INTERNATIONAL STANDARD

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Information technology — Digital compression and coding of continuous-tone still images: Application to printing systems

Technologies de l'information — Compression numérique et codage des images fixes à modèle continu: Application aux systèmes d'impression

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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ISO/IEC 10918-6 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.872 (06/2012).

ISO/IEC 10918 consists of the following parts, under the general title *Information technology -- Digital compression and coding of continuous-tone still images*:

— *Part 1: Requirements and guidelines*

— *Part 2: Compliance testing*

— *Part 3: Extensions*

— *Part 4: Registration of JPEG profiles, SPIFF profiles, SPIFF tags, SPIFF colour spaces, APPn markers, SPIFF compression types and Registration Authorities (REGAUT)*

— *Part 5: JPEG File Interchange Format (JFIF)*

— *Part 6: Application to printing systems*

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Introduction

This Recommendation | International Standard specifies a subset of features and application tools for the interchange of images encoded according to the JPEG image coding standard (Rec. ITU-T T.81 | ISO/IEC 10918-1) for printing.

INTERNATIONAL STANDARD

RECOMMENDATION ITU-T

Information technology – Digital compression and coding of continuous-tone still images: Application to printing systems

1 Scope

This Recommendation | International Standard specifies a subset of features and application tools for printing applications that encode or decode images based on JPEG (Recommendation ITU-T T.81 | ISO/IEC 10918-1) encoding. Its creation was proposed by members of the digital printing industry to ensure that applications developed for printing systems can exchange JPEG images.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

– Recommendation ITU-T T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines*.

– Recommendation ITU-T T.871 (2011) | ISO/IEC 10918-5:2011, *Information technology – Digital compression and coding of continuous-tone still images – JPEG File Interchange Format (JFIF)*.

– Recommendation ITU-R BT.601-6 (2007), *Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios*.

– ISO 15076-1:2010, *Image technology colour management – Architecture, profile format and data structure – Part 1: Based on ICC.1:2004-10*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 CMYK: 32-bit four-colour channel encoding in which the first channel consists of an eight-bit value for Cyan, the second channel consists of an eight-bit value for Magenta, the third channel consists of an eight-bit value for Yellow, and the fourth channel consists of an eight-bit value for Key (black); in the absence of appropriate metadata, the interpretation of these values is device dependent.

3.2 complement: Subtract from 255.

3.3 grayscale: Eight-bit single channel encoding in which the value is monochromatic, e.g., describes the intensity of light varying from white to black or from black to white.

3.4 ICC Profile: Set of data that characterizes the input or output values of a colour device, e.g., as specified in ISO 15076-1.

3.5 JPEG File Interchange Format (JFIF): The interchange format specified in Rec. ITU-T T.871 | ISO/IEC 10918-5 having 1 or 3 colour channels and 8 bits per colour channel.

3.6 RGB: 24-bit three-colour channel encoding in which the first channel consists of an eight-bit value for Red, the second channel consists of an eight-bit value for Green, and the third channel consists of an eight-bit value for Blue; in the absence of appropriate metadata, the interpretation of these values is device dependent.

4   Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

Ap$_i$	Byte i of application data (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
APP$_2$	Application data marker, type 2 (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
APP$_{14}$	Application data marker, type 14 (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
CMYK	Cyan, Magenta, Yellow, and Key (black) colour component values
DNL	Define Number of Lines (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
EOI	End of Image (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
ICC	International Color Consortium
JFIF	JPEG File Interchange Format (specified in Rec. ITU-T T.871 | ISO/IEC 10918-5)
JPEG	Joint Photographic Experts Group (also used to refer to the image coding specification Rec. ITU-T T.81 | ISO/IEC 10918-1)
Lf	Length of frame header (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
Lp	Length of application data segment (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
Nf	Number of components in frame (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
RGB	Red, Green, and Blue colour component values
SOF	Start of Frame (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
SOI	Start of Image (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1)
YC_BC_R	Luminance (denoted as *Y*), Chrominance toward Blue, and Chrominance toward Red colour component values
YCCK	Luminance (denoted as *Y*), Chrominance toward Blue, Chrominance toward Red, and Key (black) colour component values.

