Video Electronics Standards Association

VESA DSC Standard

Version 1.2 Errata List

Revision 1.0

18 January, 2017

Notice

The VESA errata process starts with one or more Standard Change Requests (SCRs) that are reviewed by the VESA Display Stream Compression (DSC) task group and all VESA members. Approved SCRs becomes Engineering Change Notices (ECNs), and are then published as errata. All SCRs in this errata are adopted as changes to *VESA Display Stream Compression (DSC) Standard, v1.2 (DSC v1.2)*.

Errata Revision History

Date	Revision	Description
January 18, 2017	1.0	Initial release of Errata.

SCR Summary

Date	Version	SCR Name and *DSC v1.2* Content Affected
Adopted SCRs The following adopted SCRs are included in this errata and affect *VESA Display Stream Compression (DSC) Standard, v1.2* (*DSC v1.2*).		
October 7, 2016	1	DSC 1.2 RGB 16bpc clarification SCR – Sections 6.1 and 7.7
May 3, 2016	3	Change on rules for slice_height/picture_height in 4:2:2 and 4:2:0 – Table 4-1
October 7, 2016	1	DSC 1.2 QP Restriction in 1.1 YCbCr Mode SCR – Table 4-3 and Annex E
October 7, 2016	1	DSC 1.2 4:2:2 mode specification typos SCR – Sections 3.10.1 and 6.5.3.1
October 28, 2016	4	DSC 1.2 4:2:0 prediction and RC bug fixes SCR – Sections 1.3 and 6.8.4, and Tables 1-1 and 4-1
November 7, 2016	2	DSC 1.2 C model max QP check SCR – Annex E
November 20, 2016	1	DSC 1.2 YCbCr QP map spec typo fix SCR – Section 6.8.6
Dispositioned SCR The following dispositioned SCR is included in this errata and affects *DSC v1.2*.		
October 17, 2016	5	Full ICH Error Precision SCR – Section 6.5.3.3

1 DSC 1.2 RGB 16bpc clarification SCR – Sections 6.1 and 7.7

Summary of the Proposed Change(s)

This change involves two clarifications to the handling of RGB 16bpc pictures:

- Fix typo in Section 6.1 where the formulae for Co and Cg in RGB 16bpc mode do not match the C model.
- Fix the formulae referenced above to clarify that the results of the computation shall not exceed 16 bits. Adjust the C model to match this behavior.

Benefits as a Result of the Change(s)

The updates fix a potential bug if a maximum value 16-bpc Co value is generated. The proposed changes also fix typos.

Section 6.1 Change

The following change applies to Section 6.1 in *DSC v1.2* (page 74).

…

When ***bits_per_component*** is 16 (*DSC v1.2* and higher), the encoder shall round the chroma's lsb. Co and Cg component bit depth (**`cpntBitDepth_C`**) is then the same as the luma bit depth (16 bits). The final Co and Cg values are centered around the midpoint:

Co = MIN(0xFFFF, ((**`cscCo`**+1) >> 1) + 0x8000~~32768~~)

Cg = MIN(0xFFFF, ((**`cscCg`**+1) >> 1) + 0x8000~~32768~~)

…

Section 7.7 Change

The following change applies to Section 7.7 in *DSC v1.2* (page 121).

…

Or, if ***bits_per_component*** is programmed to 16 (*DSC v1.2* and higher) in the current PPS, a slightly different conversion is used:

`cscCo` = (Co - 0x8000~~32768~~) << 1

`cscCg` = (Cg - 0x8000~~32768~~) << 1

…

2 Change on rules for slice_height/ picture_height in 4:2:2 and 4:2:0 – Table 4-1

Summary of the Proposed Change(s)

Table 4-1, page 52, last row enforces requirements on **slice_width** and **slice_height** for 422 and 420 modes:

- "**slice_height** shall be a multiple of 2 if either native_422 or native_420 is set to 1"
- **"slice_width** shall be a multiple of 2 if native_420 is set to 1"

There are no reasons to restrict the **slice_height** (or) to multiple of 2 in 4:2:2 since all lines are identical (packing is horizontal, and each line have same color samples). This could prevent the use of DSC on interlaced video (e.g., SDTV).

