GE Medical Systems

Technical Publications

SenoVision Dicom V3.0 Conformance Statement

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Sep. 02, 1996	Initial release to Direction Stock.
1	November, 03, 1997	Minor update.

LIST OF EFFECTIVE PAGES

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SECTION 1 – INTRODUCTION

1–0 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 (Secondary Capture Image Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Caprture Information Object.

1–1 OVERALL 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:

Senovision

Conformance Statement for DICOM v3.0

ref G/GXRE/MAMMO–SL/SAB/97/496

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:

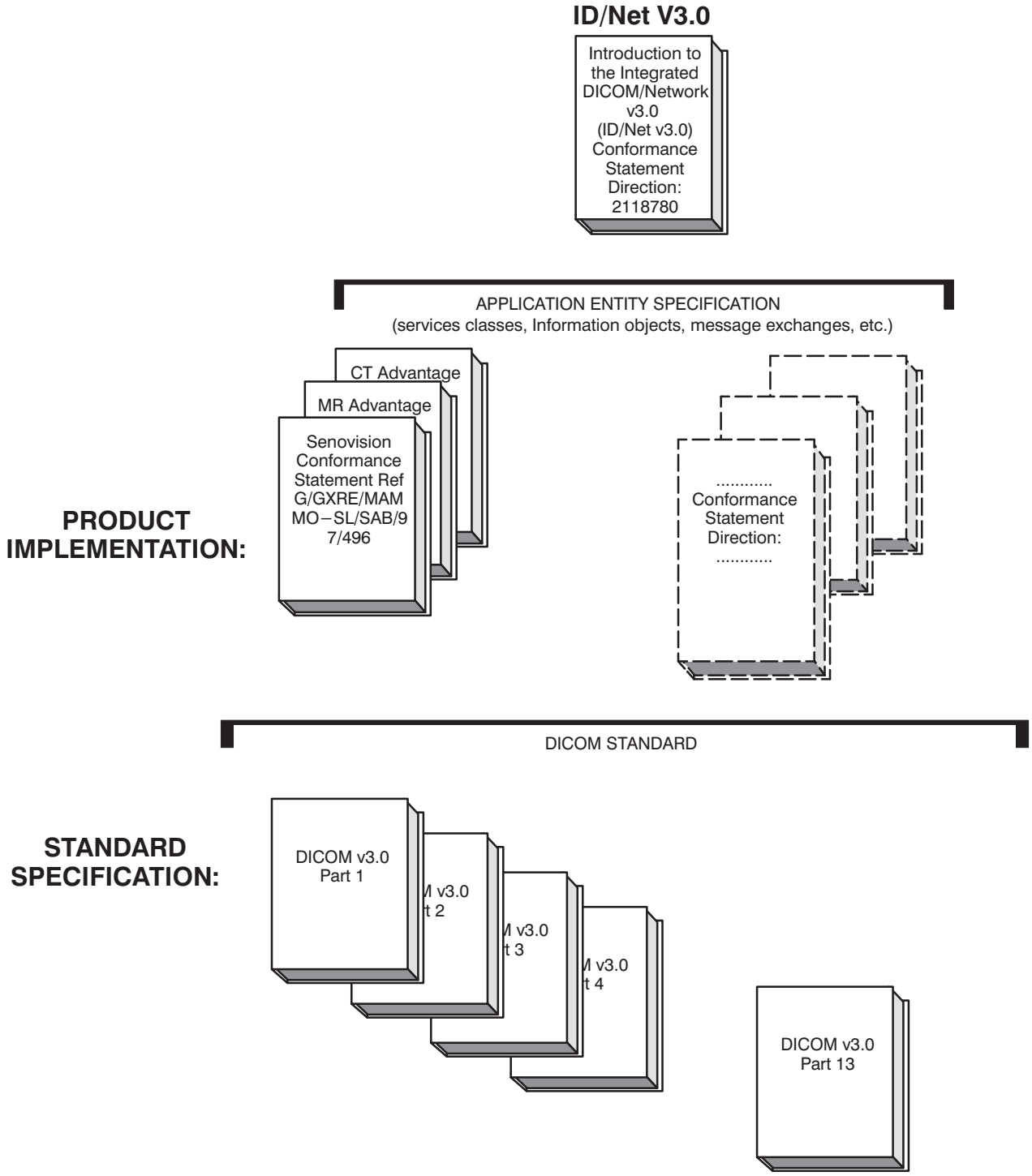
Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)

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.

ILLUSTRATION 1–1
DOCUMENTATION STRUCTURE



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

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

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

ID/Net v3.0 Conformance Statements

Direction: 2117016

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

NEMA Publication

1300 North 17th Street

Suite 1847

Rosslyn, VA 22209

USA

Phone: (703) 841–3200

1–2 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

1–3 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.

1–4 IMPORTANT REMARKS

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

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

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

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

1–5 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).

