DXOMARK

DISPLAY QUALITY EVALUATION REPORT

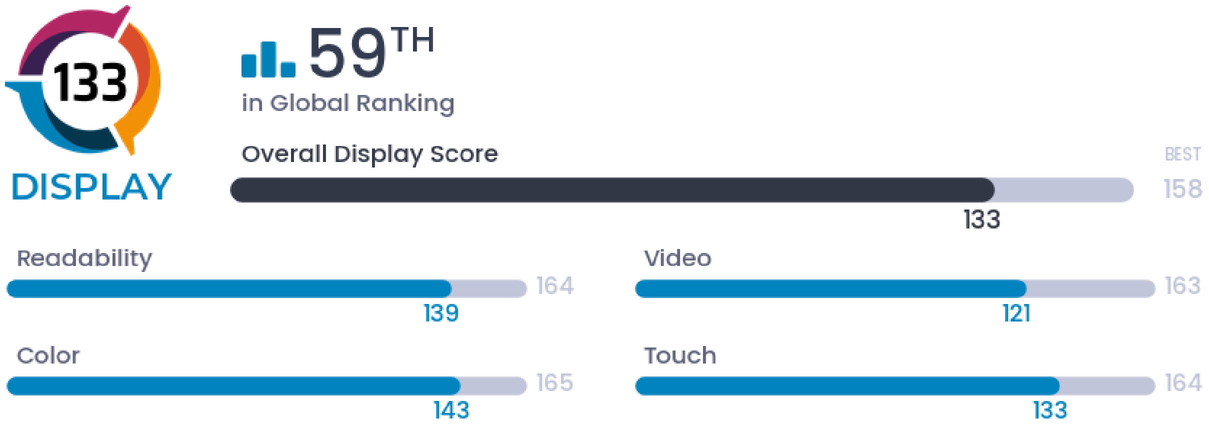
Sample Report

TABLE OF CONTENT

1. Tables of Figures

TABLES OF FIGURES

2. Summary



2.1 Pros and cons

Pros	Comment 1 Comment 2 Comment 3 …
Cons	Comment 1 Comment 2 Comment 3 …

2.2 Device Specifications

Panel Technology	OLED
Form Factor	Traditional
Curved Edges	False
Display Cutout	Punch hole
Fingerprint Sensor	True
Fingerprint Sensor Location	Under display
Under-Display Selfie Camera	False
Screen Size (diagonal, inches)	-
Screen Resolution	-
Screen Pixel Density (PPI)	-
Aspect Ratio	20:9
Software Version	version
Video Player App Version	version
Gallery App Version	version
Maximum Screen Refresh Rate (Hz)	120
Tested Color Mode for Display-P3 Content	Natural
Tested Color Mode for sRGB Content	Natural

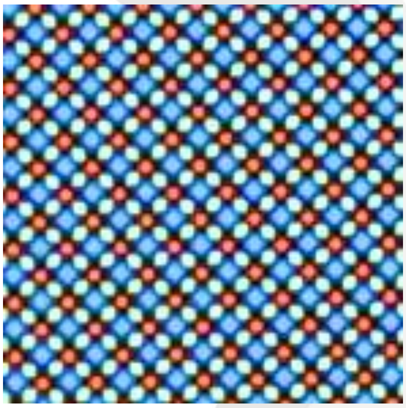


Figure 1 Panel sub-pixel arrangement

3. Readability

The most important thing about a display is how easily an end-user can see its contents, be it text or images. Using the device's default gallery app to display images or the default web app for text reading, DXOMARK's Readability tests evaluate different aspects of display performance under a variety of lighting conditions that range from nighttime and low-light indoor environments to full sunshine outdoors. Other factors such as angle and reflectance also have a measurable impact on readability.

Readability artefacts are also investigated, such as uniformity issues and temporal light artefacts induced by refresh rate and PWM.

DXOMARK carries out its tests for readability using a spectroradiometer for measurements, and computer-controlled lighting arrays composed of different illuminants and capable of providing light levels from 1 to 50,000 Lux to imitate all possible ambient light conditions.

f(x)	Score
Global Readability	139

f(x)	Score
Low Light	10
Indoor	9
Outdoor	6
Dynamic Luminance Adaptation	8
Angle	8
Uniformity	8
Artifacts	8

READABILITY

3.1 Readability vs Ambient Lighting

A smartphone needs to automatically adjust its luminance to the ambient lighting conditions whether indoor with very dim lighting or outdoor with bright sun light. Luminance adaptation is particularly challenging when outdoors with sunlight at noon; since device luminance is always limited, adaptation often involves tuning local contrasts and colors so that content becomes readable.

3.1.1 Global Scores

f(x)	Score
Low Light	10
Indoor	9
Outdoor	6

3.1.2 Objective Measurements

f(x)	Score
Low light	10
Indoor	9
Outdoor Shades	6
Outdoor Sunlight	4

Luminance (cd/m²) vs ambient lighting (lux) at APL 20% with various brightness settings

	None	A	Home	D65	D55		High Brightness Mode Luminance
	0 lux	25 lux	250 lux	830 lux	20,000 lux	50,000 lux	
Luminance Auto Setting	3.62	72	108	161	983	1146	1109
Luminance Min Setting	2.52	-	-	-	-	-	-

READABILITY

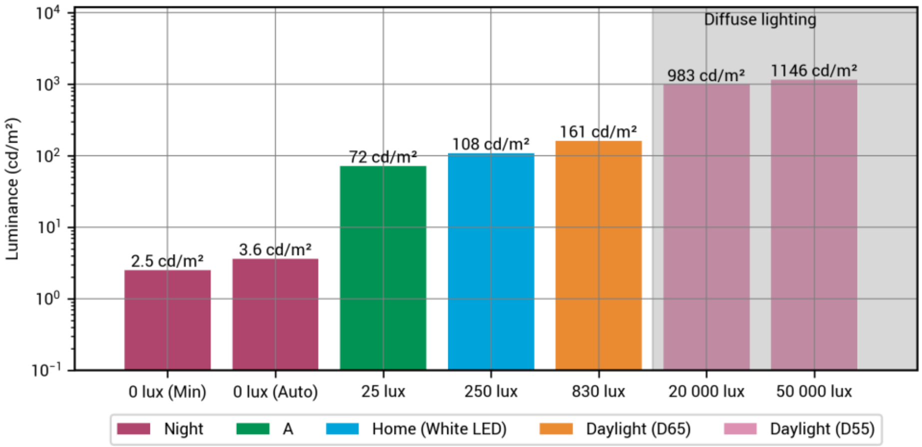


Figure 2 Luminance (cd/m²) of the display depending on the environment (APL 20%)

Contrast (:1) vs ambient lighting (lux) at APL 20% with various brightness settings

	None	A	Home	D65	D55	
	0 lux	25 lux	250 lux	830 lux	20,000 lux	50,000 lux
Contrast Auto Setting	182	177	139	109	4	3

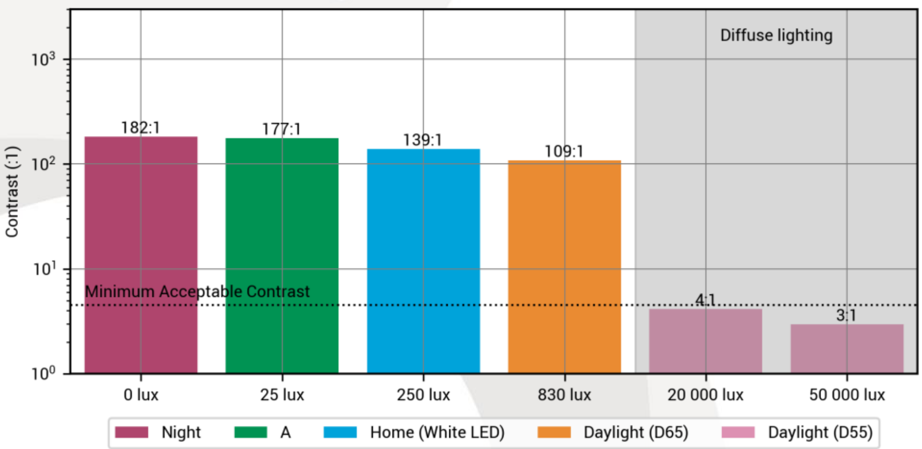


Figure 3 Contrast (:1) of the display depending on the environment (APL 20%)

3.1.3 Perceptual Scores (Readability vs Ambient Lighting)

	Score
Low Light	10
Indoor	10
Outdoor Shades	8
Outdoor Direct Sunlight	6

OBSERVATION

Perceptual readability comment

3.2 Readability vs Average Pixel Level (APL)

OLED panels have APL-dependent behaviors, particularly visible for challenging environments. This might impact user experience depending on the use-case. For example, photos are close to a 20% APL pattern while a web page is around 80% APL. It is important to provide consistent luminance for a given environment to limit user disturbance.

3.2.1 Scores

f(x)	Score
Objective	10

3.2.2 Objective Measurements

Luminance (cd/m²) vs APL (%) under 20,000 lux (D65)

	APL (%)	5	10	20	30	40	50	60	70	80	90	100
Luminance Auto Setting (cd/m²)	20,000 lux (D65)	1034	1042	1034	1031	1034	1035	1038	1043	1041	1044	1047

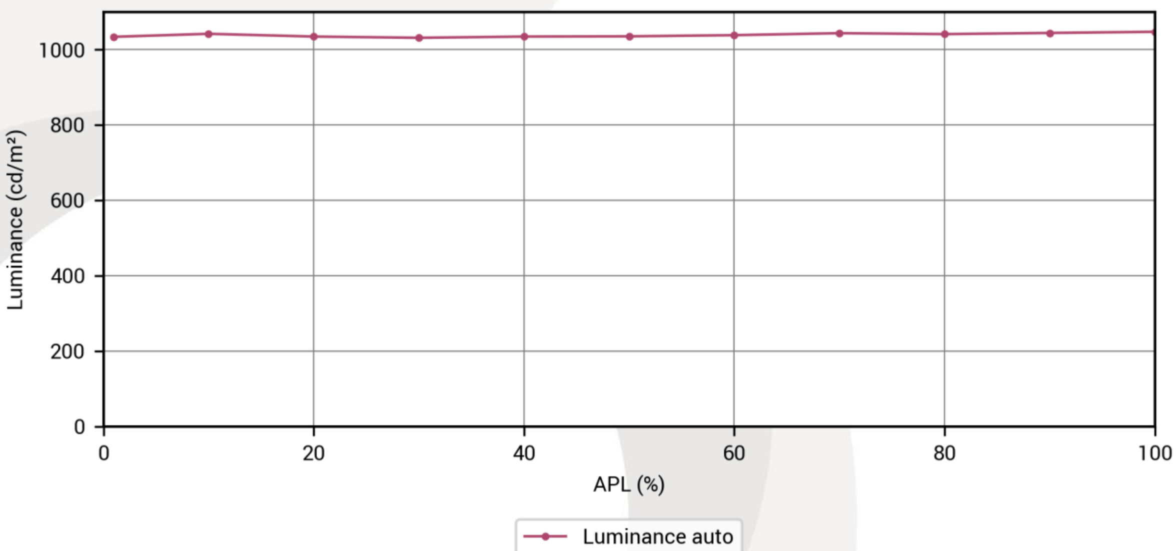


Figure 4 Luminance (cd/m²) stability regarding the APL, under 20 000 lux (D65)

3.3 Dynamic Luminance Adaptation

When changing between environments, the device should adapt its luminance continuously. The transition can be very smooth and at a proper speed (fast when it needs to deliver more luminance, slow when the luminance drops – in order to follow the eye's response) or on the other hand the transition can show some steps, be too fast or too slow and even be unstable. Our protocol evaluates how comfortable the transitions are.

3.3.1 Perceptual Scores

	Score
Dynamic Luminance Adaptation	8

OBSERVATION

Perceptual dynamic adaptation to ambient lighting comment

3.4 Electro-Optical Transfer Function (EOTF)

Electro-Optical Transfer Function (EOTF) is the relationship between the numerical value of a pixel in an image file and its luminance when viewed on a screen. The aim is to ensure that every detail is visible in all environments.

3.4.1 Scores

f(x)	Score
Low Light	8
Indoor	5
Outdoor	3

3.4.2 Objective Measurements

Luminance (cd/m²) vs gray level (APL fixed at 20%) in the dark, under 830 lux (D65) and under 20,000 lux (D65)

Signal Value (1-255)	0 lux	830 lux (D65)	20,000 lux (D65)
3	0.00	0.88	21.43
4	0.00	0.88	21.49
6	0.00	0.88	21.69
8	0.00	0.88	21.92
13	0.00	0.97	22.87
26	0.02	1.50	26.93
38	0.05	2.36	33.54
51	0.10	3.70	42.53
77	0.31	8.51	74.73
102	0.61	15.35	117.19
128	1.03	24.30	171.62

153	1.53	35.13	235.86
179	2.12	49.53	315.78
204	2.83	65.87	413.17
230	3.69	86.62	531.54
255	4.65	109.47	670.05

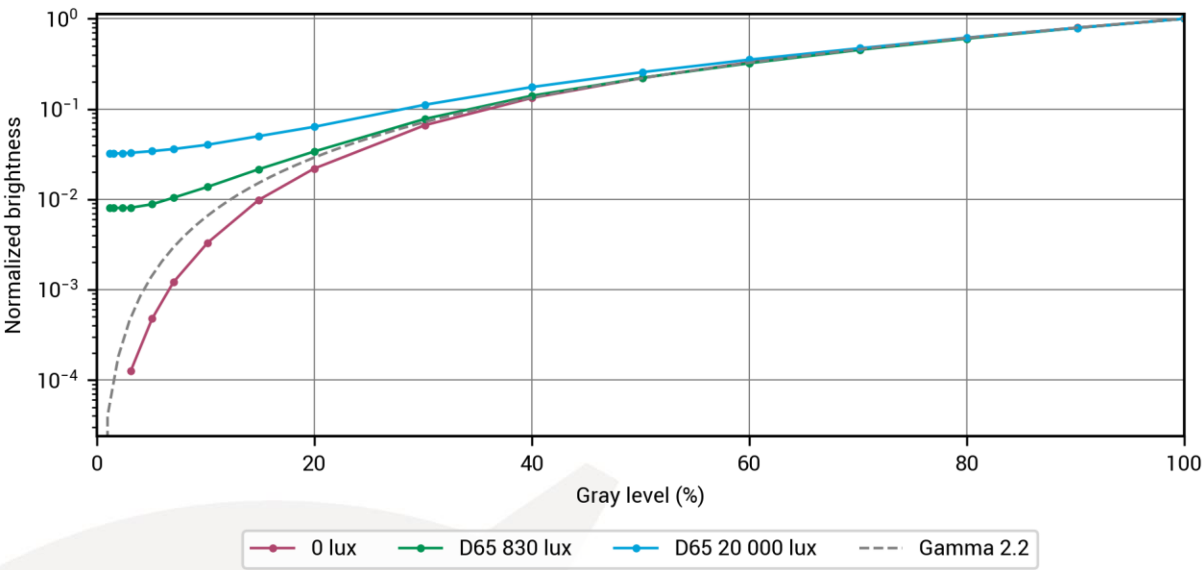


Figure 5 Normalized luminance of gray levels under different lighting conditions (APL 20%)

3.5 Screen Reflectance

These tests characterize the reflectance of the device when the display is off. Reflections have a strong impact on effective contrast, particularly in challenging lighting conditions. Cover glass without coating reflects about 5%, while plastic film is around 6% or higher.

3.5.1 Scores

f(x)	Score
Overall	7

3.5.2 Objective Measurements

Specular Component Included/Excluded (SCI/SCE) data

	Y	a*	b*
SCI	5.0	-0.07	-0.80
SCE	0.4	-0.23	-0.79

SCI and SCE, as shown in the graph below, quantitively characterize the specular reflection (mirror-like reflection) and the diffused reflection, respectively.

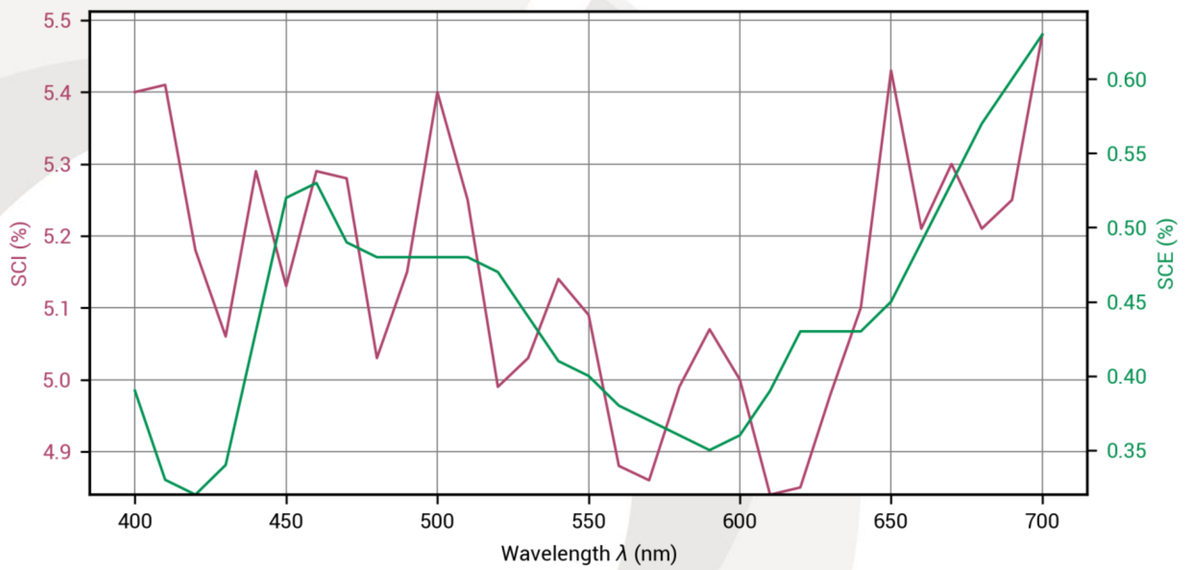


Figure 6 SCI and SCE measurements

3.6 Readability vs Angle

There are use-cases where users are not always able to hold their smartphones exactly perpendicular to their eyes (that is, "on axis"), such as in-car navigation or when they show videos or photos to friends or relatives. Hence, it is important to understand what effect holding the device at angles of up to 45° has on the luminance of screen content. DXOMARK uses a conoscopic lens mounted on an imaging colorimeter to perform these measurements.
The measurements are performed with the smartphone in portrait position.

3.6.1 Scores

f(x)	Score
Overall	8

3.6.2 Objective Measurements

Luminance (cd/m²) vs angle (°) along the given azimuth sections under 0 lux (auto brightness)

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	191.0	374.4	533.4	587.4	553.7	418.9	223.0
Azimuth section: 90°	229.7	415.0	552.4	587.4	545.9	400.1	215.1
Azimuth section: 45°	212.9	401.8	544.2	587.4	555.6	423.0	229.6
Azimuth section: -45°	211.9	410.2	553.3	587.4	535.4	370.0	180.4

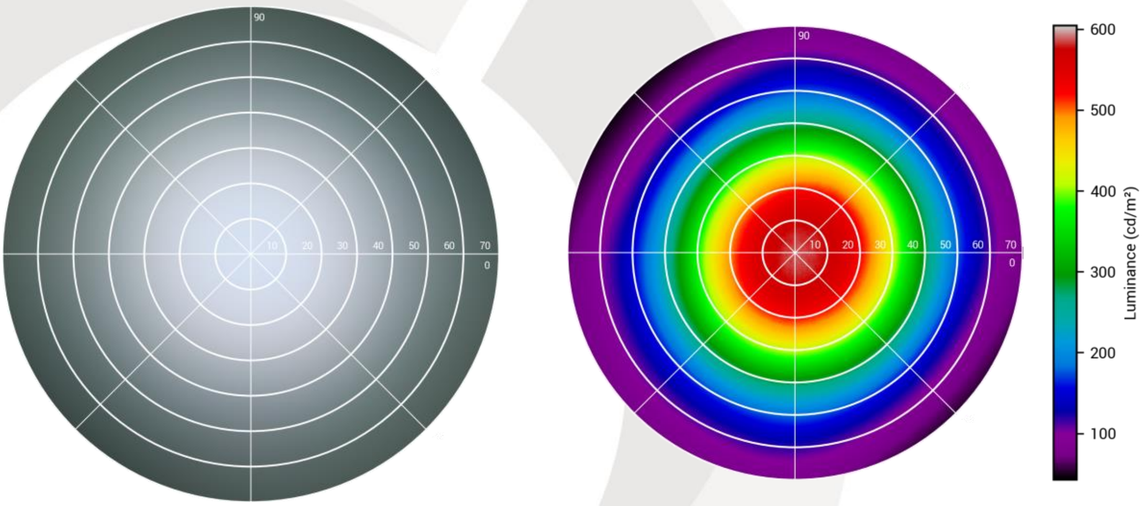


Figure 7 Luminance distribution of the white for different angle from 0° in the center to 70° on the edge. (True color on the left, false color on the right)

READABILITY

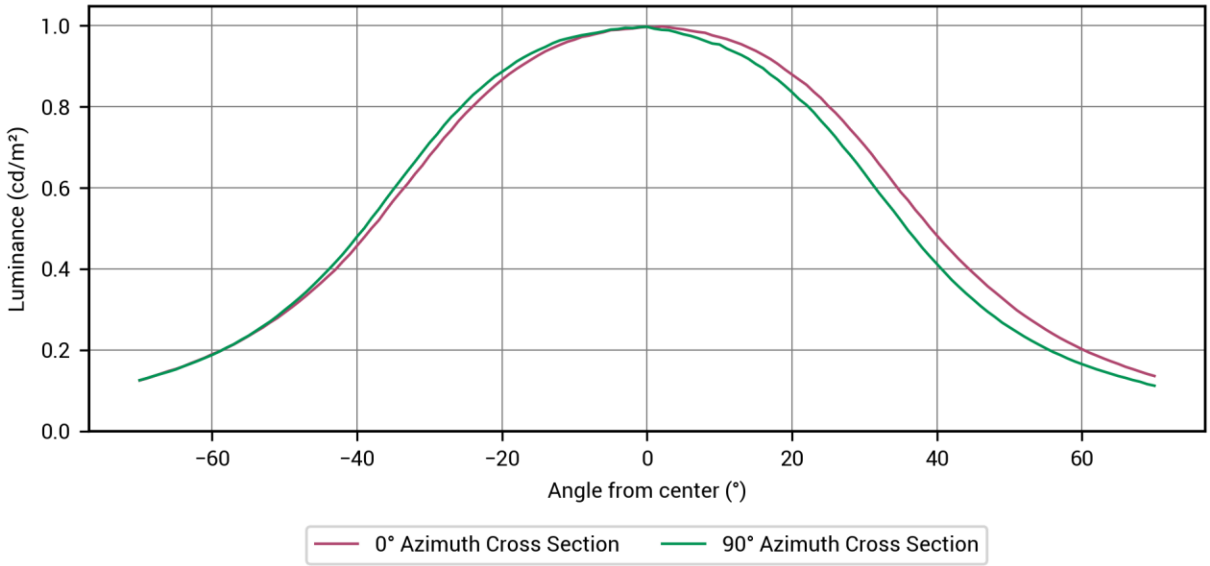


Figure 8 Luminance (cd/m²) cross section of the Luminance VS Angle map

3.7 Uniformity

Non-uniformities are mostly visible on dark content viewed in a dark environment (being the menu or the web in dark mode or dark pictures). Final users expect a very uniform display.

