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| **Source** | **WG 03, MPEG Systems** |
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**X. Syntax and semantics for complexity metrics**

**X.1 Overview**

As EVC Baseline profile and Main profile share almost no tools and the methods used for partition of the pictures are not same, , the profile the CVS conforming to is used to decide the set of syntax elements to describe the complexity metrics to be applied to each CVS. In addition, As the largest size of picture is indicated by the level the CVS is conformed to, the length of the syntax elements indicating the number of pixels and coding units are decided by the level. In addition, the width and height of the coding units are also considered when the length of the syntax elements indicating the number of coding units for the CVS conforming to the baseline profile is decided.

**X.2 EVC CM syntax**

The syntax for the EVC CMs is as follows:

|  |  |
| --- | --- |
|  |  |
| **period\_type** | u(8) |
| if (profile\_idc == 0) { |  |
| if (period\_type = = 0 || period\_type == 2 || period\_type == 4) { |  |
| **num\_non\_zero\_4\_cus** | uk(v) |
| **num\_non\_zero\_8\_cus** | uk(v) |
| **num\_non\_zero\_16\_cus** | uk(v) |
| **num\_non\_zero\_32\_cus** | uk(v) |
| **num\_non\_zero\_64\_cus** | uk(v) |
| **portion\_fractional\_prediction\_sample** | u(8) |
| } else if (period\_type = = 1 || period\_type == 3   || period\_type == 5) { |  |
| **num\_count** | u(16) |
| for (t=0; t<num\_count; t++ ) { |  |
| **num\_non\_zero\_4\_cus [t]** | uk(v) |
| **num \_non\_zero\_8\_cus [t]** | uk(v) |
| **num \_non\_zero\_16\_cus [t]** | uk(v) |
| **num \_non\_zero\_32\_cus [t]** | uk(v) |
| **num \_non\_zero\_64\_cus [t]** | uk(v) |
| **portion\_fractional\_prediction\_sample [t]** | u(8) |
| } |  |
| } |  |
| else if (profile\_idc ==1) { |  |
| if (period\_type = = 0 || period\_type == 2 || period\_type == 4) { |  |
| **num\_non\_zero\_samples** | uk(v) |
| **num\_affine\_samples** | uk(v) |
| **num\_dmvr\_samples** | uk(v) |
| **num\_alf\_samples** | uk(v) |
| **num\_deblocking\_filter\_samples** | uk(v) |
| **num\_htdf\_samples** | uk(v) |
| } else if (period\_type = = 1 || period\_type == 3   || period\_type == 5) { |  |
| **num\_count** | u(8) |
| for (t=0; t<num\_count; t++ ) { |  |
| **num\_non\_zero\_samples [t]** | uk(v) |
| **num\_\_samples [t]** | uk(v) |
| **num\_dmvr\_samples [t]** | uk(v) |
| **num\_alf\_samples [t]** | uk(v) |
| **num\_deblocking\_filter\_samples [t]** | uk(v ) |
| **num\_htdf\_samples [t]** | uk(v ) |
| } |  |
| } |  |
| } |  |

**X. 3Variable length syntax element**

The maximum number of pixels and coding units depend on the size of the picture the complexity metric is applied to. As the largest size of picture is indicated by the level the CVS is conformed to the length of the syntax elements indicating the number of pixels and coding units are decided by the levels. In addition, the width and height of the coding units are also considered when the length of the syntax elements indicating the number of coding units for the CVS conforming to the baseline profile as the width and height of the coding units get larger than the maximum number of coding units get smaller.

– uk(v): the field is unsigned integer and the length is decided by the value of the level\_idc field in the SPS used by the CVS this SEI message is applied to and the value of k assigned to each field based on the size of the units counted. The length of the field according to each value of both level\_idc and k is shown in the Table 5.

**Table 5 – length of uk(v)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **level** | **value of level\_idc** | **length of the field** | | | | | |
| **k==1** | **k==4** | **k==8** | **k==16** | **k==32** | **k==64** |
| 1 | 30 | 16 | 16 | 16 | 8 | 8 | 8 |
| 2 | 60 | 24 | 16 | 16 | 16 | 8 | 8 |
| 2.1 | 63 | 24 | 16 | 16 | 16 | 8 | 8 |
| 3 | 90 | 24 | 16 | 16 | 16 | 16 | 8 |
| 3.1 | 93 | 24 | 16 | 16 | 16 | 16 | 8 |
| 4 | 120 | 24 | 24 | 16 | 16 | 16 | 16 |
| 4.1 | 123 | 24 | 24 | 16 | 16 | 16 | 16 |
| 5 | 150 | 24 | 24 | 24 | 16 | 16 | 16 |
| 5.1 | 153 | 24 | 24 | 24 | 16 | 16 | 16 |
| 5.2 | 156 | 24 | 24 | 24 | 16 | 16 | 16 |
| 6 | 180 | 32 | 24 | 24 | 24 | 16 | 16 |
| 6.1 | 183 | 32 | 24 | 24 | 24 | 16 | 16 |
| 6.2 | 186 | 32 | 24 | 24 | 24 | 16 | 16 |

**X.4 EVC CM semantics**

**profile\_idc** indicates the profile of the CVS this SEI message is associated with.

**period\_type** specifies the type of upcoming period over which the complexity metrics are applicable and is defined in the Table 6.

