



GE Medical Systems

Technical Publications

**Direction 5127964-100
Revision 3**

Advantage Paste 2.0 DICOM CONFORMANCE STATEMENT

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GE Medical Systems

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
1	Nov 2004.	External Evaluation version
2	March 2005	Pilot Evaluation version
3	March 2009	Changes in DICOM mapping and fixes afer review

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TABLE OF CONTENTS

1. INTRODUCTION	2
1.1 OVERVIEW	2
1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE.....	2
1.3 INTENDED AUDIENCE	5
1.4 SCOPE AND FIELD OF APPLICATION	5
1.5 IMPORTANT REMARKS	6
1.6 REFERENCES.....	7
1.7 DEFINITIONS	7
1.8 SYMBOLS AND ABBREVIATIONS	7
2. NETWORK CONFORMANCE STATEMENT	8
2.1 INTRODUCTION.....	8
2.2 IMPLEMENTATION MODEL	9
2.2.1 Application Data Flow Diagram	9
2.2.2 Presentation Context Table	9
2.2.3 Real-World Activities	10
2.2.4 SOP Instance UID and Series UID	10
3. X-RAY ANGIOGRAPHY (XA) INFORMATION OBJECT IMPLEMENTATION	11
3.1 Introduction.....	11
3.2 X-Ray Image IOD Implementation	11
3.3 X-Ray Image IOD Entity-Relationship Model	11
3.4 Entities Description.....	12
3.5 Advantage paste Mapping of DICOM entities	12
3.6 IOD MODULE TABLE.....	13
3.7 Information Modul Definitions.....	14
3.7.1 Common Information Module Definitions.....	14
3.7.2 Private Data Attributes.....	29

1. INTRODUCTION

1.1 OVERVIEW

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

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

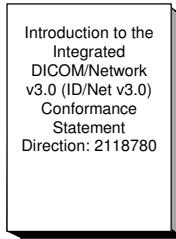
Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

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

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

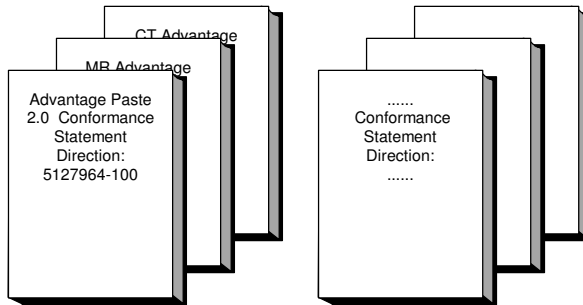
The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in the Illustration below.

ID/Net v3.0



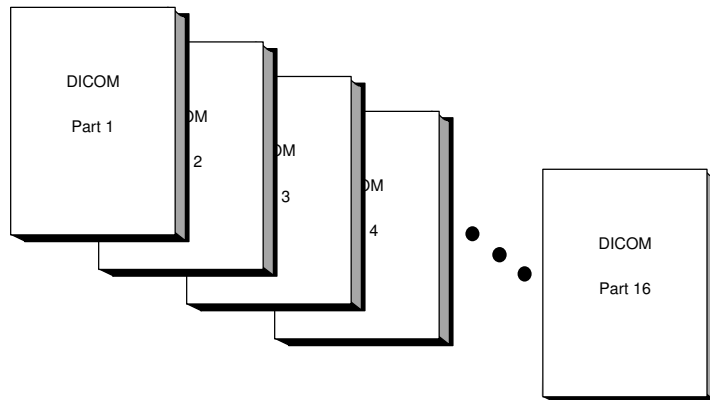
APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

**Product
Implementation:**



DICOM STANDARD

**Standard
Specification:**



This document specifies the DICOM implementation. It is entitled:

Advantage Paste 2.0
Conformance Statement for DICOM
Direction 5127964-100

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

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

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

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

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

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM 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 (ID/Net 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 Advantage Paste 2.0 compliance to DICOM requirements for Networking features.

Advantage Paste is report tool that is installed on the same hardware platform as the base application, **Advantage Workstation**. This base application is a Networked Medical Imaging Console dedicated to Examination Review and Diagnosis. The workstation uses DICOM services to import acquisition images for possible further analysis or processing, and to export images and radiotherapy data to other vendors. Advantage Paste is compatible with the following **Advantage Workstation** versions:

Release Identifier	Comment
AW4.2_06	AW4.2P M4
AW4.2_07	AW4.2P M5
AW4.3_04	AW4.3 M4
AW4.3_05	AW4.3 Post M4
AW4.3_06	AW4.3 Post M4
AW4.4_03	VS2 M3
AW4.4_04	VS2 M4
AW4.4_06	VS2 Productivity M3

Advantage Paste does not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE. For some detailed information on DICOM features of Advantage Window, refer to the respective Conformance Statement - *Advantage Workstation where Advantage Paste 2.0 application is running*.