3.7.1 Scores

	Score
Overall	8

3.7.2 Objective Measurements

DXOMARK uses an imaging colorimeter to measure uniformity; measurements are carried out under 0 lux conditions (no ambient light).

Luminance uniformity (%) vs gray level in the dark

	Gray Level (%)	5	10	20	30	50	100
Luminance Uniformity (%)	0 lux	26%	48%	65%	71%	72%	70%

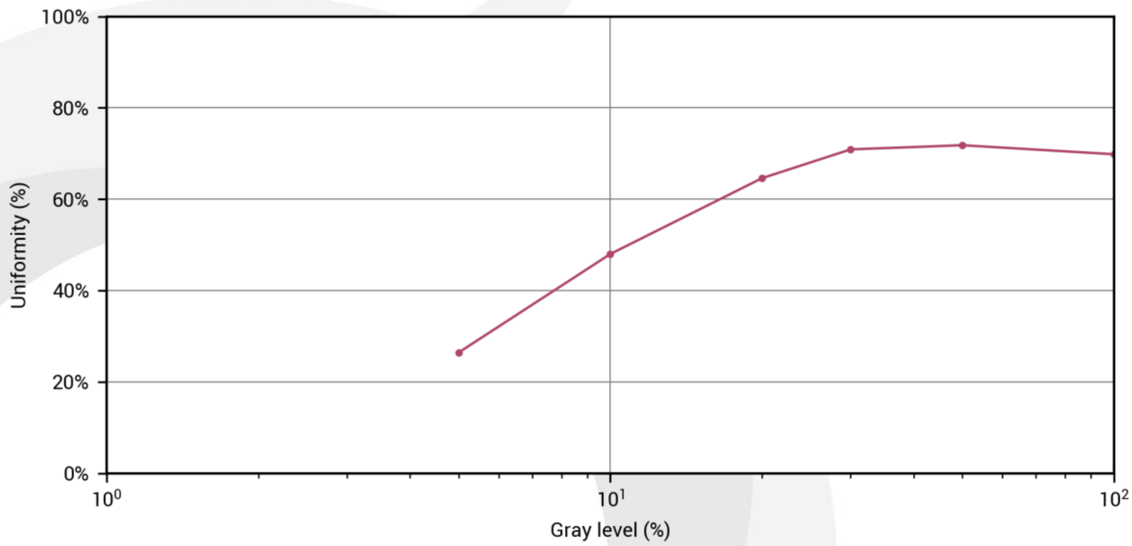


Figure 9 Luminance Uniformity (%) at different gray levels (%)

READABILITY

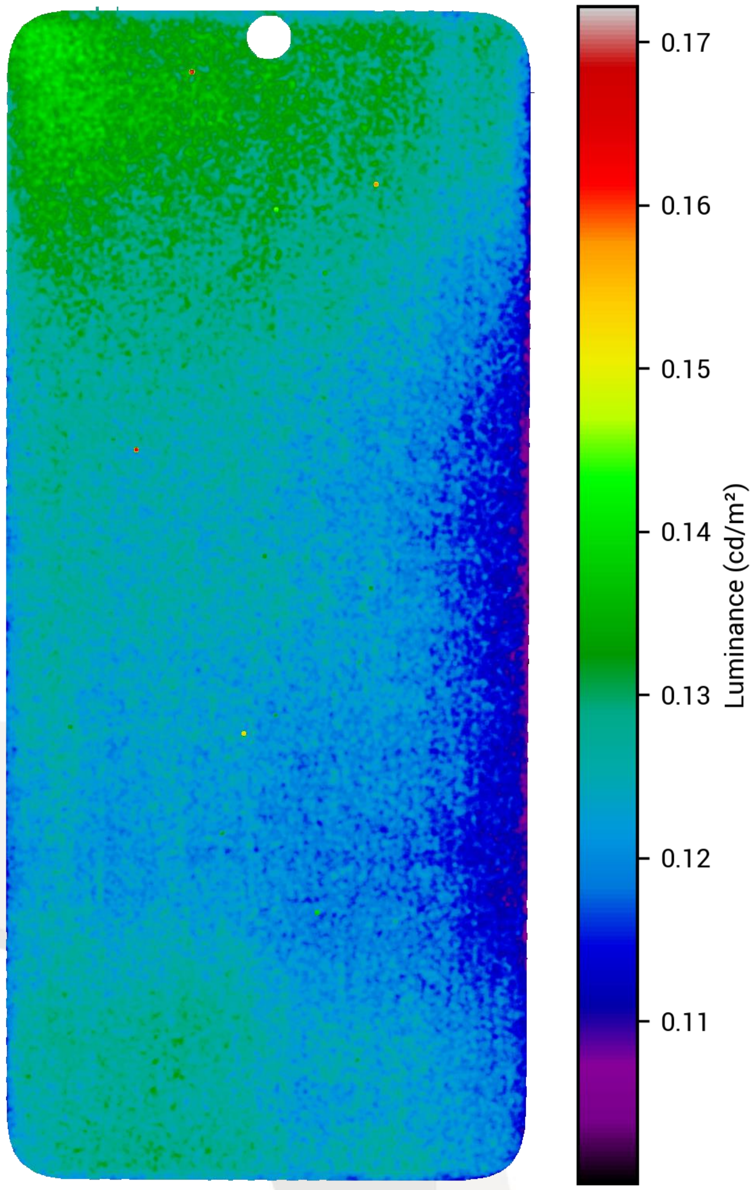


Figure 10 Luminance map in false color for 20% gray

3.8 Temporal Light Modulation

Every user has its own sensitivity to temporal light artefacts, to evaluate it DXOMARK uses a precisely-calibrated flicker meter. In the second graph, what is most important is the amplitude of the spikes and their associated frequency: the higher the frequency the less likely it is to be noticed, the higher the spike the more likely flicker is to be noticed.

3.8.1 Scores

f(x)	Score
Overall	8

3.8.2 Objective Measurements

Temporal Light Modulation metrics

Max Flicker Frequency (Hz)	239.0
Power Associated (dB)	4.1
Power at 60Hz (dB)	-43.2
Flicker Visibility Measurement	0.35
Temporal Light Artifact	9.64

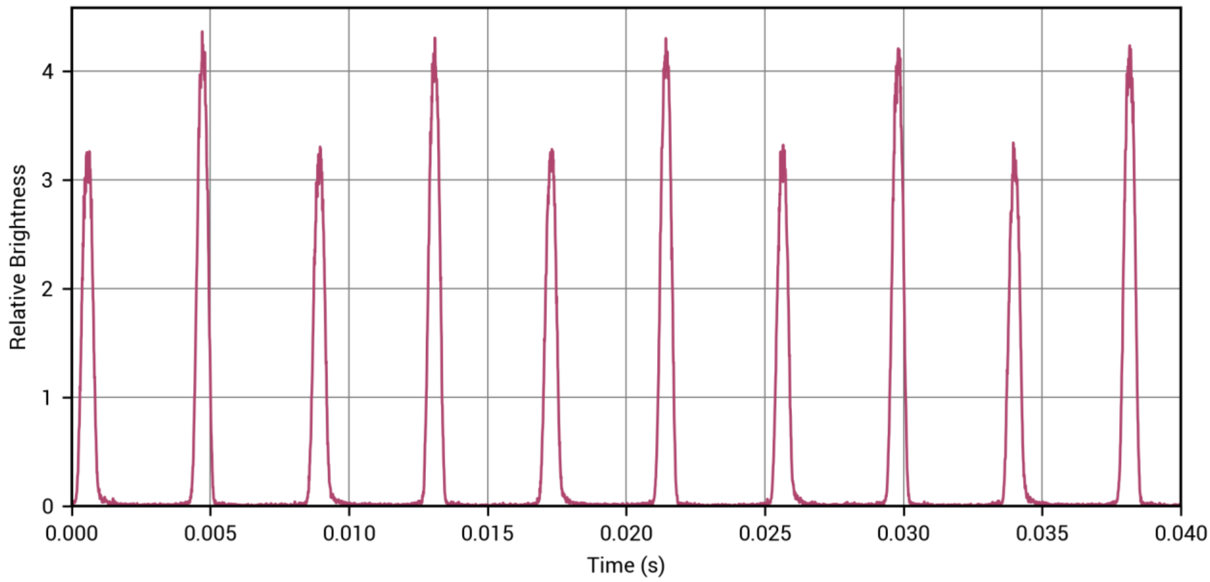


Figure 11 Temporal luminance measurement

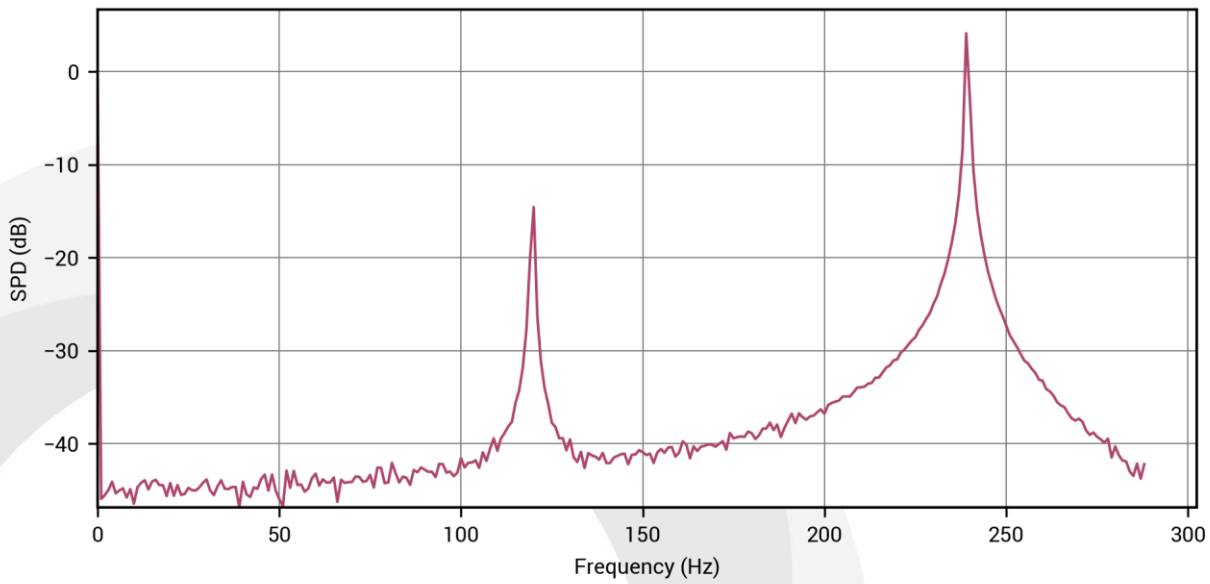


Figure 12 Frequential luminance measurement

3.9 Notch Disturbance

Many smartphones have a notch on the display where front cameras, speakers, microphones, and/or other features are located. How much room the notch takes up on the display is important, but so is its location in terms of how noticeable it is and how much it may cover important visual information, especially during gaming.

3.9.1 Scores

f(x)	Score
Overall	4

Screen-to-body ratio	91.4%

Figure 13 Full white screen illustrating the Screen to Body Ratio

4. Color

Another important display characteristic is its ability to faithfully reproduce color. Using the faithful color mode, a device should render any color the way they have been design in the numerical file. As with readability, ambient lighting conditions, angle, and reflectance all have an impact on color rendering.
In addition, an evaluation of the *Night Mode*, or the blue light filtering mode, is provided along with color uniformity performance.
Mainly using a spectroradiometer and an imaging colorimeter mounted in its specially designed Ambient Lighting Bench, DXOMARK measures color attributes under a variety of illuminants and light levels.

f(x)	Score
Global	143

f(x)	Score
Low Light	9
Indoor	9
Outdoor	7
Angle	9
Uniformity	9
Night Mode Impact	6

4.1 Color Rendering vs Ambient Lighting

These tests aim to characterize colors in terms of white point, coverage, accuracy and rendering.
The calculation of gamut coverage and color rendering are performed with a D65 white point adaptation of the measurements.
More precisely, it reveals how much of a color range a device covers within two common color spaces, Display-P3 and sRGB. The closer the reference gamut is matched, the more accurate the coverage is.
Additionally, the test assesses the color fidelity differences for a range of illuminants and irradiance.
The calculation of the color fidelity is performed with two different methods, the Δu'v' (CIE 1976) and the ΔE_{ITP} (ITU BT.2100).

4.1.1 Global Scores

	Score
Low Light	9
Indoor	9
Outdoor	7

4.1.2 Objective Measurement

4.1.2.1 Objective Scores

	Score
Low Light	9
Indoor	9
Outdoor	6

COLOR

4.1.2.2 Objective White Point

This measurement is the characterization of the white point of the device, using the faithful color mode, and whether the white point rendering changes depending on the ambient lighting.

Variation of the white point with ambient lighting

	None	A	Home	D65	
	0 lux	25 lux	250 lux	830 lux	20,000 lux
u'	0.1974	0.1981	0.1990	0.1995	0.1972
v'	0.4691	0.4679	0.4672	0.4658	0.4666
CCT (K)	6493	6525	6507	6551	6663

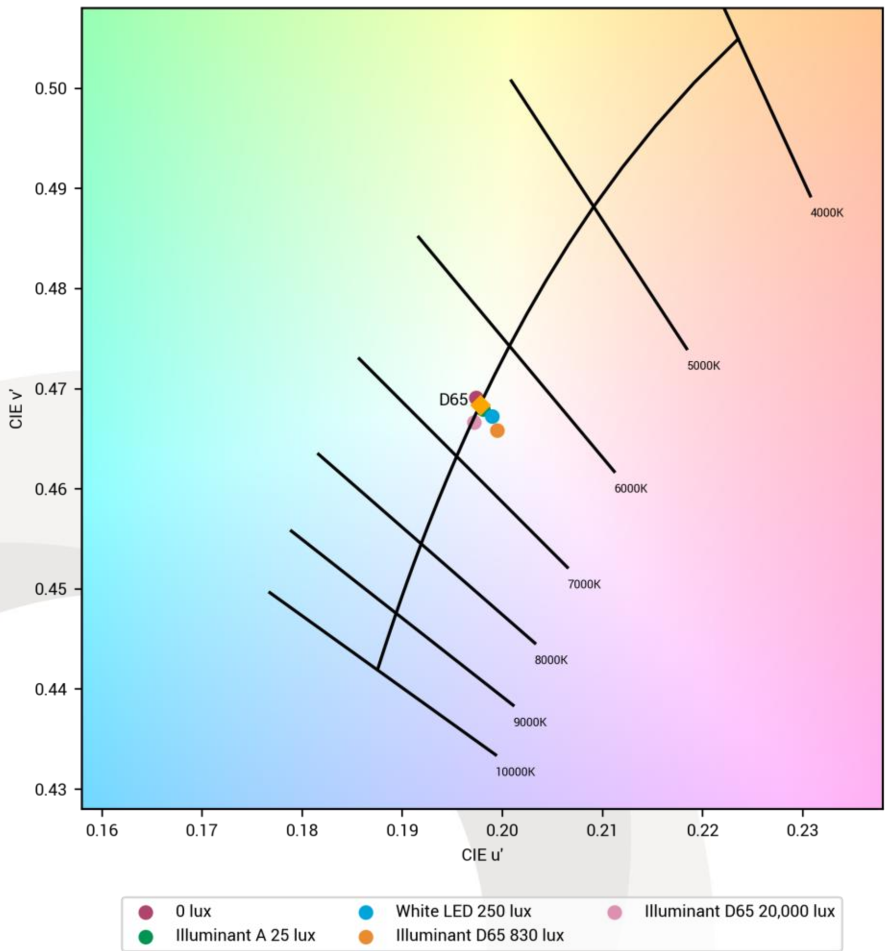


Figure 14 White Point under different lighting conditions

4.1.2.3 Objective Gamut Coverage

Gamut coverage performance

	None	A	Home	D65	
	0 lux	25 lux	250 lux	830 lux	20,000 lux
Display-P3 Gamut Coverage	99%	99%	99%	96%	77%
Display-P3 Gamut Coverage Exceedance	3%	3%	2%	0%	0%
sRGB Gamut Coverage	99%	99%	99%	96%	75%
sRGB Gamut Coverage Exceedance	5%	5%	5%	1%	0%

Display-P3 Gamut Coverage

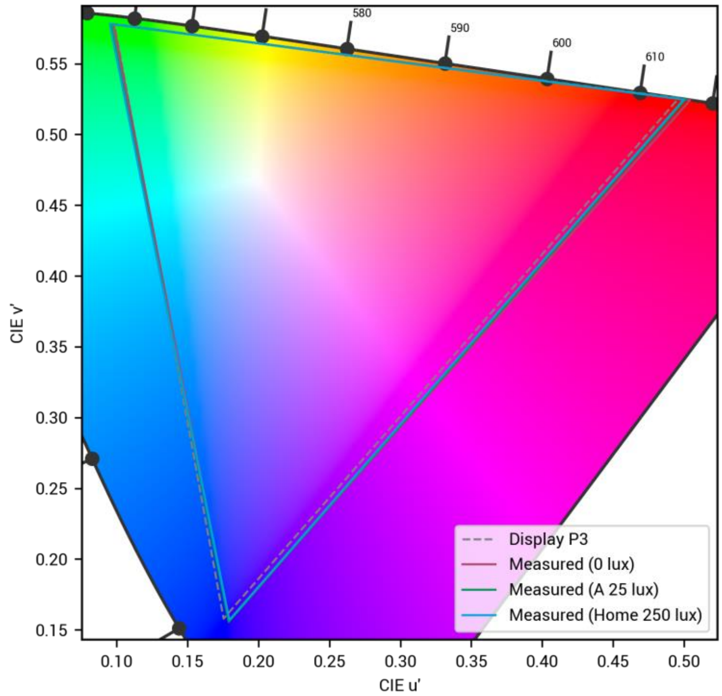


Figure 15 Gamut Coverage for Display-P3 content under 0 lux, 25 lux (A), 250 lux (Home)