For 4:2:2 native mode or simple_422 mode, the **slice_width** also requires to be an even number of pixels but this is not stated in the Standard.

Benefits as a Result of the Change(s)

More flexibility and consistency between Standard and C model.

Table 4-1 Change

The following change applies to Table 4-1 in *DSC v1.2* (page 52, last row, last column).

Excerpt from Table 4-1: Picture Parameter Set Syntax Elements

Syntax Element	Size (Bits)	Format	Maps To	Description
slice_height	16	Unsigned	PPS10[7:0], PPS11[7:0]	Specify the size for each slice, in units of pixels. All slices that comprise a single picture are required to have an identical size. If the ***pic_height*** is not evenly divisible by the ***slice_height***, lines consisting of midpoint-valued samples are added to the bottommost slice(s) so that these slices are the same height as the other slices. If the ***pic_width*** is not evenly divisible by the ***slice_width***, the rightmost column of pixels is replicated to pad the rightmost slices to be the same width as the other slices. The transport must allocate transmission time for sending the compressed bits corresponding to any replicated pixels. ***slice_height*** shall be a multiple of 2 if ~~either native_422 or~~ ***native_420*** is set to 1. ***slice_width*** shall be a multiple of 2 if either either ***simple_422***, ***native_422***, or ***native_420*** is set to 1.
slice_width	16	Unsigned	PPS12[7:0], PPS13[7:0]	

3 DSC 1.2 QP Restriction in 1.1 YCbCr Mode SCR – Table 4-3 and Annex E

Summary of the Proposed Change(s)

This change involves creating a restriction on QP values in *DSC v1.1* YCbCr mode. QP values from 13 + 2 * (***bits_per_component*** - 8) to 15 + 2 * (***bits_per_component*** - 8) result in undefined behavior because the chroma quantization level is 8 and chroma samples only have 8 bits. This may result in a negative size prediction, which can cause errors in the C model. Therefore, we are proposing to restrict the QP value so that it cannot land within that range, and we propose to update the guidance for *DSC v1.1* YCbCr mode to reduce QP values by one to ensure that 8bpp mode still has a valid parameter set and to better use the available rate buffer space.

Benefits as a Result of the Change(s)

The update clarifies an issue with *DSC v1.1* YCbCr mode that certain large QP values cannot be used without generating an error condition. This also clarifies the RC QP parameter guidance when *DSC v1.1* YCbCr mode is used.

Table 4-3 Change

The following change applies to Table 4-3 in *DSC v1.2* (page 58).

Excerpt from Table 4-3: *rc_range_parameters* Field Descriptions

Syntax Element	Size (Bits)	Format	Description
range_max_qp	5	Unsigned	Specifies the maximum QP that is allowed if the RC model has tracked to the current range (see Section 6.8.4). This value shall be less than 13 + 2 * (***bits_per_component*** - 8) if ***dsc_version_minor*** is equal to 1 and ***convert_rgb*** is equal to 0.

Annex E Change

Note: *This content is also affected by a change documented in Section 6 of this errata.*

The following change applies to Annex E in *DSC v1.2* (page 132):

…

The other RC parameters are specified in the sample RC files, and are empirically optimized to maximize performance on a wide range of test content. These values are reproduced in Table E-4 and Table E-5 for convenience. Note that the QP-related values (***range_min_qp[]***, ***range_max_qp[]***, ***flatness_min_qp***, ***flatness_max_qp***, ***rc_quant_incr_limit0***, and ***rc_quant_incr_limit1***) should be decreased by 1 if ***dsc_version_minor*** is equal to 1 and ***convert_rgb*** is equal to 0.

…

4 DSC 1.2 4:2:2 mode specification typos SCR – Sections 3.10.1 and 6.5.3.1

Summary of the Proposed Change(s)

This change involves fixing a few typos and inconsistencies in the Standard related to native 4:2:2 mode.

Benefits as a Result of the Change(s)

These changes clarify the Standard by making the document consistent with itself and the behavior of the C model.

