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| *Title:* | **On parameter sets** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This document proposes 1) to remove the referencing of SPS in PPS; 2) to introduce the group parameter set (GPS) that groups an SPS, a PPS and zero or more APS's, such that a slice can refer to an SPS, a PPS and zero or more APS's through referencing a GPS; and 3) a changed parameter set activation process per proposal pieces 1 and 2.

It is asserted that the proposal enables reducing the maximum number of allowed PPS's as well as solves the APS partial update problem.

# Proposal

## Syntax and semantics changes

### Sequence parameter set RBSP syntax

No change.

### Sequence parameter set RBSP semantics

**profile\_idc** and **level\_idc** indicate the profile and level to which the coded video sequence conforms.

**reserved\_zero\_8bits** shall be equal to 0. Decoders shall ignore the value of reserved\_zero\_8bits.

**seq\_parameter\_set\_id** identifies a sequence parameter set. The value of seq\_parameter\_set\_id shall be in the range of 0 to 31, inclusive.

**...**

### Picture parameter set RBSP syntax

|  |  |
| --- | --- |
| pic\_parameter\_set\_rbsp( ) { | Descriptor |
| **pic\_parameter\_set\_id** | ue(v) |
| **…** |  |
| rbsp\_trailing\_bits( ) |  |
| } |  |

### Picture parameter set RBSP semantics

**pic\_parameter\_set\_id** identifies a picture parameter set that is referred to in the group parameter set. The value of pic\_parameter\_set\_id shall be in the range of 0 to 31, inclusive.

**...**

### Adaptation parameter set RBSP syntax

No change.

### Adaptation parameter set RBSP semantics

**aps\_id** identifies the adaptation parameter set that is referred to in the group parameter set. The value of aps\_id shall be in the range of 0 to 31, inclusive.

**...**

### Group parameter set RBSP syntax (new)

|  |  |
| --- | --- |
| group\_parameter\_set\_rbsp( ) { | Descriptor |
| **group\_parameter\_set\_id** | ue(v) |
| **sps\_id** | ue(v) |
| **pps\_id** | ue(v) |
| **num\_ref\_aps\_ids** | ue(v) |
| for( i = 0; i < num\_ref\_aps\_ids; i++ ) { |  |
| **ref\_aps\_id[** i **]** | ue(v) |
| **ref\_aps\_param\_type[** i **]** | ue(v) |
| } |  |
| **gps\_extension\_flag** | u(1) |
| if( gps\_extension\_flag ) |  |
| while( more\_rbsp\_data( ) ) |  |
| **gps\_extension\_data\_flag** | u(1) |
| rbsp\_trailing\_bits( ) |  |
| } |  |

### Group parameter set RBSP semantics (new)

**group\_parameter\_set\_id** identifies a group parameter set. The value of group\_parameter\_set\_id shall be in the range of 0 to 255, inclusive.

**sps\_id** identifies the sequence parameter set referenced by the group parameter set. The value of sps\_id shall be in the range of 0 to 31, inclusive.

**pps\_id** identifies the picture parameter set referenced by the group parameter set. The value of pps\_id shall be in the range of 0 to 31, inclusive.

**num\_ref\_aps\_ids** specifies the number of the following ref\_aps\_id[ i ] syntax elements. The value of num\_ref\_aps\_ids shall be in the range of 0 to 4, inclusive.

**ref\_aps\_id[** i **]** identifies the i-th adaptaion parameter set referenced by the group parameter set. The value of ref\_aps\_id[ i ] shall be in the range of 0 to 31, inclusive.

NOTE – The same value of the ref\_aps\_id[ i ] may be present in the loop more than once, thus more than one type of APS parameters from the same APS can be referenced by the same GPS and applies to coded slices referring to the GPS.

**ref\_aps\_param\_type[** i **]** specifies the type of the APS parameters included in the i-th adaptaion parameter set referenced by the group parameter set. The value of ref\_aps\_parame\_type[ i ] shall be in the range of 0 to 3, inclusive. The values of 0 to 3, inclusive, for ref\_aps\_parame\_type[ i ] correspond to the APS parameter types of scaling list, deblocking filter, SAO, and ALF, respectively. The values of ref\_aps\_parame\_type[ i ] for any two different values of i shall not be identical.

**gps\_extension\_flag** equal to 0 specifies that no gps\_extension\_data\_flag syntax elements are present in the sequence parameter set RBSP syntax structure. gps\_extension\_flag shall be equal to 0 in bitstreams conforming to this Recommendation | International Standard. The value of 1 for gps\_extension\_flag is reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore all data that follow the value 1 for gps\_extension\_flag in a grouping parameter set NAL unit.

