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# Information technology — Coding of audio-visual objects —

## Part 10: Advanced Video Coding

## AMENDMENT 1: Additional profiles and supplemental enhancement information (SEI) messages

*Technologies de l'information — Codage des objets audiovisuels —*

*Partie 10: Codage visuel avancé*

*AMENDEMENT 1: Profils additionnels et messages d'informations d'amélioration supplémentaires (SEI)*

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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Amendment 1 to ISO/IEC 14496-10:2012 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

# Information technology — Coding of audio-visual objects —

# Part 10:
# Advanced Video Coding

## AMENDMENT 1: Additional profiles and supplemental enhancement information (SEI) messages

*At the end of 0.4, replace the following:*

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 15 (the current Specification) refers to the integrated version 14 text with miscellaneous corrections and clarifications as specified in a fifth technical corrigendum.

*with:*

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 15 refers to the integrated version 14 text with miscellaneous corrections and clarifications as specified in a fifth technical corrigendum.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 16 refers to the integrated version 15 text after its amendment to define three new profiles intended primarily for communication applications (the Constrained High, Scalable Constrained Baseline, and Scalable Constrained High profiles).

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 17 (the current Specification) refers to the integrated version 15 text after its amendment to define additional supplemental enhancement information (SEI) message data, including the multiview view position SEI message, the display orientation SEI message, and two additional frame packing arrangement type indication values for the frame packing arrangement SEI message (the 2D and tiled arrangement type indication values).

*In 7.4.2.1.1, replace the following:*

**constraint_set5_flag** is specified as follows:

- If profile_idc is equal to 118, constraint_set5_flag equal to 1 indicates that the coded video sequence obeys all constraints specified in subclause H.10.1.2 and constraint_set5_flag equal to 0 indicates that the coded video sequence may or may not obey all constraints specified in subclause H.10.1.2.
- Otherwise (profile_idc is not equal to 118), the value of 1 for constraint_set5_flag is reserved for future use by ITU-T | ISO/IEC. constraint_set5_flag shall be equal to 0 when profile_idc is not equal to 118 in bitstreams conforming to this Recommendation | International Standard. Decoders shall ignore the value of constraint_set5_flag when profile_idc is not equal to 118.

*with:*

**constraint_set5_flag** is specified as follows:

- If profile_idc is equal to 77, 88, or 100, constraint_set5_flag equal to 1 indicates that B slice types are not present in the coded video sequence. constraint_set5_flag equal to 0 indicates that B slice types may or may not be present in the coded video sequence.

- Otherwise, if profile_idc is equal to 118, constraint_set5_flag equal to 1 indicates that the coded video sequence obeys all constraints specified in subclause H.10.1.2 and constraint_set5_flag equal to 0 indicates that the coded video sequence may or may not obey all constraints specified in subclause H.10.1.2.
- Otherwise (profile_idc is not equal to 77, 88, 100, or 118), the value of 1 for constraint_set5_flag is reserved for future use by ITU-T | ISO/IEC. constraint_set5_flag shall be equal to 0 when profile_idc is not equal to 118 in bitstreams conforming to this Recommendation | International Standard. Decoders shall ignore the value of constraint_set5_flag when profile_idc is not equal to 118.

*In 8.7, replace the following:*

A conditional filtering process is specified in this subclause that is an integral part of the decoding process which shall be applied by decoders conforming to the Baseline, Constrained Baseline, Main, Extended, High, Progressive High, High 10, High 4:2:2, and High 4:4:4 Predictive profiles. For decoders conforming to the High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles, the filtering process specified in this subclause, or one similar to it, should be applied but is not required.

*with:*

A conditional filtering process is specified in this subclause that is an integral part of the decoding process which shall be applied by decoders conforming to the Baseline, Constrained Baseline, Main, Extended, High, Progressive High, Constrained High, High 10, High 4:2:2, and High 4:4:4 Predictive profiles. For decoders conforming to the High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles, the filtering process specified in this subclause, or one similar to it, should be applied but is not required.

*Add A.2.4.2 "Constrained High profile" as follows:*

### A.2.4.2 Constrained High profile

Bitstreams conforming to the Constrained High profile shall obey all constraints specified in subclause A.2.4.1 for the Progressive High profile, and shall additionally obey the constraint that B slice types shall not be present.

Conformance of a bitstream to the Constrained High profile is indicated by profile_idc being equal to 100 with both constraint_set4_flag and constraint_set5_flag being equal to 1.

Decoders conforming to the Constrained High profile at a specific level shall be capable of decoding all bitstreams in which one or more of the following conditions are true:

- (profile_idc is equal to 66 or constraint_set0_flag is equal to 1), constraint_set1_flag is equal to 1, and the combination of level_idc and constraint_set3_flag represents a level less than or equal to the specified level.
- profile_idc is equal to 77, constraint_set0_flag is equal to 1, and the combination of level_idc and constraint_set3_flag represents a level less than or equal to the specified level.
- profile_idc is equal to 77, constraint_set4_flag is equal to 1, constraint_set5_flag is equal to 1, and level_idc represents a level less than or equal to the specified level.
- profile_idc is equal to 88, constraint_set1_flag is equal to 1, constraint_set4_flag is equal to 1, constraint_set5_flag is equal to 1, and the combination of level_idc and constraint_set3_flag represents a level less than or equal to the specified level.
- profile_idc is equal to 100, constraint_set4_flag is equal to 1, constraint_set5_flag is equal to 1, and level_idc represents a level less than or equal to the specified level.

*Replace the heading of A.3.2 with the following:*

### A.3.2 Level limits common to the High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles



 

*In A.3.2, replace the following:*

Bitstreams conforming to the High, Progressive High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles at a specified level shall obey the following constraints:

*with:*

Bitstreams conforming to the High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles at a specified level shall obey the following constraints:

*Also in A.3.2, replace the following:*

Table A-1 specifies the limits for each level. A definition of all levels identified in the "Level number" column of Table A-1 is specified for the High, Progressive High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles. Each entry in Table A-1 indicates, for the level corresponding to the row of the table, the absence or value of a limit that is imposed by the variable corresponding to the column of the table, as follows:

*with:*

Table A-1 specifies the limits for each level. A definition of all levels identified in the "Level number" column of Table A-1 is specified for the High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles. Each entry in Table A-1 indicates, for the level corresponding to the row of the table, the absence or value of a limit that is imposed by the variable corresponding to the column of the table, as follows:

*Replace A.3.3 and its Table A-2 with the following:*

### A.3.3 Profile-specific level limits

a) In bitstreams conforming to the Main, High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles, the removal time of access unit 0 shall satisfy the constraint that the number of slices in picture 0 is less than or equal to ( Max( PicSizeInMbs, fR * MaxMBPS ) + MaxMBPS * ( $t_r$( 0 ) − $t_{r,n}$( 0 ) ) ) ÷ SliceRate, where MaxMBPS and SliceRate are the values specified in Tables A-1 and A-4, respectively, that apply to picture 0 and PicSizeInMbs is the number of macroblocks in picture 0.

b) In bitstreams conforming to the Main, High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles, the difference between consecutive removal times of access units n and n − 1 with n > 0 shall satisfy the constraint that the number of slices in picture n is less than or equal to MaxMBPS * ( $t_r$( n ) − $t_r$( n − 1 ) ) ÷ SliceRate, where MaxMBPS and SliceRate are the values specified in Tables A-1 and A-4, respectively, that apply to picture n.

c) In bitstreams conforming to the Main, High, Progressive High, High 10, High 4:2:2, High 4:4:4 Predictive profiles, sequence parameter sets shall have direct_8x8_inference_flag equal to 1 for the levels specified in Table A-4.

