

DICOM Correction Proposal

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Correction Number	CP-1342
Log Summary: Extend Image Type for Breast X-Ray Image IODs	
Name of Standard PS 3.3-2013	
Rationale for Correction: Contrast enhanced digital mammography (CEDM) a.k.a. contrast enhanced spectral mammography (CESM) is a recent addition to breast projection x-ray imaging. In order for general workstations that are accustomed to using the values of Image Type (0008,0008) to distinguish, for example, image flavor (value 3) and derived pixel contrast (value 4) for various purposes, the values of Image Type (0008,0008) for the breast x-ray imaging IODs are being extended to support identification of CEDM/CESM images and additional types of digital breast tomosynthesis images. Proposed by DICOM WG 15 (Mammography and CAD).	
Correction Wording:	

Extend Image Type values 3, 4 and 5 in Mammography Image module

C.8.11.7 Mammography Image Module

Table C.8-74 contains IOD Attributes that describe a Digital Mammography X-Ray Image including its acquisition and positioning.

Table C.8-74. Mammography Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Image identification characteristics. See C.8.11.7.1.4 for specialization.
Positioner Type	(0018,1508)	1	Enumerated Values: MAMMOGRAPHIC NONE
...			

C.8.11.7.1 Mammography Image Attribute Descriptions

...

C.8.11.7.1.4 Image Type

Image Type (0008,0008) Value 1 and Value 2 shall identify the Pixel Data Characteristics in accordance with Section C.8.11.3.1.1.

Value 3 shall be present and have zero length (null value), except when used to identify a stereotactic mammography image, ~~or~~ digital breast tomosynthesis projection or generated 2D image, or contrast enhanced image.

Note: In a previous version of PS 3.3, Value 3 was required to be zero length (null value). If Value 3 is zero length, the image may or may not be a stereotactic mammography image, ~~or~~ digital breast tomosynthesis projection or generated 2D image, or contrast enhanced image, if the Instance was created before these terms were defined.

The Enumerated Values for Value 3 of stereotactic mammography images are:

Table C.8-74a. Enumerated Values of Image Type (0008,0008) Value 3 for Stereotactic Mammography

Enumerated Value	Definition	ACR MQCM Equivalent
STEREO_SCOUT	A localizer image for a stereotactic acquisition.	...SC
STEREO_MINUS	The paired image obtained with the X-Ray source angle decreased from the scout position, to determine positioning coordinates prior to needle positioning.	...ST-
STEREO_PLUS	The paired image obtained with the X-Ray source angle increased from the scout position, to determine positioning coordinates prior to needle positioning.	...ST+
PREFIRE_MINUS	The paired image obtained with the X-Ray source angle decreased from the scout position, with the biopsy needle in position prior to needle deployment.	...PRF-
PREFIRE_PLUS	The paired image obtained with the X-Ray source angle increased from the scout position, with the biopsy needle in position prior to needle deployment.	...PRF+
POSTFIRE_MINUS	The paired image obtained with the X-Ray source angle decreased from the scout position, with the biopsy needle in position following needle deployment through the targeted lesion.	...POF-
POSTFIRE_PLUS	The paired image obtained with the X-Ray source angle increased from the scout position, with the biopsy needle in position following needle deployment through the targeted lesion.	...POF+
POSTBIOPSY_MINUS	The image obtained following tissue acquisition with the X-Ray source angle decreased from the scout position.	...POB-
POSTBIOPSY_PLUS	The image obtained following tissue acquisition with the X-Ray source angle increased from the scout position.	...POB+

POSTBIOPSY	The image obtained following tissue acquisition with the X-Ray source in the scout position.	...POB
POSTMARKER_MINUS	The image obtained following micromarker placement with the X-Ray source angle decreased from the scout position.	...POM-
POSTMARKER_PLUS	The image obtained following micromarker placement with the X-Ray source angle increased from the scout position.	...POM+
POSTMARKER	The image obtained following micromarker placement with the X-Ray source in the scout position.	...POM

The Enumerated Values for Value 3 of digital breast tomosynthesis projection images **and mathematically generated 2D images** are:

Table C.8-74b. Enumerated Values of Image Type (0008,0008) Value 3 for Digital Breast Tomosynthesis Projection and Generated 2D Images

