



**Technical
Publications**

**Direction 2216638-100
Revision 0.0**

**DSX DICOM Software V2.1
CONFORMANCE STATEMENT
for DICOM V3.0**

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

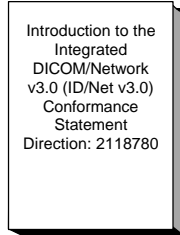
Section 3 (X-RAY RF (XRF) Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a XRF Information Object.

Section 5 (Modality Worklist Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

**1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT
STRUCTURE**

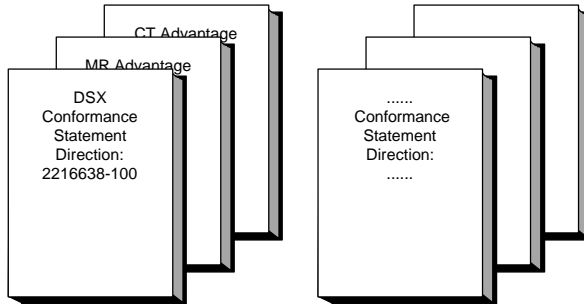
The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in the Illustration below.

ID/Net v3.0



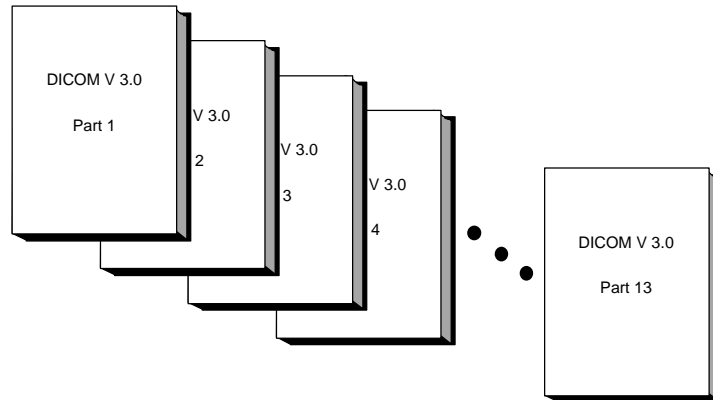
APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

Product Implementation:



DICOM STANDARD

Standard Specification:



This document specifies the DICOM v3.0 implementation. It is entitled:

DSX DICOM Software V2.1
Conformance Statement for DICOM v3.0
Direction: 2216638-100

This DICOM Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GEMS network interface. Introductory information, which is applicable to all GEMS Conformance Statements, is described in the document:

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780.

This Introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' GEMS Conformance Statements.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM v3.0 Part 8 standard.

For more information including Network Architecture and basic DICOM concepts, please refer to the Introduction.

For the convenience of software developers, there is "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published GEMS Product Conformance Statements will be received. The collector Direction is:

ID/Net v3.0 Conformance Statements
Direction: 2117016

For more information regarding DICOM v3.0, copies of the Standard may be obtained by written request or phone by contacting:

NEMA Publication
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209
USA
Phone: (703) 841-3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM v3.0 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 Standard itself, prior to reading this DICOM Conformance Statement document.

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780*

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM v3.0 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM v3.0. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM v3.0 standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful.** The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements.** The user should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **To be informed of the evolution of the implementation described in this document, the User is advised to regularly check the GE Internet Server, accessible via anonymous ftp (GE Internet Server Address: ftp.med.ge.com, 192.88.230.11).**
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

A list of references which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

The information object implementation refers to DICOM PS 3.3 (Information Object Definition) and Supplement 6 (X-Ray Radiofluoroscopic Image Object Definition).

