GE Healthcare

Technical Publications

Direction 2391078-3-800
Revision 2

Seno Advantage 2.1 WorkStation

CONFORMANCE STATEMENT for DICOM V3.0

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CONFORMANCE STATEMENT OVERVIEW

Seno Advantage 2.1 is a diagnostic mammography review workstation with capability for multi-modality image review, image comparison and processing. When interpreted by a trained physician, mammography images displayed on the high-resolution B&W portrait monitors may be used as an element for diagnosis.

The Seno Advantage 2.1 Workstation inherits networking and media storage features from the AW4.4 Workstation. See the AW4.4 DCS manual ref. 5181424-100 applicable to the Seno Advantage 2.1 Workstation.

Table 0.1 provides an overview of the network services specific to Seno Advantage 2.1 Workstation. (See the AW4.4 DCS manual ref. 5181424-100 for additional common Network Services and Media Storage features)

Table 0.1 – NETWORK SERVICES

SOP Classes	Provider of Service (SCP)	User of Service (SCU)
Transfer		
Digital Mammography X-Ray Image Storage – For Presentation	Yes	No
Digital Mammography X-Ray Image Storage – For Processing	Yes	No
Secondary Capture Image Storage	Yes	Yes
Basic Text SR	No	Yes
RT Structure Set (RTSS) Storage	Yes	No

REVISION HISTORY

Rev	Date	Reason for change
1	January 14, 2008	Context SA2.1 M4 Language policy release Creation based on 2391078-2-800 rev 1
2	February 08, 2011	Adapting to new DCS template. Inclusion of Conformance Statement Overview and section for specific behavior based on DICOM inputs.

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement describes only the services used by the Seno Advantage Application.

It 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 GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

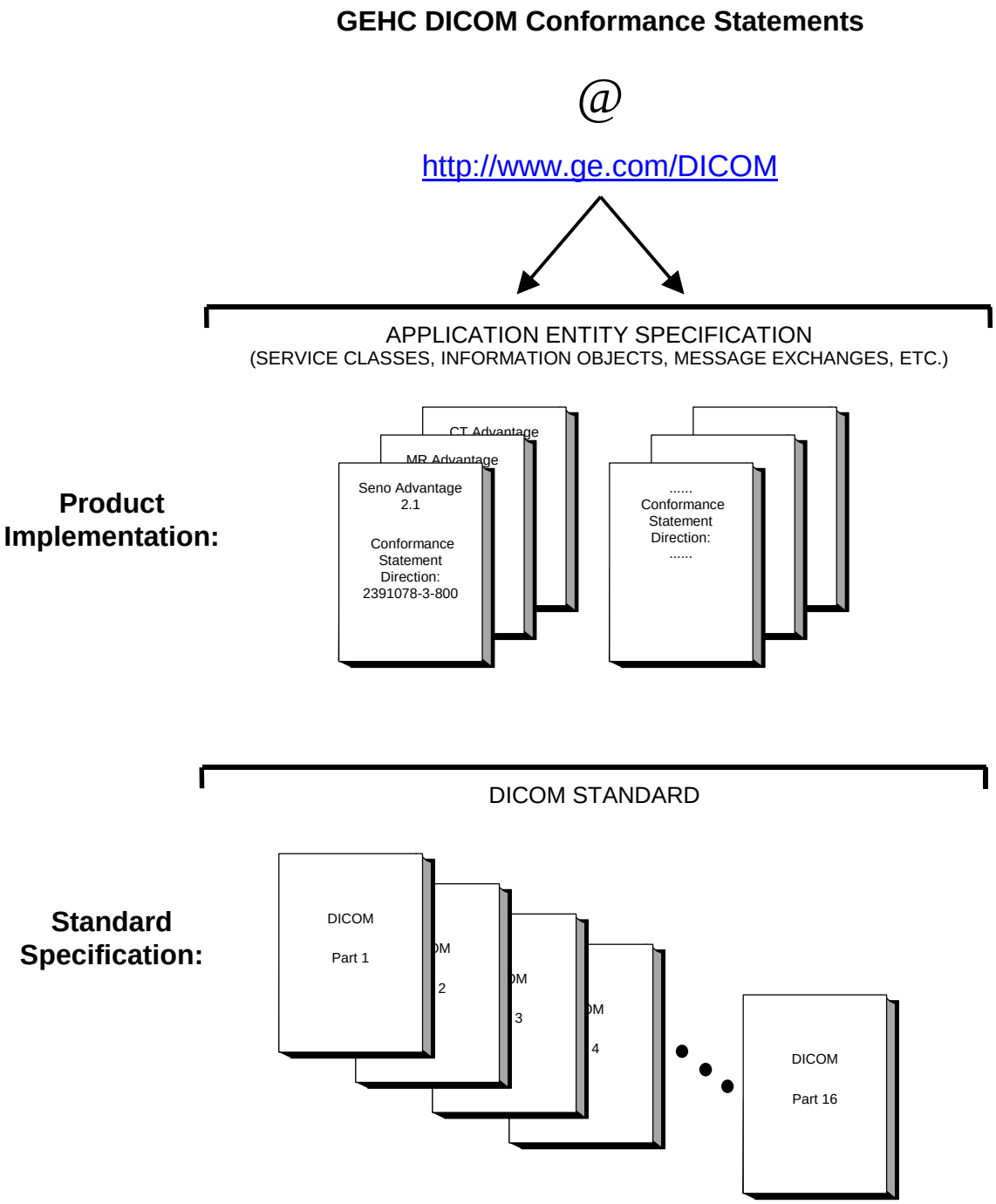
Section 3 (SC Information Object Implementation), which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of SC Information Object Implementation feature.

