TVTechnology

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# DTV and 'The Annoyingly Loud Commercial Problem'

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Last time we investigated how audio metadata is created and distributed, and what happens if the values are wrong or missing. We also discovered that the Dolby Digital (AC-3) system can potentially be "tricked" into allowing overly loud program material to be delivered to consumers. This led us into the topic for this issue: Loudness, or as it is more commonly known: "the annoyingly loud commercial problem." This is such an important issue that back in the 1960s the FCC studied it and made it illegal to broadcast irritatingly loud commercials (unfortunately, they made no such rules for irritating content). Have things gotten better? What will happen with DTV? Let's start by figuring out how to measure this often disagreed-upon-thing called loudness.

**COMMON METERS**

VU, or Voltage Unit meters, and PPM, or Peak Program Meters, are both very common measuring devices found on modern audio equipment. The VU meter traces back to the 1930s, well before most of us made that fateful choice of a career in broadcasting. PPM has also been around for quite some time and although more popular in Europe, has seen its use increase world-wide since the introduction of digital technologies.

Although they are both common and useful, both these devices were designed to measure and display voltages and do not give an accurate measurement of program loudness. The reason for this is quite simple: Loudness is a subjective quantity, and VU and PPM meters are objective voltage-measuring devices. This means that if two programs are measured with a VU or PPM meter (or even a combination of the two) and adjusted for equal readings, it is quite likely that they will still differ in perceived loudness. What we need is a way to accurately describe a quantity that can be perceived but not directly measured.

**SUBJECTIVE MEASUREMENT METHODS**

Back in the 1960's, Emil Torick, Bronwyn Jones, and colleagues at CBS Laboratories developed a loudness meter modeled after human hearing. Simply put, the meter divides the audio into seven bands, weights the gain of each band to match the so-called equal loudness curve of the ear, averages each band with a given time constant, sums the averages, then averages the total again with a time constant about 13 times longer than the first. The resulting signal is applied to a display with an instantaneous response. Okay, maybe not so simple, but the CBS meter was found to agree with listeners within 2 dB (although listeners disagreed among themselves by as much as 4 dB when judging the loudness of a given piece of audio).

This was one of the first truly successful attempts to measure loudness accurately and helped solve the problem. Unfortunately CBS Laboratories does not exist anymore and there are very few CBS loudness meters in existence today, so the use of this measurement technique has become rare. One exception is that a few broadcast audio processor manufacturers use an algorithm developed from the CBS loudness meter to combat the "loud ad" problem. When the algorithm detects that audio would sound too loud to a listener, it causes gain reduction thereby eliminating the problem.

Another method is called Equivalent Loudness, or Leq(A), where the "A" represents A-weighting. Leq(A) can be defined as: "The level of a constant sound, which in a given time period has the same energy as a time-varying sound." Leq(A) is the method that is specified by the ATSC for measuring dialnorm, and until recently relied on the use of some rather complex meters, conversion tables and a bunch of luck to get the correct result. This complexity did not lend itself well to solving loudness problems.

Thankfully, Dolby Laboratories recognized that a simpler method was necessary if the proper setting of dialnorm was ever to be achieved and developed the LM-100, which was shown at NAB2002. The device displays both the Leq(A) value and the corresponding dialnorm value and happily requires no conversion charts!

**CAUSES OF LOUDNESS PROBLEMS**

The major cause of loudness problems then is probably the use of the wrong meter. As we discussed earlier, VU and PPM meters only measure voltage and because of their very nature cannot be used to adjust program loudness; however, most facilities still rely on them to adjust both the level and the loudness of programs. This inevitably leads to content that looks fine on the meters but can cause viewer complaints when broadcast.

Another cause of loudness problems is programming with mismatched dynamic ranges. Programs that have a large variation between the softest and loudest sounds (i.e., have a large dynamic range) are difficult to match to other programs. For modern digital media, dynamic range can theoretically be in excess of 90 to 100 dB. If you wish to integrate a program with such a wide dynamic range, what section do you measure when trying to gauge loudness? Do you line up the crickets of one movie with the cannon shots of another? This is probably not a good idea and will give predictable (and irritating) results. The general answer would be to measure and line up the "anchors" aka the dialogue of both films, assuming of course there is dialogue.

Modern commercials, on the other hand, intentionally have little dynamic range in an effort to keep the dialogue or the message as clear and present as possible - maybe sometimes too clear and too present! Restricting dynamic range lowers the peak-to-average ratio of the audio and allows a given program to have increased loudness without causing overloads like you would have if you adjusted for crickets and got cannons. The only drawback to restricting dynamic range is that, well, the dynamic range is restricted, and this tends to remove some of the fun of cannon shots.

**SOLUTIONS FOR LOUDNESS PROBLEMS**

There are several options for solving loudness problems, and they range from measuring and adjusting to dynamic range control. With meters such as the LM-100, it is possible to check all programming that will be carried via Dolby Digital (AC-3) and adjust its dialnorm value in the audio metadata. This will allow the proper attenuation to be applied in the consumer decoder, and all programs will be reproduced with equal dialogue loudness. However, as we discussed above, programs that have a large dynamic range may be problematic for this method.

Another approach is to use an audio dynamic range processor to narrow the range between the softest and loudest sounds. Doing so provides for much easier loudness matching of one program to the next, and in fact one broadcast signal to the next. These devices from Orban and others are commonly found in analog broadcast facilities but have not yet made their way into DTV facilities. This is partly due to the built-in dynamic range control (DRC) system contained within Dolby Digital (AC-3) and partly due to the need to deal with up to 5.1 channels of audio. As I found out in some late-night experiments, it is not possible to just use three two-channel processors as it causes strange things to happen to the soundfield as well as making for some very bad downmixes. Also, remember that unlike DRC where viewers have the choice of ignoring the dynamic range control metadata and hearing full dynamics, once the dynamic range of the audio has been reduced by an audio processor prior to the Dolby Digital (AC-3) encoder, it cannot be undone.

In summary, loudness problems have plagued television for many years and will surely cause some problems with DTV as well. It would seem that the Dolby Digital (AC-3) system alone might not be enough, but severe restriction of dynamic range is certainly not the answer. I believe the best answer is a combination of carefully measuring program loudness using a meter based on Leq(A), setting dialnorm properly if possible, and judicious use of dynamic range processors that are designed to work in combination with audio metadata. These devices should pay attention to the audio and the metadata and process only when they need to, such as when dialnorm is mistakenly or purposefully set wrong. This will keep viewers happy, keep the FCC happy, and preserve the benefits of DRC for those of us who just cannot get enough of those full-throttle cannon shots.

Next time we will look at the second-largest complaint with television audio, namely audio/video synchronization better known as lip-sync. We will look at some of the causes, but also discuss some new and inexpensive tools that should make lip-sync error improve dramatically.

Thanks for your continued support and the steady flow of e-mails. I would like to thank Jeffrey Riedmiller of Dolby Laboratories whose expertise with loudness issues both helped with this article and thankfully led the development of the LM-100. **Print Page**