DICOM

Conformance Statement

MOSAIC and MOSAIC HP
PETView Version 9.40

PHILIPS

Issued by:

Philips Medical Systems (Cleveland), Inc.
Philips Medical Systems
595 Miner Road
Cleveland, Ohio 44143
USA

Philips Medical Systems Nederland B.V.
CTO C&S Interoperability Competence Center

P.O. Box 10.000
5680 DA Best
The Netherlands

email: mailto:dicom@philips.com
Internet: http://www.medical.philips.com

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1 DICOM CONFORMANCE STATEMENT OVERVIEW

1.1 INTRODUCTION

This DICOM Conformance Statement applies to MOSAIC systems using PETView software version PETView software version 9.40.

1.2 STORAGE SOP CLASSES

All storage SOP Classes in Table 1-1 are supported.

Table 1-1: Network and Print Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Instance Transfer		
Computed Tomography (CT) Image Storage	Yes	Stored and Viewed
Magnetic Resonance (MR) Image Storage	Yes	Stored and Viewed
Single-Frame Secondary Capture Image Storage	Yes	Stored and Viewed
Multi-Frame Secondary Capture Image Storage	Yes	Stored and Viewed
RT Structure Sets	Yes	Yes
Storage Commitment	Yes	No
Query-Retrieve	Yes	Yes
Nuclear Medicine (NM) Image Storage	Yes	Stored and Viewed
Positron Emission Tomography (PET) Image Storage	Yes	Stored and Viewed
Raw Data Storage (for Philips PET raw data)	Yes	Yes
Print		
Basic Grayscale Print Management	Yes	No
Basic ColorPrint	Yes	No

1.3 ACRONYMS AND ABBREVIATIONS

Table 1-2: Common Acronyms and Abbreviations

ACR	American College of Radiology
AE	Application Entity
ANSI	American National Standards Institute
DICOM	Digital Imaging and Communication in Medicine
DIMSE-C	DICOM Message Service Element-Composite
DIMSE-N	DICOM Message Service Element-Normalized
IOD	Information Object Definition
ISO	International Standards Definition
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnections
PDU	Protocol Data Unit
SCP	Service Class Provider (server)
SCU	Service Class User (client)
TCP/IP	Transmission Control Protocol/Internet Protocol
SOP	Service Object Pair
UID	Unique Identification

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3 INTRODUCTION

3.1 REVISION HISTORY

Table 3-1: Revision History

Document Version	Date of Issue	Description
Rev. A	April 2008	Mosaic and Mosaic HP with PETView 9.40 release.

3.2 REMARKS

Not applicable.

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

Import

Print

DICOM Standard Interface
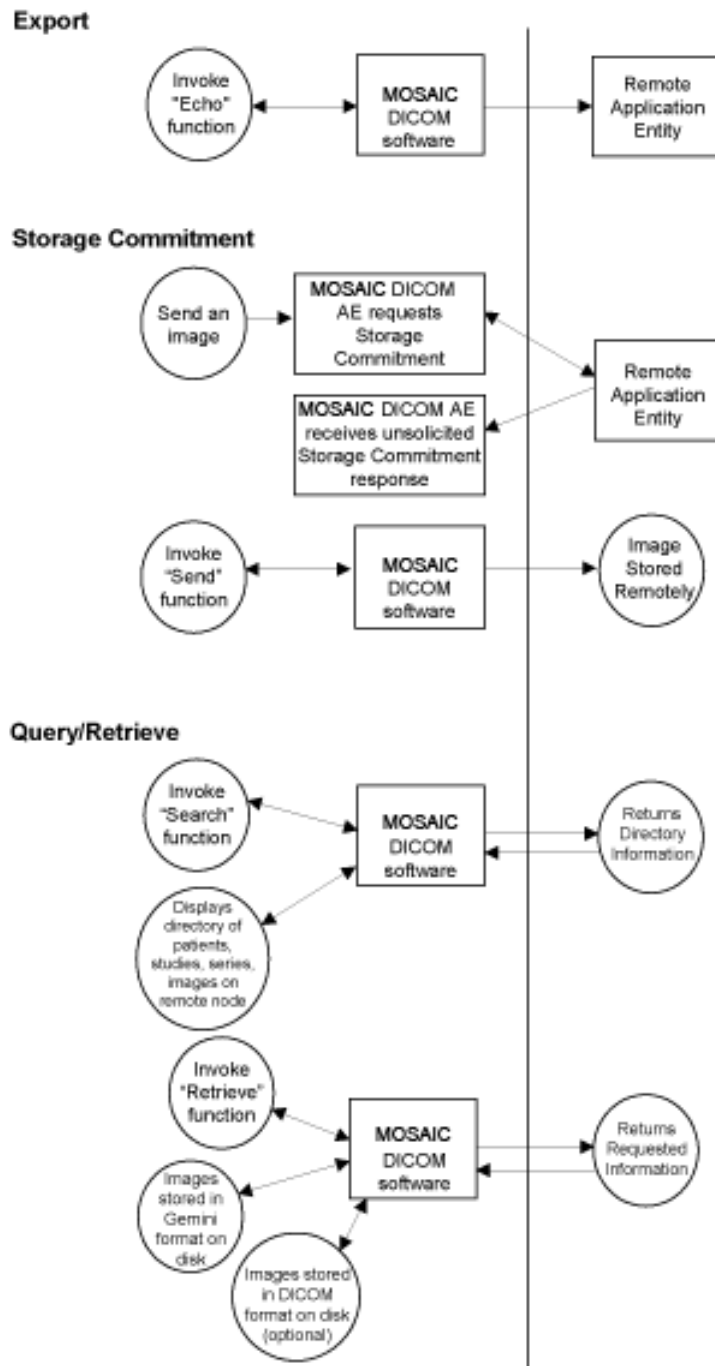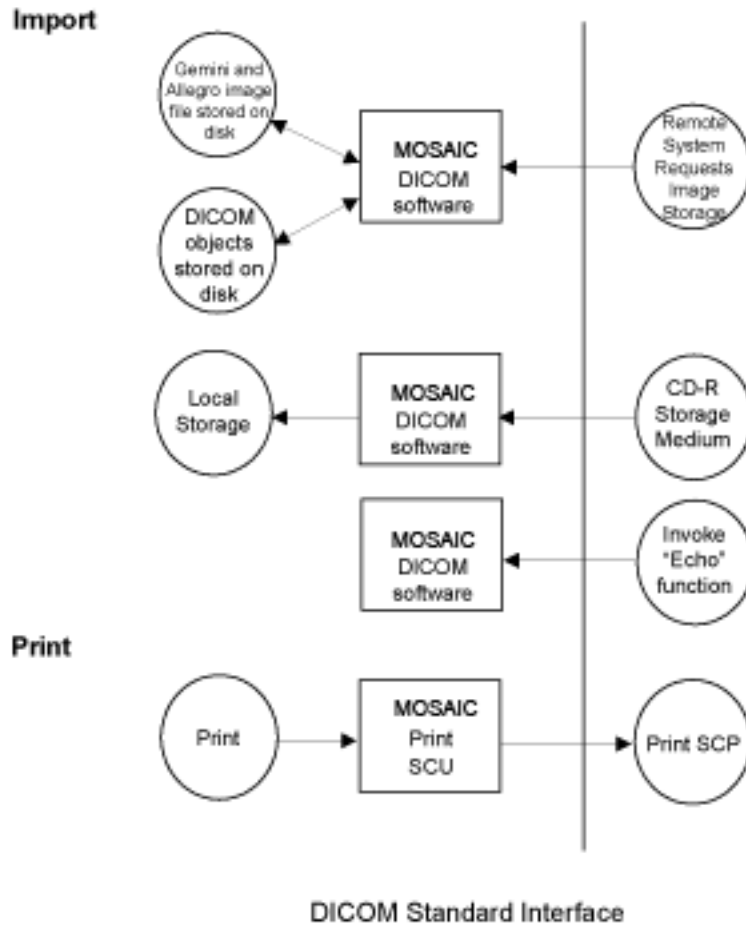
This implementation provides for simple transfer of PET, CT, NM, Secondary Capture, and MR images; RT Structure Sets; and PET Raw Data using the DICOM Storage Service Class as both a Service Class User (SCU) and a Service Class Provider (SCP). Transfers from the MOSAIC to a remote Application Entity (AE) are initiated by an operator by selecting the appropriate options from the File Manager. Query-Retrieve-SCU and Query-Retrieve-SCP are supported. No operator action is required on the MOSAIC to service Storage requests initiated by a remote Application Entry (AE).

For diagnostic purposes, this implementation also provides for simple communication testing using the DICOM Verification Service Class, as both SCU and SCP. Verification of communications to a remote AE is initiated by an operator by clicking Test Connection on the DICOM Export window. Verification of communications from a remote AE is handled automatically and requires no operator actions.

4.1.2 Functional Definitions as AEs

4.1.2.1 Import Server (ECHO-SCP and STORAGE-SCP)

The Import Server waits in the background for a connection. It will accept Presentation Contexts for SOP Classes of the Verification Service Class, and will respond to echo requests.

It will also accept associations with Presentation Contexts for SOP Classes of the Storage Service Class, and will store the received images to the local database where they may subsequently be listed and viewed through the user interface.

4.1.2.2 Export (ECHO-SCU and STORAGE-SCU)

The Test Connection function provides an easy way to determine if the remote AE is available. When Test Connection is pressed, an association which includes a Presentation Context for Verification Class is proposed. A successful response indicates that the remote AE is available. The association is immediately closed.

DICOM Export is activated through File Manager when a user selects one of the following image files: PET, CT, NM, Secondary Capture, MR images, RT Structure Sets, or PET Raw Data (xml) files from the local database and requests that they be sent to a remote AE (selected from a pre-configured list). Storage Commitment is supported during export, but the remote AE must be configured to accept it.

4.1.2.3 Print (PRINT-SCU)

The Print function is available from within several processing functions. It prints to a DICOM-compatible network color printer or film imager using an implementation of the SCU role of DICOM Print Management Class. The Print function:

1. uses N-GET to request the printer status information.

2. starts a film session and film box and sets the attributes of an image/annotation box in the background according to the format defined by the application.

3. sends pixels/LUT data to the service provider.

4. requests printing of a single film session.

5. requests cancellation of printing per user request.

4.1.2.4 Query-Retrieve-SCU

QUERY-RETRIEVE-SCU AE initiates a new association for each query operation. Queries are initiated by the operator. When a QUERY-RETRIEVE-SCU C-MOVE request is made, the association remains open until all images have been transferred so that any error reports can be received if there are problems transferring the images. The actual image transfer occurs on a separate association initiated by the remote Application Entity.

4.1.2.5 Query-Retrieve-SCP

The QUERY-RETRIEVE-SCP AE will never initiate Associations; it only accepts Association Requests from external DICOM AEs. The QUERY-RETRIEVE-SCP AE will accept Associations for Verification, C-FIND, and C-MOVE requests. In the case of a C-MOVE request, the The QUERY-RETRIEVE-SCP AE will issue a command to the STORAGE-SCU AE to initiate an Association with the Destination DICOM AE to send images as specified by the originator of the C-MOVE Request.

4.1.3 Sequencing of Real-World Activities

All SCP (Import Server) activities are performed asynchronously in the background and are not dependent on any sequencing.

All SCU (Export, Print, and Secondary Capture Image Export) activities are initiated using File Manager or a specific application.

4.2 AE SPECIFICATIONS

4.2.1 Import Server (ECHO-SCP and STORAGE-SCP)

4.2.1.1 SOP Classes

The Import Server Application Entity provides Conformance to the following DICOM V3.0 SOP Classes.

Table 4-1: SOP Classes Supported by Import Server

SOP Class Name	SOP Class UID	Conformance	Role
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Standard	SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Standard	SCP
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Standard	SCP
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Standard	SCP
Verification	1.2.480.10008.1.1	Standard	SCP
Storage Commitment PUSH Model	1.2.840.10008.1.20.1	Standard	SCU
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Standard	SCP
Multi-Frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Standard	SCP
Multi-Frame True-Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Standard	SCP
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Standard	SCP
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Standard	SCP

4.2.1.2 Association Policies

4.2.1.2.1 General

Import Server does not initiate associations.

The Import Server AE waits for another application to connect at the presentation address configured for its Application Entity Title. The application that connects must be a DICOM application. Associations are accepted with Presentation Contexts for SOP Classes of the Storage Service Class, or the Verification Service Class. It will receive images on the Storage Service Class Presentation Contexts and create MOSAIC image files from them. It also stores a complete copy of the original DICOM message. This feature allows such images to be retransmitted exactly as they were received.

Table 4-2: Maximum PDU Size Received as a SCP for Import Server

Maximum PDU size received	32 KB

NOTE: This option is configurable.

Images including CT, MR, NM, PET, RT and SC SOP Instances can be read from a DICOM CD-R using QUERY-RETRIEVE-SCU.

Images including CT, MR, NM, PET, and SC SOP Instances can also be read from non-DICOM conformant CDs, but you must import the images manually using the *import_dicom_file* script.

4.2.1.2.2 Number of Associations

Table 4-3: Number of Associations as a SCP for Import Server

Maximum number of simultaneous associations	Unlimited

The Import Server AE will generate a separate process for each connection that is established.