NOTE 1 – direct_8x8_inference_flag is not relevant to the Baseline, Constrained Baseline, Constrained High, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles as these profiles do not allow B slice types, and direct_8x8_inference_flag is equal to 1 for all levels of the Extended profile.

d) In bitstreams conforming to the Main, High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, CAVLC 4:4:4 Intra, or Extended profiles, sequence parameter sets shall have frame_mbs_only_flag equal to 1 for the levels specified in Table A-4 for the Main, High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles and in Table A-5 for the Extended profile.

NOTE 2 – frame_mbs_only_flag is equal to 1 for all levels of the Baseline, Constrained Baseline, Constrained High, and Progressive High profiles (specified in clauses A.2.1, A.2.1.1, and A.2.4.1, respectively).

e) In bitstreams conforming to the Main, High, Progressive High, High 10, High 4:2:2, High 4:4:4 Predictive, or Extended profiles, the value of sub_mb_type[ mbPartIdx ] with mbPartIdx = 0..3 in B macroblocks with mb_type equal to B_8x8 shall not be equal to B_Bi_8x4, B_Bi_4x8, or B_Bi_4x4 for the levels in which MinLumaBiPredSize is shown as 8x8 in Table A-4 for the Main, High, Progressive High, High 10, High 4:2:2, High 4:4:4 Predictive profiles and in Table A-5 for the Extended profile.

f) In bitstreams conforming to the Baseline, Constrained Baseline, or Extended profiles, ( $xInt_{max} - xInt_{min} + 6$ ) * ( $yInt_{max} - yInt_{min} + 6$ ) <= MaxSubMbRectSize in macroblocks coded with mb_type equal to P_8x8, P_8x8ref0 or B_8x8 for all invocations of the process specified in clause 8.4.2.2.1 used to generate the predicted luma sample array for a single reference picture list (reference picture list 0 or reference picture list 1) for each 8x8 sub-macroblock with the macroblock partition index mbPartIdx, where NumSubMbPart( sub_mb_type[ mbPartIdx ] ) > 1, where MaxSubMbRectSize is specified in Table A-3 for the Baseline and Constrained Baseline profiles and in Table A-5 for the Extended profile and the following apply:

- $xInt_{min}$ is the minimum value of $xInt_L$ among all luma sample predictions for the sub-macroblock
- $xInt_{max}$ is the maximum value of $xInt_L$ among all luma sample predictions for the sub-macroblock
- $yInt_{min}$ is the minimum value of $yInt_L$ among all luma sample predictions for the sub-macroblock
- $yInt_{max}$ is the maximum value of $yInt_L$ among all luma sample predictions for the sub-macroblock

g) In bitstreams conforming to the High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles, for the VCL HRD parameters, BitRate[ SchedSelIdx ] <= cpbBrVclFactor * MaxBR and CpbSize[ SchedSelIdx ] <= cpbBrVclFactor * MaxCPB for at least one value of SchedSelIdx, where cpbBrVclFactor is specified in Table A-2 and BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are given as follows:

- If vcl_hrd_parameters_present_flag is equal to 1, BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are given by Equations E-37 and E-38, respectively, using the syntax elements of the hrd_parameters( ) syntax structure that immediately follows vcl_hrd_parameters_present_flag.
- Otherwise (vcl_hrd_parameters_present_flag is equal to 0), BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are inferred as specified in clause E.2.2 for VCL HRD parameters.

MaxBR and MaxCPB are specified in Table A-1 in units of cpbBrVclFactor bits/s and cpbBrVclFactor bits, respectively. The bitstream shall satisfy these conditions for at least one value of SchedSelIdx in the range 0 to cpb_cnt_minus1, inclusive.

h) In bitstreams conforming to the High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles, for the NAL HRD parameters, BitRate[ SchedSelIdx ] <= cpbBrNalFactor * MaxBR and CpbSize[ SchedSelIdx ] <= cpbBrNalFactor * MaxCPB for at least one value of SchedSelIdx, where cpbBrNalFactor is specified in Table A-2 and BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are given as follows:

- If nal_hrd_parameters_present_flag is equal to 1, BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are given by Equations E-37 and E-38, respectively, using the syntax elements of the hrd_parameters( ) syntax structure that immediately follows nal_hrd_parameters_present_flag.
- Otherwise (nal_hrd_parameters_present_flag is equal to 0), BitRate[ SchedSelIdx ] and CpbSize[ SchedSelIdx ] are inferred as specified in clause E.2.2 for NAL HRD parameters.

MaxBR and MaxCPB are specified in Table A-1 in units of cpbBrNalFactor bits/s and cpbBrNalFactor bits, respectively. The bitstream shall satisfy these conditions for at least one value of SchedSelIdx in the range 0 to cpb_cnt_minus1, inclusive.

i) In bitstreams conforming to the High, Progressive High, or Constrained High profiles, the sum of the NumBytesInNALunit variables for access unit 0 is less than or equal to 384 * ( Max( PicSizeInMbs, fR * MaxMBPS ) + MaxMBPS * ( $t_r( 0 ) - t_{r,n}( 0 )$ ) ) ÷ MinCR, where MaxMBPS and MinCR are the values specified in Table A-1 that apply to picture 0 and PicSizeInMbs is the number of macroblocks in picture 0.

NOTE 3 – Such a limit involving MinCR is not imposed for bitstream conformance to the High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles.

j) In bitstreams conforming to the High, Progressive High, or Constrained High profiles, the sum of the NumBytesInNALunit variables for access unit n with n > 0 is less than or equal to 384 * MaxMBPS * ( $t_r$( n ) − $t_r$( n − 1 ) ) ÷ MinCR, where MaxMBPS and MinCR are the values specified in Table A-1 that apply to picture n.

NOTE 4 – Such a limit involving MinCR is not imposed for bitstream conformance to the High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles.

k) In bitstreams conforming to the High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles, when PicSizeInMbs is greater than 1620, the number of macroblocks in any coded slice shall not exceed MaxFS / 4, where MaxFS is specified in Table A-1.

**Table A-2 – Specification of cpbBrVclFactor and cpbBrNalFactor**

| Profile | cpbBrVclFactor | cpbBrNalFactor |
|---|---|---|
| **High**<br>**Progressive High**<br>**Constrained High** | 1 250 | 1 500 |
| **High 10**<br>**High 10 Intra** | 3 000 | 3 600 |
| **High 4:2:2**<br>**High 4:2:2 Intra** | 4 000 | 4 800 |
| **High 4:4:4 Predictive**<br>**High 4:4:4 Intra**<br>**CAVLC 4:4:4 Intra** | 4 000 | 4 800 |

*Replace A.3.3.2 and its Table A-4 with the following:*

### A.3.3.2 Level limits of the Main, High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profile

Table A-4 specifies limits for each level that are specific to bitstreams conforming to the Main, High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, or CAVLC 4:4:4 Intra profiles. Each entry in Table A-4 indicates, for the level corresponding to the row of the table, the absence or value of a limit that is imposed by the variable corresponding to the column of the table, as follows:

– If the table entry is marked as "-", no limit is imposed by the value of the variable as a requirement of bitstream conformance to the profile at the specified level.