1.7 DEFINITIONS

A set of definitions which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

1.8 SYMBOLS AND ABBREVIATIONS

A list of symbols and abbreviations which is applicable to all GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

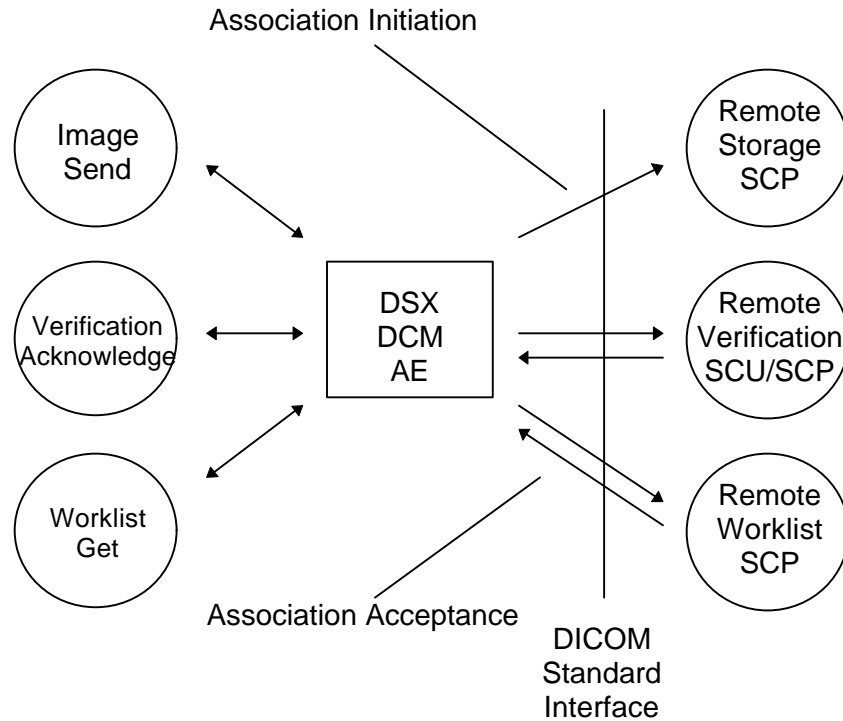
This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features on this GEMS product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

DSX DICOM is an optional product which supports DICOM v3.0 and permits interoperability across equipment produced by different vendors that also utilize DICOM v3.0 services. On any given network, DSX can send images to multiple archive/review stations (PACS). The network is easily configured at any time, but is normally done at installation by a GEMS Field Engineer. DSX has one application entity (AE) that provides all DICOM services that are required to support the 'send', 'verify' and 'modality worklist' services. DSX allows a user to query for and display DICOM modality worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the scanner. In this situation, DSX is providing the DICOM C-FIND service as a service class user (SCU).

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following Illustration :



The DSX DCM Application Entity (AE) is an application which handles all DICOM protocol communications. DCM AE is automatically brought up when the machine is powered on if the DICOM option is installed on the system.

All remote DICOM AE's must be manually configured via the network configuration menu on the DSX system. Normally this done at software installation by a GE Field engineer.

There are three local real world activities: Image Send (IS), Worklist Get (WG) and Verification, which can cause the DCM AE to initiate a DICOM association to store an image.

IS consists of an operator selecting one or several images to be sent on a selected remote system. Selection of images is done from the operator console screen. Selection of the remote system is done from the User Configuration menu.

WG consists of an operator request for the transfer of a list of Patient/Exam entries from a predefined remote HIS/RIS system. This remote HIS/RIS system must be DICOM compliant, and must support the Modality Worklist Management SOP class.

2.2.2 Functional Definition of AE's

The DCM Application Entity supports the following three functions:

1. Image Send:
 - Access to patient demographics and pixel data in the local database.
 - Build a DICOM format data set.

- Initiates a DICOM verification to assist network diagnostics.
 - Initiates a DICOM association to send the image(s).
2. Worklist Get:
 - Build a DICOM formatted worklist management data request.
 - Initiate a DICOM association to send the request.
 - Wait for worklist response(s).
 - Access the local database to add new patient/exam demographic data.
 3. Verification:
 - Responds to DICOM verification requests from the remote system.

2.2.3 Sequencing of Real-World Activities

Non Applicable

2.3 AE SPECIFICATIONS

2.3.1 DSX DCM AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Verification SOP Class	1.2.840.10008.1.1
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

Note: Verification SOP Class service can not be invoked individually. It is invoked just before sending image to the remote host to confirm the existence of the host. This feature can be removed by modifying the DSX system configuration.

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCP** :

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The Maximum Length PDU negotiation is included in all association establishment requests.

