

# Communications **TECHNOLOGY**

BROADBAND ENGINEERING FOR YOUR BOTTOM LINE VOL 21, NO 02 FEBRUARY 2004



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Official Trade Journal of the Society of Cable Telecommunications Engineers



Solving TV  
**Loudness**  
Problems



# Can You 'Accurately' Hear the Difference?

By Jeffrey C. Riedmiller, Dolby Laboratories

As TV viewers, we've all experienced the annoyance of sudden jumps or drops in volume at a commercial break or between channels. So we reach for our remotes, again and again. Surveys have shown that the remote controls get a strenuous and repeated workout just to keep the volume constant. And, as cable providers know, irritated viewers may complain to you, to the station involved or even to the network.

Generally, the problem lies not with the signal level per se, but the dialogue level within the programs. Not only are viewers very sensitive to dialogue level, they're very consistent in judging just how loud it is. In one study, listeners were asked to compare the loudness of a set of audio samples against a reference item. The results indicated that with samples primarily containing speech material, the listeners all agreed to within one dB. However, this high correlation did not hold true when the same group judged the loudness of samples primarily containing music or sound effects; there, listener evaluations varied by as much as 12 dB.

Major causes of these loudness variations include differences among program sources arriving at the local cable headend, the difficulty in accurately measuring the actual dialogue level and the dialogue levels expected by the viewer's digital set-top box. Let's take a closer look at these issues and how to handle them.

## Understand the source

Programs arriving at the local provider come from analog and digital sources. With digitally tiered sources, the network feed cannot be modified by the local cable system and is passed straight through to the subscriber. However, the dialogue levels can at least be monitored, logged and most importantly validated (against the metadata value *dialnorm*), as will be covered. With analog feeds, on the other hand, local cable technicians usually can make level adjustments at the modulator in an effort to keep levels consistent.

Here's where the other difficulties arise. In fact, these adjustments and how they're determined are perhaps the most important causes of loudness variations as well as systematic loudness differences between channels. First, local cable operators simply may not consider what levels the subscribers' set-top boxes expect on analog services, and thus not take that into account when adjusting analog signal levels. A second major reason is the inaccuracy of traditional methods of actually measuring the signals themselves.

## Dialogue level settings

A very important and almost always overlooked fact about digital set-top boxes is that their internal gain structures have been

designed with assumptions as to where the actual dialogue level exists (relative to 100 percent modulation) in all of the analog (NTSC) services presented to them. For analog-tiered services, the digital set-top box assumes an NTSC dialogue level of about 17 dB Leq (A) below 100 percent modulation (i.e., a 25 kHz peak deviation).

Many technicians and engineers may not know this and, therefore, make no attempt to set the dialogue level for their analog services to 17 dB Leq (A) below 100 percent modulation. Instead, typically, cable technicians may set levels by ear,

## How Loud Are Your Channels?

### BOTTOM LINE

Loudness variations can cause subscriber complaints and result in customer service calls. Major causes of loudness variations include differences among program sources arriving at the local cable headend, the difficulty in accurately measuring the actual dialogue level and the dialogue levels expected by the viewer's digital set-top box.

Fortunately, new tools exist to help solve these problems. New meters and software can analyze the "perceived" loudness of a content source and provide cable operators with consistent, nonsubjective measurements.

comparing a local over-the-air channel to the channel currently being adjusted. The problem with this method is that a technician has no way of knowing whether the "reference" channel has its dialogue levels consistently set at about 17 dB below 100 percent modulation.

Several studies throughout the United States and Canada have indicated that the dialogue levels on analog cable services often can be several dB above or below the -17 dB target. This fact has led to confusion as to the real source of the problem. For example, subscribers tuned to a digital service may complain that the volume levels are too low. Because the digital service is quiet, the cable system technician may think that it's the culprit (i.e., the digital service). However, the problem actually may lie with the analog service levels, specifically their actual dialogue levels. And as the previously-cited studies show, it is frequently the analog service that needs to be adjusted to bring the speech level down (or up to) to 17 dB below 100 percent modulation.

