TESTING AND LINK ANALYSIS OF MULTICHANNEL TELEVISION SOUND

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ABSTRACT

The transmission of Multichannel Television Sound (MTS) is a reality; over 200 stations are now operational in the stereo mode. The technical effect of carrying the MTS signal over cable television systems is not yet clearly understood. In order to understand what effect our systems have on carriage of MTS, a testing program was designed and implemented using link analysis. This testing program included each system component from the broadcaster's master control, through to the end of a cable cascade. This presentation will document the measured results of that testing, and method used.

INTRODUCTION

Since the advent of Multichannel Television Sound, a number of articles have been published describing ways to test and evaluate the MTS signal. Testing this complex waveform and understanding the effect the MTS technology will have on the cable television industry is very difficult, at best. Understanding the operational impact to the systems so that business and marketing plans can be implemented, is the present challenge.

The purpose of this paper is to outline the test methods used to evaluate the MTS signal, and present the measured results of testing on an operational system.

DESCRIPTION OF THE MTS BTSC SYSTEM

The delivery of MTS uses the system recommended by the Broadcast Television Systems Committee (BTSC). This audio delivery system allows stereo to be added to the existing television system. By comparison, the BTSC system is similar to the FM broadcast system now in use. There is, however, one major difference. A companding system is incorporated in the (L-R) channel. This companding system is used to improve the signal-to-noise ratio of the stereo system.

The main channel aural-carrier audio modulaton consists of an (L+R) signal that is subject to a 75us pre-emphasis. The subchannel (L-R) signal is subject to the effect of compression at the encoder or transmitter part of the system, and a complementary expansion occurs at the decoder or receiver part of the system. The compressed (L-R) signal double-sideband, suppressed-carrier amplitude modulation of a subcarrier at 2fh, where fh is the transmitted video horizontal scanning frequency of 15.734 KHz.

The main channel (L+R) peak deviation is ±25 KHz. The stereo subchannel (L-R) and the main channel (L+R) have a peak deviation of ±50 KHz when full interleaving with (L-R) channel is compressed. The stereo pilot subchannel has a peak deviation of ±5 KHz. Also, included in the BTSC system is a Second Audio Program channel (SAP) at 5fh. The peak deviation for the SAP subchannel is ±10 KHz. The Professional Channel is at 6.5fh at a peak deviation of ±3 KHz. The total deviation sum is 73 KHz.

The SAP channel uses the BTSC companding system. The Professional Channel uses 150us pre-emphasis.

THE EFFECT OF COMPANDING

The effect of companding on the (L-R) stereo channel and the ability of the decoder to rack the encoder are the main difficulties in testing and using the system. If the companding in the (L-R) subchannel does not track the 75us pre-emphasis in the (L+R) main channel, a host of measuring and operating problems are encountered. The BTSC recognized this problem when they set their recommended specifications, published in report OST-60. Those specifications acknowledge that at certain frequencies, stereo separation and other parameters would be degraded. In order to maintain a high degree of quality to our subscribers, accurate level setting and phase adjustment are a must.

75us EQUIVALENT MODE

It is possible to remove the companding system during testing. By inserting a 75us pre-emphasis network in the (L-R) channel at the encoder, and also inserting a 75us de-emphasis network in the decoder receiver, this, in effect, bypasses the companding system in the (L-R) stereo subchannel. The bypass of the companding system allows the system to be linear throughout, much like the conventional FM broadcast system. Using this equivalent mode allows all parts of the system, including the link, to be tested accurately with exception of the companding system, i.e., compressor and expander. Most manufacturers of broadcast encoders have this 75us equivalent mode built in. The only decoders being built with this mode are modulation monitors. Their cost is very high for cable applications.

MURPHY'S LAW

At this point in the paper, I had planned to present the method and measurement. As all good engineers know, our best friend Murphy can sometimes spoil the plan. After six attempts, working the after midnight sign off shift, we found a number of problems with the testing that could not be overcome in time for this paper to meet the January 15 deadline to the printer.

Test equipment is one of the key factors that need to be addressed in order to overcome the problem. The other is a broadcast encoder that performs well in the BTSC mode. With support from the manufacturers of encoders and decoders, and the support from broadcasters and test equipment vendors, we can solve the problems of carrying MTS on our systems. On completion of the testing, I will add the results to this paper, hopefully in time for the presentation in March.

Anyone desiring more information can call me at ATC (303) 799-1200 ext. 709.