The application creates X-Ray Angiographic SOP Instances and use X-Ray Angiographic images. The following SOP Classes created and used by the application:

Function	Name	SOP Class
CREATE	X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
USE	X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

Refer to the respective Conformance Statement - *Advantage Workstation* where *Advantage Paste 2.0* application is running.

2.2.2 Presentation Context Table

Refer to the respective Conformance Statement - *Advantage Workstation* where *Advantage Paste 2.0* application is running.

2.2.3 Real-World Activities

The user should select X-Ray image (XA) acquired with bolus protocol, then start application from AW application. Start the pasting algorithm by pressing 'Start'. After user request the X-Ray SOP Instance is created and saved into Advantage Windows database as Pasted Image.

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

- the X-Ray IMAGE DICOM IOD

2.2.4 SOP Instance UID and Series UID

Implementation UID assigned to Advantage Paste 2.0 is:
1.2.840.113619.6.187

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

For a GE product root is 1.2.840.113619 where

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

For Series, Instances created in GE the suffix is 2.Imp.id
where

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

So Advantage Paste 2.0 will generate UIDs for instances and series that looks like: **1.2.840.113619.2.187.id**

3. X-RAY ANGIOGRAPHY (XA) INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

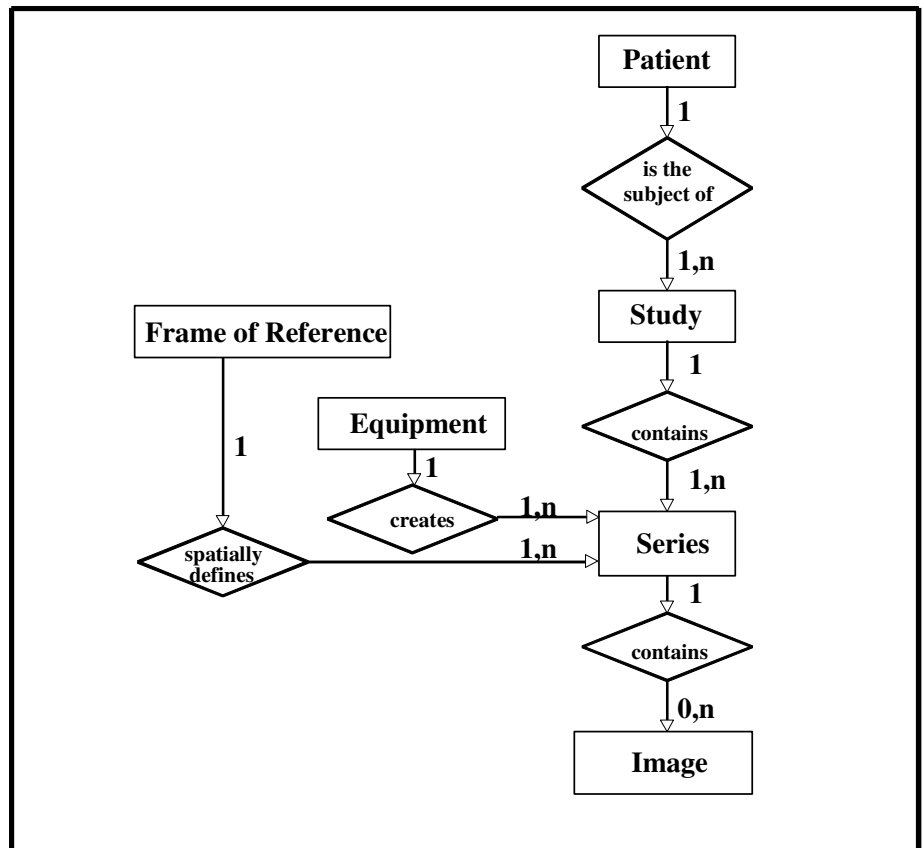
This section specifies the requirements for the DICOM X-Ray Image IOD when being used as input to Advantage Paste and how to produce output of Advantage Paste.

3.2 X-RAY IMAGE IOD IMPLEMENTATION

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

3.3 X-RAY IMAGE IOD ENTITY-RELATIONSHIP MODEL

ILLUSTRATION 3-1
X-RAY IMAGE ENTITY RELATIONSHIP DIAGRAM



The Entity-Relationship diagram for the X-Ray Image interoperability schema is shown in ILLUSTRATION 3-1. In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. See DICOM Part 3 Section 5.1.2 for an explanation of the entity-relationship notation.

