SEMI D58-0310
TERMINOLOGY AND TEST PATTERN FOR THE COLOR BREAKUP OF FIELD SEQUENTIAL COLOR DISPLAY

This Standard was technically approved by the Flat Panel Display – Metrology Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on January 20, 2010. Available at www.semiviews.org and www.semi.org in March 2010.

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1 Purpose

1.1 Field sequential color technique in the flat panel display has become more and more important. The effect of color breakup (CBU) will occur in the panels in which the color sequential technique is used. There are still no adaptive measurement standards to quantify the quality of color breakup. To standardize the classification of color breakup for flat panel displays (e.g., LCD) is necessary.

2 Scope

2.1 This Standard defines the phenomenon of color breakup in flat panel displays design and implement the test pattern of color breakup. This Standard is applicable to the terminology of color breakup on the field sequential color display, such as LCD and DLP.

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3 Limitations

3.1 None.

4 Referenced Standards and Documents

4.1 None.

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *CBU* — color breakup

5.1.2 *DLP* — digital light processing

5.1.3 *LCD* — liquid crystal display

5.2 *Definitions*

5.2.1 *color breakup (CBU)* — a phenomenon wherein the time sequence of colors, constructive showing some colors of the display, broken by some reasons then produces color separation visually in motion conditions. There are two major components in color breakup which correspond to color separation and seen by human vision, respectively. CBUs could be classified into two different types, dynamic CBU and static CBU, respectively. In contrast, color motion blur (CMB) is defined that the color mixed by the hold-type effect of liquid crystal and the unexpected colors perceived by the human vision system. Hence, the difference between CBU and CMB is the cause reason.

5.2.2 *dynamic CBU* — dynamic CBU occurs in the color transition area of a moving image. When the image (generated by color sequence) is moved by a certain motion vector, eyes are tracking the same motion vector smoothly. During this movement, the colors in sequence are broken on a retina. This phenomenon is called dynamic CBU. Figure 1 is an example of dynamic CBU captured by a pursuit camera system.

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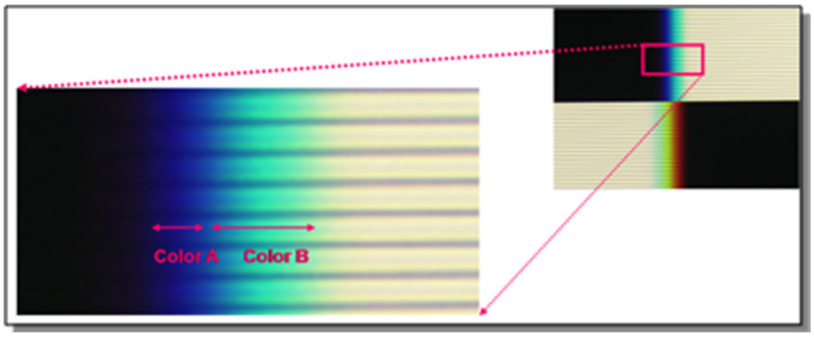

Figure 1
Dynamic Color Breakup

5.2.3 *test pattern of dynamic CBU* — a test pattern (foreground) is a moving block, which is scrolled on a display (background). Even in the same color transition pair, the CBU phenomena are different in the reverse color transition (i.e., black to white vs. white to black). For this reason, we propose the testing pattern as 2 × 2 checker board pattern, such as Figure 2. Then the two different color breakups could be captured at the same time.

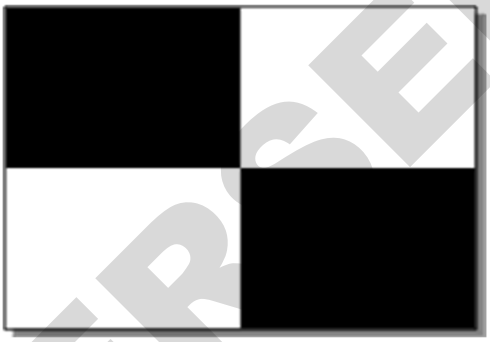

Figure 2
Test Pattern of Dynamic CBU

5.2.4 *static CBU* — a static image shown on a color sequential display is interfered with a fast moving object in front of screen or blinking human eyes, the human vision system will perceive the color separation, this phenomenon is called the static CBU. This effect is much easier to see than dynamic CBU. A wheel chopper is a simple method to detect static CBU. Figure 3 is an example of static CBU of a DLP color projector as captured by a high speed camera.

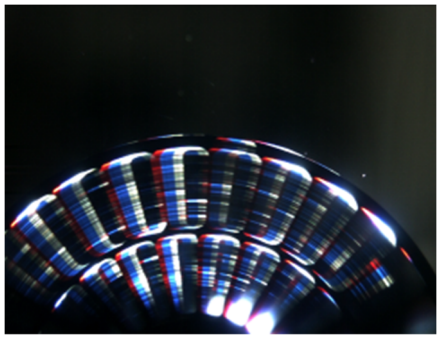

Figure 3
Static Color Breakup

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