Section 4 (Basic Text SR Object Implementation), which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Basic Text SR Information Object Implementation feature.

Section 5 (Digital Mammography XRAY Information Object Implementation), which specify the GEHC equipment compliance to the DICOM requirements for the support of Digital Mammography XRAY Information Object.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

Seno Advantage Workstation 2.1
Conformance Statement for DICOM
*Direction **2391078-3-800***

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

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

For more information 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 1752
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

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

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC 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 GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1.5 IMPORTANT REMARKS

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

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM 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 Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. 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

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

AW4.4 Workstation Refer the AW4.4 DCS manual ref. 5181424-100

1.7 DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitons of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MG	Mammography (X-ray)
MR	Magnetic Resonance Imaging
PDU	Protocol Data Unit
RT	Radiotherapy

SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation

2. NETWORKING CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Seno Advantage 2.1 compliance to DICOM requirements for **Networking** features.

The Seno Advantage 2.1 Workstation is a medical image review station that allows easy selection; processing; filming and media interchange of multi-modality images from a variety of diagnostic imaging systems. When interpreted by a trained physician, mammography images displayed on the high-resolution B&W portrait monitors may be used as an element for diagnosis.

The Seno Advantage 2.1 Workstation uses the DICOM services to import images for possible further analysis or processing and to export images to other DICOM implementations, DICOM printers or DICOM Interchange media. It also uses the DICOM Storage Commitment service to transfer ownership of images to a remote workstation supporting storage commitment such as an archive system. All DICOM services are inherited from the AW4.4 Workstation. See the AW4.4 DCS manual ref. 5181424-100 applicable to the Seno Advantage 2.1 Workstation.

2.2 SUPPORTED DICOM INPUTS

The Seno Advantage 2.1 Workstation supports the following DICOM inputs.

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7 and the original modality (0008,0060) is MG
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 Storage (RTSS)	1.2.840.10008.5.1.4.1.1.481.3 and the manufacturer (0008,0070) is “R2”, “CADx” , and the modality (0008,0060) is MG

2.3 GENERATED OUTPUTS

The Seno Advantage 2.1 Workstation can create specific Information Object Definitions that will be described in this conformance statement.

