GE Medical Systems

Technical Publications

2389238-100

Revision 5

Stenosis Analysis 1.6 and Left Ventricle Analysis 1.6 (Cardiac X-Ray Analysis Applications) Conformance Statement

do not duplicate

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Aug, 2003	External Evaluation version (Cardiac X-Ray Applications 1.0)
1	Oct 2003	Pilot version (Cardiac X-Ray Applications 1.0)
2	May 2004	Final version (Cardiac X-Ray Applications 1.0)
3	Mar 2005	Pilot version for (Cardiac X-Ray Applications 1.2)
4	Jul 2007	Post-M4 version (Cardiac X-Ray Applications 1.3)
5	Mar 2009	Post-M4 version (Cardiac X-Ray Applications 1.6)

SECTION 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, *Secondary Capture Information Object Implementation,* which defines the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture information object.

SECTION 4, *X-Ray Image Information Object Requirements,* which defines the requirements for X-Ray Images used as input to Cardiac X-Ray Analysis Applications.

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 ILLUSTRATION **-1**.

This document specifies the DICOM v3.0 implementation for the Cardiac X-Ray Analysis Applications application. It forms part of the following document set:

Left Ventricle Analysis 1.6
Stenosis Analysis 1.6
Conformance Statement
Direction .....# 2389238-100.

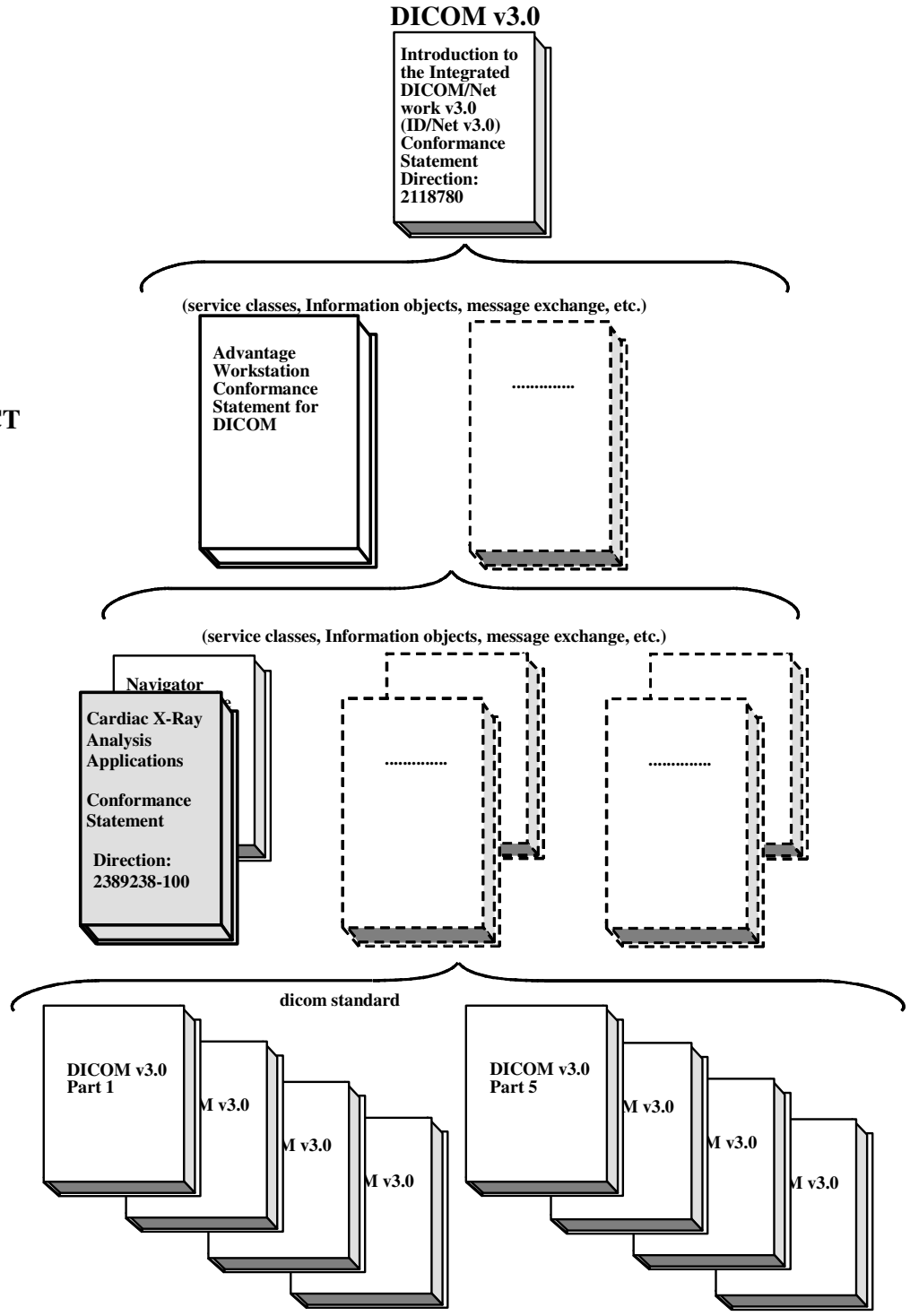
This DICOM Conformance Statement documents the DICOM compatibility of the Cardiac X-Ray Analysis Applications application, which is not already provided by the base platform application, Advantage Workstation. The DICOM compatibility of this base application is in turn described in the document:

ADVANTAGE WORKSTATION Conformance Statement for DICOM

Refer to the Conformance Statement corresponding to the version of Advantage Workstation on which Cardiac X-Ray Applications are running

Those sections of the Cardiac X-Ray Analysis Applications Conformance Statement, which have been modified with respect to the Workstation Conformance Statement, are included in the current document. The reader should refer to the Advantage Workstation Conformance Statement for all sections not found in the current document.

ILLUSTRATION **-1**
DOCUMENTATION STRUCTURE



The above DICOM Conformance Statements document the DICOM Conformance Statement and Technical Specification required to interoperate with the GEMS DICOM v3.0 network interface. Introductory information, which is applicable to all GEMS DICOM v3.0 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 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 Standards and with the terminology and concepts, which are used in those Standards.

If readers are unfamiliar with DICOM terminology they should first refer to the document listed below, then read the DICOM Standard itself, prior to reading this 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*, and the *Advantage Workstation Conformance Statement (*Refer to the Conformance Statement corresponding to the version of Advantage Workstation on which Cardiac X-Ray Applications are running*)* 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. The GEMS Conformance Statements are available to the public.

The reader of this Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions.

Included in this 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 retransmit 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 and radiotherapy 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 or therapy data once it has crossed the interface between the GE imaging or radiotherapy equipment and the non–GE device and the stability of the image or radiotherapy data for the intended applications.

  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images and radiotherapy data acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images and radiotherapy data 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 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. Failures to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** – It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging or radiotherapy equipment performance and/or function.

1.6 References

A list of references which is applicable to all DICOM v3.0 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 PS3.3-2003. (Information Object Definitions).

1.7 Definitions

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

A set of definitions, which is applicable to radiotherapy, is included in DICOM PS3.3-2003 (Information Object Definitions).

