



Technical Publications

Direction 2258357
Revision 3

Signa Horizon Lx DICOM CONFORMANCE STATEMENT for DICOM v3.0

Supported products:

- **Signa Horizon Lx (8.3M5)**
- **Signa Pulsar (8.4, 8.4ACGD)**
- **Signa Lx ASP1 (8.3.7)**
- **Signa Lx ASP2 (8.3.8)**
- **Signa Fiesta (CNV3)**
- **Signa SuperNova (CNV4)**
- **Signa OpenSpeed (HFO)**
- **Signa Ovation (MFO)**
- **Signa 3T (VH1)**

sm - Service Manual

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Revisions

Revision #	Date	Comments
2.8	12/99	<i>Initial Revision for 8.3 Release</i>
2.9	10/10/00	<i>Update title for 8.3 M5 Release</i>
2.9a	1/4/01	<i>Added CV/NV (ACGD only) to products</i>
2.9b	2/28/01	<i>Added CV/NV/ASP 1.0/ASP2.0/3T VH2 to products</i>
3.0	9/13/01	<i>Updated product list and reformatted cover page, removed embedded references to software releases from document</i>

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WARNING

- THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.
- IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.
- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THE SERVICE MANUAL HAS BEEN CONSULTED AND UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

1 SECTION 1 - INTRODUCTION

1.0 Overview

Section 1, *Introduction*, provides general information about the content and scope of this document.

Section 2, *Network Conformance Statement*, is the DICOM v3.0 Conformance Statement related to this product Conformance Statements define the subset of options selected from those offered by the DICOM v3.0 standard.

Section 3, *Media Storage Conformance Statement*, is the DICOM v3.0 Conformance Statement related to Media Storage Application Profile.

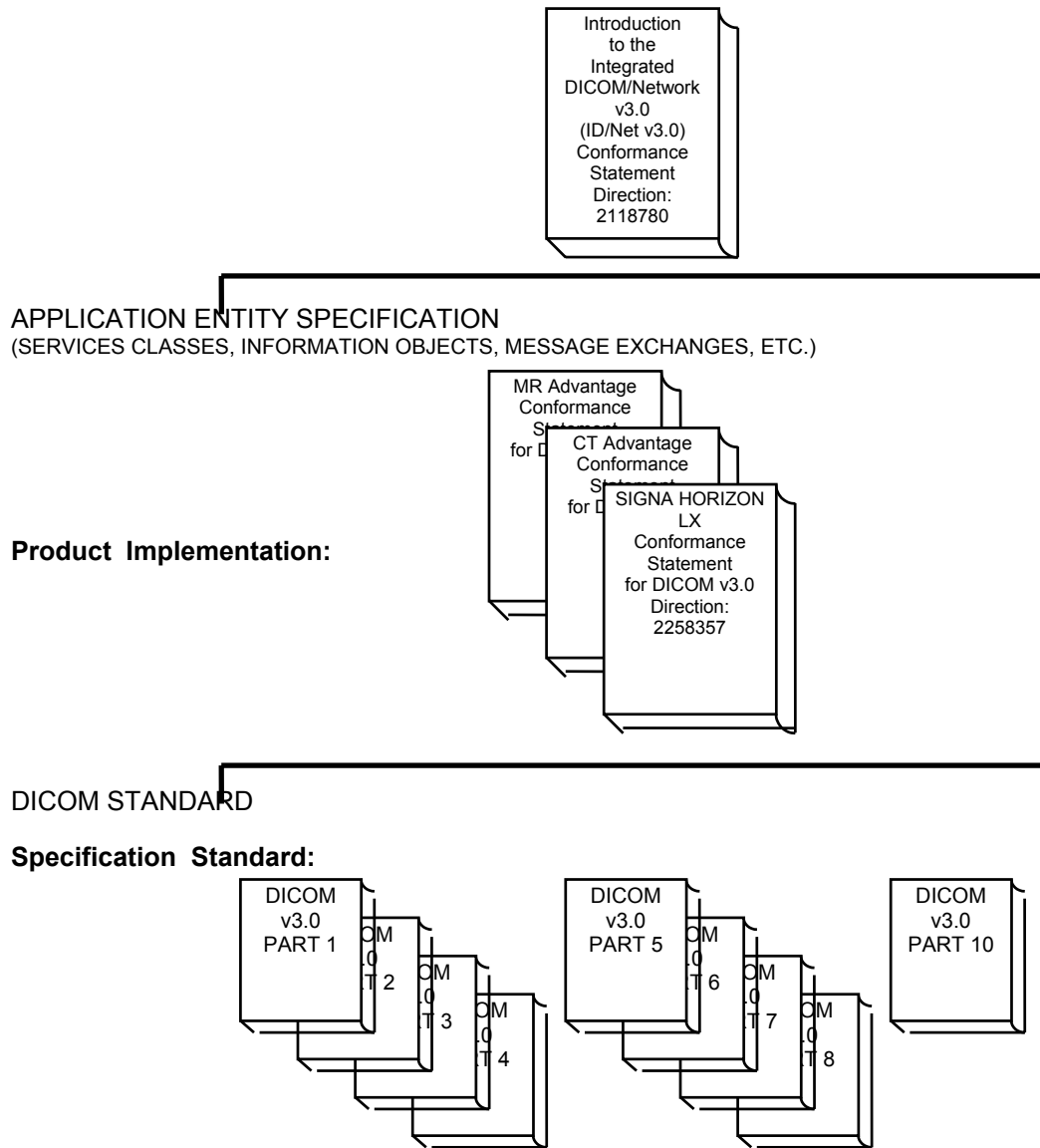
Section 4, *Print SCU Conformance Statement*, is the DICOM v3.0 Conformance Statement related to DICOM Print SCU.

1.1 Overall Conformance Statement Documentation Structure

The documentation structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in Illustration 1-1.

Illustration 1-1
DOCUMENTATION STRUCTURE

ID/Net v3.0



The Documentation structure given in Illustration 1-1 shows the overall documentation structure for all of the GE ID/Net v3.0 Conformance Statements.

ID/Net v2.0 documentation is also openly available, but the two documentation structures are independent of each other. Refer to Direction 46-269546G2.

This document specifies the DICOM v3.0 implementation supported by the following products:

- Signa Horizon Lx (8.3M5)
- Signa Pulsar (8.4, 8.4ACGD)
- Signa Lx ASP1 (8.3.7)
- Signa Lx ASP2 (8.3.8)
- Signa Fiesta (CNV3)
- Signa SuperNova (CNV4)
- Signa OpenSpeed (HFO)
- Signa Ovation (MFO)
- Signa 3T (VH1)

It is entitled:

Signa Horizon Lx
*DICOM Conformance Statement
for DICOM v3.0
Direction 2258357*

This Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GE ID/Net v3.0 network interface. Introductory information, which is applicable to all GE ID/Net v3.0 Conformance Statements, is described in the document:

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

This introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading individual products' ID/Net v3.0 Conformance Statements.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g. TCP/IP). However, the Technical Specifications are defined in the DICOM v3.0 Part 8 standard.

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

For the convenience of developers, there is a "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published ID/Net v3.0 Product Conformance Statements will be received. The collector Direction is:

*ID/Net v3.0 Conformance Statements
Direction 2117016*

For more information regarding DICOM v3.0, copies of the Standard may be obtained by written request by contacting:

NEMA Publication
1300 N. 17th Street
Suite 1847
Rosslyn, VA 22209
USA

1.2 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 v3.0 standards and with the terminology and concepts which are used in those standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 Standard itself, prior to reading this Conformance Statement document.

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

1.3 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 Statements Direction 2118780*, to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM v3.0 Conformance Statement and is necessary to insure proper processing and interpretation of GE medical image data exchanged using DICOM v3.0. The GEMS Conformance Statements are available to the public.

The reader of this conformance statement should be aware that different GE devices are capable of using different Information Object Definitions. For example, a GE CT scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this Conformance Statement are Module Definitions which define all data elements used by the GEMS implementation. If the user encounters unspecified private data elements while parsing a GE Data Set, the user is well advised to ignore those data elements (per the DICOM v3.0 standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and retransmit all of the private data elements which are sent by GE devices.

1.4 Important Remarks

The use of these Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to insure 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 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 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 v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans 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.
- **To be kept informed of the evolution of the implementation described in this document, the user should register on the GE internet server, accessible via anonymous ftp, by entering his/her e-mail address (GE Internet Server Address: ftp.med.ge.com : 192.88.230.11).**
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communications with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.5 References

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

1.6 Definitions

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

1.7 Symbols and Abbreviations

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

2 SECTION 2 - NETWORK CONFORMANCE STATEMENT

2.0 INTRODUCTION

This Conformance Statement (CS) specifies the Signa Horizon Lx compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product in the versions listed in section 1.1.

The Signa Horizon Lx product uses DICOM services to import images for possible further analysis and/or processing. It also uses DICOM services to export images to other DICOM-compliant machines.

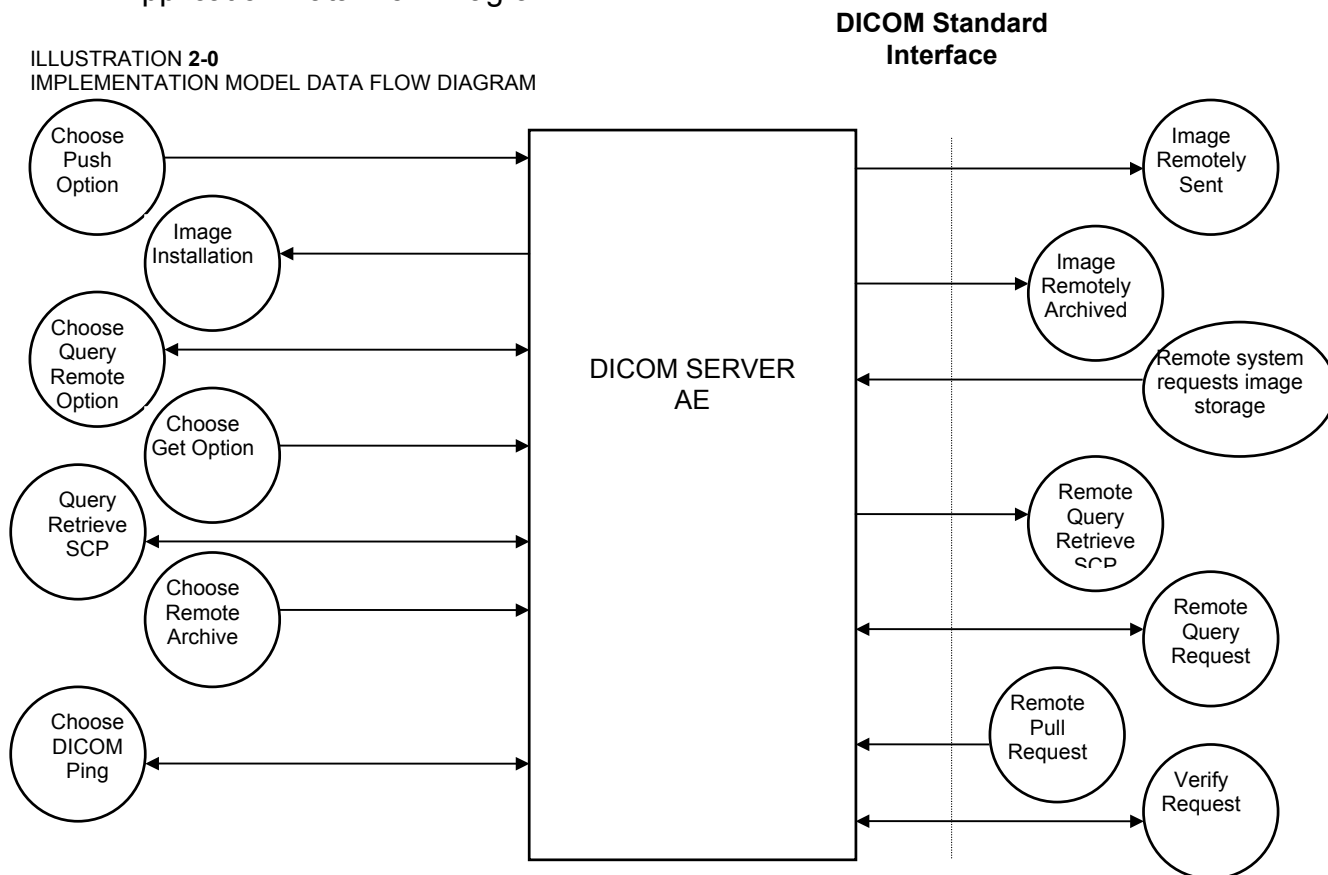
Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

2.1 IMPLEMENTATION MODEL

All DICOM functionality on the Signa Horizon Lx product is handled by the DICOM Server Application Entity (AE). The DICOM Server AE is commanded to perform DICOM services through the buttons and menu selections on the main user interface panel. The DICOM Server AE is also listening to a pre-defined port for incoming connections.

2.1.1 Application Data Flow Diagram

ILLUSTRATION 2-0
IMPLEMENTATION MODEL DATA FLOW DIAGRAM



There are three Real-World Activities that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate a DICOM association to a remote DICOM Application Entity.

