

WHITE PAPER

High-brightness displays What it takes to take the screen outside



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Many of the most compelling uses for digital signage involve the placement of screens outdoors, or indoors in high-ambient-light conditions, such as near a window. In both of those cases, the challenge for providing the highest-quality picture on a digital sign increases, mainly because of the ambient light.

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Nearby ambient light shining on a screen directly impacts the light produced by the display itself – the result of that impact is less contrast and washed-out images and colors. The images then become very difficult to read, and the viewing angle becomes reduced due to the lower contrast level

When a screen is used outdoors, the problem becomes much worse, said Andy Weis, of Samsung. Some types of sunlight can have devastating effects on a screen, and not just by washing out the picture. Direct sunlight, in the form of high-brightness-standard Visible Light (VL), Ultraviolet (UV) and Infrared(IR), can have the following effects on a unit:

VL: Washed-out colors, lower contrast and lower viewing angles. There are no damages associated with this spectrum of light.

UV: Discoloration over time, in the form of yellowing or graying of the LCD surface and the image being produced. This UV damage is permanent and should be avoided.

IR: Internal heat buildup, tiger-stripe or Mura-type dark and grey bands on the image being displayed. The IR damage can be either temporarily or permanent, depending on the length of usage. When circuits are operated at a higher temperature, their life spans are reduced. This includes the LCD panel itself.

Over the years, and after much trial-and-error, screen manufacturers realized that to accommodate the growing number of customers who needed screens for outdoor and challenging lighting projects, they had to create a screen that was not only durable on the outside, but also produced enough light to maintain a good picture in all conditions, including the full ambient-temperature and humidity ranges.

The result was high-brightness screens, designed to emit more light than normal commercial-grade digital signs on the market and able to withstand the harsh external usage conditions. These screens are certainly much more durable than consumer-grade televisions that manufacturers commonly supply for these harsh environments.

High brightness screens are designed to emit more light, which means more luminance and contrast, than traditional commercial-grade screens.



Photos courtesy Samsung

Advantages and disadvantages

Many of the large display manufacturers such as Samsung, Sony, Toshiba, Mitsubishi, NEC and LG have come out with high-brightness displays in the past several years as options in their digital signage product line-ups. They have also made clear the advantages of using a high-brightness display as opposed to a standard digital sign.

To date, Samsung said it is the only company with the highest-brightness panel available; the company takes full responsibility for the entire design and manufacture of not only the panel, but also the entire outdoor, environmentally ready, large-format display.

First, high-brightness displays can output up to three times as much light as a standard digital sign, according to Jean McLaughlin, senior program manager of product development for NEC Display Solutions. This combats the effects of high-ambient light and direct sunlight conditions by maintaining a visible image, even as the light attempts to wash out the picture.

Also, many high-brightness screens are equipped with a wider viewing angle, which is ideal (and some might say necessary) for outdoor deployments where people are constantly on the move. For example, Samsung's latest high-brightness display has a viewing angle of 180 degrees (178 degrees with the bezel), which means it can be read clearly from almost any angle in front of the screen in a conical setting.

Under normal conditions, one would expect that the more than 300-percent brightness improvement would cause tremendous negative impact for the environment in the form of higher power consumption or higher mercury content of the cold-compact-fluorescent-light (CCFL) source. However, Samsung, with its patented technology, has been able to provide the higher-brightness panels without any negative impact on the environment. Samsung achieved this by deploying its patented CCFL technology, which the company says is more efficient than typical CCFL solutions, as well as offering an LED-backlit light source, which contains no mercury.

Samsung said its goal is to continue offering even higher-brightness panels using even less power and, eventually, with no mercury usage at all.

It is to be expected that three times the brightness doesn't come without a bigger price tag than traditional commercial-grade screens, due to the latest technology offerings and the research and development investments.

According to McLaughlin, the price for a high-brightness screen can be as much as 50 percent higher than its normal-brightness counterpart, although that amount will likely decrease over time as rising demand creates more efficient manufacturing processes and economies of scale.

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Under the hood

A hypothetical helps one understand the many advantages of high-brightness screens. If a standard digital sign is a stripped down Ford Mustang, then a high-brightness screen is a Mustang Shelby Cobra. They may look similar on the outside, and even on the inside, but the souped-up parts are what make the difference.

Here are several characteristics of digital signage screens that are amplified in their high-brightness counterparts:

Luminance is the measure of how much luminous intensity is coming from a certain area and how much of that light will be perceived by the human eye looking at the screen from a particular angle of view.

