

### DICOM Correction Item

Correction Number CP-624	
Log Summary: CAD Operating Point Definition	
Type of Modification Addition	Name of Standard PS 3.3, 3.16 – 2006
<p>Rationale for Correction:</p> <p>CP-479 added the CAD Operating Point concept to the CAD SR templates, with guidance for use with “Rendering Intent” of “Presentation Optional”. However, it has become clear in implementing this that it is desirable for the recipient of the CAD SR object to have a grounded understanding of what the operating point actually means. For instance, in the illustration below, which CP-479 added to PS 3.17, operating points are indicated. However, there is no indication of where they lie on the X or Y axis, which can be an important piece of information for a workstation and a radiologist user. In addition, it may be desirable to label the X and Y axes with terms other than sensitivity and specificity.</p> <div> <p>The figure is a graph titled "FROC Curve of CAD Algorithm". The vertical axis is labeled "Sensitivity" and the horizontal axis is labeled "False Markers/Image". A curve starts at the origin (0,0) and rises steeply, then levels off. Five points are marked on the curve with black dots and labeled 0, 1, 2, 3, and 4 from left to right. The label "Operating Point" is placed near the curve. The points represent different trade-offs between sensitivity and the number of false markers.</p> </div> <p>This CP proposes to add definitions of the X and Y axes and the (X,Y) value along those axes associated with each operating point.</p> <p>In addition it is important for the manufacturer of a CAD system to be able to recommend one specific operating point for initial display of CAD findings.</p>	
Sections of documents affected	
PS 3.3 A.35.5.3.1, A.36.5.3.1 and PS 3.16 Annex A, Annex B, Annex D	
Correction Wording:	
See below.	

**Modify PS 3.3, Table A.35.5-2 and A.35.6-2**

**Table A.35.5-2**  
**RELATIONSHIP CONTENT CONSTRAINTS FOR MAMMOGRAPHY CAD SR IOD**

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	CODE, NUM, SCOORD, IMAGE <sup>1</sup> , CONTAINER.
TEXT, CODE, NUM, CONTAINER	HAS OBS CONTEXT	TEXT, CODE, NUM, DATE, TIME, PNAME, COMPOSITE <sup>1</sup> .
IMAGE	HAS ACQ CONTEXT	TEXT, CODE, DATE, TIME, NUM.
CONTAINER, CODE	HAS CONCEPT MOD	TEXT, CODE <sup>2</sup> .
TEXT, CODE	HAS PROPERTIES	<b>CONTAINER</b> , TEXT, CODE, NUM, DATE, IMAGE <sup>1</sup> , SCOORD.
CODE, NUM	INFERRED FROM	CODE, NUM, SCOORD, CONTAINER.
SCOORD	SELECTED FROM	IMAGE <sup>1</sup> .

**Table A.35.6-2**  
**RELATIONSHIP CONTENT CONSTRAINTS FOR CHEST CAD SR IOD**

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	CODE, NUM, IMAGE <sup>1</sup> , CONTAINER.
TEXT, CODE, NUM, CONTAINER	HAS OBS CONTEXT	TEXT, CODE, NUM, DATE, TIME, PNAME, UIDREF, COMPOSITE <sup>1</sup> .
IMAGE, WAVEFORM	HAS ACQ CONTEXT	TEXT, CODE, DATE, TIME, NUM.
CONTAINER, CODE, COMPOSITE	HAS CONCEPT MOD	TEXT, CODE <sup>2</sup> .
TEXT, CODE, NUM	HAS PROPERTIES	<b>CONTAINER</b> , TEXT, CODE, NUM, DATE, IMAGE <sup>1</sup> , WAVEFORM <sup>1</sup> , SCOORD, TCOORD.
CODE, NUM	INFERRED FROM	CODE, NUM, IMAGE <sup>1</sup> , WAVEFORM <sup>1</sup> , SCOORD, TCOORD, CONTAINER.
SCOORD	SELECTED FROM	IMAGE <sup>1</sup> .
TCOORD	SELECTED FROM	SCOORD, IMAGE <sup>1</sup> , WAVEFORM <sup>1</sup> .

**Modify PS 3.16, Annex A**

**TID 4017 CAD Detection Performed Template**

This template fully identifies a detection algorithm and the images and/or image regions on which it operated (see TID 4015).

