

**DICOM Conformance Statement
for Trident Acquisition Workstation
Software Version 1.0**

Trident™
Specimen Radiography System

Trident™

Specimen Radiography System

DICOM Conformance Statement
For Trident Acquisition Workstation
Software Version 1.0
Part Number MAN-02381
Revision 001

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Table of Contents

1.0 OVERVIEW5

2.0 INTRODUCTION6

2.1. AUDIENCE6

2.2. REMARKS.....6

2.3. DEFINITIONS, TERMS AND ABBREVIATIONS6

2.4. REFERENCES.....7

3.0 NETWORKING8

3.1. IMPLEMENTATION MODEL.....8

3.1.1 *Application Data Flow*.....8

3.1.2 *Functional Definition of AE's*.....9

3.1.3 *Sequencing of Real World Activities*.....10

3.2. AE SPECIFICATIONS11

3.2.1 *Modality Worklist Client AE*.....11

3.2.2 *Print Client AE*.....15

3.2.3 *Storage Client AE*.....22

3.2.4 *Storage Commitment Client AE*.....25

3.2.5 *Verification AE*.....29

3.3. NETWORK INTERFACES30

3.3.1 *Physical Network Interface*30

3.3.2 *Additional Protocols*30

3.4. CONFIGURATION.....31

3.4.1 *AE Title/Presentation Address Mapping*.....31

3.4.2 *Configuration Parameters for Local AEs*.....33

4.0 MEDIA INTERCHANGE.....34

4.1. IMPLEMENTATION MODEL.....34

4.1.1 *Application Data Flow Diagram*.....34

4.1.2 *Functional Definition of AEs*.....34

4.1.3 *Sequencing of Real World Activities*.....34

4.1.4 *File Meta Information for Implementation Class Version*.....34

4.2. AE SPECIFICATIONS.....34

4.2.1 *Media Server AE Specification*.....34

4.3. AUGMENTED AND PRIVATE APPLICATION PROFILES35

4.4. MEDIA CONFIGURATION35

5.0 SUPPORT OF CHARACTER SETS36

DICOM Conformance Statement

6.0 SECURITY.....36

7.0 ANNEXES36

7.1. IOD CONTENTS.....36

7.1.1 *Created SOP Instance(s)*.....36

7.1.2 *Usage of Attributes from Received IODs*.....46

7.1.3 *Attribute Mapping*.....46

7.1.4 *Coerced/Modified Attributes*.....47

7.2. DATA DICTIONARY OF PRIVATE ATTRIBUTES47

7.3. CODED TERMINOLOGY AND TEMPLATES47

7.4. GRAYSCALE IMAGE CONSISTENCY47

7.5. STANDARD EXTENDED/SPECIALIZED/PRIVATE SOP CLASSES47

7.5.1 *Secondary Capture Image Storage SOP Class*.....47

7.6. PRIVATE TRANSFER SYNTAXES.....47

1.0 Overview

The Hologic Trident RC Specimen Radiography Acquisition Workstation implements the necessary DICOM services to:

- Download work lists from an information system,
- Send acquired Digital Mammography For Processing, Digital Mammography For Presentation and created Secondary Capture images to a networked storage device or removable media,
- Request Storage Commitment from a networked storage device,
- Print to a networked hardcopy device.

Table 1-1 provides an overview of the network services supported by the Trident Acquisition Workstation.

Table 1-1
NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Digital Mammography X-Ray Image Storage – For Presentation	Yes	No
Digital Mammography X-Ray Image Storage – For Processing	Yes	No
Secondary Capture Image Storage	Yes	No
Print Management		
Basic Grayscale Print Management Meta SOP Class	Yes	No
Print Job SOP Class	Option	No
Presentation LUT SOP Class	Option	No
Workflow Management		
Modality Worklist Information Model – FIND	Option	No
Storage Commitment Push Model SOP Class	Option	No

Table 1-2 provides an overview of the Media Storage Application Profiles supported by the Trident Acquisition Workstation.

Table 1-2
MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
General Purpose CD-R	Yes	No
General Purpose DVD-R	Yes	No
General Purpose USB 2.0	Yes	No

2.0 Introduction

Hologic, Inc. develops and markets a full line of mammography products including Trident RC Specimen Radiography.

The Trident Acquisition Workstation is a component of Trident RC Specimen Radiography. It provides an interface to the amorphous selenium X-ray detector as an image acquisition device, routing acquired breast specimen images and accompanying information to output devices through DICOM interfaces. The Acquisition Workstation uses a graphical user interface (GUI) with a monitor, keyboard, and pointing device (mouse).

2.1. Audience

This document contains the DICOM conformance claim for the Trident Acquisition Workstation. This document is intended to aid in connecting the Acquisition Workstation to other components that make use of the DICOM standard for interconnecting networked imaging devices.

The information within this document applies to Trident AWS Software version 1.0. The reader of this document should be familiar with the DICOM standard and PACS components that utilize the standard.

2.2. Remarks

A DICOM conformance statement—the structure and content of which are stipulated by the DICOM standard, is intended to aid in determining the suitability of interconnecting digital imaging devices. References to specific functionality in a conformance statement are not sufficient to guarantee interoperability between components. The following should be considered when evaluating interoperability:

- The Acquisition Workstation conformance statement provides a starting point for ascertaining whether the product can communicate with other systems.
- The only way to know for certain whether the Acquisition Workstation can interoperate with other systems is to perform connectivity testing.
- This document represents a best effort to document the functionality of commercial versions of the Acquisition Workstation and is not a functional specification of any Hologic component or product. Hologic reserves the right to make changes at any time to the functionality of the DICOM components described herein, and is committed to following the evolution of the DICOM standard.

2.3. Definitions, Terms and Abbreviations

Amorphous Selenium: Semiconductor material used in the direct capture X-ray detector.

ACR: American College of Radiology

AE: Application Entity

AWS: Acquisition Workstation

DICOM: Digital Imaging and Communications in Medicine

DIMSE: DICOM Message Service Element

Direct Capture: Technique used to convert X-ray energy directly into electrical signals without using intensifying screens or scintillation.

FSC: File-set Creator

FSR: File-set Reader

HIPAA: Health Insurance Portability and Accountability Act

IOD: Information Object Definition

JPEG: Joint Photographic Experts Group (data compression techniques)

DICOM Conformance Statement

LUT: Lookup Table

MWL: Modality Worklist

NEMA: National Electrical Manufacturers Association

PACS: Picture Archive and Communications System (image management and long-term storage)

PDU: Protocol Data Unit

RLE: Run Length Encoding (data compression technique)

SCP: Service Class Provider

SCU: Service Class User

SOP: Service Object Pair

TCP/IP: Transmission Control Protocol/Internet Protocol

UID: Unique Identifier

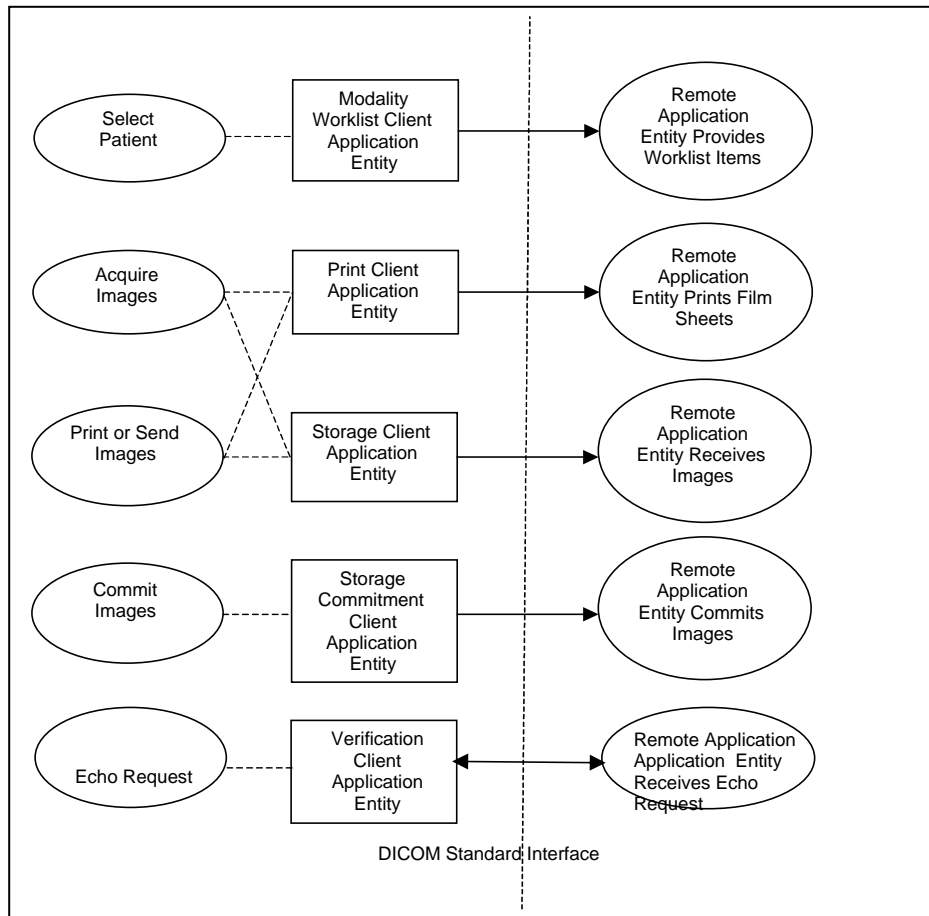
2.4. References

- ACR-NEMA DICOM Standard

3.0 Networking

3.1. Implementation Model

3.1.1 Application Data Flow



- The Modality Worklist Client Application Entity requests and receives Worklist information from a remote AE containing patient schedule and procedure information. It is associated with the local real-world activity “Select Patient”. “Select Patient” is performed as a result of a user request or can be performed automatically at specific time intervals. The Modality Worklist Client queries a remote AE for worklist items and provides to the user the set of worklist items matching the query request.
- The Print Client Application Entity prints images to film on a remote AE (Printer). It is associated with the local real-world activities “Acquire Images” and “Print or Send Images”. When a user performs the “Acquire Images” local real-world activity, remote Print AE destinations will receive images upon closing the patient. “Print or Send Images” can be performed upon a user request for a selected procedure or specific images. This allows the user to automatically print images based on system configurable parameters. When a selected remote AE is a Printer, the Print Client creates a print job within the print queue containing one or more virtual film sheets composed from the acquired or selected images.
- The Storage Client Application Entity sends images to a remote AE. It is associated with the local real-world activities “Acquire Images” and “Print or Send Images”. When a user performs the “Acquire

DICOM Conformance Statement

Images" local real-world activity, remote AE destinations are selected to receive images as a group upon closing the patient. "Print or Send Images" is performed upon user request for a selected procedure or specific images to be sent to one or more remote AEs. If the remote AE is configured as an archive device with storage commitment enabled, the "Commit Images" local real-world activity is triggered.

- The Verification Application Entity sends an echo request to a remote AE. The Verification Application Entity is available as part of the Trident Service Tool utility.

3.1.2 Functional Definition of AE's

Multiple local Application Entities may be active simultaneously.

3.1.2.1 Functional Definition of Modality Worklist Client Application Entity

The Modality Worklist Client AE attempts to download a worklist from a remote node. If the Modality Worklist Client establishes an Association to a remote AE, it will accept all worklist item responses via the open Association. User interactive and automated query results are displayed and stored in a worklist. The resulting worklist is updated from subsequent automated worklist queries. While receiving the worklist responses, if the configurable limit of items is exceeded, an error is reported to the user. Those items that exceeded the configurable limit are not displayed.