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7 and the original modality (0008,0060) is MG
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11 with the root node equal to “Mini Report Presentation”

3. SC INFORMATION OBJECT IMPLEMENTATION

3.1 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:

3.2- SC ENTITY-RELATIONSHIP MODEL

3.3- SC-IOD MODULE TABLE

3.4- SC-INFORMATION MODULE DEFINITIONS

3.5- PRIVATE DATA DICTIONARY

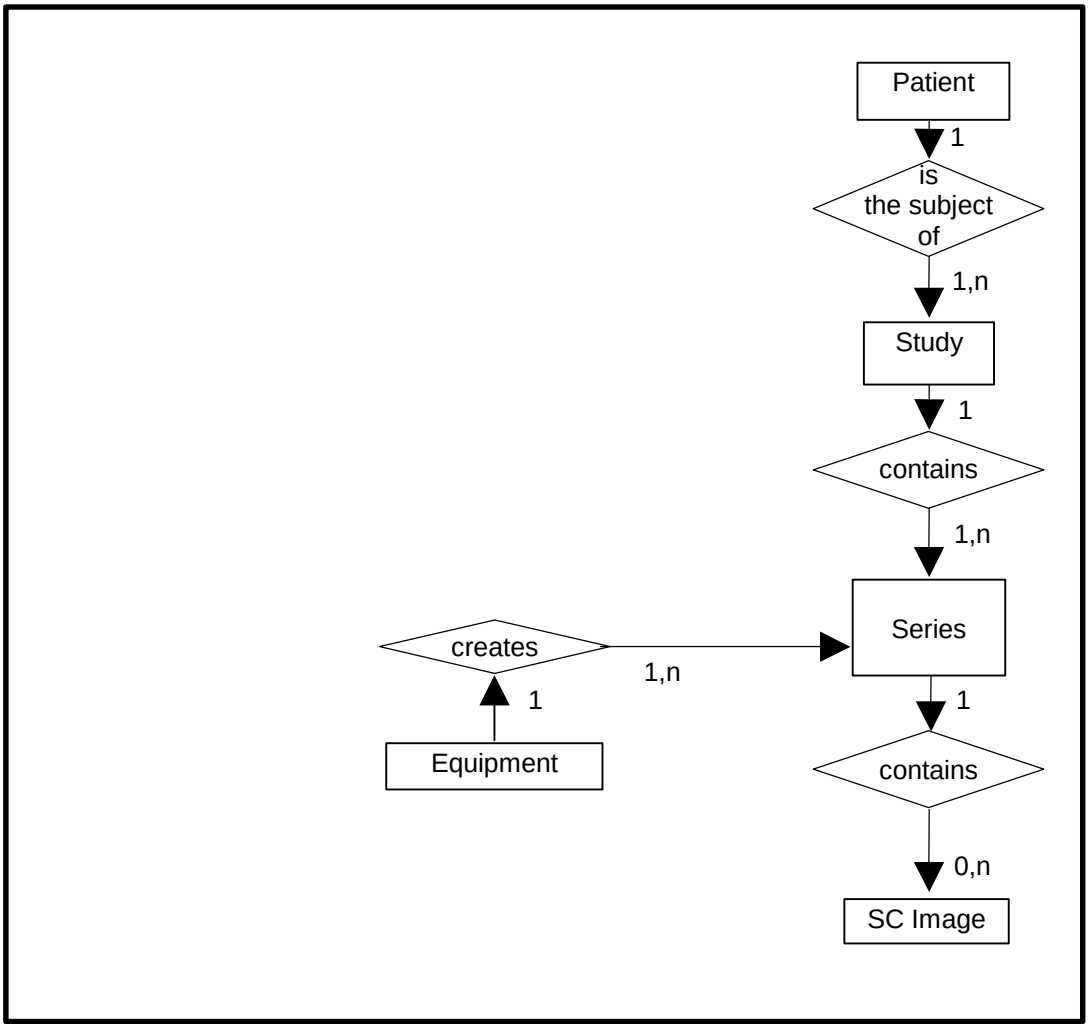
3.2 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in **Illustration 3.2.1.** 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 3.2-1
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



3.2.1 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.