The *Choose "Push" Option* Real-World activity consists of an operator selecting one or more study, series or image in the local database manager and choosing either "Send examination", "Send series" or "Send image" from the "Network" pulldown menu on the local database manager to send the image(s) to a selected destination.

Real-World Activity, *Query Remote*, causes the DICOM Server AE to initiate an association to the Remote DICOM AE and request the list of all studies. Once the DICOM Server AE receives the list of studies, it will select the first study (as determined through the local database manager list sort criterion) and request the list of series for that study. After receiving the list of series the DICOM Server AE will ask for the list of images for the first series in the list. The operator can then select any study in the study list to retrieve the list of series and images.

Real-World Activity, *Choose "Pull" Option*, will be available once the *Query Remote* activity is performed. The operator can now select one or more study (series or image) and ask the DICOM Server AE to retrieve the selected image(s) from the Remote DICOM AE by choosing either "Get Examination", "Get Series", or "Get Images".

The *Choose Archive save Option* Real-World activity consists of an operator choosing a remote DICOM AE that supports Storage Commitment as provider as the archive device

and selecting one or more exam or series from the local database and choosing either *Save Exam* or *Save Series* from the archive menu. The images to be committed are sent to the remote provider entity first. The Commitment request for the transferred image instances is sent after the complete image transfer. The Commitment response can come on same association or on a different association.

Real-World Activity, *Choose DICOM Ping*, consists of an operator selecting DICOM Ping from the “Network” pull down menu on the local database manager to check the status of the selected remote DICOM AE.

There is no Real-World activity required for the DICOM Server AE to respond to an incoming DICOM store, query or retrieve. The DICOM Server AE is always prepared to respond to a DICOM Store, Query, or Retrieve by any remote DICOM AE.

The DICOM Server AE will perform the Real-World activity *Image Installation* after the remote AE sends an image to the Signa Horizon Lx product.

Once a *Query* request is received, the DICOM Server AE will search the local database for all entries that match the keys requested by the Remote DICOM AE and send back the list of matches. The DICOM Server AE will also respond to an incoming retrieval request from a Remote AE by sending the image(s) to the Destination AE.

2.1.2 Functional Definition of AE's

DICOM Server Application Entity initiates the following operations:

- Initiate an association to a Remote AE for the purpose of sending images to the Remote AE. If the Remote AE accepts the presentation context applicable to the image(s) being sent, the DICOM Server AE will send the image(s) to the receiving Remote AE by invoking the C-STORE-RQ operation for each image on the same association.
- Initiate an association to a Remote AE for the purpose of committing images previously sent successfully to the Remote AE for the purpose of the remote AE to commit to the storage of those images. If the Remote AE accepts the presentation context, a storage commitment will be established with the Remote AE with the DICOM Server AE sending the N-Action Request. The Remote AE completes the commitment by sending the N-EVENT REPORT. The DICOM Server AE updates the archive flag in the image browser for successful instances. The archive flag is shared with the local archive and the two can not be distinguished.
- Initiate an association with a Remote AE to query for images on the remote host. A Study-Root Study-Level C-FIND-RQ request will be sent to the Remote AE once an association has been established. After all responses are received, DICOM Server AE will issue a Series-Level C-FIND-RQ request to get the series for a study in the list. An Image-Level C-FIND-RQ will be issued for the first series in the series list.
- Send a C-MOVE-RQ request to a Remote AE for retrieve of images after successful association establishment. The DICOM Server AE's Storage SCP will receive the images over a separate association.
- Initiate an association with a Remote AE to verify it's status with a C-ECHO-RQ. The Remote AE will report it's status in a C-ECH-RSP.

The DICOM Server AE waits for association requests from Remote AEs that wish to perform the following operations:

- *Verification*: If a C-ECHO-RQ message is received, the DICOM Server AE will send back a C-ECHO-RSP message with a status of “success”.
- *Image Storage*: If a C-STORE-RQ message is received, the DICOM Server AE will receive the image and try to update the local database. If the image is stored successfully on storage media and the database updated a status of “success” will be returned in a C-STORE-RSP message.
- *Query*: If a C-FIND-RQ message is received the DICOM Server AE will search the database for the requested attributes and send back a C-FIND-RSP message containing a match and a status of “pending”. After all matching records have been sent, a status of “success’ will be returned in a C-FIND-RSP message. The Remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.
- *Retrieve*: If a C-MOVE-RQ message is received the DICOM Server AE will lookup its list of configured Remote AEs for the Destination AE. If the Destination AE is configured, the DICOM Server AE will open a new association to the Destination AE and use C-STORE-RQ to send the image(s). The DICOM Server AE will send a C-MOVE-RSP message with a status of “pending” after every five images are sent. When all images are sent or if DICOM Server AE receives a C-CANCEL-MOVE-RQ a final C-STORE-RSP will be sent back with an appropriate status.

2.1.3 Sequencing of Real-World Activities

2.1.3.1 Query Remote

Real-World Activity *Query Remote* must be performed before *Choose Pull Option* can be performed.

2.1.3.2 Storage Commitment

The user has to select the remote commitment provider and the exams/series to be pushed before clicking Save Exam/Series button on the Archive menu.

2.2 AE SPECIFICATIONS

2.2.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an SCU:

SOP Class Name (SCU)	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8
Study Root Query/Retrieve – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve – MOVE	1.2.840.10008.5.1.4.1.2.2.2
Storage Commitment Push model SOP class	1.2.840.10008.1.20.1

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP classes as an SCP:

SOP Class Name (SCP)	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1
CT Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8
Study Root Query/Retrieve – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve – MOVE	1.2.840.10008.5.1.4.1.2.2.2

2.2.1.1 Association Establishment Policy

2.2.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1
---------------------------------	------------------------------

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Server AE is:

Maximum Length PDU	36 kbytes
---------------------------	------------------

SOP class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that is supported is 60. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.

The user information items sent by this product are:

Maximum PDU Length and,
Implementation UID

2.2.1.1.2 Number of Associations

The DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a remote host or retrieve image(s) from a Remote AE.

The DICOM Server AE (SCP) can have a maximum of four DICOM associations open simultaneously to receive and store image or respond to an echo.

A single association is used to send the commitment request. This waits for the response from commitment provider on the same association for a configurable

amount of time. It will also accept an association for receiving the response from commitment provide at any time.

2.2.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.2.1.1.4 Implementation Identifying Information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The Implementation UID for this GEMS Implementation is:

Signa Horizon Lx Implementation UID	1.2.840.113619.6.44
-------------------------------------	---------------------

2.2.1.2 Association Initiation by Real-World Activity

2.2.1.2.1 Push Image(s) to Remote AE

2.2.1.2.1.1 Associated Real-World Activity

The operator must first select a destination by choosing “Selected remote host:” from the “Network” pull-down menu on the local database manager and then choose a hostname.

The “Push” operation will cause the DICOM server AE to initiate an Association when the operator selects one or more study, series, or images in the local database manager and then chooses either “Send examination”, “Send series”, or “Send image” from the “Network” pull-down menu on the local database manager.

Note: If multiple study, series, or images are chosen to be pushed, one association will be established for each of the studies, series, or images. A single association for a single series will be used for the multiple C-STORE operations necessary for the images in the series.

2.2.1.2.1.2 Proposed Presentation Contexts

The following table shows the proposed presentation contexts for the DICOM Server AE after Real-World Activity “Push” Operation has been performed. The following selection method is used when choosing from multiple accepted transfer syntaxes:

1. If image is stored locally in Implicit VR the order of preference is as follows:
 - i) Implicit VR Big Endian (GE private transfer syntax, see section 2.4.3)
 - ii) Implicit VR Little Endian

2. If image is stored locally in Explicit VR or in proprietary Advantage format the order of preference is as follows:
 - i) Explicit VR Big Endian
 - ii) Implicit VR Big Endian (GE private transfer syntax, see section 2.4.3)
 - iii) Implicit VR Little Endian
 - iv) Explicit VR Little Endian

Table 2.2.1.2.1.2-1 Proposed Presentation Contexts for DICOM Server AE and Real-World activity Push Image(s)

Presentation Context Table - Proposal					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Note: Other Presentation Contexts with private SOP class names may be offered when establishing an association. These are private SOP classes which may be ignored. See section 2.4.2.

2.2.1.2.1.2.1 SOP Specific Conformance Statement for Image Storage SOP Classes

This implementation can perform multiple C-STORE operations over a single association. A single association for a single series will be used for the multiple C-STORE operations necessary for the images in the series

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-STORE confirmation containing any status that is not Success or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send the remaining images in the request on the same association.

Each C-STORE operation supports an "Association Timer". This timer starts when the association request is sent and stops when the association is established. The time-out is configurable in `dcs.cfg` as `bi_assoc_tio` and defaults to 30 seconds.

Each C-STORE operation also supports an "Operation Inactivity Timer". This time-out starts once the first C-STORE request has been issued (on association) or received and is reset each time a C-STORE response has been received or when subsequent C-STORES are sent. This time-out is configurable in `dcs.cfg` as `bi_store_tio` and defaults to 90 seconds.

Each C-STORE operation also supports a "Session Timer". This timer starts when the association is established and stops when the association is ended. This time-out is configurable in `dcs.cfg` as `bi_session_tio` and defaults to 60 minutes.

If any of the three timers mentioned above expires, the connection is closed and the operation in progress is considered failed.

When DICOM Server AE initiates an association to issue a C-STORE, one of the following two operations will be performed:

If the image is stored locally on the Signa Horizon Lx in DICOM format ("Dic" appears in the "Fmt" column at the exam level of the local database manager), the image will be transmitted by the DICOM Server AE with the same elements as was originally received or created locally (for the standard elements only).

If the image is stored locally on the Signa Horizon Lx in a non-DICOM Advantage format ("Adv" appears in the "Fmt" field at the exam level of the local database manager), the image will be translated and then transmitted by the DICOM Server AE to the identical profiles specified by the CT Advantage Conformance Statement for DICOM v3.0 (Direction 2118781) and the MR Signa Advantage Conformance Statement for DICOM v3.0 (Direction 2118782).

2.2.1.2.2 Query Remote AE

2.2.1.2.2.1 Associated Real-World Activity

The operator must first select a destination by choosing “*Selected remote host:*” from “*Network*” pull-down menu on the local database manager and then choose a hostname.

Provided that the operator had set “*Custom search?*” to “*Off*” when setting the Remote host parameters, the “*Query*” operation will cause the DICOM Server AE to initiate an association (with zero length Patient name, Patient id, Study date, Accession number, and Study id) to the selected Remote AE when the “*Receive*” entry is selected from the “*Network*” pull-down menu.

Otherwise, if the operator had set “*Custom search?*” to “*On*” when setting the Remote host parameters, the “*Query*” operation will cause a *Customize search parameters* menu to appear. The operator can enter values for Patient name, Patient id, Study date, Accession number, and Study id. Not entering a value means match on any value for that field. Patient name will match on any patient name that contains what the operator entered. Patient id, Study id, and Accession number will match on what the operator enters. For Study date, the operator selects a range type from the “*Exam date*” pull down menu, where the choices are All, Before, Between, or Exactly. Once a range type is selected, the correct number of fields appear and the operator enters dates into those fields. Once the desired parameters are entered the operator chooses “*Ok*” and that will cause the DICOM Server AE to initiate an association to the selected Remote AE.

Once a list of Study/Series/Image is retrieved, the operator can invoke the “*Pull*” operation by choosing “*Get Exam*” or “*Get Series*” or “*Get Image*” from the “*Network*” pull-down menu, or the operator can cause a new association with different parameters to the same Remote AE by choosing “*Change search parameters*” from the “*Search*” pull-down menu on the remote database manager.

2.2.1.2.2.2 Proposed Presentation Contexts

When the Real-World activity “*Query*” or “*Pull*” is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-FIND related contexts are applicable to this activity.

2.2.1.2.2.2.1 SOP Specific Conformance Statement for C-FIND SCU

After the *Query* operation is initiated, the DICOM Server AE will perform a study-root C-FIND-RQ request at each of the three levels (Study, Series, and Image) in succession.

The Initial Study-Level request will ask for studies in the Remote database that match the user specified Patient name, Patient id, Study date, Accession number, and Study id. Zero length data in any of those fields means match on any value. Zero length data is the default value if the user does not specify a value. The user specified Patient name will come surrounded by single asterisks (asterisk is a wild card that matches any number of characters). The Study date is a range of dates where a *date* is exactly 8 characters long and the format of the range is:

"" is any date,

"yyyymmdd-" is any date on or after that year/month/day,

"-yyyymmdd" is any date on or before that year/month/day,

"yyyymmdd-yyyymmdd" is any date on or between those dates,
 "yyyymmdd" is only on that date.

The C-FIND SCU will not perform any extended negotiation and so will only perform hierarchical query.

Each C-FIND SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 300 seconds, 300 seconds and 60 minutes respectively. These values are configurable in dcs.cfg.

If a "Cancel" or "Refused" status is returned from the Remote AE the association is closed and the operation terminated.