Enumerated Value	Definition	ACR MQCM Equivalent
TOMO_PROJ	Identifies the image as a digital breast tomosynthesis projection image.	n/a
<u>TOMOSYNTHESIS</u>	<u>Identifies the image as digital breast tomosynthesis; shall be used only for generated 2D images when no other Value 3 takes precedence.</u>	<u>n/a</u>
TOMO_SCOUT	A localizer image that may be used to determine positioning coordinates prior to needle positioning.	...SC
PREFIRE	The image obtained with the biopsy needle in position prior to needle deployment.	...PRF
POSTFIRE	The image obtained with the biopsy needle in position following needle deployment through the targeted lesion.	...POF
POSTBIOPSY	The image obtained following tissue acquisition with the X-Ray source in the scout position.	...POB
POSTMARKER	The image obtained following micromarker placement with the X-Ray source in the scout position.	...POM

Note: Digital breast tomosynthesis projection images acquired as part of a biopsy procedure (**and resulting derived images such as mathematically generated 2D**) omit the _MINUS and _PLUS endings because a single digital breast tomosynthesis acquisition produces a set of projection images that replaces the _MINUS and _PLUS image pair used in conventional 2D breast biopsy imaging.

The Enumerated Values for Value 3 of contrast enhanced images are:

Table C.8-74c. Enumerated Values of Image Type (0008,0008) Value 3 for Contrast Enhanced Images

<u>Enumerated Value</u>	<u>Definition</u>
<u>PRE_CONTRAST</u>	<u>Collected before contrast was administered</u>
<u>POST_CONTRAST</u>	<u>Collected during or after contrast was administered</u>

If more than one characteristic (biopsy, tomosynthesis, contrast enhanced) applies to an image, Value 3 shall contain the biopsy image type. If biopsy is not involved, Value 3 shall contain the tomosynthesis image type.

Note: For example, attributes of the Contrast/Bolus module may be used to identify contrast enhanced characteristics of a biopsy and/or tomosynthesis projection or generated 2D image that is also contrast enhanced.

Value 4 shall be present for images acquired using contrast enhanced digital x-ray imaging of the breast (but may be empty if none of the Defined Terms applies), and for mathematically generated 2D images. For other images Value 4 remains optional and implementation specific.

Table C.8-74d. Defined Terms of Image Type (0008,0008) Value 4 for Contrast Enhanced and Generated 2D Images

<u>Defined Term</u>	<u>Definition</u>
<u>GENERATED_2D</u>	<u>Mathematically generated 2D view</u>
<u>ADDITION</u>	<u>Created through Pixel by pixel addition operation</u>
<u>SUBTRACTION</u>	<u>Created through Pixel by pixel subtraction operation</u>

If more than one characteristic (contrast enhanced, tomosynthesis) applies to an image, Value 4 shall contain the contrast enhanced image type. If contrast enhanced is not involved, Value 4 shall contain the generated 2D image type.

Value 5 shall be present for images acquired using contrast enhanced digital x-ray imaging of the breast, but may be empty if none of the Defined Terms applies. For non-contrast images Value 5 remains optional and implementation specific.

Table C.8-74e. Defined Terms of Image Type (0008,0008) Value 5 for Contrast Enhanced 2D Images

<u>Defined Term</u>	<u>Definition</u>
<u>LOW_ENERGY</u>	<u>Low energy image</u>
<u>HIGH_ENERGY</u>	<u>High energy image</u>

Note: A recipient may use the different values for biopsy, tomosynthesis and contrast views to determine how to display them, for example in hanging protocols:

	<u>Image Type Value 3</u>	<u>Image Type Value 4</u>	<u>Image Type Value 5</u>
<u>Conventional 2D mammography</u>	<u>empty</u>	<u>:</u>	<u>:</u>
<u>Stereotactic post-biopsy</u>	<u>POSTBIOPSY</u>	<u>:</u>	<u>:</u>
<u>Pre-contrast 2D</u>	<u>PRE_CONTRAST</u>	<u>empty</u>	<u>empty</u>

