# Technical Publications

DOC0636569
**Revision 2 Version 4**

# GSI Viewer

# DICOM CONFORMANCE STATEMENT

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# REVISION HISTORY

| REV | VERSION | AUTHOR | DATE | REASON FOR CHANGE |
|---|---|---|---|---|
| 1 | 1 | Srinivas Aluri & David Littlejohn | Aug 4, 2009 | INITIAL REVISION |
| 2 | 1 | Brad Gabrielse | July 2, 2010 | Updating for GSI Viewer 2.0 |
| 2 | 2 | Brad Gabrielse | July 21, 2010 | Removing WW/WL tags for SC images |
| 2 | 3 | Brad Gabrielse | July 30, 2010 | Updated SC Image Module, Comments from Harry Solomon |
| 2 | 4 | Brad Gabrielse | August 11, 2010 | Comments from Harry Solomon |
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# CONFORMANCE STATEMENT OVERVIEW

The GSI Viewer is an application that uses and creates CT and SC images. Table 0.1 provides an overview of the network services supported by the GSI Viewer.

**Table 0.1 – APPLICATION**

| SOP Classes | User of Object Instances | Creator of Object Instances |
|---|---|---|
| CT Image | Yes | Yes |
| Secondary Capture Image | Yes | Yes |

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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

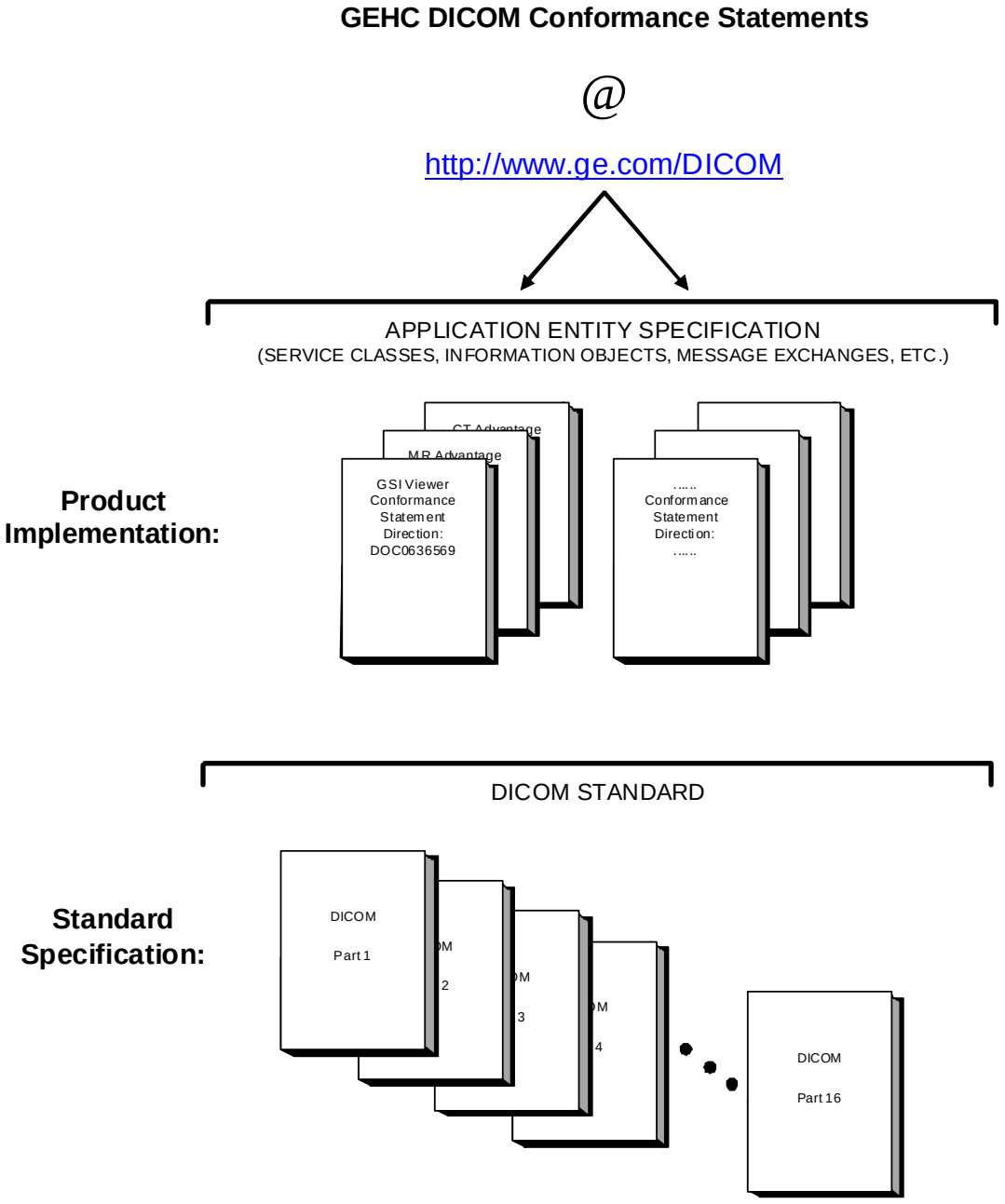
**Section 2 (Network Conformance Statement),** which specifies the GE HEALTHCARE equipment compliance to the DICOM requirements for the implementation of Networking features.

**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 (SC Information Object Implementation),** which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of SC Information object.

## 1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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




This document specifies the DICOM implementation. It is entitled:

*GSI Viewer 2.0*
*Conformance Statement for DICOM*

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

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

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

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1752
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

## 1.3 INTENDED AUDIENCE

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

## 1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document 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 of GSI Viewer. If the user encounters unspecified private data elements while parsing GSI Viewer 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 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

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

## 1.7 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 1.8 SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| AE | Application Entity |
| AET | Application Entity Title |
| CT | Computed Tomography |
| DICOM | Digital Imaging and Communications in Medicine |
| HL7 | Health Level 7 Standard |
| IHE | Integrating the Healthcare Enterprise |
| IOD | Information Object Definition |
| ISO | International Organization for Standards |
| LUT | Look-up Table |
| PACS | Picture Archiving and Communication System |
| SC | Secondary Capture |
| SOP | Service-Object Pair |
| VR | Value Representation |

## 1.9 TERMS DEFINITIONS

In the following conformance statement, the following terms describe the use of each of the DICOM tags. When GSI 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 the 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 consistent, the tag will be absent from the data set if “Ignored” at load or possibly regenerated if “Used” at load

# 2. CONFORMANCE STATEMENT

GSI Viewer is a software application, designed for CT system console and Advantage Windows workstations. This means that networking and media storage features are inherited from this platform. The application uses DICOM images to create reformatted slices. The slices displayed by the application are saved in DICOM format (Secondary Capture or modality reformatted images). These images can be loaded and displayed by other GE HEALTHCARE applications (such as Volume Viewer or the Image Viewer) or by other non-GE applications conformant to the DICOM Standard.