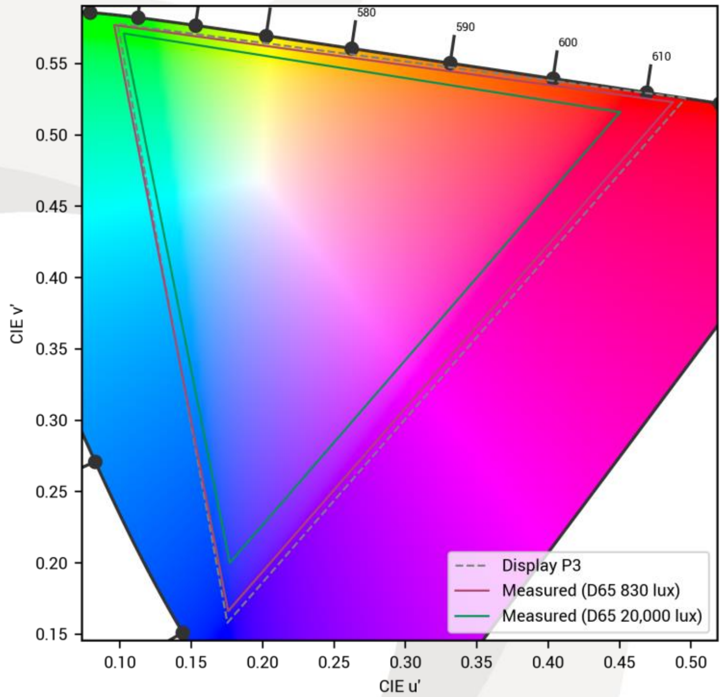


Figure 16 Gamut Coverage for Display-P3 content under 830 lux (D65) and 20 000 lux (D65)

sRGB Gamut Coverage

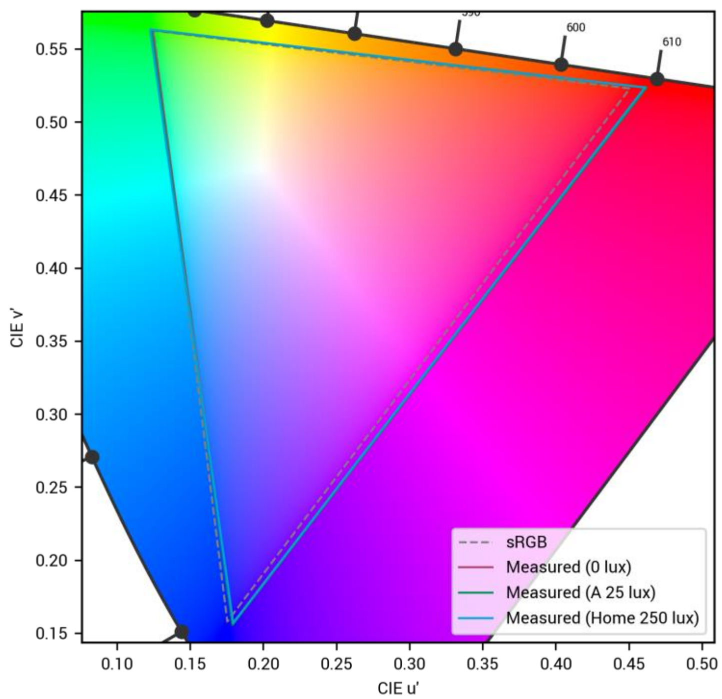


Figure 17 Gamut coverage for sRGB content under 0 lux, 25 lux (A) and 250 lux (Home)

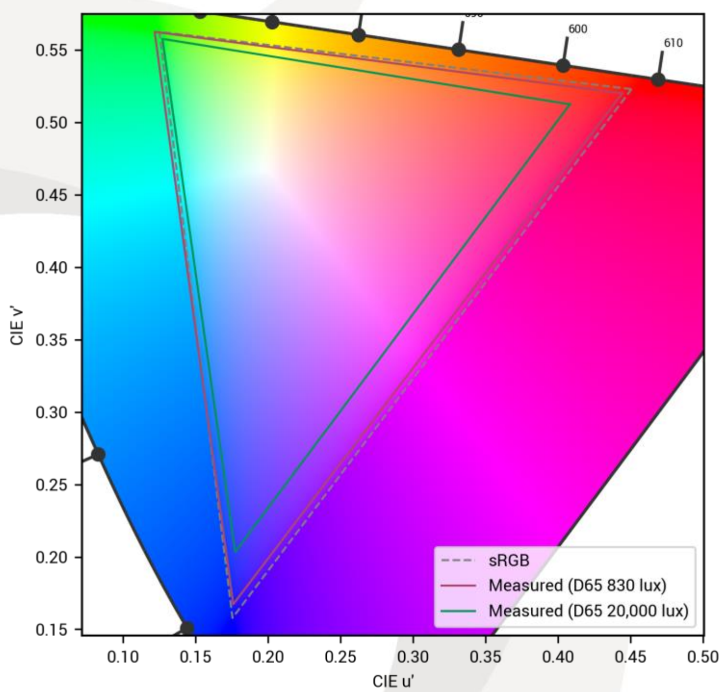


Figure 18 Gamut coverage for sRGB content under 850 lux (D65) and 20 000 lux (D65)

4.1.2.4 Objective Color Fidelity

Display-P3 Color fidelity calculated with Δu'v'

The value in the table (represented by the size of the arrow in the next graphs) is the distance to the color target. The smaller this value the better. Below 3 Δu'v' JND, the color difference is almost unnoticeable and below 1 Δu'v' JND, it is not.

$$1\ \text{JND} = 0{,}004\ \Delta u'v'$$

Color fidelity measurements for Display-P3 content in Δu'v' (Δu'v' JND)

			None	A	Home	D65	
RGB Value			0 lux	25 lux	250 lux	830 lux	20,000 lux
#1	255, 0, 0		2	1	1	2	12
#2	0, 255, 0		0	1	1	1	2
#3	0, 0, 255		1	1	1	2	11
#4	107, 66, 46		3	3	3	4	10
#5	81, 95, 46		1	1	1	2	5
#6	0, 124, 160		1	1	0	1	4
#7	136, 65, 175		1	2	2	1	7
#8	167, 183, 71		0	0	0	1	2
#9	190, 142, 123		0	0	0	0	2
#10	183, 144, 112		0	1	1	0	2
#11	134, 95, 66		1	2	2	2	5
#12	150, 90, 48		1	3	2	3	8
#13	30, 79, 158		2	2	2	2	9
#14	93, 160, 114		0	0	1	0	1
#15	118, 75, 144		1	2	1	1	6
#16	113, 118, 163		0	1	0	0	3
#17	183, 147, 127		0	0	0	0	1
#18	207, 213, 163		0	0	0	0	0

#19	177, 76, 138		1	2	2	1	5
#20	26, 40, 134		5	5	4	7	21
#21	235, 117, 31		0	1	1	1	5
#22	182, 74, 81		2	2	2	2	8

In the graphs below, the color target is located at the base of the arrow, while the measured color is set at the arrow tip.

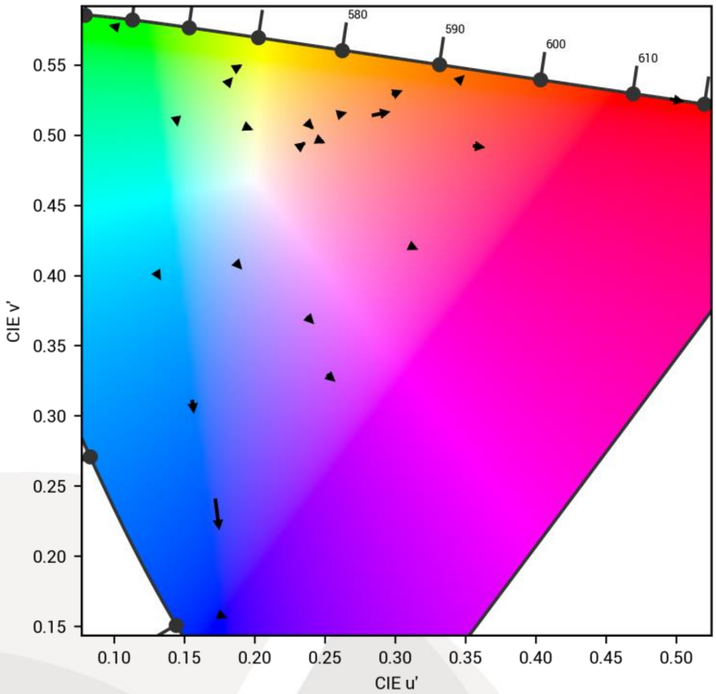


Figure 19 Color fidelity for Display-P3 content under 0 lux

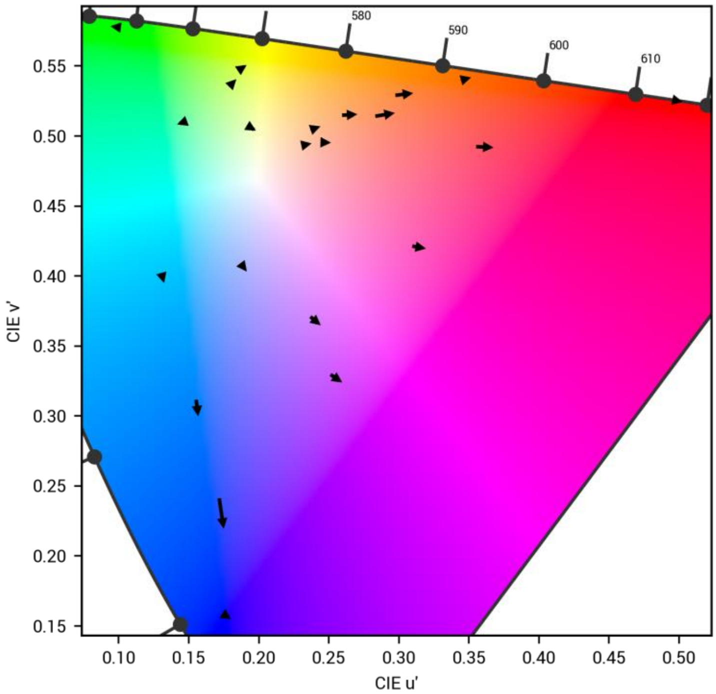


Figure 20 Color fidelity for Display-P3 content under 25 lux (A)

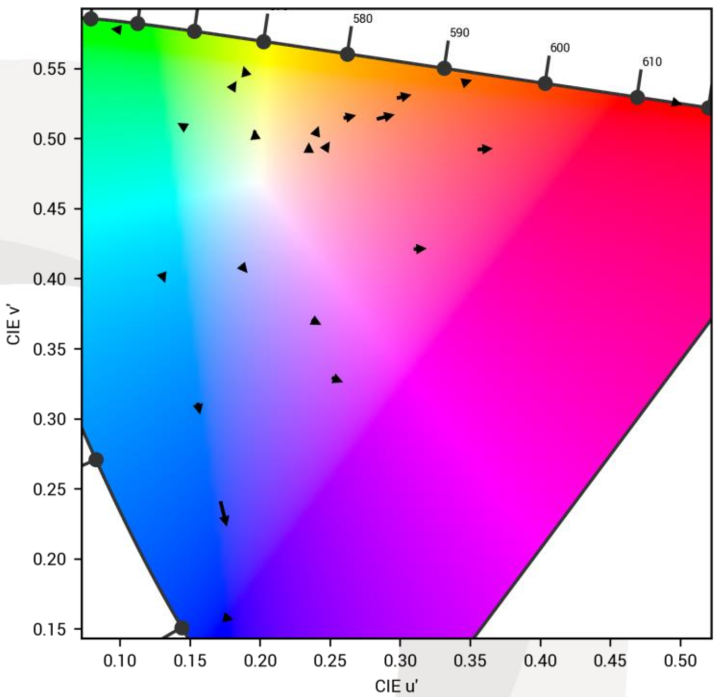


Figure 21 Color fidelity for Display-P3 content under 250 lux (Home)

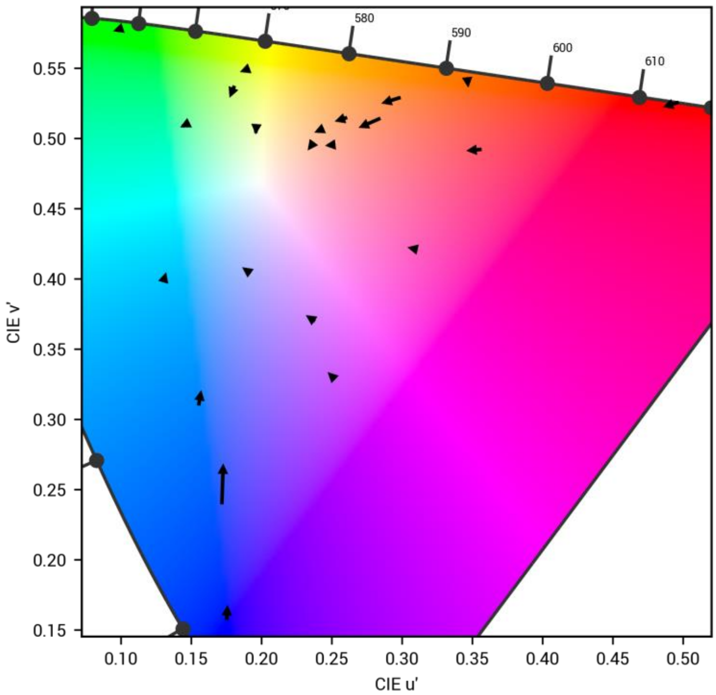


Figure 22 Color fidelity for Display-P3 content under 830 lux (D65)

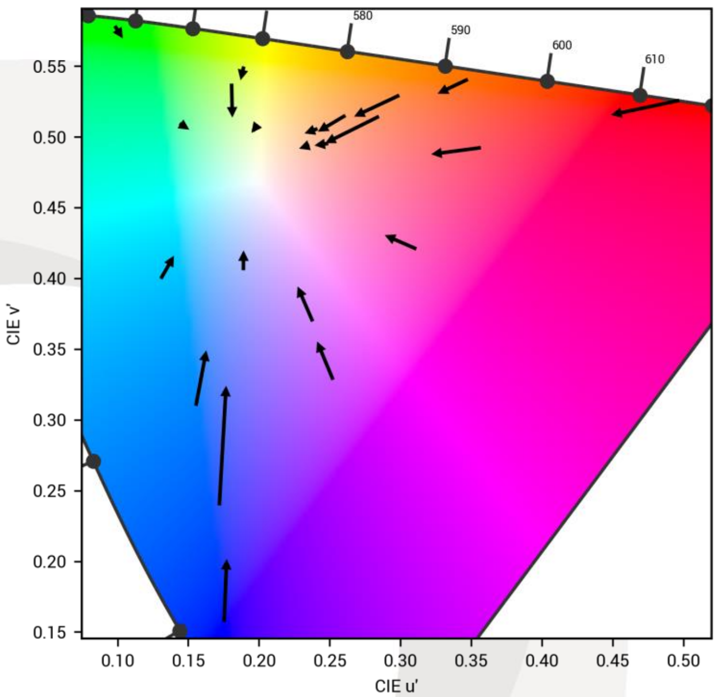


Figure 23 Color fidelity for Display-P3 content under 20 000 lux (D65)

COLOR

Color fidelity for Display-P3 content calculated with ΔE_{ITP}

The value in the following table is the distance to the color target, including the clarity difference. The smaller this value the better. The formula for this calculation is:

$\Delta E_{ITP} = 720 * \sqrt{\Delta I^2 + \Delta T^2 + \Delta P^2}$ with $I = I,\ T = 0.5 * C_T,\ P = C_P$ from the IC_TC_P standard

Color fidelity measurements for Display-P3 content in ΔE_{ITP} (JND)

			None	A	Home	D65	
	RGB Value		0 lux	25 lux	250 lux	830 lux	20,000 lux
#1	255, 0, 0		3	4	3	13	57
#2	0, 255, 0		0	2	3	4	18
#3	0, 0, 255		3	5	6	6	32
#4	107, 66, 46		3	7	7	10	34
#5	81, 95, 46		2	3	3	6	23
#6	0, 124, 160		1	1	1	2	14
#7	136, 65, 175		2	6	6	4	15
#8	167, 183, 71		1	1	2	3	13
#9	190, 142, 123		0	1	1	1	7
#10	183, 144, 112		0	2	2	1	7
#11	134, 95, 66		1	5	5	5	19
#12	150, 90, 48		2	7	6	9	32
#13	30, 79, 158		2	3	2	5	24
#14	93, 160, 114		1	1	2	1	5
#15	118, 75, 144		2	5	4	4	14
#16	113, 118, 163		1	1	1	1	6
#17	183, 147, 127		0	1	1	1	5
#18	207, 213, 163		1	0	0	0	1
#19	177, 76, 138		2	6	5	4	20

COLOR

#20	26, 40, 134		4	6	5	12	43
#21	235, 117, 31		2	3	4	5	31
#22	182, 74, 81		3	7	6	6	27

Color fidelity for sRGB content calculated with Δu'v'

Color fidelity measurements for sRGB content in Δu'v' (Δu'v' JND)

		None	A	Home	D65	
	RGB Value	0 lux	25 lux	250 lux	830 lux	20,000 lux
#1	255, 0, 0	3	3	3	2	11
#2	0, 255, 0	0	0	1	1	1
#3	0, 0, 255	1	1	1	2	11
#4	113, 63, 42	3	3	3	3	10
#5	77, 96, 38	1	1	1	2	5
#6	0, 127, 164	0	1	0	0	3
#7	146, 60, 182	1	2	2	1	7
#8	163, 184, 44	0	0	0	1	2
#9	199, 139, 119	0	0	0	0	2
#10	190, 142, 106	0	1	1	0	2
#11	141, 60, 182	1	2	2	2	5
#12	160, 87, 37,	1	2	2	2	8
#13	0, 81, 164	1	2	1	2	10
#14	67, 162, 109	0	0	1	1	2
#15	125, 73, 149	1	2	2	1	6
#16	112, 118, 167	0	1	0	1	2
#17	190, 145, 124	0	0	1	0	2
#18	206, 214, 157	0	0	0	0	0
#19	191, 67, 140	1	2	2	1	6
#20	26, 42, 139	5	5	4	6	20
#21	252, 108, 0	1	1	1	1	5
#22	197, 65, 78	1	2	2	2	8

COLOR

In the graphs below, the color target is located at the base of the arrow, while the measured color is set at the arrow tip.

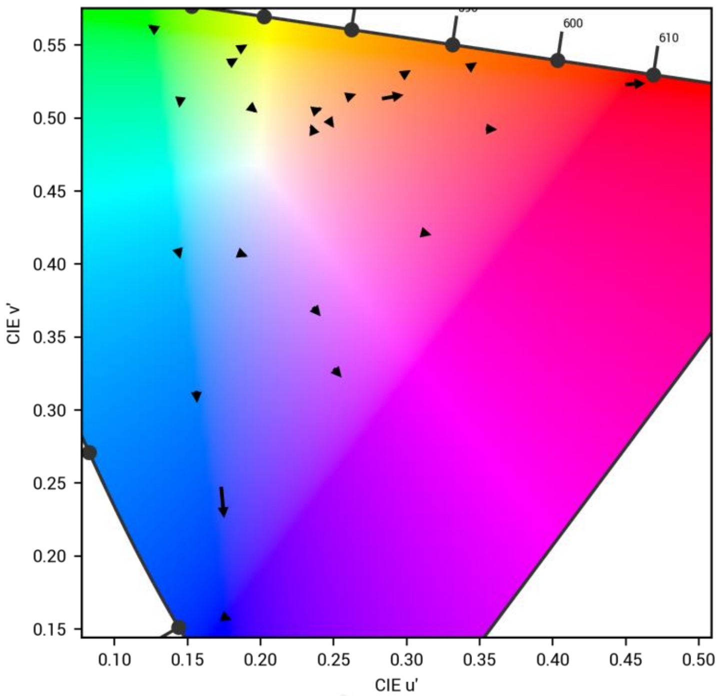


Figure 24 Color fidelity for sRGB content under 0 lux

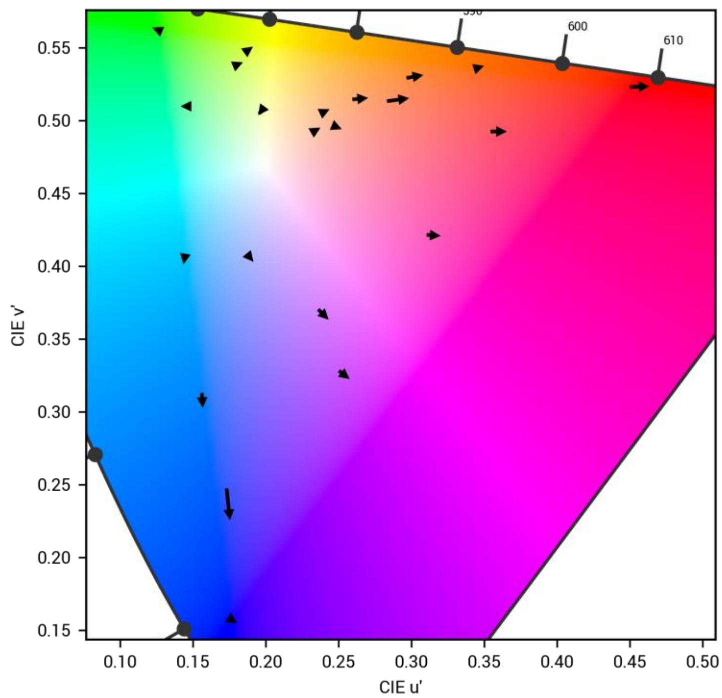
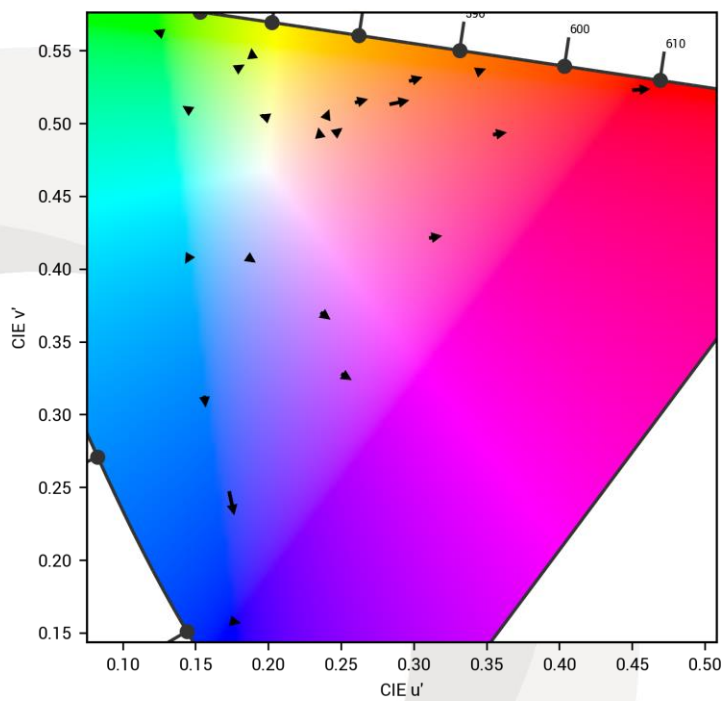


