MTS STEREO CONSIDERATIONS

"AN OPPORTUNITY OR A CRISIS"

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ABSTRACT

This paper considers the current status of the MTS system with regard to alternative delivery systems and reviews some of the current MTS decoder designs. It considers interface requirements, performance characteristics and compatibility with current in-home terminals. New methods in baseband processing are examined to illustrate their full compatibility with the MTS system.

INTRODUCTION

The endorsement of the Zenith / DBX Multichannel Television Sound (MTS) system by the Electronics Industries Association (EIA) has led to an almost universal standard for broadcast TV stereo. This has provided the broadcasters with the opportunity to promote their program software in a new dimension while still maintaining compatibility with the existing monaural transmission and reception equipment. The Cable Industry has been faced with incompatibility issues in both the transmission and reception of the MTS signal. Alternative methods of delivering stereo services to subscribers are currently being reviewed by the Cable Industry. The consumer demand for enhanced audio services is increasing as MTS programs and products are promoted.

The MTS format is, as it turns out, providing a better than anticipated performance and is encouraging an overall improvement in the quality of the received audio for television. In addition, the incompatibility issues initially raised by the Cable Industry are being overcome. The MTS signal format may by default become a defacto standard for all cable programming. Why? Because it is there, it is endorsed by the EIA and it is being heavily promoted at no cost to the Cable Industry by broadcasters and by television and VCR manufacturers. The quality of the MTS signal may not be as good as that of CD players and other premium quality stereo delivery systems. However, it is good enough for consumers who are interested in both the visual and aural presence of a program.

As an industry in a free market place, we have to continually adapt to market trends and deliver new services as the market and consumer demand warrants it. The motivating forces in favor of the MTS system are its compatibility with the existing monaural audio system, the fact that it is endorsed by the EIA and that MTS products are readily available from multiple sources. The questions raised by the Cable Industry of incompatibility and cost crisis are giving way to the fact that the MTS system can be made compatible and that opportunities may exist for enhanced audio services. In any case, the Cable Industry may need to become compatible with MTS in order to remain competitive with alternative program sources. There is of course, the obvious need to meet the growing demands of subscribers who have purchased a new MTS stereo television or VCR.

PRODUCT CONFIGURATIONS

A range of MTS products are currently available to meet the projected demand from consumers. These MTS products can be integrated systems such as stereo televisions and VCR's or component type add-on stereo decoders which can either be owned or leased by the consumer to receive enhanced stereo services.

Our prime concern in this paper is to focus on the component type of stereo decoders. How do they functionally operate? What interface standards should be considered? What are the performance characteristics of these devices? How do they interface with current in-home terminals?

The interface point of any component type of stereo decoder should preferably track the video source to which it is being tuned. To meet this obvious need, in a baseband system the stereo interface can be taken from either the IF, the 4.5 MHz intercarrier audio or the multiplexed baseband audio. In RF type systems the

interface has to be at the converter output at either channel 2, 3 or 4. In a baseband converter the channel 2, 3 or 4 RF output can be used, but only if the device is designed to provide sufficient audio bandwidth together with good linearity in the audio and video detectors. In the remodulator the incidental phase modulation should be minimized and the audio deviation has to be accurately maintained for optimum stereo separation. As with all choices, there are compromises and trade-offs in performance and costs depending on the interface point chosen. The layouts illustrated in figures 1 through 3 show typical product configurations for stereo decoders. Note that in all of these configurations the output levels are typically low power levels and are meant to drive either an audio amplifier system or powered loudspeakers.

In figure 1 a multiplexed baseband MTS decoder interface is illustrated. This configuration is common to television set manufacturers and could be used with baseband converters. This concept is probably the lowest cost unit but the stereo separation is very sensitive to the signal level input and must be matched accurately. A remote volume dc control from the television or the converter can also be implemented with this configuration to provide variable left and right outputs. The amount of intercarrier buzz in this system will be determined by the quality of the device feeding it. It is unlikely that this configuration will have much application in cable television. However, it is one of the interface options being considered by the NCTA interface standards committee.