3.4 ENTITIES DESCRIPTION

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

3.5 ADVANTAGE PASTE MAPPING OF DICOM ENTITIES

DICOM entities map to the Advantage Paste entities in the following manner:

**TABLE 3-1 ADVANTAGE PASTE
 MAPPING OF DICOM ENTITIES**

DICOM	Advantage Paste
Patient Entity	Patient Entity (Advantage Workstation)
Study Entity	Exam Entity (Advantage Workstation)
Series Entity	Series Entity (Advantage Workstation)
Equipment Entity	Equipment Entity (Advantage Workstation)
Image Entity	Image Entity (Advantage Workstation)

3.6 IOD MODULE TABLE

The X-Ray Angiography Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes. Common modules and XA modality specific modules are described in Section [3.7.1](#). Private attributes are described in Section [3.7.2](#)

TABLE 3-2
XA IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	3.7.1.1
Study	General Study	M	3.7.1.2
	Patient Study	Used	3.7.1.3
Series	General Series	M	3.7.1.4
Equipment	General Equipment	M	3.7.1.5
Image	General Image	M	3.7.1.6
	Image Pixel	M	3.7.1.7
	Contrast/Bolus	Used	3.7.1.8
	Cine	Used	3.7.1.9
	Multi-frame	Used	3.7.1.10
	Frame Pointers	Used	3.7.1.11
	Mask	Used	3.7.1.12
	Display Shutter	Used	3.7.1.13
	X-Ray Image	M	3.7.1.14
	X-Ray Acquisition	M	3.7.1.15
	X-Ray Table	Used	3.7.1.16
	XA Positioner	M	3.7.1.17
	Modality LUT	Used	3.7.1.18
	VOI LUT	Used	3.7.1.19
	SOP Common	M	3.7.1.20

3.7 INFORMATION MODUL 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 XA 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).

Important Note:

Advantage Paste is an X-Ray angiography application, which computes new XA DICOM Object from an original XA DICOM Object specified by *Advantage Workstation Conformance Statement for DICOM*. In order to explain how the new XA DICOM Object is created, for each module **two tables are displayed:**

- One to describe the original XA DICOM Object (INPUT)
- One to describe the new XA DICOM Object (OUTPUT)

Also noted if the attributes are only used for a specific acquisition mode of the supported AdvantX or Innova ones using the prefix **AdvantX** and **Innova** respectively. There is a private attribute (0019,xx14) to decide which acquisition mode is relevant

3.7.1 Common Information Module Definitions

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

3.7.1.1 Patient Module

**TABLE 3-3-1
PATIENT MODULE ATTRIBUTES (INPUT)**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Any non null string ; used for display
Patient ID	(0010,0020)	2	Required with any value (including no value, zero length data element)
Patient's Birth Date	(0010,0030)	2	Required with any value (including no value, zero length data element)
Patient's Sex	(0010,0040)	2	Required with any value (including no value, zero length data element)

GE MEDICAL SYSTEMS

DIR 5127964 –100 REV 3

TABLE 3-3-2

PATIENT MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Duplicated from original object.
Patient ID	(0010,0020)	2	Duplicated from original object.
Patient's Birth Date	(0010,0030)	2	Duplicated from original object.
Patient's Sex	(0010,0040)	2	Duplicated from original object.

3.7.1.2 General Study Module

TABLE 3-4-1

GENERAL STUDY MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Required with any not null value.
Study Date	(0008,0020)	2	Required with any value (including no value, zero length data element)
Study Time	(0008,0030)	2	Required with any value (including no value, zero length data element)
Referring Physician's Name	(0008,0090)	2	Required with any value (including no value, zero length data element)
Study ID	(0020,0010)	2	Required with any value (including no value, zero length data element)
Accession Number	(0008,0050)	2	Required with any value (including no value, zero length data element)
Study Description	(0008,1030)	3	Transfer into output without processing
Name of Physician(s) Reading Study	(0008,1060)	3	Transfer into output without processing

TABLE 3-4-2

GENERAL STUDY MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Duplicated from original object.
Study Date	(0008,0020)	2	Duplicated from original object.
Study Time	(0008,0030)	2	Duplicated from original object.
Referring Physician's Name	(0008,0090)	2	Duplicated from original object.
Study ID	(0020,0010)	2	Duplicated from original object.
Accession Number	(0008,0050)	2	Duplicated from original object.
Study Description	(0008,1030)	3	Duplicated from original object.
Name of Physician(s) Reading Study	(0008,1060)	3	Duplicated from original object.

3.7.1.3 Patient Study Module

TABLE 3-5-1
PATIENT STUDY MODULE ATTRIBUTES (INPUT)

No attribute is required for this module.

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Transfer into output without processing
Patient's Size	(0010,1020)	3	Transfer into output without processing
Patient's Weight	(0010,1030)	3	Transfer into output without processing

TABLE 3-5-2
PATIENT STUDY MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Duplicated from original object.
Patient's Size	(0010,1020)	3	Duplicated from original object.
Patient's Weight	(0010,1030)	3	Duplicated from original object.