Figure 25 Color fidelity for sRGB content under 25 lux (A)



S

Figure 26 Color fidelity for sRGB content under 250 lux (Home)

COLOR

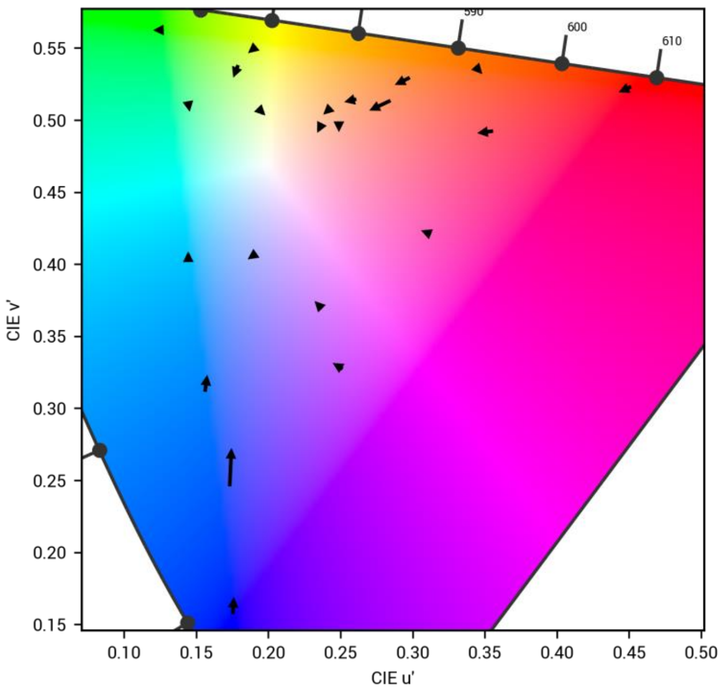


Figure 27 Color fidelity for sRGB content under 830 lux (D65)

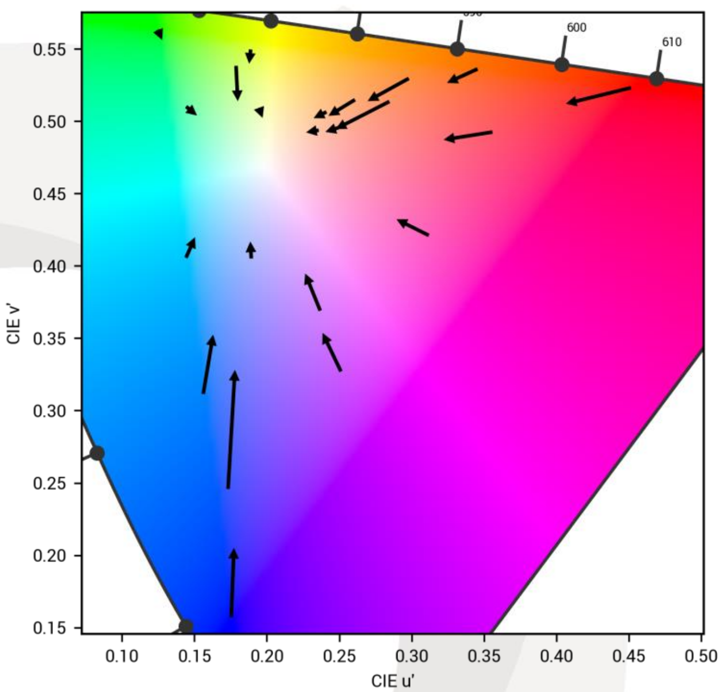


Figure 28 Color fidelity for sRGB content under 20 000 lux (D65)

COLOR

Color fidelity for sRGB content calculated with ΔE_{ITP}

Color fidelity measurements for sRGB content in ΔE_{ITP} (JND)

			None	A	Home	D65	
	RGB Value		0 lux	25 lux	250 lux	830 lux	20,000 lux
#1	255, 0, 0		5	8	8	8	44
#2	0, 255, 0		0	1	2	3	10
#3	0, 0, 255		3	5	6	7	34
#4	113, 63, 42		4	7	7	9	34
#5	77, 96, 38		2	3	3	6	24
#6	0, 127, 164		0	2	1	0	10
#7	146, 60, 182		2	5	5	5	16
#8	163, 184, 44		1	2	2	3	13
#9	199, 139, 119		0	1	1	2	7
#10	190, 142, 106		0	2	2	1	7
#11	141, 60, 182		2	5	5	4	18
#12	160, 87, 37,		2	6	6	8	31
#13	0, 81, 164		1	3	2	5	24
#14	67, 162, 109		0	1	2	2	6
#15	125, 73, 149		2	5	4	3	14
#16	112, 118, 167		0	1	1	2	5
#17	190, 145, 124		0	1	2	1	6
#18	206, 214, 157		0	0	1	1	1
#19	191, 67, 140		2	6	5	3	21
#20	26, 42, 139		4	6	5	10	41
#21	252, 108, 0		2	4	4	5	27
#22	197, 65, 78		2	6	5	6	26

4.1.3 Perceptual Scores (Color rendering vs Ambient Lighting)

	Score
Low Light	9
Indoor	10
Outdoor	10

OBSERVATION

Perceptual color comment

4.2 Color vs Angle

Display colors tend to shift with angle, in this section we evaluate the difference between the on-axis color and the color seen at an angle. DXOMARK uses a conoscopic lens mounted on an imaging colorimeter to perform these measurements.

4.2.1 Scores

f(x)	Score
Overall	9

4.2.2 Objective Measurements

All measurements in this section are done on patterns using sRGB color gamut.
In the following graphs the inner circle represents 1 Δu'v' JND, all measurements inside this area are faithfully reproduced. The outer circle represents 3 Δu'v' JND, only professional eyes can distinguish colors within its perimeter. The further away the dots are from the center of the circles, the greater and more noticeable the color shift.

RGB (255, 255, 255) vs Angle calculated with Δu'v'

Δu'v' difference expressed in Just Noticeable Color Difference (Δu'v' JND) along the given azimuth sections

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	1	1	1	0	1	1	2
Azimuth section: 90°	2	1	1	0	1	2	2
Azimuth section: 45°	2	1	1	0	1	2	2
Azimuth section: -45°	2	1	0	0	1	1	2

COLOR

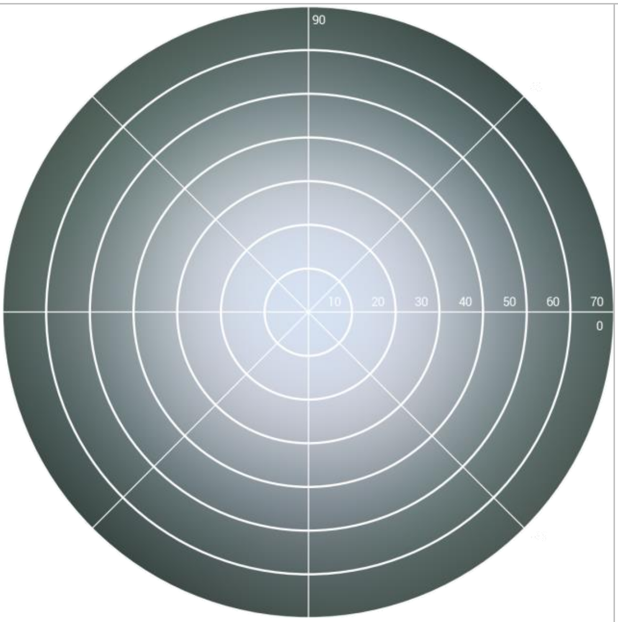


Figure 29 RGB (255, 255, 255) distribution in angle from 0° in the center to 70° on the edge.

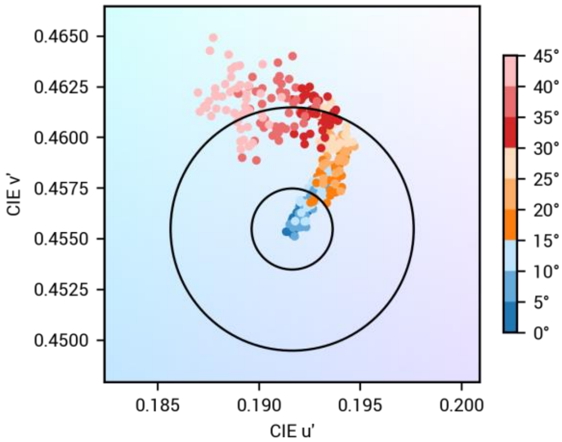


Figure 30 RGB (255, 255, 255) color shift at an angle (0 to 45°)

RGB (99, 159, 227) vs Angle calculated with Δu'v'

Δu'v' difference expressed in Just Noticeable Color Difference (Δu'v' JND) along the given azimuth sections

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	3	3	1	0	1	3	4
Azimuth section: 90°	3	2	1	0	2	4	4
Azimuth section: 45°	4	3	1	0	1	3	4
Azimuth section: -45°	3	2	1	0	1	3	4

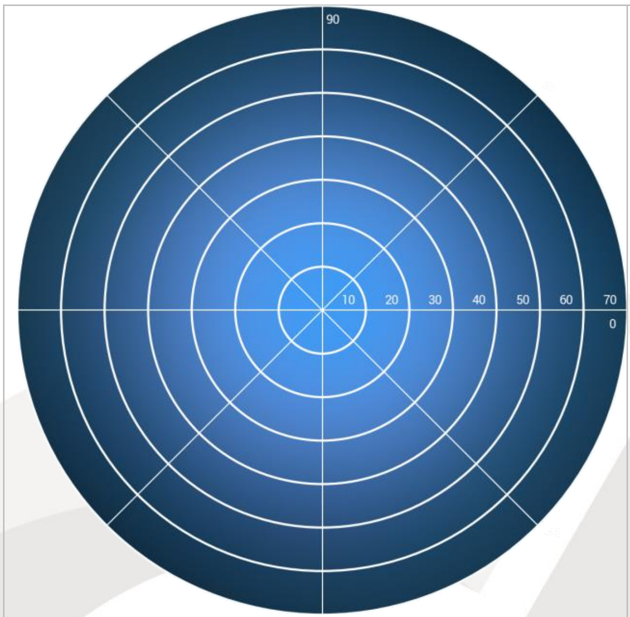


Figure 31 RGB (99, 159, 227) distribution in angle from 0° in the center to 70° on the edge

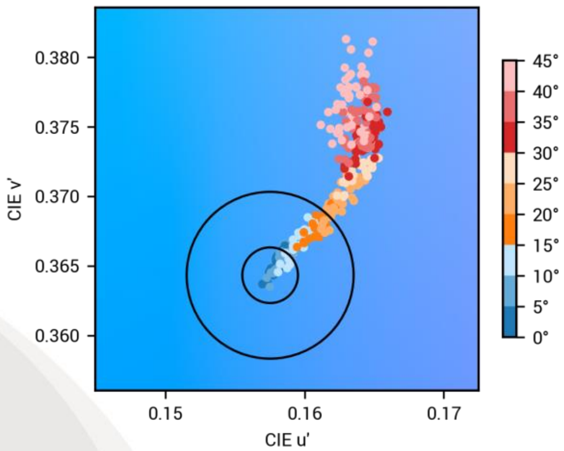


Figure 32 RGB (99, 159, 227) color shift at an angle (0 to 45°)

RGB (175, 213, 226) vs Angle calculated with Δu'v'

Δu'v' difference expressed in Just Noticeable Color Difference (Δu'v' JND) along the given azimuth sections

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	1	1	1	0	1	2	2
Azimuth section: 90°	2	1	1	0	1	2	2
Azimuth section: 45°	2	2	1	0	1	2	3
Azimuth section: -45°	2	1	0	0	1	2	2

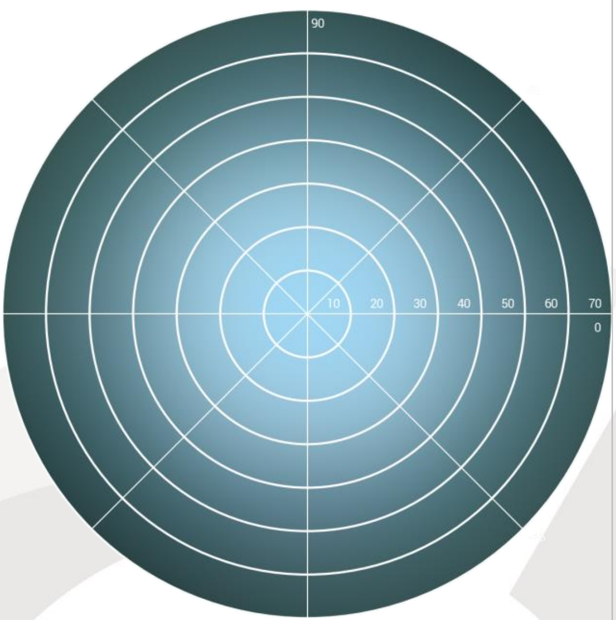


Figure 33 RGB (175, 213, 226) distribution in angle from 0° in the center to 70° on the edge

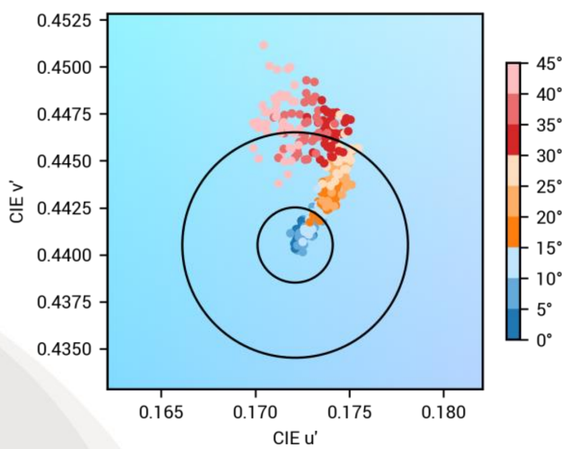


Figure 34 RGB (175, 213, 226) color shift at an angle (0 to 45°)

RGB (2, 96, 46) vs Angle calculated with Δu’v’

Δu’v’ difference expressed in Just Noticeable Color Difference (Δu’v’ JND) along the given azimuth sections

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	3	2	1	0	0	2	3
Azimuth section: 90°	2	2	1	0	1	2	3
Azimuth section: 45°	3	2	1	0	1	2	3
Azimuth section: -45°	3	2	1	0	1	2	3

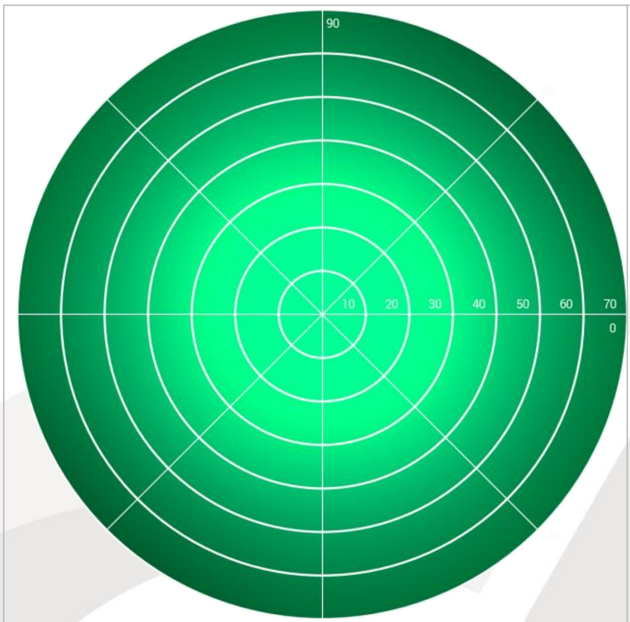


Figure 35 RGB (2, 96, 46) distribution in angle from 0° in the center to 70° on the edge

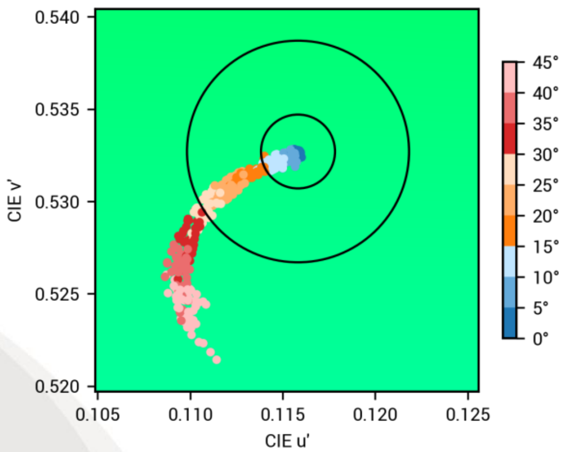


Figure 36 RGB (2, 96, 46) color shift at an angle (0 to 45°)

RGB (174, 111, 78) vs Angle calculated with Δu’v’

Δu’v’ difference expressed in Just Noticeable Color Difference (Δu’v’ JND) along the given azimuth sections

	-45	-30	-15	0	15	30	45
Azimuth section: 0°	3	1	0	0	0	1	4
Azimuth section: 90°	3	1	0	0	0	1	3
Azimuth section: 45°	4	1	0	0	0	1	4
Azimuth section: -45°	4	1	0	0	0	1	4

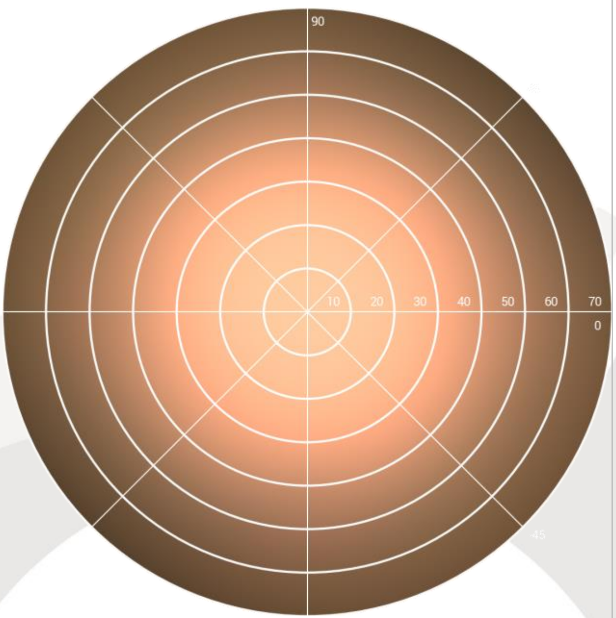


Figure 37 RGB (174, 111, 78) distribution in angle from 0° in the center to 70° on the edge

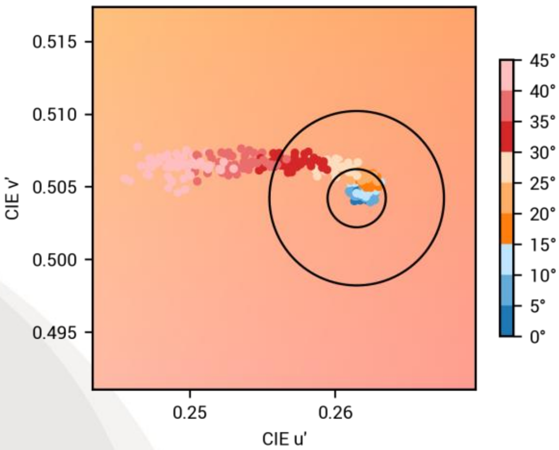


Figure 38 RGB (174, 111, 78) color shift at an angle (0 to 45°)

4.3 Color Uniformity

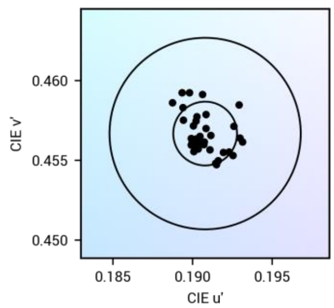
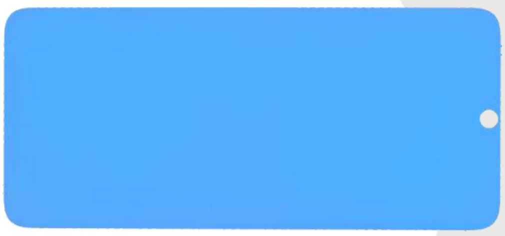
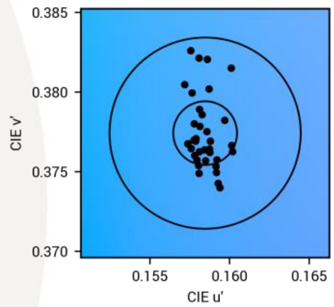
This section evaluates the color uniformity of different shades of gray ranging from a 100% white to a 10% gray, plus 4 generic colorful solid area fills, representing different possible backgrounds. The evaluation is made on the whole display surface.

