To reduce colour Flashing in Grey Scale Signal Generator by analysing and correcting signal waveforms.

Sarika Malhotra *memberIEEE* , Prof. R.K Singh ,
1 : Associate Professor , RKGIT , GZB 2:Professor ECE Dept,Kumaon Engg College, Dwarahat
.

***Abstract*— : The technology of manufacturing display devices such as CRT, LCD & LED displays are advancing at a very fast pace. Due to change in technology , the manufacturing process requirement are also changing . 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.**

***Index Terms*— Complex waveforms, Pattern Generator, GPIB Grey Scale signal , Sync, chrominance .**

I. INTRODUCTION

THE Alignment of display devices is one of the critical process in display devices 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]

Manuscript received March 28, 2010. This work was supported in part by the Raj Kumar Goel Institute of Technology, Ghaziabad (Uttar Pradesh) and Jamia Millia Islamia University New Delhi.

Sarika Malhotra is with the RajKumar Goel Institute of Technology, Ghaziabad and pursuing her Ph.D. research work from Uttarakhand Technical University,Dehradun. (phone: 91-9211608641; fax: 0120-2788350; e-mail:sarika_jatin@yahoo.com).

Prof. R.K Singh is Professor, ECE Dept., Kumaon Engg. College & former Joint Director, SPFU, Directorate of Tech. Ed., OSD, Uttarakhand Technical Unversity, Mobile: +91- 9412-051891 (M), Email-rksingkec12@rediffmail.com

II. GREY SCALE SIGNAL

A. 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 level
(ii) Sync Level
(iii) Chroma level
(iv) Porches

The above component constitutes a signal responsible to generate pre defined image on the display device. This pre defined image is used for the alignment of the display. The process is elaborated with the help of following block diagram

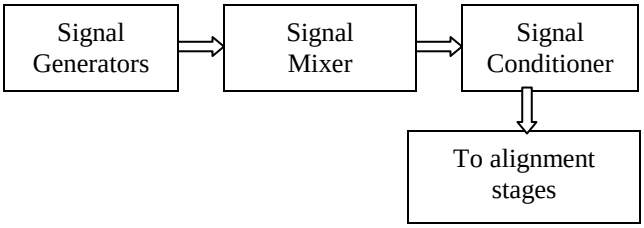

Fig 1 (Block Diagram)

B. Grey Scale signals

Grey Scale signals are utilised to perform following alignment jobs

i Color Purity adjustment
ii White Balance Adjustment
iii Peak white & peak Black level adjustment
iv AGC (automatic gain control) 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.

C. 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:

i 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.

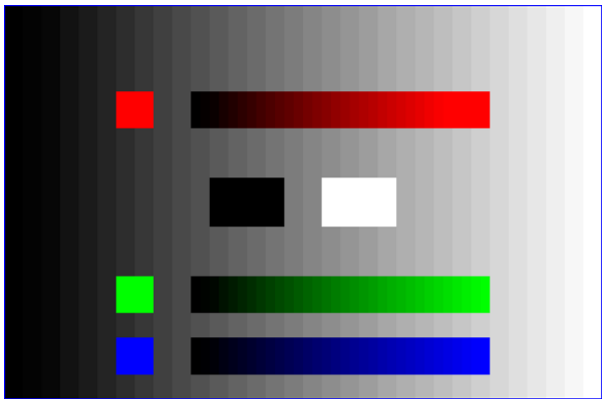

Fig 2 : Grey Scale Mixed Pattern

The Grey Scale test pattern was first used by broadcasters to provide a test pattern for receiver adjustments. It employed a special analog generator using an engraved CRT with precision deflection . Digitally synthesized generators followed but were prohibitively expensive . Leader now offers the 435B that features a digitally-generated Grey Scale pattern with wedges calibrated to read up to 1000 lines of TV resolution the ideal source to test and offer proof of performance for high performance TV monitors and VCRs. The Grey Scale pattern also offers perfect geometry for precise deflection size and linearity adjustments, provides resolution patterns in the corners to check corner focus, includes a 10-step grayscale to check tonal range and calibrated markers to check line-rate tilt (the cause of H streaking) and ringing.

ii: Window Pattern

Window pattern is This great to test the low frequency and clamp response of the system. The video signal will 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.