The GSI Viewer will run on AW 4.4 or higher as well as AW Server 2. For a complete description of the networking conformance, refer to the AW 4.4 conformance statement, direction 2340652-100, the AW Server conformance statement, or the Discovery CT750 HD scanner conformance statement, DOC0636565.

The GSI Viewer takes GSI images (multi-energy CT images) created by the Discovery CT750 HD scanner and is capable of transforming them into new image types, such as different monochromatic kev levels, material density images, or effective z images. These images can be read or saved and used by another application.

The GSI Viewer requires CT or SC Images as its input. The CT Images can be any conforming image, but the SC Images must have been saved by the GSI Viewer and have a valid, available reference to a CT series. Only the reference is used from the SC image; no other information is read.

| SOP Class Name | SOP Class UID |
|---|---|
| CT Image Information Storage | 1.2.840.10008.5.1.4.1.1.2 |
| Secondary Capture Information Storage | 1.2.840.10008.5.1.4.1.1.7 |

The GSI Viewer creates the following outputs:

| SOP Class Name | SOP Class UID |
|---|---|
| CT Image Information Storage | 1.2.840.10008.5.1.4.1.1.2 |
| Secondary Capture Information Storage | 1.2.840.10008.5.1.4.1.1.7 |

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

- The DICOM CT IODs that are required for use with and saved by the GSI Viewer (Section 3),
- The DICOM SC IODs written by the application (section 4),

# 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 read and produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:



## 3.2 CT IOD DESCRIPTION

The CT Image Information Object Definition specifies an image, which has been created by a CT imaging device.

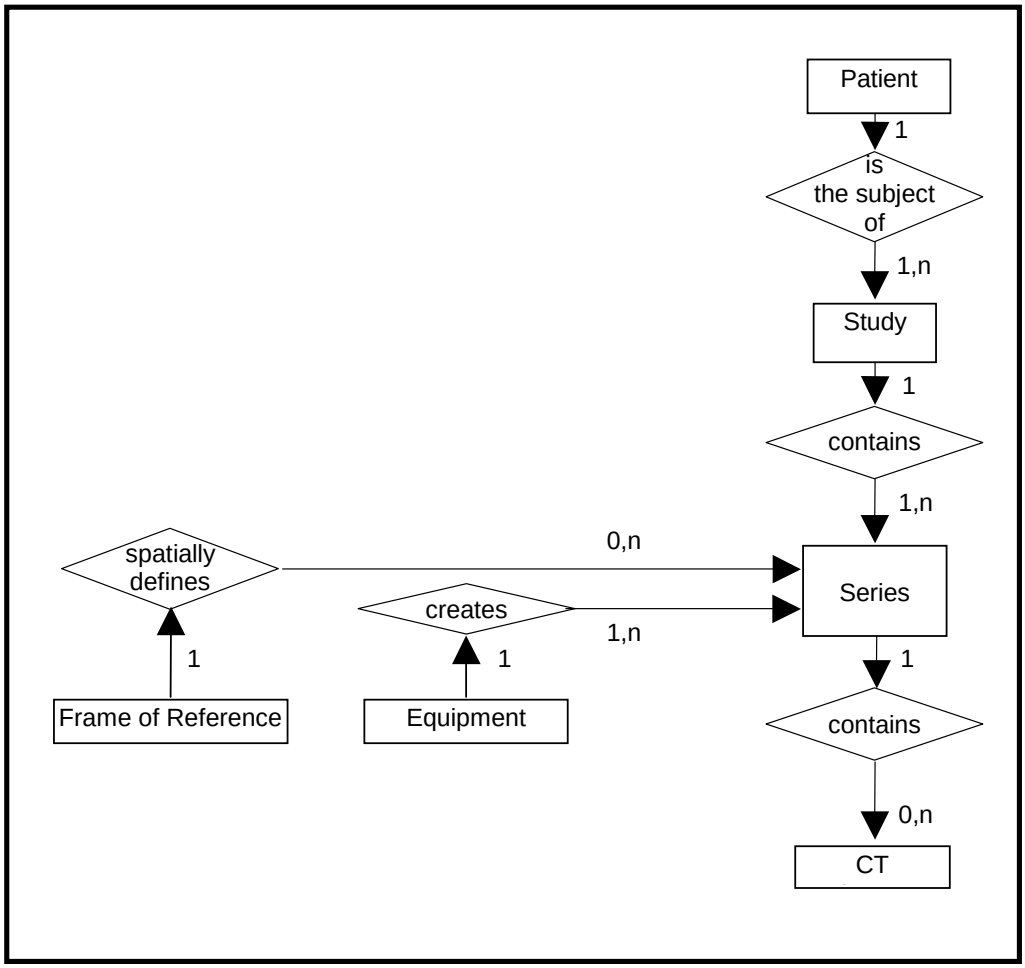
## 3.3 CT ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the CT Image interoperability schema is shown in**.** In this figure Illustration-3.3.1, 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 Patient for each Study (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 GSI Viewer Mapping of DICOM entities

**TABLE 3.3-1**
**MAPPING OF DICOM ENTITIES TO GSI VIEWER ENTITIES**

| DICOM | GSI Viewer Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Series |
| Image | Image |

## 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.

## 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. Attributes not listed are ignored and removed if new output is generated.

| Entity Name | Module Name | Reference | Usage |
|---|---|---|---|
| Patient | Patient | 3.5.1.1 | M |
| Study | General Study | 3.5.2.1 | M |
| | Patient Study | 3.5.2.2 | U |
| Series | General Series | 3.5.3.1 | M |
| Frame of Reference | Frame of Reference | 3.5.4.1 | M |
| Equipment | General Equipment | 3.5.5.1 | M |
| Image | General Image | 3.5.6.1 | M |
| | Image Plane | 3.5.6.2 | M |
| | Image Pixel | 3.5.6.3 | M |
| | Conrtrast Bolus | 0 | C |
| | CT Image | 3.5.7.1 | M |
| | VOI LUT | 3.5.8.1 | U |
| | SOP Common | 3.5.9.1 | M |