3.2.2 Seno Advantage Mapping of DICOM entities

TABLE 3.2-1
MAPPING OF DICOM ENTITIES TO SENO ADVANTAGE ENTITIES

DICOM	Seno Advantage Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

3.3 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 3.3.1 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 3.3.1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	**3.4.1.1**
Study	General Study	**3.4.2.1**
	Patient Study	**3.4.2.2**
Series	General Series	**3.4.3.1**
Equipment	General Equipment	**3.4.4.1**
	SC Equipment	**3.4.9.1**
Image	General Image	**3.4.5.1**
	Image Pixel	**3.4.5.2**
	SC Image	**3.4.9.2**
	Modality LUT	**3.4.7.2**
	VOI LUT	**3.4.7.1**
	SOP Common	**3.4.8.1**

3.4 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).

The elements not listed below are not generated by the Seno Advantage 2.1 workstation.

3.4.1 Common Patient Entity Modules

3.4.1.1 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 3.4-1
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

3.4.2 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.

3.4.2.1 General Study Module

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

TABLE 3.4-2
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

3.4.2.2 Patient Study Module

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

TABLE 3.4-3
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

3.4.3 Common Series Entity Modules

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

3.4.3.1 General Series Module

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

TABLE 3.4-4
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
Series Description	(0008,103E)	3	Screen Save

3.4.4 Common Equipment Entity Modules

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

3.4.4.1 General Equipment Module

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

TABLE 3.4-5
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

3.4.4.1.1 General Equipment Attribute Descriptions

3.4.4.1.1.1 **Pixel Padding Value**

Not used

3.4.5 Common Image Entity Modules

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

3.4.5.1 General Image Module

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

TABLE 3.4-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated
Patient Orientation	(0020,0020)	2C	See 3.4.5.1.1.1.
Image Date	(0008,0023)	2C	derived from original
Image Time	(0008,0033)	2C	derived from original
Image Type	(0008,0008)	3	See 3.4.5.1.1.2.

3.4.5.1.1 General Image Attribute Descriptions

3.4.5.1.1.1 Patient Orientation

derived from original

3.4.5.1.1.2 Image Type

This type is set to:

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

3.4.5.1.1.3 Derivation Description and Source Image Sequence

This sequence is not encoded

3.4.5.1.1.4 Lossy Image Compression

Not Supported

3.4.5.2 Image Pixel Module

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

TABLE 3.4-7
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	

3.4.6 Common Overlay Modules

This module is not implemented for this IOD.

3.4.7 Common Lookup Table Modules

3.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 3.4-8
VOI LUT MODULE ATTRIBUTES

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

3.4.7.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

TABLE 3.4-9
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

3.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.4.8.1 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 3.4-10
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	Set to “ISO_IR 100”

3.4.9 SC Modules

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

3.4.9.1 SC Equipment Module

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

TABLE 3.4-11
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.4.2
Secondary Capture Device Software Version	(0018,1019)	3	build: <date and time of software creation>

3.4.9.2 SC Image Module

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

TABLE 3.4-12
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

3.5 PRIVATE DATA DICTIONARY

No private elements are being used for this IOD.