3.1.2.3 Functional Definition of Print Client Application Entity

When an internal request to create a hardcopy of image data is generated, the Print Client AE will become active. The print job is created and resides in the Print Queue. The Print Client then attempts to establish an association with the remote printer. If the printer is operating normally, the film sheets described within the print job will be printed. Changes in printer status (e.g., out of film) are detected and reported to the user. If the printer is not operating normally, the print job will be set to an error state and retried. The retry timer and retry count can be configured for the Print Client. Upon reaching the retry limit, the user is notified and the print job remains in the queue with a status of stopped. The user may view the status of the print job in the Print Queue and restart the job via a job control interface.

When the Print Job SOP Class is configured, a configured print job timeout controls how long Associations remain open waiting for the print job to complete. When the Print Job SOP Class is not used, the established Association remains open until the printer responds to a status request that is sent after print action is requested, or until the Print Client times out waiting for a response.

3.1.2.4 Functional Definition of Storage Client Application Entity

The existence of a store job in the output queue will activate the Storage Client AE. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer is started. If the association cannot be opened or the store request fails, the related store job is set to an error state and can be restarted by the user via job control interface. For some error conditions, such as timeouts, the Storage Client will attempt to retry a failed store job automatically. The retry timer and retry count can be configured for the Storage Client. Upon reaching the retry limit, the user is notified and the store job remains in the queue with a status of stopped. The user is notified when a store job does not complete successfully. The user may view the status of store jobs in the output queue.

3.1.2.5 Functional Definition of Storage Commitment Client Application Entity

The existence of a commit job in the output queue will activate the Storage Commitment Client AE. An association request is sent to the destination AE and upon successful negotiation; commitment of the image is requested. The Storage Commitment Client AE waits for commitment confirmation on a separate association. The listening port is always active for commitment confirmation when the Trident application is running.

If the commit request association cannot be opened or the commit request fails, the related commit job is set to an error state and can be restarted by the user via job control interface. For some error conditions, such as timeouts, the Storage Commitment Client will attempt to resend a failed commit job request automatically.

DICOM Conformance Statement

The retry timer and retry count can be configured for the Storage Commitment Client. The user is notified if the remote AE does not accept a commit job request. The user may also view the status of output queues.

3.1.2.8 Functional Definition of Verification Application Entity

The Verification AE is available to the user as a DICOM troubleshooting tool in the Service Tool utility. It is available to test all remote SCP devices.

3.1.3 Sequencing of Real World Activities

A user initiates DICOM storage or print by selecting one or more output devices from a list, acquiring one or more specimen images, and then closing the patient. The images are transmitted to the selected remote AEs when the user closes the patient. When Storage Commitment is enabled, a storage commitment request is sent for each image that is stored successfully. The user may also initiate DICOM storage or print separate from the image acquisition procedure by selecting one or more images from the currently open patient and selecting a destination.

In cases where error(s) occur during transmission, the affected job(s) will be retried if the error condition is temporary—otherwise it will be stopped. The user is always notified when an error occurs. The user may be able to cancel the job or restart the job if desired (depending on the error condition).

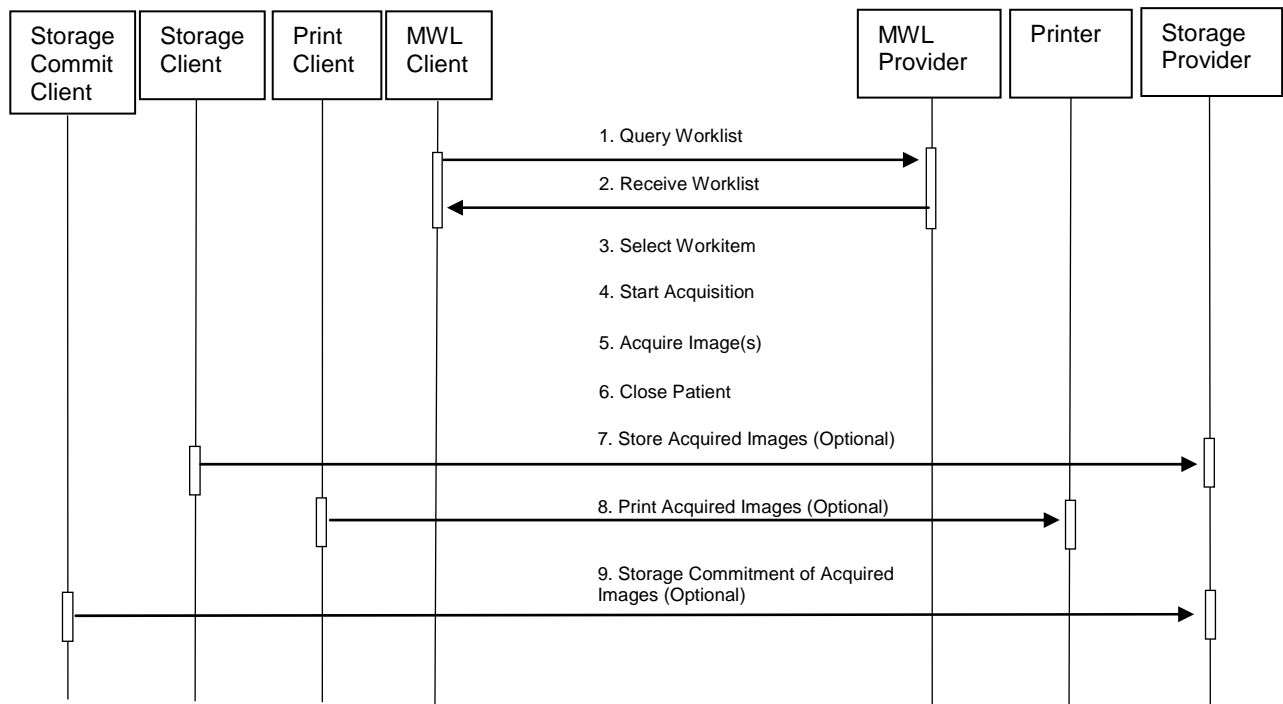


Figure 3.1-1: Image Acquisition Sequence Diagram

3.2. AE Specifications

3.2.1 Modality Worklist Client AE

3.2.1.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Class:

Table 3.2.1-1
SOP CLASS FOR MODALITY WORKLIST CLIENT AE

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No

3.2.1.2 Association Policies

3.2.1.2.1 General

The DICOM standard Application context shall be specified.

Table 3.2.1-2
DICOM APPLICATION CONTEXT

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.1.2.2 Number of Associations

One association is initiated at a time for the Modality Worklist Client AE.

3.2.1.2.3 Asynchronous Nature

The Acquisition Workstation does not support asynchronous operations (multiple outstanding transactions over a single Association).

3.2.1.2.4 Implementation Identifying Information

Table 3.2.1-3
DICOM IMPLEMENTATION CLASS AND VERSION FOR MODALITY WORKLIST CLIENT

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

3.2.1.3 Association Initiation Policy

3.2.1.3.1 Select Patient

3.2.1.3.1.1 Description and Sequencing of Activities

The Select Patient request for a Modality Worklist update is initiated by user interaction, or automatically at defined periods (polling). When the user initiates Select Patient, the user enters data to be used as search criteria, and the data entered by the user are used as matching keys in the query. The search criteria (query keys) and return key attributes for user-entered queries and automatic updates are site configurable.

When an internal request for Modality Worklist update is received, the Modality Worklist Client attempts to establish an association with the configured remote AE. When the association is established a C-FIND request is made to retrieve a worklist using the defined matching and return keys. The Modality Worklist Client waits for C-FIND responses to be returned. The established association remains active until a C-FIND response from the remote AE indicates the end of worklist items or until a configurable timeout period expires. The Modality Worklist Client limits the number of stored worklist responses to a configurable maximum. If the maximum is exceeded during an interactive query, the user is notified that the maximum number of responses was exceeded. For an automatic query, an alarm is posted. In either case, when the maximum is exceeded none of the responses received after the maximum is exceeded are displayed or stored.

DICOM Conformance Statement

The activity of the Modality Worklist Client is transparent to the user. The Modality Worklist Client queries the remote AE using the C-FIND operation and displays the returned worklist items. The user selects a worklist item to begin an exam. The Acquisition Workstation incorporates information from the selected worklist item into the acquired image object. The quality of the information returned in worklist items directly impacts the efficiency of the user. When the remote AE returns insufficient information or is off-line, the Acquisition Workstation requires the user to manually enter information used to identify the patient and procedure.

3.2.1.3.1.2 Proposed Presentation Contexts

The Modality Worklist Client attempts to establish associations using the following presentation contexts:

*Table 3.2.1-4
PROPOSED PRESENTATION CONTEXTS FOR SELECT PATIENT*

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3.1.3 SOP Specific Conformance for Modality Worklist

The behavior of the Acquisition Workstation when encountering status codes in a Modality Worklist C-FIND response is summarized in the Table below. If the Acquisition Workstation receives a SCP response status other than "Success" or "Pending", the user is notified.

*Table 3.2.1-5
DICOM COMMAND RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. Worklist items are available for display. However, if more than the configured maximum number of responses were received, the AWS aborts the association and posts an error message to the user.
Pending	Matches are continuing	FF00	AWS continues the association with the Worklist Provider.
	Matches are continuing-Warning	FF01	AWS continues the association with the Worklist Provider.
Failure	Refused: Out of resources	A700	AWS Aborts association. Error message to user indicates "Dimse Exception: Out of resources"
	Identifier does not match SOP Class	A900	AWS Aborts association. Error message to user indicates "Dimse Exception: Data set does not match (error)"
	Unable to process	Cxxx	AWS Aborts association. Error message to user indicates "Dimse Exception: Cannot understand"

The behavior of the Acquisition Workstation during communication failure is summarized in the Table below.

*Table 3.2.1-6
DICOM COMMAND COMMUNICATION FAILURE BEHAVIOR*

Exception	Behavior
Timeout	The Association is aborted and an error message is posted to the user.
Association aborted by SCP	The responses received prior to the association being aborted are displayed. The error message "remote AE aborted association" is posted to the user.

The Modality Worklist Client is designed to function using a configurable query strategy. The query strategy defines:

- Query method (on-demand, polling, or both)
- Matching keys used
- Return keys requested
- Timeout parameters
- User displayed attributes

For user interactive queries Modality Worklist Client supports any combination of the following matching key attributes as a default:

*Table 3.2.1-7
MWL SOP Class: Supported Matching Keys – User Interactive Queries*

Matching Key Attribute	Tag	Matching Type
Patient's Name	(0010,0010)	Wild Card Matching
Patient ID	(0010,0020)	Single Value Matching
Accession Number	(0008,0050)	Single Value Matching
Requested Procedure ID	(0040,1001)	Single Value Matching
Scheduled Procedure Step Start Date	(0040,0002)	Range Matching

Note: The Acquisition Workstation supports all Matching Keys as specified in DICOM PS 3.4, Table K.6-1.

For automated queries the Modality Worklist Client supports any combination of the following matching key attributes:

*Table 3.2.1-8
MWL SOP Class: Supported Matching Keys – Automated Queries*

Matching Key Attribute	Tag	Matching Type
Modality	(0008,0060)	Single Value Matching (default "MG")
Scheduled Procedure Step Start Date	(0040,0002)	Range Matching
Scheduled Station Name	(0040,0010)	Single Value Matching (Configurable Text)
Scheduled Station AE Title	(0040,0001)	Single Value Matching (Configurable Text)

The Modality Worklist Client can be configured to request any combination of return key attributes. Table 3.2.1-9 contains the default list of attributes that may be requested. Unexpected attributes returned in a C-FIND response are ignored. Requested return key attributes that are not supported by the Modality Worklist SCP are set to have no value.