The maximum length PDU for an association initiated by the DCM AE is:

Maximum Length PDU	10000 bytes
---------------------------	--------------------

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 1

The user information Items sent by this product are :

- Maximum PDU Length
- Implementation UID

Note: Max. PDU length can be configured at installation time.

2.3.1.1.2 Number of Associations

The DCM AE will initiate only one DICOM association to perform each local activity.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

DSX Implementation UID	1.2.840.113619.6.42
-------------------------------	----------------------------

2.3.1.2 Association Initiation Policy

DCM AE attempts to initiate a new association for each image it attempts to transfer. This association corresponds to 1 Real-World Activity : Image Send (IS).

2.3.1.2.1 Real-World Activity “Image Send”

2.3.1.2.1.1 Associated Real-World Activity

Upon request an image will be sent to a DICOM Storage SCP.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table - Proposed
--

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A7xx	Out of resources	Association is terminated; image not transferred.	(0000,0902)
	0122	SOP Class not Supported	Association is terminated; image not transferred.	(0000,0902)
Error	Cxxx	Cannot Understand	Association is terminated; image not transferred.	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	Association is terminated; image not transferred.	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	Association is terminated; image not transferred.	(0000,0901) (0000,0902)
	B007	Data Set does not match SOP Class	Association is terminated; image not transferred.	(0000,0901) (0000,0902)
	B006	Elements Discarded	Association is terminated; image not transferred.	(0000,0901) (0000,0902)
Success	0000			None

2.3.1.2.1.2.2 SOP Specific DICOM Conformance Statement for Image Storage SOP Class

This implementation performs a single C-STORE operation over an association. although an operator does not need to wait for the completion of one image transmission to transmit another image: there is a queue which holds the images to be transmitted.

If the AE doesn't receive a C-ECHO confirmation or receive a C-ECHO confirmation containing an Error, Refused or Warning status, this implementation will terminate the association. The transfer is considered as failed, no association for C-STORE will be attempted.

This C-ECHO can not be invoked if the system configuration is modified.

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation.

Upon receiving a C-STORE confirmation containing an Error or Refused status, this implementation will terminate the association. The current image is considered failed. If more images are left to be sent, they will be transmitted on a different association.

Each DICOM operation supports a "Per Packet Send" Time-out and a "Per Packet Receive" Time-out. These time-outs start once a packet send/wait has been issued and stops a packet send/receive has been completed. Both time-outs are 600 seconds and modifiable by modifying the system configuration.

2.3.1.2.2 Real-World Activity "Worklist Get"

2.3.1.2.2.1 Associated Real-World Activity

Upon request a list of Patient/Exam entries will be got from a DICOM Worklist SCP.

2.3.1.2.2.2 Proposed Presentation Context Table

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

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model - FIND SOP Class

Following are the status codes that are more specifically processed when receiving messages from a **Modality Worklist** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A700	Out of resources	Association is terminated; worklist not transferred.	(0000,0902)
	0122	SOP Class not Supported	Association is terminated; worklist not transferred.	(0000,0902)
Failed	A900	Identifier does not match SOP	Association is terminated; worklist not transferred.	(0000,0901)

		Class		(0000,0902)
	Cxxx	Unable to process	Association is terminated; worklist not transferred.	(0000,0901) (0000,0902)
Cancel	FE00	Matching terminated due to cancel	Association is terminated; worklist not transferred.	None
Success	0000	Matching is complete - No final identifier is supplied		None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Receive the next PDU.	
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier	Receive the next PDU.	

2.3.1.2.2.2.2 SOP Specific DICOM Conformance Statement for Modality Worklist SOP Class

If the remote AE does not support the proposed Presentation Context, an appropriate error is logged and the operator is notified.

The implementation can receive multiple C-FIND results over a single association. Only one association is opened at a time.

Upon receiving a C-FIND confirmation containing a Successful status, this implementation will perform the adding new patient/exam data. When the number of patient/exam data of the system exceeds the system limitation, the remained data is discarded and the operator is notified.

Upon receiving a C-FIND confirmation containing an Error or Refused status, this implementation will terminate the association. Any previously received worklist items are discarded.