1–6 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.*

1–7 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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SECTION 2 – NETWORK CONFORMANCE STATEMENT

2−0 INTRODUCTION

This conformance statement (CS) specifies the GE SenoVision compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product.

SenoVision is an Integrated Digital Mammography Imaging System for Stereotactic and Digital Spot applications. It uses DICOM services to export images to remote workstations

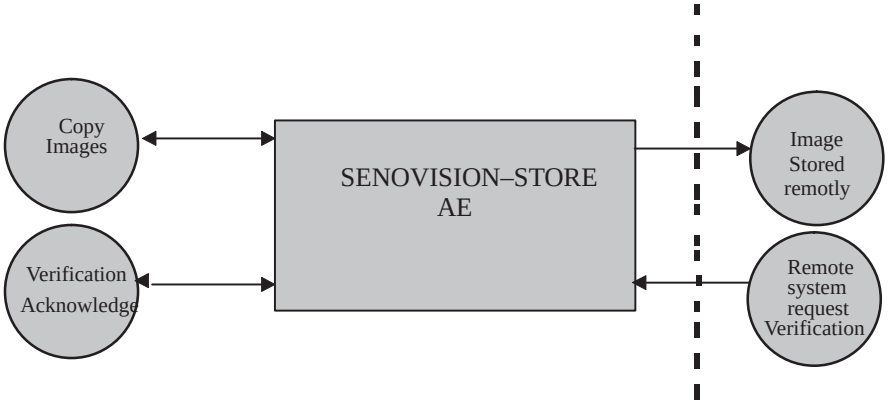
Note that the format of this section strictly follows the format of DICOM Standard Part 2 (Conformance) Annex A. Please refer to that part of the standard while reading this section.

2−1 IMPLEMENTATION MODEL

2−1−1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in Ill. 1–2 .

ILLUSTRATION 1–2
SPECIFIC AE APPLICATION MODEL



The SENOVISION–STORE Application Entity (AE) is an application which handles DICOM protocol communication. SENOVISION–STORE AE is automatically brought up when the Digital System of SenoVision is powered on.

All remote DICOM's AE must be manually configured on SenoVision, usually at the software installation time, by a GE field engineer.

There is 1 local real world activity Copy Image (CI), which can cause the SENOVISION–STORE AE to initiate a DICOM association to store an Image

CI consists of an operator selecting one or several images to be sent on one or several Remote System(s), but transfer will be performed in a sequential order, not in parallel. Selection of Images is done from the Operator console screens (known as BROWSER and VIEWER); selection of Remote Systems and visualisation of the status of the transfer is done on a specific menu (known as TRANSFER menu) . Remote Workstation can be any DICOM compliant WorkStation.

2−1−2 Functional Definition of AE's

The SENOVISION–STORE Application Entity supports the following functions:

- Access to patient demographics and Pixel Data in the local database.
- Build a DICOM format data set.
- Initiates a DICOM association to send the image(s).

2−1−3 Sequencing of Real−World Activities

Not Applicable

2−2 AE SPECIFICATIONS

2−2−1 SENOVISION−STORE 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

Standard conformance as an SCP is not applicable for this Application Entity.

SenoVision DataBase includes also private objects in addition to secondary capture, that will be rejected by non–SenoVision systems.

The SOP Class is a standard extended one, since it is a standard Secondary Capture extended with private fields.

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

SOP Class Name	SOP Class UID
Verification Service Class	1.2.840.10008.1.1

Note that the Verification SCU is not implemented in SenoVision.

2−2−1−1 Association Establishment Policies

2−2−1−1−1 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 SENOVISION–STORE AE is (defined as MAX_MESSAGE_SIZE in constant.h in Phoenix):

Maximum Length PDU	16 Kbytes

The SOP class Extended Negotiation is not supported.

The maximum number of Presentation Contexts Items that will be proposed is 2.

The user info items sent by this product are:

- Maximum PDU Length
- Implementation UID

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

2−2−1−1−2 Number of Associations

The SENOVISION–STORE AE will initiate only one DICOM association to perform an image storage as an SCU to a remote host.

2−2−1−1−3 Asynchronous Nature

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

2−2−1−1−4 Implementation Identifying Information

The Implementation UID for this ID/Net v3.0 Implementation is:

SenoVision Implementation UID	1.2.840.113619.6.34

2−2−1−2 Association Initiation Policy

SENOVISION–STORE AE attempts to initiate a new association for each transfer. This association corresponds to 1 Real–World Activity : Copy Images (CI).

2−2−1−2−1 Real−World Activity ”Copy Image”

2−2−1−2−1−1 Associated Real−World Activity

The operator selects a destination by selecting an Host in the ’Remote Hosts List’ Window (by default the last selected host is active).

Then he selects Image(s) to be sent by selection in both BROWSER (at patient level), or VIEWER (at sequence or photo level).