*Table 3.2.1-9
Modality Worklist SOP Class: Requested Return Key Attributes*

Module/Attribute	Tag
Scheduled Procedure Step	
Scheduled Procedure Step Sequence	(0040,0100)
>Scheduled Station AE Title	(0040,0001)
>Scheduled Procedure Step Start Date	(0040,0002)
>Scheduled Procedure Step Start Time	(0040,0003)
>Modality	(0008,0060)
>Scheduled Performing Physician's Name	(0040,0006)
>Scheduled Procedure Step Description	(0040,0007)
>Scheduled Station Name	(0040,0010)
>Scheduled Procedure Step Location	(0040,0011)
>Scheduled Protocol Code Sequence	(0040,0008)
>>Code Value	(0008,0100)
>>Coding Scheme Designator	(0008,0102)

Module/Attribute	Tag
>>Code Meaning	(0008,0104)
>Scheduled Procedure Step ID	(0040,0009)
Requested Procedure	
Requested Procedure ID	(0040,1001)
Reason for Requested Procedure Code Sequence	(0040,100A)
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
>Code Meaning	(0008,0104)
Requested Procedure Description	(0032,1060)
Requested Procedure Code Sequence	(0032,1064)
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
>Code Meaning	(0008,0104)
Study Instance UID	(0020,000D)
Referenced Study Sequence	(0008,1110)
>Referenced SOP Class UID	(0008,1150)
>Referenced SOP Instance UID	(0008,1155)
Imaging Service Request	
Accession Number	(0008,0050)
Requesting Physician	(0032,1032)
Referring Physician's Name	(0008,0090)
Visit Identification	
Admission ID	(0038,0010)
Visit Status	
Current Patient Location	(0038,0300)
Patient Identification	
Patient's Name	(0010,0010)
Patient ID	(0010,0020)
Issuer of Patient ID	(0010,0021)
Other Patient IDs	(0010,1000)
Patient Demographic	
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Patient's Age	(0010,1010)
Patient's Address	(0010,1040)
Patient Comments	(0010,4000)
Standard Extended	
Study Description	(0008,1030)
Procedure Code Sequence	(0008,1032)
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
>Code Meaning	(0008,0104)
Study ID	(0020,0010)

By default the attribute used to select the configured study code and configured procedure for a given modality workload item is:

- Requested Procedure Code Sequence (0032,1064)
 >Code Value (0008,0100)

The Acquisition Workstation may be configured to use an alternate attribute for the study code. The alternative attributes are:

- Requested Procedure Code Sequence (0032,1064)
 >Code Value (0008,0100)

DICOM Conformance Statement

- >Code Meaning (0008,0104)
- Scheduled Procedure Step Sequence (0040,0100)
 - >Scheduled Procedure Step Description (0040,0007)
 - >Scheduled Procedure Step ID (0040,0009)
 - >Scheduled Protocol Code Sequence (0040,0008)
 - >>Code Value (0008,0100)
 - >>Code Meaning (0008,0104)
- Study Description (0008,1030)

When the configured study code attribute is missing from a returned modality worklist item or the value does not match a code in the procedure database, the user is prompted to select a procedure manually.

See Section 7.1.3 for the mapping of worklist item return key attributes to acquired image attributes.

3.2.1.4 Association Acceptance Policy

The Modality Worklist Client AE does not accept associations.

3.2.2 Print Client AE

3.2.2.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes:

*Table 3.2.2-1
SOP CLASSES FOR PRINT CLIENT AE*

SOP Class Name	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Print Job SOP Class	1.2.840.10008.5.1.1.14	Yes	No
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Yes	No

3.2.3.2 Association Policies

3.2.2.2.1 General

The DICOM standard Application context shall be specified.

*Table 3.2.2-2
DICOM APPLICATION CONTEXT*

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.2.2.2 Number of Associations

One association is initiated at a time for the Print Client AE.

3.2.2.2.3 Asynchronous Nature

The Acquisition Workstation does not support asynchronous operations (multiple outstanding transactions over a single Association).

3.2.2.2.4 Implementation Identifying Information

*Table 3.2.2-3
DICOM IMPLEMENTATION CLASS AND VERSION FOR PRINT CLIENT*

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

3.2.2.3 Association Initiation Policy

3.2.2.3.1 Acquire Images / Print or Send Images

3.2.2.3.1.1 Description and Sequencing of Activities

The Print Client attempts to establish an association with a remote print AE when an internal request to print one or more images is received. When the Print Job SOP Class is configured, the print job timeout controls how long associations remain open waiting for the print job to complete. When the Print Job SOP Class is not used, the association remains open until the remote print AE responds to a status request that is sent after print action is requested, or until the Print Client times out waiting for a response. The Presentation LUT SOP Class is an option that can be enabled on a per printer basis.

For requested image(s) to be printed the Print Client requests the establishment of an association with a Remote Print AE using the Basic Grayscale Print Management Meta SOP Class. If so configured the Print Client negotiates the optional Print Job SOP class and/or Presentation LUT SOP Class.

Once an association is established the Print Client sends print jobs to the remote print AE. Each print job consists of the following steps:

- The Print Client sends the remote print AE an N-GET request for the Printer SOP Class to determine the status of the printer. The Print Client records the status and continues. The Print Client sends an N-CREATE request to the remote print AE to create a film session. After receiving a successful N-CREATE response, the Print Client then sends an N-CREATE request to the remote print AE to create a film box containing a single image box. The remote print AE creates the film session, film box, and image box. The Presentation LUT SOP Class is an option that can be enabled on a per printer basis.

Note: When configured, the Presentation LUT SOP Class is negotiated upon a receiving a successful Film Session N-CREATE response.

- The Print Client sends the remote print AE an N-SET request to update the image box with the image pixel data and other information needed for the image to be printed as part of a film box.
- Once the image has been transferred, the Print Client sends the remote print AE an N-ACTION request for the film box. This triggers the remote print AE to print the film. Note that the Print Client does not request N-ACTION at the film session level.
- When the Print Job SOP Class is negotiated the Print Client polls the remote print AE by sending alternate N-GET requests for the Print Job and Printer SOP Classes at pre-configured intervals until an execution status of either "FAILURE" or "DONE" is received in an N-GET response or N-EVENT-REPORT request, or until the configured job timeout period expires.
- When the Print Job SOP Class is not used, the Print Client sends one N-GET request for the Printer SOP Class after the N-ACTION response is received. The association remains open until the N-GET response or a N-EVENT-REPORT request is received, or until the Print Client times out waiting for the N-GET response.
- Before closing the association under any circumstance, the Print Client sends an N-DELETE request for the film box and then for the film session.
- An alarm is posted to the user when a printer warning or failure status message is received from the remote print AE.

3.2.2.3.1.2 Proposed Presentation Contexts

The Print Client attempts to establish associations using the following presentation contexts:

*Table 3.2.2-4
 PROPOSED PRESENTATION CONTEXTS FOR ACQUIRE IMAGES*

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.9	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		
Print Job SOP Class	1.2.840.10008.5.1.14	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		

3.2.2.3.1.3 SOP Specific Conformance for Print Client

The general behavior of the Print Client AE during communication failure is summarized in the Table below. This behavior is common to all SOP Classes supported by the Print Client AE. Depending on the type of failure, and retry configuration, the print job may be retried several times before reporting an error to the user.

*Table 3.2.2-5
 DICOM COMMAND COMMUNICATION FAILURE BEHAVIOR*

Exception	Behavior
Timeout	The Association is aborted and an error message is posted to the user: "Print job was not completed in the allotted time, or timeout waiting for response. Status of print job is unknown."
Association aborted by SCP	An error message is posted to the user: "Cannot open socket to specified host/port, a network error has occurred, or received abort from remote system."

The Print Client supports various printer types that may expect different values for the film session, film box, and image box attributes. These attribute values are defined within model files for each specific printer. This section describes the DIMSE services and the attributes supported for various remote print AEs and includes the particular attributes that may be configured per printer type.

3.2.2.3.1.3.1 Specific Conformance to Basic Film Session SOP Class

*Table 3.2.2-6
 Basic Film Session SOP Class: Supported DIMSE operations*

Name	Description
N-CREATE	Creates the film session
N-DELETE	Deletes the film session

*Table 3.2.2-7
 Basic Film Session SOP Class: Supported Attributes*

Attribute Name	Tag	Supported Values	Default Value
Number Of Copies	(2000,0010)	1-10	1
Print Priority	(2000,0020)	HIGH, MED, LOW	HIGH
Medium Type	(2000,0030)	BLUE FILM CLEAR FILM DR BLUE FILM MAMMO BLUE FILM MAMMO CLEAR FILM	Configurable
Film Destination	(2000,0040)	(Configurable)	(Configurable)
Film Session Label	(2000,0050)	64 characters max.	HOLOGIC TRIDENT

The behavior of Print Client AE when encountering status codes in a N-CREATE or N-DELETE response is summarized in the Table below.

*Table 3.2.2-8
 FILM SESSION SOP CLASS RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Warning	Memory allocation	B600	Proceed to next step.
Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.3.3.1.3.2 Specific Conformance to Basic Film Box SOP Class

*Table 3.2.2-9
 Basic Film Box SOP Class: Supported DIMSE operations*

Name	Description
N-CREATE	Creates the film box
N-DELETE	Deletes the film box
N-ACTION	Prints the film box

*Table 3.2.2-10
 Basic Film Box SOP Class: Supported Attributes*

Attribute Name	Tag	Supported Values	Default Value
Image Display Format	(2010,0010)	STANDARD\1,1	STANDARD\1,1
Film Orientation	(2010,0040)	PORTRAIT	PORTRAIT
Film Size ID	(2010,0050)	8INX10IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN (Configurable per printer)	Configured per each printer's requirements with image matrix size, or set to calculate automatically for true size printing.
Magnification Type	(2010,0060)	REPLICATE BILINEAR CUBIC NONE (Configurable per printer)	CUBIC

DICOM Conformance Statement

Attribute Name	Tag	Supported Values	Default Value
Smoothing Type	(2010,0080)	(Configurable)	Configured per printer, only if Magnification Type = CUBIC.
Border Density	(2010,0100)	BLACK WHITE	Configured per printer.
Empty Image Density	(2010,0110)	BLACK WHITE	Configured per printer.
Min Density	(2010,0120)	numeric, OD x 100 (Configurable per printer)	20
Max Density	(2010,0130)	numeric, OD x 100 (Configurable per printer)	360
Trim	(2010,0140)	YES NO (Configurable per printer)	NO
Configuration Information	(2010,0150)	Cxxx, where xxx = Code Value obtained from printer vendors	Configured per printer.
Illumination	(2010,015E)	0-65535 (Configurable per printer)	5000 (U.S.) 4000 (Europe) Used with Presentation LUT
Reflected Ambient Light	(2010,1060)	0-65535 (Configurable per printer)	10 (U.S.) 1 (Europe) Used with Presentation LUT
Requested Resolution ID	(2020,0050)	STANDARD HIGH (Configurable per printer)	Omit attribute
Referenced Film Session Sequence	(2010,0500)		
>Referenced SOP Class UID	(0008,1150)		1.2.840.10008.5.1.1.1
>Referenced SOP Instance UID	(0008,1155)		Returned by SCP in the Basic Film Session N-CREATE-RSP
Referenced Image Box Sequence	(2010,0510)		Returned by SCP
Referenced Presentation LUT Sequence	(2050,0500)	Sent only when Presentation LUT is successfully negotiated	Returned by SCP only when Presentation LUT is successfully negotiated
>Referenced SOP Class UID	(0008,1150)		1.2.840.10008.5.1.1.23
>Referenced SOP Instance UID	(0008,1155)		Returned by SCP in the Basic Film Box N-CREATE-RSP

The behavior of Print Client AE when encountering status codes in a N-CREATE, N-ACTION, or N-DELETE response is summarized in the Table below.

