Implementation Guidelines
for
Home Printing with Mobile Terminals

Version 1.0

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1.   Abstract

Image capable mobile devices, home photo printers, and options for connecting them are proliferating in the marketplace. As they do so, the importance of interoperability and simplicity to consumers is also rapidly increasing. Recognizing this situation, the Mobile Imaging and Printing Consortium (MIPC) was founded to align industry leaders on mobile imaging and home printing solutions that ensure a good end user experience through interoperability and ease of use.

MIPC defines a class of mobile imaging devices called mobile terminals. A mobile terminal is a handheld mobile device that has imaging capability and long distance wireless connectivity. The term includes: mobile camera phones, mobile phones that can receive images, PDAs with phone functionality. The term excludes: laptop computers, PDAs without long distance wireless connectivity, mobile phones that can not capture or receive images.

The MIPC approach to interoperability is to make specific usage recommendations for existing standards and practices. One of the obstacles to interoperability today is that there are too many printing choices. Instead of broadening the field by creating new standards, MIPC will narrow the choices by developing guidelines with specific recommendations for enhancing interoperability based on a small number of pre-existing standards and practices. This document, *Implementation Guidelines for Home Printing with Mobile Terminals* (hereinafter referred to as the Guidelines), contains recommendations that cover a small but important set of mobile terminal printing use cases in a single use model. The use model is simple direct printing from a mobile terminal to a home printer.

MIPC restricts its recommendations to standards with an Intellectual Property Rights (IPR) policy of Reasonable and Nondiscriminatory (RAND) or less restrictive. Also, there must be adequate public information about the standard and its functionality for developers to evaluate its capabilities and usefulness without having to license the technology. There may, however, be a fee or license requirement for accessing the specification.

MIPC does not have a logo program, conformance criteria, or compliance testing. Plugfests will, however, be arranged by MIPC to allow companies to meet to test their devices and services. The testing is at the responsibility of the individual companies. Unannounced products can be tested confidentially under an MIPC non-disclosure agreement that must be signed by all participants.

When followed, the recommendations found in the Guidelines should provide good user experiences by helping the manufacturers to design their devices and services with a high level of interoperability. This includes recommendations to ensure consistent and predictable printed output independent of the device vendor and model.

The Guidelines start with a description of the Use Model, followed by covered Use Cases. For each Use Case, the user operations are mapped to the technical features needed on a mobile terminal and/or printer to support the user. Mappings are provided for each of three connection methods—Bluetooth®, USB and memory cards. Following that are the Guidelines' assumptions about device capabilities. Then, for each connection method the recommendations are given for physical support, print protocol and, finally, implementation and invocation of specific features.

After these Guidelines are published, MIPC will continue to evaluate market conditions and user needs for recommendations on additional Use Models, Use Cases and connection methods.

2.   Document Scope and Structure

2.1. Scope

The Guidelines contain a set of recommendations that are intended to help developers satisfy the most common printing needs of mobile terminal users.

1. Mobile terminal users have text and images they would like to print. These text and image objects may come from a variety of sources, but Version 1.0 of the Guidelines will restrict recommendations to the printing of objects that the printer receives directly from the terminal at the time of printing.
2. In the ideal world for end users, there would be only one connection method and one print protocol. That would maximize interoperability with no special considerations on the user's part or even on the part of the mobile terminal and printer developers.
   a. However, for marketplace realities today and in the near future, no single connection method will be supported by all mobile terminals and printers. Version 1.0 of the Guidelines covers three connection methods: Bluetooth, USB and memory card transfer.
   b. Further realities today are that no single print protocol works with all three connection methods. Therefore the recommendations in the Guidelines will use a different print protocol for each connection method. Specifically, these will be the Basic Printing Profile (BPP) on Bluetooth, PictBridge™ on USB, and DPOF on memory cards.
   c. Finally, each of these print protocols uses a different print language. For BPP, the Guidelines use the BPP-required language, XHTML-Print. For both PictBridge and DPOF, the print language is unique and built into the protocol.

There are features in each referenced specification that are not needed to satisfy the MIPC use cases. Therefore, the recommendations in the Guidelines do not cover the complete feature set of the referenced specifications. There are optional features in each specification that are recommended herein. Such recommended optional features will, of course, be implemented by developers following the Guidelines. There also are optional features that are not mentioned herein. Implementation decisions on these unmentioned optional features are completely up to the individual developers. Finally, there are required features in some specifications that are not mentioned in the Guidelines. They are not mentioned for one of two reasons. Either they are not needed for MIPC use cases, or there is an alternative that is much more likely to be implemented in a consistent and interoperable manner across vendors. MIPC is *not* recommending limited implementations.

This document is written for two primary sets of readers—developers of MIPC recommended print services and developers of mobile terminal print applications that will be clients for these services. For both groups there are references to relevant specifications, supporting documentation and implementation recommendations for enhancing consistency and robustness while avoiding potential pitfalls.

2.2. Structure

2.2.1.   Organizing Principles

All of the recommendations in the Guidelines derive from a set of use cases—common user print tasks—designed for a single use model. The use model and cases are described in Section 4.

Support for these use cases requires developers of mobile terminals and printers to implement a certain set of features on their respective devices. The detailed implementation recommendations are organized by features.

The Guidelines are structured around the following concepts:

- Local data use model

    – Users will be printing to a home printer.

    – All information necessary to complete the print job either pre-exists on the printer or is supplied by the mobile terminal at print time.

    – A small number of typical use cases covers the major printing needs of most mobile terminal users.

    – The capabilities necessary to satisfy the use cases generate requirements that are mapped to a set of device features, which in turn are described from the developer's point of view.

- Feature based recommendations

    – Sections 6 through 9 elaborate the MIPC recommendations for supporting the features derived from the use cases across the MIPC connection methods.

2.2.2.   Topics Covered

Different connection methods are covered in differing levels of detail, according the needs of the developer and the availability of other relevant documents. The Guidelines provide reference pointers to the specifications that underlie the recommendations and other documents deemed useful to developers. The Guidelines also:

- Include clarifications where specifications are sometimes difficult to read.
- Note optional features of specifications that must be implemented to support the Guidelines.
- Recommend restrictions on specification features to promote consistency and interoperability.

For Bluetooth/BPP application developers, the important characteristics of XHTML and Cascading Style Sheets used by XHTML-Print are described. The sample XHTML-Print documents given demonstrate the MIPC recommended way of creating printed output for the user for each of the Use Cases described in section 4.2. For printer developers, the expected behavior of, and output from, a printer is described when it processes the sample documents included herein. The Guidelines are not intended to and do not provide an exhaustive description of XHTML-Print.

There are brief sections covering the widely used USB/PictBridge and memory card/DPOF combinations. Due to disclosure restrictions of PictBridge and DPOF, limited information can be publicly revealed within the Guidelines.

Topics Not Covered

No attempt is made to give full coverage of any of the referenced specifications.

Specification features that are not needed to support MIPC use cases are not covered.

2.3. How to Read the Guidelines

1. Read the <u>Use Cases</u>. They define the print capabilities that MIPC would like to provide to all users of mobile terminals.
2. Look at the features required for each use case and their implementation recommendations.

    –   Mobile terminal application developers should look for implementation techniques and for things to avoid because they might cause problems or inconsistencies.

    –   Printer developers should look for features that are necessary to fulfill MIPC recommendations that may be declared as *optional* in the underlying specification.

2.4. Future Directions

MIPC has three objectives for future work:

1. To broaden the coverage of mobile terminal printing by adding new connection methods and adding new Use Models and Use Cases.
2. To unify print languages and minimize the number of print protocols used on the different connection methods. This would reduce the number of device options required of mobile terminal and printer vendors. It would also reduce the number of interface options for end users.
3. To manage the simplifications of objective 2 in the context of the broadened coverage of objective 1 by working with standards bodies to help enable this long-term vision of MIPC.

3.   Major Terminology and Conventions Used in This Document

3.1. Terminology

Term	Definition
adornment{ XE "adornment" }	An addition to an object for the purpose of beautification or added information. Specifically, a secondary image, graphic or text superimposed on a primary image to enhance its appearance. Adornments{ XE "adornment" } do not involve image editing, only simple image overlays{ XE "overlay:image" }. Adornment operations covered in the Guidelines are performed on the printer using directions from the print client.
annotation	Text associated with an image. The most common annotations are date and time of image capture, image caption, and image file name.
border	White space between the edge of an image and the edge of the paper when an image is printed slightly smaller than the page size.
borderless	Refers to an image that completely fills the printed page. There is no unfilled space left on any side between the image and the edge of the page.
connection method	Physical method used by mobile terminal to connect to the printer. For this document, it is one of Bluetooth wireless technology, USB cable, or memory card transfer (card removed from mobile terminal and inserted in printer).
the Guidelines	This document: *Implementation Guidelines for Home Printing with Mobile Terminals*
home printer	A personal printer used in the home. Home printers loosely include those models that are targeted at consumers and loosely exclude those models targeted exclusively at commercial users. A multi-function or all-in-one device with print capability is considered a home printer if it meets the other criteria in this definition.
image fit or crop	Refers to different methods of rendering a source image on the printed page when the aspect ratios of print region and the source image differ. In either case, the image is scaled to the proper size while preserving its horizontal and vertical proportions. 'Fit', also short for 'fit-whole', scales the image so that no portion of the image is lost, but the print region is not quite filled. 'Crop', also short for 'fit-and-crop', scales the image so that the print region is completely filled, which necessitates cropping or removing some portion of the image on one or two edges. A more complete description of the meaning and the printed results may be found in section 9.10.2.
mobile terminal	A handheld mobile device that has imaging capability and long distance wireless connectivity. The term includes: mobile camera phones, mobile phones that can receive images; PDAs with phone functionality. The term excludes: laptop computers, PDAs without long distance wireless connectivity, mobile phones that can neither capture nor receive images.

Term	Definition
page description language, PDL	A print language that is capable of providing a complete description of printed information for a multi-page document. This description is self-contained; can exist in a standalone file, document or data stream; and can typically be used with many different print protocols. Examples of PDLs include XHTML-Print and PostScript.
plugfest	Organized gathering of vendors for the purpose of device interoperability testing. Vendors may bring both released and unreleased products. Most plugfests schedule time slots for one-to-one interoperability tests. Depending on the nature of the devices and tested interfaces, some plugfests may also schedule time slots for many-to-one, one-to-many and many-to-many tests.
print client	Any device that submits a print job to a printer.
print protocol	Standardized or proprietary set of messages exchanged between a print client and a printer to submit and manage a print job. In some environments this is also called a print profile or a print service description.
print language	Any standardized or proprietary data sequence that describes what should be marked on paper for a print job. All PDLs are print languages. Other examples of print languages include the embedded combination of commands and data found in PictBridge communications and the DPOF AUTPRINT.MRK file.
service provider, SP	Vendor that provides the long-distance wireless connection service used by the mobile terminal.
user	The term 'user' in this document refers to the end user who operates the mobile terminal, the printer, or both.

3.2. Conventions

Primary text is set in Times New Roman.

XHTML source for print documents and print document excerpts is set in Arial.

This document contains both internal and external hyperlinks. The displayed text for all external hyperlinks always appears formatted as a URI. Thus, it will be obvious before clicking on a link whether that will jump to an external reference or merely to another location within this document.

Hyperlinks in [brackets] always represent an external document that is listed in the References section. Clicking that link jumps to the document's citation in the References section.

4.   Use Cases

4.1. Use Model

Version 1.0 of the Guidelines is based on a local data, two-device model for printing. This means that the mobile terminal specifies print content and the printer prints as directed by the mobile terminal. The mobile terminal cannot expect the printer to have access to any other information source, including but not limited to a second mobile terminal, a PC, a local area network, or the Internet. Similarly, the printer cannot expect the mobile terminal to provide any data other than what the terminal explicitly makes available. It is irrelevant to the printer whether the mobile terminal is connected to a service provider (SP), the SP's network services, a second mobile terminal, a PC, a local area network, or the Internet.

This local data, two-device model is illustrated in Figure 4-1.

Print Data Transfer
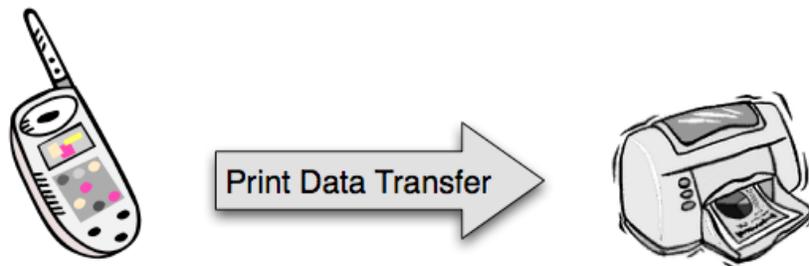
Figure 4-1 MIPC Local Data, Two Device Use Model Diagram

Printable objects for Version 1.0 of the Guidelines include
- Images — JPEG format only
- Image adornment overlays — PNG format only
- Emails — self-generated or received
- Messages — text or multi-media with photos
- Personal information manager (PIM) data

These objects may originate from any source, so long as they are directly made available to the printer from the mobile terminal. Possible sources include, but are not limited to:
- Self-captured photos
- Locally entered text
- Images or text preloaded on the mobile terminal
- Any communication exchange with another mobile terminal
- Synchronization with or download from a PC, SP server, web server or other external device
- Email system
- Messaging system

Alternatives to this local data Use Model are under consideration by MIPC for future guidelines.

4.2. Use Cases

The following use cases represent typical home printing scenarios for users of mobile terminals.

Each use case is described first in terms of user behavior through a representative User Scenario. This general description is then elaborated in a detailed sequence of user action steps. The latter form corresponds more closely to implementation features. The action steps are provided in table form. The tables have a column for each print protocol—labeled BPP for Basic Printing Profile, PBR for PictBridge, DPOF for DPOF—with links to the MIPC implementation recommendations for that user action. The print protocol entry for each step is a link to the section in the Guidelines where recommendations for implementation of that step are found. In some cases, MIPC provides no specific recommendations beyond the underlying specification. For those, the column entry contains a direct reference to the specification. Finally, for those steps that cannot be implemented using a particular print protocol, the column contains 'na', meaning "not available".

Reading the Use Case action step tables

There is flexibility in the ordering of some steps at the discretion of the mobile terminal developer based on device- or vendor-specific user interface features. *Note:* It is sometimes important to determine the destination printer before offering the optional steps, due to differences in feature support according to the capabilities of the print protocol and individual printers.

4.2.1.   Use Case 1 — Photo Prints

Use Case 1 comprises two sub-cases: Sub-case 1A for basic photo prints, Sub-case 1B for enhanced photo prints. Sub-case 1B is an extension of 1A; it encompasses all of Sub-case 1A with the added features of annotations, adornments and advanced layout options. The two sub-cases are so closely related, that user action sequences are combined in a single table. Steps for the added features of Sub-case 1B are signified visually using a light gray background for that line in the table.

4.2.1.1. Sub-case 1A — Basic Photo Prints

User scenario

Kathy has received some pictures on her phone from her son Andy on his first day of college. She would like to make some prints to place on her refrigerator. Kathy decides to use her snapshot printer at home. She picks a couple of her favorite photos, then sends them to her printer using Bluetooth. The printer then makes borderless 4x6 prints, suitable for the fridge or for framing.

The following month, Kathy visits Andy at college. She takes pictures with her camera phone of Andy and his friends as they tour campus. Andy asks for some copies for his dorm room. Kathy suggests printing them two per page so that he will have enough room to post them all on his bulletin board. Kathy then selects images from her memory card to print so that when she gets home all she has to do is insert her memory card into her printer and press print. Cool!

Andy has also sent pictures of a beautiful sunset from his dorm room window to his sister Sue. Sue thinks these are great shots, so she connects her phone to her mom's printer with a USB cable, reviews them and picks the best one for printing. Sue then simply selects "Print" on her handset, and within minutes she has a great photo.

