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AMENDMENT 2
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Information technology — Coding of audio-visual objects

Part 10: Advanced Video Coding

AMENDMENT 2: New profiles for professional applications

Technologies de l'information — Codage des objets audiovisuels

Partie 10: Codage visuel avancé

AMENDEMENT 2: Nouveaux profils pour applications professionnelles

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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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Amendment 2 to ISO/IEC 14496-10:2005 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

Amendment 2 to ISO/IEC 14496-10:2005 is technically aligned with ITU-T Rec. H.264 (2005)/Amd.2 (2007), but is not published as identical text.

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Information technology — Coding of audio-visual objects

Part 10:
Advanced Video Coding

AMENDMENT 2: New profiles for professional applications

In subclause 0.4, replace the following:

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 1 refers to the first (2003) approved version of this Recommendation | International Standard.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 2 refers to the integrated text containing the corrections specified in the first technical corrigendum.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 3 refers to the integrated text containing both the first technical corrigendum (2004) and the first amendment, which is referred to as the "Fidelity range extensions".

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 4 (the current specification) refers to the integrated text containing the first technical corrigendum (2004), the first amendment (the "Fidelity range extensions"), and an additional technical corrigendum (2005). In the ITU-T, the next published version after version 2 was version 4 (due to the completion of the drafting work for version 4 prior to the approval opportunity for a final version 3 text).

with:

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 1 refers to the first (2003) approved version of this Recommendation | International Standard. The first published version in ISO/IEC corresponded to version 1.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 2 refers to the integrated text containing the corrections specified in the first technical corrigendum. The first fully-published version in the ITU-T was version 2, due to the development of the corrigendum during the publication process. Version 2 was also published in integrated form by ISO/IEC.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 3 refers to the integrated text containing both the first technical corrigendum (2004) and the first amendment, which is referred to as the "Fidelity range extensions".

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 4 refers to the integrated text containing the first technical corrigendum (2004), the first amendment (the "Fidelity range extensions"), and an additional technical corrigendum (2005). In both ITU-T and ISO/IEC, the next complete published version after version 2 was version 4.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 5 refers to the integrated version 4 text with its specification of the High 4:4:4 profile removed. In ISO/IEC, the changes from version 4 to version 5 were published as a corrigendum text.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 6 refers to the integrated version 5 text after its amendment to support additional colour space indicators. In the ITU-T, the changes for versions 5 and 6 were approved and published as a single amendment.

ITU-T Rec. H.264 | ISO/IEC 14496-10 version 7 refers to the integrated version 6 text after its amendment to define five new profiles intended primarily for professional applications (the High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, CAVLC 4:4:4 Intra, and High 4:4:4 Predictive profiles) and two new types of supplemental enhancement information (SEI) messages (the post-filter hint SEI message and the tone mapping information SEI message).

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In the second paragraph of subclause 0.6, replace the sentence:

With the exception of the transform bypass mode of operation for lossless coding in the I_PCM mode of operation in all profiles, the algorithm is typically not lossless, as the exact source sample values are typically not preserved through the encoding and decoding processes.

with:

With the exception of the transform bypass mode of operation for lossless coding in the High 4:4:4 Intra, CAVLC 4:4:4 Intra, and High 4:4:4 Predictive profiles, and the I_PCM mode of operation in all profiles, the algorithm is typically not lossless, as the exact source sample values are typically not preserved through the encoding and decoding processes.

In the third paragraph of subclause 0.7, replace the sentence:

Annex A specifies six profiles (Baseline, Main, Extended, High, High 10 and High 4:2:2), each being tailored to certain application domains, and defines the so-called levels of the profiles.

with:

Annex A specifies eleven profiles (Baseline, Main, Extended, 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), each being tailored to certain application domains, and defines the so-called levels of the profiles.

Replace subclause 3.6 with the following:

3.6 **arbitrary slice order**: A *decoding order* of *slices* in which the *macroblock address* of the first *macroblock* of some *slice* of a *picture* may be less than the *macroblock address* of the first *macroblock* of some other preceding *slice* of the same *coded picture* or, in the case of a *picture* that is coded using three separate colour planes, some other preceding *slice* of the same colour plane.

Replace subclause 3.75 with the following:

3.75 **macroblock**: A 16x16 *block* of *luma* samples and two corresponding *blocks* of *chroma* samples of a *picture* that has three sample arrays; or a 16x16 *block* of samples of a monochrome *picture* or a *picture* that is coded using three separate colour planes. The division of a *slice* or a *macroblock pair* into macroblocks is a *partitioning*.

Replace subclause 3.136 with the following:

3.136 **slice**: An integer number of *macroblocks* or *macroblock pairs* ordered consecutively in the *raster scan* within a particular *slice group*. For the *primary coded picture*, the division of each *slice group* into slices is a *partitioning*. Although a slice contains *macroblocks* or *macroblock pairs* that are consecutive in the *raster scan* within a *slice group*, these *macroblocks* or *macroblock pairs* are not necessarily consecutive in the *raster scan* within the *picture*. The addresses of the *macroblocks* are derived from the address of the first *macroblock* in a slice (as represented in the *slice header*), the *macroblock to slice group map*, and, when a *picture* is coded using three separate colour planes, a colour plane identifier.

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In subclause 6.2 "Source, decoded, and output picture formats", make the following changes.

Replace the following:

The variables SubWidthC, and SubHeightC are specified in Table 6-1, depending on the chroma format sampling structure, which is specified through chroma_format_idc. An entry marked as "-" in Table 6-1 denotes an undefined value for SubWidthC or SubHeightC. Other values of chroma_format_idc, SubWidthC, and SubHeightC may be specified in the future by ITU-T | ISO/IEC.

Table 6-1 –SubWidthC, and SubHeightC values derived from chroma_format_idc

chroma_format_idc	Chroma Format	SubWidthC	SubHeightC
0	monochrome	-	-
1	4:2:0	2	2
2	4:2:2	2	1
3	4:4:4	1	1

with:

The variables SubWidthC and SubHeightC are specified in Table 6-1, depending on the chroma format sampling structure, which is specified through chroma_format_idc and separate_colour_plane_flag. An entry marked as "-" in Table 6-1 denotes an undefined value for SubWidthC or SubHeightC. Other values of chroma_format_idc, SubWidthC, and SubHeightC may be specified in the future by ITU-T | ISO/IEC.

Table 6-1 –SubWidthC, and SubHeightC values derived from chroma_format_idc and separate_colour_plane_flag

chroma_format_idc	separate_colour_plane_flag	Chroma Format	SubWidthC	SubHeightC
0	0	monochrome	-	-
1	0	4:2:0	2	2
2	0	4:2:2	2	1
3	0	4:4:4	1	1
3	1	4:4:4	-	-

Replace the following paragraph:

In 4:4:4 sampling, each of the two chroma arrays has the same height and width as the luma array.

with:

In 4:4:4 sampling, depending on the value of separate_colour_plane_flag, the following applies.