*Table 3.2.2-11
FILM BOX SOP CLASS RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Failure	Existing Film Box	C616	Proceed to next step.
Warning or Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.2.3.1.3.3 Specific Conformance to Basic Image Box SOP Class

*Table 3.2.2-12
 Basic Image Box SOP Class: Supported DIMSE Operations*

Name	Description
N-SET	Updates an image box in a previously created film box.

*Table 3.2.2-13
 Basic Image Box SOP Class: Supported Attributes*

Attribute Name	Tag	Supported Values	Default Value
Image Box Position	(2020,0010)	1	1
Polarity	(2020,0020)	NORMAL	NORMAL
Basic Grayscale Image Sequence	(2020,0110)		
> Samples Per Pixel	(0028,0002)	1	1
> Photometric Interpretation	(0028,0004)	MONOCHROME2	MONOCHROME2
> Rows	(0028,0010)	Calculated automatically	Calculated automatically
> Columns	(0028,0011)	Calculated automatically	Calculated automatically
> Pixel Aspect Ratio	(0028,0034)	180\180	180\180
> Bits Allocated	(0028,0100)	16	16
> Bits Stored	(0028,0101)	12	12
> High Bit	(0028,0102)	11	11
> Pixel Representation	(0028,0103)	0000H	0000H
> Pixel Data	(7FE0,0010)		
Magnification Type	(2010,0060)	REPLICATE BILINEAR CUBIC NONE (Configurable per printer)	CUBIC
Smoothing Type	(2010,0080)	(Configurable)	Configured per printer, only if Magnification Type = CUBIC.
Configuration Information	(2010,0150)	Cxxx, where xxx = Code Value obtained from printer vendors	Configured per printer.
Requested Image Size	(2020,0030)	Calculated automatically	Indicates required row size (true size) in mm.

The behavior of Print Client AE when encountering status codes in an N-SET response is summarized in the Table below:

*Table 3.2.2-14
 IMAGE BOX SOP CLASS N-SET RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.2.3.1.3.4 Specific Conformance to Printer SOP Class

*Table 3.2.2-15
 Printer SOP Class: Supported DIMSE operations*

Name	Description
N-EVENT-REPORT	Receives status notification.

DICOM Conformance Statement

Name	Description
N-GET	Retrieves an instance of a physical printer.

The Print Client displays descriptive text corresponding to Printer Status Info (2110,0020) attribute values received from a remote print AE using the N-GET operation, or received via N-EVENT-REPORT. The displayed text is based on DICOM Part 3, C.13.9.1. When the remote print AE sends a Printer Status Info value that is not recognized, the Print Client displays the Printer Status Info value directly.

The behavior of Print Client AE when encountering status codes in a N-GET response is summarized in the Table below:

*Table 3.2.2-16
PRINTER SOP CLASS N-GET RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.2.3.1.3.5 Specific Conformance to Presentation LUT SOP Class

*Table 3.2.2-17
Presentation LUT SOP Class: Supported DIMSE operations*

Name	Description
N-CREATE	Creates a Presentation LUT to be referenced by a film box

*Table 3.2.2-18
Presentation LUT SOP Class: Supported Attributes*

Attribute Name	Tag	Supported Values	Default Value
Presentation LUT Shape	(2050,0020)	IDENTITY LIN OD	Configurable per printer

The behavior of the Print SCU when encountering status codes in the N-CREATE response is summarized in the Table below:

*Table 3.2.2-19
PRESENTATION LUT SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.2.3.1.3.6 Specific Conformance to Print Job SOP Class

*Table 3.2.2-20
Print Job SOP Class: Supported DIMSE operations*

Name	Description
N-EVENT-REPORT	Receives status notification.
N-GET	Retrieves an instance of an existing print job.

The Print Client displays descriptive text corresponding to Execution Status Info (2100,0030) attribute values received from a remote print AE using the N-GET operation, or received via N-EVENT-REPORT. The

DICOM Conformance Statement

displayed text is based on DICOM Part 3, C.13.9.1. When the remote print AE sends an Execution Status Info value that is not recognized, the Print Client displays the Execution Status Info value directly.

The behavior of Print Client AE when encountering status codes in a N-GET response is summarized in the Table below:

*Table 3.2.2-1
PRINT JOB SOP CLASS N-GET RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Proceed to next step.
Failure	Any	Any	AWS Aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response." Specific status information is logged.

3.2.2.4 Association Acceptance Policy

The Print Client AE does not accept associations.

3.2.3 Storage Client AE

3.2.3.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes:

*Table 3.2.3-1
SOP CLASSES FOR STORAGE CLIENT AE*

SOP Class Name	SOP Class UID	SCU	SCP
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No

3.2.3.2 Association Policies

3.2.3.2.1 General

The DICOM standard Application context shall be specified.

*Table 3.2.3-2
DICOM APPLICATION CONTEXT*

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.4.2.2 Number of Associations

Up to three associations are initiated at a time for the Storage Client AE.

3.2.4.2.3 Asynchronous Nature

The Acquisition Workstation does not support asynchronous operations (multiple outstanding transactions over a single Association).

3.2.3.2.4 Implementation Identifying Information

*Table 3.2.3-3
DICOM IMPLEMENTATION CLASS AND VERSION FOR STORAGE CLIENT*

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

3.2.3.3 Association Initiation Policy

3.2.3.3.1 Acquire Images / Print or Send Images

3.2.3.3.1.1 Description and Sequencing of Activities

When the user closes a patient an internal request to transmit all of the newly acquired image data to pre-selected remote storage AEs is generated. The Storage Client then attempts to establish an association with each remote storage AE and transmits the newly acquired images. The Storage Client releases each association after receiving a response from the remote storage AE. It is configurable per remote storage AE whether to send only one object or multiple objects within a single association.

When a storage request is generated to transmit images from the Acquisition Workstation, the Storage Client establishes an association with a remote storage AE, requesting the Digital Mammography X-Ray Image Storage (For Processing) SOP Class, the Digital Mammography X-Ray Image Storage (For Presentation) SOP Class and/or the Secondary Capture Image Storage SOP Class. The output formats are configured per remote storage AE. After the association is established a C-STORE request is made to transfer an image object to the remote storage AE. The Storage Client waits for a C-STORE response to be received before sending the next C-STORE request or releasing the association (depending on configuration).

3.2.3.3.1.2 Proposed Presentation Contexts

The Storage Client attempts to establish associations using the following presentation contexts:

*Table 3.2.3-4
 PROPOSED PRESENTATION CONTEXTS FOR ACQUIRE AND PRINT OR SEND IMAGES*

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR, Little Endian	1.2.840.10008.1.2.1		
		Explicit VR, Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70		

3.2.3.3.1.3 SOP Specific Conformance for Storage

The behavior of the Acquisition Workstation when encountering status codes in a C-STORE response is summarized in the Table below.

*Table 3.2.3-5
 STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR*

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the SOP Instance. Proceed to next step.
Warning	Coercion of Data Elements	B000	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Data element coercion"
	Data set does not match SOP Class	B007	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Data set does not match (warning)"
	Elements discarded	B006	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Elements discarded"
	Attribute list error	0107	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Unrecognized attribute"
Failure	Refused: Out of resources	A7xx	Upon receiving the initial error code, the AWS aborts the association. The AWS will then begin a retry strategy. When the retry strategy fails an error message to user indicates "A DICOM DIMSE error was returned in a response: Out of resources"
	Data set does not match SOP Class	A9xx	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Data set does not match (error)"

DICOM Conformance Statement

Service Status	Further Meaning	Error Code	Behavior
	Cannot understand	Cxxx	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Cannot understand"
	Class instance conflict	0119	AWS aborts association. Error message to user indicates "A DICOM DIMSE error was returned in a response: Class instance conflict"

The behavior of the Acquisition Workstation during communication failure is summarized in the Table below. Depending on the type of failure, and retry configuration, the send job may be retried several times before reporting an error to the user.

*Table 3.2.3-6
STORAGE COMMUNICATION FAILURE BEHAVIOR*

Exception	Behavior
Timeout	The Association is aborted and an error message is posted to the user: "Timeout waiting for response."
Association aborted by SCP	The error message "Unable to connect to destination host/port" is posted to the user.

Instance UIDs are globally unique for all SOP instances generated by the Acquisition Workstation. The UID root is "1.2.840.113681."

- The Acquisition Workstation populates all Type 1 attributes with valid data and always sends them to the Remote Storage AE.
- The Acquisition Workstation sends all Type 2 attributes and populates them if valid source data are available.
- When configured the Acquisition Workstation sends Type 3 (optional), standard extended, and private attributes to the Remote Storage AE and populates them if valid source data are available.

3.2.3.4 Association Acceptance Policy

The Storage Client AE does not accept associations.

3.2.4 Storage Commitment Client AE

3.2.4.1 SOP Class

This Application Entity provides Standard Conformance to the following SOP Class:

*Table 3.2.4-1
SOP CLASS FOR STORAGE COMMITMENT CLIENT AE*

SOP Class Name	SOP Class UID	SCU	SCP
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

3.2.4.2 Association Policies

3.2.4.2.1 General

The DICOM standard Application context shall be specified.

*Table 3.2.4-2
DICOM APPLICATION CONTEXT*

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

DICOM Conformance Statement

3.2.4.2.2 Number of Associations

One association is initiated at a time for the Storage Commitment Client AE.

3.2.4.2.3 Asynchronous Nature

The Acquisition Workstation does not support asynchronous operations (multiple outstanding transactions over a single Association).

3.2.4.2.4 Implementation Identifying Information

Table 3.2.4-3

DICOM IMPLEMENTATION CLASS AND VERSION FOR STORAGE COMMITMENT CLIENT

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

3.2.4.3 Association Initiation Policy

3.2.4.3.1 Commit Images

3.2.4.3.1.1 Description and Sequencing of Activities

When the Storage Commitment Client is configured it attempts to establish an association with a remote storage commitment AE after the Storage Client receives successful C-STORE responses for one or more images. When an association is established, a N-ACTION request is sent to request storage commitment for previously stored images. The Storage Commitment Client releases the association immediately after receiving the N-ACTION response from the remote storage commitment AE.

3.2.4.3.1.2 Proposed Presentation Contexts

The Storage Commitment Client attempts to establish associations using the following presentation contexts:

Table 3.2.4-4

PROPOSED PRESENTATION CONTEXTS FOR COMMIT IMAGES

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.4.3.1.3 SOP Specific Conformance for Storage Commitment

The behavior of the Acquisition Workstation when encountering status codes in a Storage Commitment N-ACTION response is summarized in the Table below.