### 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 3.5-2**
**PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Patient's Name | (0010,0010) | 2 | Used / Copied |
| Patient ID | (0010,0020) | 2 | Used / Copied |
| Issuer of Patient ID | (0010, 0021) | 3 | Ignored / 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 | Ignored / Copied |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Copied |
| Patient's Birth Time | (0010,0032) | 3 | Ignored / Copied |
| Other Patient IDs | (0010,1000) | 3 | Ignored / Copied |
| Other Patient IDs Sequence | (0010,1002) | 3 | Ignored / Copied |
| >Patient ID | (0010, 0020) | 1 | Ignored / Copied |
| >Issuer of Patient ID | (0010, 0021) | 3 | Ignored / Copied |
| >Issuer of Patient ID Qualifiers Sequence | (0010, 0024) | 3 | Ignored / Copied |
| >Type of Patient ID | (0010, 0022) | 1 | Ignored / Copied |
| Other Patient Names | (0010,1001) | 3 | Ignored / Copied |
| Ethnic Group | (0010,2160) | 3 | Ignored / Copied |
| Patient Comments | (0010,4000) | 3 | Ignored / Copied |

### 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 Modules 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 that describe and identify the Study performed upon the Patient.

**TABLE 3.5-3**
**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 | Ignored / 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 | Ignored / Copied |
| Referenced Study Sequence | (0008,1110) | 3 | Ignored / Copied |
| >Referenced SOP Class UID | (0008,1150) | 1C | Ignored / Copied |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Copied |
| Procedure Code Sequence | (0008,1032) | 3 | Ignored / Copied |
| >Code Value | (0008,0100) | 1C | Ignored / Copied |
| >Code Scheme Designator | (0008,0102) | 1C | Ignored / Copied |
| >Code Meaning | (0008,0104) | 1C | Ignored / Copied |

#### 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 3.5-4**
**PATIENT STUDY MODULE ATTRIBUTES**

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

### 3.5.3 Common Series Entity Modules

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

#### 3.5.3.1 General Series Module

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

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

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Modality | (0008,0060) | 1 | Mandatory / Copied<br>Defined Terms:<br>CT = Computed Tomography |
| Series Instance UID | (0020,000E) | 1 | Mandatory / Generated |
| Series Number | (0020,0011) | 2 | Used / Generated |
| Laterality | (0020,0060) | 2C | Ignored / Copied |
| Series Date | (0008,0021) | 3 | Used / Generated (Current Date) |
| Series Time | (0008,0031) | 3 | Used / Generated (Current Time) |
| Performing Physicians' Name | (0008,1050) | 3 | Ignored / Copied |
| Protocol Name | (0018,1030) | 3 | Ignored / Copied |
| Series Description | (0008,103E) | 3 | Used / Generated (application generated on save) |
| Operators' Name | (0008,1070) | 3 | Ignored / Generated |
| Referenced Performed Procedure Step Sequence | (0008,1111) | 3 | Ignored / Copied |
| >Referenced SOP Class UID | (0008,1150) | 1C | Ignored / Copied |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Copied |
| Related Series Sequence | (0008,1250) | 3 | Generated |
| > Study Instance UID | (0020,000D) | 3 | Generated |
| > Series Instance UID | (0020,000E) | 3 | Generated |
| > Purpose of Reference Code Sequence | (0040,A170) | 3 | Generated |
| >> Code Value | (0008,0100) | 3 | Generated: 122401 |
| >> Code Scheme Designator | (0008,0102) | 3 | Generated: DCM |
| >> Code Meaning | (0008,0104) | 3 | Generated: Same Anatomy |
| Body Part Examined | (0018,0015) | 3 | Ignored / Copied |
| Patient Position | (0018,5100) | 2C | Used / Copied |
| Smallest Pixel Value in Series | (0028,0108) | 3 | Ignored / Removed |
| Largest Pixel Value in Series | (0028,0109) | 3 | Ignored / Removed |
| Request Attribute Sequence | (0040,0275) | 3 | Ignored / Copied |
| >Accession Number | (0008,0050) | 3 | Ignored / Copied |
| >Study Instance UID | (0020,000D) | 3 | Ignored / Copied |
| >Referenced Study Sequence | (0008,1110) | 3 | Ignored / Copied |
| >>Referenced SOP Class UID | (0008,1150) | 1C | Ignored / Copied |
| >>Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Copied |
| >Requested Procedure Description | (0032,1060) | 3 | Ignored / Copied |
| >Requested Procedure Code Sequence | (0032,1064) | 3 | Ignored / Copied |

| | | | |
|---|---|---|---|
| >>Code Value | (0008,0100) | 1C | Ignored / Copied |
| >>Code Scheme Designator | (0008,0102) | 1C | Ignored / Copied |
| >>Code Meaning | (0008,0104) | 1C | Ignored / Copied |
| >Scheduled Procedure Step Description | (0040,0007) | 3 | Ignored / Copied |
| >Scheduled Protocol Code Sequence | (0040,0008) | 3 | Ignored / Copied |
| >>Code Value | (0008,0100) | 1C | Ignored / Copied |
| >>Code Scheme Designator | (0008,0102) | 1C | Ignored / Copied |
| >>Code Meaning | (0008,0104) | 1C | Ignored / Copied |
| >Scheduled Procedure Step ID | (0040,0009) | 1C | Ignored / Copied |
| >Requested Procedure ID | (0040,1001) | 1C | Ignored / Copied |
| 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 Procedure Code Sequence | (0040,0260) | 3 | Ignored / Removed |
| >Code Value | (0008,0100) | 1C | Ignored / Removed |
| >Code Scheme Designator | (0008,0102) | 1C | Ignored / Removed |
| >Code Meaning | (0008,0104) | 1C | Ignored / Removed |

### 3.5.4 Common Frame Of Reference Entity Modules

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

#### 3.5.4.1 Frame of Reference Module

**TABLE 3.5-6**
**FRAME OF REFERENCE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Frame of Reference UID | (0020,0052) | 1 | Mandatory / Copied |
| Position Reference Indicator | (0020,1040) | 2 | Ignored / Copied |

### 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 that identify and describe the piece of equipment that produced a Series of Images.

GSI Viewer 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.

**TABLE 3.5-7**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Manufacturer | (0008,0070) | 2 | Used / Generated “GE MEDICAL SYSTEMS” |
| Institution Name | (0008,0080) | 3 | Used / Generated |
| Institution Address | (0008,0081) | 3 | Ignored / Generated |
| Station Name | (0008,1010) | 3 | Ignored / Generated |
| Institutional Department Name | (0008,1040) | 3 | Ignored / Generated |
| Manufacturer's Model Name | (0008,1090) | 3 | Used / Generated “Dual Energy Viewer” |
| Device Serial Number | (0018,1000) | 3 | Ignored / Removed |
| Software Versions | (0018,1020) | 3 | Ignored / Generated |
| 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 / Copied |

### 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 that identify and describe an image within a particular series.