**Table 6 – specification of period\_type for EVC**

|  |  |
| --- | --- |
| **Value** | **Description** |
| 0x0 | complexity metrics are applicable to a single picture |
| 0x1 | complexity metrics are applicable over a specified number of pictures counted in decoding order |
| 0x2 | complexity metrics are applicable to a single slice |
| 0x3 | complexity metrics are applicable to a specified number of slices counted in decoding order |
| 0x4 | complexity metrics are applicable to a single NAL unit |
| 0x5 | complexity metrics are applicable to a specified number of NAL units counted in receiving order |
| 0x6-0xF | user-defined |

**num\_non\_zero\_4\_cus** indicates the number of coding units whose width and height are not greater than 4 samples and have non-zero transform coefficients values in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 4.

**num\_non\_zero\_8\_cus** indicates the number of coding units whose width and height are 8 samples and have non-zero transform coefficients values in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 8.

**num\_non\_zero\_16\_cus** indicates the number of coding units whose width and height are 16 samples and have non-zero transform coefficients values in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 16.

**num\_non\_zero\_32\_cus** indicates the number of coding units whose width and height are 32 samples and have non-zero transform coefficients values in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field applied to and the value of the k is equal to 32.

**num\_non\_zero\_64\_cus** indicates the number of coding units whose width and height are 32 samples and have non-zero transform coefficients values in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 64.

**portion\_fractional\_prediction\_sample** indicates the portion of the samples requires fractional sample interpolation process applied in the period complexity metrics is applied to. It is defined as follows:

(0‑1)

**num\_count** indicates the number of pictures, slices or NAL units over which the complexity metrics is applicable when period\_type is 1, 3, or 5.

When period\_type is 1, then num\_count indicates the number of pictures in decoding order. When period\_type is 3, then num\_count indicates the number of slices in decoding order. When period\_type is 5, then num\_count indicates the number of NAL unites in receiving order.

**num\_non\_zero\_4\_cus [t]** indicates the number of coding units whose width and height are not greater than 4 samples and have non-zero transform coefficients values in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to with and the value of the k is equal to 4. When period\_type is 1, the period this metrics applied is tth picture in decoding order. When period\_type is 3, the period this metrics applied is tth slice in decoding order. When period\_type is 5, the period this metrics applied is tth NAL unit in receiving order.

**num\_non\_zero\_8\_cus [t]** indicates the number of coding units whose width and height are 8 samples and have non-zero transform coefficients values in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 8. When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_non\_zero\_16\_cus [t]** indicates the number of coding units whose width and height are 16 samples and have non-zero transform coefficients values in the period (t+1)th complexity metrics is applied to . The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to with and the value of the k is equal to 16. When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_non\_zero\_32\_cus [t]** indicates the number of coding units whose width and height are 32 samples and have non-zero transform coefficients values in the period (t+1)th complexity metrics is applied to . The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 32. When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_non\_zero\_64\_cus [t]** indicates the number of coding units whose width and height are 64 samples and have non-zero transform coefficients values in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 464 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**portion\_fractional\_prediction\_sample [t]** indicates the portion of the samples requires fractional sample interpolation process applied to in the period (t+1)th complexity metrics is applied. When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_non\_zero\_samples** indicates the number of non-zero transform coefficients in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_affine\_samples** indicates the number of pixels affine model based motion compensation is applied to in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_dmvr\_samples** indicates the number of pixels decoder-side motion vector refinement is applied to in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_alf\_samples** indicates the number of pixels adaptive loop filter is applied to in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_deblocking\_filter\_samples** indicates the number of pixels deblocking filter is applied to in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_htdf\_samples** indicates the number of pixels hadamard transform domain filter is applied to in the period complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS applied the CVS the SEI message this field is associated with and the value of the k is equal to 1.

**num\_non\_zero\_samples [t]** indicates the number of non-zero transform coefficients in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1. When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_affine\_samples** **[t]** indicates the number of pixels affine model based motion compensation is applied to in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_dmvr\_samples** **[t]** indicates the number of pixels decoder-side motion vector refinement is applied to in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_alf\_samples** **[t]** indicates the number of pixels adaptive loop filter is applied to in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_deblocking\_filter\_samples** **[t]** indicates the number of pixels deblocking filter is applied to in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.

**num\_htdf\_samples** **[t]** indicates the number of pixels Hadamard transform domain filter is applied to in the period (t+1)th complexity metrics is applied to. The length of this field is decided by the value of the level\_idc field in the SPS used by the CVS the SEI message this field is applied to and the value of the k is equal to 1 . When period\_type is 1, the period this metrics applied is (t+1)th picture in decoding order. When period\_type is 3, the period this metrics applied is (t+1)th slice in decoding order. When period\_type is 5, the period this metrics applied is (t+1)th NAL unit in receiving order.