Technical Publications

Direction 00-888080-01
Revision A

GE OEC 1Kx1K Elite Workstation
DICOM CONFORMANCE STATEMENT

GE Healthcare

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Revision

Revision	Date	Description
0	8/10/2005	First Draft
1	8/30/2005	Review comments incorporated
A	9/2/2005	Released for M3

TABLE OF CONTENTS

1. INTRODUCTION

1.1   OVERVIEW

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

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

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

Section 3 (Media Storage Conformance Statement), specifies the GE OEC Medical Systems equipment compliance to the DICOM requirements for the implementation of Media Storage features.

Section 4 (General Information Element Implementations), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of a General Information Object Definitions (IOD).

Section 5 (XA and RF Information Object Implementations), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of an X-Ray Angiography and Radio fluoroscopy Information Objects.

Section 6 (SC Information Object Implementation), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of a Secondary Capture Image Information Object.

Section 7 (Raw Information Object Implementation), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of a Raw Data Image Information Object.

Section 8 (Basic Directory Information Object Implementation), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of a Basic Directory Information Object.

Section 9 (Modality Worklist Information Model), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section 10 (Query/Retrieve Information Model), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of the Patient, Study and Patient/Study Only Root Query/Retrieve service.

Section 11 (Basic Print Meta SOP Class Information Model), specifies the GE OEC Medical Systems equipment compliance to DICOM requirements for the implementation of the Basic Print Meta SOP Classes (Grayscale).

1.2   OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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

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

Product Implementation:

CT Advantage

MR Advantage

9900 Elite
Workstation
Conformance
Statement
Direction: 888080

......
Conformance
Statement
Direction:
......

DICOM STANDARD

Standard Specification:

DICOM

Part 1

OM

2

OM

3

OM

4

DICOM

Part 16
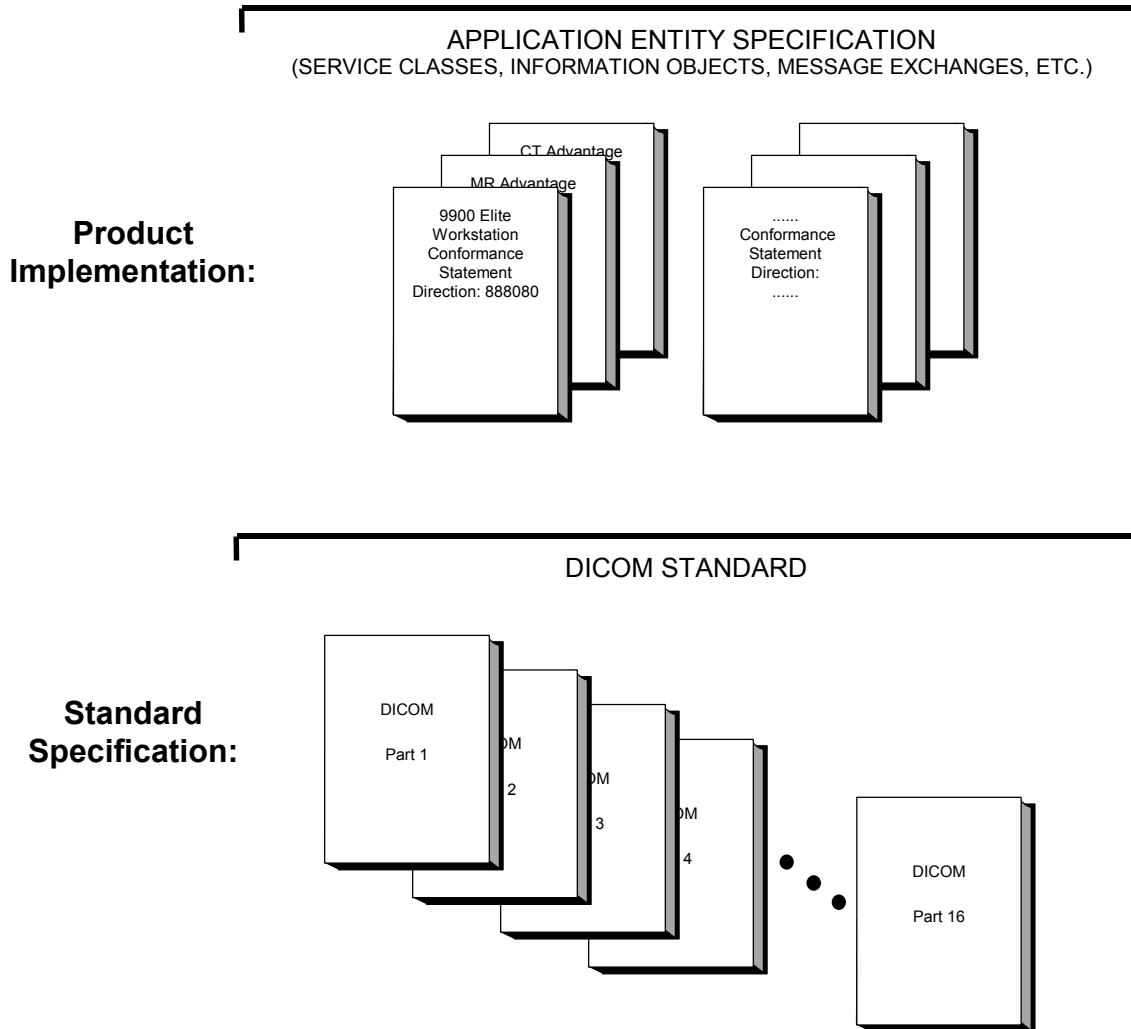
This document specifies the DICOM implementation. It is entitled:

> **GE OEC 1Kx1K Elite Workstation**
> *Conformance Statement for DICOM*
> *Direction **00-888080-01***

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 Part 8 standard.

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

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

> DICOM Secretariat
> NEMA
> 1300 N. 17th Street, Suite 1847
> Rosslyn, VA 22209
> USA
> Phone: +1.703.841.3200

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 Standard and with the terminology and concepts, which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. 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 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 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), 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 Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices, which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described 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. Failures 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.

- **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

2004 version of the DICOM standard found at http://medical.nema.org.

1.7 DEFINITIONS

2004 version of the DICOM standard found at http://medical.nema.org.

1.8 SYMBOLS AND ABBREVIATIONS

2004 version of the DICOM standard found at http://medical.nema.org.

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the GE OEC 1Kx1K Elite Workstation compliance to DICOM requirements for **Networking** features.

GE OEC 1Kx1K Elite Workstation for X-Ray system runs on a set of single board computers. It allows for the following DICOM functionality:

- Sending and receiving Echo message to and from DICOM Verification SCP and client.

- Exporting DICOM images to a DICOM Store SCP or saving the DICOM images to DICOM media format (CD/DVD only, option to be de-identified).

- Browsing and viewing DICOM images on DICOM media format (CD/DVD).

- Backup/Restore of images to removable media, which allows for movement to other 1Kx1K Elite Workstations.

- Querying DICOM Modality Worklist from a Worklist SCP.

- Printing acquired images to a DICOM Printer.

- Querying for saved examinations and retrieving saved examinations from a DICOM Query/Retrieve SCP.

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.

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

The network application model for the 1Kx1K Elite Workstation is shown in the following Illustration :

ILLUSTRATION 2-1
1Kx1K ELITE WORKSTATION NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM
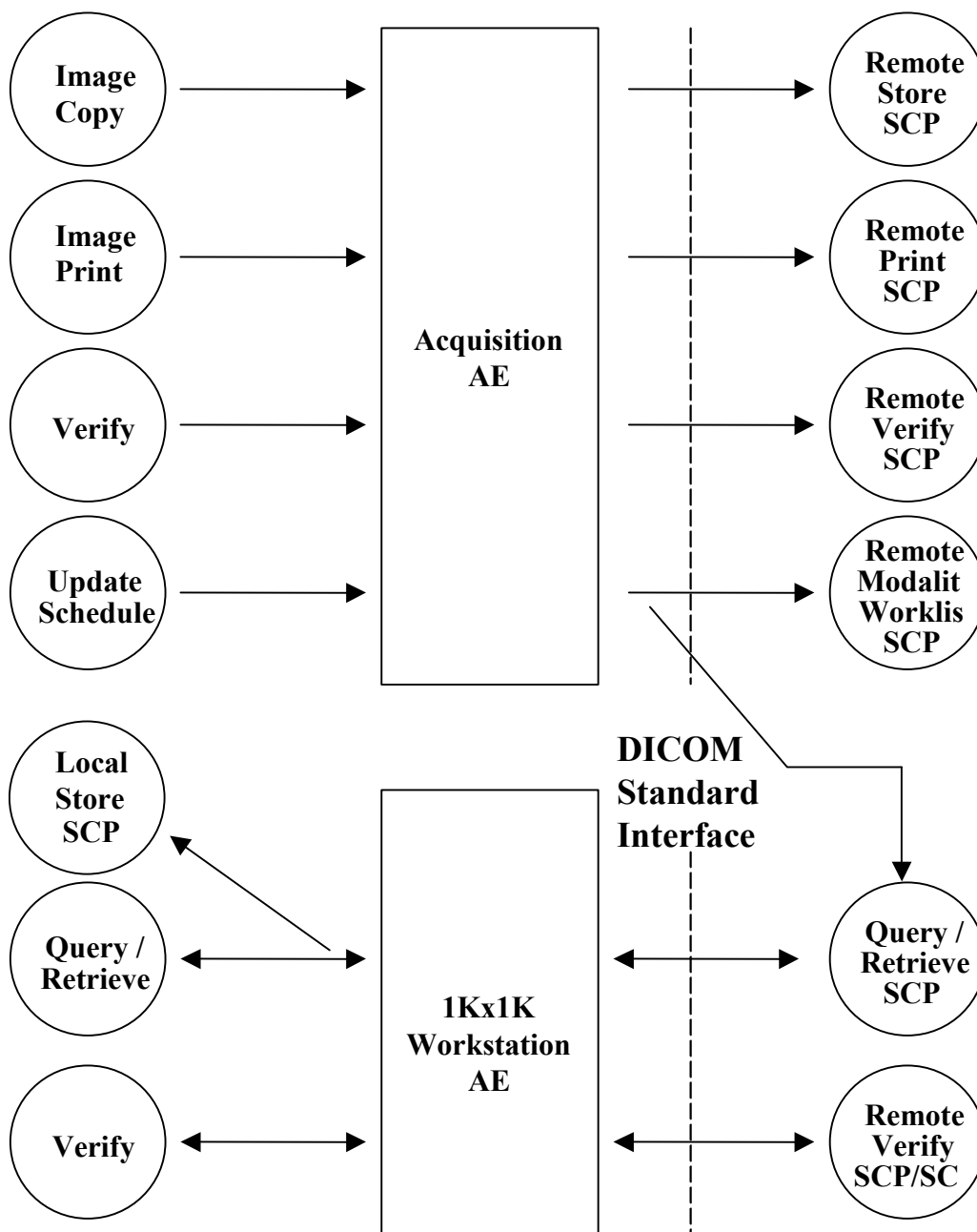
2.2.2   Functional Definition of AE's

Both Application entities are displayed seamlessly to the user.

Application Entity "ACQUISITION" supports the following functions:

- Initiates a DICOM association to send images.

- Transmits DICOM images to the DICOM Storage SCP.

- Initiates a DICOM verification to assist in network diagnostics.

- Initiates a DICOM association to print images.

- Transmits images data to DICOM Print SCP.

- Initiates a DICOM association to query for examination information (simple Worklist query).

- Initiates a DICOM Worklist Query to receive Worklist information. Also, can initiate Study Root Query for "Poor man's" Worklist.

Application Entity "1KX1K WORKSTATION" supports the following functions:

- Initiates a DICOM verification and responds to a DICOM verification to assist in network diagnostics.

- Initiates a DICOM association to query for and retrieve examinations.

- Accepts DICOM associations for DICOM Store requests.

2.2.3   Sequencing of Real-World Activities

System configuration allows for Store, Print, Worklist Query and Query retrieve. DICOM Verification can be performed during configuration enabling the user to perform network diagnostics before procedures. The verification is available for all Store server, Print server, Query server and Worklist query server configurations allowed on the system.

For Query Retrieve the Query server must also be configured with the workstation AE Title, IP and port for the local server.

Configuration must be performed before the system is able to perform DICOM Store, Print, Worklist Query or Query Retrieve.