1.8 Symbols and Abbreviations

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

A set of symbols and abbreviations, which is applicable to radiotherapy, is available in CEI/IEC 1217: 1996 (Radiotherapy equipment – Coordinates, movements and scales).

SECTION 2 NETWORK CONFORMANCE STATEMENT

2.1 Introduction

This section of the conformance statement (CS) specifies the Cardiac X-Ray Analysis Applications compliance to DICOM Media Interchange.

Cardiac X-Ray Analysis Applications are analysis and measurement tools that are installed on the same hardware platform as the base application, Advantage Workstation (Refer to the Conformance Statement corresponding to the version of Advantage Workstation on which Cardiac X-Ray Applications are running.). This base application is a Networked Medical Imaging Console dedicated to Examination Review and Diagnosis. The workstation uses DICOM services to import acquisition images for possible further analysis or processing, and to export images ~~and radiotherapy data~~ to other vendors. ~~Additionally, radiotherapy data may be imported for further processing by Advantage Workstation or Cardiac X-Ray Analysis Applications.~~

Cardiac X-Ray Analysis Applications do not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE. For some detailed information on DICOM features of Advantage Window, refer to the respective Conformance Statement - ***Advantage Workstation*** *Conformance Statement for DICOM (Refer to the Conformance Statement corresponding to the version of Advantage Workstation on which Cardiac X-Ray Applications* are *running).*

The application parses the following DICOM objects:

SOP Class Name	**SOP Class UID**
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1

The application creates the following DICOM objects:

SOP Class Name	**SOP Class UID**
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

2.2 Implementation model

2.2.1 Application Data Flow Diagram

Refer to the respective Conformance Statement - ***Advantage Workstation*** *Conformance Statement for DICOM on which Cardiac X-Ray Applications are running.*

2.2.2 Presentation Context Table

Refer to the respective Conformance Statement - ***Advantage Workstation*** *Conformance Statement for DICOM on which Cardiac X-Ray Applications are running.*

2.2.3 Real-World Activities

The user should select X-Ray image with XA modality, then start application from AW Viewer application. Do quantification, then user action needs to indicate saving SC. After user request the Secondary Capture is created and saved into Advantage Windows database.

The **goal of this document** is to give a detailed description of:

- the X-Ray IMAGE DICOM IOD
- the SC IMAGE written by the application

~~Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.~~

2.2.4 SOP Instance UID, Series UID

Implementation UID assigned to Cardiac X-Ray Applications is: **1.2.840.113619.6.xxx**

(Left Ventricle Analysis **148** and Stenosis Analysis **147)**

An UID generated by a product has 2 parts : <root>.<suffix>.

For a GE product root is 1.2.840.113619 where

- 1 identifies ISO
- 2 identifies the ISO member body branch
- 840 identifies the country code
- 113619 identifies GEMS as a specific organization.

For a ~~Study,~~ Series, Instances created in GE suffix is 2.Imp.id
where

- Imp identifies a specific implementation and is registered by GCC
- id is an number or a substring (i.j or i.j.l...) defined by the implementation. In our implementation it means get UID from Advantage Windows (Conformance Statement - ***Advantage Workstation*** *Conformance Statement for DICOM.)*

So Cardiac X-Ray Applications will generate UIDs for instances that looks like : **1.2.840.113619.2.xxx.id**

SECTION 3 SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

3.1 Introduction

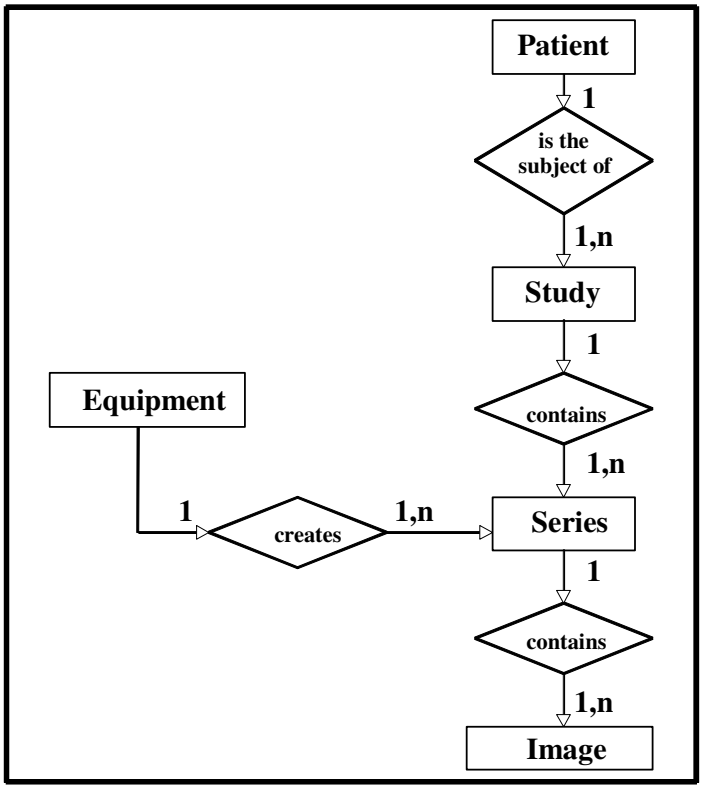
This section specifies the use of the DICOM Secondary Capture Image IOD to represent the information included in Secondary Capture images produced by this implementation. Corresponding attributes are conveyed using the module construct.

Note that the implementation described in this section relates to generation of SC Images by the Cardiac X-Ray Analysis Applications product only. The application does not display SC Images directly, but relies on the Advantage Workstation product for this function. SC Image conformance for Advantage Workstation is described in a related document entitled ***Advantage Workstation*** *Conformance Statement for DICOM.*

3.2 SC Image IOD Implementation

This section defines the implementation of the SC Image information object in the Cardiac X-Ray Analysis Applications application. It refers to the DICOM Standard, Part 3 (Information Object Definition).SC Image IOD Entity-Relationship Model

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



The Entity-Relationship diagram for the SC Image interoperability schema is shown in **ILLUSTRATION** -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. See DICOM Part 3 Section 5.1.2 for an explanation of the entity-relationship notation.

3.2.1 Entities Description

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

3.2.2 Cardiac X-Ray Analysis Applications Mapping of DICOM entities

DICOM entities map to the Cardiac X-Ray Analysis Applications entities in the following manner:

DICOM	Cardiac X-Ray Analysis Applications
Patient Entity	Patient Entity (Advantage Workstation)
Study Entity	Examination Entity (Advantage Workstation)
Series Entity	Series Entity (Advantage Workstation)
Equipment Entity	Workstation on which Cardiac X-Ray Analysis Applications application is running
Image Entity	Screen save of any Cardiac X-Ray Analysis Applications image (generated from within application using Cardiac X-Ray Analysis Applications menu option in main panel). Cardiac X-Ray Analysis Applications does not directly display SC Images.

3.3 SC Image IOD Module Table

Within an entity of the DICOM SC Image Information Object Definition, 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 -1 identifies the defined modules within the entities, which comprise the DICOM SC Image Information Object Definition. Modules are identified by Module Name.