– Otherwise, the table entry specifies the value of the variable for the associated limit that is imposed as a requirement of bitstream conformance to the profile at the specified level.

NOTE – The constraints for MinLumaBiPredSize and direct_8x8_inference_flag are not relevant to the Constrained High, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles, as these profiles do not support B slices.

**Table A-4 – Main, High, Progressive High, Constrained High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profile level limits**

| Level_number | SliceRate | MinLumaBiPredSize | direct_8x8_inference_flag | frame_mbs_only_flag |
|---|---|---|---|---|
| **1** | - | - | - | 1 |
| **1b** | - | - | - | 1 |
| **1.1** | - | - | - | 1 |
| **1.2** | - | - | - | 1 |
| **1.3** | - | - | - | 1 |
| **2** | - | - | - | 1 |
| **2.1** | - | - | - | - |
| **2.2** | - | - | - | - |
| **3** | 22 | - | 1 | - |
| **3.1** | 60 | 8x8 | 1 | - |
| **3.2** | 60 | 8x8 | 1 | - |
| **4** | 60 | 8x8 | 1 | - |
| **4.1** | 24 | 8x8 | 1 | - |
| **4.2** | 24 | 8x8 | 1 | 1 |
| **5** | 24 | 8x8 | 1 | 1 |
| **5.1** | 24 | 8x8 | 1 | 1 |
| **5.2** | 24 | 8x8 | 1 | 1 |

*In D.1, replace the following rows of the table:*

| | | |
|---|---|---|
| else if( payloadType == 45 ) | | |
| frame_packing_arrangement( payloadSize ) | 5 | |
| else | | |
| reserved_sei_message( payloadSize ) | 5 | |

*with the following:*

| | | |
|---|---|---|
| else if( payloadType == 45 ) | | |
| frame_packing_arrangement( payloadSize ) | 5 | |
| else if( payloadType == 46 ) | | |
| multiview_view_position( payloadSize ) /* specified in Annex H */ | 5 | |
| else if( payloadType == 47 ) | | |
| display_orientation( payloadSize ) | 5 | |
| else | | |
| reserved_sei_message( payloadSize ) | 5 | |

*Add D.1.26 "Display orientation SEI message syntax" as follows;*

### D.1.26 Display orientation SEI message syntax

| display_orientation( payloadSize ) { | **Descriptor** |
|---|---|
| **display_orientation_cancel_flag** | u(1) |
| if ( !display_orientation_cancel_flag ) { | |
| **hor_flip** | u(1) |
| **ver_flip** | u(1) |
| **anticlockwise_rotation** | u(16) |
| **display_orientation_repetition_period** | ue(v) |
| **display_orientation_extension_flag** | u(1) |
| } | |
| } | |

*Renumber the heading of D.1.26 to D.1.27 as follows:*

### D.1.27 Reserved SEI message syntax

*In D.2.25, replace Table D-8 and the following text:*

**Table D-8 – Definition of frame_packing_arrangement_type**

| Value | Interpretation |
|---|---|
| 0 | Each component plane of the decoded frames contains a "checkerboard" based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-1. |
| 1 | Each component plane of the decoded frames contains a column based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-2 and Figure D-3. |
| 2 | Each component plane of the decoded frames contains a row based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-4 and Figure D-5. |
| 3 | Each component plane of the decoded frames contains a side-by-side packing arrangement of corresponding planes of two constituent frames as illustrated in Figure D-6, Figure D-7, and Figure D-10. |
| 4 | Each component plane of the decoded frames contains a top-bottom packing arrangement of corresponding planes of two constituent frames as illustrated in Figure D-8 and Figure D-9. |
| 5 | The component planes of the decoded frames in output order form a temporal interleaving of alternating first and second constituent frames as illustrated in Figure D-11. |

NOTE 1 – Figure D-1 to Figure D-10 provide typical examples of rearrangement and upconversion processing for various packing arrangement schemes. Actual characteristics of the constituent frames are signalled in detail by the subsequent syntax elements of the frame packing arrangement SEI message. In Figure D-1 to Figure D-10, an upconversion processing is performed on each constituent frame to produce frames having the same resolution as that of the decoded frame. An example of the upsampling method to be applied to a quincunx sampled frame as shown in Figure D-1 or Figure D-10 is to fill in missing positions with an average of the available spatially neighbouring samples (the average of the values of the available samples above, below, to the left and to the right of each sample to be generated). The actual upconversion process to be performed, if any, is outside the scope of this Specification.

NOTE 2 – The sample aspect ratio (SAR) indicated in the VUI parameters should indicate the output picture shape for the packed decoded frame output by a decoder that does not interpret the frame packing arrangement SEI message. In the examples shown in Figure D-1 to Figure D-10, the SAR produced in each upconverted colour plane would be the same as the SAR indicated in the

VUI parameters, since the illustrated upconversion process produces the same total number of samples from each constituent frame as existed in the packed decoded frame.

NOTE 3 – When the output time of the samples of constituent frame 0 differs from the output time of the samples of constituent frame 1 (i.e., when field_views_flag is equal to 1 or frame_packing_arrangement_type is equal to 5) and the display system in use presents two views simultaneously, the display time for constituent frame 0 should be delayed to coincide with the display time for constituent frame 1. (The display process is not specified in this Recommendation | International Standard.)

NOTE 4 – When field_views_flag is equal to 1 or frame_packing_arrangement_type is equal to 5, the value 0 for fixed_frame_rate_flag is not expected to be prevalent in industry use of this SEI message.

NOTE 5 – frame_packing_arrangement_type equal to 5 describes a temporal interleaving process of different views.

All other values of frame_packing_arrangement_type are reserved for future use by ITU-T | ISO/IEC. It is a requirement of bitstream conformance that the bitstreams shall not contain such other values of frame_packing_arrangement_type.

**quincunx_sampling_flag** equal to 1 indicates that each colour component plane of each constituent frame is quincunx sampled as illustrated in Figure D-1 or Figure D-10, and quincunx_sampling_flag equal to 0 indicates that the colour component planes of each constituent frame are not quincunx sampled.

When frame_packing_arrangement_type is equal to 0, it is a requirement of bitstream conformance that quincunx_sampling_flag shall be equal to 1. When frame_packing_arrangement_type is equal to 5, it is a requirement of bitstream conformance that quincunx_sampling_flag shall be equal to 0.

NOTE 6 – For any chroma format (4:2:0, 4:2:2, or 4:4:4), the luma plane and each chroma plane is quincunx sampled as illustrated in Figure D-1 when quincunx_sampling_flag is equal to 1.

**content_interpretation_type** indicates the intended interpretation of the constituent frames as specified in Table D-9. Values of content_interpretation_type that do not appear in Table D-9 are reserved for future specification by ITU-T | ISO/IEC.

For each specified frame packing arrangement scheme, there are two constituent frames that are referred to as frame 0 and frame 1.