3.7.1.4 General Series Module

TABLE 3-6-1
GENERAL SERIES MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	XA
Series Instance UID	(0020,000E)	1	Required with any not null value
Series Number	(0020,0011)	2	Required with any value (including no value, zero length data element)
Laterality	(0020,0060)	2C	AdvantX only: Transfer into output without processing
Performing Physicians' Name	(0008,1050)	3	Transfer into output without processing
Protocol Name	(0018,1030)	3	AdvantX only: Transfer into output without processing
Series Description	(0008,103E)	3	"Pasted Series"
Operators' Name	(0008,1070)	3	Transfer into output without processing
Patient Position	(0018,5100)	2C	Transfer into output without processing

GE MEDICAL SYSTEMS

DIR 5127964 –100 REV 3

TABLE 3-6-2

GENERAL SERIES MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Duplicated from original object.
Series Instance UID	(0020,000E)	1	If there already is a series that contains pasted image results for a given series use it, otherwise generate a new UID with AW's UID generator (see how it works: 2.2.4) what ensure that all sequence in the same series will be in the same Pasted Series also
Series Number	(0020,0011)	2	Duplicated from original object.
Laterality	(0020,0060)	2C	AdvantX only: Duplicated from original object.
Series Date	(0008,0021)	3	Duplicated from original object
Series Time	(0008,0031)	3	Duplicated with original object
Performing Physicians' Name	(0008,1050)	3	Duplicated from original object.
Protocol Name	(0018,1030)	3	AdvantX only: Duplicated from original object.
Series Description	(0008,103E)	3	"Pasted Series"
Operators' Name	(0008,1070)	3	Duplicated from original object.
Patient Position	(0018,5100)	2C	Duplicated from original object.

3.7.1.5 General Equipment Module

TABLE 3-7-1

GENERAL EQUIPMENT MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	AdvantX only: GE MEDICAL SYSTEMS
Manufacturer's Model Name	(0008,1090)	3	AdvantX only: DLX
Institution Name	(0008,0080)	3	Transfer into output without processing
Institution Address	(0008,0081)	3	Transfer into output without processing
Station Name	(0008,1010)	3	Transfer into output without processing
Institutional Department Name	(0008,1040)	3	Transfer into output without processing

GE MEDICAL SYSTEMS

DIR 5127964 –100 REV 3

TABLE 3-7-2

GENERAL EQUIPMENT MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Duplicated from original object.
Institution Name	(0008,0080)	3	Duplicated from original object.
Institution Address	(0008,0081)	3	Duplicated from original object.
Station Name	(0008,1010)	3	Duplicated from original object.
Institutional Department Name	(0008,1040)	3	Duplicated from original object.
Manufacturer's Model Name	(0008,1090)	3	Duplicated from original object.
Software Versions	(0018,1020)	3	Advantage Paste 2.0.[minor version (build number)]

3.7.1.6 General Image Module

TABLE 3-8-1

GENERAL IMAGE MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Required with any value (including no value, zero length data element)
Content Date	(0008,0023)	2C	Transfer into output without processing
Content Time	(0008,0033)	2C	Transfer into output without processing
Image Type	(0008,0008)	3	ORIGINAL\PRIMARY\SINGLE PLANE
Acquisition Date	(0008,0022)	3	Transfer into output without processing
Acquisition Time	(0008,0032)	3	Transfer into output without processing
Source Image Sequence	(0008,2112)	3	Required with any value if exists
>>Referenced SOP Instance UID	(0008,1155)	1C	Required with any value if exists
Patient Orientation	(0020,0020)	2C	AdvantX: Transfer into output without processing Innova: Used for calculation of patient orientation of target pasted image.
Image Comments	(0020,4000)	3	Transfer into output without processing

GE MEDICAL SYSTEMS

DIR 5127964 –100 REV 3

TABLE 3-8-2

GENERAL IMAGE MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Duplicated from original object.
Patient Orientation	(0020,0020)	2C	AdvantX: Duplicated from original object. Innova: Calculated from original.
Content Date	(0008,0023)	2C	Duplicated from original object.
Content Time	(0008,0033)	2C	Duplicated from original object.
Image Type	(0008,0008)	3	DERIVED\SECONDARY\SINGLE PLANE\IMAGE PASTING
Acquisition Date	(0008,0022)	3	Duplicated from original object.
Acquisition Time	(0008,0032)	3	Duplicated from original object.
Derivation Description	(0008,2111)	3	“Computed Pasted Images”
Source Image Sequence	(0008,2112)	3	Sequence that identifies the sequence images that were used to derive this image.
>Referenced SOP Class UID	(0008,1150)	1C	Derived from original object.
>Referenced SOP Instance UID	(0008,1155)	1C	Derived from original object.
>Referenced Frame Number	(0008,1160)	3	Identify the frames that contributed to the generation of this derived image
Image Comments	(0020,4000)	3	Duplicated from original object.