– If separate_colour_plane_flag is equal to 0, each of the two chroma arrays has the same height and width as the luma array.

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– Otherwise (separate_colour_plane_flag is equal to 1), the three colour planes are separately processed as monochrome sampled pictures.

Replace the following paragraph:

The number of bits necessary for the representation of each of the samples in the luma and chroma arrays in a video sequence is in the range of 8 to 12, and the number of bits used in the luma array may differ from the number of bits used in the chroma arrays.

with:

The number of bits necessary for the representation of each of the samples in the luma and chroma arrays in a video sequence is in the range of 8 to 14, and the number of bits used in the luma array may differ from the number of bits used in the chroma arrays.

Replace the following paragraph:

– If chroma_format_idc is equal to 0 (monochrome), MbWidthC and MbHeightC are both equal to 0 (as no chroma arrays are specified for monochrome video).

with:

– If chroma_format_idc is equal to 0 (monochrome) or separate_colour_plane_flag is equal to 1, MbWidthC and MbHeightC are both set equal to 0.

In subclause 6.3 "Spatial subdivision of pictures and slices", make the following changes:

Replace the following:

Each macroblock is comprised of one 16x16 luma array and, when the video format is not monochrome, two corresponding chroma sample arrays. When macroblock-adaptive frame/field decoding is not in use, each macroblock represents a spatial rectangular region of the picture. For example, a picture may be divided into two slices as shown in Figure 6-7.

with:

Each macroblock is comprised of one 16x16 luma array and, when the chroma sampling format is not equal to 4:0:0 and separate_colour_plane_flag is equal to 0, two corresponding chroma sample arrays. When separate_colour_plane_flag is equal to 1, each macroblock is comprised of one 16x16 luma or chroma sample array. When macroblock-adaptive frame/field decoding is not in use, each macroblock represents a spatial rectangular region of the picture. For example, a picture may be divided into two slices as shown in Figure 6-7.

When a picture is coded using three separate colour planes (separate_colour_plane_flag is equal to 1), a slice contains only macroblocks of one colour component being identified by the corresponding value of colour_plane_id, and each colour component array of a picture consists of slices having the same colour_plane_id value. Coded slices with different values of colour_plane_id within an access unit can be interleaved with each other under the constraint that for each value of colour_plane_id, the coded slice NAL units with that value colour_plane_id shall be in the order of increasing macroblock address for the first macroblock of each coded slice NAL unit.

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Insert a new subclause 6.4.3.1 as follows:

6.4.3.1 Inverse 4x4 Cb or Cr block scanning process for ChromaArrayType equal to 3

This process is only invoked when ChromaArrayType is equal to 3.

The inverse 4x4 chroma block scanning process is identical to inverse 4x4 luma block scanning process as specified in subclause 6.4.3 when substituting the term "luma" with the term "Cb" or the term "Cr", and substituting the term "luma4x4BlkIdx" with the term "cb4x4BlkIdx" or the term "cr4x4BlkIdx" in all places in subclause 6.4.3.

Insert a new subclause 6.4.4.1 as follows:

6.4.4.1 Inverse 8x8 Cb or Cr block scanning process for ChromaArrayType equal to 3

This process is only invoked when ChromaArrayType is equal to 3.

The inverse 8x8 chroma block scanning process is identical to inverse 8x8 luma block scanning process as specified in subclause 6.4.4 when substituting the term "luma" with the term "Cb" or the term "Cr", and substituting the term "luma8x8BlkIdx" with the term "cb8x8BlkIdx" or the term "cr8x8BlkIdx" in all places in subclause 6.4.4.

In subclause 6.4.8 "Derivation processes for neighbouring macroblocks, blocks, and partitions", make the following changes.

Insert the following sentence after the paragraph starting with **"**Subclause 6.4.8.2 specifies*":*

Subclause 6.4.8.2.1 specifies the derivation process for neighbouring 8x8 chroma blocks for ChromaArrayType equal to 3.

Insert the following sentence after the paragraph starting with **"**Subclause 6.4.8.4 specifies".

Subclause 6.4.8.4.1 specifies the derivation process for neighbouring 4x4 chroma blocks for ChromaArrayType equal to 3.

Replace the paragraph starting with "Table 6-2 specifies*" with the following:*

Table 6-2 specifies the values for the difference of luma location (xD, yD) for the input and the replacement for N in mbAddrN, mbPartIdxN, subMbPartIdxN, luma8x8BlkIdxN, cb8x8BlkIdxN, cr8x8BlkIdxN, luma4x4BlkIdxN, cb4x4BlkIdxN, cr4x4BlkIdxN, and chroma4x4BlkIdxN for the output. These input and output assignments are used in subclauses 6.4.8.1 to 6.4.8.5. The variable predPartWidth is specified when Table 6-2 is referred to.

Insert a new subclause 6.4.8.2.1 as follows:

6.4.8.2.1 Derivation process for neighbouring 8x8 chroma blocks for ChromaArrayType equal to 3

This process is only invoked when ChromaArrayType is equal to 3.

The derivation process for neighbouring 8x8 chroma block is identical to the derivation process for neighbouring 8x8 luma block as specified in subclause 6.4.8.2 when substituting the term "luma" with the term "Cb" or the term "Cr", and substituting the term "luma8x8BlkIdx" with the term "cb8x8BlkIdx" or the term "cr8x8BlkIdx" in all places in subclause 6.4.8.2.

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In subclause 6.4.8.4 "Derivation process for neighbouring 4x4 chroma blocks", make the following changes.

*Replace the paragraph starting with "*Depending on chroma_format_idc*" with the following:*

The position (x, y) of the upper-left sample of the 4x4 chroma block with index chroma4x4BlkIdx is derived by

x = InverseRasterScan(chroma4x4BlkIdx, 4, 4, 8, 0) (6-25)
y = InverseRasterScan(chroma4x4BlkIdx, 4, 4, 8, 1) (6-26)

Update all equation numbers in the subsequent subclauses due to the removal of equation 6-27 and 6-28.

Insert a new subclause 6.4.8.4.1 as follows:

6.4.8.4.1 Derivation process for neighbouring 4x4 chroma blocks for ChromaArrayType equal to 3

This process is only invoked when ChromaArrayType is equal to 3.

