*GE Medical Systems*

# Technical Publications

**2243724-100**
**Revision 2**

# Senographe 2000 D Review WorkStation

# CONFORMANCE STATEMENT for DICOM V3.0

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# REVISION HISTORY

| Rev | Date | Reason for change |
|---|---|---|
| 0 | May, 31th 1999 | Creation |
| 1 | March, 20 2000 | FFDM M4<br>3-5-1-1 Table updated |
| 2 | February 6, 2003 | Corrected bad cross-refs Section 6.<br>SPR BUCge79705:<br>Table 4.4.2 updated with new “Modalities in study” DICOM field (0008,0061)<br>Rewrote last note in Section 2.3.1 to specify RWS guaranteed for database, networking, archiving and review of MG and SC images only.<br><br>SPR BUCge86331:<br>HII done by Hervé Hoehn. |

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# 1. INTRODUCTION

## 1.1 OVERVIEW

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

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

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

**Section 3 (Media Storage Conformance Statement),** which. specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Media Storage features

**Section 4 (Study Root Query/Retrieve Information Model),** which specifies the GEMS equipment compliance to the DICOM requirements for the Study Root Query/Retrieve Information Model feature.

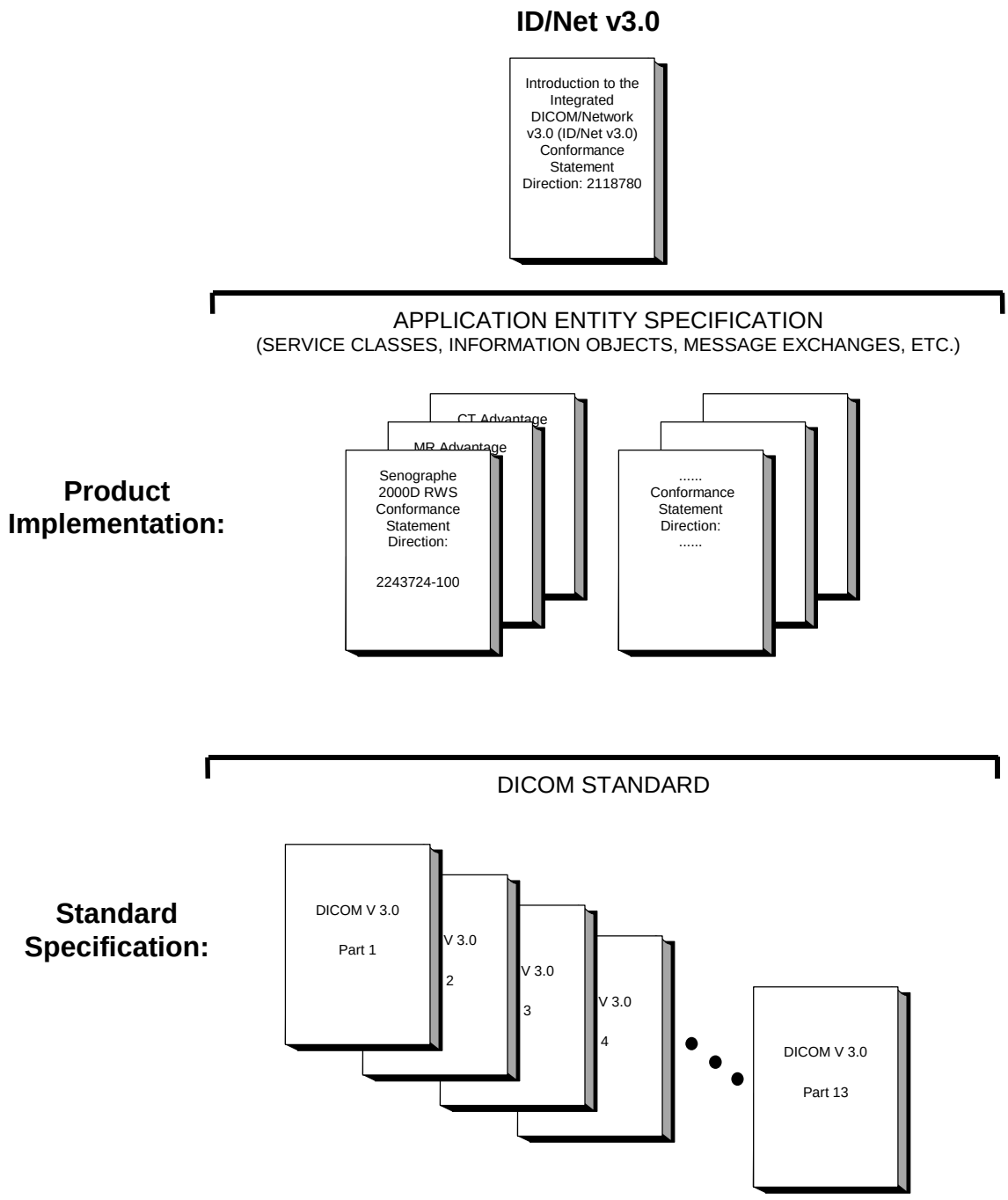
**Section 5 (Network Print SCU Conformance Statement),** which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Network Print features.

**Section 6 (Network Print Management SOP Class definition)** which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Network Print Management SOP Class.

**Section 7 (SC Information Object Implementation),** which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of SC Information Object Implementation feature.

### 1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



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

***Senographe 2000 D Review Workstation***
*Conformance Statement for DICOM v3.0*
*Direction **2243724-100***

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

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

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

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

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

For 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 v3.0 Standards and with the terminology and concepts which are used in those Standards.

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

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

### 1.4 SCOPE AND FIELD OF APPLICATION

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

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

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

### 1.5 IMPORTANT REMARKS

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

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

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

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

### 1.6 REFERENCES

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

The information object implementation refers to DICOM PS 3.3 (Information Object Definition) and DICOM supplement 32: Digital X-Ray Supplement.

### 1.7 DEFINITIONS

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

### 1.8 SYMBOLS AND ABBREVIATIONS

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

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# 2. NETWORK CONFORMANCE STATEMENT

## 2.1 INTRODUCTION

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

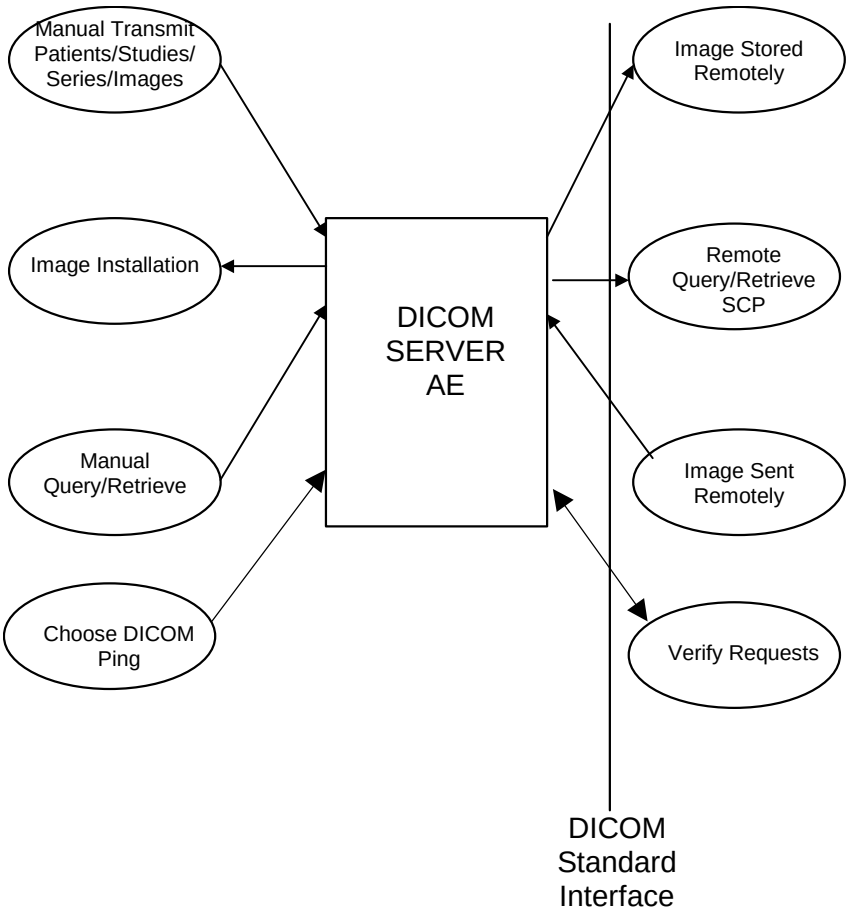
The Senographe 2000 D RWS is a Networked Medical Imaging Console dedicated to Examination Review and Diagnosis. The workstation uses DICOM services to import images for possible further analysis or processing and to export images to other vendors.

## 2.2 IMPLEMENTATION MODEL

### 2.2.1 Application Data Flow Diagram

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

DICOM SERVER AE APPLICATION MODEL



**Note:** Please also refer to sections 3 and 5 of the current document for Media Storage and Network Print Management SCU Conformance Statement.

The DICOM SERVER Application Entity (AE) is an application which handles DICOM protocol communication. DICOM SERVER AE is automatically brought up when the Senographe 2000 D RWS is powered on.

All remote DICOM AE must be manually configured on the Senographe 2000 D RWS by an operator or by a field engineer.

The DICOM SERVER AE is invoked by the following Real World Activities:

- Manual Transmit Patients/Studies/Series/Images from the Senographe 2000 D RWS to a Remote Host.

For this operation, the operator selects patients, studies, series or images on the console browser and then sends the selected patients, studies, series or images on one or several remote DICOM AE by a drag and drop on the icon that represents the wanted remote DICOM AE.

The declaration of remote DICOM AE is done through a specific menu (known as NETWORK MANAGEMENT menu).

The visualization of the transfer status is done on a specific message window.

- Images Sent Remotely from a Remote DICOM AE to the Senographe 2000 D RWS.

When images are installed in the local database, they are displayed in the Senographe 2000 D RWS local database.

- Manual Query/Retrieve

For this operation, the operator queries a remote database to obtain a list of data at Patient/Study/Series/Image by clicking on the icon that represents the wanted remote DICOM AE. Once the remote browser is displayed, the operator can retrieve the SOP Classes supported by the Senographe 2000 D RWS from the remote DICOM AE.

The query is selective based on criteria described below in the document.

- Choose DICOM ping

A DICOM Ping Tool is available in the “Service Tools” of the workstation. This tool causes the Senographe 2000 D RWS to send a C-ECHO request to the selected remote DICOM AE.

