ISO/IEC JTC 1/SC 29/WG 1
(ITU-T SG16)

Coding of Still Pictures

JBIG
Joint Bi-level Image Experts Group

JPEG
Joint Photographic Experts Group


SOURCE: WG 1

PROJECT: ISO/IEC 15444-16

STATUS: Working Draft

REQUESTED ACTION: For distribution

DISTRIBUTION: WG 1

Contact:
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ISO/IEC JTC 1/SC29/WG1 m101062
101th Meeting – Online

International Telecommunication Union

ITU-T T.815
TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

(06/2021)

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


Recommendation ITU-T T.815
### ITU-T T-SERIES RECOMMENDATIONS

#### TERMINALS FOR TELEMATIC SERVICES

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For further details, please refer to the list of ITU-T Recommendations.
Summary

ISO/IEC 23008-12 specifies a framework for the interchange of images and image sequences using tools defined in the ISO base media file format (ISO/IEC 14496-12), which is in wide use worldwide. This framework is defined independently of the formats of the images and image sequences, allowing a wide range of such formats to be used in combination with ISO/IEC 23008-12.

To simplify the use of the JPEG 2000 family of image formats (Rec. ITU-T T.8xx series | ISO/IEC 15444) in applications that use the ISO base media file format, Rec. ITU-T T.815 | ISO/IEC 15444-16 specifies the encapsulation of these image formats in the framework defined in ISO/IEC 23008-12 and related applications such as ISO/IEC 23000-22.


This second edition cancels and replaces the first edition, which has been technically revised.

The main changes compared to the previous edition are as follows:

- the encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences is deprecated, and replaced by the encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 image sequences;
- adds support for quality and resolution layers;
- the syntax and semantics of the JPEG 2000 header item property are clarified; and reader conformance requirements are removed.

History

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Keywords


* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.
FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents/software copyrights, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the appropriate ITU-T databases available via the ITU-T website at http://www.itu.int/ITU-T/ipr/.

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1 Scope

This Recommendation | International Standard specifies the encapsulation of image formats specified in the JPEG 2000 family of Recommendations | International Standards in the framework defined in ISO/IEC 23008-12.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. At the time of publication, the editions indicated in dated references 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 Recommendations.

2.1 Identical Recommendations | International Standards


2.2 Paired Recommendations | International Standards equivalent in technical content

None.

2.3 Additional references


3 Definitions

3.1 Terms defined elsewhere

This Recommendation | International Standard uses the following terms defined elsewhere:

For the purposes of this Recommendation | International Standard, the definitions given in ISO/IEC 23008-12 apply. ITU, ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– ITU terminology database: https://www.itu.int/go/terms
– ISO Online browsing platform: https://www.iso.org/obp
– IEC Electropedia: http://www.electropedia.org/

3.2 Terms defined in this Recommendation | International Standard

This Recommendation | International Standard defines the following terms:

None.
4 Abbreviations

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

JPEG Joint Photographic Experts Group

5 Conventions

None.

6 Encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 images and image collections

6.1 General

This clause specifies the encapsulation of individual JPEG 2000 codestreams, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1, as individual images or as image collections as specified in ISO/IEC 23008-12.

6.2 JPEG 2000 coded image item

A JPEG 2000 coded image item is a coded image item, as defined in ISO/IEC 23008-12, with type 'j2k1' that conforms to the provisions of this subclause.

The body of the coded image item shall be exactly one Contiguous Codestream box as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.


The coded image item shall be associated with exactly one JPEG 2000 header item property specified in 6.3, and the essential field of the item property shall be equal to 1.

The coded image item shall be associated with exactly one 'colr' item property, and the essential field of that item property shall be equal to 1.

If a 'pixi' item property is associated with the coded image item, its information shall be consistent with the Ssiz fields of the SIZ marker of the JPEG 2000 codestream within the Contiguous Codestream box.

If a 'lsel' item property is associated with the coded image item, then:

- the layers field of the JPEG 2000 header item property shall be present and contain an entry with a layer_id field equal to that of the 'lsel' item property; and
- the decoded image shall be the result of decoding the layer identified by the layer_id field of the 'lsel' item property.

The image_width and image_height fields of the 'ispe' item property shall be equal to width and height of the decoded image.

NOTE 2 – Item properties other than those referenced above can be associated with the coded image item.
6.3 JPEG 2000 header item property

6.3.1 Syntax

```java
class J2KHeaderItemProperty extends ItemProperty('j2kH') {
    J2KChannelDefinition channels[1];
    J2KComponentMapping components[0..1];
    J2KPalette palette[0..1];
    J2KLayers layers[0..1];
    J2KColour colour[0..*];
    J2KPixelFormat pixel_format[0..1];
}
```

NOTE – Boxes other than those listed above can be present.

6.3.2 channels field

The channels field is a Channel Definition box, as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1.

The channels field shall be present.

Each Typ^i value shall be equal to 0, 1, or 2.

If Typ^i is equal to 0, then Asoc^i shall be in the range \([1, 2^{16} \, 2]\).

At most one Typ^i value shall be equal to 1 or 2, and the corresponding Asoc^i field shall be equal to 0.

