

# Energy Star7.0

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## Display 6.0

Table 1: Calculation of Maximum On Mode Power Requirements ( $P_{ON\_MAX}$ )

Product Type and Diagonal Screen Size, $d$ (in inches)	$P_{ON\_MAX}$ where $D_p \leq 20,000$ pixels/in <sup>2</sup> (in watts) Where: <ul style="list-style-type: none"> <li>▪ <math>r</math> = Screen resolution in megapixels</li> <li>▪ <math>A</math> = Viewable screen area in in<sup>2</sup></li> <li>▪ The result shall be rounded to the nearest tenth of a watt</li> </ul>	$P_{ON\_MAX}$ where $D_p > 20,000$ pixels/in <sup>2</sup> (in watts) Where: <ul style="list-style-type: none"> <li>▪ <math>r</math> = Screen resolution in megapixels</li> <li>▪ <math>A</math> = Viewable screen area in in<sup>2</sup></li> <li>▪ The result shall be rounded to the nearest tenth of a watt</li> </ul>
$30.0 \leq d \leq 61.0$ (for products meeting the definition of a Signage Display only)	$(0.27 \times A) + 8.0$	$(0.27 \times A) + 8.0$

## Display 7.0 Final

### 3.4 On Mode Requirements for Signage Displays

3.4.1 The Maximum On Mode Power ( $P_{ON\_MAX}$ ) in watts shall be calculated per Equation 6.

#### Equation 6: Calculation of Maximum On Mode Power ( $P_{ON\_MAX}$ ) in Watts for Signage Displays

$$P_{ON\_MAX} = (4.0 \times 10^{-5} \times \ell \times A) + 119 \times \tanh(0.0008 \times (A - 200.0) + 0.11) + 6$$

Where:

- $P_{ON\_MAX}$  is the Maximum on Mode Power, in watts;
- $A$  is the Screen Area in square inches;
- $\ell$  is the Maximum Measured Luminance of the display in candelas per square meter, as measured in Section 6.2 of the test method;
- $\tanh$  is the hyperbolic tangent function; and
- The result shall be rounded to the nearest tenth of a watt for reporting.

# Energy Star 7.0

Energy Star 6.0 Sinage Display		US California Sinage Display	Energy Star 7.0 Sinage Display					Energy Star 6.0 TV	Energy Star 7.0 TV	
P=0.27*A+8		P=0.12*A+25	$\alpha = X \tanh(Y(A+Z)+B)+C$ Where A = screen area (in <sup>2</sup> )					$P = X \tanh(Y(A+Z)+B)+C$ Where A = screen area (in <sup>2</sup> )	$P = X \tanh(Y(A+Z)+B)+C$ Where A = screen area (in <sup>2</sup> )	
			X	119				100	X	71
			Y	0.0008				0.00085	Y	0.0005
			Z	-200				-140	Z	-140
			B	0.11				0.052	B	0.045
			C	6				14.1	C	14
			$\beta = 4 \times 10^{-5} \times L * A$							
Energy Star 6.1		US CEC	Energy Star 7.0 Final					Energy star6.1 TV	Energy star 7.0 TV	
			$\alpha + \beta$							
Size	Sinage 6.1	US CEC	2500	2000	700	500	450	TV6.1 FHD	TV7.0 FHD	TV7.0 4K2K
32	126.14	77.51	84.43	75.68	52.92	49.42	48.55	43.68	27.59	42.76
40	192.59	107.04	129.07	115.40	79.85	74.38	73.01	61.42	35.77	55.45
42	211.51	115.45	141.21	126.13	86.93	80.90	79.40	65.91	38.00	58.90
46	252.12	133.50	166.29	148.21	101.19	93.96	92.15	74.63	42.60	66.04
47	262.85	138.27	172.70	153.82	104.73	97.18	95.30	76.73	43.78	67.85
48	273.81	143.14	179.15	159.46	108.26	100.39	98.42	78.78	44.95	69.68
55	357.00	180.11	225.08	199.23	132.02	121.68	119.09	91.56	53.19	82.45
65			291.74	255.64	161.76	147.32	143.70	104.01	64.07	99.31
70			325.49	283.62	174.74	157.99	153.80	107.80	68.71	106.51
75			359.86	311.79	186.81	167.58	162.77	110.33	72.68	112.65
80			395.21	340.51	198.31	176.43	170.96	111.94	75.93	117.69
84			424.41	364.11	207.33	183.21	177.18	112.75	78.04	120.96
90			470.08	400.86	220.88	193.19	186.27	113.47	80.46	124.72
98			535.01	452.93	239.54	206.71	198.50	113.89	82.58	128.00

# Uniformity should be considered

Uniformity is a very important spec for a Signage display. But Uniformity improvement effects Power Consumption. We should consider the Uniformity element. Below is one of our proposal.

## Standard Panel Spec (Reference)

Bref=75		Cref=75	Aref'(%)=100	} 400
	Aref=100		Bref(%)=75	
Dref=75		Eref=75	Cref(%)=75	
			Dref(%)=75	
			Eref(%)=75	
<b>Actual Uniformity (measured)</b>				
B(cd)		C(cd)	A''(%)=100	
	A(cd)		B''(%)=B/A*100	
D(cd)		E(cd)	C''(%)=C/A*100	
			D''(%)=D/A*100	
			E''(%)=E/A*100	

Measuring point for surface luminance & measuring point for luminance variation.