The derivation process for neighbouring 4x4 chroma block in 4:4:4 chroma format is identical to the derivation process for neighbouring 4x4 luma block as specified in subclause 6.4.8.3 when substituting the term "luma" with the term "Cb" or the term "Cr", and substituting the term "luma4x4BlkIdx" with the term "cb4x4BlkIdx" or the term "cr4x4BlkIdx" in all places in subclause 6.4.8.3.

In subclause 7.3.2.1 "Sequence parameter set RBSP syntax", make the following changes.

*Replace the syntax element "***residual_colour_transform_flag***" with the syntax element "***separate_colour_plane_flag***".*

*Replace the expression "*profile_idc == 144*" with "*profile_idc == 44 || profile_idc == 244*".*

*Replace the expression "*i < 8*" with "*i < ((chroma_format_idc != 3) ? 8 : 12)*".*

*In subclause 7.3.2.2 "Picture parameter set RBSP syntax", replace the expression "*i < 6 + 2* transform_8x8_mode_flag*" with "*i < 6 + ((chroma_format_idc != 3) ? 2 : 6) * transform_8x8_mode_flag".

Replace the slice data partition B RBSP syntax table of subclause 7.3.2.9.2 "Slice data partition B RBSP syntax" with the following:

slice_data_partition_b_layer_rbsp( ) {	C	Descriptor
slice_id	All	ue(v)
if(separate_colour_plane_flag == 1)		
colour_plane_id	All	u(2)
if(redundant_pic_cnt_present_flag)		
redundant_pic_cnt	All	ue(v)
slice_data( ) /* only category 3 parts of slice_data( ) syntax */	3	
rbsp_slice_trailing_bits( )	3	
}		

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Replace the slice data partition C RBSP syntax table of subclause 7.3.2.9.3 "Slice data partition C RBSP syntax" with the following:

slice_data_partition_c_layer_rbsp( ) {	C	Descriptor
slice_id	All	ue(v)
if(separate_colour_plane_flag = = 1)		
colour_plane_id	All	u(2)
if(redundant_pic_cnt_present_flag)		
redundant_pic_cnt	All	ue(v)
slice_data( ) /* only category 4 parts of slice_data( ) syntax */	4	
rbsp_slice_trailing_bits( )	4	
}		

Replace the slice header syntax table of subclause 7.3.3 "Slice header syntax" with the following:

slice_header( ) {	C	Descriptor
first_mb_in_slice	2	ue(v)
slice_type	2	ue(v)
pic_parameter_set_id	2	ue(v)
if(separate_colour_plane_flag = = 1)		
colour_plane_id	2	u(2)
frame_num	2	u(v)
if(!frame_mbs_only_flag) {		
field_pic_flag	2	u(1)
if(field_pic_flag)		
bottom_field_flag	2	u(1)
}		
if(nal_unit_type = = 5)		
idr_pic_id	2	ue(v)
if(pic_order_cnt_type = = 0) {		
pic_order_cnt_lsb	2	u(v)
if(pic_order_present_flag && !field_pic_flag)		
delta_pic_order_cnt_bottom	2	se(v)
}		
if(pic_order_cnt_type = = 1 && !delta_pic_order_always_zero_flag) {		
delta_pic_order_cnt[0 **]**	2	se(v)
if(pic_order_present_flag && !field_pic_flag)		
delta_pic_order_cnt[1 **]**	2	se(v)
}		
if(redundant_pic_cnt_present_flag)		
redundant_pic_cnt	2	ue(v)
if(slice_type = = B)		
direct_spatial_mv_pred_flag	2	u(1)
if(slice_type = = P | | slice_type = = SP | | slice_type = = B) {		
num_ref_idx_active_override_flag	2	u(1)
if(num_ref_idx_active_override_flag) {		

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num_ref_idx_l0_active_minus1	2	ue(v)
if(slice_type == B)		
num_ref_idx_l1_active_minus1	2	ue(v)
}		
}		
ref_pic_list_reordering( )	2	
if((weighted_pred_flag && (slice_type == P || slice_type == SP)) || (weighted_bipred_idc == 1 && slice_type == B))		
pred_weight_table( )	2	
if(nal_ref_idc != 0)		
dec_ref_pic_marking( )	2	
if(entropy_coding_mode_flag && slice_type != I && slice_type != SI)		
cabac_init_idc	2	ue(v)
slice_qp_delta	2	se(v)
if(slice_type == SP || slice_type == SI) {		
if(slice_type == SP)		
sp_for_switch_flag	2	u(1)
slice_qs_delta	2	se(v)
}		
if(deblocking_filter_control_present_flag) {		
disable_deblocking_filter_idc	2	ue(v)
if(disable_deblocking_filter_idc != 1) {		
slice_alpha_c0_offset_div2	2	se(v)
slice_beta_offset_div2	2	se(v)
}		
}		
if(num_slice_groups_minus1 > 0 && slice_group_map_type >= 3 && slice_group_map_type <= 5)		
slice_group_change_cycle	2	u(v)
}		

In the syntax table of subclause 7.3.3.2 "Prediction weight table syntax", replace the syntax expression:

chroma_format_idc != 0

with:

ChromaArrayType != 0

(in all 3 occurrences)

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In the syntax table of subclause 7.3.5.1 "Macroblock prediction syntax", replace the syntax expression

chroma_format_idc != 0

with:

ChromaArrayType == 1 || ChromaArrayType == 2

(in one occurrence)

Replace the content of subclause 7.3.5.3 "Residual data syntax" with the following:

residual( ) {	C	Descriptor
if(!entropy_coding_mode_flag)		
residual_block = residual_block_cavlc		
else		
residual_block = residual_block_cabac		
residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8)		
Intra16x16DCLevel = i16x16DClevel		
Intra16x16ACLevel = i16x16AClevel		
LumaLevel = level		
LumaLevel8x8 = level8x8		
if(ChromaArrayType == 1 || ChromaArrayType == 2) {		
NumC8x8 = 4 / (SubWidthC * SubHeightC)		
for(iCbCr = 0; iCbCr < 2; iCbCr++)		
if(CodedBlockPatternChroma & 3) /* chroma DC residual present*/		
residual_block(ChromaDCLevel[iCbCr], 4 * NumC8x8)	3 | 4	
else		
for(i = 0; i < 4 * NumC8x8; i++)		
ChromaDCLevel[iCbCr][i] = 0		
for(iCbCr = 0; iCbCr < 2; iCbCr++)		
for(i8x8 = 0; i8x8 < NumC8x8; i8x8++)		
for(i4x4 = 0; i4x4 < 4; i4x4++)		
if(CodedBlockPatternChroma & 2) /* chroma AC residual present */		
residual_block(ChromaACLevel[iCbCr][i8x8*4+i4x4],15)	3 | 4	
else		
for(i = 0; i < 15; i++)		
ChromaACLevel[iCbCr][i8x8*4+i4x4][i] = 0		
} else if(ChromaArrayType == 3) {		
residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8)		
CbIntra16x16DCLevel = i16x16DClevel		
CbIntra16x16ACLevel = i16x16AClevel		
CbLevel = level		
CbLevel8x8 = level8x8		
residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8)		
CrIntra16x16DCLevel = i16x16DClevel		

