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ABSTRACT

Audio - how boring - how basic!   Audio is really basic stuff, right?? After all, why worry about it when you have your precious video to coddle and perfect.   I'll bet you get just as many, if not more, subscriber complaints about sound than about the pictures.   I know, the pictures are real important, always have been, always will be, but the sound is a source of subscriber content or irritation.

LISTEN UP YOU BROADCASTERS!

I will call this paper Audio 101 because that's what it's about - the basics, and <u>why</u> if basic good common sense is applied your audio based service calls can be effectively reduced or eliminated. For the sake of this paper, we need to consider ourselves as <u>broadcasters</u> for three very simple reasons:

1.   Subscribers are receiving our signals with equipment specifically designed to broadcast standards. (TV SETS).
2.   Our signals are generated by cost effective versions of little broadcast transmitters. (MODULATORS).
3.   Subscribers compare cable signals to broadcast signals all the time.   (SWITCHING CHANNELS).

Try a little experiment when you get back home.   Disconnect the cable and connect the antenna. Tune back and forth between the off-air broadcasters and compare the <u>sound</u>.   (Turn the brightness all the way down!)   Chances are, the sound will be remarkably similar between all stations.   Repeat this little test several times during the day and the results will probably be the same.

Chances are that even if the picture is very snowy, (you may cheat and turn the brightness back up) the audio performance could be quantified to be at least as good as:

Frequency Response: +/- 1dB 50Hz-15kHz
Distortion: < 1%
Signal to Noise: > 60dB Unweighted
Stereo Separation: > 20dB

Granted, these numbers do not represent the pinnacle of audio achievement, but if done properly, will satisfy both "Joe 6 Pack" and "Fred Golden Ears".

GARBAGE IN - GARBAGE OUT

Since the audio signal is FM, as a general rule, whatever you send from the head-end is what will be received at a subscriber's TV set.   Even BTSC stereo is a pretty rugged format and remarkably tolerant to "bruises" on the way from head-end to home.   So...if you want a good indication of overall audio quality, the tests, measurements, and listening, you in the head-end will go a long way toward insuring subscriber happiness. The secret here is <u>consistency</u> - more on this later.

SATELLITE DELIVERED AUDIO

We receive the bulk of nonbroadcast signals via satellite.   Most is digital via the scrambling system.   This system is capable of delivering excellent audio quality.   Several analog systems are in use including conventional high level wideband as well as narrowband companded subcarriers.   A few simple rules here will keep you out of trouble.

1. When dealing with high level subcarriers (6.8MHZ mono audio), be sure the audio section of the receiver has an IF bandwidth wide enough for the signal involved.   A majority of programmers using this method have peak deviation of 237 kHz. This requires an IF bandwidth of about 500kHz. Receivers that "cheat" in this area will be subject to annoying "sibilance" distortion (nasty sounding "S" on some program material).

2.   When dealing with low level companded subcarriers, be sure the subcarrier demodulator has an expander that matches the compressor in use at the uplink.   Many "all in one" receivers have serious problems in this area.   Improper demodulation will generally result in signal with excessive noise and/or high frequency compression artifacts.

In general, satellite signals are handed to us ready for broadcast. With day-to-day and program-to-program consistency. As I said, more on this consistency stuff later on.

HOW WE BROADCAST

We broadcast to subscriber via cable using the exact same technical standards as the TV stations. Disregarding stereo for the moment, the basic transmission media is FM with 75 microsecond pre-emphasis. Our old friend, the 75 microsecond pre-emphasis curve was a fine tool in its day; very useful in reducing noise based upon statistic characteristics of audio. Well, things have changed. Audio is getting "hotter" with respect to high frequency content. Digital sources are no longer limited to the old roll-off curves of the LP and tape decks. There are two ways to cope with the situation.

1. Lower the overall program level so that all material peaks will fit within the bounds of the curves or;
2. Use modern audio processing techniques to dynamically "fit" the program material within the curve.

Figure 1 is a basic block diagram of a TV station audio chain. The box labeled "Audio Processor" is worth some comment. First of all, a TV station can afford to spend a few bucks for audio. After all, they only have to worry about one channel, not 35 or 50. The television audio processor is typically a multi-band limiter/compressor specifically designed for TV sound. It is also expensive. The audio processor is used to provide consistency to a station's sound and make it sound similar to other stations in the market.
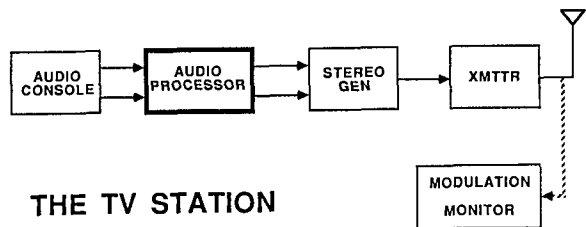

THE TV STATION

FIGURE 1

A CURIOUS PHENOMENON

Audio processing is relatively new to television. In the "old days" a typical TV station did little audio processing other than protective peak limiting to prevent overmodulation.

When the big fuss started over stereo, broadcasters began to pay attention to audio. When one station in a market converted, it usually meant new audio processing coupled with the new stereo generator. In fact, 2 of the 3 major vendors of broadcast BTSC stereo encoders include sophisticated multi-band processing as part of the package. All it took was one station in the market to process and the rest had to follow just to maintain consistency. Thus, over the past 5 years or so, the "sound" of American TV has changed - for better or worse, it is fairly consistent. In all fairness to the processor manufacturer, today's processing can be set up to sound very clean and natural while maintaining high modulation levels.

CONSISTENCY

Our objective as cable programmers and operators should be to maintain this consistency from channel to channel. It is impractical to expect each head-end to have expensive processing on each and every channel. The task of maintaining consistency belongs to the programmer. A few simple steps if taken by programmers would go a long way toward solving level problems:

1. Insure that the transmission chain from audio board through downlink monitor meets or exceeds specifications.
2. Use broadcast grade audio processing to control loudness, high frequency peaks and ride gain.
3. Have your downlink monitor feed a typical CATV modulator and adjust it for 100% modulation using program material, just like a head-end tech would do. (Using the flashing light.)
4. Compare the signal received via the cable modulator to the major market off-air channels. If there is a significant difference, you have created a problem for your affiliates!
5. Repeat step 4 often.

For the cable operators, if level inconsistencies are a chronic problem on a given channel, consider the use of AGC products on that particular channel. On channels with local commercial inserts, the use of AGC products on the local commercial audio is highly recommended. Again, keep local spot audio consistent in level to network audio.

THE FUTURE

TV sound today is a constant battle to achieve consistency and parity with the broadcasters. In the future as HDTV develops, this may change. It is just too early to tell whether or not TV sound in the future will be natural or highly processed. In the meantime, if Fred Golden Ears wants the highest quality audio he will rent a movie and listen to it in VHS HI-FI. Great sound - but not the same type of sound as broadcast entertainment.

I know this subject is confusing and frustrating, but if programmers and operators strive for consistency today while keeping an eye toward future development, we will have done all we can as an industry to ensure subscriber satisfaction.