Each DICOM operation supports a “Per Packet Send” Time-out and a “Per Packet Receive” Time-out. These time-outs start once a packet send/wait has been issued and stops a packet send/receive has been completed. Both time-outs are 60 seconds and modifiable by modifying the system configuration.

2.3.1.3 Association Acceptance Policy

The DCM AE provides only DICOM Verification Service Class.

2.3.1.3.1 Real-World Activity “Verification acknowledge”

DSX echoes to a Verification request from any DICOM node. The function is transparent to the user (no user interface, no successful message logged on screen).

2.3.1.3.1.1 Associated Real-World Activity

2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The DCM AE provides standard conformance to the Verification SOP Class as a SCP.

2.3.1.3.1.3 Presentation Context Acceptance Criterion

No criterion.

2.3.1.3.1.4 Transfer Syntax Selection Policies

Only Little Endian transfer Syntax is supported and there is no priority selection policy.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

2.4.2 OSI Stack

OSI stack not supported

2.4.3 TCP/IP Stack

The TCP/IP stack is inherited from a QNX Operating System.

2.4.3.1 API

Not applicable to this product.

2.4.3.2 Physical Media Support

Ethernet V2.0,IEEE 802.3.

2.4.4 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Standard Extended /Specialized/Private SOPs

Not applicable to this product.

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

The Local AE title is configurable and is normally configured by a GEMS Service Engineer during installation. It can also be modified by the user in the User Configuration menu.

2.6.2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title
- Local IP Address
- Local IP Netmask

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number
- Router IP Address

Note: All configurations must be performed by a GE Field Engineer

2.7 SUPPORT OF EXTENDED CHARACTER SETS

No extended character sets are supported.

3. X-RAY RF (XRF) INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM XRF Image IOD to represent the information included in X-Ray RF images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

3.2 - IOD Description

3.3 - IOD Entity-Relationship Model

3.4 - IOD Module Table

3.5 - IOD Module Definition

3.2 XRF IOD IMPLEMENTATION

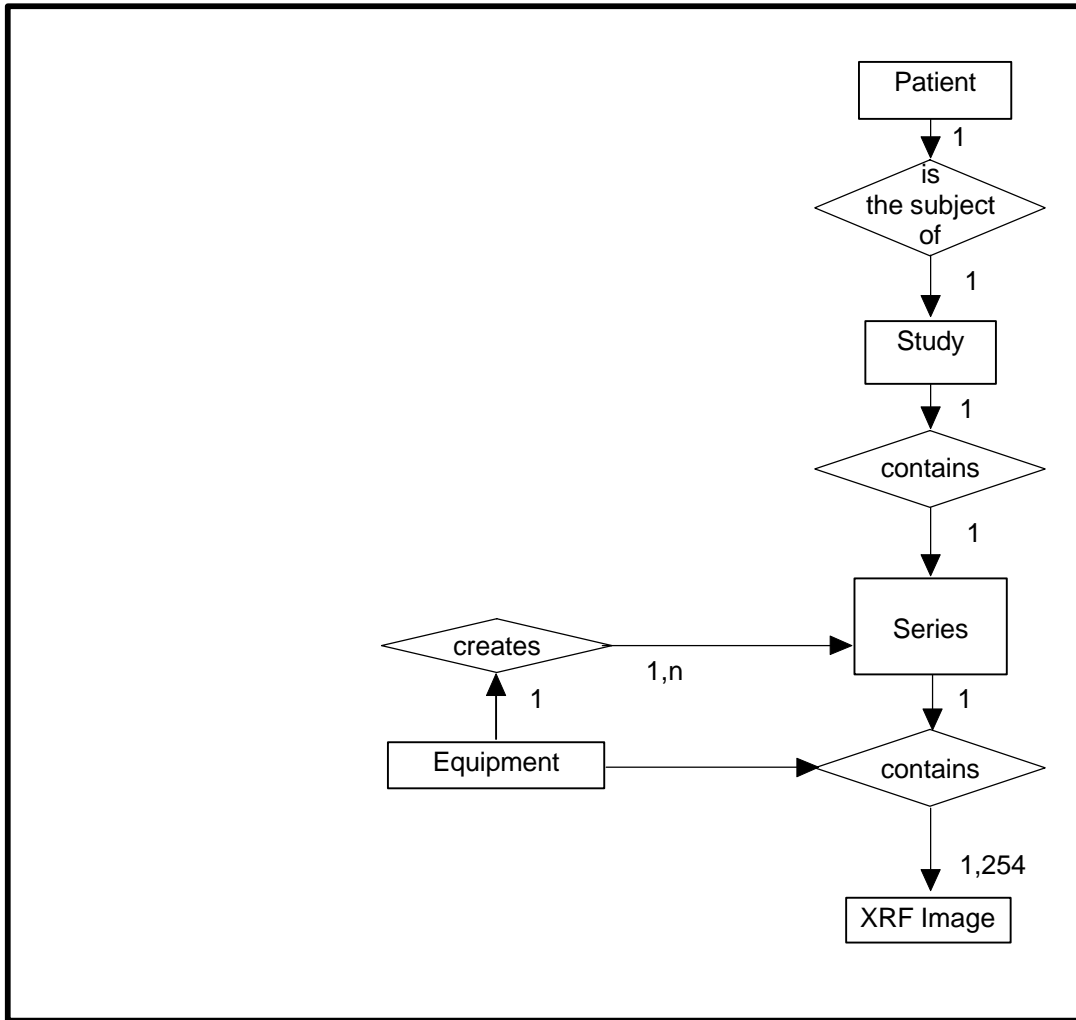
3.3 XRF ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the XRF Image interoperability schema is shown in Illustration 3.3-1. In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to 254 Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 3.3-1
XRF IMAGE ENTITY RELATIONSHIP DIAGRAM