### 2.2.2 Functional Definition of AE's

The DICOM SERVER AE initiates the following operations:

- Access to patient demographics and pixel data in the local database.
- Build a DICOM format data set.
- Initiate a DICOM association to send DICOM SOP Classes to a remote DICOM AE.
- Initiate a DICOM association to ask for remote patient demographics, remote study, remote series and remote image information.
- Initiate a DICOM association to ask for transmit images from a remote DICOM AE to Senographe 2000 D RWS.

The DICOM SERVER AE waits for association requests from Remote AE:

- Answer to DICOM associations transmitting DICOM SOP Classes to be stored on the Senographe 2000 D RWS.
- Answer to DICOM associations transmitting Verification SOP Class to the Senographe 2000 D RWS.

### 2.2.3 Sequencing of Real-World Activities

Not applicable.

## 2.3 AE SPECIFICATIONS

### 2.3.1 DICOM SERVER AE Specification

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

| SOP Class Name | SOP Class UID |
|---|---|
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| 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 |
| Digital Mammography X-Ray Image Storage - For Presentation | 1.2.840.10008.5.1.4.1.1.1.2 |
| Digital Mammography X-Ray Image Storage - For Processing | 1.2.840.10008.5.1.4.1.1.1.2.1 |
| Verification SOP Class | 1.2.840.10008.1.1 |
| RT Structure Set Information Storage | 1.2.840.10008.5.1.4.1.1.481.3 |

**Note:** C-FIND is done using Study Root Information Model.

**Note:** C-MOVE is done either using Patient Root Information Model when the operator asks for retrieving different patient folders all together at a time, if configured to do so, or Study Root Information Model in other cases.

**Note:** Please also refer to sections 6 for Network Print Management SCU Conformance Statement.

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

| SOP Class Name | SOP Class UID |
|---|---|
| Verification SOP Class | 1.2.840.10008.1.1 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Digital Mammography X-Ray Image Storage - For Presentation | 1.2.840.10008.5.1.4.1.1.1.2 |
| Digital Mammography X-Ray Image Storage - For Processing | 1.2.840.10008.5.1.4.1.1.1.2.1 |
| RT Structure Set Information Storage | 1.2.840.10008.5.1.4.1.1.481.3 |

**Note:** The RWS is guaranteed for database storage, networking, archiving and review of MG and secondary capture images ONLY.

**Note:** The RT structure set is only used to interpret results sent by some Computer Aided Detection (CAD) products.

#### 2.3.1.1 Association Establishment Policies

##### 2.3.1.1.1 General

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

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

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

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

| Maximum Length PDU | 51 200 bytes |
|---|---|

**Note:** 0 as PDU length is not supported in this implementation.

**Note:** Maximum length PDU can be configured at installation time.

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 21.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID

#### 2.3.1.1.2 Number of Associations

The DICOM SERVER AE will initiate only one DICOM association at a time to perform a DICOM store operation as a SCU to a Remote Host AE.

The DICOM SERVER AE can have a maximum of 4 open DICOM associations at a time to perform a DICOM store operation as a SCP or respond to an echo.

The DICOM SERVER AE will initiate only one DICOM association at a time to perform a Query/Retrieve with a Remote Host AE.

#### 2.3.1.1.3 Asynchronous Nature

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

#### 2.3.1.1.4 Implementation Identifying Information

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

| | |
|---|---|
| **Senographe 2000 D RWS Implementation UID** | **1.2.840.113619.6.76** |

#### 2.3.1.1.5 Real-World Activity : Choose DICOM Ping

A DICOM Ping Tool is available in the “Service Tools” of the workstation. This tool causes the Senographe 2000 D RWS to send a C-ECHO request to the selected remote DICOM AE. Only a GE Field Engineer can have access to this tool.

If a C-ECHO response is received with a success, the DICOM Server will post a pop-up to the operator indicating that the remote device is alive.

##### 2.3.1.1.5.1 Proposed Presentation Context Table

| **Presentation Context Table - Proposed** | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Verification | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

##### 2.3.1.1.5.2 SOP Specific Conformance Statement to Verification SOP Class

The DICOM Server AE provides standard conformance to the DICOM Verification SOP Class.

Each ECHO operation supports an “Association Timer” with a time out value of 60 seconds.

#### 2.3.1.1.6 Real-World Activity: Manual Transmit Patients/Studies/Series/images

##### 2.3.1.1.6.1 Associated Real-World Activity

The operator selects in the BROWSER one or several Patient Folders (or Studies/Series/Images) to be sent. Then, the user can either drag and drop the selection on the icon representing then Remote DICOM AE, or click on the "Push" icon and select a Remote DICOM AE in the LIST OF REMOTE HOST.

This operation will cause:

- The Senographe 2000 D RWS to build a DICOM image from its data.
- The DICOM SERVER AE to initiate a DICOM association, negotiate with the Remote AE an appropriate Abstract and Transfer Syntax.
- To emit C-STORE command to send the image, if the negotiation is successful.

##### 2.3.1.1.6.2 Association Initiation Policy

The DICOM SERVER AE initiates a new association for pushing Patient Folders (or Studies/Series/Images) selected by the operator to a remote DICOM AE. This association corresponds to one Real World Activity:

- Manual Transmit Patients/Studies/Series/images

**Note:** The length to End field (0000, 0001) is sent in this implementation.

##### 2.3.1.1.6.3 Proposed Presentation Context Table

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| RT Structure Set Information Storage | 1.2.840.10008.5.1.4.1.1.481.3 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| Digital Mammography X-Ray Image Storage - For Presentation | 1.2.840.10008.5.1.4.1.1.1.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| Digital Mammography X-Ray Image Storage - For Processing | 1.2.840.10008.5.1.4.1.1.1.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| 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 |

#### 2.3.1.1.6.3.1 SOP Specific DICOM Conformance Statement for Image Storage SOP Classes

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

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Refused | A7xx | Out of resources | Association is closed with Remote AE.<br>Error is logged; Retry is done until 3 times<br>Appropriate message is displayed to the user. |
| | 0122 | SOP Class not Supported | General Warning message is logged.<br>Association is closed with Remote AE.<br>Appropriate message is displayed to the user. |
| Error | Cxxx | Cannot Understand | General Warning message is logged.<br>Association is closed with Remote AE.<br>Error message is displayed to the user. |
| | A9xx | Data Set does not match SOP Class | General Warning message is logged.<br>Association is closed with Remote AE.<br>Error message is displayed to the user. |
| Warning | B000 | Coercion of Data Elements | General error is displayed to the user<br>Association is closed. |
| | B007 | Data Set does not match SOP Class | General error is displayed to the user<br>Association is closed. |
| | B006 | Elements Discarded | General error is displayed to the user<br>Association is closed. |
| Success | 0000 | | |

Each C-STORE operation supports an “Association Timer”. This timer starts when the association request is sent and stops when the association is established. This time-out is configurable at installation time and defaults to 60 seconds.

Each C-STORE operation supports an “Operation Inactivity Timer”. This timer starts when a C-STORE request is emitted and is reset each time a C-STORE response has

been received, or when subsequent C-STORE are received. This time-out is configurable at installation time and defaults to 180 seconds.

Each C-STORE operation supports an “Session Timer”. This timer starts when the association is established and stops when the association is ended. This time-out is configurable at installation time and defaults to 3600 seconds.

If any of the three timers mentioned above expires, the connection is aborted and the operation is considered to be failed.

#### 2.3.1.1.7 Real-World Activity: Manual Query/Retrieve

##### 2.3.1.1.7.1 Associated Real-World Activity

The operator queries a Remote database by clicking on the icon representing the DICOM Remote AE. A new BROWSER (known as the REMOTE BROWSER) appears on the screen(s) upon successful query.

Then, the operator can select one or several Patient Folders/Studies/Series/Images and can either drag on drop the selection on the icon representing the Senographe 2000 D RWS or click on the “Pull” icon to retrieve the selection on the Senographe 2000 D RWS database.

- These operation will cause:
- the DICOM SERVER AE to initiate a DICOM association.
- the DICOM SERVER AE to emit a C-FIND request to get a list of patients regarding the criteria listed below, then to get the selected studies, series or images.
- the DICOM SERVER AE to emit a C-MOVE request to specify a selected list of Patient Folders/Studies/Series/Images to be sent by the Remote Host to the Senographe 2000 D RWS.

##### 2.3.1.1.7.2 Association Initiation Policy

The DICOM SERVER AE initiates a new association for querying Patient Folders (or Studies/Series/Images) on a remote DICOM AE. This association corresponds to one Real World Activity: Manual Query/Retrieve.

#### 2.3.1.1.7.3 Proposed Presentation Context Table

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **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 | 1.2.840.10008.1.2 | SCU | None |
| Study Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

#### 2.3.1.1.7.3.1 SOP Specific DICOM Conformance Statement for the Model, Study Root Query/Retrieve Information Model -FIND SOP Class

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

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Refused | A700 | Out of resources | Association is closed.<br><br>Appropriate message is displayed to the user. |
| | 0122 | SOP Class not Supported | Association is closed.<br><br>Appropriate message is displayed to the user. |
| Failed | A900 | Identifier does not match SOP Class | Association is closed.<br><br>Error message is displayed to the user. |
| | Cxxx | Unable to process | Association is closed.<br><br>Error message is displayed to the user. |
| Cancel | FE00 | Matching terminated due to cancel | Association is closed.<br><br>Error message is displayed to the user. |
| Success | 0000 | Matching is complete - No final identifier is supplied | |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | |
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier | |

The C-FIND SCU will only perform hierarchical query (No extended negotiation supported)

Each C-FIND SCU supports an “Association Timer, “Operation Timer”, “Session Timer” that can be configured at installation time. These timers are defaulted to 60, 90, 3600 seconds.

The DICOM SERVER AE will parse each matching C-FIND-RSP reply and will abort the association if an entry does not contain a valid dataset.

**2.3.1.1.7.3.2 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE , Study Root Query/Retrieve Information Model - MOVE SOP Classes**

Each C-MOVE operation supports an "Association Establishment Timer". This timer starts when the association request is sent and stops when the association is established. This timer is set to 60 seconds by default.

