GE Medical Systems

Technical
Publications

Direction 5198554-100
Revision 1

Cortex ID

CONFORMANCE STATEMENT
for DICOM

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Including:

REVISION HISTORY

REV	Version	DATE	REASON FOR CHANGE
1		Apr 10, 2006	INITIAL REVISION, based on VXTL and Dynamic Review
2		Aug 16 2006	Updated to include input on saved SSP images and DICOM SR's
3		Dec 18 2006	Updated with HII Log input from Bill Bridge and based on the M3 1.03.0H .version of the application.
1	1	Jan 09 2007	1st Version in eLibrary, same document as above.

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Co nformance 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 (Media Storage Conformance Statement), which specifies the GE HEALTHCARE equipment compliance to the DICOM requirements for the implementation of Media Storage features.

Section 3 (CT Information Object Implementation), which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of a CT Information Object.

Section 4 (MR Information Object Implementation), which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of a MR Information Object.

Section 5 (PET Information Object Implementation), which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of a PET Information Object.

Section 6 (Secondary Capture Information Object Implementation), which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Object.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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

ID/Net v3.0

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

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

Product Implementation:

CT Advantage

MR Advantage

PET AD Conformance Statement Direction: 5198554-100
+ AW 4.2 Conformance Statement Direction: 2381100-100

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

DICOM STANDARD

Standard Specification:

DICOM Part 1

DICOM 2

DICOM 3

DICOM 4

DICOM Part 18

This document specifies the DICOM implementation. It is entitled:

Cortex ID

Conformance Statement for DICOM

Direction: 5198554-100

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GE HEALTHCARE network interface. Introductory information, which is applicable to all GE HEALTHCARE 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' GE HEALTHCARE Conformance Statements.

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

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

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

ID/Net v3.0 Conformance Statements
Direction: 2117016

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 DICOM Conformance Statement document.

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

Direction: 2118780

1.4 SCOPE AND FIELD OF APPLICATION

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

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

1.5 IMPORTANT REMARKS

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

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

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

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of

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the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GE HEALTHCARE protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

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

1.6   REFERENCES

A list of references which is applicable to all GE HEALTHCARE 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).

1.7   DEFINITIONS

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

1.8   SYMBOLS AND ABBREVIATIONS

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

1.9   TERMS DEFINITIONS

In the following conformance statement, the following terms describe the use of each of the DICOM tags. When Volume Viewer is loading DICOM data files, we use the following terms:

- **Ignored**: the software will ignore the value of the tag

- **Used**: the software might use at some point the value of this tag; the value could be use for computations, for display, or to regenerate thee value of a secondary capture

- **Mandatory**: the software will need a valid value for this tag; this value will be used for computations and an invalid value will prevent the software to load the data

When the application is saving some reformatted or secondary capture images, we use the following terms:

- **Removed**: the tag is removed of the module and will be absent from the data set

- **Generated**: the software will generate a value, generally by computing a new value

- **Copied**: the software will try as much as possible to duplicate the value found in the source images if the value is the same on all the source images; if the value is not constant, the tag will be absent from the data set if "Ignored" at load or possibly regenerated if "Used" at load

2. MEDIA STORAGE CONFORMANCE STATEMENT

CORTEX ID is a software application developed for use on the Advantage Windows workstation. This means that networking and media storage features are inherited from this platform.

For a complete description of the media storage conformance, refer to the AW 4.2 conformance statement, direction 2381100-100.

The application will display any PET series as well as a registered CT image where it exists. It is primarily used for the review and analysis of PET Neurology exams using 18F-FDG PET Neurology scanning. The application it is also capable of displaying an MR exam. PET series generated by the application include PET Oblique re-oriented to the AC/PC line, and PET 3DSSP projections of cortical hypometabolism or uptake.

The application may create a DICOM Structured Report (SR) although it will not read in a DICOM SR.

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

- the DICOM CT IODs that are required to reconstruct a 3-dimensional volume and post processed reformatted CT IODs.

- the DICOM MR IODs that are required to reconstruct a 3-dimensional volume and post processed reformatted MR IODs.

- the DICOM PET IODs that are required to reconstruct and write a 3-dimensional volume (section 7),

- the DICOM SC IODs written by the application (section 8).

Modality	SOP Class	FSR	FSC	Remarks
CT	1.2.840.10008.5.1.4.1.1.2	Yes	Yes	
MR	1.2.840.10008.5.1.4.1.1.4	Yes	Yes	
PET	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	
SC	1.2.840.10008.5.1.4.1.1.7	No	Yes	

3. CT INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

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

3.2 - IOD Description

3.3 - IOD Entity-Relationship Model

3.4 - IOD Module Table

3.5 - IOD Module Definition

3.2 CT IOD IMPLEMENTATION

3.3 CT ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the CT Image interoperability schema is shown in Illustration 3.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization:

• each entity is represented by a rectangular box

• each relationship is represented by a diamond shaped box.

• the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

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

ILLUSTRATION 3.3-1
CT IMAGE ENTITY RELATIONSHIP DIAGRAM
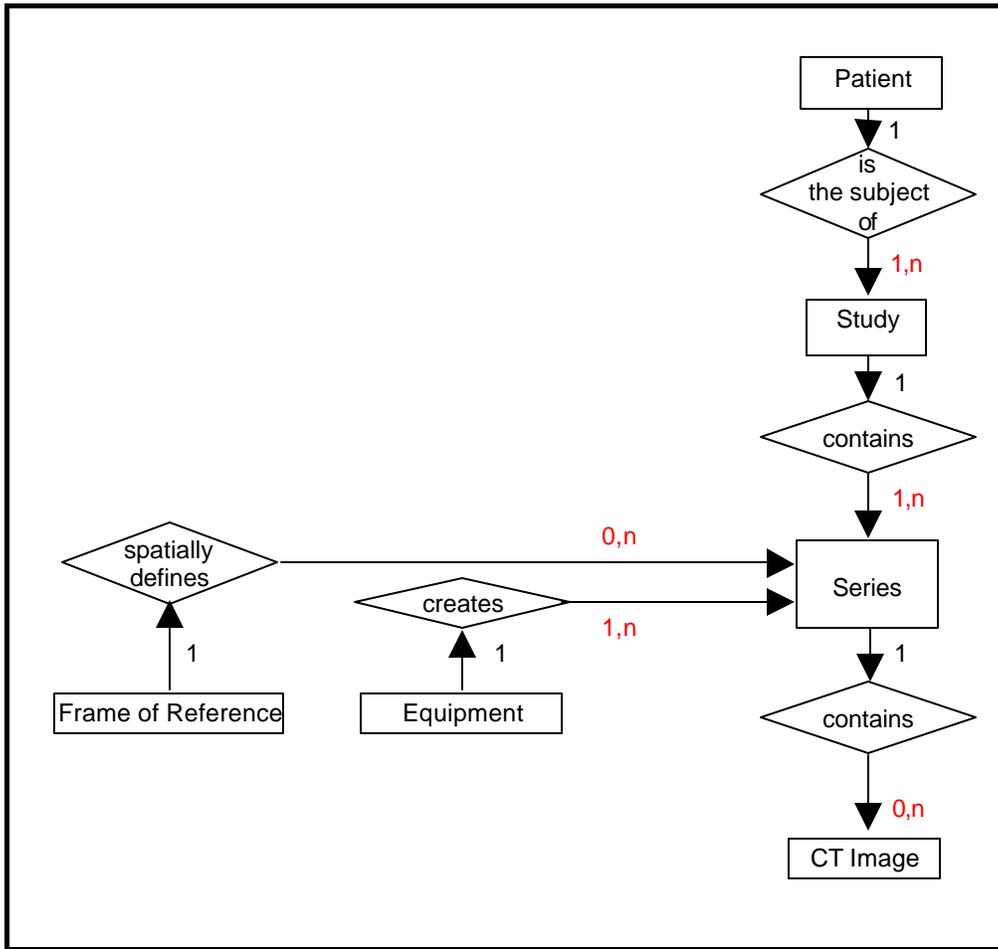
3.3.1 ENTITY DESCRIPTIONS

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

3.3.2 Mapping of DICOM entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO APPLICATION ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

3.4 IOD MODULE TABLE

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

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM CT IOD. Modules are identified by Module Name.

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

TABLE 3.4-1
CT IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
Study	General Study	3.5.2.1
	Patient Study	3.5.2.2
Series	General Series	3.5.3.1
Frame of Reference	Frame of Reference	3.5.4.1
Equipment	General Equipment	3.5.5.1
Image	General Image	3.5.6.1
	Image Plane	3.5.6.2
	Image Pixel	3.5.6.3
	Contrast/Bolus	3.5.6.4
	CT Image	3.5.10.1
	Overlay Plane	3.5.7.1
	VOI LUT	3.5.8.1
	SOP Common	3.5.9.1

3.5 INFORMATION MODULE DEFINITIONS

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

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

3.5.1 Common Patient Entity Modules

3.5.1.1 Patient Module

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

TABLE 3.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored
Other Patient IDs	(0010,1000)	3	Ignored
Other Patient Names	(0010,1001)	3	Ignored
Ethnic Group	(0010,2160)	3	Ignored
Patient Comments	(0010,4000)	3	Ignored

3.5.2 Common Study Entity Modules

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

3.5.2.1   General Study Module

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

TABLE 3.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory
Study Date	(0008,0020)	2	Used
Study Time	(0008,0030)	2	Used
Referring Physician's Name	(0008,0090)	2	Ignored
Study ID	(0020,0010)	2	Used
Accession Number	(0008,0050)	2	Ignored
Study Description	(0008,1030)	3	Ignored
Physician(s) of Record	(0008,1048)	3	Ignored
Name of Physician(s) Reading Study	(0008,1060)	3	Ignored
Referenced Study Sequence	(0008,1110)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

3.5.2.2   Patient Study Module

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

TABLE 3.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored
Patient's Age	(0010,1010)	3	Used
Patient's Size	(0010,1020)	3	Ignored
Patient's Weight	(0010,1030)	3	Used
Occupation	(0010,2180)	3	Ignored
Additional Patient's History	(0010,21B0)	3	Ignored

3.5.3   Common Series Entity Modules

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

3.5.3.1   General Series Module

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

TABLE 3.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used Defined Terms: CT = Computed Tomography
Series Instance UID	(0020,000E)	1	Mandatory
Series Number	(0020,0011)	2	Used
Laterality	(0020,0060)	2C	Ignored
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Performing Physicians' Name	(0008,1050)	3	Ignored
Protocol Name	(0018,1030)	3	Ignored
Series Description	(0008,103E)	3	Used
Operators' Name	(0008,1070)	3	Ignored
Referenced Study Component Sequence	(0008,1111)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored
Patient Position	(0018,5100)	2C	Used The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Ignored
Largest Pixel Value in Series	(0028,0109)	3	Ignored
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	

>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	Ignored
Performed Procedure Step Start Date	(0040,0244)	3	Ignored
Performed Procedure Step Start Time	(0040,0245)	3	Ignored
Performed Procedure Step Description	(0040,0254)	3	Ignored
Performed Action Item Sequence	(0040,0260)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

3.5.4   Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

3.5.4.1   Frame Of Reference Module

Images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, , the same pixel size, the same tilt, the same study ID, the same reconstruction algorithm, the same patient name.

TABLE 3.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Mandatory
Position Reference Indicator	(0020,1040)	2	Ignored

3.5.5 Common Equipment Entity Modules

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

3.5.5.1 General Equipment Module

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

As Voxtool can simulate the generation of an image by the scanner, we have chosen to copy this module, but to omit the fields that could be altered by the reformation

TABLE 3.5-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used
Institution Name	(0008,0080)	3	Used
Institution Address	(0008,0081)	3	Ignored
Station Name	(0008,1010)	3	Ignored
Institutional Department Name	(0008,1040)	3	Ignored
Manufacturer's Model Name	(0008,1090)	3	Used
Device Serial Number	(0018,1000)	3	Ignored
Software Versions	(0018,1020)	3	Ignored
Spatial Resolution	(0018,1050)	3	Ignored
Date of Last Calibration	(0018,1200)	3	Ignored
Time of Last Calibration	(0018,1201)	3	Ignored
Pixel Padding Value	(0028,0120)	3	Ignored

3.5.6 Common Image Entity Modules

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

3.5.6.1 General Image Module

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

TABLE 3.5-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used
Patient Orientation	(0020,0020)	2C	Used
Image Date	(0008,0023)	2C	Used
Image Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used
Acquisition Number	(0020,0012)	3	Used
Acquisition Date	(0008,0022)	3	Used

Acquisition Time	(0008,0032)	3	Used
Referenced Image Sequence	(0008,1140)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored
Source Image Sequence	(0008,2112)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored
Image Comments	(0020,4000)	3	Ignored
Quality Control Image	(0028,0300)	3	Ignored
Burned In Annotations	(0028,0301)	3	Ignored
Lossy Image Compression	(0028,2110)	3	Ignored
Lossy Image Compression Ratio	(0028,2112)	3	Ignored

3.5.6.1.1 General Image Attribute Descriptions

3.5.6.1.1.1 Patient Orientation

Since the coordinates of the image are always written, this field is never present in the created images.

3.5.6.1.1.2 Image Type

As an FSC, here are the values that may be sent.

Value 1 has the following value:
- DERIVED identifies a Derived Image

Value 2 has the following value:
- SECONDARY identifies a Secondary Image

Value 3 has the following value:
- REFORMATTED identifies a Reformatted Image

Value 4, if defined, can have the following values:
- MIP identifies a thick Maximum Intensity Projection Image
- MIN IP identifies a thick Minimum Intensity Projection Image
- AVERAGE identifies a thick Average Image
- VOLREN identifies a thick Volume Rendered Image

3.5.6.1.1.3 Derivation Description and Source Image Sequence

These tags are not yet used.