Description

The user has one or more images to print. These images may have been captured using the mobile terminal's built-in camera, received from a friend or transferred from another source. The user prepares for printing by selecting images to print, and doing one of:

- Selecting images to print from the memory card on the mobile terminal.

- Connecting a USB cable between the mobile terminal and the printer.

- Opening a Bluetooth connection to a printer.

Next, the user chooses printing characteristics such as image size and layout, paper size and type, and print quality. Finally, for either USB or Bluetooth, the user chooses to start the print job. For a memory card, the user removes it from the terminal, inserts it in the printer and starts the print job using a printer-specific interface.

4.2.1.2. Sub-case 1B — Enhanced Photo Prints

User scenario

Over time, Kathy becomes more comfortable using her camera phone. She wows her friends with the cool stuff she can do. One of Kathy's favorite subjects is her little niece Josie. She changes so fast!   Now when Kathy takes pictures of Josie, she likes to put the date on the print so that later she can quickly tell Josie's age in the photo. Occasionally Kathy also writes some comments on the pictures, which she likes to print in captions on her photos. These options are easy to select on her handset right before she makes her prints.

Of course, Josie likes to get prints too. One of her favorite things is the little kitty cartoon that frames her pictures. One time Kathy made a funny picture with Josie's head on top of the kitty's body – what a laugh! That picture was so good that Josie's mom put it in a frame and it is now proudly displayed in Josie's bedroom.

Description

The user has one or more images to print. These prints will include enhancements of annotations—such as date, location, image file name or caption—and/or adornments. All annotations and adornments are directly accessible to the printer from the mobile terminal during printing. These optional enhancements are added by the user after image selection, prior to printing.

4.2.1.3. User Action Sequence for Combined Sub-cases 1A and 1B

Note: Lines highlighted in light gray mark steps for the added features of Sub-case 1B.

	Guidelines section		
User action sequence step:	BPP	PBR	DPOF
1. Find, select or connect to a printer			
2. Select one or more images to print			
3. User optional steps:			
a. Select number of copies	6.1, 9.10.2, 9.10.5	7.1.2	8.1.2
b. Select image size(s)	9.10.2	7.1.2	8.1.2
c. Select text annotations			
• Date	9.10.4	7.1.2	8.1.2
• Image file name	9.10.4	7.1.2	8.1.2
• Caption	9.10.4	na	8.1.2
d. Select and position adornments (PNG image format used for adornments)	9.10.3	na	na

		Guidelines section		
User action sequence step:		**BPP**	**PBR**	**DPOF**
e.	Select print job characteristics	6.1	7.1.2	na
	• Borderless print	9.8.3 9.10.2 Sample A-2	7.1.2	na
	• Paper size	6.1, 9.8	7.1.2	8.1.2
	• Paper type	6.1	7.1.2	8.1.2
	• N-up layout	9.10.5	7.1.2	8.1.2
	▫ Index print	9.10.5	7.1.2	8.1.2
	▫ Different images	9.10.5	7.1.2	8.1.2
	▫ Same image, multiple times	9.10.5	7.1.2	8.1.2

Note: the cases of index print, multiple copies of the same image or multiple different images are identical or very nearly identical from the viewpoint of the print job. The bigger difference is in the mobile terminal user interface—how the choices are offered to and described for the user.

		BPP	**PBR**	**DPOF**
	• Print quality	[BPP.95]	[PBR]	na
	• Image or page orientation	9.8	na	8.1.2
	• Image fit or crop	9.10.2	na	na
	• Multi-image layout with general text	9.10.4, 9.10.5, 9.10.6	na	na

4. Print

4.2.2.   Use Case 2 — Message Prints

User scenario

Randy has received messages that he wants to print—an SMS text message from his boss, an MMS message from his wife with a photo of their newborn daughter and an email from his secretary with a meeting agenda. He wants to print the messages from his boss and secretary so he doesn't forget the details. He wants to print the message and photo from his wife to carry with him.

He selects the work messages, connects to his printer, and chooses draft quality on plain paper for a quick print. For his wife's message and daughter's photo, he selects highest quality on glossy photo paper. He decides he will print two copies—one for his desk, and one to carry in his briefcase."

Description

The user has SMS, MMS and/or email messages to print. These messages may be text only, or text plus image.

Note: Bluetooth is the only connection method in the Guidelines that enables this use case.

	Guidelines section		
User action sequence step:	**BPP**	**PBR**	**DPOF**
1. Select one or more messages to print. If MMS messages contain image(s), choose whether to print them.		| | |	| | |
2. Find, select or connect to a printer	6.1.2	|	|
3. User optional steps:		|	|
a. Select:		Not available	Not available
• Layout	9.10.5		
• Paper size	6.1, 9.8		
• Paper type	6.1		
• Print quality	[BPP.95]		
• Page orientation	9.8		
• Copies	6.1, 9.10.2, 9.10.5	| | |	| | |
4. Print			

4.2.3.   Use Case 3 — PIM Data Prints

User scenario

Andy has just completed adding the names and addresses of all his new school friends to his address book on his mobile terminal. He has also added his major assignments to his calendar, listing important "to do" items. He wants to print all this so he can post it on the bulletin board in his dorm room. He formats it so that it will be easy to read from across the room, connects to his printer and sends the print job.

Description

The end user has personal information on his mobile terminal that he would like to print. This information could be an address book, or calendar entries, a to do list, etc.

Note: Bluetooth is the only connection method in the Guidelines that enables this use case.

User action sequence step:	Guidelines section		
	BPP	PBR	DPOF
1. Select a range of PIM records to print, such as			
• Names from address book			
• Calendar date range			
• List or memo item			
2. Select items in the records to print Including whether to print images, if they exist			
3. Find, select or connect to a printer	6.1.2		
4. User optional steps:		Not available	Not available
a. Select:			
• Layout	9.10.5		
• Paper size	6.1, 9.8		
• Paper type	6.1		
• Print quality	[BPP.95]		
• Page orientation	9.8		
• Copies	6.1, 9.10.2, 9.10.5		
5. Print			

5.   General Device Guidelines

The Guidelines are offered to promote interoperability and ease of use of home printers with mobile terminals. While MIPC's definition of mobile terminal does not include all handheld mobile devices, any mobile device that supports one of the three recommended connection methods could benefit from the Guidelines.

Home printers comprise a range from specialty photo printers to general purpose designs suitable for printing a variety of documents including text, graphics, and images. The primary use of most home printers is with personal computers, but some can operate without a host computer. Such standalone printers might print images from an integrated scanner or files from a memory card; or they might operate by connection to mobile devices such as mobile terminals, digital cameras and PDAs.

Device characteristics and recommendations for mobile terminals and home printers suitable for mobile image printing are discussed in the following sections.

Mobile Terminal Recommendations

MIPC encourages mobile terminal developers to implement all of the recommended features for the connection methods and print protocols they support. However, MIPC also recognizes that based on user considerations, some mobile terminals will elect not to implement support for some features in the use cases.

A mobile terminal designed according to the Guidelines is expected to have the following capabilities:

- **Image format support:**
    - Ability to store captured images in the baseline-JPEG compressed file formats:
        - EXIF as described in Appendix B
        - JFIF as described in [JFIF]
- **Image sizes:**
    - MIPC makes no specific recommendations on a maximum size for JPEG images to be printed. Since most printers that follow the Guidelines will also print photos from digital still cameras (DSCs), the printers will need to accommodate DSC photo sizes. These Guidelines are targeted to home printers, so mobile terminal developers should realize that some printers may have difficulty with image sizes larger than those produced by consumer DSCs.
    - For image adornments, MIPC again makes no specific recommendations on maximum size for PNG images. Developers do need to be aware, though, that PNG images have a more complex structure and are more difficult to manage than equivalent sized JPEGs. _Note:_ Smaller and fewer PNG adornments are more likely to print successfully.
- **Print size selection:** MIPC recommends printing images at a minimum of 150 source pixels per inch. Note that a digital zoom feature reduces the information content and may produce images that are unsuitable for printing.

Home Printer Recommendations

MIPC recommends that all printers implement all features that can be supported for each connection method and print protocol included in the printer.

A home printer designed according to the Guidelines is expected to have the following capabilities:

- **Character repertoire:** For use cases that include text, the printer should provide embedded font support appropriate to the expected market requirement for that printer and the capabilities of the print protocol.

- **Paper size:** Paper sizes are region or market dependent. In the following items, when a paper size is recommended, it should be considered as a recommendation for the regions/markets where the size is used, as given in Appendix D

   - "Snapshot" printers should support the common photo sizes: A6, 4x6, L-size, Hagaki

   - "Full-size" printers should support the above photo sizes plus the common letter sizes: A4, 8½x11

   - Some specialty printers may only support snapshot or smaller paper. Mobile terminals are also encouraged to support the page sizes for these popular printers.

   - Additionally, printers may support other paper sizes appropriate to market requirements where the printer is sold. See Appendix D for a list of paper and envelope sizes that may be supported on home printers.

- **Borderless printing:** Printers should support borderless printing on the common letter and snapshot sizes identified above.

Print quality and performance will vary widely across the range of printers available in the market.

6.   Guidelines for Bluetooth

MIPC recommends the Basic Printing Profile (BPP) [BPP.95] for mobile terminal printing on Bluetooth. When combined with the Enhanced Layout Extension of XHTML-Print, BPP is capable of supporting all features of all MIPC Use Cases.

Note: At the time these Guidelines are being written, the Bluetooth SIG is nearing completion of Version 1.0 of BPP. For the purposes and content of these Guidelines, MIPC anticipates no substantive differences between the referenced Version .95a and the forthcoming Version 1.0. MIPC therefore recommends that developers refer to 1.0 after it becomes available instead of 0.95a.

6.1. Basic Printing Profile

6.1.1.   Document Format

MIPC recommends XHTML-Print with the Enhanced Layout Extension [XHTMLPR] as the document format for BPP. Most of the features of the Enhanced Layout Extension are needed to support MIPC use cases. The Enhanced Layout Extension of XHTML-Print should not be confused with the BPP optional set of features called 'Enhanced Layout'. The BPP Enhanced Layout option requires XHTML-Print Enhanced Layout Extension, but base-level BPP does not; and, the Enhanced Layout Extension of XHTML-Print can still be used without the BPP Enhanced Layout option. MIPC does not expect printers to support the BPP Enhanced Layout option.

MIPC recommends that mobile terminal developers include all images and other external objects in their XHTML-Print documents by reference. Embedding external objects inline in the XHTML-Print document is strongly discouraged. Printing is far more robust with referenced external objects—this allows the printer to make much more efficient use of its internal memory and other resources to print more complex documents.

6.1.2.   Implementation Details

Recommendations for Mobile Terminals

MIPC recommends the following for mobile terminal developers:

- **Bluetooth certification for**
  - Bluetooth Core Specification.
  - Basic Printing Profile.
- **External objects**
  - Pass external objects by reference in XHTML-Print source.
  - Provide printer access to referenced objects with the GetReferencedObjects operation.
- **Character repertoire**
  - Verify printer's supported character repertoire using the method described in section 12.2.3 of [BPP.95].

- Do not include characters in the XHTML-Print document that the target printer does not support. BPP only requires support for 7-bit US-ASCII characters. See section 9.5 for printer behavior when it receives unsupported characters.

- **Enhanced Layout option** — Do not expect support for the CreatePreciseJob and GetMargin operations of the BPP Enhanced Layout option

- **Printer identification and selection**

  - Present the printer's Bluetooth device name to the user. The device name is defined in section 3.2.2 of [BTGAP].

  - Be able to present a list of printer names, since there may be more than one.

- **Bluetooth SIG Guidelines —** Mobile terminal manufacturers may also want to refer to two implementation guidelines for BPP clients available from the Bluetooth SIG [BPPM1, BPPM2].

Recommendations for Printers

MIPC recommends the following for printer developers:

- **Bluetooth certification for**

  - Bluetooth Core Specification.

  - Basic Printing Profile.

- **XHTML-Print** — Support the Enhanced Layout Extension.

- **Character repertoire**

  - Support character repertoires that are commonly used in the region where the printer is sold.

  - Properly report the printer's supported character repertoire as described in section 12.2.3 of [BPP.95].

- **Printer identification**

  - Report printer's Bluetooth device name according to section 3.2.2 of [BTGAP].

  - Support end-user configurable name or have a pre-configured name that is unique.

7.   Guidelines for USB

MIPC recommends using PictBridge, *CIPA DC-001-2003 Digital Photo Solutions for Imaging Devices* [PBR], for mobile terminal printing on USB. PictBridge is capable of supporting all of the features of Use Case 1A, and some of the features of Use Case 1B.

7.1. Guidelines for PictBridge

Even though the PictBridge specification is publicly available, note that it is not available for direct download. CIPA (Camera & Imaging Products Association) requires prospective developers to pay a fee and sign an agreement to receive a copy of the specification. See http://www.cipa.jp/pictbridge/contents_e/04guide1_e.html.

7.1.1.   Print Document Format

PictBridge does not define a standalone print document format. The print job description is sent to the printer in the PictBridge operation DPS_StartJob (see Section 7.2.5 in [PBR]; see also both Fig. 4 and Step '4)' of Section '5.(4)' in *White Paper of CIPA DC-001-2003 Digital Photo Solutions for Imaging Devices* [PBRW]).

7.1.2.   Implementation Details

The mandatory feature set for PictBridge is small; implementing optional features may be required to meet MIPC use cases. Therefore, PictBridge implementers are cautioned to pay close attention to relevant sections of [PBR]. Two things are important to understand:
1. Which features are mandatory and which are not.
    –   See Appendix E of [PBR]
2. For each supported feature, the level of support is determined by supported parameter values
    –   See Section 10.5 of [PBR] for support level and parameter values
    –   See Section 10.8 of [PBR] for constraints on date and image file name support

The following features of Use Case 1A and 1B are possible using PictBridge. Refer to the aforementioned sections of the PictBridge specification for support levels.

- Image size

- Number of copies

- Date

- Image file name

- Borderless print

- Paper size and paper type

- Index print

- N-up layout with a mix of different images and/or multiple copies of the same image

- Print quality

Recommendations for Mobile Terminals

MIPC recommends the following for mobile terminal developers:

- **USB:**
  - USB device capability with throughput performance equal to or better than USB 2.0 Full Speed.

- **PictBridge certification**

- **Printing options:**
  - Support for the PictBridge features listed above according to market needs.
  - Mobile terminal developers should carefully read the portions of [PBR] on DPS_GetCapability (sections 7.2.2, 10.5) and DPS_StartJob (sections 7.2.5, 10.8) to understand how to determine the printer's capabilities and how to invoke them.

Recommendations for Printers

MIPC recommends the following for printer developers:

- **PictBridge certification**

- **Printing support:**
  - Implement support for all of the features listed above.
  - Printer developers should carefully read the portions of [PBR] on DPS_GetCapability (sections 7.2.2, 10.5) and DPS_StartJob (sections 7.2.5, 10.8) to understand how to report the printer's capabilities when the mobile terminal requests them.

Recommendations for Both Mobile Terminals and Printers

Developers of both mobile terminals and printers are also encouraged to look at *Implementer's Guidelines for CIPA DC-001-2003 Digital Photo Solutions for Imaging Devices* [PBRIG].

8.   Guidelines for Memory Cards

MIPC recommends using DPOF (Digital Print Order Format) [DPOF] for mobile terminal printing with memory cards. DPOF is capable of supporting all of the features of Use Case 1A, and some of the features of Use Case 1B.

8.1. Guidelines for DPOF

Even though the DPOF specification is publicly available, it is not available for direct download. The DPOF Originators require prospective developers to sign a license agreement to receive a copy of the specification. See the DPOF Summary [DPOFW] for details.