3.7.1.7 Image Pixel Module

TABLE 3-9-1
IMAGE PIXEL MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	AdvantX: MONOCHROME2 Innova: Transfer into output without processing
Rows	(0028,0010)	1	AdvantX: 512 or 1024 Innova: Any value (same as Columns)
Columns	(0028,0011)	1	AdvantX: 512 or 1024 Innova: Any value (same as Rows)
Bits Allocated	(0028,0100)	1	AdvantX: 8 or 16 Innova: 16
Bits Stored	(0028,0101)	1	AdvantX: 8 or 10 Innova: 12
High Bit	(0028,0102)	1	AdvantX: 7 or 9 Innova: 11
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Required with any value

TABLE 3-9-2
IMAGE PIXEL MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	Duplicated from original image.
Rows	(0028,0010)	1	Computed by Advantage Paste algorithm.
Columns	(0028,0011)	1	Computed by Advantage Paste algorithm.
Bits Allocated	(0028,0100)	1	Duplicated from original image.
Bits Stored	(0028,0101)	1	Duplicated from original image.
High Bit	(0028,0102)	1	Duplicated from original image.
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Computed by Advantage Paste algorithm.

3.7.1.8 Contrast/Bolus Module

TABLE 3-10-1
CONTRAST/BOLUS MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Required with any value (including no value, zero length data element)
Contrast/Bolus Ingredient	(0018,1048)	3	Innova: If exists expected value is different from "CARBON DIOXIDE"

TABLE 3-10-2
CONTRAST/BOLUS MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Duplicated from original image.
Contrast/Bolus Ingredient	(0018,1048)	3	Duplicated from original image.

3.7.1.9 Cine Module

TABLE 3-11-1
CINE MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Start Trim	(0008,2142)	3	AdvantX: 1 to Number Of Frames (0028,0008)
Stop Trim	(0008,2143)	3	AdvantX: Start Trim (0008,2142) to Number Of Frames (0028,0008)

TABLE 3-11-2
CINE MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	0.0
Start Trim	(0008,2142)	3	1
Stop Trim	(0008,2143)	3	2
Recommended Display Frame Rate	(0008,2144)	3	0
Cine Rate	(0018,0040)	3	0
Frame Delay	(0018,1066)	3	0.0

3.7.1.10 Multi-Frame Module

**TABLE 3-12-1
MULTI-FRAME MODULE ATTRIBUTES (INPUT)**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Up to 500
Frame Increment Pointer	(0028,0009)	1	Not used

**TABLE 3-12-2
MULTI-FRAME MODULE ATTRIBUTES (OUTPUT)**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	2
Frame Increment Pointer	(0028,0009)	1	"0x0018,0x1063"

3.7.1.11 Frame Pointers Module

**TABLE 3-13-1
FRAME POINTERS MODULE ATTRIBUTES (INPUT)**

No attribute is required for this module.

**TABLE 3-13-2
FRAME POINTERS MODULE ATTRIBUTES (OUTPUT)**

Attribute Name	Tag	Type	Attribute Description
Representative Frame Number	(0028,6010)	3	2
Frame Numbers Of Interest (FOI)	(0028,6020)	3	AdvantX only:1,2

3.7.1.12 Mask Module

**TABLE 3-14-1
MASK MODULE ATTRIBUTES (INPUT)**

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1	Innova only: Required to start operation
>Mask Operation	(0028,6101)	1	Innova only: AVG_SUB
>Applicable Frame Range	(0028,6102)	3	Innova only: from frame number/to frame number
>Mask Frame Numbers	(0028,6110)	1C	Innova only: mask frame number applicable for range of [from frame number, to frame number] (0028,6102)

GE MEDICAL SYSTEMS

DIR 5127964 –100 REV 3

TABLE 3-14-2

MASK MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1	Written based on Advantage Paste algorithm result which has a final format specification.
>Mask Operation	(0028,6101)	1	AVG_SUB
>Applicable Frame Range	(0028,6102)	3	2/2
>Mask Frame Numbers	(0028,6110)	1C	1
>Mask Sub-pixel Shift	(0028,6114)	3	0.0/0.0
Recommended Viewing Mode	(0028,1090)	2	SUB

3.7.1.13 Display Shutter Module

TABLE 3-15-1

DISPLAY SHUTTER MODULE (INPUT)

No attribute is required for this module.

TABLE 3-15-2

DISPLAY SHUTTER MODULE (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	RECTANGULAR
Shutter Left Vertical Edge	(0018,1602)	1C	AdvantX: 0 Innova: Computed by Advantage Paste algorithm.
Shutter Right Vertical Edge	(0018,1604)	1C	AdvantX: Columns attribute (0028,0011) –1 Innova: Computed by Advantage Paste algorithm.
Shutter Upper Horizontal Edge	(0018,1606)	1C	AdvantX: 0 Innova: Computed by Advantage Paste algorithm.
Shutter Lower Horizontal Edge	(0018,1608)	1C	AdvantX: Rows attribute (0028,0010) –1 Innova: Computed by Advantage Paste algorithm.

