Evaluating Color Gamut of Smartphone Display

Introduction

With increased image and video content available over the internet, there is now a growing emphasis on color fidelity and accuracy of display used in smartphone.

One reason for this growing emphasis is the emergence of online merchandising. Consumers want to be sure that the colors they see on their smartphone display are actually what they will get eventually.

Another reason is that we are now accustomed to seeing displays which are able to reproduce colors we see in the real world. Anything less, the smartphone display would be deemed as mediocre.

The good news is color fidelity and accuracy of display have improved throughout the years due to better display technology, advanced signal processing and color management solution.

To ensure displays are able to portray specific colors accurately, evaluating parameter like color gamut is necessary. Apart from color gamut, parameters like white point and gamma are also of equal importance in evaluating the visual characteristic of display.

What is Color Gamut?

Color gamut is defined as the range of colors that a display can reproduce. The larger or wider the gamut, the more saturated colors are obtainable.

Various reference spaces are used to express the color gamut, but the most common reference spaces used for display products are CIE Yxy (1931) and CIE Lu'v' (1976) chromaticity chart.

CIE Yxy (1931) chromaticity chart

CIE Lu'v' (1976) chromaticity chart
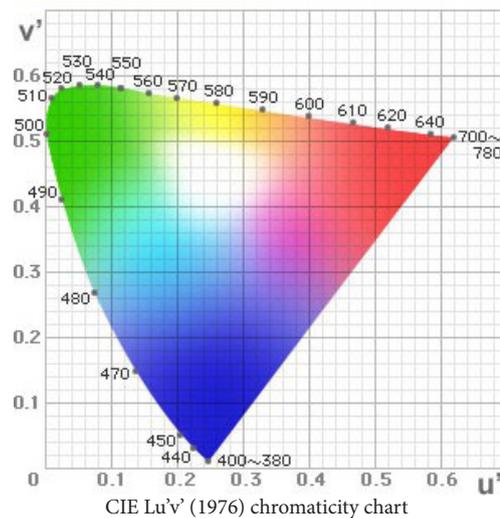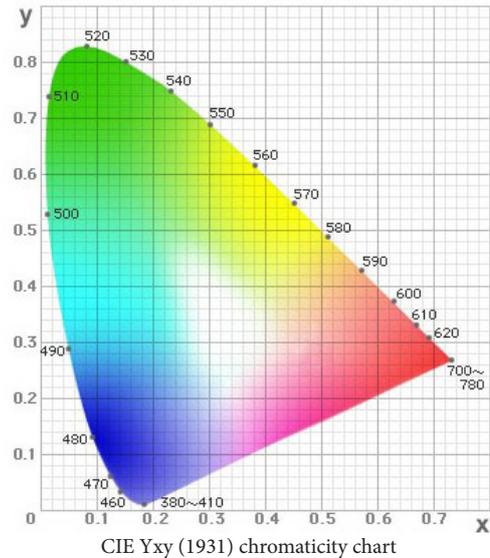
TThere are various color gamut standards drafted for expressing color display range according to different industry and different application. For smartphone and PC displays, the standard gamut is sRGB/ Rec.709. However, with the growing adoption of wide color gamut solutions in the high-end display market, wide color gamut standards such as Adobe RGB (used in high end digital cameras) and DCI-P3 (used in 4K Ultra HD TVs) are emerging as a key requirement for premium smartphone.

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The color gamut defined by each standard is shown as a triangle on the xy or the u'v' chromaticity chart. The triangle is established by peak RGB coordinates connected by straight lines. A given display can only reproduce the colors that lie inside the color triangle formed by its primary colors (i.e., RGB). A larger triangle area represents a standard capable of displaying more saturated colors as shown below:
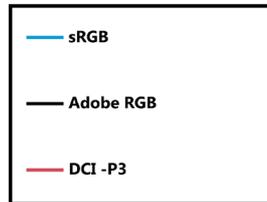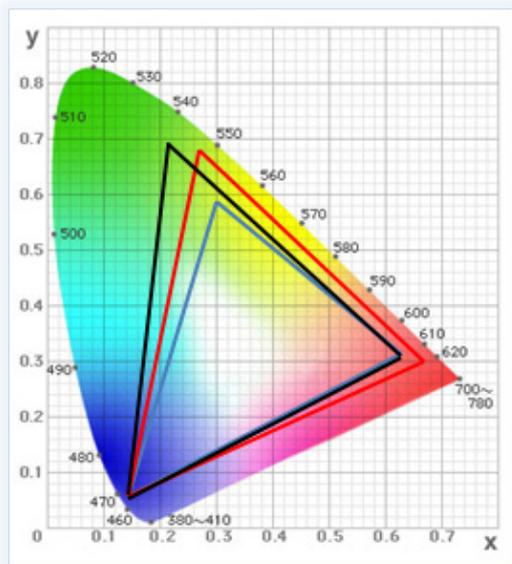

Color Coordinates for sRGB, Adobe RGB, and DCI-P3 in xy chromaticity chart						
	sRGB		Adobe RGB		DCI-P3	
Primary	x	y	x	y	x	y
Red	0.640	0.330	0.640	0.330	0.680	0.320
Green	0.300	0.600	0.21	0.71	0.265	0.690
Blue	0.150	0.060	0.150	0.060	0.150	0.060

Area Ratio Versus Color Coverage

The size of a display color gamut is represented by the chromaticity area ratio (CAR). The ratio is obtained by comparing the chromaticity triangle area (formed by its RGB primary colors) and the chromaticity triangle area of a specific color gamut standard (e.g., sRGB) in CIE xy or u'v' chromaticity chart. The CAR is a relative specification which will also depend on the chromaticity chart used.

It is important to note that using CAR can be misleading when color coverage is concerned. For example, if a product claims 100% area ratio for sRGB, it merely indicates that the chromaticity triangle area of the display under examination and the specified sRGB gamut is similar. It does not indicate any information concerning its color coverage as shown below:
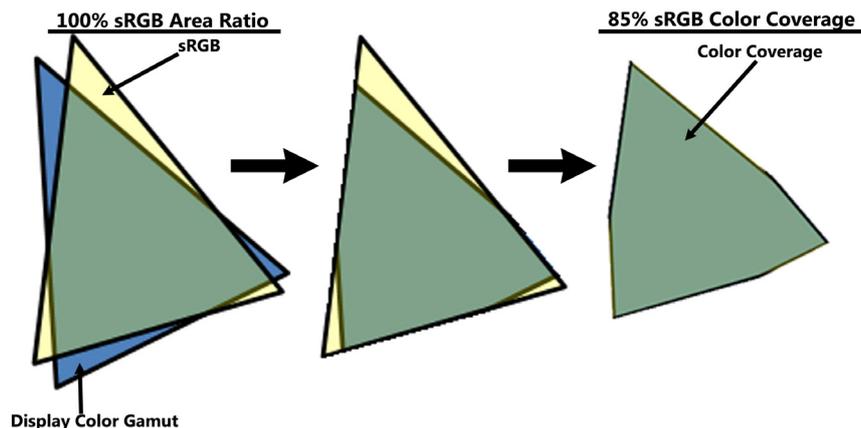
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From the user's perspective, color coverage is easier to understand and is a more accurate specification of display color gamut. It is especially important with the proliferation and widespread availability of digital image content across devices.

Konica Minolta offers a wide range of display measuring instruments that are capable of evaluating white point, gamma and color gamut.

Learn more about the basic concepts of photometry and colorimetry with our free education booklet. Alternatively, you can call us at 6563 5533 or contact us through here for a free consultation or to arrange a product demonstration.