3.5.6.1.1.4 Lossy Image Compression

Application does not support compression.

3.5.6.2 Image Plane Module

This section specifies the Attributes which define the transmitted pixel array of a two dimensional image plane.

TABLE 3.5-8
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Mandatory
Image Orientation (Patient)	(0020,0037)	1	Mandatory
Image Position (Patient)	(0020,0032)	1	Mandatory
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Ignored

3.5.6.2.1 Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is "GE MEDICAL SYSTEMS").

Otherwise, the Image Position is treated as the position of the center of the first pixel of the image.

3.5.6.3 Image Pixel Module

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

TABLE 3.5-9
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1")
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024)
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024)
Bits Allocated	(0028,0100)	1	Ignored (expect "16")
Bits Stored	(0028,0101)	1	Ignored (expect "16")
High Bit	(0028,0102)	1	Ignored (expect "15")
Pixel Representation	(0028,0103)	1	Ignored (expect "1")
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Ignored
Largest Image Pixel Value	(0028,0107)	3	Ignored
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored

Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

3.5.6.4   Contrast/Bolus Module

This section specifies the Attributes that describe the contrast /bolus used in the acquisition of the Image.

3.5.6.4.1   Contrast annotation mark (+c)

The "+c" annotation appears if a contrast agent is present ((0018,0010) in the data set) and the Contrast/Bolus Route contains "IV" or something different than "Oral". This means that if the Contrast/Bolus Route contains "Oral", the "+c" annotation will not appear.

TABLE 3.5-10
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used
Contrast/Bolus Agent Sequence	(0018,0012)	3	Ignored
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
Contrast/Bolus Route	(0018,1040)	3	Used
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Ignored
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Additional Drug Sequence	(0018,002A)	3	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Contrast/Bolus Volume	(0018,1041)	3	Ignored
Contrast/Bolus Start Time	(0018,1042)	3	Ignored
Contrast/Bolus Stop Time	(0018,1043)	3	Ignored
Contrast/Bolus Total Dose	(0018,1044)	3	Ignored
Contrast Flow Rate(s)	(0018,1046)	3	Ignored
Contrast Flow Duration(s)	(0018,1047)	3	Ignored
Contrast/Bolus Ingredient	(0018,1048)	3	Ignored
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Ignored

3.5.7 Common Overlay Modules

3.5.7.1 Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

This module is not currently supported by the CORTEX ID product and will be ignored.

TABLE 3.5-11
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	Module Unsupported
Overlay Columns	(60xx,0011)	1	Module Unsupported
Overlay Type	(60xx,0040)	1	Module Unsupported
Origin	(60xx,0050)	1	Module Unsupported
Overlay Bits Allocated	(60xx,0100)	1	Module Unsupported
Bit Position	(60xx,0102)	1	Module Unsupported
Overlay Data	(60xx,3000)	1C	Module Unsupported
Overlay Description	(60xx,0022)	3	Module Unsupported
Overlay Subtype	(60xx,0045)	3	Module Unsupported
Overlay Label	(60xx,1500)	3	Module Unsupported
ROI Area	(60xx,1301)	3	Module Unsupported
ROI Mean	(60xx,1302)	3	Module Unsupported
ROI Standard Deviation	(60xx,1303)	3	Module Unsupported
Overlay Descriptor - Gray	(60xx,1100)	3	Module Unsupported
Overlay Descriptor - Red	(60xx,1101)	3	Module Unsupported
Overlay Descriptor - Green	(60xx,1102)	3	Module Unsupported
Overlay Descriptor - Blue	(60xx,1103)	3	Module Unsupported
Overlays - Gray	(60xx,1200)	3	Module Unsupported
Overlays - Red	(60xx,1201)	3	Module Unsupported
Overlays - Green	(60xx,1202)	3	Module Unsupported
Overlays - Blue	(60xx,1203)	3	Module Unsupported

3.5.8 Common Lookup Table Modules

3.5.8.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 3.5-12
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	

Window Center	(0028,1050)	3	Ignored at load (an automatic W/L is computed on the whole series).
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series).
Window Center & Width Explanation	(0028,1055)	3	Ignored

3.5.9   General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.5.9.1   SOP Common Module

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

TABLE 3.5-13
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used
SOP Instance UID	(0008,0018)	1	Used
Specific Character Set	(0008,0005)	1C	Used Only the "ISO_IR 100" character sets are supported.
Instance Creation Date	(0008,0012)	3	Ignored
Instance Creation Time	(0008,0013)	3	Ignored
Instance Creator UID	(0008,0014)	3	Ignored
Time zone Offset From UTC	(0008,0201)	3	Ignored
Instance Number	(0020,0013)	3	Used
SOP Instance Status	(0100,0410)	3	Ignored
SOP Authorization Date and Time	(0100,0420)	3	Ignored
SOP Authorization Comment	(0100,0414)	3	Ignored
Authorization Equipment Certification Number	(0100,0416)	3	Ignored

3.5.10   CT Modules

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

3.5.10.1   CT Image Module

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

TABLE 3.5-14
CT IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 3.5.10.1.1.1.
Samples per Pixel	(0028,0002)	1	Shall be 1.
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Bits Allocated	(0028,0100)	1	Shall be 16.
Bits Stored	(0028,0101)	1	Ignored (expect 16)
High Bit	(0028,0102)	1	Ignored (expect 15)
Rescale Intercept	(0028, 1052)	1	Used (default to –1024 if not found)
Rescale Slope	(0028,1053)	1	Used
KVP	(0018,0060)	2	Used
Acquisition Number	(0020,0012)	2	Ignored
Scan Options	(0018,0022)	3	Used
Data Collection Diameter	(0018,0090)	3	Used
Reconstruction Diameter	(0018,1100)	3	Ignored
Distance Source to Detector	(0018,1110)	3	Ignored
Distance Source to Patient	(0018,1111)	3	Ignored
Gantry/Detector Tilt	(0018,1120)	3	Used
Table Height	(0018,1130)	3	Ignored
Rotation Direction	(0018,1140)	3	Ignored
Exposure Time	(0018,1150)	3	Used
X-ray Tube Current	(0018,1151)	3	Used
Exposure	(0018,1152)	3	Ignored
Exposure in µAs	(0018,1152)	3	Ignored
Filter Type	(0018,1160)	3	Ignored
Generator Power	(0018,1170)	3	Ignored
Focal Spot	(0018,1190)	3	Ignored
Convolution Kern el	(0018,1210)	3	Used

3.5.10.1.1 CT Image Attribute Descriptions

3.5.10.1.1.1 Image Type

Value 1 has the following value:

- DERIVED   identifies a Derived Image

Value 2 has the following value:

- SECONDARY   identifies a Secondary Image

Value 3 has the following value:

- REFORMATTED identifies a Reformatted Image

Value 4, if defined, indicates that the image has a slice thickness superior to the pixel
size; the rendering algorithm over the thickness can have the following values:

- MIP   identifies a thick Maximum Intensity Projection Image
- MIN IP   identifies a thick Minimum Intensity Projection Image
- AVERAGE   identifies a thick Average Image
- VOLREN   identifies a thick Volume Rendered Image

ILLUSTRATION 3.5-1
CT IMAGE TYPE DECISION TREE
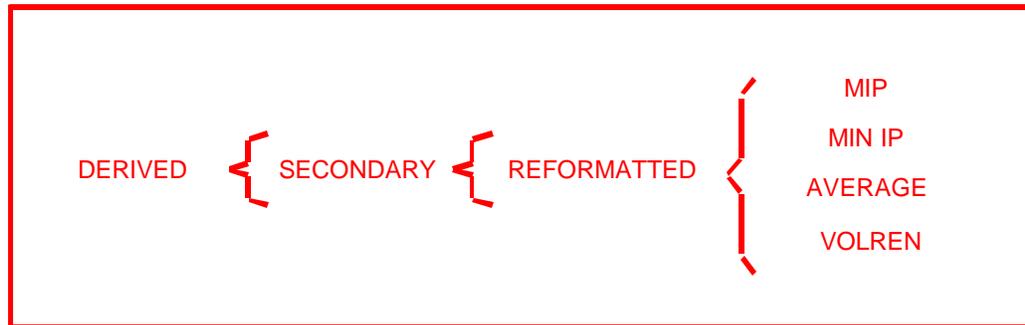
3.6 PRIVATE DATA

The following private elements are used

PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0019, 00xx)	3	GE HEALTHCARE_ACQU_01: Used
Table Speed	(0019, xx23)	3	Used
Midscan Time	(0019, xx24)	3	Used
Gantry Velocity	(0019, xx27)	3	Used
SFOV Type	(0019, xx39)	3	Used
Dependent on #views processed	(0019, xx6A)	3	Used
Private Creator	(0043, 00xx)	3	GE HEALTHCARE_PARM_01: Used
Pitch Ratio	(0043, xx27)	3	Used
Private Scan Options	(0043, xx2B)	3	Used
motCorr	(0043, xx65)	3	Used
IBOCorr	(0043, xx67)	3	Used
Private Creator	(0045, 00xx)	3	GE HEALTHCARE_HELIOS_01: Used
Sigma Mode	(0045, xx13)	3	Ignored
Ibone Flag	(0045, xx21)	3	Used
Peris Flag	(0045, xx22)	3	Used
Cardiac Recon Algo	(0045, xx30)	3	Used
Average Heart Rate	(0045, xx31)	3	Used
Temporal Resolution	(0045, xx32)	3	Used
Cardiac Phase Number	(0045, xx33)	3	Used

4. MR INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 – IOD Description

4.3 – IOD Entity-Relationship Model

4.4 – IOD Module Table

4.5 – IOD Module Definition

4.2 MR IOD IMPLEMENTATION

4.3 MR ENTITY-RELATIONSHIP MODEL

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

- each entity is represented by a rectangular box

- each relationship is represented by a diamond shaped box.

- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

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

ILLUSTRATION 4.3-1
MR IMAGE ENTITY RELATIONSHIP DIAGRAM

```
                                            ┌─────────┐
                                            │ Patient │
                                            └─────────┘
                                                 │ 1
                                                 ▼
                                            ╱─────────╲
                                           ╱    is     ╲
                                          ╱ the subject ╲
                                           ╲    of     ╱
                                            ╲─────────╱
                                                 │ 1,n
                                                 ▼
                                            ┌─────────┐
                                            │  Study  │
                                            └─────────┘
                                                 │ 1
                                                 ▼
                                            ╱─────────╲
                                           ╱  contains ╲
                                            ╲─────────╱
                                                 │ 1,n
                                                 ▼
   ╱─────────╲                              ┌─────────┐
  ╱ spatially ╲         0,n                 │         │
 ╱   defines   ╲───────────────────────────▶│ Series  │
  ╲           ╱          ╱───────╲          │         │
   ╲─────────╱          ╱ creates ╲─────────▶└─────────┘
        ▲ 1             ╲─────────╱  1,n          │ 1
        │                    ▲ 1                  ▼
┌──────────────────┐   ┌───────────┐         ╱─────────╲
│Frame of Reference│   │ Equipment │        ╱  contains ╲
└──────────────────┘   └───────────┘         ╲─────────╱
                                                  │ 0,n
                                                  ▼
                                            ┌─────────┐
                                            │ MR Image│
                                            └─────────┘
```
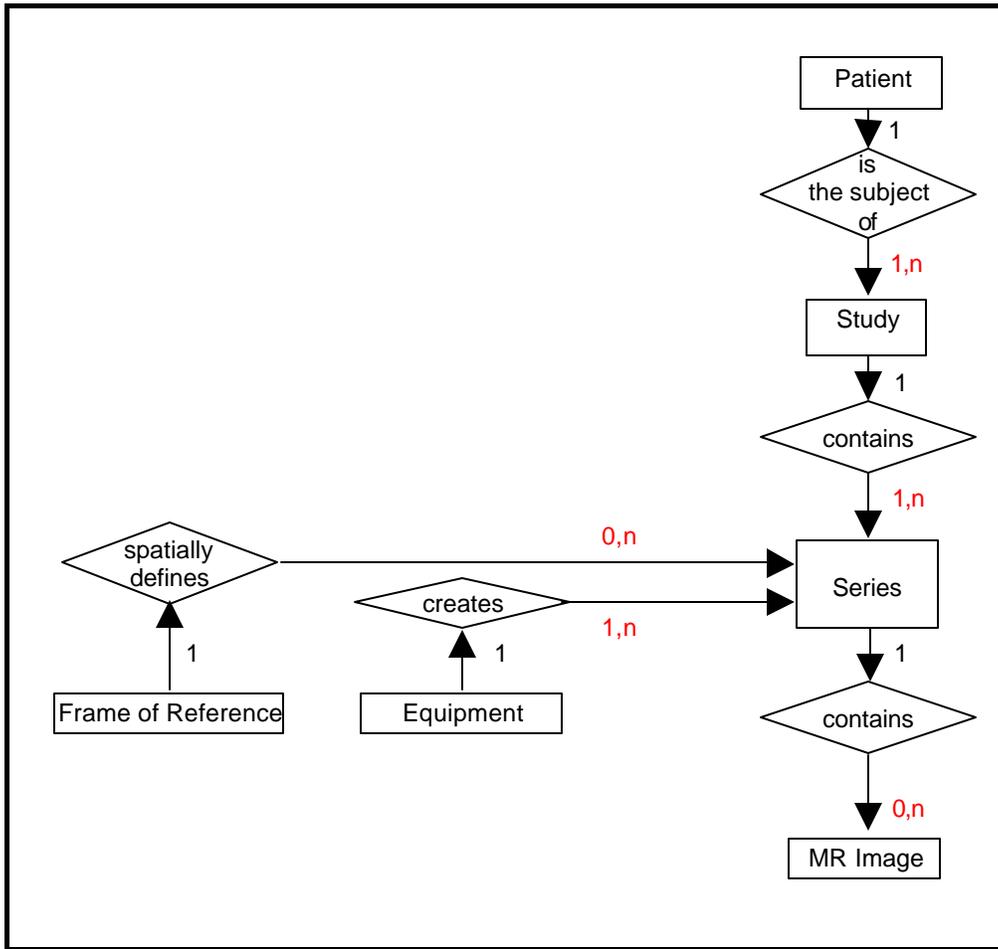
4.3.1 ENTITY DESCRIPTIONS

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

4.3.2 Mapping of DICOM entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO APPLICATION ENTITIES

DICOM	Application Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

4.4 IOD MODULE TABLE

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

Table 4.4-1 identifies the defined modules within the entities which comprise the DICOM MR IOD. Modules are identified by Module Name.