Section 3.10.1 Change

The following change applies to Section 3.10.1 in *DSC v1.2* (page 48).

…

In ~~either~~ Native 4:2:0 mode, the block prediction and block prediction search applies only to luma pixels, and MMAP or MPP is always used for chroma.

Section 6.5.3.1 Change

The following change applies to Section 6.5.3.1 in *DSC v1.2* (page 88).

…

For each pixel within the group, the encoder searches over the 32 ICH entries and finds the best entry for each pixel with the smallest weighted SAD of per-component errors (**weightedSad**):

```
weightedSad = lumaWeight * ABS(Y_orig - Y_history) +
  ABS(Co_orig - Co_history) + ABS(Cg_orig - Cg_history) + 2 ~~+~~*
  ABS(Y2_orig - Y2_history)
```

…

5 DSC 1.2 4:2:0 prediction and RC bug fixes SCR – Sections 1.3 and 6.8.4, and Tables 1-1 and 4-1

Summary of the Proposed Change(s)

This SCR deprecates Native 4:2:0 mode for *DSC v1.2*.

Benefits as a Result of the Change(s)

The original Standard may require additional hardware because it requires use of a prediction method that is not used anywhere else (MMAP with midpoint value used in place of previous line). The SCR reduces the hardware requirement and makes the behavior more consistent. Fixing the predicted activity measure slightly improves some images and creates more consistent behavior across modes.

Section 1.3 Change

The following change applies to Section 1.3 in *DSC v1.2* (page 16).

There are some issues with the Native 4:2:0 mode in *DSC v1.2* that have been identified in reviews that were conducted after the Standard's release. *DSC v1.2a* is under development that will address these issues. Therefore, the Native 4:2:0 mode is deprecated in *DSC v1.2* and shall **not** be used. Native 4:2:0 support will be allowed in the upcoming *DSC v1.2a* release.

Although *DSC v1.2* replaces *DSC v1.1*, *DSC v1.1* implementations are still fully supported in this Standard. The main objectives of *DSC v1.2* are to add support for 14 and 16 bits/component (bpc) and Native 4:2:0 and 4:2:2 modes. *DSC v1.2* also includes minor adjustments to some parts of the algorithm.

…

Table 1-1 Change

The following change applies to Table 1-1 in *DSC v1.2* (page 16).

Table 1-1: DSC Supported Modes, by Version

Mode	*DSC v1.1*	*DSC v1.2*	*Future DSC v1.2a*
4:4:4 RGB, 8, 10, and 12bpc	✔	✔	✔
4:4:4 YCbCr, 8, 10, and 12bpc	✔	✔	✔
4:2:2 YCbCr 8, 10, and 12bpc	✔ (Simple mode only)	✔ (Native and Simple modes)	✔ (Native and Simple modes)
4:2:0 YCbCr, 8, 10, and 12bpc		✔	✔
Any mode, 14 and 16bpc		✔	✔

Table 4-1 Change

The following change applies to Table 4-1 in *DSC v1.2* (page 55).

Excerpt from Table 4-1: Picture Parameter Set Syntax Elements

Syntax Element	Size (Bits)	Format	Maps To	Description
native_420	1	Flag	PPS88[1]	Value shall be 0. ~~if any of the following conditions exist:~~ ~~• dsc_version_minor = 1~~ ~~• simple_422 or native_422 = 1~~ ~~0 = Native 4:2:0 mode is not used.~~ ~~1 = Native 4:2:0 mode is used.~~

Section 6.8.4 Change

The following change applies to Section 6.8.4 in *DSC v1.2* (page 108).

…

- When ***dsc_version_minor*** is programmed to 0x2, the `prev2Qp` value, before it is used, is adjusted for flatness using the equations defined in Section 6.8.5.2 if the current group is signaled as flat. Also, the final `stQp` value is clamped to be between `minQp` and `maxQp` after these values are adjusted according to the logic illustrated in Figure 6-17 and Figure 6-18. **`adjustedMaxQp`** is equal to MIN(2 * ***bits_per_component*** - 1, maxQp + 1). **`lowMinQp`** is equal to `MAX(`**`maxQp`**` - 4, 0)`. **`bitSaveMode`** is computed according to the following pseudocode:

…

6 DSC 1.2 C model max QP check SCR – Annex E

Summary of the Proposed Change(s)

This change involves adding a check to the C model to ensure that the overflow avoid QP is sufficiently high to ensure the buffer model does not overflow.