2.3 AE SPECIFICATIONS

Two AE specifications follow; the first is equivalent to the specifications for the GE OEC 9800 workstation. The second adds the Query/Retrieve capability.

2.3.1 Acquisition AE Specification

The Acquisition Application Entity provides Standard Conformance to the following DICOM SOP Classes as a Storage **SCU**:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as a Storage **SCP** :

No SOP Classes are supported from the Acquisition Application Entity.

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 receive size for the 1Kx1K Workstation Acquisition is:

Maximum Length PDU	**32768**

2.3.1.1.2 Number of Associations

The Acquisition AE will initiate a maximum of 1 simultaneous association to remote nodes.

The Acquisition AE does not accept DICOM associations.

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 Implementation is:

Acquisition Implementation UID	**1.2.840.113780.1.2.0**

The Implementation Version Name for this DICOM Implementation is:

Acquisition Implementation Version Name	**OEC 9900 v2.0**

2.3.1.2 Association Initiation Policy

The Acquisition Application Entity initiates an Association with a remote device in four real-world activities:

- Image Copy, initiated by the operator for selected image(s) copy to a DICOM Store server.

- Verify, which verifies application level communication between DICOM AE's for service purposes.

- Update Schedule initiated by the operator for receiving scheduled exam information using Worklist query or Study root query initiated by operator for scheduled exam information. The type of query is configuration dependent.

- Image Print initiated by the operator for selected image(s).

2.3.1.2.1   Real-World Activity 'Image Copy'

2.3.1.2.1.1   Associated Real-World Activity

Upon a request by the operator the selected images will be sent to the configured DICOM Store SCP.

2.3.1.2.1.2   Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Image Copy					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
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
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.1.2.1   SOP Specific DICOM Conformance Statement for All Storage SOP Classes

The Acquisition AE includes optional data elements in the SOP Instances as described in Section 4, 5, 6, and 7.

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

In all cases a log message will be generated with the specific error code.

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A7xx	Refused: Out of resources	A DICOM server busy error will be displayed to the user.
	A9xx	Error: Data Set does not match SOP Class	A DICOM General error will be displayed to the user.
	Cxxx	Error: Cannot Understand	No Response error message will be displayed.
Warning	B000	Coercion of Data Elements	A DICOM Connect Failed error will be displayed to the user.

	B006	Elements Discarded	A DICOM Connect Failed will be displayed to the user.
	B007	Data Set does not match SOP Class	A DICOM Connect Failed will be displayed to the user.
Success	0000		The progress bar will disappear and return to the starting display.

2.3.1.2.2 Real-World Activity 'Image Print'

2.3.1.2.2.1 Associated Real-World Activity

Upon request by the operator, the selected images will be sent to the configured DICOM Print SCP.

2.3.1.2.2.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Image Print					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Basic Grey Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	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 Basic Grayscale SOP Class

The Acquisition AE uses the following DIMSE services of the supported SOP Classes:

SOP Class	SOP Class UID	DIMSE Service Element	SCU Usage
Basic Film Session	1.2.840.10008.5.1.1.1	N-CREATE	Used (Mandatory)
		N-SET	Not Used
		N-DELETE	Not Used
		N-ACTION	Not Used
Basic Film Box	1.2.840.10008.5.1.1.2	N-CREATE	Used (Mandatory)

		N-ACTION	Used (Mandatory)
		N-DELETE	Not Used
		N-SET	Not Used
Printer	1.2.840.10008.5.1.1.16	N-EVENT-REPORT	Used (SCU)
		N-GET	Not Used
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	N-SET	Used (Mandatory)

.

When a manual print operation is initiated, the AE:

1. Initiates a DICOM association and negotiates Presentation Contexts

2. N-CREATEs a Basic Film Session SOP Instance

3. N-CREATEs a Basic Film Box SOP Instance for each film

4. N-SETs the Image Box SOP Instance for each image on the film

5. Prints by a series of N-ACTIONs on the Basic Film Box SOP Instances, each followed by N-DELETEs of the Basic Film Box SOP Instance

6. The SCP can send an N-EVENT-REPORT request message at any time during the association, the AE will confirm this message with N-EVENT-REPORT response message.

7. Releases the DICOM association after printing is successful or failure has been signaled to the user

The Print management IODs are defined in section 11.

2.3.1.2.2.2.1.1 Basic Film Session SOP Class

Following are the status codes that are more specifically processed when receiving messages from a **Print** SCP equipment for the Basic Film Session SOP Class N-CREATE:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Warning	B600	Memory allocation not supported	Logs an error of "No Memory Allocation" and displays a dialog of "General DICOM Error".
Success	0000	Film session successfully created	Progress display disappears.

2.3.1.2.2.2.1.2 Basic Film Box SOP Class

The N-ACTION message is sent with Action Type ID = 1.

Following are the status codes that are more specifically processed when receiving messages from
a **Print** SCP equipment for the Basic Film Box SOP Class N-CREATE and N-ACTION:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Success	0000	Film accepted for printing; if supported, the Print Job SOP Instance is created	Progress display disappears.
Warning	B603	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	Displays a dialog of "General DICOM Error".
	B605	Requested Min Density or Max Density outside of printer's operating range.	Displays a dialog of "General DICOM Error".
Failure	C602	Unable to create Print Job SOP Instance; print queue is full	Displays a dialog of "General DICOM Error".
	C604	Image position collision : multiple images assigned to single image position	Displays a dialog of "General DICOM Error".
	C603	Image size is larger than image box size (by using the specified magnification value)	Displays a dialog of "General DICOM Error".
	C616	There is an existing Film Box that has not been printed and N-ACTION at the Film Session level is not supported.	Displays a dialog of "General DICOM Error".

2.3.1.2.2.2.1.3 Printer SOP Class

The Acquisition AE supports the Printer SOP Class to receive information on the status of the printer.

The Acquisition AE accepts the N-EVENT-REPORT request message at any time after a print association has been established and until the association is terminated. The association is terminated if an Event Type ID that is not equal to 1 (Normal) is received.

The SCU does not use the N-GET Message.

2.3.1.2.2.2.1.4 Basic Grayscale Image Box SOP Class

Following are the status codes that are more specifically processed when receiving messages from Print SCP equipment for the Basic Grayscale Image Box SOP Class N-SET:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Success	0000	Film accepted for printing; if supported, the Print Job SOP Instance is created	Progress display disappears.
Warning	B604	Image size larger than image box size, the image has been demagnified.	Logs an error of "Can Not Understand" and displays a dialog of "General DICOM Error".
	B605	Requested Min Density or Max Density outside of printer's operating range.	Logs an error of "Can Not Understand" and displays a dialog of "General DICOM Error".
	B609	Image size is larger than the Image Box size.	Logs an error of "Can Not Understand" and displays a dialog of "General DICOM Error".
	B60A	Image size or Combined Print Image size is larger than the Image Box size.	Logs an error of "Can Not Understand" and displays a dialog of "General DICOM Error".
Failure	C603	Image size is larger than image box size	Logs an error of "Size Conflict" and displays a dialog of "General DICOM Error".
	C605	Insufficient memory in printer to store the image.	Logs an error of "Out of Memory" and displays a dialog of "General DICOM Error".
	C616	Combined Print Image Size is larger than the Image box size.	Logs an error of "Can Not Understand" and displays a dialog of "General DICOM Error".

2.3.1.2.3 Real-World Activity 'Verify'

2.3.1.2.3.1 Associated Real-World Activity

The user may initiate a DICOM Verification Request in the configuration screen for each respective SCP configuration (Print, Store and Worklist Query).

A valid response from the SCP will result in a "Verification Successful" dialog displayed on the screen. In the event that the SCP does not response for some reason, the operation will timeout and the Acquisition AE will close the association.

2.3.1.2.3.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Verify					
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	SCU	None

2.3.1.2.4   Real-World Activity 'Update Schedule'

2.3.1.2.4.1   Associated Real-World Activity

The user may initiate a DICOM Worklist Query, which will send a C-FIND-RQ to a Worklist SCP. The system can also be configured to send a C-FIND-RQ to a Query SCP to get demographic data.

2.3.1.2.4.2   Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Update Schedule					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve SOP Class - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
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

2.3.1.2.4.2.1   SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model C- FIND SOP Classes

The Acquisition AE includes matching keys in the queries as described in section 9.4 for this STUDY level query.

The Acquisition AE evaluates a C-FIND RSP containing the Specific Character Set tag (0008,0005). Values of ISO_IR 100 or blank will be accepted, and all others will be rejected. Responses without this tag will also be accepted.

A C-FIND CANCEL will be sent when the display limit for results is reached.

The product does not support Find Extended Negotiation.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources	Logs an error and displays a dialog of "General

			DICOM Error".
	A900	Error: Identifier does not match SOP Class	Logs an error and displays a dialog of "General DICOM Error".
	Cxxx	Error: Unable to process	Logs an error and displays a dialog of "General DICOM Error".
Cancel	FE00	Matching terminated due to cancel	Logs an error and displays a dialog of "General DICOM Error".
Success	0000	Matching is complete - No final identifier is supplied	List of matches returned or dialog of "No Matches Found".
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Continues with the search until one of the previous status codes is returned. If the response list is larger than 150 an error is displayed and the request is cancelled.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	Continues with the search until one of the previous status codes is returned. If the response list is larger than 150 an error is displayed and the request is cancelled.

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

The Acquisition AE includes matching keys in the Modality Worklist queries as described in Section 9.

The results of the Worklist query are displayed to the user in the Scheduled Exam display. The operator manual discusses the layout of the screen.

The Acquisition AE evaluates a C-FIND RSP containing the Specific Character Set tag (0008,0005). Values of ISO_IR 100 or blank will be accepted, and all others will be rejected. Responses without this tag will also be accepted.

A C-FIND CANCEL will be sent when the display limit for results is reached.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources	Logs an error and displays a dialog of "General DICOM Error".

	A900	Error: Identifier does not match SOP Class	Logs an error and displays a dialog of "General DICOM Error".
	Cxxx	Error: Unable to process	Logs an error and displays a dialog of "General DICOM Error".
Cancel	FE00	Matching terminated due to cancel	Logs an error and displays a dialog of "General DICOM Error".
Success	0000	Matching is complete - No final identifier is supplied	List of matches returned or dialog of "No Matches Found".
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Continues with the search until one of the previous status codes is returned. If the response list is larger than 150 an error is displayed and the request is cancelled.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	Continues with the search until one of the previous status codes is returned. If the response list is larger than 150 an error is displayed and the request is cancelled.

2.3.2   1Kx1K Workstation AE Specification

The 1Kx1K Workstation Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

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

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Hard Copy Grayscale Image Storage	1.2.840.10008.5.1.1.29
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Retired Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Retired Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5
Retired Ultra Sound Image Storage	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1

2.3.2.1 Association Establishment Policies

2.3.2.1.1 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 receive size for the 1Kx1K Workstation AE is:

Maximum Length PDU	**32768**

2.3.2.1.2 Number of Associations

The 1Kx1K Workstation AE will initiate a maximum of 1 simultaneous associations to remote nodes.

2.3.2.1.3 Asynchronous Nature

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

2.3.2.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

1Kx1K Workstation Implementation UID	**1.2.840.113780.2.0.2.0.0**

The Implementation Version Name for this DICOM Implementation is:

1Kx1K Workstation Implementation Version Name	**OEC_DCMTK_200**

2.3.2.2 Association Initiation Policy

When the 1Kx1K Workstation Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The 1Kx1K Workstation proposes only a variable number of Transfer Syntaxes in each Presentation Context depending on the service being executed.

The Acquisition Application Entity initiates an Association with a remote device in three real-world activities:

- Image Search, initiated by the operator for a set of user configurable search values to a DICOM Query server.

- Verify, which verifies application level communication between DICOM AE's for service purposes.

- Image Retrieve initiated by the operator to retrieve a specific set of images based on the Image Search return values. A retrieve is also initiated by selecting View and there are no objects for the selected exam.

2.3.2.2.1   Real-World Activity 'Image Search'

2.3.2.2.1.1   Associated Real-World Activity

The user may initiate a DICOM Query in the Query/Retrieve browser, which will send a C-FIND-RQ to the Query/Retrieve SCP.

Associations will be released upon the receipt of C-FIND-RSP confirmation.

The user may then select an examination to be retrieved, this will send a C-MOVE-RQ to the Query/Retrieve SCP. The result of this request is a new association established by the Query/Retrieve server with the Store server on the system.