4.2.1.2.3 Asynchronous Nature

Import Server will only allow a single outstanding operation on an Association. Therefore, the import server will not perform asynchronous operations.

4.2.1.2.4 Implementation Identifying Information

Table 4-4: DICOM Implementation Class for Import Server

Implementation Class UID	1.3.46.670589.28

4.2.1.2.5 Association Initiation Policy

Import Server does not initiate associations.

4.2.1.3 Association Acceptance Policy

When Import Server accepts an association, it will respond to either echo requests or storage requests. If the called AE Title does not match the pre-configured AE Title for the import server, the association will be rejected.

4.2.1.3.1 Activity - Receive Echo Request

4.2.1.3.1.1 Description and Sequencing of Activities

When a Verification (C-ECHO) request is successfully received, it responds with a successful received message. When images are received, they are copied to the local file system, converted to PETView image files, and entered into the database. If the image received is a duplicate of a previously received instance, the old file and the database record will be overwritten with the new one.

4.2.1.3.1.2 Accepted Presentation Contexts

Table 4-5: Acceptable Presentation Contexts for Import Server Requests

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
CT Image	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
MR Image	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Table 4-5: Acceptable Presentation Contexts for Import Server Requests (Continued)

NM Image	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
PET Image	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Single-Frame Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Multi-Frame True-Color Secondary Capture	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Multi-Frame Grayscale Byte Secondary Capture	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Storage Commitment PUSH Model	1.2.840.10008.1.20.1	Implicit VR Little Endian		SCU	None

Table 4-5: Acceptable Presentation Contexts for Import Server Requests (Continued)

Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

4.2.1.3.1.2.1 Extended Negotiation

No extended negotiation is performed.

4.2.1.3.1.3 SOP Specific Conformance

4.2.1.3.1.3.1 SOP Specific Conformance to Verification SOP and Storage Classes

Import Server provides standard conformance to the Verification Service and supported Storage Service Classes.

4.2.1.3.1.3.2 Presentation Context Acceptance Criterion

Import Server will always accept a Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported.

4.2.1.3.1.3.3 Transfer Syntax Selection Policies

Import Server accepts the Transfer Syntaxes listed in Table 4-5. If offered a choice of Transfer Syntaxes in a Presentation Context, it will apply the following priority to the choice of Transfer Syntax:

    a. Explicit VR Little Endian, if accepted

    b. Explicit VR Big Endian, if accepted

    c. Default Transfer Syntax

Import Server will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts, applying the same priority for selecting a Transfer Syntax for each.

4.2.2 EXPORT (ECHO-SCU and Storage-SCU)

4.2.2.1 SOP Classes

The Export Application Entity provides Conformance to the following DICOM V3.0 SOP Classes.

Table 4-6: SOP Classes Supported by Export

SOP Class Name	SOP Class UID	Conformance	Role
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Standard	SCU
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Standard	SCU
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Standard	SCU
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Extended	SCU
Verification	1.2.480.10008.1.1	Standard	SCU
Storage Commitment PUSH Model	1.2.840.10008.1.20.1	Standard	SCU
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Standard	SCU
Multi-Frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Standard	SCU
Multi-Frame True-Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Standard	SCU
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Standard	SCU
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Standard	SCU

4.2.2.2 Association Establishment Policies

4.2.2.2.1 General

DICOM Send (Export) will attempt to establish an association each time any of its functions (Send and Test Destination) are invoked. When sending images, the association is maintained until all selected image files have been processed. Those files which cannot be transferred because the receiving AE does not support the required SOP Class are ignored.

When sending the verification (Test Destination) request, the association is immediately closed as soon as the response is received. Each new request is made on a new association.

Table 4-7: Maximum PDU Size Received as a SCU for Export

Maximum PDU size received	4, 8, 16, or 32 KB

NOTE: This option is configurable.

4.2.2.2.2 Number of Associations

DICOM Send (Export) will initiate only one association at a time. However, since there can be more than one File Manager, it is possible for multiple copies to be invoked simultaneously. There is no synchronization attempted between multiple copies of the transfer software, so there may be a number of associations attempted simultaneously, limited only by the resources available.

Table 4-8: Number of Associations as a SCU for Export

Maximum number of simultaneous associations	Unlimited

4.2.2.2.3 Asynchronous Nature

There is no asynchronous activity in this implementation.

4.2.2.2.4 Implementation Identifying Information

Table 4-9: DICOM Implementation Class for Export

Implementation Class UID	1.3.46.670589.28

4.2.2.3 Association Initiation Policy

DICOM Send (Export) initiates an association each time you click the **Export** or **Test Connection** buttons.

4.2.2.4 Association Acceptance Policy

DICOM Send (Export) application does not accept associations.

4.2.2.4.1 Activity - Export (ECHO-SCU and STORAGE-SCU)

4.2.2.4.1.1 Description and Sequencing of Activities

The Associated Real World Activity is the attempt to transfer a set of images. This occurs when the operator manually selects a set of images from File Manager and exports them using the DICOM Send (Export) function.

4.2.2.4.1.2 Proposed Presentation Contexts

Table 4-10: Proposed Presentation Contexts for Export

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
CT Image	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
MR Image	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
NM Image	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
PET Image	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Single-Frame Secondary Capture	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	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Table 4-10: Proposed Presentation Contexts for Export (Continued)

Multi-Frame True-Color Secondary Capture	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Multi-Frame Grayscale Byte Secondary Capture	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Storage Commitment PUSH Model	1.2.840.10008.1.20.1	Implicit VR Little Endian		SCU	None

4.2.2.4.1.2.1 Extended Negotiation

Extended negotiation is not applicable.

4.2.2.4.1.3 SOP Specific Conformance

4.2.2.4.1.3.1 SOP Specific Conformance to Verification and Storage SOP Class

In the DICOM Export window, text appears next to each file listed indicating the transmission progress.

After the image file is sent, the "In Progress" status changes to "Done".

"Failed" appears next to all the files if the DICOM Send (Export) function:

- is unable to determine the appropriate Abstract Syntax for a file.

- detects that the Abstract Syntax is not supported by the receiving AE.

- receives a failed, refused, or warning response to the C-STORE operation.

The image transfer software does not attempt any extended negotiation.

4.2.2.4.1.3.2 Presentation Context Acceptance Criterion

DICOM Send (Export) does not accept associations.

4.2.2.4.1.3.3 Transfer Syntax Selection Policies

If the receiving system accepts more than one Transfer Syntax for any of the proposed Presentation contexts, then the DICOM Send (Export) function will select one using the following criterion:

a. Explicit VR Little Endian, if accepted

b. Explicit VR Big Endian, if accepted

c. Implicit VR Little Endian

4.2.3 Print (PRINT-SCU)

4.2.3.1 SOP Classes

This Application Entity provides Conformance to the following DICOM V3.0 SOP Classes.

Table 4-11: Support SOP Classes

SOP Class Name	SOP Class UID	Role
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	SCU
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	SCU

4.2.3.2 Association Establishment Policies

4.2.3.2.1 General

Table 4-12: Maximum PDU Size Received as a SCP for Print

Maximum PDU size received	32 KB

> **NOTE:** This option is configurable.

4.2.3.2.2 Number of Associations

Table 4-13: Number of Associations as a SCP for Print

Maximum number of simultaneous associations	Unlimited

> **NOTE:** This is configurable.

The Print software will initiate only one association at a time. However, since there can be more than one File Manager or application, it is possible for multiple copies to be invoked simultaneously. There is no synchronization attempted between multiple copies of the print software, so there may be a number of associations attempted simultaneously, limited only by the resources available.

4.2.3.2.3 Asynchronous Nature

There is no asynchronous activity in this implementation.

4.2.3.2.4 Implementation Identifying Information

Table 4-14: DICOM Implementation Class and Version for Print

Implementation Class UID	1.2.826.0.1.3680043.2.51

4.2.3.3 Association Initiation Policy

A new association is initiated for each print operation.

4.2.3.4 Association Acceptance Policy

Print does not accept negotiations.

4.2.3.4.1 Activity - Print (PRINT-SCU)

4.2.3.4.1.1 Description and Sequencing of Activities

UGM DICOM prints to a DICOM compatible network color printer or film imager using an implementation of the SCU role of DICOM Print Management Class in the following way:

1. uses the N-GET to request the printer status information.

2. starts a film session and film box and sets the attributes of an image/annotation box in the background according to the format defined by the application.

3. sends pixel/LUT data to the service provider.

4. requests printing of a single film session.

5. requests cancellation of printing per user's request.

4.2.3.4.1.2 Proposed Presentation Contexts

Table 4-15: Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

4.2.3.4.1.2.1 Extended Negotiation

The Print software does not attempt any extended negotiation.

4.2.3.4.1.3 SOP Specific Conformance to Print SOP Class

4.2.3.4.1.3.1 SOP Specific Conformance for the Film Session SOP Class

Print supports the N-CREATE DIMSE operations for the Film Session SOP Class.

Details of the supported attribute and status handling behavior are described in the following subsections.

4.2.3.4.1.3.1.1 Film Session SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed below.

Table 4-16: Film Session SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	(2000,0010)	IS	1 .. 10	ALWAYS	
Medium Type	(2000,0030)	CS	BLUE FILM, CLEAR FILM, or PAPER	ALWAYS	

The behavior of Print when encountering status codes in a N-CREATE response is summarized below.

Table 4-17: Film Session 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.
*	*	Any other status code	The Association is aborted.

4.2.3.4.1.3.2 SOP Specific Conformance for the Film Box SOP Class

Print supports the following DIMSE operations for the Presentation LUT SOP Class:

- N-CREATE
- N-ACTION

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.4.1.3.2.1 Film Box SOP Class Operations (N-CREATE)

The attributes supplied in a N-CREATE Request are shown below.

Table 4-18: Film Session SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	CS	STANDARD\1,1	ALWAYS	Auto
Referenced Film Session Sequence	(2010,0050)	SQ		ALWAYS	Auto
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	Auto
Film Orientation	(2010,0040)	CS	PORTRAIT or LANDSCAPE	ALWAYS	User
Film Size ID	(2010,0050)	CS	8 IN X 10 IN, 10 IN X 12 IN, 10 IN X 14 IN, 14 IN X 17 IN, 24 CM X 24 CM, 24 CM X 30 CM	ALWAYS	CONFIG
Magnification Type	(2010,0060)	CS	REPLICATE	ALWAYS	User
Border Density	(2010,0010)	CS	BLACK	ALWAYS	User

4.2.3.4.1.3.2.2 Film Box SOP Class Operations (N-ACTION)

An N-ACTION Request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in a N-ACTION response is not evaluated.

The behavior of Print when encountering status codes in a N-ACTION response is summarized below.

Table 4-19: Printer SOP Class N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other status code	The Association is aborted.

4.2.3.4.1.3.3 SOP Specific Conformance for the Image Box SOP Class

Print supports the N-SET DIMSE operation for the Image Box SOP Class.

Details of the supported attribute and status handling behavior are described in the following subsections.

4.2.3.4.1.3.3.1 Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET Request are listed below.

Table 4-20: Film Session SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1	ALWAYS	AUTO
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
>Photometric Inter-pretation	(0028,0004)	US	1	ALWAYS	AUTO
>Rows	(0028,0010)	US		ALWAYS	AUTO
>Columns	(0028,0011)	US		ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	IS	1\1	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representa-tion	(0028,0103)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB	Pixels rendered film sheet	ALWAYS	AUTO

The behavior of Hardcopy AE when encountering status codes in a N-SET response is summarized below.

Table 4-21: Printer 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. Image successfully stored in Image Box.
*	*	Any other status code	The Association is aborted.

4.2.3.4.1.3.4 Transfer Syntax Selection Policies

Print always uses default transfer syntax as shown in Table 4-15.

4.2.4 Query-Retrieve-SCU

4.2.4.1 SOP Classes

QUERY-RETRIEVE-SCU Application Entity provides Standard Conformance to the following SOP Classes.

Table 4-22: SOP Classes Supported by QUERY-RETRIEVE-SCU

SOP Class Name	SOP Class UID	Conformance	Role
Study Root QUERY-RETRIEVE-SCU Information Model - Find	1.2.840.10008.5.1.4.1.2.2.1	Standard	SCU
Study Root QUERY-RETRIEVE-SCU Information Model - Move	1.2.840.10008.5.1.4.1.2.2.2	Standard	SCU

4.2.4.2 Association Policies

4.2.4.2.1 General

QUERY-RETRIEVE-SCU initiates a new association for each query operation. Queries are initiated by the operator. When a QUERY-RETRIEVE-SCU C-MOVE request is made, the association remains open until all images have been transferred so that any error reports can be received if there are problems transferring the images. The actual image transfer occurs on a separate association initiated by the remote Application Entity.

Images that are retrieved will automatically appear in the patient index.

Table 4-23: Maximum PDU Size Received as a SCP for QUERY-RETRIEVE-SCU

Maximum PDU size received	32K

NOTE: This option is configurable.

Images can also be read from a CD-R using the same user interface. Only CT, MR, NM, PET, SC, Multi-frame SC, and RT Structure Sets instances can be read. Refer to *"File Set Reader for CDs" on page 60* in this manual.

4.2.4.2.2 Number of Associations

Table 4-24: Number of Associations as a SCP for QUERY-RETRIEVE-SCU

Maximum number of simultaneous associations	1

4.2.4.2.3 Asynchronous Nature

QUERY-RETRIEVE-SCU will only allow a single outstanding operation on an Association. Therefore, it will not perform asynchronous operations negotiations.