## Subjective listening

The first step to solving these loudness problems is to accurately measure the dialogue level contained within the broadcast programming. Once that is quantified, further steps can then be taken to make any necessary corrections.

Traditional methods of measuring and monitoring signal levels include VU meters, peak program meters (PPMs) and over-deviation indicators. None of these really measure loudness, and all of them are subject to operator interpretation and preference. And while VU and PPM meters in particular have been standardized, engineers and technicians have not. Ten equally skilled and experienced technicians, reading the same signal on the same meter (i.e., moving coil or LED bar graph types), likely will come up with 10 different interpretations. And with PPMs and over-deviation indicators, different technicians also may have different criteria in adjusting levels as well.

### Analyzing 'perceived' loudness

There are alternatives. The Dolby LM100 Broadcast Loudness Meter is one example of a device designed to measure the perceived loudness of dialogue. It analyzes the input signal and measures loudness only during the presence of speech.

Meters with this feature give cable providers an intelligent tool to quantify specifically the level of dialogue within broadcast programming. Cable operators can then objectively control what subscribers try to do with their volume controls—create a consistent level of dialogue, similar to that of everyday conversational speech.

Using such a tool minimizes the subjective interpretations among a group of operators by displaying its results as a simple numeric dialogue loudness value. It also can simultaneously indicate the incoming dialnorm value of digital programming while at the same time measuring the incoming dialogue level. This allows the local cable operator to validate easily whether the actual dialogue level agrees with the incoming dialnorm value carried (as a part of metadata) within the Dolby Digital (AC-3) bitstream. If the difference between these values is significant, it most likely will lead to subscriber complaints.

Furthermore, devices like these allow the local cable operator to determine easily whether, for example, analog services are provisioned with the dialogue level set at -17 dB, the level expected by the viewer's digital set-top box. Instead of waiting for viewer complaints, or guessing with an over-the-air reference signal, the local cable operator can adjust the modulation level based on dialogue to the target level the set-top requires.

Sometimes a digital feed also will have incorrect loudness (dialogue) levels. Rather than simply notifying the program originator that viewers are complaining, the local operator now can provide definitive and accurate measurements, including a dialogue loudness history log that provides objective evidence (a "paper trail"), enabling the network to take corrective action. The log also validates the local operator's technical credibility with the networks in a way that no subjective readings could.

Cable operators also can look for measuring tools that perform monitoring functions. Some new meters

can determine the unweighted peak level and a range of other information about the signal. Useful meter features could include a set of user-definable alarms and monitoring functions to inform the local technician of input loss, signal clipping, over-modulation, high or low signal levels, silence and incorrectly set dialnorm levels.

A dedicated GPI/O port can provide a tally of these alarm conditions. Another useful function is the ability to enable operators to automatically scan all of their channels while logging the loudness history, alarm data and bitstream errors for each channel.

Cable operators no longer need to feel helpless when faced with loudness complaints from subscribers. New tools are available that accurately measure loudness levels and provide operators with a means for documenting and correcting loudness problems at their source. ↩

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## Take Control of Television Loudness



**The first step to solve loudness variations between programs or channels of your television service is to take accurate and consistent measurements. The award-winning Dolby LM100 Broadcast Loudness Meter includes design innovations to easily measure the subjective loudness of dialogue in terrestrial, satellite, and cable services. Once television loudness is measured, at last, you can control it to make both you and your viewers happy.**

For more information, please visit our website or email us at [tvaudio@dolby.com](mailto:tvaudio@dolby.com).

**LM100 Features**

**Dialogue Intelligence™** is a revolutionary algorithm that analyzes the input signal and only measures during the presence of speech.

**Multiple inputs** accept two-channel analog and digital, multichannel Dolby Digital and Dolby E, and, optionally, in-the-clear analog CDTV and off-air RF signals (LM100-NTSC version).

**Software Remote Control** allows extended logging and enhanced analysis via PCs.

**Comes in two configurations:** LM100-UTC can log to external timecode; LM100-NTSC additionally measures NTSC CDTV and off-air signals.



LM100 Software Remote Control



[www.dolby.com/tvaudio](http://www.dolby.com/tvaudio)