*with:*

**Table D-8 – Definition of frame_packing_arrangement_type**

| Value | Interpretation |
|---|---|
| 0 | Each component plane of the decoded frames contains a "checkerboard" based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-1. |
| 1 | Each component plane of the decoded frames contains a column based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-2. |
| 2 | Each component plane of the decoded frames contains a row based interleaving of corresponding planes of two constituent frames as illustrated in Figure D-3. |
| 3 | Each component plane of the decoded frames contains a side-by-side packing arrangement of corresponding planes of two constituent frames as illustrated in Figure D-4 and Figure D-6. |
| 4 | Each component plane of the decoded frames contains top-bottom packing arrangement of corresponding planes of two constituent frames as illustrated in Figure D-5. |
| 5 | The component planes of the decoded frames in output order form a temporal interleaving of alternating first and second constituent frames as illustrated in Figure D-7. |
| 6 | The decoded frame constitutes a complete 2-D frame without any frame packing (see NOTE 6) |
| 7 | Each component plane of the decoded frames contains a tile format packing arrangement of corresponding planes of two constituent frames as illustrated in Figure D-12. |

NOTE 1 – Figure D-1 to Figure D-10 provide typical examples of rearrangement and upconversion processing for various packing arrangement schemes. Actual characteristics of the constituent frames are signalled in detail by the subsequent syntax elements of the frame packing arrangement SEI message. In Figure D-1 to Figure D-10, an upconversion processing is performed on each constituent frame to produce frames having the same resolution as that of the decoded frame. An example of the upsampling method to be applied to a quincunx sampled frame as shown in Figure D-1 or Figure D-10 is to fill in missing positions with an

average of the available spatially neighbouring samples (the average of the values of the available samples above, below, to the left and to the right of each sample to be generated). The actual upconversion process to be performed, if any, is outside the scope of this Specification.

NOTE 2 – The sample aspect ratio (SAR) indicated in the VUI parameters should indicate the output picture shape for the packed decoded frame output by a decoder that does not interpret the frame packing arrangement SEI message. In the examples shown in Figure D-1 to Figure D-10, the SAR produced in each upconverted colour plane would be the same as the SAR indicated in the VUI parameters, since the illustrated upconversion process produces the same total number of samples from each constituent frame as existed in the packed decoded frame.

NOTE 3 – When the output time of the samples of constituent frame 0 differs from the output time of the samples of constituent frame 1 (i.e., when field_views_flag is equal to 1 or frame_packing_arrangement_type is equal to 5) and the display system in use presents two views simultaneously, the display time for constituent frame 0 should be delayed to coincide with the display time for constituent frame 1. (The display process is not specified in this Recommendation | International Standard.)

NOTE 4 – When field_views_flag is equal to 1 or frame_packing_arrangement_type is equal to 5, the value 0 for fixed_frame_rate_flag is not expected to be prevalent in industry use of this SEI message.

NOTE 5 – frame_packing_arrangement_type equal to 5 describes a temporal interleaving process of different views.

NOTE 6 – The value of frame_packing_arrangement_type equal to 6 is used to signal presence of 2D content (that is not frame packed) in 3D services that use a mix of 2D and 3D content. The frame_packing_arrangement_type value of 6 should only be used with frame pictures.

NOTE 7 – Figure D-12 provides an illustration of the rearrangement process for the frame packing arrangement scheme for the frame_packing_arrangement_type value of 7.

All other values of frame_packing_arrangement_type are reserved for future use by ITU-T | ISO/IEC. It is a requirement of bitstream conformance that the bitstreams shall not contain such other values of frame_packing_arrangement_type.

**quincunx_sampling_flag** equal to 1 indicates that each colour component plane of each constituent frame is quincunx sampled as illustrated in Figure D-1 or Figure D-10, and quincunx_sampling_flag equal to 0 indicates that the colour component planes of each constituent frame are not quincunx sampled.

When frame_packing_arrangement_type is equal to 0, it is a requirement of bitstream conformance that quincunx_sampling_flag shall be equal to 1. When frame_packing_arrangement_type is equal to 5, 6, or 7, it is a requirement of bitstream conformance that quincunx_sampling_flag shall be equal to 0.

NOTE 6 – For any chroma format (4:2:0, 4:2:2, or 4:4:4), the luma plane and each chroma plane is quincunx sampled as illustrated in Figure D-1 when quincunx_sampling_flag is equal to 1.

Let croppedWidth and croppedHeight be the width and height, respectively, of the cropped frame area output from the decoder in units of luma samples, derived as follows:

$$croppedWidth = PicWidthInSamples_L - CropUnitX * ( frame\_crop\_left\_offset + frame\_crop\_right\_offset ) \quad (D\text{-}29)$$

$$croppedHeight = 16 * FrameHeightInMbs - CropUnitY * ( frame\_crop\_top\_offset + frame\_crop\_bottom\_offset ) \quad (D\text{-}30)$$

When frame_packing_arrangement_type is equal to 7, it is a requirement of bitstream conformance that croppedWidth and croppedHeight shall be integer multiples of 3.

Let oneThirdWidth and oneThirdHeight be derived as follows:

$$oneThirdWidth = croppedWidth / 3 \quad (D\text{-}31)$$

$$oneThirdHeight = croppedHeight / 3 \quad (D\text{-}32)$$

When frame_packing_arrangement_type is equal to 7, the frame packing arrangement is composed of five rectangular regions identified as R0, R1, R2, R3, and R4 as illustrated in Figure D-12.

The width and height of the region R0 are specified in units of frame luma samples as follows:

$$r0_W = 2 * oneThirdWidth \quad (D\text{-}33)$$

$r0_H$ = 2* oneThirdHeight (D-34)

The width and height of the region R1 are specified in units of frame luma samples as follows:

$r1_W$ = oneThirdWidth (D-35)

$r1_H$ = 2* oneThirdHeight (D-36)

The width and height of the region R2 are specified in units of frame luma samples as follows:

$r2_W$ = oneThirdWidth (D-37)

$r2_H$ = oneThirdHeight (D-38)

The width and height of the region R3 are specified in units of frame luma samples as follows:

$r3_W$ = oneThirdWidth (D-39)

$r3_H$ = oneThirdHeight (D-40)

The width and height of the region R4 are specified in units of frame luma samples as follows:

$r4_W$ = oneThirdWidth (D-41)

$r4_H$ = oneThirdHeight (D-42)

When frame_packing_arrangement_type is equal to 7, constituent frame 0 is obtained by cropping from the decoded frames the region R0, and constituent frame 1 is obtained by stacking vertically the regions R2 and R3 and placing the resulting rectangle to the right of the region R1. The region R4 is not part of either constituent frame and is discarded.

**content_interpretation_type** indicates the intended interpretation of the constituent frames as specified in Table D-9. Values of content_interpretation_type that do not appear in Table D-9 are reserved for future specification by ITU-T | ISO/IEC. When frame_packing_arrangement_type is equal to 6, content_interpretation_type shall be equal to 0.

When frame_packing_arrangement_type is not equal to 6, for each specified frame packing arrangement scheme, there are two constituent frames that are referred to as frame 0 and frame 1.