4. BASIC TEXT SR INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 BASIC TEXT SR ENTITY-RELATIONSHIP MODEL

4.3 BASIC TEXT SR-IOD MODULE TABLE

4.4 BASIC TEXT SR-INFORMATION MODULE DEFINITIONS

4.6 EXAM NOTE - PRESENTATION TEMPLATE

Note: The Basic Text DICOM SR produced by this implementation is also named: “Exam Note”

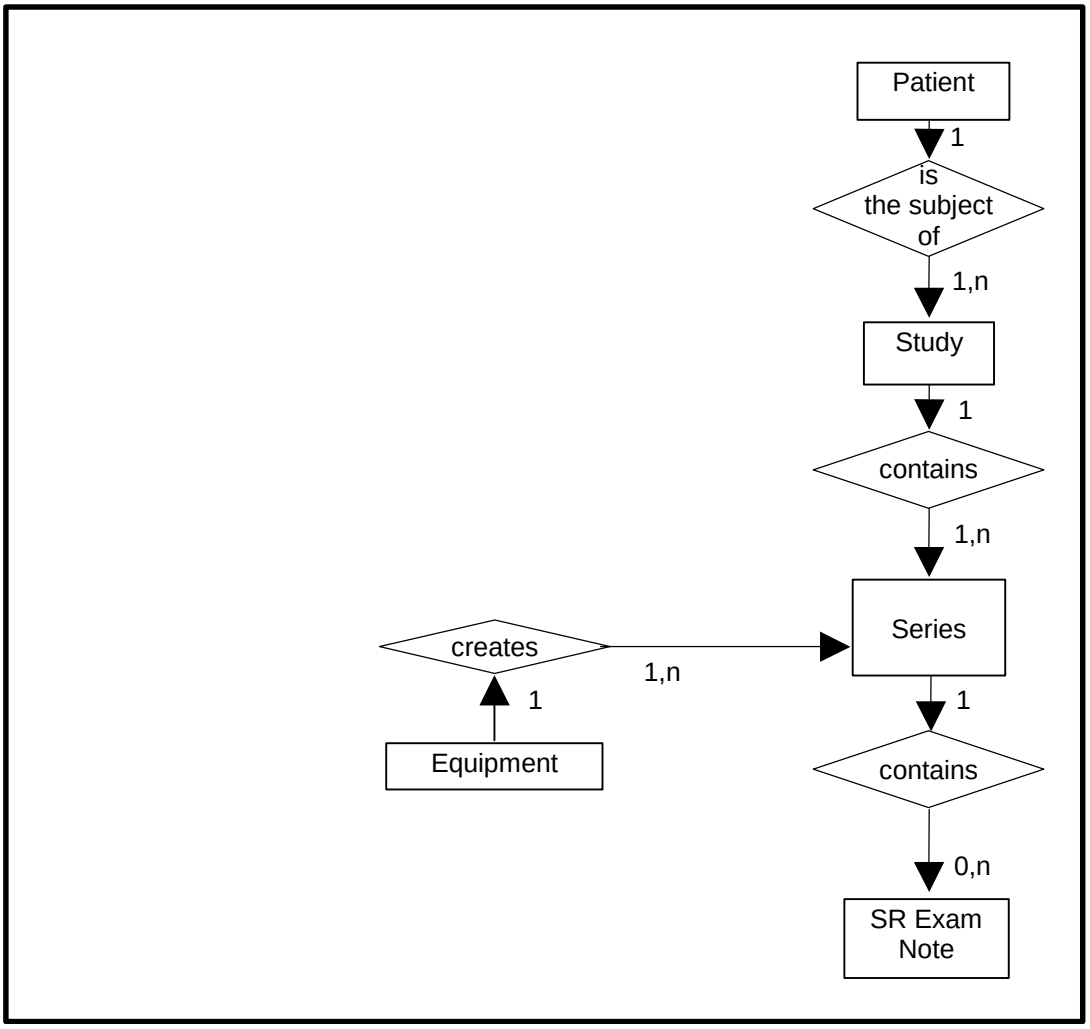
4.2 BASIC TEXT SR ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Basic Text SR interoperability schema is shown in **Illustration 4.2.1.** 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 4.2-1
BASIC TEXT SR ENTITY RELATIONSHIP DIAGRAM