Table 3.2.4-5

STORAGE COMMITMENT N-ACTION RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The request for storage comment is considered successfully sent. The commit status of each image is set to REQUESTED.
Warning	Attribute value out of range	0106	AWS aborts association. Error message to user indicates: "A DICOM DIMSE error was returned in a response. Storage Commit job failed."
Failure	Unrecognized operation	0211	AWS aborts association. Error message to user indicates: "A DICOM DIMSE error was returned in a response. Storage commit job failed."

DICOM Conformance Statement

The behavior of the Acquisition Workstation during communication failure is summarized in the Table below. Depending on the type of failure, and retry configuration, the commit job request may be retried several times before reporting an error to the user.

Table 3.2.4-6
STORAGE COMMITMENT COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	The Association is aborted and an error message is posted to the user: "Storage Commit job was not acknowledged in the allotted time. Status of commit job is unknown."
Association aborted by SCP	The error message "Cannot open socket to specified host/port, a network error has occurred, or received abort from remote system" is posted to the user.

The Storage Commitment Client supports the following N-ACTION attributes:

Table 3.2.4-7
Supported Storage Commitment N-ACTION Attributes

Action Type Name	Action Type ID	Attribute	Tag	Notes
Request Storage Commitment	1	Transaction UID	(0008,1195)	Acquisition Workstation generates
		Referenced SOP Sequence	(0008,1199)	Acquisition Workstation generates, one or more Items
		> Referenced SOP Class UID	(0008,1150)	1.2.840.10008.5.1.4.1.1.1.2 or 1.2.840.10008.5.1.4.1.1.1.2.1
		> Referenced SOP Instance UID	(0008,1155)	Instance UID of image to be committed

3.2.4.4 Association Acceptance Policy

3.2.4.4.1 Activity – Receive Storage Commitment Response

3.2.4.4.1.1 Description and Sequencing of Activities

The Storage Commitment Client AE will accept associations in order to receive responses to a Storage Commitment Request.

The Storage Commitment Client AE accepts a reverse role association request from a remote storage commitment AE using the Storage Commitment Push Model SOP Class. After accepting an association an N-EVENT-REPORT request is expected that provides the status of a previous request for storage commitment of an image. The Storage Commitment Client AE waits for a configurable period of time, and if a N-EVENT-REPORT request is not received, the association is aborted.

The Transaction UID value in a received N-EVENT-REPORT request is checked. SOP Instances UIDs that are successfully committed are checked and recorded. SOP Instances UIDs that are not committed are logged.

3.2.4.4.1.2 Accepted Presentation Contexts

Table 3.2.4-8
ACCEPTABLE PRESENTATION CONTEXTS FOR STORAGE COMMITMENT CLIENT AND RECEIVE STORAGE COMMITMENT RESPONSE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

DICOM Conformance Statement

3.2.4.4.1.3 SOP Specific Conformance for Storage Commitment

Upon receipt of a N-EVENT-REPORT request, the commit status of the referenced images is updated, and a N-EVENT-REPORT response is sent.

The behavior of Storage Commitment Client AE when receiving Event Types within the N-EVENT-REPORT request is summarized in the Table below.

*Table 3.2.4-9
STORAGE COMMITMENT N-EVENT-REPORT BEHAVIOR*

Event Type Name	Event Type ID	Behavior
Storage Commitment Request Successful	1	The commit status of the Referenced SOP Instances under Referenced SOP Sequence (0008,1199) is set to ACKNOWLEDGED. Successfully committed SOP Instances are candidates for automatic deletion from the local database if local resources become scarce, unless they are otherwise protected from deletion. The conditions under which automatic deletion is initiated and the amount of space freed are site configurable.
Storage Commitment Request Complete – Failures Exist	2	The Referenced SOP Instances under Referenced SOP Sequence (0008,1199) are treated in the same way as in the success case (Event Type 1). A message is logged for each of the Referenced SOP Instances under Failed SOP Sequence (0008,1198).

The reasons for returning specific status codes in a N-EVENT-REPORT response are summarized in the Table below.

*Table 3.2.4-10
STORAGE COMMITMENT N-EVENT-REPORT RESPONSE STATUS*

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	

3.2.5 Verification AE

3.2.5.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Class:

*Table 3.2.5-1
SOP CLASS FOR VERIFICATION SCP AE*

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	No

3.2.5.2 Association Policies

3.2.5.2.1 General

The DICOM standard Application context shall be specified.

*Table 3.2.5-2
DICOM APPLICATION CONTEXT*

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

3.2.5.2.2 Number of Associations

One association is initiated at a time for the Verification SCU.

DICOM Conformance Statement

3.2.5.2.3 Asynchronous Nature

The Acquisition Workstation does not support asynchronous operations (multiple outstanding transactions over a single Association).

3.2.5.2.4 Implementation Identifying Information

Table 3.2.8-3

DICOM IMPLEMENTATION CLASS AND VERSION FOR VERIFICATION SCP

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

3.2.5.3 Association Initiation Policy

The Verification SCU AE does initiate associations. The Verification SCP AE does not initiate associations.

3.2.5.3.1 Activity - C-ECHO

3.2.5.3.1.1 Description and Sequencing of Activities

The Acquisition Workstation provides the user with the capability to C-ECHO any remote Service Class Provider configured on the system as a virtual device.

3.2.5.3.1.2 Proposed Presentation Contexts

The SCU AE attempts to establish associations Presentation Contexts using the following Presentation Contexts.

Table 3.2.5-4

PROPOSED PRESENTATION CONTEXTS FOR ECHO REQUESTS

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.5.3.1.3 SOP Specific Conformance for Verification SOP Class

Verification SCU provides standard conformance to the Verification Service Class. The behavior of the Acquisition Workstation when encountering status codes in a C-ECHO response is summarized in the Table below.

Table 3.2.5-5

VERIFICATION C-ECHO RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Indicate a status of success to the user.

3.2.5.4 Association Acceptance Policy

The Verification SCU AE does not accept associations.

3.3. Network Interfaces

3.3.1 Physical Network Interface

The Acquisition Workstation is tested and supports using 10-BaseT, 100-BaseT and 1000-BaseT Ethernet media.

3.3.2 Additional Protocols

None.

DICOM Conformance Statement

3.4. Configuration

The DICOM Storage, Storage Commitment, Print, and Modality Worklist Clients are configured during site installation.

A Verification SCU, used primarily as a troubleshooting tool, is made available through a service tool utility. It attempts to establish an association with a remote Verification SCP when invoked by the service tool utility. It requests one presentation context, the Verification SOP Class with the DICOM default transfer syntax.

3.4.1 AE Title/Presentation Address Mapping

3.4.1.1 Local AE Titles

*Table 3.4-1
AE TITLE CONFIGURATION TABLE*

Application Entity	Default AE Title	Default TCP/IP Port
Storage Client	DIRECT_DIGXRAY	N/A
Print Client	DIRECT_DIGXRAY	N/A
Modality Worklist Client	DIRECT_DIGXRAY	N/A
Storage Commitment Client	DIRECT_DIGXRAY	104
Verification SCU	DIRECT_DIGXRAY	N/A

The default AE Title and TCP/IP Port number may be modified.

3.4.1.2 Remote AE Title/Presentation Address Mapping

Up to 64 Remote Storage or Print SCPs can be configured.

3.4.1.2.1 Remote Modality Worklist SCP

The following are some of the relevant configurable items for the Remote Modality Worklist SCP:

*Table 3.4-2
Remote Modality Worklist SCP Configuration*

Parameter description	Range
Application Entity Title (Called AE)	The Acquisition Workstation supports one AE acting as a Modality Worklist provider.
Remote Host/IP Address	IP address and hostname associated with the Modality Worklist provider AE.
Remote Port Number	Port number to use when establishing TCP/IP connection to the Modality Worklist provider AE. Range = 1 to 65,535
Study Code	The attribute used to match the procedure to be performed to the procedure codes available on the AWS. The available Study Code attributes include: <ul style="list-style-type: none"> • (default) Requested Procedure Code Sequence, Code Value (0032,1064.0008,0100) • Requested Procedure Code Sequence, Code Meaning (0032,1064.0008,0104) • Scheduled Procedure Step Sequence, Scheduled Protocol Code Sequence, Code Meaning (0040,0100.0040,0008,0008,0104) • Scheduled Procedure Step Sequence, Scheduled Protocol Code Sequence, Code Value (0040,0100.0040,0008,0008,0100) • Scheduled Procedure Step Sequence, Scheduled Procedure Step Description (0040,0100.0040,0007) • Scheduled Procedure Step Sequence, Scheduled Procedure Step ID (0040,0100.0040,0009) • Study Description (0008,1030)

3.4.1.2.2 Remote Print SCP

The following are some of the relevant configurable items for each Remote Print SCP:

*Table 3.4-3
Remote Print SCP Configuration*

Parameter Description	Range
Application Entity Title (Called AE)	The Acquisition Workstation supports multiple AEs acting as Remote Print SCP.
Remote Host/IP Address	IP address and hostname, one per Remote Print AE.
Remote Port Number	Port number to use when establishing TCP/IP connection, one per Remote Print AE. Range = 1 to 65,535
Maximum PDU Length	Default = 16384
Transfer Syntax	<ul style="list-style-type: none"> • Implicit VR Little Endian (default) • Explicit VR Little Endian • Explicit VR Big Endian
Print Job SOP Class	Enable or Disable
Print Job Polling	Enable or Disable
Print Job Poll Period	Applies only when Print Job is enabled. Number of seconds to wait between sending Printer and Print Job N-GET requests after receiving N-ACTION response. Default = 30
Presentation LUT Shape	<ul style="list-style-type: none"> • IDENTITY • LINEAR OD
Send Presentation LUT Info	Enable or Disable negotiation of Presentation LUT SOP Class
Response timeout	Number of seconds to wait for a response from the printer. Default = 240
Times to retry a job	Number of times to attempt a print request before failing it. Default = 3
Retry Interval	Number of hours, minutes and/or seconds to wait before retrying a print request. Default = 1 minute + 30 seconds

3.4.1.2.3 Remote Storage SCP

The following are some of the relevant configurable items for each Remote Storage SCP:

*Table 3.4-4
Remote Storage SCP Configuration*

Parameter Description	Range
Application Entity Title (Called AE)	The Acquisition Workstation supports multiple AEs acting as Remote Storage SCP.
Remote Host/IP Address	IP address and hostname, one per Remote Storage AE.
Remote Port Number	Port number to use when establishing TCP/IP connection, one per Remote Storage AE. Range = 1 to 65,535
Store SOP Class(es)	<ul style="list-style-type: none"> • Digital Mammography X-Ray Image Storage - For Processing and/or • Digital Mammography X-Ray Image Storage – For Presentation and/or • Secondary Capture Image Storage
Storage Commitment	Enable or disable
Transfer Syntax	<ul style="list-style-type: none"> • Implicit VR Little Endian • Explicit VR Little Endian • Explicit VR Big Endian • JPEG Lossless Non-Hierarchical First Order Prediction
Maximum PDU Length	Default = 16384
Response timeout	Number of seconds to wait for a C-STORE response. Default = 300
Times to retry a job	Number of times to attempt a print request before failing it. Default = 3
Retry Interval	Number of hours, minutes and/or seconds to wait before retrying a print request. Default = 30 seconds

3.4.1.2.4 Remote Storage Commitment SCP

The following are some of the relevant configurable items for the Remote Storage Commitment SCP:

*Table 3.4-5
 Remote Storage Commitment SCP Configuration*

Parameter description	Range
Application Entity Title (Called AE)	One Remote Storage AE should be configured for storage commitment, if desired.
Remote Host/IP Address	IP address and hostname of Remote Storage Commitment AE.
Port Number	Port number to be used when establishing TCP/IP connection to the Remote Storage Commitment SCP. Range = 1 to 65,535
Maximum PDU length	Default = 500
N-EVENT-REPORT timeout	Number of seconds to wait for N-EVENT-REPORT request. Default = 300

3.4.2 Configuration Parameters for Local AEs

The following are some of the relevant configurable items for the local AEs:

Table 3.4-8 – CONFIGURATION PARAMETERS

Parameter	Configurable (Yes/No)	Default Value
Modality Worklist Client		
Polling (On/Off)	Yes	Off
Poll interval in minutes	Yes	10
Maximum PDU length	Yes	16384
MWL query timeout: Number of seconds to wait for C-FIND response	Yes	30
Maximum number of MWL items accepted	Yes	100
Matching Keys: Configured and mapped using attributes defined in section 3.2.1.3.1.3	Yes	
Return Keys: Configured and mapped using attributes defined in section 3.2.1.3.1.3	Yes	

4.0 Media Interchange

4.1. Implementation Model

4.1.1 Application Data Flow Diagram

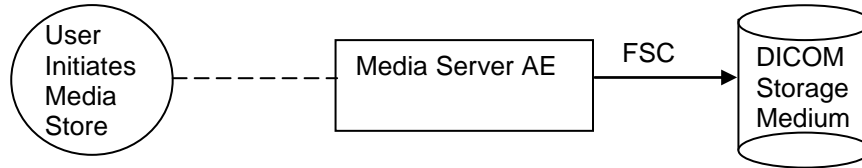


Figure 4.1-1 Application Data Flow Diagram for Media Storage

The Media Server AE provides a means to export Digital Mammography X-Ray Image and Secondary Capture Image objects using DICOM Part 10: Media Storage and File Format for Media Interchange. The objects can be recorded to removable media. This feature is provided as a matter of convenience for users to move objects from one system to another via removable media. This feature is not intended to serve as an archive for permanently storing images.

4.1.2 Functional Definition of AEs

The Media Server AE can store Digital Mammography X-Ray For Processing, For Presentation and Secondary Capture image objects to removable media (see Table 1-2). Formats available for image storage:

- DICOM Part 10 format, storing images using the Digital Mammography X-Ray Image Storage – For Processing SOP Class
- DICOM Part 10 format, storing images using the Digital Mammography X-Ray Image Storage – For Presentation SOP Class
- DICOM Part 10 format, storing images using the Secondary Capture Image Storage SOP Class

The Acquisition Workstation supports DICOM Media Storage as an FSC.

4.1.3 Sequencing of Real World Activities

The Acquisition Workstation user interface provides access to configure and use removable media (see Table 1-2) as an output device to export images to removable media.

4.1.4 File Meta Information for Implementation Class Version

The implementation information written to the File Meta Header in each file is:

Table 4.1-1
DICOM IMPLEMENTATION CLASS AND VERSION FOR MEDIA STORAGE

Implementation Class UID	1.2.840.114089.1.0.0.3.3.12
Implementation Version Name	DCF 3.3.12c

4.2. AE Specifications

4.2.1 Media Server AE Specification

The Media Server AE provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class (SC). The Application Profiles and roles are listed below:

DICOM Conformance Statement

*Table 4.2-1
AE RELATED APPLICATION PROFILES, REAL-WORLD ACTIVITIES, AND ROLES*

Supported Application Profile	Real-World Activity	Roles	SC Option
STD-GEN-CD	User Initiates Media Store	FSC	Interchange
STD-GEN-DVD	User Initiates Media Store	FSC	Interchange
STD-GEN-USB	User Initiates Media Store	FSC	Interchange

4.2.1.1 File Meta Information for Media Server AE

The Source Application Entity Title included in the File Meta Header is the configured system SCU AE Title.

4.2.1.2 Real-World Activities

4.2.1.2.1 Activity – User Initiates Media Store

The Media Server AE acts as an FSC using the interchange option when requested to export images to removable media such as CD-R, DVD or USB 2.0.

A Removable Media utility is available to configure what data is written to the removable media device and the format the image data is written to removable media. The removable media device is available as an output destination via the Export utility found on the Performed Exam Page (PEP).

4.2.1.2.1.1 Media Storage Application Profile

The Media Server AE supports the STD-GEN-CD, STD-GEN-DVD and STD-GEN-USB Application Profiles.

4.2.1.2.1.1.1 Options

The Media Server AE supports the SOP Classes and Transfer Syntaxes listed in the Table below:

*Table 4.2-2
IODS, SOP CLASSES AND TRANSFER SYNTAXES FOR MEDIA SERVER*

SOP Class Name	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1

4.3. Augmented and Private Application Profiles

None

4.4. Media Configuration

The Media output device may be configured to store Digital Mammography X-Ray Image Storage - For Presentation, Digital Mammography X-Ray Image Storage - For Processing and Secondary Capture Image Storage SOP Instances. The Media label, File-set ID (0004,1130), is configurable.

DICOM Conformance Statement**5.0 Support of Character Sets**

The Acquisition Workstation supports the following character sets for the values of Data Elements with a VR of SH, LO, ST, PN or LT:

- Default: ISO-IR 6
- Latin Alphabet No. 1: ISO-IR 100

6.0 Security

The Trident Acquisition Workstation does not support any specific DICOM security measures.

It is assumed that the Trident Acquisition Workstation is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the Trident Acquisition Workstation.
- Firewall or router protections to ensure that the Trident Acquisition Workstation only has network access to approved external hosts and services.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN)).
- Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

7.0 Annexes**7.1. IOD Contents****7.1.1 Created SOP Instance(s)**

Abbreviations for Presence of Value:

ALWAYS	Attribute always present with a value
ANAP	Attribute not always present
EMPTY	Attribute is sent without a value (zero length)
VNAP	Attribute value not always present (zero length if no value is present)

Abbreviations for Source:

AUTO	Attribute value is generated automatically
CONFIG	Attribute value source is a configurable parameter
MWL	Attribute value is the same as the value received using Modality Worklist
USER	Attribute value source is from User input

7.1.1.1 Digital Mammography X-Ray Image IOD

The default attributes that are contained in created SOP Instances are listed in the following tables. The attributes contained in created SOP Instances are configurable.

*Table 7.1-1
IOD OF CREATED DIGITAL MAMMOGRAPHY X-RAY IMAGE SOP INSTANCES*

IE	Module	Reference	Presence of Module
Patient	Patient	Table 7.1-2	ALWAYS
Study	General Study	Table 7.1-3	ALWAYS
	Patient Study	Table 7.1-3	ALWAYS
Series	General Series	Table 7.1-4	ALWAYS
	DX Series	Table 7.1-4	ALWAYS
	Mammography Series	Table 7.1-4	ALWAYS
Equipment	General Equipment	Table 7.1-5	ALWAYS
Image	General Image	Table 7.1-6	ALWAYS
	Image Pixel	Table 7.1-7	ALWAYS
	Specimen	Table 7.1-8	ANAP
	DX Anatomy Imaged	Table 7.1-9	ALWAYS
	DX Image	Table 7.1-6	ALWAYS
	DX Detector	Table 7.1-10	ALWAYS
	DX Positioning	Table 7.1-11	ALWAYS
	X-Ray Acquisition Dose	Table 7.1-12	ALWAYS
	X-Ray Generation	Table 7.1-13	ALWAYS
	X-Ray Filtration	Table 7.1-14	ALWAYS
	Mammography Image	Table 7.1-6	ALWAYS
	VOI LUT	Table 7.1-6	ANAP
	Acquisition Context	Table 7.1-15	ALWAYS
SOP Common	Table 7.1-16	ALWAYS	

*Table 7.1-2
Patient Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Patient's Name	(0010,0010)		ALWAYS	MWL/USER
Patient ID	(0010,0020)		ALWAYS	MWL/USER
Issuer of Patient ID	(0010,0021)		ANAP	MWL
Patient's Birth Date	(0010,0030)		ALWAYS	MWL/USER
Patient's Sex	(0010,0040)		ALWAYS	MWL/USER
Other Patient IDs	(0010,1000)		ANAP	MWL

*Table 7.1-3
General / Patient Study Modules of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Study Date	(0008,0020)		ALWAYS	AUTO
Study Time	(0008,0030)		ALWAYS	AUTO
Accession Number	(0008,0050)		VNAP	MWL/USER
Referring Physician's Name	(0008,0090)		VNAP	MWL/USER
Study Description	(0008,1030)	Internal procedure name	ALWAYS	AUTO
Study Instance UID	(0020,000D)	Unique value generated by AWS if not provided by MWL	ALWAYS	MWL/AUTO

DICOM Conformance Statement

Attribute Name	Tag	Value	Presence of Value	Source
Study ID	(0020,0010)	Value generated by AWS if not provided by MWL Requested Procedure ID (0040,1001)	ALWAYS	MWL/AUTO
Patient's Age	(0010,1010)	Calculated from (0010,0030) Based on the age of the patient when the study was performed	ALWAYS	AUTO

*Table 7.1-4
General / DX / Mammography Series Modules of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Modality	(0008,0060)	MG	ALWAYS	AUTO
Presentation Intent Type	(0008,0068)	Original image: "FOR PROCESSING" Derived image: "FOR PRESENTATION"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	Unique value generated by AWS	ALWAYS	AUTO
Series Number	(0020,0011)	1	ALWAYS	AUTO
Series Date	(0008,0021)		ALWAYS	AUTO
Series Time	(0008,0031)		ALWAYS	AUTO
Series Description	(0008,103E)	'L SPECIMEN' or 'R SPECIMEN'	ALWAYS	AUTO
Operators' Name	(0008,1070)		ALWAYS	AUTO
Body Part Examined	(0018,0015)	BREAST	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	One Item	ALWAYS	AUTO
>Requested Procedure ID	(0040,1001)		ANAP	MWL
>Requested Procedure Description	(0032,1060)		ANAP	MWL
>Requested Procedure Code Sequence	(0032,1064)		ANAP	MWL
>>Code Value	(0008,0100)		ANAP	MWL
>>Coding Scheme Designator	(0008,0102)		ANAP	MWL
>>Code Meaning	(0008,0104)		ANAP	MWL
>Reason for Requested Procedure Code Sequence	(0040,100A)	At least one Item, representing "Diagnostic"	ALWAYS	AUTO/MWL
>>Code Value	(0008,0100)		ALWAYS	AUTO/MWL
>>Coding Scheme Designator	(0008,0102)		ALWAYS	AUTO/MWL
>>Code Meaning	(0008,0104)		ALWAYS	AUTO/MWL
>Scheduled Procedure Step ID	(0040,0009)		ANAP	MWL
>Scheduled Procedure Step Description	(0040,0007)		ANAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)		ANAP	MWL
>>Code Value	(0008,0100)		ANAP	MWL
>>Coding Scheme Designator	(0008,0102)		ANAP	MWL
>>Code Meaning	(0008,0104)		ANAP	MWL

*Table 7.1-5
 General Equipment Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Manufacturer	(0008,0070)	HOLOGIC, Inc.	ALWAYS	CONFIG
Institution Name	(0008,0080)		ALWAYS	CONFIG
Institution Address	(0008,0081)		ALWAYS	CONFIG
Station Name	(0008,1010)		ALWAYS	CONFIG
Institutional Department Name	(0008,1040)		ALWAYS	CONFIG
Manufacturer's Model Name	(0008,1090)	Trident	ALWAYS	CONFIG
Device Serial Number	(0018,1000)		ALWAYS	CONFIG
Software Versions	(0018,1020)	Multiple values	ALWAYS	AUTO