*In D.2.25, renumber the notes that follow the above replaced text to account for the two notes added therein.*

*In D.2.25, add the following Figure D-12 after Figure D-11:*

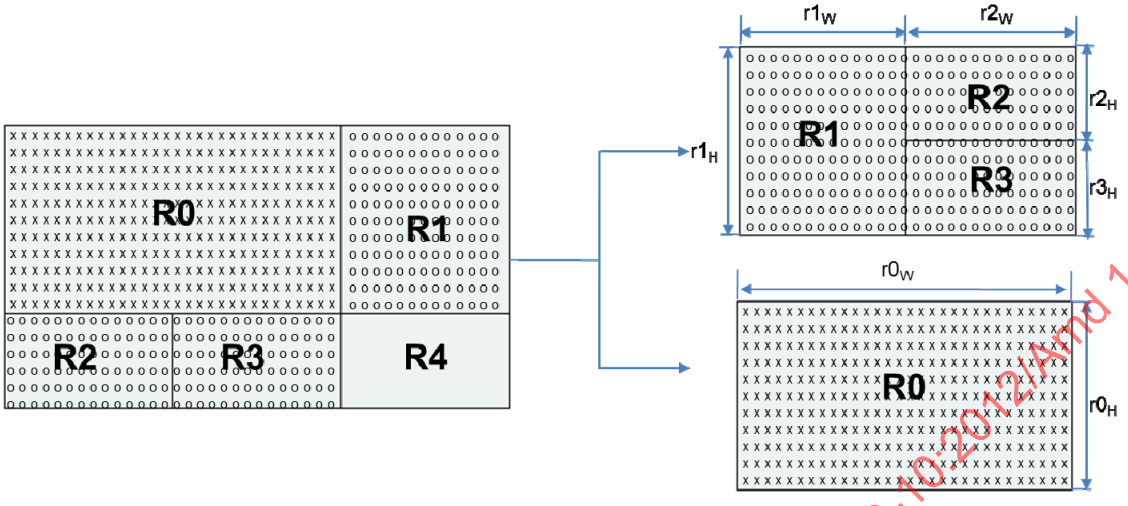


**Figure D-12 – Rearrangement and upconversion of tile format packing arrangement (frame_packing_arrangement_type equal to 7)**

*Add D.2.26 "Display orientation SEI message semantics" as follows:*

### D.2.26 Display orientation SEI message semantics

This SEI message informs the decoder of a transformation that is recommended to be applied to the output decoded and cropped picture prior to display.

**display_orientation_cancel_flag** equal to 1 indicates that the SEI message cancels the persistence of any previous display orientation SEI message in output order. display_orientation_cancel_flag equal to 0 indicates that display orientation information follows.

**hor_flip** equal to 1 indicates that the cropped decoded picture should be flipped horizontally for display. hor_flip equal to 0 indicates that the decoded picture should not be flipped horizontally.

When hor_flip is equal to 1, the cropped decoded picture should be flipped as follows for each colour component Z = L, Cb, and Cr, letting dZ be the final cropped array of output samples for the component Z:

```
for( x = 0; x < croppedWidthInSamplesZ; x++ )
        for( y = 0; y < croppedHeightInSamplesZ; y++ )
                dZ[ x][ y ] = Z[ croppedWidthInSamplesZ − x − 1 ][ y ]
```

**ver_flip** equal to 1 indicates that the cropped decoded picture should be flipped vertically (in addition to any horizontal flipping when hor_flip is equal to 1) for display. ver_flip equal to 0 indicates that the decoded picture should not be flipped vertically.

When ver_flip is equal to 1, the cropped decoded picture should be flipped as follows for each colour component Z = L, Cb, and Cr, letting dZ be the final cropped array of output samples for the component Z:

```
for( x = 0; x < croppedWidthInSamplesZ; x++ )
        for( y = 0; y < croppedHeightInSamplesZ; y++ )
                dZ[ x ][ y ] = Z[ x ][ croppedWidthInSamplesZ − y − 1 ]
```

**anticlockwise_rotation** specifies the recommended anticlockwise rotation of the decoded picture (after applying horizontal and/or vertical flipping when hor_flip or ver_flip is set) prior to display. The decoded picture should be rotated by 360 * anticlockwise_rotation ÷ $2^{16}$ degrees (2 * π * anticlockwise_rotation ÷ $2^{16}$ radians, where π is Archimedes' Constant (3.141 592 653 589 793 …) in the anticlockwise direction prior to display. For example, anticlockwise_rotation equal to 0 indicates no rotation and anticlockwise_rotation equal to 16 384 indicates 90 degrees (π ÷ 2 radians) rotation in the anticlockwise direction.

NOTE – It is possible for equivalent transformations to be expressed in multiple ways using these syntax elements. For example, the combination of having both hor_flip and ver_flip equal to 1 with anticlockwise_rotation equal to 0 can alternatively be expressed by having both hor_flip and ver_flip equal to 1 with anticlockwise_rotation equal to 0x8000000, and the combination of hor_flip equal to 1 with ver_flip equal to 0 and anticlockwise_rotation equal to 0 can alternatively be expressed by having hor_flip equal to 0 with ver_flip equal to 1 and anticlockwise_rotation equal to 0x8000000.

**display_orientation_repetition_period** specifies the persistence of the display orientation SEI message and may specify a picture order count interval within which another display orientation SEI message or the end of the coded video sequence shall be present in the bitstream. The value of display_orientation_repetition_period shall be in the range 0 to 16 384, inclusive.

display_orientation_repetition_period equal to 0 specifies that the display orientation SEI message applies to the current decoded picture only.

display_orientation_repetition_period equal to 1 specifies that the display orientation SEI message persists in output order until any of the following conditions are true:

– A new coded video sequence begins.

– A picture in an access unit containing a display orientation SEI message is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ).

display_orientation_repetition_period greater than 1 specifies that the display orientation SEI message persists until any of the following conditions are true:

– A new coded video sequence begins.

– A picture in an access unit containing a display orientation SEI message is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ) and less than or equal to PicOrderCnt( CurrPic ) + display_orientation_repetition_period.

display_orientation_repetition_period greater than 1 indicates that another display orientation SEI message shall be present for a picture in an access unit that is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ) and less than or equal to PicOrderCnt( CurrPic ) + display_orientation_repetition_period; unless the bitstream ends or a new coded video sequence begins without output of such a picture.

**display_orientation_extension_flag** equal to 0 indicates that no additional data follows within the display orientation SEI message. The value of display_orientation_extension_flag shall be equal to 0. The value of 1 for display_orientation_extension_flag is reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore all data that follows the value of 1 for display_orientation_extension_flag in a display orientation SEI message.

*Renumber D.2.26 to D.2.27 as follows:*

### D.2.27 Reserved SEI message semantics

*Replace G.7.4.2.1.1 with the following:*

#### G.7.4.2.1.1 Sequence parameter set data semantics

The semantics specified in subclause 7.4.2.1.1 apply with substituting SVC sequence parameter set for sequence parameter set. Additionally, the following applies.

**profile_idc** and **level_idc** indicate the profile and level to which the coded video sequence conforms when the SVC sequence parameter set is the active SVC sequence parameter set.

**constraint_set0_flag** is specified as follows:

– If the sequence parameter set data syntax structure is included in a sequence parameter set RBSP, the semantics specified in subclause 7.4.2.1.1 apply.

– Otherwise (the sequence parameter set data syntax structure is included in a subset sequence parameter set RBSP), constraint_set0_flag equal to 1 specifies that all of the following conditions are obeyed:

  – the coded video sequence obeys all constraints specified in subclause G.10.1.1,



 

– the output of the decoding process as specified in subclause G.8 is identical to the output of the decoding process that is obtained when profile_idc would be set equal to 83.

constraint_set0_flag equal to 0 specifies that the coded video sequence may or may not obey all constraints specified in subclause G.10.1.1 and that the output of the decoding process as specified in subclause G.8 may or may not be identical to the output of the decoding process that is obtained when profile_idc would be set equal to 83.

