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Exif 2.31 metadata for XMP

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Introduction

The "Exchangeable image file format for digital still cameras" (Exif) defined a useful set of tag based metadata in binary form. This metadata set has been widely used as "Exif metadata" especially to store and transfer metadata of picture-taking conditions in various digital still-image files that are converted from Exif files.

Adobe Systems Incorporated first introduced the Extensible Metadata Platform (XMP) in 2001 for the definition, creation, and processing of metadata that can be embedded to various formats of files. XMP is used for workflows which prefer metadata in XML form and the "Exif metadata" has been an important part of XMP.

Since 2010, ISO had started projects to standardize XMP. The first one is ISO16684-1 in TC130 which is based on the Adobe Systems XMP Specification Part 1, version of July 2010 which provides a thorough understanding of the XMP data model. In 2011, TC42 started an XMP related project for an area of digital photography application, ISO12234-3, jointly with TC130. The project has direct relationship to the "Exif metadata".

To meet such trends on the "Exif metadata", Camera and Imaging Products Association (CIPA) decided to develop a CIPA standard to define Exif metadata for XMP. The primary purpose is to keep the integrity of "Exif metadata" whose entire contents of the metadata are always identical to the most up-to-the-date Exif file format standard.

Revision History

Ver.	Date	Comments
2.3	January, 2012	Published First Edition 2.3
2.31	August, 2017	Published Revision 2.31 Added newly defined metadata in Exif 2.31. Corrected misprint.

1 Scope

This standard defines a set of metadata-mapping definitions between the tag based ones defined in the Exif standard and the XML properties used in XMP for still-image files, but does not specify the full definition of each metadata item, methods of embedding the metadata set into image files or reconciliation policy when an image file can have different forms of metadata.

This standard is applicable to devices and application software that create image data files with Exif metadata in XMP.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO 12232, *Photography — Digital still cameras — Determination of exposure index, ISO speed ratings, standard output sensitivity, and recommended exposure index*

ISO 12233, *Photography — Electronic still-picture cameras — Resolution measurements*

ISO 14524, *Photography — Electronic still-picture cameras — Methods for measuring opto-electronic conversion functions (OECFs)*

ISO 16684-1, *Extensible metadata platform (XMP) specification — Part 1: Data model, serialization, and core properties*

ISO/IEC 10464-1, *Information technology — Universal multiple-octet coded character set (UCS) — Part 1: Architecture and basic multilingual plane*

W3C Recommendation, *Namespaces in XML 1.0 (Third Edition)*, December 8, 2010

<http://www.w3.org/TR/REC-xml-names/>

IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*, January 2005

<http://www.ietf.org/rfc/rfc3986.txt>

Dublin Core Metadata Element Set, Version 1.1

<http://dublincore.org/documents/dces/>

CIPA DC-008-2016, *Exchangeable image file format for digital still cameras - Exif 2.31*

http://www.cipa.jp/english/hyoujunka/kikaku/cipa_e_kikaku_list.html

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

compressed data

data referred to in the JPEG standard as "entropy coded data"

3.2

DCF

an abbreviation of "Design rule for camera file system"

3.3

DSC

an abbreviation of "Digital still camera"

3.4

Exif

an abbreviation of "Exchangeable image file format for digital still cameras"

3.5

property

named container for a metadata value at the top level of an XMP packet

3.6

tag

a field of ancillary data about an image which corresponds to "field" in TIFF

3.7

thumbnail

a small image used to index a primary image

3.8

URI

Uniform Resource Identifier as defined in IETF RFC 3986

4 General

Mappings between the tag based Exif metadata and the corresponding XML properties in XMP are defined in the following clauses and the metadata items are described in the properties tables. They appear in the tables in the identical orders as in the Exif specifications of CIPA.

Full definition of each metadata item is not given in the mapping tables. Description of each metadata item in this specification is for the reader's convenience. Refer to the corresponding normative references for the full definition. Yellow cells in the mapping tables denote additions or changes made in Exif 2.21 or later and blue cells indicate they are not used in XMP relevant to Exif 2.3.

For numeric Exif tags, other than 34855 PhotographicSensitivity, the count from the Exif specification defines the XMP value form. If the Exif count is 1, the XMP property shall be a simple value. If the Exif count is greater than 1 or ANY, the XMP property shall be an ordered array. When the Exif count is greater than 1 and not ANY, the XMP array shall have exactly the number of entries given by the Exif count.

NOTE Tag 34855 PhotographicSensitivity is a special case. The Exif count is ANY for historical reasons, Exif 2.3 recommends only writing 1 value. The XMP form of **exifEX:PhotographicSensitivity** is a simple value, mapped to the first tag value. The XMP form of the deprecated **exif:ISOSpeedRatings** property is an ordered array.

5 Exif metadata namespaces

5.1 Namespace and prefix

Namespaces in Table 1 are used in the scope of Exif metadata. When using those XML namespaces the URIs shall be as in Table 1 and the preferred namespace prefixes should be as in Table 1.

Table 1 — Namespaces used in Exif metadata

Name	URI	Recommended prefix
Exif 2.21 or later	http://cipa.jp/exif/1.0/	exifEX
Exif 2.2 or earlier	http://ns.adobe.com/exif/1.0/	exif
TIFF Rev. 6.0	http://ns.adobe.com/tiff/1.0/	tiff
Dublin Core	http://purl.org/dc/elements/1.1/	dc
XMP	http://ns.adobe.com/xap/1.0/	xmp

NOTE For convenience in this document, XMP names are commonly written in a **prefix:local** style, for example, **dc:title**. The relevant URI for the prefix used in this document is either explicit or clear from local context.

