

TO REDUCE CHROMINANCE INTERFERENCE IN GREY SCALE MULTI-FORMAT GENERATOR BY ANALYZING AND CORRECTING SIGNAL WAVEFORMS

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ABSTRACT

The basic components of the video signal comprises of Video information, Chrominance level and Sync. Pulses. The Grey scale signals are required to check the compatibility of the display device with composite form of the modern signals, which is affected by chrominance interferences. In this paper, we will analyse the multi format signal generators, which are utilised and has the capability to generate signals, compatible for display inspection of SDTV, HDTV, Monitors display inspections. The major job in display inspection is white balance of the device. White balancing is performed on Monochrome signals which are corrupted by intermittent colour transients. The aim of this study is to reduce the colour transients in Grey Scale signals, by observing the waveforms of Grey Scale patterns, generated by a multi format pattern generator. The analysis of waveforms includes the study of waveforms related to Y/colour difference, greyscale, chrominance, and sync level components.

Keywords: Complex waveforms, pattern generator, GPIB grey scale signal, sync, chrominance.

1. INTRODUCTION

The compatible display devices with modern composite video signal is the tough challenge and need of the manufacturing industry. With the new technologies coming up, it is the need of the hour to utilise multi-format signal generators which has the capability to generate signals, suitable to all type of display devices like LCD, LED, CRT, Plasma panels. The signals generated by these signal generators have digital as well as analog output and it utilises the mixing of in built patterns to generate multi patterns as desired during various alignment procedures. The output of these signal generators is enhanced with the help of signal conditioners and enhancers so that the desired set of signals can be supplied to various alignment stages. The alignment stages perform alignment of display device which includes symmetry, vertical & horizontal alignment, white balance, focus adjustment and linearity of the pattern. To perform the above stated alignments various test signals are needed. The signal include color as well as Grey Scale signals.[1]

2. GREY SCALE SIGNAL

2.1. GREY SCALE SIGNAL GENERATORS

Grey Scale signal generators are multi - format signal generators, which have the capability to generate Monochrome as well as colour signals. The signal generators can be operated in talk mode also with the help of general purpose interface bus port. The main component of monochrome signal [2] are:

- (i) Video information.
- (ii) Synchronisation Pulses.
- (iii) Chrominance level.
- (iv) Front & Back Porches.

The predefined image is produced with the combination of the above components. This pre defined image is used for the alignment of the display. The composite signal's main components are described below in Figure 1.

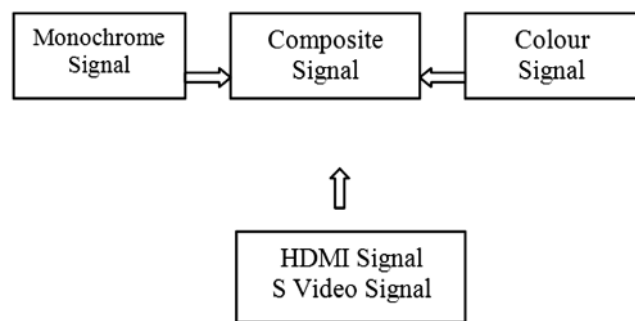


Figure 1: (Block Diagram).

2.2. Grey Scale Signals/Monochrome

Grey Scale signals are utilised to perform following alignment jobs.

- (i) Grey scale response of the display panel.
- (ii) Purity Adjustment.
- (iii) Peak white & peak Black level adjustment.
- (iv) SNR (Signal to noise ratio) adjustment.

These alignments can be performed on Grey Scale signals only and color component of the multi - format signal generator is suppressed. The effectiveness of the alignment depends on the purity of the monochrome signals. If the signal is distorted by any noise/interference, the alignment process fails. As for example, the white noise in signal results into increased value setting of AGC controls. Similarly, low white purity level of monochrome signal results in inappropriate color balancing of the display panel, resulting into discolored images and un natural colors.

2.3. Monochrome Test Patterns

The Monochrome Test Patterns [3] are combination of predefined patterns, that are used to check the various properties/attributes of the display device. The selection of Tests patterns depends on the type of alignment to be performed for the display panels. Mainly following patterns are used for the alignment process:

2.3.1. Grey Scale Mixed Pattern

Grey Scale test patterns is one of the most versatile pattern utilised for the geometric alignment. The pattern is utilised to perform Vertical alignment , Horizontal alignment as well as for the symmetry of the display and vary from 0 IRE to 100 IRE at a 1 second rate. The video signal should not distort or clip under either condition and maintain a constant sync tip level if the clamp circuitry is functioning properly. The television monitor should not change brightness or width with the widely varying average picture level of the bounce signal.

This Pattern is also used for white Balance alignment of TV. The white balance signifies the balance of color mixing i.e. red, green, blue, colors, that mix to produce other colours. The instrument used for white balance is Minolta make color analyzer CA 100. It utilises the optical fiber camera to perform color balance.

2.4. Composite Signal

The Color pattern and monochrome patterns are generated by the same Signal Generator. The characteristic of the signal generator are modified to generate Composite patterns. Following waveforms explains the characteristics of the color and of the monochrome composite pattern Figure 2.

