



A Project of the PWG IPPFAX Working Group

Universal Image Format (UIF)

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Abstract

This standard specifies the Universal Image Format (UIF). The UIF requirements [7] are derived from the requirements for IPPFAX [8] and Internet Fax [9].

In summary UIF is a raster image data format intended for use by, but not limited to, the IPPFAX protocol, which is used to provide a synchronous, reliable exchange of image Documents between Senders and Receivers. UIF is based on the TIFF-FX specification [4], which describes the TIFF (Tag Image File Format) representation of image data specified by the ITU-T Recommendations for black-and-white and color facsimile.

This document (1) formally defines a series of “UIF profiles” distinguished primarily by the method of compression employed and color space used; (2) describes the use of CONNEG in capabilities communication between two UIF-enabled Devices; and (3) defines a set of baseline capabilities that permit a CONNEG implementation to be optional.

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Table of Contents

1			
2			
3	1	Introduction.....	5
4	2	Terminology	5
5	2.1	Conformance Terminology.....	5
6	2.2	Model.....	5
7	3	Indicating Support using MIME.....	6
8	3.1	MIME content type type	6
9	3.2	MIME application parameter.....	6
10	4	TIFF-FX support.....	6
11	4.1	UIF Profile Relationships	7
12	4.2	UIF Profile S	7
13	4.3	UIF Profile F	8
14	4.4	UIF Profile J	10
15	4.5	UIF Profile C	12
16	4.6	UIF Profile L.....	13
17	4.7	UIF Profile M	15
18	5	Capabilities communication	18
19	5.1	Receiver capabilities string.....	18
20	5.1.1	New CONNEG Tags	18
21	5.1.2	Minimum Receiver capabilities	18
22	5.1.2.1	Minimum capabilities for UIF Profile S	18
23	5.1.2.2	Minimum capabilities for UIF Profile F	19
24	5.1.2.3	Minimum capabilities for UIF Profile J.....	19
25	5.1.2.4	Minimum capabilities for UIF Profile C	19
26	5.1.2.5	Minimum capabilities for UIF Profile L.....	20
27	5.1.2.6	Minimum capabilities for UIF Profile M.....	20
28	5.2	UIF profiles supported	20
29	5.3	Media supported	21
30	5.4	Media ready	21
31	5.5	Image reduction supported	21
32	6	Sender requirements	21
33	6.1	Image-Reduction.....	21
34	6.2	Intra-job media selection	22
35	7	Conformance Requirements	22
36	8	References.....	22
37	9	Issues.....	23
38	9.1	Outstanding Issues	23
39	9.2	Resolved Issues.....	24
40	10	Actions	25
41	11	Revision History (to be removed when standard is approved).....	25

42

Table of Tables

1		
2	Table 1. UIF Profile S Baseline Fields	7
3	Table 2. UIF Profile S Extension Fields	8
4	Table 3. UIF Profile F Baseline Fields	9
5	Table 4. UIF Profile F Extension Fields	9
6	Table 5. UIF Profile F New Fields	10
7	Table 6. UIF Profile J Baseline Fields	11
8	Table 7. UIF Profile J Extension Fields.....	11
9	Table 8. UIF Profile J New Fields	11
10	Table 9. UIF Profile C Baseline Fields.....	12
11	Table 10. UIF Profile C Extension Fields	13
12	Table 11. UIF Profile C New Fields	13
13	Table 12. UIF Profile L Baseline Fields	14
14	Table 13. UIF Profile L Extension Fields.....	15
15	Table 14. UIF Profile L New Fields	15
16	Table 15. UIF Profile M Baseline Fields.....	16
17	Table 16. UIF Profile M Extension Fields.....	17
18	Table 17. UIF Profile M New Fields	17
19	Table 18. Underlying Protocol Conformance.....	22
20		

1

2 **1 Introduction**

- 3 ➤ This document specifies an image data format based on TIFF-FX [4] especially suited for use with
4 synchronous protocols (e.g., IPPFAX[10]). The increased conformance requirements found in this
5 UIF specification reflect the need for a data format where quality document transmission is the
6 primary concern. The complete support for TIFF-FX in this way is called Universal Image Format
7 (UIF). There are several pieces to this support: A specification of precisely what parts of the TIFF-
8 FX specification are to be supported
- 9 ➤ How the UIF-capable Sender uses CONNEG to discover the UIF characteristics (resolution,
10 drawing surface, etc.) of a potential UIF Receiver.
- 11 ➤ How the Sender specifies options for the transmission (reducing for example).

12

13 **2 Terminology**

14 This section defines the following additional terms that are used throughout this standard.

15 **2.1 Conformance Terminology**

16 The key words **MUST**, **MUST NOT**, **REQUIRED**, **SHOULD**, **SHOULD NOT**,
17 **RECOMMENDED**, **MAY**, and **OPTIONAL** in this document are to be interpreted as described in
18 RFC 2119 [18].

19 **2.2 Model**

20 The following terms are introduced and capitalized in order to indicate their specific meaning:

21 **Baseline Field** – One of the core set of TIFF fields introduced by the TIFF specification [19]

22 **Device** – A Sender or Receiver

23 **Document** – The electronic representation of a set of one or more pages that the Sender sends to the
24 Receiver.

25 **Extension Field** – One of the TIFF extension fields introduced by the current TIFF specification [19],
26 specification, the set of Pagemaker TIFF Technical Notes [20], or TIFF Technical Note 2 [21].

