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| *Title:* | **Signaling of quantization matrices in SPS and PPS** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

# This contribution recommends signaling quantization matrices in SPS and PPS instead of in APS for better error resiliency, and enabling an option of partial PPS update for frequent update of quantization matrices without incurring large overhead.

# Introduction

In the HEVC committee draft [2] the quantization matrices are carried in adaptation parameter set (APS), as opposed to carrying them in sequence parameter set (SPS) and picture parameter set (PPS). The motivation of such a design is to allow frequent update of quantization matrices from picture to picture without need of sending PPS very frequently, but this leads to error resiliency issue.

Loss of quantization matrices during the transmission will have significant impact on video quality. APS is sent very frequently, potentially once every picture. There is no mechanism to protect the data in the APS with higher priority than other data in the picture. But SPS and PPS are differently, the data in the SPS and PPS change rarely, SPS and PPS can be sent out-of-band and be ensured error free. Therefore, it is preferable to carry the quantization matrices in SPS and PPS, same as the way specified in the H.264/AVC.

# Proposed changes

To address the error resiliency issue discussed above, we propose to carry the quantization matrices in SPS and PPS, and to enable an option of PPS partial update for signaling new quantization matrices, so that the overhead can be contained when frequent sending of PPS is needed for frequent update of quantization matrices, e.g. from picture to picture.

To support the proposed method, changes in the SPS, PPS and APS syntax are summarized as follows (see CD text in section 6):

* Add signaling of quantization matrices (i.e. scaling\_list\_param( )) back to SPS and PPS
* In the PPS, insert a new flag, **pps\_partial\_update\_flag,** which allows partial update of the PPS. If this flag is set equal to 1, only new quantization matrices are carried in the PPS, the other parameters for the PPS are inherited from PPS whose ID (**pic\_parameter\_set \_inherit\_id**) is explicitly signaled in the bitstream.
* Delete signaling of quantization matrices from the APS.

The semantics of scaling\_list\_param() remains the same as defined in JCTVC-H1003 [2]. Just like H.264/AVC, the quantization matrices in PPS can override the ones in SPS.

# Conclusions

# Signaling quantization matrices in SPS and PPS are beneficial to error resiliency. It is recommended to remove quantization matrices signaling from APS and move them back to SPS and PPS.

# References

[1] F. Bossen, “Common test conditions and software reference configurations,” JCT-VC Document, JCTVC-G1100, San Jose, CA, USA, February 2012.

[2] [B. Bross](mailto:benjamin.bross@hhi.fraunhofer.de), [W.-J. Han](mailto:wjhan.han@samsung.com), [J.-R. Ohm](mailto:ohm@ient.rwth-aachen.de), [G. J. Sullivan](mailto:garysull@microsoft.com), [T. Wiegand](mailto:thomas.wiegand@hhi.fraunhofer.de) “High Efficiency Video Coding (HEVC) Test Model 6 (HM 6) Encoder Description,” JCT-VC Document, JCTVC-G1003, San Jose, CA, USA, February 2012.

# Patent rights declaration(s)

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# CD text

Changes marked as yellow

#### 7.3.2.1 Sequence parameter set RBSP syntax

|  |  |
| --- | --- |
| seq\_parameter\_set\_rbsp( ) { | Descriptor |
| … … |  |
| **vui\_parameters\_present\_flag** | u(1) |
| if( vui\_parameters\_present\_flag ) |  |
| vui\_parameters( ) |  |
| **sps\_scaling\_list\_data\_present\_flag** | u(1) |
| if ( sps\_scaling\_list\_data\_present\_flag ) |  |
| scaling\_list\_param( ) |  |
| **sps\_extension\_flag** | u(1) |
| if( sps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **sps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

#### 7.3.2.2 Picture parameter set RBSP syntax

|  |  |
| --- | --- |
| pic\_parameter\_set\_rbsp( ) { | Descriptor |
| **pic\_parameter\_set\_id** | ue(v) |
| **pps\_partial\_update\_flag** | u(1) |
| If (pps\_partial\_update\_flag ==0) { |  |
| **seq\_parameter\_set\_id** | ue(v) |
| **sign\_data\_hiding\_flag** | u(1) |
| **… ….** |  |
| **Pps\_extension\_flag** | u(1) |
| if( pps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **pps\_extension\_data\_flag** | u(1) |
| **}** else |  |
| **pic\_parameter\_set \_inherit\_id** | ue(v) |
| **pps\_scaling\_list\_data\_present\_flag** | u(1) |
| if( pps\_scaling\_list\_data\_present\_flag ) |  |
| scaling\_list\_param( ) |  |
| rbsp\_trailing\_bits( ) |  |
| } |  |

#### 7.3.2.5 Adaptation parameter set RBSP syntax

|  |  |
| --- | --- |
| aps\_rbsp( ) { | Descriptor |
| **aps\_id** | ue(v) |
| **~~aps\_scaling\_list\_data\_present\_flag~~** | ~~u(1)~~ |
| ~~if( aps\_scaling\_list\_data\_present\_flag )~~ |  |
| ~~scaling\_list\_param( )~~ |  |
| **aps\_deblocking\_filter\_flag** | u(1) |
| … …. |  |
| } |  |

#### In 7.4.2.1 Sequence parameter set RBSP semantics, add

**sps\_scaling\_list\_data\_present\_flag** equal to 1 specifies that the scaling list parameters exist in this SPS, equal to 0 specifies that scaling list parameters do not exist in this SPS.

#### In 7.4.2.2 Picture parameter set RBSP semantics, add

**pps\_scaling\_list\_data\_present\_flag** equal to 1 specifies that the scaling list parameters exist in this PPS, equal to 0 specifies that scaling list parameters do not exist in this PPS.

**pps\_partial\_update\_flag** equal to 1 specified that only scaling lists are present in this PPS, the other parameters of the PPS are inherited from a PPS whose ID is excplitly signaled by pic\_parameter\_set\_inherit\_id.

**pic\_parameter\_set\_inherit\_id** identifies the picture parameter set that is referred to for PPS parameters inheritance. The value of pic\_parameter\_set\_inherit\_id shall be in the range of 0 to 255, inclusive.