**gps\_extension\_data\_flag** may have any value. It shall not affect the conformance to profiles specified in this Recommendation | International Standard.

### Slice header syntax

|  |  |  |
| --- | --- | --- |
| slice\_header( ) { | Descriptor | |
| **first\_slice\_in\_pic\_flag** | | u(1) |
| if( first\_slice\_in\_pic\_flag = = 0 ) | |  |
| **slice\_address** | | u(v) |
| **slice\_type** | | ue(v) |
| **entropy\_slice\_flag** | | u(1) |
| if( !entropy\_slice\_flag ) { | |  |
| **gps\_id** | | ue(v) |
| **…** |  | |
| if( slice\_type = = P | | slice\_type = = B ) { | |  |
| **num\_ref\_idx\_active\_override\_flag** | | u(1) |
| **…** |  | |
| } |  | |

### Slice header semantics

When present, the value of the slice header syntax elements gps\_id, pic\_output\_flag, idr\_pic\_id, no\_output\_of\_prior\_pics\_flag, pic\_order\_cnt\_lsb, short\_term\_ref\_pic\_set\_sps\_flag, short\_term\_ref\_pic\_set\_idx and num\_long\_term\_pics shall be the same in all slice headers of a coded picture. When present, the value of the slice header syntax elements delta\_poc\_lsb\_lt[ i ], delta\_poc\_msb\_present\_flag[ i ], delta\_poc\_msb\_cycle\_lt\_minus1[ i ] and used\_by\_curr\_pic\_lt\_flag[ i ] shall be the same in all slice headers of a coded picture for each i in the range of 0 to num\_long\_term\_pics, inclusive.

**first\_slice\_in\_pic\_flag** indicates whether the slice is the first slice of the picture. If first\_slice\_in\_pic\_flag is equal to 1, the variables SliceCbAddrZS and SliceCtbAddrRS are both set to 0 and the decoding starts with the first coding treeblock in the picture.

**...**

**entropy\_slice\_flag** equal to 1 specifies that the value of slice header syntax elements not present is inferred to be equal to the value of slice header syntax elements in a proceeding slice, where a proceeding slice is defined as the slice containing the coding treeblock with location (SliceCtbAddrRS − 1). entropy\_slice\_flag shall be equal to 0 when SliceCtbAddrRS equal to 0.

**gps\_id** specifies the group parameter set in use. The value of gps\_id shall be in the range of 0 to 255, inclusive.

**...**

*<The semantics of aps\_id is missing in the latest HEVC WD. If present, it would be proposed to be removed.>*

**...**

## Activation of parameter sets

**7.4.1.2.1 Order of sequence, picture and adaptation parameter set RBSPs and their activation**

This subclause specifies the activation process of picture, sequence and adaptation parameter sets for coded video sequences that conform to one or more of the profiles specified in Annex 10 that are decoded using the decoding process specified in clauses 2-9.

NOTE 1 – The sequence, picture and adaptation parameter set mechanism decouples the transmission of infrequently changing information from the transmission of coded macroblock data. Sequence, picture and adaptation parameter sets may, in some applications, be conveyed "out-of-band".

An adaptation parameter set RBSP includes parameters that can be referred to by the coded slice NAL units of one or more coded pictures indirectly through one or more group parameter sets referred to by the coded slice NAL units. Each adaptation parameter set RBSP is initially considered not active at the start of the operation of the decoding process. At most one adaptation parameter set RBSP is considered active for each type of APS parameters at any given moment during the operation of the decoding process, and the activation of any particular adaptation parameter set RBSP for a particular type of APS parameters results in the deactivation of the previously-active adaptation parameter set RBSP (if any) for that particular type of APS parameters.

When an adaptation parameter set RBSP (with a particular value of aps\_id) is not active for a particular type of APS parameters and it is referred to by a coded slice NAL unit for that particular type of APS parameters (using that value of aps\_id) indirectly through a group parameter set referred to by the coded slice NAL unit, it is activated for that particular type of APS parameters. This adaptation parameter set RBSP is called the active adaptation parameter set RBSP for that particular type of APS parameters until it is deactivated by the activation of another adaptation parameter set RBSP for that particular type of APS parameters. An adaptation parameter set RBSP, with that particular value of aps\_id, shall be available to the decoding process prior to its activation.

A picture parameter set RBSP includes parameters that can be referred to by the coded slice NAL units of one or more coded pictures indirectly through one or more group parameter sets referred to by the coded slice NAL units. Each picture parameter set RBSP is initially considered not active at the start of the operation of the decoding process. At most one picture parameter set RBSP is considered active at any given moment during the operation of the decoding process, and the activation of any particular picture parameter set RBSP results in the deactivation of the previously-active picture parameter set RBSP (if any).