Parameter Name	Parameter Usage
\$DetectionCode	Coded term or Context Group for Detection Performed

**TID 4017  
 CAD DETECTION PERFORMED  
 Type: Non-Extensible**

NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CODE	EV(111022, DCM, "Detection Performed")	1	M		\$DetectionCode
2	>	HAS PROPERTIES	INCLUDE DTID (4019) "CAD Algorithm Identification"	1	M		
3	>	HAS PROPERTIES	IMAGE	1-n	MC	At least one of row 3, 4, 5 or 6 shall be present	
4	>	R-HAS PROPERTIES	IMAGE	1-n	MC	At least one of row 3,4,5 or 6 shall be present	Shall reference IMAGE content item(s) in the (111028, DCM, "Image Library")
5	>	HAS PROPERTIES	UIDREF EV(112002,DCM,"Series Instance UID")	1-n	MC	At least one of row 3,4,5 or 6 shall be present	
6	>	HAS PROPERTIES	SCOORD EV(111030, DCM, "Image Region")	1-n	MC	At least one of row 3,4,5 or 6 shall be present	
7	>>	SELECTED FROM	IMAGE	1	MC	XOR row 8	
8	>>	R-SELECTED FROM	IMAGE	1	MC	XOR row 7	Shall reference an IMAGE content item in the (111028, DCM, "Image Library")
9	>	HAS PROPERTIES	<del>(111072, DCM, "Maximum CAD Operating Point")</del>	4	U		<b>UNITS = DT ({arb'U}), UCUM, "arbitrary unit"</b>  <b>Value is restricted to being an integer</b>
9	≥	INCLUDE	<u>DTID (4023) CAD Operating Points</u>	1	U		

**Content Item Descriptions**

CAD Algorithm Identification	If more than one detection algorithm has the same "Detection Performed" code value (e.g., CID 6014) then the "CAD Algorithm Identification" shall unambiguously distinguish between algorithms.
Rows 3 - 6	When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, thus only row 4 and/or row 6 shall be present. When this template is invoked for the Chest CAD SR, the Image Library is optional, thus any combination of rows 3, 4, 5 and 6 may be present.
Rows 7 - 8	When this template is invoked for the Mammography CAD SR, the Image Library is mandatory, thus only row 8 shall be present. When this template is invoked for the Chest CAD SR, the Image Library is optional, thus row 7 or 8 may be present.

<b>Maximum CAD Operating Point</b>	<b>The maximum possible value of CAD Operating Point for this type of Detection Performed. No CAD Operating Point value recorded in the CAD Processing and Findings Summary sub-tree of the report for this type of Detection Performed shall exceed this value. The report may or may not contain Rendering Intent = "Presentation-Optional" detections that are assigned the maximum value.</b>
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Add to PS 3.16, Annex A

**TID 4023 CAD Operating Points**

This template describes CAD operating points. The description is deliberately left flexible and optional to allow implementation at differing levels of complexity.

**TID 4023  
 CAD OPERATING POINTS  
 Type: Non-Extensible**

	<u>NL</u>	<u>Rel with Parent</u>	<u>VT</u>	<u>Concept Name</u>	<u>VM</u>	<u>Req Type</u>	<u>Condition</u>	<u>Value Set Constraint</u>
1		<u>HAS PROPERTIES</u>	<u>NUM</u>	(111072, DCM, "Maximum CAD Operating Point")	1	<u>M</u>		<u>UNITS = DT ([arb'U], UCUM, "arbitrary unit")</u> <u>Value is restricted to being an integer</u>
2		<u>HAS PROPERTIES</u>	<u>NUM</u>	(111092, DCM, "Recommended CAD Operating Point")	1	<u>U</u>		<u>UNITS = DT ({0:n}, UCUM, "range: 0:n"), where n is the value specified in row 1</u> <u>Value is restricted to being an integer</u>
3		<u>HAS PROPERTIES</u>	<u>CONTAINER</u>	(111093, DCM, "CAD Operating Point Table")	1	<u>U</u>		
4	>	<u>CONTAINS</u>	<u>CODE</u>	(122698, DCM, "X-Concept")	1	<u>M</u>		<u>DCID (6048) CAD Operating Point Axis Label</u>
5	>	<u>CONTAINS</u>	<u>CODE</u>	(122699, DCM, "Y-Concept")	1	<u>M</u>		<u>DCID (6048) CAD Operating Point Axis Label</u>
6	>	<u>CONTAINS</u>	<u>NUM</u>	(111071, DCM, "CAD Operating Point")	1-n	<u>M</u>	<u>Number of instances of this row shall equal value of row 1, plus 1.</u>	<u>UNITS = DT ({0:n}, UCUM, "range: 0:n"), where n is the value of Row 1. Value is restricted to being an integer that is unique within the invocation of this template.</u>
7	>>	<u>HAS PROPERTIES</u>	<u>TEXT</u>	(111081, DCM, "CAD Operating Point Description")	1	<u>U</u>		
8	>>	<u>HAS PROPERTIES</u>	<u>NUM</u>	The value of Row 4	1	<u>M</u>		
9	>>	<u>HAS PROPERTIES</u>	<u>NUM</u>	The value of Row 5	1	<u>M</u>		