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

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Instance Number | (0020,0013) | 2 | Used / Generated |
| Patient Orientation | (0020,0020) | 2C | Ignored/ Removed |
| Content Date | (0008,0023) | 2C | Used / Generated (Current date) |
| Content Time | (0008,0033) | 2C | Used / Generated (Current time) |
| Image Type | (0008,0008) | 3 | Used / Generated. See Section 3.5.7.1.1 |
| Acquisition Number | (0020,0012) | 3 | Used / 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 | Ignored / Removed |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Removed |
| Derivation Description | (0008,2111) | 3 | Ignored / Removed |
| Source Image Sequence | (0008,2112) | 3 | Ignored / Generated |
| >Referenced SOP Class UID | (0008,1150) | 1C | Generated from contributing images |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Generated from contributing images |
| 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 / Removed |

| | | | |
|---|---|---|---|
| Lossy Image Compression | (0028,2110) | 3 | Ignored / Removed |
| Lossy Image Compression Ratio | (0028,2112) | 3 | Ignored / Removed |

#### 3.5.6.2 Image Plane Module

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

**TABLE 3.5-9**
**IMAGE PLANE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| 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 |

#### 3.5.6.3 Image Pixel Module

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

**TABLE 3.5-10**
**IMAGE PIXEL MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| 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 / Generated |
| Columns | (0028,0011) | 1 | Mandatory / 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 / Removed |
| Largest Image Pixel Value | (0028,0107) | 3 | Ignored / Removed |
| 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 |

### 3.5.7 CT Specific Modules

#### 3.5.7.1 CT Image module

**TABLE 3.5-11**
**CT IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Image Type | (0008,0008) | 1 | Used / Generated. See Section 3.5.7.1.1 |
| Samples per Pixel | (0028,0002) | 1 | Ignored / Generated "1" |
| Photometric Interpretation | (0028,0004) | 1 | Ignored / Generated "MONOCHROME2" |
| Bits Allocated | (0028,0100) | 1 | Ignored / Generated "16" |
| Bits Stored | (0028,0101) | 1 | Ignored / Generated "16" |
| High Bit | (0028,0102) | 1 | Ignored / Generated "15" |
| Rescale Intercept | (0028,1052) | 1 | Used / Generated. See Section 3.5.7.1.2. |
| Rescale Slope | (0028,1053 | 1 | Used / Generated. See Section 3.5.7.1.2. |
| Rescale Type | (0028,1054) | 1C | Used / Generated. See Section 3.5.7.1.2. |
| KV | (0018,0060) | 2 | Used / Copied |
| Acquisition Number | (0020,0012) | 2 | Used / Copied |
| Scan Options | (0018,0022) | 3 | Used / Copied |
| Data Collection Diameter | (0018,0090) | 3 | Used / Copied |
| Reconstruction Diameter | (0018,1100) | 3 | Used / Removed |
| Distance Source to Detector | (0018,1110) | 3 | Ignored / Copied |
| Distance Source to Patient | (0018,1111) | 3 | Ignored / Copied |
| Gantry / Detector Tilt | (0018,1120) | 3 | Used / Generated |
| Table Height | (0018,1130) | 3 | Ignored / Copied |
| Rotation Direction | (0018,1140) | 3 | Ignored / Copied |
| Exposure Time | (0018,1150) | 3 | Ignored / Copied |
| X-Ray Tube Current | (0018,1151) | 3 | Used / Copied |
| Exposure | (0018,1152) | 3 | Ignored / Copied |
| Filter Type | (0018,1160) | 3 | Ignored / Copied |
| Generator Power | (0018,1170) | 3 | Ignored / Copied |
| Focal Spot | (0018,1190) | 3 | Ignored / Copied |
| Convolution Kernel | (0018,1210) | 3 | Used / Generated |
| Revolution Time | (0018, 9305) | 3 | Ignored / Removed |
| Single Collimation Width | (0018, 9306) | 3 | Ignored / Removed |
| Total Collimation Width | (0018, 9307) | 3 | Ignored / Removed |
| Table Speed | (0018, 9309) | 3 | Ignored / Removed |
| Table Feed per Rotation | (0018, 9310) | 3 | Ignored / Removed |
| CT Pitch Factor | (0018, 9311) | 3 | Ignored / Removed |

##### 3.5.7.1.1 Image Type

When producing CT Images, here are the values that may be generated:

Value 1 has the following value:

– DERIVED all images generated are results of post processing input images.

Value 2 has the following value:

– SECONDARY assumes all images created as secondary images.

Value 3 has one of the following values:

– REFORMATTED orthogonal or oblique reformatting (MPR)

– PROCESSED contains a masked region

Value 4, if defined, can have the following values:

– GSI MONO identifies a GSI Monochromatic Image

– GSI MD identifies a GSI Material Density Image

Value 5, if defined, can have the following values:

– MIPidentifies that the image has been reformatted with a MIP algorithm

– MIN IP identifies that the image has been reformatted with a MINIP algorithm

– AVERAGE identifies that the image has been reformatted with a AVG algorithm

#### 3.5.7.1.2 Rescale parameters

The values saved in these fields are generated according to the type of image being saved as defined in the table below:

| | **Monochromatic Images** | **Material Density Images** |
|---|---|---|
| **Rescale Intercept** | -1024 | 0 |
| **Rescale Slope** | 1 | .5 or 1 from GE predefined materials<br>Can be any number (up to 6 decimal places) for user-defined materials |
| **Rescale Type** | HU | Scale of g/cm3<br>(e.g. mg/cm3, 200 ug/cm3) |

Warning : Images that have a rescale slope other than 1 have the potential to lose accuracy or precision in applications that do not fully support the rescale slope field.

Warning: Images that ignore the rescale type field may incorrectly annotate images, for example it assume the image to be in Hounsfield units. Algorithms expecting Hounsfield units may not work as expected.