2.3.2.2.1.2   Proposed Presentation Context Table

The Presentation Context presented is dependent on the user configurable value for the Information model to use on the Query SCP. The models the user can choose are Patient, Study or Patient/Study only and are mutually exclusive.

Presentation Context Table – Proposed by AE 1Kx1K Workstation for Activity Image Search					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

The 1Kx1K Workstation AE only supports hierarchical queries; relational queries are not currently supported.

2.3.2.2.1.2.1   SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - FIND, Study Root Query/Retrieve Information Model - FIND and Patient/Study Only Query/Retrieve Information Model - FIND SOP Classes

The 1Kx1K Workstation includes matching keys in the queries as described in Section 10.

The 1Kx1K Workstation AE looks at the Character Set tag (0008,0005) when interpreting responses and will only display responses where this tag value is "ISO_IR 100". Responses without this tag will also be accepted.

The 1Kx1K Workstation AE will send a C-FIND CANCEL if the user requests a cancel of the operation or if an internal resource limit has been reached. Only 500 responses will be processed before a C-FIND CANCEL is sent to the Query/Retrieve SCP. A C-FIND CANCEL will also be sent if a system shutdown is performed during this operation.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources	An error is logged and a dialog is displayed saying the server is out of resources.
	A900	Error: Identifier does not match SOP Class	An error is logged and a dialog is displayed saying the requested operation failed.
	Cxxx	Error: Unable to process	An error is logged and a dialog is displayed saying the requested operation failed.
Cancel	FE00	Matching terminated due to cancel	A log entry for a cancel request from SCP is logged. Display has results returned up to this point.
Success	0000	Matching is complete - No final identifier is supplied	Displays results.
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Displays progress bar.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	A log entry for the warning of unsupported keys from the SCP is logged. Displays progress bar.

2.3.2.2.2   Real-World Activity 'Verify'

2.3.2.2.2.1   Associated Real-World Activity

The user may initiate a DICOM Verification Request in the configuration screen for each respective SCP configuration (Query server).

A valid response from the SCP will result in a "Verification Successful" dialog displayed on the screen. In the event that the SCP does not response for some reason, the operation will timeout and the Acquisition AE will close the association.

2.3.2.2.2.2   Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Verify					
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	SCU	None

2.3.2.3   Association Acceptance Policy

2.3.2.3.1   Real-World Activity 'Verify'

2.3.2.3.1.1   Associated Real-World Activity

An incoming Verification request will cause the 1Kx1K Workstation AE to accept the association and respond with a verification response.

2.3.2.3.1.2   Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Acquisition for Activity Verify					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None

2.3.2.3.2   Real-World Activity 'Image Retrieve'

2.3.2.3.2.1   Associated Real-World Activity

The user initiates a retrieve operation by selecting the Retrieve or View button on the user interface. View will start a retrieve if the exam to be viewed is not retrieved to the 1Kx1K workstation.

2.3.2.3.2.2   Proposed Presentation Context Table

The Presentation Context presented is dependent on the user configurable value for the Information model to use on the Query SCP. The models the user can choose are Patient, Study or Patient/Study only and are mutually exclusive.

Presentation Context Table – Proposed by AE 1Kx1K Workstation for Activity Image Retrieve					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.2.3.2.2.1   SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE , Study Root Query/Retrieve Information Model - MOVE and Patient/Study Only Query/Retrieve Information Model - MOVE SOP Classes

The C-MOVE-RQ will use the AE Title of the 1Kx1K Workstation Application Entity as the Move Destination AE Title. This AE title must be configured in the Query/Retrieve SCP along with the IP and/or host address and port number.

The user can initiate a C-MOVE CANCEL by canceling the "retrieve" request.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A701	Refused: Out of resources - Unable to calculate number of matches	An error is logged and a dialog is displayed saying the server is out of resources.
	A702	Refused: Out of resources - Unable to perform sub-operations	An error is logged and a dialog is displayed saying the server is out of resources.
	A801	Refused: Move Destination Unknown	An error is logged and a dialog is displayed saying the requested operation failed.
	A900	Error: Identifier does not match SOP Class	An error is logged and a dialog is displayed saying the requested operation failed.
	Cxxx	Error: Unable to process	An error is logged and a dialog is displayed saying the requested operation failed.
Cancel	FE00	Sub-operations terminated due to a Cancel indication	No error is displayed since this is user inititiated. All objects that were moved are available for viewing.
Warning	B000	Sub-operations Complete - One or more Failures.	A warning is logged and a dialog is displayed saying the requested operation failed.
Success	0000	Sub-operations Complete - No Failure.	The moved objects are available for viewing. If no images are received by the workstation Store SCP then an error message is displayed advising the user to check the settings on the PACS.
Pending	FF00	Sub-operations are continuing -	Progress bar with Cancel button continues to be displayed.

2.3.2.3.2.3   Accepted Presentation Context Table

Following is the list of Composite information objects that the 1Kx1K Workstation AE will accept.

Presentation Context Table - Accepted by AE 1Kx1K Workstation for Activity Image Retrieve					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Hard Copy Grayscale Image Storage	1.2.840.10008.5.1.1.29	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Retired Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Retired Nuclear	1.2.840.10008.5.1.4.1.	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

Medicine Image Storage	1.5	Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Retired Ultra Sound Image Storage	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
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	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

2.3.2.3.2.3.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The 1Kx1K Workstation AE provides standard conformance, and stores all standard and private data elements of received SOP Instances.   Group length tag values are recalculated and stored.

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Storage:**

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A7xx	Refused: Out of resources	Not enough disk space is available or system has run out of memory. This error is also returned if a	NA

		Store association is already open and another Store association is requested. An error log entry will be made.	
	A9xx	Error: Data Set does not match SOP Class	Data set does not match SOP Class. Specifically if pixel data is required and not present this error will be returned. An error log entry will be made.	NA
	Cxxx	Error: Cannot Understand	Dataset does not have the expected tags like the character set in the data is not supported by the system. An error log entry will be made.	NA
Success	0000			None

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the products Operating System.

2.4.2 Physical Media Support

The product is provided with a 10/100 Mb/s auto-sensing Ethernet interface. Additional advanced configuration screens allow for static configuration of link speed and duplex.

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

2.5.1.1 Standard Extended SOP Class

The product provides a Standard Extended SOP Class, through the inclusion of additional Private Data Elements. The extensions are defined in Raw Data INFORMATION OBJECT IMPLEMENTATION Section 7.

2.6   CONFIGURATION

2.6.1   AE Title/Presentation Address Mapping

The AE Title is configurable on the DICOM configuration screen. The same AE title text is used for both Application Entities.

2.6.2   Configurable Parameters

The following fields are configurable:

The default value for these fields is blank unless otherwise specified.

Network

- Use DHCP or static IP (default static IP with no IP defined).

- Local IP Address

- Local IP Net mask

- Default Gateway

- Network speed/duplex. (Default – Auto Detect).

- DNS server IP addresses

Local values

- Local AE Title (Both AE's use the same title. Default – OEC_9900)

- Station Name (Default is OEC 9900)

- Local Listening Port Number (available with Query/Retrieve option default is 10004)

- Days for Cache (Default is 3)

CD/DVD Options (Media Exchange)

- Modality to save (XA, RF, SC. Default is XA)

- Resolution (1kx1k, 0.5kx0.5k. Default is 1kx1k)

- Remote Patient Information (Default – No).

- Merge into one Overlay (Default – Yes).

- Save 9900 Compatible

- Other values are configurable but do not affect DICOM and can be found in the operators manual.

Every Remote DICOM AE SCP: (Store, Print, Modality Worklist, Query/Retrieve)

- Remote AE Title

- Remote IP Address

- Remote Port Number

- Gateway IP Address (not available for Query/Retrieve).

Additional fields for Remote DICOM Store

- Modality to store (RF, XA or SC. Default - XA)

- Image Resolution (Default – 0.5k x 0.5k)

- Send Overlay(s) options (Default - Never)

- Merge Patient and Measurement overlays (Default – No)

Additional fields for Remote DICOM Print

- Configuration information for Printer (see printer conformance statement for tag 2010,0150)

- Min/Max Density for Printer

- Border Density

- Empty Density

- Number of Copies

- Print Priority

- Destination

- Medium Type

- Film Size

- Format (Default 1,1)

Additional fields for Remote DICOM Query Worklist

- Modality (Default is All, for all modalities. Used for StudyRoot query for schedule update)

- Get Worklist checkbox (Default - unchecked)

- Get Today's exam

- Patient Name

- Patient ID

- Accession #

- Study Date

- Study Time

- Physician

Additional fields for Remote DICOM Query/Retrieve

- Timeout in seconds (Association Establishment, Find, Move Timeout. Default is 60)

- Information model (Patient, Study and Patient/Study Only roots. Default is Study Root)

- Days to cache (Default is 3).

Note: All configurations are under the control of the customer but can be performed by a GE Field Engineer.

2.7   SUPPORT OF EXTENDED CHARACTER SETS

The 1Kx1K Workstation will support the extended character set of ISO_IR 100 (Latin alphabet Number 1 supplementary set) for the characters supported on the keyboard.

As a Storage SCP or Media Storage FSR, the product will accept SOP Instances with ISO_IR 100 compatible values found in Specific Character Set (0008,0005). As a Query SCU, it will similarly accept response items with ISO_IR 100 compatible values of Specific Character Set. Compatible values to ISO_IR 100 are ISO_IR 6 and ISO_IR 100, according to the standard lack of the Specific Character set (0008,0005) tag is defined to be ISO_IR 6 (Part 5 section 6.1.2).

The product user interface will allow the user to enter characters from the console keyboard that are within ISO_IR 100 extended character set.

The product will accept, as a Modality Worklist SCU, Scheduled Procedure Step Identifiers with ISO_IR 100 compatible values of Specific Character Set (0008,0005). It will map that Specific Character Set value without change into the images created pursuant to that Scheduled Procedure Step. Text attributes of the Scheduled Procedure Step Identifier, including Patient and Physician names, that include extended characters will be displayed as described above. Responses with non-compatible values will be discarded.

2.8   CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.9   SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network

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(VPN))

3. MEDIA STORAGE CONFORMANCE STATEMENT

3.1 INTRODUCTION

This section of the DICOM conformance statement specifies the 1Kx1K Elite Workstation compliance to DICOM requirements for **Media Interchange**. It details the DICOM Media Storage Application Profiles and roles, which are supported by this product.

The 1Kx1K Elite Workstation is able to export images to DICOM media, browse DICOM media and read images from DICOM media.

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.

3.2 IMPLEMENTATION MODEL

3.2.1 Application Data Flow Diagram

The media interchange application model for the Elite Workstation is shown in the following Illustration:

ILLUSTRATION 3-1
1KX1K ELITE WORKSTATION MEDIA INTERCHANGE APPLICATION MODEL AND DATA FLOW DIAGRAM
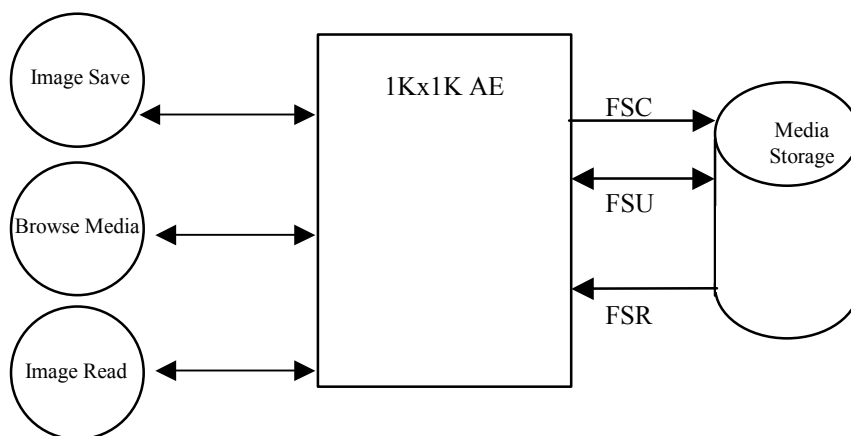
The 1Kx1K Elite Workstation supports the General Purpose CD-R and DVD interchange profiles.

3.2.2 Functional Definition of AE's

The 1Kx1K Workstation can perform these functions:

- Create a new DICOM File-Set on Media

- Update a DICOM File-Set by adding new SOP instance to the File-Set, only possible using multi-session CD or DVD.