<u>Post-contrast 2D low energy</u>	<u>POST_CONTRAST</u>	<u>empty</u>	<u>LOW ENERGY</u>
<u>Post-contrast 2D addition</u>	<u>POST_CONTRAST</u>	<u>ADDITION</u>	<u>empty</u>
<u>Stereotactic scout pre-contrast</u>	<u>STEREO_SCOUT</u>	<u>empty</u>	<u>empty</u>
<u>Stereotactic stereo post-contrast high energy</u>	<u>STEREO_PLUS</u>	<u>empty</u>	<u>HIGH ENERGY</u>
<u>Stereotactic post-fire post-contrast subtraction</u>	<u>POSTFIRE MINUS</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis generated 2D</u>	<u>TOMOSYNTHESIS</u>	<u>GENERATED 2D</u>	<u>:</u>
<u>Tomosynthesis biopsy scout generated 2D</u>	<u>TOMO_SCOUT</u>	<u>GENERATED 2D</u>	<u>:</u>
<u>Tomosynthesis generated 2D post-contrast low energy</u>	<u>TOMOSYNTHESIS</u>	<u>GENERATED 2D</u>	<u>LOW ENERGY</u>
<u>Tomosynthesis generated 2D post-contrast subtraction</u>	<u>TOMOSYNTHESIS</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis projection</u>	<u>TOMO_PROJ</u>	<u>:</u>	<u>:</u>
<u>Tomosynthesis projection post-biopsy</u>	<u>POSTBIOPSY</u>	<u>:</u>	<u>:</u>
<u>Tomosynthesis projection post-biopsy post-contrast subtraction</u>	<u>POSTBIOPSY</u>	<u>SUBTRACTION</u>	<u>empty</u>

Extend Image Type values 3, 4 and 5 in Breast View module

C.8.21.6 Breast View Module

Table C.8.21.6-1 contains IOD Attributes that describe the view of a **Breast Tomosynthesis Imagedigital breast tomosynthesis image**.

Table C.8.21.6-1. Breast View Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Image identification characteristics. See C.8.21.6.1.1 for specialization.
View Code Sequence	(0054,0220)	1	Sequence that describes the view of the patient anatomy in this image. Only a single Item shall be included in this sequence.
...			

C.8.21.6.1 Breast View Module Attribute Description

C.8.21.6.1.1 Image Type and Frame Type

In addition to the requirements specified in C.8.21.1.1.1 Image Type and Frame Type, the following **additional** Defined Terms are specified for Value 3 of Image Type (0008,0008) and Frame Type (0008,9007):

Table C.8.21.6-1a. Defined Terms of Image Type (0008,0008) Value 3 for Contrast Enhanced, Tomosynthesis and Biopsy

Defined Term	Definition	ACR MQCM Equivalent
<u>Contrast</u>		
<u>PRE CONTRAST</u>	<u>Collected before contrast was administered</u>	<u>n/a</u>
<u>POST CONTRAST</u>	<u>Collected during or after contrast was administered</u>	<u>n/a</u>
<u>Tomosynthesis</u>		
<u>TOMO PROJ</u>	<u>Identifies the image as a digital breast tomosynthesis projection image</u>	<u>n/a</u>
<u>TOMOSYNTHESIS</u>	<u>Tomographic reconstruction from limited angle projection data</u>	<u>n/a</u>
<u>Biopsy</u>		
TOMO_SCOUT	A localizer image set that may be used to determine positioning coordinates prior to needle positioning.	...SC
PREFIRE	An image set obtained with the biopsy needle in position prior to needle deployment.	...PRF
POSTFIRE	An image set obtained with the biopsy needle in position following needle deployment through the targeted lesion.	...POF
POSTBIOPSY	An image set obtained following tissue acquisition with the X-Ray source in the scout position.	...POB
POSTMARKER	An image set obtained following micromarker placement with the X-Ray source in the scout position.	...POM

Note: There is no need for _MINUS or _PLUS because a single digital breast tomosynthesis acquisition produces a **projection and/or reconstruction reconstructed slices** image set that replaces the _MINUS and _PLUS image pair used in conventional 2D breast biopsy imaging (see Section C.8.11.7.1.4).

If more than one characteristic (biopsy, tomosynthesis, contrast enhanced) applies to an image, Value 3 shall contain the biopsy image type. If biopsy is not involved, Value 3 shall contain the tomosynthesis image type.

Note: For example, attributes of the Enhanced Contrast/Bolus module may be used to identify contrast enhanced characteristics of a biopsy and/or tomosynthesis image that is also contrast enhanced.

Value 4 shall be NONE except for applicable contrast enhanced images, mathematically generated 2D images and other tomosynthesis reconstructions. The following Defined Terms are specified for Value 4 of Image Type (0008,0008) and Frame Type (0008,9007). For additional Defined Terms see Section C.8.16.1.4.