The DICOM Server AE will parse each matching C-FIND-RSP reply and ignore the entries that do not contain a valid DICOM data stream. No VR validation is performed which means that syntax errors will be ignored.

Tables 2.2.1.2.2.2.1-1 - 2.2.1.2.2.2.1-3 show the various fields that are requested at the Study, Series, and Image levels of the C-FIND request.

Table 2.2.1.2.2.2.1-1: Requested Study Level Keys

Description	Type	Tag	Value
Study date	R	0008,0020	Zero length for any Study date, or "yyyymmdd-yyyymmdd" matches inclusive range of 'from-to' Study dates. 'From' or 'To' date can be zero length meaning that side of the range is any date.
Study time	R	0008,0030	Zero length
Accession number	R	0008,0050	Zero length for any Accession number, or Accession number matches this value
Patient's name	R	0010,0010	Zero length for any Patient name, or Patient's name matches this value
Patient id	R	0010,0020	Zero length for any Patient id, or Patient id matches this value
Study id	R	0020,0010	Zero length for any Study id, or Study id matches this value
Study Instance UID	U	0020,000D	Zero length for Study level query. Study Instance UID of study for which matches are requested at a lower level
Study description	O	0008,1030	Zero length
Private Creator Identification	P	0009,0010	GEMS_IDEN_01
Suite Id	P	0009,1002	Zero Length

Table 2.2.1.2.2.1-2: Requested Series Level Keys

Description	Type	Tag	Value
Modality	R	0008,0060	Zero length
Series number	R	0020,0011	Zero length
Series Instance UID	U	0020,000E	Zero length for Series level query. Series instance UID of series for which matches are requested at a lower level
Series description	O	0008,103E	Zero length
Manufacturer	O	0008,0070	Zero length
Images in series	O	0020,1002	Zero length

Table 2.2.1.2.2.1-3: Requested Image Level Keys

Description	Type	Tag	Value
Image number	R	0020,0013	Zero length
Image Instance UID	U	0008,0018	Zero length
Image type	O	0008,0008	Zero length
Rows	O	0028,0010	Zero length
Columns	O	0028,0011	Zero length
Image position	O	0020,0032	Zero length
Image orientation	O	0020,0037	Zero length
Slice thickness	O	0018,0050	Zero length
Slice spacing	O	0018,0088	Zero length
Gantry tilt	O	0018,1120	Zero length
Convolution kernel	O	0018,1210	Zero length
Reconstruction diameter	O	0018,1100	Zero length
Data collection diameter	O	0018,0090	Zero length
Flip angle	O	0018,1314	Zero length
Echo number	O	0018,0086	Zero length
Echo time	O	0018,0081	Zero length
Inversion time	O	0018,0082	Zero length
Repetition time	O	0018,0080	Zero length
Private Creator Identification	P	0019,0010	GEMS_ACQU_01
Dfov Rect	P	0019,101E	Zero Length
Midscan Time	P	0019,1024	Zero Length
Azimuth	P	0019,1026	Zero Length
Number of Echo	P	0019,107E	Zero Length
Private Creator Identification	P	0021,0010	GEMS_REL_01
Scout Anref	P	0021,104A	Zero Length
Private Creator Identification	P	0027,0010	GEMS_IMAG_01
Location RAS	P	0027,1040	Zero Length
Location	P	0027,1041	Zero Length
Center R Coordinate	P	0027,1042	Zero Length
Center A Coordinate	P	0027,1043	Zero Length
Table Start Location	P	0027,1050	Zero Length
Table End Location	P	0027,1051	Zero Length
RAS Letter for Side of Image	P	0027,1052	Zero Length
RAS Letter for Anterior/Posterior	P	0027,1053	Zero Length
RAS Letter for Scout Start Location	P	0027,1054	Zero Length

Description	Type	Tag	Value
RAS Letter for Scout End Location	P	0027,1055	Zero Length
Image Dimension X	P	0027,1060	Zero Length
Image Dimension Y	P	0027,1061	Zero Length

Note: In the above tables the type field has the following meaning:

- R - Required
- U - Unique
- O - Optional
- P - Private

2.2.1.2.3 Get Image(s) from Remote AE

2.2.1.2.3.1 Associated Real-World Activity

The operator must first select a destination by choosing “*Selected remote host:*” from “*Network*” pull-down menu on the local database manager and then choose a hostname. The operator then has to perform the Real-World activity “*Query*” to get a list of Study/Series/Image. Once the list of Study/Series/Image is retrieved, the operator can invoke the “*Get*” operation by choosing “*Get Exam*” or “*Get Series*” or “*Get Image*” from the “*Network*” pull-down menu.

2.2.1.2.3.2 Proposed Presentation Contexts

When the Real-World activity “*Get*” is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-MOVE related contexts are applicable to this activity.

2.2.1.2.3.2.1 SOP Specific Conformance Statement for C-MOVE SCU

When the operator starts a *Get* operation at any level (Study, Series, Image) the DICOM Server AE will initiate a C-MOVE-RQ request to the Remote AE with the DICOM Server AE as the Destination AE. The Storage SCP will handle the incoming images as described in section 2.2.1.3.1.

Each C-MOVE SCU operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with time out values of 300 seconds, 300 seconds and 60 minutes respectively. These time-outs are configurable in dcs.cfg as *bi_assoc_tio*, *bi_store_tio* and *bi_session_tio* respectively.

The DICOM Server AE will send a C-CANCEL-MOVE-RQ to the Remote AE if the operator “*Pauses*” or “*Clears*” the job from the local database manager Network queue.

2.2.1.2.4 DICOM Ping to Remote AE

2.2.1.2.4.1 Associated Real-World Activity

The operator must first select a destination by choosing “*Selected remote host:*” from “*Network*” pull-down menu on the local database manager and then choose a hostname. The operator then has to perform the Real-World activity “*Choose DICOM PING*” to send a C-ECHO request to get the status of the Remote AE.

If the C-ECHO response is received with a success, the DICOM Server will post a pop-pup to the operator indicating that the remote device is alive.

2.2.1.2.4.2 Presentation Context Table

Table 2.2.1.3.2.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity DICOM Ping

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.1.2.4.2.1 SOP Specific Conformance Statement to Verification SOP Class

The DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 300 seconds, 90 seconds and 60 minutes respectively.

Upon receiving a C-ECHO-RSP, containing a successful status, a message will be posted to the operator indicating success.

2.2.1.2.5 Save exam/series to Remote AE

The user selects the exam/series to be committed. All the images currently in the selected exam/series will be sent to the selected remote archive node(which is also the Storage commitment SCP) using DICOM C-STORE operations. Once all the images are transferred the commitment request will be sent on a separate association.

2.2.1.2.6 Auto Archive exam/series to Remote AE

The Auto archive API’s are used to archive the exams/series onto local archive media or the remote archive node (which shall be a Storage Commitment SCP) without manual interface. If the default device selected for Auto Archive is a remote Storage Commitment SCP then all the images currently in the specified exam/series will be sent to the selected Storage commitment SCP using C-STORE operations. On successful transfer of all the images the Storage Commitment request will be sent.

2.2.1.3 Association Acceptance Policy

The DICOM Server AE places no limitations on whom it may connect to.

When the DICOM Server AE accepts an association for image storage, it will receive any images transmitted on that association and store the images on disk.

It will also respond to queries from Remote AEs by sending matching entries. Any Remote AE can request and receive a list of images on the local database. The Remote AE must be configured in the local database manager's list of Remote AE for it to be able to retrieve images from DICOM Server AE.

Any remote AE can open an association to the DICOM Server AE for the purpose of verification.

2.2.1.3.1 Receive Image(s)

This AE is indefinitely listening for associations. No operator action is required to receive an image.

2.2.1.3.1.1 Associated Real-World Activity

The Real-World Activity associated with the Receive Image(s) operation is the storage of the image on the disk drive of the Signa Horizon Lx.

Presentation Context Table

Table 2.2.1.3.1.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity

Receive Image(s)

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Big Endian(GE Private)	1.2.840.113619.5.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Big Endian(GE Private)	1.2.840.113619.5.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Implicit VR Big Endian(GE Private)	1.2.840.113619.5.2	SCP	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Implicit VR Big Endian(GE Private)	1.2.840.113619.5.2	SCP	None
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

Note: The SCP does not have a default acceptance policy if more that one acceptable transfer syntaxes are proposed by the SCU. It is the responsibility of the SCU to make a selection from more than one transfer syntaxes accepted. If multiple transfer syntaxes are proposed in the same presentation context, the SCP will accept the first one.

2.2.1.3.1.1.1 SOP Specific Conformance to Storage SOP Classes

The DICOM Server AE conforms to the SOP's of the Storage Service Class at level 1 (base). Type 3 elements will be discarded unless explicitly stated otherwise (reference *Appendix A IOD Definitions*). Private elements will be discarded from the image when receiving images containing non-GE private data elements.

Each C-STORE SCP operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with time out values of 900 seconds, 900 seconds and 60 minutes respectively.

Image Reception

If the DICOM Server AE returns one of the following status codes, then the C-STORE operation was unsuccessful and no image will be installed:

0110 (Processing Failure) Indicates that an internal system call has failed while processing an image.

A711 (Out of Resources) Indicates that probably there was not enough disk space to store the image. The user should attempt recovery by removing some images from the Signa Horizon Lx system.

A712 (Out of Resources) Indicates that there was not enough resource (such as memory) to store the image.

A800 (SOP Class not supported)

In the event of a successful C-STORE operation, the image has successfully been written to disk. The image will then be accessed in the same manner as any other image by the applications on the Signa Horizon Lx system.

Images may be deleted when instructed to do so by the user. Thus the duration of the storage of the image is determined by the users of the Signa Horizon Lx system.

Image Installation

If the image installation is unsuccessful, a message will appear in the Message Log informing the user of the failure and the image will be removed.

If the image installation process finds that an element is not encoded according to the DICOM standard, it will fail to install the image and the file will be removed.

Image Installation of GE Created MR or CT Images

Images that were originally created on recent GE MR and CT scanners will be converted from their native Advantage Proprietary Format to DICOM format for transmission. If the images are stored as full fidelity representations and are subsequently returned to recent GE scanners, then the images will be transformed back to Advantage Proprietary Format.

There is an assumption made by such GE scanners:

The private element (0009,1001) is used as the full fidelity flag. If this flag contains the string: “GE_GENESIS_FF” when received by a scanner, then it is assumed that the image object was originally a GE created image object and contains all private elements that it was sent with.

If full fidelity flag is present and not all the elements are sent back as sent (i.e., not full fidelity) there are 2 possible actions:

the translator will do its best to convert the image and will use default values where DICOM fields are missing

If certain critical information is not provided then the image will be stored as a screen save

It is strongly suggested that if GE private element (0009,1001) is present then all GE private elements originally associated with the image be preserved.

Image Installation of non-GE Created MR or CT Images

Images received from non GE products are installed as appropriate image object without any of their private data elements. Also if some critical fields (mandatory) are missing, then the image will not be installed.

2.2.1.3.2 Verification Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *verification* message.

2.2.1.3.2.1 Associated Real-World Activity

The Real-World Activity associated with the verification request is to send a C-ECHO response message with a status of “success” to the requesting AE.

2.2.1.3.2.2 Presentation Context Table

Table 2.2.1.3.2.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Verification Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.2.1.3.2.2.1 SOP Specific Conformance to Verification SOP Class

The DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 300 seconds, 90 seconds and 60 minutes respectively.

2.2.1.3.3 Query Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *query* request.

2.2.1.3.3.1 Associated Real-World Activity

The Real-World Activity associated with the query request is to search the local database for entries that match the request and send a C-FIND response message with a status of “pending” for each matching entry.

2.2.1.3.3.2 Presentation Context Table

Table 2.2.1.3.1.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Query Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.2.1.3.3.2.1 SOP Specific Conformance to C-FIND SCP

Each C-FIND SCP operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 300 seconds, 300 seconds and 60 minutes respectively.

All Required(R) and Unique(U) study, series, and image level keys for the Study-Root Query/Retrieve information model are supported. Some optional (O) keys are also supported as described in the following tables.

Table 2.2.1.3.3.2.1-1 Supported study level keys

Description	Type	Tag	Usage
Study date	R	0008,0020	Matched
Study time	R	0008,0030	Matched
Accession number	R	0008,0050	Matched
Patient’s name	R	0010,0010	Matched ¹
Patient id	R	0010,0020	Matched
Study id	R	0020,0010	Matched
Study Instance UID	U	0020,000D	Matched
Study description	O	0008,1030	Returned
Private Creator Identification	P	0009,0010	GEMS_IDEN_01
Suite Id	P	0009,1002	Returned

Table 2.2.1.3.3.2.1-2 Supported series level keys

Description	Type	Tag	Usage
Modality	R	0008,0060	Matched
Series number	R	0020,0011	Matched
Series Instance UID	U	0020,000E	Matched
Series description	O	0008,103E	Returned

¹ The local database does not store the different components of the patient’s name in separate fields so it is not possible to query for studies by last name or any other component.