6 Mapping for TIFF metadata

6.1 Overview

The following clauses define the properties for TIFF-derived data. Only those TIFF properties that are mentioned in the Exif 2.3 specification are included here.

6.2 Namespace and prefix

Namespaces in Table 2 are used in the scope of TIFF-derived metadata. When using those XML namespaces the URIs shall be as in Table 2 and the preferred namespace prefixes should be as in Table 2.

Table 2 — Namespaces used in TIFF namespace

Name	URI	Recommended prefix
TIFF Rev. 6.0	http://ns.adobe.com/tiff/1.0/	tiff
Dublin Core	http://purl.org/dc/elements/1.1/	dc
XMP	http://ns.adobe.com/xap/1.0/	xmp

6.3 Properties for image data structure

Table 3 lists the properties for TIFF-derived image data structure metadata. Only those TIFF properties that are mentioned in the Exif 2.3 specification are included here. Mapping between the tag based metadata and the XMP properties shall follow the list in Table 3.

Table 3 — TIFF properties for image data structure

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ImageWidth	256	100	Image width in pixels.	tiff:ImageWidth	Integer
ImageLength	257	101	Image height in pixels.	tiff:ImageLength	Integer
BitsPerSample	258	102	Number of bits per component in each channel.	tiff:BitsPerSample	Ordered array of Integer
Compression	259	103	Compression scheme: 1 = Uncompressed 6 = JPEG.	tiff:Compression	Closed choice of Integer
PhotometricInterpretation	262	106	Pixel Composition: 2 = RGB 6 = YCbCr.	tiff:PhotometricInterpretation	Closed choice of Integer
Orientation	274	112	Orientation: 1 = 0th row at top, 0th column at left 2 = 0th row at top, 0th column at right 3 = 0th row at bottom, 0th column at right 4 = 0th row at bottom, 0th column at left 5 = 0th row at left, 0th column at top 6 = 0th row at right, 0th column at top 7 = 0th row at right, 0th column at bottom 8 = 0th row at left, 0th column at bottom	tiff:Orientation	Closed choice of Integer
SamplesPerPixel	277	115	Number of components per pixel.	tiff:SamplesPerPixel	Integer
PlanarConfiguration	284	11C	Data layout 1 = chunky 2 = planar	tiff:PlanarConfiguration	Closed choice of Integer
YCbCrSubSampling	530	212	Sampling ratio of chrominance components: [2, 1] = YCbCr4:2:2 [2, 2] = YCbCr4:2:0	tiff:YCbCrSubSampling	Closed choice of ordered array of Integer
YCbCrPositioning	531	213	Position of chrominance vs. Luminance components: 1 = centered 2 = co-sited	tiff:YCbCrPositioning	Closed choice of Integer

XResolution	282	11A	Horizontal resolution in pixels per ResolutionUnit.	tiff:XResolution	Rational
YResolution	283	11B	Vertical resolution in pixels per ResolutionUnit.	tiff:YResolution	Rational
ResolutionUnit	296	128	Unit used for XResolution and YResolution. Value is one of: 2 = inches 3 = centimeters	tiff:ResolutionUnit	Closed choice of Integer

6.4 Properties for recording offset

No mapping is given to each of the Exif metadata that relates to configuration of Exif image files since they are Exif file format specific. The field names of such Exif metadata are:

StripOffsets
RowsPerStrip
StripByteCounts
JPEGInterchangeFormat
JPEGInterchangeFormatLength

6.5 Properties for image data characteristics

Table 4 lists the properties for TIFF-derived image data characteristics metadata. Only those TIFF properties that are mentioned in the Exif 2.3 specification are included here. Mapping between the tag based metadata and the XML properties shall follow the list in Table 4.

Table 4 — TIFF properties for image data characteristics

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
TransferFunction	301	12D	Transfer function for image described in tabular style with 3 * 256 entries.	tiff:TransferFunction	Ordered array of Integer
WhitePoint	318	13E	Chromaticity of white point.	tiff:WhitePoint	Ordered array of Rational
PrimaryChromaticities	319	13F	Chromaticity of the three primary colours.	tiff:PrimaryChromaticities	Ordered array of Rational
YCbCrCoefficients	529	211	Matrix coefficients for RGB to YCbCr transformation.	tiff:YCbCrCoefficients	Ordered array of Rational
ReferenceBlackWhite	532	214	Reference black and white point values.	tiff:ReferenceBlackWhite	Ordered array of Rational

6.6 Other properties

Table 5 lists the properties for TIFF-derived other metadata. Only those TIFF properties that are mentioned in the Exif 2.3 specification are included here. Mapping between the tag based metadata and the XML properties shall follow the list in Table 5.

Table 5 — Other TIFF properties

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
DateTime	306	132	Date and time when the file was last modified (no time zone in Exif), stored in ISO 8601 format, not in the original Exif format. This property includes the value for the Exif SubSecTime (37520, 0x9290) attribute.	xmp:ModifyDate	Date
ImageDescription	270	10E	The title of the image as an ASCII string.	dc:description	Language Alternative
Make	271	10F	Manufacturer of recording equipment as an ASCII string.	tiff:Make	Proper-Name
Model	272	110	Model name or number of the equipment as an ASCII string.	tiff:Model	Text
Software	305	131	Software or firmware used to generate image as an ASCII string	xmp:CreatorTool	Agent-Name
Artist	315	13B	Camera owner, photographer or image creator as an ASCII string	dc:creator	Ordered array of Proper-Name
Copyright	33432	8298	Copyright information as an ASCII string	dc:rights	Language Alternative

7 Mapping for Exif-specific metadata

7.1 Overview

The following clauses define the properties for Exif specific metadata.