5   Conformance

Some requirements in this Recommendation | International Standard are expressed as format or syntax requirements rather than as software or hardware implementation requirements. Implementations fall into two categories: JPEG print-application supporting decoders and JPEG print-application supporting encoders.

In order for a JPEG print-application supporting decoder to be considered conforming, the decoder shall not report errors when processing conforming instances of the specified format, except when forced to do so by resource exhaustion.

> NOTE – The decoder should report errors when processing non-conforming deviations from the specified format.

In order for a JPEG print-application supporting encoder to be considered conforming, the files produced by the encoder shall be formatted as specified.

6   JPEG print-application support overview

6.1   Colour encodings and associated values to define white and black

Images encoded with one or three or four components in the start of frame (SOF) marker segment as specified in 6.4 shall be supported. In the absence of other information or metadata, such as a file format, container, or other printing system mechanism that specifies the interpretation of the colour or grayscale values of the image, then the interpretation of such colour or grayscale values is as follows:

–   Images encoded with only one component are assumed to be grayscale data in which 0 is black and 255 is white.

–   Images encoded with three components are assumed to be *RGB* data encoded as YC_bC_r unless the image contains an APP$_{14}$ marker segment as specified in 6.5.3, in which case the colour encoding is considered either *RGB* or YC_bC_r according to the application data of the APP$_{14}$ marker segment. The relationship between *RGB* and YC_bC_r is defined as specified in Rec. ITU-T T.871 | ISO/IEC 10918-5.

– Images encoded with four components are assumed to be *CMYK*, with (0,0,0,0) indicating white unless the image contains an APP₁₄ marker segment as specified in 6.5.3, in which case the colour encoding is considered either *CMYK* or *YCCK* according to the application data of the APP₁₄ marker segment. The relationship between *CMYK* and *YCCK* is defined as specified in clause 7.

6.2   Characterization of colour or grayscale values

An APP₂ marker segment encoded as specified in 6.5.2, if present in the image, shall contain an ICC profile that can be used to characterize the colour or grayscale values of the image. If no such marker is present, then information that can be used to characterize the colours or grayscales is assumed to be known to the decoder by some other means.

6.3   Order of components for images encoded with three or four components

The ordering of components for images encoded with three components using YC_bC_r colour encoding is such that the first component in the image is the *Y* channel, the second component is the C_b channel, and the third component is the C_r channel.

The ordering of components for images encoded with three components using *RGB* colour encoding is such that the first component in the image is the red channel, the second component is the green channel, and the third component is the blue channel.

The ordering of components for images encoded with four components using *CMYK* colour encoding is such that the first component in the image is the cyan channel, the second component is the magenta channel, the third component is the yellow channel, and the fourth component is the black channel.

The ordering of components for images encoded with four components using *YCCK* colour encoding is such that the first component in the image is the *Y* channel, the second component is a first *C* channel with chrominance toward blue, the third component is a second *C* channel with chrominance toward red, and the fourth component is the *K* (i.e., black) channel.

6.4   Start of Frame (SOF) markers

The following SOF markers shall be supported:

X'FFC0' – Baseline DCT.

X'FFC1' – Huffman Extended Sequential DCT.

X'FFC2' – Huffman Progressive DCT.

No other SOF markers shall be present.

For the Huffman Progressive DCT data, both full progression and spectral selection as defined in Annex G of Rec. ITU-T T.81 | ISO/IEC 10918-1 shall be supported by conforming decoders.

NOTE 1 – A single image can be encoded using full progression which is spectral selection within successive approximation or the allowed subset of spectral selection alone.

The following SOF marker fields have values that are restricted as described below:

Sample precision: Shall be 8.

Number of lines: Shall be a positive number. The DNL marker shall not be present.

NOTE 2 – Rec. ITU-T T.81 | ISO/IEC 10918-1 allows a value of zero to be specified for the number of lines to indicate that a subsequent DNL marker is intended to provide the number of lines for the image.

Number of components in frame: Shall be 1, 3 or 4.

6.5   Application markers and marker segments

6.5.1   Application markers interpreted by conforming decoders

The following application markers and marker segments shall be interpreted by conforming decoder implementations

X'FFE2' – APP₂ marker to identify ICC profiles as specified in 6.5.2.

X'FFEE' – APP₁₄ marker to identify colour encoding as specified in 6.5.3.