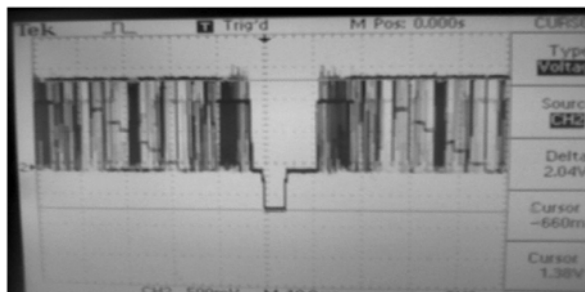


Figure 2: Composite Signal Wave Form.

The waveform in figure 2 is the waveform of the composite signal as displayed by a CRO. It indicates the various components of composite signal, namely Color Bar Pattern, Greyscale mixed with cross hatch pattern to provide one stop solution for the overall adjustment of the geometrical alignment of the display device. The seven bars (gray, yellow, cyan, green, magenta, red, and blue) are at 75% amplitude, 100% saturation. Each color bar uses 1/7 of the image area. These are helpful in display device testing to see if there are any purity problems. If there are problems, you would see off color areas rather than full saturated vivid colors throughout the screen.

Each component of the waveform is responsible for its unique characteristic. The colour information is contained by color bands from white to Black. Each band has its unique amplitude and pulse width. If the values are changed, the corresponding patterns is distorted.

In monochrome signal, the difference is only about the absence of color information bands i.e. from white to black. The steps exist, but the color information is suppressed to convert the color pattern into monochrome signal. The overall amplitude as well as the time period of both of the patterns remains the same.

3. CHROMIANCE FLASHING IN GREY SCALE SIGNAL

When Greyscale signal is transmitted for the alignment process, the linearity of the process depends on the purity and quality of the transmitted signal. During propagation the signal is corrupted due to various sources of noise. The effect of the noise depends upon the source from where it is originated as well the section of the signal to which it is affecting. The minor change in overall amplitude of the signal will affect the overall brightness of the signal where as a minor change in sync width will cause rolling of the signal.

3.1. Source of Noise

The noise [4] in the signal is mainly contributed by two major factors namely internal and external noise. The external noise originates from disturbances due to external sources such as interference by another signal, image frequency distortion, channel noise, cable problems etc. Whereas internal noise is due the noise generated by limitations of signal generator or due to malfunctioning of the signal generator. The noise generated internally is difficult to recognize as well as difficult to be isolated from the desired pattern. [8]

In monochrome signals, the information of color signal is also passed on, but it is suppressed before transmission. The suppressed color component are supposed not to interfere with the monochrome signal. In some cases. it is being observed that the monochrome signals/patterns are affected by sudden spikes/transients of color signals. The color transients persists only for few milliseconds , but its presence disturbs the

overall process of the alignment of display devices.

3.2. Effect of Color Flashing

The color transients [5] are the color information of the transmitted signal which was suppressed before the transmission. The presence of color information even though for few milliseconds effects the alignment process. The white balance [6] of the display devices can not be performed if the color transients are present. For the instance, when color information is present display properties changes.

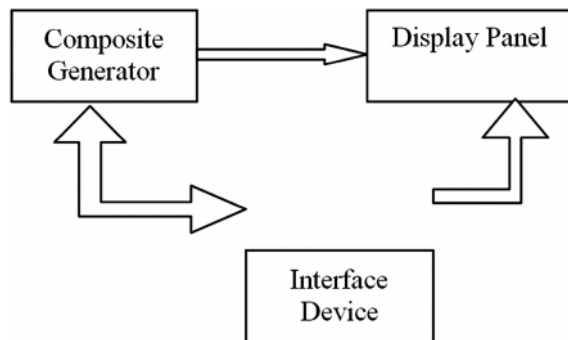


Figure 3: Block Diagram.

The block diagram in figure 3, clearly explains that the white balance adjustment process depends on the signal supplied by the signal generator [9]. The white balance is being done by utilizing PC (computer) and Signal generator (operated in talk mode). The interface device scans the panel of the display device with the camera which may be a calibrated camera or uncalibrated camera, depends on the type of alignment process. [10]

The color transients flashes wrong information to the interface device as it is assumed during the white balance process that the color information in the transmitted monochrome signal is fully suppressed. Due the sudden exposure of color information the color coordinates adjustment touches the peak value resulting into misalignment of colors of the panel of the display device.

4. SIMULATION TO REDUCE NOISE

It is clear that in the presence of color transients, white balance of the display devices cannot be performed. To analyse the cause of the presence of color transients, we have to decode the information of the transmitted signal with the help of CRO. Each component of the transmitted signal has to be compared with the standard / Ideal wave form and the difference among the two is to be minimized to correct the problem.

