

Standard of Japan Electronics and Information Technology Industries Association

JEITA CP-3451-1

Amendment 1

**Exchangeable image file format for digital still cameras:
Exif Version 2.21 (Amendment Ver2.2)**

Established in XXX, 2003 Draft

**Prepared by
Technical Standardization Committee on AV & IT Storage Systems and Equipment**

**Published by
Japan Electronics and Information Technology Industries Association**

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1. Original Source JEITA CP-3451

This amendment is issued to add, and revise some part of JEITA CP-3451, and its Explication.

DRAFT

2. Revision history

Exif Version 2.21 consists of Exif version 2.2, and this amendment, which describes the difference between 2.2, and 2.21.

Following points have been changed and added;

Chapters	Pages on Exif ver.2.2 – Pages on this amendment	
- 4.4.3	P4-P5	Description on pixel composition and sampling has been changed
- 4.6.5-Table4	P25-P6	Gamma tag has been added.
- 4.6.5-A	P27-P6	The value which is written on Exif Version Tag, has been changed from “2.20” to “2.21”.
- 4.6.5-B	P27-P7	Definition of Color Space tag has been changed.
- 4.6.5-B	P27-P7	Definition of Gamma tag has been added.
- 4.6.5-G	P38-P8	Definition of Flash tag has been changed.
- 4.6.5-G	P44-P9	The permissible value of FileSource tag has been added.
- 4.6.5-G	P49-P10	Typographical error on DeviceSettingDescription has been corrected.
- 4.6.7	P59-P11	The permissible value of InterOperabilityIndex tag has been changed.
- 4.6.8-A, Table14	P60-P12	The levels recorded on Transfer Function has been changed.
- 4.6.8-Table15	P62-P13	Gamma tag has been added.
- 4.6.8-Table17	P63-P14	Typographical error on InterOperabilityIndex has been corrected.

4.4.3 Pixel Composition and Sampling

When uncompressed data is used, the combination of pixel composition and pixel sampling for image data shall be RGB 4:4:4 and either Y:Cb:Cr = 4:2:2 or Y:Cb:Cr = 4:2:0. When compressed data is used, the combination shall be Y:Cb:Cr = 4:2:2 or Y:Cb:Cr = 4:2:0. The pixel composition of image data shall also be 8 bits each. This specification is applied similarly to thumbnails.

As sampling points on the elements making up pixels, the Y and Cb,Cr sampling points may be either co-sited or centered. Figure3 shows typical pixel sampling for image width w and height h. In the case of Y:Cb:Cr = 4:2:2, co-sited is recommended for the sake of improved image quality on TV systems. For Y:Cb:Cr = 4:2:0, centered is recommended according to the TIFF default which is most common format of the personal computer applications.

4.6.5 Exif IFD Attribute Information

4.6.5-A. Tags Relating to Version

ExifVersion

The version of this standard supported. Nonexistence of this field is taken to mean nonconformance to the standard (see section 4.2). Conformance to this standard is indicated by recording "0221" as 4-byte ASCII. Since the type is UNDEFINED, there is no NULL for termination.

Tag = 36864 (9000.H)
 Type = UNDEFINED
 Count = 4
 Default = "0221"

The attribute information (field names and codes) recorded in the Exif IFD is given in Table 4 and Table 5 followed by an explanation of the contents.

Table 4 Exif IFD Attribute Information (1)

Tag Name	Field Name	Tag ID		Type	Count
		Dec	Hex		
A. Tags Relating to Version					
Exif version	ExifVersion	36864	9000	UNDEFINED	4
Supported Flashpix version	FlashpixVersion	40960	A000	UNDEFINED	4
B. Tag Relating to Image Data Characteristics					
Color space information	ColorSpace	40961	A001	SHORT	1
Gamma	Gamma	42240	A500	RATIONAL	1
C. Tags Relating to Image Configuration					
Meaning of each component	ComponentsConfiguration	37121	9101	UNDEFINED	4
Image compression mode	CompressedBitsPerPixel	37122	9102	RATIONAL	1
Valid image width	PixelXDimension	40962	A002	SHORT or LONG	1
Valid image height	PixelYDimension	40963	A003	SHORT or LONG	1
D. Tags Relating to User Information					
Manufacturer notes	MakerNote	37500	927C	UNDEFINED	Any
User comments	UserComment	37510	9286	UNDEFINED	Any
E. Tag Relating to Related File Information					
Related audio file	RelatedSoundFile	40964	A004	ASCII	13
F. Tags Relating to Date and Time					
Date and time of original data generation	DateTimeOriginal	36867	9003	ASCII	20
Date and time of digital data generation	DateTimeDigitized	36868	9004	ASCII	20
DateTime subseconds	SubSecTime	37520	9290	ASCII	Any
DateTimeOriginal subseconds	SubSecTimeOriginal	37521	9291	ASCII	Any
DateTimeDigitized subseconds	SubSecTimeDigitized	37522	9292	ASCII	Any
G. Tags Relating to Picture-Taking Conditions					
See Table5					
H. Other Tags					
Unique image ID	ImageUniqueID	42016	A420	ASCII	33