Description	Type	Tag	Usage
Manufacturer	O	0008,0070	Returned
Images in series	O	0020,1002	Returned

Table 2.2.1.3.3.2.1-3 Supported image level keys

Description	Type	Tag	Usage
Image number	R	0020,0013	Matched
Image Instance UID	U	0008,0018	Matched
Image type	O	0008,0008	Returned
Rows	O	0028,0010	Returned
Columns	O	0028,0011	Returned
Image position	O	0020,0032	Returned
Image orientation	O	0020,0037	Returned
Slice thickness	O	0018,0050	Returned
Slice spacing	O	0018,0088	Returned
Gantry tilt	O	0018,1120	Returned
Convolution kernel	O	0018,1210	Returned
Reconstruction diameter	O	0018,1100	Returned
Data collection diameter	O	0018,0090	Returned
Flip angle	O	0018,1314	Returned
Echo number	O	0018,0086	Returned
Echo time	O	0018,0081	Returned
Inversion time	O	0018,0082	Returned
Repetition time	O	0018,0080	Returned
Trigger time	O	0018,1060	Returned
Private Creator Identification	P	0019,0010	GEMS_ACQU_01
Dfov Rect	P	0019,101E	Returned
Midscan Time	P	0019,1024	Returned
Azimuth	P	0019,1026	Returned
Number of Echo	P	0019,107E	Returned
Private Creator Identification	P	0021,0010	GEMS_RELA_01
Scout Anref	P	0021,104A	Returned
Private Creator Identification	P	0027,0010	GEMS_IMAG_01
Location RAS	P	0027,1040	Returned
Location	P	0027,1041	Returned
Center R Coordinate	P	0027,1042	Returned
Center A Coordinate	P	0027,1043	Returned
Table Start Location	P	0027,1050	Returned
Table End Location	P	0027,1051	Returned
RAS Letter for Side of Image	P	0027,1052	Returned
RAS Letter for Anterior/Posterior	P	0027,1053	Returned
RAS Letter for Scout Start Location	P	0027,1054	Returned
RAS Letter for Scout End Location	P	0027,1055	Returned
Image Dimension X	P	0027,1060	Returned
Image Dimension Y	P	0027,1061	Returned

Note: In the above tables the type field has the following meaning:

R - Required **U** - Unique **O** - Optional **P** - Private

Only keys with Usage type *Matched* will be matched against values in the database.

Values in keys of type *Returned* will be ignored and will be filled in with data from the database.

If an optional key is requested that does not appear in any of the tables above, that key will be ignored and no corresponding element will be returned.

If the database does not have a value corresponding to any requested optional key a zero-length element will be returned.

Except sequence matching all other matchings are supported.

Only hierarchical query is supported. Therefore, the C-FIND SCP will not perform any extended negotiation.

2.2.1.3.4 Retrieve Request From Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *retrieve* request.

2.2.1.3.4.1 Associated Real-World Activity

The Real-World Activity associated with the Retrieve Request is to send all images corresponding to the C-MOVE request to the destination AE through a separate association.

2.2.1.3.4.2 Presentation Context Table

Table 2.2.1.3.4.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity

Retrieve Request.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.1.3.4.2.1 SOP Specific Conformance to C-MOVE SCP

The DICOM Server AE provides standard conformance to the baseline Study-root C-MOVE Service Class SCP.

Each C-MOVE SCP operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 300 seconds, 300 seconds and 60 minutes respectively. These time-outs are configurable in dcs.cfg as *bi_assoc_tio*, *bi_store_tio* and *bi_session_tio* respectively

All images requested in a C-MOVE-RQ will be sent over a single association. A C-MOVE-RSP with a “pending” status will be returned to the requester every five images.

The C-MOVE SCP will invoke C-STORE requests for the following SOP classes:

SOP Class Name	SOP Class UID
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8

In addition to the C-MOVE response status values defined in DICOM V3.0 part 4 the following status values will be returned:

- C000 - Indicates that an error occurred while retrieving records from the local database.
- C001 - Indicates all other processing error.
- C011 - If the Destination AE returns a “*Storage Full*” condition this status will be returned. This status will only be sent if the Destination AE returns a status of A711 and is only applicable if the Destination AE is an SdC-based product.

2.2.1.3.4.3 Presentation Context Acceptance Criteria

No criterion.

2.2.1.3.4.4 Transfer Syntax Selection Policy

The SCP does not have a default acceptance policy if more than one acceptable transfer syntaxes are proposed for the same SOP class (in separate presentation contexts). It is the responsibility of the SCU to make a selection from the list of accepted presentation contexts that apply to any particular SOP class. If multiple transfer syntaxes are proposed in the same presentation context, the SCP will accept the first one.

2.3 COMMUNICATION PROFILES

2.3.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

2.3.2 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

2.3.2.1 Physical Media Support

Ethernet v2.0, IEEE 802.3.

2.3.3 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

2.4 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.4.1 Specialized Information Object Definition

Following is a list of additional private attributes defined for a standard MR IOD. For incoming third-party DICOM images the values in these elements are retained without modification.

- (0008,0008) Value 3: MR Image IOD specific specializations
 - PROJECTION IMAGE
 - REFORMATTED
 - SCREEN SAVE
 - PROC
 - COMB

- Value 4 : MR Image implementation specific
 - COLLAPSE
 - VASCULAR
 - IVI

Note: When converting a received DICOM IOD to Advantage format if element 8,8 does not contain any of the defined values the IOD will be converted to secondary capture IOD.

- (0018,0022) Scan Options : Defined Terms
 - NONE
 - VASCTOF_GEMS
 - VASCPC_GEMS
 - CINE_GEMS
 - FAST_GEMS
 - IIC_GEMS
 - GRAPH_GEMS
 - IRP_GEMS
 - DEP_GEMS
 - CL_GEMS
 - SAT_GEMS
 - NPW
 - RT_GEMS
 - VB_GEMS
 - POMP_GEMS
 - VB_GEMS
 - EDR_GEMS
 - SEQ_GEMS
 - CS_GEMS
 - MP_GEMS
 - SQPIX_GEMS
 - MT_GEMS
 - EPI_GEMS
 - TRF_GEMS
 - RTR_GEMS
 - FT_GEMS
 - NF_GEMS
 - RAMP_RL_GEMS
 - RAMP_LR_GEMS

RAMP_AP_GEMS
 RAMP_PA_GEMS
 RAMP_SI_GEMS
 RAMP_IS_GEMS
 FC_FREQ_AX_GEMS
 FC_SLICE_AX_GEMS
 SS_GEMS
 VASCANGIO_GEMS

Note: When converting a received DICOM IOD to Advantage format if element 18,22 does not contain any of the defined values the received data will be interpreted as having the value "NONE".

2.4.2 Private SOP Classes

ID/Net v2.0 Private IODs are based upon the April 1993 draft version of the DICOM v3.0. ID/Net v2.0 IODs are supported for backward compatibility. The following private SOP classes are defined:

Abstract Syntax Name	UID
GE Private DICOM MR Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.2
GE Private DICOM CT Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.3
GE Private DICOM Display Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.4

Note: See the "ID/Net v2.0 Implementation Profiles" (Direction 46-269546G2) for definitions of Information Objects.

2.4.3 Private Transfer Syntax

The following private SOP transfer syntax is defined:

Transfer Syntax Name	UID
Implicit VR Big Endian	1.2.840.113619.5.2

This private transfer syntax is identical to the DICOM Implicit VR Little Endian syntax except for the encapsulation of the pixel data. Pixel data (element 7FE0, 0010) is encoded in Big Endian format for this private transfer syntax. All other elements are encoded in Little Endian format as dictated by the DICOM standard.

The following table shows the presentation contexts that are proposed for GE private SOP classes.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
GE Private DICOM MR Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.2	Implicit VR Little Endian	1.2.840.10008.1.2	Both	None
GE Private DICOM MR Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.2	Implicit VR Big Endian (GE Private)	1.2.840.113619.5.2	Both	None
GE Private DICOM CT Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	Both	None

GE Private DICOM CT Image Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.3	Implicit VR Big Endian (GE Private)	1.2.840.113619.5.2	Both	None
GE Private DICOM Display Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.4	Implicit VR Little Endian	1.2.840.10008.1.2	Both	None
GE Private DICOM Display Information Object (ID/Net v2.0 compatible)	1.2.840.113619.4.4	Implicit VR Big Endian (GE Private)	1.2.840.113619.5.2	Both	None

2.4.4 Private Data Elements

Refer to *Appendix B* for a complete listing of private data elements used with this implementation.

2.5 CONFIGURATION

2.5.1 AE Title/Presentation Address Mapping

The Signa Horizon Lx system allows the user to “add”, “Remove”, or “Update the mapping of remote AE Titles to IP Addresses and Ports. These options can be selected from the “Remote Host Selection” menu displayed by choosing “Selected remote host:” from the “Network” pull-down menu from the local database manager.

2.5.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address
- Local IP Netmask
- Max PDU length
- Time-outs, which are set for all hosts, are configurable in dcs.cfg:
 - note: * denotes any SOP class (time in sec)
 - *Association time-out - *bj_assoc_tio*
 - *Inactivity time-out - *bj_store_tio*
 - *Session timeout - *bj_session_tio*
 - *Move operation time-out - *bj_move_tio*
 - *Find time-out - *bj_find_tio*

Note: All configurations should be performed by a GE Field Service Engineer.

Note: The local port on which the Signa Horizon Lx system receives DICOM incoming TCP connections is port **4006**.

2.6 SUPPORT OF EXTENDED CHARACTER SETS

In addition to the DICOM default character set, *Signa Horizon Lx* supports the ISO IR 100 Latin alphabet #1 supplementary set for the purpose of interchange.

3 MEDIA STORAGE CONFORMANCE STATEMENT

3.0 Introduction

This Conformance Statement (CS) specifies the Signa Horizon Lx compliance to DICOM v3.0 Media Interchange. It details the DICOM Media Storage Application Profiles and roles which are supported by this product in the versions listed in Section 1.1.

Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

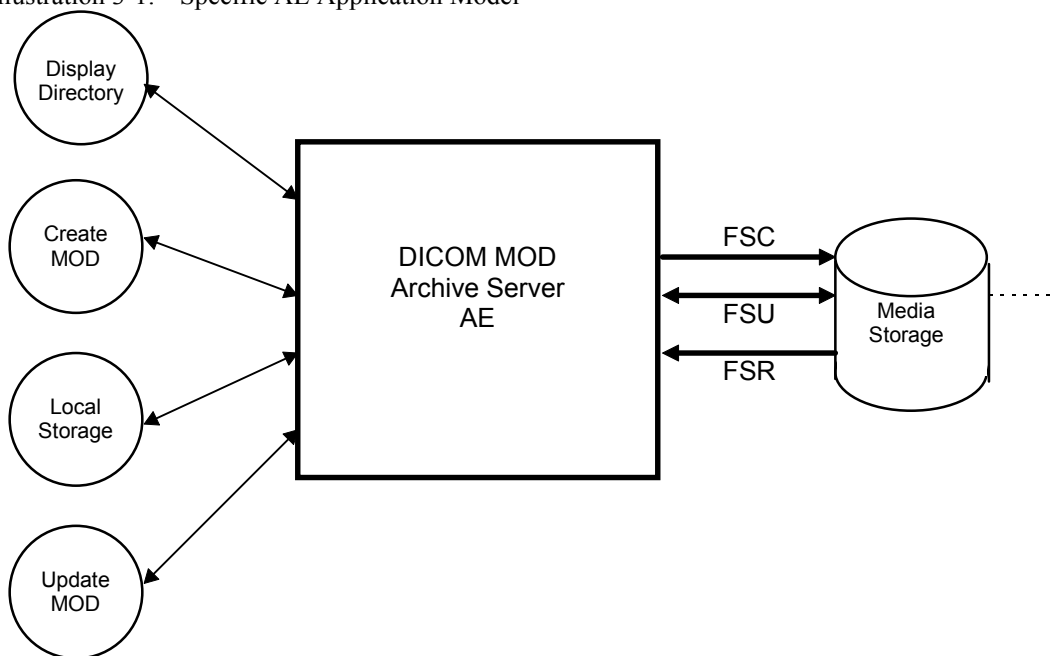
3.1 Implementation Model: MOD Archive Server

All DICOM functionality on the Signa Horizon Lx product is handled by the DICOM Server Application Entity (AE). The DICOM Server AE is commanded to perform DICOM services through the buttons and menu selections on the main user interface panel.

3.1.1 Application Data Flow Diagram

The MOD Archive Server creates and/or updates the 5.25 inch (130mm) MOD media with various DICOM SOP instances, It can process CT, MR, Secondary Capture and Overlay IOD's.

Illustration 3-1: Specific AE Application Model



The MOD Archive Server AE has a local storage that may contain various SOP instances. These may have been obtained by original creation, network (DICOM or proprietary) or by removable media using other application entities. These instances are external to this conformance claim and the origin of SOP instances is outside the scope of this claim.

The MOD Archive Server AE can initialize Media by acting as an FSC to create a new DICOM File-set on a 2.3GB MOD media or a 1.2GB MOD media. It initializes the DICOM File-set and writes the specified SOP instances onto the MOD. The SOP instances written will be limited to instances that match the criteria of one of the Application Profiles that is supported. When updating media, a pre-existing File-set will be updated with the selected SOP instances that match one of the supported Application Profiles.