4.2.4.2.4 Implementation Identifying Information

Table 4-25: DICOM Implementation Class and Version for QUERY-RETRIEVE-SCU

Implementation Class UID	1.3.46.670589.28.2

4.2.4.3 Association Initiation Policy

QUERY-RETRIEVE-SCU attempts to initiate a new association when the user performs the query action from the user interface. If this involves recursive queries for lower query levels in the hierarchy, these will be performed on the same association.

The QUERY-RETRIEVE-SCU Application Entity initiates associations.

4.2.4.3.1 Activity - Query Remote AE

4.2.4.3.1.1 Description and Sequencing of Activities

A single attempt will be made to query the remote AE. If the query fails, for whatever reason, no retry will be performed. For the entity (study, series or instance) selected from the user interface to be retrieved, a single attempt will be made to retrieve it from the selected remote AE. If the retrieve fails, for whatever reason, no retry will be performed.

4.2.4.3.1.2 Proposed Presentation Contexts

Table 4-26: Proposed Presentation Contexts for QUERY-RETRIEVE-SCU AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Study Root QUERY-RETRIEVE-SCU Information Model - Find	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Study Root QUERY-RETRIEVE-SCU Information Model - Move	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

4.2.4.3.1.2.1 Extended Negotiation

No extended negotiation is performed. In particular, relational queries are not supported.

4.2.4.3.1.3 SOP Specific Conformance

4.2.4.3.1.3.1 SOP Specific Conformance to C-FIND-SCU

QUERY-RETRIEVE-SCU provides standard conformance to the supported C-FIND SOP classes.

Only a single information model, Study Root, is supported.

All queries are initiated at the highest level of the information model (STUDY level), and then for each response received, recursively repeated at the next lower levels (SERIES and then IMAGE levels), in order to completely elucidate the "tree" of instances available on the remote AE (from which the user may subsequently request a retrieval at any level).

No CANCEL requests are ever issued.

Unexpected attributes returned in a C-FIND response (those not requested) are ignored. Requested return attributes not returned by the SCP are ignored. Non-matching responses returned by the SCP due to unsupported (hopefully optional) matching keys are not filtered locally by the FIND-SCU and thus will still be presented in the browser. No attempt is made to filter out duplicate responses.

Specific Character Set will always be included at every query level. If present in the response, Specific Character Set will be used to identify character sets other than the default character set for display of strings in the browser.

Table 4-27: Study Root Request Identifier for C-FIND-SCU

Name	Tag	Types of Matching
STUDY Level		
Patient's ID	(0010,0020)	S,*,U
Patient's Name	(0010,0010)	S,*,U
Study ID	(0020,0010)	S,*,U
Study Description	(0008,1030)	S,*,U
Modalities In Study	(0008,0061)	NONE
Study Date	(0008,0020)	S,*,U,R
Study Time	(0008,0030)	NONE
Accession Number	(0008,0050)	S,*,U
Study Instance UID	(0020,000D)	UNIQUE

Table 4-27: Study Root Request Identifier for C-FIND-SCU (Continued)

Name	Tag	Types of Matching
SERIES Level		
Series Number	(0020,0011)	S,*,U
Series Description	(0008,103E)	S,*,U
Modality	(0008,0060)	S,*,U
Series Instance UID	(0020,000E)	UNIQUE
IMAGE Level		
Instance Number	(0020,0013)	S,*,U
Image ID	(0054,0400)	S,*,U
SOP Instance UID	(0008,0018)	UNIQUE
COMMON to all query levels		
Specific Character Set	(0008,0005)	NONE

The Types of Matching supported by the C-FIND SCU include the following:

- S indicates the identifier attribute uses Single Value Matching

- R indicates Range Matching

- U indicates Universal Matching

- L indicates UID lists are sent

- NONE indicates no matching is supported, but values for this Element are requested to be returned (i.e. universal matching)

- UNIQUE indicates this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is used depending on the query level.

- * indicates Wildcard Matching

4.2.4.3.1.3.1.1 Presentation Context Acceptance Criterion

QUERY-RETRIEVE-SCU does not accept associations.

4.2.4.3.1.3.1.2 Response Status

FIND-SCU will behave as described in the table below in response to the status returned in the C-FIND and C-MOVE response command message(s).

Table 4-28: Response Status for QUERY-RETRIEVE-SCU and Query Remote AE Request

Service Status	Further Meaning	Status Codes	Behavior
Refused	Out of Resources	A700	Current query is terminated.
Error	Identifier does not match SOP Class	A900	Current query is terminated.
	Unable to process	Cxxx	Current query is terminated.
Cancel	Matching terminated due to Cancel request	FE00	Ignored (should never occur, since cancels never issued).
Success	Matching is complete - No final Identifier is supplied	0000	Current query is terminated.
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier used to populate browser.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Identifier used to populate browser.

4.2.4.3.1.3.2 SOP Specific Conformance to C-MOVE-SCU

QUERY-RETRIEVE-SCU provides standard conformance to the supported C-MOVE SOP Classes.

Only a single information model, Study Root, is supported.

A retrieval will be performed at the STUDY, SERIES or IMAGE level depending on what level has been selected by the user in the browser.

No CANCEL requests are ever issued.

The retrieval is performed from the AE that was specified in the Retrieve AE attribute returned from the query performed by FIND-SCU. The instances are retrieved to the current application's local database by specifying the destination as the AE Title of the STORE-SCP AE of the local application. This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the STORE-SCP AE. The STORE-SCP AE will accept storage requests addressed to it from anywhere, so no pre-configuration of the local application to accept from the remote AE is necessary (except in so far as it was necessary to configure FIND-SCU).

Table 4-29: Study Root Request Identifier for MOVE-SCU

Name	Tag	Unique, Matching or Return Key
STUDY level		
Study Instance UID	(0020,000D)	U
SERIES level		
Series Instance UID	(0020,000E)	U
IMAGE level		
SOP Instance UID	(0008,0018)	U

4.2.4.3.1.3.2.1 Presentation Context Acceptance Criterion

QUERY-RETRIEVE-SCU does not accept associations.

4.2.4.3.1.3.2.2 Response Status

MOVE-SCU will behave as described in Table 4-30 in response to the status returned in the C-MOVE response message(s).

Table 4-30: Response Status for MOVE-SCU and Retrieve from Remote AE Request

Service Status	Further Meaning	Status Codes	Related Fields	Behavior
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)	Retrieval is terminated
	Out of Resources - Unable to perform sub-operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval is terminated
	Move Destination unknown	A801	(0000,0902)	Retrieval is terminated
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)	Retrieval is terminated
	Unable to process	Cxxx	(0000,0901) (0000,0902)	Retrieval is terminated
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval is terminated (should never occur, since cancels never issued)
Warning	Sub-operations Complete - One or more Failures	B000	(0000,1020) (0000,1022) (0000,1023)	Retrieval is terminated
Success	Sub-operations Complete - No Failures	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval is terminated
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)	Retrieval continues

4.2.4.3.1.3.2.3 Sub-operation Dependent Behavior

Since the C-MOVE operation is dependent on completion of C-STORE sub-operations that are occurring on a separate association, the question of failure of operations on the other association(s) must be considered.

MOVE-SCU completely ignores whatever activities are taking place in relation to the STORAGE-SCP AE that is receiving the retrieved instances. Once the C-MOVE has been initiated it runs to completion (or failure) as described in the C-MOVE response command message(s). There is no attempt by MOVE-SCU to confirm that instances have actually been successfully received or locally stored.

Whether or not completely or partially successful retrievals are made available in the local database to the user is purely dependent on the success or failure of the C-STORE sub-operations, not on any explicit action by MOVE-SCU.

Whether or not the remote AE attempts to retry any failed C-STORE sub-operations is beyond the control of MOVE-SCU.

If the association on which the C-MOVE was issued is aborted for any reason, whether or not the C-STORE sub-operations continue is dependent on the remote AE. The local STORAGE-SCP will continue to accept associations and storage operations regardless.

4.2.4.4 Association Acceptance Policy

QUERY-RETRIEVE-SCU does not accept associations.

4.2.5 Query-Retrieve-SCP

4.2.5.1 SOP Classes

QUERY-RETRIEVE-SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

Table 4-31: SOP Classes Supported by QUERY-RETRIEVE-SCP

SOP Class Name	SOP Class UID	Conformance	Role
Patient Root QUERY-RETRIEVE-SCP Information Model - Find	1.2.840.10008.5.1.4.1.2.1.1	Standard	SCP
Patient Root QUERY-RETRIEVE-SCP Information Model - Move	1.2.840.10008.5.1.4.1.2.1.2	Standard	SCP
Study Root QUERY-RETRIEVE-SCP Information Model - Find	1.2.840.10008.5.1.4.1.2.2.1	Standard	SCP
Study Root QUERY-RETRIEVE-SCP Information Model - Move	1.2.840.10008.5.1.4.1.2.2.2	Standard	SCP
Patient/Study Only QUERY-RETRIEVE-SCP Information Model - Find	1.2.840.10008.5.1.4.1.2.3.1	Standard	SCP
Patient/Study Only QUERY-RETRIEVE-SCP Information Model - Move	1.2.840.10008.5.1.4.1.2.3.2	Standard	SCP

4.2.5.2 Association Policies

4.2.5.2.1 General

The QUERY-RETRIEVE-SCP AE will never initiate Associations; it only accepts Association Requests from external DICOM AEs. The QUERY-RETRIEVE-SCP AE will accept Associations for Verification, C-FIND, and C-MOVE requests. In the case of a C-MOVE request, the The QUERY-RETRIEVE-SCP AE will issue a command to the STORAGE-SCU AE to initiate an Association with the Destination DICOM AE to send images as specified by the originator of the C-MOVE Request.

The DICOM standard Application Context Name for DICOM 3.0 is always accepted:

Table 4-32: DICOM Application Context for QUERY-RETRIEVE-SCP

Application Context Name	1.2.840.10008.3.1.1.1

4.2.5.2.2 Number of Associations

The QUERY-RETRIEVE-SCP AE can support multiple simultaneous Associations. Each time the QUERY-RETRIEVE-SCP AE receives an Association, a child process will be spawned to process the Verification, Query, or Retrieval request. The maximum number of child processes, and thus the maximum number of simultaneous Associations that can be processed is limited only by system resources.

Table 4-33: Number of Simultaneous Associations as a SCP for QUERY-RETRIEVE-SCP

Maximum number of simultaneous associations	limited only by system resources

4.2.5.2.3 Asynchronous Nature

QUERY-RETRIEVE-SCP does not support asynchronous communication (multiple outstanding transactions over a single association). All association requests must be completed and acknowledged before a new operation can be initiated.

Table 4-34: Asynchronous Nature as a SCP for QUERY-RETRIEVE-SCP

Maximum number of outstanding asynchronous transactions	1

4.2.5.2.4 Implementation Identifying Information

The implementation information for the Application Entity is:

Table 4-35: DICOM Implementation Class and Version for QUERY-RETRIEVE-SCP

Implementation Class UID	1.3.46.670589.28.2

Note that the STORAGE-SCU AE and QUERY-RETRIEVE-SCP AE use the same Implementation Class UID.

4.2.5.3 Association Initiation Policy

QUERY-RETRIEVE-SCP does not initiate associations.

4.2.5.4 Association Acceptance Policy

4.2.5.4.1 Activity - Handling Query and Retrieval Requests

4.2.5.4.1.1 Description and Sequencing of Activities

The QUERY-RETRIEVE-SCP AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected.

If QUERY-RETRIEVE-SCP AE receives a query (C-FIND) request, then the response(s) will be sent over the same Association used to send the C-FIND-Request.