27 **New Field** – One of the new TIFF fields introduced by the TIFF-FX specification [4]. Note that the
28 UIF specification does not introduce any new TIFF tags.

29 **Receiver** – This is the agent (software, hardware or some combination) that receives the Document
30 sent by the Sender.

31 **Sender** – This is the agent (software, hardware or some combination) that is used to transmit a
32 Document to a Receiver.

1 **3 Indicating Support using MIME**

2 [22] describes the registration of the MIME content-type image/tiff to refer to TIFF encoded image
3 data. In addition, an optional "application" parameter is defined for image/tiff to identify a particular
4 application's subset of TIFF and TIFF extensions for the encoded image data, if it is known. Typically,
5 this would be used to assist the recipient in dispatching a suitable rendering package to handle the
6 display or processing of the image file.

7 **3.1 MIME content type type**

8 When transported by MIME, the TIFF content defined by this document **MUST** be encoded within an
9 'application/tiff' content type.

10 **3.2 MIME application parameter**

11 The two values of the image/tiff application parameter as defined for UIF are 'uifbw' and 'uifcolor'.

12 The "uifbw" application parameter is suitable for use by Senders that can process one or more UIF
13 profiles used for the encoding of black and white facsimile data.

14 The "uifcolor" application parameter is suitable for use by Senders that can process one or more UIF
15 profiles or subsets that can be used for the encoding of black and white, AND color facsimile data.

16 Since this document defines several UIF profiles, the following rules **MUST** be followed when setting
17 the application parameter value. Senders that use UIF Profiles S, F, or J, **MUST** set the value of the
18 application parameter to "uifbw". Senders which use UIF Profiles C, L, or M, **MUST** set the value of
19 the application parameter to "uifcolor".

20 An example of the use of the image/tiff MIME Content-type with the application parameter set with
21 the value 'uifbw' follows:

22 Content-type: image/tiff; application=uifbw

23 In this example, use of this parameter value will enable a Receiver to identify the content as being
24 within a profile or subset of UIF that is suitable for encoding black and white image data, before
25 attempting to process the image data.

26 In a similar respect, an example of the image/tiff MIME Content-type with the application parameter
27 setting suitable for handling a color subset or profile of TIFF for facsimile is shown below:

28 Content-type: image/tiff; application=uifcolor

29

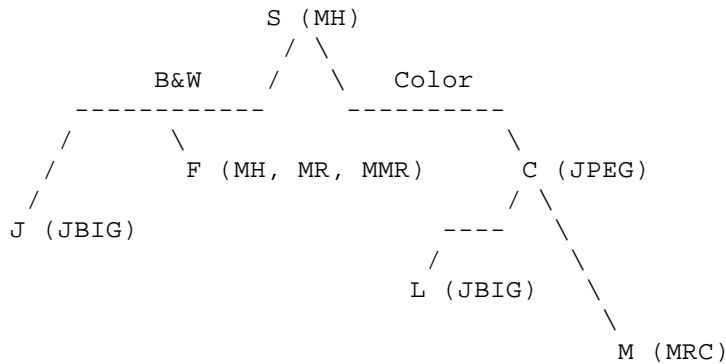
30 **4 TIFF-FX support**

31 A profile is based on a collection of ITU-T facsimile coding methods. The UIF profiles listed below
32 have been derived from TIFF-FX [4]. The reader is referred to this document for a complete
33 description of each profile, as the subsections below briefly summarize each profile and list only the
34 differences between the UIF version of the profile and TIFF-FX profile on which it is based.

35 A printer that supports UIF must support at least UIF Profile S.

4.1 UIF Profile Relationships

The following tree diagram, which is adapted from TIFF-FX[4] shows the relationship among UIF profiles and between UIF profiles and coding methods.



All implementations of UIF MUST implement UIF Profile S, which is the root node of the tree. All color implementations of UIF MUST implement UIF Profile C. The implementation of a particular profile MUST also implement those profiles on the path that connect it to the root node, and MAY optionally implement profiles not on the path connecting it to the root node. For example, an implementation of UIF Profile M must also implement UIF Profiles C and S, and may optionally implement UIF Profile F, J or L. For another example, an implementation of UIF Profile C must also implement UIF Profile S, and may optionally implement UIF Profile F or J.

4.2 UIF Profile S

UIF Profile S is modeled after Profile S of TIFF-FX[4], which describes the minimal black-and-white subset of TIFF for facsimile. UIF Profile S uses 1-dimensional Modified Huffman (MH) compression as defined in ITU-T T.4 [11] and MUST adopt the same requirements and restrictions for Baseline Fields, Extension Fields, byte order, bit order, and image file directory (IFD) placement as stated in Section 3 of TIFF-FX[4] with the exception of the following:

- 1) ImageWidth is not constrained
- 2) XResolution is not constrained, but 200, 300, and 600dpi MUST be supported
- 3) YResolution is not constrained, but 200, 300, and 600dpi MUST be supported

Note that 'XResolution' and 'YResolution' values refer to the resolutions that the Receiver is capable of processing, not necessarily the resolutions that the Receiver is physically capable of producing (e.g., printer engine delivery).

The following Baseline and Extension Fields and field values MUST be supported by all UIF implementations. For a complete description of the Baseline and Extension Fields shown below, see the TIFF-FX specification [4].