- Browse/Read information from media of an existing File-Set and read images.

3.2.3 Sequencing of Real-World Activities

Image Save - Images are acquired and from the Image Directory images can be selected and "copied" to media. Images can be saved "processed" (viewable by any DICOM workstation which supports Media Exchange) or "unprocessed" used to transfer images from one system to another or as a backup.

Browse Media – Different browse capabilities exist in different applications of the 1Kx1K Workstation. Image directory can display list of patients with "unprocessed" images for import from media and display thumbnails of the images. Query/Retrieve can display a list of patient/series with "processed" images (multi-modality, part10) that can be imported for viewing using Query/Retrieve application.

Image Read – Different read capabilities exist in different applications of the 1Kx1K workstation. Image directory can read "unprocessed" images and store them into the system for use from Image Directory. Query/Retrieve can read multi-modality "processed" images (part 10) into the system and view them in the Query/Retrieve viewer.

3.2.4 File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is :

File Meta-Information Version	1
1Kx1K Workstation Implementation UID	1.2.840.113780.1.2.0
Implementation Version Name	**OEC 9900 v2.0**

3.3 AE SPECIFICATIONS

3.3.1   1Kx1K Workstation AE Specification

The 1Kx1K Workstation Application Entity provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The supported Application Profiles and roles are listed below.

Supported Application Profile	Real World Activity	Role	Option
STD-GEN-CD, STD-GEN-DVD	Image Save	FSC, FSU, FSR	Interchange
STD-GEN-CD, STD-GEN-DVD	Browse Media	FSR	Interchange
STD-GEN-CD, STD-GEN-DVD	Image Read	FSR	Interchange

3.3.1.1   File Meta Information for the 1Kx1K Workstation Application Entity

Following are the values set in the File Meta Information for this AE Title :

Source Application Entity Title	Configurable by the user

3.3.1.2   Real-World Activities for the 1Kx1K Workstation Application Entity

3.3.1.2.1   Real-World Activity Image Save

"Image Save" save a DICOM SOP instance to media and updates the DICOM File set. The user has the ability to modify the modality saved, the resolution used, and whether "unprocessed" images (ones that can be restored to a system) should be saved.

3.3.1.2.1.1   Media Storage Application Profile for the RWA Image Save

See list in section 3.3.1above.

3.3.1.2.1.1.1   FSC/FSU Directory Options

The DICOMDIR Directory Records created by this AE will include key attributes as described in Section 8.

3.3.1.2.1.1.2   Options for STD-GEN-CD and STD-GEN-DVD Application Profile

Following are the optional SOP Classes supported by this AE. All SOP Instances use the Explicit VR Little Endian Uncompressed Transfer Syntax, UID 1.2.840.10008.1.2.1.

SOP Class	SOP Class UID
Basic Directory	1.2.840.10008.1.3.10
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66

3.3.1.2.2   Real-World Activity Browse Image

"Browse Image" will read the DICOMDIR file to list the series information on the media. The user will see the Patient name, ID, Series description, modality, accession number and series date. The user can then select a series for import.

3.3.1.2.2.1   Media Storage Application Profile for the RWA Browse Image

See list in section 3.3.1.

3.3.1.2.2.1.1   Options for STD-GEN-CD and STD-GEN-DVD Application Profile

Following are the optional SOP Classes supported by this AE. All SOP Instances use the Explicit VR Little Endian Uncompressed Transfer Syntax, UID 1.2.840.10008.1.2.1.

SOP Class	SOP Class UID
Basic Directory	1.2.840.10008.1.3.10

3.3.1.2.3   Real-World Activity Image Read

"Image Read" will read the selected series and all images contained on the media for this series and transfer the data to the workstation. The user can view the images in the series at this time.

3.3.1.2.3.1   Media Storage Application Profile for the RWA Image Read

See list in section 3.3.1above.

3.3.1.2.3.1.1   Options for STD-GEN-CD and STD-GEN-DVD Application Profile

Following are the optional SOP Classes supported by this AE.

Abstract Syntax		Transfer Syntax	
Name	**UID**	**Name List**	**UID List**
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Explicit VR Little Endian	1.2.840.10008.1.2.1
Hard Copy Grayscale Image Storage	1.2.840.10008.5.1.1.29	See list below	See list below

Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	See list below	See list below
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	See list below	See list below
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	See list below	See list below
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	See list below	See list below
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	See list below	See list below
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See list below	See list below
Retired Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3	See list below	See list below
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See list below	See list below
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	See list below	See list below
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See list below	See list below
Retired Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5	See list below	See list below
Retired Ultra Sound Image Storage	1.2.840.10008.5.1.4.1.1.6	See list below	See list below
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See list below	See list below
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	See list below	See list below
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	See list below	See list below
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	See list below	See list below
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128	See list below	See list below

RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	See list below	See list below

Transfer Syntax Name list	Transfer Syntax UID list
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2
RLE Lossless	1.2.840.10008.1.2.5
JPEG Lossless, Non-hierarchical, 1st Order Prediction	1.2.840.10008.1.2.70
JPEG Lossless, Non-hierarchical, Process 14	1.2.840.10008.1.2.4.57
JPEG Baseline	1.2.840.10008.1.2.4.50
JPEG Extended, Process 2+4	1.2.840.10008.1.2.4.51

3.4 AUGMENTED AND PRIVATE APPLICATION PROFILES

1Kx1K Elite Workstation uses private tags to store information in the Raw Data Storage SOP Class to allow for the image to be restored to the system for processing.

3.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

3.5.1 Standard Extended / Specialized / Private SOP Classes

3.5.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to the Raw Data Storage SOP Class, through the inclusion of additional Private Data Elements. The extensions are defined in Section 7.

3.5.1.2 Private Creator Groups

The following private creator groups are added to the Raw Data SOP class.

Element Name	Tag	VR	VM	Description
GEHC_OEC_WS	000B,0010	LO	1	Workstation attributes
GEHC_OEC_SESSION	0009,0010	LO	1	Session data

GEHC_OEC_SHOT	0011,0010	LO	1	Shot data
GEHC_OEC_CINE	0013,0010	LO	0-1	Cine Data
GEHC_OEC_MARKER	0013,0010	LO	0-1	Marker Data in different data set than Cine data.
GEHC_OEC_MARKER_MDI	0015,0010	LO	0-1	Marker Sequence
GEHC_ OEC_MARKER_TMK	0017,0010	LO	0-n	Marker data
GEHC_ OEC_MARKER_GMK	0019,0010	LO	0-n	Marker data
GEHC_ OEC_MEASUREMENTS	0021,0010	LO	0-1	Measurement Sequence
GEHC_ OEC_MEASUREMENTS_AM	0023,0010	LO	0-n	Measurement data
GEHC_ OEC_MEASUREMENTS_DM	0025,0010	LO	0-n	Measurement data
GEHC_ OEC_MEASUREMENTS_SM	0027,0010	LO	0-n	Measurement data
GEHC_ OEC_CALIBRATION	0029,0010	LO	0-1	Measurement calibration
GEHC_ OEC_SINGLE_MASK	0031,0010	LO	0-1	Mask

3.6 CONFIGURATION

The following parameter are configurable by the user:

- AE Title

3.7 SUPPORT OF EXTENDED CHARACTER SETS

The 1Kx1K Elite Workstation will only support ISO_IR 100. Any incoming SOP instance that is encoded using another extended character set will not be read, browse operations will also not display entries.

4.   GENERAL IMAGE INFORMATION OBJECT IMPLEMENTATION

This section specifies the general use of the DICOM Composite Image IODs to represent the information included in SOP Instances produced or displayed by this implementation. This section deals only with common (non-modality-specific) information.

4.1   1KX1K ELITE WORKSTATION MAPPING OF DICOM ENTITIES

The 1Kx1K Elite Workstation maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 4.1-1
MAPPING OF DICOM ENTITIES TO 1KX1K ELITE WORKSTATION ENTITIES

DICOM IE	1Kx1K Elite Workstation Entity
Patient	Exam
Study	Exam
Series	Exam
Image	Image

4.2   INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the Information Object.

Note that not all of the modules described here are used in any particular IOD. See the IOD Module Table for each specific supported IOD for the specific list of modules used.

DIR 00-888080-01 REV A

4.2.1 Patient Module

TABLE 4.2-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	May be entered from user interface or taken from Worklist.
Patient ID	(0010,0020)	2	May be entered from user interface or taken from Worklist.
Patient's Birth Date	(0010,0030)	2	May be entered from user interface or taken from Worklist.
Patient's Sex	(0010,0040)	2	May be entered from user interface or taken from Worklist.
Patient Comments	(0010,4000)	3	May be entered from user interface.

4.2.2 General Study Module

TABLE 4.2-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Uniquely generated by the equipment. Worklist used if available. Regenerated, if the user edits Accession number.
Study Date	(0008,0020)	2	Set to the first shot date in the exam.
Study Time	(0008,0030)	2	Set to the first shot time in the exam.
Referring Physician's Name	(0008,0090)	2	Taken from the Worklist.
Study ID	(0020,0010)	2	Set to Worklist value of Requested Procedure ID or generated by equipment.
Accession Number	(0008,0050)	2	Taken from the Worklist else the user can enter from the user interface.
Study Description	(0008,1030)	3	Taken from the Worklist else the user can enter from the user interface (procedure field).

4.2.3 Patient Study Module

The product does not use this module.

4.2.4 General Series Module

TABLE 4.2-3
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Set to XA, RF or SC depending on the configuration. The proper SOP class will be created based on this configuration.
Series Instance UID	(0020,000E)	1	Uniquely generated by the equipment.
Series Number	(0020,0011)	2	Currently always set to "1".
Series Date	(0008,0021)	3	Set to the first shot date in the exam
Series Time	(0008,0031)	3	Set to the first shot time in the exam
Performing Physicians' Name	(0008,1050)	3	Taken from the Worklist scheduled performing physician else the user can enter from the user interface. For Study Root query (non-worklist), the performing physician tag (0008,1050) will populate the Physician field on the display. The user is free to modify this field.

DIR 00-888080-01 REV A

4.2.5 General Equipment Module

TABLE 4.2-4
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Set to GE_HEALTHCARE
Institution Name	(0008,0080)	3	Configurable by user on setup screen (The field name is "Hospital Name").
Station Name	(0008,1010)	3	Configurable by user on DICOM setup screen.
Manufacturer's Model Name	(0008,1090)	3	Set to type and model of the system.
Device Serial Number	(0018,1000)	3	Set to serial number of the system.
Software Versions	(0018,1020)	3	Set to workstation software version.
Date of Last Calibration	(0018,1200)	3	Set to date of DAP Calibration.
Time of Last Calibration	(0018,1201)	3	Set to time of DAP Calibration.

4.2.6 General Image Module

TABLE 4.2-5
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Set to image number on this workstation.
Patient Orientation	(0020,0020)	2C	Currently blank.
Content Date	(0008,0023)	2C	Set to date image was taken.
Content Time	(0008,0033)	2C	Set to time image was taken.
Image Type	(0008,0008)	3	Set to "ORIGINAL\PRIMARY\SINGLE PLANE".
Burned In Annotation	(0028,0301)	3	Set to "NO" when XA or RF objects stored. Set to "YES " when SC (OT) object is stored.

4.2.7 Image Pixel Module

TABLE 4.2-6
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Set to a value of 1.
Photometric Interpretation	(0028,0004)	1	The value is set to "MONOCHROME2".
Rows	(0028,0010)	1	This value varies based on the modality and image resolution selected by the user. Full Resolution will be 1024, Half resolution will be 512.
Columns	(0028,0011)	1	This value varies based on the modality and image resolution selected by the user. Full Resolution will be 1024, Half resolution will be 512.

Bits Allocated	(0028,0100)	1	This value varies based on the modality. 16 for XA and RF. 8 for SC (OT).
Bits Stored	(0028,0101)	1	This value varies based on the modality. 16 for XA and RF. 8 for SC (OT).
High Bit	(0028,0102)	1	This value varies based on the modality. 15 for XA and RF. 7 for SC (OT).
Pixel Representation	(0028,0103)	1	This value is set to 0 for unsigned integer.
Pixel Data	(7FE0,0010)	1	Pixel data of the image.

4.2.8   Contrast/Bolus Module

TABLE 4.2-7
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Blank.
Contrast/Bolus Start Time	(0018,1042)	3	Set to time that injector signal displayed to user.