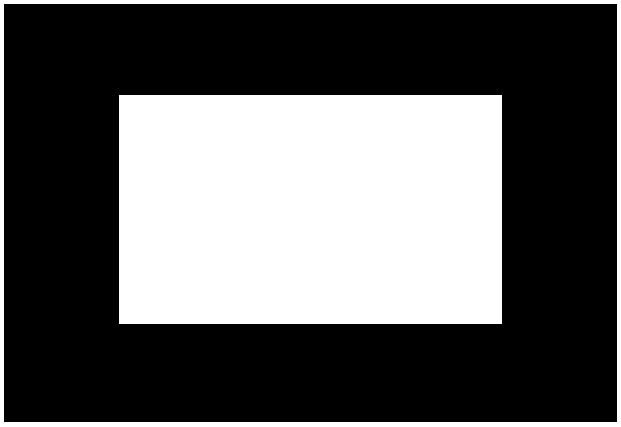

Fig3 : Window Pattern

D Color Pattern Vs Monochrome Pattern

The Color pattern and monochrome patterns are generated by the same Signal Generator. The characteristic of the signal generator are modified to generate both Type of patterns . Following waveforms explains the difference in the characteristics of the color and of the monochrome pattern

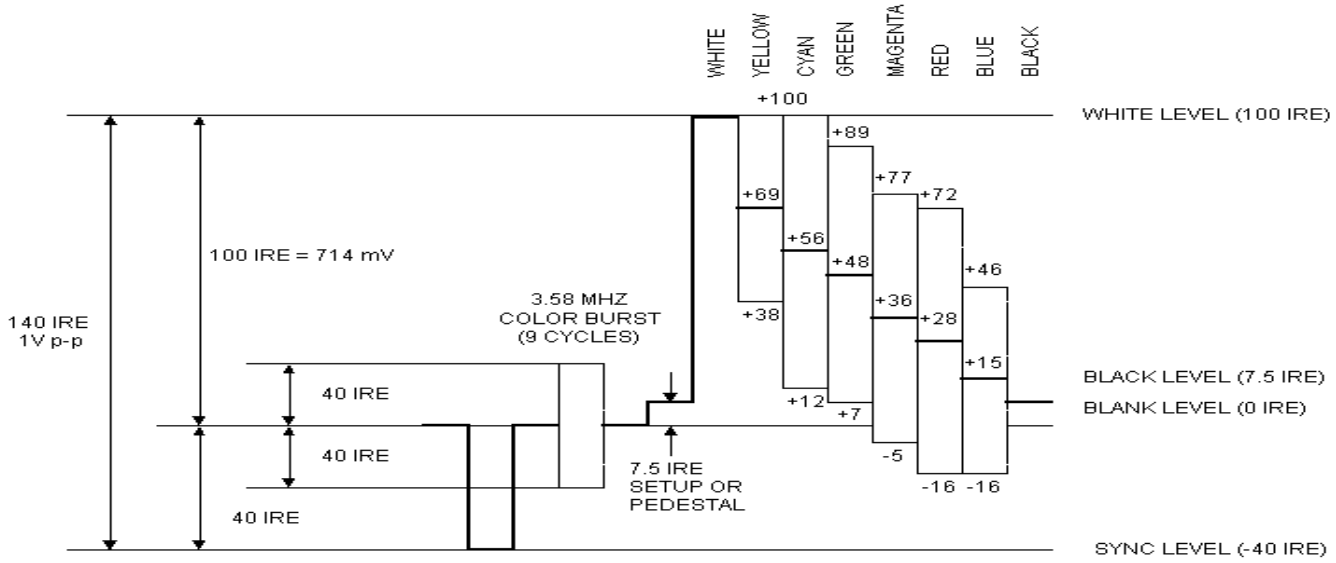

Fig. 4 Colour Signal Wave form

The above waveform is the waveform of the color signal as displayed by a CRO. It indicates the various components of a color signal, namely Color Bar Pattern. 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. Window The window pattern consists of a white rectangular area in the middle of the screen surrounded by black. This pattern is good for testing low frequency response and video tilt as well as the performance of video clamping in the video processing system. In Fig 4.5 Red, Green, Blue and Black Full Field These patterns are full image screens of red, green , or blue. These are helpful in television monitor 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.

III COLOR TRANSIENTS IN MONOCHROME SIGNAL

When Monochrome signal is transmitted for the alignment process, the accuracy 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.

a *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.

b *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.