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

TABLE -1
SC Image Information Object Definition (IOD) Module Table

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	3.4.1.1
Study	General Study	M	3.4.2.1
	Patient Study	U	3.4.2.2
Series	General Series	M	3.4.3.1
Equipment	General Equipment	U	3.4.4.1
	SC Equipment	M	3.4.4.2
Image	General Image	M	3.4.5.1
	Image Pixel	M	3.4.5.2
	SC Image	M	3.4.5.3
	VOI LUT	U	3.4.5.4
	SOP Common	M	3.4.5.5

3.4 SC Information Module Definitions

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

3.4.1 Patient Entity Modules

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.

3.4.1.1 Patient Module

Attribute Name	Element Tag	TP	Notes
Patient's Name	(0010,0010)	2	Derived from original image
Patient ID	(0010,0020)	2	Derived from original image
Patient's Birth Date	(0010,0030)	2	Derived from original image
Patient's Sex	(0010,0040)	2	Derived from original image

3.4.2 Study Entity Modules

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

3.4.2.1 General Study

Attribute Name	Element Tag	TP	Notes
Study Instance UID	(0020,000D)	1	Derived from original image
Study Date	(0008,0020)	2	Derived from original image
Study Time	(0008,0030)	2	Derived from original image
Referring Physicians' Name	(0008,0090)	2	Derived from original image
Accession number	(0008,0050)	2	Derived from original image
Study ID	(0020,0010)	2	Derived from original image
Study Description	(0008,1030)	3	Derived from original image
Name of Physician(s) Reading Study	(0008,1060)	3	Derived from original image

3.4.2.2 Patient Study

Attribute Name	Element Tag	TP	Notes
Patient Age	(0010,1010)	3	Derived from original image
Patient's Size	(0010,1020)	3	Derived from original image, or new value is saved if any entered
Patient's Weight	(0010,1030)	3	Derived from original image, or or new value is saved if any entered

3.4.3 Series Entity Modules

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

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

3.4.3.1 General Series

Attribute Name	Element Tag	TP	Notes
Modality	(0008,0060)	1	'XA'
Series Instance UID	(0020,000E)	1	If there already is a DICOM series that contains SC image results for a given series use it, otherwise generate a new UID with AW's UID generator (see how it works: 2.2.4). This ensures SC images generated based on DICOM objects part of the same series will be placed in the same SC series.
Series Number	(0020,0011)	2	Generated according to AW specification based on original Series Number
Series Date	(0008,0021)	3	Filled with actual (system) date in the following format: yyyymmdd
Series Time	(0008,0031)	3	Filled with actual (system) time in the following format: hhmmss.000000
Series Description	(0008,103E)	3	'X-Ray Analysis'
Performing Physicians' Name	(0008,1050)	3	Derived from original image
Operator's Name	(0008,1070)	3	Name of the current user logged on the station
Protocol Name	(0018,1030)	3	Derived from original image

3.4.4 Equipment Entity Modules

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

3.4.4.1 General Equipment

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

Attribute Name	Element Tag	TP	Notes
Manufacturer	(0008,0070)	2	'GE MEDICAL SYSTEMS'
Institution Name	(0008,0080)	3	Derived from original image
Institution Address	(0008,0081)	3	Derived from original image
Device Serial Number	(0018,1000)	3	Host id of the workstation
Station Name	(0008,1010)	3	Hostname of the workstation
Software Versions	(0018,1020)	3	Current version of Cardiac X-Ray Analysis Applications
Manufacturer's Model Name	(0008,1090)	3	'Left Ventricle Analysis' or 'Stenosis Analysis'

3.4.4.2 SC Equipment

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

Attribute Name	Element Tag	TP	Notes
Conversion Type	(0008,0064)	1	'WSD'
Modality	(0008,0060)	3	'XA'
Secondary Capture Device ID	(0018,1010)	3	Host id of the workstation
Secondary Capture Device Manufacturer	(0018,1016)	3	'GE MEDICAL SYSTEMS'
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	'Left Ventricle Analysis' or 'Stenosis Analysis'
Secondary Capture Device Software Version	(0018,1019)	3	Current version of Cardiac X-Ray Analysis Applications

3.4.5 Image Entity Modules

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

3.4.5.1 General Image

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

Attribute Name	Element Tag	TP	Notes
Image (Instance) Number	(0020,0013)	2	Generated according to AW spec – Unique image number in series
Patient Orientation	(0020,0020)	2C	Derived from original image
Image (Content) Date	(0008,0023)	2C	Filled with actual (system) date in the following format: yyyymmdd
Image (Content) Time	(0008,0033)	2C	Filled with actual (system) time in the following format: hhmmss.000000
Image Type	(0008,0008)	3	'DERIVED\SECONDARY\SINGLE PLANE' or 'DERIVED\SECONDARY\BIPLANE A' or 'DERIVED\SECONDARY\BIPLANE B' (Value 4 not supplied)
Acquisition Date	(0008,0022)	3	Derived from original image
Acquisition Time	(0008,0032)	3	Derived from original image
Source Image Sequence	(0008,2112)	3	A Sequence that identifies the set of Image SOP Class/Instance pairs of the Images that were used to derive this Image. 1 Item is included.
>Referenced SOP Class UID	(0008,1150)	1C	Derived from original image
>Referenced SOP Instance UID	(0008,1155)	1C	Derived from original image
Image Comments	(0020,4000)	3	'LV Analysis Report' or 'SA Analysis Report'
Burned In Annotation	(0028,0301)	3	'YES'

3.4.5.2 Image Pixel

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

Attribute Name	Element Tag	TP	Notes
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'
Rows	(0028,0010)	1	1024 (full-screen image)
Columns	(0028,0011)	1	1024 (full-screen image)
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0000H
Pixel Data	(7FE0,0010)	1	Overlay data in Cardiac X-Ray Analysis Applications image display are converted into monochrome, 'burned in' to the image (i.e. obscure the image pixels) and transmitted as part of Pixel Data

3.4.5.3 SC Image

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

Attribute Name	Element Tag	TP	Notes
Date of Secondary Capture	(0018,1012)	3	Filled with actual (system) date in the following format: yyyymmdd
Time of Secondary Capture	(0018,1014)	3	Filled with actual (system) time in the following format: hhmmss.000000

3.4.5.4 VOI LUT

The table in this Section contains IOD Attributes that describe in VOI LUT.

Attribute Name	Element Tag	TP	Notes
Window Center	(0028,1050)	3	"128"
Window Width	(0028,1051)	1C	"256"

3.4.5.5 SOP Common

The SOP Common Module is mandatory for all DICOM IODs.

This section defines the Attributes that 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.

Attribute Name	Element Tag	TP	Notes
SOP Class UID	(0008,0016)	1	'1.2.840.10008.5.1.4.1.1.7'
SOP Instance UID	(0008,0018)	1	See chapter 2.2.4 for further information
Specific Character Set	(0008,0005)	1C	'ISO_IR 100'
Instance Creation Date	(0008,0012)	3	Filled with actual (system) date in the following format: yyyymmdd
Instance Creation Time	(0008,0013)	3	Filled with actual (system) time in the following format: hhmmss.000000
Image (Instance) Number	(0020,0013)	2	Generated according to AW spec – Unique image number in series

3.5 SC-Private data dictionary

This section describes the private attributes of this IOD.