4.6.5-B. Tags Relating to ColorSpace

ColorSpace

The color space information tag (ColorSpace) is always recorded as the color space specifier. Normally sRGB (=1) is used to define the color space based on the PC monitor conditions and environment. If a color space other than sRGB is used, Uncalibrated (=FFFF.H) is set. Image data recorded as Uncalibrated can be treated as sRGB when it is converted to Flashpix. On sRGB see Annex E.

Tag	=	40961 (A001.H)
Type	=	SHORT
Count	=	1
1	=	sRGB
FFFF.H	=	Uncalibrated
Other	=	reserved

Gamma

Indicates the value of coefficient gamma. The formula of transfer function used for image reproduction is expressed as follows.

$$\text{(Reproduced value)} = (\text{Input value})^{\text{gamma}}$$

Both reproduced value and input value indicate normalized value, whose minimum value is 0 and maximum value is 1.

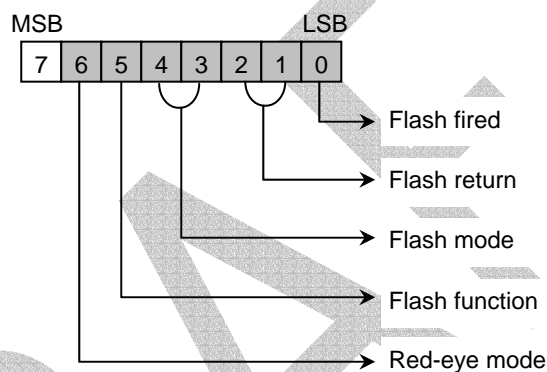
Tag	=	42240 (A500.H)
Type	=	RATIONAL
Count	=	1
Default	=	None

4.6.5-G Flash

This tag indicates the status of flash when the image was shot. Bit 0 indicates the flash firing status, bits 1 and 2 indicate the flash return status, bits 3 and 4 indicate the flash mode, bit 5 indicates whether the flash function is present, and bit 6 indicates "red eye" mode (see Figure11).

Tag = 37385 (9209.H)
Type = SHORT
Count = 1

Figure 11 Bit Coding of the Flash Tag



Values for bit 0 indicating whether the flash fired.

- 0b = Flash did not fire.
- 1b = Flash fired.

Values for bits 1 and 2 indicating the status of returned light.

- 00b = No strobe return detection function
- 01b = reserved
- 10b = Strobe return light not detected.
- 11b = Strobe return light detected.

Values for bits 3 and 4 indicating the camera's flash mode.

- 00b = unknown
- 01b = Compulsory flash firing
- 10b = Compulsory flash suppression
- 11b = Auto mode

Values for bit 5 indicating the presence of a flash function.

- 0b = Flash function present
- 1b = No flash function

Values for bit 6 indicating the camera's red-eye mode.

- 0b = No red-eye reduction mode or unknown
- 1b = Red-eye reduction supported

(The other descriptions about Flash Tag definition which were mentioned in Exif Version 2.2 are invalid.)

4.6.5-G FileSource

Indicates the image source. If a DSC recorded the image, this tag value always be set to 3, indicating that the image was recorded on a DSC.

Tag	=	41728 (A300.H)
Type	=	UNDEFINED
Count	=	1
Default	=	3
<u>0</u>	=	<u>others</u>
<u>1</u>	=	<u>scanner of transparent type</u>
<u>2</u>	=	<u>scanner of reflex type</u>
3	=	DSC
Other	=	reserved

4.6.5-G DeviceSettingDescription

This tag indicates information on the picture-taking conditions of a particular camera model. The tag is used only to indicate the picture-taking conditions in the reader.