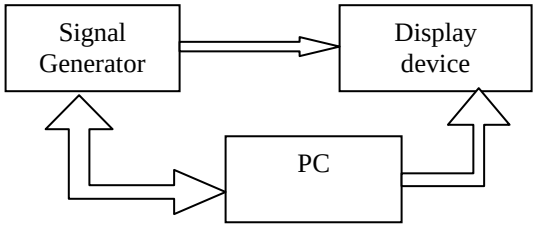

Fig5 : Block Diagram

The block diagram in figure 5, 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 PC scans the panel of the display device with the camera which may be a calibrated camera or unacalibrated camera, depends on the type of alignment process.[10]

The color transients flashes wrong information to the PC 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.

The effect of the color transients is more visible in white purity , Grey Scale patterns where the overall alignment depends only upon the white peak level of the pattern.

I. 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 6 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

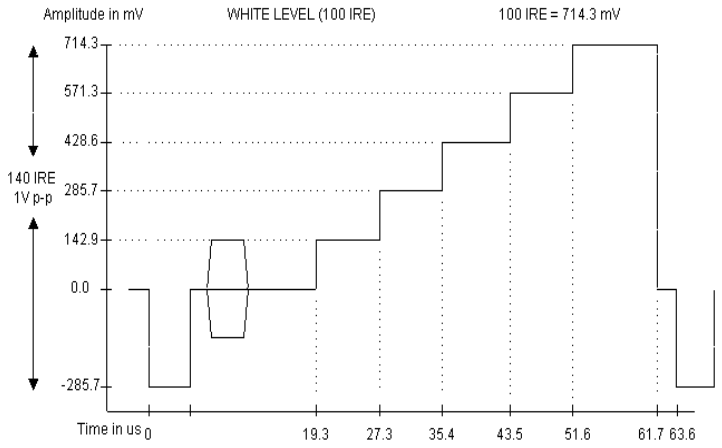

Figure 6 : Grey scale Standard wave form

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]

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 7 shows the waveform of signal generator showing color transients in its output signal.[11]

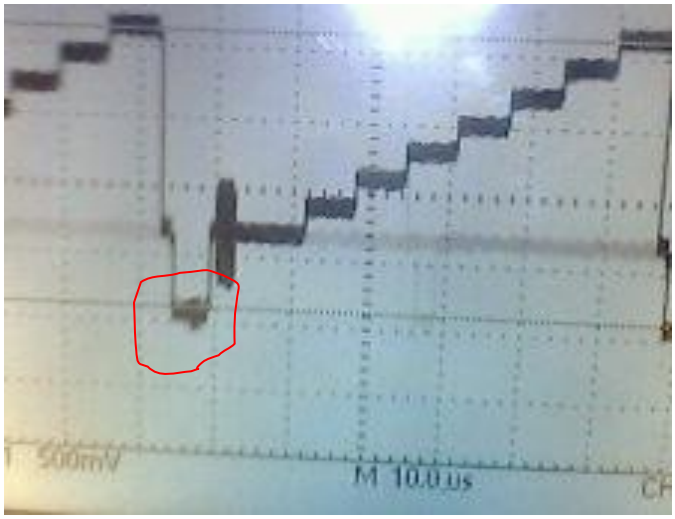

Figure 7 : Grey scale transmitted waveform

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 100 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. The program is in the machine language of the signal generator and can be modified by following steps(fig 8).

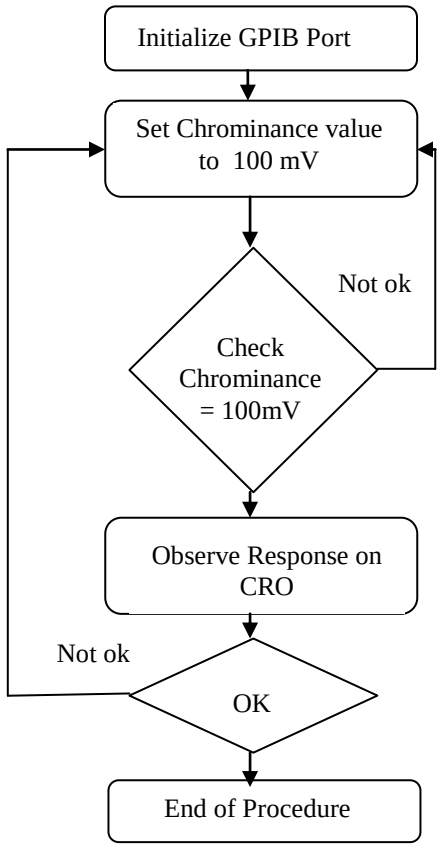

Figure 8 : Block Diadram

The block diagram in Figure 8 exhibits the general method of reducing the chrominance signal to the considerable low value signal. 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