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

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Refused | A701 | Out of resources - Unable to calculate number of matches | The association is aborted.<br>Error message is returned to the user. |
| | A702 | Out of resources - Unable to perform sub-operations | The association is aborted.<br>Error message is returned to the user. |
| | A801 | Move Destination Unknown | The association is aborted.<br>Error message is returned to the user. |
| | 0122 | SOP Class not Supported | The association is aborted.<br>Error message is returned to the user. |
| Failed | A900 | Identifier does not match SOP Class | The association is aborted.<br>Error message is returned to the user. |
| | Cxxx | Unable to process | The association is aborted.<br>Error message is returned to the user. |
| Cancel | FE00 | Sub-operations terminated due to a Cancel indication | The association is aborted.<br>Error message is returned to the user. |
| Warning | B000 | Sub-operations Complete - One or more Failures. | The association is not aborted.<br>No error message is returned to the user. |
| Success | 0000 | Sub-operations Complete - No Failure. | |
| Pending | FF00 | Sub-operations are continuing - | |

Each C-MOVE SCU supports an "Association Timer, "Operation Timer", "Session Timer" that can be configured at installation time. These timers are defaulted to 60, 300, 3600 seconds.

#### 2.3.1.1.8 Real-World Activity "Image Installation"

The DICOM SERVER AE accepts an association when it receives a valid association request from a DICOM Storage SCU.

##### 2.3.1.1.8.1 Associated Real-World Activity

The DICOM SERVER AE waits for any association. No operator action is required to receive an image.

##### 2.3.1.1.8.2 Association Acceptance Policy

When the DICOM SERVER AE accepts an association, it will receive any images transmitted on that association and store the supported SOP Classes on disk. Any Remote DICOM AE can send images to the DICOM SERVER AE.

#### 2.3.1.1.8.3 Accepted Presentation Context Table

| Presentation Context Table - Accepted | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| RT Structure Set Information Storage | 1.2.840.10008.5.1.4.1.1.481.3 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Digital Mammography X-Ray Image Storage - For Presentation | 1.2.840.10008.5.1.4.1.1.1.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Digital Mammography X-Ray Image Storage - For Processing | 1.2.840.10008.5.1.4.1.1.1.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

#### 2.3.1.1.8.3.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

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

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields sent back to the SCU |
|---|---|---|---|---|
| Refused | A7xx | Out of resources | indicates that there was not enough space or some other internal resource (such as memory) to store the image. The user should attempt recovery by removing some images from the Senographe 2000 D RWS. | (0000,0902) |
| Error | 0110 | Processing Failure | indicates that an internal system call has failed while processing the image. | (0000,0902) |
| Success | 0000 | | | None |

Each C-STORE SCP supports an “Association Timer, “Operation Timer”, “Session Timer” that can be configured at installation time. These timers are defaulted to 60, 180, 3600 seconds.

The DICOM Server AE conforms to the SOP’s of the Storage Service Class at Level 2 (Full) as described in Section B4.1 of PS 3.4 of the DICOM Standard Document.

**Image Reception phase:**

- If the DICOM Server AE fails to parse the received image, the error 110 (Processing Failure) is returned to the C-STORE SCU.
- If the DICOM Server AE fails to install the received image into the local database, the error A700 (Out of Resources) is returned to the C-STORE SCU.

When a C-STORE operation is returned Successful to the C-STORE SCU, the image has been written to the disk and declared into the local database. The image will then be accessed in the same manner as any other image by the applications on the Senographe 2000 D RWS.

When a C-STORE operation is returned Error to the C-STORE SCU, the image will be removed and a message will appear in the browser message log informing the user of a failure.

**Image Declaration phase:**

The overlay planes (group 6000 and 6002) are burnt into the pixel data and deleted from the original image. A Stand Alone Overlay image will have pixel data created from the overlay data which will be stored with the image. An image containing overlay planes must fulfill the following conditions:

- Overlay planes are encoded in groups 6000 and 6002 and not embedded in image pixel data.

- Overlay planes must have the same size as the image.
- Bits Allocated (0028, 0100) of the image is 16.

**Note:** Images that have the fields Patient's Name (0010,0010) and Patient ID (0010,0020) empty are accepted into the local database.

**Note:** The rescale slope (0028,1053) is ignored. The system defaults this value to 1.

**Note:** Measurement algorithm use only Pixel Spacing (0028,0030). If optional Imager Pixel Spacing (0018,1164) is filled instead, measurement will not be reported in mms but in pixels.

**Note:** All the images will be installed with the same elements in which it was received except Window Center (0028, 1050), Window Width (0028, 1051) which may be modified at installation time.

**Note:** Only grayscale images will be supported by the Senographe 2000 D RWS.

**Note:** Modality LUT and VOI LUT will be ignored by the Senographe 2000 D RWS.

**Note:** Images with non square pixels are not handled correctly by the Senographe 2000 D RWS.

**Note:** No optional data elements (Type 3) or filled data elements (Type 2) are required to be declared on the Senographe 2000 D RWS.

#### 2.3.1.1.8.4 Presentation Context Acceptance Criterion

Only known SOP Classes are accepted.

#### 2.3.1.1.8.5 Transfer Syntax Selection Policies

The default transfer syntax for SOP Classes is always chosen (Implicit VR Little Endian: 1.2.840.10008.1.2).

## 2.4 COMMUNICATION PROFILES

### 2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

### 2.4.2 OSI Stack

OSI stack not supported

#### 2.4.3 TCP/IP Stack

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

##### 2.4.3.1 API

Not applicable to this product.

##### 2.4.3.2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI, Ethernet 100Mb)

**Note:** For more information about the Physical Media available for Senographe 2000 D RWS, please refer to the Product Data Sheet.

#### 2.4.4 Point-to-Point Stack

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

### 2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

#### 2.5.1 Standard Extended /Specialized/Private SOPs

Neither Specialized nor Private SOP Classes are used by Senographe 2000D RWS.

#### 2.5.2 Private Transfer Syntaxes

No private Transfer Syntax are negotiated.

### 2.6 CONFIGURATION

#### 2.6.1 AE Title/Presentation Address Mapping

The Local AE Title is configurable. This must be configured by a GE Field Engineer during installation.

#### 2.6.2 Configurable Parameters

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

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

The Local Listening Port Number is not configurable and set to **4006**.

The following fields are configurable for every remote DICOM AE:

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

A **default router** IP Address for **all remote nodes** can be configured.

The following fields are configurable:

- Association Establishment Timer
- Store, Find, Move, Timers
- Inactivity Timers
- Maximum Length PDU

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

### 2.7 SUPPORT OF EXTENDED CHARACTER SETS

**The Senographe 2000 D RWS will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets**

# 3. MEDIA STORAGE CONFORMANCE STATEMENT

## 3.1 INTRODUCTION

This section of the conformance statement (CS) specifies the Senographe 2000 D RWS compliance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles which are supported by this product.

This station provides capabilities to DICOM interchange on CD-Rs (Compact Disc-Recordable), and on CDROMs (Compact Disc Read Only Memory). The Senographe 2000 D RWS works with Secondary capture (SC), Digital Mammography X-Ray (MG) For Processing, and Digital Mammography X-Ray (MG) For Presentation images.

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 Basic and Specific Application models for the CDR device and the CDROM device are shown in the following Illustrations:

SPECIFIC AE APPLICATION MODEL FOR THE CDR DEVICE

- Description of the data Flow Diagram for the CD-R device.

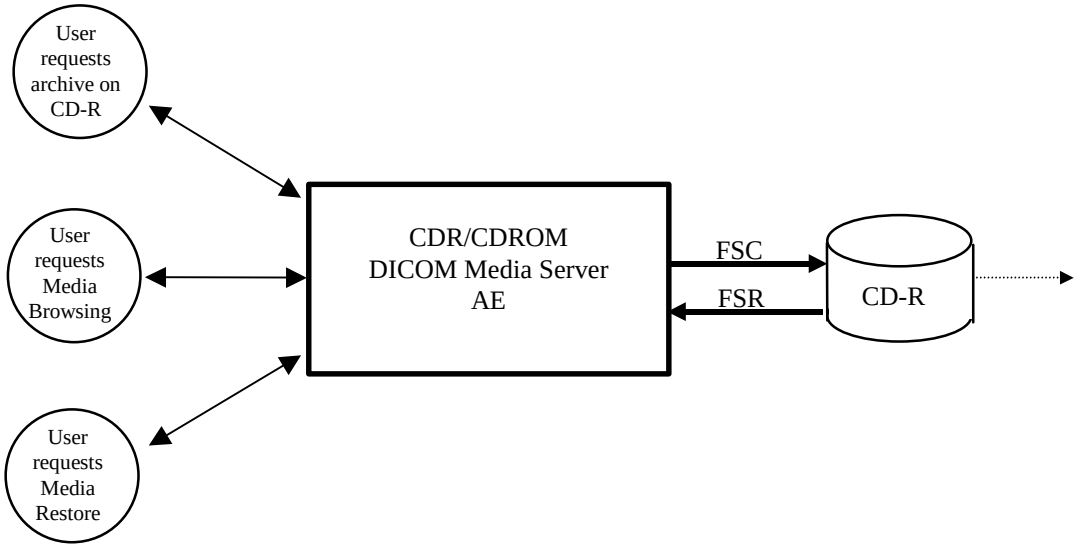
The DICOM ARCHIVE/RESTORE functionality for the CD-R device is handled by the CD-R/CDROM DICOM Media Server Application Entity (AE). The CD-R/CDROM DICOM Media Server Application Entity (AE) is commanded by the user to perform DICOM services operating on the DICOM media through the use of buttons and menu selections on the graphical user interface of the station.

The user requests the creation of a DICOM file set and the writing of this DICOM File Set on a blank CD-R by selecting images in the local Browser, and by a drag and drop of those images on the CD-R icon Images are saved on a mono-session disk in a one shot operation.

The user can request the reading of a DICOM file set written on a CDROM by selecting the CD-R drive as the active archive device, and browsing the archive using the “Query” Item of the Archive drop down menu, and then restore the selected items by a drag and drop on the local browser icon or by clicking on the suitable restore buttons.

The Application models for the CDR device are shown in Illustration 3-1.