If QUERY-RETRIEVE-SCP AE receives a retrieval (C-MOVE) request, then the responses will be sent over the same Association used to send the C-MOVE-Request. The QUERY-RETRIEVE-SCP AE will notify the STORAGE-SCU to send the requested SOP Instances to the C-MOVE Destination. The STORAGE-SCU AE notifies the QUERY-RETRIEVE-SCP AE of the success or failure of each attempt to send a Composite SOP Instance to the peer C-MOVE Destination AE. The QUERY-RETRIEVE-SCP AE then sends a C-MOVE Response indicating this status after each attempt. Once the STORAGE-SCU AE has finished attempting to transfer all the requested SOP Instances, the QUERY-RETRIEVE-SCP AE sends a final C-MOVE Response indicating the overall status of the attempted retrieval

.
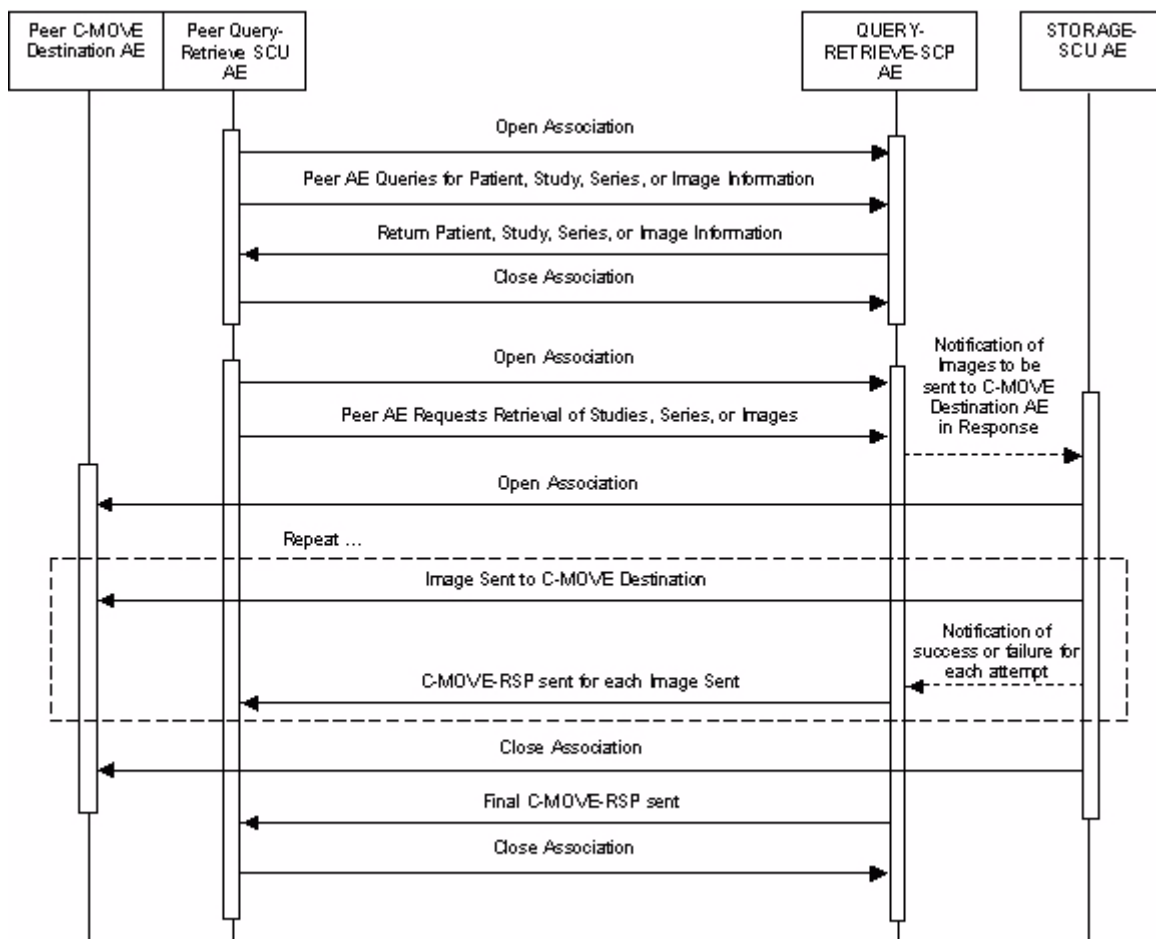
Figure 4-1: Sequencing of Activity - Handling Query and Retrieval Requests

The following sequencing constraints illustrated in Figure 4-1 apply to the QUERY-RETRIEVE-SCP AE for handling queries (C-FIND-Requests):

1. Peer AE opens an Association with the QUERY-RETRIEVE-SCP AE.

2. Peer AE sends a C-FIND-RQ Message.

3. QUERY-RETRIEVE-SCP AE returns a C-FIND-RSP Message to the peer AE with matching information. A C-FIND-RSP is sent for each entity matching the identifier specified in the C-FIND-RQ. A final C-FIND-RSP is sent indicating that the matching is complete.

4. Peer AE closes the Association. Note that the peer AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The following sequencing constraints illustrated in Figure 4-1 apply to the QUERY-RETRIEVE-SCP AE for handling retrievals (C-MOVE-Requests):

1. Peer AE opens an Association with the QUERY-RETRIEVE-SCP AE.

2. Peer AE sends a C-MOVE-RQ Message.

3. QUERY-RETRIEVE-SCP AE notifies the STORAGE-SCU AE to send the Composite SOP Instances to the peer C-MOVE Destination AE as indicated in the C-MOVE-RQ.

4. After attempting to send a SOP Instance, the STORAGE-SCU AE indicates to the QUERY-RETRIEVE-SCP AE whether the transfer succeeded or failed. The QUERY-RETRIEVE-SCP AE then returns a C-MOVE-RSP indicating this success or failure.

5. Once the STORAGE-SCU AE has completed all attempts to transfer the SOP Instances to the C-MOVE Destination AE, or the first failure occurred, the QUERY-RETRIEVE-SCP AE sends a final C-MOVE-RSP indicating the overall success or failure of the retrieval.

6. Peer AE closes the Association. Note that the peer AE does not have to close the Association immediately. Further C-FIND or C-MOVE Requests can be sent over the Association before it is closed.

The QUERY-RETRIEVE-SCP AE may reject Association attempts as shown in Table 4-36. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

a. 1 – DICOM UL service-user

b. 2 – DICOM UL service-provider (ASCE related function)

Table 4-36: Association Rejection Reasons

Result	Source	Reason/Diag	Explanation
1 - rejected-permanent	a	2 - application-context-name-not-supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will not succeed at a later time.
1 - rejected-permanent	a	7 - called-AE-title-not-recognized	The Association request contained an unrecognized Called AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association initiator is incorrectly configured and attempts to address the Association acceptor using the wrong AE Title.
1 - rejected-permanent	b	1 - no-reason-given	The Association request could not be parsed. An Association request with the same format will not succeed at a later time.

4.2.5.4.1.2 Accepted Presentation Contexts

QUERY-RETRIEVE-SCP will accept Presentation Contexts as shown in Table 4-37:

Table 4-37: Acceptable Presentation Contexts for QUERY-RETRIEVE-SCP Request as SCP

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Study Only Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Patient Study Only Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

4.2.5.4.1.3 SOP Specific Conformance for Query SOP Classes

The QUERY-RETRIEVE-SCP AE supports hierarchical queries and not relational queries. There are no attributes always returned by default. Only those attributes requested in the query identifier are returned. Exported SOP Instances are always updated with the latest values in the database prior to export. Thus, a change in Patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE.

Patient Root Information Model

All required search keys on each of the four levels (Patient, Study, Series, and Image) are supported. However, the Patient ID key (0010,0020) should have at least a partial value if the Patient's Name (0010,0010) is not present in a Patient level query.

Study Root Information Model

All the required search keys on each of the three levels (Study, Series, and Image) are supported. If no partial values are specified for Study attributes then either the Patient ID (0010,0020) key or the Patient's Name (0010,0010) should have at least a partial value specified.

Patient/Study Only Information Model

All the required search keys on the Patient and Study levels are supported. The Patient ID key (0010,0020) should be at least partially stated if the Patient's Name (0010,0010) is not present in a Patient level query.

The tables should be read as follows:

Attribute Name: Attributes supported for returned C-FIND Responses.

Tag: Appropriate DICOM tag for this attribute.

VR: Appropriate DICOM VR for this attribute.

Table 4-38: Patient Root C-Find SCP Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
SOP CommonSpecific Character Set	0008,0005	CS	NONE
PATIENT Level			
Patient's Name Patient ID Patient's Birth Date	0010,0010 0010,0020 0010,0030	PN LO DA	S,*,U S,*,U NONE
STUDY Level			
Study Date Study Time Accession Number Study ID Study Instance UID Study Description	0008,0020 0008,0030 0008,0050 0020,0010 0020,000D 0008,1030	DA TM SH SH UI LO	S,R,U R,U S,*,U S,*,U S,U,L S,*,U
SERIES Level			
Modality Series Number Series Instance UID Series Description	0008,0060 0020,0011 0020,000E 0008,103E	CS IS UI LO	S,U S,*,U S,U,L S,*,U
IMAGE Level			
Instance Number SOP Instance UID Image ID	0020,0013 0008,0018 0054,0400	IS UI SH	S,*,U S,U,L NONE

Table 4-39: Study Root C-Find SCP Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
STUDY Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	NONE
Study Level	0008,0020	DA	S,R,U
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	R,U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U,L
Study Description	0008,1030	LO	S,*,U
SERIES Level			
Modality	0008,0060	CS	S,U
Series Number	0020,0011	IS	S,*,U
Series Instance UID	0020,000E	UI	S,U,L
Series Description	0008,103E	LO	S,*,U
IMAGE Level			
Instance Number	0020,0013	IS	S,*,U
SOP Instance UID	0008,0018	UI	S,U,L
Image ID	0054,0400	SH	NONE

Table 4-40: Patient/Study Only Root C-Find SCP Supported Elements

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common			
Specific Character Set	0008,0005	CS	NONE
PATIENT Level			
Patient's Name	0010,0010	PN	S,*,U
Patient ID	0010,0020	LO	S,*,U
Patient's Birth Date	0010,0030	DA	NONE
STUDY Level			
Study Date	0008,0020	DA	S,R,U
Study Time	0008,0030	TM	R,U
Accession Number	0008,0050	SH	S,*,U
Study ID	0020,0010	SH	S,*,U
Study Instance UID	0020,000D	UI	S,U,L
Study Description	0008,1030	LO	S,*,U

The Types of Matching supported by the C-FIND SCP include the following:

- S indicates the identifier attribute uses Single Value Matching

- R indicates Range Matching

- "*"indicates Wildcard Matching

- U indicates Universal Matching

- L indicates UID lists are supported for matching

- NONE indicates no matching is supported, but values for this Element in the database can be returned.

Table 4-41: QUERY-RETRIEVE-SCP AE C-Find Response Status Return Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Matching is complete. No final identifier is supplied.
Refused	Out of Resources	A700	System reached the limit in disk space or memory usage. Error message is output as an alert to the User Interface, and to the Service Log.
Failed	Identifier does not match SOP Class	A900	The C-FIND query identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class. Error message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted.
Pending	Matches are continuing and current match is supplied.	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. This status code is returned if all Optional keys in the query identifier are actually supported.
	Matches are continuing but one or more Optional Keys were not supported.	FF01	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. This status code is returned if there are Optional keys in the query identifier that are not supported.

4.2.5.4.1.3.1 SOP Specific Conformance for Retrieval SOP Classes

The QUERY-RETRIEVE-SCP AE will convey to the STORAGE-SCU AE that an Association with a DICOM AE named by the external C-MOVE SCU (through a MOVE Destination AE Title) should be established. It will also convey to the STORAGE-SCU AE to perform C-STORE operations on specific images requested by the external C-MOVE SCU. One or more of the Image Storage Presentation Contexts listed in Table 4-37 will be negotiated.

The QUERY-RETRIEVE-SCP AE can support lists of UIDs in the C-MOVE Request at the Study, Series, and Image Levels. The list of UIDs must be at the Level of the C-MOVE Request, however. For example, if the C-MOVE Request is for Series Level retrieval but the identifier contains a list of Study UIDs, then the C-MOVE Request will be rejected, and the A900 Failed Status Code will be returned in the C-MOVE Response.

The QUERY-RETRIEVE-SCP AE will return a response to the C-MOVE SCU after the STORAGE-SCU AE has attempted to send each image. This response reports the number of remaining SOP Instances to transfer, and the number transferred having a successful, failed, or warning status.

Table 4-42: QUERY-RETRIEVE-SCP AE C-Move Response Status Return Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete - No Failures	0000	All the Composite SOP Instances have been successfully sent to the C-MOVE Destination AE.
Refused	Out of Resources - Unable to calculate number of matches	A701	Number of matches cannot be determined due to system failure. Returned if the server's database is not functioning so the search for matches to the C-MOVE Request cannot be found. Error message is output as an alert on the User Interface, and to the Service Log.
	Move destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query-Retrieve SCP AE. Error message is output to the Service Log.
Failed	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level.Error message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-MOVE SCU sent a Cancel Request. This has been acknowledged and the export of Composite SOP Instances to the C-MOVE Destination AE has been halted.
Pending	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Table 4-43: QUERY-RETRIEVE-SCP AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The QUERY-RETRIEVE-SCP AE is waiting for the next C-FIND or C-MOVE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If the STORAGE-SCU AE is still exporting Composite SOP Instances as a result of an earlier C-MOVE Request received on this Association, it will continue attempting to complete the entire C-MOVE Request.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout). I.e. The QUERY-RETRIEVE-SCP AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If the STORAGE-SCU AE is still exporting Composite SOP Instances as a result of an earlier C-MOVE Request received on this Association, it will continue attempting to complete the entire C-MOVE Request.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	Error message is output to the Service Log. If the STORAGE-SCU AE is still exporting Composite SOP Instances as a result of an earlier C-MOVE Request received on this Association, it will continue attempting to complete the entire C-MOVE Request.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The TCP/IP protocol stack is supported over a standard Ethernet connection.

4.3.2 Additional Protocols

Host name and IP addresses are set up as part of the configuration process.

4.4 CONFIGURATION

All configuration for Import and Export is performed using the GUI interface provided with the software. Configuration of Print can be performed only by your local Philips Service Representative. Configuration of Import, Export, Storage Commitment, and Query/Retrieve can be performed by typing **sudo dicomcfg** at the prompt in an XTerm window. This process is documented only in documents for field service use.

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

All local AE Titles and TCP/IP Ports are configurable. The local AE Title used by each individual application can be configured separately. <HOST_NAME> is the host name of the PETView system. It is recommended that the same AE title be used for all applications, but the system is flexible enough to use different AE Titles, if needed.

