

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**T.800**

**Amendment 2**

(03/2009)

SERIES T: TERMINALS FOR TELEMATIC SERVICES  
Still-image compression – JPEG 2000

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Information technology – JPEG 2000 image coding  
system: Core coding system

**Amendment 2: Extended profiles for cinema and  
video production and archival applications**

Recommendation ITU-T T.800 (2002) – Amendment 2



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**Information technology – JPEG 2000 image coding  
system: Core coding system**

**Amendment 2**

**Extended profiles for cinema and video production and  
archival applications**

**Summary**

Recommendation ITU-T T.800 | ISO/IEC 15444-1 describes the core elements of a flexible image compression system known as "JPEG 2000".

Amendment 2 to this Recommendation | International Standard adds profiles for the support of post-production and archival formats. There are two cinema profiles and one video profile.

The cinema profiles are intended for use from camera capture through the production chain on to the final distribution masters. The cinematic profiles are designed such that it could also be used to archive the final distribution masters but with higher quality layers. In this way, the content can be retrieved for future editing without appreciable quality loss.

The video archive is intended for similar purposes but is limited to only (5,3) kernel support. The reason for limited support is that the current broadcast profiles are limited to (9,7) due to the contribution nature of the broadcast market. The lossless kernel is better suited for archival applications and therefore is better placed in this amendment.

**Source**

Amendment 2 to Recommendation ITU-T T.800 (2002) was approved on 16 March 2009 by ITU-T Study Group 16 (2009-2012) under Recommendation ITU-T A.8 procedure. An identical text is also published as ISO/IEC 15444-1, Amendment 2.

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INTERNATIONAL STANDARD  
RECOMMENDATION ITU-TInformation technology – JPEG 2000 image coding  
system: Core coding system

## Amendment 2

Extended profiles for cinema and video production and  
archival applications

## 1) Annex A

Add the following at the end of Annex A (i.e., immediately following Table A.46):

The profiles listed under profile indication numbers Rsiz = 5 to 7 are intended for archiving and production purposes. The two extended scalable profiles are intended to be used for easily accessible archives. The long-term storage profile is intended for original camera capture or post-production workflows.

**Table A.46 (contd.) – Codestream restrictions for cinema and video production and archival applications**

	Scalable 2k digital cinema profile	Scalable 4k digital cinema profile	Long-term storage profile
<b>SIZ marker segment</b>			
Profile Indication	Rsiz = 5	Rsiz = 6	Rsiz = 7
Image size	Xsiz ≤ 2048, Ysiz ≤ 1080	Xsiz ≤ 4096, Ysiz ≤ 2160	Xsiz ≤ 16384, Ysiz ≤ 8640
Tiles	One tile for the whole image: YTsiz + YTOsiz ≥ Ysiz XTsiz + XTOsiz ≥ Xsiz	One tile for the whole image: YTsiz + YTOsiz ≥ Ysiz XTsiz + XTOsiz ≥ Xsiz	One tile for the whole image or minimum tile size: YTsiz + YTOsiz ≥ 512 XTsiz + XTOsiz ≥ 1024
Image and tile origin	XOsiz = YOsiz = XTOsiz = YTOsiz = 0	XOsiz = YOsiz = XTOsiz = YTOsiz = 0	XOsiz = YOsiz = XTOsiz = YTOsiz = 0
Sub-sampling	XRsiz <sup>1</sup> = YRsiz <sup>1</sup> = 1	XRsiz <sup>1</sup> = YRsiz <sup>1</sup> = 1	No restriction
Number of components	Csiz = 3	Csiz = 3	Csiz ≤ 8
Bit depth	Ssiz <sup>1</sup> = 11 (i.e., 12-bit unsigned)	Ssiz <sup>1</sup> = 11 (i.e., 12-bit unsigned)	No restriction
<b>RGN marker segment</b>	Disallowed, i.e., no region of interest	Disallowed, i.e., no region of interest	Disallowed, i.e., no region of interest
<b>COD/COC marker segments</b>	Main header only	Main header only	Main header only
Coding style	Scod, Scoc = 0000 0esp, where e = s = 0, and p = 1 NOTE – e = 0: EPH marker shall not be used s = 0: SOP marker shall not be used p = 1: precincts defined in SPcod <sup>1</sup> /SPcoc <sup>1</sup>	Scod, Scoc = 0000 0esp, where e = s = 0, and p = 1 NOTE – e = 0: EPH marker shall not be used s = 0: SOP marker shall not be used p = 1: precincts defined in SPcod <sup>1</sup> /SPcoc <sup>1</sup>	Scod, Scoc = 0000 0esp, where e = s = 1, and p = 0 or 1 NOTE – e: EPH marker shall be used s: SOP marker may be used p: precincts with PPx = 15 and PPy = 15 or defined in SPcod <sup>1</sup> /SPcoc <sup>1</sup>
Progression order	CPRL	CPRL	CPRL
Number of layers	L = 2	L = 2	L ≤ 5
Multiple component transform	All component transforms defined in this Recom- mendation   International Standard may be used.	All component transforms defined in this Recom- mendation   International Standard may be used.	All component transforms defined in this Recom- mendation   International Standard may be used.