Tag = 41995 (A40B.H)
Type = UNDEFINED
Count = Any
Default = none

The information is recorded in the format shown in Figure17. The data is recorded in Unicode using SHORT type for the number of display rows and columns and UNDEFINED type for the camera settings. The Unicode (UCS-2) string including Signature is NULL terminated. The specifics of the Unicode string are as given in ISO/IEC 10646-1.

Length	Type	Meaning
2	SHORT	Display columns
2	SHORT	Display rows
Any	UNDEFINED	Camera setting-1
Any	UNDEFINED	Camera setting-2
:	:	:
Any	UNDEFINED	Camera setting-n

Figure 17 Format used to record picture-

4.6.7 Interoperability IFD Attribute Information

The attached information(field name, code) stored in Interoperability IFD is listed in Table13. The meaning is explained below.

Table 13Interoperability IFD Attribute Information

Tag Name		Tag ID		Type	Count
		Dec	Hex		
A. Attached Information Related to Interoperability					
	Interoperability Identification InteroperabilityIndex	1	1	ASCII	Any

A. Tags Relating to Interoperability

The rules for Exif image files defines the description of the following tag. Other tags stored in Interoperability IFD may be defined dependently to each Interoperability rule.

InteroperabilityIndex

Indicates the identification of the Interoperability rule. The following rules are defined. Four bytes used including the termination code (NULL).

Tag = 1 (1.H)

Type = ASCII

Count = Any

Default = none

"R98" = Indicates a file conforming to R98 file specification of Recommended Exif Interoperability Rules (ExifR98) or to DCF basic file stipulated by Design Rule for Camera File System.

"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.

4.6.8 Tag Support Levels

The tags and their support levels are given here.

A. Primary Image (0th IFD) Support Levels

The support levels of primary image (0th IFD) tags are given in Table14, Table15, Table16 and Table17

Table 14 Tag Support Levels (1) - 0th IFD TIFF Tags -

Tag Name	Field Name	Tag ID		Uncompressed			Compressed
		Dec	Hex	Chunky	Planar	YCC	
Image width	ImageWidth	256	100	M	M	M	J
Image height	ImageLength	257	101	M	M	M	J
Number of bits per component	BitsPerSample	258	102	M	M	M	J
Compression scheme	Compression	259	103	M	M	M	J
Pixel composition	PhotometricInterpretation	262	106	M	M	M	N
Image title	ImageDescription	270	10E	R	R	R	R
Manufacturer of image input equipment	Make	271	10F	R	R	R	R
Model of image input equipment	Model	272	110	R	R	R	R
Image data location	StripOffsets	273	111	M	M	M	N
Orientation of image	Orientation	274	112	R	R	R	R
Number of components	SamplesPerPixel	277	115	M	M	M	J
Number of rows per strip	RowsPerStrip	278	116	M	M	M	N
Bytes per compressed strip	StripByteCounts	279	117	M	M	M	N
Image resolution in width direction	XResolution	282	11A	M	M	M	M
Image resolution in height direction	YResolution	283	11B	M	M	M	M
Image data arrangement	PlanarConfiguration	284	11C	O	M	O	J
Unit of X and Y resolution	ResolutionUnit	296	128	M	M	M	M
Transfer function	TransferFunction	301	12D	O	O	O	O
Software used	Software	305	131	O	O	O	O
File change date and time	DateTime	306	132	R	R	R	R
Person who created the image	Artist	315	13B	O	O	O	O
White point chromaticity	WhitePoint	318	13E	O	O	O	O
Chromaticities of primaries	PrimaryChromaticities	319	13F	O	O	O	O
Offset to JPEG SOI	JPEGInterchangeFormat	513	201	N	N	N	N
Bytes of JPEG data	JPEGInterchangeFormatLength	514	202	N	N	N	N
Color space transformation matrix coefficients	YCbCrCoefficients	529	211	N	N	O	O
Subsampling ratio of Y to C	YCbCrSubSampling	530	212	N	N	M	J
Y and C positioning	YCbCrPositioning	531	213	N	N	M	M
Pair of black and white reference values	ReferenceBlackWhite	532	214	O	O	O	O
Copyright holder	Copyright	33432	8298	O	O	O	O
Exif tag	Exif IFD Pointer	34665	8769	M	M	M	M
GPS tag	GPSInfo IFD Pointer	34853	8825	O	O	O	O

Notation

M : Mandatory (shall be recorded)