PRIVATE CREATOR IDENTIFICATION QCA_RESULTS

Attribute Name	Element Tag	VR	VM	Notes
Analysis Views	(0009,XX00)	CS	1	Enumerated type containing one of the following values: PRE, POST The value given by the user
Segment	(0009,XX10)	LO	1	ACC segment name.Defined terms: (3-6 a) The value given by the user
Pre Catheter Name	(0009,XX11)	LO	1	Name of pre-procedure catheter in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Saved if known
Pre Catheter Size	(0009,XX12)	DS	1	Size of pre-procedure catheter in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Saved if known
Pre Reference Diameter	(0009,XX13)	DS	1	Pre-procedure Reference Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Pre Minimum Lumen Diameter	(0009,XX14)	DS	1	Pre-procedure Minimum Lumen Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Pre Average Diameter	(0009,XX15)	DS	1	Pre-procedure Average Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Pre Stenosis Length	(0009,XX16)	DS	1	Pre-procedure Stenosis Length, in millimeters. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Pre Stenosis %	(0009,XX17)	IS	1	Pre-procedure Stenosis as a percentage. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Pre Geometric Area Reduction %	(0009,XX18)	IS	1	Pre-procedure Geometric Area Reduction as a percentage. Present if Analysis Views (0009, XX00) is "PRE" Given by the Stenosis algorithm
Post Catheter Name	(0009,XX21)	LO	1	Name of pre-procedure catheter in millimeters. Present if Analysis Views (0009, XX00) is "POST" Saved if known
Post Catheter Size	(0009,XX22)	DS	1	Size of post-procedure catheter in millimeters. Present if Analysis Views (0009, XX00) is "POST" Saved if known

Post Reference Diameter	(0009,XX23)	DS	1	Post-procedure Reference Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm
Post Minimum Lumen Diameter	(0009,XX24)	DS	1	Post-procedure Minimum Lumen Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm
Post Average Diameter	(0009,XX25)	DS	1	Post-procedure Average Diameter, in millimeters. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm
Post Stenosis Length	((0009,XX26)	DS	1	Post-procedure Stenosis Length, in millimeters. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm
Post Stenosis %	(0009,XX27)	IS	1	Post-procedure Stenosis as a percentage. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm
Post Geometric Area Reduction %	(0009,XX28)	IS	1	Post-procedure Geometric Area Reduction as a percentage. Present if Analysis Views (0009, XX00) is "POST" Given by the Stenosis algorithm

*(3-6 a) Defined terms:

"1st Diagonal Coronary Artery",
"1st Left Posterolateral Coronary Artery",
"1st Marginal Coronary Artery",
"1st Right Posterolateral",
"1st Septal Coronary Artery",
"2nd Diagonal Coronary Artery",
"2nd Left Posterolateral Coronary Artery",
"2nd Marginal Coronary Artery",
"2nd Right Posterolateral",
"3rd Diagonal",
"3rd Left Posterolateral Coronary Artery",
"3rd Marginal Coronary Artery",
"3rd Right Posterolateral",
"Acute Marginal",
"AV Groove Continuation Of Circumflex Artery",
"Distal Circumflex Coronary Artery",
"Distal Left Anterior Descending Coronary Artery",
"Distal Right Coronary Artery",
"Lateral 1st Diagonal Coronary Artery",
"Lateral 1st Marginal Coronary Artery",
"Lateral 2nd Diagonal Coronary Artery",
"Lateral 2nd Marginal Coronary Artery",
"Lateral 3rd Diagonal",
"Lateral 3rd Marginal Coronary Artery",
"Lateral Ramus",
"Left Main Coronary Artery",
"Left Main Coronary Artery Ostium",
"Left Posterior Descending Artery",
"Mid Circumflex Coronary Artery",
"Mid Left Anterior Descending Coronary Artery",
"Mid Right Coronary Artery",
"Posterior Descending Right Coronary Artery",
"Posterior Descending Septal Perforators",
"Proximal Circumflex Coronary Artery",
"Proximal Left Anterior Descending Coronary Artery",
"Proximal Right Coronary Artery",
"Ramus",
"Right Coronary Artery Ostium",
"Right Posterior AV",
"Left Anterior Descending Coronary Artery",
"Right Coronary Artery",
"Circumflex Coronary Artery",
"Abdominal Aorta",
"Anterior Communicating Artery",
"Anterior Spinal Artery",
"Aorta",
"Aortic Arch",
"Aortic Fistula",
"Artery (NOS)",
"Ascending Aorta",
"Axillary Artery",
"Baffle",
"Basilar Artery",
"Brachial Artery",
"Brachiocephalic Trunk",
"Carotid Artery",
"Cerebral Artery",
"Common Carotid Artery",
"Coronary Artery (NOS)",
"Descending Aorta",
"Facial Artery",
"Femoral Artery",
"Fistula Coronary To Left Atrium",
"Fistula Coronary To Left Ventricle",
"Fistula Coronary To Right Atrium",
"Fistula Coronary To Right Ventricle",
"Geniculate Artery",
"Hepatic Artery",
"Iliac Artery",
"Innominate Artery",
"Internal Carotid Artery",
"Internal Mammary Artery",
"Lactrimal Artery",
"Lateral Plantar Artery",
"Left Pulmonary Artery",
"Lingual Artery",
"Lumbar Artery",
"Mesenteric Artery",
"Medial Plantar Artery",
"Neo-Aorta (Primitive Aorta)",
"Neonatal Pulmonary Artery (Primitive PA)",
"Occipital Artery",
"Ophthalmic Artery",
"Patent Ductus Arteriosus",
"Peroneal Artery",
"Popliteal Artery",
"Posterior Communicating Artery",
"Pulmonary Arteriovenous Fistula",
"Pulmonary Artery",
"Pulmonary Artery Conduit",
"Pulmonary Vein Wedge",
"Radial Artery",
"Renal Artery",
"Right Femoral Artery",
"Right Pulmonary Artery",

"Subclavian Artery",
"Superficial Temporal Artery",
"Superior Thyroid Artery",
"Systemic Collateral Artery To Lung",
"Thoracic Aorta",
"Tibial Artery",
"Truncus Arteriosus Communis",
"Umbilical Artery",
"Vertebral Artery"

PRIVATE CREATOR IDENTIFICATION QUANTITATIVE_RESULTS

Attribute Name	Element Tag	VR	VM	Notes
Calibration Frame	(0009,xx40)	IS	1	Frame in this image used for calibration; no value if image was not calibrated or calibration was extended from another image. ~~Implicitly is given by the user~~
End Diastolic Frame	(0009,xx41)	IS	1	Frame number of the end-diastolic frame used in the analysis. ~~Implicitly is given by the user~~
End Systolic Frame	(0009,xx42)	IS	1	Frame number of the end-systolic frame used in the analysis. ~~Implicitly is given by the user~~
End Diastolic Volume	(0009,xx43)	DS	1	End Diastolic Volume, given in cubic centimeters. (3-6 b)
End Systolic Volume	(0009,xx44)	DS	1	End Systolic Volume, given in cubic centimeters. (3-6 b)
Stroke Volume	(0009,xx45)	DS	1	Stroke Volume, given in cubic centimeters. (3-6 b)
Ejection Fraction	(0009,xx47)	DS	1	Ejection Fraction expressed as a percentage. (3-6 b)
Body Surface Area	(0009,xx48)	DS	1	Body Surface Area, given in square meters. (3-6 b)
Artery Territory Region	(0009,xx49)	SH	1	“CFX”
Number of Diseased Vessels	(0009,xx50)	IS	1	“1”
Hypokinesis in Region	(0009,xx51)	DS	1	The amount of hypokinetic wall motion in the region of interest, in standard deviations. (3-6 c) The same as (0009,xx68)
Hyperkinesis in Opposite Region	(0009,xx52)	DS	1	The amount of hyperkinetic wall motion in the region opposite the region of interest, in standard deviations. (3-6 c) The same as (0009,xx69)
Percent Total LV Hypokinesis	(0009,xx53)	IS	1	Percentage of chords in the total LV contour which are hypokinetic by more than 2 standard deviations (3-6 c) The same as (0009,xx6A)
Calibration Factor	(0009,xx55)	DS	1	Calibration factor used for GEF calculations The same as (0019,xx84).

