

Danny,

About your demonstration of a speaker wire acting as an antenna and Amir's response at Audio Science Review, neither of you is doing real science. First, the RF from an FM station is frequency modulated so even if it did get into an amplifier, there is no way to detect the audio because an amplifier has no capability to discriminate the varying RF frequency and thus detect the audio. So using an FM station as an example shows your lack of knowledge of how RF signals might influence audio. But any Amplitude Modulated RF signals like DTV stations, AM band stations, amateur radio stations, WiFi transceivers, cell phones, cell towers, light dimmers, EMI from televisions, computers, cable TV set-top boxes, on and on can induce noise into an audio amplifier, and these are the sources you should be concerned with.

Amir's measurements are valid, although he did not apply any science to confirm his hypothesis that the low voltages of noise he measured are not audible, other than the claim that the noise is inaudible because it is below the threshold of audibility.

So let's do a little more science right here. I don't remember the actual noise amplitudes, but let's assume a one microvolt amplitude which is fairly typical for a weak RF signal for a radio receiver. A one microvolt RF broadband noise amplitude applied to the speaker output of an audio amplifier sees an impedance not of the stated amplifier's output impedance, but of some greater impedance because the stated output impedance is specified for audio frequencies and the impedance at RF frequencies CAN be much higher. So let's assume that this 1 microvolt level of noise sees the typical 10kOhm load impedance at the amplifier's input and therefore is not attenuated because the source impedance of the antenna is much lower, maybe 50-75 ohms.

Now the high frequency of the RF is not something that can be amplified by an audio amplifier, BUT the amplitude modulated RF can be detected by the diode P-N junctions of a transistor, so now we CAN have audio frequencies at the amplifier input stage as a result of RF from the speaker "antenna", as well as RF coming in from the device and interconnects connected to the input. Now let's assume this amplifier has a voltage gain of 26dB, typical for power amplifiers. So the voltage at the output from the noise signal is +26dB (20 times) 1 microvolt or 20 microvolts. Now the voltage for a 1 watt at 8-ohm signal used to measure speaker sensitivity is 2.83 volts. So the noise amplitude relative to the signal amplitude is $2.83 / .000020$ or -103dB. Now let's assume that the 2.83 volt signal creates a 90dB SPL at 1 meter from one speaker. The background noise in a very quiet room might be 20dBA, so the background noise is 70dB down from the 90dB SPL signal. A noise SPL of 103dB below the 90dB signal SPL is 13dB BELOW the typical threshold of hearing at it's most sensitive frequency.

Now let's account for an RF noise level of 100 microvolts on a speaker "antenna" that might be present in a high RF noise environment. This is 40dB greater than the 1 microvolt example, so the noise at the amplifier output would be 103 - 40dB or 63dB below the 2.83-volt signal. Now this means that the noise SPL in the same system would be 27dB (90 - 63) SPL, or 7 dB greater than the background noise in a very quiet environment. So it might potentially be audible but not

likely given the masking effect of a music signal. But the possible influence on small signal details is a subject for psychoacoustics to explain.

But all this analysis is neglecting the RF noise abatement measures typically designed into modern amplifiers. Now this is not something typically measured or certainly published, but I think it is fair to assume that the RF attenuation in a well-designed amplifier would be greater than 40dB above 100kHz or so and greater than 60dB at 1 MHz, meaning that the noise SPL from RF entering into the amplifier would be more than 13dB BELOW the hearing threshold in a really RF noisy environment.

Now you claim to be able to easily hear the difference in speaker cables and that it is because of RF noise differences. Can you detect a flaw in my analysis? I am neither a cable naysayer nor a cable believer, but I do believe that this subject suffers from inadequate science. As Albert Einstein said, everything should be made as simple as possible, but no simpler. i.e., dig deeper to get to the truth.

Danny,

About your reluctance to perform double-blind tests, without properly designed and executed DB testing, you are not doing true science. You are obviously heavily oriented to listening to confirm your belief of cable differences, which is fine. However your assertion that you can't do DB tests of cables is patently false. As someone who did DB testing at the CBS Technology Center, I can assure you that you can do DB tests of cables. If you want to learn how, let me know and we can talk on the phone. There are way too many variables involved in properly done DB tests that can influence and skew the results and accuracy of the testing. Doing DB testing is not easy to do properly. However well thought out and well done single-blind tests are not too difficult to do and even can be almost as good as true DB testing.

Being an engineer yourself and damned good at crossover design and using measurements, I find it curious that you do not attempt to use any measurements to try to reveal and explain WHY you hear what you hear. This ought to be the drive for any engineer, and I don't understand why I don't see that in you. I think that your current measurement set cannot help explain why you hear the differences in cables and I would suggest looking into the phase delay and group delay characteristics at the speaker terminals with different cables. Group delay as small as 1msec is known to be audible and it might be interesting to measure this and see if there is any correlation to the sound, especially in soundstage and imaging.