7.2 Namespace and prefix

Namespaces in Table 2 are used in the scope of Exif specific metadata. When using those XML namespaces the URIs shall be as in Table 6 and the preferred namespace prefixes should be as in Table 6.

Table 6 — Namespaces used in Exif namespace

Name	URI	Recommended prefix
Exif 2.21 or later	http://cipa.jp/exif/1.0/	exifEX
Exif 2.2 or earlier	http://ns.adobe.com/exif/1.0/	exif
XMP	http://ns.adobe.com/xap/1.0/	xmp

7.3 Properties for version related information

Table 7 lists the properties for Exif version related metadata. Mapping between the tag based metadata and the XML properties shall follow the list in Table 7.

Table 7 — Exif properties for version related metadata

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ExifVersion	36864	9000	Exif version number. Version 2.3 is written as "0230".	exif:ExifVersion	Text
FlashpixVersion	40960	A000	Version of FlashPix. "0100" is the fixed value.	exif:FlashpixVersion	Closed choice of Text

7.4 Properties for image data characteristics

Table 8 lists the properties for image data characteristics. Mapping between the tag based metadata and the XML properties shall follow the list in Table 8.

Table 8 — Exif properties for image data characteristics

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ColorSpace	40961	A001	Colour space information: 1 = sRGB 65535 = uncalibrated	exif:ColorSpace	Closed choice of integer
Gamma	42240	A500	Indicates the value of coefficient gamma.	exifEX:Gamma	Rational

7.5 Properties for image configuration

Table 9 lists the properties for image configuration. Mapping between the tag based metadata and the XML properties shall follow the list in Table 9.

Table 9 — Exif properties for image configuration

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ComponentsConfiguration	37121	9101	Configuration of components in data: 4 5 6 0 (if RGB compressed data), 1 2 3 0 (other cases). 0 = does not exist 1 = Y 2 = Cb 3 = Cr 4 = R 5 = G 6 = B	exif:ComponentsConfiguration	Closed choice of ordered array of Integer
CompressedBitsPerPixel	37122	9102	Compression mode used for a compressed image is indicated in unit bits per pixel.	exif:CompressedBitsPerPixel	Rational
PixelXDimension	40962	A002	Valid image width, in pixels.	exif:PixelXDimension	Integer
PixelYDimension	40963	A003	Valid image height, in pixels.	exif:PixelYDimension	Integer

7.6 Properties for user information

Table 10 lists the property for user information. Mapping between the tag based metadata and the XML property shall follow the list in Table 10..

Table 10 — Exif properties for user information

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
MakerNote	37500	927C	Records any desired information. The contents are up to the manufacture.	Not used ^a	-
UserComment	37510	9286	Comments from user	exif:UserComment	Language Alternative

^a The value type of the 37500 MakerNote tag field is not defined in the Exif specification and its usage is fully vendor unique. Mapping to XMP property is not given to this tag field because no unified valid value type can be defined.

7.7 Properties for file information

Table 11 lists the property for file information. Mapping between the tag based metadata and the XML property shall follow the list in Table 11.

Table 11 — Exif property for file information

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
RelatedSoundFile	40964	A004	An ASCII string of "8.3" characters of file name and file extension for the related sound file.	exif:RelatedSoundFile	Text

7.8 Properties for date and time

Table 12 lists the properties for date and time. Mapping between the tag based metadata and the XML properties shall follow the list in Table 12.

Table 12 — Exif properties for date and time

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
DateTimeOriginal	36867	9003	Date and time when the original data was generated (no time zone in Exif), stored in ISO 8601 format, not in the original Exif format. This property includes the value for the Exif SubSecTimeOriginal (37521, 0x9291) attribute.	exif:DateTimeOriginal	Date
DateTimeDigitized	36868	9004	The date and time when the image was stored as digital data (no time zone in Exif), stored in ISO 8601 format, not in the original Exif format. This property includes the value for the Exif SubSecTimeDigitized (37522, 0x9292) attribute.	xmp:CreateDate	Date
OffsetTime	36880	9010	Offset from UTC of the time of DateTime.	Not used ^a	-
OffsetTimeOriginal	36881	9011	Offset from UTC of the time of DateTimeOriginal.	Not used ^a	-

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
OffsetTimeDigitized	36882	9012	Offset from UTC of the time of DateTimeDigitized.	Not used ^a	-
SubSecTime	37520	9290	Fractions of seconds for the DateTime. Merged to DateTime.	Not used ^a	-
SubSecTimeOriginal	37521	9291	Fractions of seconds for the DateTime-Original. Merged to DateTimeOriginal.	Not used ^a	-
SubSecTimeDigitized	37522	9292	Fractions of seconds for the DateTime-Digitized. Merged to DateTimeDigitized.	Not used ^a	-
^a Mapping to XMP property is not given to this Exif tag field because the value of this tag field is mapped to an XMP property corresponding to a different Exif tag field.					