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

TABLE 4.4-1
MR IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
	Patient Study	4.5.2.2
Series	General Series	4.5.3.1
Frame of Reference	Frame of Reference	4.5.4.1
Equipment	General Equipment	4.5.5.1
Image	General Image	4.5.6.1
	Image Plane	4.5.6.2
	Image Pixel	4.5.6.3
	Contrast/Bolus	4.5.6.4
	MR Image	4.5.10.1
	Overlay Plane	4.5.7.1
	VOI LUT	4.5.8.1
	SOP Common	4.5.9.1

4.5 INFORMATION MODULE DEFINITIONS

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

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

4.5.1 Common Patient Entity Modules

4.5.1.1 Patient Module

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

TABLE 4.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored
Other Patient Ids	(0010,1000)	3	Ignored
Other Patient Names	(0010,1001)	3	Ignored
Ethnic Group	(0010,2160)	3	Ignored
Patient Comments	(0010,4000)	3	Ignored

4.5.2 Common Study Entity Modules

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

4.5.2.1 General Study Module

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

TABLE 4.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory
Study Date	(0008,0020)	2	Used
Study Time	(0008,0030)	2	Used
Referring Physician's Name	(0008,0090)	2	Used
Study ID	(0020,0010)	2	Used
Accession Number	(0008,0050)	2	Used
Study Description	(0008,1030)	3	Used
Physician(s) of Record	(0008,1048)	3	Ignored
Name of Physician(s) Reading Study	(0008,1060)	3	Used
Referenced Study Sequence	(0008,1110)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

4.5.2.2 Patient Study Module

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

TABLE 4.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored
Patient's Age	(0010,1010)	3	Used
Patient's Size	(0010,1020)	3	Ignored
Patient's Weight	(0010,1030)	3	Used
Occupation	(0010,2180)	3	Ignored
Additional Patient's History	(0010,21B0)	3	Used

4.5.3   Common Series Entity Modules

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

4.5.3.1   General Series Module

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

TABLE 4.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used Defined Terms: MR = Magnetic Resonance
Series Instance UID	(0020,000E)	1	Mandatory
Series Number	(0020,0011)	2	Used
Laterality	(0020,0060)	2C	Ignored
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Performing Physicians' Name	(0008,1050)	3	Used
Protocol Name	(0018,1030)	3	Used
Series Description	(0008,103E)	3	Used
Operators' Name	(0008,1070)	3	Used
Referenced Study Component Sequence	(0008,1111)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored
Patient Position	(0018,5100)	2C	Used The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Ignored
Largest Pixel Value in Series	(0028,0109)	3	Ignored
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	

>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	Ignored
Performed Procedure Step Start Date	(0040,0244)	3	Ignored
Performed Procedure Step Start Time	(0040,0245)	3	Ignored
Performed Procedure Step Description	(0040,0254)	3	Ignored
Performed Action Item Sequence	(0040,0260)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

4.5.4   Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

4.5.4.1   Frame Of Reference Module

Images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, , the same pixel size, the same tilt, the same study ID, the same reconstruction algorithm, the same patient name.

TABLE 4.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Mandatory
Position Reference Indicator	(0020,1040)	2	Ignored

4.5.5 Common Equipment Entity Modules

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

4.5.5.1 General Equipment Module

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

TABLE 4.5-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used
Institution Name	(0008,0080)	3	Used
Institution Address	(0008,0081)	3	Ignored
Station Name	(0008,1010)	3	Used
Institutional Department Name	(0008,1040)	3	Ignored
Manufacturer's Model Name	(0008,1090)	3	Used
Device Serial Number	(0018,1000)	3	Ignored
Software Versions	(0018,1020)	3	Ignored
Spatial Resolution	(0018,1050)	3	Ignored
Date of Last Calibration	(0018,1200)	3	Ignored
Time of Last Calibration	(0018,1201)	3	Ignored
Pixel Padding Value	(0028,0120)	3	Ignored

4.5.6 Common Image Entity Modules

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

4.5.6.1 General Image Module

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

TABLE 4.5-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used
Patient Orientation	(0020,0020)	2C	Ignored
Image Date	(0008,0023)	2C	Used
Image Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used
Acquisition Number	(0020,0012)	3	Ignored
Acquisition Date	(0008,0022)	3	Used
Acquisition Time	(0008,0032)	3	Used
Referenced Image Sequence	(0008,1140)	3	Ignored

>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored
Source Image Sequence	(0008,2112)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored
Image Comments	(0020,4000)	3	Ignored
Quality Control Image	(0028,0300)	3	Ignored
Burned In Annotations	(0028,0301)	3	Ignored
Lossy Image Compression	(0028,2110)	3	Ignored
Lossy Image Compression Ratio	(0028,2110)	3	Ignored

4.5.6.1.1 General Image Attribute Descriptions

4.5.6.1.1.1 Patient Orientation

Since the coordinates of the image are always present, this field is never used.

4.5.6.1.1.2 Image Type

As an FSC, here are the values that may be sent.

Value 1 has the following value:
  − DERIVED   identifies a Derived Image
Value 2 has the following value:
  − SECONDARY   identifies a Secondary Image
Value 3 has the following value:
  − REFORMATTED identifies a Reformatted Image
Value 4, if defined, can have the following values:
  − MIP   identifies a thick Maximum Intensity Projection Image
  − MIN IP   identifies a thick Minimum Intensity Projection Image
  − AVERAGE   identifies a thick Average Image
  − VOLREN   identifies a thick Volume Rendered Image

4.5.6.1.1.3 Derivation Description and Source Image Sequence

These tags are not yet used.

4.5.6.1.1.4 Lossy Image Compression

Application does not support compression.

4.5.6.2 Image Plane Module

This section specifies the Attributes which define the transmitted pixel array of a two dimensional image plane.

TABLE 4.5-8
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Mandatory
Image Orientation (Patient)	(0020,0037)	1	Mandatory
Image Position (Patient)	(0020,0032)	1	Mandatory
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Ignored

4.5.6.2.1   Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is "GE MEDICAL SYSTEMS"), which software version (first value of Software Version) is strictly inferior to 11.

The Image Position is treated as the position of the center of the first pixel of the image for images coming from other manufacturer than GE or MR GE systems that have MR 11.0 software (Excite II, …) and above.

4.5.6.3   Image Pixel Module

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

TABLE 4.5-9
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1")
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024)
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024
Bits Allocated	(0028,0100)	1	Ignored (expect "16")
Bits Stored	(0028,0101)	1	Ignored (expect "16")
High Bit	(0028,0102)	1	Ignored (expect "15")
Pixel Representation	(0028,0103)	1	Ignored (expect "1")
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Used
Largest Image Pixel Value	(0028,0107)	3	Used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored

Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

4.5.6.4   Contrast/Bolus Module

4.5.6.4.1   Contrast annotation mark (+c)

The "+c" annotation appears if a contrast agent is present ((0018,0010) in the data set) and the Contrast/Bolus Route contains "IV" or something different than "Oral". This means that if the Contrast/Bolus Route contains "Oral", the "+c" annotation will not appear.

TABLE 4.5-10
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used
Contrast/Bolus Agent Sequence	(0018,0012)	3	Ignored
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
Contrast/Bolus Route	(0018,1040)	3	Used
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Ignored
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Additional Drug Sequence	(0018,002A)	3	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Contrast/Bolus Volume	(0018,1041)	3	Ignored
Contrast/Bolus Start Time	(0018,1042)	3	Ignored
Contrast/Bolus Stop Time	(0018,1043)	3	Ignored
Contrast/Bolus Total Dose	(0018,1044)	3	Ignored
Contrast Flow Rate(s)	(0018,1046)	3	Ignored
Contrast Flow Duration(s)	(0018,1047)	3	Ignored
Contrast/Bolus Ingredient	(0018,1048)	3	Ignored
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Ignored

4.5.7   Common Overlay Modules

4.5.7.1   Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

This module is not currently supported by Voxtool products and will be ignored.

TABLE 4.5-11
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	Module Unsupported
Overlay Columns	(60xx,0011)	1	Module Unsupported
Overlay Type	(60xx,0040)	1	Module Unsupported
Origin	(60xx,0050)	1	Module Unsupported
Overlay Bits Allocated	(60xx,0100)	1	Module Unsupported
Bit Position	(60xx,0102)	1	Module Unsupported
Overlay Data	(60xx,3000)	1C	Module Unsupported
Overlay Description	(60xx,0022)	3	Module Unsupported
Overlay Subtype	(60xx,0045)	3	Module Unsupported
Overlay Label	(60xx,1500)	3	Module Unsupported
ROI Area	(60xx,1301)	3	Module Unsupported
ROI Mean	(60xx,1302)	3	Module Unsupported
ROI Standard Deviation	(60xx,1303)	3	Module Unsupported
Overlay Descriptor – Gray	(60xx,1100)	3	Module Unsupported
Overlay Descriptor – Red	(60xx,1101)	3	Module Unsupported
Overlay Descriptor – Green	(60xx,1102)	3	Module Unsupported
Overlay Descriptor – Blue	(60xx,1103)	3	Module Unsupported
Overlays – Gray	(60xx,1200)	3	Module Unsupported
Overlays – Red	(60xx,1201)	3	Module Unsupported
Overlays – Green	(60xx,1202)	3	Module Unsupported
Overlays – Blue	(60xx,1203)	3	Module Unsupported

4.5.8   Common Lookup Table Modules

4.5.8.1   VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 4.5-12
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	

Window Center	(0028,1050)	3	Ignored at load (an automatic W/L is computed on the whole series).
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series).
Window Center & Width Explanation	(0028,1055)	3	Ignored

4.5.9 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.9.1 SOP Common Module

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

TABLE 4.5-13
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used
SOP Instance UID	(0008,0018)	1	Used
Specific Character Set	(0008,0005)	1C	Used Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored
Instance Creation Time	(0008,0013)	3	Ignored
Instance Creator UID	(0008,0014)	3	Ignored
Time zone Offset From UTC	(0008,0201)	3	Ignored
Instance Number	(0020,0013)	3	Used
SOP Instance Status	(0100,0410)	3	Ignored
SOP Authorization Date and Time	(0100,0420)	3	Ignored
SOP Authorization Comment	(0100,0414)	3	Ignored
Authorization Equipment Certification Number	(0100,0416)	3	Ignored

4.5.10   MR Modules

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

4.5.10.1   MR Image Module

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

TABLE 4.5-14
MR IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 4.5.10.1.1.1.
Samples per Pixel	(0028,0002)	1	Shall be 1.
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Bits Allocated	(0028,0100)	1	Shall be 16.
Scanning Sequence	(0018,0020)	1	Used
Sequence Variant	(0018,0021)	1	Used
Scan Options	(0018,0022)	2	Used
MR Acquisition Type	(0018,0023)	2	Used
Repetition Time	(0018,0080)	2C	Used
Echo Time	(0018,0081)	2	Used
Echo Train Length	(0018,0091)	2	Used
Inversion Time	(0018,0082)	2C	Used
Trigger Time	(0018,1060)	2C	Used
Sequence Name	(0018,0024)	3	Ignored
Angio Flag	(0018,0025)	3	Ignored
Number of Averages	(0018,0083)	3	Used
Imaging Frequency	(0018,0084)	3	Used
Imaged Nucleus	(0018,0085)	3	Ignored
Echo Number	(0018,0086)	3	Used
Magnetic Field Strength	(0018,0087)	3	Used
Spacing Between Slices	(0018,0088)	3	Ignored
Number of Phase Encoding Steps	(0018,0089)	3	Ignored
Percent Sampling	(0018,0093)	3	Used
Percent Phase Field of View	(0018,0094)	3	Ignored
Pixel Bandwidth	(0018,0095)	3	Used
Nominal Interval	(0018,1062)	3	Ignored
Beat Rejection Flag	(0018,1080)	3	Ignored
Low R-R Value	(0018,1081)	3	Ignored
High R-R Value	(0018,1082)	3	Ignored
Intervals Acquired	(0018,1083)	3	Ignored
Intervals Rejected	(0018,1084)	3	Ignored

PVC Rejection	(0018,1085)	3	Ignored
Skip Beats	(0018,1086)	3	Ignored
Heart Rate	(0018,1088)	3	Ignored
Cardiac Number of Images	(0018,1090)	3	Used
Trigger Window	(0018,1094)	3	Ignored
Reconstruction Diameter	(0018,1100)	3	Ignored
Receiving Coil	(0018,1250)	3	Used
Transmitting Coil	(0018,1251)	3	Ignored
Acquisition Matrix	(0018,1310)	3	Used
Phase Encoding Direction	(0018,1312)	3	Ignored
Flip Angle	(0018,1314)	3	Used
SAR	(0018,1316)	3	Ignored
Variable Flip Angle Flag	(0018,1315)	3	Ignored
dB/dt	(0018,1318)	3	Ignored
Temporal Position Identifier	(0020,0100)	3	Ignored
Number of Temporal Positions	(0020,0105)	3	Ignored
Temporal Resolution	(0020,0110)	3	Ignored

4.5.10.1.1 MR Image Attribute Descriptions

4.5.10.1.1.1 Image Type

Value 1 has the following value:

− DERIVED   identifies a Derived Image

Value 2 has the following value:

− SECONDARY   identifies a Secondary Image

Value 3 has the following value:

− PJN   identifies a MIP reconstructed image

− REFORMATTED identifies a Multi Planar Reformatted Image

PJN is the same than PROJECTION IMAGE, and REFORMATTED is the same than MPR, but it kept in order to ensure the image can be pushed on old GE MR system.