NOTE 1 – The output of the decoding process may be different, if the array sTCoeff contains non-zero scaled luma transform coefficient values for a transform block of a macroblock that is coded in an Inter macroblock prediction mode, but all reconstructed luma residual samples of the array $rS_L$ that are associated with the transform blocks are equal to 0. In this case, the boundary filter strength that is derived as specified in subclause G.8.7.4.3 can depend on the value of profile_idc.

**constraint_set1_flag** is specified as follows:

– If the sequence parameter set data syntax structure is included in a sequence parameter set RBSP, the semantics specified in subclause 7.4.2.1.1 apply.

– Otherwise (the sequence parameter set data syntax structure is included in a subset sequence parameter set RBSP), constraint_set1_flag equal to 1 specifies that all of the following conditions are obeyed:

– the coded video sequence obeys all constraints specified in subclause G.10.1.2,

– the output of the decoding process as specified in subclause G.8 is identical to the output of the decoding process that is obtained when profile_idc would be set equal to 86.

constraint_set1_flag equal to 0 specifies that the coded video sequence may or may not obey all constraints specified in subclause G.10.1.2 and that the output of the decoding process as specified in subclause G.8 may or may not be identical to the output of the decoding process that is obtained when profile_idc would be set equal to 86.

NOTE 2 – The output of the decoding process may be different, if the array sTCoeff contains non-zero scaled luma transform coefficient values for a transform block of a macroblock that is coded in an Inter macroblock prediction mode, but all reconstructed luma residual samples of the array $rS_L$ that are associated with the transform blocks are equal to 0. In this case, the boundary filter strength that is derived as specified in subclause G.8.7.4.3 can depend on the value of profile_idc.

**constraint_set2_flag** is specified as follows:

– If the sequence parameter set data syntax structure is included in a sequence parameter set RBSP, the semantics specified in subclause 7.4.2.1.1 apply.

– Otherwise (the sequence parameter set data syntax structure is included in a subset sequence parameter set RBSP), the value of 1 for constraint_set2_flag is reserved for future use by ITU-T | ISO/IEC. constraint_set2_flag shall be equal to 0 for coded video sequences with profile_idc equal to 83 and 86 in bitstreams conforming to this Recommendation | International Standard. Decoders shall ignore the value of constraint_set2_flag when profile_idc is equal to 83 or 86.

**constraint_set3_flag** is specified as follows:

– If the sequence parameter set data syntax structure is included in a sequence parameter set RBSP, the semantics specified in subclause 7.4.2.1.1 apply.

– Otherwise (the sequence parameter set data syntax structure is included in a subset sequence parameter set RBSP), the following applies:

– If profile_idc is equal to 86, constraint_set3_flag equal to 1 specifies that the coded video sequence obeys all constraints specified in subclause G.10.1.3, and constraint_set3_flag equal to 0 specifies that the coded video sequence may or may not obey these corresponding constraints.

– Otherwise (profile_idc is not equal to 86), the value of 1 for constraint_set3_flag is reserved for future use by ITU-T | ISO/IEC. constraint_set3_flag shall be equal to 0 for coded video sequences with profile_idc not equal to 86 in bitstreams conforming to this Recommendation | International Standard. Decoders shall ignore the value of constraint_set3_flag when profile_idc is not equal to 86.

**constraint_set5_flag** is specified as follows:

– If the sequence parameter set data syntax structure is included in a sequence parameter set RBSP, the semantics specified in subclause 7.4.2.1.1 apply.

– Otherwise (the sequence parameter set data syntax structure is included in a subset sequence parameter set RBSP), the following applies:
  – If the profile_idc is equal to 83, constraint_set5_flag equal to 1 specifies that the coded video sequence obeys all constraints specified in subclause G.10.1.1.1.
  – Otherwise, if the profile_idc is equal to 86, constraint_set5_flag equal to 1 specifies that the coded video sequence obeys all constraints specified in subclause G.10.1.2.1.
  – Otherwise (profile_idc is not equal to 83 or 86), the value of 1 for constraint_set5_flag is reserved for future use by ITU-T | ISO/IEC. constraint_set5_flag shall be equal to 0 for coded video sequences with profile_idc not equal to 83 or 86 in bitstreams conforming to this Recommendation | International Standard. Decoders shall ignore the value of constraint_set5_flag when profile_idc is not equal to 83 or 86.

The value of separate_colour_plane_flag shall be equal to 0 and the value of qpprime_y_zero_transform_bypass_flag shall be equal to 0.

When the seq_parameter_set_data( ) syntax structure is present in a subset sequence parameter set RBSP and vui_parameters_present_flag is equal to 1, timing_info_present_flag shall be equal to 0, nal_hrd_parameters_present_flag shall be equal to 0, vcl_hrd_parameters_present_flag shall be equal to 0, and pic_struct_present_flag shall be equal to 0. The value of 1 for timing_info_present_flag, nal_hrd_parameters_present_flag, vcl_hrd_parameters_present_flag, and pic_struct_present_flag for subset sequence parameter set RBSPs is reserved for future use by ITU-T | ISO/IEC. When timing_info_present_flag is equal to 1, decoders shall ignore the values of the directly following num_units_in_tick, time_scale, fixed_frame_rate_flag syntax elements. When nal_hrd_parameters_present_flag is equal to 1, decoders shall ignore the value of the syntax elements in the directly following hrd_parameters( ) syntax structure. When vcl_hrd_parameters_present_flag is equal to 1, decoders shall ignore the value of the syntax elements in the directly following hrd_parameters( ) syntax structure.

When the seq_parameter_set_data( ) syntax structure is present in a sequence parameter set RBSP and vui_parameters_present_flag is equal to 1, the values of timing_info_present_flag, num_units_in_tick, time_scale, fixed_frame_rate_flag, nal_hrd_parameters_present_flag, vcl_hrd_parameters_present_flag, low_delay_hrd_flag, pic_struct_present_flag and the values of syntax elements included in the hrd_parameters( ) syntax structures, when present, shall be such that the bitstream activating the sequence parameter set is conforming to one or more of the profiles specified in Annex A.

**max_num_ref_frames** specifies the maximum number of short-term and long-term reference frames, complementary reference field pairs, and non-paired reference fields that may be used by the decoding process for inter prediction of any picture in the coded video sequence. max_num_ref_frames also determines the size of the sliding window operation as specified in subclause G.8.2.4.2. The value of max_num_ref_frames shall be in the range of 0 to MaxDpbFrames (as specified in subclause G.10), inclusive.

The allowed range of values for pic_width_in_mbs_minus1, pic_height_in_map_units_minus1, and frame_mbs_only_flag are specified by constraints in subclause G.10.

*Add G.10.1.1.1 "Scalable Constrained Baseline profile" as follows:*

#### G.10.1.1.1 Scalable Constrained Baseline profile

Bitstreams conforming to the Scalable Constrained Baseline profile shall obey the following constraints:

a) The base layer bitstream as specified in subclause G.8.8.2 shall obey the following constraints:
  i) All constraints of the Baseline and Constrained Baseline profiles specified in subclauses A.2.1 and A.2.1.1 shall be obeyed.
  ii) Sequence parameter sets should have profile_idc equal to 66. Sequence parameter sets may have profile_idc equal to 77 or 88. Sequence parameter sets shall not have profile_idc equal to a value other than 66, 77, or 88.
  iii) Sequence parameter sets shall have constraint_set0_flag, constraint_set1_flag, and constraint_set2_flag equal to 1.