3.1.2 Functional Definitions of AE's

This Server has only one Application Entity: the MOD Archive Application

The MOD Archive Application can perform these functions:

- It can initialize (create DOS filesystem) a piece of media, writing a new label and DICOM File-set onto the media. ("LABEL")
- It can update a piece of media by adding new SOP instances to an already existing DICOM File-set from local storage. ("SAVE")
- It can display a directory listing of the File-set on a piece of media. (QUERY)
- It can copy SOP instance from the MOD onto local storage. ("RESTORE")

3.1.3 Sequencing of Real World Activities

The updating function can only be performed on a piece of media that has already had a DICOM File-set created.

The display function can only be performed on a piece of media that has already has a DICOM File-set created. With no SOP instances having been added, the directory will be displayed empty.

The copy function can only be performed with a piece of media that has been updated and has DICOM SOP instances in the File-set.

There are no other sequencing requirements.

3.1.4 File Meta Information for Implementation Class and Version

The File Meta-Information for this implementation is:

File Meta-Information Version	1
Signa Horizon Lx Implementation UID	1.2.840.113619.6.44
Implementation Version Name	<Software Release Build (varies)>

3.2 AE Specifications

3.2.1 MOD Archive Specification

The MOD Archive provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed in Table 3.2-1.

Table 3.2-1: Application Profile, Activities and Roles for MOD Update

Application Profiles Supported	Real World Activity	Role	SC Option
STD-CTMR-MOD23	Create MOD	FSC	Interchange
	Update MOD	FSU	Interchange
	Display Directory	FSR	Interchange
	Copy To Local Storage	FSR	Interchange
STD-CTMR-MOD12	Create MOD	FSC	Interchange
	Update MOD	FSU	Interchange
	Display Directory	FSR	Interchange
	Copy To Local Storage	FSR	Interchange
PRI-CTMR-MOD12	Update MOD	FSU	Interchange
	Display Directory	FSR	Interchange
	Copy To Local Storage	FSR	Interchange

The MOD Archive Application will query the user before initializing media when a File-set is found on the media and an initialize operation has been requested.

Depending on the physical media type being 2.3GB or 1.2GB media, the system will apply the correct characteristics as an FSC to meet the appropriate Application Profile.

As an FSU role, the system will produce directory sequences for each SOP instance that is added to the File-set consistent with the STD-CTMR-MOD{12,23} profile and it will make the File-set directory so that an early installed base system that only understands the PRI-CTMR-MOD12 profile will not be able to use the media. An upgrade to the installed base system will be required to learn how to be a FSU or FSR of the STD-CTMR-MOD{12,23} profile directory sequences.

3.2.1.1 File Meta Information for the Application Entity

Following are the values set in the File Meta Information for this AE:

Source Application Entity Title	Not used by the MOD Archive Application
Private Information Creator UID	Not used by the MOD Archive Application
Private Information	Not used by the MOD Archive Application

3.2.1.2 Real World Activities

3.2.1.2.1 Real World Activity: Create MOD Request

The MOD Archive Application acts as an FSC using the Interchange option when requested to initialize (“LABEL”) the media. The AE will use the appropriate Application Profile depending on the physical media type that is in the optical disk drive (be it 2.3GB or 1.2GB media).

The MOD Archive Application will label the media and take the user provided list of SOP instances eliminating any SOP instances on that list that does not correspond to one of the Application Profiles in Table 3.2-1. These SOP instances are written to the media and a corresponding DICOMDIR sequence record is created. The determination of the potentially applicable Application Profile is dependent on the type of media and the associated software on which the AE has been invoked.

3.2.1.2.1.1 Application Profiles for the RWA: Create MOD

For the list of Application Profiles that invoke this AE for the Create MOD RWA, see Table 3.2-1.

3.2.1.2.2 Real World Activity: Display Directory

The MOD Archive Application acts as an FSR using the Interchange option when requested to provide a directory listing.

When an MOD update Application is requested to provide a directory listing it will read the File-set and display the DICOMDIR directory entries for those SOP instances in the File-set that correspond to the user selected Application Profile.

3.2.1.2.2.1 Media Storage Application Profile for the RWA: Display Directory

For the list of Application Profiles that invoke this AE for the MOD directory listing RWA, see Table 3.2-1.

There are no extensions or specialization's.

3.2.1.2.2.2 Options:

None applicable.

3.2.1.2.3 Real World Activity: Copy to Local Storage

The MOD Archive Application acts as an FSR when copying from the MOD to local storage.

The MOD Archive Application will copy any SOP Instance selected from an MOD Directory list from the MOD to the local storage upon request. The MOD Directory listing Real-World Application will filter out the SOP Instances that do not match the Application Profile.

3.2.1.2.3.1 Application Profiles for the RWA: Copy to Local Storage

For the list of Application Profiles that invoke this AE for the MOD Copy to Local Storage RWA, see Table 3.2-1.

3.2.1.2.3.2 Options:

None applicable.

3.2.1.2.4 Real World Activity: Update MOD

The MOD Archive Application acts as an FSU using the Interchange option when requested to update an MOD.

The MOD Archive Application will take the selected list of SOP instances and eliminate any SOP instance that does not correspond to permissible SOP instances listed in the Application Profiles Table 3.2-1. The remaining SOP instances are written to the media that is found in the MOD Archive Application disk drive. The determination of the potentially applicable Application Profile is dependent on the type of media and associated software on which the AE has been invoked.

3.2.1.2.4.1 Application Profiles for the RWA: Update MOD Request

For the list of Application Profiles that invoke this AE for the MOD Copy to Local Storage RWA, see Table 3.2-1.

3.2.1.2.4.2 Options:

None applicable.

3.3 Standard, Augmented and Private Application Profiles

3.3.1 Class and Profile Identification

The Class of Application Profiles defined here is for Computed Tomography and Magnetic Resonance Imaging Clinical applications.

The identifier for this class is CTMR-MOD.

The specific Application Profile in this class is shown in Table 3.3.1-1.

Table 3.3.1-1: CT/MR MOD Profiles

Application Profile	Identifier	Description
CT/MR Studies on 2.3GB MOD media	STD-CTMR-MOD23	Handles single 12 or 16 bit grayscale compressed / uncompressed images.
CT/MR Studies on 1.2GB MOD media	STD-CTMR-MOD12	Handles single 12 or 16 bit grayscale compressed / uncompressed images.
CT/MR Studies on 1.2 GB MOD media	PRI-CTMR-MOD12	Handles single 12 or 16 bit grayscale compressed / uncompressed images.

3.3.2 Clinical Contexts

This Application Profile facilitates the interchange of primary CT and MR images as well as processed CT and MR images as Secondary Capture and Standalone Overlay Images. Please refer to appendix A for the IOD definitions. CT, MR, SC and OV images may co-exist within the same File-set.

Typical interchanges would be between acquisition devices, archives and workstations within and between institutions.

3.3.2.1 Roles and Service Class Options

This Application Profile Class uses the Media Storage Service Class defined in PS3.4 with the Interchange Option.

The Application Entity shall support one or more roles of the File-set Creator, File-set Reader and File-set Updater defined in PS3.10.

3.3.2.1.1 File Set Creator

The Application Entity acting as a File-set Creator generates a File Set under the PRI-CTMR-MOD12 Application Profile Class. Typical entities using this role would include CT or MR equipment and archive systems which generate a patient record to transfer to another institution. File Set Creator shall be able to generate the Basic Directory SOP Class in the DICOMDIR File with all types of Directory Records related to the SOP Classes stored in the File-set.

FSC for the MOD profile has no concept of finalizing the disc at the completion of most recent write session. This is a requirement of CD-R and does not apply to the MOD profiles.

3.3.2.1.2 File Set Reader

The role of File Set Reader is used by the Application Entities which receive a transferred File Set. Typical entities using this role would include display workstations and archive systems which receive a patient record transferred from another institution. File Set Readers shall be able to read all the SOP Classes defined for the specific Application Profile for which a Conformance Statement is made using all the defined Transfer Syntaxes.

3.3.2.1.3 File Set Updater

The role of File Set Updater is used by Application Entities which receive a transferred File Set and update it by the addition of information. Typical entities using this role would include analytic workstations which for instance may add to the File-set an information object containing a processed (e.g., edge-enhanced) image. File-set Updaters do not have to read the images. File-set Updaters shall be able to generate one or more of the SOP Instances defined for the specific Application Profile for which a conformance statement is made and to read and update the DICOMDIR file.

3.3.3 Standard Application Profiles

The MOD Archive Server supports the standard Application Profile: CTMR-MOD as an FSC, FSR or FSU.

3.3.3.1 STD-CTMR-MOD12 Class Profile

3.3.3.1.1 SOP Classes and Transfer Syntaxes

This class of Application Profiles is based on the Media Storage Service Class with the Interchange Option. (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by the STD-CTMR-MOD12 Application Profiles is also specified in the Table 3.3.3.1.1-1.

Table 3.3.3.1.1-1 : IOD's and Transfer Syntaxes for CTMR-MOD Application Profiles

Information Object Definition	SOP Class UID	Transfer Syntax and UID	FSC Req.	FSR Req.	FSU Req.
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	M
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	JPEG Lossless Process Selection Value 14 1.2.840.10008.1.2.4.70	O	M	O
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless Process Selection Value 14 1.2.840.10008.1.2.4.70	O	M	O
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian Uncompressed	O	M	O

		1.2.840.10008.1.2.2			
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless Process Selection Value 14 1.2.840.10008.1.2.4.70	O	M	O
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	O	O
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	JPEG Lossless Process Selection Value 14 1.2.840.10008.1.2.4.70	O	O	O

M : Mandatory O : Optional

NOTE:

The MOD Archive Application chooses the JPEG Lossless compression (selection value 1) as the default transfer syntax for storing images on the media. But the transfer syntax is selectable on a per media basis at install time using a method defined by the Application.

3.3.3.1.2 Physical Media and Media Formats

The CT/MR Application Profiles in the STD-CTMR-MOD12 require the 130mm 1.2GB 512 Byte per Sector Magneto-Optical Rewriteable physical media with the PC File System as defined in PS3.12.

3.3.3.1.3 Logical Format

The STD-CTMR-MOD12 Application profile media format conforms to the Logical Format specification in PS3.12. The following tables 3.3.4.1.3-1 defines the specific values used for this profile.

Table 3.3.4.1.3-1 : Boot Sector for STD-CTMR-MOD12 conformant media

Bytes(s)	Big Endian	As Stored	Description
00 - 02		0xEB3C90	Jump instruction to loader (NOPs)
03 - 10	0x4d53444F53342E30		"MSDOS4.0" The formatting DOS (vendor specific)
11 - 12	0x0200	0x0002	512 bytes/sector
13	32	0x20	sectors/cluster
14-15	0x0001	0x0100	1 sector in boot record
16	0x02	0x02	2 File Allocation Tables (FAT)
17 - 18	0x0200	0x0002	512 root directory entries
19 - 20	0x0000	0x0000	Flag for more than 65536 sector/disk. Use offset 32 value
21	0xF8	0xF8	Flag for disk type; F0H if not otherwise specified
22 - 23	143	0x8F00	143 sectors/FAT
24 - 25	31	0x1F00	31 sectors/track
26 - 27	1	0x0100	1 side (head) per disk
28 - 31	00000000	0x0...0	0 reserved or hidden sectors
32 - 35	1163306	0x2AC01100	1163306 Total sector/disk. Varies from disk to disk
36 - 37	0x0080	0x8000	Physical Drive number = 80
38	0x29	0x29	Extended boot record signature = 41
39 - 42	<i>Date Stamp</i>		Volume serial number
43 - 53	0x47454D535F4449434F4D20		"GEMS-DICOM"
54 - 61	0x0...0	0x0...0	The file system label
62 - 509	-		Don't care. Any contents acceptable
510 - 511	0xAA55	0x55AA	Signature flag

3.3.3.1.4 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set. All DICOM files in the File-set incorporating SOP Instances defined for the specific Application Profile shall be referenced by the Directory Records.

All DICOM SOP Instance files in the File-set are stored in the MSDOS filesystem subdirectory \GEMS and are referenced from the DICOMDIR directory records.

Refer to *Appendix C* for a complete listing of all the optional modules and optional attributes used in the DICOMDIR definition. Please note that the mandatory attributes in each of the directory records as mentioned in Part 3 Addendum (Basic Directory Information Object Definition) are not listed in the appendix, but are supported by the implementation.

NOTE:

The modality attribute (0008,0060) in the DICOMDIR Series records should be CT/MR for Secondary Capture and Standalone Overlay SOP Class Images. Otherwise the Signa Horizon Lx DICOM media display browser will not list-up the series for contents rendering the retrieval to local storage impossible.

3.3.3.1.4.1 Additional Keys

None.

3.3.3.1.5 Other Parameters

This section defines other parameters common to all specific Application Profiles in the PRI-CTMR-MOD12 class which need to be specified in order to ensure interoperable information interchange.

3.3.3.1.5.1 Image Attribute Values

The attributes listed in Table 3.3.4.1.6.1-1 used within the CT/MR/SC/Standalone Overlay Image files, shall take the values specified.