*(3-6 b) Given by the Left Ventricle algorithm part Global Ejection Fraction

*(3-6 c) Given by the Left Ventricle algorithm part Wall Motion

PRIVATE CREATOR IDENTIFICATION GEMS_QVA_PHOTO_01

Attribute Name	Element Tag	VR	VM	Notes
Dodge End Diastolic Volume ml	(0009,xx60)	FL	1	(3-6 b)
Dodge End Diastolic Volume ml/m2	(0009,xx7A)	FL	1	(3-6 b)
Dodge End Systolic Volume ml	(0009,xx61)	FL	1	(3-6 b)
Dodge End Systolic Volume ml/m2	(0009,xx7C)	FL	1	(3-6 b)
Dodge Stroke Volume ml	(0009,xx62)	FL	1	(3-6 b)
Dodge Stroke Volume ml/m2	(0009,xx7E)	FL	1	(3-6 b)
Dodge Ejection Fraction	(0009,xx63)	IS	1	(3-6 b)
Simpson End Diastolic Volume ml	(0009,xx64)	FL	1	(3-6 b)
Simpson End Diastolic Volume ml/m2	(0009,xx80)	FL	1	(3-6 b)
Simpson End Systolic Volume ml	(0009,xx65)	FL	1	(3-6 b)
Simpson End Systolic Volume ml/m2	(0009,xx82)	FL	1	(3-6 b)
Simpson Stroke Volume ml	(0009,xx66)	FL	1	(3-6 b)
Simpson Stroke Volume ml/m2	(0009,xx84)	FL	1	(3-6 b)
Simpson Ejection Fraction	(0009,xx67)	IS	1	(3-6 b)
CFX Single Hypokinesia in Region	(0009,xx68)	FL	1	(3-6 c)
CFX Single Hyperkinesia in Opposite Region	(0009,xx69)	FL	1	(3-6 c)
CFX Single Total LV contour Percent	(0009,xx6A)	IS	1	(3-6 c)
CFX Multiple Hypokinesia in Region	(0009,xx6B)	FL	1	(3-6 c)
CFX Multiple Hyperkinesia in Opposite Region	(0009,xx6C)	FL	1	(3-6 c)
CFX Multiple Total LV contour Percent	(0009,xx6D)	IS	1	(3-6 c)
RCA Single Hypokinesia in Region	(0009,xx6E)	FL	1	(3-6 c)
RCA Single Hyperkinesia in Opposite Region	(0009,xx6F)	FL	1	(3-6 c)
RCA Single Total LV contour Percent	(0009,xx70)	IS	1	(3-6 c)
RCA Multiple Hypokinesia in Region	(0009,xx71)	FL	1	(3-6 c)
RCA Multiple Hyperkinesia in Opposite Region	(0009,xx72)	FL	1	(3-6 c)
RCA Multiple Total LV contour Percent	(0009,xx73)	IS	1	(3-6 c)
LAD Single Hypokinesia in Region	(0009,xx74)	FL	1	(3-6 c)
LAD Single Hyperkinesia in Opposite Region	(0009,xx75)	FL	1	(3-6 c)
LAD Single Total LV contour Percent	(0009,xx76)	IS	1	(3-6 c)
LAD Multiple Hypokinesia in Region	(0009,xx77)	FL	1	(3-6 c)
LAD Multiple Hyperkinesia in Opposite Region	(0009,xx78)	FL	1	(3-6 c)
LAD Multiple Total LV contour Percent	(0009,xx79)	IS	1	(3-6 c)

PRIVATE CREATOR IDENTIFICATION GEMS_DL_IMG_01

Attribute Name	Element Tag	VR	VM	Notes
Calibration Frame	(0019,xx81)	US	1	Implicitly is given by the user
Calibration Method	(0019,xx82)	CS	1	Implicitly is given by the user
Calibration Object Size	(0019,xx83)	DS	1	Implicitly is given by the user
Calibration Factor	(0019,xx84)	FL	1	(3-6 d)
Calibration Date	(0019,xx85)	DA	1	Implicitly is given by the user
Calibration Time	(0019,xx86)	TM	1	Implicitly is given by the user
Calibration Imprecision	(0019,xx87)	US	1	(3-6 d)
Calibration Extended	(0019,xx88)	CS	1	“YES” or “NO”
Calibration Image Original	(0019,xx89)	US	1	Implicitly is given by the user
Calibration Frame Original	(0019,xx8A)	US	1	Implicitly is given by the user
Calibration Number of Points	(0019,xx8B)	US	1	Implicitly is given by the user
Calibration Points Row	(0019,xx8C)	US	1-2	Implicitly is given by the user
Calibration Points Column	(0019,xx8D)	US	1-2	Implicitly is given by the user
Calibration Software version	(0019,xx8F)	LO	1	(3-6 d)
Calibration return code	(0019,xx91)	IS	1	(3-6 d)
Distance to table top	(0019,xx2B)	FL	1	Explicitly is given by the user
Source Series Number	(0019,xx50)	IS	1	Derived from original image
Source Image Number	(0019,xx51)	IS	1	Derived from original image
Source Frame Number	(0019,xx52)	IS	1	Derived from original image
Acquisition Plane	(0019,xxDE)	CS	1	Derived from original image

*(3-6 d) Given by the calibration algorithm

PRIVATE CREATOR IDENTIFICATION DLX_SERIE_01

Attribute Name	Element Tag	VR	VM	Notes
Regression Slope Coefficient	(0019,xx25)	DS	1	Derived from original image, or or new value is saved if any entered
Regression Intercept	(0019,xx26)	DS	1	Derived from original image, or or new value is saved if any entered

PRIVATE CREATOR IDENTIFICATION GEMS_DL_STUDY_01

Attribute Name	Element Tag	VR	VM	Notes
Study Number	(0015,xx8F)	IS	1	Derived from original image