In Figure 2 an MTS decoder with a 4.5 MHz intercarrier interface is illustrated. This system could be used with either a television or a baseband converter and can also provide a remote volume control via the television or converter. This system interface is not susceptible to input signal level variations. The amount of intercarrier buzz in this system also will be determined by the quality of the device feeding it. This system configuration could see considerable application in cable television because of the significant numbers of baseband converters currently in use.

In figure 3 an RF MTS decoder is shown with a channel 2,3 or 4 RF input interface. This configuration is similar to figure 2 but is specifically for converter applications. This too can be designed to provide a remote volume control via the converter as in the previous systems. This stereo decoder has the advantage that it can be designed as a quasi split sound detecter with filtering favoring the audio bandpass. This can reduce the intercarrier buzz and improve the signal to noise by 5dB. This stereo decoder is likely to be the most common application in cable television because of the large base of RF converters. It should be noted that with this configuration any or all of the above input interfaces could be added to this type of decoder. Note also that an MTS stereo decoder with an IF interface would have similar performance characteristics as that of figure 3.

BASEBAND CONVERTER CONSIDERATIONS

Recent developments in baseband converter technology have shown that with proper design and alignment it is possible to demodulate and remodulate the audio signal and still be transparent to an MTS signal. This is possible by using a very linear audio detector and by increasing the audio bandwidth to pass the complete multiplexed stereo signal. The intercarrier buzz is minimized by proper IF alignment and by improving the linearity in the video detector. In the remodulator the audio deviation has to be accurately maintained for optimum stereo separation and the incidental phase modulation has to be minimized. The advantage of doing this is that you can still maintain the volume control and mute function. However, any change in the volume control will significantly affect the stereo separation.

The sensitivity of the stereo separation to volume control was examined using the configuration illustrated in figure 4. This test set-up used current production equipment to determine the effects of stereo separation over a frequency range from 0 Hz to 12.5 KHz. In figure 5 a comparison of the stereo separation of the system versus the system including a Z-TAC II baseband converter is illustrated. In this case, it can be seen that little degradation in separation has taken place and certainly none that could be subjectively observed by a consumer listening to a stereo television.

The effects on separation with changing volume control in a baseband converter are further illustrated in figure 6. Here it can be seen that because of the non-linear characteristics of the MTS encoding, the stereo separation significantly degrades as the volume (deviation of L+R) is reduced in the converter. However, by allowing the audio to overdeviate the carrier, it is possible to maintain a more acceptable degree of separation for a limited amount of volume control. Figure 7 illustrates the effect on stereo separation when the carrier is overdeviated to 30KHz and then

correspondingly reduced by 1.5 dB and 3 dB. Comparison of figures 6&7 show that by doing this the separation is improved by 5 dB when the volume is reduced by 3 dB. If such an approach is used to provide a limited volume control, then it is necessary to provide the consumer with some means of control to accurately return to the correct deviation setting for optimum stereo separation.

ALTERNATIVE DELIVERY SYSTEMS

Alternative methods of stereo delivery are being promoted in the Cable Industry. The majority of these are either out of band analog type systems in the FM spectrum or some form of digital audio systems. They may have the potential to offer a higher quality signal to the consumer. However, because there is no predominant standard and no clear market is defined for such an enhanced service, it is uncertain as to how these systems will develop. These systems are further negated because of the potentially higher costs and the question of who will assume those costs. As engineering purists we need to be realistic and not lose sight of the basic business economics. The MTS system is likely to be the lowest cost option for providing an enhanced TV audio service since most of the terminal costs will be assumed by the consumer who has an incentive to listen to the TV broadcast channels in stereo.