3.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the XRF Information Object.

3.3.2 DSX Mapping of DICOM entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO DSX ENTITIES

DICOM	DSX Entity
Patient	Patient
Study	no match
Series	no match
Image	Sequence
Frame	Image

3.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 XRF IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 XRF IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

**TABLE 3.4-1
XRF IMAGE IOD MODULES**

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
Study	General Study	3.5.2.1
	Patient Study	3.5.2.2
Series	General Series	3.5.3.1
Equipment	General Equipment	3.5.4.1
Image	General Image	3.5.5.1
	Image Pixel	3.5.5.2
	Cine	3.5.5.3
	Multi-frame	3.5.5.4
	Frame Pointers	3.5.5.5
	Display Shutter	3.5.5.6
	X-Ray Image	3.5.8.1
	X-Ray Acquisition	3.5.8.2
	VOI LUT	3.5.6.1
	SOP Common	3.5.7.1

3.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the XRF Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

3.5.1 Common Patient Entity Modules

3.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 3.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From user interface field PATIENT NAME
Patient ID	(0010,0020)	2	From user interface field PATIENT-ID
Patient's Birth Date	(0010,0030)	2	From user interface field BIRTH DATE
Patient's Sex	(0010,0040)	2	From user interface field SEX

3.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

3.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 3.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	
Study Date	(0008,0020)	2	Date the study is created
Study Time	(0008,0030)	2	Time the study is created
Referring Physician's Name	(0008,0090)	2	No value, zero length
Study ID	(0020,0010)	2	Automatically generated by the system
Accession Number	(0008,0050)	2	If the study is created via HIS/RIS, its generating value is set. If not, no value, zero length is set.
Study Description	(0008,1030)	3	From user interface field STUDY DESCRIPTION

3.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 3.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	From user interface field AGE

3.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

3.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 3.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Defined Terms: RF = X-Ray RF
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	2	value : 1
Series Date	(0008,0021)	3	Date the series is created
Series Time	(0008,0031)	3	Time the series is created
Performing Physicians' Name	(0008,1050)	3	From user interface field RADIOLOGIST NAME

3.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

3.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

**TABLE 3.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Defined Terms: "GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	From user interface field HOSPITAL NAME in User Configuration menu
Manufacturer's Model Name	(0008,1090)	3	Defined Terms: "DSX"
Device Serial Number	(0018,1000)	3	Serial number of the system
Software Versions	(0018,1020)	3	Software version of the system

3.5.5 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

3.5.5.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

**TABLE 3.5-6
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	DSX Sequence number
Patient Orientation	(0020,0020)	2C	No value, zero length
Image Date	(0008,0023)	2C	Date the image is created
Image Time	(0008,0033)	2C	Time the image is created
Image Type	(0008,0008)	3	Value = "ORIGINAL\PRIMARY\SINGLE PLANE"
Lossy Image Compression	(0028,2110)	3	Value = 00, Image has NOT been subjected to lossy compression.