This operation will cause

- the SENOVISION−STORE AE to initiate a DICOM association.
- the SENOVISION−STORE AE to emit C−STORE command to send the image.

2−2−1−2−1−2 Proposed Presentation Contexts

Presentation Context Table − Proposed					
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	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2−2−1−2−1−2−1 SOP Specific Conformance Statement for Image Storage SOP Class

This implementation performs a C–Store operation for each image transfered over an association.

Upon receiving a C–STORE confirmation containing an Error or a Refused status, the current C–STORE is considered as failed.

Service Status	Status Codes	Further Meaning	Application Behavior when receiving status codes	Related Fields processed if received
Refused	A7xx	Out of resources	”Transfer Failed” pop up is displayed	
	0122	SOP Class not Supported	”Transfer Failed” pop up is displayed	
Error	Cxxx	Cannot understand	”Transfer Failed” pop up is displayed	
	A9xx	data Set does not match SOP Class	”Transfer Failed” pop up is displayed	
Warning	B000	Coercion of Data Elements	No message	
	B007	Data Set does not match SOP Class	No message	
	B006	Elements Discarded	No message	
Success	0000		No message	

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 timer is set to 60 seconds.

Each C–STORE operation supports an " Operation Inactivity Timer ".. This timer starts once a C–STORE request has been issued and stops once a C–STORE confirmation has been received. This Timer is set to 3 minutes.

If any of the 2 timers expires, the connection is closed and the operation is considered as failed.

2−2−1−3 Association Acceptance Policy

The SENOVISION–STORE AE provides only DICOM Verification Service Class.

2−2−1−3−1 Real−World Activity "Verification acknowledge"

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

2−2−1−3−1−1 Associated Real−World Activity

2−2−1−3−1−2 Accepted Presentation Contexts

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

2−2−1−3−1−2−1 SOP Specific Conformance Statement for Verification SOP Class

The SENOVISION–STORE AE provides standard conformance to the DICOM Verification Service Class.

2−3 COMMUNICATION PROFILES

2−3−1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

2−3−2 TCP/IP Stack

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

2−3−2−1 API

Not applicable to this product.

2−3−2−2 Physical Media Support

Ethernet v2.0, IEEE 802.3.

2−3−3 Point−to−Point Stack

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

2–4 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

Refer to Section 3 for the description of Secondary capture Private DICOM Data Dictionary

2–5 CONFIGURATION

2–5–1 AE Title/Presentation Address Mapping

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

2–5–2 Configurable Parameters

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

- Local AE Title
- Local IP Address

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Responding TCP/IP Port
- Remote IP Address

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

2–6 SUPPORT OF EXTENDED CHARACTER SETS

This implementation supports the following extended character set:
ISO–IR–100

SECTION 3 – SECONDARY CAPTURE IMPLEMENTATION

3–0 INTRODUCTION

This section specifies the use of the DICOM v3.0 Secondary Capture Image IOD to represent the information included in Secondary Capture images produced by this implementation. Corresponding attributes are conveyed using the module construct.

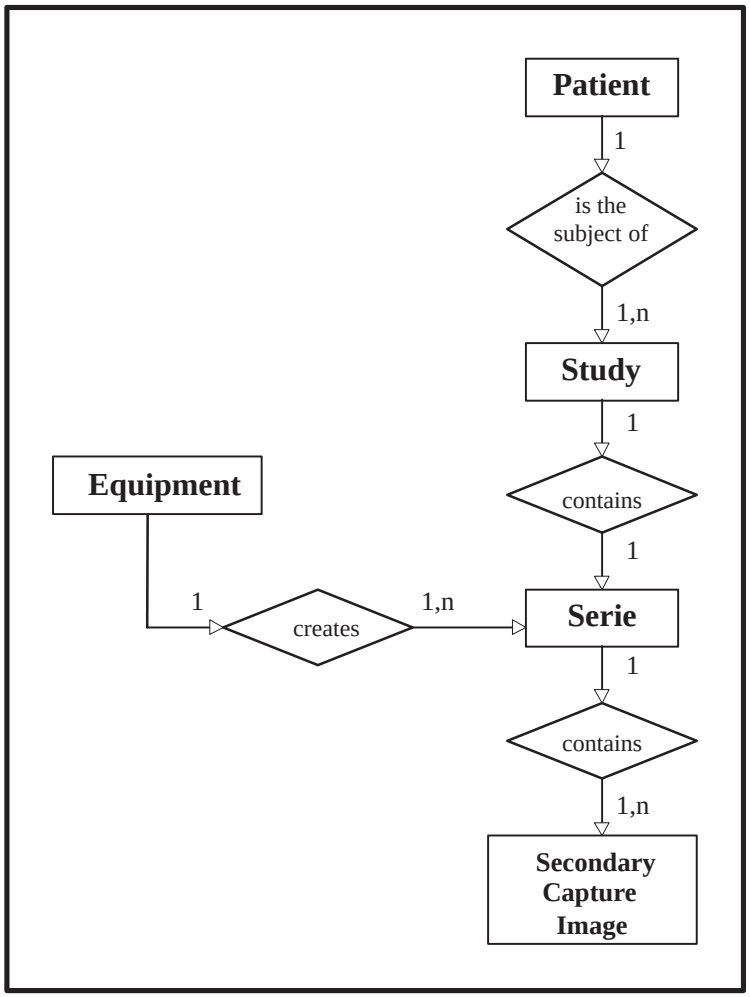
The secondary capture object used in SenoVision will host image information as well as non–image information (puncture information, trace information). Thus we define only one object structure for all these kinds of information.

