ELIMINATION OF GHOST IN TELEVISION PICTURE

Abstract

TV signals travel in straight lines. When there are obstructions between the transmitter point and the receiver point, the signals get reflected by these objects. Hence at the receive point, many signals are received. Since all of these signals are carrying the same information with a little time difference, on the television receiver multiple pictures will appear. These multi images are called 'Ghost' since it distracts viewing. Broadcast cannot control the signal path. Hence only possible technique is to process this signal at the receiver to remove ghost signals. This can be achieved by characterizing the propagation channel for different viewers and even that may change form time to time. Hence an adaptive digital filter can be used for this purpose and the filter parameters can be changed according to the behaviour of the propagation channel. Propagation channel can be characterized by sending a signal having many frequency components.

This paper describes such a ghost canceling system, which is available for the adoption in Sri Lanka. It also describes the hardware requirements to offer this value added facility and the general principle of operation of the system.

1. Introduction

The quality of the Image receive for viewers of a broadcast depends on several factors. Some relate to the transmission system while other relate to the receive equipment. Ghost, which is caused by reflection from building and other obstructions between transmit and receiving points, falls some where in between. It is critical, a broadcaster to know how to keep its viewers from turning to another channel for a clearer picture from the profitability point of view. Using the tools of modern electronics, TV receivers manufacture can give viewer a great improved, ghost free image.

2. What are Ghost on Television

TV ghosts are multiple images caused by multiple echoes. In theory, TV signals travel along straight lines. The signal may have a short, direct path between the transmitting antenna and the receiving antenna. The same signal also can reach the receiver antenna over a different, longer echo path because of reflection off near by buildings and other objects. Under such conditions, the receiver will show two images – a strong, main image and a weaker image, shifted echo or ghost. These ghost seriously degrade received image quality.

The Ghosting for conventional television (Analog) cannot be completely eliminated. It can be reduced to a greater extent by signal processing. To carry out signal processing and to make corrections, there is a pre-requisite for a Ghost Cancellation Reference Signal. The specifications for Ghost Cancellation Reference Signals are laid down in ITU-R Recommendations. This signal is used in a GCR Decoder to correct the Ghosting.

3. Function of the GCR Decoder

The video signal is first filtered then converted from Analog video signal to a Digital video signal. Digital video signal is then fed into a DSP (Digital Signal Processor) which studies the reference signal on line 318 (for 625 line system). The DSP then corrects the video levels and phasing. Then the DSP calculates what level of anti ghost signal is required per video line to electrically cancel the ghosting effect. The DSP can place up to 576 anti ghost signal is required per video line. The DSP makes twenty billion mathematical calculations per second, making up to nine million individual picture adjustments per second. The corrected digital video signal is then converted to an analog video signal.

4, Systems for GCR Signal Transmission

There are three world systems which are standardised by the International Tele-communication Union (ITU) for the transmission of Ghost Cancellation Reference Signal. They are,

1. System - A
   This is the system used by Japan and has been using this since 1989.

2. System - B
   In January 1994 Korea started a test transmission for their NTSC Transmission. They have been using this system since then.

3. System - C
   The Third System is the system developed for NTSC in the United States of America and has been adopted as a standard for Canada too. The same GCR system has been adopted for PAL, SECAM, and 625Line system of Europe, Australia and in New Zealand.

The specifications for the Ghost Cancellation Reference (GCR) Signal are described in the recommendation of ITU-R BT.1124. This gives specific parameters for 525 and 625 line NTSC, PAL and SECAM conventional television systems. The GCR signal is placed on a single line in the vertical blanking interval, on one line per field in 525 line systems, and on one line per frame (two fields) in 625 line systems. The GCR signal has a flat spectrum and high energy up to the frequency of the end of the base band.
In 525 line systems the GCR signal is placed on line 19 (and the corresponding line in the following field), in 625 line systems, the GCR signal is preferably placed on line 318, with the preceding line 317 containing no time varying information. The GCR has nominally constant amplitude within the band of interest and is placed on a pedestal.

Presently, the system C is the dominant world standard for GCR signal transmission and is the only standard that can be adopted for 625 line, PAL conventional television system.

4. Principles of Operation

Ghost Cancellation decoder is an adaptive digital filter. The filter co-efficients are calculated according to the received reference signal. With the Ghost Cancellation Reference signal, which is transmitted by the broadcaster, it characterises the ghosting channel. The decoder compares the received, ghosted version of the GCR signal with a clear, stored replica of the same signal.

The results of the comparisons are computed by a digital signal processor chip, which uses ghost cancellation algorithms to calculate coefficients to be fed to digital adaptive filter that cancel ghosts. The process occurs continuously with the coefficients of the filter being constantly updated to follow transient conditions as measured from the received GCR. Figure 1 shows a simplified block diagram of a ghost cancellation system. As A/D converter changes the received analog signal to digital form, the received GCR signal with ghost is captured providing the computed setting for the ghost canceling filter. The corrected signal with the ghosts removed is converted back to analog for normal display.

6. Conclusions

Sri Lanka may adopt GCR System C for her television transmission which enables viewers those who are having the facility to receive GCR & to reduce the ghost in their TV pictures.

7. References

Hermen. S., Cancel that Ghosts, Research Officer, Philips Laboratory, NW, 1993

ITU-R BT. 1124 Recommendation of the International Telecommunication Union radio sector.

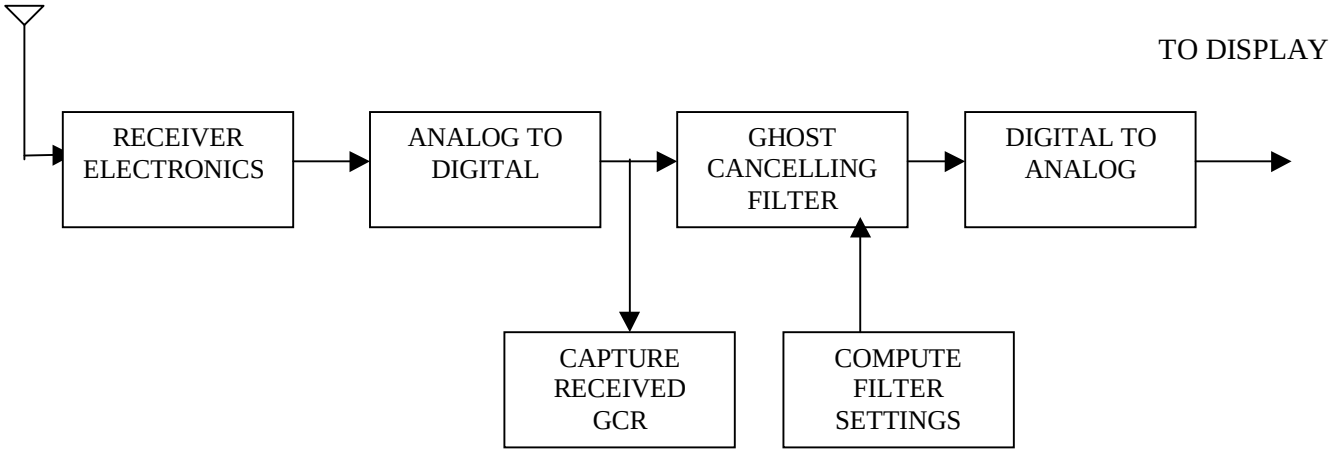

Figure 1. *Simplified block diagram of a ghost-cancellation system*