Table 3.3.4.1.6.1-1: CT/MR-MOD Profiles Required Image Attribute Values for CT and MR, SC and OV Images

Attribute	Tag	Value
Modality	(0008,0060)	CT/MR
Photometric Interpretation	(0028,0004)	MONOCHROME2
Bits Allocated	(0028,0100)	16
Bits Stored	(0028,0101)	16

Overlay data if present shall be encoded in Overlay Data (60XX,3000).

3.3.3.1.5.1.1 Attribute Value Precedence

None.

3.3.3.2 STD-CTMR-MOD23 Class Profile

3.3.3.2.1 SOP Classes and Transfer Syntaxes

This class of Application Profiles is based on the Media Storage Service Class with the Interchange Option. (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by the STD-CTMR-MOD23 Application Profiles is also specified in the Table 3.3.4.1.1-1.

3.3.3.2.2 Physical Media and Media Formats

The CT/MR Application Profiles in the STD-CTMR-MOD23 require the 130mm 2.3GB 512 Byte per Sector Magneto-Optical Rewriteable physical media with the PC File System as defined in PS3.12.

3.3.3.2.3 Logical Format

The STD-CTMR-MOD23 Application profile media format conforms to the Logical Format specification in PS3.12. The following tables 3.3.3.2.3-2 defines the specific values used for this profile.

Table 3.3.3.2.3-1 : Boot Sector for STD-CTMR-MOD23 conformant media

Bytes(s)	Big Endian	As Stored	Description
00 - 02		0xEB3C90	Jump instruction to loader (NOPs)
03 - 10	0x4d53444F53342E30		"MSDOS4.0" The formatting DOS (vendor specific)
11 - 12	0x0200	0x0002	512 bytes/sector
13	64	0x40	sectors/cluster
14-15	0x0001	0x0100	1 sector in boot record
16	0x02	0x02	2 File Allocation Tables (FAT)
17 - 18	0x0200	0x0002	512 root directory entries
19 - 20	0x0000	0x0000	Flag for more than 65536 sector/disk. Use offset 32 value
21	0xF8	0xF8	Flag for disk type; F0H if not otherwise specified
22 - 23	138	0x8A00	138 sectors/FAT
24 - 25	62	0x3E00	62 sectors/track
26 - 27	1	0x0100	1 side (head) per disk
28 - 31	00000000	0x0...0	0 reserved or hidden sectors
32 - 35	2244896	0x20412200	2244896 Total sector/disk. Varies from disk to disk
36 - 37	0x0080	0x8000	Physical Drive number = 80
38	0x29	0x29	Extended boot record signature = 41
39 - 42	<i>Date Stamp</i>		Volume serial number
43 - 53	0x47454D535F4449434F4D20		"GEMS-DICOM"
54 - 61	0x0...0	0x0...0	The file system label
62 - 509	-		Don't care. Any contents acceptable
510 - 511	0xAA55	0x55AA	Signature flag

3.3.3.2.4 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set. All DICOM files in the File-set incorporating SOP Instances defined for the specific Application Profile shall be referenced by the Directory Records.

All DICOM SOP Instance files in the File-set are stored in the MSDOS filesystem subdirectory \GEMS and are referenced from the DICOMDIR directory records.

Refer to *Appendix C* for a complete listing of all the optional modules and optional attributes used in the DICOMDIR definition. Please note that the mandatory attributes in each of the directory records as mentioned in Part 3 Addendum (Basic Directory Information Object Definition) are not listed in the appendix, but are supported by the implementation.

NOTE:

The modality attribute (0008,0060) in the DICOMDIR Series records should be CT/MR for Secondary Capture and Standalone Overlay SOP Class Images. Otherwise the Signa Horizon Lx DICOM media display browser will not list-up the series for contents rendering the retrieval to local storage impossible.

3.3.3.2.4.1 Additional Keys

None.

3.3.3.2.5 Other Parameters

This section defines other parameters common to all specific Application Profiles in the PRI-CTMR-MOD12 class which need to be specified in order to ensure interoperable information interchange.

3.3.3.2.5.1 Image Attribute Values

The attributes listed in Table 3.3.3.1.5.1-1 used within the CT/MR/SC/Standalone Overlay Image files, shall take the values specified.

Overlay data if present shall be encoded in Overlay Data (60XX,3000).

3.3.3.2.5.2 Attribute Value Precedence

None.

3.3.4 Private Application Profiles

The MOD Archive Server supports a private Application Profile: PRI-CTMR-MOD12 as an FSR or FSU.

3.3.4.1 PRI-CTMR-MOD12 Class Profile

3.3.4.1.1 SOP Classes and Transfer Syntaxes

This class of Application Profiles is based on the Media Storage Service Class with the Interchange Option. (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by the PRI-CTMR-MOD12 Application Profiles is specified in the Table 3.3.3.1.1-1.

NOTE:

The MOD Archive Application chooses the JPEG Lossless compression (selection value 1) as the default transfer syntax for storing images on the media. But the transfer syntax is selectable on a per media basis at install time using a method defined by the Application.

The SOP instance files in the Media File-set in the PRI-CTMR-MOD12 profile uses a non-standard JPEG compression process resulting in interoperability problems when decoded using readily available industry decompression routines. See section 3.4.2 for details of the encoding problem unique to the PRI-CTMR-MOD12 profile.

3.3.4.1.2 Physical Media and Media Formats

The CT/MR Application Profiles in the PRI-CTMR-MOD12 require the 130mm 1.2GB 512 Byte per Sector Magneto-Optical Rewriteable physical media with the PC File System as defined in PS3.12.

3.3.4.1.3 Logical Format

The PRI-CTMR-MOD12 Application profile media format conforms to the Logical Format specification in PS3.12. The table 3.3.3.1.3-1 defines the specific values used for this profile.

3.3.4.1.4 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set. All DICOM files in the File-set incorporating SOP Instances defined for the specific Application Profile shall be referenced by the Directory Records.

All DICOM SOP Instance files in the File-set are stored in the MSDOS filesystem subdirectory \GEMS and are referenced from the DICOMDIR directory records.

Refer to *Appendix C* for a complete listing of all the optional modules and optional attributes used in the DICOMDIR definition. Please note that the mandatory attributes in each of the directory records as mentioned in Part 3 Addendum (Basic Directory Information Object Definition) are not listed in the appendix, but are supported by the implementation.

Directory records found in the PRI-CTMR-MOD12 profile do not contain the Attribute "Frame of Reference" (0020,0052). This Attribute was specified as Required after the first release of this Application Profile.

3.3.4.1.5 Additional Keys

None.

3.3.4.1.6 Other Parameters

This section defines other parameters common to all specific Application Profiles in the PRI-CTMR-MOD12 class which need to be specified in order to ensure interoperable information interchange.

See 3.4.2 for JPEG encoding problem in the PRI-CTMR-MOD12 profile.

3.3.4.1.6.1 Image Attribute Values

The attributes listed in Table 3.3.3.1.5.1-1 used within the CT/MR/SC/Standalone Overlay Image files, shall take the values specified.

Overlay data if present shall be encoded in Overlay Data (60XX,3000).

3.3.4.1.6.2 Attribute Value Precedence

None.

3.4 Extensions, Specialization's and Privatization's of SOP Classes and Transfer Syntaxes**3.4.1 Extensions, Specialization's and Privatization's of SOP Classes**

The CT/MR SOP Class Images have definitions extended for Defined Terms and include GE specific Private Data elements. The following sections describe the details for these SOP classes.

3.4.1.1 SOP Specific Conformance Statement for CT SOP Class

Refer to **section 2.4** for standard extensions and **Appendix B** for private data elements.

3.4.1.2 SOP Specific Conformance Statement for MR SOP Class

Refer to **section 2.4** for standard extensions and **Appendix B** for private data elements.

3.4.2 Private Transfer Syntax Specification

The SOP instance files in the Media File-set in the PRI-CTMR-MOD12 profile uses a non-standard JPEG compression process resulting in interoperability problems when decoded using readily available industry standard JPEG decompression routines.

Note: **Some earlier versions of that were intended to write JPEG Lossless Process Selection Value 14 1.2.840.10008.1.2.4.70 actually contained errors in byte ordering of encapsulation of fragment item tags, selection of entropy coding tables, and calculation of difference values from predictors. These errors cause the compressed images to be unreadable by non-GEMS software. All future GEMS CT/i software will read (but not write) archive media written with these errors.**

The early release product software had a JPEG encode routine that is called the BAD_ENCODER for the following explanation.

In the BAD_ENCODER produced 'SOS' (0xFFDA) header, the entropy coding table selector codes are 0x11. They should be 0x00. This mistake is the key that specifies the BAD_ENCODER processing problems

The BAD_ENCODER computation of the pixel value difference to be entropy encoded is computed as (Predictor - value) when it should be calculated as (value - Predictor)². The result is that the decompression via industry standard packages result in a negative of the original image pixel value.

The BAD_ENCODER predictor value used at the beginning of each line uses the last value of the previous line in the image. The JPEG standard says the predictor for the first line element of each line should be the first element of the line immediately above the current line. The first line, first element predictor should be the unsigned value that is half the full scale range for the "sample precision". The first line, first element predictor is correctly determined in the BAD_ENCODER.

² No specific direct confirmation of the (value - Predictor) policy was found, but the graphic on page 185 of the book "JPEG still image data compression standard" by Pennebaker shows the predictor entering the adder as a negative element and the value entering as positive element. Like wise, both Cornell and Stanford packages perform the computation as (value - Predictor).

3.5 Configuration

The MOD Archive Application will have only 1.2GB drive installed.

Table 3.5-1 : Supported Profiles for various Drive Configurations

Disk Drive Installed	Profiles Supported
1.3GB Optical Disk Drive	PRI-CTMR-MOD12
	STD-CTMR-MOD12
2.6GB-Optical Disk Drive	PRI-CTMR-MOD12
	STD-CTMR-MOD12
	STD-CTMR-MOD23

Support of Extended Character Sets

The MOD Archive Application will support copy of SOP instances containing the ISO IR 100 (Latin alphabet No. 1, supplementary set) and DICOM default character sets as defined in PS3.5.

4 PRINT SCU CONFORMANCE

4.0 Introduction

This Conformance Statement (CS) specifies the Signa Horizon Lx compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product in the versions indicated in section 1.1.

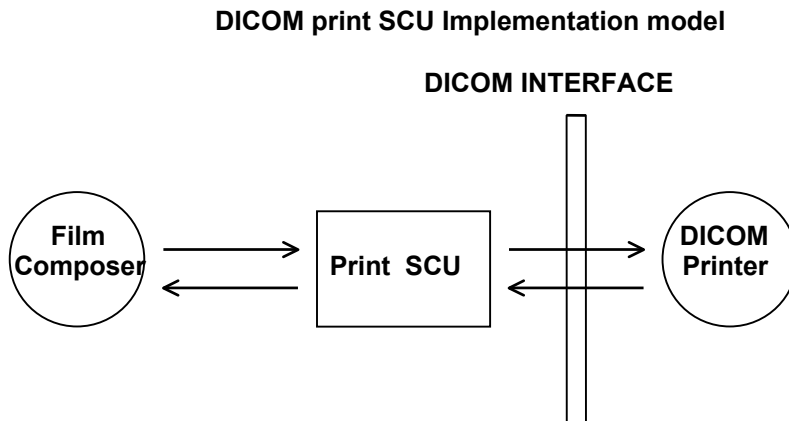
The Signa Horizon Lx product uses DICOM services to provide the DICOM Print SCU Application Profile. The Signa Horizon Lx product uses DICOM Print SCU to print images on DICOM Compliant Printers.

Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

4.1 IMPLEMENTATION MODEL : PRINT SCU

The DICOM Print SCU is a DICOM print filter, which provides the capability to print images to DICOM printers. The DICOM Print filter acts as an SCU of the DICOM print management SOP class.

4.1.1 Application Data Flow Diagram



Film Composer is the User interface and this is used to initiate the local real world activity. User issues the print request using Film Composer. Film composer allows printer selection and it composes the preformatted film file. This film file is interpreted by SCU and it sends the appropriate messages to DICOM print SCP running on DICOM printer.

4.1.2 Functional Definition of AE's

DICOM Print SCU Establishes the Association with requested printer to print the composed film. If the Remote AE accepts the presentation context applicable to the print job, the DICOM Print AE SCU will send the print job to the receiving Remote AE by using the N-CREATE and N-SET services.

4.1.3 Sequencing of Real-World Activities

User has to select the DICOM printer from Film Composer Interface.

The images to be printed shall be dragged and dropped into film composer slots from Viewing applications either manually or automatically.

In case of manual drag and drop user has to press Print Button to print the images .

The Print SCU will start the Print Session. The Print Session involves establishing association with printer followed by the next sequence of activities.

The Print SCU gets the Printer status using N-GET service. If the Printer returns FAILURE status the print session will be terminated and the requester will be notified of the printer status.

The film session is created using N-CREATE service. In case of error return the print session will be terminated. The attribute values for the Film session will be specified with the film session request.

The film box is created using N-CREATE service. The print session will be terminated if the printer fails to create the film box. The film box attribute values will be sent in the film box create request.