Table 1. UIF Profile S Baseline Fields

Baseline Fields	Values
-----------------	--------

BitsPerSample	1
Compression	3: 1D Modified Huffman coding set T4Options = 0 or 4
FillOrder	2: least significant bit first
ImageWidth	m: width of image in pixels
ImageLength	n: length of image in pixels (total number of scanlines)
NewSubFileType	2: Bit 1 identifies single page of a multi-page Document
PhotometricInterpretation	0: pixel value 1 means black
ResolutionUnit	2: inch
RowsPerStrip	number of scanlines per strip = ImageLength, with one strip
SamplesPerPixel	1
StripByteCounts	number of bytes in TIFF strip
StripOffsets	offset from beginning of file to single TIFF strip
XResolution	200, 300, 600, other resolutions are optional (written in pixels per inch)
YResolution	200, 300, 600, other resolutions are optional (written in pixels per inch)

1 **Table 2. UIF Profile S Extension Fields**

Extension Fields	Values
PageNumber	n,m: page number n followed by total page count m
T4Options	0: MH coding, EOLs not byte aligned 4: MH coding, EOLs byte aligned

2

3 **4.3 UIF Profile F**

4 This section defines UIF Profile F, which uses Modified Read and Modified Modified Read (MMR)
5 compression (described in ITU-T T.4 [11] and ITU-T T.6 [12]) in addition to the Modified Huffman
6 compression used for UIF Profile S. UIF Profile F is based on TIFF-FX Profile F. The table that
7 follows summarizes fields and field values that are REQUIRED / RECOMMENDED for UIF Profile
8 F. For a complete description of the Baseline, Extension, and New Fields shown below, see the TIFF-
9 FX specification [4]. A Device implementing this profile is REQUIRED to also implement UIF Profile
10 S.

11 Here are the differences between TIFF-FX Profile F and UIF Profile F. For UIF Profile F,

- 12 1) ImageWidth is not constrained
- 13 2) XResolution is not constrained, but 200, 300, and 600dpi MUST be supported
- 14 3) YResolution is not constrained, but 200, 300, and 600dpi MUST be supported
- 15 4) MMR coding (Compression=4) MUST be supported, while MH (Compression=3) is optional

5) The following TIFF-FX RECOMMENDED fields have been omitted: 'BadFaxLines', 'CleanFaxData', 'ConsecutiveBadFaxLines', 'ProfileType', and 'FaxProfile'

Recommended fields are shown with an asterisk *.

REQUIRED fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are REQUIRED of implementations; if the double asterisks are in the Values column, then only the values suffixed with a double asterisk are REQUIRED of implementations.

Optional fields have no asterisks in either the field name or the Values column, however, the Values field may contain a condition which REQUIRES the field.

Table 3. UIF Profile F Baseline Fields

Baseline Fields	Values
BitsPerSample	1**
Compression	3: 1D Modified Huffman and 2D Modified Read coding 4**: 2D Modified Modified Read coding
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType	2**: Bit 1 identifies single page of a multi-page Document
Orientation	1**-8, Default is 1
PhotometricInterpretation**	0: pixel value 1 means black 1: pixel value 1 means white
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel	1**
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	200**, 300**, 600**, other resolutions are optional (written in pixels per inch)
YResolution	200**, 300**, 600**, other resolutions are optional (written in pixels per inch)

Table 4. UIF Profile F Extension Fields

Extension Fields	Values
T4Options	0**: REQUIRED if Compression is Modified Huffman, EOLs are not byte aligned 1: REQUIRED if Compression is 2D Modified Read, EOLs are not byte aligned 4**: REQUIRED if Compression is Modified Huffman, EOLs are byte aligned 5: REQUIRED if Compression is 2D Modified Read, EOLs are byte aligned
T6Options	0: REQUIRED if Compression is 2D Modified Modified Read
DocumentName*	{ASCII}: name of UIF Document
PageNumber**	n,m: page number followed by total page count

1
2

Table 5. UIF Profile F New Fields

New Fields	Values
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file

3
4

4.4 UIF Profile J

5 This section defines Profile J for UIF, which uses lossless JBIG compression as it is defined in ITU-T
6 T.82 [16] subject to the application rules given in ITU-T T.85 [17]. UIF Profile J is based on TIFF-FX
7 Profile J. The following table summarizes fields and field values that are REQUIRED /
8 RECOMMENDED. For a complete description of the Baseline, Extension, and New Fields shown
9 below, see the TIFF-FX specification [4]. A Device implementing this profile is REQUIRED to also
10 implement UIF Profile S.

11 Here are the differences between TIFF-FX Profile J as defined in [4] and UIF Profile J. For UIF Profile
12 J,

- 13 1) ImageWidth is not constrained
- 14 2) XResolution is not constrained, but 200, 300, and 600dpi MUST be supported
- 15 3) YResolution is not constrained, but 200, 300, and 600dpi MUST be supported
- 16 4) The following TIFF-FX RECOMMENDED fields have been omitted: 'ProfileType' and
17 'FaxProfile'

18 Recommended fields are shown with an asterisk *.

19 REQUIRED fields or values are shown with a double asterisk **. If the double asterisk is on the field
20 name, then all the listed values are REQUIRED of implementations; if the double asterisks are in the
21 Values column, then the attribute and only the values suffixed with a double asterisk are REQUIRED
22 of implementations.

23 Optional fields have no asterisks in either the field name or the Values column, however, the Values
24 field may contain a condition which REQUIRES the field.

