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Subject: Re: Question about magnetic flux modulation

Posted by [Wayne Parham](#) on Wed, 21 May 2008 18:17:09 GMT

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Distortion rises with power as flux modulation increases with power. Magnetic loss increases as power rises too. For that matter, excursion also rises at higher power levels, and that brings in its own set of non-linearities. The thing is, distortion tracks the power levels pretty closely. Say a driver without a shorting ring has -30dB distortion from 100Hz to 500Hz at 100 watts. This same driver may have -35dB distortion at 10 watts and -40dB at 1 watt. Now take the motor and machine a shorting ring of the right size and position to reduce distortion as much as possible. Add back some magnet and metal to make up the flux difference so the electro-mechanical specs are the same. If done right, the driver will have the same electro-mechanical specs, but will have about 15dB reduction of distortion, which is about a 50x improvement. That's what you see from good shorting rings. At 100 watts, from 100-500Hz, the driver would now have -45dB distortion. That's as good or better than the driver without the shorting ring does at 1 watt. At 10 watts, the driver is down to -50dB and at 1 watt, it's at -55dB. So medium/high power to a driver with a shorting ring is cleaner than low power to a similar driver without. I like to have both types of speakers available at different price points. It's sort of a good/better/best arrangement, allowing for many budgets. The same system design principles are used, but drivers are available with varying quality levels. Beyond the numbers, these are my listening impressions, for what they're worth. Forgive my subjective impressions, but it's the best way I can describe what I perceive. We can look at distortion charts, they're pretty easy to read. Distortion goes up as power goes up. At some point, when thermal effects start to come into play, bass response shifts. My alignments are slightly overdamped, a safe way to do it since thermal effects tend to reduce damping. You can see this in the response curve at high power levels. But beyond the numbers, these are my descriptions of what I hear. Let me use the little Alpha 10 and Delta 12LFA woofers as an example, since I'm real familiar with them. They sound great at moderate listening levels. They're inexpensive but very good bang-for-the-buck parts. They have nice round bass with deep extension, especially in large boxes. But the midrange quality cannot match that of a speaker with a properly designed shorting ring. This is more apparent at moderate to high volume levels. The difference to me is the midrange doesn't sound quite as pure. I also notice listening fatigue happens sooner at the same volume level. Looking at another example, if I have a JBL 2226 in a loudspeaker and swap it with an Eminence Omega 15, all other things being equal, the sound from the Omega is fatiguing at a lower volume level than the JBL. The bass from the Omega sounds "rounder" and the JBL sounds "tighter". It isn't the amplitude response, they're tuned very similarly. It's the amount of distortion, because the JBL driver has a shorting ring and the Eminence driver doesn't. At low levels, the Omega woofer sounds nearly the same as the JBL. At medium levels, you start to hear a difference in the midrange and the pluck of bass strings. At high levels, neither speaker sounds strained, but the one with the JBL woofer sounds tighter and doesn't give you listening fatigue. The Omega gives listening fatigue sooner than the one with the JBL. There's another place I notice it. Even at very low levels, there seems to be a time factor involved that spans hours or days rather than minutes. So even at low volume levels, listening fatigue sets in sooner on a driver with higher distortion. Before experiencing this, I wouldn't have expected to ever become fatigued from a speaker played at very low volume levels, low enough you can talk over. At these levels, even the driver without a shorting ring has very low distortion. But the one with a shorting ring is still better by 15dB. I find that the lower the distortion present, the longer I can listen at a given volume level. When we're at those weekend long shows, the volume levels aren't

very high. But the music is on constantly. When I go to them with a pair of low-distortion speakers, I feel refreshed even after I leave. I enjoy listening to the radio on the way home. But if I take out speakers with drivers that don't have shorting rings, I'm ready to shut down on Sunday and I don't really want to hear anything for a while. My ears are tired and I just feel exhausted. The volume level isn't high enough for the distortion to make an obvious difference in sound between the driver with a shorting ring and the one without. But over the course of the weekend, listening fatigue sets in on the drivers without shorting rings even at low volume levels.

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