7.9 Properties for picture-taking conditions & shooting situation

Table 13 lists the properties for picture-taking conditions. Mapping between the tag based metadata and the XML properties shall follow the list in Table 13.

Table 13 — Exif properties for picture-taking conditions & shooting situation

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ExposureTime	33434	829A	Exposure time in seconds.	exif:ExposureTime	Rational
FNumber	33437	829D	F number.	exif:FNumber	Rational
ExposureProgram	34850	8822	Class of program used for exposure: 0 = not defined 1 = Manual 2 = Normal program 3 = Aperture priority 4 = Shutter priority 5 = Creative program 6 = Action program 7 = Portrait mode 8 = Landscape mode	exif:ExposureProgram	Closed Choice of Integer
SpectralSensitivity	34852	8824	Spectral sensitivity of each channel by an ASTM standard.	exif:SpectralSensitivity	Text

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
PhotographicSensitivity (Exif 2.3 or later)	34855	8827	Indicates the sensitivity of the camera or input device when the image was shot up to the value of 65535 with one of the following parameters that are defined in ISO 12232: standard output sensitivity (SOS), recommended exposure index (REI), or ISO speed.	exifEX:PhotographicSensitivity	Integer
ISOSpeedRatings ^a (till Exif 2.21)	34855	8827	<p>ISO Speed and ISO Latitude of the input device as specified in ISO 12232 up to the value of 65535.</p> <p>The field name ISOSpeedRatings was used till Exif 2.21 and changed to PhotographicSensitivity in Exif 2.3.</p> <p>This mapping is included only for backward compatibility purpose.</p> <p>Otherwise exif:ISOSpeedRatings property should not be used.</p>	exif:ISOSpeedRatings ^b	Ordered array of Integer
OECF	34856	8828	Opto-Electronic Conversion Function as specified in ISO 14524.	exif:OECF	OECF/ SFR

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
SensitivityType	34864	8830	Indicates which one of the parameters of ISO12232 is used for PhotographicSensitivity:0 = Unknown 1 = Standard output sensitivity (SOS) 2 = Recommended exposure index (REI) 3 = ISO speed 4 = Standard output sensitivity (SOS) and recommended exposure index (REI) 5 = Standard output sensitivity (SOS) and ISO speed 6 = Recommended exposure index (REI) and ISO speed 7 = Standard output sensitivity (SOS) and recommended exposure index (REI) and ISO speed	exifEX:SensitivityType	Closed choice of Integer
StandardOutputSensitivity	34865	8831	Indicates the standard output sensitivity value of a camera or input device defined in ISO 12232.	exifEX:StandardOutput-Sensitivity	Integer
RecommendedExposureIndex	34866	8832	Indicates the recommended exposure index value of a camera or input device defined in ISO 12232.	exifEX:RecommendedExposureIndex	Integer
ISOSpeed	34867	8833	Indicates the ISO speed value of a camera or input device that is defined in ISO 12232.	exifEX:ISOSpeed	Integer
ISOSpeedLatitudeyyy	34868	8834	Indicates the ISO speed latitude yyy value of a camera or input device that is defined in ISO 12232.	exifEX:ISOSpeedLatitudeyyy	Integer

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ISOSpeedLatitudezzz	34869	8835	Indicates the ISO speed latitude zzz value of a camera or input device that is defined in ISO 12232.	exifEX:ISOSpeedLatitudezzz	Integer
ShutterSpeedValue	37377	9201	Time value, unit is APEX.	exif:ShutterSpeedValue	Rational
ApertureValue	37378	9202	Aperture value, unit is APEX	exif:ApertureValue	Rational
BrightnessValue	37379	9203	Brightness value, unit is APEX.	exif:BrightnessValue	Rational
ExposureBiasValue	37380	9204	Exposure bias in exposure value, unit is APEX.	exif:ExposureBiasValue	Rational
MaxApertureValue	37381	9205	Smallest F number of lens in aperture value, unit is APEX.	exif:MaxApertureValue	Rational
SubjectDistance	37382	9206	Distance to subject, in meters.	exif:SubjectDistance	Rational
MeteringMode	37383	9207	Metering mode: 0 = unknown 1 = Average 2 = Center Weighted Average 3 = Spot 4 = Multi Spot 5 = Pattern 6 = Partial 255 = other	exif:MeteringMode	Closed choice of Integer

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
LightSource	37384	9208	Light source: 0 = unknown 1 = Daylight 2 = Fluorescent 3 = Tungsten 4 = Flash 9 = Fine weather 10 = Cloudy weather 11 = Shade 12 = Daylight fluorescent (D 5700 – 7100K) 13 = Day white fluorescent (N 4600 – 5500K) 14 = Cool white fluorescent (W 3800 – 4500K) 15 = White fluorescent (WW 3250 – 3800K) 16 = Warm white fluorescent (L2600 - 3250K) 17 = Standard light A 18 = Standard light B 19 = Standard light C 20 = D55 21 = D65 22 = D75 23 = D50 24 = ISO studio tungsten 255 = other	exif:LightSource	Closed choice of Integer
Flash	37385	9209	Strobe light (flash) source data.	exif:Flash	Flash
FocalLength	37386	920A	Focal length of the lens, in millimeters	exif:FocalLength	Rational
SubjectArea	37396	9214	The location and area of the main subject in the overall scene.	exif:SubjectArea	Ordered array of Integer
FlashEnergy	41483	A20B	Strobe energy during image capture.	exif:FlashEnergy	Rational
SpatialFrequencyResponse	41484	A20C	Input device spatial frequency table and SFR values as specified in ISO 12233.	exif:SpatialFrequencyResponse	OECF/ SFR
FocalPlaneXResolution	41486	A20E	Horizontal focal resolution, measured pixels per FocalPlaneResolution Unit.	exif:FocalPlaneXResolution	Rational