### 3.5.7.2 Contrast / Bolus module

**TABLE 3.5-12**
**CONTRAST / BOLUS MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Contrast/Bolus Agent | (0018,0010) | 2 | Ignored / Copied |
| Contrast/Bolus Route | (0018,1040) | 3 | Used / Copied |

### 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 3.5-13**
**VOI LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| VOI LUT Sequence | (0028,3010) | 3 | Ignored / Removed |
| >LUT Descriptor | (0028,3002) | 1C | Ignored / Removed |
| >LUT Explanation | (0028,3003) | 3 | Ignored / Removed |
| >LUT Data | (0028,3006) | 1C | Ignored / Removed |
| Window Center | (0028,1050) | 3 | Used / Generated |
| Window Width | (0028,1051) | 1C | Used / Generated |
| Window Center & Width Explanation | (0028,1055) | 3 | Ignored / Removed |

### 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 that are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

**TABLE 3.5-14**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| SOP Class UID | (0008,0016) | 1 | Used / Copied |
| SOP Instance UID | (0008,0018) | 1 | Used / Generated |
| Specific Character Set | (0008,0005) | 1C | Used / Copied<br>Only the “ISO_IR 100” character sets is supported. |
| Instance Creation Date | (0008,0012) | 3 | Ignored / Generated |
| Instance Creation Time | (0008,0013) | 3 | Ignored / Generated |
| 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. |
| 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 |

### 3.5.10 Private Data Elements

The following private elements are ignored or used. Data from the input/original image is copied, generated, or removed:

### 3.5.10.1 Private Creator Identification (GEMS_ACQU_01)

**TABLE 3.5-15**
**PRIVATE ATTRIBUTES**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Creator ID | (0019,0010) | LO | 1 |
| Gantry period | (0019,1027) | DS | 1 |
| Scan FOV type | (0019,1039) | SS | 1 |
| Dependent on #views processed | (0019,106A) | SS | 1 |

### 3.5.10.2 Private Creator Identification (GEMS_PARM_01)

**TABLE 3.5-17**
**PRIVATE ATTRIBUTES**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Creator ID | (0043,0010) | LO | 1 |
| Scan pitch ratio | (0043,1027) | SH | 1 |
| Private Scan Options | (0043,102b) | SS | 4 |

### 3.5.10.3 Private Creator Identification (GEMS_HELIOS_01)

**TABLE 3.5-18**
**PRIVATE ATTRIBUTES**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Creator ID | (0045,0010) | LO | 1 |
| Sigma Mode | (0045,1013) | SS | 1 |
| Iterbone Flag | (0045,1021) | SS | 1 |
| Perisstaltic Flag | (0045,1022) | SS | 1 |
| NoiseReductionImageFilterDesc | (0045, 103B) | LO | 1 |

**3.5.10.4 Private Creator Identification (GEHC_CT_ADVAPP_001)**

**TABLE 3.5-19**
**PRIVATE ADVANTAGE ATTRIBUTES**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| GEMS Private Creator ID | (0053,0010) | LO | 1 |
| MultiEnergyNoiseRedBlendingFact | (0053, 1001) | FL | 1-n |
| MultiEnergyNoiseRedScaleFact | (0053, 1002) | FL | 1-n |
| MultiEnergyMDTransformEnergies | (0053, 1003) | IS | 2 |
| IterativeReconAnnotation | (0053, 1040) | SH | 1 |
| HiResMode | (0053, 1061) | SH | 1 |
| Image Position Patient Setting | (0053, 1063) | CS | 1 |
| Image Browser Annotation | (0053, 1066) | LO | 1 |
| MultiEnergySourceCount | (0053, 1070) | IS | 1 |
| MultiEnergyScanType | (0053, 1071) | LO | 1 |
| MultiEnergyReconType | (0053, 1072) | LO | 1 |
| MultiEnergyImageType<br>Defined Terms:<br>MONO, Material Density | (0053, 1073) | LO | 1 |
| MultiEnergyMaterialType | (0053, 1074) | LO | 1 |
| MonochromaticEnergy | (0053, 1075) | DS | 1 |
| MultiEnergyWeightedSubtractionWeight1 | (0053, 1076) | DS | 1 |
| MultiEnergyWeightedSubtractionWeight2 | (0053, 1077) | DS | 1 |
| MultiEnergyWeightedSubtractionType | (0053, 1078) | LO | 1 |
| MultiEnergyAcqMethod | (0053, 1079) | LO | 1 |
| MultiEnergyFeatAnnotName | (0053, 107A) | SH | 1 |
| MultiEnergyNoiseReduced | (0053, 107B) | SH | 1 |
| MultiEnergyNoiseReducedMethod | (0053, 107C) | LO | 1 |
| SubOptimalIQString | (0053, 107D) | LO | 1 |
| MultiEnergyHighLowRatio | (0053, 107E) | DS | 1 |
| AnnotationmA | (0053, 1083) | DS | 1 |
| CommandedFirstkVp | (0053, 1084) | DS | 1 |
| CommandedFirstmA | (0053, 1085) | DS | 1 |
| CommandedSecondkVp | (0053, 1086) | DS | 1 |
| CommandedSecondmA | (0053, 1087) | DS | 1 |
| MultiEnergyKVAnnotName | (0053, 1088) | SH | 1 |
| MultiEnergyKVUnitLabel | (0053, 1089) | SH | 1 |
| MaterialType#1 | (0053, 108A) | LO | 1 |
| MaterialType#2 | (0053, 108B) | LO | 1 |
| GSIScanModePreset | (0053, 108C) | LO | 1 |
| MonoWindowLow | (0053, 108D) | IS | 2 |
| MonoWindowHigh | (0053, 108E) | IS | 2 |
| MD1 Attenuation curve | (0053, 108F) | FL | 110 |
| MD1 intercept | (0053, 1092) | DS | 1 |
| MD1 slope | (0053, 1093) | DS | 1 |

| | | | |
|---|---|---|---|
| MD1 support data | (0053, 1095) | OW | 1 |
| MD2 support data | (0053, 1096) | OW | 1 |
| NM1 data | (0053, 1097) | OW | 1 |
| MD2 intercept | (0053, 1098) | DS | 1 |
| MD2 slope | (0053, 1099) | DS | 1 |
| NM2 data | (0053, 109A) | OW | 1 |
| MD2 Attenuation curve | (0053, 109B) | FL | 110 |
| GSI Data Version | (0053, 109C) | SH | 1 |
| MARs Annotation | (0053, 109D) | LO | 1 |
| MultiEnergyNumNoiseRedPair | (0053, 109E) | IS | 1 |
| MultiEnergyNoiseRedPairString | (0053, 109F) | LO | 1-n |