3–1 SC IMAGE IOD IMPLEMENTATION

This section defines the implementation of SC image information object. It refers to the DICOM V3.0 Standard, Part 3 (Information Object definition).

3–2 SC IMAGE IOD ENTITY–RELATIONSHIP MODEL

ILLUSTRATION 1–3
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



The Entity–Relationship diagram for the SC Image interoperability schema is shown in Illustration 4–1. The following diagrammatic convention is established to represent the information organisation :

- each entity is represented by a rectanglar 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.

3–2–1 Entities Description

Refer to DICOM Standard Part 3 (Information Object Definitions) for a descripion of each of the entities contained within the Secondary Capture Image Information Object Definition.

3–2–2 SenoVision Mapping of DICOM entities

DICOM entities map to the SenoVision entities in respect to the following :

DICOM	SenoVision
Patient Entity	Patient Entity
Study Entity	Examination Entity
Serie Entity	no match, there is a one to one relationship between DICOM Study and Serie
Secondary Image Entity	Image Entity

3–3 SENOVISION SECONDARY CAPTURE OBJECT MODULE DEFINITIONS

The following tables define the modules composing our SenoVision DICOM objects. Tables format is the same as in DICOM NEMA standards, NEMA PS 3.3–1993, annex A and C. Some of the modules are standard mandatory DICOM SC modules. The other ones are private SenoVision modules, containing optionnal fields. We used as much as possible the existing fields in the standard modules to encode our own information, in order to limit the number of new tags.

Field types are coded in the following way :

– 1 means that the field is mandatory and must be filled.

– 2 means that the field is mandatory but can be empty.

– 3 means that the field is optionnal.

– A ”C” letter joined to the type code means that the information of the field is sent only if it satisfies to a particular condition, usually the presence of an other field or a constraint on the information of an other field.

Tag values are the usual ones for DICOM standard modules. For private modules, we will use the following group number : 45 .**This group number is characteristic of the mammography modality**. Private fields are grouped and re–displayed at the end of this document in a private data dictionnary, for implementation purposes.

We summarize in the following table our modules classification (M mandatory, U user Option) :

Table 1: SenoVision DICOM modules

IE	Module	Reference	Status	Usage
Patient	Patient	3–4–1	Standard DICOM	M
Study	General Study	3–4–2	Standard DICOM	M
Study	Patient Study	3–4–3	Standard DICOM	U
Series	General Series	3–4–4	Standard DICOM	M

Equipment	General Equipment	3–4–5	Standard DICOM	U
Equipment	SC Equipment	3–4–6	Standard DICOM	M
Image	General Image	3–4–7	Standard DICOM	M
Image	Image Pixel	3–4–8	Standard DICOM	M
Image	SC Image	3–4–9	Standard DICOM	M
Image	SOP Common	3–4–10	Standard DICOM	M
Image	X–Ray/System	3–4–11	Private Senovision	U
Image	IDS/Image	3–4–12	Private Senovision	U
Image	Medical	3–4–13	Private Senovision	U
Image	Measures	3–4–14	Private Senovision	U
Image	Application	3–4–15	Private Senovision	U
Image	Stereotaxy	3–4–16	Private Senovision	U
Image	Vignette	3–4–17	Private Senovision	U

3–4 MODULE LIBRARY

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

Modules contain also **type 3 Private elements**.

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

N.B. : enumerated values of private fields of CS type are detailed in the private data dictionnary at the end of this document, as well as physical units for fields which require to be detailed.

3–4–1 Patient Module

Table 2: Patient Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient’s Name	(0010,0010)	2	Patient’s full legal name. Includes the Patient’s first name.
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient.
Patient’s Birth Date	(0010,0030)	2	Birth date of the patient.
Patient’s Sex	(0010,0040)	2	Sex of the named patient.
Patient Comments	(0010,4000)	3	User–defined additional information about the patient.

3–4–2 General Study Module

Table 3 contains attributes relating to the General Study Module (DICOM Part 3, Section C.7.2.1).