R : Recommended

O : Optional

N : Not recorded

J : Included in JPEG marker and so not recorded

4.6.8 Tag Support Levels

Table 15 Tag Support Levels (2) - 0th IFD Exif Private Tags -

Tag Name	Field Name	Tag ID		Uncompressed			Compressed
		Dec	Hex	Chunky	Planar	YCC	
Exposure time	ExposureTime	33434	829A	R	R	R	R
F number	FNumber	33437	829D	O	O	O	O
Exposure program	ExposureProgram	34850	8822	O	O	O	O
Spectral sensitivity	SpectralSensitivity	34852	8824	O	O	O	O
ISO speed ratings	ISOSpeedRatings	34855	8827	O	O	O	O
Optoelectric coefficient	OECF	34856	8828	O	O	O	O
Exif Version	ExifVersion	36864	9000	M	M	M	M
Date and time original image was generated	DateTimeOriginal	36867	9003	O	O	O	O
Date and time image was made digital data	DateTimeDigitized	36868	9004	O	O	O	O
Meaning of each component	ComponentsConfiguration	37121	9101	N	N	N	M
Image compression mode	CompressedBitsPerPixel	37122	9102	N	N	N	O
Shutter speed	ShutterSpeedValue	37377	9201	O	O	O	O
Aperture	ApertureValue	37378	9202	O	O	O	O
Brightness	BrightnessValue	37379	9203	O	O	O	O
Exposure bias	ExposureBiasValue	37380	9204	O	O	O	O
Maximum lens aperture	MaxApertureValue	37381	9205	O	O	O	O
Subject distance	SubjectDistance	37382	9206	O	O	O	O
Metering mode	MeteringMode	37383	9207	O	O	O	O
Light source	LightSource	37384	9208	O	O	O	O
Flash	Flash	37385	9209	R	R	R	R
Lens focal length	FocalLength	37386	920A	O	O	O	O
Subject area	SubjectArea	37396	9214	O	O	O	O
Manufacturer notes	MakerNote	37500	927C	O	O	O	O
User comments	UserComment	37510	9286	O	O	O	O
DateTime subseconds	SubSecTime	37520	9290	O	O	O	O
DateTimeOriginal subseconds	SubSecTimeOriginal	37521	9291	O	O	O	O
DateTimeDigitized subseconds	SubSecTimeDigitized	37522	9292	O	O	O	O
Supported Flashpix version	FlashpixVersion	40960	A000	M	M	M	M
Color space information	ColorSpace	40961	A001	M	M	M	M
Valid image width	PixelXDimension	40962	A002	N	N	N	M
Valid image height	PixelYDimension	40963	A003	N	N	N	M
Related audio file	RelatedSoundFile	40964	A004	O	O	O	O
Interoperability tag	Interoperability IFD Pointer	40965	A005	N	N	N	O
Flash energy	FlashEnergy	41483	A20B	O	O	O	O
Spatial frequency response	SpatialFrequencyResponse	41484	A20C	O	O	O	O
Focal plane X resolution	FocalPlaneXResolution	41486	A20E	O	O	O	O
Focal plane Y resolution	FocalPlaneYResolution	41487	A20F	O	O	O	O
Focal plane resolution unit	FocalPlaneResolutionUnit	41488	A210	O	O	O	O
Subject location	SubjectLocation	41492	A214	O	O	O	O
Exposure index	ExposureIndex	41493	A215	O	O	O	O
Sensing method	SensingMethod	41495	A217	O	O	O	O
File source	FileSource	41728	A300	O	O	O	O
Scene type	SceneType	41729	A301	O	O	O	O
CFA pattern	CFAPattern	41730	A302	O	O	O	O
Custom image processing	CustomRendered	41985	A401	O	O	O	O
Exposure mode	ExposureMode	41986	A402	R	R	R	R
White balance	WhiteBalance	41987	A403	R	R	R	R
Digital zoom ratio	DigitalZoomRatio	41988	A404	O	O	O	O
Focal length in 35 mm film	FocalLengthIn35mmFilm	41989	A405	O	O	O	O
Scene capture type	SceneCaptureType	41990	A406	R	R	R	R
Gain control	GainControl	41991	A407	O	O	O	O
Contrast	Contrast	41992	A408	O	O	O	O
Saturation	Saturation	41993	A409	O	O	O	O
Sharpness	Sharpness	41994	A40A	O	O	O	O
Device settings description	DeviceSettingDescription	41995	A40B	O	O	O	O
Subject distance range	SubjectDistanceRange	41996	A40C	O	O	O	O
Unique image ID	ImageUniqueID	42016	A420	O	O	O	O
Gamma	Gamma	42240	A500	O	O	O	O

