# INTERNATIONAL STANDARD

## ISO/IEC
## 15444-1

Second edition
2004-09-15
**AMENDMENT 2**
2009-12-15

# Information technology — JPEG 2000 image coding system: Core coding system

## AMENDMENT 2: Extended profiles for cinema and video production and archival applications

*Technologies de l'information — Système de codage d'images JPEG 2000: Système de codage de noyau*

*AMENDEMENT 2: Profils étendus pour production au cinéma et vidéo, et applications d'archivage*

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# Foreword

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Amendment 2 to ISO/IEC 15444-1:2004 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T. The identical text is published as Rec. ITU-T T.800 (2002)/Amd.2 (03/2009).

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**INTERNATIONAL STANDARD**
**RECOMMENDATION ITU-T**

# Information 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 |
|---|---|---|---|
| **SIZ marker segment** |  |  |  |
| Profile Indication | Rsiz = 5 | Rsiz = 6 | Rsiz = 7 |
| Image size | Xsiz ≤ 2048,<br>Ysiz ≤ 1080 | Xsiz ≤ 4096,<br>Ysiz ≤ 2160 | Xsiz ≤ 16384,<br>Ysiz ≤ 8640 |
| Tiles | One tile for the whole image:<br>YTsiz + YTOsiz ≥ Ysiz<br>XTsiz + XTOsiz ≥ Xsiz | One tile for the whole image:<br>YTsiz + YTOsiz ≥ Ysiz<br>XTsiz + XTOsiz ≥ Xsiz | One tile for the whole image or minimum tile size:<br>YTsiz + YTOsiz ≥ 512<br>XTsiz + XTOsiz ≥ 1024 |
| Image and tile origin | XOsiz = YOsiz = XTOsiz = YTOsiz = 0 | XOsiz = YOsiz = XTOsiz = YTOsiz = 0 | XOsiz = YOsiz = XTOsiz = YTOsiz = 0 |
| Sub-sampling | $XRsiz^i = YRsiz^i = 1$ | $XRsiz^i = YRsiz^i = 1$ | No restriction |
| Number of components | Csiz = 3 | Csiz = 3 | Csiz ≤ 8 |
| Bit depth | $Ssiz^i = 11$ (i.e., 12-bit unsigned) | $Ssiz^i = 11$ (i.e., 12-bit unsigned) | No restriction |
| **RGN marker segment** | Disallowed, i.e., no region of interest | Disallowed, i.e., no region of interest | Disallowed, i.e., no region of interest |
| **COD/COC marker segments** | Main header only | Main header only | Main header only |
| Coding style | Scod, Scoc = 0000 0esp, where e = s = 0, and p = 1<br>NOTE – e = 0: EPH marker shall not be used<br>s = 0: SOP marker shall not be used<br>p = 1: precincts defined in $SPcodI^i/SPcocI^i$ | Scod, Scoc = 0000 0esp, where e = s = 0, and p = 1<br>NOTE – e = 0: EPH marker shall not be used<br>s = 0: SOP marker shall not be used<br>p = 1: precincts defined in $SPcodI^i/SPcocI^i$ | Scod, Scoc = 0000 0esp, where e = s = 1, and p = 0 or 1<br>NOTE – e: EPH marker shall be used<br>s: SOP marker may be used<br>p: precincts with PPx = 15 and PPy = 15 or defined in $SPcodI^i/SPcocI^i$ |
| 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
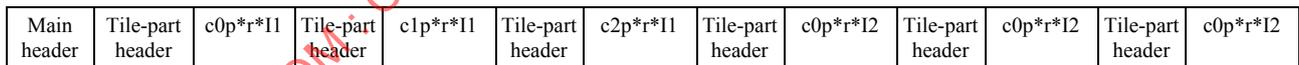video production and archival applications**