4.2.9   Multi-Frame Module

The following tags are only available when a CINE image is stored.

TABLE 4.2-8
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Set to the number of frames in the multi-frame image.
Frame Increment Pointer	(0028,0009)	1	See 4.2.9.1.1 for further explanation.

4.2.9.1   Multi-Frame Attribute Descriptions

4.2.9.1.1   Number Of Frames And Frame Increment Pointer

The Frame increment pointer uses tag (0018,1063) as the pointer; this tag is the Frame Time (number of frames/frame rate).

DIR 00-888080-01 REV A

4.2.10 Mask Module

TABLE 4.2-9
MASK MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1	
>Mask Operation	(0028,6101)	1	Set to NONE. The subtracted run is stored in the multi-frame image.
Recommended Viewing Mode	(0028,1090)	2	Set to NAT = native viewing of image as sent.

4.2.11 Overlay Plane Module

The 1Kx1K Elite Workstation supports two overlays and the merging of both overlays into one for viewers that only display one overlay.

The 6000 group overlay is the Patient information. The Patient information setup screen controls what is displayed and is user configureable.

The 6002 group overlay is the Annotation information markers, comments, and measurements.

These overlays are only applicable to the XA and RF objects. The SC object does not contain these tags since the annotation and patient information are burned into the image.

TABLE 4.2-10
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	This value varies based on the image resolution selected by the user. Full Resolution will be 1024, Half resolution will be 512.
Overlay Columns	(60xx,0011)	1	This value varies based on the image resolution selected by the user. Full Resolution will be 1024, Half resolution will be 512.
Overlay Type	(60xx,0040)	1	Value set to "G ".
Overlay Origin	(60xx,0050)	1	1,1
Overlay Bits Allocated	(60xx,0100)	1	1
Overlay Bit Position	(60xx,0102)	1	0
Overlay Data	(60xx,3000)	1C	Overlay image data.
Overlay Label	(60xx,1500)	3	This value is set to "Demographic Annotation Overlay" for group 6000, except when the overlays are merged when it is set to "Demographic-Image Annotation Overlay". The group 6002 overlay label is set to "Image Annotation Overlay".

4.2.12 Cine Module

TABLE 4.2-11
CINE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Preferred Playback Sequencing	(0018,1244)	3	Values set to: 0 = Looping (1,2...n,1,2,...n,1,2,....n,...)
Frame Time	(0018,1063)	1C	Set to 1000/Frame rate of acquisition in milliseconds.
Recommended Display Frame Rate	(0008,2144)	3	Set to the frame rate of during acquisition.
Cine Rate	(0018,0040)	3	Set to the frame rate of during acquisition.
Effective Duration	(0018,0072)	3	Set to Total Frames divided by Frame rate.
Actual Frame Duration	(0018,1242)	3	Value will be set according to the mode used for acquisition.

4.2.13   Multi-frame Overlay Module

The product 1Kx1K Elite Workstation does not support multi-frame overlays.

4.2.14   VOI LUT module

TABLE 4.2-12
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Set to 32767
Window Width	(0028,1051)	1C	Set to 65535

4.2.15   SOP Common Module

TABLE 4.2-13
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SOP Class UID for the Class that the dataset contains. (XA, RF, SC, Raw Data)
SOP Instance UID	(0008,0018)	1	Created using OEC prefix 1.2.840.113780. Concatenate the following, system type, Model serial number, Image Date, Image Time, Image number followed by ".40".
Specific Character Set	(0008,0005)	1C	Set to "ISO_IR 100" = Latin Alphabet No. 1
Instance Creation Date	(0008,0012)	3	Date image transferred from system
Instance Creation Time	(0008,0013)	3	Time image transferred from system
Instance Creator UID	(0008,0014)	3	Created using OEC prefix 1.2.840.113780. Concatenate the following, system type, serial number, and workstation barcode.

Instance Number	(0020,0013)	3	Set to image number on the workstation.

5.   X-RAY ANGIOGRAPHY AND RADIOFLUOROSCOPY INFORMATION OBJECT IMPLEMENTATION

5.1   IOD MODULE TABLE

The X-Ray Angiography and X-Ray Radiofluoroscopy Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes. Common modules are described in Section 4.2. XA and XRF modality-specific modules are described in this section.

TABLE 5.1-1
XA IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.2.1
Study	General Study	Used	4.2.2
	Patient Study	Used	4.2.3
Series	General Series	Used	4.2.4
Equipment	General Equipment	Used	4.2.5
Image	General Image	Used	4.2.6
	Image Pixel	Used	4.2.7
	Contrast/Bolus	Used	4.2.8
	Cine	Used when Cine run was created	4.2.12
	Multi-frame	Used when Cine run was created	4.2.9
	Mask	Used when Cine run was created	4.2.10
	X-Ray Image	Used	5.2.1
	X-Ray Acquisition	Used	5.2.2
	XA Positioner	Used	5.2.3
	Overlay Plane	Used when overlay requested by user in DICOM Store configuration and overlay available.	4.2.11
	VOI LUT	Used	4.2.14
	SOP Common	Used	4.2.15

TABLE 5.1-1
XRF IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.2.1
Study	General Study	Used	4.2.2
	Patient Study	Used	4.2.3
Series	General Series	Used	4.2.4
Equipment	General Equipment	Used	4.2.5
Image	General Image	Used	4.2.6
	Image Pixel	Used	4.2.7
	Contrast/Bolus	Used	4.2.8
	Cine	Used when Cine run was created	4.2.12
	Multi-frame	Used when Cine run was created	4.2.9
	Mask	Used when Cine run was created	4.2.10
	X-Ray Image	Used	5.2.1
	X-Ray Acquisition	Used	5.2.2
	XRF Positioner	Used	5.2.4
	Overlay Plane	Used when overlay requested by user in DICOM Store configuration and overlay available.	4.2.11
	VOI LUT	Used	4.2.14
	SOP Common	Used	4.2.15

5.2   INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the XA and XRF Information Objects.

5.2.1   X-Ray Image Module

TABLE 5.2-2
X-RAY IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	Set to Frame Time (0018,1063)
Image Type	(0008,0008)	1	ORIGINAL\PRIMARY\SINGLE PLANE
Pixel Intensity Relationship	(0028,1040)	1	DISP
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Bits Allocated	(0028,0100)	1	16
Bits Stored	(0028,0101)	1	16
High Bit	(0028,0102)	1	15
Pixel Representation	(0028, 0103)	1	0

5.2.2   X-Ray Acquisition Module

TABLE 5.2-3
X-RAY ACQUISITION MODULE

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	kVp of the shot.
Radiation Setting	(0018,1155)	1	Set to "GR" unless shot was taken in Low Dose mode then it will be "SC".
X-Ray Tube Current	(0018,1151)	2C	mA of the shot.
Exposure Time	(0018,1150)	2C	mSec of the shot.
Exposure	(0018,1152)	2C	mAs of the shot. Calculated from values supplied by the generator. Rounded up to 1 mAs for values below 1.
Exposure in µAs	(0018,1153)	3	µAs of the shot. Calculated from values supplied by the generator. Rounded up to 1 µAs for values below 1.
Intensifier Size	(0018,1162)	3	Size in mm of intensifier reported by the generator. If the generator is not connected then it will report as a 9 inch II.
Image Area Dose Product	(0018,115E)	3	Total Dose for all shots taken of patient during this exam. Low Dose, Standard and HLF are all added together.

5.2.3   XA Positioner Module

TABLE 5.2-4
XA POSITIONER MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Distance Source to Detector	(0018,1110)	3	1000 mm
Positioner Motion	(0018,1500)	2C	STATIC
Positioner Primary Angle	(0018,1510)	2	Blank unless system is an MD where RAO/LAO degrees are reported.
Positioner Secondary Angle	(0018,1511)	2	Blank unless system is an MD where CAU/CRA degrees are reported.

5.2.4   XRF Positioner Module

TABLE 5.2-5
XRF POSITIONER MODULE

Attribute Name	Tag	Type	Attribute Description
Distance Source to Detector	(0018,1110)	3	1000 mm

5.3   STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

Not applicable.

5.4   STANDARD EXTENDED AND PRIVATE CONTEXT GROUPS

Not applicable.

6.   SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

6.1   IOD MODULE TABLE

The Secondary Capture Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Common modules are described in Section 4.2. SC-specific modules are described in Section 6.2. Standard Extended and Private attributes are described in Section 6.3.

TABLE 6.1-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.2.1
Study	General Study	Used	4.2.2
	Patient Study	Used	4.2.3
Series	General Series	Used	4.2.4
Equipment	General Equipment	Used	4.2.5
	SC Equipment	Used	6.2.1
Image	General Image	Used	4.2.6
	Image Pixel	Used	4.2.7
	SC Image	Used	6.2.2
	VOI LUT	Used	4.2.14
	SOP Common	Used	4.2.15

6.2   INFORMATION MODULE DEFINITIONS

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

6.2.1   SC Equipment Module

TABLE 6.2-2
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Conversion Type	(0008,0064)	1	Set to DV = Digitized Video.
Modality	(0008,0060)	3	Set to OT, which on our DICOM setup screen is listed as SC. OT is the DICOM value used for Secondary Capture.
Secondary Capture Device ID	(0018,1010)	3	Serial number and Barcode of the workstation.
Secondary Capture Device Manufacturer	(0018,1016)	3	GE_HEALTHCARE
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	System Type and Model.
Secondary Capture Device Software Version	(0018,1019)	3	Workstation Software version

6.2.2   SC Image Module

TABLE 6.2-3
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Date of Secondary Capture	(0018,1012)	3	Workstation Date the image was sent to the media, since the image is created at that time.
Time of Secondary Capture	(0018,1014)	3	Workstation Time the image was sent to the media, since the image is created at that time.

6.3   STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

Not applicable.

6.4   STANDARD EXTENDED AND PRIVATE CONTEXT GROUPS

Not applicable.

7.   RAW DATA INFORMATION OBJECT IMPLEMENTATION

7.1   IOD MODULE TABLE

The Raw Data Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Common modules are described in Section 4.2. Raw-specific, standard extended and private attribute modules are described in this section.

TABLE 7.1-1
RAW DATA IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.2.1
Study	General Study	Used	4.2.2
	Patient Study	Used	4.2.3
Series	General Series	Used	4.2.4
Equipment	General Equipment	Used	4.2.5
Raw Data	Acquisition Context	Used	7.2.1
	Raw Data	Used	7.2.2
	SOP Common	Used	4.2.15

7.2   INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Raw Data 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. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

7.2.1   Acquisition Context Module

TABLE 7.2-2
ACQUISITION CONTEXT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Acquisition Context Sequence	(0040,0555)	2	Zero length sequence.

DIR 00-888080-01 REV A

7.2.2 Raw Data Module

TABLE 7.2-3
RAW DATA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Instance Number	(0020,0013)	2	Image number from the workstation.
Content Date	(0008,0023)	1	Date Image was saved.
Content Time	(0008,0033)	1	Date Image was saved.
Creator-Version UID	(0008,9123)	1	1.2.840.113780.SystemModel.SoftwareVersion SystemModel = 9900

7.3 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended Raw Data SOP Instances as Type 3 data elements.

7.3.1 Standard Attributes

The Product supports the following attributes, not specified in the Raw Data IOD, in SOP Instances as Type 3 data elements.

TABLE 7.3-1
STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Patient	Not applicable		
Study	Not applicable		
	Not applicable		
Series	Not applicable		
	Not applicable		
Image			
	Pixel Data	(7FE0,0010)	Raw Pixel data of the image.

7.3.2 Private Groups

See table in section 3.5.1.2.

7.4 STANDARD EXTENDED AND PRIVATE CONTEXT GROUPS

Not applicable.

8. BASIC DIRECTORY INFORMATION OBJECT IMPLEMENTATION

8.1 IOD MODULE TABLE

Table 8.1-1 identifies the defined modules within the entities which comprise the Basic Directory IOD. Modules are identified by Module Name.

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

TABLE 8.1-1
BASIC DIRECTORY IOD MODULES

Entity Name	Module Name	Reference
File Set Identification	File Set Identification	8.2.1.1
Directory Information	Directory Information	8.2.2.1

The FSC of this implementation creates a Directory Information Module for new media and creates Raw Data IOD, XA, RF and SC entries. There are two FSR implementations, one for reading the Raw Data IOD that can be written by the 1Kx1K workstation, the other reads any Basic directory IOD and can import any of the supported IODs.