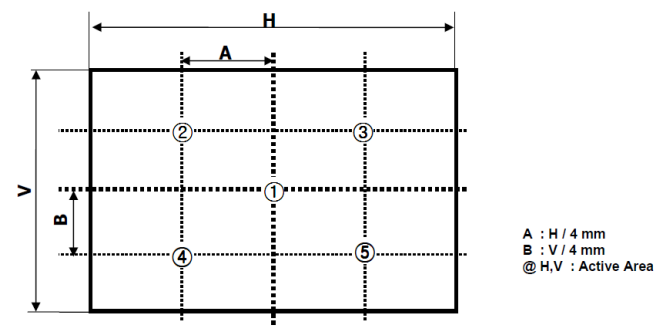


FIG. 2 5 Points for Luminance Measure

Weighting factor = W

$$W = \left( \frac{A'' + B'' + C'' + D'' + E''}{Aref + Bref + Cref + Dref + Eref} \right) - 1$$

$$= \left( \frac{A'' + B'' + C'' + D'' + E''}{400} \right) - 1$$

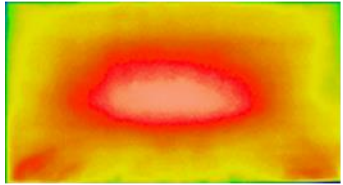
IF  $A'', B'', C'', D'', E'' = 100 \gg W = 0.2$

$$P(\text{uni}) = W \times P_{\text{on}}(\text{max})$$

# Uniformity

## Example

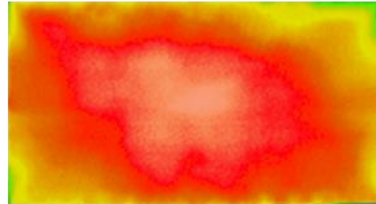
Panel A



72.1%		72.7%
	100.0%	
81.7%		77.8%

W=0.011      1.011

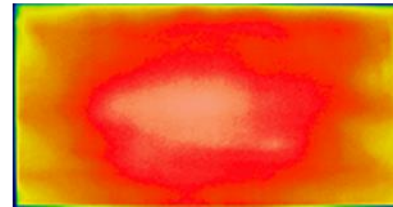
Panel B



90.5%		76.1%
	100.0%	
79.1%		85.1%

W=0.077      1.077

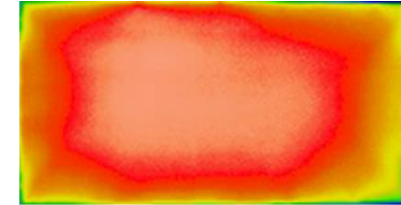
Panel C



81.5%		86.4%
	100.0%	
82.0%		82.6%

W=0.081      1.081

Panel D



91.9%		85.3%
	100.0%	
86.0%		80.8%

W=0.11      1.110

Measuring point for surface luminance & measuring point for luminance variation.

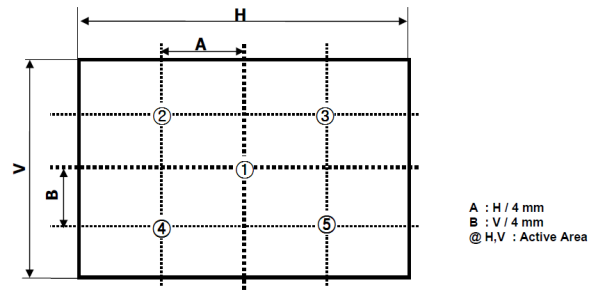


FIG. 2 5 Points for Luminance Measure

## Energy Star 7.0 TV

## 3.3 On Mode Requirements

- 3.3.1 For all TVs, On Mode power, as determined per Section 7.1.2 *On Mode Test for TVs without ABC Enabled by Default* or Section 7.1.3.2 *On Mode Power Calculation* (for TVs with ABC Enabled by Default) in Appendix H shall be less than or equal to the Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ) and high resolution allowance, as shown in Equation 1.

**Equation 1: On Mode Power Requirement for All TVs**

$$P_{ON} \leq P_{ON\_MAX} + P_{HR}$$

Where:

- $P_{ON}$  is On Mode Power in watts;
- $P_{ON\_MAX}$  is the Maximum On Mode Power requirement in watts, calculated in Equation 2; and
- $P_{HR}$  is a high resolution allowance in watts, as applicable, calculated in Equation 3.

- 3.3.2 The Maximum On Mode Power Requirement ( $P_{ON\_MAX}$ ) in watts shall be calculated per Equation 2.

**Equation 2: Maximum On Mode Power Requirement for All TVs**

$$P_{ON\_MAX} = 78.5 \times \tanh[0.0005 \times (A - 140) + 0.038] + 14$$

Where:

- $P_{ON\_MAX}$  is the maximum allowable On Mode Power consumption in watts;
- $A$  is the viewable Screen Area of the product in square inches; and
- $\tanh$  is the hyperbolic tangent function.

- 3.3.3 TVs with Native Vertical Resolution greater than or equal to 2160 lines are eligible for a high resolution On Mode Power Allowance ( $P_{HR}$ ) as calculated per Equation 3.

**Equation 3: Calculation of On Mode Power Allowance for TVs with Native Vertical Resolution Greater than or Equal to 2160 lines**

$$P_{HR} = 0.5 \times P_{ON\_MAX}$$

Where:

- $P_{HR}$  is the high resolution On Mode Power Allowance in watts; and
- $P_{ON\_MAX}$  is the maximum allowable On Mode Power consumption in watts, calculated in Equation 2.

Display also need to consider 4k2k

P(HR)

$$P_{on} < P_{on} (\text{max}) + P(\text{ABC}) + \underline{P(\text{uni}) + P(\text{HR})}$$



Signage Display need to consider Uniformity and Resolution.