Value 4, if defined, indicates that the image has a slice thickness superior to the pixel size; the rendering algorithm over the thickness can have the following values:

− MIP   identifies a thick Maximum Intensity Projection Image

− MIN IP   identifies a thick Minimum Intensity Projection Image

− AVERAGE   identifies a thick Average Image

− VOLREN   identifies a thick Volume Rendered Image

ILLUSTRATION 4.5-1
MR IMAGE TYPE DECISION TREE
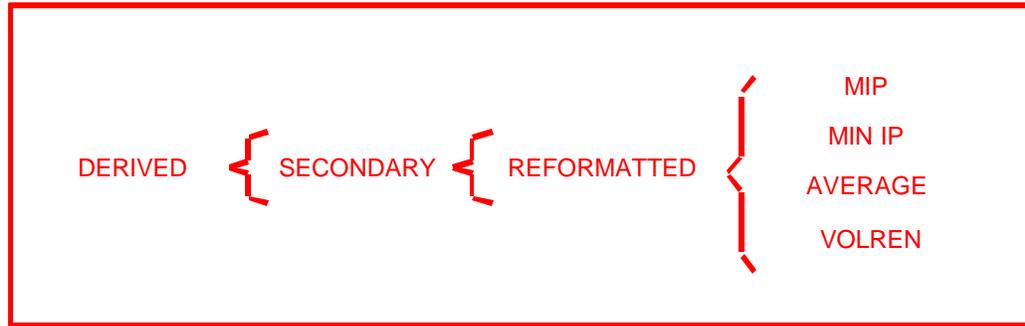
4.6   PRIVATE DATA DICTIONARY

In the case of a GE image (manufacturer 0008,0070 starts with GE MEDICAL SYSTEMS), the following private groups are copied:

0x09, 0x11, 0x19, 0x21, 0x23, 0x25, 0x27, 0x29, 0x43

This should ensure that these images can be pushed back on GE non DICOM native consoles.

TABLE 4.6-15
PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0009, 00xx)	3	GE HEALTHCARE_IDEN_01: Used
Genesis Full Fidelity Flag	(0009, xx01)	3	Ignored
Suite ID	(0009, xx02)	3	Ignored
Product ID	(0009, xx04)	3	Ignored
Unique Service ID	(0009, xx30)	3	Ignored
Mobile Location Number	(0009, xx31)	3	Ignored
Equipment UID	(0009, xxE3)	3	Ignored
Genesis Version – Now	(0009, xxE6)	3	Ignored
Private Creator	(0019, 00xx)	3	GE HEALTHCARE_ACQU_01: Used
Series Pulse Sequence	(0019, xx12)	3	Ignored
Display FOV-Y	(0019, xx1E)	3	Ignored
Duration of scan	(0019, xx5A)	3	Used
Number of echos	(0019, xx7E)	3	Used
Continuous slices flag	(0019, xx81)	3	Ignored
actual receive gain analog	(0019, xx8A)	3	Ignored
actual receive gain digital	(0019, xx8B)	3	Ignored
Swap Phase/Freq. Axis	(0019, xx8F)	3	Used
Pause Time	(0019, xx91)	3	Ignored

Pulse Sequence Name	(0019, xx9C)	3	Used
Coil Type	(0019, xx9F)	3	Ignored
SAT fat/water/bone	(0019, xxA4)	3	Used
User Variable0	(0019, xxA7)	3	Ignored
User Variable1	(0019, xxA8)	3	Ignored
User Variable2	(0019, xxA9)	3	Ignored
User Variable3	(0019, xxAA)	3	Ignored
User Variable4	(0019, xxAB)	3	Ignored
User Variable5	(0019, xxAC)	3	Ignored
User Variable6	(0019, xxAD)	3	Ignored
User Variable7	(0019, xxAE)	3	Ignored
User Variable8	(0019, xxAF)	3	Ignored
User Variable9	(0019, xxB0)	3	Ignored
User Variable10	(0019, xxB1)	3	Ignored
User Variable11	(0019, xxB2)	3	Ignored
User Variable12	(0019, xxB3)	3	Ignored
User Variable13	(0019, xxB4)	3	Ignored
User Variable14	(0019, xxB5)	3	Ignored
User Variable15	(0019, xxB6)	3	Ignored
User Variable16	(0019, xxB7)	3	Ignored
User Variable17	(0019, xxB8)	3	Ignored
User Variable18	(0019, xxB9)	3	Ignored
User Variable19	(0019, xxBA)	3	Ignored
User Variable20	(0019, xxBB)	3	Ignored
User Variable21	(0019, xxBC)	3	Ignored
User Variable22	(0019, xxBD)	3	Ignored
Saturation Planes	(0019, xxC0)	3	Used
Surface Coil Intensity Correction Flag	(0019, xxC1)	3	Used
Phase contrast flow axis	(0019, xxCB)	3	Used
Velocity Encoding	(0019, xxCC)	3	Used
Fractional Echo/EffectiveTE	(0019, xxD5)	3	Used
Cardiac Phase Number	(0019, xxD7)	3	Used
variable echo flag	(0019, xxD8)	3	Used
Concatenated Sat Type flg	(0019, xxD9)	3	Used
User Variable23	(0019, xxDF)	3	Ignored
User Variable24	(0019, xxE0)	3	Ignored
Number of Phases	(0019, xxF2)	3	Used
Transmit Gain	(0019, xxF9)	3	Ignored
Private Creator	(0021, 00xx)	3	GE HEALTHCARE_RELA_01: Used
Series fr which prescribed	(0021, xx03)	3	Ignored

ex_verscur ?	(0021, xx05)	3	Ignored
series fr which prescribed	(0021, xx35)	3	Ignored
Image fr which prescribed	(0021, xx36)	3	Ignored
Screen Format	(0021, xx37)	3	Ignored
Row Axis Rot from src img	(0021, xx51)	3	Ignored
Col Axis Rot from src img	(0021, xx52)	3	Ignored
Normal Axis Rot from src img	(0021, xx53)	3	Ignored
Slop int 1	(0021, xx56)	3	Ignored
Slop int 2	(0021, xx57)	3	Ignored
Slop int 3	(0021, xx58)	3	Ignored
Slop int 4	(0021, xx59)	3	Ignored
Slop int 5	(0021, xx5A)	3	Ignored
Slop float 1	(0021, xx5B)	3	Ignored
Slop float 2	(0021, xx5C)	3	Ignored
Slop float 3	(0021, xx5D)	3	Ignored
Slop float 4	(0021, xx5E)	3	Ignored
Slop float 5	(0021, xx5F)	3	Ignored
Private Creator	(0025, 00xx)	3	GE HEALTHCARE_SERS_01: Used
Primary Receiver	(0025, xx1A)	3	Ignored
Private Creator	(0027, 00xx)	3	GE HEALTHCARE_IMAG_01: Used
Imaging Mode	(0027, xx31)	3	Ignored
Pulse Sequence	(0027, xx32)	3	Ignored
Imaging Options	(0027, xx33)	3	Ignored
Plane Type	(0027, xx35)	3	Ignored
RAS letter of image loc	(0027, xx40)	3	Ignored
Image Location	(0027, xx41)	3	Ignored
Image Dimension – X	(0027, xx60)	3	Ignored
Image Dimension – Y	(0027, xx61)	3	Ignored
Number of Excitations	(0027, xx62)	3	Ignored
Private Creator	(0029, 00xx)	3	GE HEALTHCARE_IMPS_01: Used
ver of the hdr structure	(0029, xx26)	3	Ignored
Lower Range of Pixels 1	(0029, xx15)	3	Ignored
Upper Range of Pixels 1	(0029, xx16)	3	Ignored
Private Creator	(0043, 00xx)	3	GE HEALTHCARE_PARM_01: Used
bitmap of prescan options	(0043, xx01)	3	Ignored
number of EPI shots	(0043, xx06)	3	Ignored
views per segment	(0043, xx07)	3	Ignored
respiratory rate	(0043, xx08)	3	Ignored
respiratory trigger point	(0043, xx09)	3	Ignored
type of receiver used	(0043, xx0A)	3	Ignored

pk rate of chg of Grad fld	(0043, xx0B)	3	Ignored
Limit in units per percent	(0043, xx0C)	3	Ignored
version of header structure	(0043, xx26)	3	Ignored
Collapse Image	(0043, xx30)	3	Ignored
user_usage_tag	(0043, xx35)	3	Ignored
User Variable25…User Variable48	(0043, xx38)	3	Ignored
Slop Int 6 ... 9	(0043, xx39)	3	Ignored
Slop Int 10 ... 17	(0043, xx60)	3	Ignored
scanner study entity uid	(0043, xx61)	3	Ignored
scanner study uid	(0043, xx62)	3	Ignored
table Position / angle / offset / WholeOrZoom	(0043, xx6F)	3	Ignored

5. PET INFORMATION OBJECT IMPLEMENTATION

5.1   INTRODUCTION

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

3.2 - IOD Description

3.3 - IOD Entity-Relationship Model

3.4 - IOD Module Table

3.5 - IOD Module Definition

5.2   PET IOD IMPLEMENTATION

5.3   PET ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Image interoperability schema is shown in Illustration 3.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box

- each relationship is represented by a diamond shaped box.

- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

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

ILLUSTRATION 3.3-1
PET IMAGE ENTITY RELATIONSHIP DIAGRAM

```
                                          ┌──────────┐
                                          │ Patient  │
                                          └──────────┘
                                               │ 1
                                               ▼
                                          ╱─────────╲
                                         ⟨     is     ⟩
                                         ⟨ the subject ⟩
                                         ⟨     of     ⟩
                                          ╲─────────╱
                                               │ 1,n
                                               ▼
                                          ┌──────────┐
                                          │  Study   │
                                          └──────────┘
                                               │ 1
                                               ▼
                                          ╱─────────╲
                                         ⟨  contains ⟩
                                          ╲─────────╱
                                               │ 1,n
                                               ▼
    ╱─────────╲                  0,n     ┌──────────┐
   ⟨ spatially ⟩────────────────────────▶│          │
   ⟨ defines   ⟩        ╱────────╲       │  Series  │
    ╲─────────╱        ⟨ creates  ⟩─────▶│          │
         ▲ 1            ╲────────╱  1,n  └──────────┘
         │                  ▲ 1               │ 1
   ┌───────────────┐   ┌──────────┐           ▼
   │ Frame of      │   │ Equipment│      ╱─────────╲
   │ Reference     │   └──────────┘     ⟨  contains ⟩
   └───────────────┘                     ╲─────────╱
                                               │ 0,n
                                               ▼
                                          ┌──────────┐
                                          │   PET    │
                                          └──────────┘
```
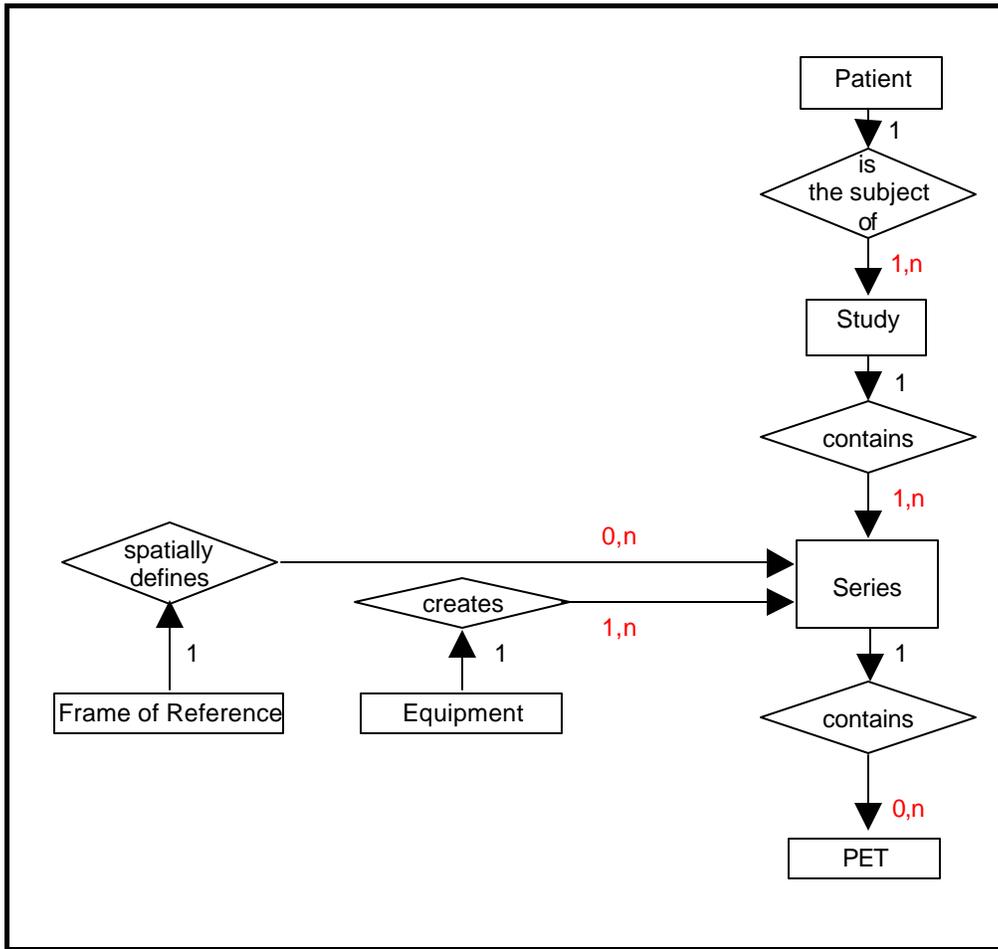
5.3.1 ENTITY DESCRIPTIONS

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

5.3.2 CORTEX ID Mapping of DICOM entities

TABLE 5.3-1
MAPPING OF DICOM ENTITIES TO CORTEX ID ENTITIES

DICOM	CORTEX ID Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

5.4   IOD MODULE TABLE

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

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM PET IOD. Modules are identified by Module Name.