*Table 7.1-6
 General / DX / Mammography Image Modules of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Image Type	(0008,0008)	Original: ORIGINAL\PRIMARY Derived: DERIVED\PRIMARY	ALWAYS	AUTO
Samples per Pixel	(0028,0002)	1	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	Original image: MONOCHROME1 Derived image: MONOCHROME2	ALWAYS	AUTO
Bits Allocated	(0028,0100)	16	ALWAYS	AUTO
Bits Stored	(0028,0101)	Original: 14 Derived: 12	ALWAYS	AUTO
High Bit	(0028,0102)	Original: 13 Derived: 11	ALWAYS	AUTO
Pixel Representation	(0028,0103)	0000H	ALWAYS	AUTO
Pixel Intensity Relationship	(0028,1040)	Original image: LIN Derived image: LOG	ALWAYS	AUTO
Pixel Intensity Relationship Sign	(0028,1041)	Original image: 1 Derived image: -1	ALWAYS	AUTO
Rescale Intercept	(0028,1052)	0	ALWAYS	AUTO
Rescale Slope	(0028,1053)	1	ALWAYS	AUTO
Rescale Type	(0028,1054)	US	ALWAYS	AUTO
Presentation LUT Shape	(2050,0020)	Original image: INVERSE Derived image: IDENTITY	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	00	ALWAYS	AUTO
Patient Orientation	(0020,0020)		EMPTY	AUTO
Burned in Annotation	(0028,0301)	NO	ALWAYS	AUTO
Window Center	(0028,1050)	Original image: not included Derived image: 2100	ANAP	AUTO
Window Width	(0028,1051)	Original image: not included Derived image: 3200	ANAP	AUTO
Positioner Type	(0018,1508)	NONE	ALWAYS	AUTO
Distance Source to Detector	(0018,1110)		ALWAYS	CONFIG
Distance Source to Patient	(0018,1111)		ALWAYS	CONFIG
Positioner Primary Angle	(0018,1510)	0	ALWAYS	AUTO
Image Laterality	(0020,0062)	R, L	ALWAYS	AUTO, USER
Organ Exposed	(0040,0318)	BREAST	ALWAYS	AUTO
Anatomic Region Sequence	(0008,2218)	One Item	ALWAYS	AUTO
>Code Value	(0008,0100)	T-04000	ALWAYS	AUTO
>Code Scheme Designator	(0008,0102)	SRT or SNM3	ALWAYS	CONFIG
>Code Meaning	(0008,0104)	Breast	ALWAYS	AUTO
View Code Sequence	(0054,0220)	One Item	ALWAYS	AUTO
>Code Value	(0008,0100)	G-8310	ALWAYS	AUTO

DICOM Conformance Statement

Attribute Name	Tag	Value	Presence of Value	Source
>Code Scheme Designator	(0008,0102)	SRT or SNM3	ALWAYS	CONFIG
>Code Meaning	(0008,0104)	tissue specimen from breast	ALWAYS	AUTO
>View Modifier Code Sequence	(0054,0222)	Zero or one Item	VNAP	AUTO, USER
>>Code Value	(0008,0100)	R-102D6	ANAP	AUTO
>>Code Scheme Designator	(0008,0102)	SRT or SNM3	ANAP	CONFIG
>>Code Meaning	(0008,0104)	Magnification	ANAP	AUTO
Instance Number	(0020,0013)		ALWAYS	AUTO
Content Date	(0008,0023)	Same as Acquisition Date (0008,0022)	ALWAYS	AUTO
Content Time	(0008,0033)	Same as Acquisition Time (0008,0032)	ALWAYS	AUTO
Acquisition Date	(0008,0022)		ALWAYS	AUTO
Acquisition Time	(0008,0032)		ALWAYS	AUTO
Source Image Sequence	(0008,2112)	Original image: not included Derived image: references the FOR PROCESSING image	ANAP	AUTO
>Referenced SOP Class UID	(0008,1150)		ANAP	AUTO
>Referenced SOP Instance UID	(0008,1155)		ANAP	AUTO
>Purpose of Referenced Code Sequence	(0040,A170)	One Item	ANAP	AUTO
>>Code Value	(0008,0100)	121322	ANAP	CONFIG
>>Coding Scheme Designator	(0008,0102)	DCM	ANAP	CONFIG
>>Code Meaning	(0008,0104)	Source image for image processing operation	ANAP	CONFIG
>Spatial Locations Preserved	(0028,135A)	YES	ANAP	AUTO
Image Comments	(0020,4000)	Included if user enters	ANAP	USER

Table 7.1-7

Image Pixel Module of Created SOP Instances

Attribute Name	Tag	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	See Table 7.1-6		
Photometric Interpretation	(0028,0004)	See Table 7.1-6		
Rows	(0028,0010)	2048	ALWAYS	AUTO
Columns	(0028,0011)	1792	ALWAYS	AUTO
Bits Allocated	(0028,0100)	See Table 7.1-6		
Bits Stored	(0028,0101)	See Table 7.1-6		
High Bit	(0028,0102)	See Table 7.1-6		
Pixel Representation	(0028,0103)	See Table 7.1-6		
Pixel Data	(7FE0,0010)		ALWAYS	AUTO

Table 7.1-8

Specimen Module of Created SOP Instances

Attribute Name	Tag	Value	Presence of Value	Source
Container Identifier	(0040,0512)	Module included only if user enters	ANAP	USER
Issuer of the Container Identifier Sequence	(0040,0513)		EMPTY/ANAP	AUTO
Container Type Code Sequence	(0040,0518)		EMPTY/ANAP	AUTO
Specimen Description Sequence	(0040,0560)	One Item if user enters	ANAP	USER
>Specimen Identifier	(0040,0551)	Same as (0040,0512)	ANAP	USER
>Issuer of the Specimen Identifier Sequence	(0040,0562)		EMPTY/ANAP	AUTO
>Specimen UID	(0040,0554)		ANAP	AUTO

DICOM Conformance Statement

Attribute Name	Tag	Value	Presence of Value	Source
>Specimen Preparation Sequence	(0040,0610)		EMPTY/ANAP	AUTO
>Primary Anatomic Structure Sequence	(0008,2228)	One Item	ANAP	AUTO
>>Code Value	(0008,0100)	T-04000	ANAP	AUTO
>>Coding Scheme Designator	(0008,0102)	SRT or SNM3	ANAP	CONFIG
>>Code Meaning	(0008,0104)	Breast	ANAP	AUTO
>>Primary Anatomic Structure Modifier Sequence	(0008,2230)	One Item if user selects	ANAP	USER
>>>Code Value	(0008,0100)		ANAP	AUTO
>>>Coding Scheme Designator	(0008,0102)		ANAP	AUTO
>>>Code Meaning	(0008,0104)		ANAP	AUTO

*Table 7.1-9
DX Anatomy Imaged Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
The supported attributes are overridden by the Mammography Image module. See Table 7.1-6.				

*Table 7.1-10
DX Detector Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Detector Type	(0018,7004)	DIRECT	ALWAYS	AUTO
Detector ID	(0018,700A)		ALWAYS	AUTO
Date of Last Detector Calibration	(0018,700C)		ALWAYS	AUTO
Time of Last Detector Calibration	(0018,700E)		ALWAYS	AUTO
Detector Binning	(0018,701A)	1\1	ALWAYS	AUTO
Detector Temperature	(0018,7001)		ALWAYS	AUTO
Imager Pixel Spacing	(0018,1164)	.70\70	ALWAYS	AUTO
Pixel Spacing	(0028,0030)	Depends on magnification factor	ALWAYS	AUTO

*Table 7.1-11
DX Positioning Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
View Code Sequence	(0054,0220)	See Table 7.1-6		
Distance Source to Detector	(0018,1110)	See Table 7.1-6		
Distance Source to Patient	(0018,1111)	See Table 7.1-6		
Estimated Radiographic Magnification Factor	(0018,1114)	Non-Mag Images: 1.039 Mag Images: 1.489 or 1.973	ALWAYS	CONFIG
Positioner Type	(0018,1508)	See Table 7.1-6		
Positioner Primary Angle	(0018,1510)	See Table 7.1-6		

*Table 7.1-12
X-ray Acquisition Dose Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
KVP	(0018,0060)		ALWAYS	AUTO
X-Ray Tube Current	(0018,1151)		ALWAYS	AUTO
Exposure Time	(0018,1150)		ALWAYS	AUTO
Exposure	(0018,1152)		ALWAYS	AUTO
Exposure in uAs	(0018,1153)		ALWAYS	AUTO
Distance Source to Detector	(0018,1110)	See Table 7.1-6		
Distance Source to Patient	(0018,1111)	See Table 7.1-6		
Half Value Layer	(0040,0314)		ALWAYS	AUTO
Organ Exposed	(0040,0318)	See Table 7.1-6		
Anode Target Material	(0018,1191)	TUNGSTEN	ALWAYS	AUTO
Filter Type	(0018,1160)	See Table 7.1-14		
Relative X-Ray Exposure	(0018,1405)		ALWAYS	AUTO

*Table 7.1-13
X-ray Generation Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
KVP	(0018,0060)	See Table 7.1-12		
X-ray Tube Current	(0018,1151)	See Table 7.1-12		
Exposure Time	(0018,1150)	See Table 7.1-12		
Exposure	(0018,1152)	See Table 7.1-12		
Exposure in uAs	(0018,1153)	See Table 7.1-12		
Focal Spot	(0018,1190)		ALWAYS	AUTO
Anode Target Material	(0018,1191)	See Table 7.1-12		
Exposure Control Mode	(0018,7060)	e.g. MANUAL, AUTO_KV	ALWAYS	AUTO
Exposure Control Mode Description	(0018,7062)	e.g. Manual	ALWAYS	AUTO

*Table 7.1-14
X-ray Filtration Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Filter Type	(0018,1160)	NONE	ALWAYS	AUTO

*Table 7.1-15
Acquisition Context Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
Acquisition Context Sequence	(0040,0555)		EMPTY	AUTO

*Table 7.1-16
SOP Common Module of Created SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UID for Digital Mammography X-ray Image Storage – For Presentation or For Processing	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	Unique value generated by AWS	ALWAYS	AUTO
Specific Character Set	(0008,0005)	ISO_IR 100	ALWAYS	AUTO
Timezone Offset From UTC	(0008,0201)		ALWAYS	AUTO

7.1.1.2 Secondary Capture Image IOD

The attributes that are contained in created Secondary Capture Image Instances are listed in the following tables.