Table 3: General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the study.
Study Date	(0008,0020)	2	Date the Study started.
Study Time	(0008,0030)	2	Time the Study started.
Referring Physician's Name	(0008,0090)	2	Patient's referring physician.
Study ID	(0020,0010)	2	Set to "No Value, Zero Length"
Accession Number	(0008,0050)	2	Set to "No Value, Zero Length"
Study Description	(0008,1030)	3	Set to "No Value, Zero Length"

3–4–3 Patient Study Module

Table 4: Patient Study Module Attributes

Patient's Age	(0010,1010)	3	Set to "No Value, Zero Length"

3–4–4 Series Module

Table 5: Serie Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this serie. In the case of SenoVision, "OT" will be the value of this field.
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.
Series Number	(0020,0011)	2	A number that identifies this Series.
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined. Required if the body part examined is a paired structure. Enumerated Values : R=right, L=left. This field is present in SenoVision but remains empty : The laterality field is at the image level (Medical Module), since the two breasts can be in the same exam.

Series Date	(0008,0021)	3	Date the series started
Series Time	(0008,0031)	3	Time the series started
Name of Physician(s) Performing Study	(0008,1050)	3	Physician(s) performing the Study.
Digital Senograph configuration	(0045,yy01)	3	Type of mammo exam (Stereotactic, Digital Spot or Full Field) (type of material configuration)
User Series description	(0008,103E)	3	Exam Description
Operator name	(0008,1070)	3	Name of the operator who performed the exam.

3–4–5 General Equipment Module

Table 6 contains attributes relating to the General Equipment Module (DICOM Part 3, Section C.7.5.1). This module is optional to retain compatibility with versions of the SenoVision objects, but its inclusion is strongly encouraged.

Table 6: General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the IOD. ”GE MEDICAL SYSTEMS” will be the value of this field.
Institution Name	(0008,0080)	3	Institution where the equipment is located that produced the IOD instance.
Institution Address	(0008,0081)	3	Set to ”No Value, Zero Length”
Institutional Department Name	(0008,1040)	3	Set to ”No Value, Zero Length”
Manufacturer’s Model Name	(0008,1090)	3	Manufacturers model number of the equipment that produced the IOD instance. ”SENO 2” will be the value of this field.
Device Serial Number	(0018,1000)	3	Set to ”No Value, Zero Length”
Software Versions	(0018,1020)	3	Set to ”No Value, Zero Length”

3–4–6 SC Equipment Module

See (DICOM Part 3, Section C.8.6.1)

Table 7: SC Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Conversion type	(0008,0064)	1	Describes the kind of image conversion. Defined Terms are : DI = Digital Interface

3−4−7 General Image Module

Nota : This module contains fields which handle the image pairing (0008, 1140), (0008, 1150), (0008, 1155). These field are pointers on other SC images (identified by SOP Class/Instance UIDs), and they will refer on the other image of a pair in our application.

Pairing will use cross–referencing, i.e. each image will point on its corresponding pair. In that way, pairing management will use standard DataBase services to retrieve pairs.

Table 8: General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image number	(0020,0013)	2	A number that identifies this image
Patient Orientation	(0020,0020)	2C	Set to ”No value, Zero length”
Image type	(0008,0008)	3	Image identification characteristics. See DICOM NEMA standards, PS 3.3, C.7.6.1.1.2 for defined terms and further explanation
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started.
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started.

3−4−8 Image Pixel Module

Table 9: Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per pixel	(0028,0002)	1	Number of samples (planes) in this image. Value = 1.
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. Values = MONOCHROME1, MONOCHROME2.
Rows	(0028,0010)	1	Number of rows in the image. Handles at least 2048.

Columns	(0028,0011)	1	Number of columns in the image. Handles at least 2048
Bits allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Value = 16.
Bits stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits allocated. Value = 12.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. Value = 11
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated values : 0000H = unsigned integer 0001H = 2's complement
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples which comprise the Image. Pixels are square.

3–4–9 SC Image Module

Table 10: SC Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	The date the Secondary Capture Image was captured.
Time of Secondary Capture	(0018,1014)	3	The time the Secondary Capture Image was captured.

3–4–10 SOP common module

Table 11: SOP common module attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class

SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance.
Specific Character Set	(0008,0005)	1C	Character set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used (other alphabets). See DICOM NEMA standards PS 3.3, C.12.1.1.2 for defined terms. In case of Senovision, ISO–IR–100 is supported.

