

DisplayHDR CTS r1.1 Errata E2

Published 03/09/21

This errata contains all SCRs published through 03/09/2021

The following SCRs are included in DisplayHDR_CTS_r1.1_E2:

- DisplayHDR CTS r1.1 Language Clarification SCR v0.90
- DisplayHDR CTS r1.1 Checkerboard test luminance for True Black



VESA STANDARDS CHANGE REQUEST FORM

To be Filled in by Submitter (Refer to VESA Document VP235F, Section 5):

TITLE:	DPM_CTS_1.1_Language_Clarification_SCR v0.90
AFFECTED DOCUMENT:	DisplayHDR_CTS_v1.1.pdf
REVISION CATEGORY:	Category 3 – “New Mandatory Features”
SUBMITTED TO:	Task Group
SPONSOR:	Roland Wooster, Intel Corp. Jim Choate, VESA Compliance Manager

SCR REVISION HISTORY	
(DATE)	(CHANGE)
10/27/2019	Initial Submission of SCR
10/29/2019	Rename of SCR title and increment to version 0.51
11/13/2019	v0.80 – changed “shall be measured within 5 seconds” to “10 seconds” for measurements involving black level testing, i.e. dual corner box, and checkerboard. Added a note about the potential addition of CA-P427 probe as a suggested measurement tool.
12/17/2019	V0.90 – ready for adoption vote – changes since v.80: highlighted in yellow. <ol style="list-style-type: none">1. Added both Konica Minolta CA-P427 and CA-VP427 probes to replace the CA-410 (family name).2. Added the caveat to the black luminance measurements that if the probe takes more than 10 seconds to take the recording it must commence within the 10 seconds.3. Removed all the “Supporting informational text” previously in green.

(add more rows as needed)

To be Filled in by VESA Office:

VESA SCR NUMBER:	(To be assigned by VESA office)
SCR ENTRY DATE:	10/29/2019

To be Filled in by Task Group or VESA Office

SCR ADOPTED, REJECTED, or otherwise DISPOSITIONED for other action	SCR is (adopted) or (rejected) or (Dispositioned for other action) If rejected, explain reason for acceptance or rejection If dispositioned, explain action or plan for action (such as including in future draft specification revision, or re-visiting at future date, or other)
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DATE SCR ADOPTED or REJECTED or DISPOSITIONED	12/28/2019 Adopted
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1 Summary of the Proposed Change(s)

- Replaces the word “should” with “shall” for several of the test criteria directions. Adds definition upon the timing of testing which previously was undefined.

1.1 IPR (Intellectual Property Rights) declaration, if any

- None.

1.2 Benefits as a Result of the Changes

- Clarifies testing requirements with hard requirements instead of recommendations.

1.3 Assessment of the Impact

- Device certification is likely unaffected.

1.4 Analysis of the Device Hardware Implication

- Likely none.

1.5 Analysis of the Device Software Implications

- None.

1.6 Analysis of the Compliance Test & Interop Implications

- Eliminates some variables in the test procedure, making test determination of pass/fail easier. Impact to testing duration is that depending upon how many measurement probes are being used, and how quickly they can be moved certification testing will take less than 8 minutes longer.

1.7 New Referenced Documents Resulting from Change

- None

1.8 Attachments

None.

2 Proposed Document Change(s) or Addition(s)

Instructions & Color Key

- Delete the red ~~strikeout~~ text.
- Add the text in red.
- Black text is original CTS v1.1 content that remains.

5.1.1 – 10% White Patch Test

Luminance is measured at the screen's center once per minute for 30 minutes, using the same panel. The first measurement ~~should~~ shall be obtained within 5 seconds of when the **white** patch begins to display. The **red** box indicated in [Figure 5-1](#) is provided for illustrative purposes only.

5.1.3 – Full Screen White Test

Luminance is measured at the screen's center once per minute for 30 minutes, using the same panel. The first measurement ~~should~~ shall be obtained within 5 seconds of when the **white** screen begins to display.

B.8 – Appendix for Rise Time

The Rise-time test uses a patch that switches ON for 5 seconds, OFF for 5 seconds, and then loops indefinitely. The first five rise times from **black** to **white** ~~should~~ shall be recorded and used for the measured values of this test.

5.2.1 Dual Corner Box Test

~~“Screen center and both **white** corners are measured after allowing the display sufficient time to stabilize”~~

Screen center and both **white** corners shall all be measured within 10 seconds of the start of the test. In the case where one measurement device is being used that needs to be repositioned between each of the three test points the display device shall be returned to a black screen while the probe is being repositioned between each of the three measurements. The test can be started three times to enable repositioning of the probe, and recording of each of the three test points each within 10 seconds of the start of the test. If testing with the DisplayHDR automated test tool, pressing the “C” key initiates a 60 second black screen that can be used for this exact purpose, as it then automatically returns to the test at the end of the 60 seconds cool down period.