8.1.1.   Print Document Format

DPOF uses a file named AUTPRINT.MRK on a memory card to hold print instructions. The AUTPRINT.MRK file is placed in a directory named MISC, which is always at the root level on the memory card. An overview of the structure and content of this file may be found in the summary document [DPOFW]. For details refer to the specification [DPOF].

8.1.2.   Implementation Details

The mandatory feature set for DPOF is small; implementing optional features may be required to meet MIPC use cases. Therefore, DPOF implementers are cautioned to pay close attention to section 8-1-1 of [DPOF] where these requirements are defined.

The following features for Use Cases 1A and 1B are possible using DPOF. They are organized by DPOF function level. Each is mentioned briefly in the DPOF Summary. For a complete description—including support levels, limitations and restrictions—refer to the specification [DPOF] for support levels.

Basic functions

- Standard Print: one image per sheet

- Number of copies

- Date

- Image file name

- Caption

Advanced functions

- Image size

- Paper size and paper type

- Index print

- N-up layout with a mix of different images and/or multiple copies of the same image

- Image orientation

Recommendations for Mobile Terminals

MIPC recommends the following for mobile terminal developers:

- **Memory card slot:**

  – Supports the FAT file system [FAT]. Implementations should also include long file name capability with support for Unicode characters.

  – MIPC makes no specific recommendation on physical card formats.

- **Printing options:**

  – Support for the DPOF functions listed above according to market needs.

  – Mobile terminal developers should carefully read section 8-1-1 of [DPOF] to understand which features printers must implement and which are optional. Developers should also carefully read appropriate sections of [DPOF] for limitations on number of copies, character sets for string objects, number of characters in string objects, etc. They should further include appropriate error handling instructions to the printer for those features requested in the AUTPRINT.MRK file that the printer does not support.

Recommendations for Printers

MIPC recommends the following for printer developers:

- **Memory card slot:**

  – Supports the FAT file system [FAT]. Implementations should also include long file name capability with support for Unicode characters.

  – MIPC makes no specific recommendation on physical card formats.

  – MIPC makes no specific recommendations on directory structure formats. Printers should expect, however, that they will process at least some memory cards using the DCF system.

- **Printing options:**

  – Support for all of the DPOF functions listed above.

9.   XHTML-Print Guidelines

Consistency in usage and implementations of XHTML-Print is an important objective of the Guidelines. That is why this section forms such a large part of this document.

9.1. XHTML-Print is a Subset of XHTML

HTML has evolved significantly over the years through 4 major versions. The World Wide Web Consortium (W3C) stopped HTML development at version 4.01 [HTML4], and is continuing in that language family with XHTML [XHTML]. XHTML-Print [XHTMLPR] is a subset of XHTML. XHTML-Print includes several recently developed features designed specifically for printing, but the vast majority of its features come from HTML—a language that was originally designed for web browsers. Occasionally that creates some difficulties for developers of print applications, because HTML and XHTML were designed primarily for screen output. One of the objectives of the Guidelines is to point out places where the developer needs to be aware of this difficulty when interpreting the underlying XHTML/HTML specifications.

For those readers familiar with HTML but not XHTML, XHTML 1.0 is a *reformulation* of HTML 4.01 in XML. The major resulting differences are that XHTML is:
1. Case-sensitive—all XHTML element names (tags) and attribute names are in lower case.
2. Well-formed
    a. Every non-empty element must have an end tag. An empty element must either have an end tag, or the start tag must end with **/>**. For example, an empty table cell element must be expressed either **<td></td>** or **<td />**.
    b. All elements must be properly nested—each element must be completely contained in its parent element—the element's end tag must occur before its parent element's end tag.

A significant component of XHTML-Print is a subset of *Cascading Style Sheets, Level 2, Revision 1* [CSS21], defined in the *CSS Print Profile* [CSSPP]. Cascading Style Sheets is abbreviated CSS, and *CSS Level 2, Revision 1* is also called CSS 2.1.. The same relationship holds between the CSSPP and CSS 2.1 as holds between XHTML-Print and XHTML—it is a subset of a language defined for web browsers that has a small number of features added for printing. CSS and CSSPP are discussed further in section 9.3.

9.2. Structure of an XHTML-Print Document

Sample 9-1 shows a minimal XHTML-Print document. The output of this document when processed by a conforming printer will be the single word "Hello" printed in the top, left-hand corner of the page. The distance of the word "Hello" from the top and left edges of the sheet will be determined by printer-dependent default margins. Lines 1-8 and 10-11 are required in every conforming XHTML-Print document. Line 9 is the text object to be printed. Line 1 indicates this is an XML document and that it uses UTF-8 character encoding. Lines 2 and 3 identify this as a document that conforms to Version 1.0 of the XHTML-Print specification. Line 4 declares that the rest of the document is HTML source whose element and attribute names conform to the XHTML 1.0 namespace. The **<head>** and **<title>** elements (lines 5-7) are required by XHTML and therefore also by XHTML-Print. Even though the **<title>** element is required, it will not be used for printed output. If the **<head>** and/or **<title>** elements are missing, the document may still print properly, but conforming printers are allowed to reject the document and produce no

output ([XHTMLPR], section 2.3.1), and it will not pass the W3C's XHTML validation suite referenced in section 9.4.

Sample 9-1 Minimal XHTML-Print Document

```
1    <?xml version="1.0" encoding="utf-8"?>
2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3          "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4    <html xmlns="http://www.w3.org/1999/xhtml">
5        <head>
6            <title> Hello sample </title>
7        </head>
8        <body>
9            <p>Hello</p>
10       </body>
11   </html>
```

9.3. Style Sheets

The Guidelines follow the recommendation of the W3C since the creation of HTML 4.0 in encouraging XHTML document creators to control presentation by the use of Cascading Style Sheets. The primary reference for XHTML-Print style sheets is the *CSS Print Profile* [CSSPP]. It defines the CSS properties required of conforming XHTML-Print implementations. The actual meanings of those identified properties may be found in the supporting documents [CSS21], *CSS3 Paged Media Module* [CSS3PM], and *Media Queries* [MEDIAQ]. For a very brief overview of style sheets, refer to [CSS21], Chapter 2, Introduction to CSS 2.1, paying particular attention to section 2.1 and the portion of section 2.3 before section 2.3.1.

Style rules for a given XHTML document can exist in any or all of three locations:
1. External style sheet(s).
2. The <style …> element in the document header.
3. A style attribute in an individual XHTML element.

Style rules are processed in source order—each property declaration value replaces any prior value for that property on the same selector. This replacement is on a per property basis, not a per selector basis. Style sheet properties applied to an element always override any attributes on the element that have the same meaning.

Whether to use internal or external style sheets is at the discretion of individual developers. Each of the samples in the Guidelines uses internal style sheets so the complete document is all seen together. Internal style sheets have the advantage of being simple and tailored to a single document. External style sheets have the advantage of reusability for many print documents. When an external style sheet is used, the source order processing still allows individual selector and property values from the external sheet to be overridden by the inline sheet after the inclusion of the external one.

9.4. Document Validators

Application developers may test their XHTML-Print documents for syntactic correctness using the XHTML validator provided by the W3C at http://validator.w3.org/.

Application developers may also validate style sheets using the W3C's CSS validator at http://jigsaw.w3.org/css-validator/. As of this writing, the CSS validator appears to work much better with a standalone CSS document, such as an external style sheet, than with the CSS of an internal style sheet of an (X)HTML document. To check an inline style sheet, extract the content of the <style> element and either place it in a separate file for validation or paste it into the input box on the validation page.

Note: The CSS validator currently supports only CSS 2, not even CSS 2.1. As a result, there are many valid properties and at-rules of [CSS3PM] that it does not recognize and flags as errors. Even with this limitation, thought, the validator can be quite helpful.

9.5. Printer Support Recommendations

MIPC recommends that printers support the following:

1. **XHTML-Print and CSSPP**
   Enhanced Layout Extension of both specifications [XHTMLPR], [CSSPP]
2. **Paper size**
   All page sizes that the printer supports in the print protocol should also be supported for formatting in XHTML-Print.
3. **Character repertoire**
   Minimum: the Latin characters of the set ISO-8859-1 [ISO8859].
   Extended: It is anticipated that most printer vendors will support appropriate extended character repertoires based on market requirements. When printers encounter characters that they cannot render, they should print the document "in such a way that it is obvious to the user that normal rendering has not taken place." ([XHTML], section 3.2).
4. **Character encoding**
   UTF-8
5. **Font families**
   MIPC recommends the following font-family property support for printers:

   - sans-serif for the printer's complete character repertoire.

   - serif, sans-serif and monospace for Latin characters.
     Printers that are unable to support all three font families should support sans-serif as a minimum.
6. **Line breaks in text**
   Line layout processing is described in section 9.7 below. Simple procedures for determining line breaks are given in CSS 2.1 (section 9.4, [CSS21]), but no language-specific guidelines are provided. Additional, language-specific guidelines are available in Unicode Standard Annex #14 [UAX14]. MIPC recommends that printers support the aforementioned procedures in CSS 2.1. MIPC further recommends, as a minimum, support for the following methods described in Unicode Annex 14:

   - Western — white space and hyphens are used to determine breaks. Allow breaks:

     □ after white space.

     □ after a single hyphen unless followed by a number

     □ before or after an em dash (Unicode 0x2014). Treat two consecutive hyphens as an em dash.

   - East Asian — lines can break anywhere, unless prohibited

- South East Asian — line breaks require morphological analysis

9.6. Client Usage Recommendations

9.6.1.   Size Units

9.6.1.1. Length Units

There are nine valid units for specifying physical length in XHTML-Print. Their recommended and discouraged uses are described in Table 9-1. There are other valid units defined in [CSS21], but these nine are the only length units required of an XHTML-Print conforming printer.

Table 9-1 Length Unit Recommendations

Property		Usage	
Value	**Definition**	**Recommended**	**Discouraged**
in	inches	Object positioning. Object sizing.	None
cm	centimeters		
mm	millimeters		
pt	points 1pt = 1/72 inch		
pc	picas 1pc = 12 points		
%	percentage	Image fitting (see 9.10). There are also many uses for adapting to varying page widths and heights.	Percentage should be used carefully. Be particularly careful about applying percentages of page size with large differences in size or aspect ratio.

em	Font size
	   1em = font-size
	      of current font
		Font relative sizing.
		
		Text box height sizing.
		
		Text box relative positioning.
			All uses other than font sizing and positioning of text-only boxes. They are not absolute units and will not give consistent results across different printers. They are font metric dependent and will differ between printers even with fonts of the same name.

ex	x-height of current font		
Px	pixels	Pixels should never be used. There is no reliable standard conversion from pixels to any printer physical unit.	

9.6.1.2. Relative units

Border widths for boxes can be specified using either the physical units just listed or the relative units thin, medium, thick. MIPC recommends the use of physical units for predictability and consistency across printers. The relative units are printer dependent.

Font sizes. Similarly, relative font sizes (small, medium, etc.) are printer dependent. For higher consistency across printers, MIPC recommends the use of actual point sizes. This does not, however, guarantee consistency due to differences between printers in font family support and differences in font metrics even for the same named font families.

9.7. Default Layout and Page Behavior

The basic printable objects of XHTML-Print documents are text, images, graphics and forms. The Guidelines describe and make recommendations for managing text and images.

Given a source XHTML-Print document containing only text, the printer "flows" or lays out the text word-by-word, line-by-line, page-by-page. Words can roughly be considered strings of characters with no embedded white space. Lines are generally broken between words, though it may be necessary to break in the middle of a long word (see section 9.5, item 6 for more details about words and line breaks). Pages are broken between lines. By default, all of this layout management occurs automatically under printer control. When an image is added to the document by inserting an <img …> element in the text, the image object flows with the text as if it were one large character.

The details of layout procedures are governed by the CSS 2.1 Box Model, described in Sections 8, 9 and 10 of [CSS21]. The basic box model is described in Section 8; general flow and layout algorithms in Section 9; and low level details in Section 10. The next two paragraphs summarize this information from CSS 2.1. Refer to the specification for details. This summary assumes the simplest document layout model: a sequence of lines rendered to a sequence of pages. More complex situations are covered in the specification and in following sections of the Guidelines. Also, there is more information about the CSS Box Model in section 9.8.1 below.

Inline objects are rendered side-by-side, left-to-right for the width of the current line. Right-to-left layout is out-of-scope for this version of the Guidelines—it is not a required feature of XHTML-Print Enhanced Layout Extension. Current line width is determined by the width of the line's containing box (see section 9.4.2 [CSS21]). Line height is as large as necessary to completely contain all the objects in it. When the next word or image to be rendered on a line would extend beyond the right end of the line, the printer inserts a line break and the object is rendered at the beginning of the next line. If the word is still too long to fit in the line width, CSS 2.1 states that the word should overflow the line. MIPC, however, recommends that the printer split the word between characters and use as many lines as necessary to print the entire word. The overflow behavior is more reasonable in a browser environment where the user typically has the ability to scroll the rendered output to see the content that overflowed. However, for the case of printing, any object that is not rendered is lost—there is no opportunity to scroll. If an individual character is too wide for the line, it should overflow. Characters should not be split. Similarly, if an inline image is wider than the line, it should overflow the line.

Lines are stacked vertically down the page. When a new line is too tall to fit in the space remaining on the page, the printer inserts a page break and renders the line at the top of the next page. Finally, lines should not be split vertically across page boundaries. Computer-based browsers frequently split lines vertically when printing. But printers should never do this when rendering an XHTML-Print document, unless a single line is taller than the current page.

9.8. Rendering to Paper

There are two major processing steps in producing a printed page—rendering source documents objects to a page image followed by transferring the page image to paper. The page image is extremely precise—the sizes and positions of all objects rendered to it are, for all practical purposes, exact.

When the page image is transferred to a sheet of paper, three factors affect how accurately the printed result matches the page image:

1. The physical limitations of the printer. The major variations are caused by registration and skew issues.
2. Printer-dependent compensation for the physical limitations that may be applied when the page image includes objects placed at or near the edge of the paper.
3. Printer-dependent adjustments that may be applied when the size and margins of the page image differ from the size and margins of the physical page.

9.8.1.   The Page Box

Every page image of an XHTML-Print document that is actually printed is rendered into a page box. The detailed definition of the page box is in [CSS3PM]. Figure 9-2 contains a diagram of the page box as defined there. The page box is a special case of the general CSS box model (section 8.1, [CSS21]). Figure 9-1 contains a diagram of an ordinary box as defined in [CSS21]. The page box has a content area, padding, border, and margin, just like other CSS boxes, but there are two important differences:

- Different properties and procedures are used to determine the physical extent of both the whole box and its content area.
- A page box can have specialty content in 'margin boxes' in the margin area.