Table C.8.21.6-1b. Defined Terms of Image Type (0008,0008) Value 4 for Contrast Enhanced and Tomosynthesis

Defined Term	Definition
<u>Tomosynthesis</u>	
<u>GENERATED 2D</u>	<u>Mathematically generated 2D view</u>
<u>MAXIMUM</u>	<u>Created through Pixel by pixel Maximum operation</u>
<u>MEAN</u>	<u>Created through Pixel by pixel mean operation</u>
<u>Contrast</u>	
<u>ADDITION</u>	<u>Created through Pixel by pixel addition operation</u>
<u>SUBTRACTION</u>	<u>Created through Pixel by pixel subtraction operation</u>

If more than one characteristic (contrast enhanced, tomosynthesis) applies to an image, Value 4 shall contain the contrast enhanced image type. If contrast enhanced is not involved, Value 4 shall contain the tomosynthesis image type.

Value 5 shall be present for images acquired using contrast enhanced digital x-ray imaging of the breast, but may be empty if none of the Defined Terms applies. For non-contrast images Value 5 remains optional and implementation specific.

Table C.8.21.6-1c. Defined Terms of Image Type (0008,0008) Value 5 for Contrast Enhanced Images

Defined Term	Definition
<u>LOW ENERGY</u>	<u>Low energy image</u>
<u>HIGH ENERGY</u>	<u>High energy image</u>

Note: A recipient may use the different values for biopsy, tomosynthesis and contrast views to determine how to display them, for example in hanging protocols:

	<u>Image Type Value 3</u>	<u>Image Type Value 4</u>	<u>Image Type Value 5</u>
<u>Tomosynthesis thin reconstructed slices</u>	<u>TOMOSYNTHESIS</u>	<u>NONE</u>	<u>:</u>
<u>Tomosynthesis thick reconstructed slices</u>	<u>TOMOSYNTHESIS</u>	<u>MAXIMUM</u>	<u>:</u>
<u>Tomosynthesis generated 2D</u>	<u>TOMOSYNTHESIS</u>	<u>GENERATED 2D</u>	<u>:</u>
<u>Tomosynthesis projections</u>	<u>TOMO PROJ</u>	<u>NONE</u>	<u>:</u>
<u>Tomosynthesis thin reconstructed slices biopsy post-fire</u>	<u>POSTFIRE</u>	<u>NONE</u>	<u>:</u>
<u>Tomosynthesis thick reconstructed slices post-biopsy</u>	<u>POSTBIOPSY</u>	<u>MEAN</u>	<u>:</u>
<u>Tomosynthesis generated 2D biopsy pre-fire</u>	<u>PREFIRE</u>	<u>GENERATED 2D</u>	<u>:</u>
<u>Tomosynthesis projections biopsy scout</u>	<u>TOMO_SCOUT</u>	<u>NONE</u>	<u>:</u>

<u>Tomosynthesis thick reconstructed slices pre-contrast</u>	<u>TOMOSYNTHESIS</u>	<u>MAXIMUM</u>	<u>empty</u>
<u>Tomosynthesis thin reconstructed slices post-contrast subtraction</u>	<u>TOMOSYNTHESIS</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis thick reconstructed slices post-contrast subtraction</u>	<u>TOMOSYNTHESIS</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis generated 2D post-contrast addition</u>	<u>TOMOSYNTHESIS</u>	<u>ADDITION</u>	<u>empty</u>
<u>Tomosynthesis generated 2D post-contrast low energy</u>	<u>TOMOSYNTHESIS</u>	<u>GENERATED 2D</u>	<u>LOW ENERGY</u>
<u>Tomosynthesis projections post-contrast high energy</u>	<u>TOMO PROJ</u>	<u>NONE</u>	<u>HIGH ENERGY</u>
<u>Tomosynthesis thick reconstructed slices biopsy scout pre-contrast</u>	<u>TOMO SCOUT</u>	<u>MAXIMUM</u>	<u>empty</u>
<u>Tomosynthesis thin reconstructed slices biopsy pre-fire post-contrast subtraction</u>	<u>PREFIRE</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis thick reconstructed slices biopsy post-fire post-contrast subtraction</u>	<u>POSTFIRE</u>	<u>SUBTRACTION</u>	<u>empty</u>
<u>Tomosynthesis generated 2D post-biopsy post-contrast addition</u>	<u>POSTBIOPSY</u>	<u>ADDITION</u>	<u>empty</u>
<u>Tomosynthesis generated 2D biopsy scout post-contrast low energy</u>	<u>TOMO SCOUT</u>	<u>GENERATED 2D</u>	<u>LOW ENERGY</u>
<u>Tomosynthesis projections post-biopsy post-contrast high energy</u>	<u>POSTBIOPSY</u>	<u>NONE</u>	<u>HIGH ENERGY</u>