# 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:



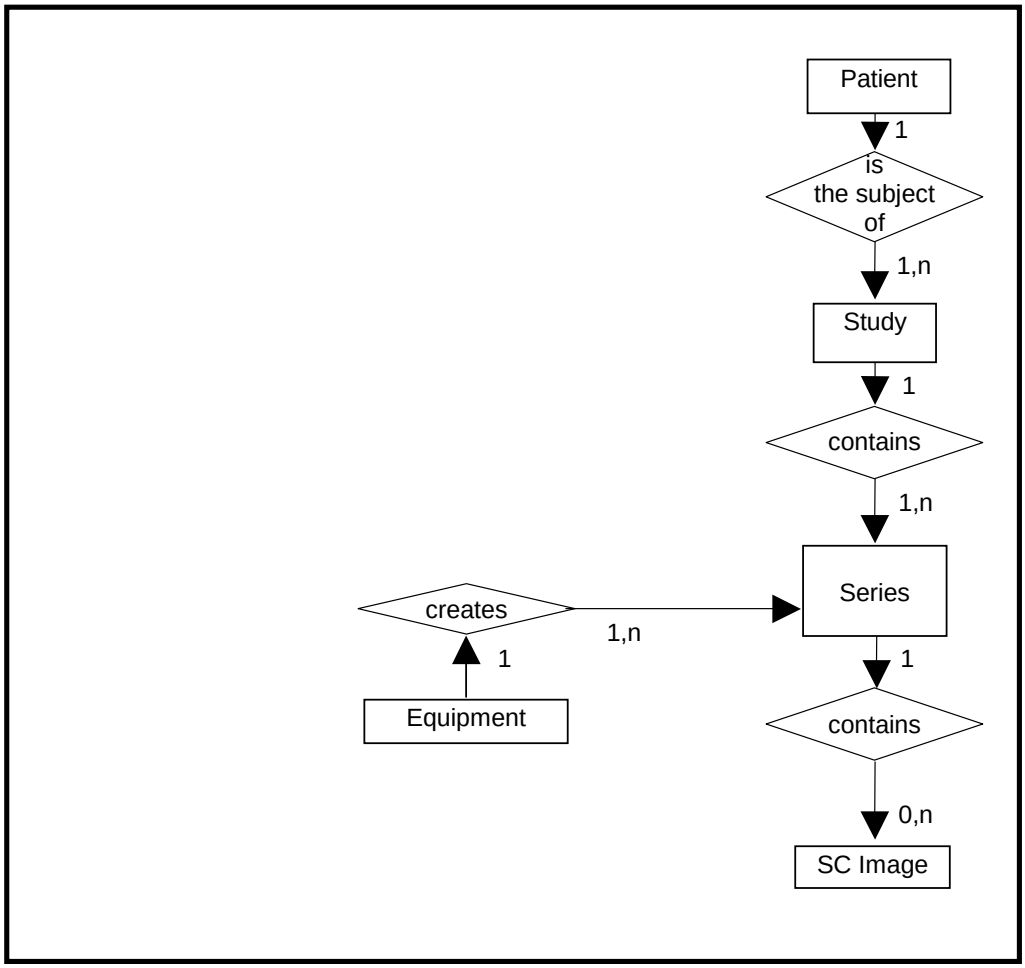
## 4.2 SC ENTITY RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 4.2-2**.** 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 Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

**ILLUSTRATION 4.2-2**
**SC IMAGE ENTITY RELATIONSHIP DIAGRAM**




### 4.2.1 Entity Descriptions

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

### 4.2.2 GSI Viewer Mapping of DICOM entities

**TABLE 4.2-16**
**MAPPING OF DICOM ENTITIES TO GSI VIEWER ENTITIES**

| DICOM | GSI Viewer Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Series |
| Image | Image |

## 4.3 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 4.3-17**
**SC IMAGE IOD MODULES**

| Entity Name | Module Name | Reference | Usage |
|---|---|---|---|
| Patient | Patient | 4.4.1.1 | M |
| Study | General Study | 4.4.2.1 | M |
| | Patient Study | 4.4.2.2 | U |
| Series | General Series | 4.4.3.1 | M |
| Equipment | General Equipment | 4.4.4.1 | U |
| | SC Equipment | 4.4.8.1 | M |
| Image | General Image | 4.4.5.1 | M |
| | Image Pixel | 4.4.5.2 | M |
| | SC Image | 4.4.8.2 | M |
| | Overlay Plane | Not used | U |
| | Modality LUT | 4.4.6.2 | U |
| | VOI LUT | 4.4.6.1 | U |
| | SOP Common | 4.4.7.1 | M |

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

## 4.4 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 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. Attributes not listed are removed in the output generated.

### 4.4.1 Common Patient Entities modules

#### 4.4.1.1 Patient module

**TABLE 4.4-18**
**GENERAL PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Patient's Name | (0010,0010) | 2 | Used / Copied |
| Patient ID | (0010,0020) | 2 | Used / Copied |
| Issuer of Patient ID | (0010, 0021) | 3 | Ignored / 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 | Ignored / Copied |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Ignored / Copied |
| Patient's Birth Time | (0010,0032) | 3 | Ignored / Copied |
| Other Patient IDs | (0010,1000) | 3 | Ignored / Copied |
| Other Patient IDs Sequence | (0010,1002) | 3 | Ignored / Copied |
| >Patient ID | (0010, 0020) | 1 | Ignored / Copied |
| >Issuer of Patient ID | (0010, 0021) | 3 | Ignored / Copied |
| >Issuer of Patient ID Qualifiers Sequence | (0010, 0024) | 3 | Ignored / Copied |
| >Type of Patient ID | (0010, 0022) | 1 | Ignored / Copied |
| Other Patient Names | (0010,1001) | 3 | Ignored / Copied |
| Ethnic Group | (0010,2160) | 3 | Ignored / Copied |
| Patient Comments | (0010,4000) | 3 | Ignored / Copied |

### 4.4.2 Common Study Entity Modules

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

#### 4.4.2.1 General Study module

**TABLE 4.4-19**
**GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| 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 | Copied |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Copied |
| Procedure Code Sequence | (0008,1032) | 3 | Copied |
| >Code Value | (0008,0100) | 1C | Copied |
| >Code Scheme Designator | (0008,0102) | 1C | Copied |
| >Code Meaning | (0008,0104) | 1C | Copied |

#### 4.4.2.2 Patient Study Module

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

**TABLE 4.4-20**
**PATIENT STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| 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 |