The image attributes for the images to be printed in this session will be set using the N-SET service. If the printer fails to accommodate the images in the image set to be printed the print session will be terminated.

The film will be printed using the N-ACTION service. Only film box printing is supported. In case of error the print session will be terminated.

Film box instance will be deleted using the N-DELETE service.

The SCU does not wait for N-EVENT-REPORT from Printer after deleting the film box instance. The N-EVENT-REPORT received when the association is still active are handled but the data received will be ignored.

Finally the association will be terminated and if all the above operations are successful the requester will be notified of the successful print session. This just indicates the images to be printed have been successfully sent to the printer.

4.2 AE SPECIFICATIONS

4.2.1 DICOM Print SCU AE Specification

Print SCU provides Standard Conformance to the following DICOM 3.0 SOP classes as an SCU:

SOP CLASS name	SOP CLASS UID
Basic grayscale print management meta SOP class	1.2.840.10008.5.1.1.9
Print Job SOP class	1.2.840.10008.5.1.1.14

4.3 Association Establishment Policy

4.3.1 General

The Print SCU provides options to indicate the printer AE title, Printer host name. In this product these inputs are provided by Film Composer. Depending on these inputs the Print SCU will establish the association with the desired printer.

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1
---------------------------------	------------------------------

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Print SCU AE is:

Maximum Length PDU	10 kbytes
---------------------------	------------------

4.3.2 Number of Associations

The Print SCU will initiate only one association with printer. This will not initiate any other associations while the current association is active.

4.3.3 Asynchronous Nature

The print SCU does not support asynchronous operations. All operations will be performed synchronously.

Implementation identifying information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The Implementation UID for this GEMS Implementation is:

Signa Horizon Lx Implementation UID	1.2.840.113619.6.44
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4.4 Association Establishment Policy

Print SCU initiates association with the Printer (which is running DICOM print SCP) provided as input to print SCU by film Composer.

4.5 Real World Activity

Associated Real-World Activity - "Print"

The Film Composer allows the user to select printers and it also allows the user to drag and drop the images (from viewer application) into the film. It also allows the user to manipulate some print parameters like film format and number of copies to print. When user presses the "Print" Button the Film composer communicates this request to Print SCU which then tries to establish the association with requested printer and sends the images for printing.

4.6 Proposed Presentation Contexts

The Proposed Presentation Context table for the Print SCU is as shown in following Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Grayscale Print Management SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Print Job SOP Class	1.2.840.10008.5.1.1.14	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

4.7 SOP Specific Conformance Statement

The Print SCU supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class.

Mandatory Print SOP Classes supported by Print SCU :

NAME	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.4
Printer SOP Class	1.2.840.10008.5.1.16

The Print SCU does not support any optional SOP Classes.

4.7.1 Basic Film Session SOP Class

The Print SCU supports the following DIMSE Service Elements for the Basic Film Session SOP Class.

N-CREATE - Requests the Print SCP to create an instance of Basic Film Session.

The following Attribute values are supported by the N-CREATE:

Attribute	DICOM Tag	Valid Range	Default Value
Number of Copies	(2000, 0010)	1-99	Set by user
Print Priority	(2000, 0020)	HIGH	HIGH
Medium Type	(2000, 0030)	CLEAR FILM BLUE FILM PAPER	Set in Configuration File
Film Destination	(2000, 0040)	MAGAZINE PROCESSOR	Set in Configuration File
Session Label	(2000, 0050)	“Sdc_DICOM_PRINT”	“Sdc_DICOM_PRINT”
Memory Allocation	(2000, 0060)	Sent zero length	Sent zero length

If a Failure status is returned during the N-CREATE operation of the Film Session the association will be terminated.

If a Warning status is returned during the N-CREATE operation of the Film Session the association will be terminated.

4.7.2 Basic Film box SOP Class

The Print SCU supports the following DIMSE Service Elements for the Basic Film Box SOP Class.

N-CREATE - Requests the Print SCP to create an instance of Film Box.

N-ACTION - Requests the Print SCP to print the Film Box onto Printer.

N-DELETE - Requests the Print SCP to delete the Film Box Instance.

The Following Attribute values are supported.

Attribute	DICOM Tag	Valid Range	Default Value
Image Display Format	(2010, 0010)	STANDARD/C,R Printer Dependent	Set in User Interface
Reference Film Session Sequence	(2010, 0500)		
Film Orientation	(2010, 0040)	PORTRAIT	Set in Configuration File
Film Size ID	(2010, 0050)	Sent zero length	Sent zero length
Magnification type	(2010, 0060)	BILINEAR CUBIC REPLICATE NONE	Set in Configuration File
Max Density	(2010, 0130)	0-4095	Set in Configuration File
Configuration Information	(2010, 0150)	Printer Dependent	Set in Configuration File
Smoothing type	(2010, 0080)	Printer Dependent	Set in Configuration File
Border density	(2010, 0100)	BLACK WHITE	Set in Configuration File
Empty image density	(2010, 0110)	BLACK WHITE	Set in Configuration File
Min density	(2010, 0120)	0-4095	Set in Configuration File

Note: Attributes “sent zero length” use the camera default values.

If a Failure status is returned during the N-CREATE operation of the Film Box the association will be terminated.

If a Warning status is returned during the N-CREATE operation of the Film Box the association will be terminated.

4.7.3 Basic Grayscale Image Box SOP Class

The Print SCU supports the following DIMSE Service Elements for Grayscale Image Box SOP Class.

N-SET - Requests the Printer to set the image box attributes.

The Following Attribute values are supported.

Attribute	DICOM Tag	Valid Range	Default Value
Image Position	(2020, 0010)	Based on Image Display Format	No Default Value
Preformatted Grayscale Image Sequence	(2020,0110)		
>Samples per pixel	(0028, 0002)	1	1
>Photometric Interpretation	(0028, 0004)	MONOCHROME2	MONOCHROME2

>Rows	(0028, 0010)	Image Dependent	Image Dependent
>Columns	(0028, 0011)	Image Dependent	Image Dependent
>Pixel Aspect Ratio	(0028, 0034)	1/1	1/1
>Bits Allocated	(0028, 0100)	8	8
>Bits Stored	(0028, 0101)	8	8
>High Bit	(0028, 0102)	7	7
>Pixel Representation	(0028, 0103)	0 (unsigned integer)	0 (unsigned integer)
Polarity	(2020, 0020)	NORMAL	NORMAL

If a Failure status is returned during the N-CREATE operation of the Image Box the association will be terminated.

If a Warning status is returned during the N-CREATE operation of the Image Box the association will be terminated.

4.7.4 Printer SOP Class

The N-GET DIMSE service is supported for the Printer SOP Class. If an N-EVENT-REPORT DIMSE service is received when the association is active, Print SCU handles the relevant states but the data received is ignored.

The Print SCU issues the request to retrieve following attributes.

Optional Attribute	DICOM Tag
Printer Status	(2110, 0010)
Printer Status Info	(2110, 0020)
Printer Name	(2110, 0030)
Manufacturer	(0008, 0070)
Manufacturer Model Name	(0008, 1090)
Device Serial No.	(1800, 1000)
Software Versions	(1800, 1020)
Date Last Calibrated	(1800, 1200)
Time Last Calibrated	(1800, 1201)

The Print SCU issues the N-GET service to retrieve the printer status. The statuses are processed as follows:

If Printer status (2110,0010) is NORMAL, the film is printed.

If Printer status (2110,0010) is FAILURE the print job is terminated. The Printer Status Info (2110,0020) attribute is not processed.

If Printer status (2110,0010) is WARNING one of three things will happen:

- a) If the Printer Status Info (2110,0020) is "SUPPLY LOW" the status is displayed to the user and the print job continues.
- b) If the Printer Status Info (2110,0020) is "RECEIVER FULL" or "SUPPLY EMPTY", or "FILM JAM" the status is displayed to the user and the print job is aborted.
- c) For all other Printer Status Info (2110,0020) values, the status is ignored and the print job continues.

4.7.5 Print Job SOP Class

Print SCU looks for the following attributes in N-EVENT REPORT data received from Print SCP. If Print SCU does not receive N-EVENT_REPORT, it requests the Print SCP to retrieve the following set of attributes:

Attribute Name	DICOM Tag	Default Value
Execution Status	(2100, 0020)	Printer Shall return Value
Execution Status Info	(2100, 0030)	Printer Shall return Value
Printer Name	(2000, 0020)	Printer Shall return Value
Creation Date	(2100, 0040)	Printer Shall return Value
Creation Time	(2100, 0040)	Printer Shall return Value
Printer Name	(2110, 0030)	Printer Shall return Value
Originator	(2100, 0070)	Printer Shall return Value

4.8 Association Acceptance Policy

The Print SCU does not accept associations.

4.9 COMMUNICATION PROFILES

4.9.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

4.9.2 TCP/IP Stack

The TCP/IP stack is inherited from the UNIX Operating System.

4.9.3 API

Not Applicable

4.9.4 Physical Media Support

Ethernet v2.0, IEEE 802.3.

4.9.5 Standard Extended/Specialized/Private SOPs

None.

4.9.6 Configuration

4.10 AE Title/Presentation Address Mapping

4.10.1 The Local AE title is "Print_SCU" .

The Signa Horizon Lx system allows the user to "add", "Remove", or "Update the mapping of remote DICOM Printer AE Titles to IP Addresses and Ports. These options can be selected from the "Remote Printer Selection" menu displayed by choosing "Configure" button from the Film Composer .

4.10.2 Configurable Parameters

The following fields are configurable for the DICOM Print SCU AE:

Local IP Address

Local IP Netmask

Max PDU length

Time-outs, which are set for all hosts, are configurable in dprint.cfg:

*Association time-out	- <i>bi_assoc_tio</i>
*Session timeout	- <i>bi_session_tio</i>
*Create timeout	- <i>bi_ncreate_tio</i>

Note: All configurations should be performed by a GE Field Service Engineer.

4.10.3 Support of Extended Character Set

The Print SCU does not support any Extended Character Set.

Appendix A IOD Definitions

Enclosed is a listing of only the Optional/Conditional modules/attributes used by this implementation for CT/MR/SC and Standalone Overlay IODs.

NOTE: All other modules which are mandatory and consist of only type 1 elements and attributes which are type 1 per DICOM standard are supported by this implementation but are not explicitly listed here.

A.1 CT Specific IOD Definition

A.1.1 CT Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	A.5.1	M
Study	General Study	A.5.2	M
	Patient Study	A.5.3	U
Series	General Series	A.5.4	M
Frame of Reference	Frame of Reference	A.5.12	M
Equipment	General Equipment	A.5.5	M
Image	General Image	A.5.6	M
	Image Plane	A.5.7	M
	Image Pixel	Only the type 1 elements are sent.	M
	Contrast/Bolus	A.5.8	C
	CT Image	A.1.2	M
	SOP Common	A.5.9	M

A.1.2 CT Image Module

Attribute Name	Tag	Type	Notes
Rescale Intercept	(0028,1052)	1	-1024 or 0 sent
Rescale Slope	(0028,1053)	1	Value of 1 is sent
KVP	(0018,0060)	2	Value always sent.
Acquisition Number	(0020,0012)	2	Value always sent.
Date Collection Diameter	(0018,0090)	3	Value always sent.
Reconstruction Diameter	(0018,1100)	3	Value sent for all images except scouts.
Distance Source to Detector	(0018,1110)	3	Value always sent.
Distance Source to Patient	(0018,1111)	3	Value always sent.
Gantry / Detector Tilt	(0018,1120)	3	Value always sent.
Table Height	(0018,1130)	3	Value always sent.
Rotation Direction	(0018,1140)	3	Not sent for scout or axials
Exposure Time	(0018,1150)	3	Value always sent.
Xray Tube Current	(0018,1151)	3	Value always sent.
Exposure	(0018,1152)	3	Value always sent.
Filter Type	(0018,1160)	3	Sent. Defined terms: BODY FILTER BOWTIE FLAT FILT FLAT FILTER LARGE BOWTIE FIL
Focal Spot	(0018,1190)	3	Sent. Fixed value of 0.7 or 1.2

Convolution Kernel	(0018,1210)	3	Not sent for scouts. Defined Terms: <u>SMOOTH</u> <u>SOFT</u> <u>STANDARD</u> <u>DETAIL</u> <u>BONE</u> <u>EDGE</u> <u>SHARP</u> <u>LUNG</u>
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A.2 MR Specific IOD Definition

A.2.1 MR Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	A.5.1	M
Study	General Study	A.5.2	M
	Patient Study	A.5.3	U
Series	General Series	A.5.4	M
Frame of Reference	Frame of Reference	A.5.12	M
Equipment	General Equipment	A.5.5	M
Image	General Image	A.5.6	M
	Image Plane	A.5.7	M
	Image Pixel	Only the type 1 elements are sent.	M
	Contrast/Bolus	A.5.8	C
	MR Image	A.2.2	M
	SOP Common	A.5.9	M