8.2 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Basic Directory 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. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

8.2.1 Common File Set identification Modules

8.2.1.1 File Set identification Module

TABLE 8.2-1
FILE-SET IDENTIFICATION MODULE

Attribute Name	Tag	Type	Attribute Description
File-set ID	(0004,1130)	2	The value is set to YYYYMMDDHHMM, YYYY – year MM – month DD – Day HH – 00-23 MM - minute

8.2.2 Common Directory Information Modules

8.2.2.1 Directory Information Module

TABLE 8.2-2
DIRECTORY INFORMATION MODULE

Attribute Name	Tag	Type	Attribute Description
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	
File-set Consistency Flag	(0004,1212)	1	FSC writes 0000H: no known inconsistencies FSR does not interrogate this flag.
Directory Record Sequence	(0004,1220)	2	FSC creates items in this sequence (Directory Records).
>Offset of the Next Directory Record	(0004,1400)	1C	Is set by FSC
>Record In-use Flag	(0004,1410)	1C	FSC sets flag when record in use and reset to not in use when done. FSR does not interrogate this flag.
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	Is set by FSC
>Directory Record Type	(0004,1430)	1C	Specifies which Enumerated Values are created by an FSC or FSU and which are supported by an FSR: PATIENT STUDY SERIES IMAGE RAW DATA
>Referenced File ID	(0004,1500)	1C	Present when record type is IMAGE or RAW DATA. Contains relative path to the file with the image.

>Referenced SOP Class UID in File	(0004,1510)	1C	
>Referenced SOP Instance UID in File	(0004,1511)	1C	
>Referenced Transfer Syntax UID in File	(0004,1512)	1C	
>Record Selection Keys			See 8.2.3.

8.2.3 Definition of Specific Directory Records

8.2.3.1 Patient Directory Record Definition

TABLE 8.2-3
PATIENT KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Patient's Name	(0010,0010)	2	As specified in section 4.2.1 and qualified by section 8.4 for de-identification of data.
Patient ID	(0010,0020)	1	As specified in section 4.2.1 and qualified by section 8.4 for de-identification of data.
Patient Birth Date	(0010,0030)	3	As specified in section 4.2.1 and qualified by section 8.4 for de-identification of data.
Patient Sex	(0010,0040)	3	As specified in section 4.2.1 and qualified by section 8.4 for de-identification of data.

8.2.3.2 Study Directory Record Definition

TABLE 8.2-4
STUDY KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Study Date	(0008,0020)	1	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.
Study Time	(0008,0030)	1	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.
Study Description	(0008,1030)	2	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.
Study Instance UID	(0020,000D)	1C	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.
Study ID	(0020,0010)	1	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.
Accession Number	(0008,0050)	2	As specified in section 4.2.2 and qualified by section 8.4 for de-identification of data.

8.2.3.3 Series Directory Record Definition

TABLE 8.2-5
SERIES KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Modality	(0008,0060)	1	As specified in section 4.2.4 and qualified by section 8.4 for de-identification of data.
Series Instance UID	(0020,000E)	1	As specified in section 4.2.4 and qualified by section 8.4 for de-identification of data.
Series Number	(0020,0011)	1	As specified in section 4.2.4 and qualified by section 8.4 for de-identification of data.
Performing Physician's Name	(0008,1050)	3	As specified in section 4.2.4 and qualified by section 8.4 for de-identification of data.

8.2.3.4 Image Directory Record Definition

TABLE 8.2-6
IMAGE KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Image Number	(0020,0013)	1	As specified in section 4.2.6 and qualified by section 8.4 for de-identification of data.
Icon Image Sequence	(0088,0200)	3	FSC and FSR use as described in section 8.2.3.8.
Image Type	(0008,0008)	3	As specified in section 4.2.6 and qualified by section 8.4 for de-identification of data.
Rows	(0028,0010)	3	As specified in section 4.2.7 and qualified by section 8.4 for de-identification of data.
Columns	(0028,0011)	3	As specified in section 4.2.7 and qualified by section 8.4 for de-identification of data.
Number of Frames	(0028,0008)	3	As specified in section 4.2.9 and qualified by section 8.4 for de-identification of data.

8.2.3.5 Raw Data Directory Record Definition

TABLE 8.2-7
RAW DATA KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Image Number	(0020,0013)	1	As specified in section 4.2.6 and qualified by section 8.4 for de-identification of data.
Icon Image Sequence	(0088,0200)	3	FSC and FSR use as described in section 8.2.3.8.
Image Type	(0008,0008)	3	As specified in section 4.2.6 and qualified by section 8.4 for de-identification of data.
Rows	(0028,0010)	3	As specified in section 4.2.7 and qualified by section 8.4 for de-identification of data.

Columns	(0028,0011)	3	As specified in section 4.2.7 and qualified by section 8.4 for de-identification of data.
Number of Frames	(0028,0008)	3	As specified in section 4.2.9 and qualified by section 8.4 for de-identification of data.

8.2.3.6 **Private Directory Record Definition**

Not used.

8.2.3.7 **Multi-Referenced File Directory Record Definition**

Not used.

8.2.3.8 **Icon Image Sequence Definition**

Describe:

- The FSC creates the icon image sequence for later use by an FSR and is used by the FSR to display image icons to the user before transfer from the media.

- Photometric Interpretations (0028,0004) is set to MONOCHROME 2,

- Row/Column (0028,0010) and (0028,0011) is set to 196x196 for larger surgical needs.

- Bits Allocated (0028,0100) and Bits Stored (0028,0101) are created and set to 8

- High Bit (0028,0102) is created and set to 7.

- Pixel Representation (0028,0103) is created and set to 0.

- Pixel Data (7EF0,0010) is set with the 196x196 icon image data.

8.3   PRIVATE DATA DICTIONARY

Not used.

8.4   DE-IDENTIFICATION VALUES

When the system is so configured to de-identify the images being written.

The following rules will be followed:

- The values for all type 2 and 3 tags will be set to an empty value for all strings based data types. Binary number based data types will be set to zero.

- For type 1 tags the values will be set to de-identified values. For instance, the patient name tag will be set to "UNNAMED". For ID fields the value will be "UNKNOWNID", for UID's a shortened value will be stored. For Dates, the current date will be entered. For CS data types a value from the set list is chosen.

The ordered (by group,element) list of tags that are affected follows: (note some tags may not be present in the IOD since this is a common list)

Source Application Entity Title (0002,0016)

Instance Creator UID (0008,0014)

SOP Instance UID (0008,0018)

Accession Number (0008,0050)

Institution Name (0008,0080)

Institution Address (0008,0081)

Referring Physician's Name (0008,0090)

Station Name (0008,1010)

Study Description (0008,1030)

Series Description (0008,103E)

Institutional Department Name (0008,1040)

Physician(s) of Record (0008,1048)

Performing Physicians' Name (0008,1050)

Name of Physician(s) Reading Study (0008,1060)

Operators' Name (0008,1070)

Admitting Diagnoses Description (0008,1080)

Referenced SOP Instance UID (0008,1155)

Derivation Description (0008,2111)

Patient's Name (0010,0010)

Patient ID (0010,0020)

Patient's Birth Date (0010,0030)

Patient's Birth Time (0010,0032)

Patient's Sex (0010,0040)

Other Patient Ids (0010,1000)

Other Patient Names (0010,1001)

Patient's Age (0010,1010)

Patient's Size (0010,1020)

Patient's Weight (0010,1030)

Ethnic Group (0010,2160)

Occupation (0010,2180)

Additional Patient's History (0010,21B0)

Patient Comments (0010,4000)

Device Serial Number (0018,1000)

SC Device ID (0018,1010)

Protocol Name (0018,1030)

Study Instance UID (0020,000D)

Series Instance UID (0020,000E)

Study ID (0020,0010)

Frame of Reference UID (0020,0052)

Synchronization Frame of Reference UID (0020,0200)

Image Comments (0020,4000)

UID (0040,A124)

Request Attributes Sequence (0040,0275)

DIR 00-888080-01 REV A

Storage Media File-set UID (0088,0140)

Referenced Frame of Reference UID (3006,0024)

Related Frame of Reference UID (3006,00C2)

9. MODALITY WORKLIST QUERY IMPLEMENTATION

9.1 1KX1K ELITE WORKSTATION MAPPING OF DICOM ENTITIES

The 1Kx1K Elite Workstation maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 9.1-1
MAPPING OF DICOM ENTITIES TO 1KX1K ELITE WORKSTATION ENTITIES

DICOM	1Kx1K Elite Workstation Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Not Applicable
Patient	Exam

9.2 WORKLIST QUERY MODULE TABLE

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

TABLE 9.2-1
MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	9.3.1
	Scheduled Procedure Step	9.3.2
Requested Procedure	Requested Procedure	9.3.3
Imaging Service Request	Imaging Service Request	9.3.4
Visit	Visit Identification	9.3.5
	Visit Status	9.3.6
	Visit Relationship	9.3.7
	Visit Admission	9.3.8
Patient	Patient Relationship	9.3.9
	Patient Identification	9.3.10
	Patient Demographic	9.3.11
	Patient Medical	9.3.12

9.3 WORKLIST QUERY MODULE DEFINITIONS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the query key attributes contained within the Modality Worklist Information Model.

9.3.1 SOP Common Module

TABLE 9.3-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Use
Specific Character Set	(0008,0005)	O	1C	Yes	See section 9.3.1.1.1 below.

9.3.1.1 SOP Common Module Attribute Descriptions

9.3.1.1.1 Specific Character Set

The attribute Specific Character Set (0008,0005) will always be sent using the value "ISO-IR 100".

9.3.2 Scheduled Procedure Step Module

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-2
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Use
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	
>Scheduled Station AE Title	(0040,0001)	R	1	No	

>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching is done here using the data from the DICOM query form. The following matching can be done: YYYY- year, MM- month, DD- day. Single match where the date entered is YYYYMMDD – Match only this date Range matching can also be done YYYYMMDD-YYYYMMDD - all matches included between those dates. The "dash" is important -YYYYMMDD - all matches prior to and including this date. The beginning "dash" is important. YYYYMMDD- all matches after and including this date. The ending "dash" is important. The data entered on the user interface is passed to the Server as entered; if it does not work see the Server DICOM conformance statement.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	Matching is done here using the data from the DICOM query form. The following matching can be done: HH – Hour 0-23, MM – minute 0-59, SS – second 0-59. Single match where the date entered is HHMMSS – Match only this time Range matching can also be done HHMMSS-HHMMSS All matches included between those times. The "dash" is important. -HHMMSS All matches prior to and including this time. The beginning "dash" is important. HHMMSS- All matches after and including this time. The ending "dash" is important. The data entered on the user interface is passed to the Server as entered; if it does not work see the Server DICOM conformance statement.
>Scheduled Procedure Step End Date	(0040,0004)	O	3	No	In the request, but not used or set for match.
>Scheduled Procedure Step End Time	(0040,0005)	O	3	No	In the request, but not used or set for match.
>Modality	(0008,0060)	R	1	No	Matching is supported and is configured by the user interface. Currently the choices are XA, RF, SC or "ALL". "ALL" allows for any modality.

>Scheduled Performing Physician's Name	(0040,0006)	R	2	Yes	Matching is performed here. The data entered on the user interface is passed to the server as is. Any wildcard searches must include the "*" all remaining characters or '?' for single wild character.
>Scheduled Procedure Step Description	(0040,0007)	O	1C	No	In the request, but not used or set for match.
>Scheduled Station Name	(0040,0010)	O	2	No	In the request, but not used or set for match.
>Scheduled Procedure Step Location	(0040,0011)	O	2	No	In the request, but not used or set for match.
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	No	Not in the request, not used.
>> *'Code Sequence Macro'*					Not in the request, not used.
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	In the request, but not used or set for match.
>Pre-Medication	(0040,0012)	O	2C	No	In the request, but not used or set for match.
>Scheduled Procedure Step Status	(0040,0020)	O	1	No	In the request, but not used or set for match.
>Comments on the Scheduled Procedure Step	(0040,0400)	O	3	No	Not in the request, not used.
>Requested Contrast Agent	(0032,1070)	O	2C	No	In the request, but not used or set for match.

9.3.2.1 Scheduled Procedure Step Module Attribute Descriptions

9.3.2.1.1 Scheduled Station AE Title

This field is not currently populated.