4.2.1 ENTITY DESCRIPTIONS

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

4.2.2 Seno Advantage Mapping of DICOM entities

TABLE 4.2-1
MAPPING OF DICOM ENTITIES TO SENO ADVANTAGE ENTITIES

DICOM	Seno Advantage Entity
Patient	Patient
Study	Exam
Series	Series
SR Document	SR Document

4.3 BASIC TEXT SR-IOD MODULE TABLE

Within an entity of the DICOM v3.0 BASIC TEXT SR 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 4.3.1 identifies the defined modules within the entities which comprise the DICOM v3.0 Basic Text SR IOD. Modules are identified by Module Name.

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

TABLE 4.3.1
BASIC TEXT SR IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	**4.4.1.1**
Study	General Study	**4.4.2.1**
Series	SR Document Series	**4.4.3.1**
Equipment	General Equipment	**4.4.3.2**
Document	SR Document General	**4.4.4.1**
	SR Document Content	**4.4.4.2**
	SOP Common	**4.4.5.1**

4.4 BASIC TEXT SR-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 Basic Text SR 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).

The elements not listed below are not generated by the Seno Advantage 2.1 workstation.

4.4.1 Common Patient Entity Modules

4.4.1.1 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 4.4-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copy of the patient name of the more recent exam if present, empty string otherwise
Patient ID	(0010,0020)	2	Copy of the patient ID of the more recent exam if present, empty string otherwise
Patient's Birth Date	(0010,0030)	2	Copy of the patient birth date of the more recent exam if present, empty string otherwise
Patient's Sex	(0010,0040)	2	Copy of the patient sex of the more recent exam if present, empty string otherwise

4.4.2 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.

4.4.2.1 General Study Module

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

TABLE 4.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	Copy of the study instance UID of the more recent exam
Study Date	(0008,0020)	2	Copy of the study date of the more recent exam if present, empty string otherwise
Study Time	(0008,0030)	2	Copy of the study time of the more recent exam if present, empty string otherwise
Accession Number	(0008,0050)	2	Copy of the accession number of the more recent exam if present, empty string otherwise
Referring Physician's Name	(0008,0090)	2	Copy of the physician name of the more recent exam if present, empty string otherwise
Study Description	(0008,1030)	3	Copy of the study description of the more recent exam if present, not defined otherwise
Study ID	(0020,0010)	2	Copy of the study ID of the more recent exam if present, empty string otherwise

4.4.3 SR Document Series entity Modules

The following SR Document Series IE Modules are common to all Composite Image IODs that reference the SR Document Series IE.

4.4.3.1 SR Document Series Module

This section specifies the attributes that identify and describe general information about the SR Document Series within a Study.

TABLE 4.4-2
SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SR
Series Instance UID	(0020, 000e)	1	Generated from GE Based UID: 1.2.840.113619.2.198
Series Number	(0020, 0011)	1	Generated
Series Description	(0008, 103E)	3	Free text filled by the end user
Referenced Study Component Sequence	(0008, 1111)	2	Empty

4.4.3.2 General Equipment Module

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

TABLE 4.4-3
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	GE MEDICAL SYSTEMS
Station Name	(0008,1010)	3	Not present
Manufacturer's Model Name	(0008,1090)	3	SA2.0

4.4.4 SR Document Entity Modules

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

4.4.4.1 SR Document General Module

This section specifies the Attributes which identify and describe the SR Document.