Table 4-44: AE Title Configurations

Application Entity	Default AE Title	Default TCP/IP Port
Import Server	<HOST_NAME>_ST	104
Export	<HOST_NAME>_ST	104
Print	No default	104
QUERY-RETRIEVE-SCU	<HOST_NAME>_ST	104
QUERY-RETRIEVE-SCP	<HOST_NAME>_ST	104

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Title, host names, and port numbers used by Import Server and Export are configured using the *dicomcfg* tool. Print requires manual configuration.

4.4.1.2.1 Import Server

The *dicomcfg* function must be used to set the AE Title and port number for the Import Server. Associations will be accepted from any AE Titles.

4.4.1.2.2 Export

The *dicomcfg* function is used to set the AE Titles, port numbers, timeout durations, max PDU size and host names for the remote SCPs for Storage, Storage Commitment, and Query. The Calling AE Title can also be configured separately for each remote SCP.

4.4.1.2.3 Print

The host name, AE Title, and port number for each printer must be manually configured.

4.4.1.2.4 Query-Retrieve-SCU

The *dicomcfg* function is used to set the AE Titles, port numbers and host names for the remote SCPs. The Calling AE Title can also be configured separately for each remote SCP. The Query-Retrieve-SCU is supported by the *dicomcfg* function. Refer to Section *4.4.1.2.2 "Export" on page 53* in this manual.

4.4.1.2.5 Query-Retrieve-SCP

The same AE Title and port number as the Import Server is used by the Query-Retrieve-SCP. The Query-Retrieve-SCP is supported by the Import Server. Refer to Section *4.4.1.2.1 "Import Server" on page 53* in this manual.

4.4.2 Parameters

A large number of parameters related to acquisition and general operation can be configured. The table below shows those configuration parameters relevant to DICOM communication.

Table 4-45: Configuration Parameters

Parameter	Configurable (Yes/No)	Default Value
Export Parameters		
Protocol	Yes	TCP/IP
Port Number	Yes	104
Called AE Title (Local AE Title)	Yes	<HOST_NAME>_ST
Calling AE Title (Remote AE Title)	Yes	None
Remote Host Name	Yes	None
Remote IP Address	Yes	None
Destination Menu Title	Yes	None
Time-out Duration	Yes	60s
Max PDU Size	Yes	16 KB
Export Native Data as PET or NM	Yes	PET
Allow Query/Retrieve	Yes	Yes
Allow Export	Yes	Yes
In addition to Transverse, send Saggital or Coronal	Yes	None
Export Color SC Images as Color, Grayscale or Both	Yes	Color
Convert Multi-Frame SC to Single-frame SC	Yes	No

Table 4-45: Configuration Parameters (Continued)

Allow export of Raw Data objects	Yes	Yes
Treat this Destination as an Archive	Yes	No
Auto-Export Parameters		
Time Between System Scans	1 hour	
Minimum File Age for Export	2 hours	
Schedule Raw Data Export	No	
Raw Data Export Time	2 AM	
Storage Commitment Parameters		
Request Storage Commitment	Yes	No
Remote Storage Commitment Port Number	Yes	104
Remote Storage Commitment AE Title	Yes	None
Remote Storage Commitment Host Name	Yes	None
Import Parameters		
Port Number	Yes	104
Called AE Title (Local AE Title)	Yes	<HOST_NAME>_ST
Time-out Duration	Yes	60s
Max PDU Size	Yes	16 KB
Print Parameters		
Name of Printer	Yes	None
Node Name in /etc/hosts	Yes	None
TCP Port Number	Yes	104
Called AE Title (Local AE Title)	Yes	ADAC
Calling AE Title (Remote AE Title)	Yes	None
Medium Type	Yes	Blue Film
Image Display Format	Yes	Standard\1,1
Display Orientation	Yes	Landscape
Copies to Print	Yes	1
Printing Priority	Yes	Med
Magnification Method	Yes	Replicate
Smoothing for CUBIC	Yes	0
Border Color	Yes	Black

Table 4-45: Configuration Parameters (Continued)

No Image Box Color	Yes	Black
Trim Option	Yes	Yes
Black Density	Yes	1.7
Transpose the Image?	Yes	No
Convert to 8-bit Grayscale?	Yes	Yes
Storage Parameters		
Number of times a failed send job may be retried	No	Operator may manually retry as many times as desired
Maximum number of simultaneously initiated Associations by the Storage AE	No	1
Print Parameters		
Number of times a failed print-job may be retried	Yes	0 (Failed send jobs are not retried)

5 MEDIA INTERCHANGE

5.1 IMPLEMENTATION MODEL

5.1.1 Application Data Flow
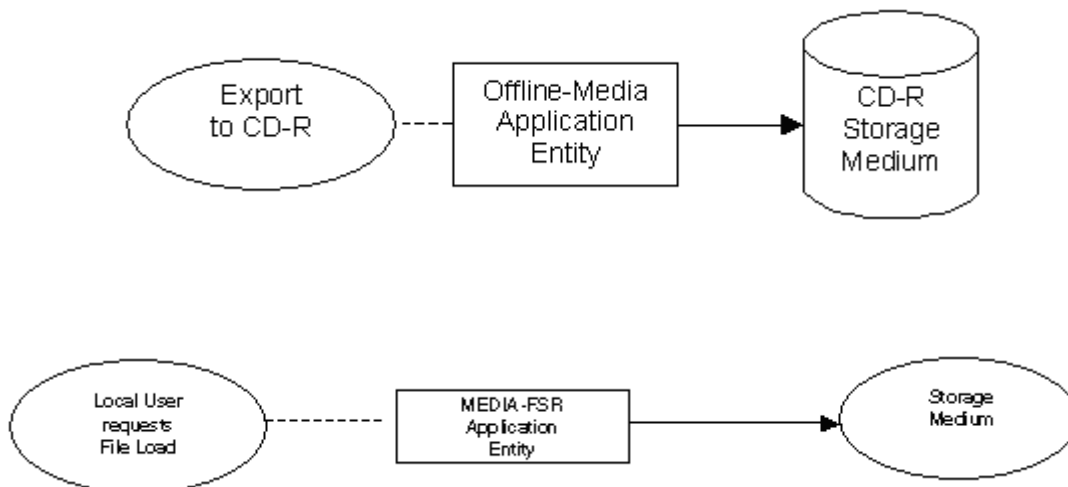
5.1.2 Functional Definition of AEs

5.1.2.1 Functional Definition of File Set Creator for CDs

Creation of a DICOM CD is a two-step process. First, the SOP instances to be placed on the CD must be created by exporting them to the CD Holding Area using the DICOM Export Application Entity. This may include images and RT Structure Set objects from one or more patients, studies, series or images.

The DICOM CD Creator Application Entity provides its own user interface and provides all functionality necessary for managing the CD Holding Area, including removing objects, selecting objects to be placed on a CD, and creating one or more CDs.

5.1.2.2 Functional Definition of File Set Reader for CDs

The DICOM Retrieve Application Entity is used to query for and retrieve SOP Instances from other devices, including the local DICOM CD. The DICOM Retrieve AE is activated when the CD is selected as the device to be queried, and a query is initiated. Images and RT Structure Set SOP Instances can be retrieved from the CD. Once retrieved, they can be accessed through the File Manager for display or processing.

5.1.3 Sequencing of Real-World Activities

At least one image or RT Structure Set object must exist in the CD Holding Area before the DICOM CD Creator AE can be invoked. The operator can insert a new CD-R media at any time before or after invocation of the DICOM CD Creator AE. The DICOM CD Creator AE will wait indefinitely for a media to be inserted before starting to write to the CD-R device.

5.1.4 File Meta Information Options

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

Table 5-1: DICOM Implementation Class and Version for Media Storage

Implementation Class IUD	1.3.46.670589.28.2

5.2 AE SPECIFICATIONS

5.2.1 File Set Creator for CDs

The File Set Creator for CDs Application Entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

Table 5-2: Application Profiles, Activities and Roles for File Set Creator for CDs

Application Profiles Supported	Real World Activity	Role	SC Option
STD-GEN-CD	Export to CD-R	FSC	Interchange

5.2.1.1 File Meta Information for the Application Entity

The Source Application Entity Title is not included in the File Meta Header.

5.2.1.2 Real-World Activities

5.2.1.2.1 Activity — Export to CD-R

The DICOM CD Creator AE acts as an FSC using the interchange option when requested to export SOP Instances from the CD Holding Area to a CD-R medium.

The DICOM CD Creator AE displays the number of CDs that are required to write the data that is stored in the CD Holding Area in the DICOM CD Creator window. It also builds and displays a DICOMDIR directory of the patients and files in the CD Holding Area.

After the user confirms that the information displayed in the DICOM CD Creator window is correct, the DICOM CD Creator AE writes the data and its associated DICOMDIR along with PC viewing software to a single-session CD-R. After the write operation is complete, it automatically verifies that the data was written correctly, removes the data from the CD Holding Area, and ejects the CD. The DICOM CD Creator AE does not support multi-session mode.

5.2.1.2.1.1 Media Storage Application Profiles

The File Set Creator for CDs Application Entity supports the STD-GEN-CD Application Profile.

5.2.1.2.1.1.1 Options

The File Set Creator for CDs Application Entity supports the SOP Classes and Transfer Syntaxes listed below:

Table 5-3: IODs, SOP Classes and Transfer Syntaxes for File Set Creator for CDs

Information Object Definition	SOP Class IUD	Transfer Syntax	Transfer Syntax IUD
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.10008.1.2.1
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian	1.2.840.10008.1.2.1
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian	1.2.840.10008.1.2.1
Single-Frame Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-Frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-Frame True-Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Explicit VR Little Endian	1.2.840.10008.1.2.1

5.2.2 File Set Reader for CDs

The DICOM Retrieve Application Entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

Table 5-4: Application Profiles, Activities and Roles for File Set Reader for CDs

Application Profiles Supported	Real World Activity	Role	SC Option
STD-GEN-CD	Export to CD-R	FSR	Interchange

5.2.2.1 Real-World Activities

5.2.2.1.1 Activity — Import from CD

The DICOM Retrieve AE acts as an FSR using the interchange option when requested to import SOP Instances from a CD-R medium to the local database.

The DICOM Retrieve AE provides the means to import data from a CD-R medium. The user selects DICOM Retrieve from the PETView File Management window. After the Query/Retrieve Browser window opens, the user selects Read CD as the source. Once the DICOM Retrieve AE reads the DICOMDIR from the CD, the user selects the Search and Retrieve functions to locate files of interest and import them into the PETView system.

5.2.2.1.1.1 Media Storage Application Profiles

The DICOM Retrieve for CDs AE supports the STD-GEN-CD Application Profile.

5.2.2.1.1.1.1 Options

The DICOM Retrieve AE supports the SOP Classes and Transfer Syntaxes listed below:

Table 5-5: IODs, SOP Classes, Transfer Syntaxes for File Set Reader for CDs

Information Object Definition	SOP Class IUD	Transfer Syntax	Transfer Syntax IUD
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.10008.1.2.1
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian	1.2.840.10008.1.2.1
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian	1.2.840.10008.1.2.1
Single-Frame 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
Multi-Frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
Multi-Frame True-Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Explicit VR Little Endian	1.2.840.10008.1.2.1

5.3 AUGMENTED AND DRIVE APPLICATION PROFILES

This implementation does not support any augmented for private application profiles.

5.4 MEDIA CONFIGURATION

None.

6 SUPPORT OF CHARACTER SETS

6.1 OVERVIEW

The Latin Alphabet No. 1, supplementary character set, identified as ISO-IR 100, is used and supported.

7 SECURITY

7.1 SECURITY PROFILES

None supported.

7.2 ASSOCIATION LEVEL SECURITY

None supported.

Any Calling AE Titles and/or IP addresses may open an Association.

7.3 APPLICATION LEVEL SECURITY

None supported.

8 ANNEXES

8.1 IOD CONTENTS

8.1.1 Created SOP Instances

The tables in this section use numerous abbreviations. The following abbreviations are used in the "Presence of Modules" column:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value
NEVER	Attribute or Module is never sent

The following abbreviations are used in the "Source" column:

MWL	Attribute value source Modality Worklist
USER	Attribute value source is from User input
AUTO	Attribute value is generated automatically
MPPS	Attribute value is the same as that used for Modality Performed Procedure Step
CONFIG	Attribute value source is a configurable parameter

NOTE: All dates and times are encoded in the local configured calendar and time.