**ILLUSTRATION 3–1**
SPECIFIC AE APPLICATION MODEL



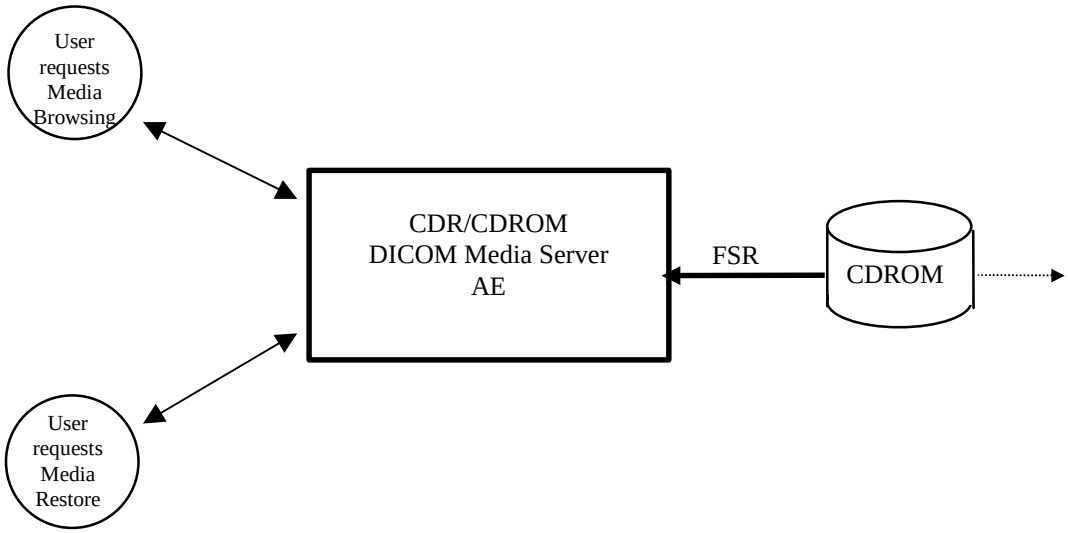

- Description of the data Flow Diagram for the CDROM device.

The DICOM ARCHIVE/RESTORE functionality for the CDROM device is handled by the CD-R/CDROM DICOM Media Server Application Entity (AE). The CD-R/CDROM DICOM Media Server Application Entity (AE) is commanded by the user to perform DICOM services operating on the DICOM media through the use of buttons and menu selections on the graphical user interface of the station.

The user can request the reading of a DICOM file set written on a CDROM by selecting the CD-R drive as the active archive device, and browsing the archive using the “Query” Item of the Archive drop down menu, and then restore the selected items by a drag and drop on the local browser icon or by clicking on the suitable restore buttons.

The Application model for the CDROM device are shown in Illustration 3-2

**ILLUSTRATION 3-2**




### 3.2.2 Functional Definition of AE's

#### 3.2.2.1 Functional Definition of the DICOM Media Server AE

##### 3.2.2.1.1 Functional definition of the CDR/CDROM DICOM Media Server AE

The CDR/CDROM DICOM Media Server Application Entity supports the following functions:

- Has access to patient demographics and pixel data in the local database.
- Can generate a DICOM File Set (FSC) for Digital Mammography X-Ray (MG) For Processing and MG For Presentation data types in a one shot activity.
- Can write a DICOM File Set (FSC) on a CD-R in mono-session.
- Can read a DICOM File Set (FSR) on a CD-R/CDROM.

### 3.2.3 Sequencing Requirements

Non Applicable for writing a CD-R.

For restoring images from a CD-R/CD-ROM:

1. Browse the CD-R/CD-ROM
2. User selects images to be restored from CD-R/CD-ROM to the system.
3. System restores Images.

#### 3.2.4 File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is:

| File Meta-Information Version | 1 |
|---|---|
| Senographe 2000 D RWS Implementation UID | 1.2.840.113619.6.76 |
| Implementation Version Name | The Implementation Version Name is set dynamically through an environment variable |

### 3.3 AE SPECIFICATIONS

#### 3.3.1 DICOM CDR/CDROM SERVER AE Specification

The DICOM CDR/CDROM SERVER Application Entity provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The application Profiles and roles are listed below.

| Supported Application Profile | Real World Activity | Role | Description |
|---|---|---|---|
| STD-GEN-CD | Browse CD | FSR | Interchange |
| STD-GEN-CD | Restore CD | FSR | Interchange |
| STD-GEN-CD | Archive CD | FSC<br>See Note | Interchange |

**Note:** Archive is available only on blank CD-Rs.

**Note:** Browse and Restore is possible on CD-R and CD-ROM

##### 3.3.1.1 File Meta Information for the DICOM CDR/CDROM Application Entity

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

| Source Application Entity Title | Set to system hostname |
|---|---|

##### 3.3.1.2 Real-World Activities for the DICOM CDR/CDROM Application Entity

###### 3.3.1.2.1 Real-World Activity (RWA) "Browse CD"

The CD-R/CDROM DICOM Media Server AE acts as an FSR using the interchange option when requested to browse the CD.

When the CD-R/CDROM DICOM Media Server AE is requested to provide a directory listing, it reads the File-set and displays the DICOMDIR directory entries, according to the PATIENT, STUDY, SERIES, IMAGE paradigm.

If the DICOMDIR file is not found in the File-set, the CD is ejected out of the drive.

#### 3.3.1.2.1.1 Media Storage Application Profile for the RWA "Browse CD":

For the list of Application Profiles that invoke this AE for the Browse CD RWA, see the Table in Section 3.3.1.

##### 3.3.1.2.1.1.1 Options:

Following are the SOP Classes supported by the RWA "Browse CD":

| Information Object Definition | SOP Class UID | Transfer Syntax | Transfer Syntax UID |
|---|---|---|---|
| Media Storage Directory Storage | 1.2.840.10008.1.3.10 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |

### 3.3.1.2.2 Real-World Activity (RWA) "Restore CD"

The CD-R/CDROM DICOM Media Server AE acts as an FSR using the interchange option when requested to copy SOP instances from the CD to the local database.

The user selects the SOP instances that he wants the DICOM Media Server AE to copy on the local data base by a drag and drop on the local browser icon or or by clicking on the suitable restore buttons. Once selected, the SOP instances are copied from the media to the local database.

Only, the SOP classes supported by the station are declared to the database in a transfer syntax supported by the station.

#### 3.3.1.2.2.1 Media Storage Application Profile for the RWA "Restore CD":

For the list of Application Profiles that invoke this AE for the Restore CD RWA, see the Table in Section 3.3.1.

##### 3.3.1.2.2.1.1 Options:

Following are the SOP Classes supported by the RWA "Restore CD":

| Information Object Definition | SOP Class UID | Transfer Syntax | Transfer Syntax UID |
|---|---|---|---|
| Media Storage Directory Storage | 1.2.840.10008.1.3.10 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Digital Mammography Xray For Processing Image Storage | 1.2.840.10008.5.1.4.1.1.1.2.1 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Digital Mammography Xray for Presentation Image Storage | 1.2.840.10008.5.1.4.1.1.1.2 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |

**Note:** Only Secondary Captures whose modality is MG, CR or OT are supported

#### 3.3.1.2.3 Real-World Activity (RWA) "Archive CD"

The CD-R/CDROM DICOM Media Server acts as an FSC using the interchange option when requested to copy SOP Instances from the local data base to the CD-R.

The user has to insert a blank CD into the CD-R drive. Then, the user selects the entries in the local database that he wants the CD-R/CDROM DICOM Media Server to copy onto the CD.

A confirmation pop-up that indicates what can be archived on the CD-R is displayed.

Before writing the CD, the DICOM Media Server checks for the following conditions:

- The inserted media is blank and writable. If the condition is not met, an error is displayed and the CD is ejected.
- The corresponding SOP instances have been encoded with the ISO_IR 100 Specific Character Set or DICOM Default Character Set.

The corresponding SOP instances are set to the transfer syntax defined by the application and copied to the CD. Unknown Private Data Elements are coded as "UN" for Unknown.

##### 3.3.1.2.3.1 Media Storage Application Profile for the RWA "Archive CD":

Please refer to the Table in Section 3.3.1.

###### 3.3.1.2.3.1.1 Options:

Following are the SOP Classes supported by the RWA "Archive CD":

| Information Object Definition | SOP Class UID | Transfer Syntax | Transfer Syntax UID |
|---|---|---|---|
| Media Storage Directory Storage | 1.2.840.10008.1.3.10 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Digital Mammography Xray For Processing Image Storage | 1.2.840.10008.5.1.4.1.1.1.2.1 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Digital Mammography Xray For Presentation Image Storage | 1.2.840.10008.5.1.4.1.1.1.2 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |

### 3.4 AUGMENTED AND PRIVATE APPLICATION PROFILES

No augmented/private profile is implemented

## 3.5 EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS OF SOP CLASSES AND TRANSFER SYNTAXES

### 3.5.1 Extensions, Specializations, and Privatizations of SOP Classes

#### 3.5.1.1 SOP Specific Conformance Statement for SOP Media Storage Directory

The following keys are added as Type 3 data elements in the Basic Directory IOD:

| Key Attribute | Tag | Directory Record Type |
|---|---|---|
| Patient's Birth Date | (0010,0030) | PATIENT |
| Patient's Sex | (0010,0040) | PATIENT |
| Series Description | (0008,103E) | SERIES |
| Manufacturer | (0008,1090) | SERIES |
| Institution Name | (0008,0080) | SERIES |
| Institution Address | (0008,0081) | SERIES |
| Attending Physician's Name | (0008,1050) | SERIES |
| Body Part Examined | (0018,0015) | SERIES |
| Image Type | (0008,0008) | IMAGE |
| Rows | (0028,0010) | IMAGE |
| Columns | (0028,0011) | IMAGE |
| Acquisition Device Processing Description | (0018,1400) | IMAGE |
| Image Laterality | (0020,0062) | IMAGE |

**Note:** The CD-ROM Browser displays less information than the local Browser.

### 3.5.2 Private Transfer Syntax Specification

No private Transfer Syntax is written on media by the described DICOM CDR/CDROM SERVER AE of Senographe 2000 D RWS.

## 3.6 CONFIGURATION

The source AE Title encoded in the File Meta-Information can not be modified.

### 3.7 SUPPORT OF EXTENDED CHARACTER SETS

**The Senographe 2000 D RWS will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.**

# 4. STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

## 4.1 INTRODUCTION

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

4.2 - Information Model Description

4.3 - Information Model Entity-Relationship Model

4.4 - Information Model Keys

## 4.2 STUDY ROOT INFORMATION MODEL DESCRIPTION

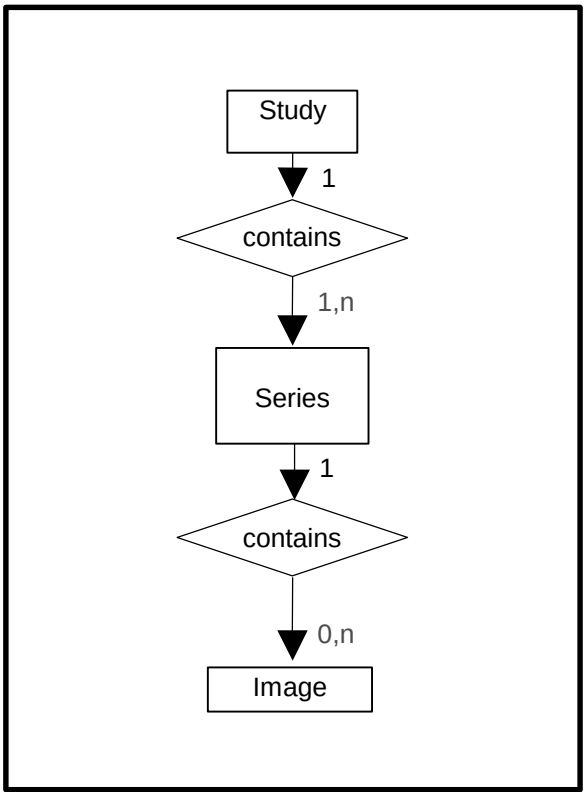
## 4.3 STUDY ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Study Root Information Model schema is shown in Illustration 4.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization:

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series.

