

Technical Publications

**Direction 2390421-100
Revision 1**

Pasting 1.1 DICOM CONFORMANCE STATEMENT

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1. INTRODUCTION

1.1 OVERVIEW

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

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

Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features. Conformance Statement defines the subset of options selected from those offered by the DICOM standard.

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

Section 4 (SC Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Object.

**1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT
STRUCTURE**

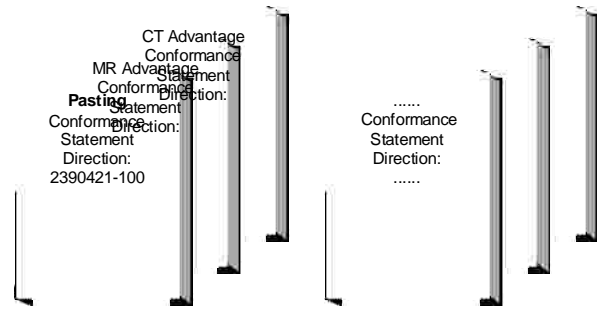
The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in the Illustration below.

ID/Net v3.0

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

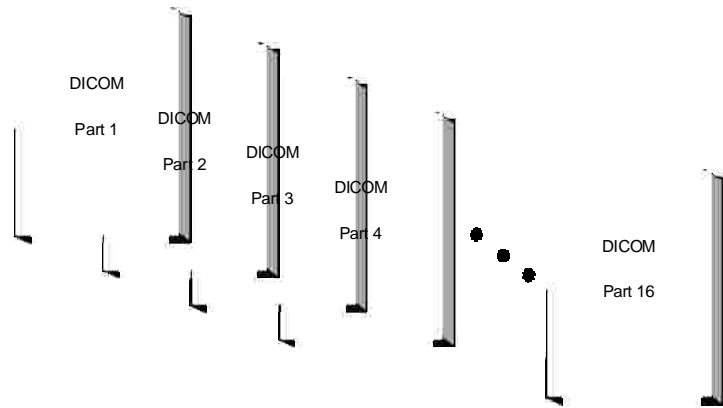
APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGE C.)

**Product
Implementation:**



DICOM STANDARD

**Standard
Specification:**



This document specifies the DICOM implementation. It is entitled:

Pasting 1.1

*Conformance Statement for DICOM
Direction 2390421-100*

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

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

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

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

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

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

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

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 GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM v3.0. The GEMS Conformance Statements are available to the public.

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

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

1.5 IMPORTANT REMARKS

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

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

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

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

1.6 REFERENCES

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

1.7 DEFINITIONS

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

1.8 SYMBOLS AND ABBREVIATIONS

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

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Pasting 1.1 compliance to DICOM requirements for **Networking** features.

Pasting 1.1 is a software application designed to be used on the Advantage workstation. It can load DICOM images to create the pasted images. The resulting pasted images can be saved in DICOM format and recalled later in the Advantage Windows image viewer.

Pasting 1.1 does not have intrinsic network feature. It does not directly invoke the DICOM Server AE. For more detailed information on the DICOM features of the Advantage Workstation, refer to the platform DICOM Conformance Statement.

The goal of this document is to give a detailed description of the content of the DICOM IODs (MR), which are required for pasting as well as the DICOM IODs (MR or SCPT) which are generated.

Section 3 describes the MR IOD, which is required for pasting and which is generated by this implementation. Again, refer to the platform DICOM Conformance Statement for a complete description of the associated Presentation Context Table.

Section 4 describes the SC IOD, which is generated by implementation. Again, refer to the platform DICOM Conformance Statement for complete description of the associated Presentation Context Table.

2.2 PRESENTATION CONTEXT

The transfer syntax used to save the output images is **Explicit VR Big Endian**.

Transfer Syntax Name	Transfer Syntax UID
DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2

The implementation UID for this DICOM Implementation is:

MR Pasting 1.1 Implementation UID	1.2.840.113619.6.233
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The saving generates two different kind of DICOM IODs on the nature of the input images.