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
FocalPlaneYResolution	41487	A20F	Vertical focal resolution, measured pixels per FocalPlaneResolution Unit.	exif:FocalPlaneYResolution	Rational
FocalPlaneResolutionUnit	41488	A210	Unit used for FocalPlaneXResolution and FocalPlaneYResolution: 2 = inches 3 = centimeters	exif:FocalPlaneResolutionUnit	Closed choice of Integer
SubjectLocation	41492	A214	Indicates the location of the main subject in the scene.	exif:SubjectLocation	ordered array of Integer
ExposureIndex	41493	A215	Exposure index of input device.	exif:ExposureIndex	Rational
SensingMethod	41495	A217	Image sensor type on input device: 1 = Not defined 2 = One-chip colour area sensor 3 = Two-chip colour area sensor 4 = Three-chip colour area sensor 5 = Colour sequential area sensor 7 = Trilinear sensor 8 = Colour sequential linear sensor	exif:SensingMethod	Closed choice of Integer
FileSource	41728	A300	Indicates image source: 0 = others 1 = scanner of transparent type 2 = scanner of reflex type 3 = DSC	exif:FileSource	Closed choice of Integer
SceneType	41729	A301	Indicates the type of scene: 1 (directly photographed image) is the only choice.	exif:SceneType	Closed choice of Integer
CFAPattern	41730	A302	Colour filter array geometric pattern of the image sensor.	exif:CFAPattern	CFA-Pattern
CustomRendered	41985	A401	Indicates the use of special processing on image data: 0 = Normal process 1 = Custom process	exif:CustomRendered	Closed choice of Integer

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ExposureMode	41986	A402	Indicates the exposure mode set when the image was shot: 0 = Auto exposure 1 = Manual exposure 2 = Auto bracket	exif:ExposureMode	Closed choice of Integer
WhiteBalance	41987	A403	Indicates the white balance mode set when the image was shot: 0 = Auto white balance 1 = Manual white balance	exif:WhiteBalance	Closed choice of Integer
DigitalZoomRatio	41988	A404	Indicates the digital zoom ratio when the image was shot.	exif:DigitalZoomRatio	Rational
FocalLengthIn35mmFilm	41989	A405	Indicates the equivalent focal length assuming a 35mm film camera, in mm. A value of 0 means the focal length is unknown.	exif:FocalLengthIn35mmFilm	Integer
SceneCaptureType	41990	A406	Indicates the type of scene shot: 0 = Standard 1 = Landscape 2 = Portrait 3 = Night scene	exif:SceneCaptureType	Closed choice of Integer
GainControl	41991	A407	Indicates the degree of overall image gain adjustment: 0 = None 1 = Low gain up 2 = High gain up 3 = Low gain down 4 = High gain down	exif:GainControl	Closed choice of Integer
Contrast	41992	A408	Indicates the direction of contrast processing applied by the camera: 0 = Normal 1 = Soft 2 = Hard	exif:Contrast	Closed choice of Integer
Saturation	41993	A409	Indicates the direction of saturation processing applied by the camera: 0 = Normal 1 = Low saturation 2 = High saturation	exif:Saturation	Closed choice of Integer

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
Sharpness	41994	A40A	Indicates the direction of sharpness processing applied by the camera: 0 = Normal 1 = Soft 2 = Hard	exif:Sharpness	Closed choice of Integer
DeviceSettingDescription	41995	A40B	Indicates information on the picture-taking conditions of a particular camera model.	exif:DeviceSettingDescription	Device-Settings
SubjectDistanceRange	41996	A40C	Indicates the distance to the subject: 0 = Unknown 1 = Macro 2 = Close view 3 = Distant view	exif:SubjectDistanceRange	Closed choice of Integer
Temperature	37888	9400	Temperature as the ambient situation at the shot. The unit is °C	exifEX:Temperature	Rational
Humidity	37889	9401	Humidity as the ambient situation at the shot. The unit is %.	exifEX:Humidity	Rational
Pressure	37890	9402	Pressure as the ambient situation at the shot. The unit is hPa.	exifEX:Pressure	Rational
WaterDepth	37891	9403	Water depth as the ambient situation at the shot. The unit is m.	exifEX:WaterDepth	Rational
Acceleration	37892	9404	Acceleration (a scalar regardless of direction) as the ambient situation at the shot. The unit is mGal.	exifEX:Acceleration	Rational
CameraElevationAngle	37893	9405	Elevation/depression. angle of the orientation of the camera(imaging optical axis) as the ambient situation at the shot. The unit is degree(°).	exifEX:CameraElevationAngle	Rational
<p>^a Field name and definition of 34855 ISOSpeedRatings tag field are changed in Exif 2.3. See the tag field 34855 PhotographicSensitivity. The mapping is given only for backward compatibility purpose.</p> <p>^b It is not recommended to use this property to indicate sensitivity.</p>					

7.10 Other properties

Table 14 lists the properties of other Exif information. Mapping between the tag based metadata and the XML properties shall follow the list in Table 14.