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CrIntra16x16ACLevel = i16x16AClevel		
CrLevel = level		
CrLevel8x8 = level8x8		
}		
}		

Replace the content of subclause 7.3.5.3.2 "Residual block CABAC syntax" with the following:

residual_block_cabac(coeffLevel, maxNumCoeff) {	C	Descriptor
if(maxNumCoeff != 64 || (ChromaArrayType == 3))		
coded_block_flag	3 | 4	ae(v)
if(coded_block_flag) {		
numCoeff = maxNumCoeff		
i = 0		
do {		
significant_coeff_flag[i **]**	3 | 4	ae(v)
if(significant_coeff_flag[i]) {		
last_significant_coeff_flag[i **]**	3 | 4	ae(v)
if(last_significant_coeff_flag[i]) {		
numCoeff = i + 1		
for(j = numCoeff; j < maxNumCoeff; j++)		
coeffLevel[j] = 0		
}		
}		
i++		
} while(i < numCoeff - 1)		
coeff_abs_level_minus1[numCoeff - 1 **]**	3 | 4	ae(v)
coeff_sign_flag[numCoeff - 1 **]**	3 | 4	ae(v)
coeffLevel[numCoeff - 1] = (coeff_abs_level_minus1[numCoeff – 1] + 1) * (1 – 2 * coeff_sign_flag[numCoeff – 1])		
for(i = numCoeff - 2; i >= 0; i--)		
if(significant_coeff_flag[i]) {		
coeff_abs_level_minus1[i **]**	3 | 4	ae(v)
coeff_sign_flag[i **]**	3 | 4	ae(v)
coeffLevel[i] = (coeff_abs_level_minus1[i] + 1) * (1 – 2 * coeff_sign_flag[i])		
} else		
coeffLevel[i] = 0		
} else		
for(i = 0; i < maxNumCoeff; i++)		
coeffLevel[i] = 0		
}		

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Insert a new subclause 7.3.5.3.3 as follows:

7.3.5.3.3 Residual luma data syntax

residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8) {	C	Descriptor
if(!entropy_coding_mode_flag)		
residual_block = residual_block_cavlc		
else		
residual_block = residual_block_cabac		
if(MbPartPredMode(mb_type, 0) == Intra_16x16)		
residual_block(i16x16DClevel, 16)	3	
for(i8x8 = 0; i8x8 < 4; i8x8++)		
if(!transform_size_8x8_flag || !entropy_coding_mode_flag)		
for(i4x4 = 0; i4x4 < 4; i4x4++) {		
if(CodedBlockPatternLuma & (1 << i8x8))		
if(MbPartPredMode(mb_type, 0) == Intra_16x16)		
residual_block(i16x16AClevel[i8x8*4+ i4x4], 15)	3	
else		
residual_block(level[i8x8 * 4 + i4x4], 16)	3 | 4	
else if(MbPartPredMode(mb_type, 0) == Intra_16x16)		
for(i = 0; i < 15; i++)		
i16x16AClevel[i8x8 * 4 + i4x4][i] = 0		
else		
for(i = 0; i < 16; i++)		
level[i8x8 * 4 + i4x4][i] = 0		
if(!entropy_coding_mode_flag && transform_size_8x8_flag)		
for(i = 0; i < 16; i++)		
level8x8[i8x8][4 * i + i4x4] = level[i8x8 * 4 + i4x4][i]		
}		
else if(CodedBlockPatternLuma & (1 << i8x8))		
residual_block(level8x8[i8x8], 64)	3 | 4	
else		
for(i = 0; i < 64; i++)		
level8x8[i8x8][i] = 0		
}		

In subclause 7.4.1.2.5 "Order of VCL NAL units and association to coded pictures", replace the following paragraph:

- Otherwise (arbitrary slice order is not allowed), the order of coded slice of an IDR picture NAL units shall be in the order of increasing macroblock address for the first macroblock of each coded slice of an IDR picture NAL unit.

with:

- Otherwise (arbitrary slice order is not allowed), the following applies.
  - If separate_colour_plane_flag is equal to 0, the order of coded slices of IDR picture NAL units shall be in the order of increasing macroblock address for the first macroblock of each coded slice of an IDR picture NAL unit.

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– Otherwise (separate_colour_plane_flag is equal to 1), the order of coded slices of IDR picture NAL units for each value of colour_plane_id shall be in the order of increasing macroblock address for the first macroblock of each coded slice of the particular value of colour_plane_id of an IDR picture NAL unit.

NOTE – When separate_colour_plane_flag is equal to 1, the relative ordering of coded slices having different values of colour_plane_id is not constrained.

In subclause 7.4.2.1 "Sequence parameter set RBSP semantics", make the following changes.

Replace the paragraphs that state as follows:

NOTE – When more than one of constraint_set0_flag, constraint_set1_flag, or constraint_set2_flag are equal to 1, the bitstream obeys the constraints of all of the indicated subclauses of subclause A.2.

constraint_set3_flag indicates the following.

– If profile_idc is equal to 66, 77, or 88 and level_idc is equal to 11, constraint_set3_flag equal to 1 indicates that the bitstream obeys all constraints specified in Annex A for level 1b and constraint_set3_flag equal to 0 indicates that the bitstream may or may not obey all constraints specified in Annex A for level 1b.

– Otherwise (profile_idc is equal to 100, 110, 122, or 144 or level_idc is not equal to 11), 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 in bitstreams conforming to this Recommendation | International Standard when profile_idc is equal to 100, 110, 122, or 144 or level_idc is not equal to 11. Decoders conforming to this Recommendation | International Standard shall ignore the value of constraint_set3_flag when profile_idc is equal to 100, 110, 122, or 144 or level_idc is not equal to 11.

with:

NOTE – When one or more than one of constraint_set0_flag, constraint_set1_flag, or constraint_set2_flag are equal to 1, the bitstream must obey the constraints of all of the indicated subclauses of subclause A.2. When profile_idc is equal to 44, 100, 110, 122, or 244, the values of constraint_set0_flag, constraint_set1_flag, and constraint_set2_flag must all be equal to 0.

constraint_set3_flag indicates the following.