In the case where the measurement probe takes longer than 10 seconds to measure the black level, the measurement must commence within 10 seconds of the test image being displayed.

5.2.2.1 – Checkerboard Test Measurement.

Each of the four measurements on each Checkerboard luminance test shall be measured within 10 seconds of the start of the test. Where one measurement probe is being used for each of the four measurement locations and needs to be repositioned, a black screen shall proceed each of the tests. If using the DisplayHDR automated test tool the “C” key can be used to initiate a 60 second black screen, thus making it easy to reposition the probe, then ensure the display has a 60 second black out period, and then take the measurement within the first 10 seconds of the checkerboard image being displayed.

In the case where the measurement probe takes longer than 10 seconds to measure the black level, the measurement must commence within 10 seconds of the test image being displayed.

9.2 White Point Measurement Methodology

Measurement ~~is~~ shall be performed at the screen's center within 5 seconds of the relevant luminance test patch being displayed. The tests shall be measured in sequentially increasing luminance levels i.e. from lowest to highest luminance measurements. The PQ code values that are used for the test are chosen to be divisible by 4, thus enabling 8-bit signal generators to be used, if necessary.

3.4 Measurement Device Name Update

- For DisplayHDR certification:
 - Konica Minolta™ CA-310, ~~CA-410~~ CA-P427, CA-VP427, and CS-2000

- End of Document -



VESA STANDARDS CHANGE REQUEST FORM

To be Filled in by Submitter (Refer to VESA Document VP235H, Section 5)

TITLE:	DHDR 1.1 SCR Add new 4x3 checkerboard and True Black test luminance limit
AFFECTED DOCUMENT:	VESA High-performance Monitor and Display Compliance Test Specification (DisplayHDR CTS) v1.1
REVISION CATEGORY:	Refer to VP235H Appendix A; will be subject to Task Group review
SUBMITTED TO:	DPM Task Group
SPONSOR:	Dale Stoltzka (Samsung Electronics) Su Young Kim (Samsung Display)

SCR REVISION HISTORY	
(DATE)	(CHANGE)
11/17/2020	Initial Submission of SCR
12/01/2020	Minor editorial updates by the submitters
12/02/2020	TGR version, changed display crossover to 20"
01/05/2021	GMR candidate with TGR comments resolved, shorter title, changed a sponsor assignment, noted as version 4.
02/11/2021	Adoption candidate with all comments resolved (v6)

(add more rows as needed)

To be Filled in by VESA Office:

VESA SCR NUMBER:	(To be assigned by VESA office)
SCR ENTRY DATE:	11/17/2020

To be Filled in by Task Group or VESA Office

SCR ADOPTED, REJECTED, or otherwise DISPOSITIONED for other action	SCR is (adopted) or (rejected) or (Dispositioned for other action) If rejected, explain reason for acceptance or rejection If dispositioned, explain action or plan for action (such as including in future draft specification revision, or re-visiting at future date, or other)
DATE SCR ADOPTED or REJECTED or DISPOSITIONED	02/26/2021 ADOPTED

Summary of the Proposed Change(s)

The checkerboard test intended for a verification of the active dimming for backlit display types has an unintended consequence for True Black self-emissive pixel displays. Further, the demand for HDR products is leading to smaller displays where the check size of a 6 by 4 checkerboard is increasingly tiny. This SCR proposed solutions for both issues.

The following changes are proposed for True Black test units.

1. Set a fixed limit for the white luminance of the checkerboard in Section 10.1, Table 10-2.
2. Small displays may opt to use a cropped 4x3 checkerboard as proposed below, where the center height is 48% of the image height. Additionally, the center two column widths are determined such that the center checks are square for an aspect ratio 3:2 display.
3. This SCR proposes 20" as the convenient crossover where the change does not affect monitor products. Today, all True Black sets below this value are mobile panels. The following table shows some examples of small displays with a 4x3 compared to common monitor sizes, 24" and 27".