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

TABLE 5.4-1
PET IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	5.5.1.1
Study	General Study	5.5.2.1
	Patient Study	5.5.2.2
Series	General Series	5.5.3.1
	PET Series	5.5.10.1
	PET Isotope	5.5.10.1.1
	PET Multi-gated Acquisition	5.5.10.3
	NM/PET Patient Orientation	5.5.10.4
Frame of Reference	Frame of Reference	5.5.4.1
Equipment	General Equipment	5.5.5.1
Image	General Image	5.5.6.1
	Image Plane	5.5.6.1.1
	Image Pixel	5.5.6.3
	PET Image	5.5.10.5
	Overlay Plane	5.5.7.1
	VOI LUT	5.5.8.1
	SOP Common	5.5.9.1

5.5   INFORMATION MODULE DEFINITIONS

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

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

5.5.1 Common Patient Entity Modules

TABLE 5.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Patient's Birth Date	(0010,0030)	2	Used / Copied
Patient's Sex	(0010,0040)	2	Used / Copied
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient Ids	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

5.5.1.1 Patient Module

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

5.5.2 Common Study Entity Modules

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

5.5.2.1 General Study Module

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

TABLE 5.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / Copied
Study Time	(0008,0030)	2	Used / Copied
Referring Physician's Name	(0008,0090)	2	Used / Copied
Study ID	(0020,0010)	2	Used / Copied
Accession Number	(0008,0050)	2	Used / Copied
Study Description	(0008,1030)	3	Used / Copied
Physician(s) of Record	(0008,1048)	3	Ignored / Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Used / Copied
Referenced Study Sequence	(0008,1110)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Requested Procedure ID	(0040,1001)		Ignored / Copied
Procedure Code Sequence	(0008,1032)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

5.5.2.2 Patient Study Module

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

TABLE 5.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored / Copied
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Size	(0010,1020)	3	Used / Copied
Patient's Weight	(0010,1030)	3	Used / Copied
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient's History	(0010,21B0)	3	Used / Copied

5.5.3   Common Series Entity Modules

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

5.5.3.1   General Series Module

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

TABLE 5.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Copied Defined Terms: PT = Positron Emission Tomography
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Series Number	(0020,0011)	2	Ignored / Generated (platform generated)
Laterality	(0020,0060)	2C	Ignored / Copied
Series Date	(0008,0021)	3	Used / Copied
Series Time	(0008,0031)	3	Used / Copied
Performing Physicians' Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated (user entered on save)
Operators' Name	(0008,1070)	3	Used / Copied
Referenced Perform Procedure Step Sequence	(0008,1111)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored / Copied
Patient Position	(0018,5100)	2C	Used / Copied The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Ignored / Removed
Largest Pixel Value in Series	(0028,0109)	3	Ignored / Removed
Request Attributes Sequence	(0040,0275)	3	Ignored / Co pied

>Requested Procedure ID	(0040,1001)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed
Performed Action Item Sequence	(0040,0260)	3	Ignored / Removed
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

5.5.3.1.1 Series Date and Time

The Series Date and Time refer to the scan date and time. They cannot be changed, since they are the reference point for all temporal measurements in the images.

5.5.3.1.2 Series Number

The Series number shall be provided automatically by the platform.

5.5.4 Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

TABLE 5.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Mandatory / Copied or Generated (5.5.4.1)
Position Reference Indicator	(0020,1040)	2	Ignored / Copied

5.5.4.1 Frame Of Reference UID

Images should share the same Frame Of Reference UID as a necessary condition for fusion.

Reformatted PET Images shall have the frame of reference UID copied.

3D-SSP projection PET images shall have a frame of reference UID indicating the atlas used in anatomic normalization.

5.5.5 Common Equipment Entity Modules

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

5.5.5.1 General Equipment Module

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

CORTEX ID can create derived series. This module will then be generated according to the System on which the application is running and the name of the application creating it.

As the application can simulate the generation of an image by the scanner, we have chosen to copy this module, but to omit the fields that could be altered by the reformation

TABLE 5.5-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used / Generated (GE Healthcare)
Institution Name	(0008,0080)	3	Used / Generated (from platform configuration)
Institution Address	(0008,0081)	3	Ignored / Generated (from platform configuration)
Station Name	(0008,1010)	3	Used / Generated (from platform configuration)
Institutional Department Name	(0008,1040)	3	Ignored / Generated (from platform configuration)
Manufacturer's Model Name	(0008,1090)	3	Used / Generated Cortex ID and platform name
Device Serial Number	(0018,1000)	3	Ignored/Removed
Software Versions	(0018,1020)	3	Ignored / Generated (Application and platform)
Spatial Resolution	(0018,1050)	3	Ignored/Removed
Date of Last Calibration	(0018,1200)	3	Ignored / Removed
Time of Last Calibration	(0018,1201)	3	Ignored / Removed
Pixel Padding Value	(0028,0120)	3	Ignored / Removed

5.5.6 Common Image Entity Modules

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

5.5.6.1 General Image Module

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

TABLE 5.5-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used / Generated (same as Image Index (0054, 1330), see PET Image Module Attributes)
Patient Orientation	(0020,0020)	2C	Ignored / Copied
Content Date	(0008,0023)	2C	Used / Generated (from platform, date image created ?) SW assumes platform clock is correct.
Content Time	(0008,0033)	2C	Used / Generated (from platform, time image created ?) SW assumes platform clock is correct.
Image Type	(0008,0008)	3	Used / Generated
Acquisition Number	(0020,0012)	3	Ignored / Copied
Acquisition Date	(0008,0022)	3	Used / Copied
Acquisition Time	(0008,0032)	3	Used / Copied
Referenced Image Sequence	(0008,1140)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / Removed
Source Image Sequence	(0008,2112)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Quality Control Image	(0028,0300)	3	Ignored / Removed
Burned In Annotations	(0028,0301)	3	Ignored / Generated
Lossy Image Compression	(0028,2110)	3	Ignored / Removed
Lossy Image Compression Ratio	(0028,2112)	3	Ignored / Removed

5.5.6.1.1 General Image Attribute Descriptions

5.5.6.1.1.1 Image Number

5.5.6.1.1.2 Patient Orientation

Since the coordinates of the image are always written, this field is never present in the created images.

 PET images use Image Orientation Patient (0020,0037) and Image Position Patient (0020,0032).

5.5.6.1.1.3 Image Type

As an FSC, here are the values that may be sent.

Value 1 has the following value:
- DERIVED   all images generated are results of post processing input images. Application does not support source data (raw scan data).

Value 2 has the following value:
- PRIMARY   assumes all images created as part of initial patient examination.
- SECONDARY   not supported by the application

Value 3 has the following value:
- REFORMATTED orthogonal or oblique reformatting (MPR)
- SUMMED   sum of multiple images.
- PROJECTION   images   derived   by   projection   rendering techniques, MIP, Volume Rendering, Ray Tracing, Surface Rendering, Surface Extraction and Projection
- REGISTERED   images transformed to a new frame of reference by rigid and/or non-rigid processes.

Value 4, if defined, can have the following values:
- MIP   identifies a thick Maximum Intensity Projection Image
- MIN IP   identifies a thick Minimum Intensity Projection Image
- AVERAGE   identifies a thick Average Image
- VOLREN   identifies a thick Volume Rendered Image
- TIME   identifies a image created by summing over time.
- LOCATION   identifies a image created by summing over location.
- REFRAME   identifies a image created by adding frames or bins
- 3DSSP   3D Stereotaxic Surface Projection
- RIGID
- NONRIGID

5.5.6.1.1.4 Derivation Description and Source Image Sequence

These tags are ignored.

5.5.6.1.1.5 Lossy Image Compression

The application does not support reading or writing of compressed images.

5.5.6.2 Image Plane Module

This section specifies the Attributes which define the transmitted pixel array of a two dimensional image plane.

TABLE 5.5-8
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Mandatory / Generated
Image Orientation (Patient)	(0020,0037)	1	Mandatory / Generated
Image Position (Patient)	(0020,0032)	1	Mandatory / Generated
Slice Thickness	(0018,0050)	2	Used / Generated
Slice Location	(0020,1041)	3	Ignored / Removed

5.5.6.2.1 Pixel Spacing

The Pixel spacing is calculated by the application for all output images.

5.5.6.2.2 Image Orientation

Generated for all output images.

5.5.6.2.3 Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is "GE MEDICAL SYSTEMS") where the Manufacturer Model Name is "Advance", "Discovery LS" or "Discovery QX/i".

Otherwise, the Image Position is treated as the position of the center of the first pixel of the image.

All images saved by the application are encoded with Image Position as the center of the first pixel of the image. Thus converting from the upper left hand corner to the center as necessary.

5.5.6.2.4 Slice Thickness

The Slice Thickness shall be generated for all output images.

5.5.6.3 Image Pixel Module

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

TABLE 5.5-9
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1") / Generated "1"

Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2"
Rows	(0028,0010)	1	Mandatory (expect from 64 to 256) / Generated
Columns	(0028,0011)	1	Mandatory (expect from 64 to 256) / Generated
Bits Allocated	(0028,0100)	1	Ignored (expect "16") / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect "16") / Generated "16"
High Bit	(0028,0102)	1	Ignored (expect "15") / Generated "15"
Pixel Representation	(0028,0103)	1	Ignored (expect "1") / Generated "1"
Pixel Data	(7FE0,0010)	1	Used / Generated
Planar Configuration	(0028,0006)	1C	Ignored/Copied
Pixel Aspect Ratio	(0028,0034)	1C	Ignored/Copied
Smallest Image Pixel Value	(0028,0106)	3	Ignored/Copied
Largest Image Pixel Value	(0028,0107)	3	Ignored/Copied
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored/Copied
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored/Copied
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored/Copied
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored/Copied
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored/Copied
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored/Copied

5.5.7 Common Overlay Modules

5.5.7.1 Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

This module is not currently supported by the applications and will be ignored.

TABLE 5.5-10
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	Module Unsupported
Overlay Columns	(60xx,0011)	1	Module Unsupported
Overlay Type	(60xx,0040)	1	Module Unsupported
Origin	(60xx,0050)	1	Module Unsupported
Overlay Bits Allocated	(60xx,0100)	1	Module Unsupported
Bit Position	(60xx,0102)	1	Module Unsupported
Overlay Data	(60xx,3000)	1C	Module Unsupported
Overlay Description	(60xx,0022)	3	Module Unsupported
Overlay Subtype	(60xx,0045)	3	Module Unsupported
Overlay Label	(60xx,1500)	3	Module Unsupported
ROI Area	(60xx,1301)	3	Module Unsupported
ROI Mean	(60xx,1302)	3	Module Unsupported
ROI Standard Deviation	(60xx,1303)	3	Module Unsupported
Overlay Descriptor - Gray	(60xx,1100)	3	Module Unsupported
Overlay Descriptor - Red	(60xx,1101)	3	Module Unsupported
Overlay Descriptor - Green	(60xx,1102)	3	Module Unsupported
Overlay Descriptor - Blue	(60xx,1103)	3	Module Unsupported
Overlays - Gray	(60xx,1200)	3	Module Unsupported
Overlays - Red	(60xx,1201)	3	Module Unsupported
Overlays - Green	(60xx,1202)	3	Module Unsupported
Overlays - Blue	(60xx,1203)	3	Module Unsupported

5.5.8 Common Lookup Table Modules

5.5.8.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 5.5-11
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored / Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	

Window Center	(0028,1050)	3	Ignored at load (an automatic W/L is computed on the whole series) / Generated
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series) / Generated
Window Center & Width Explanation	(0028,1055)	3	Ignored / Removed

5.5.8.1.1 Window Center and Width

Generated from the current W/L max and min for the series.