– If profile_idc is equal to 66, 77, or 88 and level_idc is equal to 11, constraint_set3_flag equal to 1 indicates that the bitstream obeys all constraints specified in Annex A for level 1b and constraint_set3_flag equal to 0 indicates that the bitstream may or may not obey all constraints specified in Annex A for level 1b.

– Otherwise, if profile_idc is equal to 100 or 110, constraint_set3_flag equal to 1 indicates that the bitstream obeys all constraints specified in Annex A for the High 10 Intra profile, and constraint_set3_flag equal to 0 indicates that the bitstream may or may not obey these corresponding constraints.

– Otherwise, if profile_idc is equal to 122, constraint_set3_flag equal to 1 indicates that the bitstream obeys all constraints specified in Annex A for the High 4:2:2 Intra profile, and constraint_set3_flag equal to 0 indicates that the bitstream may or may not obey these corresponding constraints.

– Otherwise, if profile_idc is equal to 44, constraint_set3_flag shall be equal to 1. When profile_idc is equal to 44, the value of 0 for constraint_set3_flag is forbidden.

– Otherwise, if profile_idc is equal to 244, constraint_set3_flag equal to 1 indicates that the bitstream obeys all constraints specified in Annex A for the High 4:4:4 Intra profile, and constraint_set3_flag equal to 0 indicates that the bitstream may or may not obey these corresponding constraints.

– Otherwise (profile_idc is equal to 66, 77, 88 and level_idc is not equal to 11), 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 in bitstreams conforming to this Recommendation | International Standard when profile_idc is equal

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to 66, 77, or 88 and level_idc is not equal to 11. Decoders conforming to this Recommendation | International Standard shall ignore the value of constraint_set3_flag when profile_idc is equal to 66, 77, or 88 and level_idc is not equal to 11.

Delete the paragraph starting with "**residual_colour_transform_flag".**

*Add the following paragraph before the paragraph starting with "***bit_depth_luma_minus8***".*

separate_colour_plane_flag equal to 1 specifies that the three colour components of the 4:4:4 chroma format are coded separately. separate_colour_plane_flag equal to 0 specifies that the three colour components of the 4:4:4 chroma format are not coded separately. When separate_colour_plane_flag is not present, it shall be inferred to be equal to 0. When separate_colour_plane_flag is equal to 1, the primary coded picture consists of three separate components, each of which consists of coded samples of one colour plane (Y or Cb or Cr) that conforms to the monochrome coding syntax. In this case, each picture is associated with a specific colour_plane_id value.

NOTE – There is no dependency in decoding processes between the colour planes having different colour_plane_id values. For example, the decoding process of a monochrome picture with one value of colour_plane_id does not use any date from monochrome pictures having different values of colour_plane_id for inter prediction.

Depending on the value of separate_colour_plane_flag, assign the value of the variable ChromaArrayType as follows.

– If separate_colour_plane_flag is equal to 0, ChromaArrayType is set equal to chroma_format_idc.

– Otherwise (separate_colour_plane_flag is equal to 1), ChromaArrayType is set equal to 0.

Replace the paragraph starting with "**bit_depth_luma_minus8"** *with the following:*

bit_depth_luma_minus8 specifies the bit depth of the samples of the luma array and the value of the luma quantisation parameter range offset $QpBdOffset_Y$, as specified by

$$BitDepth_Y = 8 + bit_depth_luma_minus8 \quad (7\text{-}1)$$

$$QpBdOffset_Y = 6 * bit_depth_luma_minus8 \quad (7\text{-}2)$$

When bit_depth_luma_minus8 is not present, it shall be inferred to be equal to 0. bit_depth_luma_minus8 shall be in the range of 0 to 6, inclusive.

Replace the paragraph starting with "**bit_depth_chroma_minus8"** *with the following.*

bit_depth_chroma_minus8 specifies the bit depth of the samples of the chroma arrays and the value of the chroma quantisation parameter range offset $QpBdOffset_C$, as specified by

$$BitDepth_C = 8 + bit_depth_chroma_minus8 \quad (7\text{-}3)$$

$$QpBdOffset_C = 6 * bit_depth_chroma_minus8 \quad (7\text{-}4)$$

When bit_depth_chroma_minus8 is not present, it shall be inferred to be equal to 0. bit_depth_chroma_minus8 shall be in the range of 0 to 6, inclusive.

NOTE – The value of bit_depth_chroma_minus8 is not used in the decoding process when ChromaArrayType is equal to 0. In particular, when separate_colour_plane_flag is equal to 1, each colour plane is decoded as a distinct monochrome picture using the luma component decoding process (except for the selection of scaling matrices) and the luma bit depth is used for all three colour components.

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*Replace the paragraph starting with "***seq_scaling_matrix_present_flag equal to 1***" with the following:*

seq_scaling_matrix_present_flag equal to 1 specifies that the flags seq_scaling_list_present_flag[i] for i = 0..11 are present. seq_scaling_matrix_present_flag equal to 0 specifies that these flags are not present and the sequence-level scaling list specified by Flat_4x4_16 shall be inferred for i = 0..5 and the sequence-level scaling list specified by Flat_8x8_16 shall be inferred for i = 6..11. When seq_scaling_matrix_present_flag is not present, it shall be inferred to be equal to 0.

Replace Table 7–2 with the following:

Table 7-2 – Assignment of mnemonic names to scaling list indices and specification of fall-back rule

Value of scaling list index	Mnemonic name	Block size	MB prediction type	Component	Scaling list fall-back rule set A	Scaling list fall-back rule set B	Default scaling list
0	Sl_4x4_Intra_Y	4x4	Intra	Y	default scaling list	sequence-level scaling list	Default_4x4_Intra
1	Sl_4x4_Intra_Cb	4x4	Intra	Cb	scaling list for i = 0	scaling list for i = 0	Default_4x4_Intra
2	Sl_4x4_Intra_Cr	4x4	Intra	Cr	scaling list for i = 1	scaling list for i = 1	Default_4x4_Intra
3	Sl_4x4_Inter_Y	4x4	Inter	Y	default scaling list	sequence-level scaling list	Default_4x4_Inter
4	Sl_4x4_Inter_Cb	4x4	Inter	Cb	scaling list for i = 3	scaling list for i = 3	Default_4x4_Inter
5	Sl_4x4_Inter_Cr	4x4	Inter	Cr	scaling list for i = 4	scaling list for i = 4	Default_4x4_Inter
6	Sl_8x8_Intra_Y	8x8	Intra	Y	default scaling list	sequence-level scaling list	Default_8x8_Intra
7	Sl_8x8_Inter_Y	8x8	Inter	Y	default scaling list	sequence-level scaling list	Default_8x8_Inter
8	Sl_8x8_Intra_Cb	8x8	Intra	Cb	scaling list for i = 6	scaling list for i = 6	Default_8x8_Intra
9	Sl_8x8_Inter_Cb	8x8	Inter	Cb	scaling list for i = 7	scaling list for i = 7	Default_8x8_Inter
10	Sl_8x8_Intra_Cr	8x8	Intra	Cr	scaling list for i = 8	scaling list for i = 8	Default_8x8_Intra
11	Sl_8x8_Inter_Cr	8x8	Inter	Cr	scaling list for i = 9	scaling list for i = 9	Default_8x8_Inter

*Replace the paragraph starting with "***frame_crop_left_offset, frame_crop_right_offset, frame_crop_top_offset, frame_crop_bottom_offset"** *with the following.*

frame_crop_left_offset, frame_crop_right_offset, frame_crop_top_offset, frame_crop_bottom_offset specify the samples of the pictures in the coded video sequence that are output from the decoding process, in terms of a rectangular region specified in frame coordinates for output.