*Table 7.1-17
IOD OF CREATED SECONDARY CAPTURE IMAGE INSTANCES*

IE	Module	Reference	Presence of Module
Patient	Patient	Table 7.1-18	ALWAYS
Study	General Study	Table 7.1-19	ALWAYS
	Patient Study	Table 7.1-19	ALWAYS
Series	General Series	Table 7.1-20	ALWAYS
Equipment	General Equipment	Table 7.1-21	ALWAYS
	SC Equipment	Table 7.1-22	ALWAYS
Image	General Image	Table 7.1-23	ALWAYS
	SC Image	Table 7.1-23	ALWAYS
	Image Pixel	Table 7.1-24	ALWAYS
	Specimen	Table 7.1-25	ANAP
	Modality LUT	Table 7.1-26	ALWAYS
	VOI LUT	Table 7.1-27	ALWAYS
	SOP Common	Table 7.1-28	ALWAYS

*Table 7.1-18
PATIENT MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES*

Attribute Name	Tag	Value	Presence of Value	Source
Patient's Name	(0010,0010)	Copied from current patient	ALWAYS	AUTO
Patient ID	(0010,0020)	Copied from current patient	ALWAYS	AUTO
Patient's Birth Date	(0010,0030)	Copied from current patient	ALWAYS	AUTO
Patient's Sex	(0010,0040)	Copied from current patient	ALWAYS	AUTO
All other Patient Attributes		Copied from current patient	ANAP	AUTO

*Table 7.1-19
GENERAL / PATIENT STUDY MODULES OF CREATED SECONDARY CAPTURE IMAGE INSTANCES*

Attribute Name	Tag	Value	Presence of Value	Source
Study Date	(0008,0020)	Copied from current study	ALWAYS	AUTO
Study Time	(0008,0030)	Copied from current study	ALWAYS	AUTO
Accession Number	(0008,0050)	Copied from current study	VNAP	AUTO
Referring Physician's Name	(0008,0090)	Copied from current study	VNAP	AUTO
Study Description	(0008,1030)	Copied from current study	ALWAYS	AUTO
Study Instance UID	(0020,000D)	Copied from current study	ALWAYS	AUTO
Study ID	(0020,0010)	Copied from current study	VNAP	AUTO
Patient's Age	(0010,1010)	Copied from current study	ALWAYS	AUTO

*Table 7.1-20
GENERAL SERIES MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES*

Attribute Name	Tag	Value	Presence of Value	Source
Modality	(0008,0060)	See Table 7.1-22		
Series Instance UID	(0020,000E)	Unique value generated	ALWAYS	AUTO
Series Number	(0020,0011)	1	ALWAYS	AUTO
Laterality	(0020,0060)	Same as (0020,0062) Image Laterality in source image	ALWAYS	AUTO

DICOM Conformance Statement

Attribute Name	Tag	Value	Presence of Value	Source
Series Date	(0008,0021)		ALWAYS	AUTO
Series Time	(0008,0031)		ALWAYS	AUTO
Series Description	(0008,103E)	'L SPECIMEN SC' or 'R SPECIMEN SC'	ALWAYS	AUTO
Operators' Name	(0008,1070)		ALWAYS	AUTO
Body Part Examined	(0018,0015)	Same as (0018,0015) in source image	ALWAYS	AUTO

Table 7.1-21

GENERAL EQUIPMENT MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Manufacturer	(0008,0070)	HOLOGIC, Inc.	ALWAYS	CONFIG
Institution Name	(0008,0080)		ALWAYS	CONFIG
Institution Address	(0008,0081)		ALWAYS	CONFIG
Station Name	(0008,1010)		ALWAYS	CONFIG
Institutional Department Name	(0008,1040)		ALWAYS	CONFIG
Manufacturer's Model Name	(0008,1090)	Trident	ALWAYS	CONFIG
Software Versions	(0018,1020)		ALWAYS	AUTO

Table 7.1-22

SC EQUIPMENT MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Conversion Type	(0008,0064)	WSD	ALWAYS	AUTO
Modality	(0008,0060)	Same as (0008,0060) in source image	ALWAYS	AUTO

Table 7.1-23

GENERAL / SC IMAGE MODULES OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Image Type	(0008,0008)	DERIVED\SECONDARY	ALWAYS	AUTO
Presentation LUT Shape	(2050,0020)	IDENTITY	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	00	ALWAYS	AUTO
Patient Orientation	(0020,0020)		EMPTY	AUTO
Burned in Annotation	(0028,0301)	YES or NO	ALWAYS	USER
Instance Number	(0020,0013)	1	ALWAYS	AUTO
Content Date	(0008,0023)		ALWAYS	AUTO
Content Time	(0008,0033)		ALWAYS	AUTO
Acquisition Date	(0008,0022)		ALWAYS	AUTO
Acquisition Time	(0008,0032)		ALWAYS	AUTO
Derivation Description	(0008,2111)	Secondary Capture	ALWAYS	AUTO
Source Image Sequence	(0008,2112)	One Item	ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	Of source image	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	Of source image upon creation	ALWAYS	AUTO
>Purpose of Reference Code Sequence	(0040,A170)	One Item	ALWAYS	AUTO
>>Code Value	(0008,0100)	121324	ALWAYS	AUTO
>>Coding Scheme Designator	(0008,0102)	DCM	ALWAYS	AUTO
>>Code Meaning	(0008,0104)	Source image	ALWAYS	AUTO
>Spatial Locations Preserved	(0028,135A)	NO	ALWAYS	AUTO
Image Comments	(0020,4000)	Copied from source image, user may edit	ANAP	USER

Table 7.1-24
IMAGE PIXEL MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	1	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	MONOCHROME2	ALWAYS	AUTO
Rows	(0028,0010)	1280	ALWAYS	AUTO
Columns	(0028,0011)	1200	ALWAYS	AUTO
Bits Allocated	(0028,0100)	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	8	ALWAYS	AUTO
High Bit	(0028,0102)	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	0000H	ALWAYS	AUTO
Pixel Data	(7FE0,0010)		ALWAYS	AUTO

Table 7.1-25
SPECIMEN MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Container Identifier	(0040,0512)	Module included only if copied from source image or user edits	ANAP	USER
Issuer of the Container Identifier Sequence	(0040,0513)		EMPTY/ANAP	AUTO
Container Type Code Sequence	(0040,0518)		EMPTY/ANAP	AUTO
Specimen Description Sequence	(0040,0560)	One Item if copied from source image or user edits	ANAP	USER
>Specimen Identifier	(0040,0551)	Same as (0040,0512)	ANAP	USER
>Issuer of the Specimen Identifier Sequence	(0040,0562)		EMPTY/ANAP	AUTO
>Specimen UID	(0040,0554)		ANAP	AUTO
>Specimen Preparation Sequence	(0040,0610)		EMPTY/ANAP	AUTO
>Primary Anatomic Structure Sequence	(0008,2228)	One Item if copied from source image or user edits modifier	ANAP	AUTO
>>Code Value	(0008,0100)	T-04000	ANAP	AUTO
>>Coding Scheme Designator	(0008,0102)	SRT or SNM3	ANAP	CONFIG
>>Code Meaning	(0008,0104)	Breast	ANAP	AUTO
>>Primary Anatomic Structure Modifier Sequence	(0008,2230)	One Item if copied from source image or user edits	ANAP	USER
>>>Code Value	(0008,0100)		ANAP	AUTO
>>>Coding Scheme Designator	(0008,0102)		ANAP	AUTO
>>>Code Meaning	(0008,0104)		ANAP	AUTO

Table 7.1-26
MODALITY LUT MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Rescale Intercept	(0028,1052)	0	ALWAYS	AUTO
Rescale Slope	(0028,1053)	1	ALWAYS	AUTO
Rescale Type	(0028,1054)	US	ALWAYS	AUTO

Table 7.1-27
VOI LUT MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
Window Center	(0028,1050)	128	ALWAYS	AUTO

DICOM Conformance Statement

Attribute Name	Tag	Value	Presence of Value	Source
Window Width	(0028,1051)	256	ALWAYS	AUTO

Table 7.1-28

SOP COMMON MODULE OF CREATED SECONDARY CAPTURE IMAGE INSTANCES

Attribute Name	Tag	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UID for Secondary Capture Image Storage	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	Unique value generated	ALWAYS	AUTO
Specific Character Set	(0008,0005)	ISO_IR 100	ALWAYS	AUTO
Timezone Offset from UTC	(0008,0201)		ALWAYS	AUTO

7.1.2 Usage of Attributes from Received IODs

The Acquisition Workstation does not receive any SOP Instances.

7.1.3 Attribute Mapping

The default relationships between attributes received via Modality Worklist and stored in acquired images are summarized in Table 7.1-29. Attribute mapping is configurable.

Table 7.1-29

Attribute Mapping between Modality Worklist and Image

Modality Worklist	Image IOD
Patient's Name	Patient's Name
Patient ID	Patient ID
Issuer of Patient ID	Issuer of Patient ID
Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex
Other Patient IDs	Other Patient IDs
Referring Physician's Name	Referring Physician's Name
Requested Procedure ID	Study ID
Study Instance UID	Study Instance UID
Accession Number	Accession Number
Scheduled Procedure Step Sequence	Request Attributes Sequence
>Scheduled Procedure Step Description	>Scheduled Procedure Step Description
>Scheduled Protocol Code Sequence	>Scheduled Protocol Code Sequence
>>Code Value	>>Code Value
>>Coding Scheme Designator	>>Coding Scheme Designator
>>Code Meaning	>>Code Meaning
>Scheduled Procedure Step ID	>Scheduled Procedure Step ID
Reason for Requested Procedure Code Sequence	>Reason for Requested Procedure Code Sequence
>Code Value	>>Code Value
>Coding Scheme Designator	>>Coding Scheme Designator
>Code Meaning	>>Code Meaning
Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description	>Requested Procedure Description
Requested Procedure Code Sequence	>Requested Procedure Code Sequence
>Code Value	>>Code Value
>Coding Scheme Designator	>>Coding Scheme Designator
>Code Meaning	>>Code Meaning

DICOM Conformance Statement

The following additional rules apply for mapping Modality Worklist attributes to image Instances:

Attributes mapped to the Request Attribute Sequence Item in image Instances:

- For a scheduled procedure the Acquisition Workstation incorporates the attributes from the worklist item into the Request Attributes Sequence (0040,0275) Item of the image object.
- For unscheduled procedures the Request Attributes Sequence (0040,0275) in the image object contains only Reason for Requested Procedure Code Sequence (0040,100A) with one Item.

7.1.4 Coerced/Modified Attributes

The following characters in textual return key attribute values of a Modality Worklist item are modified automatically by the Acquisition Workstation when mapped to an image object:

- Ampersand Symbol (&): Mapped to “.AND.”
- Double Quote Symbol (“): Mapped to “” (single quote)
- Greater Than Symbol (>): Mapped to “.GT.”
- Less than Symbol (<): Mapped to “.LT.”

7.2. Data Dictionary of Private Attributes

Created Digital Mammography X-Ray Image SOP Instances may contain a Private Group (0019) labeled HOLOGIC, Inc., containing proprietary image characteristics.

7.3. Coded Terminology and Templates

None.

7.4. Grayscale Image Consistency

None.

7.5. Standard Extended/Specialized/Private SOP Classes

7.5.1 Secondary Capture Image Storage SOP Class

By default the Secondary Capture Image Storage SOP Class is Standard Extended by the attributes defined in Table 7.5-1.

*Table 7.5-1
Standard Extended Attributes of Created Secondary Capture Image SOP Instances*

Attribute Name	Tag	Value	Presence of Value	Source
View Code Sequence	(0054,0220)	One Item copied from source image	ALWAYS	AUTO
>Code Value	(0008,0100)		ALWAYS	AUTO
>Coding Scheme Designator	(0008,0102)		ALWAYS	CONFIG
>Code Meaning	(0008,0104)		ALWAYS	AUTO
>View Modifier Code Sequence	(0054,0222)	Zero or one Item copied from source image	VNAP	AUTO
>>Code Value	(0008,0100)		ANAP	AUTO
>>Coding Scheme Designator	(0008,0102)		ANAP	CONFIG
>>Code Meaning	(0008,0104)		ANAP	AUTO

7.6. Private Transfer Syntaxes

None.