**Table A.46 (contd.) – Codestream restrictions for cinema and video production and archival applications**

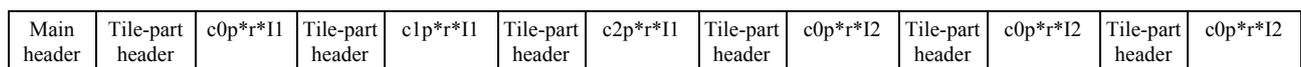
	<b>Scalable 2k digital cinema profile</b>	<b>Scalable 4k digital cinema profile</b>	<b>Long-term storage profile</b>
Number of decomposition levels	$N_L \leq 5$ Every component of every image of a codestream shall have the same number of wavelet transform levels. The number of deployed decomposition levels shall be set accordingly in all COD and COC markers.	$1 \leq N_L \leq 6$ Every component of every image of a codestream shall have the same number of wavelet transform levels. The number of deployed decomposition levels shall be set accordingly in all COD and COC markers.	No restriction, with respect to: $(Xsiz - XOsiz)/D(I) \leq 64$ $(Ysiz - YOsiz)/D(I) \leq 64$ and $D(I) = \text{pow}(2, N_L)$ for each component $I$ Every component of every image of a codestream shall have the same number of wavelet transform levels. The number of deployed decomposition levels shall be set accordingly in all COD and COC markers.
Code-block size	$xcb = ycb = 5$ The corresponding values shall be set accordingly in all deployed COD and COC markers.	$xcb = ycb = 5$ The corresponding values shall be set accordingly in all deployed COD and COC markers.	$xcb \leq 6, ycb \leq 6$ The corresponding values shall be set accordingly in all deployed COD and COC markers.
Code-block style	SPcod, SPcoc = 0000 0000	SPcod, SPcoc = 0000 0000	SPcod, SPcoc = 00sp vtra where $r = v = 0$ , and $a, t, p, s = 0$ or $1$ NOTE – $a = 1$ for selective arithmetic coding bypass, $t = 1$ for termination on each coding pass, $p = 1$ for predictive termination, $s = 1$ for segmentation symbols.
Transformation	9-7 irreversible filter The corresponding filter shall be set accordingly in all COD and COC markers.	9-7 irreversible filter The corresponding filter shall be set accordingly in all COD and COC markers.	9-7 irreversible filter 5-3 reversible filter The corresponding filter shall be set accordingly in all COD and COC markers.
Precinct size	$PPx = PPy = 7$ for $N_{LL}$ band, else 8 The corresponding values shall be set accordingly in all COD and COC markers.	$PPx = PPy = 7$ for $N_{LL}$ band, else 8 The corresponding values shall be set accordingly in all COD and COC markers.	$PPx \geq xcb, PPy \geq ycb$ The corresponding values shall be set accordingly in all COD and COC markers.