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The variables CropUnitX and CropUnitY are derived as follows:

– If ChromaArrayType is equal to 0, CropUnitX and CropUnitY are derived as

CropUnitX = 1 (7-16)
CropUnitY = 2 – frame_mbs_only_flag (7-17)

– Otherwise (ChromaArrayType is equal to 1, 2, or 3), CropUnitX and CropUnitY are derived as

CropUnitX = SubWidthC (7-18)
CropUnitY = SubHeightC * (2 – frame_mbs_only_flag) (7-19)

The frame cropping rectangle contains luma samples with horizontal frame coordinates from CropUnitX * frame_crop_left_offset to $PicWidthInSamples_L$ – (CropUnitX * frame_crop_right_offset + 1) and vertical frame coordinates from CropUnitY * frame_crop_top_offset to (16 * FrameHeightInMbs) – (CropUnitY * frame_crop_bottom_offset + 1), inclusive. The value of frame_crop_left_offset shall be in the range of 0 to ($PicWidthInSamples_L$ / CropUnitX) – (frame_crop_right_offset + 1), inclusive; and the value of frame_crop_top_offset shall be in the range of 0 to (16 * FrameHeightInMbs / CropUnitY) – (frame_crop_bottom_offset + 1), inclusive.

When frame_cropping_flag is equal to 0, the values of frame_crop_left_offset, frame_crop_right_offset, frame_crop_top_offset, and frame_crop_bottom_offset shall be inferred to be equal to 0.

When ChromaArrayType is not equal to 0, the corresponding specified samples of the two chroma arrays are the samples having frame coordinates (x / SubWidthC, y / SubHeightC), where (x, y) are the frame coordinates of the specified luma samples.

For decoded fields, the specified samples of the decoded field are the samples that fall within the rectangle specified in frame coordinates.

In subclause 7.4.2.1.2 "Sequence parameter set extension RBSP semantics", replace the text:

The value of chroma_format_idc

with:

The value of chroma_format_idc and the value of ChromaArrayType

(in one occurrence)

Add the following note at the end of subclause 7.4.2.2 "Picture parameter set RBSP semantics":

NOTE – The values of bit_depth_chroma_minus8, chroma_qp_index_offset and second_chroma_qp_index_offset are not used in the decoding process when ChromaArrayType is equal to 0. In particular, when separate_colour_plane_flag is equal to 1, each colour plane is decoded as a distinct monochrome picture using the luma component decoding process (except for the selection of scaling matrices), including the application of the luma quantisation parameter derivation process without application of an offset for the decoding of the pictures having colour_plane_id not equal to 0.

In subclause 7.4.2.9.1 "Slice data partition A RBSP semantics", replace the paragraph that states as follows:

slice_id identifies the slice associated with the data partition. Each slice shall have a unique slice_id value within the coded picture that contains the slice. When arbitrary slice order is not allowed as specified in Annex A, the first slice of a

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coded picture, in decoding order, shall have slice_id equal to 0 and the value of slice_id shall be incremented by one for each subsequent slice of the coded picture in decoding order.

with:

slice_id identifies the slice associated with the data partition. The value of slice_id is constrained as follows.

- If separate_colour_plane_flag is equal to 0, the following applies.
  - If arbitrary slice order is not allowed as specified in Annex A, the first slice of a coded picture, in decoding order, shall have slice_id equal to 0 and the value of slice_id shall be incremented by one for each subsequent slice of the coded picture in decoding order.
  - Otherwise (arbitrary slice order is allowed), each slice shall have a unique slice_id value within the set of slices of the coded picture.
- Otherwise (separate_colour_plane_flag is equal to 1), the following applies.
  - If arbitrary slice order is not allowed as specified in Annex A, the first slice of a coded picture having each value of colour_plane_id, in decoding order, shall have slice_id equal to 0 and the value of slice_id shall be incremented by one for each subsequent slice of the coded picture having the same value of colour_plane_id, in decoding order.
  - Otherwise (arbitrary slice order is allowed) each slice shall have a unique slice_id value within each set of slices of the coded picture that have the same value of colour_plane_id.

In subclause 7.4.2.9.2 "Slice data partition B RBSP semantics", insert the following after the paragraph starting with "**slice_id**".

colour_plane_id specifies the colour plane associated with the current slice RBSP when separate_colour_plane_flag is equal to 1. The value of colour_plane_id shall be in the range of 0 to 2, inclusive. colour_plane_id equal to 0, 1, and 2 correspond to the Y, Cb, and Cr planes, respectively.

NOTE – There is no dependency between the decoding processes of pictures having different values of colour_plane_id.

In subclause 7.4.2.9.3 "Slice data partition C RBSP semantics", insert the following after the paragraph starting with "**slice_id**":

colour_plane_id has the same semantics as specified in subclause 7.4.2.9.2.

In subclause 7.4.3 "Slice header semantics", make the following changes.

Replace the following paragraph:

first_mb_in_slice specifies the address of the first macroblock in the slice. When arbitrary slice order is not allowed as specified in Annex A, the value of first_mb_in_slice shall not be less than the value of first_mb_in_slice for any other slice of the current picture that precedes the current slice in decoding order.

with:

first_mb_in_slice specifies the address of the first macroblock in the slice. When arbitrary slice order is not allowed as specified in Annex A, the value of first_mb_in_slice is constrained as follows.

- If separate_colour_plane_flag is equal to 0, the value of first_mb_in_slice shall not be less than the value of first_mb_in_slice for any other slice of the current picture that precedes the current slice in decoding order.

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– Otherwise (separate_colour_plane_flag is equal to 1), the value of first_mb_in_slice shall not be less than the value of first_mb_in_slice for any other slice of the current picture that precedes the current slice in decoding order and has the same value of colour_plane_id.