5.5.9 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5.5.9.1 SOP Common Module

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

TABLE 5.5-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated
SOP Instance UID	(0008,0018)	1	Used / Generated
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored / Generated (system clock)
Instance Creation Time	(0008,0013)	3	Ignored / Generated (system clock)
Instance Creator UID	(0008,0014)	3	Ignored / Removed
Time zone Offset From UTC	(0008,0201)	3	Ignored / Removed
Instance Number	(0020,0013)	3	Used / Generated (same as Image Index 0054, 1330).
SOP Instance Status	(0100,0410)	3	Ignored / Removed
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Removed
SOP Authorization Comment	(0100,0414)	3	Ignored / Removed
Authorization Equipment Certification Number	(0100,0416)	3	Ignored / Removed

5.5.10 PET Modules

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

5.5.10.1 PET Series

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 5.5-13
PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Series Date	(0008,0021)	1	Used / Copied
Series Time	(0008,0031)	1	Used / Copied
Units	(0054,1001)	1	Used / Generated
Counts Source	(0054,1002)	1	Ignored / Copied
Series Type	(0054,1000)	1	Used / Generated
Reprojection Method	(0054,1004)	2C	Used / Generated
Number of R-R Intervals	(0054,0061)	1C	Ignored / Copied
Number of Time Slots	(0054,0071)	1C	Ignored / Copied
Number of Time Slices	(0054,0101)	1C	Ignored / Copied
Number of Slices	(0054,0081)	1	Used / Generated
Corrected Image	(0028,0051)	2	Used / Copied
Randoms Correction Method	(0054,1100)	3	Ignored / Copied
Attenuation Correction Method	(0054,1101)	3	Ignored / Copied
Scatter Correction Method	(0054,1105)	3	Ignored / Copied
Decay Correction	(0054,1102)	1	Ignored / Copied
Reconstruction Diameter	(0018,1100)	3	Ignored/ Copied
Convolution Kernel	(0018,1210)	3	Ignored / Copied
Reconstruction Method	(0054,1103)	3	Ignored / Copied
Detector Lines of Response Used	(0054,1104)	3	Ignored / Copied
Acquisition Start Condition	(0018,0073)	3	Ignored / Copied
Acquisition Start Condition Data	(0018,0074)	3	Ignored / Copied
Acquisition Termination Condition	(0018,0071)	3	Ignored / Copied
Acquisition Termination Condition Data	(0018,0075)	3	Ignored / Copied
Field of View Shape	(0018,1147)	3	Ignored / Copied
Field of View Dimensions	(0018,1149)	3	Ignored / Copied
Gantry/Detector Tilt	(0018,1120)	3	Ignored / Copied
Gantry/Detector Slew	(0018,1121)	3	Ignored / Copied
Type of Detector Motion	(0054,0202)	3	Ignored / Copied
Collimator Type	(0018,1181)	2	Ignored / Copied

Collimator/Grid Name	(0018,1180)	3	Ignored / Copied
Axial Acceptance	(0054,1200)	3	Ignored / Copied
Axial Mash	(0054,1201)	3	Ignored / Copied
Transverse Mash	(0054,1202)	3	Ignored / Copied
Detector Element Size	(0054,1203)	3	Ignored / Copied
Coincidence Window Width	(0054,1210)	3	Ignored / Copied
Energy Window Range Sequence	(0054,0013)	3	Ignored / Copied
>Energy Window Lower Limit	(0054,0014)	3	Ignored / Copied
>Energy Window Upper Limit	(0054,0015)	3	Ignored / Copied
Secondary Counts Type	(0054,1220)	3	Ignored / Copied

`

5.5.10.1.1 Units

Insert Table

STDDEV

NONE

PCNT

Otherwise units are copied.

5.5.10.1.2 Series Type

Value 1 is always copied

Value 2 is IMAGE for multi-plane reformats, registration images, summed images, reframed images

Value 2 is REPROJECTION if the images are MIP, 3DSSP Projections, Volume Rendering

5.5.10.1.3 Reprojection Method

MAX PIXEL used for MIP and 3DSSP Projections.

5.5.10.2 PET Isotope

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 5.5-14
PET ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Radiopharmaceutical Information Sequence	(0054,0016)	2	Used / Copied
>Radionuclide Code Sequence	(0054,0300)	2	Used / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Route	(0018,1070)	3	Ignored / Copied
>Administration Route Code Sequence	(0054,0302)	3	Ignored / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Volume	(0018,1071)	3	Used / Copied
>Radiopharmaceutical Start Time	(0018,1072)	3	Used / Copied
>Radiopharmaceutical Stop Time	(0018,1073)	3	Used / Copied
>Radionuclide Total Dose	(0018,1074)	3	Used / Copied
>Radionuclide Half Life	(0018,1075)	3	Used / Copied
>Radionuclide Positron Fraction	(0018,1076)	3	Used / Copied
>Radiopharmaceutical Specific Activity	(0018,1077)	3	Used / Copied
>Radiopharmaceutical	(0018,0031)	3	Used / Copied
>Radiopharmaceutical Code Sequence	(0054,0304)	3	Used / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Intervention Drug Information Sequence	(0018,0026)	3	Ignored / Copied
>Intervention Drug Name	(0018,0034)	3	Ignored / Copied
>Intervention Drug Code Sequence	(0018,0029)	3	Ignored / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Intervention Drug Start Time	(0018,0035)	3	Ignored / Copied
>Intervention Drug Stop Time	(0018,0027)	3	Ignored / Copied
>Intervention Drug Dose	(0018,0028)	3	Ignored / Copied

5.5.10.3   PET Multi-gated Acquisition

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 5.5-15
PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description

Beat Rejection Flag	(0018,1080)	2	Ignored / Copied
Trigger Source or Type	(0018,1061)	3	Ignored / Copied
PVC Rejection	(0018,1085)	3	Ignored /Copied
Skip Beats	(0018,1086)	3	Ignored / Copied
Heart Rate	(0018,1088)	3	Ignored / Copied
Framing Type	(0018,1064)	3	Ignored / Copied

5.5.10.4 NM/PET Patient Orientation

The table in this Section contains IOD Attributes that describe NM/PET Patient Orientation.

TABLE 5.5-16
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Ignored / Copied
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Ignored / Copied
>> Code value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Ignored / Copied
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	

5.5.10.5 PET Image Module

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

TABLE 5.5-17
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used / Generated
Samples per Pixel	(0028,0002)	1	Ignored (expect 1) / Generated "1"
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2" or "MONOCHROME1"
Bits Allocated	(0028,0100)	1	Shall be 16 / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect 16) / Generated "16"

High Bit	(0028,0102)	1	Ignored (expect 15) / Generated "15"
Rescale Intercept	(0028,1052)	1	Used / Generated (set to 0)
Rescale Slope	(0028,1053)	1	Used / Generated
Frame Reference Time	(0054,1300)	1	Ignored / Copied
Trigger Time	(0018,1060)	1C	Ignored / Copied
Frame Time	(0018,1063)	1C	Ignored / Copied
Low R-R Value	(0018,1081)	1C	Ignored / Copied
High R-R Value	(0018,1082)	1C	Ignored / Copied
Lossy Image Compression	(0028,2110)	1C	Ignored / Copied
Image Index	(0054,1330)	1	Used / Generated
Acquisition Date	(0008,0022)	2	Used / Copied
Acquisition Time	(0008,0032)	2	Used / Copied
Actual Frame Duration	(0018,1242)	2	Ignored / Copied
Nominal Interval	(0018,1062)	3	Ignored / Removed
Intervals Acquired	(0018,1083)	3	Ignored / Removed
Intervals Rejected	(0018,1084)	3	Ignored / Removed
Primary (Prompts) Counts Accumulated	(0054,1310)	3	Ignored / Removed
Secondary Counts Accumulated	(0054,1311)	3	Ignored / Removed
Slice Sensitivity Factor	(0054,1320)	3	Ignored / Removed
Decay Factor	(0054,1321)	1C	Ignored / Copied
Dose Calibration Factor	(0054,1322)	3	Ignored / Removed
Scatter Fraction Factor	(0054,1323)	3	Ignored / Removed
Dead Time Factor	(0054,1324)	3	Ignored / Removed
Referenced Overlay Sequence	(0008,1130)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Referenced Curve Sequence	(0008,1145)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Anatomic Region Sequence	(0008,2218)	3	Ignored / Removed
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Anatomic Region Modifier Sequence	(0008,2220)	3	Ignored / Removed
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Primary Anatomic Structure Sequence	(0008,2228)	3	Ignored / Removed

>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Ignored / Removed
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	

5.5.10.6 Image Type

Value 1 : DERIVED
Value 2 : SECONDARY
Value 3: SUMMED

5.5.10.7 Rescale Slope

The computed rescale slope will be the same for all images in the resulting series.

5.5.10.8 Primary Counts Accumulated

The result is the sum of all contributing images primary counts.

5.5.10.9 Secondary Counts Accumulated

The result is the sum of all contributing images secondary counts.

5.6 OTHER PRIVATE DATA

Private Elements from not described in this module are not used by the applic ation and not carried through to saved images.

5.7 PET-AD PRIVATE DATA

The following table describes the Private Elements used when saving the 8 3D SSP Zscore surface projection images.

PRIVATE NEURO AD ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Comments	(0008,4000)	3	Ignored/Generated SSP Results from SSP
Private Creator	(0025, 00xx)	3	Used / Generated defines the private group, GEMS_PET_NRAD_01
Neuro Reorientation Parameter	(0025, xx10)	3	Used / Generated affine transla tion parameters from original image to Atlas space.
Neuro Warped Image Parameter	(0025, xx11)	3	Used / Generated – 3DSSP warping parameters.
Neuro Cortical Warped Indices	(0025, xx14)	3	Used / Generated – 3DSSP image indices for the extracted cortical surface from data registered in atlas space.

Neuro Cortical Surface Values	(0025, xx15)	3	Used / Generated – 3DSSP extracted cortical surface.
Neuro Pons Z Cortical Surface	(0025, xx16)	3	Used / Generated – 3DSSP PONS normalized cortical surface Z score.
Neuro Cereb Z Cortical Surface	(0025, xx17)	3	Used / Generated - 3DSSP CEREB normalized cortical surface Z score.
Neuro Thalm Z Cortical Surface	(0025, xx18)	3	Used / Generated - 3DSSP THALMUS normalized cortical surface Z score.
Neuro Global Z Cortical Surface	(0025, xx19)	3	Used / Generated - 3DSSP GLOBAL normalized cortical surface Z score.
Neuro Normals Database Name	(0025, xx1A)	3	Used / Generated – name (age range) of the Normals Database used to generate the Z score images.
Neuro Cortical Surface Indices	(0025, xx1B)	3	Used / Generated - Image indices for the extracted cortical surface mapped.
Neuro Pons Cortical Region Z	(0025, xx1C)	3	Used/Generated – 3DSSP cortical region Z scores Pons normalization.
Neuro Cereb Cortical Region Z	(0025, xx1D)	3	Used/Generated – 3DSSP cortical region Z scores Cereb normalization.
Neuro Thalm Cortical Region Z	(0025, xx1E)	3	Used/Generated – 3DSSP cortical region Z scores Thalm normalization.
Neuro Global Cortical Region Z	(0025, xx1F)	3	Used/Generated – 3DSSP cortical region Z scores Global normalization.
Neuro Cortical Original Indices	(0025, xx21)	3	Used / Generated – 3DSSP image indices for the extracted cortical surface in the original patient space.
Neuro Meta Z Cortical Surface	(0025, xx31)	3	Used / Generated -3DSSP Metabolic normalized cortical surface Z score.
Source Study Instance UID	(0025, xx32)	3	Used / Generated – Study UID of the source images.
Source Series Instance UID	(0025, xx33)	3	Used / Generated – Series UID of the source images.
Surface Name	(0025, xx34)	3	Used / Generated – Surface Name
Normalization Region	(0025, xx35)	3	Used / Generated – Region of the Brain used for this image.

6. SC INFORMATION OBJECT IMPLEMENTATION

6.1   INTRODUCTION

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

6.2 - IOD Description

6.3 - IOD Entity-Relationship Model

6.4 - IOD Module Table

6.5 - IOD Module Definition

6.2   S C IOD IMPLEMENTATION

6.3   S C ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 6.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box

- each relationship is represented by a diamond shaped box.

- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

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

ILLUSTRATION 6.3-1
SC IMAGE ENTITY RELATIONSHIP DIAGRAM

```
                                    ┌──────────┐
                                    │ Patient  │
                                    └──────────┘
                                         │ 1
                                    ◇ is the subject of ◇
                                         │ 1,n
                                    ┌──────────┐
                                    │  Study   │
                                    └──────────┘
                                         │ 1
                                    ◇ contains ◇
                                         │ 1,n
        ◇ creates ◇ ──── 1,n ──→   ┌──────────┐
            │ 1                     │  Series  │
        ┌──────────┐               └──────────┘
        │ Equipment│                    │ 1
        └──────────┘               ◇ contains ◇
                                         │ 0,n
                                    ┌──────────┐
                                    │ SC Image │
                                    └──────────┘
```
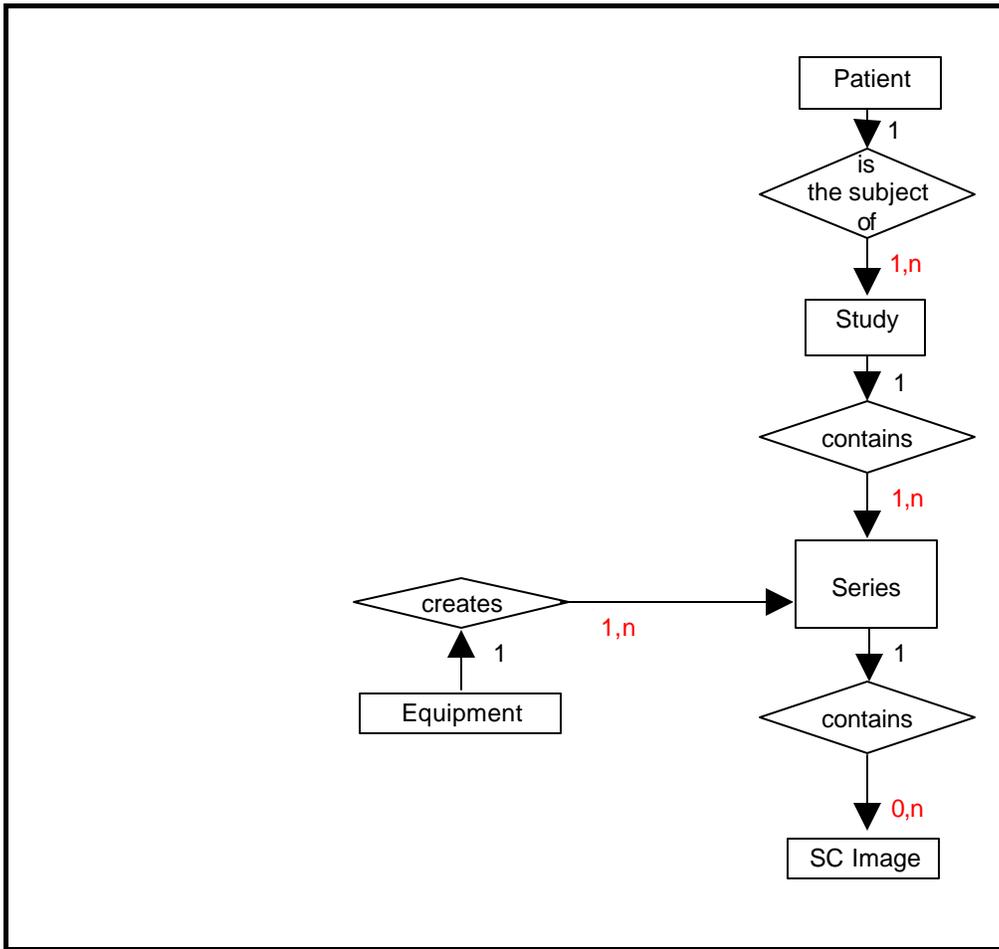
6.3.1 ENTITY DESCRIPTIONS

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

6.3.2 Mapping of DICOM entities

TABLE 6.3-1
MAPPING OF DICOM ENTITIES TO APPLICATION ENTITIES

DICOM	Application Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

6.4 IOD MODULE TABLE

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

Table 6.4-1 identifies the defined modules within the entities which comprise the DICOM SC IOD. Modules are identified by Module Name.