4.3.1 Scores

f(x)	Score
Overall	9

4.3.2 Objective Measurements

All measurements in this section are done on patterns using sRGB color gamut. DXOMARK uses an imaging colorimeter mounted within the Display Bench to perform these measurements.
The inner circle represents 1 Δu'v' JND, all measurements inside this area match the average color of the display. The outer circle represents 3 Δu'v' JND, only professional eyes can distinguish colors within its perimeter. The further away the dots are from the center of the circles, the greater and more noticeable the color difference.

RGB VALUE	True Colors Pictures	Distribution of the Non Uniformity
255, 255, 255		
99, 159, 227		

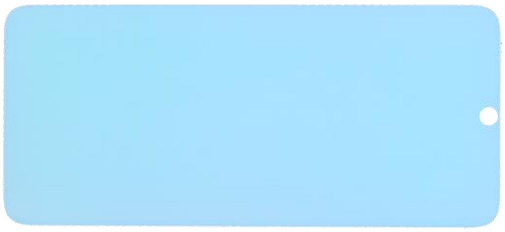
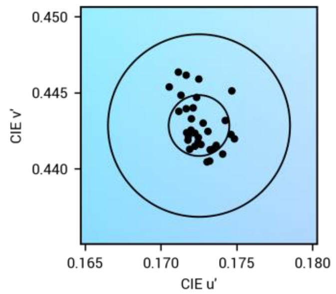
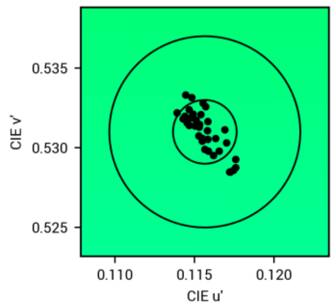
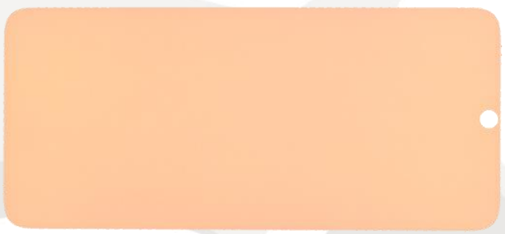
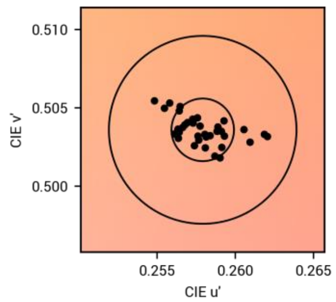
175, 213, 226		
2, 96, 46		
174, 111, 78		

Figure 39 Color uniformity of different pattern

COLOR

Maximum color deviation (Δu’v’ JND) vs color (RGB value)

	RGB Value		Max Color Deviation (Δu’v’ JND)
#1	255, 255, 255		1
#2	128, 128, 128		2
#3	77, 77, 77		2
#4	51, 51, 51		2
#5	26, 26, 26		5
#6	99, 159, 227		2
#7	175, 213, 226		2
#8	2, 96, 46		1
#9	174, 111, 78		2

4.4 Night Mode Impact

Night modes are provided to reduce the impact of blue light on our circadian rhythm, users widely use it in the evening. It usually induces a white point shift. DXOMARK evaluates the efficiency of blue light filtering using the default settings of the *Night Mode*, while ensuring that the color gamut is stable.

4.4.1 Scores

f(x)	Score
Overall	6

4.4.2 Objective Measurements

Calculated Circadian Action Factor (CAF) with and without the Night Mode under 0 lux

	Circadian Action Factor
Night Mode Off	0.989
Night Mode On	0.701

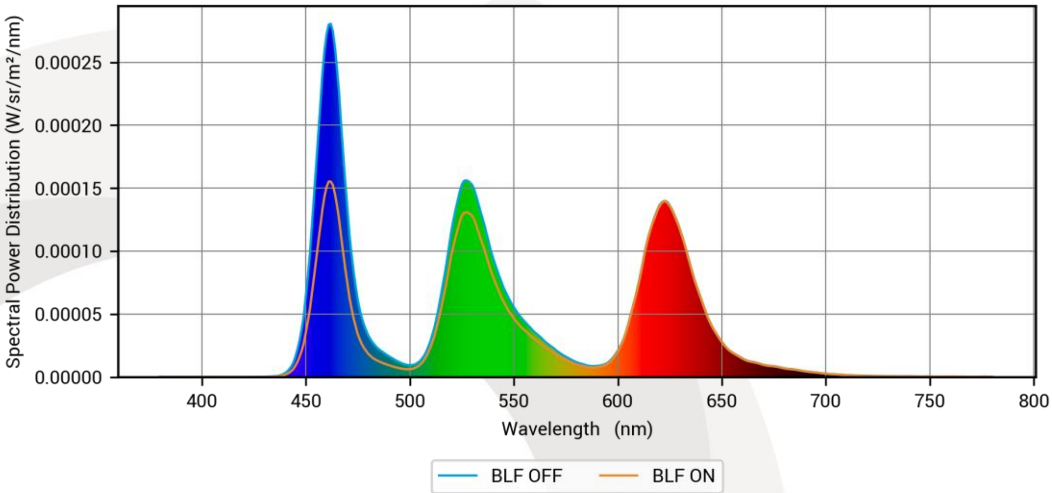


Figure 40 Spectrum with BLF On and Off

COLOR

Gamut coverage of Display-P3 content with and without the Night Mode under 0 lux

	Night Mode Off	Night Mode On
Display-P3 Gamut Coverage	100%	100%
Display-P3 Gamut Coverage Exceedance	13%	15%

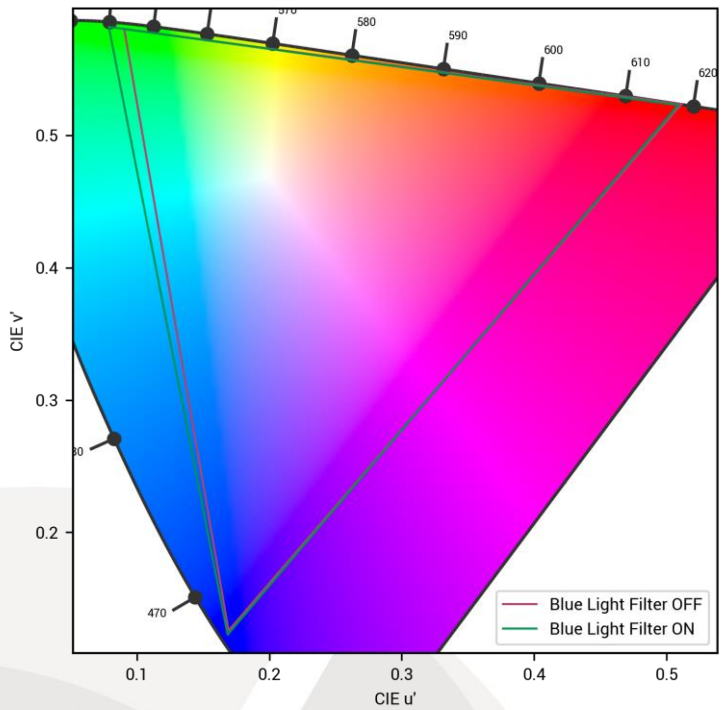


Figure 41 Gamut coverage with night mode on and off

COLOR

Variation of the white point with and without the Night Mode

	Night Mode Off	Night Mode On
u’	0.1915	0.2062
v’	0.4561	0.4882
CCT (K)	7903	5145

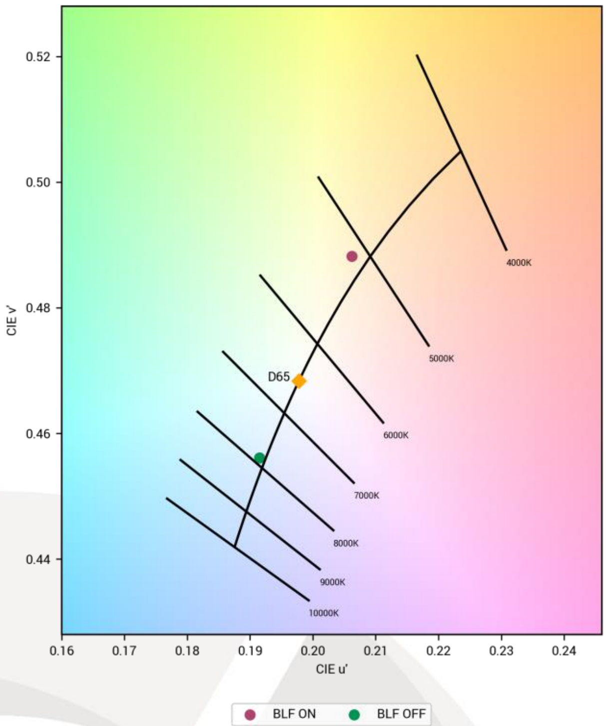


Figure 42 White point with night mode on and off

5. Video

As with content displayed using the device's default gallery app, how easily an end-user can see video content is of paramount importance. DXOMARK uses the device's default video app for processing dynamic content when evaluating how bright a display is, and how faithfully it reproduces the contents under a variety of lighting conditions that range from nighttime to bright indoor environments.
DXOMARK uses a spectroradiometer mounted within the Display Bench to perform these measurements.
DXOMARK also uses a Sony BVM-HX310 professional monitor as a reference to compare the rendering of the details and color compared with the artistic intent of the videos.

f(x)	Score
Global	121

f(x)	Score
Low Light HDR10 Content	7
Indoor HDR10 Content	6
Low Light SDR Content	7
Indoor SDR Content	9
Video Artifacts	9

5.1 Luminance

The smartphone luminance needs to be adapted to the surrounding environment when watching videos, while it also need to provide enough luminance to render HDR content. The measurements of this section are the luminance values of the white (supposedly the peak luminance) with different APL (Average Pixel Level). The gray 50% is also considered for HDR10 content as its luminance describes better the average luminance of HDR10 content.

5.1.1 Scores

f(x)	Score
Low Light HDR10	2
Indoor HDR10	2
Low Light SDR	6
Indoor SDR	10

5.1.2 Objective Measurements

Luminance (cd/m²) Vs APL (%) measurements at 0 lux

	APL (%)	5	10	20	30	40	50	60	70	80	90	100
Luminance (cd/m²)	HDR10	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
	SDR	6.9	6.9	6.8	6.8	6.8	6.8	6.9	6.8	6.8	6.8	6.8

Luminance (cd/m²) VS APL measurements at 830 lux (D65)

	APL (%)	5	10	20	30	40	50	60	70	80	90	100
Luminance (cd/m²)	HDR10	287	286	285	284	283	282	281	281	281	281	281
	SDR	289	289	288	287	286	285	284	283	283	283	283

Luminance (cd/m²) of SDR and HDR10 content under 0 lux and 830 lux (D65)

	0 lux	830 lux (D65)
HDR10 Peak Luminance (cd/m²)	6.8	286.2
HDR10 Gray 50% Luminance (cd/m²)	0.7	32.9
SDR Peak Luminance (cd/m²)	6.9	291.2

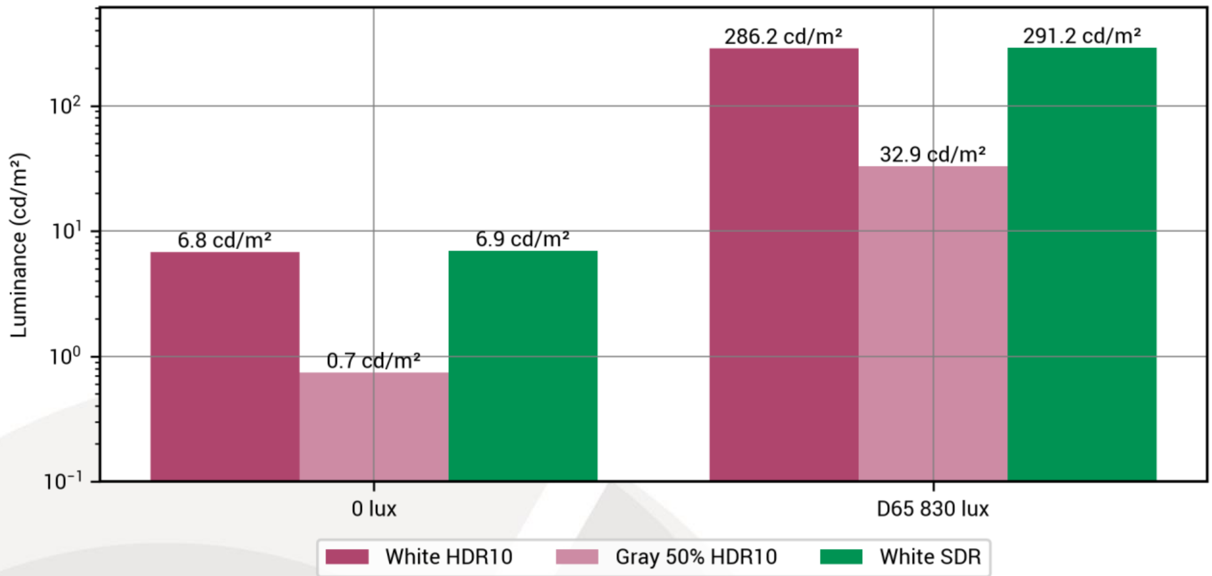


Figure 43 Video content luminance (cd/m²) under 0 lux and 830 lux (D65) (Window size fixed at 10%)

5.1.3 Perceptual Scores (Brightness)

	Score
Low Light HDR10 Content	10
Indoor HDR10 Content	9
Low Light SDR Content	6
Indoor SDR Content	10

OBSERVATION

Perceptual video comment

5.2 Video Electro Optical Transfer Function (EOTF)

The EOTF is the relationship between the numerical value of a pixel in an image file and its luminance when viewed on a screen. This element is important to provide a good video rendering and to preserve the content's artistic intent, assuming artists are working on monitor calibrated to PQ for HDR10 content and to 2.2 or 2.4 gamma for SDR content.

5.2.1 Objective Scores

f(x)	Score
Low Light HDR10 Content	6
Indoor HDR10 Content	5
Low Light SDR Content	8
Indoor SDR Content	7

5.2.2 Objective Measurements

HDR10 EOTF

Luminance (cd/m²) vs gray level (window size fixed at 10%) for HDR10 content under 0 lux and 830 lux (D65)

	White	
Signal Value (0-1023)	0 lux	830 lux (D65)
12	0.00	1.20
21	0.00	1.20
37	0.00	1.20
67	0.00	1.23
121	0.00	1.37
182	0.01	1.69
246	0.03	2.64
308	0.07	4.53
371	0.17	8.63

433	0.35	15.62
495	0.64	28.45
512	0.74	32.87
558	1.18	51.62
620	2.12	91.64
682	3.52	150.79
744	4.82	204.10
793	5.85	246.36
872	6.47	271.96
952	6.77	285.92
1023	6.78	286.22

From these EOTFs measurements, it is possible to convert each luminance delta between consecutive measurements to JND. This calculation is done using the Barten model, with the parameters used for the definition of the PQ curve.
This conversion is then used to evaluate the EOTF on several points, namely the clipping point, the local contrast variations, and the difference from a perceptually uniform (constant JND levels) EOTF. It is possible to find more information about this calculation in the Annex section 8.1.

VIDEO

JND vs gray level (window size fixed at 10%) for HDR10 content under 0 lux and 830 lux (D65)

	White	
Signal Value (0-1023)	0 lux	830 lux (D65)
12	0.2	0.0
21	0.1	0.0
37	0.2	0.1
67	0.4	0.4
121	0.5	0.7
182	0.7	1.6
246	1.0	2.1
308	1.3	2.8
371	1.4	2.8
433	1.5	3.1
495	1.5	2.8
512	1.8	3.3
558	2.0	3.3
620	1.9	2.9
682	1.3	1.8
744	1.0	1.4
793	0.3	0.5
872	Clipped	Clipped
952	Clipped	Clipped
1023	Clipped	Clipped
Average On Unclipped Area	1.1	1.9

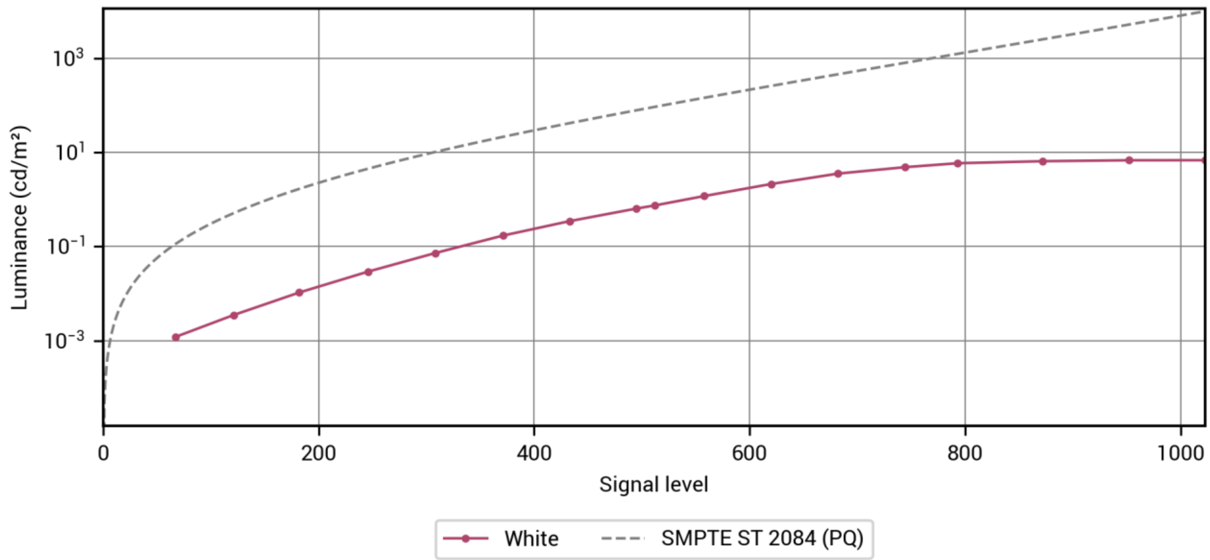


Figure 44 HDR10 content EOTF under 0 lux

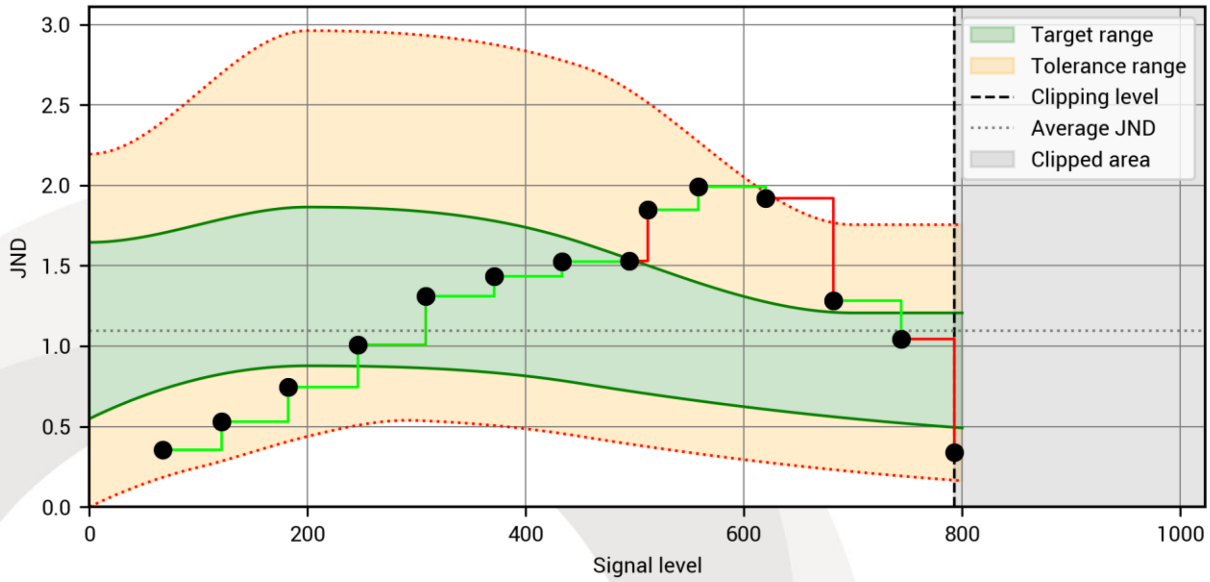


Figure 45 HDR10 content EOTF JND curve under 0 lux

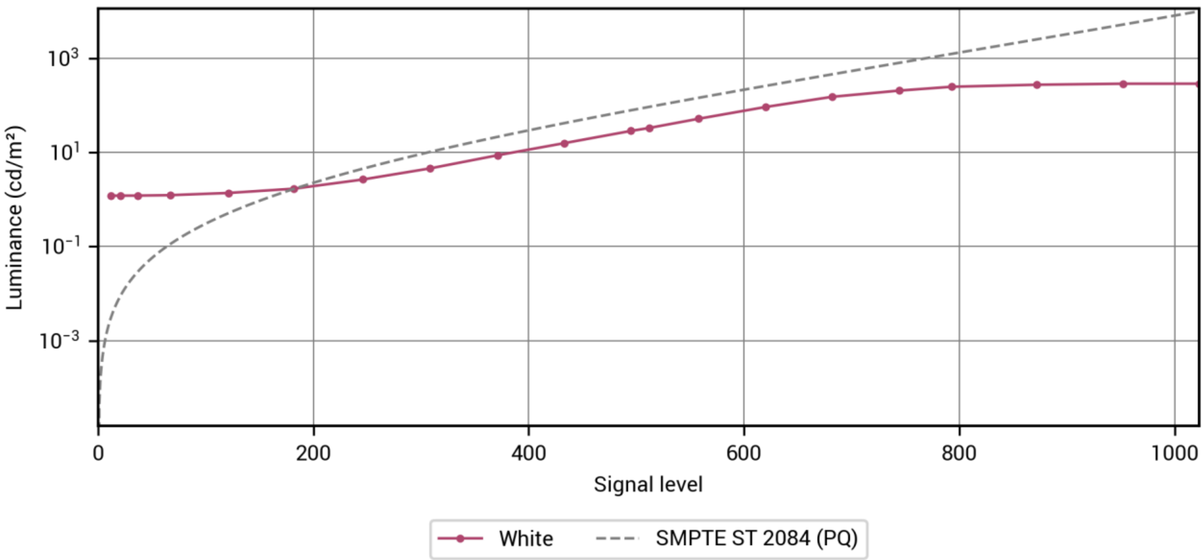


Figure 46 HDR10 content EOTF under 830 (D65)