NOTE 1 – The above constraint implies that picture parameter sets must have num_slice_groups_minus1 equal to 0 and redundant_pic_cnt_present_flag equal to 0 and that arbitrary slice order is not allowed.



 

NOTE 2 – In addition to the base layer constraints specified above in items i) through iii), the value of the syntax element constrained_intra_pred_flag for picture parameter sets of the base layer stream is constrained as specified below in item m).

b) A list of integer values specifying layer representation identifiers is derived by invoking the process specified in subclause G.8.1.1 with the output being the list dqIdList. The SVC sequence parameter sets that are referred to by coded slice NAL units with DQId greater than 0 and DQId in the list dqIdList shall have profile_idc equal to 83 and both constraint_set1_flag and constraint_set5_flag equal to 1 or (profile_idc equal to 86 and both constraint_set0_flag and constraint_set5_flag equal to 1).

c) Only I, P, EI, and EP slices shall be present.

d) SVC sequence parameter sets shall have chroma_format_idc equal to 1.

e) SVC sequence parameter sets shall have bit_depth_luma_minus8 equal to 0.

f) SVC sequence parameter sets shall have bit_depth_chroma_minus8 equal to 0.

g) SVC sequence parameter sets shall have separate_colour_plane_flag equal to 0.

h) SVC sequence parameter sets shall have qpprime_y_zero_transform_bypass_flag equal to 0.

i) SVC sequence parameter sets shall have frame_mbs_only_flag equal to 1.

j) Picture parameter sets shall have redundant_pic_cnt_present_flag equal to 0.

k) Picture parameter sets shall have num_slice_groups_minus1 equal to 0.

l) Arbitrary slice order is not allowed.

m) A list of integer values specifying layer representation identifiers is derived by invoking the process specified in subclause G.8.1.1 with the output being the list dqIdList. The variable numDQEntries is set equal to the number of elements in the list dqIdList. When numDQEntries is greater than 1, for any element dqIdList[ i ] with i = 1..(numDQEntries − 1), when MaxTCoeffLevelPredFlag is equal to 0 for any layer representation with DQId in the set specified by dqIdList[ k ] with k = 0..i, the picture parameter set that is referenced by the coded slice NAL units of the layer representation with DQId equal to dqIdList[ i ] shall have constrained_intra_pred_flag equal to 1.

n) For each present layer representation with dependency_id greater than 0, quality_id equal to 0, and MinNoInterLayerPredFlag equal to 0, one of the following constraints shall be obeyed.

   – $ScaledRefLayerPicWidthInSamples_L$ is equal to $RefLayerPicWidthInSamples_L$ and $ScaledRefLayerPicHeightInSamples_L$ is equal to $RefLayerPicHeightInSamples_L$

   – $ScaledRefLayerPicWidthInSamples_L$ is equal to (1.5 * $RefLayerPicWidthInSamples_L$) and $ScaledRefLayerPicHeightInSamples_L$ is equal to (1.5 * $RefLayerPicHeightInSamples_L$)

   – $ScaledRefLayerPicWidthInSamples_L$ is equal to (2 * $RefLayerPicWidthInSamples_L$) and $ScaledRefLayerPicHeightInSamples_L$ is equal to (2 * $RefLayerPicHeightInSamples_L$)

o) For each present layer representation with dependency_id greater than 0, quality_id equal to 0, and MinNoInterLayerPredFlag equal to 0, all of the following constraints shall be obeyed.

   – (ScaledRefLayerLeftOffset % 16) is equal to 0

   – (ScaledRefLayerTopOffset % 16) is equal to 0

p) The level constraints specified in subclause G.10.2 shall be fulfilled.

Conformance of a bitstream to Scalable Constrained Baseline profile is indicated by constraint_set5_flag being equal to 1 with profile_idc equal to 83.

Decoders conforming to the Scalable Constrained Baseline profile at a specific level shall be capable of decoding all bitstreams in which both of the following conditions are true:

a) All active SVC sequence parameter sets have one or more of the following conditions fulfilled:

   – profile_idc is equal to 83, and constraint_set5_flag is equal to 1,

   – profile_idc is equal to 86, constraint_set0_flag is equal to 1, and constraint_set5_flag equal to 1,

   – profile_idc is equal to 66 and constraint_set1_flag is equal to 1,

– profile_idc is equal to 77 and constraint_set0_flag is equal to 1,

– profile_idc is equal to 88, constraint_set0_flag is equal to 1, and constraint_set1_flag is equal to 1.

b) level_idc or (level_idc and constraint_set3_flag) for all active SVC sequence parameter sets represent a level less than or equal to the specified level.

*Add G.10.1.2.1 "Scalable Constrained High profile" as follows:*

**G.10.1.2.1 Scalable Constrained High profile**

Bitstreams conforming to the Scalable Constrained High profile shall obey the following constraints:

a) The base layer bitstream as specified in subclause G.8.8.2 shall obey the following constraints:

i) All constraints of the Constrained High profile specified in subclause A.2.4.2 shall be obeyed.

ii) Sequence parameter sets should have profile_idc equal to 100. Sequence parameter sets may have profile_idc equal to 66, 77, or 88 and constraint_set1_flag equal to 1. Sequence parameter sets shall not have profile_idc equal to a value other than 66, 77, 88, or 100.

iii) The syntax element direct_spatial_mv_pred_flag shall be equal to 1.

NOTE – In addition to the base layer constraints specified above in items i) through iii), the value of the syntax element constrained_intra_pred_flag for picture parameter sets of the base layer stream is constrained as specified below in item l).

b) A list of integer values specifying layer representation identifiers is derived by invoking the process specified in subclause G.8.1.1 with the output being the list dqIdList. The SVC sequence parameter sets that are referred to by coded slice NAL units with DQId greater than 0 and DQId in the list dqIdList shall have profile_idc equal to 86 and constraint_set5_flag equal to 1 or (profile_idc equal to 83 and both constraint_set1_flag and constraint_set5_flag equal to 1).

c) Only I, P, EI, and EP slices shall be present.

d) SVC sequence parameter sets shall have chroma_format_idc equal to 1.

e) SVC sequence parameter sets shall have bit_depth_luma_minus8 equal to 0.

f) SVC sequence parameter sets shall have bit_depth_chroma_minus8 equal to 0.

g) SVC sequence parameter sets shall have separate_colour_plane_flag equal to 0.

h) SVC sequence parameter sets shall have qpprime_y_zero_transform_bypass_flag equal to 0.

i) SVC sequence parameter sets shall have frame_mbs_only_flag equal to 1.

j) Picture parameter sets shall have redundant_pic_cnt_present_flag equal to 0.

k) Picture parameter sets shall have num_slice_groups_minus1 equal to 0.

l) A list of integer values specifying layer representation identifiers is derived by invoking the process specified in subclause G.8.1.1 with the output being the list dqIdList. The variable numDQEntries is set equal to the number of elements in the list dqIdList. When numDQEntries is greater than 1, for any element dqIdList[ i ] with i = 1..(numDQEntries − 1), when MaxTCoeffLevelPredFlag is equal to 0 for any layer representation with DQId in the set specified by dqIdList[ k ] with k = 0..i, the picture parameter set that is referenced by the coded slice NAL units of the layer representation with DQId equal to dqIdList[ i ] shall have constrained_intra_pred_flag equal to 1.

m) Arbitrary slice order is not allowed.

n) For each present layer representation with dependency_id greater than 0, quality_id equal to 0, and MinNoInterLayerPredFlag equal to 0, one of the following constraints shall be obeyed.