Using the design in this SCR for a cropped 4x3 checkerboard, some example check sizes are:

Diagonal size	Aspect ratio	Checkerboard	Horizontal (mm)	Vertical (mm)
27"	16:9	6x4	99.6	84.0
24"	16:9	6x4	88.5	74.7
13.3"	16:9	Proposed 4x3	94.2	79.5
12.0"	3:2	Proposed 4x3	81.2	81.2

4. Secondly, the True Black checkerboard test passed against a fixed black level but with ever increasing applied white luminance. Recent display evolution will take small panels to exceeding high luminance where True Black, baselines at 0.0005 cd/m². As L_{MAX} rises, the contrast ratio is unbounded since black level should remain at 0.0005 cd/m². We suggest 500 as the upper limit coinciding with a 1,000,000:1 limit, which can be achieved by True Black 500 products at 50% loading. However, we also note that the actual contrast ratio is specified within the two-corner test, not the checkerboard.

The coupling of both higher luminance and smaller size has been considered carefully by this SCR with what the authors consider as the lightest touch possible to the DisplayHDR brands.

The [Background Information](#) section contains a physical diagram.

The assigned Task Group may make additional comments or clarifications using this format in any section of this submitted form. The comment should be dated and formatted as follows:

No comments as of the version.

IPR (Intellectual Property Rights) declaration, if any

The submitter must be familiar with VESA Policy 200D. If an IPR declaration is to be made:

Submitter must provide the declaration in writing to VESA as per section 4.2 of VESA Policy 200D.

The published Standard Revision or Errata document will include the IPR holder name, contact information, and claims known, in keeping with VESA specification standards.

Benefits as a Result of the Changes

Corrects unforeseen consequences of display demand for smaller size and more luminance without impacting the contrast ratio advertised by True Black.

Assessment of the Impact

See SCR details.

Analysis of the Device Hardware Implication

None.

Analysis of the Device Software Implications

The SCR recommends OEMs populate the physical size field values provided by EDID or DisplayID.

Analysis of the Compliance Test & Interop Implications

One, the test pattern tool will require an update, per the SCR contents.

- A method to read the DisplayID or EDID for the physical size
- Two 4x3 patterns (mirror images)
- A luminance control to adjust white luminance for the checkerboard, if > 500

New Referenced Documents Resulting from Change

None.

Attachments

No attachment.

Proposed Document Change(s) or Addition(s)

1. Add text in Section 5.2.2, Figure 5.7 and Figure 5-8.

a. Change the first paragraph of *Section 5.2.2* to:

In both tests, a simple 6x4 checkerboard is used, as illustrated in [Figure 5-5](#) and [Figure 5-6](#) or a simple 4x3 checkerboard, as illustrated in [Figure 5-7](#) and [5-8](#) (mirrored image), may be used for testing in lieu of a 6x4 checkerboard, [Figure 5-5](#) and [5-6](#), only for displays measuring less than 20”.

o Add following bullets to the end of the list on page 35 (Section 5.2.2):

“• The optional cropped 4x3 checkerboard may be used for small displays as mandated in this section. The size of each checkerboard box varies by display size and aspect ratio. The 4x3 checkerboard mandates the row and column percentage sizes in [Figures 5-7](#) and [5-8](#).

• When the 4x3 checkerboard is chosen, this specification mandates this test records the black luminance of the black check near the center, noted in this specification with a cross hair pattern for both a checkerboard shown in [Figure 5-7](#) and the horizontally mirrored version shown in [Figure 5-8](#).

• When the 4x3 checkerboard is chosen, this specification mandates this test records the white luminance of the white checks near the center, noted in this specification with a cross hair pattern for both a checkerboard shown in [Figure 5-7](#) and the horizontally mirrored version shown in [Figure 5-8](#).

• In order to identify the display size automatically, this document recommends display vendors

populate the physical size field values in DisplayID (or legacy EDID).”

- b. Add Figure 5.7 and Figure 5-8, captions, table and text after Figure 5-6 and before the *Note*.