3.7.1.14 X-Ray Image Module

TABLE 3-16-1
X-RAY IMAGE MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	Not used
Image Type	(0008,0008)	1	ORIGINAL\PRIMARY\SINGLE PLANE
Pixel Intensity Relationship	(0028,1040)	1	Transfer into output without processing
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	AdvantX: MONOCHROME2 Innova: Transfer into output without processing
Bits Allocated	(0028,0100)	1	AdvantX: 8 or 16 Innova: 16
Bits Stored	(0028,0101)	1	AdvantX: 8 or 10 Innova: 12
High Bit	(0028,0102)	1	AdvantX: 7 or 9 Innova: 11
Pixel Representation	(0028, 0103)	1	0
Scan Options	(0018,0022)	3	CHASE

TABLE 3-16-2
X-RAY IMAGE MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	"0x0018,0x1063"
Image Type	(0008,0008)	1	DERIVED\SECONDARY\SINGLE PLANE\IMAGE PASTING
Pixel Intensity Relationship	(0028,1040)	1	Duplicated from original image.
Samples per Pixel	(0028,0002)	1	Duplicated from original image.
Photometric Interpretation	(0028,0004)	1	Duplicated from original image.
Bits Allocated	(0028,0100)	1	Duplicated from original image.
Bits Stored	(0028,0101)	1	Duplicated from original image.
High Bit	(0028,0102)	1	Duplicated from original image.
Pixel Representation	(0028, 0103)	1	0
Derivation Description	(0008,2111)	3	"Computed Pasted Images"

3.7.1.15 X-Ray Acquisition Module

TABLE 3-17-1
X-RAY ACQUISITION MODULE (INPUT)

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	Transfer into output without processing
Radiation Setting	(0018,1155)	1	GR
Intensifier Size	(0018,1162)	3	Required any value
Field of View Shape	(0018,1147)	3	AdvantX: ROUND Innova: RECTANGLE
Field of View Dimension(s)	(0018,1149)	3	AdvantX: between 300 and 420 Innova: between 180 and 420

TABLE 3-17-2
X-RAY ACQUISITION MODULE (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	Duplicated from original image.
Radiation Setting	(0018,1155)	1	Duplicated from original image.
X-Ray Tube Current	(0018,1151)	2C	AdvantX only: Duplicated from original image.
Exposure Time	(0018,1150)	2C	AdvantX only: Duplicated from original image.
Exposure	(0018,1152)	2C	Innova only: Duplicated from original image.
Radiation Mode	(0018,115A)	3	Innova only: Duplicated from original image.
Field of View Shape	(0018,1147)	3	Duplicated from original image.
Field of View Dimension(s)	(0018,1149)	3	Duplicated from original image.

3.7.1.16 X-Ray Table Module

TABLE 3-18-1
X-RAY TABLE MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Table Motion	(0018,1134)	2	DYNAMIC
Table Vertical Increment	(0018,1135)	2C	Innova only: Expected value a vector with Number of Frames (0028,0008) length. Max of incrementations between two frames less than 5.0 mm
Table Longitudinal Increment	(0018,1137)	2C	Expected value a vector with Number of Frames (0028,0008) length. For Innova case max of incrementations between two frames less than 100.0 mm. For AdvantX case max of incrementations between two frames less than (FOV/4) (FOV: (0018,1149)).
Table Lateral Increment	(0018,1136)	2C	Innova only: Expected value a vector with Number of Frames (0028,0008) length. Max of incrementations between two frames less than 5.0 mm
Table Angle	(0018, 1138)	3	Innova only: Used for calculation of Height of Table, transferred into output without further processing.

TABLE 3-18-2
X-RAY TABLE MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Table Angle	(0018,1138)	3	Innova only: Duplicated from original image.
Table Motion	(0018,1134)	2	Innova only: empty field.

3.7.1.17 XA Positioner Module

TABLE 3-19-1
XA POSITIONER MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
Distance Source to Patient	(0018,1111)	3	AdvantX : Required any value. Innova : Required value between 680 and 1000.
Distance Source to Detector	(0018,1110)	3	AdvantX : Required value between 860 and 2000. Innova : Required value between 700 and 2000.
Positioner Motion	(0018,1500)	2C	STATIC
Positioner Primary Angle	(0018,1510)	2	Innova only: expected value between 0+/-20.0 (degree). Transfer into output without processing
Positioner Secondary Angle	(0018,1511)	2	Innova only: expected value between 0+/-5.0 (degree). Transfer into output without processing

TABLE 3-19-2
XA POSITIONER MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Distance Source to Patient	(0018,1111)	3	Duplicated from original image.
Distance Source to Detector	(0018,1110)	3	Duplicated from original image
Positioner Motion	(0018,1500)	2C	STATIC
Positioner Primary Angle	(0018,1510)	2	Duplicated from original image.
Positioner Secondary Angle	(0018,1511)	2	Duplicated from original image.