If input images do not contain oblique images:

SOP Class Name	SOP Class UID
MR Image Storage	1.2.840.10008.5.1.4.1.1.4

If input images contain oblique images:

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

3. MR INFORMATION OBJECT IMPLEMENTATION

3.1 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:

- 3.2 - IOD Description
- 3.3 - IOD Entity-Relationship Model
- 3.4 - IOD Module Table
- 3.5 - IOD Module Definition

3.2 MR IOD IMPLEMENTATION

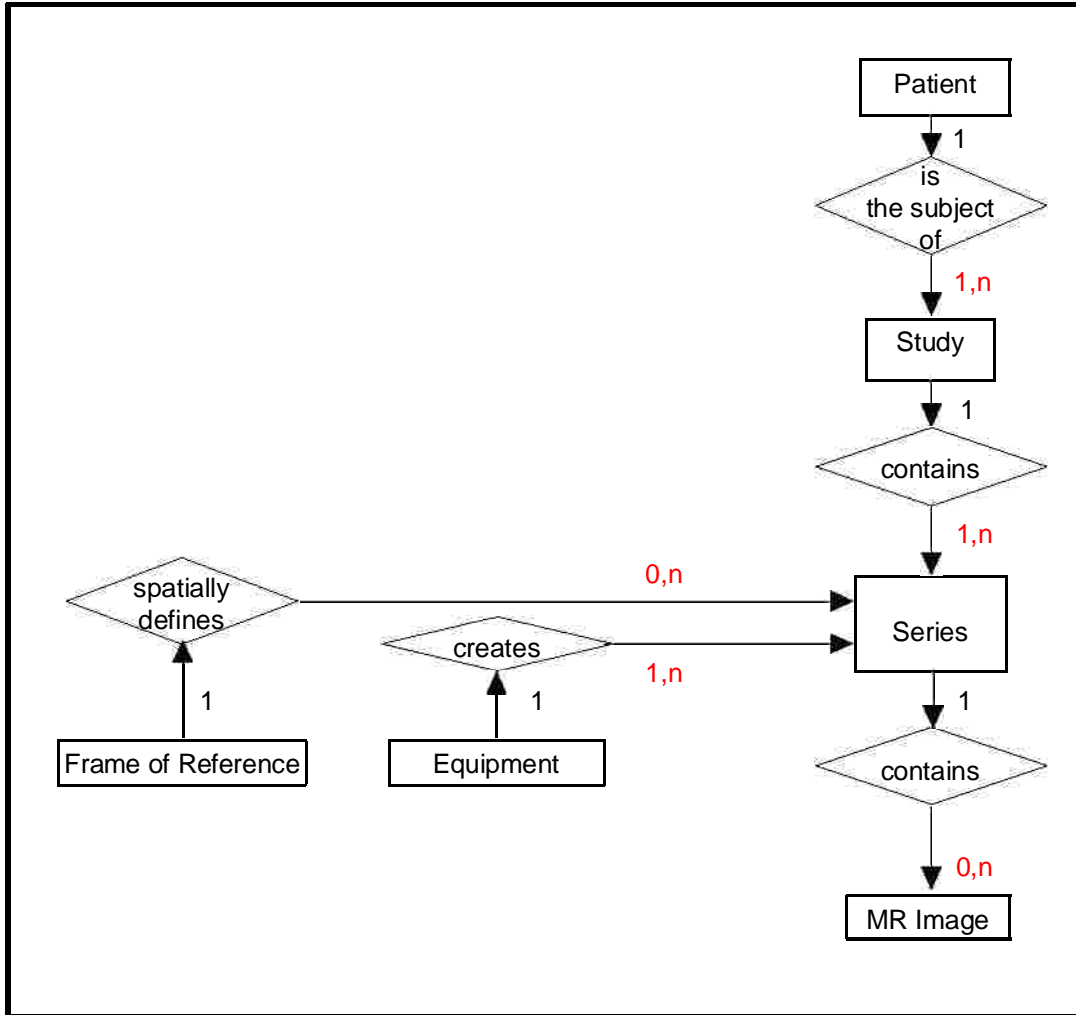
3.3 MR ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the MR Image interoperability schema is shown in Illustration 3.3-1. In this figure, the following diagrammatic convention 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
MR 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 MR Information Object.

3.3.1.1 Patient Entity Description

3.3.1.2 Study Entity Description

3.3.1.3 Series Entity Description

3.3.1.4 Equipment Entity Description

3.3.1.5 Frame of Reference Entity Description

3.3.1.6 MR Image Entity Description

3.3.1.7 Overlay Entity Description

3.3.1.8 VOILookup Table Entity Description

3.3.2 Pasting 1.1 Mapping of DICOM entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO PASTING 1.1 ENTITIES

DICOM	Pasting 1.1 Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

3.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 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 of information into datasets.

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 MR IOD. Modules are identified by Module Name.