**ILLUSTRATION 4.3-1**
**STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM**




### 4.3.1 Entity Descriptions

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

### 4.3.2 Senographe 2000 D RWS Mapping of DICOM entities

**TABLE 4.3-1**
**MAPPING OF DICOM ENTITIES TO SENOGRAPHE 2000 D RWS ENTITIES**

| DICOM | Senographe 2000 D RWS Entity |
|---|---|
| Study | Exam |
| Series | Series |
| Image | Image |

## 4.4 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 Study Root Query/Retrieve Information Model.

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

### 4.4.1 Supported Matching

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

- Single Value Matching
- List of UID Matching
- Universal Matching
- Wild Card Matching
- Range of date, Range of Time Matching

### 4.4.2 Study Level

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

**TABLE 4.4-2**
**STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Study Date | (0008,0020) | R | filtering is possible |
| Study Time | (0008,0030) | R | filtering is possible |
| Accession Number | (0008,0050) | R | |
| Patient's Name | (0010,0010) | R | filtering is possible |
| Patient ID | (0010,0020) | R | filtering is possible |
| Study ID | (0020,0010) | R | |
| Study Instance UID | (0020,000D) | U | filtering is possible |
| Study Description | (0008,1030) | O | |
| Name of Physician reading study | (0008,1060) | O | |
| Modalities in Study | (0008,0061) | O | filtering is possible (from RWS V8 release on) |

**TABLE 4.4-3**
**Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = STUDY |

### 4.4.3 Series Level

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

**TABLE 4.4-4**
**SERIES LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Modality | (0008,0060) | R | filtering is possible |
| Series Number | (0020,0011) | R | |
| Series Instance UID | (0020,000E) | U | filtering is possible |
| Series Description | (0008,103E) | O | |
| Manufacturer | (0008,0070) | O | |

**TABLE 4.4-5**
**Q/R SERIES LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = SERIES |

### 4.4.4 Image Level

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

**TABLE 4.4-6**
**IMAGE LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Image Number | (0020,0013) | R | |
| SOP Instance UID | (0008,0018) | U | filtering is possible |
| Image Date | (0008,0023) | O | |
| Image Time | (0008,0033) | O | |
| Gantry/Detector Tilt | (0018,1120) | O | |
| Acquisition Matrix | (0018,1310) | O | |
| Flip Angle | (0018,1314) | O | |
| Image Position Patient | (0020,0032) | O | |
| Image Orientation Patient | (0020,0037) | O | |
| Rows | (0028,0010) | O | |
| Columns | (0028,0011) | O | |

**TABLE 4.4-7**
**Q/R IMAGE LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = IMAGE |

## 4.5 PRIVATE DATA DICTIONARY

No private data dictionary is defined.

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# 5. NETWORK PRINT SCU CONFORMANCE STATEMENT

## 5.1 INTRODUCTION

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

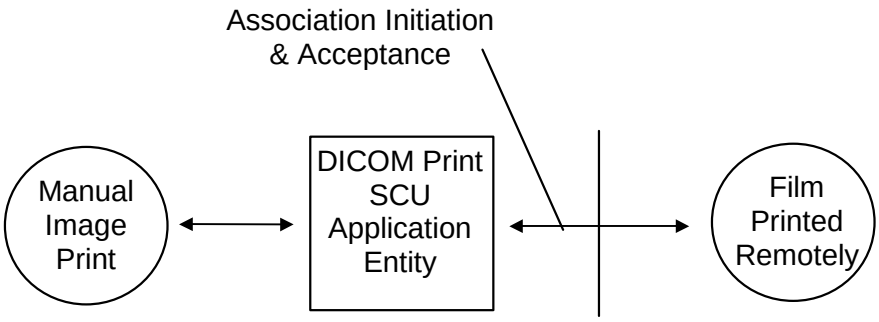
The Senographe 2000 D RWS has the ability to compose films through the use of an applications known as PRINT MANAGER. The Senographe 2000 D RWS uses DICOM Print Management Service Class to send images to hard copy printers. The films can then be used for possible further analysis.

## 5.2 IMPLEMENTATION MODEL

### 5.2.1 Application Data Flow Diagram

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

DICOM Print SCU Application Entity Model




The DICOM Print SCU Application Entity (AE) is an application which handles DICOM protocol communication with Remote DICOM Printers. The DICOM Print SCU AE is activated when the user requests for a print.

The DICOM Print SCU AE is invoked by the following Real World Activity:

- Manual Image Print.

For this operation, the operator selects an image in the VIEWER, then prints the image using the “Simple print” function.

The PRINT MANAGER receives the “Simple print” request composes a film then send the film to the selected Remote DICOM Printer.

### 5.2.2 Functional Definition of AE's

The DICOM Print SCU AE supports the following functions:

- Access to pixel data in the local database.
- Initiate a DICOM association to send DICOM SOP Classes (corresponding to the DICOM Print Management service class) to a remote DICOM Printer.

### 5.2.3 Sequencing of Real-World Activities

#### 5.2.3.1 Manual Image Print

1. The user selects the remote DICOM Printer from the Print Manager GUI.
2. The user selects an image in the VIEWER, then prints the image using the "Simple print" function.
3. The PRINT MANAGER receives the "Simple print" request, composes a film then activates the DICOM Print SCU AE that initiate the following actions.
4. Initiates a DICOM association and selects a Presentation Context
5. N-GETs printer status from the Printer SOP Instance

   If Printer Status is FAILURE

   Signal print failure to the user

   Association is aborted

   Else If Printer Status is WARNING and Printer Status Info is not equal to SUPPLY LOW or SUPPLY EMPTY

   Signal print warning to the user

   Association is released
6. N-CREATEs a Basic Film Session SOP Instance
7. N-CREATEs a Basic Film Box SOP Instance for the current film
8. N-SETs the Basic Film Box SOP Instance with the Image Box SOP Instance for each image on the film
9. N-ACTIONs on the Basic Film Box SOP Instance
10. N-DELETEs on the Basic Film Box SOP Instance

If DICOM_PRINT_WAIT_SCP_EVENT environment variable is set

11. Wait for N-EVENT-REPORTs of the Printer SOP Instance indicating printer status

12. If no N-EVENT-REPORT has been received after a configurable time out performs an NGET to obtain the printer status from the Printer SOP Instance

(The time out value is defined in the file ~sdc/app-defaults/dicom_print/dprint.cfg)

end condition

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

## 5.3 AE SPECIFICATIONS

### 5.3.1 DICOM Print SCU AE Specification

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

| SOP Class Name | SOP Class UID |
|---|---|
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.1.9 |

**Note:** Support of the Basic Grayscale Print Management Meta SOP Class as an SCU mandates support for the Basic Film Session, Basic Film Box, Basic Grayscale Image Box and Printer SOP Classes as a SCU.

#### 5.3.1.1 Association Establishment Policies

##### 5.3.1.1.1 General

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

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

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

The maximum length PDU for an association initiated by the DICOM Print SCU is:

| Maximum Length PDU | 16384 |
|---|---|

The Print Management Service Class does not support extended negotiation.

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

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

**Note:** The maximum PDU length can be modified at installation time. 0 as PDU length is not supported but accepted by this implementation.

#### 5.3.1.1.2 Number of Associations

The DICOM Print SCU AE supports only one association at a time. Request are internally queued.

#### 5.3.1.1.3 Asynchronous Nature

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

#### 5.3.1.1.4 Implementation Identifying Information

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

| Senographe 2000 D RWS Implementation UID | 1.2.840.113619.6.76 |
|---|---|

The Implementation Version Name for this DICOM v3.0 Implementation is:

| Senographe 2000 D RWS Implementation Version Name | 1_2_10 |
|---|---|

### 5.3.1.2 Association Initiation Policy

The DICOM Print SCU AE initiates one association with the selected REMOTE DICOM Printer. No other association can be opened by the DICOM Print SCU AE while the current association is active.

#### 5.3.1.2.1 Real-World Activity “Manual Image Print”

##### 5.3.1.2.1.1 Associated Real-World Activity

The user has the possibility to select an image in the VIEWER and to print it through to the PRINT MANAGER application. The PRINT MANAGER application also allows to define, suppress and select different REMOTE DICOM printers and to manipulate some print parameters like the number of copies. When the user requests for a print by pushing the “Simple Print” button, the DICOM Print SCU tries to establish the association with the requested printer and sends the images for printing.

#### 5.3.1.2.1.2 Proposed Presentation Context Table

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Basic Grayscale 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 |

##### 5.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for Print Management SOP Classes

For each of the supported Print Management SOP and Meta SOP Classes, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behavior are described in section 6.

## 5.4 COMMUNICATION PROFILES

### 5.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

### 5.4.2 OSI Stack

OSI stack not supported

### 5.4.3 TCP/IP Stack

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

#### 5.4.3.1 API

Not applicable to this product.

#### 5.4.3.2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI)

**Note:** For more information about the Physical Media available on Senographe 2000 D RWS, please refer to the Product Data Sheet.

### 5.4.4 Point-to-Point Stack

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

## 5.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

### 5.5.1 Standard Extended /Specialized/Private SOP Classes

No Standard Extended, no Specialized, no Private SOP Classes are managed by this application.

### 5.5.2 Private Transfer Syntaxes

No Private Transfer Syntaxes are managed by this product.