– $ScaledRefLayerPicWidthInSamples_L$ is equal to $RefLayerPicWidthInSamples_L$ and $ScaledRefLayerPicHeightInSamples_L$ is equal to $RefLayerPicHeightInSamples_L$

– $ScaledRefLayerPicWidthInSamples_L$ is equal to (1.5 * $RefLayerPicWidthInSamples_L$) and $ScaledRefLayerPicHeightInSamples_L$ is equal to (1.5 * $RefLayerPicHeightInSamples_L$)

- $ScaledRefLayerPicWidthInSamples_L$ is equal to (2 * $RefLayerPicWidthInSamples_L$) and $ScaledRefLayerPicHeightInSamples_L$ is equal to (2 * $RefLayerPicHeightInSamples_L$)

o) For each present layer representation with dependency_id greater than 0, quality_id equal to 0, and MinNoInterLayerPredFlag equal to 0, all of the following constraints shall be obeyed.

- (ScaledRefLayerLeftOffset % 16) is equal to 0
- (ScaledRefLayerTopOffset % 16) is equal to 0

p) The level constraints specified in subclause G.10.2 shall be fulfilled.

Conformance of a bitstream to Scalable Constrained High profile is indicated by constraint_set5_flag being equal to 1 with profile_idc equal to 86.

Decoders conforming to the Scalable High profile at a specific level shall be capable of decoding all bitstreams in which both of the following conditions are true:

a) All active SVC sequence parameter sets have one or more of the following conditions fulfilled:

- profile_idc is equal to 86 and constraint_set5_flag is equal to 1,
- profile_idc is equal to 83, constraint_set1_flag is equal to 1, and constraint_set5_flag is equal to 1,
- (profile_idc is equal to 66 or constraint_set0_flag is equal to 1) and constraint_set1_flag is equal to 1,
- profile_idc is equal to 77 and constraint_set0_flag is equal to 1,
- profile_idc is equal to 77, constraint_set4_flag is equal to 1, and constraint_set5_flag is equal to 1,
- profile_idc is equal to 88, constraint_set1_flag is equal to 1, constraint_set4_flag is equal to 1, and constraint_set5_flag is equal to 1,
- profile_idc is equal to 100 and constraint_set4_flag is equal to 1, and constraint_set5_flag is equal to 1,

b) level_idc or (level_idc and constraint_set3_flag) for all active SVC sequence parameter sets represent a level less than or equal to the specified level.

*Replace the heading of G.10.2.1 with the following:*

**G.10.2.1 Level limits common to Scalable Baseline, Scalable Constrained Baseline, Scalable High, Scalable Constrained High, and Scalable High Intra profiles**

*In G.10.2.1, replace the following:*

Bitstreams conforming to the Scalable Baseline, Scalable High, or Scalable High Intra profiles at a specific level shall obey the following constraints:

*with:*

Bitstreams conforming to the Scalable Baseline, Scalable Constrained Baseline, Scalable High, Scalable Constrained High, or Scalable High Intra profiles at a specific level shall obey the following constraints:

*Also in G.10.2.1, replace the following:*

Table A-1 specifies the limits for each level. A definition of all levels identified in the "Level number" column of Table A-1 is specified for the Scalable Baseline, Scalable High, and Scalable High Intra profiles. Each entry in Table A-1 indicates, for the level corresponding to the row of the table, the absence or value of a limit that is imposed by the variable corresponding to the column of the table, as follows:

– If the table entry is marked as "-", no limit is imposed by the value of the variable as a requirement of bitstream conformance to the profile at the specified level.

– Otherwise, the table entry specifies the value of the variable for the associated limit that is imposed as a requirement of bitstream conformance to the profile at the specified level.

In bitstreams conforming to the Scalable Baseline, Scalable High, or Scalable High Intra profiles, the conformance of the bitstream to a specified level is indicated by the syntax element level_idc as follows:

– If level_idc is equal to 9, the indicated level is level 1b.

– Otherwise (level_idc is not equal to 9), level_idc is equal to a value of ten times the level number (of the indicated level) specified in Table A-1.

*with:*

Table A-1 specifies the limits for each level. A definition of all levels identified in the "Level number" column of Table A-1 is specified for the Scalable Baseline, Scalable Constrained Baseline, Scalable High, Scalable Constrained High, and Scalable High Intra profiles. Each entry in Table A-1 indicates, for the level corresponding to the row of the table, the absence or value of a limit that is imposed by the variable corresponding to the column of the table, as follows:

– If the table entry is marked as "-", no limit is imposed by the value of the variable as a requirement of bitstream conformance to the profile at the specified level.

– Otherwise, the table entry specifies the value of the variable for the associated limit that is imposed as a requirement of bitstream conformance to the profile at the specified level.

In bitstreams conforming to the Scalable Baseline, Scalable Constrained Baseline, Scalable High, Scalable Constrained High, or Scalable High Intra profiles, the conformance of the bitstream to a specified level is indicated by the syntax element level_idc as follows:

– If level_idc is equal to 9, the indicated level is level 1b.

– Otherwise (level_idc is not equal to 9), level_idc is equal to a value of ten times the level number (of the indicated level) specified in Table A-1.

*Replace G.10.2.2 and its Tables G-16 and G-17 with the following:*

### G.10.2.2 Profile specific level limits

The variable dqIdMax is set equal to the maximum value of DQId for the layer representation of the access unit.

A list of integer values specifying layer representation identifiers for the access unit is derived by invoking the process specified in clause G.8.1.1 with the output being the list dqIdList. The variable numDQEntries is set equal to the number of elements in the list dqIdList.

The variable numSVCSlices is derived as specified by the following pseudo-code:

```
numSVCSlices = 0
for( i = 0; i < numDQEntries; i++ )                                    (G-369)
    numSVCSlices += number of slices in layer representation with DQId equal to dqIdList[ i ]
```

The variable svcPicSizeInMbs is derived as specified in clause G.10.2.1.

The following constraints are specified:

a) In bitstreams conforming to the Scalable Baseline, Scalable Constrained Baseline, Scalable High, Scalable Constrained High, or Scalable High Intra profiles, the removal time of access unit 0 shall satisfy the constraint that the numSVCSlices variable for picture 0 is less than or equal to ( Max( svcPicSizeInMbs, fR * MaxMBPS ) + MaxMBPS * ( $t_r$( 0 ) − $t_{r,n}$( 0 ) ) ) ÷ SliceRate, where MaxMBPS and SliceRate are the values that apply to picture 0. MaxMBPS is specified in Table A-1. For Scalable Baseline and Scalable Constrained Baseline profiles, SliceRate is specified in Table G-16. For Scalable High, Scalable Constrained High, and Scalable High Intra profiles, SliceRate is specified in Table A-4.