3.5.5.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

**TABLE 3.5-7
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Value = 1
Photometric Interpretation	(0028,0004)	1	Defined Terms: "MONOCHROME2"
Rows	(0028,0010)	1	Value = 940
Columns	(0028,0011)	1	Value = 1024
Bits Allocated	(0028,0100)	1	Value = 16
Bits Stored	(0028,0101)	1	Value = 10
High Bit	(0028,0102)	1	Value = 9
Pixel Representation	(0028,0103)	1	Value = 0
Pixel Data	(7FE0,0010)	1	

3.5.5.3 Cine Module

The table in this section specifies the Attributes of a Multi-frame Cine Image.

**TABLE 3.5-8
CINE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Frame Time Vector	(0018,1065)	1C	
Start Trim	(0008,2142)	3	Value = 1
Stop Trim	(0008,2143)	3	The last frame number
Recommended Display Frame Rate	(0008,2144)	3	According to the acquisition rate

3.5.5.4 Multi-Frame Module

This section specifies the Attributes of a Multi-frame pixel data Image.

**TABLE 3.5-9
MULTI-FRAME MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	
Frame Increment Pointer	(0028,0009)	1	Value = 00181065H, Frame Time Vector (0018,1065).

3.5.5.5 Frame Pointers Module

This section specifies the attributes of a Frame Pointer Module.

TABLE 3.5-10
FRAME POINTERS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Representative Frame Number	(0028,6010)	3	Value = 1
Frame Numbers Of Interest (FOI)	(0028,6020)	3	Set all the frame
Frame Of Interest Description	(0028,6022)	3	Frame number and each frame's description

3.5.5.6 Display Shutter Module

TABLE 3.5-11
DISPLAY SHUTTER MODULE

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	Value = "CIRCULAR\RECTANGULAR"
Shutter Left Vertical Edge	(0018,1602)	1C	The operator setting value
Shutter Right Vertical Edge	(0018,1604)	1C	The operator setting value
Shutter Upper Horizontal Edge	(0018,1606)	1C	The operator setting value
Shutter Lower Horizontal Edge	(0018,1608)	1C	The operator setting value
Center of Circular Shutter	(0018,1610)	1C	Center of the image
Radius of Circular Shutter	(0018,1612)	1C	Same as image radius

3.5.6 Common Lookup Table Modules

3.5.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 3.5-12
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	The operator setting value
Window Width	(0028,1051)	1C	The operator setting value

3.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.5.7.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

TABLE 3.5-13
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Value = 1.2.840.10008.5.1.4.1.1.12.2
SOP Instance UID	(0008,0018)	1	Generated using the Series Instance UID, the number of the first frame and the frame number of the image. Note : For multiframe images, the DSX allows selection of images to be sent. Thus, for example, if the multiframe images are 4, 5 and 6, the UID will be the same if the selected images are 4 and 5, or 4 and 6.

3.5.8 X-Ray Modules

This Section describes Modules used in one or more X-Ray IODs. These Modules contain Attributes that are specific to X-Ray images.

3.5.8.1 X-Ray Image Module

**TABLE 3.5-14
X-RAY IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	Value = 00181065H, Frame Time Vector (0018,1065).
Lossy Image Compression	(0028,2110)	1C	Value = 00, Image has NOT been subjected to lossy compression.
Image Type	(0008,0008)	1	Value = "ORIGINAL\PRIMARY\SINGLE PLANE"
Pixel Intensity Relationship	(0028,1040)	1	Value = LIN
Samples per Pixel	(0028,0002)	1	Value = 1
Photometric Interpretation	(0028,0004)	1	Defined Terms: "MONOCHROME2"
Bits Allocated	(0028,0100)	1	Value = 16
Bits Stored	(0028,0101)	1	Value = 10
High Bit	(0028,0102)	1	Value = 9
Pixel Representation	(0028, 0103)	1	Value = 0