## 5.6 CONFIGURATION

### 5.6.1 AE Title/Presentation Address Mapping

The local DICOM Print SCU AE Title is: “PR_<hostname>”. The Print SCU AE Title value is defined in the file:

~sdc/app-defaults/dicom_print/dprint.cfg

The PRINT MANAGER application allows the user to add, delete, or update the following Remote DICOM Printers parameters:

- AE Title
- DICOM Port Number
- IP address

### 5.6.2 Configurable Parameters

For this AE (local), the following fields are configurable in the file

~sdc/app-defaults/dicom_print/dprint.cfg:

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

**Note:** The local Port Number may be not applicable because the product is never responding to an association request.

The following fields are configurable for every remote DICOM AE:

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

Only one default router IP Address can be configured for all DICOM remote nodes (including printers, Storage SCP Workstations, etc.)

The following fields are configurable:

- Association Establishment Timer (default set to 600s)
- N-SET timer (default set to 300s)
- N-ACTION timer (default set to 300s)
- N-GET timer (default set to 300s)
- N-DELETE timer (default set to 300s)
- Inactivity Timers (default set to 3000s)
- N-EVENT timer (default set to 30s)
- Maximum Length PDU

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

**Note:** Only one association can be performed at a time by this implementation.

### 5.7 SUPPORT OF EXTENDED CHARACTER SETS

The Senographe 2000 D RWS will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be installed in the local database.

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# 6. PRINT MANAGEMENT SOP CLASS DEFINITION

## 6.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the supported Print Management SOP and Meta SOP Classes, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behavior.

This section contains:

6.2.1 - Basic Film Session SOP Class

6.2.2 - Basic Film Box SOP Class

6.2.3 - Image Box SOP Classes

6.2.4 - Printer SOP Class

6.2.5 - Print Job SOP Class

6.2.6 - Basic Annotation Box SOP Class

6.2.7 - Image Overlay Box SOP Class

## 6.2 PRINT MANAGEMENT SOP CLASS DEFINITIONS

### 6.2.1 Basic Film Session SOP Class

The DICOM Print SCU AE supports the N-CREATE DIMSE Service Element for the Basic Film Session SOP Class.

- The N-CREATE DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to create an instance of Basic Film Session.

#### 6.2.1.1 IOD Description

##### 6.2.1.1.1 IOD modules

| Module | Reference | Module Description |
|---|---|---|
| SOP Common | | Contains SOP Common information |
| Basic Film Session Presentation Module | 6.2.1.1.2 | Contains Film Session presentations information |

##### 6.2.1.1.2 Basic Film Session Presentation Module

| Attribute name | Tag | Attribute Description |
|---|---|---|
| Number of Copies | (2000,0010) | 1 to 10. |
| Print Priority | (2000,0020) | HIGH or MED or LOW depending of configuration of associated Remote DICOM printer. |
| Film Session Label | (2000,0050) | Human readable label that identifies the film session. depending of configuration of associated Remote DICOM printer. Empty by default or set to free text. |
| Medium Type | (2000,0030) | PAPER or CLEAR FILM or BLUE FILM depending of configuration of associated Remote DICOM printer |
| Film Destination | (2000,0040) | MAGAZINE or PROCESSOR depending of configuration of associated Remote DICOM printer |

#### 6.2.1.2 DIMSE Service Group

| DIMSE Service Element | Usage SCU |
|---|---|
| N-CREATE | M |
| N-SET | Not used |
| N-DELETE | Not used |
| N-ACTION | Not used |

##### 6.2.1.2.1 N-CREATE

###### 6.2.1.2.1.1 Attributes

| Attribute Name | Tag | Usage SCU |
|---|---|---|
| Number of Copies | (2000,0010) | Used |
| Print Priority | (2000,0020) | Used |
| Medium Type | (2000,0030) | Used |
| Film Session Label | (2000,0050) | Used, not sent if empty |
| Memory Allocation | (2000,0060) | Not used |
| Film Destination | (2000,0040) | Used |

#### 6.2.1.2.1.2 Status

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Warning | B600 | Memory allocation not supported | Association is aborted |
| Success | 0000 | Film session successfully created | Next step described in the sequencing of Real-World Activities paragraph is performed |

#### 6.2.1.2.1.3 Behavior

No specific behavior.

#### 6.2.1.2.2 N-SET

This service is not used.

#### 6.2.1.2.3 N-DELETE

This service is not used.

#### 6.2.1.2.4 N-ACTION

This service is not used.

### 6.2.2 Basic Film Box SOP Class

The DICOM Print SCU AE supports the following DIMSE Service Element for the Basic Film Box SOP Class.

- The N-CREATE DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to create an instance of Basic Film Box
- The N-ACTION DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to print the Basic Film Box onto the hard copy printer.
- The N-DELETE DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to release the Basic Film Box instance.

#### 6.2.2.1 IOD Description

##### 6.2.2.1.1 IOD modules

| Module | Reference | Module Descripion |
|---|---|---|
| SOP Common | | Contains SOP Common information |
| Basic Film Box Presentation Module | 6.2.2.1.2 | Contains Film Box presentation information |
| Basic Film Box Relationship | 6.2.2.1.3 | References to related SOPs |

##### 6.2.2.1.2 Basic Film Box Presentation Module

| Attribute Name | Tag | Attribute Description |
|---|---|---|
| Image Display Format | (2010,0010) | STANDARD\C,R [C 1] and [R 1]<br>SLIDE<br>SUPERSLIDE |
| Annotation Display Format ID | (2010,0030) | Not sent. |
| Film Orientation | (2010,0040) | PORTRAIT<br>LANDSCAPE |
| Film Size ID | (2010,0050) | 8INX10IN<br>10INX12IN<br>10INX14IN<br>11INX14IN<br>14INX14IN<br>14INX17IN<br>24CMX24CM<br>24CMX30CM |
| Border density | (2010,0100) | Empty by default or set to BLACK or WHITE depending of configuration of associated Remote DICOM printer. |
| Empty Image Density | (2010,0110) | Empty by default or set to BLACK or WHITE depending of configuration of associated Remote DICOM printer. |
| Magnification Type | (2010,0060) | One of the following defined term is sent:<br>REPLICATE<br>BILINEAR<br>CUBIC<br>NONE |
| Smoothing Type | (2010,0080) | Only valid for Magnification type = CUBIC |
| Min Density | (2010,0120) | -1 by default or set to positive integer |
| Max Density | (2010,0130) | -1 by default or set to positive integer |
| Trim | (2010,0140) | Empty by Default or set to YES or NO according to value set by user when declaring the printer |
| Configuration Information | (2010,0150) | Empty by default or set to a value defined when printer is declared. |

#### 6.2.2.1.3 Basic Film Box Relationship Module

| Attribute Name | Tag | Attribute Description |
|---|---|---|
| Referenced Film Session Sequence | (2010,0500) | Used |
| >Referenced SOP Class UID | (0008,1150) | Used |
| >Referenced SOP Instance UID | (0008,1155) | Used |
| Referenced Image Box Sequence | (2010,0510) | Empty |
| >Referenced SOP Class UID | (0008,1150) | Empty |
| >Referenced SOP Instance UID | (0008,1155) | Empty |

### 6.2.2.2 DIMSE Service Group

| DIMSE Service Element | Usage SCU |
|---|---|
| N-CREATE | M |
| N-ACTION | M |
| N-DELETE | Used |

#### 6.2.2.2.1 N-CREATE

##### 6.2.2.2.1.1 Attributes

| Attribute Name | Tag | Usage SCU |
|---|---|---|
| Image Display Format | (2010,0010) | M |
| Referenced Film Session Sequence | (2010,0500) | M |
| >Referenced SOP Class UID | (0008,1150) | M |
| >Referenced SOP Instance UID | (0008,1155) | M |
| Referenced Image Box Sequence | (2010,0510) | Used |
| >Referenced SOP Class UID | (0008,1150) | Used |
| >Referenced SOP Instance UID | (0008,1155) | Used |
| Referenced Basic Annotation Box Sequence | (2010,0520) | Not used |
| >Referenced SOP Class UID | (0008,1150) | Not used |
| >Referenced SOP Instance UID | (0008,1155) | Not used |
| Film Orientation | (2010,0040) | Used |
| Film Size ID | (2010,0050) | Used |
| Magnification Type | (2010,0060) | Used |
| Max Density | (2010,0130) | Used, not sent if = -1 |
| Configuration Information | (2010,0150) | Used, not sent if empty |
| Annotation Display Format ID | (2010,0030) | Not used |
| Smoothing Type | (2010,0080) | Used, not sent if empty or magnification is not equal to CUBIC |
| Border Density | (2010,0100) | Used, not send if empty |
| Empty Image Density | (2010,0110) | Used, not send if empty |
| Min Density | (2010,0120) | Used, not sent if = -1 |
| Trim | (2010,0140) | Used, not sent if empty |

##### 6.2.2.2.1.2 Status

There are no specific status codes.

##### 6.2.2.2.1.3 Behavior

There is no specific behavior.

#### 6.2.2.2.2 N-DELETE

##### 6.2.2.2.2.1 Behavior

The SCU uses the N-DELETE to request the SCP to delete the Basic Film Box SOP Instance hierarchy.

#### 6.2.2.2.3 N-ACTION

N-ACTION is used to print the current film of the film session.

#### 6.2.2.2.3.1 Attributes

| Action Type Name | Action Type ID | Attribute | Tag | Usage SCU |
|---|---|---|---|---|
| Print | 1 | Referenced Print Job Sequence | (2100,0500) | Not used |
| | | >Referenced SOP Class UID | (0008,1150) | Not used |
| | | >Referenced SOP Instance UID | (0008,1155) | Not used |

#### 6.2.2.2.3.2 Status

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Success | 0000 | Film accepted for printing. | Next step describe in the sequencing of Real-World Activities paragraph is performed |
| Warning | B603 | Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page) | This case should not happen. This warning is considered as an error.<br>Association is aborted. |
| Failure | C602 | Unable to create Print Job SOP Instance; print queue is full | Appropriate message is returned to the user.<br>Association is aborted. |
| | C604 | Image position collision: multiple images assigned to single image position | Appropriate message is returned to the user.<br>Association is aborted. |
| | C603 | Image size is larger than image box size (by using the specified magnification value) | Appropriate message is returned to the user.<br>Association is aborted. |

#### 6.2.2.2.3.3 Behavior

SCU uses the N-ACTION to request the SCP to print one or more copies of a single film of the film session.

### 6.2.3 Image Box SOP Classes

#### 6.2.3.1 Basic Grayscale Image Box SOP Class

The DICOM Print SCU AE supports the following DIMSE Service Element for the Basic Grayscale Image Box SOP Class.

- The N-SET DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to set the attributes of the Basic Grayscale Image Box Instance.

