E.A.R. SoundChecker

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December 2010

I enjoy using a $3,000 mic preamp or vintage style compressor as much as the next engineer, but it's the small, practical gadgets that attract my attention at a trade show. Such was the case when I found the SoundChecker at the EAR booth at the 2010 US AES show. E.A.R. Inc has been a show exhibitor (NAMM, too) for many years, offering on-the-spot ear canal impressions from which custom molded ear protectors are made. If you're a musician or engineer, you surely know the importance of protecting your ears from exposure to overly loud music and noise. But how loud is too loud? When do you really need to put in your ear plugs? SoundChecker can tell you.

What It Is

The SoundChecker is fundamentally simple - a tiny, highly portable sound level meter that clearly indicates the presence of a sound level high enough to warrant ear protection. It's convenient to carry on a key chain or, using the supplied chain and ring, attach to the case containing your ear plugs (E.A.R. Inc sells just such a plug + SoundChecker package). It's powered by two CR927 3v. lithium button cells (supplied and pre-installed) with an estimated service life of up to 10,000 measurements. Given the long shelf life of this type of battery, it's unlikely that you'll ever need to replace it – after making 10,000 measurements you should have a pretty good sense of how loud is too loud. But rest assured, the batteries are field replaceable, though you may need to make a trip to your local watchmaker to do it since the case is held together with a #00 Phillips screw.

Operation is literally point-and-shoot. Point it in the direction of the sound source, press the button, and look at the three LEDs. This isn't a laboratory grade instrument, but rather provides good guidance. The sound pressure level (SPL)

threshold for the green LED is 60 dB (safe), 75 dB for the yellow LED (getting there), and 100 dB for the red LED (hold your ears!). Each LED begins to flicker at threshold and becomes solidly illuminated as the level increases. Solid green indicates an SPL between 60-75 dB, solid yellow between 80-100 dB, and solid red indicates greater than 105 dB. Audiologists generally concur that for continuous exposure (which could be considered to be the duration of a concert or a gig) above 85 dB SPL, hearing protection is strongly recommended.

In Use

Since I don't have an acoustic test chamber, I couldn't do much in the way of laboratory verification of the SoundChecker's calibration accuracy. My field testing, however, began unexpectedly while, on the day I picked up my SoundChecker review sample. I was waiting to cross Market Street on my walk from the AES show to the BART station. When I heard a fire engine heading in my direction, I remembered the SoundChecker in my bag, whipped it out, and got a solid red LED as the engine roared by with its siren wailing full blast. Fortunately, it passed within a few seconds, so my hearing lived to survive another day.

At home, I compared SoundChecker's indications to measurements taken with my two SPL meters, a vintage Radio Shack model (which is surprisingly accurate) and a Phonic PAA3 audio analyzer, which, in addition to giving a single number SPL reading, also shows a 1/3 octave spectrum distribution, giving me an idea of which frequencies contributed most to the SPL measurement. Using both recorded music and pink noise playing through both my living room and studio control room speakers as a sound source, I observed that the SoundChecker thresholds (when the each LED just begins to flicker) tracked within about 2 dB of either meter set to A-weighting (stay tuned).

I e-mailed Garry Gordon, E.A.R.'s chief audiologist to ask if the SoundChecker's calibration was based on A-weighting, and he confirmed that it was. Incidentally, when I contacted him, he was attending an auto racing industry trade show in Florida – the company recognizes that not just the music community, but sports, industrial/manufacturing trades, as well as the military all have need for ear protection, and they have a finger in the ears of people in many walks of life.

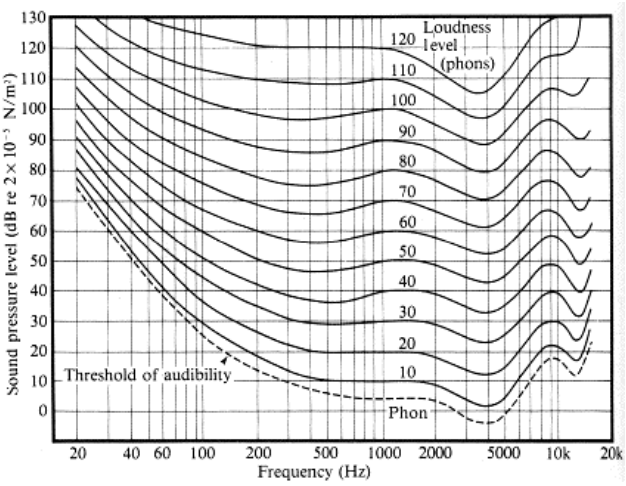
I consciously avoid concerts that are too damn loud, so I haven't yet had the opportunity to check it out where it's likely to be most useful to musicians and rock music fans. At shows I've attended over the past month, it was rare for me to see more than a flicker of the yellow LED (75-80 dB SPL), which is probably why I still have good hearing at the ripe old age of 68. Movies were louder, but it never got into the red, which, to me, is a good thing. A restaurant that I judged as "very noisy" was frequently flickering the yellow LED. The vacuum truck that collects leaves in my neighborhood did, indeed, tickle the red LED, and I was

pleased to see that the county's contractor provided ear protection (the ear muff style) for the working crew.