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

TABLE 3.4-1
MR IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
Study	General Study	3.5.2.1
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
	MR Image	3.5.10.1
	VOILUT	3.5.8.1
	SOP Common	3.5.9.1

3.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the 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 v3.0 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	Input: Shall be constant between images. Output: Same as input.
Patient ID	(0010,0020)	2	Input: Shall be constant between images. Output: Same as input.
Patient's Birth Date	(0010,0030)	2	Input: Shall be constant between images. Output: Same as input.
Patient's Sex	(0010,0040)	2	Input: Shall be constant between images. Output: Same as input.
Referenced Patient Sequence	(0008,1120)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Patient's Birth Time	(0010,0032)	3	Not used
Other Patient IDs	(0010,1000)	3	Not used
Other Patient Names	(0010,1001)	3	Not used
Ethnic Group	(0010,2160)	3	Not used
Patient Comments	(0010,4000)	3	Not used

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	Input: Shall be constant between images. Output: Same as input.
Study Date	(0008,0020)	2	Input: Shall be constant between images Output: Same as input.
Study Time	(0008,0030)	2	Input: Shall be constant between images Output: Same as input.
Referring Physician's Name	(0008,0090)	2	Input: Everything is supported. Output: <ul style="list-style-type: none"> • Same as input if constant between input images. • Empty otherwise.
Study ID	(0020,0010)	2	Input: Shall be constant between images. Output: Same as input.
Accession Number	(0008,0050)	2	Input: Everything is supported. Output: <ul style="list-style-type: none"> • Same as input if constant between input images. • Empty otherwise.
Study Description	(0008,1030)	3	Not used
Physician(s) of Record	(0008,1048)	3	Not used
Name of Physician(s) Reading Study	(0008,1060)	3	Not used
Referenced Study Sequence	(0008,1110)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used

3.5.2.2 Patient Study Module

No attributes from this module are used.

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 3.5-3
GENERAL SERIES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Input & Output : Shall be MR
Series Instance UID	(0020,000E)	1	Output : Generated based on root Implementation UID
Series Number	(0020,0011)	2	Output : Generated
Laterality	(0020,0060)	2C	Output : Used only if all input images have this attribute with the same value. This value is then used as the output value.
Series Date	(0008,0021)	3	The date when the first image of the series was generated
Series Time	(0008,0031)	3	The time when the first image of the series was generated
Performing Physicians' Name	(0008,1050)	3	Not used
Protocol Name	(0018,1030)	3	Not used
Series Description	(0008,103E)	3	Output : Always used. Generated by the user.
Operators' Name	(0008,1070)	3	Not used
Referenced Study Component Sequence	(0008,1111)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Body Part Examined	(0018,0015)	3	Not used
Patient Position	(0018,5100)	2C	Input : Everything is supported. Output : <ul style="list-style-type: none"> • Same as input if constant between input images. • Empty otherwise.
Smallest Pixel Value in Series	(0028,0108)	3	Not used
Largest Pixel Value in Series	(0028,0109)	3	Not used

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

This section specifies the Attributes necessary to uniquely identify a frame of reference, which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

Input images shall all have the same Frame Of Reference to allow relative positioning. As a result, the pasted images have the same Frame Of Reference.

**TABLE 3.5-4
FRAME OF REFERENCE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	See 3.5.4.1.1.1 for further explanation.
Position Reference Indicator	(0020,1040)	2	See 3.5.4.1.1.2 for further explanation.

3.5.4.1.1 Frame Of Reference Attribute Descriptions

3.5.4.1.1.1 Frame Of Reference UID

Input: All images shall have the same Frame Of Reference UID.

Output: The pasted images have the same Frame Of Reference UID as the input images.

3.5.4.1.1.2 Position Reference Indicator

Always set to **Empty**.

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 describe the piece of equipment, which produced a Series of Images.

**TABLE 3.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Input: Everything is supported. Output: <ul style="list-style-type: none"> • Same as input if constant between input images. • Empty otherwise.
Institution Name	(0008,0080)	3	Not used
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Not used
Institutional Department Name	(0008,1040)	3	Not used
Manufacturer's Model Name	(0008,1090)	3	Not used
Device Serial Number	(0018,1000)	3	Not used
Software Versions	(0018,1020)	3	Not used
Spatial Resolution	(0018,1050)	3	Not used
Date of Last Calibration	(0018,1200)	3	Not used
Time of Last Calibration	(0018,1201)	3	Not used
Pixel Padding Value	(0028,0120)	3	See 3.5.5.1.1.1

3.5.5.1.1 General Equipment Attribute Descriptions

3.5.5.1.1.1 Pixel Padding Value

Not used.