SECTION 4 X-RAY IMAGE INFORMATION OBJECT REQUIREMENTS

4.1 Introduction

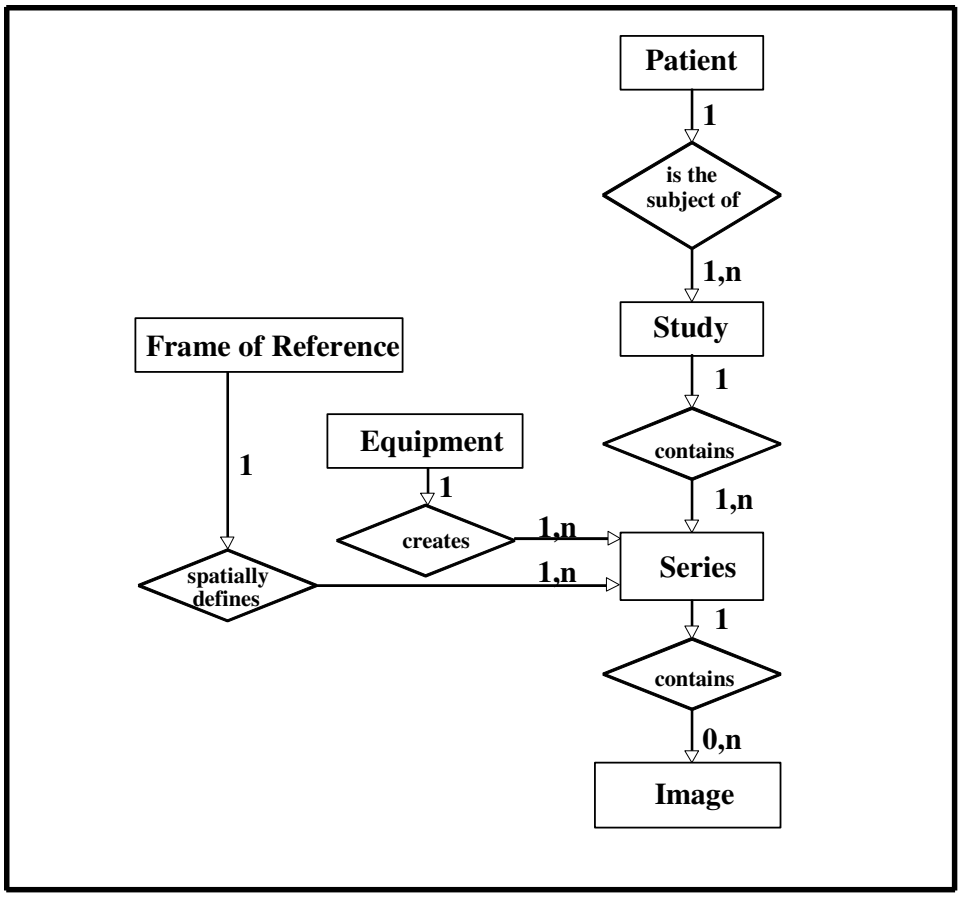
This section specifies the requirements for the DICOM X-Ray Image IOD when being used as input to Cardiac X-Ray Analysis Applications.

4.2 X-Ray Image IOD Implementation

This section defines how X-Ray Image attributes are used within the Cardiac X-Ray Analysis Applications implementation, and whether these attributes are mandatory or optional for the correct operation of Cardiac X-Ray Analysis Applications.

4.3 X-Ray Image IOD Entity-Relationship Model

ILLUSTRATION **-1**
X-RAY IMAGE ENTITY RELATIONSHIP DIAGRAM



The Entity-Relationship diagram for the X-Ray Image interoperability schema is shown in **ILLUSTRATION** -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. See DICOM Part 3 Section 5.1.2 for an explanation of the entity-relationship notation.

4.3.1 Entities Description

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the X-Ray Image information object.

4.3.2 Cardiac X-Ray Analysis Applications Mapping of DICOM entities

DICOM entities map to the Cardiac X-Ray Analysis Applications entities in the following manner:

DICOM	Cardiac X-Ray Analysis Applications
Patient Entity	Patient Entity (Advantage Workstation)
Study Entity	Examination Entity (Advantage Workstation)
Series Entity	Series Entity (Advantage Workstation)
Equipment Entity	Series Entity (Advantage Workstation)
Image Entity	Image Entity (Advantage Workstation)

4.4 X-Ray Image IOD Module Table

Within an entity of the DICOM X-Ray Image Information Object Definition, attributes are grouped into a 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 -1 identifies the defined modules within the entities, which comprise the DICOM X-Ray Image Information Object Definition. Modules are identified by Module Name.

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

TABLE -1
X-RAY IMAGE INFORMATION OBJECT DEFINITION (IOD) MODULE TABLE

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	4.5.1.1
Study	General Study	M	4.5.2.1
	Patient Study	Used	4.5.2.2
Series	General Series	M	4.5.3.1
Equipment	General Equipment	M	4.5.4.1
Image	General Image	M	4.5.5.1
	Image Pixel	M	4.5.5.2
	Multi-Frame Module	Used	4.5.5.3
	Mask Module	Used	4.5.5.4
	X-Ray Image	M	4.5.5.5
	X-Ray Acquisition	M	4.5.5.6
	X-Ray Collimator	Not used	4.5.5.7
	X-Ray Table	Used	4.5.5.8
	XA Positioner	M	4.5.5.9
	VOI LUT	Used	4.5.5.10
	SOP Common	M	4.5.5.11

4.5 Information Module Definitions

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

4.5.1 Patient Entity Modules

4.5.1.1 Patient Module

Attribute Name	Element Tag	TP	Notes
Patient's Name	(0010,0010)	2	Used for display and for SC save if provided. REQUIRED FOR SAFE PATIENT IDENTIFICATION.
Patient ID	(0010,0020)	2	Used for display and for SC save if provided. STRONGLY RECOMMENDED FOR SAFE PATIENT IDENTIFICATION.
Patient's Birth Date	(0010,0030)	2	Used for display and for SC save if provided.
Patient's Sex	(0010,0040)	2	Used for display and for SC save if provided.

4.5.2 Study Entity Modules

4.5.2.1 General Study

Attribute Name	Element Tag	TP	Notes
Study Instance UID	(0020,000D)	1	Used by AW and for SC save
Study Date	(0008,0020)	2	Used for SC save if provided.
Study Time	(0008,0030)	2	Used for SC save if provided
Referring Physicians' Name	(0008,0090)	2	Used for SC save if provided
Accession number	(0008,0050)	2	Used for SC save if provided
Study ID	(0020,0010)	2	Used for SC save if provided
Study Description	(0008,1030)	3	Used for SC save if provided
Name of Physician(s) Reading Study	(0008,1060)	3	Used for SC save if provided

4.5.2.2 Patient Study

Attribute Name	Element Tag	TP	Notes
Patient Age	(0010,1010)	3	Used for SC save if provided
Patient's Size	(0010,1020)	3	Derived from original image, or if it was new value entered Used for display, SC save and compute body area if provided
Patient's Weight	(0010,1030)	3	Derived from original image, or if it was new value entered Used for display, SC save and compute body area if provided

4.5.3 Series Entity Modules

4.5.3.1 General Series

Attribute Name	Element Tag	TP	Notes
Modality	(0008,0060)	1	Only 'XA' images are supported by Cardiac X-Ray Analysis Applications
Series Instance UID	(0020,000E)	1	Used by AW
Series Number	(0020,0011)	2	Used by AW if provided.
Series Description	(0008,103E)	3	Used by AW if provided.
Performing Physicians' Name	(0008,1050)	3	Used for display and for SC save if provided.
Operator's Name	(0008,1070)	3	Used by AW if provided.
Protocol Name	(0018,1030)	3	Used for SC save if provided

4.5.4 Equipment Entity Modules

4.5.4.1 General Equipment

Cardiac X-Ray applications accept only GEMS images from INNOVA systems.