Table 14 — Exif properties for other information

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
ImageUniqueID	42016	A420	An identifier assigned uniquely to each image. It is recorded as a 32 character ASCII string, equivalent to hexadecimal notation and 128-bit fixed length.	exif:ImageUniqueID	Text
CameraOwnerName	42032	A430	This tag records the owner of a camera used in photography as an ASCII string.	exifEX:CameraOwnerName	Proper-Name
BodySerialNumber	42033	A431	The serial number of the camera or camera body used to take the photograph.	exifEX:BodySerialNumber	Text
LensSpecification	42034	A432	notes minimum focal length, maximum focal length, minimum F number in the minimum focal length, and minimum F number in the maximum focal length, which are specification information for the lens that was used in photography.	exifEX:LensSpecification	Ordered array of Rational
LensMake	42035	A433	Records the lens manufacturer as an ASCII string.	exifEX:LensMake	Proper-Name
LensModel	42036	A434	Records the lens's model name and model number as an ASCII string.	exifEX:LensModel	Text
LensSerialNumber	42037	A435	This tag records the serial number of the interchangeable lens that was used in photography as an ASCII string.	exifEX:LensSerialNumber	Text

8 Mapping for Exif GPS specific metadata

8.1 Overview

The following clauses define the properties for Exif specific metadata related to GPS information.

8.2 Namespace and prefix

The XML namespace URI for the GPS information shall be: <http://ns.adobe.com/exif/1.0/>

The preferred namespace prefix should be: exif

8.3 Properties for GPS information

Table 15 lists the properties of other Exif information. Mapping between the tag based metadata and the XML properties shall follow the list in Table 15.

Table 15 — Exif properties for GPS information

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
GPSTimeStamp	7	7	Time stamp of GPS data consists of Date and Time, in Coordinated Universal Time.	exif:GPSTimeStamp	Date
GPSAltitude	6	6	Indicates altitude in meters.	exif:GPSAltitude	Rational
GPSAltitudeRef	5	5	Indicates whether the altitude is above or below sea level: 0 = Above sea level 1 = Below sea level	exif:GPSAltitudeRef	Closed choice of Integer
GPSLongitude	4	4	Indicates longitude. Consists of position and East/West.	exif:GPSLongitude	GPSCo ordinate
GPSLongitudeRef	3	3	Indicates whether the longitude is east or west longitude. Merged to GPSLongitude.	Not used ^a	-
GPSLatitude	2	2	Indicates latitude. Consists of position and North/South.	exif:GPSLatitude	GPSCo ordinate
GPSLatitudeRef	1	1	Indicates whether the latitude is north or south latitude. Merged to GPSLatitude.	Not used ^a	-
GPSTimeStamp	0	0	A decimal encoding of each of the four Exif bytes with period separators. The current value is "2.3.0.0".	exif:GPSTimeStamp	Text

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
GPSSatellites	8	8	Satellite information in an ASCII string, format is unspecified.	exif:GPSSatellites	Text
GPSStatus	9	9	Status of GPS receiver at image creation time: "A" = measurement in progress "V" = measurement interrupted	exif:GPSStatus	Closed choice of Text
GPSMeasureMode	10	A	GPS measurement mode: "2" = two-dimensional measurement "3" = three-dimensional measurement	exif:GPSMeasureMode	Closed choice of Integer
GPSDOP	11	B	Degree of precision for GPS data.	exif:GPSDOP	Rational
GPSSpeedRef	12	C	Units used to speed measurement: "K" = kilometers per hour "M" = miles per hour "N" = knots	exif:GPSSpeedRef	Closed choice of Text
GPSSpeed	13	D	Speed of GPS receiver movement.	exif:GPSSpeed	Rational
GPSTrackRef	14	E	Reference for movement direction: "T" = true direction "M" = magnetic direction	exif:GPSTrackRef	Closed choice of Text
GPSTrack	15	F	Direction of GPS movement, values range from 0 to 359.99.	exif:GPSTrack	Rational
GPSTrackRef	16	10	Reference for movement direction: "T" = true direction "M" = magnetic direction	exif:GPSTrackRef	Closed choice of Text
GPSTrack	17	11	Direction of image when captured, values range from 0 to 359.99.	exif:GPSTrack	Rational
GPSTrack	18	12	Geodetic survey data as an ASCII string.	exif:GPSTrack	Text
GPSTrack	19	13	Indicates whether the latitude of the destination point is north or south latitude. Merged to GPSTrack	Not used ^a	-
GPSTrack	20	14	Indicates destination latitude. Consists of position and North/South.	exif:GPSTrack	GPSTrack

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
GPSTDestLongitudeRef	21	15	Indicates whether the longitude of the destination point is east or west longitude. Merged to GPSTDestLongitude.	Not used ^a	-
GPSTDestLongitude	22	16	Indicates destination longitude. Consists of position and East/West.	exif:GPSTDestLongitude	GPSCoordinate
GPSTDestBearingRef	23	17	Reference for movement direction: "T" = true direction "M" = magnetic direction	exif:GPSTDestBearingRef	Closed choice of Text
GPSTDestBearing	24	18	Destination bearing, values from 0 to 359.99.	exif:GPSTDestBearing	Rational
GPSTDestDistanceRef	25	19	Units used for distance measurement: "K" = kilometers "M" = miles "N" = Nautical miles	exif:GPSTDestDistanceRef	Closed choice of Text
GPSTDestDistance	26	1A	Distance to destination.	exif:GPSTDestDistance	Rational
GPSTProcessingMethod	27	1B	An ASCII string recording the name of the method used for location finding.	exif:GPSTProcessingMethod	Text
GPSTAreaInformation	28	1C	An ASCII string recording the name of the GPS area.	exif:GPSTAreaInformation	Text
GPSTDateStamp	29	1D	A character string recording date information relative to UTC (Coordinated Universal Time). Merged to GPSTTimeStamp.	Not used ^a	-
GPSTDifferential	30	1E	Indicates whether differential correction is applied to the GPS receiver: 0 = Without correction 1 = Correction applied	exif:GPSTDifferential	Closed choice of Integer
GPSTHPositioningError	31	1F	Indicates horizontal positioning errors in meters.	exif:GPSTHPositioningError ^b	Rational
^a Mapping to XMP property is not given to this Exif tag field because the value of this tag field is mapped to an XMP property corresponding to a different Exif tag field. ^b Prefix exif: is used for the backward compatibility with existing application software even though this field is an addition in Exif 2.3.					