3.7.1.18 Modality LUT module

TABLE 3-20-1
MODALITY LUT MODULE ATTRIBUTES (INPUT)

No attribute is required for this module.

TABLE 3-20-2
MODALITY LUT MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Rescale Intercept	(0028,1052)	1C	AdvantX only: 0
Rescale Slope	(0028,1053)	1C	AdvantX only: 1
Rescale Type	(0028,1054)	1C	AdvantX only: US

3.7.1.19 VOI LUT module

TABLE 3-21-1
VOI LUT MODULE ATTRIBUTES (INPUT)

No attribute is required for this module.

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Transfer into output without processing
Window Width	(0028,1051)	1C	Transfer into output without processing

TABLE 3-21-2
VOI LUT MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Duplicated from original image AdvantX : 400 by default if does not exist.
Window Width	(0028,1051)	1C	Duplicated from original image AdvantX : 800 by default if does not exist.

3.7.1.20 SOP Common Module

TABLE 3-22-1
SOP COMMON MODULE ATTRIBUTES (INPUT)

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.12.1
SOP Instance UID	(0008,0018)	1	Required with any not null value.
Specific Character Set	(0008,0005)	1C	AdvantX: ISO_IR 100 = Latin Alphabet No. 1 Innova: Transfer into output without processing.
Instance Number	(0020,0013)	3	Transfer into output without processing.

TABLE 3-22-2
SOP COMMON MODULE ATTRIBUTES (OUTPUT)

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.12.1
SOP Instance UID	(0008,0018)	1	See 2.2.4 for further information
Specific Character Set	(0008,0005)	1C	AdvantX: ISO_IR 100 = Latin Alphabet No. 1 Innova: Duplicated from original Image
Instance Number	(0020,0013)	3	Duplicated from original image

3.7.2 Private Data Attributes

The Product supports the Private Attributes defined in the following sections in Standard Extended CR SOP Instances as Type 3 data elements. For each group the Private Group defines the Private Creator ID marked *xx* in the listed tables.

3.7.2.1 Private Group DLX_SERIE_01

Private Group DLX_SERIE_01 is modeled as part of the Image (X-Ray Acquisition, X-Ray Table, X-Ray Positioner and Mask) Information Entity.

TABLE 3-23-1
PRIVATE GROUP DLX_SERIE_01 (INPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Adx Acq Mode	(0019,xx14)	IS	1	AdvantX: expected value 16 Innova: expected value: 116
Table position X (longitudinal) first frame	(0019,xx22)	DS	1	Innova only: Input for Advantage Paste algorithm
Table position Y (lateral) first frame	(0019,xx23)	DS	1	AdvantX: any value; -5000 by default if does not exist Innova: expected value between –500 and 500
Table position Z (vertical) first frame	(0019,xx21)	DS	1	Not used.
Gantry machine angles (L) first frame	(0019,xx01)	DS	1	Innova only: expected value between 90+/-5.0 (degree)
Gantry machine angles (P) first frame	(0019,xx02)	DS	1	Transfer into output without processing
Gantry machine angles (C) first frame	(0019,xx03)	DS	1	Transfer into output without processing
Gantry machine Angle Label 1	(0019,xx04)	CS	1	Transfer into output without processing
Gantry machine Angle Label 2	(0019,xx05)	CS	1	Transfer into output without processing
Gantry machine Angle Label 3	(0019,xx06)	CS	1	Transfer into output without processing
Percent Landscape	(0019,xx1E)	IS	1	Transfer into output without processing
Current Spatial Filter Strength	(0019,xx17)	DS	1	Transfer into output without processing

TABLE 3-23-2
PRIVATE GROUP DLX_SERIE_01 (OUTPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Adx Acq Mode	(0019,xx14)	IS	1	16
Gantry machine angles (L) first frame	(0019,xx01)	DS	1	Duplicated from original object.
Gantry machine angles (P) first frame	(0019,xx02)	DS	1	Duplicated from original object.
Gantry machine angles (C) first frame	(0019,xx03)	DS	1	Duplicated from original object.
Gantry machine Angle Label 1	(0019,xx04)	CS	1	AdvantX only: can be L. Duplicated from original object.
Gantry machine Angle Label 2	(0019,xx05)	CS	1	AdvantX only: can be CAU or CRA. Duplicated from original object.
Gantry machine Angle Label 3	(0019,xx06)	CS	1	AdvantX only: can be LAO or RAO. Duplicated from original object.
Percent Landscape	(0019,xx1E)	IS	1	Duplicated from original object.
Current Spatial Filter Strength	(0019, xx17)	DS	1	AdvantX only: Duplication from original object

3.7.2.2 Private Group GEMS_DL_IMG_01 Innova Only

Private Group GEMS_DL_IMG_01 is modeled as part of the Image (X-Ray Acquisition, X-Ray Positioner, VOI Lut and SUB Lut) Information Entity.