For both kinds of boxes, the box extent is determined by the margin edge. For ordinary boxes, the dimensions of the content area are determined from the width and height properties. These dimensions remain fixed, independent of padding, border, and margin dimensions. The total box dimensions may be computed by adding padding, border and margin dimensions to the content area dimensions (see also Figure 9-1):

box width = margin-left + border-left + padding-left + width +
                 padding-right + border-right + margin-right

box height = margin-top + border-top + padding-top + height +
                 padding-bottom + border-bottom + margin-bottom
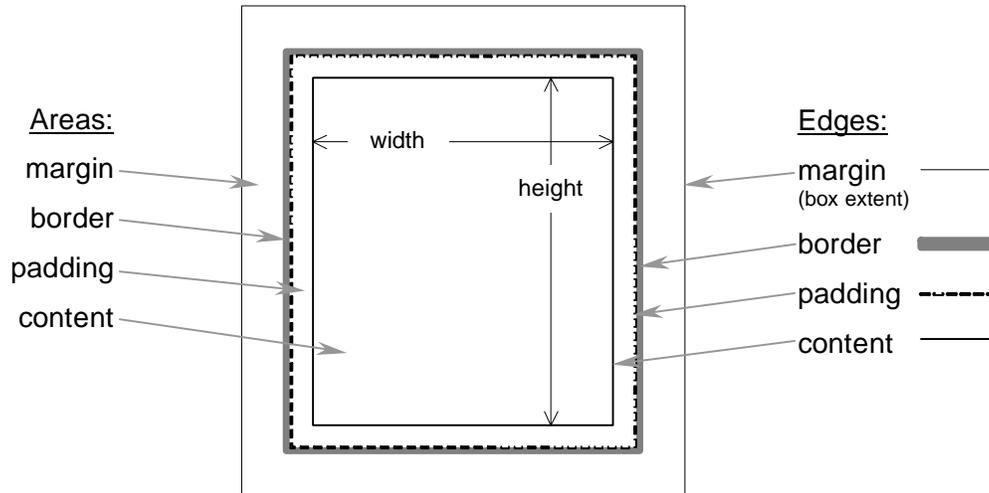
Figure 9-1 Box model (from Section 8.1 [CSS21])

But for the page box, its extent is fixed by its size property (section 3.3.2, [CSS3PM]). The width of the page box is given by the first value of the size property, the height by the second. The content area, or page area, dimensions are computed by subtracting the other region dimensions from the page box dimensions (see also Figure 9-2):

page (content) area width =
                size [1] – margin-left – border-left – padding-left –
                padding-right – border-right – margin-right

page (content) area height =
                size [2] – margin-top – border-top – padding-top –
                padding-bottom – border-bottom – margin-bottom
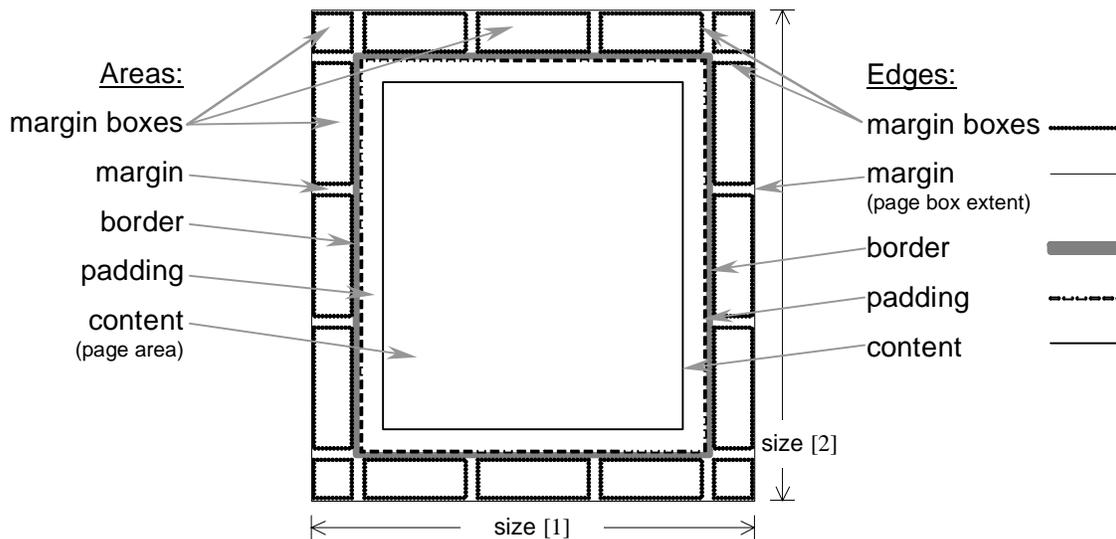
Figure 9-2 Page box model (from [CSS3PM])

Note in Figure 9-2 that there are five margin boxes in the top margin area, five in the bottom margin area and three each in the left and right margin areas. The corner boxes are considered parts of the top and bottom margin areas, not the sides. The five top margin boxes are referenced by these five at-rules, in order, left-to-right: @top-left-corner, @top-left, @top-center, @top-right, @top-right-corner. The five bottom margin boxes are referenced similarly: @bottom-left-corner, @bottom-left, @bottom-center, @bottom-right, @bottom-right-corner. These ten at-rules MUST be supported by a conforming XHTML-Print implementation (section 3.1, [CSSPP]), and are therefore recommended by MIPC. The side margin boxes, from top-to-bottom, left-to-right are referenced by @left-top, @left-center, @left-bottom, @right-top, @right-center, @right-bottom.

The full margin box model from CSS3 Paged Media Module is given in Figure 9-2. Additionally, CSS3 Paged Media Module describes two deprecated margin boxes, @top and @bottom. According to that specification, the deprecated margin boxes may be supported by an implementation. But, if any of the five more specialized @top-… (@bottom-…) boxes appears in the same @page rule with a deprecated @top (@bottom) rule, the deprecated box must be ignored. CSS Print Profile states that these two deprecated at-rules SHOULD be supported by conforming XHTML-Print Enhanced Layout Extension implementations, so MIPC recommends support for them, but encourages mobile terminal developers to use the new boxes instead.

MIPC recommends against the use of all left and right margin boxes until the following specification discrepancies are resolved: There is an error in section 3.1 of [CSSPP]. It lists two margin box rules named @left and @right. It further references [CSS3PM] as the defining document for those rules, but those rules do not exist there.

9.8.2.   Mapping the Page Box to the Printed Sheet

This version of the Guidelines assumes that only one page box is rendered on one side of a sheet of paper; for a document printed two-sided, only one page box is rendered on each side of each sheet. In sections 8.3.1 and 8.3.2, [CSSPP] recommends a sequence of steps to determine the best mapping of the page box to a physical sheet. In order of decreasing preference, they are:
  1.   If page box size matches sheet size, map directly.

2. Rotate the page box 90 degrees if that makes it fit.
3. Scale the page to make it fit. CSSPP prefers but does not require preservation of aspect ratio.
4. Reformat the page, including "spilling" onto another sheet.
5. Clip.

Finally, CSSPP recommends that if the page box with or without any of the above transformations is smaller than the physical sheet, the box should be centered on the sheet.

MIPC recommends that printer developers follow the CSSPP recommendations to the extent possible within printer physical capabilities—some printers can detect page width but not height, some printers cannot know size at all. If mapping option 3 is used, MIPC strongly recommends that aspect ratio be preserved.

9.8.3.   Margins, Borders and Borderless Prints

There are two standard approaches to "filling" a sheet of paper with a single image. The first is to print the image with some white space between all edges of the image and the paper edges. The second is to print the image all the way to the edges of the paper, with no white space. The white space edges are typically called a "border," so the case without the white edges is called "borderless." Borderless printing is far more common—it is the default behavior for all commercial printing of consumer photos from both film and digital cameras. Virtually all consumer photo printers on the market today support borderless printing.

The MIPC recommended approach to borderless printing is that the XHTML-Print document specify the appropriate page size with zero width margins. MIPC recommends that printers treat a page that has zero width margins and an image object fitted to all four edges of the page as a request for borderless print. The process used to achieve the borderless result within the physical limitations of the printer is entirely vendor-dependent. The Guidelines make no recommendation regarding how to do this—MIPC just notes that this indicates clear intent on the part of the client that there should be no white space around the edges of the page.

Some printers will also recognize that *any* image object placed exactly at the page edge when zero width margins are specified is a request to have no white space between the edge of that image and the edge of the page.

Due to the aforementioned physical limitations of printers, MIPC recommends that clients do not place text or graphic objects at or very near page edges unless they are willing to accept that such positioned objects or portions of them may disappear off the edge of the page.

Border and padding of the page box are zero width by default when they are unspecified. Then inside the page area the containing box for the image should also be set to the same dimensions as the page area. Finally the image should be positioned in its containing box according to the recommendations in section 9.10.2. For example, to print a borderless 6-inch x 4-inch photo (common U.S. size), the page size would be given with the following @page rule and body selector:

```
@page { size : 6in 4in ; margin : 0; }
body { padding: 0; }
```

Sections 9.9 and following demonstrate how to use this rule in XHTML-Print documents.

9.9. Page Breaks

MIPC recommends using one of following three methods for controlling page breaks.

1. Automatic page breaks

   Let the printer determine the page breaks. Text and images will not be split across page boundaries as sometimes happens when printing from a browser. The XHTML-Print conformant printer will never break vertically in the middle of a text row or an image.

2. "Manual" page breaks

   For precise control of the objects to be printed on each page, create a style for a <div> element, such as the div.page selector in Sample 9-2, then follow these steps (numbers in parentheses refer to line numbers in Sample 9-2):

   a. Select a page size (9).
   b. Declare the page selector div.page (10-17).
   c. The div.page selector width property is set to 100% (12) to match page area width. That allows nested elements inside the div.page to use percentage widths that are still fractions of page area width.
   d. The page break properties (14-16) direct the printer to:
      1. Start this block on new page (15).
      2. Put nothing else on this page after this block (16).
      3. Avoid starting a new page in the middle of the block if possible (14).

      Directing the printer to avoid page breaks inside the <div> element does not mean they are forbidden. If this <div> element has more content than will fit on a page, the printer *will* insert a page break. It will not discard objects just because they do not all fit on one page.

   e. Create one <div class="page"> element for each page to be specified completely (23-28).
3. "Semi-automatic" page breaks

   This is a combination of the first two methods. Let the printer generate page breaks automatically. But, wherever a new page start is needed, force that break with the following method, again referring to Sample 9-2:

   a. Define the selector that forces a page break (18).
   b. Use that selector with an empty <div> element to start the new page (30).

The output that results from sending the XHTML-Print document in Sample 9-2 to an XHTML-Print conformant printer is 4 pages, each with one line of text as follows:

1. "Page 1 content"
2. "Page 2 content"
3. "Top of page 3--content that could go on for many pages."
4. "Now we're at the top of a new page--page 4 or greater."

Sample 9-2 Page control

```
1     <?xml version="1.0" encoding="utf-8"?>
2     <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3          "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4     <html xmlns="http://www.w3.org/1999/xhtml">
5
6         <head>
7             <title>Sample Page Control</title>
8             <style type="text/css">
9                 @page { size: 210mm 297mm; margin: 0mm; }
10                div.page {
11                    position : relative;
12                    width: 100%; height: auto;
13                    overflow : visible;
14                    page-break-inside : avoid;
15                    page-break-before : always;
16                    page-break-after  : always;
17                }
18                div.pagebreak { page-break-before: always; }
19            </style>
20        </head>
21
22        <body>
23            <div class="page">
24                <p>Page 1 content</p>
25            </div>
26            <div class="page">
27                <p>Page 2 content</p>
28            </div>
29                <p>Top of page 3--content that could go on for many pages.</p>
30            <div class="pagebreak" />
31                <p>Now we're at the top of a new page--page 4 or greater.</p>
32        </body>
33    </html>
```

9.10. Image-centric Layout Control

This section describes how to layout one or more images on a page. Individual images may or may not have text associated with them. This section refers to a single sample document, Sample 9-3. It builds up the necessary controlling elements and properties from the inside out. See also Figure B-1 for the output generated by this sample document. The following sequence of steps builds a final multi-page document with multiple images and image labels per page. For the simplest single-image page, only steps 1b and 3a are required.

1. Create the composite image for print:
    a. Orient the image to the page (section 9.10.1).
    b. Size and fit the image (section 9.10.2).
    c. Add adornments (section 9.10.3).
2. Add image labels (section 9.10.4):
    a. Caption, date, etc.
    b. Select one of: overprinting on the image, or placing above/below the image.
3. Position the image on the page (section 9.10.5):
    a. Borderless or bordered.
    b. N-up.

      c.   Multiple pages.
    4. Add page headers, footers, page numbers, … (section 9.10.6)

Sample 9-3 Image-centric Layout Control

```
1    <?xml version="1.0" encoding="utf-8"?>
2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3       "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4    <html xmlns="http://www.w3.org/1999/xhtml">
5
6    <head>
7      <title>Sample Layout Control</title>
8      <style type="text/css">
9        @page { size: 8.5in 11in; margin: .9in 1in .5in; text-align: center;
10         @top-center { font-size: 20pt; vertical-align: middle; content: "Stick Figures"; }
11         @bottom-center { vertical-align: top; content: "Page " counter(page); }
12       }
13       img { position: relative; }
14       body { padding: 0; }
15       .rowBox { position: relative; width: 100%; height: 2.4in; }
16         .columnLoc0 { position: absolute; left: 0.00in; overflow: visible; }
17         .columnLoc1 { position: absolute; left: 2.25in; overflow: visible; }
18         .columnLoc2 { position: absolute; left: 4.50in; overflow: visible; }
19
20         .imgLabelBox { position: absolute; width: 2in; height: 2.3in; }
21           .imgBox { position: relative; width: 2in; height: 1.6in; overflow: hidden; }
22             .img4-3crop5-4  { left: -3.33%; width: 106.67%; height: 100%; }
23             .img3-4crop5-4  { top: -33.33%; width: 100%;    height: 166.67%; }
24             .img4-3whole5-4 { top:   3.13%; width: 100%;    height:  93.75%; }
25             .img3-4whole5-4 { left: 20.0%;  width:  60.0%;  height: 100%; }
26             .rotate90img3-4whole5-4  { image-orientation: 90deg;
27                 left: 20.0%;  width:  60.0%;  height: 100%; }
28             .dateOverImg { position: absolute; bottom: 2mm; color: yellow;
29                 right: 2mm; text-align: right; font-weight: 900;
30                 width: auto; height: 1.2em; overflow: hidden; }
31           .imgFrame { position: absolute; width: 2in; height: 1.6in; top: 0; left: 0; }
32           .smiley { position: absolute; width: 5mm; height: 5mm; right: 3mm; bottom: 3mm; }
33         .labelBox { position: relative; width: 2in; height: .7in;
34             overflow: hidden; text-align: center; }
35           .captionBox { position: absolute; width: 100%; height: 1.4em; overflow: hidden; }
36           .dateBox { position: absolute; top: 1.4em; width: 100%; height: 1.2em; overflow: hidden; }
37      </style>
38    </head>
39
40    <body>
41      <div class="rowBox">
42        <div class="columnLoc0">
43          <div class="imgLabelBox">
44            <div class="imgBox">
45              <img class="img4-3crop5-4" src="images/Landscape.jpg" alt="" />
46            </div>
47            <div class="labelBox">
48              Caption that uses the whole label box and flows across
49              multiple lines (at least 2 lines, maybe 3 or more).
50            </div>
51          </div>
52        </div>
53        <div class="columnLoc1">
54          <div class="imgLabelBox">
```

```
55              <div class="imgBox">
56                <img class="img3-4crop5-4" src="images/Portrait.jpg" alt="" />
57                <div class="dateOverImg">
58                  2004.07.20 16:50
59                </div>
60              </div>
61            </div>
62          </div>
63          <div class="columnLoc2">
64            <div class="imgLabelBox">
65              <div class="imgBox">
66                <img class="rotate90img3-4whole5-4" src="images/PortraitLeft.jpg" alt="" />
67              </div>
68              <div class="labelBox">
69                <div class="captionBox">
70                  overflow:hidden crops second and following lines.
71                </div>
72                <div class="dateBox">
73                  January 20, 2004 10:42 pm
74                </div>
75              </div>
76            </div>
77          </div>
78        </div>
79        <div class="rowBox" style="font-size: 120%;">
80          <div class="columnLoc0">
81            <div class="imgLabelBox">
82              <div class="imgBox">
83                <img class="img4-3whole5-4" src="images/Landscape.jpg" alt="" />
84              </div>
85              <div class="labelBox">
86                Caption that again uses the whole label box. 20% larger
87                font than used for the image immediately above.
88              </div>
89            </div>
90          </div>
91          <div class="columnLoc1">
92            <div class="imgLabelBox">
93              <div class="imgBox">
94                <img class="img3-4whole5-4" src="images/Portrait.jpg" alt="" />
95              </div>
96              <div class="labelBox">
97                <div class="captionBox">
98                  Stick figure alone
99                </div>
100               <div class="dateBox">
101                 January 20, 2004
102               </div>
103             </div>
104           </div>
105         </div>
106         <div class="columnLoc2">
107           <div class="imgLabelBox">
108             <div class="imgBox">
109               <img class="img4-3crop5-4" src="images/Landscape.jpg" alt="" />
110               <img class="imgFrame" src="images/frame.png" alt="" />
111               <img class="smiley" src="images/smiley.png" alt="" />
112             </div>
113             <div class="labelBox">
114               Adornment example with a simple lined frame and a smiley face.
115             </div>
```

```
116          </div>
117         </div>
118       </div>
119     </body>
120   </html>
```

9.10.1. Image Orientation

If the orientation of the image relative to the page is important, *and* the raster orientation of the source image differs from the page orientation, the client must explicitly tell the printer to rotate the image before printing. Table 9-2 helps select the image-orientation property value to apply. The mobile terminal may need help from the user to determine the actual source raster orientation of the image.