9 Mapping for Exif interoperability metadata

9.1 Overview

The following clauses define the properties for Exif specific metadata related to interoperability.

9.2 Namespace and prefix

The XML namespace URI for the Exif version 2.21 or later shall be: <http://cipa.jp/exif/1.0/>

The preferred namespace prefix should be: exifEX

9.3 Property for interoperability

Table 16 lists the property of interoperability. Mapping between the tag based metadata and the XML property shall follow the list in Table 16.

Table 16 — Exif properties for intreopreability

Exif field name	Tag ID		Description	XMP name	Type
	Dec	Hex			
InteroperabilityIndex	1	1	Indicates the identification of the Interoperability rule. "R98" = Indicates a file conforming to R98 file specification of Recommended Exif Interoperability Rules (Exif R 98) or to DCF basic file stipulated by Design Rule for Camera File System (DCF). "THM" = Indicates a file conforming to DCF thumbnail file stipulated by Design rule for Camera File System. "R03" = Indicates a file conforming to DCF Option File stipulated by Design rule for Camera File System.	exifEX: InteroprabilityIndex	Closed choice of Text

Annex A

(normative)

Value forms and value types

A.1 Value forms

XMP value forms are defined in clause 6.3, ISO 16684-1. Especially, "Ordered array" type is defined in clause 6.3.4.

A.2 Value types

A.2.1 Overview

Core value types are defined in ISO 16684-1. Following types shall be used in properties described in this specification when applicable.

A.2.2 Basic value types

A.2.2.1 Boolean

Boolean values shall be "True" or "False".

A.2.2.2 Date

Date is a date-time value, which is represented using a subset of Date and Time Formats formatting:

YYYY

YYYY-MM

YYYY-MM-DD

YYYY-MM-DDThh:mmTZD

YYYY-MM-DDThh:mm:ssTZD

YYYY-MM-DDThh:mm:ss.sTZD

In which:

- YYYY = four-digit year
- MM = two-digit month (01=January)
- DD = two-digit day of month (01 through 31)
- hh = two digits of hour (00 through 23)
- mm = two digits of minute (00 through 59)

- `ss` = two digits of second (00 through 59)
- `s` = one or more digits representing a decimal fraction of a second
- `TZD` = time zone designator (Z or +hh:mm or -hh:mm)

The time zone designator need not be present in XMP. When not present, the time zone is unknown, and an XMP processor should not assume anything about the missing time zone.

Local time-zone designators +hh:mm or -hh:mm should be used when possible instead of converting to UTC.

NOTE If a file was saved at noon on October 23, a timestamp of 2004-10-23T12:00:00-06:00 conveys more information than 2004-10-23T18:00:00Z.

A.2.2.3 Integer

Integer is a signed or unsigned numeric string used as an integer number representation. The string consists of an arbitrary length decimal numeric string with an optional leading “+” or “-” sign.

A.2.2.4 Text

Text is a possibly empty Unicode string.

A.2.3 Derived value types

A.2.3.1 AgentName

Value of Agent Name is the name of an XMP processor, a Text value. It is recommended that the value use this format convention:

Organization Software_name Version (token;token;...)

- Organization: The name of the company or organization providing the software, no SPACES.
- Software_name: The full name of the software, SPACES allowed.
- version: The version of the software, no SPACES.
- tokens: Can be used to identify an operating system, plug-in, or more detailed version information.

EXAMPLE "Adobe Acrobat 9.0 (Mac OS X 10.5)"

A.2.3.2 Choice

Choice is a value chosen from a vocabulary of values. Vocabularies provide a means of specifying a limited and possibly extensible set of values for a property.

A choice can be *open* or *closed*:

- An open choice has one or more lists of preferred values, but other values can be used freely.
- A closed choice has one or more lists of allowed values, other values shall not be used.

NOTE An XMP reader would be more robust if it tolerates unexpected values for closed choice types when the set of allowed values can be expected to grow over time.

A.2.3.3 LanguageAlternative

Value of LanguageAlternative is an alternative array of simple text items. Language alternatives facilitate the selection of a simple text item based on a desired language. Each array item shall have an **xml:lang** qualifier. Each **xml:lang** value shall be unique among the items. As defined in IETF RFC 3066, the **xml:lang** value is composed of one or more parts: A primary language subtag and a (possibly empty) series of subsequent subtags. The same primary subtag may be used alone and in conjunction with one or more lower-level subtags. A default value, if known, should be the first array item. The order of other array items is not specified by this document.