8.1.1.1 PET Image IOD

Table 8-1: IOD of Created PET SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
Patient	Clinical Trial Subject	TABLE XXX	ALWAYS
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
Series	General Series	Table 8-14	ALWAYS
	PET Series	Table 8-24	ALWAYS
	PET Isotope	Table 8-25	ALWAYS
	PET Multi-Gated Acquisition		VNAP
	NM/PET Patient Orientation	Table 8-26	ALWAYS
Frame of Reference	Frame of Reference	Table 8-15	ALWAYS
Equipment	General Equipment	Table 8-16	ALWAYS
Image	General Image	Table 8-18	ALWAYS
	Image Plane	Table 8-19	ALWAYS
	Image Pixel	Table 8-20	ALWAYS
	PET Image	Table 8-27	ALWAYS
	VOI LUT		NEVER
	Overlay Plane Module		NEVER
	SOP Common	Table 8-22	ALWAYS

8.1.1.2 NM Image IOD

Table 8-2: IOD of Created NM SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
Patient	Clinical Trial Subject	TABLE XXX	ALWAYS
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
Series	General Series	Table 8-14	ALWAYS
	NM/PET Orientation module	Table 8-26	ALWAYS
Frame of Reference	Frame of Reference	Table 8-15	ALWAYS
Equipment	General Equipment	Table 8-16	ALWAYS
Image	NM Image Pixel	Table 8-28	ALWAYS
	General Image	Table 8-18	ALWAYS
	Image Pixel	Table 8-20	ALWAYS
	Multi-frame	Table 8-23	ALWAYS
	NM Multi-frame	Table 8-29	ALWAYS
	NM Image	Table 8-30	ALWAYS
	NM Isotope	Table 8-31	ALWAYS
	NM Detector	Table 8-32	ALWAYS
	NM TOMO Acquisition	Table 8-33	ALWAYS
	NM Multi-gated Acquisition		VNAP
	NM Phase		VNAP
	NM Reconstruction	Table 8-34	ALWAYS
	Overlay Plane		NEVER
	Multi-frame Overlay		NEVER
	Curve		NEVER
	VOI LUT		NEVER
	SOP Common		ALWAYS

8.1.1.3 Secondary Capture Image IOD

Table 8-3: IOD of Created Secondary Capture SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
Series	General Series	Table 8-14	ALWAYS
Equipment	General Equipment	Table 8-16	ALWAYS
	SC Equipment	Table 8-17	ALWAYS
Image	General Image	Table 8-18	ALWAYS
	Image Pixel	Table 8-20	ALWAYS
	SC Image	Table 8-21	ALWAYS
	Overlay Plane		NEVER
	Modality LUT		NEVER
	VOI LUT		NEVER
	SOP Common	Table 8-22	ALWAYS

8.1.1.4 Multi-Frame Grayscale Byte Secondary Capture Image IOD

Table 8-4: IOD of Created Multi-frame Grayscale Byte Secondary Capture SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
	Clinical Trial Subject		NEVER
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
	Clinical Trial Study		NEVER
Series	General Series	Table 8-14	ALWAYS
	Clinical Trial Series		NEVER
Equipment	General Equipment	Table 8-16	ALWAYS
	SC Equipment	Table 8-17	ALWAYS
Image	General Image	Table 8-18	ALWAYS
	Image Pixel	Table 8-20	ALWAYS
	Multi-frame	Table 8-23	ALWAYS
	SC Image	Table 8-21	ALWAYS
	SC Multi-frame Image	Table 8-35	ALWAYS
	SC Multi-frame Vector	Table 8-36	ALWAYS
	VOI LUT		NEVER
	SOP Common	Table 8-22	ALWAYS

8.1.1.5 True-Color Secondary Capture Image IOD

Table 8-5: IOD of Created True-Color Multi-frame Secondary Capture SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
	Clinical Trial Subject		NEVER
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
	Clinical Trial Study		NEVER
Series	General Series	Table 8-14	ALWAYS
	Clinical Trial Series		NEVER
Equipment	General Equipment	Table 8-16	ALWAYS
	SC Equipment	Table 8-17	ALWAYS
Image	General Image	Table 8-18	ALWAYS
	Image Pixel	Table 8-20	ALWAYS
	Cine		NEVER
	Frame Pointers		NEVER
	Multi-frame	Table 8-23	ALWAYS
	SC Image	Table 8-21	ALWAYS
	SC Multi-frame Image	Table 8-35	ALWAYS
	SC Multi-frame Vector	Table 8-36	ALWAYS
	VOI LUT		NEVER
	SOP Common	Table 8-22	ALWAYS

8.1.1.6 RT Structure Sets IOD

Table 8-6: IOD of RT Structure Sets for Created SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8-10	ALWAYS
	Clinical Trial Subject		NEVER
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	NEVER
	Clinical Trial Study		NEVER
Series	RT Series	Table 8-38	ALWAYS
	Clinical Trial Series		NEVER
Equipment	General Equipment	Table 8-16	ALWAYS
Structure Set	RT Structure Set	Table 8-37	ALWAYS
	ROI Contour	Table 8-7	ALWAYS
	RT ROI Observations	Table 8-8	ALWAYS
	Approval		NEVER
	Audio		NEVER
	SOP Common		ALWAYS

Table 8-7: RT ROI Contour Module Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
ROI Contour Sequence	(3006,0039)	SQ		ALWAYS	
>Referenced ROI Number	(3006,0084)	IS		ALWAYS	
>ROI Display Color	(3006,002A)	IS		ALWAYS	
>Contour Sequence	(3006,0040)	SQ		ALWAYS	
>>Contour Number	(3006,0048)	IS		NEVER	
>>Attached Contours	(3006,0049)	IS		NEVER	
>>Contour Image Sequence	(3006,0016)	SQ		ALWAYS	
>>>Referenced SOP Class UID	(0008,1150)	UI		ALWAYS	
>>>Referenced SOP Instance UID	(0008,1155)	UI		ALWAYS	
>>>Referenced Frame Number	(0008,1160)	IS		NEVER	
>>Contour Geometric Type	(3006,0042)	CS	CLOSED PLANAR	ALWAYS	
>>Contour Slab Thickness	(3006,0044)	DS		NEVER	
>>Contour Offset Vector	(3006,0045)	DS		NEVER	
>>Number of Contour Points	(3006,0046)	IS		ALWAYS	
>>Contour Data	(3006,0050)	DS		ALWAYS	

Table 8-8: RT ROI Observations Module Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
RT ROI Observations Sequence	(3006,0080)	SQ		ALWAYS	
>Observation Number	(3006,0082)	IS		ALWAYS	
>Referenced ROI Number	(3006,0084)	IS		ALWAYS	
>ROI Observation Label	(3006,0085)	SH		NEVER	
>ROI Observation Description	(3006,0088)	ST		NEVER	
>RT ROI Interpreted Type	(3006,00A4)	CS		NEVER	
>ROI Interpreter	(3006,00A6)	PN		NEVER	
>Material ID	(300A,00E1)	SH		NEVER	

8.1.1.7 Raw Data IOD

Table 8-9: Raw Data IOD Modules

IE	Module	Reference	Usage
Patient	Patient	Table 8-10	ALWAYS
	Specimen Identification		NEVER
	Clinical Trial Subject		NEVER
Study	General Study	Table 8-11	ALWAYS
	Patient Study	Table 8-13	ALWAYS
	Clinical Trial Study		NEVER
Series	General Series	Table 8-14	ALWAYS
	Clinical Trial Series		NEVER
Frame of Reference	Frame of Reference	Table 8-15	ALWAYS
	Synchronization		NEVER
Equipment	General Equipment	Table 8-16	ALWAYS
Raw Data	Acquisition Context	Table 8-39	ALWAYS
	Raw Data	Table 8-40	ALWAYS
	SOP Common	Table 8-22	ALWAYS

8.1.1.8 Common Modules

Table 8-10: Common Patient Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN		ALWAYS	MWL or User
Patient ID	(0010,0020)	LO		ALWAYS	MWL or User
Patient's Birth Date	(0010,0030)	DA		ALWAYS	MWL or User
Patient's Sex	(0010,0040)	CS		ALWAYS	MWL or User
				SC IOD VNAP	
Other Patient IDs	(0010,1000)	LO		VNAP	MWL
Patient Comments	(0010,4000)	LT		VNAP	
Ethnic Group	10,2160	SH		VNAP	MWL

Table 8-11: Common General Study Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI		ALWAYS	MWL or AUTO
Study Date	(0080,0020)	DA		ALWAYS	AUTO
Study Time	(0008,0030)	TM		ALWAYS	AUTO
Referring Physician's Name	(0008,0090)	PN		VNAP	USER
Study ID	(0020,0010)	SH		ALWAYS	USER
Accession Number	(0008,0050)	SH		VNAP	MWL or USER
Study Description	(0008,1030)	LO		ALWAYS	USER
Procedure Code Sequence	(0008,1032)	SQ		VNAP	MWL

Table 8-12: Common General Study Module for Clinical Trial Subject Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Clinical Trial Sponsor Name	(0012,0010)	LO		ALWAYS	MWL or USER
Clinical Trial Protocol ID	(0012,0020)	LO		ALWAYS	USER
Clinical Trial Protocol Name	(0012,0021)	LO		ALWAYS	MWL or USER
Clinical Trial Site ID	(0012,0030)	LO		ALWAYS (zero length)	
Clinical Trial Site Name	(0012,0031)	LO		ALWAYS (zero length)	
Clinical Trial Subject ID	(0012,0040)	LO		ALWAYS	MWL or USER
Clinical Trial Subject Reading ID	(0012,0042)	LO		NEVER	

Table 8-13: Common Patient Study Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Admitting Diagnosis Description	(0008,1080)	LO		NEVER	
Patient's Age	(0010,1010)	AS		NEVER	
Patient's Weight	(0010,1030)	DS		VNAP	USER
Additional Patient History	(0010,21B0)	LT		VNAP	MWL

Table 8-14: Common General Series Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS		ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI		ALWAYS	AUTO
Series Number	(0020,0011)	IS		ALWAYS	AUTO
Laterality	(0020,0060)	CS		NEVER	
Series Date	(0008,0021)	DA		ALWAYS	AUTO
Series Time	(0008,0031)	TM		ALWAYS	AUTO
Performing Physician's Name	(0008,1050)	PN		NEVER	
Protocol Name	(0018,1030)	LO		ALWAYS	AUTO
Series Description	(0008,103E)	LO		ALWAYS	AUTO
Operator's Name	(0008,1070)	PN		NEVER	
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ		VNAP	
>Referenced SOP Class UID	(0008,1150)	UI		VNAP	
>Referenced SOP Instance UID	(0008,1155)	UI		VNAP	
Body Part Examined	(0018,0015)	CS		NEVER	
Patient Position	(0018,5100)	CS		ALWAYS	AUTO
Smallest Pixel Value in Series	(0028,0108)	SS		NEVER	
Largest Pixel Value in Series	(0028,0109)	SS		NEVER	
Request Attributes Sequence	(0040,0275)	SQ		VNAP	MWL
>Requested Procedure ID	(0040,1001)	SH		VNAP	MWL
>Scheduled Procedure Step ID	(0040,0009)	SH		VNAP	MWL
>Scheduled Procedure Step Description	(0040,0007)	LO		VNAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)	SQ		VNAP	MWL
Performed Procedure Step ID	(0040,0253)	SH		VNAP	MWL
Performed Procedure Step Start Date	(0040,0244)	DA		VNAP	MWL
Performed Procedure Step Start Time	(0040,0245)	TM		VNAP	MWL
Performed Procedure Step Description	(0040,0254)	LO		VNAP	MWL

Table 8-14: Common General Series Module for Created SOP Instances (Continued)

Performed Protocol Code Sequence	(0040,0260)	SQ		VNAP	MWL
Comments on the Performed Procedure Step	(0040,0280)	LO		VNAP	MWL

Table 8-15: Common Frame of Reference Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame of Reference UID	(0020,0052)	UI		ALWAYS	AUTO
Position Reference Indicator	(0020,1040)	LO		VNAP	

Table 8-16: Common General Equipment Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Philips Medical Systems	ALWAYS	AUTO
Institution Name	(0008,0080)	LO		ALWAYS	AUTO
Institution Address	(0008,0081)	ST		NEVER	
Station Name	(0008,1010)	SH		ALWAYS	AUTO
Institutional Department Name	(0008,1040)	LO		NEVER	
Manufacturer's Model Name	(0008,1090)	LO		VNAP	
Device Serial Number	(0018,1000)	LO		ALWAYS	AUTO
Software Version	(0018,1020)	LO		ALWAYS	AUTO
Spatial Resolution	(0018,1050)	DS		NEVER	
Date of Last Calibration	(0018,1200)	DA		NEVER	
Time of Last Calibration	(0018,1201)	TM		NEVER	
Pixel Padding Value	(0028,0120)	US		NEVER	

Table 8-17: Common SC Image Equipment Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	WSD	ALWAYS	
Modality	(0008,0060)	CS		ALWAYS	AUTO
Secondary Capture Device ID	(0018,1010)	LO		ALWAYS	AUTO
Secondary Capture Device Manufacturer	(0018,1016)	LO		ALWAYS	AUTO
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	LO		ALWAYS	AUTO
Secondary Capture Device Software Version	(0018,1019)	LO		ALWAYS	AUTO
Video Image Format Acquired	(0018,1022)	SH		NEVER	
Digital Image Format Acquired	(0018,1023)	LO		NEVER	

Table 8-18: Common General Image Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS		ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS		NEVER	
Content Date	(0008.0023)	DA		ALWAYS	AUTO
Content Time	(0008,0033)	TM		ALWAYS	AUTO
Image Type	(0008,0008)	CS		VNAP	AUTO
Acquisition Number	(0020,0012)	IS		VNAP	
Acquisition Date	(00080022)	DA		ALWAYS	AUTO
Acquisition TIme	(0008,0032)	TM		ALWAYS	AUTO
Acquisition Datetime	(0008,0024)	DT		NEVER	
Referenced Image Sequence	(0008,1140)	SQ		NEVER	
>Referenced SOP Class UID	(0009,1150)	UI		NEVER	
>Referenced SOP Instance UID	(0008,1151)	UI		NEVER	
>Referenced Frame Number	(0008,1160)	IS		NEVER	
>Purpose of Reference Code Sequence	(0040,A170)	SQ		NEVER	
Derivation Description	(0008,2111)	ST		NEVER	
Derivation Code Sequence	(0008,9215)	SQ		NEVER	
Source Image Sequence	(0008,2112)	SQ		NEVER	
Referenced Waveform Sequence	(0008,113A)	SQ		NEVER	
Images in Acquisition	(0020,1002)	IS		NEVER	
Image Comments	(0020,4000)	LT		VNAP	AUTO
Quality Control Image	(0028,0300)	CS		NEVER	
Burned in Annotation	(0028,0301)	CS		VNAP	
Lossy Image Compression	(0028,2110)	DS		NEVER	