Luminance is measured in Candelas per meter squared (Cd/m²), a unit commonly referred to as “nits”. According to McLaughlin of NEC, a typical display will have a luminance rating somewhere between 400 and 500 nits, while a high-brightness display will number in the mid-thousands or higher.

Another characteristic that sets a high-brightness screen apart is its higher contrast ratio. This ratio measures the difference in the extreme range of the brightness and the black level, or the difference between the luminance of the screen’s “highest white point” and its “blackest black point.” The higher this number, the more dynamic and crisp imagery will appear to be on the screen. This number is unaffected by the size of the screen.

Contrast ratio for screens is often measured under the optimum condition of a room in total darkness. But contrast ratio dips quickly – from the hundreds down into single digits – when a regular screen moves from a totally dark room into an area with high-ambient light. This creates a washed-out look at best and a completely unreadable image at worst, and even affects the viewing angle.

For example, under a direct viewing angle, the contrast level may be in the 10,000 to 100,000 range, but at a slightly off-center viewing angle, the contrast level can fall to just a few hundred, said Andy Weis, senior product marketing manager for Samsung Display Group.

As for size, the highest-brightness screen lines start out small and range up into the “standard large sizes.”

“It’s probably easier to do (high-brightness) in a smaller screen than a larger screen,” McLaughlin said. “As you go larger and larger, it becomes harder to sustain (the brightness) evenly over the screen. For us, we’ll

TABLE 1

KEY MEASUREMENTS

	NORMAL COMMERCIAL-GRADE	HIGH-BRIGHTNESS SCREENS
Nits (Cd/m ²)	500	1,500
Size range	46-INCH	82-INCH
True Contrast ratio	500:1	3,000:1
Cost (avg.) for 40-inch display	\$899	\$1,699

probably do it in what we call our mainstream large-screen products, which would be in the 40- to 46-inch range. Over time, it'll migrate into the larger screens."

Weis said that the higher brightness is easier to achieve due to the light density associated with CCFL lamps and the cost associated with standard or newly developed LED light offerings. With cold-compact-fluorescent lamps, the longer the lamps are, the higher the voltage requirements and the less light that is produced in the center of the lamp over time. Weis stated that Samsung has avoided this by developing patented technology which coats the lamps with titanium, resulting in increased light output, and developing "U" shaped CCFL lamps instead of standard straight lights.

The latest screen technology

In May 2008, Samsung released a 46-inch high-brightness screen, which it has tagged as the "brightest LCD panel in the world." That display has 1,500 nits and a contrast ratio of 3000:1. The screen resolution, although not true high-definition, is still impressive at 1,366 x 768 pixels and is ideal for digital signage usage where viewing distances are greater than standard TV usage and allow for maximum light output. Samsung also offers this panel to its other monitor-maker customers.

The 46-inch high-brightness screen, released in May, is an example of the growth of large-format displays in this category. For digital signage, users typically install screens anywhere from 40-46 inches in size.

High-brightness screens in action

To date, high-brightness screens haven't seen many large-scale deployments, but industry signs point to change. In June 2008, Samsung announced that it will install high-brightness screens in 18 bus shelters along the Las Vegas strip.

Each LCD sign, which will deploy localized audio as well as full video, will be seen by an estimated 1.5 million pedestrians and 1.8 million cars every month.

"The Las Vegas strip is unique because visitors come from all over the world, staying on average just four days; therefore every four days, our curbside billboard screens essentially will be reaching a new audience," said Gary Young, president and chief executive officer of Outdoor Promotions, Samsung's partner and builder of the shelters.

The new screens will have the full high-definition HDTV resolution of 1920 x 1080 pixels and offer full 1080p high-definition content capability. Each sign can display up to 16.7 million variations of color and can be seen clearly from virtually any angle. Advertisements will be changed every 7.5 to 15 seconds on a continuous loop at each location.

The initial eighteen 70-inch displays will be installed at bus shelters in front of the Wynn, Caesars, Planet Hollywood and Tropicana resort hotels, as well as at entry points to the Las Vegas Fashion Show Mall in the fourth quarter of 2008. Another 20 screens are planned for installation in early 2009.

About the Sponsor: *Samsung's Information Technology Division (ITD) markets a complete line of award-winning LCD monitor products for a range of business and consumer needs. This line also includes more than 30 models of professional large-format LCD and plasma displays for commercial applications such as digital signage. As a leader in display technology, Samsung offers industry-leading technologies like DID (Digital Information Display) that provide increased brightness and the ability to operate continuously for over 20 hours a day.*