9.3.3 Requested Procedure Module

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-3
REQUESTED PROCEDURE MODULE ATTRIBUTES

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

Requested Procedure ID	(0040,1001)	O	1	Yes	The value is placed into the Study ID tag (0020,0010) on the objects that are stored to the PACS.
Requested Procedure Description	(0032,1060)	O	1C	Yes	Not populated for matching. Return value is mapped into the "Procedure" field of the Exam. This field is restricted to 24 characters on the display and is truncated for display, but the data is maintained internally.
Requested Procedure Code Sequence	(0032,1064)	O	1C	No	Not in the request, not used.
> *'Code Sequence Macro'*					Not in the request, not used.
Study Instance UID	(0020,000D)	O	1	Yes	See Study Instance UID section below.
Requested Procedure Comments	(0040,1400)	O	3	No	Not in the request, not used.

9.3.3.1 Requested Procedure Module Attribute Descriptions

9.3.3.1.1 Study Instance UID

The product will assign the Study Instance UID returned in the MWL response to the images related to the Exam.

9.3.4 Imaging Service Request Module

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-4
IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Use
Accession Number	(0008,0050)	O	2	Yes	The value is populated for matching from the Worklist query form. The value returned in the response will be transferred to any images in that exam.
Requesting Physician	(0032,1032)	O	2	No	Not in the request, not used.
Referring Physician's Name	(0008,0090)	O	2	Yes	The value is populated for matching from the Worklist query form. The value returned in the response will be transferred to any images in that exam.

9.3.5 Visit Identification

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-5
VISIT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Admission ID	(0038,0010)	O	2	No	Not in the request, not used.
Institution Name	(0008.0080)	O	3	No	Not in the request, not used.

9.3.6 Visit Status

Not used.

9.3.7 Visit Relationship

Not used.

9.3.8 Visit Admission

Not used.

9.3.9 Patient Relationship

Not used.

9.3.10 Patient Identification

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-6
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	Matching is performed.
					The response data is mapped to the Patient First, Last and Middle initial. The display truncates at 24 characters for First and Last name and only displays the middle initial. The image store will have the complete name as returned in the response.
Patient ID	(0010,0020)	R	1	Yes	Matching is performed.
					The response data is mapped to Patient ID in the exam. The display truncates the value but the entire value is maintained to image storage.
Other Patient IDs	(0010,1000)	O	3	No	Not Used.

9.3.11 Patient Demographic

For all un-requested data elements in the following table, the Use column indicates "Not used". If the attribute is a matched key, the source of the matching value, and the type of matching requested (single value, wild card, universal, range, sequence, etc.) If attribute is a returned key, the Use column indicates the use of the data in the created images or local database.

TABLE 9.3-7
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	No Matching is performed.
Patient's Sex	(0010,0040)	O	2	Yes	No Matching is performed.
Patient's Weight	(0010,1030)	O	2	No	Not used.
Patient Comments	(0010,4000)	O	3	Yes	No Matching is performed.

9.3.12 Patient Medical

Not used.

9.4 STUDY ROOT USED FOR "WORKLIST" MODULE DEFINITIONS

The user can configure the Worklist SCU to not use Modality Worklist query and use Study Root query instead. The user configures this using the checkbox labeled "Worklist" on the configuration screen, when the checkbox is empty (not checked) a Study Root query is done and the rules for mapping values into the image change. The rules will be described in this section.

TABLE 9.4-1
STUDY ROOT STUDY LEVEL ATTRIBUTES

Attribute Name	Tag	Mapped into the Image	Use
Character Set	(0008,0005)	No	Determine if response is recognizable by the system.
Study Date	(0008,0020)	No	Matching is done here using the data from the DICOM query form. The following matching can be done: YYYY- year, MM- month, DD- day. Single match where the date entered is YYYYMMDD – Match only this date Range matching can also be done YYYYMMDD-YYYYMMDD - all matches included between those dates. The "dash" is important -YYYYMMDD - all matches prior to and including this date. The beginning "dash" is important. YYYYMMDD- all matches after and including this date. The ending "dash" is important. The data entered on the user interface is passed to the Server as entered; if it does not work see the Server DICOM conformance statement.
Study Time	(0008,0030)	No	Matching is done here using the data from the DICOM query form. The following matching can be done: HH – Hour 0-23, MM – minute 0-59, SS – second 0-59. Single match where the date entered is HHMMSS – Match only this time Range matching can also be done HHMMSS-HHMMSS All matches included between those times. The "dash" is important. -HHMMSS All matches prior to and including this time. The beginning "dash" is important. HHMMSS- All matches after and including this time. The ending "dash" is important. The data entered on the user interface is passed to the Server as entered; if it does not work see the Server DICOM conformance statement.
Accession Number	(0008,0050)	No	Matching is done here to get a patient record.

Query Level	(0008,0052)	No	Set to "STUDY ".
Referring Physician	(0008,0090)	No	Matching is not done. The Physician field on the user interface is populated with this value, if the performing physician response is blank.
Performing Physician	(0008,1050)	Yes	Matching is supported using the physician field. The response will be placed into the physician field of the exam.
Study Description	(0008,1030)	No	Not used but in the request.
Patient Name	(0010,0010)	Yes	Matching is performed here. The data entered on the user interface is passed to the server as is. Any wildcard searches must include the "*" all remaining characters or '?' for single wild character.
Patient ID	(0010,0020)	Yes	Matching is performed. The response data is mapped to Patient ID in the exam. The display truncates the value but the entire value is maintained to image storage.
Patient Birthdate	(0010,0030)	Yes	No matching. The response data is mapped to Birth date in the exam.
Patient Sex	(0010,0040)	Yes	No matching. The response data is mapped to Sex in the exam.
Study Instance UID	(0020,000D)	No	In the request and used for Series Level request when performed to match the Modality.
Number of Patient related studies	(0020,1200)	No	Internal use.
Number of Patient related series	(0020,1202)	No	Internal use.
Number of Patient related studies	(0020,1204)	No	Internal use.

STUDY ROOT SERIES LEVEL ATTRIBUTES

Attribute Name	Tag	Mapped into the Image	Use
Query Level	(0008,0052)	No	Set to "SERIES".
Modality	(0008,0060)	No	Matching is done based on the selection made on the query options. If XA, RF or SC are selected then a series level request will be made to match on the modality.
Study Instance UID	(0020,000D)	No	
Series Instance UID	(0020,000E)	No	
Series Number	(0020,0011)	No	

10. PATIENT, STUDY AND PATIENT/STUDY ROOT QUERY IMPLEMENTATION

10.1 INTRODUCTION

This section specifies the use of the DICOM Patient Root, Study Root and Patient/Study Only Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

10.2 - Information Model Entity-Relationship Model

010.4 - Information Model Keys

10.2 INFORMATION MODEL ENTITY RELATIONSHIP DIAGRAM

The Entity-Relationship diagram for the Query Information Model schema is shown in ILLUSTRATION 10-1**.** 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.

- Lines connecting the corresponding entity boxes to the relationship boxes depict the fact that a relationship exists between two entities.

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 n Images per Series.

ILLUSTRATION 10-1
PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM
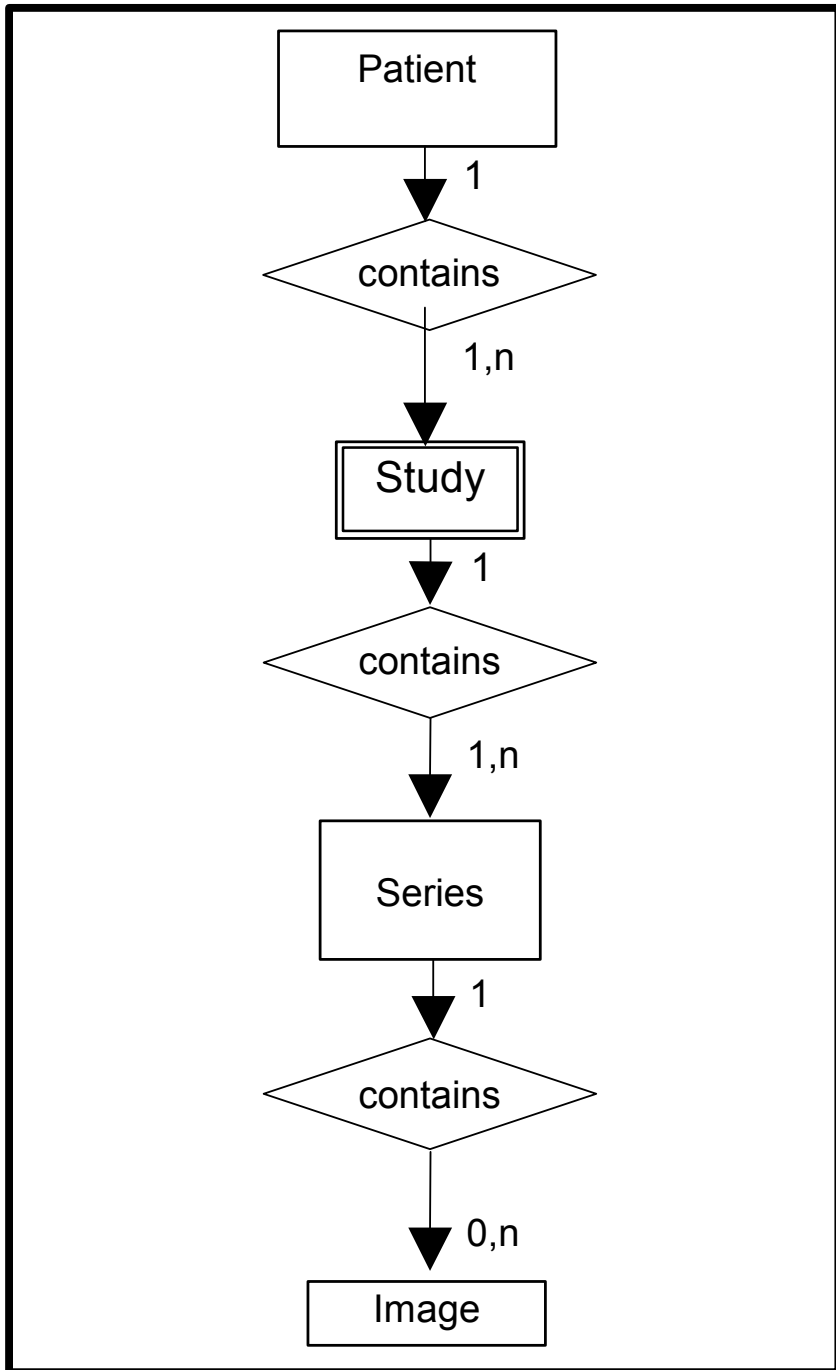
10.3   1KX1K ELITE WORKSTATION MAPPING OF DICOM ENTITIES

The 1Kx1K Elite Workstation maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 10.3-1
MAPPING OF DICOM ENTITIES TO 1KX1K ELITE WORKSTATION ENTITIES

DICOM	1Kx1K Elite Workstation Entity
Patient	Exam
Study	Exam
Series	Exam
Image	Image

10.4   INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Query/Retrieve Information Model.

10.4.1   Common Query Keys

The query key attributes specified in this section are used at all levels and in all classes of query.

TABLE 10.4-2
Q/R PATIENT LEVEL COMMON RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	SCU Use
Specific Character Set	(0008,0005)	---	See 10.4.1.1.1
Query Retrieve Level	(0008,0052)	---	Set to level of query: PATIENT STUDY SERIES
Retrieve AE Title	(0008,0054)	---	Attribute is requested in the Study and Series level requests. Returned value is not currently used for Retrieve AE Title of retrieval of query response item.
Storage Media File-set ID	(0088,0130)	---	Attribute is requested at the Study level. Returned value is ignored
Storage Media File-set UID	(0088,0140)	---	Attribute is requested at the Study level. Returned value is ignored

10.4.1.1   Q/R Common Attribute Descriptions

10.4.1.1.1   Specific Character Set

In Query requests the character set tag (0008,0005) is set to "ISO_IR 100" for all requests.

In processing of query responses the character set tag (0008,0005) is checked, absence of the tag is defined as ISO_IR 6 (7 bit ASCII). If the tag is present only the values ISO_IR 100 (ISO-8859-1 Latin 1) is allowed, disallowed responses are discarded.