TABLE 4.4-4
SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020, 0013)	1	1
Completion flag	(0040, A491)	1	COMPLETE
Verification flag	(0040, A493)	1	VERIFIED
Content Date	(0008, 0023)	1	Date of creation

Content Time	(0008, 0033)	1	Time of creation
Verifying Observer Sequence	(0040, A073)	1C	
> Verifying Observer Name	(0040, A075)	1	Name of the user that currently is logged on the station
> Verifying Observer Identification Code Sequence	(0040, A088)	2	Empty
> Verifying Organization	(0040, A027)	1	Same as Institution Name (0008,0080) of General Equipment Module
> Verifying Date Time	(0040, A030)	1	Date and time of creation
Performed Procedure Code Sequence	(0040, A372)	2	Empty

4.4.4.2 SR Document Content Module

This section specifies the attributes that identify and describe the SR content

TABLE 4.4-5
SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Content Template Sequence	(0040, A504)	1C	
> Template identifier	(0040, DB00)	1	SA2.0 MINIREPORT
> Mapping Resource	(0008, 0105)	1	PRIVATE

4.4.5 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.4.5.1 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 4.4-6
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	BASIC TEXT SR 1.2.840.10008.5.1.4.1.1.88.11
SOP Instance UID	(0008,0018)	1	Generated from GE Based UID; <station configuration> and timestamp.
Specific Character Set	(0008,0005)	1C	Set to “ISO_IR 100”

4.5 PRIVATE DATA DICTIONARY

No private elements are being used for this IOD.

4.6 EXAM NOTE - PRESENTATION TEMPLATE

This template describes how the SR Document Content Module of the Basic Text SR Information Object Definition is constrained for the purpose of implementing the Exam Note.

4.6.1 TID SA2.0 MINIREPORT: Exam Note Presentation

	NL	*Rel with Parent*	*VT*	*Concept Name*	*VM*	*Req Type*	*Condition*	*Value Set Constraint*
1			CONTAINER	EV (SA2-MR-0001, 99GEMS, "Mini Report Presentation")	1	M		Document title
2	>	HAS OBS CONTEXT	INCLUDE	DTID (1002) “Observer Context”	1	M		
3	>	CONTAINS	TEXT	EV (SA2-MR-0002, 99GEMS, "Findings, diagnostic")	1	M		

4.6.2 TID 1002 Observer Context

	NL	*Rel with Parent*	*VT*	*Concept Name*	*VM*	*Req Type*	*Condition*	*Value Set Constraint*
1		HAS OBS CONTEXT	CODE	EV (121005,DCM, “Observer Type”)	1	MC		“Person”
2		HAS OBS CONTEXT	INCLUDE	DTID (1003) Person observer	1	MC		

4.6.3 TID 1003 Person observer identifying attributes

	NL	*Rel with Parent*	*VT*	*Concept Name*	*VM*	*Req Type*	*Condition*	*Value Set Constraint*
1			PNAME	EV (121008,DCM, “Person Observer Name”)	1	M		Name of the user that currently is logged on the station
2			TEXT	EV (121009,DCM, “ Person Observer’s Organization Name”)	1	U		“no name”

4.7 PRIVATE CODED ENTRIES

The private coded entries that are required for implementing the Exam Note DICOM SR object are listed below (these are referred into the Exam Note Presentation Template).

Coded Entries		
Coding Scheme Designator (0008,0102)	**Code Value (0008,0100)**	**Code Meaning (0008,0104)**
99GEMS	SA2-MR-0001	Mini Report Presentation
99GEMS	SA2-MR-0002	Findings, diagnostic

5. DIGITAL MAMMOGRAPHY XRAY INFORMATION OBJECT IMPLEMENTATION

Seno Advantage Application supports DICOM MG images as input created by the Senographe DS Acquisition System (See DCS manual 5160883-100_rev1).

5.1 SPECIFIC BEHAVIOR BASED ON DICOM INPUTS

The Seno Advantage Viewer provides many features, which allow the end user to display, manipulate and process Mammography images. Some of these features do not apply or apply differently to images, which are not GE images.

The purpose of this section is to detail differences in the behavior of features due to the image vendor source: **GE** vendor, and other vendors (**non-GE**).