#### 6.2.3.1.1 IOD description

##### 6.2.3.1.1.1 IOD modules

| Module | Reference | Module Description |
|---|---|---|
| SOP Common | | Contains SOP Common information |
| Image Box Presentation Module | 6.2.3.1.1.2 | Contains Image Box presentation information |
| Image Box Relationship Module | 6.2.3.1.1.3 | References to related SOPs |

##### 6.2.3.1.1.2 Image Box Pixel Presentation Module

| Attribute Name | Tag | Attribute Description |
|---|---|---|
| Image Position | (2020,0010) | 1 |
| Polarity | (2020,0020) | NORMAL = pixels shall be printed as specified by the Photometric Interpretation (0028,0004)<br>REVERSE = pixels shall be printed with the opposite polarity as specified by the Photometric Interpretation (0028,0004) |
| Magnification Type | (2010,0060) | Same value as defined in the Film Box. |
| Smoothing Type | (2010,0080) | Same value as defined in the Film Box |
| Configuration Information | (2010,0150) | Same value as defined in the Film Box. |
| Requested Image Size | (2020,0030) | Not Sent |
| Preformatted Grayscale Image Sequence | (2020,0110) | This sequence is always included if the Image Box is a Basic Grayscale Image Box |
| >Samples Per Pixel | (0028,0002) | 1 |
| >Photometric Interpretation | (0028,0004) | MONOCHROME1 or MONOCHROME2 depending of configuration of associated Remote DICOM printer. |
| >Rows | (0028,0010) | Original image height |
| >Columns | (0028,0011) | Original image width |
| >Pixel Aspect Ratio | (0028,0034) | 1\1 |
| >Bits Allocated | (0028,0100) | Depends on the original image pixel depth (8 or 16). |
| >Bits Stored | (0028,0101) | Original image pixel depth (8, 10 or 12 bits). |
| >High Bit | (0028,0102) | Depends on the original image pixel depth (7, 9 or 11). |
| >Pixel Representation | (0028,0103) | 0 (Unsigned Integer) |
| >Pixel Data | (7FE0,0010) | |

##### 6.2.3.1.1.3 Image Box Relationship Module

| Attribute Name | Tag | Attribute Description |
|---|---|---|
| Referenced Image Sequence | (0008,1140) | Not used |
| >Referenced SOP Class UID | (0008,1150) | Not used |
| >Referenced SOP Instance UID | (0008,1155) | Not used |
| >Referenced Frame Number | (0008,1160) | Not used |
| Referenced Image Overlay Box Sequence | (2020,0130) | Not used |

| | | |
|---|---|---|
| >Referenced SOP Class UID | (0008,1150) | Not used |
| >Referenced SOP Instance UID | (0008,1155) | Not used |
| >Referenced Frame Number | (0008,1160) | Not used |
| Referenced VOI LUT Sequence | (2020,0140) | Not used |
| >Referenced SOP Class UID | (0008,1150) | Not used |
| >Referenced SOP Instance UID | (0008,1155) | Not used |

#### 6.2.3.1.2 DIMSE Service Group

| DIMSE Service Element | Usage SCU |
|---|---|
| N-SET | M |

##### 6.2.3.1.2.1 N-SET

###### 6.2.3.1.2.1.1 Attributes

| Attribute Name | Tag | Usage SCU |
|---|---|---|
| Image Position | (2020,0010) | M |
| Preformatted Grayscale Image Sequence | (2020,0110) | M |
| >Samples Per Pixel | (0028,0002) | M |
| >Photometric Interpretation | (0028,0004) | M |
| >Rows | (0028,0010) | M |
| >Columns | (0028,0011) | M |
| >Pixel Aspect Ratio | (0028,0034) | 1\1 |
| >Bits Allocated | (0028,0100) | M |
| >Bits Stored | (0028,0101) | M |
| >High Bit | (0028,0102) | M |
| >Pixel Representation | (0028,0103) | M |
| >Pixel Data | (7FE0,0010) | M |
| Polarity | (2020,0020) | Used |
| Referenced Overlay Sequence | (0008,1130) | Not used |
| >SOP Class UID | (0008,1150) | Not used |
| >SOP Instance UID | (0008,1155) | Not used |
| Configuration Information | (2010,0150) | Used, not sent if empty |
| Magnification Type | (2010,0060) | Used |
| Smoothing Type | (2010,0080) | Used, not sent if empty or magnification is not equal to CUBIC |
| Requested Image Size | (2020,0030) | Not used |

#### 6.2.3.1.2.1.2 Status

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes |
|---|---|---|---|
| Failure | C605 | Insufficient memory in printer to store the image | Appropriate message is returned to the user.<br><br>Association is aborted. |
| Failure | C603 | Image size is larger than image box size | No specific message |
| Failure | C613 | Combined Print Image size is larger than the Image Box size | No specific message |
| Warning | B604 | Image size is larger than image box size, the image has been demagnified | Ignored |
| Warning | B609 | Image size is larger than the Image Box Size. The image has been cropped to fit | Ignored |
| Warning | B60A | Image size or Combined Print Image Size is larger than the Image Box Size. The Image or Combined Print Image has been decimated to fit | Ignored |

#### 6.2.3.1.2.1.3 Behavior

There is no specific behavior.

The SCU does not instruct the SCP to erase the image in the image position by setting a zero length and no value in the Attribute Pre-formatted Grayscale Image Sequence (2020,0110) or Pre-formatted Grayscale Image Sequence (2020,0111)

### 6.2.4 Printer SOP Class

The DICOM Print SCU AE supports the following DIMSE Service Element for the Basic Printer SOP Class.

The N-EVENT_REPORT DIMSE Service element sent by the DICOM Print SCP to the local DICOM Print SCU AE. The DICOM Print SCU handles the Printer Status and Printer Status Info fields. All other received data are ignored.

The N-GET DIMSE Service element sent by the DICOM Print SCU AE requests the Remote DICOM Print SCP to give information on the Remote DICOM Printer.

#### 6.2.4.1 IOD Description

#### 6.2.4.1.1 IOD modules

| Module | Reference | Module Description |
|---|---|---|
| SOP Common | | Contains SOP Common information |
| Printer Module | 6.2.4.1.2 | Contains status information to monitor the printer |

#### 6.2.4.1.2 Printer Module

| Attribute Name | Tag | Attribute Description |
|---|---|---|
| Printer Status | (2110,0010) | The behaviour defined for the following term<br>NORMAL: Association goes on.<br>FAILURE: Association is aborted.<br>WARNING: Association is released except if Printer Status Info is:<br>SUPPLY LOW<br>SUPPLY EMPTY |
| Printer Status Info | (2110,0020) | The behaviour is defined for SUPPLY LOW and SUPPLY EMPTY (See upwards) |
| Printer Name | (2110,0030) | Used only if the Printer returns its value |
| Manufacturer | (0008,0070) | Used only if the printer returns its value |
| Manufacturer Model Name | (0008,1090) | Used only if the Printer returns its value |
| Device Serial Number | (0018,1000) | Used only if the Printer returns its value |
| Software Versions | (0018,1020) | Used only if the Printer returns its value |
| Date Of Last Calibration | (0018,1200) | Used only if the Printer returns its value |
| Time Of Last Calibration | (0018,1201) | Used only if the Printer returns its value |

### 6.2.4.2 DIMSE Service Group

| DIMSE Service Element | Usage SCU |
|---|---|
| N-EVENT-REPORT | M |
| N-GET | U |

#### 6.2.4.2.1 N-EVENT-REPORT

##### 6.2.4.2.1.1 Attributes

| Event Type Name | Event Type ID | Attribute | Tag | Usage SCU |
|---|---|---|---|---|
| Normal | 1 | | | |
| Warning | 2 | Printer Name | (2110,0030) | |
| | | Printer Status Info | (2110,0020) | |
| Failure | 3 | Printer Name | (2110,0030) | |
| | | Printer Status Info | (2110,0020) | |

**Note:** The N-EVENT-REPORT is waited for a time defined in the file ~sdc/app-defaults/dicom_print/dprint.cfg. The default timeout is set to 30 secs

#### 6.2.4.2.1.2 Behavior

If Printer Status is FAILURE

Signal print failure to the user

Else If Printer Status is WARNING and Printer Status Info is not equal to SUPPLY LOW or SUPPLY EMPTY

Signal print warning to the user

Else

Signal print success to the user

### 6.2.4.2.2 N-GET

#### 6.2.4.2.2.1 Attributes

| Attribute name | Tag | Usage SCU |
|---|---|---|
| Printer Status | (2110,0010) | Used |
| Printer Status Info | (2110,0020) | Used |
| Printer Name | (2110,0030) | Used |
| Manufacturer | (0008,0070) | Used |
| Manufacturer Model Name | (0008,1090) | Used |
| Device Serial Number | (0018,1000) | Used |
| Software Versions | (0018,1020) | Used |
| Date Last Calibration | (0018,1200) | Used |
| Last Calibration | (0018,1201) | Used |

#### 6.2.4.2.2.2 Behavior

If Printer Status is FAILURE

Signal print failure to the user

Else If Printer Status is WARNING and Printer Status Info is not equal to SUPPLY LOW or SUPPLY EMPTY

Signal print warning to the user

Else

Signal print success to the user

### 6.2.5 Print Job SOP Class

This SOP Class is not supported by this implementation.

### 6.2.6 Basic Annotation Box SOP Class

This SOP Class is not supported by this implementation.

### 6.2.7 Image Overlay Box SOP Class

This SOP Class is not supported by this implementation.