3–4–11 X–Ray/System Module

Table 12: X–Ray/System Module Attributes

Attribute Name	Tag	Type	Attribute Description
Exposure Time	(0018,1150)	3	Duration of the exposure
Grid Presence	(0018,1166)	3	Indicates the use (or non–use) of an anti–scatter grid: IN or NONE
kV	(0018,0060)	3	kV at the poles of the generator during acquisition
mAs	(0018,1151)	3	intensity in the generator during acquisition
Track	(0045,yy03)	3	Metal track of the anod : MO or RH
Filter	(0018,1160)	3	Filter of the X–Ray beam : MO, RH or AL.
Spot	(0018,1190)	3	Size of the focus
Exposition Mode	(0045,yy04)	3	Mode of exposition : MANUAL, AES_DENSE, AES_ADIPOSE, AES_MEAN.
Exposure Status	(0045,yy05)	3	Normal or aborted.
Angulation	(0045,yy06)	3	1 for 0 2 for –15 degre 3 for +15 degre
SID	(0018,1110)	3	Source to Image Distance in cms
Thickness	(0045,yy07)	3	Compression thickness
Force	(0045,yy08)	3	Compression force
Real Magnification Factor	(0045,yy09)	3	Real Magnification factor of the DMR

Displayed Magnification Factor	(0045,yy0A)	3	Displayed Magnification factor of the DMR
SenoGraph Type	(0045,yy0B)	3	Type of SenoGraph used (DMR, people, ...)

3−4−12 IDS/Image Module

Table 13: IDS/Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Integration Time	(0045,yy0C)	3	Duration of the integration
ROI IDS	(0045,yy0D)	3	Origin of the image (x1, y1)
Correction type	(0045,yy0E)	3	Offset & Flat–field, etc.
Acquisition Type	(0045,yy0F)	3	X, Flat–field or offset
CCD temperature	(0045,yy10)	3	Temperature of the CCD during the acquisition
Receptor_cms	(0045,yy11)	3	Size of the CCD (width and height)
Receptor_pix	(0045,yy12)	3	Size of the CCD (width and height in pixels)
Pixel pitch	(0045,yy14)	3	Pixel size of the CCD
Binning factor	(0045,yy16)	3	Binning factor between the CCD image and the output image.
IDS data buffer	(0045,yy1A)	3	A binary buffer of data containing IDS parameters supplied by the IDS vendor, and which are not interpreted at DICOM level.

3−4−13 Medical Module

Table 14: Medical Module Attributes

Attribute Name	Tag	Type	Attribute Description
Clinical View	(0045,yy1B)	3	Clinical view of the patient (CC, Lateral, ...)
Breast Laterality	(0045,yy1C)	3	Right or Left
Contact or Magnification	(0045,yy17)	3	

3−4−14 Measures Module

Table 15: Measures Module Attributes

Attribute Name	Tag	Type	Attribute Description
Mean of raw image	(0045,yy1D)	3	Mean value of the raw image grey levels
Mean of corrected image	(0045,yy1F)	3	Mean value of the corrected image grey levels
Estimated Anat_mean	(0045,yy20)	3	Mean value of the gray levels on the anatomical regions of the image (selected on histogram)
Standard deviation of raw image	(0045,yy22)	3	Standard deviation of the raw image grey levels
Standard deviation of corrected image	(0045,yy23)	3	Standard deviation of the raw image grey levels
Estimated Anat_std	(0045,yy24)	3	Standard deviation of the gray levels on the anatomical regions of the image (selected on histogram)
Estimated Anat_std_ln	(0045,yy25)	3	Standard deviation of the natural logarithm of the gray levels on the anatomical regions of the image (selected on histogram)
MAO buffer	(0045,yy26)	3	A binary buffer of data containing the manual user annotations, and which are not interpreted at DICOM level (used to archive user annotations).

3−4−15 Application Module

Table 16: Application Module Attributes

Attribute Name	Tag	Type	Attribute Description
SET Number	(0045,yy27)	3	SET number of the image
Windowing type	(0045,yy28)	3	Linear, gamma, etc.
Windowing parameters (*)	(0045,yy29)	3	WW/WL if relevant, any other parameters which define the windowing if not.
Zoom Factor	(0028,0031)	3	The amount of magnification applied to each pixel in the image.

2DLocX	(0045,yy2A)	3	X coordinates of the cross–hair cursor.
2DLocY	(0045,yy2B)	3	Y coordinates of the cross–hair cursor.

(*) This field can be changed dynamically, i.e. its values can be changed right in the original image, which will remain as the same instance (same UID) but with new values. We allowed this because we do not want to create a new image for each modification of the windowing that we want to store.
We included the standard fields for Window width and level, though it is redundant with the private ones, to be able to display contrast values on other equipments.

3−4−16 Stereotaxy Module

Table 17: Stereotaxy Module Attributes

Attribute Name	Tag	Type	Attribute Description
Ref_A_3D_X	(0045,yy2C)	3	Reference Landmark A X coordinate in 3D coordinates.
Ref_A_3D_Y	(0045,yy2D)	3	Reference Landmark A Y coordinate in 3D coordinates.
Ref_A_3D_Z	(0045,yy2E)	3	Reference Landmark A Z coordinate in 3D coordinates.
Ref_A_Marker_X	(0045,yy2F)	3	Reference Landmark A X coordinate in image coordinates.
Ref_A_Marker_Y	(0045,yy30)	3	Reference Landmark A Y coordinate in image coordinates.
Ref_B_3D_X	(0045,yy31)	3	Reference Landmark B X coordinate in 3D coordinates.
Ref_B_3D_Y	(0045,yy32)	3	Reference Landmark B Y coordinate in 3D coordinates.
Ref_B_3D_Z	(0045,yy33)	3	Reference Landmark B Z coordinate in 3D coordinates.
Ref_B_Marker_X	(0045,yy34)	3	Reference Landmark B X coordinate in image coordinates.
Ref_B_Marker_Y	(0045,yy35)	3	Reference Landmark B Y coordinate in image coordinates.
X–Ray Source x location	(0045,yy36)	3	x coordinate of the X–Ray focus.
X–Ray Source y location	(0045,yy37)	3	y coordinate of the X–Ray focus.
X–Ray Source z location	(0045,yy38)	3	z coordinate of the X–Ray focus.