An xml:lang value of "x-default" may be used to explicitly denote a default item. If used, the "x-default" item shall be first in the array and its simple text value should be repeated in another item in which xml:lang specifies its actual language. However, an "x-default" item may be the only item, in which case there is only a default value in no defined language.

EXAMPLE 1 Language alternative with an "x-default" item:

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:dc="http://purl.org/dc/elements/1.1/">

  <rdf:Description rdf:about="">

    <!-- Line wrapping of rdf:li elements is for presentation in this example. -->
    <!-- Leading and trailing white space is part of the array item values. -->

    <dc:title>
      <rdf:Alt>
        <rdf:li xml:lang="x-default">
          XMP - Extensible Metadata Platform
        </rdf:li>
        <rdf:li xml:lang="en-us">
          XMP - Extensible Metadata Platform
        </rdf:li>
        <rdf:li xml:lang="fr">
          XMP - Une Plateforme Extensible pour les Métadonnées
        </rdf:li>
      </rdf:Alt>
    </dc:title>

  </rdf:Description>

</rdf:RDF>
```

A.2.3.4 ProperName

ProperName is a simple text value denoting the name of a person or organization.

A.2.4 Exif namespace value types

Core value types are defined in the Adobe Systems XMP Specification Part 2, July 2011. Following clauses are citation from the Adobe Systems XMP Specification Part 2, July 2011.

These types are used only within Exif specific namespaces.

A.2.4.1 CFAPattern

Value type of CFAPattern is a structure describing the CFA pattern.

- The field namespace URI is <http://ns.adobe.com/exif/1.0/>

- The preferred field namespace prefix is **exif**

Table A.1 — CFAPattern fields

Name	Type	Description
exif:Columns	Integer	Number of columns, n .
exif:Rows	Integer	Number of rows, m .
exif:Values	Ordered array of Integer	CFA values, sequence should be, in order: value $[0, 0]$... value $[n - 1, 0]$ value $[0, m - 1]$... value $[n - 1, m - 1]$

A.2.4.2 DeviceSettings

Value type of DeviceSettings is a structure describing the device settings.

- The field namespace URI is <http://ns.adobe.com/exif/1.0/>
- The preferred field namespace prefix is **exif**

Table A.2 — DeviceSettings fields

Name	Type	Description
exif:Columns	Integer	Display columns
exif:Rows	Integer	Display rows
exif:Values	ordered array of Text	Camera settings, in order

A.2.4.3 Flash

Value type of Flash is a structure describing the flash state.

- The field namespace URI is <http://ns.adobe.com/exif/1.0/>
- The preferred field namespace prefix is **exif**

Table A.3 — Flash fields

Name	Type	Description
exif:Fired	Boolean	True if flash fired.
exif:Function	Boolean	True if flash function is not present.

exif:Mode	Closed choice of Integer	The flash mode. One of: 0 = unknown 1 = compulsory flash firing 2 = compulsory flash suppression 3 = auto mode
exif:RedEyeMode	Boolean	True if red-eye reduction is supported.
exif:Return	Closed choice of Integer	Whether strobe return is supported and if supported, detected. One of: 0 = no strobe return detection 2 = strobe return light not detected 3 = strobe return light detected

A.2.4.4 GPSCoordinate

Value type of GPSCoordinate is a Text value in the form “*DDD,MM,SSk*” or “*DDD,MM.mm_k*”, where:

- *DDD* is a number of degrees
- *MM* is a number of minutes
- *SS* is a number of seconds
- *mm* is a fraction of minutes
- *k* is a single character N, S, E, or W indicating a direction (north, south, east, west)

Leading zeros are not necessary for the for *DDD*, *MM*, and *SS* values. The *DDD,MM.mm_k* form should be used when any of the native Exif component rational values has a denominator other than 1. There can be any number of fractional digits.

A.2.4.5 OECF/SFR

Value type of OECF/SFR is a structure describing the OECF/SFR.

- The field namespace URI is <http://ns.adobe.com/exif/1.0/>
- The preferred field namespace prefix is *exif*

Table A.4 — OECF/SFR fields

Name	Type	Description
exif:Columus	Integer	Number of columns, <i>n</i>
exif:Names	Ordered array of Text	Column item names, <i>n</i> entries
exif:Rows	Integer	Number of rows, <i>m</i>

exif:Values	Ordered array of Rational	OECF/SFR values, sequence should be, in order: value [0,0] ... value [$n - 1$, 0] value [0, $m - 1$] ... value [$n - 1$, $m - 1$]
--------------------	---------------------------	---

A.2.4.6 Rational

To represent Exif rational values in XMP, they must be converted to text. The recommended approach is to use a value of type Text of the form *numerator/denominator*. For example, the value 2/3 becomes the text value "2/3" when converted to XMP.

Bibliography

- [1] ISO 12231: 1997 Photography - Electronic still picture imaging – Vocabulary
- [2] TIFF (Tag Image File Format), Revision 6.0, June 1992, Adobe Systems Incorporated
- [3] The Adobe Systems XMP Specification Part 2, July 2010
- [4] CIPA DC-009-2010 "Design rule for Camera File system: DCF: Version 2.0 (Edition 2010)"

Participating members

The bulk of the deliberations over the formulation of the standards described in this document was performed by the Standard Development Working Group.

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MA Shibaura Bldg., 3-8-10, Shibaura, Minato-ku, Tokyo, 108-0023

Japan

TEL +81-3-5442-4800 FAX +81-3-5442-4801

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