**Content Item Descriptions**

<b>Maximum CAD Operating Point</b>	<b>The maximum possible value of CAD Operating Point for this type of Detection Performed. No CAD Operating Point value recorded in the CAD Processing and Findings Summary sub-tree of the report for this</b>
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	<b><u>type of Detection Performed shall exceed this value. The report may or may not contain Rendering Intent = "Presentation Optional" detections that are assigned the maximum value.</u></b>
<b><u>Recommended CAD Operating Point</u></b>	<b><u>A number indicating which of the CAD operating points is recommended by the creator of a CAD SR instance as the first operating point to be used when rendering the CAD SR instance contents. Subsequent changes to the displayed operating point are implementation dependent.</u></b>

**Add to PS 3.16, Annex B**

**CID 6048 CAD Operating Point Axis Label**

**Context ID 6048**

**CAD Operating Point Axis Label**

**Type: Extensible Version: 20060612**

<b><u>Coding Scheme Designator (0008,0102)</u></b>	<b><u>Code Value (0008,0100)</u></b>	<b><u>Code Meaning (0008,0104)</u></b>
<b><u>DCM</u></b>	<b><u>111023</u></b>	<b><u>Certainty of Finding</u></b>
<b><u>DCM</u></b>	<b><u>111047</u></b>	<b><u>Probability of cancer</u></b>
<b><u>DCM</u></b>	<b><u>111086</u></b>	<b><u>False Markers per Image</u></b>
<b><u>DCM</u></b>	<b><u>111087</u></b>	<b><u>False Markers per Case</u></b>
<b><u>DCM</u></b>	<b><u>111088</u></b>	<b><u>Case Sensitivity</u></b>
<b><u>DCM</u></b>	<b><u>111089</u></b>	<b><u>Lesion Sensitivity</u></b>
<b><u>DCM</u></b>	<b><u>111090</u></b>	<b><u>Case Specificity</u></b>
<b><u>DCM</u></b>	<b><u>111091</u></b>	<b><u>Image Specificity</u></b>

**Add to PS 3.16, Annex D**

<b>Code Value</b>	<b>Code Meaning</b>	<b>Definition</b>	<b>Notes</b>
<b><u>111081</u></b>	<b><u>CAD Operating Point Description</u></b>	<b><u>The intended interpretation of a CAD Operating Point.</u></b>	
<b><u>111086</u></b>	<b><u>False Markers per Image</u></b>	<b><u>The number of false CAD markers per image.</u></b>	
<b><u>111087</u></b>	<b><u>False Markers per Case</u></b>	<b><u>The number of false markers per collection of images that are CAD processed as a group.</u></b>	
<b><u>111088</u></b>	<b><u>Case Sensitivity</u></b>	<b><u>The percentage of cancers that should be detected by a CAD algorithm where CAD marks the cancers in at least one view.</u></b>	
<b><u>111089</u></b>	<b><u>Lesion Sensitivity</u></b>	<b><u>The percentage of cancers that should be detected by a CAD</u></b>	

		<u>algorithm where CAD marks the cancers in each view.</u>	
<u>111090</u>	<u>Case Specificity</u>	<u>The percentage of cases (collections of images CAD processed as a group) without cancer that have no CAD findings whatsoever.</u>	
<u>111091</u>	<u>Image Specificity</u>	<u>The percentage of images without cancer that have no CAD findings whatsoever.</u>	
<u>111092</u>	<u>Recommended CAD Operating Point</u>	<u>The CAD operating point that is recommended for initial display by the creator of the structured report.</u>	
<u>111093</u>	<u>CAD Operating Point Table</u>	<u>A list of CAD operating points including their corresponding characteristics.</u>	