1

Table 6. UIF Profile J Baseline Fields

Baseline Fields	Values
BitsPerSample	1**
Compression	9** : JBIG coding
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page Document
Orientation	1**-8, Default is 1
PhotometricInterpretation**	0: pixel value 1 means black 1: pixel value 1 means white
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	200**, 300**, 600**, other resolutions are optional (written in pixels per inch)
YResolution	200**, 300**, 600**, other resolutions are optional (written in pixels per inch)

2

3

Table 7. UIF Profile J Extension Fields

Extension Fields	Values
DocumentName*	{ASCII}: name of UIF Document
PageNumber**	n,m: page number followed by total page count

4

5

Table 8. UIF Profile J New Fields

New Fields	Values
GlobalParametersIFD*	IFD: global parameters IFD
T82Options**	0: T.85 profile of T.82
CodingMethods*	n: compression algorithms used in file

6

1 **4.5 UIF Profile C**

2 This section defines Profile C for UIF, which uses lossy JPEG compression as it is defined in ITU-T
 3 T.81 [15]. UIF Profile C is based on TIFF-FX Profile C. The following table summarizes fields and
 4 field values that are REQUIRED / RECOMMENDED. For a complete description of the Baseline,
 5 Extension, and New Fields shown below, see the TIFF-FX specification [4]. A Device that implements
 6 this profile is REQUIRED to also implement UIF Profile S.

7 Here are the differences between TIFF-FX Profile C as defined in [4] and UIF Profile C. For UIF
 8 Profile C,

- 9 1) ImageWidth is not constrained
- 10 2) XResolution is not constrained, but 200 and 300dpi MUST be supported
- 11 3) YResolution is not constrained, but 200 and 300dpi MUST be supported
- 12 4) The following TIFF-FX RECOMMENDED fields have been omitted: 'ProfileType' and
 13 'FaxProfile'

14 Recommended fields are shown with an asterisk *.

15 REQUIRED fields or values are shown with a double asterisk **. If the double asterisk is on the field
 16 name, then all the listed values are REQUIRED of implementations; if the double asterisks are in the
 17 Values column, then only the values suffixed with a double asterisk are REQUIRED of
 18 implementations.

19 Optional fields have no asterisks in either the field name or the Values column, however, the Values
 20 field may contain a condition which REQUIRES the field.

21 **Table 9. UIF Profile C Baseline Fields**

Baseline Fields	Values
BitsPerSample	8**: 8 bits per color sample 12: optional 12 bits/sample
Compression**	7: JPEG
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page Document
Orientation	1**-8, Default is 1
PhotometricInterpretation	10**: ITULAB
ResolutionUnit**	2: inch 3: centimeter
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness)

	3: LAB
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	200**, 300** other resolutions are optional (written in pixels per inch)
YResolution	200**, 300** other resolutions are optional (written in pixels per inch)

1
2

Table 10. UIF Profile C Extension Fields

Extension Fields	Values
DocumentName*	{ASCII}: name of UIF Document
PageNumber**	n,m: page number followed by total page count
ChromaSubSampling	(1,1), (2, 2)** (1, 1): equal numbers of lightness and chroma samples horizontally and vertically (2, 2): twice as many lightness samples as chroma samples horizontally and vertically
ChromaPositioning	1**: centered

3
4

Table 11. UIF Profile C New Fields

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
VersionYear*	byte sequence: year of ITU std

5

6 **4.6 UIF Profile L**

7 This profile is modeled after TIFF-FX Profile L. It uses JBIG compression (see [16]), subject to the
8 application rules specified in ITU-T Recommendation T.43 [13] to losslessly code three types of color
9 and grayscale images: one bit per color CMY, CMYK and RGB images; a palettized (i.e. mapped)
10 color image; and continuous tone color and grayscale images.

11 Here are the differences between TIFF-FX Profile L as defined in [4] and UIF Profile L. For UIF
12 Profile L,

- 13 1) ImageWidth is not constrained
- 14 2) XResolution is not constrained, but 300dpi MUST be supported
- 15 3) YResolution must match XResolution, but it is not otherwise constrained; 300dpi MUST be
16 supported

4) The following TIFF-FX RECOMMENDED fields have been omitted: 'ProfileType' and 'FaxProfile'

The table that follows summarizes fields and field values that are REQUIRED / RECOMMENDED for implementation of UIF Profile L. For a complete description of the Baseline, Extension, and New Fields shown below, see the TIFF-FX specification [4]. A Device that chooses to implement this profile is REQUIRED to also implement UIF Profile S, and UIF Profile C.

Recommended fields are shown with an asterisk *.

REQUIRED fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are REQUIRED of implementations; if the double asterisks are in the Values column, then only the values suffixed with a double asterisk are REQUIRED of implementations.

Optional fields have no asterisks in either the field name or the Values column, however, the Values field may contain a condition which REQUIRES the field.

Table 12. UIF Profile L Baseline Fields

Baseline Fields	Values
BitsPerSample	1: Binary RGB, CMY(K) 8**: 8 bits per color sample 9-16: optional
Compression**	10**: JBIG, per T.43
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	2: Bit 1 identifies single page of a multi-page Document
Orientation	1**-8, Default is 1
PhotometricInterpretation	2: RGB 5: CMYK 10**: ITULAB
ResolutionUnit**	2: inch
RowsPerStrip**	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness) 3: LAB, RGB, CMY 4: CMYK
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	200**, 300** other resolutions are optional (written in

	pixels per inch)
YResolution	equal to XResolution (pixels MUST be square)

Table 13. UIF Profile L Extension Fields

Extension Fields	Values
DocumentName*	{ASCII}: name of UIF Document
PageNumber**	n,m: page number followed by total page count
Indexed	0: not a palette-color image 1: palette-color image

Table 14. UIF Profile L New Fields

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
VersionYear*	byte sequence: year of ITU std

4.7 UIF Profile M

This profile is modeled after TIFF-FX Profile M, which uses Mixed Raster Content (MRC), defined in ITU-T Recommendation T.44 [14]. MRC enables different coding methods and resolutions within a single page. For a more detailed description of MRC and the Baseline, Extension, and New Fields shown below, see [4] and [14].