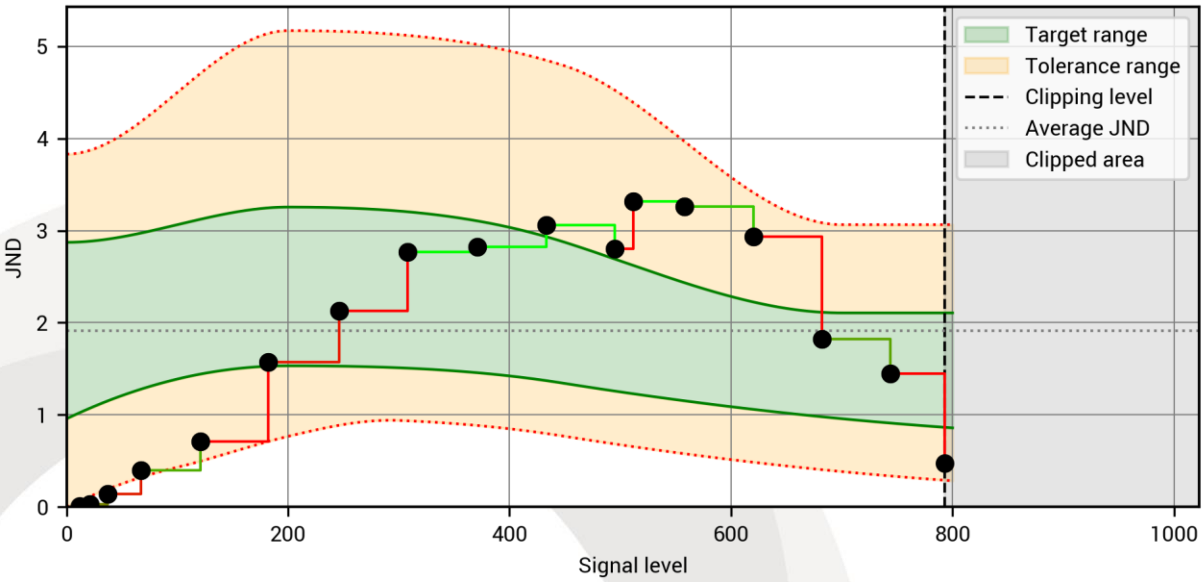


Figure 47 HDR10 content EOTF JND curve under 830 lux (D65)

Luminance (cd/m²) vs color signal value (%) (window size fixed at 10%) for HDR10 content under 0 lux and 830 lux (D65)

	Signal Value (%)	5	10	20	30	40	50	60	70	80	90	100
0 lux	Red	0.00	0.00	0.01	0.03	0.10	0.26	0.69	1.21	1.43	1.43	1.43
	Green	0.00	0.00	0.01	0.03	0.11	0.29	0.71	1.70	3.22	4.50	4.50
	Blue	0.00	0.00	0.00	0.01	0.03	0.09	0.24	0.47	0.60	0.60	0.60
830 lux (D65)	Red	1.20	1.26	1.58	2.38	5.12	12.18	30.73	52.64	61.43	61.52	61.54
	Green	1.21	1.26	1.58	2.67	5.88	13.40	31.59	73.42	137.34	190.70	190.85
	Blue	1.20	1.21	1.33	1.72	2.65	5.19	11.94	21.20	26.63	26.66	26.66

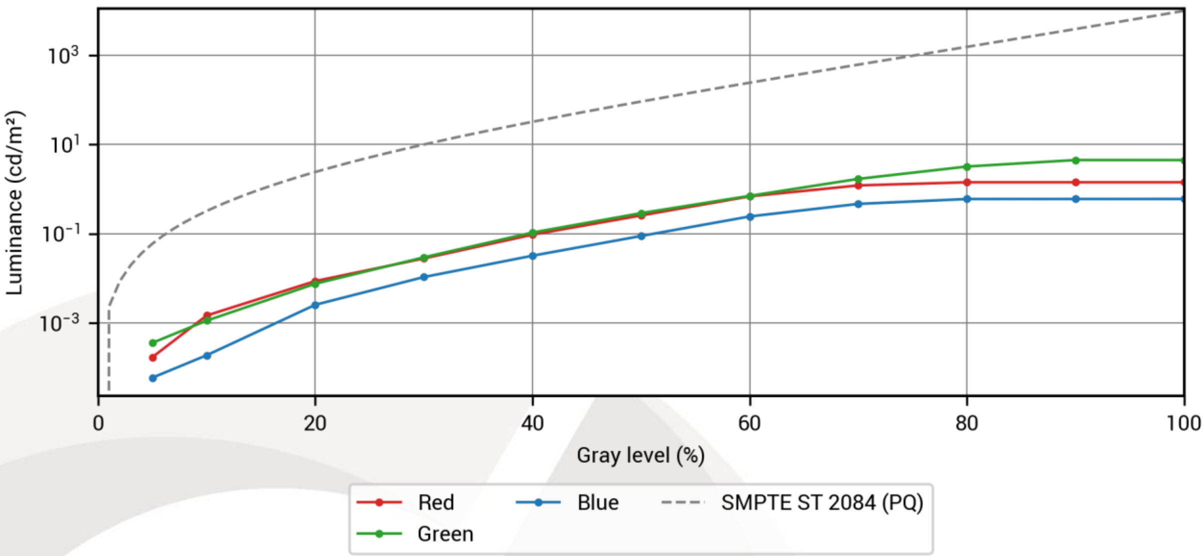


Figure 48 HDR10 content RGB EOTF under 0 lux

VIDEO

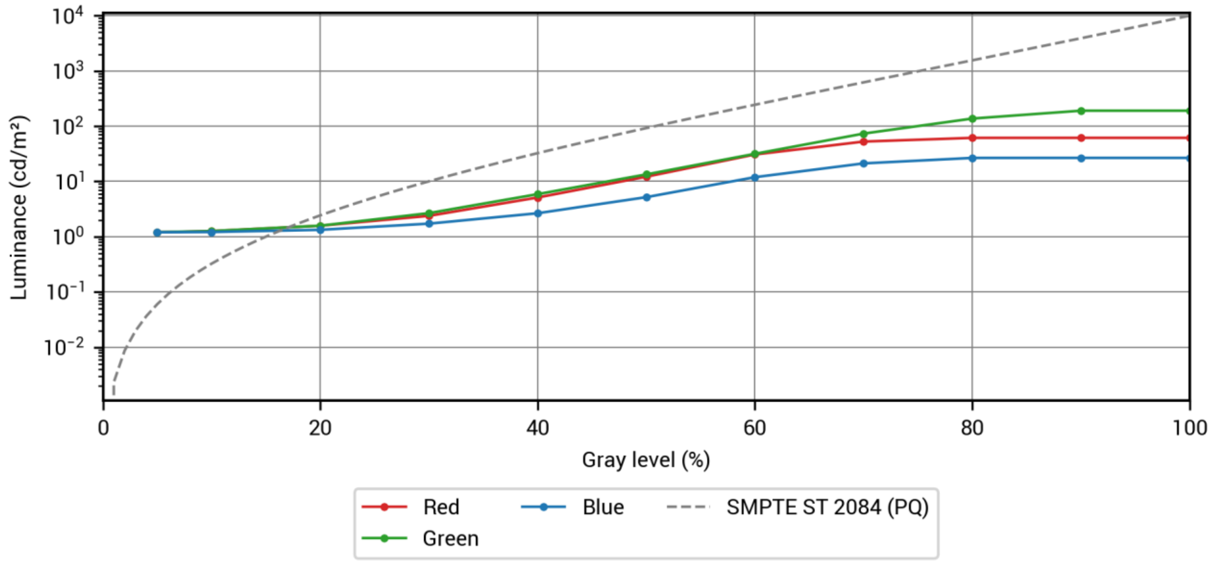


Figure 49 HDR10 content RGB EOTF under 830 lux (D65)

SDR EOTF

The EOTF (for Electro Optical Transfer Function) is the relationship between the numerical value of a pixel in an image file and its luminance when viewed on a screen. This element is very important to preserve the artistic intent of the content. Target is a 2.2 to 2.4 gamma for SDR videos.

Luminance (cd/m²) vs gray level (window size fixed at 10%) for SDR content

	White	
Signal Value (0-255)	0 lux	830 lux (D65)
3	0.00	1.20
4	0.00	1.20
6	0.00	1.21
8	0.00	1.28
13	0.01	1.48
18	0.01	1.85
26	0.03	2.81
38	0.09	5.58
51	0.17	9.10
77	0.46	20.79
102	0.88	38.32
128	1.44	62.07
153	2.15	92.03
179	3.10	131.97
204	4.16	175.17
230	5.52	231.04
255	6.93	291.19

VIDEO

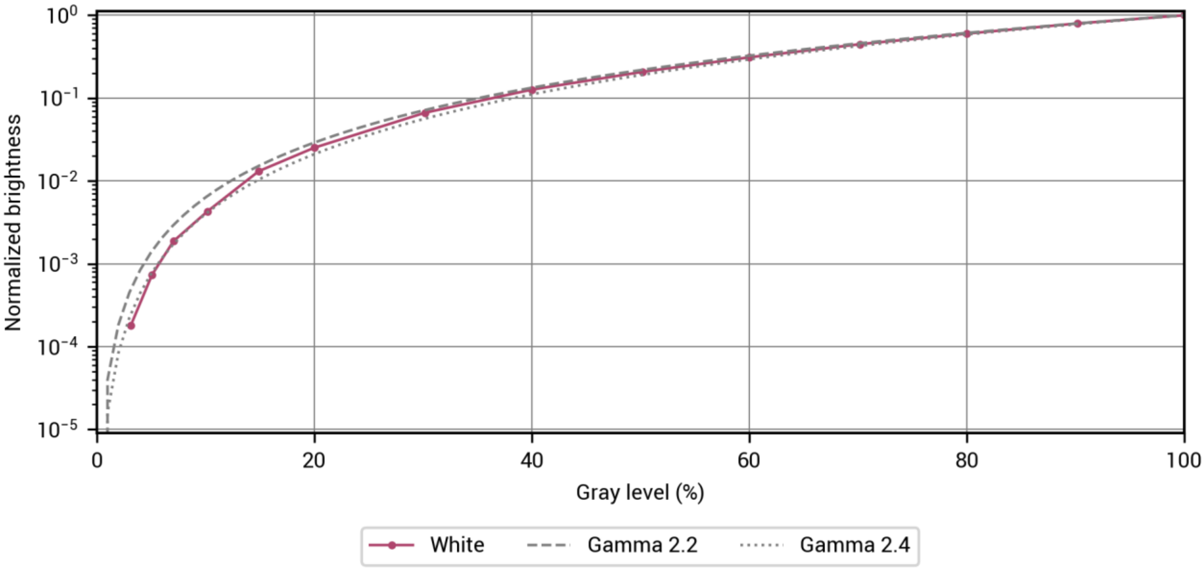


Figure 50 SDR content EOTF under 0 lux

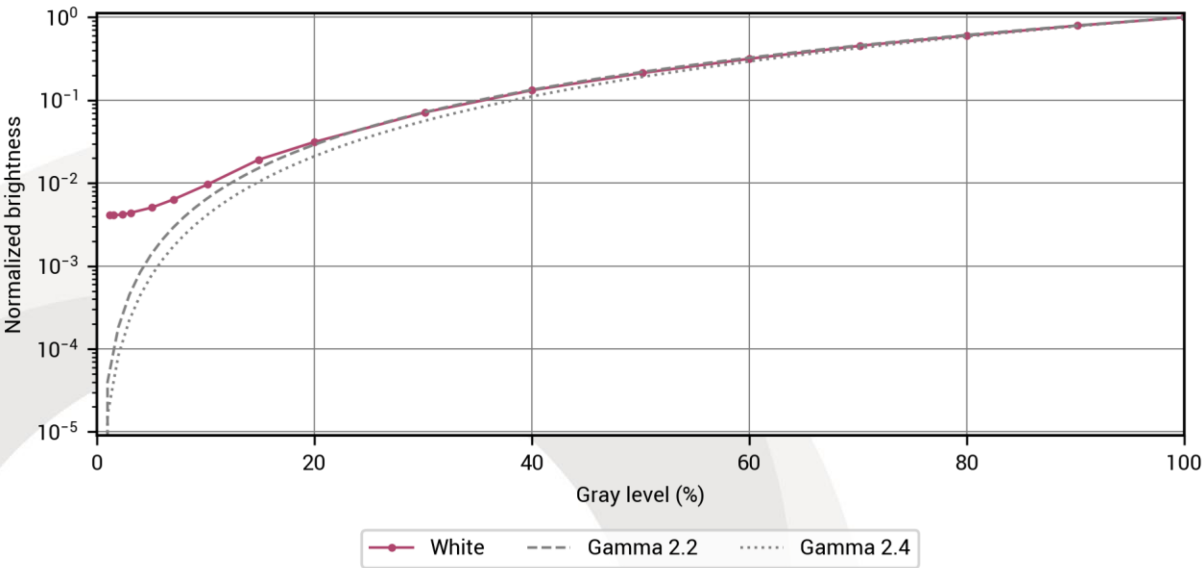


Figure 51 SDR content EOTF under 830 lux (D65)

Luminance (cd/m²) vs color signal value (%) (window size fixed at 10%) for SDR content under 0 lux and 830 lux (D65)

	Signal Value (%)	5	10	20	30	40	50	60	70	80	90	100
0 lux	Red	0.00	0.01	0.04	0.10	0.20	0.35	0.53	0.75	1.03	1.38	1.47
	Green	0.00	0.02	0.08	0.21	0.41	0.69	1.05	1.46	2.00	2.61	3.32
	Blue	0.00	0.00	0.01	0.04	0.07	0.12	0.17	0.25	0.33	0.45	0.53
830 lux (D65)	Red	1.25	1.52	2.97	5.54	9.87	15.87	23.51	32.92	44.57	59.25	62.62
	Green	1.32	1.99	4.73	10.11	18.70	30.70	45.30	62.72	85.41	111.33	140.59
	Blue	1.22	1.30	1.79	2.80	4.22	6.29	8.83	12.05	15.68	20.44	23.60

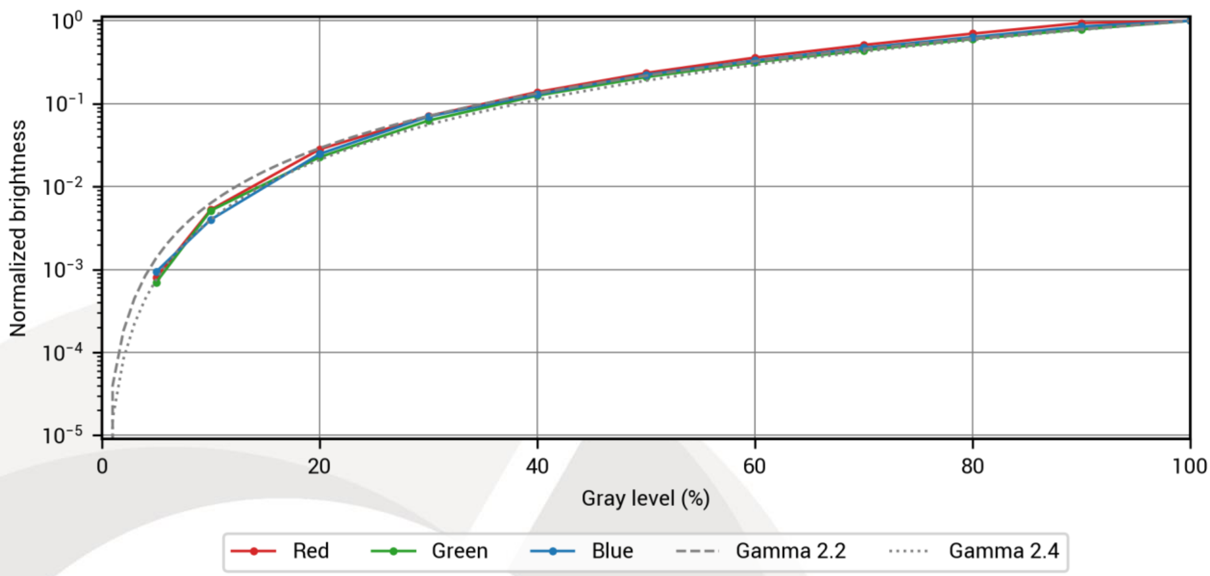


Figure 52 SDR content RGB EOTFs under 0 lux

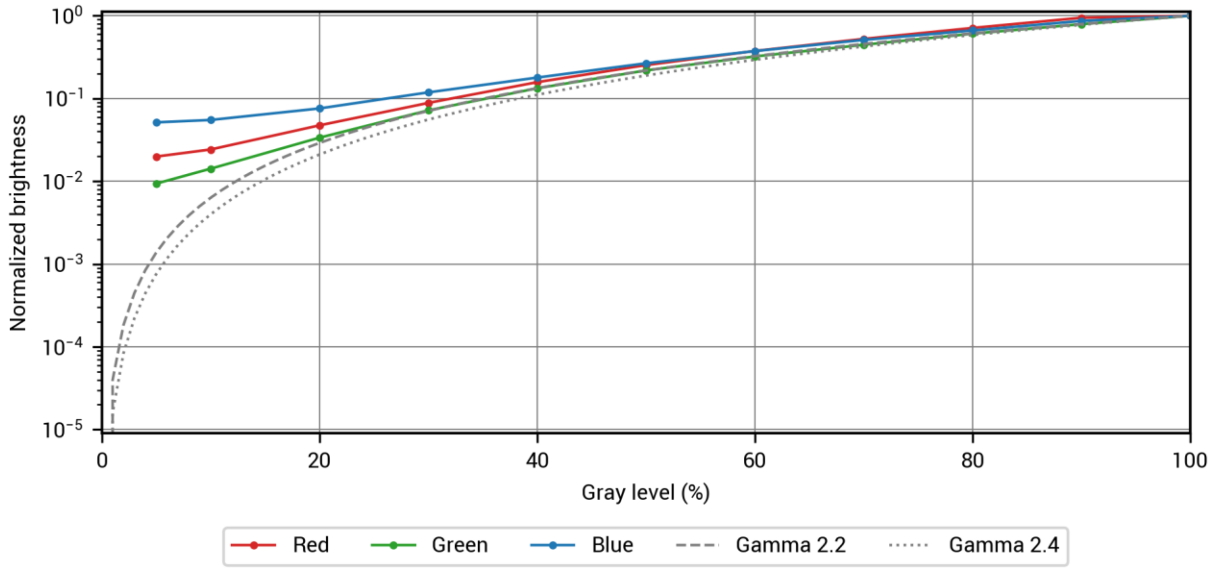


Figure 53 SDR content RGB EOTFs under 830 lux (D65)

5.2.3 Details Rendering Perceptual Scores

	Scores
Low Light HDR10 Content	10
Indoor HDR10 Content	7

5.3 Color

Those tests aim to characterize colors in terms of coverage. More precisely, it reveals how much of a color range a device covers within the standards SDR and HDR10. For SDR the target gamut to cover is Rec.709 gamut. For HDR10 content, the minimum gamut to cover is DCI-P3 and the target is REC 2020 to show the artistic intent. Color rendering is also evaluated perceptually in comparison to the Sony BVM-HX310 professional mastering monitor.