Table 17 Tag Support Levels (4) - 0th IFD Interoperability Tag -

Tag Name	Field Name	Tag ID		Uncompressed			Comp- r essed
		Dec	Hex	Chunky	Planar	YCC	
Interoperability Identification	InteroperabilityIndex	1	1	N	N	N	O

Notation

M : Mandatory (shall be recorded)

R : Recommended

O : Optional

N : Not recorded

J : Included in JPEG marker and so not recorded

3. Revision of explication.

This explication of Exif Version 2.21 is a new version of the explication of Exif Version 2.2. Following Tag information guidelines have been changed.

Chapters	Pages on Exif ver.2.2 – Pages on this amendment
- 7.3.4	P154-P16 Flash Tag
- 7.3.6	P155-P17 Custom Rendered
- 7.3.11	P156-P18 Scene Capture Type
- 7.3.13-Explication Table 3	P157-P19 Contrast/Saturation/Sharpness

7.3.4 Flash

Tag Information

This tag indicates the flash status when the picture was taken.

[Writer]

-The red-eye bit indicates whether the flash was fired for the purpose of red-eye reduction, including pre-flash.

-The red-eye bit can be set when a flash mode for the purpose of reducing red-eye reduction is set.

[Reader]

-This tag can be used along with subject distance range (or subject distance), scene type and brightness to determine whether suitable exposure is possible.

7.3.6 CustomRendered

Tag Information

This tag indicates the use of special processing on image data by writer, such as rendering geared to output. When special processing is performed, the reader is expected to disable or minimize any further processing.

[Writer]

- For ordinary shooting this is set to 0 (normal process). If the writer applies special processing such as monochrome mode or sepia mode, and it is desired to prevent or minimize automatic adjustment by the reader, a value of 1 is set (custom process).
- For ordinary shooting value of 0 is recorded (normal process). If the writer considers the specific character of output devices, a value of 1 is recorded (custom process).
- When this tag is set to 1 (custom process), vendors should leads users to understand its function.

Usage cases

- When the user changes exposure or white balance on pursose
- When the user takes pictures using not standard set up but different mode on purpose
- When the user takes pictures using sepia mode or monochrome mode
- When the user chooses soft focus effect
- When the writer chooses various effects meeting each scene

[Reader]

- When a value of 1 (custom process) is set, the reader determines that the image has already been specially processed, and should either disable or reduce any further processing in order to prevent double processing.
- Even if a value of 1(custom process) is recorded, basic processing, which depends on each output device, is not needed to be decreased. (See explication table1)

Explication Table1: Relation between Custom Rendered and Output device process.

<u>Tag record value</u>	<u>Basic process</u>	<u>Image data-adaptive process</u>	<u>Tag information-utilized process</u>
<u>Ordinary process</u>	<u>Do</u>	<u>Do</u>	<u>Do</u>
<u>Custom process</u>	<u>Do</u>	<u>No or less</u>	<u>No or less</u>

Basic process: process which depends on the output device.

Image data-adaptive process:Image data correction process which depends on the image data.(brightness retouch,color retouch etc)

Image information-utilized process: Image data correction processing, which depends on the tag information.

7.3.11 SceneCaptureType

Tag Information

This tag indicates the type of scene that was shot. It can also be used to set the mode in which the image was shot.

[Writer]

- The writer records the shooting mode set by the user or the scene type determined by the writer.
- A value of 1 (landscape) indicates a mode suitable for shooting scenery, 2 (portrait) means a mode suitable for portrait photography, and 3(night scene) means a mode suitable for night scenes was set.
- In case of multiple objects in one scene, writer chooses a value, which suites the main object.
- When the writer changes the value of contrast, saturation, sharpness, gaincontrol etc, to realize some effects on the photograph, it is better to record the directions.

[Reader]

- The reader can use this information to perform image processing suitable for the type of scene that was shot.
- The reader should use this tag and the image analysis result, or other related tags, to prevent over-correction or processing that defeats the purpose of the recorded values.
- If the captured scene type as well as saturation, sharpness and contrast are recorded, it is up to the reader which of these to use. These tags is recommended to be refered.
- Processing examples are given in the table below for each objective.