Attribute Name	Element Tag	TP	Notes
Manufacturer	(0008,0070)	2	Used by AW if provided.
Institution Name	(0008,0080)	3	Used by AW and for SC save if provided
Institution Address	(0008,0081)	3	Used by AW and for SC save if provided
Station Name	(0008,1010)	3	Used by AW if provided.
Manufacturer's Model Name	(0008,1090)	3	Used by AW if provided.

4.5.5 Image Entity Modules

4.5.5.1 General Image

Attribute Name	Element Tag	TP	Notes
Image (Instance) Number	(0020,0013)	2	Used by AW if provided
Patient Orientation	(0020,0020)	2C	Used for SC save if provided
Image Date	(0008,0023)	2C	Used by AW if provided
Image Time	(0008,0033)	2C	Used by AW if provided
Image Type	(0008,0008)	3	Used by AW if provided 3rd value used, must be one of SINGLE PLANE/BIPLANE A/BIPLANE B.
Acquisition Date	(0008,0022)	3	Used by AW and for SC save if provided
Acquisition Time	(0008,0032)	3	Used by AW and for SC save if provided
Image Comments	(0020,4000)	3	Used by AW if provided
Burned In Annotation	(0028,0301)	3	Used by AW if provided
Referenced Image Sequence	(0008,1140)	3	Used for biplane couple matching
> Referenced SOP Class UID	(0008,1150)	3	Used for biplane couple matching
> Referenced SOP Instance UID	(0008,1155)	3	Used for biplane couple matching
> Purpose of Referenced Code Sequence	(0040,A170)	3	Used for biplane couple matching
>> Code Value	(0008,0100)	3	Used for biplane couple matching when value equals "121314"
>> Code Scheme	(0008,0102)	3	Used for biplane couple matching

Designator			
>> Code Meaning	(0008,0104)	3	Used for biplane couple matching

4.5.5.2 Image Pixel

Attribute Name	Element Tag	TP	Notes
Samples per Pixel	(0028,0002)	1	All values are accepted by the application.
Photometric Interpretation	(0028,0004)	1	MONOCHROME1, MONOCHROME2 images are supported by the application.
Rows	(0028,0010)	1	Up to 1024
Columns	(0028,0011)	1	Up to 1024
Pixel Aspect Ratio	(0028,0034)	1C	Use for calibration, quantification if provided
Bits Allocated	(0028,0100)	1	In case of X-Ray images it can be 8 or 16.
Bits Stored	(0028,0101)	1	In case of X-Ray images it can be 8, 10, 12.
High Bit	(0028,0102)	1	Should be one less than bit stored value.
Pixel Representation	(0028,0103)	1	Unsigned is accepted
Pixel Data	(7FE0,0010)	1	Used for displaying frames and as algorithm input.

4.5.5.3 Multi Frame Module

Attribute Name	Element Tag	TP	Notes
Number of Frames	(0028,0008)	1	Values from 1 to 2147483648 are accepted If the tag is missing, default is 1
Frame Increment Pointer	(0028,0009)	1	Not Used

4.5.5.4 Mask Module

Attribute Name	Element Tag	TP	Notes
Mask Subtraction Sequence	(0028,6100)	1	Required if the image is Bolus
>Mask Operation	(0028,6101)	1	All values are accepted by the application
>Applicable Frame Range	(0028,6102)	3	Any value is acceptable as contrast frame
>Mask Frame Numbers	(0028,6110)	1C	Any value is acceptable as mask frame. Typically mask frames are not within the range of applicable frames given in tag (0028,6102)
>Mask Sub-pixel Shift	(0028,6114)	3	All values are accepted by the application

4.5.5.5 X-Ray Image

Attribute Name	Element Tag	TP	Notes

Image Type	(0008,0008)	1	3rd value used, must be one of SINGLE PLANE/BIPLANE A/BIPLANE B.
Samples per Pixels	(0028,0002)	1	All values are accepted by the application.
Photometric Interpretation	(0028,0004)	1	MONOCHROME1, MONOCHROME2 images are supported by the application.
Bits Allocated	(0028,0100)	1	In case of X-Ray images it can be 8 or 16.
Bits Stored	(0028,0101)	1	In case of X-Ray images it can be 8, 10, 12
High Bit	(0028,0102)	1	Should be one less than bit stored value.
Pixel Representation	(0028,0103)	1	Unsigned is accepted
Lossy Image Compression	(0028,2110)	1C	Not used.
Pixel Intensity Relationship	(0028,1040)	1	Not used.

4.5.5.6 X-Ray Acquisition

Attribute Name	Element Tag	TP	Notes
KVP	(0018,0060)	2	Not used.
Radiation Setting	(0018,1155)	1	Not used.
X-Ray Tube Current	(0018,1151)	2C	Not used.
Exposure Time	(0018,1150)	2C	Not used.
Exposure	(0018,1152)	2C	Not used.
Field of View Shape	(0018,1147)	3	(4-5-5-6 a)
Field of View Dimension(s)	(0018,1149)	3	(4-5-5-6 a)
Intensifier size	(0018,1162)	3	(4-5-5-6 a)
Image Pixel Spacing	(0018,1164)	3	(4-5-5-6 a)

*(4-5-5-6 a) Use as input of algorithms in applications (Stenosis Analysis; calibration)

4.5.5.7 X-Ray Collimator

Not used.

4.5.5.8 X-Ray Table

Attribute Name	Element Tag	TP	Notes
Table Motion	(0018,1134)	2	(4-5-5-8 a)
Table Vertical Increment	(0018,1135)	2C	(4-5-5-8 a)
Table Longitudinal Increment	(0018,1137)	2C	(4-5-5-8 a)

Table Lateral Increment	(0018,1136)	2C	(4-5-5-8 a)
Table Angle	(0018,1138)	3	(4-5-5-8 b)

*(4-5-5-8 a) Use as input of algorithms in applications (Left Ventricle Analysis; calibration). These tags are mandatory for acquisitions with table motion.

*(4-5-5-8 b) Use as input of algorithms in applications (Stenosis Analysis; Left Ventricle Analysis; calibration). If this tag is missing the applications will not start.

4.5.5.9 XA Positioner

Attribute Name	Element Tag	TP	Notes
Distance Source to Patient	(0018,1111)	3	(4-5-5-9 a)
Distance Source to Detector	(0018,1110)	3	(4-5-5-9 a)
Positioner Motion	(0018,1500)	2C	(4-5-5-9 b)
Positioner Primary Angle	(0018,1510)	2	(4-5-5-9 b)
Positioner Secondary Angle	(0018,1511)	2	(4-5-5-9 b)
Positioner Primary Angle Increment	(0018,1520)	2C	(4-5-5-9 b)
Positioner Secondary Angle Increment	(0018,1521)	2C	(4-5-5-9 b)

*(4-5-5-9 a) Use as input of calibration algorithms in applications

*(4-5-5-9 b) Use as input of algorithms in applications (Left Ventricle Analysis; calibration)

4.5.5.10 VOI LUT

The table in this Section contains IOD Attributes that describe in VOI LUT.