5.1.1 Multi-Vendor support table

The following table details the Seno Advantage Viewer features, which do not support or support with limitation the non-GE images.

All other Seno Advantage Viewer features, which are not listed, support both GE images and non-GE images the same way.

Feature	GE Images	Non-GE Images
Loading/displaying an Image on Screen.	Overlays defined in (7FE0, 0010) and (60xx, 3000) are not supported. A warning message is displayed to explain the limitation.	Overlays defined in (7FE0, 0010) and (60xx, 3000) are not supported. A warning message is displayed to explain the limitation.
Loading/displaying an Image on Screen.	GE Images acquired with non-square pixels are not supported.	Non-GE Images acquired with non-square pixels are not supported.
Loading/displaying an Image on Screen.	GE images compressed with loss are displayed with a warning annotation.	Non-GE images compressed with loss are displayed with a warning annotation.
View Name definitions	View name computation is based on the following GE acquisition limitations: Standard view names: • Image laterality: L or R • View code: ML, MLO, LM, LMO, CC, FB or SIO. • View modifier code: One of RL, RM, ID, S, TAN and M if Mag view is applied. Special view names: • CV • (R or L)AT • (R or L)XCC • (R or L)XCCM • (R or L)XCCL Means, Images only with above View Name combinations are supported.	View name computation is based on the following GE acquisition limitations: Standard view names: • Image laterality: L or R • View code: ML, MLO, LM, LMO, CC, FB or SIO. • View modifier code: One of RL, RM, ID, S, TAN and M if Mag view is applied. Special view names: • CV • (R or L)AT • (R or L)XCC • (R or L)XCCM • (R or L)XCCL Means, Images only with above View Name combinations are supported.
Magnified Image identification	Images are identified as Magnified if • the View Modifier Code Sequence (0054,0222) has code value R-102D6, or • the Estimated Radiographic Magnification Factor (0018,1114)	Images are identified as Magnified if • the View Modifier Code Sequence (0054,0222) has code value R-102D6, or • the Estimated Radiographic Magnification Factor (0018,1114)

	has a value > 1	has a value > 1.2
Contact Image identification	Images are identified as Contact when • the View Modifier Code Sequence (0054,0222) does not contain code value R-102D6, and • the Estimated Radiographic Magnification Factor (0018,1114) is absent. If present, it has a value of 1.0	Images are identified as Contact when • the View Modifier Code Sequence (0054,0222) does not contain code value R-102D6, and • the Estimated Radiographic Magnification Factor (0018,1114) is absent. If present, it has a value between 1.0 and 1.2
Fit to Breast	Applies to GE images.	Not applicable on non-GE images.
Quadrant Zoom	On GE images, it applies the Smart Quadrant function.	On non-GE images, it applies the normal Quadrant Zoom function.
VOI LUT	Gamma LUT is always used for GE images including SCPT images. The VOI LUT (0028,3010) if present is not used.	Gamma LUT is used for non-GE images if DICOM tag VOI LUT function (0028,1056) is SIGMOID. Otherwise Linear LUT is used. The VOI LUT (0028,3010) if present is not used.
Inverse Video	On GE images, it applies the *smart invert* function.	On non-GE images, it applies the normal inverted video.
Auto Windowing	Multi-valued windowing (Standard, High, Low and User) available on GE images.	Multi-valued windowing not available on non-GE images. If multiple windowing values are available in the non- GE image then the only first windowing is used.
Measurement	On GE images, the imager pixel spacing (0018, 1164) is used for measurements. For any kind of view including the mag-view the measures are adjusted with the estimated radiographic magnification factor (0018,1114) if present. Mag images with measures are displayed with a warning annotation.	On non-GE images, the imager pixel spacing (0018, 1164) is used for measurements. For any kind of view including the mag-view the measures are adjusted with the estimated radiographic magnification factor (0018,1114) if present. Mag images with measures are displayed with a warning annotation.