Here are the differences between TIFF-FX Profile M as defined in [4] and UIF Profile M. For UIF Profile M,

- 1) ImageWidth is not constrained
- 2) XResolution is not constrained, but 200 and 300dpi MUST be supported for the bi-level mask, foreground, and background layers.
- 3) YResolution must match XResolution, but it is not otherwise constrained; 200 and 300 dpi MUST be supported for the bi-level mask, foreground, and background layers.
- 4) The following TIFF-FX RECOMMENDED fields have been omitted: 'ProfileType' and 'FaxProfile'

The table that follows summarizes fields and field values that are REQUIRED / RECOMMENDED for implementation of UIF Profile M.. A device that chooses to implement this profile is REQUIRED to also implement UIF Profile S, and UIF Profile C.

Recommended fields are shown with an asterisk *.

REQUIRED fields or values are shown with a double asterisk **. If the double asterisk is on the field name, then all the listed values are REQUIRED of implementations; if the double asterisks are in the

1 Values column, then only the values suffixed with a double asterisk are REQUIRED of
 2 implementations.
 3 Optional fields have no asterisks in either the field name or the Values column, however, the Values
 4 field may contain a condition which REQUIRES the field.

5
6

Table 15. UIF Profile M Baseline Fields

Baseline Fields	Values
BitsPerSample	1**: binary mask, RGB, CMY(K) 2-8**: bits per color sample 9-16: optional 12 bits/sample
Compression**	1: None (ImageBaseColor IFD only) 3**: Modified Huffman and Modified Read 4: Modified Modified Read 7**: JPEG 9: JBIG, per [16] 10: JBIG, per [13]
DateTime*	{ASCII}: date/time in 24-hour format "YYYY:MM:DD HH:MM:SS"
FillOrder**	1: most significant bit first 2: least significant bit first
ImageDescription*	{ASCII}: A string describing the contents of the image
ImageWidth**	n: width of image in pixels
ImageLength**	n: length of image in pixels (total number of scanlines)
NewSubFileType**	16, 18: Bit 1 indicates single page of a multi-page Document on Primary IFD Bit 4 indicates MRC model
Orientation	1**-8, Default is 1
PhotometricInterpretation	0**: WhiteIsZero (Mask Layer) 2: RGB 5: CMYK 10**: ITULAB
ResolutionUnit**	2: inch
RowsPerStrip	n: number of scanlines per TIFF strip
SamplesPerPixel**	1**: L* (lightness) 3: LAB, RGB, CMY 4: CMYK
Software*	{ASCII}: name & release number of creator software
StripByteCounts**	n: number of bytes in TIFF strip
StripOffsets**	n: offset from beginning of file to each TIFF strip
XResolution	300**: background & foreground layers; 600**: binary mask layer;

	other resolutions are optional
YResolution	300**: background & foreground layers; 600**: binary mask layer; other resolutions are optional; must be equal to XResolution (pixels MUST be square)

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Table 16. UIF Profile M Extension Fields

Extension Fields	Values
T4Options	0**: REQUIRED if Compression is Modified Huffman, EOLs not byte aligned 1: REQUIRED if Compression 2D Modified Read, EOLs are not byte aligned 4**: REQUIRED if Compression Modified Huffman, EOLs byte aligned 5: REQUIRED if Compression 2D Modified Read, EOLs are byte aligned
T6Options	0: REQUIRED if Compression is 2D Modified Modified Read
DocumentName*	{ASCII}: name of scanned Document
PageNumber**	n,m: page number followed by total page count
ChromaSubSampling	(1,1), (2, 2)** (1, 1): equal numbers of lightness and chroma samples horizontally & vertically (2, 2): twice as many lightness samples as chroma horizontally and vertically
ChromaPositioning	1: centered
Indexed	0: not a palette-color image 1: palette-color image
SubIFDs	<IFD>: byte offset to FG/BG IFDs
XPosition	horizontal offset in primary IFD resolution units
YPosition	vertical offset in primary IFD resolution units

3
4

Table 17. UIF Profile M New Fields

New Fields	Values
Decode**	minL, maxL, mina, maxa, minb, maxb: minimum and maximum values for L*a*b*
ImageBaseColor	a,b,c: background color in ITULAB
StripRowCounts	n: number of scanlines in each strip
ImageLayer	n, m: layer number, imaging sequence (e.g., strip number)
T82Options	0: T.85 profile of T.82 coding
GlobalParametersIFD*	IFD: global parameters IFD
CodingMethods*	n: compression algorithms used in file
ModeNumber*	n: version of T.44 standard

1 **5 Capabilities communication**

2 A Sender needs to discover what a potential UIF-compatible Receiver supports in terms of resolution,
 3 encoding, drawing surface etc. To do this, a UIF Sender **MUST** use a protocol-specific means of
 4 communication to determine a Receiver capabilities string using CONNEG [5], the UIF profiles
 5 supported, the media that is supported, and the media that is not only supported but ready. The latter
 6 three parameters are excluded from the Receiver capabilities string so that a full Sender-side
 7 implementation of CONNEG is unnecessary if a UIF Sender decides to support only the minimum
 8 capabilities for a given profile (see section Section 5.1.2).