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

TABLE 6.4-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	6.5.1.1
Study	General Study	6.5.2.1
	Patient Study	6.5.2.2
Series	General Series	6.5.3.1
Equipment	General Equipment	6.5.4.1
	SC Equipment	6.5.9.1
Image	General Image	6.5.5.1
	Image Pixel	6.5.5.2
	SC Image	6.5.9.2
	Overlay Plane	6.5.6.1
	Modality LUT	6.5.7.2
	VOI LUT	6.5.7.1
	SOP Common	6.5.8.1

6.5 INFORMATION MODULE DEFINITIONS

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

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes support ed. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

6.5.1   Common Patient Entity Modules

6.5.1.1   Patient Module

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

TABLE 6.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copied
Patient ID	(0010,0020)	2	Copied
Patient's Birth Date	(0010,0030)	2	Copied
Patient's Sex	(0010,0040)	2	Copied
Referenced Patient Sequence	(0008,1120)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Copied
Other Patient IDs	(0010,1000)	3	Copied
Other Patient Names	(0010,1001)	3	Copied
Ethnic Group	(0010,2160)	3	Copied
Patient Comments	(0010,4000)	3	Copied

6.5.2   Common Study Entity Modules

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

6.5.2.1 General Study Module

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

TABLE 6.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Copied
Study Date	(0008,0020)	2	Copied
Study Time	(0008,0030)	2	Copied
Referring Physician's Name	(0008,0090)	2	Copied
Study ID	(0020,0010)	2	Copied
Accession Number	(0008,0050)	2	Copied
Study Description	(0008,1030)	3	Copied
Physician(s) of Record	(0008,1048)	3	Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Copied
Referenced Study Sequence	(0008,1110)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

6.5.2.2 Patient Study Module

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

TABLE 6.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Copied
Patient's Age	(0010,1010)	3	Copied
Patient's Size	(0010,1020)	3	Copied
Patient's Weight	(0010,1030)	3	Copied
Occupation	(0010,2180)	3	Copied
Additional Patient's History	(0010,21B0)	3	Copied

6.5.3 Common Series Entity Modules

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

6.5.3.1 General Series Module

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

TABLE 6.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Copied Defined Terms: CT = Computed Tomography MR = Magnetic Resonance NM = Nuclear Medicine PT = PET XA = X-Ray Angiography
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	2	Generated
Laterality	(0020,0060)	2C	Generated: ""
Series Date	(0008,0021)	3	Copied
Series Time	(0008,0031)	3	Copeid
Performing Physicians' Name	(0008,1050)	3	Copied
Protocol Name	(0018,1030)	3	Removed
Series Description	(0008,103E)	3	Used / Generated (see section 6.6)
Operators' Name	(0008,1070)	3	Used / Generated
Referenced Study Component Sequence	(0008,1111)	3	Removed on AW
>Referenced SOP Clas s UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Copied
Patient Position	(0018,5100)	2C	Copied The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Removed
Largest Pixel Value in Series	(0028,0109)	3	Removed
Request Attributes Sequence	(0040,0275)	3	Ignored / Copied
>Requested Procedure ID	(0040,1001)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	

>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Action Item Sequence	(0040,0260)	3	Ignored / Removed
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

6.5.4 Common Equipment Entity Modules

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

6.5.4.1 General Equipment Module

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

TABLE 6.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Generated
Institution Name	(0008,0080)	3	Generated
Institution Address	(0008,0081)	3	Generated
Station Name	(0008,1010)	3	Generated
Institutional Department Name	(0008,1040)	3	Generated
Manufacturer's Model Name	(0008,1090)	3	Generated
Device Serial Number	(0018,1000)	3	Copied
Software Versions	(0018,1020)	3	Generated
Spatial Resolution	(0018,1050)	3	Removed
Date of Last Calibration	(0018,1200)	3	Copied
Time of Last Calibration	(0018,1201)	3	Copied
Pixel Padding Value	(0028,0120)	3	Copied

6.5.5   Common Image Entity Modules

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

6.5.5.1   General Image Module

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

TABLE 6.5-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated
Patient Orientation	(0020,0020)	2C	Generated. See 6.5.5.1.1.1
Image Date	(0008,0023)	2C	Generated, empty "". See 6.5.5.1.1.2
Image Time	(0008,0033)	2C	Generated, empty "". See 6.5.5.1.1.2
Image Type	(0008,0008)	3	Generated. See 6.5.5.1.1.3
Acquisition Number	(0020,0012)	3	Copied
Acquisition Date	(0008,0022)	3	Copied
Acquisition Time	(0008,0032)	3	Copied
Referenced Image Sequence	(0008,1140)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Removed. See 6.5.5.1.1.4
Source Image Sequence	(0008,2112)	3	Used / Removed. See 6.5.5.1.1.4 and 6.6
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Removed
Image Comments	(0020,4000)	3	Removed
Quality Control Image	(0028,0300)	3	Removed
Burned In Annotations	(0028,0301)	3	Removed
Lossy Image Compression Ratio	(0028,2112)	3	Ignored/Removed 6.5.5.1.1.5
Lossy Image Compression	(0028,2110)	3	Ignored/Removed

6.5.5.1.1   General Image Attribute Descriptions

6.5.5.1.1.1   Patient Orientation

Since Secondary Captures do not include the patient orientation, this field must be present. This field will be filled for 2D reformatted and 3D views, and will be empty (zero length) for other views.

The precision depth could be up to 3 characters, for example "LAF\FAR ", but can be less if the view is oriented along a baseline, like "L\FA" or "L\F ".

6.5.5.1.1.2   Image Date and Time

When the application is saving a secondary capture:

- the condition to set these tags should be used if the image are temporally related, but is not clearly met for reformatted images ; anyway, since most AE will expect this tag to be present, we have decided to set this tag

- Application might set this content date to the time the reformatted image is created, but then might move away from the purpose of this date which is linked to the acquisition

- Application might set it to the original image date, but it does not make sense for reformatted images which are derived from several images

For these reasons, the application will set an empty tag to avoid possible ambiguities.

6.5.5.1.1.3   Image Type

Value 1 has the following value:
  - DERIVED   identifies a Derived Image

Value 2 has the following value:
  - SECONDARY   identifies a Secondary Image

Value 3 has the following value:
  - SCREEN SAVE   identifies a Multi Planar Reformatted Image
  - 3D   identifies a 3D view
  - VXTL STATE   identifies a Voxtool state SC: private data of the screen save holds information to restore the state of the application

Value 4, if defined, indicates the rendering algorithm of the view, and can have the following values:
  - MIP   identifies a Maximum Intensity Projection Image
  - MIN IP   identifies a Minimum Intensity Projection Image
  - AVERAGE   identifies a Average Image
  - VOLREN   identifies a Volume Rendered Image
  - SURFACE   identifies a surface shaded Image
  - RAYSUM   identifies a RaySum Image
  - INTEGRAL   identifies a Integral Image

6.5.5.1.1.4   Derivation Description and Source Image Sequence

The Derivation Description tag is not used.

The Source Image Sequence is used only when the secondary capture comes from the Direct3D / Volume Auto View software. In this case, the Series Description contains "Direct3D State" and the actual Direct3D state is stored in the private group 0x0047 "GE HEALTHCARE_3DSTATE_001" (see the private dictionary at section 6.6). This state contains all the parameters useful to reconstruct a Volume Rendered view similar to the one shown in this secondary capture. The Source Image Sequence address the list of the original images used.

6.5.5.1.1.5   Lossy Image Compression

The application does not use compression when saving images, nor does it decompress images. The application will ignore these tags and remove them in saved images.

6.5.5.2 Image Pixel Module

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

TABLE 6.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Generated • "1" for black and white images • "3" for color images
Photometric Interpretation	(0028,0004)	1	Generated • "MONOCHROME2" or "MONOCHROME1" for black and white images • "RGB" for color images
Rows	(0028,0010)	1	Generated (256, 512, 1024)
Columns	(0028,0011)	1	Generated (256, 512, 1024)
Bits Allocated	(0028,0100)	1	Generated • "16" for black and white images • "8" for color images
Bits Stored	(0028,0101)	1	Generated • "16" for black and white images • "8" for color images
High Bit	(0028,0102)	1	Generated • "15" for black and white images • "7" for color images
Pixel Representation	(0028,0103)	1	Generated • "1" for black and white images • "0" for color images
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Generated • Removed for black and white images • "0" for color images
Pixel Aspect Ratio	(0028,0034)	1C	Removed
Smallest Image Pixel Value	(0028,0106)	3	Removed
Largest Image Pixel Value	(0028,0107)	3	Removed
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Removed
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Removed
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Removed
Red Palette Color Lookup Table Data	(0028,1201)	1C	Removed
Green Palette Color Lookup Table Data	(0028,1202)	1C	Removed
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Removed

6.5.6 Common Overlay Modules

6.5.6.1 Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

This module is not currently supported by the application.

TABLE 6.5-8
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	Unsupported module
Overlay Columns	(60xx,0011)	1	Unsupported module
Overlay Type	(60xx,0040)	1	Unsupported module
Origin	(60xx,0050)	1	Unsupported module
Overlay Bits Allocated	(60xx,0100)	1	Unsupported module
Bit Position	(60xx,0102)	1	Unsupported module
Overlay Data	(60xx,3000)	1C	Unsupported module
Overlay Description	(60xx,0022)	3	Unsupported module
Overlay Subtype	(60xx,0045)	3	Unsupported module
Overlay Label	(60xx,1500)	3	Unsupported module
ROI Area	(60xx,1301)	3	Unsupported module
ROI Mean	(60xx,1302)	3	Unsupported module
ROI Standard Deviation	(60xx,1303)	3	Unsupported module
Overlay Descriptor - Gray	(60xx,1100)	3	Unsupported module
Overlay Descriptor - Red	(60xx,1101)	3	Unsupported module
Overlay Descriptor - Green	(60xx,1102)	3	Unsupported module
Overlay Descriptor - Blue	(60xx,1103)	3	Unsupported module
Overlays - Gray	(60xx,1200)	3	Unsupported module
Overlays - Red	(60xx,1201)	3	Unsupported module
Overlays - Green	(60xx,1202)	3	Unsupported module
Overlays - Blue	(60xx,1203)	3	Unsupported module

6.5.7 Common Lookup Table Modules

6.5.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

This module is not saved for color ("RGB") images.

TABLE 6.5-9
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	

>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	Generated from the current value used in the saved view
Window Width	(0028,1051)	1C	Generated from the current value used in the saved view
Window Center & Width Explanation	(0028,1055)	3	Removed

6.5.7.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

This module is not saved for color ("RGB") images.

TABLE 6.5-10
MODALITY LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality LUT Sequence	(0028,3000)	3	Removed
>LUT Descriptor	(0028,3002)	1C	Specify values created or supported.
>LUT Explanation	(0028,3003)	3	
>Modality LUT Type	(0028,3004)	1C	Specify Defined Terms used: OD = Optical density US = Unspecified
>LUT Data	(0028,3006)	1C	
Rescale Intercept	(0028,1052)	1C	Generated
Rescale Slope	(0028,1053)	1C	Generated "1"
Rescale Type	(0028,1054)	1C	Generated • "HU" for CT • "US" for other modalities

6.5.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

6.5.8.1 SOP Common Module

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

TABLE 6.5-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Generated
SOP Instance UID	(0008,0018)	1	Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number, the process ID number, the timestamp and a counter incremented each time.
Specific Character Set	(0008,0005)	1C	Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Generated: current date
Instance Creation Time	(0008,0013)	3	Generated: current time
Instance Creator UID	(0008,0014)	3	Removed
Time zone Offset From UTC	(0008,0201)	3	Removed
Instance Number	(0020,0013)	3	Generated
SOP Instance Status	(0100,0410)	3	Removed
SOP Authorization Date and Time	(0100,0420)	3	Removed
SOP Authorization Comment	(0100,0414)	3	Removed
Authorization Equipment Certification Number	(0100,0416)	3	Removed

6.5.9   SC Modules

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

6.5.9.1   SC Equipment Module

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

TABLE 6.5-12
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Generated: WSD = Workstation
Modality	(0008,0060)	3	Generated See 6.5.3.1 for Enumerated Values.
Secondary Capture Device ID	(0018,1010)	3	Generated from gethostname()
Secondary Capture Device Manufacturer	(0018,1016)	3	Generated "GE Healthcare"
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Generated: the name of the application. Cortex ID
Secondary Capture Device Software Version	(0018,1019)	3	Generated: App Version version "Cortex_ID_x_y_z"
Video Image Format Acquired	(0018,1022)	3	Removed
Digital Image Format Acquired	(0018,1023)	3	Removed

6.5.9.2   SC Image Module

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

TABLE 6.5-13
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Generated: current date
Time of Secondary Capture	(0018,1014)	3	Generated: current time

6.6 PRIVATE DATA DICTIONARY

In the case of a secondary capture coming from the Direct3D software, the following private group is read. Note that this group is read only if the Series Description contains "Direct3D State".