3.5.8.2 X-Ray Acquisition Module

**TABLE 3.5-15
X-RAY ACQUISITION MODULE**

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	Set the value if applicable
Radiation Setting	(0018,1155)	1	Value = GR
Exposure Time	(0018,1150)	2C	Set the value if applicable
Exposure	(0018,1152)	2C	Set the value if applicable

4. MODALITY WORKLIST INFORMATION MODEL DEFINITION

4.1 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The contents of this section are:

4.2 - Information Model Description

4.3 - Information Model Entity-Relationship Model

4.4 - Information Model Module Table

4.5 - Information Model Keys

4.2 MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

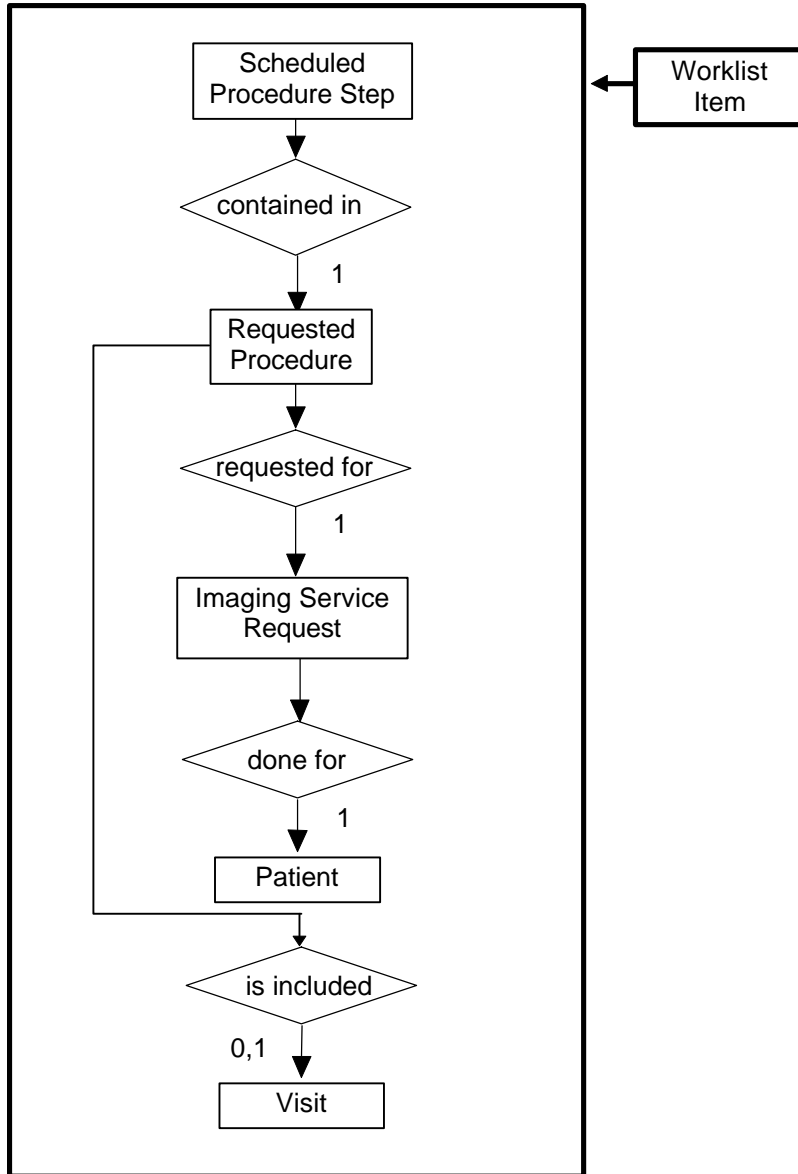
In order to serve as a Service Class Provider (SCP) of the Modality Worklist Service Class, a DICOM Application Entity (AE) possesses information about the attributes of a number of managed worklist items. These items are organized into Modality Worklist Information Modules. In this Service Class, the Information Model plays a role similar to an Information Object Definition of most other DICOM Service Classes.