Table 8-18: Common General Image Module for Created SOP Instances (Continued)

Lossy Image Compression Ratio	(0088,0200)	DS		NEVER	
Icon Image Sequence	(0088,0200)	SQ		NEVER	
Presentation LUT Shape	(2050,0020)	CS		NEVER	

Table 8-19: Common Image Plane Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Pixel Spacing	(0028,0030)	DS		ALWAYS	AUTO
Image Orientation (Patient)	(0020,0037)	DS		ALWAYS	AUTO
Image Position	(0020,0032)	DS		ALWAYS	AUTO
Slice Thickness	(0018,0050)	DS		ALWAYS	AUTO
Slice Location	(0020,1041)	DS		VNAP	

Table 8-20: Common Image Pixel Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Pixel Data	(7FEO,0010)	OW/ OB		ALWAYS	AUTO
Samples per Pixel	(0028,0002)	US		ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS		ALWAYS	AUTO
Rows	(0028,0010)	US		ALWAYS	AUTO
Columns	(0028,0011)	US		ALWAYS	AUTO
Bits Allocated	(0028,0100)	US		ALWAYS	AUTO
Bits Stored	(0028,0101)	US		ALWAYS	AUTO
High Bit	(0028,0102)	US		ALWAYS	AUTO
Pixel Representation	(0028,0103)	US		ALWAYS	AUTO
Planar Configuration	(0028,0006)	US		VNAP	
Pixel Aspect Ratio	(0028,0034)	IS		VNAP	
Smallest Image Pixel Value	(0028,0106)	US		VNAP	AUTO
Largest Image Pixel Value	(0028,0107)	US		VNAP	AUTO
Red Palette Color Lookup Table Descriptor	(0028,1101)	US		NEVER	
Green Palette Color Lookup Table Descriptor	(0028,1102)	US		NEVER	
Blue Palette Color Lookup Table Descriptor	(0028,1103)	US		NEVER	
Red Palette Color Lookup Table Data	(0028,1201)	OW		NEVER	
Green Palette Color Lookup Table Data	(0028,1202)	OW		NEVER	
BLUE Palette Color Lookup Table Data	(0028,1203)	OW		NEVER	

Table 8-21: Common SC Image Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Date of Secondary Capture	(0018,1012)	DA		ALWAYS	AUTO
Time of Secondary Capture	(0018,1014)	TM		ALWAYS	AUTO

Table 8-22: Common SOP Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI		ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI		ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS		NEVER	
Instance Creation Date	(0008,0012)	DA		VNAP	
Instance Creation Time	(0008,0013)	TM		VNAP	
Instance Creator UID	(0008,0014)	UI		NEVER	
Scheme Identification Sequence	(0008,0110)	SQ		NEVER	
Timezone Offset From UTC	(0008,0201)	SH		NEVER	
Contributing Equipment Sequence	(0008,A001)	SQ		NEVER	
Instance Number	(0020,0013)	IS		ALWAYS	AUTO
SOP Instance Status	(0100,0410)	CS		NEVER	
SOP Authorization Date and Time	(0100,0420)	DT		NEVER	
SOP Authorization Comment	(0100,0424)	LT		NEVER	
Authorization Equipment Certification Number	(0100,0426)	LO		NEVER	
Encrypted Attributes Sequence	(0040,0500)	SQ		NEVER	

Table 8-23: Common Multi-frame Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Frames	(0028,0008)	IS		ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT		ALWAYS	AUTO

8.1.1.9 PET Modules

Table 8-24: PET Series Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Series Date	(0008,0021)	DA		ALWAYS	AUTO
Series Time	(0008,0031)	TM		ALWAYS	AUTO
Units	(0054,1001)	CS	CNTS	ALWAYS	AUTO
Counts Source	(0054,1002)	CS		ALWAYS	AUTO
Series Type	(0054,1000)	CS		ALWAYS	AUTO
Reprojection Method	(0054,1004)	CS		NEVER	
Number of R-R Intervals	(0054,0061)	US		VNAP	
Number of Time Slots	(0054,0071)	US		VNAP	
Number of Time Slices	(0054,0101)	US		VNAP	AUTO
Number of Slices	(0054,0081)	US		ALWAYS	AUTO
Corrected Image	(0028,0051)	CS		ALWAYS	AUTO
Randoms Correction Method	(0054,1100)	CS		ALWAYS	AUTO
Attenuation Correction Method	(0054,1101)	LO		ALWAYS	AUTO
Scatter Correction Method	(0054,1105)	LO		ALWAYS	AUTO
Decay Correction	(0054,1102)(	CS		ALWAYS	AUTO
Reconstruction Diamter	0018,1100)	DS		ALWAYS	AUTO
Convolution Kernel	(0018,1210)	SH		NEVER	
Reconstruction Method	(0054,1103)	LO		ALWAYS	AUTO
Detector Lines of Response Used	(0054,1104)	LO		NEVER	
Acquisition Start Condition	(0018,0073)	CS		NEVER	

Table 8-24: PET Series Module for Created SOP Instances (Continued)

Acquisition Start Condition Data	(0018,0074)	IS		NEVER	
Acquisition Termination Condition	(0018,0071)	CS		NEVER	
Acquisition Termination Condition Data	(0018,0075)	IS		NEVER	
Field of View Shape	(0018,1147)	CS	CYLINDRICAL RING	ALWAYS	AUTO
Field of View Dimensions	(0018,1149)	IS		ALWAYS	AUTO
Gantry/Detector Tilt	(0018,1120)	DS		NEVER	
Gantry/Detector Slew	(0018,1121)	DS		NEVER	
Type of Detector Motion	(0054,0202)	CS	NONE	ALWAYS	AUTO
Collimator Type	(0018,1181)	CS	NONE	ALWAYS	AUTO
Collimator/Grid Name	(0018,1180)	SH		NEVER	
Axial Acceptance	(0054,1200)	DS		NEVER	
Axial Mash	(0054,1201)	IS		NEVER	
Transverse Mash	(0054,1202)	IS		NEVER	
Detector Element Size	(0054,1203)	DS		NEVER	
Coincidence Window Width	(0054,1210)	DS		NEVER	
Energy Window Range Sequence	(0054,0013)	SQ		NEVER	
Secondary Counts Type	(0054,1220)	CS		NEVER	

Table 8-25: PET Isotope Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Radiopharmaceutical Information Sequence	(0054,0016)	SQ		ALWAYS	AUTO
>Radionuclide Code Sequence	(0054,0300)	SQ		ALWAYS	AUTO
>Radiopharmaceutical Route	(0018,1070)	LO		NEVER	
>Administration Route Code Sequence	(0054,0302)	SQ		NEVER	
>Radiopharmaceutical Volume	(0018,1071)	DS		NEVER	
>Radiopharmaceutical Start Time	(0018,1072)	TM		ALWAYS	AUTO
>Radiopharmaceutical Stop Time	(0018,1073)	TM		ALWAYS	AUTO
>Radionuclide Total Dose	(0018,1074)	DS		ALWAYS	AUTO
>Radionuclide Half Life	(0018,1075)	DS		ALWAYS	AUTO
>Radionuclide Positron Fraction	(0018,1076)	DS		NEVER	
>Radiopharmaceutical Specific Activity	(0018,1077)	DS		NEVER	
>Radiopharmaceutical	(0018,0031)	LO		VNAP	
>Radiopharmaceutical Code Sequence	(0054,0304)	SQ		VNAP	
Intervention Drug Information Sequence	(0018,0026)	SQ		NEVER	

Table 8-26: NM/PET Patient Orientation Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Orientation Code Sequence	0054,0410	SQ		ALWAYS	AUTO
Patient Orientation Modifier Code Sequence	0054,0412	SQ		ALWAYS	AUTO
Patient Gantry Relationship Code Sequence	0054,0104	SQ		ALWAYS	AUTO

Table 8-27: PET Image Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Type	(0008,0008)	CS		ALWAYS	AUTO
Samples per Pixel	(0028,0002)	US		ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS		ALWAYS	AUTO
Bits Allocated	(0028,0100)	US		ALWAYS	AUTO
Bits Stored	(0028,0101)	US		ALWAYS	AUTO
High Bit	(0028,0102)	US		ALWAYS	AUTO
Rescale Intercept	(0028,1052)	DS		ALWAYS	AUTO
Rescale Slope	(0028,1053)	DS		ALWAYS	AUTO
Frame Reference Time	(0054,1300)	DS		ALWAYS	AUTO
Trigger Time	(0018,1060)	DS		VNAP	
Frame Time	(0018,1063)	DS		VNAP	
Low R-R Value	(0018,1081)	IS		VNAP	
High R-R Value	(0018,1082)	IS		VNAP	
Lossy Image Compression	(0028,2110)	CS		NEVER	
Image Index	(0054,1330)	US		ALWAYS	AUTO
Acquisition Date	(0008,0022)	DA		ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM		ALWAYS	AUTO

Table 8-27: PET Image Module for Created SOP Instances (Continued)

Actual Frame Duration	(0018,1242)	IS		ALWAYS	AUTO
Nominal Interval	(0018,1062)	IS		NEVER	
Intervals Acquired	(0018,1083)	IS		VNAP	
Intervals Rejected	(0018,1084)	IS		VNAP	
Primary (Prompts) Counts Accumulated	(0054,1310)	IS		NEVER	
Secondary Counts Accumulated	(0054,1311)	IS		NEVER	
Slice Sensitivity Factor	(0054,1320)	DS		NEVER	
Decay Factor	(0054,1321)	DS		NEVER	
Dose Calibration Factor	(0054,1322)	DS		NEVER	
Scatter Fraction Factor	(0054,1323)	DS		NEVER	
Dead Time Factor	(0054,1324)	DS		NEVER	
Referenced Overlay Sequence	(0008,1130)	SQ		NEVER	
Referenced Curve Sequence	(0008,1145)	SQ		NEVER	
Anatomic Region Sequence	(0008,2218)	SQ		NEVER	
Primary Anatomic Structure Sequence	(0008,2228)	SQ		NEVER	

8.1.1.10 NM Modules

Table 8-28: NM Image Pixel Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US		ALWAYS	AUTO
Photometric Inter-pretation	(0028,0004)	CS		ALWAYS	AUTO
Bits Allocated	(0028,0100)	US		ALWAYS	AUTO
Bits Stored	(0028,0101)	US		ALWAYS	AUTO
High Bit	(0028,0102)	US		ALWAYS	AUTO
Pixel Spacing	(0028,0030)	DS		ALWAYS	AUTO

Table 8-29: NM Multi-frame Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame Increment Pointer	(0028,0009)	AT		ALWAYS	AUTO
Energy Window Vector	(0028,0010)	US		VNAP	
Number of Energy Windows	(0028,0011)	US		ALWAYS	AUTO
Detector Vector	(0054,0020)	US		VNAP	
Number of Detectors	(0054,0021)	US		ALWAYS	AUTO
Phase Vector	(0054,0030)	US		VNAP	
Number of Phases	(0054,0031)	US		ALWAYS	
Rotation Vector	(0054,0050)	US		VNAP	
Number of Rotations	(0054,0051)	US		ALWAYS	AUTO
R-R Interval Vector	(0054,0060)	US		VNAP	
Number of R-R Intervals	(0054,0061)	US		VNAP	
Time Slot Vector	(0054,0070)	US		VNAP	
Number of Time Slots	(0054,0071)	US		VNAP	
Slice Vector	(0054,0080)	US		ALWAYS	AUTO
Number of Slices	(0054,0081)	US		ALWAYS	AUTO
Angular View Vector	(0054,0090)	US		NEVER	
Time Slice Vector	(0054,0100)	US		VNAP	

Table 8-30: NM Image Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Type	(0008,0008)	CS		ALWAYS	AUTO
Image ID	(0054,0400)	SH		NEVER	
Lossy Image Compression	(0028,2110)	CS		NEVER	
Counts Accumulated	(0018,0070)	IS		ALWAYS	AUTO
Acquisition Termination Condition	(0018,0071)	CS		NEVER	
Table Height	(0018,1130)	DS		NEVER	
Table Traverse	(0018,1131)	DS		NEVER	
Actual Frame Duration	(0018,1242)	IS		VNAP	
Count Rate	(0018,1243)	IS		NEVER	
Processing Function	(0018,5020)	LO		NEVER	
Corrected Image	(0028,0051)	CS		ALWAYS	AUTO
Whole Body Technique	(0018,1301)	CS		NEVER	
Scan Velocity	(0018,1300)	DS		NEVER	
Scan Length	(0018,1302)	IS		NEVER	
Referenced Overlay Sequence	(0008,1130)	SQ		NEVER	
Referenced Curve Sequence	(0008,1145)	SQ		NEVER	
Trigger Source or Type	(0018,1061)	LO		NEVER	
Anatomic Region Sequence	(0008,2218)	SQ		NEVER	
Primary Anatomical Structure Sequence	(0008,2228)	SQ		NEVER	