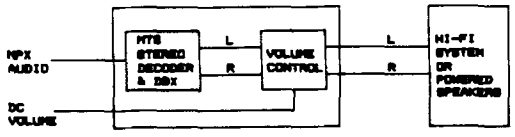


FIGURE 1: MULTIPLEXED MTS DECODER

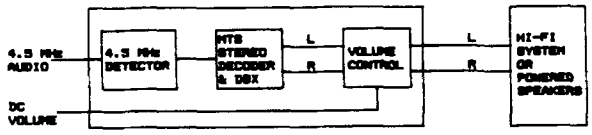


FIGURE 2: 4.5 MHz MTS DECODER

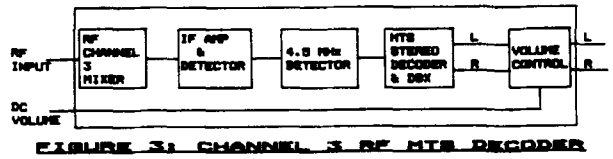


FIGURE 3: CHANNEL 3 RF MTS DECODER

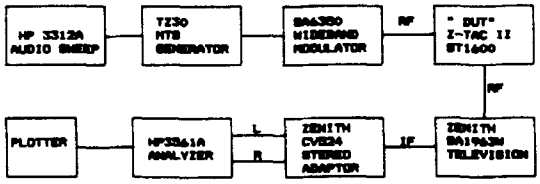
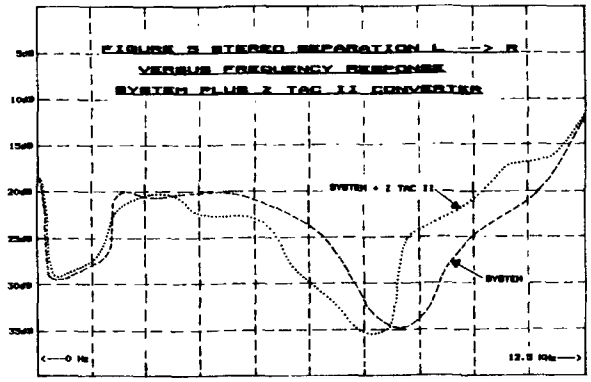


FIGURE 4: STEREO TEST CONFIGURATION

CONCLUSION

The previous sections have shown that a variety of MTS stereo decoders are available with differing interfaces, performance characteristics and costs. It is likely that these MTS stereo decoders will provide a short term solution for cable subscribers until such times as stereo television receivers significantly populate the market place. These products can help the cable operator provide enhanced audio services and remain competitive with alternative media programming. If the MTS system becomes a defacto standard for the Cable Industry, then consideration should be given as to whether it is compatible with the scrambling system being used. Analysis of current parameters would show that in reality monophonic television receivers are typically in the range of 52dB for signal to noise ratio and provide about 6KHz of bandwidth. The signal to noise ratio of FM on cable is typically 55dB and stereo separation on tape recorders and record systems is typically 20dB to 25dB. The MTS system and its circuit development is in its infancy and as the circuit technology advances, the MTS system will probably meet or exceed limits of 64dB signal to noise ratio and provide better than 25dB of separation with 15KHz of bandwidth. In perspective then, the MTS system has the potential to provide an acceptable level of service to the majority of consumers.



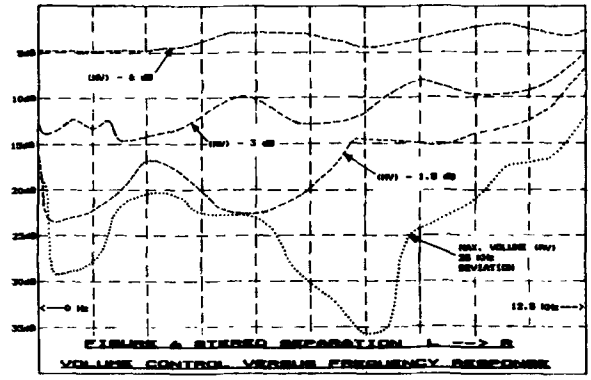
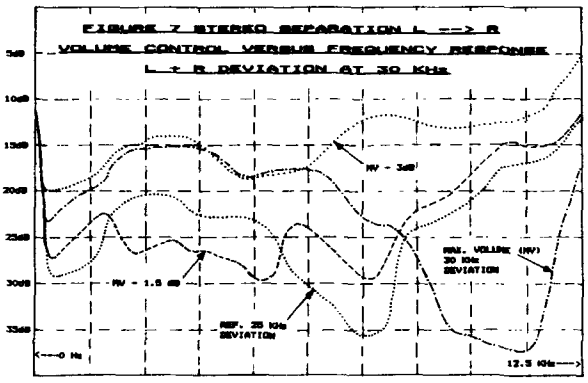


FIGURE 6 STEREO SEPARATION L ---> R
VOLUME CONTROL VERSUS FREQUENCY RESPONSE



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