**Table A.46 (contd.) – Codestream restrictions for cinema and video production and archival applications**

	Scalable 2k digital cinema profile	Scalable 4k digital cinema profile	Long-term storage profile
<b>Tile-parts</b>	Each compressed image shall have exactly 6 tile-parts. Each of the first 3 tile-parts shall contain all data necessary to decompress one 2K color component compatible to 2k digital cinema profile. Each of the next 3 tile-parts shall contain all additional data necessary to decompress the rest of one 2K color component. The resulting codestream structure is shown in Figure A-26	Each compressed image shall have exactly 12 tile-parts. Each of the first 3 tile-parts shall contain all data necessary to decompress one 2K color component compatible to 2k digital cinema profile. Each of the next 3 tile-parts shall contain all additional data necessary to decompress one 4K color component. Each of the next 3 tile-parts shall contain all additional data necessary for the rest of one 2k color component. Each of the next 3 tile-parts shall contain all additional data necessary to decompress the rest of one 4K color component.	Each compressed image tile shall consist of exactly Csiz tile-parts. Each tile-part shall contain all data from one component of the considered tile.
<b>Other markers</b>			
Packed headers (PPM, PPT)	Disallowed	Disallowed	Disallowed
Tile-part lengths marker (TLM)	TLM segments are required in each image	TLM segments are required in each image	TLM segments are required in each image
Packet length, tile-part header (PLT)	For each tile-part, a complete list of packet lengths shall be provided	For each tile-part, a complete list of packet lengths shall be provided	For each tile-part, a complete list of packet lengths shall be provided
QCD, QCC	Main header only	Main header only	Main header only
SOP, EPH	Disallowed	Disallowed	Each packet in any given tile-part shall be prepended with a SOP marker segment and each packet header in any given tile-part shall be postpended with an EPH marker segment
POC marker	There shall be exactly one POC marker segment in the main header. Other POC marker segments are disallowed. The POC marker segment shall specify exactly two progressions having the following parameters: First progression: a. $RS_{poc} = 0$ , $CS_{poc} = 0$ , $LYE_{poc} = 1$ , $RE_{poc} = N_L + 1$ , $CE_{poc} = 3$ , $Ppoc = 4$ Second progression: b. $RS_{poc} = 0$ , $CS_{poc} = 0$ , $LYE_{poc} = 2$ , $RE_{poc} = N_L + 1$ , $CE_{poc} = 3$ , $Ppoc = 4$	There shall be exactly one POC marker segment in the main header. Other POC marker segments are disallowed. The POC marker segment shall specify exactly four progressions having the following parameters: First progression: a. $RS_{poc} = 0$ , $CS_{poc} = 0$ , $LYE_{poc} = 1$ , $RE_{poc} = N_L$ , $CE_{poc} = 3$ , $Ppoc = 4$ Second progression: b. $RS_{poc} = N_L$ , $CS_{poc} = 0$ , $LYE_{poc} = 1$ , $RE_{poc} = N_L + 1$ , $CE_{poc} = 3$ , $Ppoc = 4$ Third progression: c. $RS_{poc} = 0$ , $CS_{poc} = 0$ , $LYE_{poc} = 2$ , $RE_{poc} = N_L$ , $CE_{poc} = 3$ , $Ppoc = 4$ Fourth progression: d. $RS_{poc} = N_L$ , $CS_{poc} = 0$ , $LYE_{poc} = 2$ , $RE_{poc} = N_L + 1$ , $CE_{poc} = 3$ , $Ppoc = 4$	Disallowed

**Table A.46 (contd.) – Codestream restrictions for cinema and video production and archival applications**

	Scalable 2k digital cinema profile	Scalable 4k digital cinema profile	Long-term storage profile
<b>Application-specific restrictions</b>			
Error protection	Disallowed	Disallowed	The use of marker segments defined in Rec. ITU-T T.810   ISO/IEC 15444-11 for the detection, correction and protection against errors that may result from aging media is not mandatory but optional and recommended.
Max compressed bytes for any image frame (aggregate of all 3 color components)	1302083 bytes	2604166 bytes	No restrictions
Max compressed bytes for any single color component of an image frame including all relevant tile-part headers	1041666 bytes	2083332 bytes	No restrictions
Max compressed bytes for quality layer 0 of any image frame (aggregate of all 3 color components) shall include relevant headers and markers assuring Digital Cinema packages can be obtained by simply stripping some tile-parts	1302083 bytes for 24 fps 651041 bytes for 48 fps	1302083 bytes for 24 fps	No restrictions
Max compressed bytes for layer 0 of any single color component of an image frame including all relevant tile-part headers	1041666 bytes for 24 fps 520833 bytes for 48 fps	1041666 bytes for 24 fps for 2K portion of each component	No restrictions



**Figure A.26 – Proposed codestream structure**

Assuming  $N_L$  wavelet transform levels ( $N_L+1$  resolutions), the rectangles labelled  $cip*r*11$  ( $i = 0, 1, 2$ ) contain all packets for color component  $i$ , all precincts, resolutions 0 through  $N_L$  and layer 1. The rectangles labelled  $cip*r*12$  ( $i = 0, 1, 2$ ) contain all packets for color component  $i$ , resolutions 0 through  $N_L$  and layer 2.

**2) Clause 2, reference**

Add the following to clause 2:

- Recommendation ITU-T T.810 (2006) | ISO/IEC 15444-11:2007, *Information technology – JPEG 2000 image coding system: Wireless*.



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