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 describe an image within a particular series.

**TABLE 3.5-6
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Output: Generated
Patient Orientation	(0020,0020)	2C	See 3.5.6.1.1.1.
Content Date	(0008,0023)	2C	The date when the data were generated
Content Time	(0008,0033)	2C	The time when the data were generated
Image Type	(0008,0008)	3	See 3.5.6.1.1.2.
Acquisition Number	(0020,0012)	3	Not used
Acquisition Date	(0008,0022)	3	Not used
Acquisition Time	(0008,0032)	3	Not used
Referenced Image Sequence	(0008,1140)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Derivation Description	(0008,2111)	3	See 3.5.6.1.1.3.
Source Image Sequence	(0008,2112)	3	See 3.5.6.1.1.3.
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Images in Acquisition	(0020,1002)	3	Not used
Image Comments	(0020,4000)	3	Not used
Lossy Image Compression	(0028,2110)	3	See 3.5.6.1.1.4.

3.5.6.1.1 General Image Attribute Descriptions

3.5.6.1.1.1 Patient Orientation

Attribute sent **Empty**.

3.5.6.1.1.2 Image Type

Input: Image types containing “PASTED” value are not supported. (Cannot past already images resulting from the pasting). Moreover, input images shall all have the same Image Type.

Output: The generated image type has the following structure.
DERIVED/SECONDARY/.../PASTED

If input images are not *DERIVED/SECONDARY/...* the pasted images are:

DERIVED/SECONDARY/PASTED

Else, the pasted images are: *“inputImageType”/PASTED*

3.5.6.1.1.3 Derivation Description and Source Image Sequence

Not used.

3.5.6.1.1.4 Lossy Image Compression

Not used.

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 3.5-7
IMAGE PLANE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Input: Shall be constant within images of a same station (see 3.5.6.2.1) Output: Lowest value of all input images.
Image Orientation (Patient)	(0020,0037)	1	Input: Images shall be vertical (any long-axis plane, where one of the image dimension is parallel with the S-I axis). Obliquity up to 30 degrees is supported. Output: Computed.
Image Position (Patient)	(0020,0032)	1	Input: Everything is supported. Output: Computed.
Slice Thickness	(0018,0050)	2	Input: Everything is supported. Output: Computed
Slice Location	(0020,1041)	3	Not used

3.5.6.2.1 Station definition

A station is a set of images with the same position along the Inferior / Superior RAS axis (See 3.5.6.2). There are 3 kinds of stations:

- Single image station.

- Rotation station: The intersection between two images the station is along the Inferior / Superior RAS axis. In most cases, it will be a series of MIP images rotating along this axis.
- Multi-slices station: All images are parallel. In most cases, it will be the acquisition series.

3.5.6.3 Image Pixel Module

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

**TABLE 3.5-8
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Input & Output: Shall be 1
Photometric Interpretation	(0028,0004)	1	Input & Output: Shall be MONOCHROME2
Rows	(0028,0010)	1	Input: Up to 1024 is supported. Output: Computed
Columns	(0028,0011)	1	Input: Up to 1024 is supported. Output: Computed
Bits Allocated	(0028,0100)	1	Input & Output: Shall be 16
Bits Stored	(0028,0101)	1	Output: Computed
High Bit	(0028,0102)	1	Output: Bits Stored – 1
Pixel Representation	(0028,0103)	1	Output: Computed
Pixel Data	(7FE0,0010)	1	Output: Computed
Planar Configuration	(0028,0006)	1C	Not used
Pixel Aspect Ratio	(0028,0034)	1C	Not used
Smallest Image Pixel Value	(0028,0106)	3	Not used
Largest Image Pixel Value	(0028,0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used

3.5.6.4 Contrast/Bolus Module

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

TABLE 3.5-9
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Input: Everything is supported. Output: <ul style="list-style-type: none"> • Same as input if constant between input images. • Empty otherwise.
Contrast/Bolus Agent Sequence	(0018,0012)	3	Not used
>Code Value	(0008,0100)	1C	Not used
>Coding Scheme Designator	(0008,0102)	1C	Not used
>Code Meaning	(0008,0104)	3	Not used
Contrast/Bolus Route	(0018,1040)	3	Not used
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Not used
>Code Value	(0008,0100)	1C	Not used
>Coding Scheme Designator	(0008,0102)	1C	Not used
>Code Meaning	(0008,0104)	3	Not used
>Additional Drug Sequence	(0018,002A)	3	Not used
>>Code Value	(0008,0100)	1C	Not used
>>Coding Scheme Designator	(0008,0102)	1C	Not used
>>Code Meaning	(0008,0104)	3	Not used
Contrast/Bolus Volume	(0018,1041)	3	Not used
Contrast/Bolus Start Time	(0018,1042)	3	Not used
Contrast/Bolus Stop Time	(0018,1043)	3	Not used
Contrast/Bolus Total Dose	(0018,1044)	3	Not used
Contrast Flow Rate(s)	(0018,1046)	3	Not used
Contrast Flow Duration(s)	(0018,1047)	3	Not used
Contrast/Bolus Ingredient	(0018,1048)	3	Not used
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Not used