Attribute Name	Element Tag	TP	Notes
Window Center	(0028,1050)	3	Used for display if provided
Window Width	(0028,1051)	1C	Used for display if provided

4.5.5.11 SOP Common

Attribute Name	Element Tag	TP	Notes

SOP Class UID	(0008,0016)	1	Used by Cardiac X-Ray Analysis Applications to confirm image is XA Image.
SOP Instance UID	(0008,0018)	1	Used by Cardiac X-Ray Analysis Applications for image identification.
Specific Character Set	(0008,0005)	1C	Only the ISO_IR 100 extended character set is supported by Cardiac X-Ray Analysis Applications.
Instance Creation Date	(0008,0012)	3	Used by AW if provided
Instance Creation Time	(0008,0013)	3	Used by AW if provided
Instance Creator UID	(0008,0014)	3	Not used
Image (Instance) Number	(0020,0013)	2	Used by AW if provided

4.5.6 X-Ray Acquisition, Table, Positioner Private Data Dictionary

DICOM Name	group	element	VR	VM	Private Creator	Notes
Gantry machine angles (L) first frame	0019	xx01	DS	1	DLX_SERIE_01	(4-5-6 b)
Gantry machine angles (P) first frame	0019	xx02	DS	1	DLX_SERIE_01	(4-5-6 b)
Gantry machine angles (C) first frame	0019	xx03	DS	1	DLX_SERIE_01	(4-5-6 b)
L arm Label	0019	xx04	CS	1	DLX_SERIE_01	(4-5-6 b)
C arm Label	0019	xx05	CS	1	DLX_SERIE_01	(4-5-6 b)
Pivot Label	0019	xx06	CS	1	DLX_SERIE_01	(4-5-6 b)
Table vertical position of first frame ~~Table position Z (vertical) first frame~~	0019	xx21	DS	1	DLX_SERIE_01	(4-5-6 c)
Table longitudinal position of first frame ~~Table position X (longitudinal) first frame~~	0019	xx22	DS	1	DLX_SERIE_01	(4-5-6 c)
Table lateral position of first frame ~~Table position Y (lateral) first frame~~	0019	xx23	DS	1	DLX_SERIE_01	(4-5-6 c)
Lambda	0019	xx24	DS	1	DLX_SERIE_01	(4-5-6 d)
Slope LV regression	0019	xx25	DS	1	DLX_SERIE_01	Use as input of Left Ventricle Analysis algorithm in application
Intercept LV regression	0019	xx26	DS	1	DLX_SERIE_01	Use as input of Left Ventricle Analysis algorithm in application
Primary Angle (RAO/LAO)	0025	xx06	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 b)
Secondary Angle (CAU/CRA)	0025	xx07	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 b)
Gantry machine angles (L) per frame	0025	xx09	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 b)
Gantry machine angles (P) per frame	0025	xx10	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 b)
Gantry machine angles (C) per frame	0025	xx1A	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 b)
Table position Z (vertical) per frame	0025	xx1B	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 c)
Table position X (longitudinal) per frame	0025	xx1C	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 c)
Table position Y (lateral) per frame	0025	xx1D	DS	1 - n	GEMS_DL_FRAME_01	(4-5-6 c)
Table rotation of first frame	0025	xx3B	CS	1 - n	GEMS_DL_FRAME_01	Used as input for algorithms (calibration, quantification)
FOV (double)	0019	xx0B	DS	1 - 2	GEMS_DL_IMG_01	Loaded but not used Standard value used instead (0018,1149)
Detector rotation angle	0019	xx92	DS	1	GEMS_DL_IMG_01	(4-5-6 a)
Horizontal and vertical sweep of the image	0019	xx95	CS	2	GEMS_DL_IMG_01	(4-5-6 a)

Angle 1 increment	0019	xx97	DS	1 - n	GEMS_DL_IMG_01	(4-5-6 b)
Angle 2 increment	0019	xx98	DS	1 - n	GEMS_DL_IMG_01	(4-5-6 b)
Angle 3 increment	0019	xx99	DS	1 - n	GEMS_DL_IMG_01	(4-5-6 b)
Acquisition region	0019	xxBA	CS	1	GEMS_DL_IMG_01	Used as input for algorithms (calibration, quantification)
Acquisition SUB mode	0019	xxBB	CS	1	GEMS_DL_IMG_01	Used as input for algorithms (calibration, quantification) and for display
Table rotation status vector	0019	xxBD	CS	1 - n	GEMS_DL_IMG_01	Used as input for algorithms (calibration, quantification) See also (0025,xx3B)
Source to image distance per frame vector	0019	xxBE	FL	1 - n	GEMS_DL_IMG_01	Used as input for algorithms (calibration, quantification)
Source to Isocenter distance per frame vector ~~Source to detector distance per frame vector~~	0019	xxE9	FL	1 - n	GEMS_DL_IMG_01	Used as input for algorithms (calibration, quantification)
Acquisition plane	0019	xxDE	CS	1	GEMS_DL_IMG_01	Used for biplane couple matching
Table X Position to Isocenter	0019	xxEB	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table X Position to Isocenter increment	0019	xxD7	FL	1 - n	GEMS_DL_IMG_01	(4-5-6 e)
Table X Position to Isocenter precision	0019	xxF2	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Y Position to Isocenter	0019	xxEC	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Y Position to Isocenter increment	0019	xxD8	FL	1 – n	GEMS_DL_IMG_01	(4-5-6 e)
Table Y Position to Isocenter precision	0019	xxF3	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Z Position to Isocenter	0019	xxED	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Z Position to Isocenter increment	0019	xxD9	FL	1 – n	GEMS_DL_IMG_01	(4-5-6 e)
Table Z Position to Isocenter precision	0019	xxF4	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Rotation Angle	0019	xxEA	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Rotation Angle increment	0019	xxC3	FL	1 – n	GEMS_DL_IMG_01	(4-5-6 e)
Table Rotation Angle precision	0019	xxF0	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Head Tilt Angle	0019	xxEE	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Head Tilt Angle increment	0019	xxDA	FL	1 – n	GEMS_DL_IMG_01	(4-5-6 e)
Table Head Tilt Angle precision	0019	xxEF	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Cradle Angle	0019	xxBC	FL	1	GEMS_DL_IMG_01	(4-5-6 e)
Table Cradle Angle increment	0019	xxDB	FL	1 – n	GEMS_DL_IMG_01	(4-5-6 e)
Table Cradle Angle precision	0019	xxF1	FL	1	GEMS_DL_IMG_01	(4-5-6 e)

*(4-5-6 a) Use as input of calibration algorithms in applications

*(4-5-6 b) See also 4-5-5-7 X-Ray Positioner - Use as input of algorithms in applications (Left Ventricle Analysis; calibration)

*(4-5-6 c) See also 4-5-5-6 X-Ray Table - Use as input of algorithms in applications (Left Ventricle Analysis; calibration)

*(4-5-6 d) Optional parameter for Stenosis Analysis quantification, Multi Segment algo, Segment Calibration algo, Catheter Calibration algo

*(4-5-6 e) Use as input of auto calibration and extend calibration algorithms.

4.5.7 Other Private Data Used

PRIVATE CREATOR IDENTIFICATION GEMS_DL_STUDY_01

Attribute Name	Element Tag	VR	VM	Notes
Study Number	(0015,xx8F)	IS	1	Used for SC save if provided