4.3 MODALITY WORKLIST INFORMATION MODEL ENTITY- RELATIONSHIP MODEL

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Illustration 4.3-2. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

ILLUSTRATION 4.3-2
MODALITY WORKLIST INFORMATION MODEL E/R DIAGRAM



4.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

4.3.2 DSX Mapping of DICOM entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO DSX ENTITIES

DICOM	DSX Entity
Scheduled Procedure Step	

Requested Procedure	Exam
Imaging Service Request	Exam
Visit	
Patient	Patient

4.4 INFORMATION MODEL MODULE TABLE

Within an entity of the DICOM v3.0 Modality Worklist Information Model, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 4.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM v3.0 PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

**TABLE 4.4-1
MODALITY WORKLIST INFORMATION MODEL MODULES**

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	4.5.2.1
	Scheduled Procedure Step	4.5.2.2
Requested Procedure	Requested Procedure	4.5.3.1
Imaging Service Request	Imaging Service Request	4.5.4.1
Visit	Visit Relationship	4.5.5.1
Patient	Patient Identification	4.5.6.1
	Patient Demographic	4.5.6.2

4.5 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

4.5.1 Supported Matching

Following are the types of matching that can be request by the implementation :

- Single Value matching
- Universal Matching

4.5.2 Scheduled Procedure Step Entity

4.5.2.1 SOP Common Module

TABLE 4.5-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Specific Character Set	(0008,0005)	O	1C	No	

4.5.2.2 Scheduled Procedure Step Module

TABLE 4.5-2
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	
>Scheduled Station AE Title	(0040,0001)	R	1	No	Single value matching supported and dynamically configurable.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	This attribute is sent with today's date.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	This attribute is sent with zero length.
>Modality	(0008,0060)	R	1	No	This attribute is sent with value=RF.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	Yes	This attribute is sent with zero length. The received value is end truncated to 48 characters. This value is user modifiable.
>Scheduled Station Name	(0040,0010)	O	2	No	
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	

4.5.3 Requested Procedure Entity

4.5.3.1 Requested Procedure Module

TABLE 4.5-3
REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
----------------	-----	----------------------------	----------------------------	-----------------------	------

Requested Procedure ID	(0040,1001)	O	1	No	
Requested Procedure Description	(0032,1060)	O	1C	No	
Study Instance UID	(0020,000D)	O	1	Yes	This attribute is sent with zero length.
Referenced Study Sequence	(0008,1110)	O	2	No	
>Referenced SOP Class UID	(0008,1150)	O	1C	No	
>Referenced SOP Instance UID	(0008,1155)	O	1C	No	

4.5.4 Imaging Service Request Entity

4.5.4.1 Imaging Service Request Module

**TABLE 4.5-4
IMAGING SERVICE REQUEST MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Accession Number	(0008,0050)	O	2	Yes	This attribute is sent with zero length.

4.5.5 Visit Entity

4.5.5.1 Visit Relationship

**TABLE 4.5-5
VISIT RELATIONSHIP MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Referenced Patient Sequence	(0008,1120)	O	2	No	
>Referenced SOP Class UID	(0008,1150)	O	2	No	
>Referenced SOP Instance UID	(0008,1155)	O	2	No	

4.5.6 Patient Entity

4.5.6.1 Patient Identification

**TABLE 4.5-6
PATIENT IDENTIFICATION MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
----------------	-----	----------------------------	----------------------------	-----------------------	------

Patient's Name	(0010,0010)	R	1	Yes	This attribute is sent with zero length. The received value is end truncated to 48 characters. This value is user modifiable.
Patient ID	(0010,0020)	R	1	Yes	This attribute is sent with zero length. The received value is end truncated to 32 characters. This value is user modifiable.
Patient's Age	(0010,1010)	O	3	No	This attribute is sent with zero length.

4.5.6.2 Patient Demographic

TABLE 4.5-7

PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patients Birth Date	(0010,0030)	O	2	Yes	This attribute is sent with zero length.
Patient's Sex	(0010,0040)	O	2	Yes	This attribute is sent with zero length.