3.5.7 Common Overlay Modules

3.5.7.1 Overlay plane module

No attributes from this module are used.

3.5.8 Common Lookup Table Modules

3.5.8.1 VOILUT module

This section specifies the Attributes that describe the VOILUT.

**TABLE 3.5-10
VOILUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
VOILUT Sequence	(0028,3010)	3	Not used
>LUT Descriptor	(0028,3002)	1C	Not used
>LUT Explanation	(0028,3003)	3	Not used
>LUT Data	(0028,3006)	1C	Not used
Window Center	(0028,1050)	3	Output: One value computed from input images.
Window Width	(0028,1051)	1C	Output: One value computed from input images.
Window Center & Width Explanation	(0028,1055)	3	Not used

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 3.5-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Input: MR SOP class UID. Output: If no obliquity: <ul style="list-style-type: none"> Same as input. Otherwise: <ul style="list-style-type: none"> Otherwise a Secondary Capture IOD instance is created, please refer to section 4 for Information Object Implementation description.
SOP Instance UID	(0008,0018)	1	Output: Generated based on root Implementation UID.
Specific Character Set	(0008,0005)	1C	<ul style="list-style-type: none"> If non present in the original image, and if the new Patient Name contains non English character(s), set to "ISO_IR 100" Original value otherwise
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used

3.5.10 MR Modules

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

3.5.10.1 MR Image Module

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

TABLE 3.5-12
MR 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	Input & Output: Shall be 1.
Photometric Interpretation	(0028,0004)	1	Input & Output: Shall be MONOCHROME2
Bits Allocated	(0028,0100)	1	Input & Output: Shall be 16.
Scanning Sequence	(0018,0020)	1	Input: All are supported Output: <ul style="list-style-type: none"> • Same as input if constant between images • “RM” (Research Mode) otherwise.
Sequence Variant	(0018,0021)	1	See 3.5.10.1.1.2.
Scan Options	(0018,0022)	2	See 3.5.10.1.1.3.
MR Acquisition Type	(0018,0023)	2	Input: All are supported Output: <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.
Repetition Time	(0018,0080)	2C	Output: Sent only if present in one of the input images. The value is : <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.
Echo Time	(0018,0081)	2	Input: All are supported Output: <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.
Echo Train Length	(0018,0091)	2	Input: All are supported Output: <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.
Inversion Time	(0018,0082)	2C	Output: Sent only if present in one of the input images. The value is : <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.

Trigger Time	(0018,1060)	2C	Output: Sent only if present in one of the input images. The value is : <ul style="list-style-type: none"> • Same as input if constant between images • Empty otherwise.
Sequence Name	(0018,0024)	3	Not used
Angio Flag	(0018,0025)	3	Not used
Number of Averages	(0018,0083)	3	Not used
Imaging Frequency	(0018,0084)	3	Not used
Imaged Nucleus	(0018,0085)	3	Not used
Echo Number	(0018,0086)	3	Not used
Magnetic Field Strength	(0018,0087)	3	Not used
Spacing Between Slices	(0018,0088)	3	Not used
Number of Phase Encoding Steps	(0018,0089)	3	Not used
Percent Sampling	(0018,0093)	3	Not used
Percent Phase Field of View	(0018,0094)	3	Not used
Pixel Bandwidth	(0018,0095)	3	Not used
Nominal Interval	(0018,1062)	3	Not used
Beat Rejection Flag	(0018,1080)	3	Not used
Low R-R Value	(0018,1081)	3	Not used
High R-R Value	(0018,1082)	3	Not used
Intervals Acquired	(0018,1083)	3	Not used
Intervals Rejected	(0018,1084)	3	Not used
PVC Rejection	(0018,1085)	3	Not used
Skip Beats	(0018,1086)	3	Not used
Heart Rate	(0018,1088)	3	Not used
Cardiac Number of Images	(0018,1090)	3	Not used
Trigger Window	(0018,1094)	3	Not used
Reconstruction Diameter	(0018,1100)	3	Not used
Receiving Coil	(0018,1250)	3	Not used
Transmitting Coil	(0018,1251)	3	Not used
Acquisition Matrix	(0018,1310)	3	Not used
Phase Encoding Direction	(0018,1312)	3	Not used
Flip Angle	(0018,1314)	3	Not used
SAR	(0018,1316)	3	Not used
Variable Flip Angle Flag	(0018,1315)	3	Not used
dB/dt	(0018,1318)	3	Not used
Temporal Position Identifier	(0020,0100)	3	Not used
Number of Temporal Positions	(0020,0105)	3	Not used
Temporal Resolution	(0020,0110)	3	Not used