NOTE – At most one alpha channel is allowed.

6.3.3 components field

The components field is a Component Mapping box, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.

If the components field is absent, the components of the codestream shall be mapped directly to channels, such that component \(i\) is mapped to channel \(i\).

The CMP^i values shall be equal to 0 or 1.

If one or more CMP^i value is equal to 1, then the palette field, as specified in 6.3.4, shall be present.

If the palette field is absent, then the components field shall be absent.

6.3.4 palette field

The palette field is a Palette box, as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1.

Each entry of the palette field shall be referenced by one or more PCOL^i fields of the components field specified in 6.3.3.

6.3.5 layers field

The layers field is a JPEG 2000 layers box as specified at 6.4.

6.3.6 colour field

The colour field consists of zero or more Colour Specification boxes, as defined in Rec. ITU-T T.801 | ISO/IEC 15444-2.

All Colour Specification boxes shall correspond to equivalent colour specifications. The number of Colour Specification boxes with a METH values of 1, 2 and 5 shall each be zero or one.

EXAMPLE – Multiple ICC profiles (of the unrestricted variety) can be used to specify a particular colourespace with varying degrees of complexity (1D LUT's vs 3D LUT's).
6.3.7 pixel_format field

The pixel_format field is a Pixel Format box, as defined in Rec. ITU-T T.801 | ISO/IEC 15444-2.6.4 JPEG 2000 layers box

6.4.1 General

The JPEG 2000 layers box declares a list of quality and resolution layers of a JPEG 2000 codestream.

NOTE – The JPEG 2000 codestream can contain layers not listed in the JPEG 2000 layers box.

6.4.2 Syntax

```java
class J2KLayers extends FullBox('j2kL') {
    unsigned int (16) num_layers;
    for (i=0; i < num_layers; i++) {
        unsigned int(16) layer_id;
        unsigned int(8) discard_levels;
        unsigned int(16) decode_layers;
    }
}
```

6.4.3 num_layers field

The num_layers field is the number of declared layers.

6.4.4 layer_id field

The layer_id field identifies the layer.

No two values of the layer_id field in an instance of the box shall be identical.

NOTE – The value layer_id field can be referenced from the 'lsel' item property.

6.4.5 discard_levels field

The discard_levels field specifies the number of resolution levels of the JPEG 2000 codestream that can be discarded.

6.4.6 decode_layers field

The decode_layers field specifies the minimum number of quality layers of the JPEG 2000 codestream to be decoded.

6.5 File conformance

A file that includes 'j2ki' as a compatible brand:

- shall conform to the 'mif1' brand as specified in ISO/IEC 23008-12.
- shall contain one or more JPEG 2000 coded image item specified in 6.2.

NOTE – This Recommendation | International Standard does not specify reader conformance for the 'j2ki' brand.

6.6 Media type

The image/hej2k media type, as defined in 6.7, refers to content that consists of a single file that conforms to the 'j2ki' brand specified in 6.5.
6.7 Media type registration

6.7.1 General

Many Internet protocols are designed to carry arbitrary labelled content. The mechanism used to label such content is a media type, which is defined in IETF RFC 6838 and consists of a top-level type, a subtype, and in some instances, optional parameters.

The media type specification of the following clause has a matching registration in the IANA central registry, as specified in IETF RFC 6838.
6.7.2 Registration

Type name: image
Subtype name: hej2k
Required parameters: None
Optional parameters: Same as for the media type image/heif. The presence of an image item of type 'j2ki' is signalled by including, in the itemtypes parameter, an item description whose item type string starts with 'j2ki'.
Encoding considerations: binary
Notes: None
Security considerations: See media type image/heif. In addition, image items of type 'j2ki' contain structures of variable length and have an extensible syntax. Both aspects present potential security risks for implementations. In particular, variable length structures present buffer overflow risks and extensible syntax could result in the triggering of adverse actions.
Interoperability considerations: Same as for the media type image/heif. In addition, image items of type 'j2ki' can conform to one of several profiles and/or require one of several capabilities, e.g. as specified in Rec. ITU-T.800 | ISO/IEC 15444-1, not all of which are necessarily supported by a receiving decoder. As a result, decoders might attempt to process the contents only to determine that they cannot be rendered either partially or in full.
Published specification: Rec. ITU-T.815 | ISO/IEC 15444-16
Applications: Multimedia and scientific
Fragment identifier considerations: None
Restrictions on usage: None
Additional information:
Deprecated alias names for this type: N/A
Magic number(s): None
File extension(s): hej2
Macintosh File Type Code(s): N/A
Object Identifiers: N/A
Intended usage: COMMON
Notes: None
Contact name: ISO/IEC JTC 1/SC 29/WG 1 Convenor
Contact email address: sc29-sec@itscj.ipsj.or.jp
Author/Change controller: ITU-T & ISO/IEC JTC 1

7 Encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 sequences

7.1 General
This clause specifies the encapsulation of a sequence of JPEG 2000 codestreams, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1, as an image sequence, as defined in ISO/IEC 23008-12.