9 **5.1 Receiver capabilities string**

10 A valid Receiver capabilities string **MUST** be any well-formed CONNEG string obeying the syntax of
 11 RFC2879 [5]. A UIF Sender **MAY** request the Receiver capabilities string. A UIF Receiver **MUST**
 12 return a Receiver capabilities string if a Sender requests it.

13 This string is not expected to be more than 32Kb in length. The capabilities announced by the Receiver
 14 **SHOULD** indicate those things that it can do without operator intervention. For example if the
 15 Receiver is a Device that has a manually interchangeable print cartridge with only the black cartridge
 16 loaded, it **SHOULD** only indicate support for “color=binary”. The method of transport is protocol-
 17 dependent and beyond the scope of this document.

18 **5.1.1 New CONNEG Tags**

19 Section 3.7 of CONNEG[5] describes the feature tag names that have to do with image coding. The
 20 “image-file-structure” CONNEG tag describes how the coded image data is wrapped and formatted. In
 21 addition to the legal values for the “image-file-structure” tag presented in CONNEG[5], UIF formatted
 22 data **MAY** also use “tiff-limited-uif”. The “tiff-limited-uif” tag **MUST** be interpreted as “tiff-limited”,
 23 except the requirement for one TIFF strip per page is relaxed.

24 **5.1.2 Minimum Receiver capabilities**

25 Requiring a minimum set of Receiver capabilities on a profile-specific basis is useful because it
 26 guarantees a baseline level of compatability between a Sender and a Receiver.

27 The CONNEG expressions listed in the following subsections summarize the minimum set of
 28 capabilities that a Receiver **MUST** support before advertising support for a given profile. See the
 29 CONNEG specification [5] for a complete description of the feature tags tokens.

30 **5.1.2.1 Minimum capabilities for UIF Profile S**

```
31   (& (image-file-structure=TIFF-minimal)
32    (image-coding=MH)
33    (color=Binary)
34    (dpi=[200,300,600])
35    (dpi-xyratio=1)
36    (MRC-mode=0) )
```

1 **5.1.2.2 Minimum capabilities for UIF Profile F**

```
2 ( | (& (image-file-structure=TIFF-minimal)
3     (image-coding=MH)
4     (color=Binary)
5     (dpi=[200,300,600])
6     (dpi-xyratio=1)
7     (MRC-mode=0) )
8     (& (image-file-structure=TIFF-limited-uf)
9     (image-coding=MMR)
10    (color=Binary)
11    (dpi=[200,300,600])
12    (dpi-xyratio=1)
13    (MRC-mode=0) ) )
```

14 **5.1.2.3 Minimum capabilities for UIF Profile J**

```
15 ( | (& (image-file-structure=TIFF-minimal)
16     (image-coding=MH)
17     (color=Binary)
18     (dpi=[200,300,600])
19     (dpi-xyratio=1)
20     (MRC-mode=0) )
21     (& (image-file-structure=TIFF-limited-uf)
22     (image-coding=JBIG)
23     (image-coding-constraint=JBIG-T85)
24     (color=Binary)
25     (JBIG-stripe-size=128)
26     (dpi=[200,300,600])
27     (dpi-xyratio=1)
28     (MRC-mode=0) ) )
```

29 **5.1.2.4 Minimum capabilities for UIF Profile C**

```
30 ( | (& (image-file-structure=TIFF-minimal)
31     (image-coding=MH)
32     (color=Binary)
33     (dpi=[200,300,600])
34     (dpi-xyratio=1)
35     (MRC-mode=0) )
36     (& (image-file-structure=TIFF-limited-uf)
37     (color=full)
38     (image-coding=JPEG)
39     (image-coding-constraint=JPEG-T4E)
40     (color-subsampling="4:1:1")
41     (color-levels<=16777216)
42     (color-space=CIELAB)
43     (color-illuminant=D50)
44     (CIELAB-L-min>=0)
45     (CIELAB-L-max<=100)
46     (CIELAB-a-min>=-85)
47     (CIELAB-a-max<=85)
48     (CIELAB-b-min>=-75)
49     (CIELAB-b-max<=125)
50     (dpi=[200,300])
51     (dpi-xyratio=1)
52     (MRC-mode=0) )
```

1 **5.1.2.5 Minimum capabilities for UIF Profile L**

```
2 (| (& (image-file-structure=TIFF-minimal)
3     (color=Binary)
4     (image-coding=MH)
5     (dpi=[200,300,600])
6     (dpi-xyratio=1)
7     (MRC-mode=0) )
8 (& (image-file-structure=TIFF-limited-uf)
9     (& (color=grey)
10        (| (& (image-coding=JPEG)
11            (image-coding-constraint=JPEG-T4E) )
12            (& (image-coding=JBIG)
13                (image-coding-constraint=JBIG-T43)
14                (JBIG-stripe-size=128)
15                (image-interleave=stripe) ) )
16        (color-space=CIELAB)
17        (color-levels<=256)
18        (color-illuminant=D50)
19        (CIELAB-L-min>=0)
20        (CIELAB-L-max<=100)
21        (dpi=[200,300]) (dpi-xyratio=1) )
22    (MRC-mode=0) ) )
```