3.5.10.1.1 MR Image Attribute Descriptions

3.5.10.1.1.1 Image Type

See the more general description in the General Image Module.

3.5.10.1.1.2 Sequence Variant

Input: All “Sequence Variant” values are supported.

Output: Concatenation of the input images values.

3.5.10.1.1.3 Scan Options

Input: All “Scan Options” values are supported.

Output:

- Same as input if constant between input images.
- **Empty** otherwise.

4. SC INFORMATION OBJECT IMPLEMENTATION

4.1 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:

4.2 – IOD Description

4.3 – IOD Entity-Relationship Model

4.4 – IOD Module Table

4.5 – IOD Module Definition

Secondary Capture images are not allowed as input images. Therefore, the following only applies for generated pasted images.

4.2 SC IOD IMPLEMENTATION

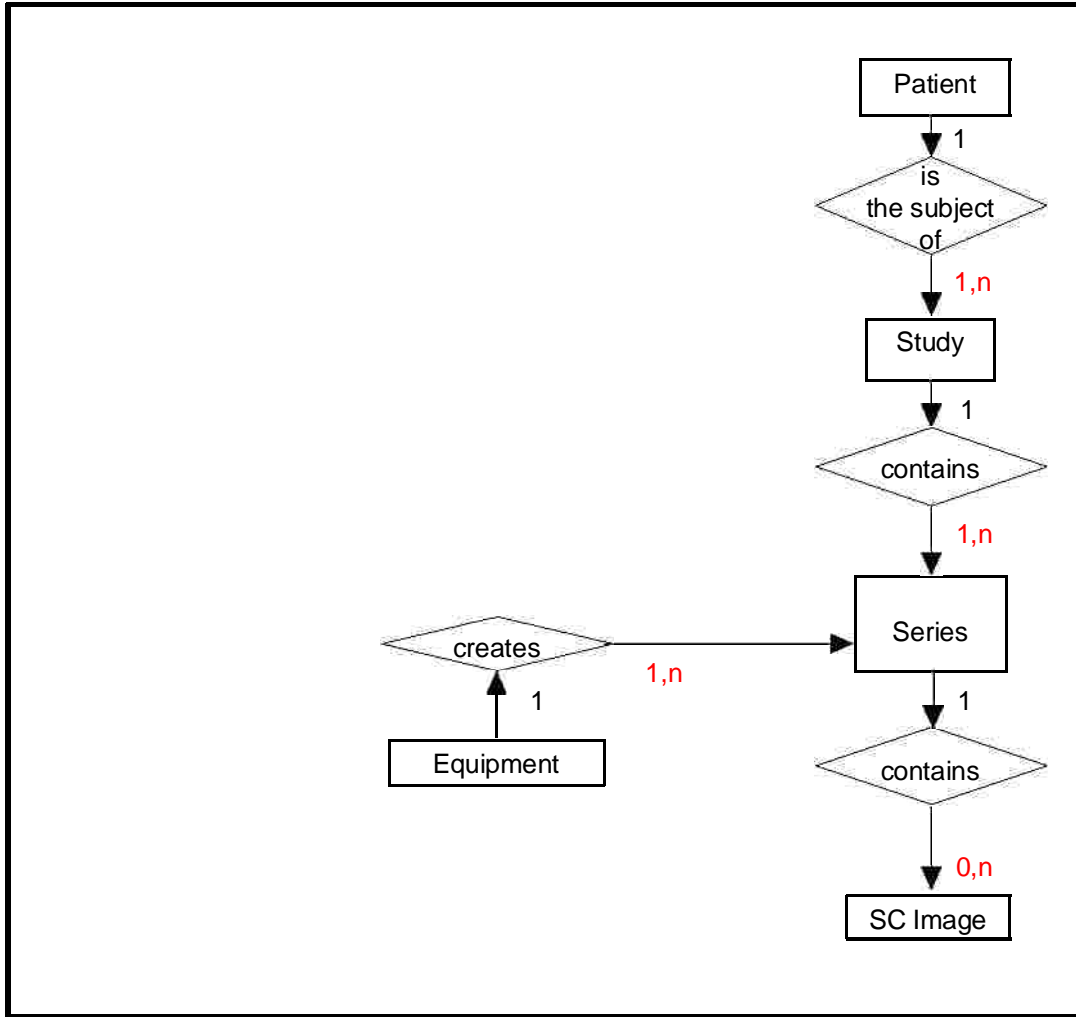
4.3 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 4.3-1. In this figure, the following diagrammatic convention 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
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