5.3.1 Scores

f(x)	Score
Low Light HDR10 Content	10
Indoor HDR10 Content	10
Low Light SDR Content	8
Indoor SDR Content	10

5.3.2 Objective measurements

Gamut coverage of various color spaces for HDR10 under 0 lux and 830 lux (D65)

	0 lux	830 lux (D65)
DCI-P3 Gamut Coverage	98%	96%
DCI P3 Gamut Coverage Exceedance	2%	0%
Rec 2020 Gamut Coverage	73%	70%
Rec 2020 Gamut Coverage Exceedance	0%	0%

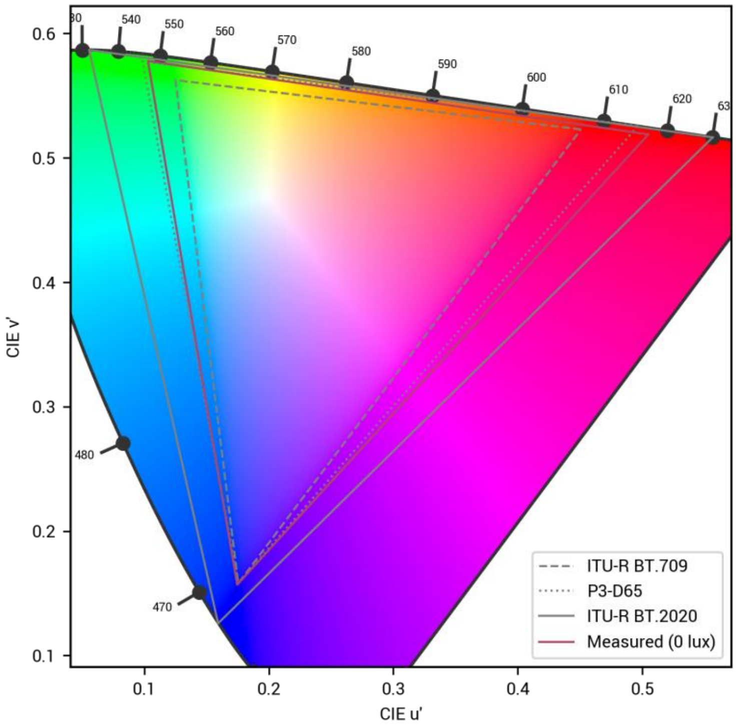


Figure 54 Gamut Coverage of HDR10 content under 0lux

VIDEO

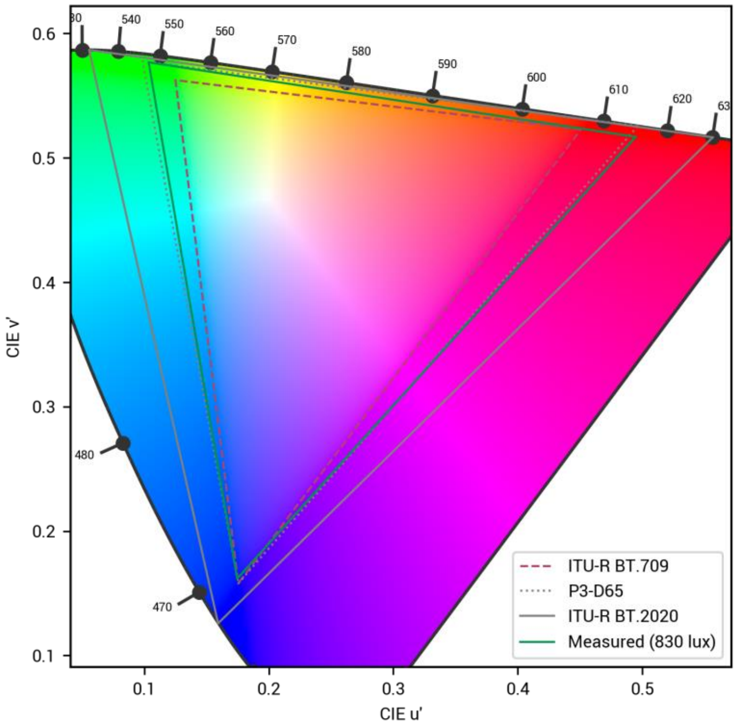


Figure 55 Gamut coverage of HDR10 content under 830 lux (D65)

Gamut coverage of various color spaces for SDR content under 0 lux 830 lux (D65)

	0 lux	830 lux (D65)
REC 709 Gamut Coverage	99%	96%
Rec 709 Gamut Coverage Exceedance	3%	1%

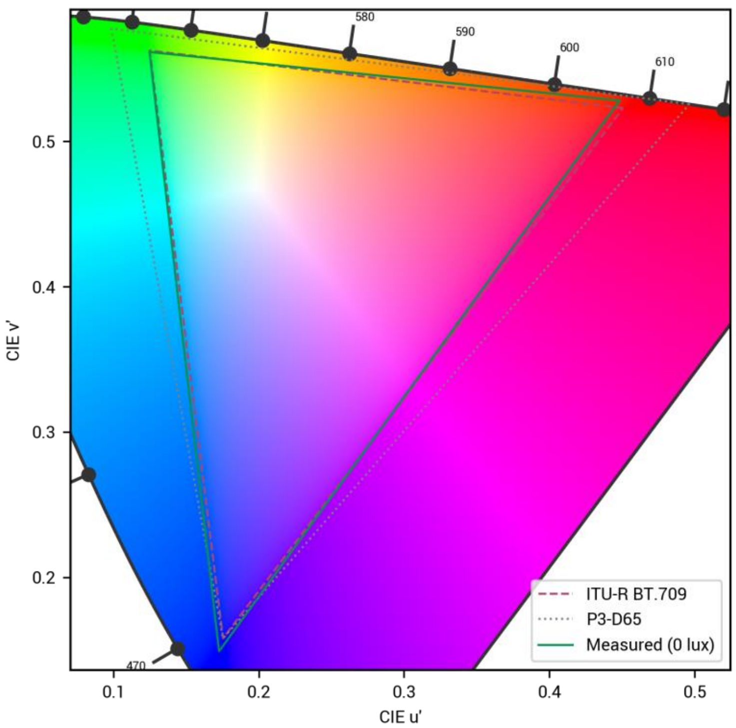


Figure 56 Gamut Coverage of SDR content under 0 lux

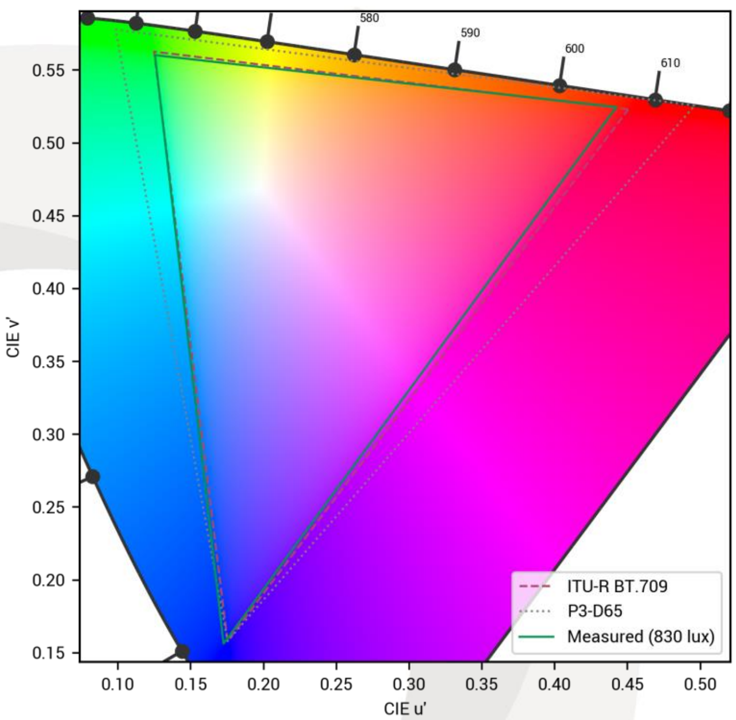


Figure 57 Gamut coverage of SDR content under 830 lux (D65)

5.3.3 Color Rendering Perceptual Scores

	Score
Low Light HDR10 Content	8
Indoor HDR10 Content	10
Low Light SDR Content	8
Indoor SDR Content	10

5.1 Frame Mismatches

In this test, DXOMARK experts evaluate the quantity and frequency of dropped or duplicated frames when watching videos.

5.1.1 Scores

	Score
Frame Mismatches HDR10 Content	8
Frame Mismatches SDR Content	7

5.1.2 Objective Measurements

Patterns are video consisting of a white square running on a black background, the square moves at each frame. This allows us to see if frames are played twice or dropped during the 32s (exposure time of the camera recording). Brighter squares are duplicated frames, darker squares are skipped frames.

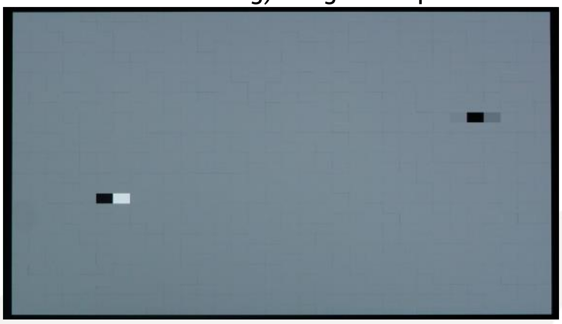


Figure 58 Illustration of a device showing very few frame mismatch performances

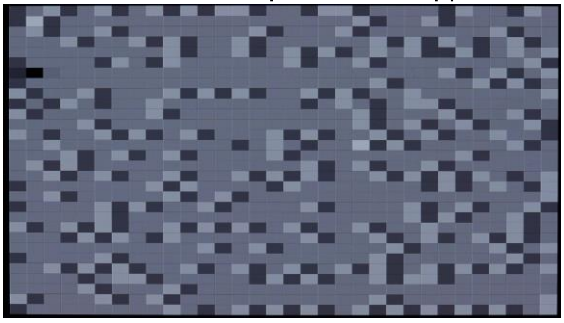


Figure 59 Illustration of a device showing a high amount of frame mismatches

Frame drops measurement for different video type of content and frame rates

		24fps	30fps	60fps
SDR Content	1080P	3.91%	1.35%	6.83%
	UHD	4.17%	1.25%	100.00%
HDR10 Content	UHD	3.65%	0.15%	100.00%

5.2 Video Artifacts

This section considers the sub-attributes that are also part of the Video attribute evolution, while not being part of the other sub-attributes. It includes a motion blur evaluation, a judder evaluation, a validation of the portrait-landscape consistency and a banding test.
The test pattern for the motion blur testing is a video consisting of a DXOMARK logo travelling from left to right at a constant speed. The evaluation is made by following the pattern with the eye.

Figure 60 Illustration picture of the motion blur test pattern

The test patterns are videos consisting of a white square running on a black background, the square moves at each frame. This allows us to see if a judder pattern exists. Brighter squares are frames displayed longer; darker squares are frames displayed shorter.


Figure 61 Illustration of a device showing no judder pattern

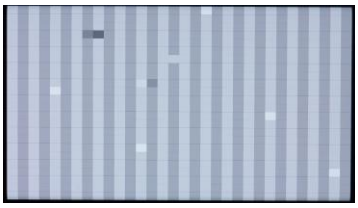


Figure 62 Illustration of a device showing a judder pattern

The banding test is performed by assessing the presence of banding on a pattern that does not present any on the reference monitor Sony BVM HX310.
When evaluating the Portrait-Landscape consistency, our experts proceed to the visualization of the same content in portrait and landscape orientation and evaluate if the rendering is similar.

	Score
Overall	9
Motion Blur	10
Judder	6
Banding	10
Portrait/Landscape Consistency	10

6. Touch

All end-users, not just gamers, care about how responsive, accurate, and smooth the touchscreen is. The DXOMARK protocol for touch evaluates how accurate and reactive it is when playing video games, and how smoothly and quickly it scrolls, among other important considerations.

f(x)	Score
Global	133

f(x)	Score
Touch Accuracy	9
Smoothness	6
Touch To Display Response Time	8

6.1 Touch Accuracy

The DXOMARK protocol for touch accuracy evaluates how accurate it is when playing a Minesweeper game. This section also takes into account how the device discriminates between user's instructions and unwanted touches.

6.1.1 Scores

f(x)	Score
Overall	9
Gaming	10
Unwanted Touches	6

6.2 Smoothness

The smoothness of the device is evaluated perceptually by scrolling on a web page and by navigating in the different menu. DXOMARK experts look for jerkiness when interacting with the touchscreen.

6.2.1 Scores

f(x)	Score
Overall	6
Interface	7
Browser App	4

6.1 Touch-to-Display Response Time (TTDRT)

The touch-to-display response time is the time elapsed between the touch on the screen and the reaction of the display. It is measured on the touch bench with a high-speed camera capturing at 1200 fps.
The following illustration pictures show the region of interest for the touch instant and the device reaction on a generic device.

Figure 63 Illustration for TTDRT Touch instant

Figure 64 Illustration for TTDRT Device reaction

6.1.1 Scores

f(x)	Score
Touch To Display Response Time	8

6.1.2 Objective Measurements

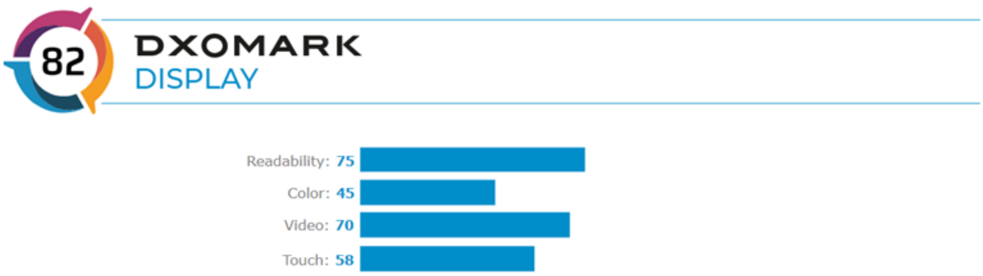
Touch To Display Response Time Measurements

Average Time (ms)	85
Standard deviation (ms)	4
Minimum time (ms)	76
Maximum time (ms)	93

7. Framework

The DXOMARK Display protocol is unique in that it is based on real-life use cases and evaluates display performance not just for still images, but also for dynamic content processed with the device's default app.

DXOMARK has set up objective tests to recreate the most typical conditions under which users use their displays, such as viewing them under different ambient light levels and holding them not just straight-on, but also at an angle. In addition to these objective tests, DXOMARK has developed a set of scientifically rigorous perceptual tests in which highly trained experts compare display and touch interface performance results against reference images and video clips.
A more detailed explanation of the different configurations and tools used for the report can be found at the following link: https://www.dxomark.com/a-closer-look-at-the-dxomark-display-protocol/



7.1 Scoring Methodology

The scoring system is an open-ended scale based on comparisons made with other devices in our database. Attribute scores for Readability, Color, Video, and Touch are derived from a combination of the cumulative objective metrics and/or perceptual evaluation results of their respective sub-attributes, which are weighted according to their impact on the end-user experience.
All perceptual scorings are using a 0 to 10 scale (10 corresponding to the best quality).

7.2 Use Cases

After careful consideration, DXOMARK has identified six use cases on which to base its objective measurements and perceptual evaluations:

- Web browsing
- Night reading
- Viewing photos
- Gaming
- Watching movies
- Light transitions

As per the table below, certain attributes are applicable only to certain use cases, and some tests are conducted under a variety of lighting conditions.

Use cases / Attributes	Web Browsing	Night Reading	Viewing Photos	Gaming	Watching Movies	Light Transitions
Readability						
Color						
Video					HDR10 & SDR	
Touch						

Outdoor	Indoor	Generic	Redundant	Not Applicable

Figure 65 Display quality attribute vs use cases and ambient lighting conditions

7.3 Terminology and Values, Equipment

7.3.1 Light Levels

	Low Light	Indoor	Outdoor
Range (lux)	0–25	50-830	830–50,000

7.3.2 Illuminants Used to Create Ambient Light Conditions

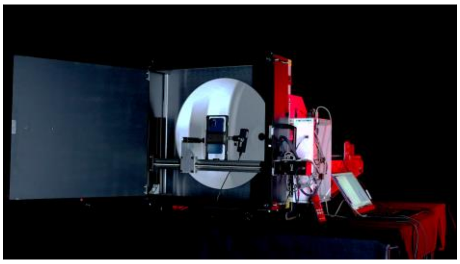
	None	A	White LED	D65		D55	
Illuminance (lux) incident on the device	N/A	25	250	830	20,000	20,000	50,000

7.3.3 Testing Equipments

7.3.3.1 DXOMARK Display Bench

The DXOMARK Display Bench is a specially designed testing chamber equipped with special mounts and lighting arrays. Using a computer placed outside the chamber (which is sealed against external light sources), technicians can precisely control shooting distances between the device under test and testing equipment, as well as control various kinds of ambient lighting conditions (daylight, indoor, low light, etc.).

7.3.3.2 DXOMARK Diffuse Ambient Lighting System (DALS)



The DXOMARK Diffuse Ambient Lighting System's goal is to reproduce outdoor lighting conditions: it provides very intense light coming from all directions, as we experience it outdoors. This set-up is used to evaluate how the devices cope with extreme lighting conditions. In the photo you can see the DUT placed on the rail inside the chamber, next to the luxmeter which monitors the lighting illuminance. The testing instrument is mounted on the other side of the half integrating sphere and acquires the measurements through a small aperture.

7.3.3.3 DXOMARK Touch robot

DXOMARK has a set of high-end measuring instruments for performing touch analyses, including a robot that simulates human gestures (tap, zoom, and scroll) on a touchscreen with a precision of 0.05 mm at 1.5 m/s. In addition, we use a high-speed Phantom camera that records 1440 images per second for slow-motion capture of each frame on a smartphone display. We use this set-up to evaluate touch-to-display response time, smoothness, and accuracy for different use cases.

7.3.3.4 Measurement matrix

	DXOMARK BENCH	DXOMARK DOME	SPECTRO-RADIO-METER	IMAGING COLORI-METER	CONO-SCOPE	TOUCH ROBOT	HIGH-SPEED CAMERA	HIGH-END DSLR	SPECTRO-PHOTO-METER	FLICKER-METER
READABILITY	x	x	x	x	x				x	x
COLOR	x		x	x	x					
VIDEO	x		x	x				x		
TOUCH						x	x			

7.4 Report version

	Date	Version
V1	2020, October	Initial protocol version
V1.1	2021, October	Updated measurements Touch response time addition
V1.5	2022, September	Data annex addition Framework update
V2.0	2024, April	V2 protocol version with updated attributes

8. Annex

8.1 Understanding HDR Perceived Contrast Graph

8.1.1 Motivation

Under the very same lighting conditions and using the same HDR content, it is common to find differences in rendering among smartphone devices.

Device A

Device B

These differences are hard to extract from an EOTF graph that is not, by definition, a qualitative criterion.

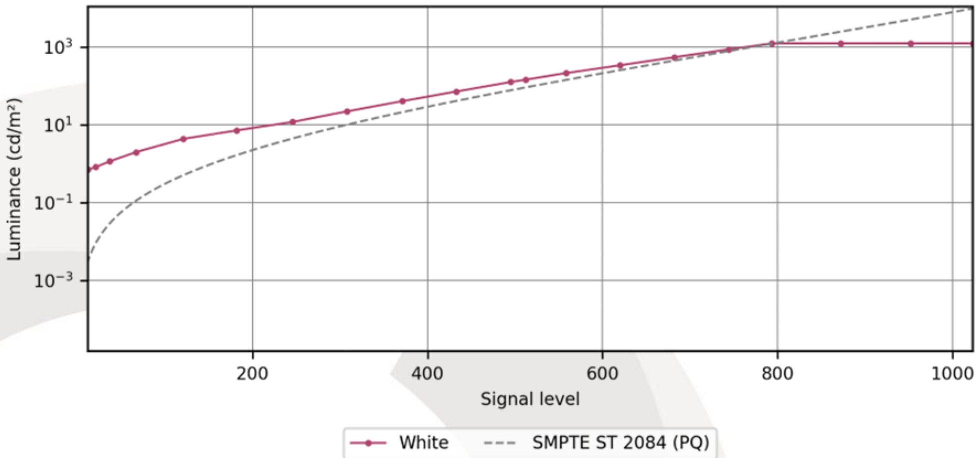


Figure 66 Example of a measured HDR10 EOTF

The PQ EOTF is perceptually uniform based on the Barten model with optimized parameter values:

- Each digital gray value step encodes an equivalent perceptual luminance step
- For a 12-bit encoded PQ a step corresponds to 0.9 JND

Smartphones shall adapt luminance and EOTF depending on viewing conditions to offer pleasant user experience. **Device adapted EOTF shall also be perceptually uniform, to retain artistic intent:**

- Each digital gray value step shall encode an equivalent perceptual luminance step
- JND step value is expected to differ from PQ EOTF JND step value

However, depending on the environment, that is not always possible and a compromise on quality might be needed. This is the purpose of our *Perceived Contrast Graph*: analyze the contrast compromises versus lighting conditions.