TABLE 3-24-1
PRIVATE GROUP GEMS_DL_IMG_01 (INPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Image Sweep	(0019,xx95)	CS	1	Expected YES or NO.
Image Detector Rotation Angle	(0019,xx92)	DS	1	Required any value.
Angle 1 Increment	(0019,xx97)	DS	1-N	Not used.
Angle 2 Increment	(0019,xx98)	DS	1-N	Not used.
Angle 3 Increment	(0019,xx99)	DS	1-N	Not used.
FOV in mm (float)	(0019,xx0B)	DS	1-2	Required value: See: (0018,1149)
Vector of ABD of each frame (mask & op)	(0019,xxB9)	FL	1-N	Required vector with length Number Of Frames (0028,0008)
EPT vector	(0019,xxA9)	DS	1-N	Required vector with length Number Of Frames (0028,0008)
ABD	(0019,xxA0)	DS	1	Transfer into output without processing
User Brightness Contrast	(0019,xx4F)	DS	2	Not used.
Applicable Review Mode	(0019,xx9D)	CS	1	Transfer into output without processing
Log Lut Control Points	(0019,xx9E)	DS	1-N	Required vector with format: MIN, MAX, Nb of Values, values
Exp Lut SUB Control Points	(0019,xx9F)	DS	1-N	Transfer into output without processing
Exp Lut NOSUB Control Points	(0019,xxAD)	DS	1-N	Required vector with format: MIN, MAX, Nb of Values, values
Sub Window Center	(0019,xxA1)	DS	1	Transfer into output without processing
Sub Window Width	(0019,xxA2)	DS	1	Transfer into output without processing
Default Spatial Filter Family	(0019,xx31)	IS	1	Transfer into output without processing
Default Spatial Filter Strength	(0019,xx32)	IS	1	Transfer into output without processing
Current Spatial Filter Strength	(0019,xxAB)	IS	1	Transfer into output without processing
Can Downscan 512	(0019,xxAA)	CS	1	Not used.
SUB Operator LUTs Names	(0019,xxAE)	ST	1-N	Transfer into output without processing
Acquisition Mode Description	(0019,xxB1)	LO	1	Not used.
Acquisition Mode Display Label	(0019,xxB2)	LO	1	Not used.
Acquisition Protocol User Name	(0019,xxB3)	LO	1	Transfer into output without processing
Table Y Position to Isocenter	(0019,xxEC)	FL	1	Used for calculation of Height of Table.
Table Z Position to Isocenter	(0019,xxED)	FL	1	Used for calculation of Height of Table.
Table Head Tilt Angle	(0019,xxEE)	FL	1	Used for calculation of Height of Table.

TABLE 3-24-2
PRIVATE GROUP GEMS_DL_IMG_01 (OUTPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
ABD	(0019,xxA0)	DS	1	Duplicated from original object
Applicable Review Mode	(0019,xx9D)	CS	1	Duplicated from original object.
Log Lut Control Points	(0019,xx9E)	DS	1-N	Duplicated from original object.
Exp Lut SUB Control Points	(0019,xx9F)	DS	1-N	Duplicated from original object.
Exp Lut NOSUB Control Points	(0019,xxAD)	DS	1-N	Duplicated from original object.
Sub Window Center	(0019,xxA1)	DS	1	Duplicated from original object.
Sub Window Width	(0019,xxA2)	DS	1	Duplicated from original object.
Default Spatial Filter Family	(0019,xx31)	IS	1	Duplicated from original object.
Default Spatial Filter Strength	(0019,xx32)	IS	1	Duplicated from original object.
Current Spatial Filter Strength	(0019,xxAB)	IS	1	Duplicated from original object.
Can Downscan 512	(0019,xxAA)	CS	1	NO
SUB Operator LUTs Names	(0019,xxAE)	ST	1-N	Duplicated from original object.
Acquisition Mode Description	(0019,xxB1)	LO	1	ANGIO SUB PASTED
Acquisition Mode Display Label	(0019,xxB2)	LO	1	PAST
Acquisition Protocol User Name	(0019,xxB3)	LO	1	Duplicated from original object.

3.7.2.3 Private Group GEMS_DL_STUDY_01 Innova only

Private Group GEMS_DL_STUDY_01 is modeled as part of the Study Information Entity.

TABLE 3-25-1

PRIVATE GROUP GEMS_DL_STUDY_01 (INPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Study Number	(0015,xx8F)	IS	1	Transfer into output without processing

TABLE 3-25-2

PRIVATE GROUP GEMS_DL_STUDY_01 (OUTPUT)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Study Number	(0015,xx8F)	IS	1	Duplicated from original object.