Note 1: The printer should ignore the EXIF 'Orientation' tag and the mobile terminal needs to control image orientation accordingly.

Note 2: For sizing and fitting the image (section 9.10.2 below), the image aspect ratio is based on the image after rotation, not before.

Table 9-2 Determination of image-orientation property

Source raster orientation	Printed image orientation	Rotation to apply	CSS property value
		none	
		90° clockwise	image-orientation: 90deg
		90° counterclockwise	image-orientation: -90deg
		180° clockwise	image-orientation: 180deg
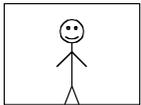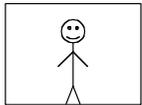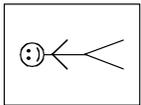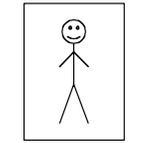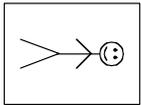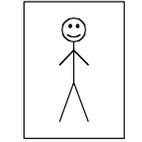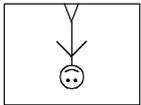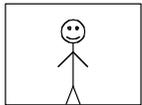
9.10.2. Image Size and Fit

There are two basic rules to follow when printing images with XHTML.
1. *Explicitly define the dimensions of the region the image will occupy on paper.* In the Guidelines, this print region is called the image box. The image box is always rectangular.
2. *Preserve the aspect ratio of the original image.* This means that when the image is scaled to fit the image box, the scaling must be done equally in the horizontal and vertical

directions. The only exceptions to this rule would be in advanced image processing, which is beyond the scope of the Guidelines.

The aspect ratio of an image is the ratio of its width to its height. This is most commonly expressed as the ratio of two small whole numbers, but it can also be expressed as a single real number. Some common aspect ratios are: 4:3 *(1.333)*, used by most digital cameras and other mobile imaging devices; 3:2 *(1.5)*, common print sizes of 6-inch by 4-inch or 150 mm by 100 mm; 16:9 *(1.778)*, high definition TV. Rule #2 requires accounting for the aspect ratios of both the source image and the output print box when creating the XHTML source to print an image.

When the source image and image box have the same aspect ratio, the entire image scales perfectly into the box for printing. But, when the aspect ratios differ, there are two major choices:
1. Fit-to-inside or fit-whole: This approach preserves the entire image content and leaves some white space in the image box either on the two sides of the image or above and below the image.
2. Fit-to-outside or fit-and-crop: This approach fills the image box leaving no white space. This means not printing, or cropping, the image portion which does not fit in the image box. Standard practice in the photo printing industry is fit-and-crop.

Finally, whether the choice is fit-whole or fit-and-crop, there is still a decision to be made about how to position the image relative to the image box. Standard practice is to place the center of the image at the center of the box. Other placements are possible, but common practice for home photo printers is this center-center alignment. MIPC recommends center-center alignment unless the mobile terminal application developer confirms the use of a different alignment with the end user. Put all of this together, and there are five possible results for image printing, based on relative aspect ratios and choice of fit algorithm, as shown in Table 9-4. In Table 9-4 the gray borderless rectangle represents the image, the white rectangle with black border represents the image box. The gray image portions outside the image box in the crop column are kept for illustrative purposes to show the extent of the original image. Those portions would not actually be printed.

The mobile terminal performs the following procedure to calculate the appropriate width and height values. The results are assigned to the width and height properties of images and image boxes:
1. Using the definitions in Table 9-3:
   a. Look up the source image width and height. If the image is to be re-oriented (sec. 9.10.1 above), use width and height *after* rotation.
   b. Set the image box dimensions.
   c. Calculate the separate aspect ratios and the relative aspect ratio.
2. Based on the value of r, the relative aspect ratio, determine from Table 9-4 which matching algorithm to use.
3. Use Table 9-5 to calculate the actual values of width, height and offset to use in the style sheet selector.

Table 9-3 Variable Definitions for Image Fit Calculations

w_i, h_i		width & height of source image in pixels
w_b, h_b		width & height of image box in mm (cm, in, …)
a_i	$=\quad w_i / h_i$	aspect ratio of source image
a_b	$=\quad w_b / h_b$	aspect ratio of image box
r	$=\quad a_i / a_b$	relative aspect ratio of source to image box
w_c, h_c		calculated width & height of printable image in %
t_c, l_c		calculated top and left offsets of printable image in %

Table 9-4 Selection Aids for "Match widths" or "Match heights"

Relative aspect ratio	Fit-and-crop	Fit-whole
$r = 1$	$w_c = w_b$ $h_c = h_b$	Same calculations
$r < 1$	Match widths	Match heights
$r > 1$	Match heights	Match widths
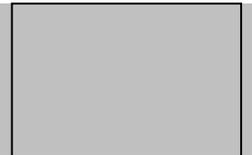
Table 9-5 Final Fit Calculations

Match widths	$w_c = 100\%$ $h_c = 100\% / r$ $t_c = (1 - 1/r) * 50\%$
Match heights	$h_c = 100\%$ $w_c = r * 100\%$ $l_c = (1 - r) * 50\%$

For the example in Sample 9-3, the following steps show how to calculate the image size selectors:

    1. Using the definitions in Table 9-3:

a. Look up the source image sizes.
There are two images, one 1024x768, the other 768x1024.
b. Set the image box dimensions.
2 inches by 1.6 inches
c. Calculate the separate aspect ratios and the relative aspect ratio.
Image 1: $a_i = 1.333$
Image 2: $a_i = 0.667$
Image box: $a_b = 1.25$
d. Based on the value of r, the relative aspect ratio, determine from Table 9-4 which matching algorithm to use.
Image 1: r = 1.0667
Image 2: r = 0..5333
2. Use Table 9-5 to calculate the actual values of width, height and offset to use in the style sheet selector.
Using fit-and-crop for both images, calculate the following for the two images:
Image 1: width=106.67%, height=100%, left=-3.33%
Image 2: width=100%, height=166.67%, top=-33.33%
3. The resulting calculations appear in the sample as follows:

Result 1b is in the selector .imgBox on line (21).

Results 2 are in the selectors .img4-3crop5-4 and .img3-4crop5-4 on lines (22-23).

These selectors are applied to actual images in the <div> and <img> elements on lines (44-45), (55-56) and several others. One important thing to note is that the identical source lines are reused in multiple places to achieve the same print result, but in different physical locations on the page.

9.10.3. Adornments

Staying within the .imgBox, adornments are added to the base image by overlaying other images on top of it. MIPC only recommends the use of PNG, the Portable Network Graphics image format [PNG] for overlays, though any image format supported by the printer can be used. PNG supports transparency, which is usually more interesting for overlays. The bottom image shows through the transparent portions of the top image. Sample 9-3 adds two adornments to the last image on the page:
1. Define the frame selector, .imgFrame (31), to be the same size as the image box.
The <img> element in line (110) applies the frame to the underlying image.
2. Define the .smiley selector, line (32), to put a 5 mm diameter smiley face at a position 2 mm in from the right and bottom edges of the image box. Overlay the smiley face on the image and the frame in line (111).

Note: There are other possible sizes and alignments for overlays, these two are illustrative examples only.

Usage notes:
1. Use absolute positioning for the overlays.
2. Image "stacking" will be according to source order of the image references in the XHTML-Print document. Images referenced first will be rendered first, later images will be rendered on top of earlier ones.
3. PNG is the only image format with transparency that MIPC recommends for overlays. MIPC further recommends the following restrictions on PNG images:
a. Filter type: 0 (none)
b. Interlace method: 0 (no interlace)

4. Pay particular attention to the PNG recommendations in section 5.

9.10.4. Text Annotations

Referring again to Sample 9-3, three different forms of text annotations are demonstrated as described here.

1. To add a multi-line caption in "paragraph" form:
    a. Define the image-label box selector, .imgLabelBox (20) for a box that will contain both the image and its annotations.
    b. Define the multi-line label box selector, .labelBox (33-34) to hold annotations. This box is relatively positioned so it can flow automatically after the image box. For this automatic flow to work correctly, the image box and label box must both be as wide as their containing image-label box.
    c. Fill the label box with text, as in lines (47-50), (85-88).
2. To add two short annotation lines—line 1 with an image file name or short caption; line 2 with the date:
    a. Use the image-label and label boxes from 1a, 1b above (20, 33-34).
    b. Define the caption box selector, .captionBox (35). It will be as wide as its containing box, and slightly taller than one text line high. The box height is defined in ems, so that it scales with the font size.
    c. Define the date box selector, .dateBox (36) similarly to the caption box. It also is full width, offset below and touching the caption box. Its height is smaller than that of the caption box so that the date text is a little closer to the caption than the caption is to the image—but both heights still scale with font size.
    d. The date and caption boxes—inside a label box—are then used in lines (68-75) and (96-103).
3. To add a date overprint directly on an image (normally used only with borderless print):
    a. Define the overprint box selector, .dateOverImg (28-30).
    b. It must have a bright color, such as yellow, and heavy font weight—900 is heavier than bold—to show over almost any image content color.
    c. This example shows the date right-aligned. The right offset and offset from the bottom of the image are set at a constant 2 mm, independent of font size.

9.10.5. Multiple Images on a Page

The preceding three subsections have described orienting an image, fitting it to a print region on the page and adding text annotations. This subsection describes placing multiple images on a single page.

After grouping an image and associated annotations together using the .imgLabelBox selector defined in paragraph 1a of section 9.10.3 above those groups can then be placed anywhere on a page by defining appropriate positioning and containing elements. The technique used is to define an image row, such that the row may be repeated as needed for any number of images. Furthermore, use of this row model allows images to flow from page to page, without the need to manage page breaks explicitly. Headers and footers are automatically generated for each page from the single occurrence of the @page rule and margin boxes in lines (9-12). Individual images are placed in columns across each row. Since the already defined .imgLabelBox is a complete container for the image and text, containing boxes for the columns are not needed, only locators for the positions of the columns. This leads to the following definitions and usage:

1. Define the selector .rowBox, line (15), to be the full width of the page and the appropriate height for the image-label boxes it will contain. In this case, for a 9.6-inch

high page area, the selection of 2.4 inches for the row and image-label box height allows exactly four rows to fit on one page.

2. Define the appropriate number of column locators, .columnLoc*n*, lines (16-18). In this case, 3 columns of 2-inch width and .25-inch spacing will exactly fit across the 6.5-inch wide page area. Again, since the column boxes are used for need to define their size, just make everything inside each box visible with the overflow: visible property.

The row box and column locators are then applied as needed in lines (41-42, 53, 63, 79-80, 91, 106). These line numbers only mark the start tag of the element, not the end tag or the element's contents.

9.10.6.   Page Headers and Footers

The margin box features of the page box (section 9.8.1) enable developers to create page headers and footers similar to those found in word processing and presentation applications. It is possible to make left-, right- or center-justified headers and footers that will appear on all pages of a document, or to apply different headers and footers to different portions of a document. Simple headers and footers use a single occurrence of @page with @top- and @bottom- rules. All @top- and @bottom- rules must appear inside an @page rule.

Again referring to Sample 9-3, the properties in line (9) tell the printer to render a page box that is 8.5 inches wide by 11 inches high. The page should have a top margin of 0.9 inches, left and right side margins of 1 inch each and a bottom margin of 0.5 inches. All text on the page should be center aligned. The 0.9 inch and 0.5 inch top and bottom margins also mean that the top and bottom margin boxes, respectively, will have those same heights. The @top-center rule on line (10) specifies header content of "Stick Figures", a 20 point font size, and that the header text should be vertically aligned in the middle of the box's 0.9 inch height. The @bottom-center rule on line (11) causes the printer to print the page number in the page footer, prefixed by the string "Page ". The footer text will be vertically aligned at the top of the 0.5 inch bottom margin.

9.11. Text-centric Layout Control

This section describes how to layout objects that are primarily text, but may include some image objects. Messages—such SMS, MMS and e-mail—and personal information manager (PIM) data are covered. The subsections below refer to the XHTML-Print document in Sample 9-4. See also Figure B-2 and Figure B-3 for the output generated by this sample document.

The examples here are just that—examples. They represent one possible layout format for these objects. They should, however, contain a rich enough set of XHTML-Print and CSSPP constructs that mobile terminals can create their own layouts, still based on the samples included in this recommendation.

Sample 9-4 Text-centric Layout

```
1    <?xml version="1.0" encoding="utf-8"?>
2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3       "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4    <html xmlns="http://www.w3.org/1999/xhtml">
5
6    <head>
7      <title>MIPC Text-Centric Layout</title>
```

```
 8        <style type="text/css">
 9         .textPlusBox { width: 98%; margin: 5mm 1%; page-break-inside: avoid;
10            border-style: solid; border-width: .1mm; }
11
12         .contentType {width: 100%; margin: 2mm; font-style: italic; text-align: left; }
13
14         table.pim,
15         table.msgHeader {width: 100%; vertical-align: top;
16            border-top-style: solid; border-top-width: .1mm; }
17         table.msgHeader {background-color: silver; }
18
19         td.fieldLabel {width: 8em; text-align: right; font-weight: bold;
20            font-family: Courier, monospace, sans-serif; }
21
22         td.fieldContent,
23         td.msgFieldContent {text-align: left; font-family: "Times New Roman", Times, serif; }
24
25         td.msgFieldContent {font-style: italic; }
26
27         .msgBodyText,
28         .msgBodyImages {width: 98%; padding: 1%;}
29
30         .msgImage {width: 51mm; height: 68mm; margin: 1mm; }
31       </style>
32     </head>
33
34     <body>
35       <div class="textPlusBox">
36         <div class="contentType">MMS message</div>
37         <table class="msgHeader">
38          <tr>
39            <td class="fieldLabel">To:</td>
40            <td class="msgFieldContent">Fred</td>
41          </tr>
42          <tr>
43            <td class="fieldLabel">From:</td>
44            <td class="msgFieldContent">Jim</td>
45          </tr>
46          <tr>
47            <td class="fieldLabel">Subject:</td>
48            <td class="msgFieldContent">Paris</td>
49          </tr>
50          <tr>
51            <td class="fieldLabel">Date:</td>
52            <td class="msgFieldContent">June 21, 2004  10:07 PDT (UTC-07:00) </td>
53          </tr>
54          <tr>
55            <td class="fieldLabel">Audio:</td>
56            <td class="msgFieldContent">8 seconds</td>
57          </tr>
58          <tr>
59            <td class="fieldLabel">Video:</td>
60            <td class="msgFieldContent">None</td>
61          </tr>
62         </table>
63         <div class="msgBodyText">
64           Here's a great shot of the Eiffel Tower!
65         </div>
66         <div class="msgBodyImages">
67           <img class="msgImage" src="images/Eiffel_Tower_3x4.jpg" alt="Eiffel Tower"/>
68         </div>
```

```
69        </div>
70
71        <div class="textPlusBox">
72          <div class="contentType">Email message</div>
73          <table class="msgHeader">
74            <tr>
75              <td class="fieldLabel">To:</td>
76              <td class="msgFieldContent">Jonathan Apple</td>
77            </tr>
78            <tr>
79              <td class="fieldLabel">From:</td>
80              <td class="msgFieldContent">William Stiles</td>
81            </tr>
82            <tr>
83              <td class="fieldLabel">Subject:</td>
84              <td class="msgFieldContent">Summer Vacation</td>
85            </tr>
86            <tr>
87              <td class="fieldLabel">Date:</td>
88              <td class="msgFieldContent">June 21, 2004  10:07 PDT (UTC-07:00) </td>
89            </tr>
90          </table>
91          <div class="msgBodyText">
92            Dear Jon,
93            <p>
94              I hope you are enjoying your summer vacation. We are managing quite well
95              around here in your absence&#8212;our new Panes system is taking the world by storm.
96              Please feel free to take an extended leave and don't worry about us back
97              at the office.  Enjoy your time off.
98            </p>
99            Best regards,<br/>
100           Bill
101         </div>
102       </div>
103
104       <div class="textPlusBox">
105         <div class="contentType">Address book entry</div>
106         <table class="pim">
107           <tr>
108             <td class="fieldLabel">Name:</td>
109             <td class="fieldContent">King Kong</td>
110           </tr>
111           <tr>
112             <td class="fieldLabel">Edress:</td>
113             <td class="fieldContent">kkong@empirestate.bldg</td>
114           </tr>
115           <tr>
116             <td class="fieldLabel">Phone:</td>
117             <td class="fieldContent">+1 000.555.1212</td>
118           </tr>
119           <tr>
120             <td class="fieldLabel">Title:</td>
121             <td class="fieldContent"></td>
122           </tr>
123           <tr>
124             <td class="fieldLabel">Company:</td>
125             <td class="fieldContent"></td>
126           </tr>
127           <tr>
128             <td class="fieldLabel">Address:</td>
129             <td class="fieldContent"></td>
```

```
130                </tr>
131                <tr>
132                  <td class="fieldLabel">Notes:</td>
133                  <td class="fieldContent">
134                    This guy is a real climber.
135                  </td>
136                </tr>
137              </table>
138            </div>
139        </body>
140        </html>
```

9.11.1. Messages

Messages of various types typically have a header—with fields such as 'To', 'From', 'Subject', etc.—and a body that contains text and, sometimes, pictures. The examples here will print header fields using a table, and then follow that with a text block and an optional image block.