When a picture parameter set RBSP (with a particular value of pic\_parameter\_set\_id) is not active and it is referred to by a coded slice NAL unit (using that value of pic\_parameter\_set\_id) indirectly through a group parameter set referred to by the coded slice NAL unit, it is activated. This picture parameter set RBSP is called the active picture parameter set RBSP until it is deactivated by the activation of another picture parameter set RBSP. A picture parameter set RBSP, with that particular value of pic\_parameter\_set\_id, shall be available to the decoding process prior to its activation.

Any picture parameter set NAL unit containing the value of pic\_parameter\_set\_id for the active picture parameter set RBSP for a coded picture shall have the same content as that of the active picture parameter set RBSP for the coded picture unless it follows the last VCL NAL unit of the coded picture and precedes the first VCL NAL unit of another coded picture.

A sequence parameter set RBSP includes parameters that can be referred to by the coded slice NAL units of one or more coded pictures indirectly through one or more group parameter sets referred to by the coded slice NAL units, or can be referred to by one or more SEI NAL units containing a buffering period SEI message. Each sequence parameter set RBSP is initially considered not active at the start of the operation of the decoding process. At most one sequence parameter set RBSP is considered active at any given moment during the operation of the decoding process, and the activation of any particular sequence parameter set RBSP results in the deactivation of the previously-active sequence parameter set RBSP (if any).

When a sequence parameter set RBSP (with a particular value of seq\_parameter\_set\_id) is not already active and it is referred to by a coded slice NAL unit indirectly through a group parameter set referred to by the coded slice NAL unit (using that value of seq\_parameter\_set\_id) or is referred to by an SEI NAL unit containing a buffering period SEI message (using that value of seq\_parameter\_set\_id), it is activated. This sequence parameter set RBSP is called the active sequence parameter set RBSP until it is deactivated by the activation of another sequence parameter set RBSP. A sequence parameter set RBSP, with that particular value of seq\_parameter\_set\_id and contained within an access unit with temporal\_id equal to 0, shall be available to the decoding process prior to its activation. An activated sequence parameter set RBSP shall remain active for the entire coded video sequence.

NOTE 2 – Because an IDR access unit begins a new coded video sequence and an activated sequence parameter set RBSP must remain active for the entire coded video sequence, a sequence parameter set RBSP can only be activated by a buffering period SEI message when the buffering period SEI message is part of an IDR access unit.

Any sequence parameter set NAL unit containing the value of seq\_parameter\_set\_id for the active sequence parameter set RBSP for a coded video sequence shall have the same content as that of the active sequence parameter set RBSP for the coded video sequence unless it follows the last access unit of the coded video sequence and precedes the first VCL NAL unit and the first SEI NAL unit containing a buffering period SEI message (when present) of another coded video sequence.

NOTE 3 – If picture parameter set RBSP, sequence parameter set RBSP or adaptation parameter set RBSP are conveyed within the bitstream, these constraints impose an order constraint on the NAL units that contain the picture parameter set RBSP or sequence parameter set RBSP, respectively. Otherwise (picture parameter set RBSP, sequence parameter set RBSP or adaptation parameter set RBSP are conveyed by other means not specified in this Recommendation | International Standard), they must be available to the decoding process in a timely fashion such that these constraints are obeyed.

All constraints that are expressed on the relationship between the values of the syntax elements (and the values of variables derived from those syntax elements) in sequence parameter sets, picture parameter sets and adaptation parameter sets and other syntax elements are expressions of constraints that apply only to the active sequence parameter set, the active picture parameter set and the active adaptation parameter set for each particular type of APS parameters. If any sequence parameter set RBSP is present that is not activated in the bitstream, its syntax elements shall have values that would conform to the specified constraints if it were activated by reference in an otherwise‑conforming bitstream. If any picture parameter set RBSP is present that is not ever activated in the bitstream, its syntax elements shall have values that would conform to the specified constraints if it were activated by reference in an otherwise-conforming bitstream. If any adaptation parameter set RBSP is present that is not ever activated in the bitstream, its syntax elements shall have values that would conform to the specified constraints if it were activated by reference in an otherwise-conforming bitstream.

During operation of the decoding process (see clause 8), the values of parameters of the active picture parameter set, the active sequence parameter set and the active adaptation parameter for each type of APS parameters shall be considered in effect. For interpretation of SEI messages, the values of the parameters of the picture parameter set and sequence parameter set that are active for the operation of the decoding process for the VCL NAL units of the coded picture in the same access unit shall be considered in effect unless otherwise specified in the SEI message semantics.

# Patent rights declaration(s)

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