This scoring

- only considers the tone mapping, not the dynamic range, black or peak luminance
- shall assess the rendering for the end user of the EOTF adaptation

8.1.2 Conversion to JND

The first step is to acquire the EOTF curve through sampled measurements along the gray levels. Then we follow an iterative construction of luminance values decreased by a fraction of JND f.

For the conversion of two consecutive measured points delta into JND, we use the minimum detectable modulation m_t (from Barten Model with same parameter values as used for PQ EOTF) and process iteratively to find the fraction of JND f allowing the constructed luminance levels to reach the next measured value.

Knowing the number of grey levels and the number of JNDs between two consecutive measurements, the JND per grey value is calculated.

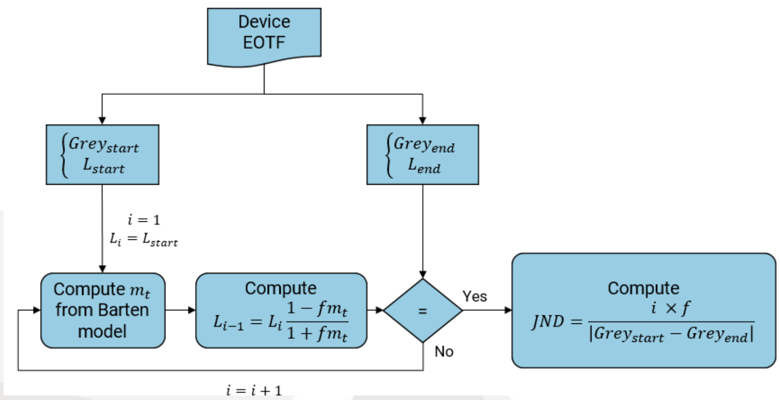


Figure 67 JND calculation flowchart

ANNEX

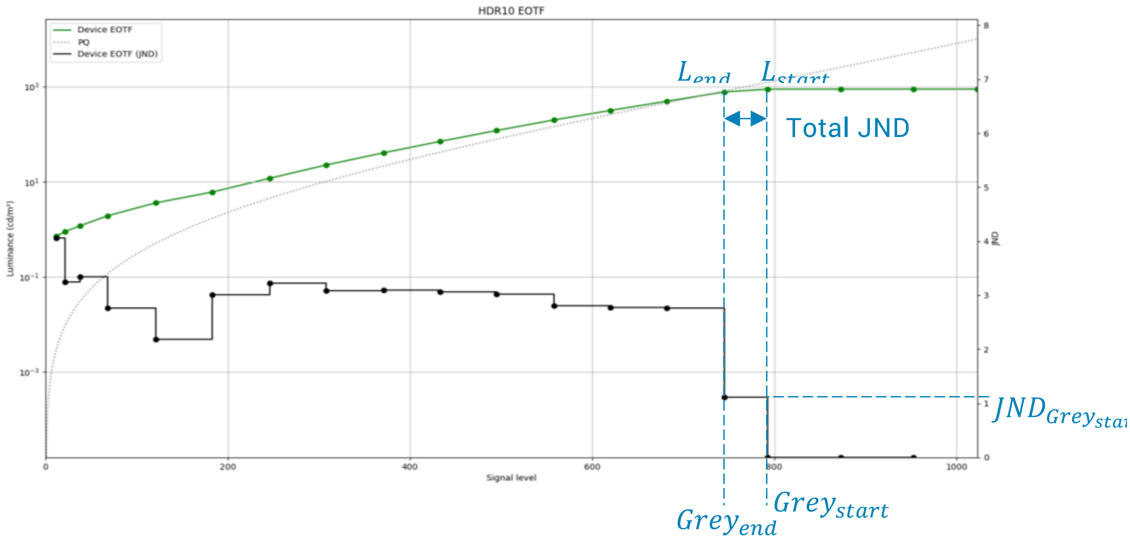


Figure 68 JND calculation illustration

8.1.3 How to read the *Perceived Contrast* graph

The HDR Perceived Contrast graph is derived from the EOTF measurement.

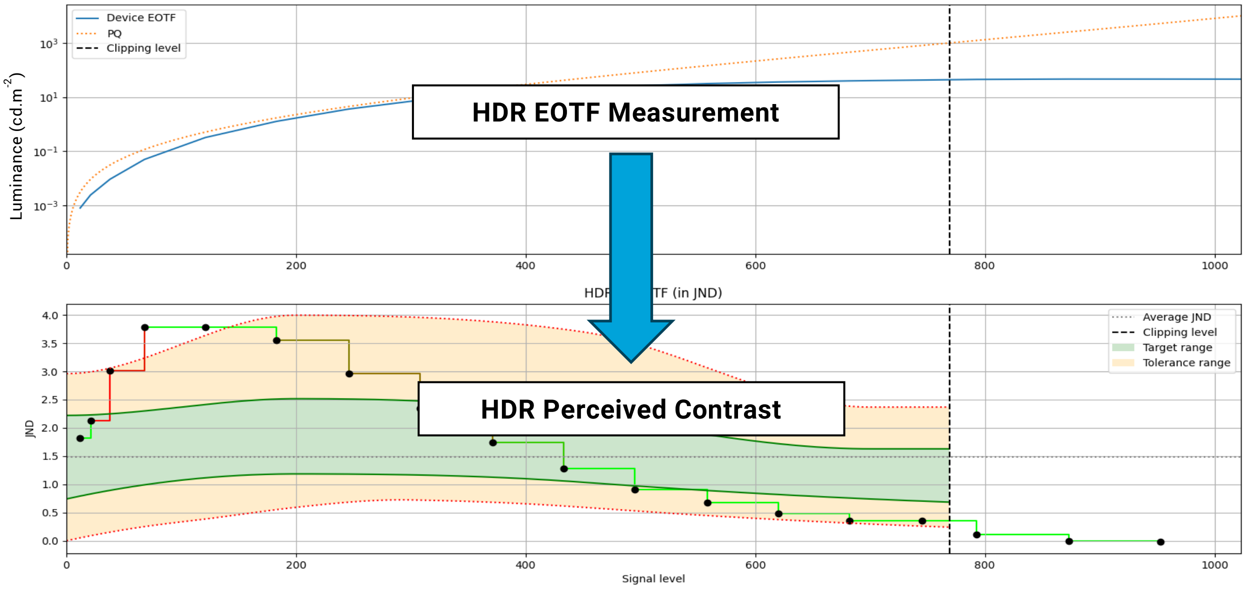


Figure 69 HDR perceived contrast graph illustration

Clipping point is shown using a vertical dotted line, here in pink. The perceived contrast is neither evaluated, nor scored after clipping.

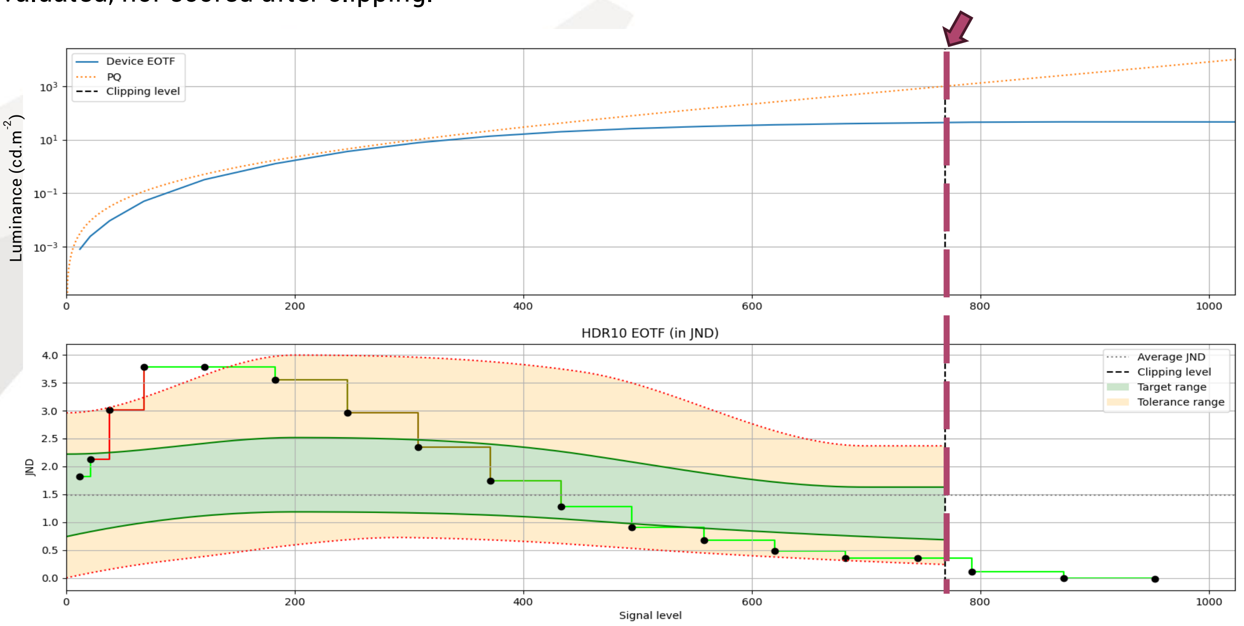


Figure 70 HDR perceived contrast graph clipping point illustration

ANNEX

The available dynamic range (including reflections) gives us a maximum number of available JNDs. Targets are centered on the **mean JND value using perceptually uniform steps** (in red below).

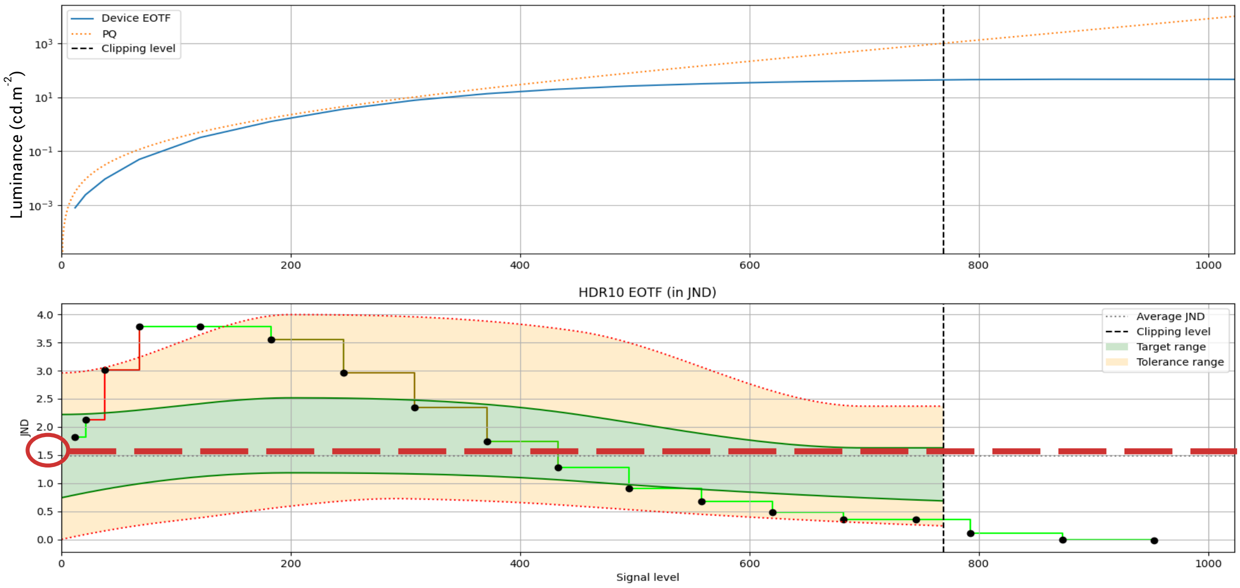


Figure 71 HDR perceived contrast graph mean JND value illustration

Green area represents the preferred range around perceptually uniform target, yellow area s represent the acceptable range (based on experts & user survey).
A different tolerance range is applied depending on the grey value considered (see pink arrows).

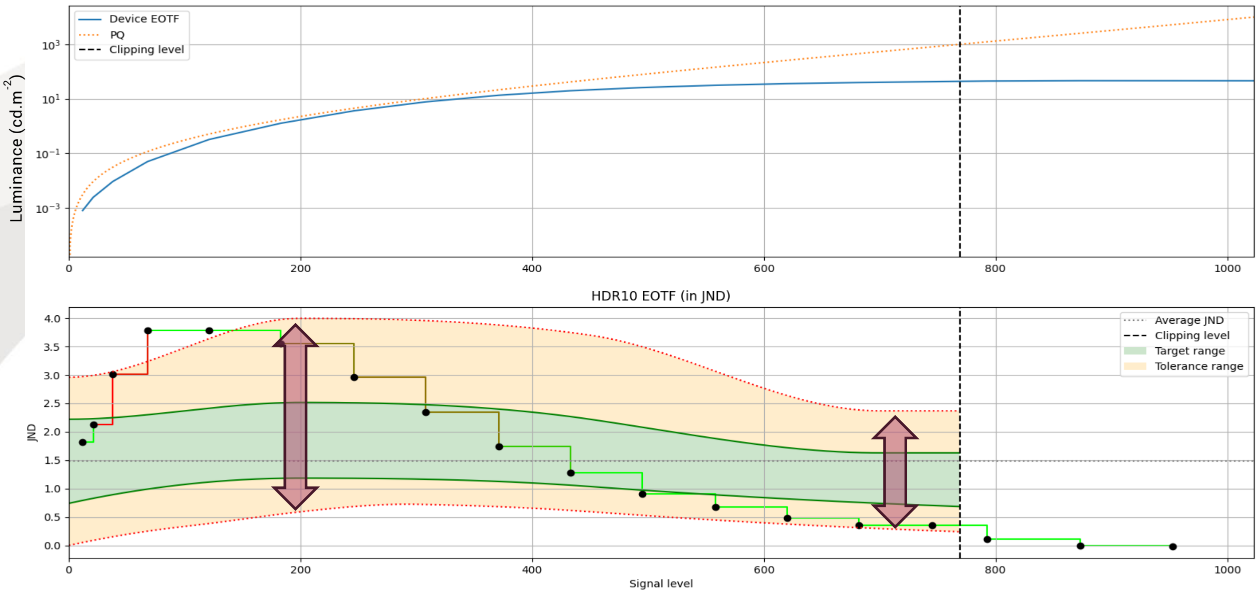


Figure 72 HDR perceived contrast graph tolerance range illustration

Tone Curve Derivative informs about possible disturbing contrast variations indicated by the colored links, green links being inconspicuous variations while red links are noticeable steps.

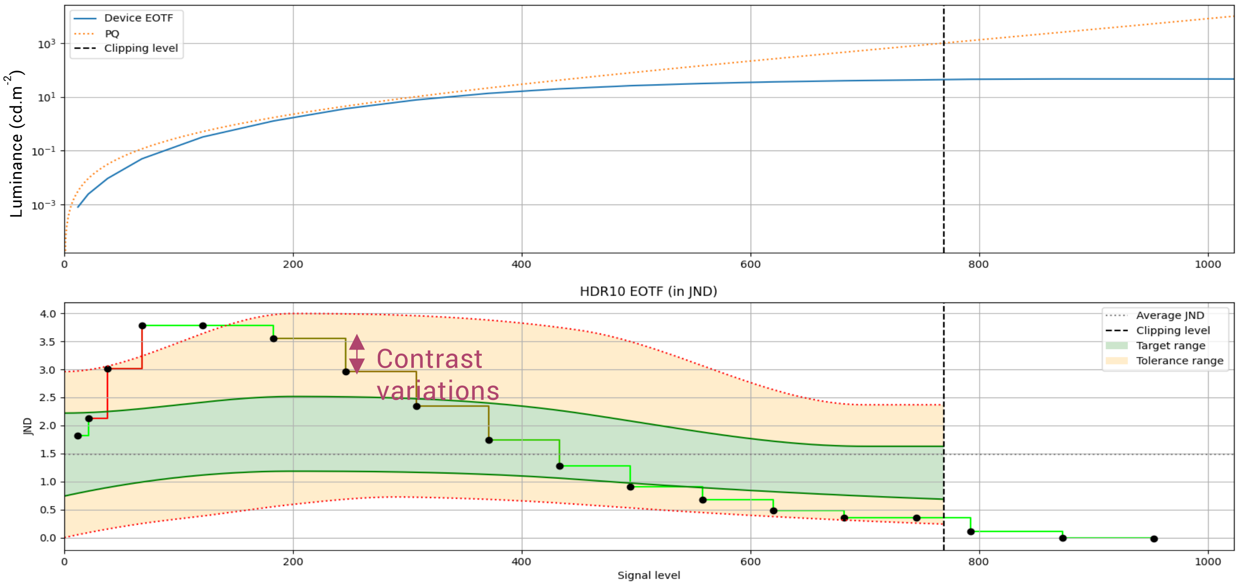


Figure 73 HDR perceived contrast graph contrast variations illustration

8.2 Color correction

8.2.1 Rationale

Some of the measurements done in the V2 protocol feature a white point correction:

- color rendering,
- color gamut coverage,
- color gamut coverage in night mode.

This is meant to compare accurately the different devices, since each model might have a different white point setting.
The color differences computed by DXOMARK, Δu'v and ΔE_{ITP} (Rec. UIT-R BT.2124-0), may therefore be slightly different than one computed without white point correction.

8.2.2 Workflow

Here is the workflow used for the correction:

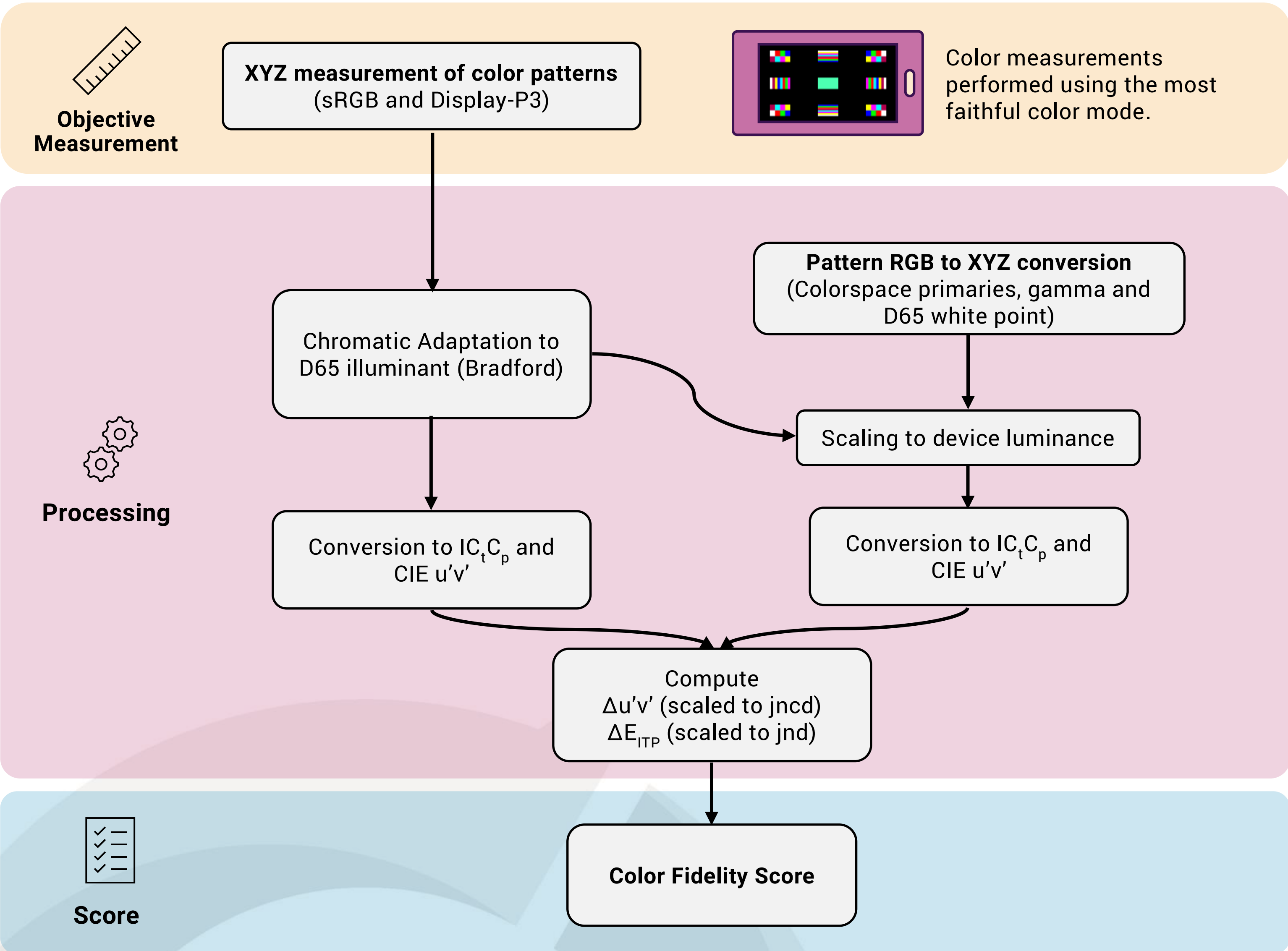


Figure 74 Color correction workflow example (color rendering)

24-26, quai Alphonse le Gallo
92100 Boulogne-Billancourt - France

www.dxomark.com