Mobile terminal processing steps (again, numbers in parentheses refer to line numbers in Sample 9-4):

1. Create a selector, .textPlusBox, lines (9-10), for the message's containing block and apply it to the <div> blocks on lines (35, 71). Use the following properties:
   a. Make it full page area width, less small left and right margins of 1%.
   b. Make top and bottom margins of 5 mm.
   c. The two border- properties enclose the complete message and its headers in a thin border.
2. Create a selector, .contentType, line (12), for the print line that identifies the type of message (MMS, email, etc.) and apply it to the <div> blocks on lines (36, 72).
3. Create a selector, table.msgHeader, lines (15-17), for the table that will show all of the message header information. Apply it to the <table> elements on lines (37, 73). Use the following properties:
   a. Full page area width and top border. The top border makes a separator between the contentType box on the previous line and the table itself. A bottom border on the contentType box would achieve the same effect, due to the box's use of margins.
   b. Note that lines (14-16) declare the same set of properties for a message header table and a PIM table. The PIM table will be used below.
   c. Line (17) adds the background color of silver (named more for on-screen appearance—it prints as gray). This background fill visually sets the entire header off from the message body. This new declaration also distinguishes the message header table from the PIM table, whose background color is not changed from the default.
4. Each header field has a label and a value (its content). The label selector is defined in lines (19-20).
   a. The width of 8em is based on font size and is wide enough to hold the text labels in the example.
   b. The labels are right aligned—this is a stylistic choice.
   c. The labels are made bold, so the field names stand out readily in print.
   d. The font-family choices represent a prioritized sequence of alternatives. The specific value on line (20) tells the printer to use Courier. If Courier is unavailable, then use any available monospace font. And, finally, if no monospace font is available, use a sans-serif font.

5. The header field content selector is defined in lines (23, 25).
    a. It also includes a prioritized font list.
    b. Line (25) says to use the italic font style.
6. The two header tables are laid out in lines (37-62, 73-90).
7. Finally, selectors for the message body blocks are defined in lines (27-28). There is a block for text, .msgBodyText, and a block for images, .msgBodyImages. The two are defined to be the same here, but using two different names would allow later changes to either one without affecting the other. They are used with <div> blocks in lines (63-68, 91-101)

9.11.2. PIM data

Address book example.

Mobile terminal processing steps:
1. Reuse the selectors .textPlusBox and .contentType from above and apply them on lines (104-105).
2. Use the table.pim selector defined above in conjunction with table.msgHeader, lines (14-16). Apply it to the <table> on line (106).
3. Fill in the table with address book field entries in lines (107-136). Note: empty value fields need to appear as an empty cell.

10. Plugfests

MIPC has developed these Guidelines to aid in improving mobile terminal and home printer interoperability. MIPC is sponsoring interoperability trials called "plugfests", three times a year in different regions of the world. These plugfests provide the opportunity for mobile terminal and home printer vendors to test the interoperability of their products in pair-wise private meetings. All participating companies must sign an MIPC Non-Disclosure Agreement. No formal tests are provided by the MIPC, thus each company is responsible for providing its own test cases. MIPC has not developed new specifications, has no official or unofficial logo program, and has no official or unofficial conformance or qualification program. Details on MIPC plugfests are posted on the MIPC website, http://www.mobileprinting.org.

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Appendix A Additional XHTML-Print Examples

A.1. Image-centric Example with Tables

The sample document in Sample A-1 generates a layout sample using <table>s that is equivalent to the image-centric document using <div>s in Sample 9-3. It uses tables to manage page centering, and long image captions. Table A-1 compares the two different approaches to image-centric layout.

Table A-1 Comparison of Image-centric Document Approaches

Operation	<div> approach		table approach		Notes
	Elem	Class	Elem	Class	
Allocate space for row of images	div	rowBox	div table tr	rowModule tableRowBox *no class used*	The '<div> approach' rowBox is fixed height. The combination of elements used in the '<table> approach' allows variable height rows and auto-centering of the columns.
Set column position for image + annotations	div	columnLoc*n*	td td	columnCell columnSpacer	The positions of the columnLoc*n* in the '<div> approach' account for both image width and column spacing. In the '<table> approach', the matches image width and the extra cell controls inter-column spacing.
Make container for image + annotations	div	imgLabelBox	td	columnCell	The '<div> approach' imgLabelBox is fixed height. The '<table> approach' table cell allows variable height for the complete combination of image and annotations.
Position image box	div	imgBox	div	imgBox	Identical behavior in both approaches
Print date over image	div	dateOverImg	div	dateOverImg	
Position annotation box	div	labelBox	div	labelBox	Fixed height in '<div> approach', variable height in '<table> approach'.
Position caption box	div	captionBox	div	captionBox	
Position date box	div	dateBox	div	dateBox	

Sample A-1 Image-centric Layout Control Using <table>

```
1    <?xml version="1.0" encoding="utf-8"?>
2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3         "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4    <html xmlns="http://www.w3.org/1999/xhtml">
5
6    <head>
7         <title>Sample Layout Control</title>
8         <style type="text/css">
9             @page { size: 8.5in 11in; margin: .9in .25in .5in; text-align: center;
10                @top { font-size: 20pt; vertical-align: middle;
11                        content: "Sample Table Layout Control"; }
12                @bottom { vertical-align: top; content: "Page " counter(pages); }
13            }
14
15            body { padding: 0; }
16            table, tr, td { border-spacing: 0; padding: 0; margin: 0; }
17            td { vertical-align: top;}
18            div, img { position: relative; }
19            p { text-align: left; }
20
21            .rowModule { width: 100%; page-break-inside: avoid; }
22            .tableRowBox  { margin: 0 auto .25in auto; }
23            .columnCell { width: 2in; overflow: hidden; }
24            .columnSpacer { width: .25in; }
25
26                .imgBox { width: 2in; height: 1.6in; overflow: hidden; }
27                    .img4-3crop5-4  { left: -3.33%; width: 106.67%; height: 100%; }
28                    .img3-4crop5-4  { top: -33.33%; width: 100%; height: 166.67%; }
29                    .img4-3whole5-4 { top: 3.13%; width: 100%; height:  93.75%; }
30                    .img3-4whole5-4 { left: 20.0%; width:  60.0%; height: 100%; }
31                    .rotate90img3-4whole5-4  { image-orientation: 90deg; left: 20.0%;
32                            width: 60.0%; height: 100%; }
33
34                    .dateOverImg { position: absolute; bottom: 2mm; color: yellow;
35                            right: 2mm; text-align: right; font-weight: 900;
36                            width: auto; height: 1.2em; }
37                .imgFrame { position: absolute; width: 2in; height: 1.6in;
38                        top: 0; left: 0; }
39                .smiley { position: absolute; width: 5mm; height: 5mm;
40                        right: 3mm; bottom: 3mm; }
41
42                .labelBox { width: 100%; text-align: center; }
43                    .captionBox { width: 100%; line-height: 1.4em; }
44                    .dateBox { width: 100%; line-height: 1.2em; }
45
46        </style>
47    </head>
48
49    <body>
50        <div class="rowModule">
51            <table class="tableRowBox">
52                <tr>
53                    <td class="columnCell">
54                        <div class="imgBox">
55                            <img class="img4-3crop5-4" src="images/Landscape.jpg" alt="" />
56                        </div>
57                        <div class="labelBox">
```

```
58                           The Parthenon
59                           <p>
60                           The chief temple of the goddess Athena built on the acropolis
61                           at Athens between 447 and 432 b.c. and considered a supreme
62                           example of Doric architecture.
63                           </p>
64                           <p style="font-size: 75%;">
65                               <i>
66                                   &mdash;The American Heritage&reg; Dictionary of
67                                   the English Language: Fourth Edition
68                               </i>
69                           </p>
70                       </div>
71                   </td>
72                   <td class="columnSpacer" />
73
74                   <td class="columnCell">
75                       <div class="imgBox">
76                           <img class="img3-4crop5-4" src="images/Portrait.jpg" alt="" />
77                           <div class="dateOverImg">
78                               2004.07.20 16:50
79                           </div>
80                       </div>
81                   </td>
82                   <td class="columnSpacer" />
83
84                   <td class="columnCell">
85                       <div class="imgBox">
86                           <img class="rotate90img3-4whole5-4"
87                               src="images/PortraitLeft.jpg" alt="" />
88                       </div>
89                       <div class="labelBox">
90                           <div class="captionBox">
91                               overflow:hidden crops second and following lines.
92                           </div>
93                           <div class="dateBox">
94                               January 20, 2004 10:42 pm
95                           </div>
96                       </div>
97                   </td>
98               </tr>
99           </table>
100      </div>
101      <div class="rowModule">
102          <table class="tableRowBox" style="font-size: 120%;">
103              <tr>
104                  <td class="columnCell" >
105                      <div class="imgBox">
106                          <img class="img4-3whole5-4"
107                              src="images/Landscape.jpg" alt="" />
108                      </div>
109                      <div class="labelBox">
110                          Caption that again uses the whole label box. 20% larger
111                          font than used for the image immediately above.
112                      </div>
113                  </td>
114                  <td class="columnSpacer" />
115
116                  <td class="columnCell" >
117                      <div class="imgBox">
118                          <img class="img3-4whole5-4"
```

```
119                                                 src="images/Portrait.jpg" alt="" />
120                                    </div>
121                                    <div class="labelBox">
122                                        <div class="captionBox">
123                                            Stick figure alone
124                                        </div>
125                                        <div class="dateBox">
126                                            January 20, 2004
127                                        </div>
128                                    </div>
129                            </td>
130                            <td class="columnSpacer" />
131
132                            <td class="columnCell" >
133                                    <div class="imgBox">
134                                        <img class="img4-3crop5-4"
135                                            src="images/Landscape.jpg" alt="" />
136                                        <img class="imgFrame" src="images/frame.png" alt="" />
137                                        <img class="smiley" src="images/smiley.png" alt="" />
138                                    </div>
139                                    <div class="labelBox">
140                                        Adornment example with a simple lined frame and a smiley face.
141                                    </div>
142                            </td>
143                    </tr>
144            </table>
145        </div>
146    </body>
147    </html>
```

A.2. Short Image-centric Examples

Sample A-2 Single Image: Borderless

```
1     <?xml version="1.0" encoding="utf-8"?>
2     <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3          "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4     <html xmlns="http://www.w3.org/1999/xhtml">
5         <head>
6             <title>Sample for Single Image: Borderless</title>
7             <style type="text/css">
8                 @page { size: 210mm 297mm; margin: 0mm; }              /* A4 */
9                 body { padding: 0; }
10                .imgLabelBox { position: relative; width: 210mm; height: 297mm; }
11                .imgBox {       position: relative; width: 210mm; height: 297mm;
12                            overflow: hidden; }
13
14                /* suppose that aspect ratio of image is 3:4 */
15                .img_borderless { position: absolute; width: auto; height: 297mm;
16                            left: -6mm; top: 0; }
17            </style>
18        </head>
19        <body>
20            <div class="imgLabelBox">
21                <div class="imgBox">
22                    <img class="img_borderless" src="images/portrait.jpg" alt="" />
```

```
23                    </div>
24                </div>
25            </body>
26        </html>
```

Sample A-3 Single Image: With Border

```
 1    <?xml version="1.0" encoding="utf-8"?>
 2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
 3         "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
 4    <html xmlns="http://www.w3.org/1999/xhtml">
 5        <head>
 6            <title>Sample for Single Image: With Border</title>
 7            <style type="text/css">
 8                @page { size: 210mm 297mm; margin: 5mm; }            /* A4 */
 9                body { padding: 0; }
10                .imgLabelBox { position: relative; width: 200mm; height: 287mm; }
11                .imgBox { position: relative; width: 200mm; height: 287mm; overflow: hidden; }
12
13                /* suppose that aspect ratio of image is 3:4 */
14                .img_withborder { position: absolute; width: auto; height: 287mm;
15                        left: -7mm; top: 0; }
16            </style>
17        </head>
18        <body>
19            <div class="imgLabelBox">
20                <div class="imgBox">
21                    <img class="img_withborder" src="images/portrait.jpg" alt="" />
22                </div>
23            </div>
24        </body>
25    </html>
26
```

Sample A-4 Single Image: With Rotation

```
 1    <?xml version="1.0" encoding="utf-8"?>
 2    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
 3         "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
 4    <html xmlns="http://www.w3.org/1999/xhtml">
 5        <head>
 6            <title>Sample for Single Image: With Rotation</title>
 7            <style type="text/css">
 8                @page { size: 210mm 297mm; margin: 0mm; }            /* A4 */
 9                body { padding: 0; }
10                .imgLabelBox { position: relative; width: 210mm; height: 297mm; }
11                .imgBox {      position: relative; width: 210mm; height: 297mm;
12                            overflow: hidden; }
13
14                /* suppose that aspect ratio of image is 3:4 */
15                .img_rotation { position: absolute; width: 210mm; height: 297mm;
16                            left: -6mm; top: 0; image-orientation: 90deg; }
17            </style>
18        </head>
19        <body>
20            <div class="imgLabelBox">
```

```
21                    <div class="imgBox">
22                        <img class="img_rotation" src="images/landscape.jpg" alt="" />
23                    </div>
24              </div>
25          </body>
26      </html>
```