7.2 JPEG 2000 image sequence
A JPEG 2000 image sequence is an image sequence, as defined in ISO/IEC 23008-12, that conforms to the following:
- each visual sample entry shall be a JPEG 2000 visual sample entry, as specified in 7.3;
- each sample shall consist of one Contiguous Codestream box as specified in Rec. ITU-T.800 | ISO/IEC 15444-1; and
- each sample shall be a sync sample.

7.3 JPEG 2000 visual sample entry

7.3.1 Syntax

class J2KSampleEntry extends VisualSampleEntry('j2ki') {
    J2KHeaderInfo j2kheader[1];
    J2KCodestreamPrefix j2kprefix[0..1];
}

7.3.2 Semantics

The width and height fields shall be equal to the width and height of the image resulting from decoding the JPEG 2000 codestreams associated with the sample entry.

The displayable data of the compressorname field should be equal to the string of "JPEG 2000".

The j2kheader field shall apply to all the JPEG 2000 codestreams associated with the sample entry.

NOTE – The j2kprefix field can be used to store repetitive data stored at the beginning of all JPEG 2000 codestreams to which the sample entry applies.

7.4 JPEG 2000 prefix

7.4.1 Syntax

class J2KCodestreamPrefix() extends Box('j2kP') {
    int(8)[] data;
}

7.4.2 Semantics

The data field contains a sequence of bytes to be prepended to the contents of a Contiguous Codestream box before presentation to the decoder.

7.5 JPEG 2000 header info

7.5.1 Syntax

class J2KHeaderInfo extends Box('j2kH') {
    // same as J2KHeaderItemProperty
}

7.5.2 Semantics

The contents and semantics of this box are identical to those of the JPEG 2000 header item property in 6.3.

7.6 File conformance

This subclause specifies requirements for a file that conforms to the 'j2is' brand.

The file shall conform to the 'msf1' brand as specified in ISO/IEC 23008-12.

The file shall include 'j2is' as a compatible brand.

The file shall contain one or more JPEG 2000 image sequences as specified in 7.2.

NOTE – This Recommendation | International Standard does not specify reader conformance for the 'j2is' brand.
7.7 Media type

The image/j2is media type, as defined in 7.8, refers to content that consists of a single file that conforms to the 'j2is' brand as specified in 7.6.

7.8 Media type registration

7.8.1 General

Many Internet protocols are designed to carry arbitrary labelled content. The mechanism used to label such content is a media type, which is defined in IETF RFC 6838 and consists of a top-level type, a subtype, and in some instances, optional parameters.

The media type specification of the following clause has a matching registration in the IANA central registry, as specified in IETF RFC 6838.

7.8.2 Registration

<table>
<thead>
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<th>Type name: image</th>
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<tr>
<td>Subtype name: j2is</td>
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<tr>
<td>Required parameters: None</td>
</tr>
<tr>
<td>Optional parameters: Same as for the media type image/heif. The presence of a sample entry of type 'j2ki' is signalled by including a value whose first element is 'j2ki' in the codecs parameter.</td>
</tr>
<tr>
<td>Encoding considerations: binary</td>
</tr>
<tr>
<td>Notes: None</td>
</tr>
<tr>
<td>Security considerations: See media type image/heif. In addition, JPEG 2000 image sequences contain structures of variable length and have an extensible syntax. Both aspects present potential security risks for implementations. In particular, variable length structures present buffer overflow risks and extensible syntax could result in the triggering of adverse actions.</td>
</tr>
<tr>
<td>Interoperability considerations: Same as for the media type image/heif. In addition, JPEG 2000 codestreams can conform to one of several profiles and/or require one of several capabilities, e.g. as specified in Rec. ITU-T T.800</td>
</tr>
<tr>
<td>Published specification: Rec. ITU-T T.815</td>
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<tr>
<td>Applications: Multimedia and scientific</td>
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<tr>
<td>Fragment identifier considerations: None</td>
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<td>Restrictions on usage: None</td>
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<td>Additional information:</td>
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<td>Deprecated alias names for this type: N/A</td>
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<td>Magic number(s): None</td>
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<td>File extension(s): j2is</td>
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<td>Macintosh File Type Code(s): N/A</td>
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<td>Intended usage: COMMON</td>
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<td>Notes: None</td>
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<td>Contact name: ISO/IEC JTC 1/SC 29/WG 1 Convenor</td>
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<tr>
<td>Author/Change controller: ITU-T &amp; ISO/IEC JTC 1</td>
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</table>
8 Encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences (informative)

The encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences, and corresponding media type image/hsj2, which are specified in the previous edition of this Recommendation | International Standard, are deprecated and not recommended for new applications. They are replaced by the encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 image sequences specified in clause 7.
Bibliography

- IETF RFC 6838 (BCP 13), Media Type Specifications and Registration Procedures.
SERIES OF ITU-T RECOMMENDATIONS

Series A  Organization of the work of ITU-T
Series D  Tariff and accounting principles and international telecommunication/ICT economic and policy issues
Series E  Overall network operation, telephone service, service operation and human factors
Series F  Non-telephone telecommunication services
Series G  Transmission systems and media, digital systems and networks
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Series R  Telegraph transmission
Series S  Telegraph services terminal equipment

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