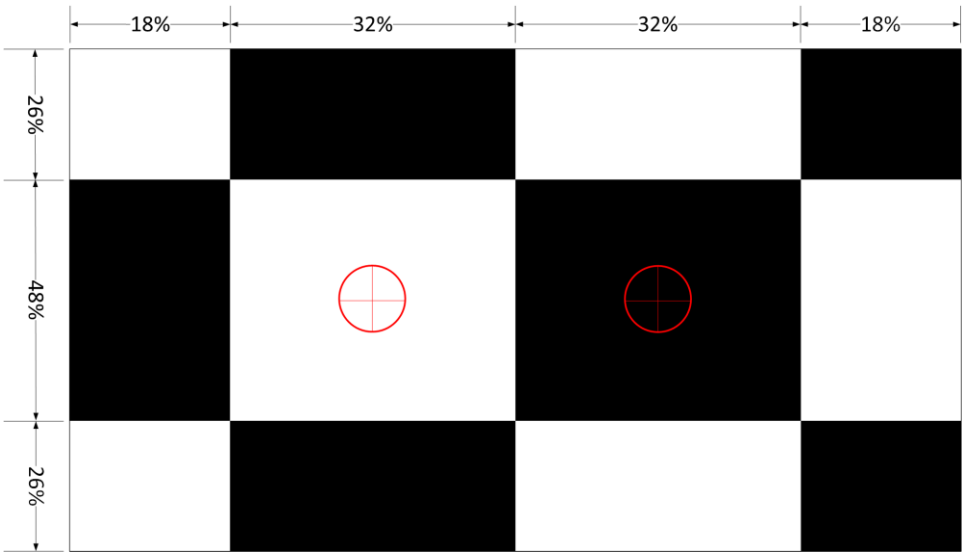


Figure 5-7. Cropped 4x3 checkerboard test pattern – shown with crosshair targets.

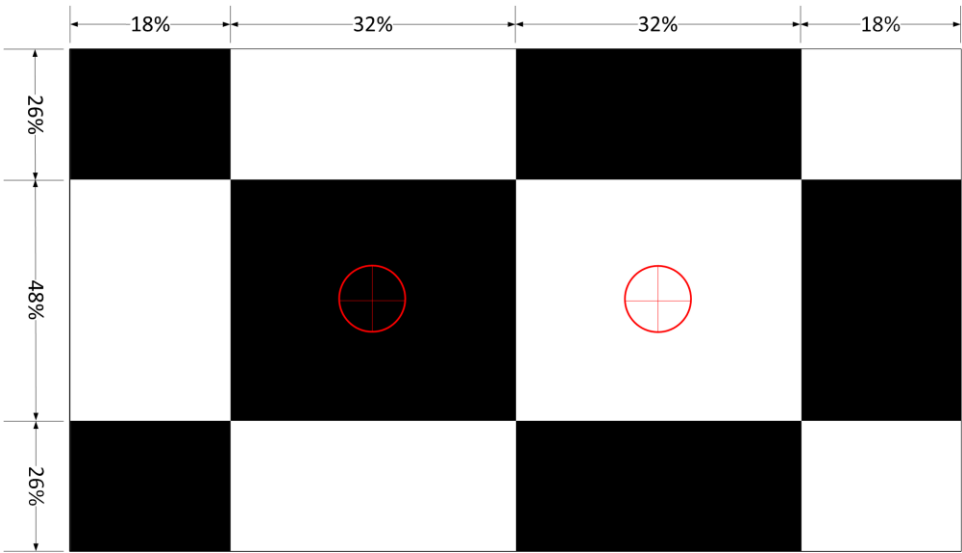


Figure 5-8. Mirrored, cropped 4x3 checkerboard test pattern – shown with crosshair targets.

When recording luminance using a pattern like Figure 5-7 and Figure 5-8, disable the cross-hair positioning hints.

For region sizes shown in Figure 5-7 and Figure 5-8 that are not integral pixel values, use the following equations to calculate whole pixel values.

Table 5-7 shows some example values using Equations 5-1 through 5-4.

Eqn. 5- 1

$$\text{center width} = \text{round}\left(\frac{2}{3} \times 48\% \times \text{horizontal resolution}\right)$$

Eqn. 5- 2

$$\text{side width} = \text{floor}\left(\frac{\text{horizontal resolution}}{2}\right) - \text{center width}^a$$

Eqn. 5- 3

$$\text{edge height} = \text{floor}(26\% \times \text{vertical resolution})$$

Eqn. 5- 4

$$\text{center height} = \text{vertical resolution} - 2 \times \text{edge height}$$

Table 5-7. Example check sizes for the cropped checkerboard (Figure 5-7 and Figure 5-8)

Display resolution		Center checks		Side columns	Top and bottom rows
horizontal	vertical	width (horz.)	height (vert.)	width (horz.)	height (vert.)
1920	1080	614	520	346	280
2560	1440	819	692	461	374
3840	1440	1229	692	691	374
3000	2000	960	960	540	520

2. Section 10.1: replace Table 10-2 with the following and add text below the table (comment 3571, 3595, 3603, 3612):

Table 10-2: DisplayHDR True Black Performance Level Test Limits (Normative)