The PPS guidance spreadsheet that is currently in development will be modified for some of the ***MaxQP[14]*** values after testing with the included update.

Benefits as a Result of the Change(s)

The update ensures that users do not program the PPS in such a way that a buffer overflow might occur with corner-case images.

Annex E Change

Note: *This content is also affected by a change documented in Section 3 of this errata.*

The following change applies to Annex E in *DSC v1.2* (page 132):

…

The other RC parameters are specified in the sample RC files, and are empirically optimized to maximize performance on a wide range of test content. These values are reproduced in Table E-4 and Table E-5 for convenience.

The ***rc_range_parameters[]*** should be configured to avoid possible encoder buffer model overflows with worst-case content. The C model includes a check for ***rc_range_parameters[14]***, ***range_max_qp*** that can help users avoid overflows due to an improper configuration. If the maximum bits per group that might continuously be generated by the entropy encoder at a QP equal to ***rc_range_parameters[14]***, ***range_max_qp*** is greater than the minimum number of bits allocated per group, an error message is created by the C model. The message indicates that some image may exist that creates a buffer overflow condition, and therefore the user should increase the value of ***rc_range_parameters[14]***, ***range_max_qp***.

…

7 DSC 1.2 YCbCr QP map spec typo fix SCR – Section 6.8.6

Summary of the Proposed Change(s)

A change is needed to fix a typographical error in the Standard on the mapping of QP values to quantization levels (Section 6.8.6) in YCbCr mode.

Benefits as a Result of the Change(s)

This change fixes erroneous text in the Standard. The normative C model is unchanged.

Section 6.8.6 Change

The following change applies to Section 6.8.6 in *DSC v1.2* (page 114).

…

If ***convert_rgb*** is set to 1 or ***dsc_version_minor*** is programmed to 0x1, **masterQp** is mapped to luma and chroma **qLevelY** and **qLevelC**, respectively, according to Table 6-2~~ for 8, 10, and 12bpc~~. If the bit depth for luma and chroma are the same and ***dsc_version_minor*** is programmed to 0x2, **masterQp** is mapped to luma **qLevelY** using Table 6-2, and chroma **qLevelC** from the table is further modified using the following equation~~for 14 and 16bpc, according to Table 6-2, as follows~~:

```
qLevelC = MAX(0, qLevelC - 1);
```

…

8 Full ICH Error Precision SCR – Section 6.5.3.3

Summary of the Proposed Change(s)

This change involves creating an alternative method for ICH selection in the encoder. Either method could be supported by decoders without a hardware change. An encoder might choose to select this alternative mode to help resolve small LSB errors when using 10+ bits per component (bpc) configurations.

The change involves increasing the precision of the errors in the ICH decision. For bit depths greater than 8bpc, it can be helpful to retain the full precision of the errors when comparing rate-distortion costs.

Benefits as a Result of the Change(s)

Implementations that choose to implement the alternate mode may see a slight improvement on fine structures and subtle gradients.

Section 6.5.3.3 Addition

The following change adds new Section 6.5.3.3, "Full Error Precision for ICH Decision" in *DSC v1.2* (page 114).

For some implementations, particularly at bit depths greater than or equal to 10 bits/component, it can be advantageous to make slight modifications to the ICH decision process. Implementations shall use either the method described in this section or Section 6.5.3.2 to compute the errors used for the ICH decision. The method described in Section 6.5.3.2 shall be used if ***dsc_version_minor*** is equal to 1.

For implementations that choose to implement the alternative decision, the error computation (for **`maxYErrIchMode`**, **`maxCoErrIchMode`**, etc.) described in Section 6.5.3.2 shall use a shift value of 0, regardless of the component bit depth (i.e., the full precision of the errors shall be used to compute the log error costs). The remainder of the calculation shall be the same as that described in Section 6.5.3.2.