For a complete description of the tags, see the conformance statement of Direct3D.

TABLE 6.6-14
3D STATE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Group Creator	(0047,00xx)	3	"GE HEALTHCARE_3DSTATE_001"
General Description	(0047,xxD6)	3	Used
TDRT	(0047,xxD7)	3	Used
NVRP	(0047,xxD8)	3	Used
CVRPN	(0047,xxD9)	3	Used
Volume Rendering Presets Sequence	(0047,xxDA)	3	Used
> Preset Name	(0047,xxDB)	3	Used
> Opacity Curve X	(0047,xxDC)	3	Used
> Opacity Curve Y	(0047,xxDD)	3	Used
> NOCP	(0047,xxDE)	3	Used
> Color Curve X	(0047,xxDF)	3	Used
> Color Curve Y	(0047,xxE0)	3	Used
> NCCP	(0047,xxE1)	3	Used
> GSA	(0047,xxE2)	3	Used
> VRSF	(0047,xxE3)	3	Used
> AF	(0047,xxE4)	3	Ignored
> DF	(0047,xxE5)	3	Ignored
> SCF	(0047,xxE6)	3	Ignored
> SPF	(0047,xxE7)	3	Ignored
Orthogonal Clipping Planes	(0047,xxE8)	3	Used
CP	(0047,xxE9)	3	Used / Generated
CFP	(0047,xxEA)	3	Used / Generated
CVU	(0047,xxEB)	3	Used / Generated
RFOV	(0047,xxEC)	3	Used / Generated
PPRP	(0047,xxED)	3	Ignored / Generated
3DWW	(0047,xxEE)	3	Used
3DWL	(0047,xxEF)	3	Used
BBV	(0047,xxF0)	3	Ignored
ERF	(0047,xxF1)	3	Used
TDRMS	(0047,xxF2)	3	Ignored
TDSSS	(0047,xxF3)	3	Ignored

7. BASIC TEXT, ENHANCED, AND COMPREHENSIVE STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

7.1 IOD MODULE TABLE

The **Basic Text**, **Enhanced**, and **Comprehensive** Structured Report Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes. SR specific modules are described in Section 7.2. Standard Extended and Private attributes are described in Section 7.3.

The contents of the SR Document Content are constrained by the supported template, as identified in Section 7.2 Standard Extended and Private templates are further described in Section 7.3.

TABLE 7.1-1
BASIC TEXT, ENHANCED AND COMPREHENSIVE SR IOD MODULES

Information Entity	Module	Usage	Reference
Patient	Patient	Used	7.2.1
	Specimen Identification	Not used	N/A
Study	General Study	Used	7.2.2
	Patient Study	Used	7.2.3
Series	SR Document Series	Used	7.2.4
Equipment	General Equipment	Used	7.2.5
Document	SR Document General	Used	7.2.6
	SR Document Content	Used	7.2.7
	SOP Common	Used	7.2.8

7.2 BASIC TEXT, ENHANCED AND COMPREHENSIVE SR - INFORMATION MODULE DEFINITIONS

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

7.2.1 Patient Module

TABLE 7.2-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copied from source header.
Patient ID	(0010,0020)	2	Copied from source header.
Patient's Birth Date	(0010,0030)	2	Copied from source header.
Patient's Sex	(0010,0040)	2	Copied from source header
Patient's Birth Time	(0010,0032)	3	Copied from source header.
Ethnic Group	(0010,2160)	3	Generated
Patient Comments	(0010,4000)	3	Generated

7.2.2 General Study Module

TABLE 7.2-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Copied from source header.
Study Date	(0008,0020)	2	Copied from source header.
Study Time	(0008,0030)	2	Copied from source header.
Referring Physician's Name	(0008,0090)	2	Copied from source header
Study ID	(0020,0010)	2	Copied from source header.
Accession Number	(0008,0050)	2	Copied from source header.
Study Description	(0008,1030)	3	Copied from source header.

7.2.3 Patient Study Module

TABLE 7.2-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Copied from source header.
Patient's Size	(0010,1020)	3	Copied from source header
Patient's Weight	(0010,1030)	3	Copied from source header
Occupation	(0010,2180)	3	Generated blank
Additional Patient's History	(0010,21B0)	3	Copied from source header.

7.2.4 SR Document Series Module

TABLE 7.2-4
SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description

Modality	(0008,0060)	1	Generated Enumerated Value: SR = SR Document
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	1	Generated
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Not used.

7.2.5 General Equipment Module

TABLE 7.2-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Copied from source header.
Institution Name	(0008,0080)	3	Copied from source header.
Institution Address	(0008,0081)	3	Copied from source header.
Station Name	(0008,1010)	3	Copied from source header.
Institutional Department Name	(0008,1040)	3	Copied from source header.
Manufacturer's Model Name	(0008,1090)	3	Copied from source header.
Device Serial Number	(0018,1000)	3	Copied from source header.

7.2.6 SR Document General Module

TABLE 7.2-6
SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description

Instance Number	(0020,0013)	1	Generated
Completion Flag	(0040,A491)	1	Copied from source header or entered by the user. Enumerated Values: PARTIAL = Partial content. COMPLETE = Complete content.
Completion Flag Description	(0040,A492)	3	Copied from source header.
Verification Flag	(0040,A493)	1	Created Enumerated Values: UNVERIFIED = Not attested to. VERIFIED = Attested to by a Verifying Observer Name (0040,A075) who is accountable for its content.
Content Date	(0008,0023)	1	Current date of creation.
Content Time	(0008,0033)	1	Current time of creation.
Verifying Observer Sequence	(0040,A073)	1C	Create empty Sequence
>Verifying Observer Name	(0040,A075)	1	Omitted
>Verifying Observer Identification Code Sequence	(0040,A088)	2	Omitted
>Verifying Organization	(0040,A027)	1	Omitted
>Verification DateTime	(0040,A030)	1	Current date and time of verification.
Predecessor Documents Sequence	(0040,A360)	1C	Empty.
Identical Documents Sequence	(0040,A525)	1C	Empty.
Referenced Request Sequence	(0040,A370)	1C	Copied from source header.
Performed Procedure Code Sequence	(0040,A372)	2	Copied from source header.
Current Requested Procedure Evidence Sequence	(0040,A375)	1C	Copied from source header.
Pertinent Other Evidence Sequence	(0040,A385)	1C	Copied from source header.

7.2.7   SR Document Content Module

TABLE 7.2-7
SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Observation DateTime	(0040,A032)	1C	Report creation date
Content Template Sequence	(0040,A504)	1C	Absent
> *'Template Identification Macro'*			
Value Type	(0040,A040)	1	Container, Image, Text, Num, Code
Continuity of Content	(0040,A050)	1C	Separate
Concept Name Code Sequence	(0040,A043)	1C	See Context ID vv_codes

> *'Code Sequence Macro'*			
Concept Value attribute(s)			
Content Sequence	(0040,A730)	1C	See TID tables
> Relationship Type	(0040,A010)	1	Contains, Has_Concept_Mod, Inferred_From, Has_Properties
> Referenced Content Item Identifier	(0040,DB73)	1C	Not used in Basic Text and Enhanced SR SOP Classes
> *SR DocumentContent Module*			*Recursive inclusion to create document content tree*

7.2.7.1   SR Document Content Descriptions

7.2.7.1.1   Content Template

The product supports the following root Templates for SR SOP Instances created, processed, or displayed by the product.

TABLE -8
SR ROOT TEMPLATES

SOP Class	Template ID	Template Name	Use
Basic Text SR	any		Display
	2000	Basic Diagnostic Imaging Report	Create
Enhanced SR	GEHC-NRAD-0001	Alzheimer's Detection SSP Report	Create/Display

7.2.8 SOP Common Module

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

TABLE 7.2-9
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Enumerated Values: 1.2.840.10008.5.1.4.1.1.88.11 1.2.840.10008.5.1.4.1.1.88.22
SOP Instance UID	(0008,0018)	1	Generated with format `1.2.840.113619.2.174.id` where `id` is a unique identifier of the instance with station information and timestamp.
Specific Character Set	(0008,0005)	1C	Copied from source header
Instance Creation Date	(0008,0012)	3	Current date of creation
Instance Creation Time	(0008,0013)	3	Current time of creation
Instance Creator UID	(0008,0014)	3	Empty
Instance Number	(0020,0013)	3	Empty

7.3 STANDARD EXTENDED AND PRIVATE TEMPLATES

The Product supports the Standard Extended and Private Templates defined in the following sections.

7.3.1 Standard Extended Templates

Not used.

7.3.2 Private Templates

The Product supports the following private templates for SOP Instances created by this product.

7.3.2.1 GEHC-NRAD-T01 Neuro_Alzheimers_SR_Template

TID NRAD_0001
NRAD_REPORT
Type: (Non-)Extensible

NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINER	EV(Neuro LN, "Neuro Imaging For Alzheimer's")	1	M		
2	>	INCLUDE	DTID(NRAD_0002)"NRAD_Automatic_Images"	1-n	M	Needs at least the four: Right Lateral, Left Lateral, Right Medial, Left Medial	
3	>	INCLUDE	DTID(NRAD_0003)"NRAD_SSP_ScoreTable"	1-n	M	Needs at least the Pons table.	

TID NRAD_0002

NRAD_Automatic_Images
Type: (Non-)Extensible

NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINER	DT(121080, 99GE HEALTHCARE, "NRAD Automatic Images")	1	M		
4	>	CONTAINS	IMAGE	EV(NRAD-001x, 99GE HEALTHCARE, " xxxx")	1	M		Right Lateral, Left Lateral, Right Medial, Left Medial, Superior, Inferior, Anterior, Posterior,

TID NRAD_003

NRAD_SSP_ZScoreTable
Type: (Non-)Extensible

NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINER	DT(121071, 99GE HEALTHCARE, "Finding")	1	M		

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
2	>	HAS_CONCEPT_MOD	TEXT	EV(VV-008, 99GE HEALTHCARE, " Name")	1	M		
3	>	CONTAINS	TEXT	EV(121106, SNM3, "Comment ")	1	M		
4	>		INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If Finding has captures	
5	>		INCLUDE	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	If Finding has Measure	
6	>		INCLUDE	DTID(vv_0007)"VV_REPORT_ROI	1-n	UC	If Finding has Roi	

TID NRAD_0004

NRAD_SSP_ZScoreTable_Row
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(NRAD-00xx,99GE HEALTHCARE, "XXX")	1	M		Parietal Association Temporal Association Frontal Association Occipital Association Posterior Cingulate Anterior Cingulate Medial Frontal Medial Parietal Sensorimotor Visual Caudate Nucleus Cerebellum Vermis Pons Average Association Average Cerebral Global Average
2	>	HAS_OBS_CONTEXT	TEXT	EV(NRAD-0004, 99GE HEALTHCARE, " Left/Right")	1	M		'L', 'R'
	>	HAS_OBS_CONTEXT	TEXT	DT(NRAD-0005, 99GE HEALTHCARE, " Mean Score")	1	M		Floating point string
	>>	HAS_OBS_CONTEXT	TEXT	DT(NRAD-0006, 99GE HEALTHCARE, " Num Samples")	1	M		Integer String
	>>	HAS_OBS_CONTEXT	TEXT	DT(NRAD-0007, 99GE HEALTHCARE, " Max Score")	1	M		Float String

Context ID NRAD_codes

Type: Extensible   Version: <20060719>

Coding Scheme Designator	Code Value	Code Meaning
99GE HEALTHCARE	NRAD-0001	ZScoreTable
99GE HEALTHCARE	NRAD-0002	Zscore Table Description

99GE HEALTHCARE	NRAD-0003	Zscore Table Row
99GE HEALTHCARE	NRAD-0004	Left/Right
99GE HEALTHCARE	NRAD-0005	Mean Score
99GE HEALTHCARE	NRAD-0006	Num Samples
99GE HEALTHCARE	NRAD-0007	Max Score
99GE HEALTHCARE	NRAD-0010	Right Lateral,
99GE HEALTHCARE	NRAD-0011	Left Lateral,,
99GE HEALTHCARE	NRAD-0012	Right Medial,
99GE HEALTHCARE	NRAD-0013	Left Medial,
99GE HEALTHCARE	NRAD-0014	Superior,
99GE HEALTHCARE	NRAD-0015	Inferior,
99GE HEALTHCARE	NRAD-0016	Anterior,
99GE HEALTHCARE	NRAD-0017	Posterior
99GE HEALTHCARE	NRAD-0020	Parietal Association
99GE HEALTHCARE	NRAD-0021	Temporal Association
99GE HEALTHCARE	NRAD-0022	Frontal Association
99GE HEALTHCARE	NRAD-0023	Occipital Association
99GE HEALTHCARE	NRAD-0024	Posterior Cingulate
99GE HEALTHCARE	NRAD-0025	Anterior Cingulate
99GE HEALTHCARE	NRAD-0026	Medial Frontal
99GE HEALTHCARE	NRAD-0027	Medial Parietal
99GE HEALTHCARE	NRAD-0028	Sensorimotor
99GE HEALTHCARE	NRAD-0029	Visual
99GE HEALTHCARE	NRAD-0030	Caudate Nucleus
99GE HEALTHCARE	NRAD-0031	Cerebellum
99GE HEALTHCARE	NRAD-0032	Vermis
99GE HEALTHCARE	NRAD-0033	Pons
99GE HEALTHCARE	NRAD-0034	Average Association
99GE HEALTHCARE	NRAD-0035	Average Cerebral
99GE HEALTHCARE	NRAD-0036	Global Average