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 SC Information Object.

4.3.1.1 Patient Entity Description

4.3.1.2 Study Entity Description

4.3.1.3 Series Entity Description

4.3.1.4 Equipment Entity Description

4.3.1.5 SC Image Entity Description

4.3.1.6 Overlay Entity Description

4.3.1.7 VOI Lookup Table Entity Description

4.3.2 Pasting 1.1 Mapping of DICOM entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO PASTING 1.1 ENTITIES

DICOM	Pasting 1.1 Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

4.4 IOD MODULE TABLE

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

Table 4.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 SC IOD. Modules are identified by Module Name.

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

TABLE 4.4-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
Series	General Series	4.5.3.1
Equipment	General Equipment	4.5.4.1
	SC Equipment	4.5.9.1
Image	General Image	4.5.5.1
	Image Pixel	4.5.5.2
	SC Image	4.5.9.2
	VOILUT	4.5.7.1
	SOP Common	4.5.8.1

4.5 INFORMATION MODULE DEFINITIONS

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

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

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 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	Same as input.
Patient ID	(0010,0020)	2	Same as input.
Patient's Birth Date	(0010,0030)	2	Same as input.
Patient's Sex	(0010,0040)	2	Same as input.
Referenced Patient Sequence	(0008,1120)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Patient's Birth Time	(0010,0032)	3	Not used
Other Patient Ids	(0010,1000)	3	Not used
Other Patient Names	(0010,1001)	3	Not used
Ethnic Group	(0010,2160)	3	Not used
Patient Comments	(0010,4000)	3	Not used

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	Same as input.
Study Date	(0008,0020)	2	Same as input
Study Time	(0008,0030)	2	Same as input
Referring Physician's Name	(0008,0090)	2	Same as input if constant between input images Empty otherwise.
Study ID	(0020,0010)	2	Same as input.
Accession Number	(0008,0050)	2	Same as input if constant between input images Empty otherwise.
Study Description	(0008,1030)	3	Not used
Physician(s) of Record	(0008,1048)	3	Not used
Name of Physician(s) Reading Study	(0008,1060)	3	Not used
Referenced Study Sequence	(0008,1110)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used

4.5.2.2 Patient Study Module

No attributes from this module are 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 4.5-3
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Shall be MR
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	2	Generated
Laterality	(0020,0060)	2C	Used only if all input images have this attribute with the same value. This value is then used as the output value.
Series Date	(0008,0021)	3	The date when the first image of the series was generated
Series Time	(0008,0031)	3	The time when the first image of the series was generated
Performing Physicians' Name	(0008,1050)	3	Not used
Protocol Name	(0018,1030)	3	Not used
Series Description	(0008,103E)	3	Always used. Generated by the user.
Operators' Name	(0008,1070)	3	Not used
Referenced Study Component Sequence	(0008,1111)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Body Part Examined	(0018,0015)	3	Not used
Patient Position	(0018,5100)	2C	Not used
Smallest Pixel Value in Series	(0028,0108)	3	Not used
Largest Pixel Value in Series	(0028,0109)	3	Not used

4.5.4 Common Equipment Entity Modules

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

4.5.4.1 General Equipment Module

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

TABLE 4.5-4
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Same as input if constant between input images. Empty otherwise.
Institution Name	(0008,0080)	3	Not used
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Not used
Institutional Department Name	(0008,1040)	3	Not used
Manufacturer's Model Name	(0008,1090)	3	Not used
Device Serial Number	(0018,1000)	3	Not used
Software Versions	(0018,1020)	3	Not used
Spatial Resolution	(0018,1050)	3	Not used
Date of Last Calibration	(0018,1200)	3	Not used
Time of Last Calibration	(0018,1201)	3	Not used
Pixel Padding Value	(0028,0120)	3	See4.5.4.1.1.1.