Wind noise is unlikely to be a problem indoors since music is nearly always louder than air handler noise, however when outdoors on a windy day (about 35 mph according to the weather report) the green LED would flicker when the wind came up on an otherwise quiet street. While the position of the microphone in the case gives it a bit of directionality, I'm pretty sure the mic capsule itself, one of those little condenser elements about the size of a TO-5 transistor case, is omnidirectional. It has a thin foam shield over it and it's set back about 1/8" from the opening in the case, so it's about as wind-resistant as it can practically be. When using my PAA3 at an outdoor show, I slip a foam wind screen over its mic, but that's just not a reasonable thing to do with the SoundChecker.

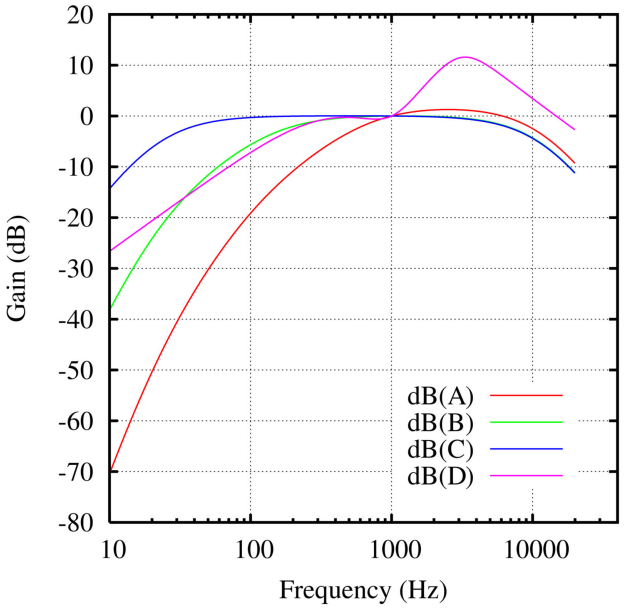
Audiology and Weighting

Of course humans are all a little different, so a sound level that's safe for one individual may be dangerous to another. The common recommendation for hearing protection above 85 dBA SPL is based on years of study of "average" cases of hearing loss, but it's as good a guideline as we have. "dBA" is shorthand for A-weighted sound pressure level, referenced to a pressure of 20 microPascacals, which is the average threshold of human hearing. Often SPL is expressed as just plain "dB" suggesting that it's an absolute measurement, but it really isn't. The unit of measurement of SPL is the phon, with 1 phon = 0 dB SPL = 20 µPa.



The frequency response of the human ear is anything but flat, though the higher the SPL, the flatter it gets until a sort of high frequency compression near the threshold of pain kicks in. The oft-referenced experimentally derived Fletcher-Munson curves show how our sensitivity to low and high frequencies varies significantly at different listening levels. Note that for the 70 phon curve (a typical "living room" music listening level), sound at 20 Hz must be more than 30 dB louder than at 1 kHz in order to be perceived as being the same loudness. At 110 phons (too loud for me!) this difference is about 20 dB. Note that for any nominal SPL, our hearing is most sensitive in the 3-4 kHz range. This is what's often called the "presence" range, and by clever design for human preservation, also the dominant frequency range of a baby's cry.

In order to correlate a single numerical SPL reading with perceived loudness, we often use “weighting” when making SPL measurements. This is a fancy name for a bandpass filter shaped to roughly coincide with the frequency response of the average ear. The 60 dB SPL curve was chosen for the weighting standard, since this is, about the level of normal conversational speech. This makes sense when we recognize that audiologists are primarily concerned with how well we understand speech, not how we enjoy music. There are several standard weighting curves used for SPL measurements as shown in the above graph. Note that the A-weighting curve is about 60 dB down at 20 Hz, which is close to how the ear hears at a level not too far above the threshold of hearing.



Hardly anyone uses B-weighting any more. D-weighting is fairly new, used primarily for measuring aircraft noise for the purpose of environmental impact evaluations. C-weighting actually comes closer to how we perceive loudness at today’s typical club or rock concert levels. Would this weighting be a better choice for indicating the loudness of contemporary music? Maybe. But nearly all recommendations for hearing protection are based on A-weighted measurements. Why? One reason is because they’ve always done it that way. Another possibility is that hearing damage isn’t necessarily directly correlated with perception of loudness, and it’s damage that is the concern of the audiologists (and lawyers). If you can’t accurately judge the potential for damage directly based on how loud something sounds, that’s good reason to have a tool to help you.

The Wrap

SPL meters used to be pretty exotic, and one with laboratory accuracy still is mighty expensive. Instruments from manufacturers such as Bruel & Kjaer are used when it’s necessary to make measurements to settle a court case involving sound and noise. On the other hand, for the past 20 years or so, the Radio Shack SPL meter (under $50) is often seen sitting on top of a live sound console to help the mix engineer keep the level down to a dull roar. Today I’d be remiss if I didn’t mention the several iPhone/iPad SPL meter applications available anywhere from free to a few bucks or so (my local restaurant reviewer uses one

to report the noise level in restaurants). But personal ear protection is the theme here, and when it comes to guidance for using your ear plugs, the SoundChecker is accurate, foolproof, and convenient.

Order direct from E.A.R Inc - $25
http://www.earinc.com/earsoundchecker.php