10.4.2 Patient Level

This section defines the keys at the Patient Level of the Patient Root and Patient/Study Only Query/Retrieve Information Models that are supported by this implementation.

TABLE 10.4-1
PATIENT LEVEL ATTRIBUTES FOR THE PATIENT ROOT
QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Patient's Name	(0010,0010)	R	Matching is supported. The user enters the value from the user interface.
Patient ID	(0010,0020)	U	Matching is supported. The user enters the value from the user interface.
Patient's Birth Date	(0010,0030)	O	No matching, but in the request so that response value can be used in the display to user.
Patient's Sex	(0010,0040)	O	No matching, but in the request so that response value can be used in the display to user.
Number of Patient Related Studies	(0020,1200)	O	No matching. Internal usage.
Number of Patient Related Series	(0020,1202)	O	No matching. Internal usage.
Number of Patient Related Instances	(0020,1204)	O	No matching. Internal usage.

10.4.3 Study Level – Patient and Patient/Study Only Root

This section defines the keys at the Study Level of the Patient Root and Patient/Study Only Query/Retrieve Information Models that are supported by this implementation.

The keys at the patient level are also included with the request. The Patient ID is filled in with the Patient ID for each response received at the patient level (hierarchical search).

TABLE 10.4-2
STUDY LEVEL ATTRIBUTES FOR THE PATIENT AND PATIENT/STUDY ONLY ROOT
QUERY/RETRIEVE INFORMATION MODELS

Attribute Name	Tag	Type	SCU Use
Study Date	(0008,0020)	R	Matching is supported. The user enters the value from the user interface.
Study Time	(0008,0030)	R	No Matching.
Accession Number	(0008,0050)	R	No Matching.
Study ID	(0020,0010)	R	No Matching.
Study Instance UID	(0020,000D)	U	No Matching.
Modalities in Study	(0008,0061)	O	No Matching.
Referring Physician's Name	(0008,0090)	O	No Matching.
Study Description	(0008,1030)	O	No Matching.
Name of Physician(s) Reading Study	(0008,1060)	O	No matching. Internal usage.
Number of Study Related Series	(0020,1206)	O	No matching. Internal usage.
Number of Study related Images	(0020,1208)	O	No matching. Internal usage.

10.4.4 Study Level – Study Root

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

The keys at the patient level are also included with the request. The difference here is that the patient name contains the wildcard character and Patient ID is empty (hierarchical search).

TABLE 10.4-3
STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT
QUERY/RETRIEVE INFORMATION MODELS

Attribute Name	Tag	Type	SCU Use
Study Date	(0008,0020)	R	Matching is supported. The user enters the value from the user interface.
Study Time	(0008,0030)	R	No Matching.
Accession Number	(0008,0050)	R	No Matching.
Study ID	(0020,0010)	R	No Matching.
Study Instance UID	(0020,000D)	U	No Matching.

Modalities in Study	(0008,0061)	O	No Matching.
Referring Physician's Name	(0008,0090)	O	No Matching.
Study Description	(0008,1030)	O	No Matching.
Name of Physician(s) Reading Study	(0008,1060)	O	No matching. Internal usage.
Number of Study Related Series	(0020,1206)	O	No matching. Internal usage.
Number of Study related Images	(0020,1208)	O	No matching. Internal usage.

10.4.5 Series Level

This section defines the keys at the Series Level of the Patient Root and Study Root Query/Retrieve Information Models that are supported by this implementation.

The keys at the patient and study level are also included with the request. The Study Instance UID is filled in with the Study Instance UID for each unique response received at the previous level. (hierarchical search).

For Patient Root and Study Root information models, the Series level query will be done following the Study level query to get the list of series for a patient.

TABLE 10.4-4
SERIES LEVEL ATTRIBUTES FOR THE
QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Modality	(0008,0060)	R	No Matching.
Series Number	(0020,0011)	R	No Matching.
Series Instance UID	(0020,000E)	U	No Matching. Internal usage for retrieval.
Number of Series Related Instances	(0020,1209)	O	No matching. Internal usage.

10.4.6 Image Level

Currently no Image level query requests are made.

10.5 VIEWER CAPABILITIES

The viewer will display color and grayscale, single and mult-frame images, which adhere to, the rules defined below.

10.5.1 Pixel plane

Samples per pixel (attribute 0028, 0002) = 1 for Monochrome and Palette color. = 3 for RGB and YBR-Full images. Variable for the remaining Photometric interpretations.

Supported photometric interpretations are: "MONOCHROME1","MONOCHROME2", "PALETTECOLOR", "RGB", "YBRFULL", "YBRFULL422", "YBRPARTIAL422".

The pixels are unsigned integers or signed integers. Tag (0028,0103).

Rows, columns follow what is specified in the dataset for any positive values.

Bits allocated (attribute 0028, 0100) = 8, or 16.

Bits stored (attribute 0028,0101) = 8-16.

High bit (attribute 0028,0102) = 7-15.

Aspect ratio 1:1 is supported, other aspect ratios are also supported.

10.5.2 Overlay plane

Overlay type (attribute 60xx, 0040) = "G" or "R".

Bits allocated (attribute 60xx, 0100) = 1.

Bit position (attribute 60xx, 0102) = 0.

Overlay data (attribute 60xx, 3000) = overlay data.

The overlay origins (60xx,0050) are supported.

The overlay sizes, (60xx,0010) and (60xx,0011), are equal to the image size, (0028,0010) and (0028,0011) or smaller.

16 overlay planes are supported.

10.5.3 General Rules

For VOI LUT, both the linear LUT (Window Center/Width) and the VOI LUT SQ are supported. (VOI LUT SQ with 8 or 16 bit LUT data)

If a VOI LUT SQ is used and the user modifies the Window Center/Width, the viewer reverts to a linear VOI LUT.

If the VOI LUT SQ contains multiple LUTs, then only the first one is used. The other VOI LUTs are not selectable.

If neither the linear VOI LUT nor the VOI LUT SQ are available then the viewer will calculate a linear VOI LUT from the dataset.

Only Rectangular and Circular Shutter Shapes are supported in this version.

The viewer does not support Standalone IODs, Overlay, VOI, Presentation State, MOD LUT, etc.

When 2 images have the same DICOM Instance UID, the latest image received will overwrite the first received image if it has the same patient/study/series identifiers.

10.5.4   Multi-Frame playback

The playback disposition is determined by the "Preferred Playback Sequencing" tag (0018, 1244).

A value of 1 (one) implies that the DICOM image should be "sweeped" (back and forth) in a cine run.

A value of 0 (zero) implies that it is a looped cine run.

The player will playback at the constant (tag: (0018,1063)) or variable (tag: (0018,1065)) frame rate specified by the multi-frame image. If neither tag is specified, it will use the Cine Rate (0018,0040) or if not present, the Recommended Display Frame Rate (0008,2144).

The player will use the Start/Stop trim tags (tags: (0018,2142), (0018,2143)).

11. PRINT MANAGEMENT IMPLEMENTATION

11.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the implementation for the specific SOP Classes supported in the Basic Grayscale Print Management Meta SOP Class, the attributes supported for both IODs and services, and the valid range of values for mandatory and optional attributes.

This section contains:

11.2 - Basic Film Session SOP Class

11.3 - Basic Film Box SOP Class

11.4 - Basic Grayscale Image Box SOP Class

11.5 - Printer SOP Class

11.2 BASIC FILM SESSION SOP CLASS

11.2.1 IOD Description

Module	Reference	Module Description
SOP Common		Contains SOP Common information
Basic Film Session Presentation Module	11.2.1.1	Contains Film Session presentations information
Basic Film Session Relationship	11.2.1.2	References to related SOPs

11.2.1.1 Basic Film Session Presentation Module

This section defines the attributes that are common for all films of a film session. The attributes described in the following table apply when the N-CREATE DIMSE service is used.

Attribute Name	Tag	VR	Attribute Description
Number of Copies	(2000,0010)	IS	User configurable 1-10. The printer defines default.
Print Priority	(2000,0020)	CS	User configurable. The printer defines default. User Values = HIGH, MED, LOW.
Medium Type	(2000,0030)	CS	User configurable. The printer defines default. User Values = PAPER, CLEAR FILM, BLUE FILM.

Film Destination	(2000,0040)	CS	User configurable. The printer defines default. User Values = MAGAZINE and PROCESSOR.

All other attributes will be defined by the printer and are not configurable.

11.2.1.2   Basic Film Session Relationship Module

Attribute Name	Tag	Use
Referenced Film Box Sequence	(2000,0500)	Not Used.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
Proposed Study Sequence	(2130,00A0)	Not used (Product does not support Stored Print)

11.3   BASIC FILM BOX SOP CLASS

11.3.1   IOD Description

11.3.1.1   IOD modules

Module	Reference	Module Descripion
SOP Common		Contains SOP Common information
Basic Film Box Presentation Module	0	Contains Film Box presentation information
Basic Film Box Relationship	Not used.	References to related SOPs

11.3.1.2   Basic Film Box Presentation Module

This section defines the attributes that are common for all films of a film session-film box.

The attributes described in the section apply when the N-CREATE DIMSE service is used.

Attribute Name	Tag	VR	Attribute Description
Image Display Format	(2010,0010)	ST	User configurable. Default is STANDARD\1,1. User values include: STANDARD\1,1 STANDARD\1,2 STANDARD\2,1 STANDARD\2,2 STANDARD\2,3 STANDARD\3,2 STANDARD\3,3 STANDARD\3,4 STANDARD\4,3 STANDARD\4,4 STANDARD\4,5 STANDARD\5,4
Film Orientation	(2010,0040)	CS	Value is not user configurable and is set to "PORTRAIT".
File Size ID	(2010,0050)	CS	User configurable. The printer defines default. User values = 8INX10IN 10INX12IN 10INX14IN 11INX14IN 14INX14IN 14INX17IN 24CMx30CM 24CMx30CM
Border Density	(2010,0100)	CS	User configurable. The printer defines default. User values = BLACK and WHITE.
Empty Image Density	(2010,0110)	CS	User configurable. The printer defines default. User values = WHITE and BLACK.
Min Density	(2010,0120)	US	User configurable. The default is 0.
Max Density	(2010,0130)	US	User configurable. The default is 300.
Configuration Information	(2010,0150)	ST	User configurable. The default is blank.
Referenced Film Session Sequence	(2010,0500)	SQ	
> Referenced SOP Class UID	(0008,1150)	UI	Not user configurable. Value = 1.2.840.10008.5.1.1.1
> Referenced SOP Instance UID	(0008,1155)	UI	Value from Printer SCP Film Session

All other attributes will be defined by the printer and are not configurable.

11.4   BASIC GRAYSCALE IMAGE BOX SOP CLASS

11.4.1   IOD Description

11.4.1.1   IOD modules

Module	Reference	Module Description
SOP Common		Contains SOP Common information
Image Box Presentation Module	11.4.1.2	Contains Image Box presentation information

11.4.1.2   Image Box Pixel Presentation Module

This section defines the attributes that are common for all films of a film session-film box – image box.

The attributes described in the following table apply when the N-SET DIMSE service is used.

Attribute Name	Tag	VR	Attribute Description
Image Position	(2020,0010)	US	Based on the image display format.
Film Orientation	(2020,0110)	SQ	Sequence.
> Samples Per Pixel	(0028,0002)	US	Value = 1.
> Photometric Interpretation	(0028,0004)	CS	MONOCHROME2
> Rows	(0028,0010)	US	980
> Columns	(0028,0011)	US	980
> Bits Allocated	(0028,0100)	US	8
> Bits Stored	(0028,0101)	US	8
> High Bit	(0028,0102)	US	7
> Pixel Representation	(0028,0103)	US	0 which represents Unsigned integer.
> Pixel Data	(7FE0,0010)	OB	Image Pixels.

11.5   PRINTER SOP CLASS

For the SOP Class the system will respond to a N-EVENT-REPORT-REQ message with a N-EVENT-RESPONSE-RESP message.

11.5.1   N-EVENT-REPORT Attributes

Event Type Name	Event Type ID	Attribute	Tag	Use
Normal	1	Printer Status Info	(2110,0020)	Not used.
Warning	2	Printer Status Info	(2110,0020)	Not used.
		Film Destination	(2000,0040)	Not used.
		Printer Name	(2110,0030)	Not used.
Failure	3	Printer Status Info	(2110,0020)	Not used.
		Film Destination	(2000,0040)	Not used.
		Printer Name	(2110,0030)	Not used.