Table 8-31: NM Isotope Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Energy Window Information Sequence	(0054,0012)	SQ		ALWAYS	AUTO
>Energy Window Name	(0054,0018)	SH		NEVER	
>Energy Window Range Sequence	(0054,0013)	SQ		NEVER	
Radiopharmaceutical Information Sequence	(0054,0015)	SQ		ALWAYS	AUTO
>Radionuclide Code Sequence	(0054,0300)	SQ		ALWAYS	AUTO
>Radiopharmeceutical Route	(0018,1070)	LO		NEVER	
>Administration Route Code Sequence	(0054,0302)	SQ		NEVER	
>Radiopharmaceutical Volume	(0018,1071)	DS		NEVER	
>Radiopharmaceutical Start Time	(0018,1072)	TM		ALWAYS	AUTO
>Radiopharmaceutical Stop Time	(0018,1073)	TM		NEVER	
>Radionuclide Total Dose	(0018,1074)	DS		ALWAYS	AUTO
>Calibration Data Sequence	(0054,0306)	SQ		NEVER	
>Radiopharmaceutical	(0018,0031)	LO		VNAP	
>Radiopharmaceutical Code Sequence	(0054,0304)	SQ		VNAP	
Intervention Drug Information Sequence	(0018,0026)	SQ		NEVER	

Table 8-32: NM Detector Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Detector Information Sequence	(0054,0022)	SQ		ALWAYS	AUTO
>Collimator/Grid Name	(0018,1180)	SH		NEVER	
>Collimator Type	(0018,1181)	CS	NONE	ALWAYS	AUTO
>Field of View Shape	(0018,1147)	CS	CYLINDRICAL RING	ALWAYS	AUTO
>Field of View Dimensions (s)	(0018,1149)	IS		ALWAYS	AUTO
>Focal Distance	(0018,1182)	IS		VNAP	AUTO
>X Focus Center	(0018,1183)	DS		NEVER	
>Y Focus Center	(0018,1184)	DS		NEVER	
>Zoom Center	(0028,0032)	DS		NEVER	
>Zoom Factor	(0028,0031)	DS		NEVER	
>Center of Rotation Offset	(0018,1145)	DS		NEVER	
>Gantry/Detector Tilt	(0018,1120)	DS		NEVER	
>Distance Source to Detector	(0018,1110)	DS		NEVER	
>Start Angle	(0054,0200)	DS		NEVER	
>Radial Position	(0018,1142)	DS		NEVER	
>Image Orientation (Patient)	(0020,0037)	DS		ALWAYS	AUTO
>Image Position (Patient)	(0020,0032)	DS		ALWAYS	AUTO
>View Code Sequence	(0054,0220)	SQ		VNAP	AUTO
>>View Modifier Code Sequence	(0054,0222)	SQ		NEVER	

Table 8-33: NM TOMO Acquisition Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Rotation Information Sequence	(0054,0052)	SQ		VNAP	AUTO
Type of Detector Motion	(0054,0202)	CS		NEVER	

Table 8-34: NM Reconstruction Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Spacing Between Slices	(0018,0088)	DS		ALWAYS	AUTO
Reconstruction Diameter	(0018,1100)	DS		ALWAYS	AUTO
Convolution Kernel	(0018,1210)	SH		NEVER	
Slice Thickness	(0018,0050)	DS		ALWAYS	AUTO
Slice Location	(0020,1041)	DS		VNAP	

8.1.1.11 Secondary Capture Modules

Table 8-35: SC Multi-frame Image Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Burned in Annotation	(0028,0301)	CS		ALWAYS	
Presentation LUT Shape	(2050,0020)	CS		NEVER	
Illumination	(2010,015E)	US		NEVER	
Reflected Ambient Light	(2010,0160)	US		NEVER	
Rescale Intercept	(0028,1052)	DS		NEVER	
Rescale Slope	(0028,1053)	DS		NEVER	
Rescale Type	(0028,1054)	LO		NEVER	
Frame Increment Pointer	(0028,0009)	AT		ALWAYS	
Nominal Scanned Pixel Spacing	(0018,2010)	DS		NEVER	
Digitalizing Device Transport Direction	(0018,2020)	CS		NEVER	
Rotation of Scanned Film	(0018,2030)	DS		NEVER	

Table 8-36: SC Multi-frame Vector Module for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame Time Vector	(0018,1065)	DS		NEVER	
Page Number Vector	(0018,2001)	SH		ALWAYS	
Frame Label Vector	(0018,2002)	SH		NEVER	
Frame Primary Angle Vector	(0018,2003)	DS		NEVER	
Frame Secondary Angle Vector	(0018,2004)	DS		NEVER	
Slice Location Vector	(0018,2005)	DS		NEVER	
Display Window Label Vector	(0018,2006)	SH		NEVER	

8.1.1.12 RT Structure Modules

Table 8-37: RT Structure Sets for Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Structure Set Label	(3006,0002)	SH		ALWAYS	
Structure Set Name	(3006,0004)	LO		NEVER	
Structure Set Description	(3006,0006)	ST		NEVER	
Instance Number	(0020,0013)	IS		ALWAYS	
Structure Set Date	(3006,0008)	PA		ALWAYS	
Structure Set Time	(3006,0009)	TM		ALWAYS	
Referenced Frame of Reference Sequence	(3006,0010)	SQ		ALWAYS	
>Frame of Reference UID	(0020,0052)	UI		ALWAYS	
>Frame of Reference Relationship Sequence	(3006,00C0)	SQ		NEVER	
>RT Referenced Study Sequence	(3006,0012)	SQ		ALWAYS	
>>Referenced SOP Class UID	(0008,1150)	UI		ALWAYS	
>>Referenced SOP Instance UID	(0008,1155)	UI		ALWAYS	

Table 8-37: RT Structure Sets for Created SOP Instances (Continued)

Attribute Name	Tag	VR	Value	Presence of Value	Source
>>RT Referenced Series Sequence	(3006,0014)	SQ		ALWAYS	
>>>Series Instance UID	(0020,000E)	UI		ALWAYS	
>>>Contour Image Sequence	(3006,0016)	SQ		ALWAYS	
>>>>Referenced SOP Class UID	(0008,1150)	UI		ALWAYS	
>>>>Referenced SOP Instance UID	(0008,1155)	UI		ALWAYS	
>>>>Referenced Frame Number	(0008,1160)	IS		NEVER	
Structure Set ROI Sequence	(3006,0020)	SQ		ALWAYS	
>ROI Number	(3006,0022)	IS		ALWAYS	
>Referenced Frame of Reference UID	(3006,0024)	UI		ALWAYS	
>ROI Name	(3006,0026)	LO		ALWAYS	
>ROI Description	(3006,0028)	ST		NEVER	
>ROI Volume	(3006,002C)	DS		ALWAYS	
>ROI Generation Algorithm	(3006,0036)	LO MANUAL		ALWAYS	
>ROI Generation Description	(3006,0038)	LO		NEVER	

Table 8-38: RT Series Module Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS		ALWAYS	
Series Instance UID	(0020,000E)	UI		ALWAYS	
Series Number	(0020,0011)	IS		ALWAYS	
Series Description	(0008,103E)	LO		ALWAYS	
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ		NEVER	
Request Attributes Sequence	(0040,0275)	SQ		NEVER	
Performed Procedure Step ID	(0040,0253)	SH		NEVER	
Performed Procedure Step Start Date	(0040,0244)	DA		NEVER	
Performed Procedure Step Start Time	(0040,0245)	TM		NEVER	
Performed Procedure Step Description	(0040,0254)	LO		NEVER	
Performed Protocol Sequence	(0040,0260)	SQ		NEVER	

Table 8-39: Acquisition Context Module Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Acquisition Context Sequence	(0040,0555)	SQ		ANAP	
Value Type	(0040,A040)	CS		NEVER	
Concept Name Code Sequence	(0040,A043)	SQ	Indicates "Patient State"	ANAP	
Referenced Frame Numbers	(0040,A136)	US		NEVER	
Numeric Value	(0040,A30A)	DS		NEVER	
Measurement Units Code Sequence	(0040,08EA)	SQ		NEVER	
Date	(0040,A121)	DA		NEVER	
Time	(0040,A122)	TM		NEVER	
Person Name	(0040,A123)	PN		NEVER	
Text Value	(0040,A160)	UT		NEVER	
Concept Code Sequence	(0040,A168)	SQ	Indicates Stress or Rest	ANAP	
Acquisition Context Description	(0040,0556)	ST		NEVER	

Table 8-40: Raw Data Module Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS		ALWAYS	
Content Date	(0008,0023)	DA		ALWAYS	
Content Time	(0008,0033)	TM		ALWAYS	
Acquisition Datetime	(0008,002A)	DT		NEVER	
Creator-Version UID	(0008,9123)	UI		ALWAYS	
Referenced Instance Sequence	(0008,114A)	SQ		NEVER	
Purpose of Reference Code Sequence	(0040,A170)	SQ		NEVER	
See Table 8-43					

8.1.2 Usage of Attributes from Received IODs

The local database, remote query, and directory browsers make use of the conventional identification attributes to distinguish patients, studies, series, and instances. In particular, if two patients have the same value for Patient ID, they will be treated as the same in the browser and the local database.

8.1.3 Attribute Mapping

Attribute Mapping is not applicable.

8.1.4 Coerced/Modified Fields

No coercion is performed.

8.2 DATA DICTIONARIES

The Export software provides Standard Extended conformances to the DICOM PET SOP Class. The additional Private data elements that may be included have group number 0x7053, and may contain MOSAIC-specific information which could not be encoded in the standard PET IOD, and would be meaningless for non-MOSAIC systems. However, some receiving systems may need to be informed of the VR for these private elements in order to properly receive and store them. The following table shows the VR for each of these elements.

Table 8-41: Private Elements for PET Images

Tag	VR	Meaning	VM
7053,0010	LO	Private Creator Data element	1

7053,1000	DS	SUV Scale Factor. This value only applies when Units (0054,1001) is equal to CNTS. The SUV Scale Factor is used to convert the pixel data from counts to an SUV value. This is done by using the following formula:
		SUV Value = ((SV * m) + b) * f
		    where SV = original stored pixel value
		        m = Rescale Slope (0028,1053)
		        b = Rescale Intercept (0028,1052)
		         f = SUV Scale Factor (7053, 1000)
		If the SUV Scale Factor is 0.0, then the pixel data cannot be converted from counts to an SUV value.
			1

7053,1001	OB	Private	1
7053,1002	OB	Private	1
7053,1003	ST	Original image file name	1

7053,1009	DS	Activity Concentration Scale Factor. This value only applies when Units (0054,1001) is equal to CNTS. The Activity Concentration Scale Factor is used to convert the pixel data from counts to Activity Concentration (in Bq/ml). This is done by using the following formula:
		Activity Concentration Value = ((SV * m) + b) * f
		    where SV = original stored pixel value
		        m = Rescale Slope (0028,1053)
		        b = Rescale Intercept (0028,1052)
		         f = Activity Concentration Scale Factor (7053, 1009)
		
		If the Activity Concentration Scale Factor is 0.0, then the pixel data cannot be converted from counts to Activity Concentration.
			1

The Private Creator Data Element [7053,0010], which is used to reserve these private data elements, has value "Philips PET Private Group."

Table 8-42: Private Elements for Secondary Capture Images

Tag	VR	Meaning	VM
7053,0010	LO	Private Creator Data element	1
7053,1003	ST	Original image file name	1

Table 8-43: Private Attributes for Raw Data Objects

Tag	VR	Meaning
7053,0010	LO	Private Creator Data element
7053,1007	SQ	Acquisition File Sequence
> 7053,1003	LO	File Name
> 7053,100F	UL	Segment Size
> 7053,1010	US	Segment Number
> 7053,1011	US	Number of Segments
> 7053,1012	SQ	File Data Sequence
>> 7053,1004	OB	File Data

8.3 CODED TERMINOLOGY

The following attributes use coded terminology:

Table 8-44: Coded Terminology in PET/NM Images

Tag	Name	CID	Configurable
0054,0300	Radionclide Code Sequence	18	NO
0054,0220	View Code Sequence	26	NO
0054,0410	Patient Orientation Code Sequence	19	NO
0054,0412	Patient Orientation Modifier Code Sequence	20	NO
0054,0414	Patient Gantry Relationship Code Sequence	21	NO
0040,A168	Concept Code Sequence	3101	NO

8.3.1 Context Groups

Context groups are not applicable.

8.3.2 Template Specifications

The Application Context Module references a template ID.

8.3.3 Private Code Definitions

Private Code Definitions are not applicable.

8.4 GRAYSCALE IMAGE CONSISTENCY

The DICOM Grayscale Standard Display Function is not supported.

8.5 STANDARD EXTENDED SOPS

No specializations or privatizations are used in this implementation. The NM and PET SOP Classes are due to addition of private attributes listed in Table 8-41 and Table 8-42. Standard conformance is provided for all other supported SOP classes.

8.6 PRIVATE TRANSFER SYNTAX

No Private Transfer Syntax is supported.