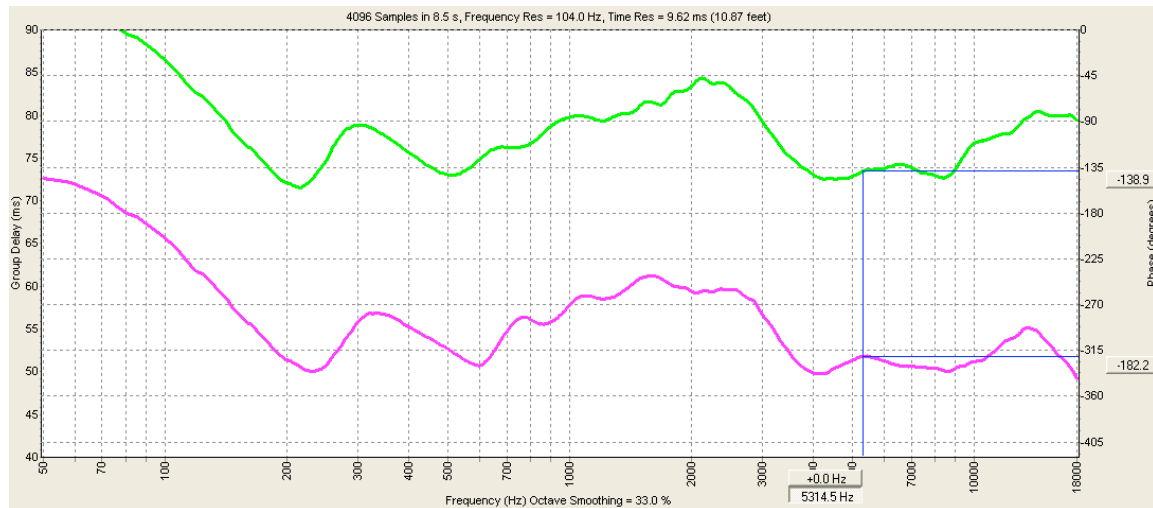
Although this might be just a loose wire, more than likely the high frequency driver in the loudspeaker aimed at the house right seating section is blown. The church's worship pastor and tech team just knew that the sound

coverage wasn't even, but didn't know why. You can imagine the raised eyebrows when I revealed this fact to them!

On the same trip, I visited another church in a town 150 miles away where I discovered that one of the floor monitors was wired out of polarity. I walked on stage with the four floor monitors lit up and knew within three seconds that one of the monitors was out of polarity. It is an unmistakable sound character that I can teach anyone to identify quickly.

I knew that one of the floor monitors was wired out of polarity, but I didn't know which one, let alone where the incorrect connection was. It could be anywhere. So I took a moment to prove it out with the TEF analyzer.

I've turned off the frequency response trace in this graph (it wasn't pretty) to focus on the phase. The green and magenta traces show the phase response of those two floor monitors. Note that one of the two traces shows a polarity reversal as compared with the other.



A little investigation and frankly some head scratching ultimately pointed to the fact that the wiring INSIDE the floor box was inverted on one of the four Neutrik SpeakOn connectors. The astute reader quickly grasps the fact that this system had been wired this way for years and yet no one had recognized there was a problem. The vocalists on stage had simply accepted the fact that this was normal.

Mis-wiring a connector is easy enough to do if one is in a hurry and doesn't have a magnifying glass to read the ridiculously small numbers stamped into the connector. But that's no excuse for not confirming proper polarity with the wiring. The installer has a 50/50 chance of getting it right the first time!

On top of that, oftentimes the company that installed the system, or the person that designed the system, didn't pull individual cables to each

loudspeaker. As a cost / labor saving measure many will parallel the speakers in the air. Sure it saves money, but that shortcut makes it impossible to listen individually to each loudspeaker.

A couple of years ago a well-known sound contractor was installing the sound system for me at two separate projects. Everything they installed in the main sanctuary worked perfectly. But when I went to test the subwoofers in the gymnasium, there was virtually no output. The two subs were placed next to each other in a solid "bunker" built into the front edge of the platform, right on the centerline. So I asked them to pull the subs out of the bunker and check the wiring, and sure enough – one of the two subwoofers was wired out of polarity (i.e., the wires to the "positive" and "negative" connection were reversed). Once the wiring was corrected, the subwoofers delivered the expected output.

SIDEBAR: Remember that when a microphone picks up a sound wave, the mic turns the acoustic energy into an electrical signal. Every piece of microphone information that I've ever read states something to the effect that "a positive acoustic pressure applied to the microphone diaphragm will produce a positive voltage on pin 2 with respect to pin 3". The sound system should be wired such that when that condition exists, the loudspeaker drivers push "out", towards the listener.

Of course that electrical signal is an alternating current, and the loudspeaker drivers are going to push out and then back in response to that alternating acoustic pressure. But ideally we would like the sound system energy to agree with the acoustic energy it is receiving.

If the entire system were wired in reverse polarity, it could be argued that few listeners would hear the difference. The real problem comes when one loudspeaker is wired out of polarity with respect to the rest of the system, and its sound waves interact with sound from other loudspeakers in that system. Keep reading and I'll share another story that clearly illustrates what can happen from such a simple wiring mistake.

Fast-forward literally just one week, to a second church clear across the country, where a different installation crew from the same sound contractor was installing the sound system that I had designed. What are the odds that this other crew would repeat the very same mistake that their counterparts had done one week before!?! But you guessed it – one of their guys had wired one of the two subwoofers out of polarity, and I had to have them pull them out of the bunker and correct the wiring mistake.

The bottom line is that, despite what we might think otherwise, this stuff happens! Far too often. Often enough that I can't just trust the crew doing

the installation. I work with some great installers, and they are driven to make it right the first time. But even the best of us can get in a hurry or get lost in the forest of cabling and accidentally invert the wiring. It happens. But without someone taking the time to check on things before the project is considered "complete", you don't know for certain that everything was in fact done correctly. Worse yet, if you weren't around when the system was installed and you have "inherited" the system, you may have inherited some surprise mistakes along with it.

Oh the stories I could tell, but I'll save those for another time. For now, what is a tech to do!?! For starters, never stop listening analytically. And if you can, at least once a year make it a routine preventative maintenance step to go through the loudspeaker system and carefully listen to each loudspeaker individually. If possible, turn off all but one of the power amplifiers so you can isolate and listen to (hopefully) just one loudspeaker at a time. At least minimize what you are hearing so that the sound from the other loudspeakers isn't masking the problem.

Loudspeaker drivers tend to fatigue over time. That is especially true for systems driven really hard. And if they are driven too hard, things can break. You may be absolutely convinced that your sound system has never, ever been driven loud at all. Could it be that maybe, just maybe someone is in your sanctuary tonight cranking up the loudspeaker system at 3:00 AM when you're sound asleep!?! Stranger things have happened.

Ready to Have Your Sound System Optimized?

Help your sound team represent the church with technical excellence. Call us today and let us get your sound system tuned properly! We're ready when you are.

Call us toll free at 888-547-1727, or in the DFW area at 972-747-8084.

Or send an email to curt@taipalemedia.com.