4.5.4.1.1 General Equipment Attribute Descriptions

4.5.4.1.1.1 Pixel Padding Value

Not used.

4.5.5 Common Image Entity Modules

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

4.5.5.1 General Image Module

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

TABLE 4.5-5
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated

Patient Orientation	(0020,0020)	2C	See 4.5.5.1.1.1.
Content Date	(0008,0023)	2C	The date when the data were generated
Content Time	(0008,0033)	2C	The time when the data were generated
Image Type	(0008,0008)	3	See 4.5.5.1.1.2.
Acquisition Number	(0020,0012)	3	Not used
Acquisition Date	(0008,0022)	3	Not used
Acquisition Time	(0008,0032)	3	Not used
Referenced Image Sequence	(0008,1140)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Derivation Description	(0008,2111)	3	See 4.5.5.1.1.3.
Source Image Sequence	(0008,2112)	3	See 4.5.5.1.1.3.
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Images in Acquisition	(0020,1002)	3	Not used
Image Comments	(0020,4000)	3	Not used
Lossy Image Compression	(0028,2110)	3	See 4.5.5.1.1.4.
Burned in Annotation	(0028,0301)	3	NO

4.5.5.1.1 General Image Attribute Descriptions

4.5.5.1.1.1 Patient Orientation

Attribute sent **Empty**.

4.5.5.1.1.2 Image Type

The generated image type has the following structure:

DERIVED/SECONDARY/.../PASTED

If input images are not *DERIVED/SECONDARY/...* the pasted images are:

DERIVED/SECONDARY/PASTED

Else, the pasted images are: *“inputImageType”/PASTED*

4.5.5.1.1.3 Derivation Description and Source Image Sequence

Not used.

4.5.5.1.1.4 Lossy Image Compression

Not used.

4.5.5.2 Image Pixel Module

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

**TABLE 4.5-6
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Shall be 1
Photometric Interpretation	(0028,0004)	1	Shall be MONOCHROME2
Rows	(0028,0010)	1	Computed
Columns	(0028,0011)	1	Computed
Bits Allocated	(0028,0100)	1	Shall be 16
Bits Stored	(0028,0101)	1	Computed
High Bit	(0028,0102)	1	Bits Stored - 1
Pixel Representation	(0028,0103)	1	Computed
Pixel Data	(7FE0,0010)	1	Computed
Planar Configuration	(0028,0006)	1C	Not used
Pixel Aspect Ratio	(0028,0034)	1C	Not used
Smallest Image Pixel Value	(0028,0106)	3	Not used
Largest Image Pixel Value	(0028,0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used

4.5.6 Common Overlay Modules

4.5.6.1 Overlay plane module

No attributes from this module are used.

4.5.7 Common Lookup Table Modules

4.5.7.1 VOILUT module

This section specifies the Attributes that describe the VOILUT.

**TABLE 4.5-7
VOILUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
VOILUT Sequence	(0028,3010)	3	Not used

>LUT Descriptor	(0028,3002)	1C	Not used
>LUT Explanation	(0028,3003)	3	Not used
>LUT Data	(0028,3006)	1C	Not used
Window Center	(0028,1050)	3	One value computed from input images.
Window Width	(0028,1051)	1C	One value computed from input images.
Window Center & Width Explanation	(0028,1055)	3	Not used

4.5.7.2 Modality LUT module

No attributes from this module are used.

4.5.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.8.1 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 4.5-8
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.7 (SCPT)
SOP Instance UID	(0008,0018)	1	Output: Generated based on root Implementation UID.
Specific Character Set	(0008,0005)	1C	<ul style="list-style-type: none"> • If non present in the original image, and if the new Patient Name contains non English character(s), set to "ISO_IR 100" • Original value otherwise
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used

4.5.9 SC Modules

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

4.5.9.1 SC Equipment Module

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

TABLE 4.5-9
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Set to WSD

Modality	(0008,0060)	3	See 4.5.3.1
Secondary Capture Device ID	(0018,1010)	3	Not used
Secondary Capture Device Manufacturer	(0018,1016)	3	Not used
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Not used
Secondary Capture Device Software Version	(0018,1019)	3	Not used
Video Image Format Acquired	(0018,1022)	3	Not used
Digital Image Format Acquired	(0018,1023)	3	Not used

4.5.9.2 SC Image Module

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

**TABLE 4.5-10
SC IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	The date when the generated data was generated
Time of Secondary Capture	(0018,1014)	3	The time when the generated data was generated