Explication Table 2 Examples of Processing for Different Scene Types

	Processing Objective	Example
Normal	To make the ordinary scenery look more attractive	Normal processing
Landscape	To make the landscape scenery look more attractive	Enhancement of contrast, saturation, and sharpness
Portrait	To make the subject look more attractive	Memory color correction of skin color
Night Scene	To make the night scene look more attractive	Inhibition of soft tone correction Noise reduction

7.3.13 Contrast/Saturation/Sharpness

Explication Table 3 Examples of Processing to be avoided by Readers

	Processing that goes against the intent of the recorded values	Double processing
Contrast	Softening when hard contrast was intended	Excessive softening when soft contrast is recorded
Saturation	Lowering saturation when high saturation was intended	Raising saturation excessively when high saturation is recorded
Sharpness	Increasing sharpness when weak sharpness was intended	Increasing sharpness excessively when strong sharpness is recorded

About Exif Version 2.21 (Exif Version2.2 Amendment)

This document provides explanatory information on the latest revision to the Exif Standard, Version 2.2. This document includes explanations referring to the definitions in the Exif Standard, reference material in relation to the standard, and information in relation to the development of the standard. This document is entirely informative and shall not be considered as an integral part of the Exif Standard.

1. Purpose of the Amendment

An aim of this amendment is to update the regulations, allowed values and recording levels of tags: Gamma tag, ColorSpace tag, InterOperabilityIndex tag, TransferFunction tag. As the Camera file system standard DCF has been revised to Version 2.0(TBC), these tags, which are related to the contents of DCF new version, need to be updated.

Firstly, regulations of following tags are invalid.

4.6.5-B Flash Tag: All the descriptions, except for the descriptions mentioned in this amendment, are invalid.

4.6.5-G: The description on the Exif version 2.2, 'this value indicates that this image is recorded by DSC.' is invalid.

Secondly, some examples how to use the tags related to image shooting condition at the time of printing are added. Descriptions how to use tag information are already mentioned in the explanation of Exif Version 2.2, however, as a result of adding these examples, it will be clearer how to use following tags and the use of those tags is expected to increase.

7.3.4 Flash tag

7.3.6 Custom Rendered tag

7.3.11 Scene Capture Type

7.3.13 Contrast/ Saturation/ Sharpness

Thirdly, followings are corrected and clarified.

4.6.5-G, table17: Errors in writing, which is found out in Exif version2.2, are corrected.

4.4.3: Descriptions of image data composition and pixel sampling, which used to be unclear, are partly changed and become clearer.

Lastly, as a result of this revision, recorded contents of ExifVersion tag have been revised to "2.21". (4.6.5-A)

2. Industrial Properties Rights

The companies listed below have declared that they hold the patent right(s) shown below, which include issued

patents and pending patent applications, and have announced that they will grant a license to these patents under reasonable and non-discriminatory terms and conditions for products which conform to the JEITA standard "Exchangeable image file format for digital still cameras: Exif Version 2.21". Such licenses should be negotiated with each patent holder.

-KONICA PHOTO IMAGING CORPORATION

-Sony Corporation

-Hewlett-Packard Japan, Ltd.

-FUJI PHOTO FILM CO., LTD.

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights other than those identified above. JEITA shall not be held responsible for any or all such patent rights.

3. Committee Organization for Preparing the Draft Standard

This standard was deliberated by ExifDCF Sub Committee of CIPA, Camera & Imaging Products Association. The draft standard was then presented to JEITA Technical Standardization Committee on AV & IT Storage-Systems and Equipment, and approved by that Committee in July 2003.

The committees involved in drafting the standard are as follows:

JEITA

Technical Standardization Committee on AV & IT Storage Systems and Equipment

Chairman: Tadashi Ezaki Sony Corporation

Technical Standardization Committee on Color Management

Chairman: Nobuaki Usui Fujitsu Corporation

Digital Camera Standardization Group

Group Leader: Takashi Sakaguchi Matsushita Electric Industrial Co., Ltd.

Sub Leader: Takao Tsuchiya Sony Corporation

Sub Leader: Hiroaki Sugiura Mitsubishi Electric Corporation

Advisor: Shin Ohno Tokyo Institute of Polytechnics

Member:	Hideaki Yoshida	Olympus Optical Co., Ltd.
	Hideaki Kawamura	Canon Inc.
	Shuji Hayashi	KONICA PHOTO IMAGING CORPORATION
	Shinji Ukita	SANYO Electric Co., Ltd.
	Mitsuhiko Maeda	SANYO Electric Co., Ltd.
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