Test	Minimum	Maximum	Applicable Test Method Is Specified in
Dual Corner Box Test – Black-level Test		0.0005 cd/m ²	Section 5.2.1
Checkerboard at Full-luminance Test or up to 500 cd/m ² whichever is less ^a — Black-level test		0.0005 cd/m ²	Section 5.2.2
Color Gamut ITU-R BT.709 Coverage for Both 10 % and Full-screen Color Patches	99 %		Section 6
Color Gamut DCI-P3 CIE D65 ^b Coverage for Both 10 % and Full-screen Color Patches	90 %		Section 6
Simulated bit-depth Test	8b + 2b FRC		Section 7.2.1
Rise time		Two frames at 60 Hz (33 ms)	Section 8.2 Section 8.4

Table notes:

- a. The checkerboard white luminance is measured according to Section 5.2.2 and if found to exceed 500 cd/m² the applied digital code value shall be reduced until the luminance is just above 500 cd/m². (There may be an arrow

key control in a test tool to adjust white luminance). Once the white luminance is set as described, measure the black luminance. The white luminance may need to be adjusted when changing from the pattern in Figure 5-7 to its mirrored version in Figure 5-8.

Measure the center black check using both a rendering with Figure 5-7 and then with Figure 5-8, (no alignment markers visible). The rest shall report the mean of the two readings. Always take readings after a one minute cool down from any previous luminance test (see Section 5.2.1).

- b. Defined in SMPTE RP-431-2

After Table 10-2, insert a new section heading

“10.2. True Black luminance measurement guidance”

At the end of the new section 10.2, add the following paragraphs (per comment 3599):

The equipment cited in Section 3-4 notably the following spectroradiometer in Table 5-3 are known to measure black luminance of a True Black display with sufficient accuracy and resolution:

Table 5- 1. True Black recommended spectroradiometer

Manufacturer (Family)	Model numbers	Recommended acceptance angle or aperture
Konica-Minolta	CS-2000/2000A	1°
Photo Research SpectraDuo®	PR-680/680L	1°
Photo Research SpectraScan®	PR-740/745/788	1°
TOPCON TECHNOHOUSE CORP.	SR-UL2	1°

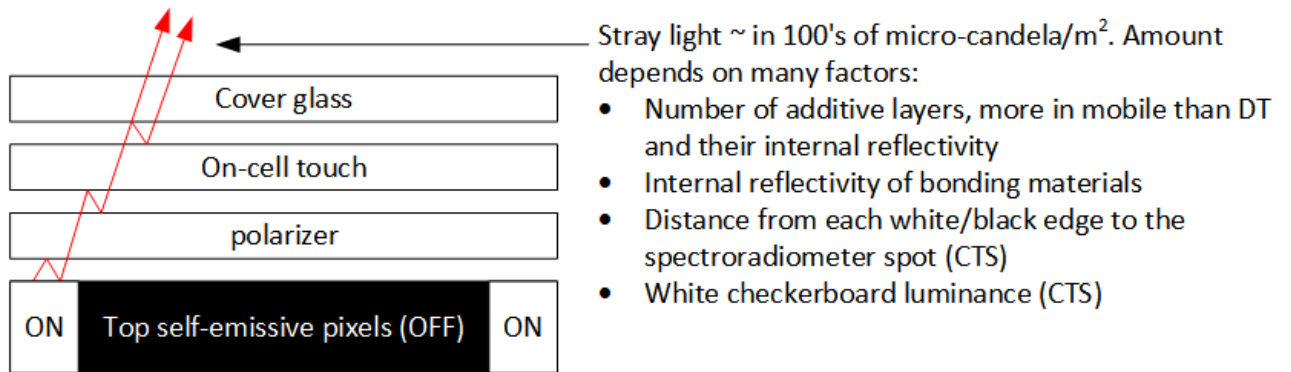
- a. Photo Research a JADAK Company.

While other equipment may suffice, this specification expects developers to use equipment with an acceptance angle setting no smaller than 1° and a standard length prime lens with an approximate focus distance equal to 350 mm, unless otherwise authorized in writing by the VESA Test Compliance Manager.

Background Information

The checkerboard test, as exists, is prone to pick up scattered light from added on-cell touch and cover glass layers, which are added exclusively to small mobile products rather than desktop monitors. The scattered light is not an increase in the black level or contrast because this SCR does not change the black level test limit in Section 5.2.1. The light scattering is consequential for small True Black self-emissive displays where the black level test is fixed but the white level unbounded. The checkerboard test applied in section 5.2.2 is otherwise only contrast ratio dependent as measured in stops, not an absolute black level.

The SCR comprehends the difference in panel construction between desktops and mobile where additional layers are bonded for desired functionality.



Return to the [Summary of Changes](#)

Return to the [Proposed Document Changes](#)

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