3−4−17 Vignette Module

Table 18: Vignette Module Attributes

Attribute Name	Tag	Type	Attribute Description
Vig_Rows	(0045,yy39)	3	Vignette Rows. Handles at least 64.
Vig_Columns	(0045,yy3A)	3	Vignette Columns. Handles at least 64.
Vig_BitsAllocated	(0045,yy3B)	3	Number of bits allocated in a pixel of the Vignette. See Image Pixel Module.
Vig_BitsStored	(0045,yy3C)	3	Number of bits stored in a pixel of the Vignette. See Image Pixel Module.
Vig_HighBit	(0045,yy3D)	3	Most significant bit value for a pixel of the Vignette. See Image Pixel Module.
Vig_PixelRep	(0045,yy3E)	3	Data representation of the pixels of the Vignette. See Image Pixel Module.
Vig_PixelData	(0045,yy3F)	3	A data stream of pixel samples which comprise the Vignette.

3–5 PRIVATE DATA DICTIONARY FOR SECONDARY CAPTURE

Attribute Name	Data Element Tag	Type	Attribute Description	VR	VM	Unit
Private Creator PRIVATE_01	**(00**45**,00**yy**)**			**LO**	**1**	
Digital Senograph configuration	(0045,yy01)	3	Type of mammo exam (STEREOTACTIC, DIGITAL_SPOT or FULL_FIELD) (type of material configuration)	LO	1	NO
System series description	(0045,yy02)	3		LT	1	NO
Track	(0045,yy03)	3	Metal track of the anod : MO, RH, ..	CS	1	NO
Exposition Mode	(0045,yy04)	3	Mode of exposition : MANUAL, AES_DENSE, AES_MEAN, AES_ADIPOSE.	CS	1	NO
Exposure Status	(0045,yy05)	3	NORMAL or ABORTED.	CS	1	NO
Angulation	(0045,yy06)	3	1 for 0, 2 for –15°, 3 for + 15°	DS	1	degrees
Thickness	(0045,yy07)	3	Compression thickness	DS	1	mm
Force	(0045,yy08)	3	Compression force	DS	1	kgf
Real Magnification Factor	(0045,yy09)	3	Real Magnification factor of the DMR	DS	1	NO
Displayed Magnification Factor	(0045,yy0A)	3	Displayed Magnification factor of the DMR	DS	1	NO
SenoGraph Type	(0045,yy0B)	3	Type of SenoGraph used (DMR, PEOPLE)	CS	1	NO
Integration Time	(0045,yy0C)	3	Duration of the integration	DS	1	ms
ROI IDS	(0045,yy0D)	3	Origin of the image (x1, y1)	DS	2	NO

Correction type	(0045,yy0E)	3	OFFSET or FLAT–FIELD	CS	3	NO
Acquisition Type	(0045,yy0F)	3	X, FLAT–FIELD or OFFSET	CS	1	NO
CCD temperature	(0045,yy10)	3	Temperature of the CCD during the acquisition	DS	1	○C
Receptor_cms	(0045,yy11)	3	Size of the CCD (width and height)	DS	2	mm
Receptor_pix	(0045,yy12)	3	Size of the CCD (width and height in pixels)	IS	2	NO
Screen	(0045,yy13)	3	Type of scintillator used in the IDS	ST	1	NO
Pixel pitch	(0045,yy14)	3	Pixel size of the CCD	DS	1	µ
Pixel Depth	(0045,yy15)	3	Pixel depth of the CCD (in number of bits)	IS	1	NO
Binning factor	(0045,yy16)	3	Binning factor between the CCD image and the output image.	IS	1	NO
Quantum Gain	(0045,yy17)	3	Theoretical gain of the IDS	DS	1	NO
Electron/EDU Ratio	(0045,yy18)	3	Conversion factor electron / EDU at IDS gain = 1	DS	1	NO
Electronic Gain	(0045,yy19)	3	Electronic gain of the IDS	DS	1	NO
IDS data buffer	(0045,yy1A)	3	A binary buffer of data containing IDS parameters supplied by the IDS vendor, and which are not interpreted at DICOM level.	OB	1	NO
Clinical View	(0045,yy1B)	3	Incidence of X–Rays (CC, LATERAL, ..)	CS	1	NO
Breast Laterality	(0045,yy1C)	3	RIGHT or LEFT	CS	1	NO
Mean of raw image	(0045,yy1D)	3	Mean value of the raw image grey levels	DS	1	NO