# 7. SC INFORMATION OBJECT IMPLEMENTATION

## 7.1 INTRODUCTION

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

7.2- SC ENTITY-RELATIONSHIP MODEL

7.3- SC-IOD MODULE TABLE

7.4- SC-INFORMATION MODULE DEFINITIONS

7.5- PRIVATE DATA DICTIONARY

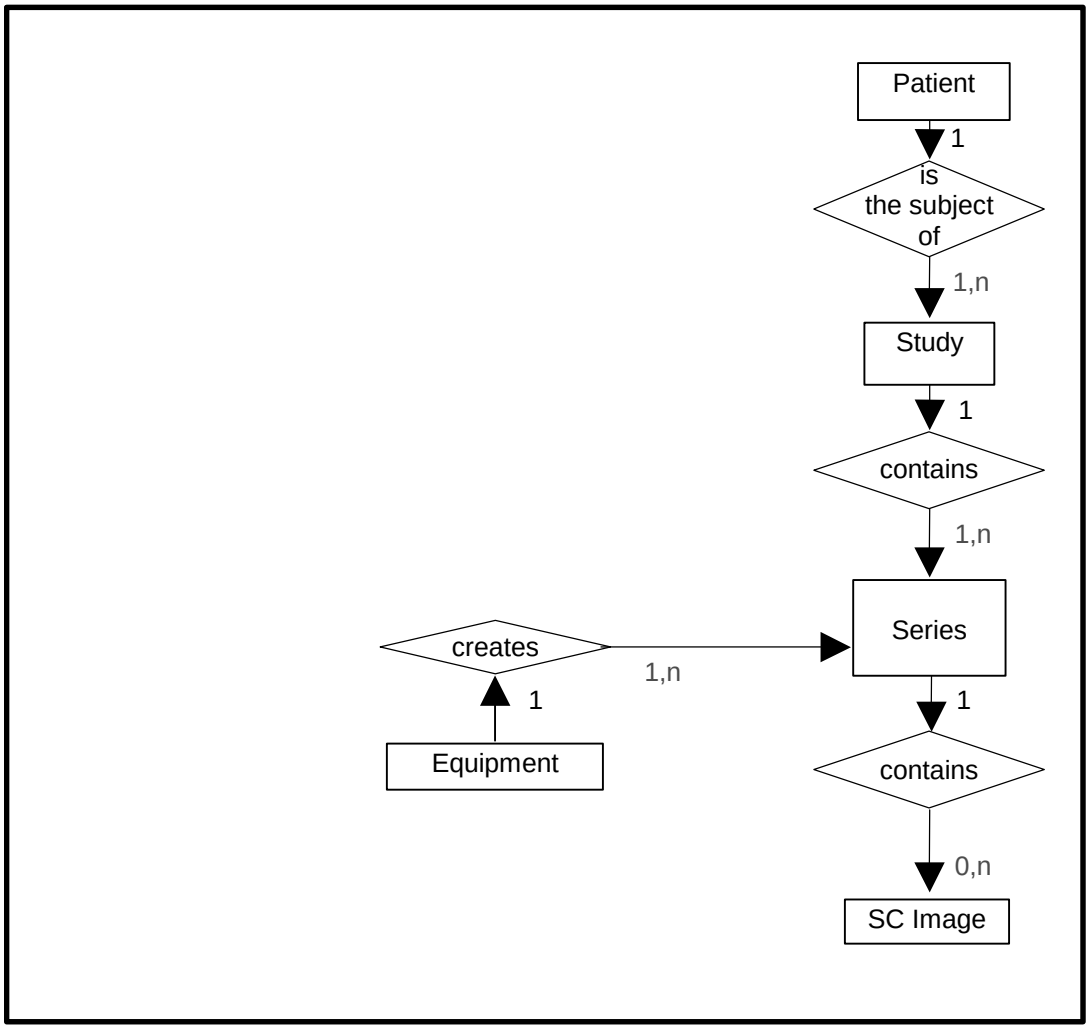
## 7.2 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in **Illustration 7.2.1.** In this figure, the following diagrammatic convention is established to represent the information organization:

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

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

**ILLUSTRATION 7.2-1**
**SC IMAGE ENTITY RELATIONSHIP DIAGRAM**




### 7.2.1 ENTITY DESCRIPTIONS

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

### 7.2.2 Senographe 2000 D RWS Mapping of DICOM entities

**TABLE 7.2-1**
**MAPPING OF DICOM ENTITIES TO SENOGRAPHE 2000 D RWS ENTITIES**

| DICOM | Senographe 2000 D RWS Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Series |
| Image | Image |

## 7.3 SC-IOD MODULE TABLE

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

Table 7.3.1 identifies the defined modules within the entities which comprise the DICOM v3.0 SC IOD. Modules are identified by Module Name.

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

**TABLE 7.3.1**
**SC IMAGE IOD MODULES**

| Entity Name | Module Name | Reference |
|---|---|---|
| Patient | Patient | **7.4.1.1** |
| Study | General Study | **7.4.1.2** |
| | Patient Study | **7.4.2.2** |
| Series | General Series | **7.4.3.1** |
| Equipment | General Equipment | **7.4.4.1** |
| | SC Equipment | |
| Image | General Image | **7.4.5.1** |
| | Image Pixel | **7.4.5.2** |
| | SC Image | |
| | Overlay Plane | |
| | Modality LUT | **7.4.7.2** |
| | VOI LUT | **7.4.7.1** |
| | SOP Common | **7.4.8.1** |

## 7.4 SC-INFORMATION MODULE DEFINITIONS

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

### 7.4.1 Common Patient Entity Modules

#### 7.4.1.1 Patient Module

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

**TABLE 7.4-1**
**PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Patient's Name | (0010,0010) | 2 | Original |
| Patient ID | (0010,0020) | 2 | Original |
| Patient's Birth Date | (0010,0030) | 2 | Original |
| Patient's Sex | (0010,0040) | 2 | Original |

### 7.4.2 Common Study Entity Modules

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

#### 7.4.2.1 General Study Module

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

**TABLE 7.4-2**
**GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Study Instance UID | (0020,000D) | 1 | Original |
| Study Date | (0008,0020) | 2 | Original |
| Study Time | (0008,0030) | 2 | Original |
| Referring Physician's Name | (0008,0090) | 2 | Original |
| Study ID | (0020,0010) | 2 | Original |
| Accession Number | (0008,0050) | 2 | Original |
| Study Description | (0008,1030) | 3 | Original |

#### 7.4.2.2 Patient Study Module

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

**TABLE 7.4-3**
**PATIENT STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Patient's Age | (0010,1010) | 3 | Original |
| Patient's Size | (0010,1020) | 3 | Original |
| Patient's Weight | (0010,1030 | 3 | Original |

### 7.4.3 Common Series Entity Modules

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

#### 7.4.3.1 General Series Module

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

**TABLE 7.4-4**
**GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Modality | (0008,0060) | 1 | Original. |
| Series Instance UID | (0020,000E) | 1 | Generated |
| Series Number | (0020,0011) | 2 | Generated |
| Laterality | (0020,0060 | 2C | |
| Series Description | (0008,103E) | 3 | Screen Save |
| Patient Position | (0018,5100 | 2C | |

### 7.4.4 Common Equipment Entity Modules

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

#### 7.4.4.1 General Equipment Module

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

**TABLE 7.4-5**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Manufacturer | (0008,0070) | 2 | derived from Original image |
| Institution Name | (0008,0080) | 3 | derived from Original image |
| Institution Address | (0008,0081) | 3 | derived from Original image |
| Station Name | (0008,1010) | 3 | derived from Original image |
| Manufacturer's Model Name | (0008,1090) | 3 | derived from Original image |
| Software Versions | (0018,1020) | 3 | derived from Original image |

##### 7.4.4.1.1 General Equipment Attribute Descriptions

7.4.4.1.1.1 **Pixel Padding Value**

Not used

### 7.4.5 Common Image Entity Modules

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

#### 7.4.5.1 General Image Module

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

**TABLE 7.4-6**
**GENERAL IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Image Number | (0020,0013) | 2 | Generated |
| Patient Orientation | (0020,0020) | 2C | See 7.4.5.1.1.1. |
| Image Date | (0008,0023) | 2C | derived from original |
| Image Time | (0008,0033) | 2C | derived from original |
| Image Type | (0008,0008) | 3 | See 7.4.5.1.1.2. |

##### 7.4.5.1.1 General Image Attribute Descriptions

###### 7.4.5.1.1.1 Patient Orientation

derived from original

###### 7.4.5.1.1.2 Image Type

This type is set to:

DERIVED\SECONDARY\<Originaltype>\SCREEN SAVE in case of Screen Save

###### 7.4.5.1.1.3 Derivation Description and Source Image Sequence

This sequence is not encoded

###### 7.4.5.1.1.4 Lossy Image Compression

Not Supported

#### 7.4.5.2 Image Pixel Module

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

**TABLE 7.4-7**
**IMAGE PIXEL MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Samples per Pixel | (0028,0002 | 1 | 1 |
| Photometric Interpretation | (0028,0004) | 1 | Set to MONOCHROME1 or MONOCHROME2 according to Original Image. |
| Rows | (0028,0010) | 1 | |
| Columns | (0028,0011) | 1 | |
| Bits Allocated | (0028,0100) | 1 | |
| Bits Stored | (0028,0101) | 1 | |
| High Bit | (0028,0102) | 1 | |
| Pixel Representation | (0028,0103) | 1 | |
| Pixel Data | (7FE0,0010) | 1 | |

### 7.4.6 Common Overlay Modules

This module is not implemented for this IOD.

### 7.4.7 Common Lookup Table Modules

#### 7.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

**TABLE 7.4-8**
**VOI LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Window Center | (0028,1050) | 3 | One value is set.<br>This value is derived from the Window Center present in the image when the operator asked for the Screen Save. |
| Window Width | (0028,1051) | 1C | One value is set.<br>This value is derived from the Window Width present in the image when the operator asked for the Screen Save. |

#### 7.4.7.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

**TABLE 7.4-9**
**MODALITY LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Rescale Intercept | (0028,1052 | 1C | 0 |
| Rescale Slope | (0028,1053) | 1C | 1 |
| Rescale Type | (0028,1054) | 1C | US |

### 7.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

#### 7.4.8.1 SOP Common Module

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

**TABLE 7.4-10**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| SOP Class UID | (0008,0016) | 1 | 1.2.840.10008.5.1.4.7 |
| SOP Instance UID | (0008,0018) | 1 | Generated from GE Based UID; <station configuration> and timestamp. |
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |

### 7.4.9 SC Modules

This Section describes SC Equipment, and Image Modules. These Modules contain Attributes that are specific to SC Image IOD.

#### 7.4.9.1 SC Equipment Module

This Module describes equipment used to convert images into a DICOM format.

**TABLE 7.4-11**
**SC IMAGE EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Conversion Type | (0008,0064) | 1 | WSD |
| Modality | (0008,0060) | 3 | Original |
| Secondary Capture Device ID | (0018,1010) | 3 | real UNIX station host name |
| Secondary Capture Device Manufacturer | (0018,1016) | 3 | GE MEDICAL SYSTEMS |
| Secondary Capture Device Manufacturer's Model Name | (0018,1018) | 3 | A.W.3.2.5 |
| Secondary Capture Device Software Version | (0018,1019) | 3 | build: <date and time of software creation> |

#### 7.4.9.2 SC Image Module

The table in this Section contains IOD Attributes that describe SC images.

**TABLE 7.4-12**
**SC IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Date of Secondary Capture | (0018,1012) | 3 | Creation date of the Secondary Capture |
| Time of Secondary Capture | (0018,1014) | 3 | Creation time of the Secondary Capture |

### 7.5 PRIVATE DATA DICTIONARY

No private elements are being used for this IOD.

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