Sample A-5 Single Image: With Adornments

```
1       <?xml version="1.0" encoding="utf-8"?>
2       <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3            "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4       <html xmlns="http://www.w3.org/1999/xhtml">
5           <head>
6               <title>Sample for Single Image: With Adornments</title>
7               <style type="text/css">
8                   @page { size: 210mm 297mm; margin: 5mm; }              /* A4 */
9                   body { padding: 0; }
10                  .imgLabelBox { position: relative; width: 200mm; height: 287mm;      }
11                  .imgBox {        position: relative; width: 200mm; height: 287mm;
12                          overflow: hidden; }
13
14                  /* suppose that aspect ratio of image is 3:4 */
15                  .img_withborder { position: absolute; width: auto; height: 287mm;
16                          left: -7mm; top: 0; }
17                  .adormentFrame {  position: absolute; width: 100%; height: 100%;
18                          left: 0; top: 0; }
19                  .adormentSmiley { position: absolute; width: 30mm; height: 30mm;
20                          right: 30mm; bottom: 30mm; }
21              </style>
22          </head>
23          <body>
24              <div class="imgLabelBox">
25                  <div class="imgBox">
26                      <img class="img_withborder" src="images/portrait.jpg" alt="" />
27                      <img class="adormentFrame"   src="images/frame.png" alt="" />
28                      <img class="adormentSmiley"  src="images/smiley.png" alt="" />
29                  </div>
30              </div>
31          </body>
32      </html>
```

Sample A-6 Single Image: With Captions

```
1       <?xml version="1.0" encoding="utf-8"?>
2       <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3            "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4       <html xmlns="http://www.w3.org/1999/xhtml">
5           <head>
6               <title>Sample for Single Image: With Captions</title>
7               <style type="text/css">
8                   @page { size: 210mm 297mm; margin: 5mm; }   /* A4 */
9                   body { padding: 0; }
10                  .imgLabelBox {  position: relative; width: 200mm; height: 287mm;   }
11                  .imgBox { position: relative; width: 200mm; height: 260mm;
12                          overflow: hidden; }
```

```
13              .labelBox { position: relative: width: 200mm; height: 27mm;
14                  overflow: hidden; text-align: center; color: black; font-size: 20pt; }
15
16              /* suppose that aspect ratio of image is 3:4 */
17              .img_withborder { position: absolute; width: 200mm; height: auto;
18                  left: 0mm;  top: -3mm;  }
19              .dateOverImg { position: absolute; bottom: 2mm; right: 2mm;
20                      color: yellow; font-size: 12pt; }
21          </style>
22      </head>
23      <body>
24          <div class="imgLabelBox">
25              <div class="imgBox">
26                  <img class="img_withborder" src="images/portrait.jpg" alt="" />
27                  <div class="dateOverImg">
28                      yyyy/mm/dd
29                  </div>
30              </div>
31              <div class="labelBox">
32                  This is a message for image, not over the image.
33              </div>
34          </div>
35      </body>
36  </html>
```

Sample A-7 <div> Approach: Simple Layout Control

```
1   <?xml version="1.0" encoding="utf-8"?>
2   <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML-Print 1.0//EN"
3       "http://www.w3.org/MarkUp/DTD/xhtml-print10.dtd">
4   <html xmlns="http://www.w3.org/1999/xhtml">
5       <head>
6           <title>Sample Layout Control: &lt;div&gt; Approach</title>
7           <style type="text/css">
8               @page { size: 210mm 297mm; margin: 6mm; }
9                   @top-center { font-size: 20pt; text-align: center; content: "Header"; }
10                  @bottom-center { text-align: center; content: "Page " counter(pages); }
11              }
12              img { position: relative; }
13              body { padding: 0; }
14              .rowBox { position: relative; width: 100%; height: 95mm; }
15              .columnLoc0 { position: absolute; left:   0;   overflow: visible; }
16              .columnLoc1 { position: absolute; left:  66mm; overflow: visible; }
17              .columnLoc2 { position: absolute; left: 132mm; overflow: visible; }
18
19              .imgLabelBox { position: absolute; width: 66mm; height: 95mm; }
20              .imgBox     { position: relative; width: 66mm; height: 51mm; overflow: hidden; }
21              .img4-3     { position: absolute; left: 3mm; top: 3mm;
22                      width: 60mm; height: 45mm; }
23              .img3-4     { position: absolute; left: 3mm; top: 3mm;
24                      width: 60mm; height: 45mm; image-orientation: 90deg; }
25              .labelBox   { position: relative; width: 66mm; height: 44mm;
26                      overflow: hidden; text-align: center; }
27          </style>
28      </head>
29
30      <body>
31          <div class="rowBox">
```

```
32                  <div class="columnLoc0">
33                      <div class="imgLabelBox">
34                          <div class="imgBox">
35                              <img class="img4-3" src="images/landscape.jpg" alt="" />
36                          </div>
37                          <div class="labelBox">
38                              position (1,1)
39                          </div>
40                      </div>
41                  </div>
42                  <div class="columnLoc1">
43                      <div class="imgLabelBox">
44                          <div class="imgBox">
45                              <img class="img4-3" src="images/landscape.jpg" alt="" />
46                          </div>
47                          <div class="labelBox">
48                              position (1,2)
49                          </div>
50                      </div>
51                  </div>
52                  <div class="columnLoc2">
53                      <div class="imgLabelBox">
54                          <div class="imgBox">
55                              <img class="img4-3" src="images/landscape.jpg" alt="" />
56                          </div>
57                          <div class="labelBox">
58                              position (1,3)
59                          </div>
60                      </div>
61                  </div>
62              </div>
63              <div class="rowBox">
64                  <div class="columnLoc0">
65                      <div class="imgLabelBox">
66                          <div class="imgBox">
67                              <img class="img4-3" src="images/landscape.jpg" alt="" />
68                          </div>
69                          <div class="labelBox">
70                              position (2,1)
71                          </div>
72                      </div>
73                  </div>
74                  <div class="columnLoc1">
75                      <div class="imgLabelBox">
76                          <div class="imgBox">
77                              <img class="img4-3" src="images/landscape.jpg" alt="" />
78                          </div>
79                          <div class="labelBox">
80                              position (2,2)
81                          </div>
82                      </div>
83                  </div>
84                  <div class="columnLoc2">
85                      <div class="imgLabelBox">
86                          <div class="imgBox">
87                              <img class="img4-3" src="images/landscape.jpg" alt="" />
88                          </div>
89                          <div class="labelBox">
90                              position (2,3)
91                          </div>
92                      </div>
```

```
93                      </div>
94                  </div>
95              <div class="rowBox">
96                  <div class="columnLoc0">
97                      <div class="imgLabelBox">
98                          <div class="imgBox">
99                              <img class="img3-4" src="images/portrait.jpg" alt="" />
100                         </div>
101                         <div class="labelBox">
102                             position (3,1)
103                         </div>
104                     </div>
105                 </div>
106                 <div class="columnLoc1">
107                     <div class="imgLabelBox">
108                         <div class="imgBox">
109                             <img class="img3-4" src="images/portrait.jpg" alt="" />
110                         </div>
111                         <div class="labelBox">
112                             position (3,2)
113                         </div>
114                     </div>
115                 </div>
116                 <div class="columnLoc2">
117                     <div class="imgLabelBox">
118                         <div class="imgBox">
119                             <img class="img3-4" src="images/portrait.jpg" alt="" />
120                         </div>
121                         <div class="labelBox">
122                             position (3,3)
123                         </div>
124                     </div>
125                 </div>
126             </div>
127         </body>
128     </html>
```
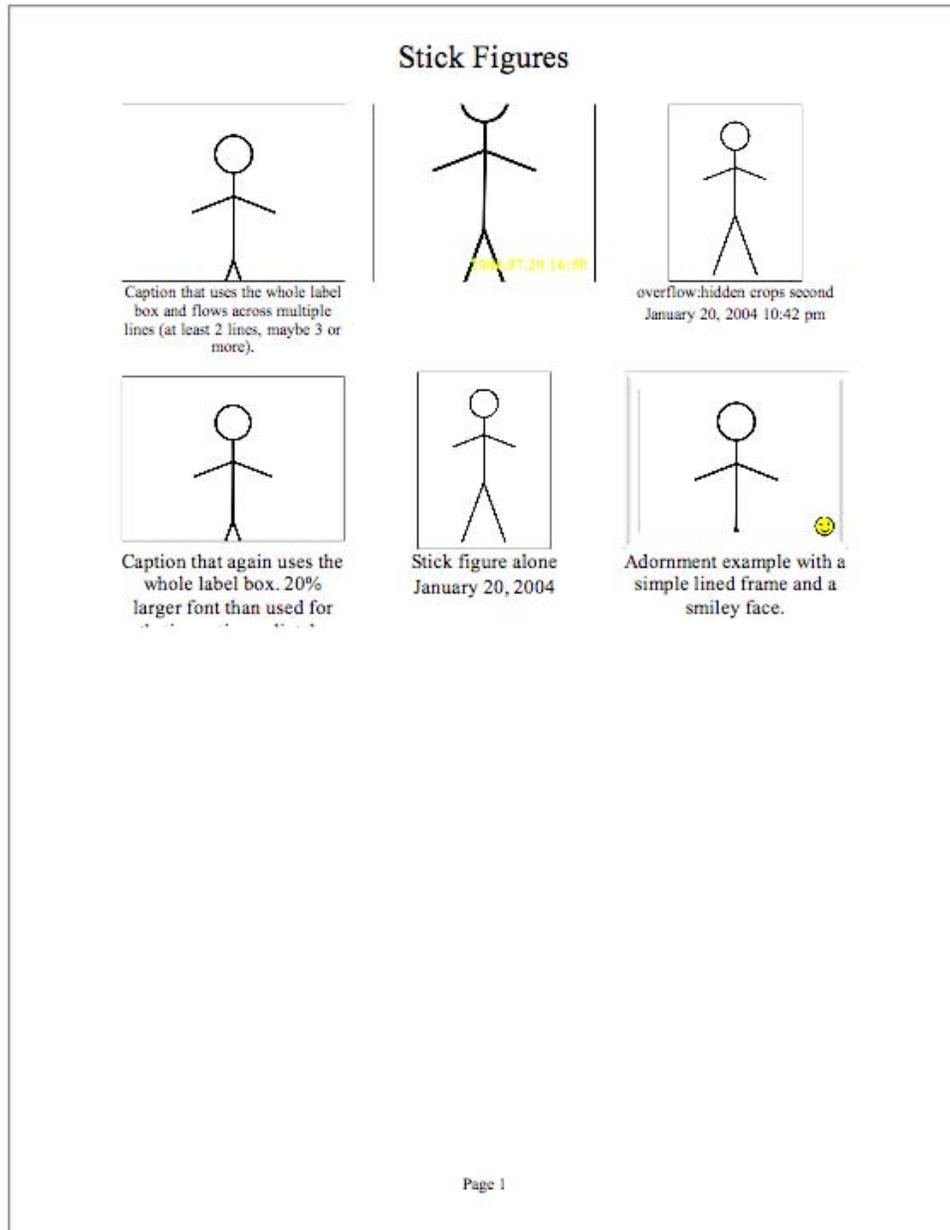
Appendix B Sample Document Output

Figure B-1 Output from Sample 9-3 Image-centric Layout Control

MMS message

To: *Fred*
From: *Jim*
Subject: *Paris*
Date: *June 21, 2004 10:07 PDT (UTC-07:00)*
Audio: *8 seconds*
Video: *None*

Here's a great shot of the Eiffel Tower!

Email message

To: *Jonathan Apple*
From: *William Stiles*
Subject: *Summer Vacation*
Date: *June 21, 2004 10:07 PDT (UTC-07:00)*

Dear Jon,

I hope you are enjoying your summer vacation. We are managing quite well around here in your absence—our new Panes system is taking the world by storm. Please feel free to take an extended leave and don't worry about us back at the office. Enjoy your time off.

Best regards,
Bill

Address book entry

Name: King Kong
Edress: kkong@empirestate.bldg
Phone: +1 000.555.1212
Title:

Figure B-2 Output from Sample 9-4 Text-centric Layout (page 1)

Company:
Address:
Notes: This guy is a real climber.

Figure B-3 Output from Sample 9-4 Text-centric Layout (top part, page 2)

Sample Table Layout Control

The Parthenon

The chief temple of the goddess Athena built on the acropolis at Athens between 447 and 432 b.c. and considered a supreme example of Doric architecture.

—*The American Heritage® Dictionary of the English Language: Fourth Edition*

2004.07.20 16:50
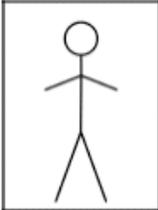
overflow:hidden crops second and following lines.
January 20, 2004 10:42 pm

Caption that again uses the whole label box. 20% larger font than used for the image immediately above.

Stick figure alone
January 20, 2004

Adornment example with a simple lined frame and a smiley face.

Page 1

Figure B-4 Output from Sample A-1 Image-centric Layout Control Using <table>

Appendix C EXIF Tag Recommendations

C.1. EXIF 2.21 and DCF 2.0 Conformance

It is the intent of MIPC to promote and improve interoperability between mobile terminals and home printers. To support this intent, MIPC strongly recommends that mobile terminals implement all mandatory items in the EXIF V2.21 specification and section 3.3 of the DCF V2.0 specification concerning DCF basic files (excluding section 3.3.2). DCF is an annex to the EXIF specification that defines interoperability recommendations for EXIF image files.

In general, the more EXIF information a mobile terminal can provide, the better. This information is used to enable a home printer to better render the requested prints. The following guidelines outline the EXIF tags that MIPC recommends for all mobile terminals to support.

C.2. Mandatory Tags from EXIF and DCF Specifications

The EXIF tags listed in this section are mandatory tags within EXIF and DCF specifications for EXIF image files. These tags represent a minimum set of tags that must be supported to ensure baseline interoperability with EXIF image files.

C.2.1. 0th IFD - Tiff Tags

Tag Field Name	Hex Value	Decimal Value	Description
Make	0x10F	271	The manufacturer of the recording equipment. This is the manufacturer of the DSC, scanner, video digitizer or other equipment that generated the image. When the field is left blank, it is treated as unknown.
Model	0x110	272	The model name or model number of the equipment. This is the model name of number of the DSC, scanner, video digitizer or other equipment that generated the image. When the field is left blank, it is treated as unknown.
XResolution	0x11A	282	Indicates the number of pixels in the image width (X) direction per FocalPlaneResolutionUnit on the camera focal plane.
YResolution	0x11B	283	The number of pixels per ResolutionUnit in the ImageLength direction. The same value as XResolution is designated.
ResolutionUnit	0x128	296	The unit for measuring XResolution and YResolution. The same unit is used for both XResolution and YResolution. If the image resolution in unknown, 2 (inches) is designated.

Tag Field Name	Hex Value	Decimal Value	Description
YCbCrPositioning	0x213	531	The position of chrominance components in relation to the luminance component. This field is designated only for JPEG compressed data or uncompressed YCbCr data. The TIFF default is 1 (centered); but when Y:Cb:Cr = 4:2:2 it is recommended in this standard that 2 (co-sited) be used to record data, in order to improve the image quality when viewed on TV systems. When this field does not exist, the reader shall assume the TIFF default. In the case of Y:Cb:Cr = 4:2:0, the TIFF default (centered) is recommended. If the reader does not have the capability of supporting both kinds of YCbCrPositioning, it shall follow the TIFF default regardless of the value in this field. It is preferable that readers be able to support both centered and co-sited positioning.
ExifIFDPointer	0x8769	34665	The value of the ExifIFDPointer tag provides an offset from the start of the TIFF header to the position where the Exif IFD is stored.

C.2.2.   1st IFD - Thumbnail

Tag Field Name	Hex Value	Decimal Value	Description
Compression	0x103	259	The compression scheme used for the image data. When a primary image is JPEG compressed, this designation is not necessary and is omitted. When thumbnails use JPEG compression, this tag value is set to 6.
XResolution	0x11A	282	Indicates the number of pixels in the image width (X) direction per FocalPlaneResolutionUnit on the camera focal plane.
YResolution	0x11B	283	The number of pixels per ResolutionUnit in the ImageLength direction. The same value as XResolution is designated.
ResolutionUnit	0x128	296	The unit for measuring XResolution and YResolution. The same unit is used for both XResolution and YResolution. If the image resolution in unknown, 2 (inches) is designated.
JPEGInterchangeFormat	0x201	513	The offset to the start byte (SOI) of JPEG compressed thumbnail data. This is not used for primary image JPEG data.