Insert the following after the paragraph starting with "**pic_parameter_set_id**".

colour_plane_id has the same semantics as specified in subclause 7.4.2.9.2.

In subclause 7.4.5 "Macroblock layer semantics", make the following changes.

*Replace the paragraph starting with "***transform_size_8x8_flag** equal to 1" *with the following.*

transform_size_8x8_flag equal to 1 specifies that for the current macroblock the transform coefficient decoding process and picture construction process prior to deblocking filter process for residual 8x8 blocks shall be invoked for luma samples, and when ChromaArrayType == 3 also for Cb and Cr samples. transform_size_8x8_flag equal to 0 specifies that for the current macroblock the transform coefficient decoding process and picture construction process prior to deblocking filter process for residual 4x4 blocks shall be invoked for luma samples, and when ChromaArrayType == 3 also for Cb and Cr samples. When transform_size_8x8_flag is not present in the bitstream, it shall be inferred to be equal to 0.

*Replace the paragraph starting with "*To each Intra_16x16*" with the following:*

To each Intra_16x16 prediction macroblock, an Intra16x16PredMode is assigned, which specifies the Intra_16x16 prediction mode.

The meaning of the variables CodedBlockPatternChroma and CodedBlockPatternLuma is specified with the semantics of coded_block_pattern.

Replace the following paragraphs:

pcm_sample_luma[i] is a sample value. The first pcm_sample_luma[i] values represent luma sample values in the raster scan within the macroblock. The number of bits used to represent each of these samples is $BitDepth_Y$. When profile_idc is not equal to 100, 110, 122, or 144, pcm_sample_luma[i] shall not be equal to 0.

pcm_sample_chroma[i] is a sample value. The first MbWidthC * MbHeightC pcm_sample_chroma[i] values represent Cb sample values in the raster scan within the macroblock and the remaining MbWidthC * MbHeightC pcm_sample_chroma[i] values represent Cr sample values in the raster scan within the macroblock. The number of bits used to represent each of these samples is $BitDepth_C$. When profile_idc is not equal to 100, 110, 122, or 144, pcm_sample_chroma[i] shall not be equal to 0.

with:

pcm_sample_luma[i] is a sample value. The first pcm_sample_luma[i] values represent luma sample values in the raster scan within the macroblock. The number of bits used to represent each of these samples is $BitDepth_Y$. When profile_idc is not equal to 44, 100, 110, 122, or 244, pcm_sample_luma[i] shall not be equal to 0.

pcm_sample_chroma[i] is a sample value. The first MbWidthC * MbHeightC pcm_sample_chroma[i] values represent Cb sample values in the raster scan within the macroblock and the remaining MbWidthC * MbHeightC pcm_sample_chroma[i] values represent Cr sample values in the raster scan within the macroblock. The number of bits used to represent each of these samples is $BitDepth_C$. When profile_idc is not equal to 44, 100, 110, 122, or 244, pcm_sample_chroma[i] shall not be equal to 0.

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*Delete the paragraph starting with "*When coded_block_pattern is present, CodedBlockPatternLuma specifies*".*

*Insert the following paragraph before the paragraph starting with "*mb_qp_delta"*:*

Depending on the value of ChromaArrayType, the following meaning is assigned to CodedBlockPatternLuma and the following restrictions are imposed on CodedBlockPatternChroma.

– If ChromaArrayType is equal to 0, CodedBlockPatternLuma specifies whether and where, for the luma component, non-zero AC transform coefficient levels are present and the derivation of the variable CodedBlockPatternChroma shall result in a value that is equal to 0.
– Otherwise, if ChromaArrayType is equal to 1 or 2, CodedBlockPatternLuma specifies whether, for the luma component, non-zero AC transform coefficient levels are present and CodedBlockPatternChroma may be in the range of 0 to 2, inclusive.
– Otherwise (ChromaArrayType is equal to 3), CodedBlockPatternLuma specifies whether and where, for the luma and the Cb and Cr component, non-zero AC transform coefficient levels are present and the derivation of the variable CodedBlockPatternChroma shall result in a value that is equal to 0.

In subclause 7.4.5.1 "Macroblock prediction semantics", make the following changes.

Replace the paragraph starting with **"prev_intra4x4_pred_mode_flag"** *with the following:*

prev_intra4x4_pred_mode_flag[luma4x4BlkIdx] and **rem_intra4x4_pred_mode**[luma4x4BlkIdx] specify the Intra_4x4 prediction of the 4x4 luma block with index luma4x4BlkIdx = 0..15. When ChromaArrayType is equal to 3, prev_intra4x4_pred_mode_flag[luma4x4BlkIdx] and rem_intra4x4_pred_mode[luma4x4BlkIdx] also specify the Intra_4x4 prediction of the 4x4 Cb block and 4x4 Cr block with luma4x4BlkIdx equal to index cb4x4BlkIdx = 0..15 or cr4x4BlkIdx = 0..15.

Replace the paragraph starting with **"prev_intra8x8_pred_mode_flag"** *with the following:*

prev_intra8x8_pred_mode_flag[luma8x8BlkIdx] and **rem_intra8x8_pred_mode**[luma8x8BlkIdx] specify the Intra_8x8 prediction of the 8x8 luma block with index luma8x8BlkIdx = 0..3. When ChromaArrayType is equal to 3, prev_intra8x8_pred_mode_flag[luma8x8BlkIdx] and rem_intra8x8_pred_mode[luma8x8BlkIdx] also specify the Intra_8x8 prediction of the 8x8 Cb block and 8x8 Cr block with index luma8x8BlkIdx equal to cb8x8BlkIdx = 0..3 or cr8x8BlkIdx = 0..3.

Replace the content of subclause 7.4.5.3 "Residual data semantics" with the following:

The syntax structure residual_block( ), which is used for parsing the transform coefficient levels, is assigned as follows.

– If entropy_coding_mode_flag is equal to 0, residual_block is set equal to residual_block_cavlc, which is used for parsing the syntax elements for transform coefficient levels.
– Otherwise (entropy_coding_mode_flag is equal to 1), residual_block is set equal to residual_block_cabac, which is used for parsing the syntax elements for transform coefficient levels.

The syntax structure residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8) is used with the variables in brackets being its output and being assigned as follows. Intra16x16DCLevel is set equal to i16x16DClevel, Intra16x16ACLevel is set equal to i16x16AClevel, LumaLevel is set equal to level, and LumaLevel8x8 is set equal to level8x8.

When ChromaArrayType is equal to 1 or 2, the following applies.

– For each chroma component, indexed by iCbCr = 0..1, the DC transform coefficient levels of the 4 * NumC8x8 4x4 chroma blocks are parsed into the iCbCr-th list ChromaDCLevel[iCbCr].