Mean of offset image	(0045,yy1E)	3	Mean value of the offset image grey levels	DS	1	NO
Mean of corrected image	(0045,yy1F)	3	Mean value of the corrected image grey levels	DS	1	NO
Estimated Anat_mean	(0045,yy20)	3	Mean value of the gray levels on the anatomical regions of the image (selected on histogram)	DS	1	NO
Estimated Anat_mean_ln	(0045,yy21)	3	Mean value of the natural logarithm of the gray levels on the anatomical regions of the image (selected on histogram)	DS	1	NO
Standard deviation of raw image	(0045,yy22)	3	Standard deviation of the raw image grey levels	DS	1	NO
Standard deviation of corrected image	(0045,yy23)	3	Standard deviation of the raw image grey levels	DS	1	NO
Estimated Anat_std	(0045,yy24)	3	Standard deviation of the gray levels on the anatomical regions of the image (selected on histogram)	DS	1	NO
Estimated Anat_std_ln	(0045,yy25)	3	Standard deviation of the natural logarithm of the gray levels on the anatomical regions of the image (selected on histogram)	DS	1	NO
MAO buffer	(0045,yy26)	3	A binary buffer of data containing the manual user annotations, and which are not interpreted at DICOM level (used to archive user annotations).	OB	1	NO
SET Number	(0045,yy27)	3	SET number of the image	IS	1	NO

Windowing type	(0045,yy28)	3	LINEAR or GAMMA.	CS	1	NO
Windowing parameters	(0045,yy29)	3	WW/WL if relevant, any other parameters which define the windowing if not.	DS	3	NO
2DLocX	(0045,yy2A)	3	X coordinates of the cross–hair cursor.	IS	1	NO
2DLocY	(0045,yy2B)	3	Y coordinates of the cross–hair cursor.	IS	1	NO
Ref_A_3D_X	(0045,yy2C)	3	Reference Landmark A X coordinate in 3D coordinates.	DS	1	mm
Ref_A_3D_Y	(0045,yy2D)	3	Reference Landmark A Y coordinate in 3D coordinates.	DS	1	mm
Ref_A_3D_Z	(0045,yy2E)	3	Reference Landmark A Z coordinate in 3D coordinates.	DS	1	mm
Ref_A_Marker_X	(0045,yy2F)	3	Reference Landmark A X coordinate in image coordinates.	IS	1	NO
Ref_A_Marker_Y	(0045,yy30)	3	Reference Landmark A Y coordinate in image coordinates.	IS	1	NO
Ref_B_3D_X	(0045,yy31)	3	Reference Landmark B X coordinate in 3D coordinates.	DS	1	mm
Ref_B_3D_Y	(0045,yy32)	3	Reference Landmark B Y coordinate in 3D coordinates.	DS	1	mm
Ref_B_3D_Z	(0045,yy33)	3	Reference Landmark B Z coordinate in 3D coordinates.	DS	1	mm
Ref_B_Marker_X	(0045,yy34)	3	Reference Landmark B X coordinate in image coordinates.	IS	1	NO
Ref_B_Marker_Y	(0045,yy35)	3	Reference Landmark B Y coordinate in image coordinates.	IS	1	NO
X–Ray Source x location	(0045,yy36)	3	x coordinate of the X–Ray focus.	DS	1	mm

X–Ray Source y location	(0045,yy37)	3	y coordinate of the X–Ray focus.	DS	1	mm
X–Ray Source z location	(0045,yy38)	3	z coordinate of the X–Ray focus.	DS	1	mm
Vig_Rows	(0045,yy39)	3	Vignette Rows. Handles at least 64.	US	1	NO
Vig_Columns	(0045,yy3A)	3	Vignette Columns. Handles at least 64.	US	1	NO
Vig_BitsAllocated	(0045,yy3B)	3	Number of bits allocated in a pixel of the Vignette. See Image Pixel Module.	US	1	NO
Vig_BitsStored	(0045,yy3C)	3	Number of bits stored in a pixel of the Vignette. See Image Pixel Module.	US	1	NO
Vig_HighBit	(0045,yy3D)	3	Most significant bit value for a pixel of the Vignette. See Image Pixel Module.	US	1	NO
Vig_PixelRep	(0045,yy3E)	3	Data representation of the pixels of the Vignette. See Image Pixel Module.	US	1	NO
Vig_PixelData	(0045,yy3F)	3	A data stream of pixel samples which comprise the Vignette.	OB	1	NO

Attribute name	Data Element Tag	Value
Private Creator PRIVATE_01	0045,00yy	GEMS_SENOVISION_PRIVATE_01