23 **5.1.2.6 Minimum capabilities for UIF Profile M**

```
24 (| (& (image-file-structure=TIFF-minimal)
25     (color=Binary)
26     (image-coding=MH)
27     (MRC-mode=0)
28     (dpi=[200,300,600])
29     (dpi-xyratio=1) )
30 (& (image-file-structure=TIFF-limited-uf)
31     (color=full)
32     (image-coding=JPEG)
33     (image-coding-constraint=JPEG-T4E)
34     (color-subsampling="4:1:1")
35     (color-levels<=16777216)
36     (color-space=CIELAB)
37     (color-illuminant=D50)
38     (CIELAB-L-min>=0)
39     (CIELAB-L-max<=100)
40     (CIELAB-a-min>=-85)
41     (CIELAB-a-max<=85)
42     (CIELAB-b-min>=-75)
43     (CIELAB-b-max<=125)
44     (dpi=[200,300]) (dpi-xyratio=1)
45     (MRC-mode=0)
46     (& (image-file-structure=TIFF-MRC-limited)
47         (MRC-mode=1)
48         (MRC-max-stripe-size<=256) ) ) )
```

49 **5.2 UIF profiles supported**

50 A UIF Sender MUST query the potential UIF Receiver for the UIF profiles supported by the Receiver.
51 A UIF Receiver MUST respond with the UIF profiles that it supports. Possible values MUST be
52 among the UIF profiles described in this document, namely, UIF Profile S, F, J, C, L, and M. The

1 Sender MUST interpret a missing or otherwise invalid response as an indication that the Receiver does
2 not support UIF. The method of transport and the actual data values used to indicate supported UIF
3 profiles are protocol-specific and beyond the scope of this document.

4 **5.3 Media supported**

5 A UIF Sender MUST query the potential UIF Receiver for media supported. A UIF Receiver MUST
6 respond with the media supported by the Receiver (e.g., letter, legal, A4, etc.). The method of
7 transport, the valid range of media, and the actual data values used to indicate supported media are
8 protocol-specific and beyond the scope of this document; however, the Sender MUST be able to infer
9 actual dimensions from the media values used.

10 **5.4 Media ready**

11 A UIF Sender MUST query the potential UIF Receiver for media ready. A UIF Receiver MUST
12 respond with the subset of media supported that is ready to print with no user intervention. The method
13 of transport, the valid range of media, and the actual data values used to indicate ready media are
14 protocol-specific and beyond the scope of this document; however, the Sender MUST be able to infer
15 actual dimensions from the media values used.

16 **5.5 Image reduction supported**

17 A UIF Sender MAY query the potential UIF Receiver to determine whether or not image reduction is
18 supported. A Receiver MUST be capable of indicating whether or not it supports image reduction. The
19 method by which this query occurs is protocol-specific and beyond the scope of this document.

20

21

22 **6 Sender requirements**

23 **6.1 Image-Reduction**

24 It is possible that a Sender might send an image that does not match the announced drawing surface of
25 the Receiver (for example a Sender may have an image that it cannot change). In this case the Sender
26 MAY indicate to the Receiver in a protocol-specific manner whether or not the RECEIVER is to
27 reduce the image.

28 If the Receiver does not support image reduction (see section 5.5) and the received image dimensions
29 are larger than what is allowed by the supported media, then the Receiver MUST flow extra data to the
30 next page. If the Receiver does support image reduction, then the Sender MAY request in a protocol-
31 specific manner that the Receiver use image-reduction if necessary. If the Receiver receives such a
32 request, and the received image dimensions are larger than what is allowed by the supported media,
33 then the Receiver MUST reduce the image so as to fit it to the page while maintaining the aspect ratio.
34 If the Receiver uses image reduction, the Receiver must determine if reduction is necessary for each
35 page and if so, apply reduction. The scaling is calculated separately for each page. The scaling applies
36 to all pages of the job unless the protocol used by the Sender and Receiver supports a means of

1 specifying image reduction on a page-by-page basis (e.g., IPPFAX's potential use of page level
2 overrides[6]).

3 **6.2 Intra-job media selection**

4 When the image dimensions are different on a page-by-page basis such that use of a single type of
5 media is not possible without scaling, the Sender / Receiver protocol MUST arbitrate media selection.
6 The ImageWidth and ImageLength TIFF tags MUST NOT select the media.

7 **7 Conformance Requirements**

8 For the listed operations, Table 18 below shows conformance requirements that apply to the protocol
9 used to transport UIF data.

10 **Table 18. Underlying Protocol Conformance.**

Operation	UIF-capable Sender	UIF-capable Receiver	Section
Receiver capabilities string	MAY	MUST	5.1.1
UIF profiles supported	MUST	MUST	5.1.2
Media supported	MUST	MUST	5.1.3
Media ready	MUST	MUST	5.1.4
Image reduction supported	MAY	MUST	5.1.5