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– For each of the 4x4 chroma blocks, indexed by i4x4 = 0..3 and i8x8 = 0..NumC8x8 – 1, of each chroma component, indexed by iCbCr = 0..1, the 15 AC transform coefficient levels are parsed into the (i8x8*4 + i4x4)-th list of the iCbCr-th chroma component ChromaACLevel[iCbCr][i8x8*4 + i4x4].

When ChromaArrayType is equal to 3, the following applies.

– The syntax structure residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8) is used for the Cb component with the variables in brackets being its output and being assigned as follows. CbIntra16x16DCLevel is set equal to i16x16DClevel, CbIntra16x16ACLevel is set equal to i16x16AClevel, CbLevel is set equal to level, and CbLevel8x8 is set equal to level8x8.

– The syntax structure residual_luma(i16x16DClevel, i16x16AClevel, level, level8x8) is used for the Cr component with the variables in brackets being its output and being assigned as follows. CrIntra16x16DCLevel is set equal to i16x16DClevel, CrIntra16x16ACLevel is set equal to i16x16AClevel, CrLevel is set equal to level, and CrLevel8x8 is set equal to level8x8.

In subclause 7.4.5.3.2 "Residual block CABAC semantics", replace the paragraph starting with "**coded_block_flag**" *with the following:*

coded_block_flag specifies whether the block contains non-zero transform coefficient levels as follows.

– If coded_block_flag is equal to 0, the block contains no non-zero transform coefficient levels.

– Otherwise (coded_block_flag is equal to 1), the block contains at least one non-zero transform coefficient level.

When maxNumCoeff is equal to 64 and ChromaArrayType is not equal to 3, coded_block_flag is set equal to 1.

Insert a new subclause 7.4.5.3.3 as follows:

7.3.5.3.3 Residual luma data semantics

Output of this syntax structure are the variables i16x16DClevel, i16x16AClevel, level, and level8x8.

The syntax structure residual_block( ), which is used for parsing the transform coefficient levels, is assigned as follows.

– If entropy_coding_mode_flag is equal to 0, residual_block is set equal to residual_block_cavlc, which is used for parsing the syntax elements for transform coefficient levels.

– Otherwise (entropy_coding_mode_flag is equal to 1), residual_block is set equal to residual_block_cabac, which is used for parsing the syntax elements for transform coefficient levels.

Depending on mb_type the syntax structure residual_block(coeffLevel, maxNumCoeff) is used with the arguments coeffLevel, which is a list containing the maxNumCoeff transform coefficient levels that are parsed in residual_block( ) and maxNumCoeff as follows. Depending on MbPartPredMode(mb_type, 0), the following applies.

– If MbPartPredMode(mb_type, 0) is equal to Intra_16x16, the transform coefficient levels are parsed into the list i16x16DClevel and into the 16 lists i16x16AClevel[i]. i16x16DClevel contains the 16 transform coefficient levels of the DC transform coefficient levels for each 4x4 luma block. For each of the 16 4x4 luma blocks indexed by i = 0..15, the 15 AC transform coefficients levels of the i-th block are parsed into the i-th list i16x16AClevel[i].

– Otherwise (MbPartPredMode(mb_type, 0) is not equal to Intra_16x16), the following applies.

  – If transform_size_8x8_flag is equal to 0, for each of the 16 4x4 luma blocks indexed by i = 0..15, the 16 transform coefficient levels of the i-th block are parsed into the i-th list level[i].

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– Otherwise (transform_size_8x8_flag is equal to 1), for each of the 4 8x8 luma blocks indexed by i8x8 = 0..3, the following applies.

  – If entropy_coding_mode_flag is equal to 0, first for each of the 4 4x4 luma blocks indexed by i4x4 = 0..3, the 16 transform coefficient levels of the i4x4-th block are parsed into the (i8x8 * 4 + i4x4)-th list level[i8x8 * 4 + i4x4]. Then, the 64 transform coefficient levels of the i8x8-th 8x8 luma block which are indexed by 4 * i + i4x4, where i = 0..15 and i4x4 = 0..3, are derived as level8x8[i8x8][4 * i + i4x4] = level[i8x8 * 4 + i4x4][i].

    NOTE – The 4x4 luma blocks with luma4x4BlkIdx = i8x8 * 4 + i4x4 containing every fourth transform coefficient level of the corresponding i8x8-th 8x8 luma block with offset i4x4 are assumed to represent spatial locations given by the inverse 4x4 luma block scanning process in subclause 6.4.3.

  – Otherwise (entropy_coding_mode_flag is equal to 1), the 64 transform coefficient levels of the i8x8-th block are parsed into the i8x8-th list level8x8[i8x8].

In clause 8 and all subclauses of clause 8, make the following changes.

*Replace all occurrences of "*chroma_format_idc*" with "*ChromaArrayType*".*

Delete all occurrences of "(monochrome)*".*

In clause 8, make the following changes.

After the first sentence, insert the following.

Depending on the value of chroma_format_idc, the number of sample arrays of the current picture is as follows.

– If chroma_format_idc is equal to 0, the current picture consists of 1 sample array S_L.

– Otherwise (chroma_format_idc is not equal to 0), the current picture consists of 3 sample arrays S_L, S_{Cb}, S_{Cr}.

*Replace the paragraph that starts with "*Each picture referred*" with the following:*

Each picture referred to in this clause is a complete or part of a primary coded picture. Each slice referred to in this clause is a slice of a primary picture. Each slice data partition referred to in this clause is a slice data partition of a primary picture.

Depending on the value of separate_colour_plane_flag, the decoding process is structured as follows.

– If separate_colour_plane_flag is equal to 0, the decoding process is invoked a single time with the current picture being the output.

– Otherwise (separate_colour_plane_flag is equal to 1), the decoding process is invoked three times. Inputs to the decoding process are all NAL units of the primary coded picture with identical value of colour_plane_id. The decoding process of NAL units with a particular value of colour_plane_id is specified as if only a coded video sequence with monochrome colour format with that particular value of colour_plane_id would be present in the bitstream. The output of each of the three decoding processes is assigned to the 3 sample arrays of the current picture with the NAL units with colour_plane_id equal to 0 being assigned to S_L, the NAL units with colour_plane_id equal to 1 being assigned to S_{Cb}, and the NAL units with colour_plane_id equal to 2 being assigned to S_{Cr}.

NOTE – The variable ChromaArrayType is derived as 0 when separate_colour_plane_flag is equal to 1 and chroma_format_idc is equal to 3. In the decoding process, the value of this variable is evaluated resulting in operations identical to that of monochrome pictures with chroma_format_idc being equal to 0.

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