High levels of compression result in undesirable spurious features and patterns, and incorrect colours in the reconstructed image[7]; these are the artefacts defined above. Image compression schemes may result in colour errors in addition to the blockiness, blur, contouring and ringing artefacts also found in coded images

The figure 4 shows the Idea waveform of the Grey Scale Signal transmitted by a signal generator. The image shown is the image as displayed by CRO when connected to the signal generator. The waveform clearly indicates that all the color codec's and information is suppressed to make the pattern appear in monochrome format. If we compare the observed waveform with the waveform of color bar signal, we can realize that the difference between the two is only the information of color band. [12]

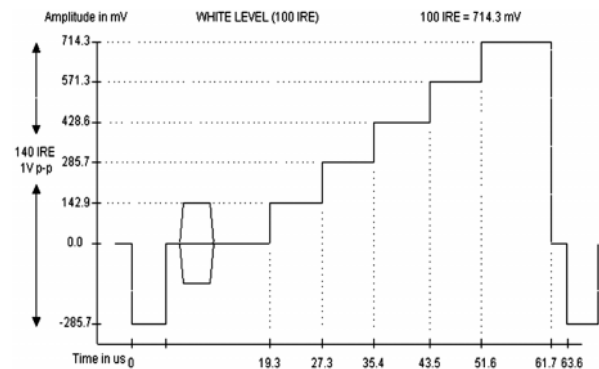


Figure 4 : Grey Scale Standard Wave Form.

To know the cause of color transients, the signal waveform as received at the receiver end is also decoded with the help of CRO. Figure 5 shows the waveform of signal generator showing color transients in its output signal.[11]

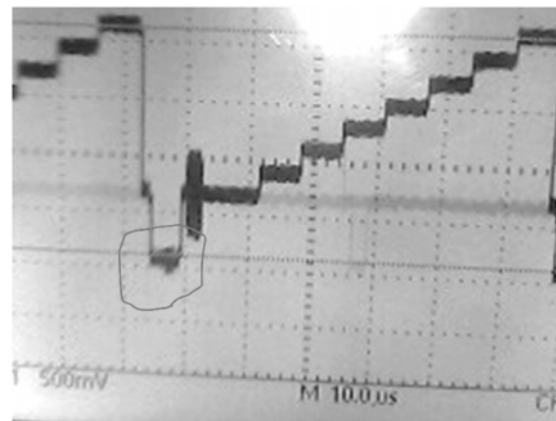


Figure 5: Grey Scale Transmitted Waveform.

When two wave forms are compared it is observed that in figure 7 the traces of color information are appearing in sync signal. The color bands information is suppressed in the respective color areas but the chrominance basic signal with amplitude of 300mV is transmitted with the monochrome signal. The transmission of chrominance signal is due to the reason as the monochrome pattern is derived from a multi format signal generator. This signal generator has the capability to generate both monochrome and color signals. Only those information is suppressed which is responsible to generate color images.[13] The effect of chrominance signal on the sync portion is due to the internal noise of the

signal generator. In some cases the effect is visible due the operation limit of the signal generator.

To reduce the effect of chrominance signal [14] in the sync portion, there are few options available.

1. To reduce the sync level by 10 %. But this will have a negative impact on the overall pattern as the stability of the pattern will also be reduced.
2. To reduce Chrominance signal. The chrominance signal is not playing any vital role in the signal transmission of the Grey Scale signal as the color information is not required to reciprocate natural colour, hue and tint. If we suppress chrominance signal also, the effect of the signal on the sync portion will be reduced which will result in disappearance of the color transients in the monochrome signal.[15]

The amplitude of the chrominance signal is reduced to 75 mV from 300mV. This is done either by varying a preset manually or by operating the signal generator in 'Talk Mode'.

In talk mode the program of the signal generator can be modified with help of computer.

As the value of the colour components fall below the colour circuitry threshold value, the adverse transients are suppressed. The suppression of the colour information allows the white balance operation of the display panels to be performed without the disturbances of the colour flashing/colour transients.

Due to the reduced chrominance amplitude the effect of the color signal on the sync portion is reduced to almost zero level.

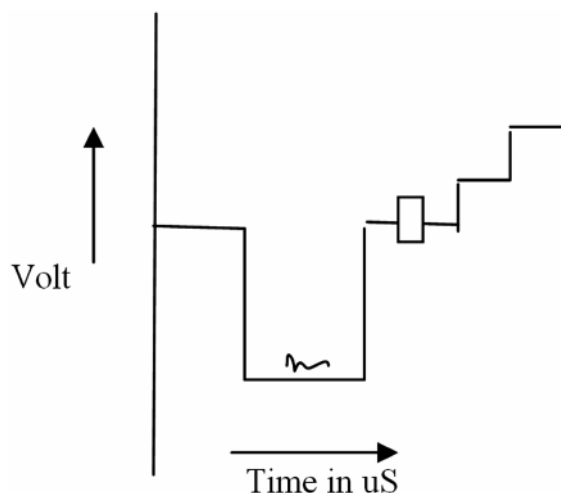


Figure 6: Corrected Wave Form.

As the effect of chrominance is reduced the appearance of color transients in the mono chrome pattern is also reduced (figure 6).

Due to the removal of color transients from the Grey Scale signals, the alignment process of Display devices can be performed more accurately and quickly.

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