INTERNATIONAL STANDARD

ISO/IEC 15444-2

First edition
2004-05-15

AMENDMENT 4
2015-07-15

Information technology — JPEG 2000 image coding system: Extensions

AMENDMENT 4: Block coder extension

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

AMENDEMENT 4: Extension de l'encodeur de bloc

Reference number
ISO/IEC 15444-2:2004/Amd.4:2015(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 4 to ISO/IEC 15444-2 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 ITU-T Rec.T. 801/Amd.4.

INTERNATIONAL STANDARD
ISO/IEC 15444-2:2004/FDAM 4 (E)
Rec. ITU-T T.801 (02/2002)/Amd.4 (201X)
ITU-T RECOMMENDATION

Information technology – JPEG 2000 image coding system: Extensions

AMENDMENT 4: Block coder extension

1. A.3.13

Insert the following text immediately before the paragraph commencing "Guidance on usage (informative)".

Table A-51 defines Ccap values corresponding to k=2, i.e., extended capabilities that are defined in this International Standard | Recommendation.

Table A-51 - Part parameter values for the Ccap parameter

Values (bits) MSB LSB	Part parameter
1xxx xxxx xxxx xxxx	Block coder extensions may be present, as defined in COD or COC marker segments
....	....
	All other values reserved

2. A.2.3

Insert the following text after the line beginning "Geometric manipulation is enabled with two bits in the Scod parameter shown in Table A.5.":

Block coder extensions are enabled with 1 bit in the Scod parameter, as shown in Table A-5. When this bit is set, the COD marker segment is extended to include a 16-bit parameter SXcod that follows SPcod as shown in Figure A-14. The meaning of SXcod is defined by Table A-49.

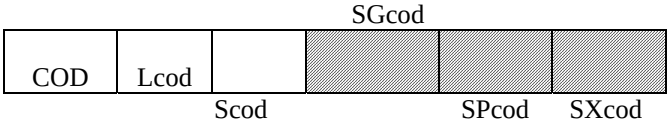

Figure A-14 – Coding style default syntax

3. Table A-5

Add the following lines to Table A-5:

xx0x xxxx	Block coder extensions not used
xx1x xxxx	Block coder extensions defined by SXcod

4. Table A-49

Add the following Table:

Table A-49 – Block Coder Extensions (see Annex P)

Values (bits) MSB LSB	Coding style
xxxx xxxx xxxx xx00	No modifications to selective arithmetic coder bypass mode
xxxx xxxx xxxx xx01	Selective arithmetic coder bypass modified to start from the 2nd significant bit-plane if bit 0 of SPcod/SPcoc set.
xxxx xxxx xxxx xx10	Selective arithmetic coder bypass modified to start from the 3rd significant bit-plane if bit 0 of SPcod/SPcoc set.
xxxx xxxx xxxx xx11	Selective arithmetic coder bypass modified to start from the 4th significant bit-plane if bit 0 of SPcod/SPcoc set.
	All other values reserved.

5. M.11 Defined boxes

In M.11.1: Reader Requirements box, insert a new slot number "84" in Table M-14 to identify block coder extension.

Table M.14 – Leal values of the SF^i field

Value	Meaning
84	Block coder extension

6. New Annex P

Add Annex P:

Annex P
Block Coder Extensions

(This annex forms an integral part of this Recommendation | International Standard)

P.1 Selective Arithmetic Coding Bypass (Lazy mode)

Selective arithmetic coding bypass, as defined in Annex D.6 of Rec. ITU-T T.800 (08/2002) | ISO/IEC 15444-1:2004, is the coding style which allows bypassing the arithmetic coder for the significance propagation pass (SP) and magnitude refinement passes (MR) starting in the 5^{th} significant bit-plane of the code-block. The COD or COC marker signals where or not this coding style is used.

The first cleanup pass (CP) which is the first bit-plane of a code-block with a non-zero element and the next three sets of SP, MR, and CP coding passes are decoded with the arithmetic coder. The fourth CP pass shall include an arithmetic coder termination as shown in Table D-9 of Rec. ITU-T T.800 (08/2002) | ISO/IEC 15444-1:2004.

Starting with the fourth SP and MR coding passes, the bits that would have been returned from the arithmetic coder are instead returned directly from the bit stream. After each MR pass, the bit stream has been "terminated" by padding to the byte boundary.

Table P-1 – Selective Arithmetic Coding Bypass (Default)
[the same as Table D-9 of Rec. ITU-T T.800 (08/2002) | ISO/IEC 15444-1:2004]

Bit-plane number	Pass type	Coding Operations
1	CP	Arithmetic coding(AC)
2	SP	AC
2	MR	AC
2	CP	AC
3	SP	AC
3	MR	AC
3	CP	AC
4	SP	AC
4	MR	AC
4	CP	AC, terminate
5	SP	Raw
5	MR	Raw, terminate
5	CP	AC, terminate
. . . .	. . . .	. . . .
Final	SP	Raw
Final	MR	Raw, terminate
final	CP	AC, terminate

P.2 Enhancement of Selective Arithmetic Coding Bypass (Fast Mode)

NOTE - Fast mode of JPEG 2000 takes advantage of the following points to speed up the coding time and maintain the compression efficiency.

1. The reduction of number of bit planes to be coded by SP pass and MR pass with arithmetic coder can contribute to the reduction of coding time

2. The compression ratio of JPEG 2000 lossless is around 1 to 2, according to many experimental results. The compression efficiency after the 2nd or 3rd bit plane from MSB is not good in many cases, because SP and MR passes are not able to contribute to the improvement of compression efficiency.

As shown in Table P-1, selective arithmetic coding bypass allows bypassing the arithmetic coder for SP pass and MR pass starting in the 5th significant bit-plane of the code-block. It leads to a speed-up in coding and decoding times in some implementations, because of the reduction in symbols that must be arithmetically coded.

Fast mode of JPEG 2000 allows the flexible selection of the coding passes in which the arithmetic coding is to be bypassed. Selection is performed via the least significant two bits of the SXcod parameter within the applicable COD marker segment. If the value of these two bits is 3, arithmetic coding is terminated after the third and subsequent CP passes, while arithmetic coding is bypassed during the third and subsequent SP and MR coding passes, in exactly the same way that the regular selective arithmetic coding bypass mode is applied to the fourth and subsequent SP and MR coding passes. Similarly, if the value of the least significant 2 bits of SXcod is 2, arithmetic coding is bypassed during the second and subsequent SP and MR passes, while if the value of the least significant 2 bits of SXcod is 1, arithmetic coding is bypassed during all SP and MR passes. If the least significant 2 bits of SXcod are both 0, the regular selective arithmetic bypass mode is not modified.

Regardless of the value of SXcod, if bit 0 of the applicable Scod or Scoc marker segment is 0, the selective arithmetic coding bypass mode is not employed.

Informative: Table P-2 is an example in which the least significant 2 bits of SXcod have the value 2. In this case, the most significant two bit planes are coded regularly and other bit planes are bypassed.

Table P-2 – Example of two bit planes (Fast mode)

Bit-plane number	Pass type	Coding Operations
1	CP	Arithmetic coding(AC)
2	SP	AC
2	MR	AC
2	CP	AC, terminate
3	SP	Raw

3	MR	Raw, terminate
3	CP	AC, terminate
. . . .	. . . .	. . . .
Final	SP	Raw
Final	MR	Raw, terminate
final	CP	AC, terminate