Tag Field Name	Hex Value	Decimal Value	Description
JPEGInterchangeFormatLength	0x202	514	The number of bytes of JPEG compressed thumbnail data. This is not used for primary image JPEG data. JPEG thumbnails are not divided but are recorded as a continuous JPEG bitstream from SOI to EOI. APPn and COM markers should not be recorded. Compressed thumbnails shall be recorded in no more than 64 Kbytes, including all other data to be recorded in APP1.

C.2.3.   EXIF IFD - Camera Capture Tags

Tag Field Name	Hex Value	Decimal Value	Description
ExifVersion	0x9000	36864	The version of this standard supported. Nonexistence of this field is taken to mean nonconformance to the Exif 2.21 standard. Conformance to this standard is indicated by recording "0221" as 4-byte ASCII. Since the type is UNDEFINED, there is no NULL for termination.
DateTimeOriginal	0x9003	36867	The date and time when the original image data was generated. For a DSC the date and time the picture was taken are recorded. The format is "YYYY:MM:DD HH:MM:SS" with time shown in 24- hour format, and the date and time separated by one blank character [20.H]. When the date and time are unknown, all the character spaces except colons (":") may be filled with blank characters, or else the Interoperability field may be filled with blank characters. The character string length is 20 bytes including NULL for termination. When the field is left blank, it is treated as unknown.
DateTimeDigitized	0x9004	36868	The date and time when the image was stored as digital data. If, for example, an image was captured by DSC and at the same time the file was recorded, then the DateTimeOriginal and DateTimeDigitized will have the same contents. The format is "YYYY:MM:DD HH:MM:SS" with time shown in 24-hour format, and the date and time separated by one blank character [20.H]. When the date and time are unknown, all the character spaces except colons (":") may be filled with blank characters, or else the Interoperability field may be filled with blank characters. The character string length is 20 bytes including NULL for termination. When the field is left blank, it is treated as unknown.

Tag Field Name	Hex Value	Decimal Value	Description
ComponentsConfiguration	0x9101	37121	Information specific to compressed data. The channels of each component are arranged in order from the 1st component to the 4th. For uncompressed data the data arrangement is given in the PhotometricInterpretation tag. However, since PhotometricInterpretation can only express the order of Y,Cb and Cr, this tag is provided for cases when compressed data uses components other than Y, Cb, and Cr and to enable support of other sequences.
FlashPixVersion	0xA000	40960	The Flashpix format version supported by a FPXR file. If the FPXR function supports Flashpix format Ver. 1.0, this is indicated similarly to ExifVersion by recording "0100" as 4-byte ASCII. Since the type is UNDEFINED, there is no NULL for termination.
ColorSpace	0xA001	40961	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.
PixelXDimension	0xA002	40962	Information specific to compressed data. When a compressed file is recorded, the valid width of the meaningful image shall be recorded in this tag, whether or not there is padding data or a restart marker. This tag should not exist in an uncompressed file.
PixelYDimension	0xA003	40963	Information specific to compressed data. When a compressed file is recorded, the valid height of the meaningful image shall be recorded in this tag, whether or not there is padding data or a restart marker. This tag should not exist in an uncompressed file. Since data padding is unnecessary in the vertical direction, the number of lines recorded in this valid image height tag will in fact be the same as that recorded in the SOF.
InteroperabilityIFDPointer	0xA005	40965	The value of the Interoperability IFD Pointer tag provides an offset from the start of the TIFF header to the position where the Interoperability IFD is stored.

C.2.4.   Interoperability IFD

Tag Field Name	Hex Value	Decimal Value	Description

Tag Field Name	Hex Value	Decimal Value	Description
InteroperabilityIndex	0x001	1	The tag indicates the type of DCF file. It is recommended that this tag be set to "R98" to indicate a DCF basic file. The format of the tag data including an end code (0x00) is 4 bytes.
InteroperabilityVersion	0x002	2	This tag records the version of the InteroperabilityIndex value. The value is the 4-byte ASCII "0100" meaning Version 1.00. This is not terminated by NULL since the tag Type is UNDEFINED.

C.3. MIPC Recommended EXIF Tags

In addition to the mandatory tags, MIPC strongly recommends that mobile terminals populate the following EXIF Tags to promote a higher level of interoperability and improve output on home printers.

C.3.1.   0th IFD - Tiff Tags

Tag Field Name	Hex Value	Decimal Value	Description
ImageDescription	0x10E	270	A character string giving the title of the image. It may be a comment such as "1988 company picnic" or the like. Two-byte character codes cannot be used. When a 2-byte code is necessary, the Exif Private tag UserComment is to be used.
Orientation	0x112	274	The image orientation viewed in terms of rows and columns. The Orientation tag value is enumerated as follows: 1 = The 0th row is at the visual top of the image, and the 0th column is the visual left-hand side. 2 = The 0th row is at the visual top of the image, and the 0th column is the visual right-hand side. 3 = The 0th row is at the visual bottom of the image, and the 0th column is the visual right-hand side. 4 = The 0th row is at the visual bottom of the image, and the 0th column is the visual left-hand side. 5 = The 0th row is the visual left-hand side of the image, and the 0th column is the visual top. 6 = The 0th row is the visual right-hand side of the image, and the 0th column is the visual top. 7 = The 0th row is the visual right-hand side of the image, and the 0th column is the visual bottom. 8 = The 0th row is the visual left-hand side of the image, and the 0th column is the visual bottom. Other = reserved

Tag Field Name	Hex Value	Decimal Value	Description
DateTime	0x132	306	The date and time of image creation. In this standard it is the date and time the file was changed. The format is "YYYY:MM:DD HH:MM:SS" with time shown in 24-hour format, and the date andtime separated by one blank character [20.H]. When the date and time are unknown, all the character spaces except colons (":") may be filled with blank characters, or else the Interoperability field may be filled with blank characters. The character string length is 20 bytes including NULL for termination. When the field is left blank, it is treated as unknown.

C.3.2.   EXIF IFD - Camera Capture Tags

Tag Field Name	Hex Value	Decimal Value	Description
ExposureTime	0x829A	33434	Exposure time, given in seconds (sec).
FNumber	0x829D	33437	Indicates the actual lens f-number, the ratio of lens aperture to focal length, used when the scene was captured.
ISOSpeedRatings	0x8827	34855	Indicates the ISO Speed and ISO Latitude of the camera or input device as specified in ISO *12232, Photography - Electronic still picture cameras - Determination of ISO speed*. The first value is the ISO saturation speed rating and the last two optional values are the minimum and maximum ISO Speed Latitude value.
ShutterSpeedValue	0x9201	37377	The tag indicates the APEX time value of the shutter speed used when the image was captured. The units are APEX (Additive Systems of Photographic Exposure) values.
ApertureValue	0x9202	37378	The tag indicates the lens aperture used when the image was captured. The unit is the APEX value that ranges from a minimum value of 0.0 to a maximum value of 99.99. The APEX unit values are assigned the following f/numbers: APEX Aperture Aperture_Val 0.0 f/1.0 1.0 f/1.4 2.0 f/2.0 3.0 f/2.8 4.0 f/4.0 5.0 f/5.6 6.0 f/8.0 7.0 f/11 8.0 f/16 9.0 f/22.0 10.0 f/32

Tag Field Name	Hex Value	Decimal Value	Description
BrightnessValue	0x9203	37379	The tag indicates the Brightness Value (luminance) that was measured when the scene was captured, using APEX units. Assuming a "reflected light meter calibration constant" of 11.4 candelas/m^2, a Brightness Value of 10.00 would correspond to a brightness value of 3508 candelas/m$^{2.}$
ExposureBiasValue	0x9204	37380	The tag indicates the exposure stop setting as an APEX value. Ordinarily it is given in the range of -99.99 to 99.99.and indicates the amount of over or under exposure that is relative to the normal exposure as determined by the camera's exposure system.
Lightsource	0x9208	37384	The light source present at scene capture. The tag value is enumerated as follows: 0 = unknown 1 = Daylight 2 = Fluorescent 3 = Tungsten (incandescent light) 4 = Flash 9 = Fine weather 10 = Cloudy weather 11 = Shade 12 = Daylight fluorescent (D 5700 – 7100K) 13 = Day white fluorescent (N 4600 – 5400K) 14 = Cool white fluorescent (W 3900 – 4500K) 15 = White fluorescent (WW 3200 – 3700K) 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 light source Other = reserved

Tag Field Name	Hex Value	Decimal Value	Description
Flash	0x9209	37385	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. The bit values are defined as follows: 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
FocalLength	0x920A	37386	The actual focal length of the lens, in mm. Conversion is not made to the focal length of a 35 mm film.
FileSource	0xA300	41728	Indicates the image source. If a DSC recorded the image, this tag value of this tag always be set to 3, indicating that the image was recorded on a DSC. Other defined sources are enumerated as follows: 0 = others 1 = scanner of transparent type 2 = scanner of reflex type 3 = DSC Other = reserved
CustomRendered	0xA401	41985	This tag indicates the use of special processing on image data, such as rendering geared to output. When special processing is performed, the reader is expected to disable or minimize any further processing. The CustomRendered tag value is enumerated as follows: 0 = Normal process 1 = Custom process Other = reserved

Tag Field Name	Hex Value	Decimal Value	Description
ExposureMode	0xA402	41986	This tag indicates the exposure mode set when the image was shot. In auto-bracketing mode, the camera shoots a series of frames of the same scene at different exposure settings. The ExposureMode tag value is enumerated as follows: 0 = Auto exposure 1 = Manual exposure 2 = Auto bracket Other = reserved
WhiteBalance	0xA403	41987	This tag indicates the white balance mode set when the image was shot. The WhiteBalance tag value is enumerated as follows: 0 = Auto white balance 1 = Manual white balance Other = reserved
DigitalZoomRatio	0xA404	41988	This tag indicates the digital zoom ratio when the image was shot. If the numerator of the recorded value is 0, this indicates that digital zoom was not used.
FocalLength35mmFilm	0xA405	41989	This tag indicates the equivalent focal length assuming a 35mm film camera, in mm. A value of 0 means the focal length is unknown. Note that this tag differs from the FocalLength tag.
SceneCaptureType	0xA406	41990	This tag indicates the type of scene that was shot. It can also be used to record the mode in which the image was shot. Note that this differs from the scene type (SceneType) tag. The SceneCaptureType tag value is enumerated as follows: 0 = Standard 1 = Landscape 2 = Portrait 3 = Night scene Other = reserved
GainControl	0xA407	41991	This tag indicates the degree of overall image gain adjustment. The GainControl tag value is enumerated as follows: 0 = None 1 = Low gain up 2 = High gain up 3 = Low gain down 4 = High gain down Other = reserved
Contrast	0xA408	41992	This tag indicates the direction of contrast processing applied by the camera when the image was shot. The Contrast tag value is enumerated as follows: 0 = Normal 1 = Soft 2 = Hard Other = reserved

Tag Field Name	Hex Value	Decimal Value	Description
Saturation	0xA409	41993	This tag indicates the direction of saturation processing applied by the camera when the image was shot.The Saturation tag value is enumerated as follows: 0 = Normal 1 = Low saturation 2 = High saturation Other = reserved
Sharpness	0xA40A	41994	This tag indicates the direction of sharpness processing applied by the camera when the image was shot. The Sharpness tag value is enumerated as follows: 0 = Normal 1 = Soft 2 = Hard Other = reserved

Appendix D Paper Sizes

Note: Many of the names in the 'Paper Format' column are commonly used, and might be recognized by users in certain world markets. Others are reference names only for the purposes of this table. The important information contained in this table is the physical dimensions of the different paper sizes. Developers should independently confirm the meaning and usefulness of any name in this table before presenting it in a device's user interface or user documentation.

	Paper Format	Dimensions					
		Millimeters			Inches		
Metric sizes	A3+	329.00	x	483.00	12.95	x	19.02
	A3	297.00	x	420.00	11.69	x	16.54
	A4	210.00	x	297.00	8.27	x	11.69
	A5	148.00	x	210.00	5.83	x	8.27
	A6	105.00	x	148.00	4.13	x	5.83
	B4 - JIS	257.00	x	364.00	10.12	x	14.33
	B5 - JIS	182.00	x	257.00	7.17	x	10.12
	B5	176.00	x	250.00	6.93	x	9.84
	C6	114.00	x	162.00	4.49	x	6.38
	DL	110.00	x	220.00	4.33	x	8.66
	2L	127.00	x	178.00	5.00	x	7.01
	L	89.00	x	127.00	3.50	x	5.00
	Choukei 3	120.00	x	235.00	4.72	x	9.25
	Choukei 4	90.00	x	205.00	3.54	x	8.07
	Hagaki	100.00	x	148.00	3.94	x	5.83
	Hagaki 2	200.00	x	148.00	7.87	x	5.83
	Yotsugiri	254.00	x	305.00	10.00	x	12.01
	Youkei 4	105.00	x	235.00	4.13	x	9.25
	Youkei 6	98.00	x	190.00	3.86	x	7.48
	Card	55.00	x	91.00	2.17	x	3.58
	Credit Card	54.00	x	86.00	2.13	x	3.39
English sizes	3x5 inch	76.20	x	127.00	3.00	x	5.00
	4x6 inch	101.60	x	152.40	4.00	x	6.00
	5x7 inch	127.00	x	177.80	5.00	x	7.00
	5x8 inch	127.00	x	203.20	5.00	x	8.00
	8x10 inch	203.20	x	254.00	8.00	x	10.00
	11x14 inch	279.40	x	355.60	11.00	x	14.00
	US B	279.40	x	431.80	11.00	x	17.00
	US executive	184.15	x	266.70	7.25	x	10.50
	US legal	215.90	x	355.60	8.50	x	14.00
	US letter	215.90	x	279.40	8.50	x	11.00
	Half Letter	139.70	x	215.90	5.50	x	8.50
	Panoramic	210.82	x	594.36	8.30	x	23.40
	Panorama 1	101.6	x	304.8	4.00	x	12.00
	Panorama 2	89.00	x	254.00	3.50	x	10.00
	Wide Print	101.6	x	203.2	4.00	x	8.00
	Envelope # 10	104.78	x	241.30	4.125	x	9.50

Appendix E Glossary

aspect ratio	The ratio of the width to the height of a rectangle or rectangular object such as a digital image, a sheet of paper or the page region occupied by a printed image on paper. Aspect ratio is commonly expressed as m:n (spoken as "m-to-n") where m and n are two small, relatively prime integers. Aspect ratio can also be expressed as a single real number—the result of dividing the width by the height. Aspect ratio is a dimensionless number. An image stored in a JPEG file that is 1024 pixels wide by 768 pixels high has the same aspect ratio as a printed picture 200 mm wide by 150 mm high—4:3 as a ratio or 1.333 as a real. When writing the ratio and real together, this document uses the notation '4:3 *(1.333)*'.

relative aspect ratio	The relative aspect ratio of two rectangular objects is the aspect ratio of the first divided by the aspect ratio of the second. In the relational expressions below, 'r' represents the relative aspect ratio. Its significance is that if the two rectangles are scaled to the same height:
	    $r > 1.0$ means the first will be wider
	    $r < 1.0$ means the first will be narrower
	    $r = 1.0$ means they will have the same width

raster orientation	Pixel-based image formats model images as a sequence of rows of pixels. For the image types recommended in the Guidelines, the standard raster orientation of the image defines the first row of pixels to be the top of the image and the last row to be the bottom when it is rendered for viewing. Within rows, the first pixel in the row is leftmost, the last pixel rightmost. Internally, each image file format organizes the image content differently, but this raster orientation model is common to all.