### 4.4.3 Common Series Entity Modules

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

#### 4.4.3.1 General Series module

**TABLE 4.4-21**
**GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Modality | (0008,0060) | 1 | Copied<br>Defined Terms:<br>CT = Computed Tomography |
| Series Instance UID | (0020,000E) | 1 | Generated |
| Series Number | (0020,0011) | 2 | Generated |
| Laterality | (0020,0060) | 2C | Removed |
| Series Date | (0008,0021) | 3 | Generated (Current Date) |
| Series Time | (0008,0031) | 3 | Generated (Current Time) |
| Performing Physicians' Name | (0008,1050) | 3 | Copied |
| Protocol Name | (0018,1030) | 3 | Copied |
| Series Description | (0008,103E) | 3 | Generated (application generated on save) |
| Operators' Name | (0008,1070) | 3 | Generated |
| Referenced Performed Procedure Step Sequence | (0008,1111) | 3 | Removed |
| >Referenced SOP Class UID | (0008,1150) | 1C | Removed |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Removed |
| Related Series Sequence | (0008,1250) | 3 | Generated |
| > Study Instance UID | (0020,000D) | 3 | Generated |
| > Series Instance UID | (0020,000E) | 3 | Generated |
| > Purpose of Reference Code Sequence | (0040,A170) | 3 | Generated |
| >> Code Value | (0008,0100) | 3 | Generated: 122401 |
| >> Code Scheme Designator | (0008,0102) | 3 | Generated: DCM |
| >> Code Meaning | (0008,0104) | 3 | Generated: Same Anatomy |
| Body Part Examined | (0018,0015) | 3 | Copied |
| Patient Position | (0018,5100) | 2C | Copied |
| Smallest Pixel Value in Series | (0028,0108 | 3 | Removed |
| Largest Pixel Value in Series | (0028,0109) | 3 | Removed |
| Performed Procedure Step ID | (0040,0253) | 3 | Removed |
| Performed Procedure Step Start Date | (0040,0244) | 3 | Removed |
| Performed Procedure Step Start Time | (0040,0245) | 3 | Removed |
| Performed Procedure Step Description | (0040,0254) | 3 | Removed |
| Request Attributes Sequence | (0040,0275) | 3 | Copied |
| >Accession Number | (0008,0050) | 3 | Copied |
| >Study Instance UID | (0020,000D) | 3 | Copied |
| >Referenced Study Sequence | (0008,1110) | 3 | Copied. |
| >>Referenced SOP Class UID | (0008,1150) | 1C | Copied |
| >>Referenced SOP Instance UID | (0008,1155) | 1C | Copied |
| >Requested Procedure Description | (0032,1060) | 3 | Copied |
| >Requested Procedure Code Sequence | (0032,1064) | 3 | Copied |

| | | | |
|---|---|---|---|
| >>Code Value | (0008,0100) | 1C | Copied |
| >>Code Scheme Designator | (0008,0102) | 1C | Copied |
| >>Code Meaning | (0008,0104 | 1C | Copied |
| >Scheduled Procedure Step Description | (0040,0007) | 3 | Copied |
| >Scheduled Protocol Code Sequence | (0040,0008) | 3 | Copied |
| >>Code Value | (0008,0100) | 1C | Copied |
| >>Code Scheme Designator | (0008,0102) | 1C | Copied |
| >>Code Meaning | (0008,0104) | 1C | Copied |
| >Scheduled Procedure Step ID | (0040,0009) | 1C | Copied |
| >Requested Procedure ID | (0040,1001) | 1C | Copied |
| Performed Procedure Code Sequence | (0040,0260) | 3 | Removed |
| >Code Value | (0008,0100) | 1C | Removed |
| >Code Scheme Designator | (0008,0102) | 1C | Removed |
| >Code Meaning | (0008,0104) | 1C | Removed |

### 4.4.4 Common Equipment Entity Modules

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

#### 4.4.4.1 General equipment module

**TABLE 4.4-22**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Manufacturer | (0008,0070) | 2 | Always sent as “GE MEDICAL SYSTEMS” |
| 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 |
| Manufacturers Model Name | (0008,1090) | 3 | Generated “Dual Energy Viewer” |
| Device Serial Number | (0018,1000) | 3 | Removed |
| Software Versions | (0018,1020) | 3 | Generated |
| Spatial Resolution | (0018,1050) | 3 | Removed |
| Date of Last Calibration | (0018,1200) | 3 | Removed |
| Time of Last Calibration | (0018,1201) | 3 | Removed |
| Pixel Padding Value | (0028,0120) | 3 | Removed |

### 4.4.5 Common Image Entity Modules

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

#### 4.4.5.1 General Image Module

**TABLE 4.4-23**
**GENERAL IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Instance Number | (0020,0013) | 2 | Generated |
| Patient Orientation | (0020,0020) | 2C | Generated |
| Image Date | (0008,0023) | 2C | Generated. |
| Image Time | (0008,0033) | 2C | Generated |
| Image Type | (0008,0008) | 3 | Generated. See Section 4.4.5.1.1 |
| Acquisition Number | (0020,0012) | 3 | Removed |
| Acquisition Date | (0008,0022) | 3 | Copied |
| Acquisition Time | (0008,0032) | 3 | Copied |
| Referenced Image Sequence | (0008,1140) | 3 | Removed |
| >Referenced SOP Class UID | (0008,1150) | 1C | Removed |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Removed |
| Derivation Description | (0008,2111) | 3 | Removed |
| Source Image Sequence | (0008,2112) | 3 | Used / Generated |
| >Referenced SOP Class UID | (0008,1150) | 1C | Generated from contributing images |
| >Referenced SOP Instance UID | (0008,1155) | 1C | Generated from contributing images |
| Images in Acquisition | (0020,1002) | 3 | Removed |
| Image Comments | (0020,4000) | 3 | Removed |
| Quality Control Image | (0028,0300) | 3 | Removed |
| Burned in Annotation | (0028,0301) | 3 | Generated |
| Lossy Image Compression | (0028,2110) | 3 | Removed |
| Lossy Image Compression Ratio | (0028,2112) | 3 | Removed |

##### 4.4.5.1.1 Image Type

When generating SC images, here are the values that may be present:.

Value 1 has the following value:

- DERIVED all images generated are results of post processing input images.

Value 2 has the following value:

- SECONDARY assumes all images created as secondary images.