11 **8 References**

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- 14 [2] Herriot, Butler, Moore, Turner, Wenn. "Internet Printing Protocol/1.1: Encoding and
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- 18 [4] McIntyre, Zilles, Buckley, Venable, Parsons, Rafferty "File Format for Internet Fax",
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- 20 [5] Klyne, McIntyre. "Content Feature Schema for Internet Fax (V2)", RFC2879.
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- 26 [8] Moore, P., "IPP Fax transport requirements", October 16, 2000,
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- 28 [9] Masinter, "Terminology and Goals for Internet Fax", RFC2542
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- 3 [12] ITU-T Recommendation T.6, Facsimile coding schemes and coding control functions for group
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- 5 [13] ITU-T Recommendation T.43, Colour and gray-scale image representations using lossless
6 coding scheme for facsimile, February 1997
- 7 [14] ITU-T Recommendation T.44, Mixed Raster Content (MRC), April 1999.
- 8 [15] ITU-T Recommendation T.81, Information technology - Digital compression and coding of
9 continuous-tone still images - Requirements and guidelines, September 1992
- 10 [16] ITU-T Recommendation T.82, Information technology - Coded representation of picture and
11 audio information - Progressive bi-level image compression, March 1995
- 12 [17] ITU-T Recommendation T.85, Application profile for Recommendation T.82 - Progressive bi-
13 level image compression (JBIG coding scheme) for facsimile apparatus, August 1995
- 14 [18] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119,
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17 <ftp://ftp.adobe.com/pub/adobe/devrelations/devtechnotes/pdffiles/tiff6.pdf>
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- 20 [20] Adobe PageMaker 6.0 TIFF Technical Notes, Sept. 14, 1995,
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- 22 [21] Draft TIFF Technical Note 2, Replacement TIFF/JPEG specification, March 17, 1995,
23 <ftp://ftp.uu.net/graphics/jpeg/>
- 24 [22] Parsons, G., Rafferty J. and S. Zilles, "Tag Image File Format (TIFF) - image/tiff MIME Sub-
25 type Registration", work in progress, draft-ietf-fax-tiff-regbis-01.txt, May 2000.
- 26 Note: [22] is being progressed as BCP and is expected to be issued prior to the issuing of TIFF-
27 FX as a Draft Standard.Issues

28 **9 Issues**

29 **9.1 Outstanding Issues**

30

- 31 1. Should the MIME types "image/tiff; application=uif" and "image/tiff; application=uifcolor" be
32 changed to the following?

33 image/tiff; application=uif-s
34 image/tiff; application=uif-f
35 image/tiff; application=uif-j
36 image/tiff; application=uif-c
37 image/tiff; application=uif-l
38 image/tiff; application=uif-m

9.2 Resolved Issues

1. Add description of new CONNEG tag used to indicate capabilities that are available *with* user intervention? We're going to use media ready.
2. What should be done concerning media selection when the TIFF image sizes are different on a page by page basis? Either determine media size by media size attribute or let the Receiver determine for itself the media to be used on each page

At the May 30 telecon, We agreed that for now, the TIFF "ImageWidth" and "ImageLength" tags do NOT select the media, but that the IPPFAX "media" Job Template attribute does. This decision works fine for documents where the image size is the same for all pages in the document. For documents that have differing image sizes within the same document, we'll wait for a future requirement/extension to see whether to add another Job Template attribute so that the Sender can request that the TIFF image tags be used to select media (or not). We also agreed NOT to bring in the IPP "page-overrides" attribute to allow the protocol to select media on a page by page basis (though an IPP Printer implementation might support such a thing). Incorporate this information into the IPPFAX spec.

3. Should the IPP attribute descriptions be moved to the IFX spec so that UIF can be made independent of the IPPFAX protocol in case other protocols would like to use it? Yes. Definitions of IPP attributes have been removed from the UIF spec, and requirements have been restated in a non protocol-specific manner.

Now the IPPFAX document will include two levels of conformance: 'uif-only' and 'authenticated'. The level being used needs to be reflected in a Printer Description attribute. Make the appropriate changes to the IFX document.

4. Change "uif-scale" attribute name to "uif-reduce"? Yes. The IFX spec should be changed to reflect this. The UIF spec has been changed using more generic terminology to reflect this.
5. Rename "uif-conneg" IPP attribute to "uif-receiver-capabilities"? Yes. The IFX spec should be changed to reflect this. The UIF spec has been changed using more generic terminology to reflect this.
6. Should additional resolutions be made mandatory? Yes. X & Y Resolution values of 200 & 300 (in addition to 600dpi) are now also REQUIRED for UIF Profiles S, F, and J. X & Y Resolution values of 200dpi (in addition to 300 dpi) are now REQUIRED for UIF Profiles C and L. For UIF Profile M, REQUIRED binary, foreground, and background X & Y resolutions have been changed to include only 200 and 300 dpi.
7. Should we change the minimum required compression for Profile F from MH to MMR? Yes, this has been done to reflect industry practice. The minimum CONNEG expressions have been changed to reflect this.
8. Should we change the minimum required color space for Profile C from grayscale to color? Yes, this has been done to reflect industry practice. The minimum CONNEG expressions have been changed to reflect this.
9. The term "default conneg" is a different meaning for "default", than used in IPP. In IPP, "default" means what the Printer does if the Sender doesn't supply some attribute. The "default

1 conneg” is what the implementation MUST support for a given profile if the implementer
2 doesn’t choose do to more.

3 Resolution: the spec has been changed so “Minimum” is used instead of “default”.

5 **10 Actions**

- 6 1. Teleconference scheduled on June 27, 2001 for 10:00am – 12:00pm (Pacific Time) to review
7 updated spec.

8 Next meeting: Toronto. Wednesday, August 1, 2001.

11 **11 Revision History (to be removed when standard is approved)**

Revision	Date	Author	Notes
1	1/16/01	Paul Moore, Netreon	Initial version
2	1/28/01	Gail Songer, Netreon	Added formal definition of new attributes
3	4/11/01	John Pulera, Minolta	Added UIF-specific Profile U and described UIF support for other TIFF-FX profiles
4	5/07/01	John Pulera, Minolta	Modifications made at Portland meeting.
5	6/14/01	John Pulera, Minolta	Added description of UIF profiles and minimal capabilities strings; generalized document so there is no dependence on IPP.

13