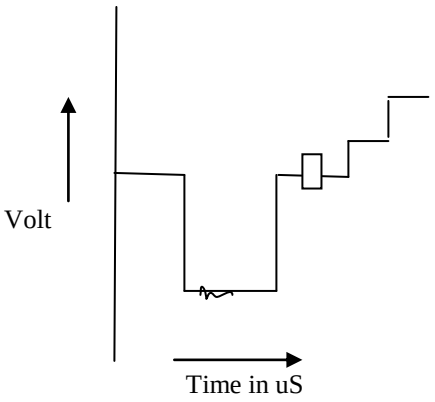

Fig 9: Corrected wave form.

As the effect of chrominance is reduced the appearance of color transients in the mono chrome pattern is also eliminated. 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.

IX REFERENCES

[1] De hann , T.G Larragy , M.M ojo , R.J Philips Semocond , Eindhoven " Television noise reduction IC " IEEE Preceeding , Vol 44 , Issue 1, PP 143 -154, Feb 1998.

[2] A Punchihewa , D.G Bailey and R. M. Hodgson, "Objective Quality Assessment of Coded Images : The Development of New Quality Metrics," Proceedings of Internet, Telecommunication Conference, Adelaide, Australia, pp. 1-6, 2004.

[3]Tetsui Ryoichi " Signal generator of digital –TV generation LCD " Semicond FPD word proceeding, Vol 23, page 94-99, 2004

[4] Mehmet Engin , Rasim Saltuk Alakus " Elimination of White Noise from Video signals of Television Transmission by using Digital Recursive Method " Istanbul University, journal Electrical & Electronics year PP 627 – 633, June2002.

[5] B. Grob, C. E. Herndon, Basic Television and Video Systems, 6th Edition, McGraw-Hill, Singapore, PP 292, 1998.

[6] Dr. Saupe &Dr. Xiong Book on ," Efficient Error

Protection for image and video transmission over noisy channels " Univ. Konstanz &Univ A&M Texas precceding May2004.
[7] M. Robin and M. Poulin, Digital Television fundamentals, McGraw Hill, New York, USA, Second Edition, p. 126, 2000.
[8] Tanaka Y , " Video Signal Noise Characteristics with regard to scanning Method " . IEEE Preceeding, Vol 40 Issue 2, PP 68 - 74, Aug 2006 .
[9] Van Roermund , Snijder R.j Philips Res. Lab " A general Purpose programmable video signal Processor "IEEE proc. Vol. 35, Issue 3, PP 249 - 258, August1989.
[10] A Peiravi & S Toosizadeh , " Automatic Adjustment of Television sets using an unacalibrated camera with a Novel Fuzzy test Pattern and an Adaptive Algorithm ". Journal of Applied Sciences , Ferdowsi Univ, Mashhad, Iran Asian Network for scientific Information ,Vol 9(1), PP 49-58, 2009
[11] Frederick .C . Everett, " Recoginition and Coreection of Waveform Errors in TV Transmission" IEEE Trans on boradcastings , Vol BC-18, N0. 1, PP. 18 to 22, March1972.
[12] Tsuyoshi Harada , Yoshie Oritake on " Video signal defect compensation system " , US Patent No. 4315276 ,US Classification 358/8 ; 360/38 , Feb 1982.
[13] J Carl hooper , Dr. Sunnyvale , sydney, "Noise Reduction System for Video Signals " US Patent No. PP 1 to 15, Feb 1986.
[14] A. Punchihewa and D. G. Bailey, " Artefacts in Image and Video Systems; Classification and Mitigation," Proceedings of the Conference of Image and Vision Computing New Zealand, Auckland, New Zealand, pp. 197-202, 2002.
[15]] A. Punchihewa, D. G. Bailey and R. M. Hodgson, "A Survey of Coded Image and Video Quality Assessment," Proceedings of Image and Vision Computing New Zealand, Palmerston North, New Zealand, pp. 326-331, 2003