| | Scalable 2k digital cinema profile | Scalable 4k digital cinema profile | Long-term storage profile |
|---|---|---|---|
| Number of decomposition levels | $N_L \leq 5$<br><br>Every component of every image of a codestream shall have the same number of wavelet transform levels.<br><br>The number of deployed decomposition levels shall be set accordingly in all COD and COC markers. | $1 \leq N_L \leq 6$<br><br>Every component of every image of a codestream shall have the same number of wavelet transform levels.<br><br>The number of deployed decomposition levels shall be set accordingly in all COD and COC markers. | No restriction, with respect to:<br><br>$(\text{Xsiz} - \text{XOsiz})/D(I) \leq 64$<br>$(\text{Ysiz} - \text{YOsiz})/D(I) \leq 64$<br>and $D(I) = \text{pow}(2, N_L)$ for each component $I$<br><br>Every component of every image of a codestream shall have the same number of wavelet transform levels.<br><br>The number of deployed decomposition levels shall be set accordingly in all COD and COC markers. |
| Code-block size | $xcb = ycb = 5$<br><br>The corresponding values shall be set accordingly in all deployed COD and COC markers. | $xcb = ycb = 5$<br><br>The corresponding values shall be set accordingly in all deployed COD and COC markers. | $xcb \leq 6$, $ycb \leq 6$<br><br>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<br><br>where r = v = 0,<br>and a, t, p, s = 0 or 1<br><br>NOTE – a = 1 for selective arithmetic coding bypass,<br><br>t = 1 for termination on each coding pass,<br><br>p = 1 for predictive termination,<br><br>s = 1 for segmentation symbols. |
| Transformation | 9-7 irreversible filter<br><br>The corresponding filter shall be set accordingly in all COD and COC markers. | 9-7 irreversible filter<br><br>The corresponding filter shall be set accordingly in all COD and COC markers. | 9-7 irreversible filter<br>5-3 reversible filter<br><br>The corresponding filter shall be set accordingly in all COD and COC markers. |
| Precinct size | $PPx = PPy = 7$ for $N_L$LL band, else 8<br><br>The corresponding values shall be set accordingly in all COD and COC markers. | $PPx = PPy = 7$ for $N_L$LL band, else 8<br><br>The corresponding values shall be set accordingly in all COD and COC markers. | $PPx \geq xcb$, $PPy \geq ycb$<br><br>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 |
|---|---|---|---|
| **Tile-parts** | 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. |
| **Other markers** | | | |
| 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:<br>First progression:<br>a. $RSpoc = 0$, $CSpoc = 0$, $LYEpoc = 1$, $REpoc = N_L+1$, $CEpoc = 3$, $Ppoc = 4$<br>Second progression:<br>b. $RSpoc = 0$, $CSpoc = 0$, $LYEpoc = 2$, $REpoc = N_L+1$, $CEpoc = 3$, $Ppoc = 4$ | 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:<br>a. $RSpoc = 0$, $CSpoc = 0$, $LYEpoc = 1$, $REpoc = N_L$, $CEpoc = 3$, $Ppoc = 4$<br>Second progression:<br>b. $RSpoc = N_L$, $CSpoc = 0$, $LYEpoc = 1$, $REpoc = N_L+1$, $CEpoc = 3$, $Ppoc = 4$<br>Third progression:<br>c. $RSpoc = 0$, $CSpoc = 0$, $LYEpoc = 2$, $REpoc = N_L$, $CEpoc = 3$, $Ppoc = 4$<br>Fourth progression:<br>d. $RSpoc = N_L$, $CSpoc = 0$, $LYEpoc = 2$, $REpoc = N_L+1$, $CEpoc = 3$, $Ppoc = 4$ | 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 |
|---|---|---|---|
| **Application-specific restrictions** | | | |
| 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<br>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<br>520833 bytes for 48 fps | 1041666 bytes for 24 fps for 2K portion of each component | No restrictions |

| Main header | Tile-part header | c0p*r*I1 | Tile-part header | c1p*r*I1 | Tile-part header | c2p*r*I1 | Tile-part header | c0p*r*I2 | Tile-part header | c0p*r*I2 | Tile-part header | c0p*r*I2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

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

Assuming $N_L$ wavelet transform levels ($N_L$+1 resolutions), the rectangles labelled c$i$p*r*l1 ($i$ = 0, 1, 2) contain all packets for color component $i$, all precincts, resolutions 0 through $N_L$ and layer 1. The rectangles labelled c$i$p*r*l2 ($i$ = 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*.