Value 3 has the following value:

- SCREEN SAVE identifies image as Secondary Capture

Value 4, if defined, can have the following values:

- GSI EFF Z identifies a GSI Effective Z Image
- GSI MD identifies a GSI Material Density Image
- GSI CLR OVRLY identifies a GSI Color Overlay Image

Value 4/5, if defined, can have the following values:

- MIPidentifies that the image has been reformatted with a MIP algorithm

– MIN IP identifies that the image has been reformatted with a MINIP algorithm

– AVERAGE identifies that the image has been reformatted with an AVG algorithm

#### 4.4.5.2 Image Pixel Module

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

**TABLE 4.4-24**
**IMAGE PIXEL MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Samples per Pixel | (0028,0002) | 1 | Generated “3” |
| Photometric Interpretation | (0028,0004) | 1 | Generated “RGB” |
| Rows | (0028,0010) | 1 | Generated |
| Columns | (0028,0011) | 1 | Generated |
| Bits Allocated | (0028,0100) | 1 | Generated “8” |
| Bits Stored | (0028,0101) | 1 | Generated “8” |
| High Bit | (0028,0102) | 1 | Generated “7” |
| Pixel Representation | (0028,0103) | 1 | Generated “0” |
| Pixel Data | (7FE0,0010) | 1 | Generated |
| Planar Configuration | (0028,0006) | 1C | Generated “0” |
| 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 |

### 4.4.6 Common Lookup Table Modules

#### 4.4.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

**TABLE 4.4-25**
**VOI LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| VOI LUT Sequence | (0028,3010) | 3 | Removed |
| >LUT Descriptor | (0028,3002) | 1C | Removed |
| >LUT Explanation | (0028,3003) | 3 | Removed |
| >LUT Data | (0028,3006) | 1C | Removed |
| Window Center | (0028,1050) | 3 | Removed |
| Window Width | (0028,1051) | 1C | Removed |

| | | | |
|---|---|---|---|
| Window Center & Width Explanation | (0028,1055) | 3 | Removed |

#### 4.4.6.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

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

**TABLE 4.4-26**
**MODALITY LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Modality LUT Sequence | (0028,3000) | 3 | Removed |
| >LUT Descriptor | (0028,3002) | 1C | Removed |
| >LUT Explanation | (0028,3003) | 3 | Removed |
| >Modality LUT Type | (0028,3004) | 1C | Removed |
| >LUT Data | (0028,3006) | 1C | Removed |
| Rescale Intercept | (0028,1052) | 1C | Removed |
| Rescale Slope | (0028,1053) | 1C | Removed |
| Rescale Type | (0028,1054) | 1C | Removed |

### 4.4.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

#### 4.4.7.1 SOP Common Module

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

**TABLE 4.4-27**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| SOP Class UID | (0008,0016) | 1 | Generated |
| SOP Instance UID | (0008,0018) | 1 | Generated |
| Specific Character Set | (0008,0005) | 1C | Generated<br>Only the "ISO_IR 100" character set 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 |

### 4.4.8 SC Modules

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

#### 4.4.8.1 SC Equipment Module

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

**TABLE 4.4-28**
**SC IMAGE EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Conversion Type | (0008,0064) | 1 | Generated:<br>WSD = Workstation |
| Modality | (0008,0060) | 3 | Generated<br>CT = Computed Tomography |
| Secondary Capture Device ID | (0018,1010) | 3 | Generated |
| Secondary Capture Device Manufacturer | (0018,1016) | 3 | Generated “GE MEDICAL SYSTEMS” |
| Secondary Capture Device Manufacturer's Model Name | (0018,1018) | 3 | Generated “Dual Energy Viewer” |
| Secondary Capture Device Software Version | (0018,1019) | 3 | Generated |
| Video Image Format Acquired | (0018,1022) | 3 | Removed |
| Digital Image Format Acquired | (0018,1023) | 3 | Removed |

#### 4.4.8.2 SC Image Module

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

**TABLE 4.4-29**
**SC IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Date of Secondary Capture | (0018,1012) | 3 | Generated: current date |
| Time of Secondary Capture | (0018,1014) | 3 | Generated: current time |
| Nominal Scanned Pixel Spacing | (0018,2010) | 3 | Removed |
| Include Basic Pixel Spacing Calibration Macro | | | |

**TABLE 4.4-31**
**BASIC PIXEL SPACING CALIBRATION MACRO ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Pixel Spacing | (0028,0030) | 1C | Removed |
| Pixel Spacing Calibration Type | (0028,0A02) | 3 | Removed |
| Pixel Spacing Calibration Description | (0028,0A04) | 1C | Removed |

### 4.4.9 SC additional attributes

#### 4.4.9.1 Additional Attributes in SC images

This section specifies other Attributes saved with the Multi Energy images.

**TABLE 4.4-30**
**ADDITIONAL ATTRIBUTES**

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Slice Thickness | (0018,0050) | 3 | Generated |
| GEMS Private Creator ID | (0053,0010) | 3 | Generated: GEHC_CT_ADVAPP_001 |
| HiResMode | (0053,1061) | 3 | Copied |
| MultiEnergySourceCount | (0053,1070) | 3 | Copied |
| MultiEnergyScanType | (0053,1071) | 3 | Copied |
| MultiEnergyReconType | (0053,1072) | 3 | Copied |
| MultiEnergyImageType<br>Defined Terms:<br>MONO, Material Density, Effective-Z | (0053,1073) | 3 | Generated |
| MultiEnergyMaterialType | (0053,1074) | 3 | Generated |
| MonochromaticEnergy | (0053,1075) | 3 | Generated |
| MultiEnergyWeightedSubtractionWeight1 | (0053,1076) | 3 | Copied |
| MultiEnergyWeightedSubtractionWeight2 | (0053,1077) | 3 | Copied |
| MultiEnergyWeightedSubtractionType | (0053,1078) | 3 | Copied |
| MultiEnergyAcqMethod | (0053,1079) | 3 | Copied |
| MultiEnergyFeatAnnotName | (0053,107A) | 3 | Copied |
| MultiEnergyNoiseReduced | (0053,107B) | 3 | Copied |
| MultiEnergyNoiseReducedMethod | (0053,107C) | 3 | Copied |
| SubOptimalIQString | (0053,107D) | 3 | Copied |
| MultiEnergyHighLowRatio | (0053,107E) | 3 | Copied |
| AnnotationmA | (0053,1083) | 3 | Copied |
| CommandedFirstkVp | (0053,1084) | 3 | Copied |
| CommandedFirstmA | (0053,1085) | 3 | Copied |
| CommandedSecondkVp | (0053,1086) | 3 | Copied |
| CommandedSecondmA | (0053,1087) | 3 | Copied |
| MultiEnergyKVAnnotName | (0053,1088) | 3 | Generated |
| MultiEnergyKVUnitLabel | (0053,1089) | 3 | Generated |
| MaterialType#1 | (0053,108A) | 3 | Generated |
| MaterialType#2 | (0053,108B) | 3 | Generated |
| GSIScanModePreset | (0053,108C) | 3 | Copied |
| MonoWindowLow | (0053,108D) | 3 | Copied |
| MonoWindowHigh | (0053,108E) | 3 | Copied |
| GSI Data Version | (0053,109C) | 3 | Copied |
| MARs Annotation | (0053,109D) | 3 | Copied |