A.2.1 MR Image Module

Attribute Name	Tag	Type	Notes
Scan Options	(0018,0022)	2	Always sent. (even if value is zero length)
MR Acquisition Type	(0018,0023)	2	2D or 3D depending on acquisition type.
Repetition Time	(0018,0080)	2C	Sent if Scanning Sequence is EP and Sequence Variant is not SK .
Echo Time	(0018,0081)	2	Always Sent. (even if value is zero length)
Inversion Time	(0018,0082)	2C	Always Sent. (even if value is zero length)
Echo Train Length	(0018,0091)	2	Always Sent. (even if value is zero length)
Trigger Time	(0018,1060)	2C	Always Sent. (even if value is zero length)
Angio Flag	(0018,0025)	3	Always sent 'Y' or 'N'
Number Of Averages	(0018,0083)	3	Always sent (even if value is zero length)
Imaging Frequency	(0018,0084)	3	Always sent (even if value is zero length)
Imaged Nucleus	(0018,0085)	3	Zero-length element is sent.
Echo Number	(0018,0086)	3	Always sent. (even if value is zero length)
Magnetic Field Strength	(0018,0087)	3	Sent if available, else not sent
Spacing Between Slices	(0018,0088)	3	Always sent (even if value is zero length)
Percent Sampling	(0018,0093)	3	Always sent (even if value is zero length)
Percent Phase Field of View	(0018,0094)	3	Always sent (even if value is zero length)
Pixel Bandwidth	(0018,0095)	3	Sent if available, else not sent
Nominal Interval	(0018,1062)	3	Sent if available, else not sent
Heart Rate	(0018,1088)	3	Sent if available, else not sent
Cardiac Number of Images	(0018,1090)	3	Sent if available, else not sent

Trigger Window	(0018,1094)	3	Sent if available, else not sent
Reconstruction Diameter	(0018,1100)	3	Always sent. (even if value is zero length)
Receiving Coil	(0018,1250)	3	Sent if available, else not sent.
Transmitting Coil	(0018,1251)	3	Sent if available, else not sent.
Acquisition Matrix	(0018,1310)	3	Sent if available, else not sent.
Phase Encoding Direction	(0018,1312)	3	Sent if available, else not sent. Is 'ROW' or 'COL' if sent.
Flip Angle	(0018,1314)	3	Sent if available, else not sent.
Variable Flip Angle Flag	(0018,1315)	3	Always sent. Value is 'Y' for RAMPED_x: where x is AP, IS, IR, PA, SI, or AL, else value is 'N'.
SAR	(0018,1316)	3	Sent if available, else not sent.
Temporal Resolution	(0020,0110)	3	Always sent. (even if value is zero length)

A.3 SC Specific IOD Definition

A.3.1 SC Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	A.5.1	M
Study	General Study	A.5.2	M
	Patient Study	A.5.3	U
Series	General Series	A.5.4	M
	SC Equipment	A.5.13	M
Equipment	General Equipment	A.5.5	U
	SC Equipment	A.5.13	M
Image	General Image	A.5.6	M
	Image Pixel	Only the type 1 elements are sent.	M
	SC Image	Not sent (consists entirely of type 3 element)	M
	Modality LUT	Only the type 1C elements are sent.	U
	VOI LUT	A.5.11	U
	SOP Common	A.5.9	M

A.4 Standalone Overlay Specific IOD Definition

A.4.1 Standalone Overlay Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	A.5.1	M
Study	General Study	A.5.2	M
	Patient Study	A.5.3	U
Series	General Series	A.5.4	M
	General Equipment	A.5.5	M
Equipment	General Equipment	A.5.5	M
	Overlay Identification	A.5.14	M
Overlay	Overlay Plane	A.5.10	M
	SOP Common	A.5.9	M

A.5 CT/MR/SC/Standalone Overlay IOD Common Module Definitions

A.5.1 Patient Module

Attribute Name	Tag	Type	Attribute Description
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Patient's Name	(0010,0010)	2	As entered at the user interface or from worklist. Supports 5 different components delimited by “^”. Supports a maximum length of 64 characters including the delimiter. Delimiters must be operator, entered from the user interface.
Patient ID	(0010,0020)	2	As entered at user interface or from worklist.
Patient's Birth Date	(0010,0030)	2	As entered at user interface or from worklist.
Patient's Sex	(0010,0040)	2	As entered at user interface or from worklist.
Referenced Patient Sequence	(0008,1120)	3	Not used. Will be discarded.
>Referenced SOP Class UID	(0008,1150)	1C	Not used. Will be discarded.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used. Will be discarded.
Patient's Birth Time	(0010,0032)	3	Not used. Will be discarded.
Other Patient IDs	(0010,1000)	3	Not used. Will be discarded.
Other Patient Names	(0010,1001)	3	Not used. Will be discarded.
Ethnic Group	(0010,2160)	3	Not used. Will be discarded.
Patient Comments	(0010,4000)	3	Not used. Will be discarded.

A.5.2 General Study Module

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Value from worklist is used if present and single worklist entry. Value is generated uniquely for each exam if worklist entry is not present or multiple worklists entries are satisfied with this study.
Study Date	(0008,0020)	2	Generated for each exam and always sent.
Study Time	(0008,0030)	2	Generated for each exam and always sent.
Referring Physician's Name	(0008,0090)	2	Value from user interface or modality worklist. Truncated to 33 characters.
Study ID	(0020,0010)	2	Value from user interface or worklist sent.
Accession Number	(0008,0050)	2	Value from user interface or worklist sent.
Study Description	(0008,1030)	3	Value from user interface or worklist sent.
Physician(s) of Record	(0008,1048)	3	Value from user interface or worklist sent.
Name of Physician(s) Reading Study	(0008,1060)	3	Not supported. Data will be lost.
Referenced Study Sequence	(0008,1110)	3	Value from the worklist
>Referenced SOP Class UID	(0008,1150)	1C	Value from the worklist
>Referenced SOP Instance UID	(0008,1155)	1C	Value from the worklist

A.5.3 Patient Study Module

Attribute Name	Tag	Type	Notes
Admitting Diagnoses Description	(0008,1080)	3	Not Supported. Information will be removed.
Patient's Age	(0010,1010)	3	Calculated from Date of Birth entered at user interface.
Patient's Size	(0010,1020)	3	Not Supported. Information will be removed.
Patient's Weight	(0010,1030)	3	Value from user interface.
Occupation	(0010,2180)	3	Not Supported. Information will be removed.
Additional Patient's History	(0010,21B0)	3	Value from modality worklist or user interface. Truncated to 60 characters

A.5.4 General Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	MR/CT
Series Instance UID	(0020,000E)	1	Locally Generated UID
Series Number	(0020,0011)	2	Generated sequentially, always sent.
Laterality	(0020,0060)	2C	Always sent zero-length.
Series Date	(0008,0021)	3	Generated for each series and always sent.
Series Time	(0008,0031)	3	Generated for each series and always sent.
Performing Physicians' Name	(0008,1050)	3	Not Used. Discarded.
Protocol Name	(0018,1030)	3	Sent if entered at user interface. Limited to 24 characters.
Series Description	(0008,103E)	3	Value from user interface is sent.
Operators' Name	(0008,1070)	3	Value from user interface is sent. Limited to 4 characters.
Referenced Study Component Sequence	(0008,1111)	3	Value used for performed procedure step
>Referenced SOP Class UID	(0008,1150)	1C	Value used for performed procedure step
>Referenced SOP Instance UID	(0008,1155)	1C	Value used for performed procedure step
Body Part Examined	(0018,0015)	3	Not Used. Will be discarded.

Patient Position	(0018,5100)	2C	Sent. As selected by operator when patient is positioned: Defined terms are: HFP = Head-First Prone HFS = Head-First Supine HFDR = Head-First Decubitus Right HFDL = Head-First Decubitus Left FFDR = Feet-First Decubitus Right FFDL = Feet-First Decubitus Left FFP = Feet-First Prone FFS = Feet-First Supine
Smallest Pixel Value in Series	(0028,0108)	3	Not Used. Will be discarded.
Largest Pixel Value in Series	(0028,0109)	3	Not Used. Will be discarded.

A.5.5 General Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	Always sent as "GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	Sent. Value is configurable. Limited to 32 characters.
Institution Address	(0008,0081)	3	Not Used. Discarded.
Station Name	(0008,1010)	3	Sent. Value is configurable. Limited to 8 characters
Institutional Department Name	(0008,1040)	3	Not Used. Discarded.
Manufacturers Model Name	(0008,1090)	3	
Device Serial Number	(0018,1000)	3	Sent if present in image.
Software Versions	(0018,1020)	3	Always sent as "08" for this version - does not distinguish individual software releases.
Spatial Resolution	(0018,1050)	3	Sent only for MR images.
Date of Last Calibration	(0018,1200)	3	
Time of Last Calibration	(0018,1201)	3	
Pixel Padding Value	(0028,0120)	3	Sent. For CT images the value used may not correspond to the actual value used in the image. Older CT scanners used -32768 while newer scanners use -2000 as padding.

A.5.6 General Image Module

Attribute Name	Tag	Type	Notes
Image Number	(0020,0013)	2	Generated sequentially, always sent.
Patient Orientation	(0020,0020)	2C	Always sent zero length.
Image Date	(0008,0023)	2C	Generated for each image, always sent.
Image Time	(0008,0033)	2C	Generated for each image, always sent.
Image Type	(0008,0008)	3	Always sent.
Acquisition Number	(0020,0012)	3	Generated for each acquisition, always sent.
Acquisition Date	(0008,0022)	3	Generated for each acquisition, always sent.
Acquisition Time	(0008,0032)	3	Generated for each acquisition, always sent.
Referenced Image Sequence	(0008,1140)	3	Not Used. Discarded
>Referenced SOP Class UID	(0008,1150)	1C	Not Used. Discarded
>Referenced SOP Instance UID	(0008,1155)	1C	Not Used. Discarded
Derivation Description	(0008,2111)	3	Not Used. Discarded
Source Image Sequence	(0008,2112)	3	Not Used. Discarded
>Referenced SOP Class UID	(0008,1150)	1C	Not Used. Discarded
>Referenced SOP Instance UID	(0008,1155)	1C	Not Used. Discarded
Images in Acquisition	(0020,1002)	3	Not Used. Discarded
Image Comments	(0020,4000)	3	Not Used. Discarded
Lossy Image Compression	(0028,2110)	3	Not Used. Discarded

A.5.7 Image Plane Module

Attribute Name	Tag	Type	Notes
Slice Thickness	(0018,0050)	2	Value always sent.
Image Orientation (Patient)	(0020,0037)	1	Value always sent.
Image Position (Patient)	(0020,0032)	1	Value always sent.
Slice Location	(0020,1041)	3	Value always sent.
Pixel Spacing	(0028,0030)	1	Value always sent.

A.5.8 Image Pixel Module

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Value always sent.
Photometric Interpretation	(0028,0004)	1	Value always sent.
Rows	(0028,0010)	1	Value always sent.
Collumns	(0028,0011)	1	Value always sent.
Bits Allocated	(0028,0100)	1	Value always sent.
Bits Stored	(0028,0101)	1	Value always sent.
High Bit	(0028,0102)	1	Value always sent.
Pixel Presentation	(0028,0103)	1	Value always sent.
Pixel Data	(7FE0,0010)	1	Value always sent.
Planar Configuration	(0028,0006)	1C	Not Used. Discarded.

Pixel Aspect Ratio	(0028,0034)	1C	Not Used. Discarded.
Smallest Image Pixel Value	(0028,0106)	3	Not Used. Discarded.
Largest Image Pixel Value	(0028,0107)	3	Not Used. Discarded.
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not Used. Discarded.
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not Used. Discarded.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not Used. Discarded.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not Used. Discarded.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not Used. Discarded.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not Used. Discarded.

A.5.9 Contrast Bolus Module

Attribute Name	Tag	Type	Notes
Contrast/Bolus Agent	(0018,0010)	2	Sent if contrast exam, as entered in user interface.
Contrast/Bolus Agent Sequence	(0018,0012)	3	Not Used. Discarded.
>Code Value	(0008,0100)	1C	Not Used. Discarded.
>Coding Scheme Designator	(0008,0102)	1C	Not Used. Discarded.
>Code Meaning	(0008,0104)	3	Sent if contrast exam, as entered in user interface.
Contrast/Bolus Route	(0018,1040)	3	Not Used. Discarded.
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Not Used. Discarded.
>Code Value	(0008,0100)	1C	Not Used. Discarded.
>Coding Scheme Designator	(0008,0102)	1C	Not Used. Discarded.
>Code Meaning	(0008,0104)	3	Not Used. Discarded.
>Additional Drug Sequence	(0018,002A)	3	Not Used. Discarded.
>>Code Value	(0008,0100)	1C	Not Used. Discarded.
>>Coding Scheme Designator	(0008,0102)	1C	Not Used. Discarded.
>>Code Meaning	(0008,0104)	3	Not Used. Discarded.
Contrast/Bolus Volume	(0018,1041)	3	Not Used. Discarded.
Contrast/Bolus Start Time	(0018,1042)	3	Not Used. Discarded.
Contrast/Bolus Stop Time	(0018,1043)	3	Not Used. Discarded.
Contrast/Bolus Total Dose	(0018,1044)	3	Not Used. Discarded.

Contrast Flow Rate(s)	(0018,1046)	3	Not Used. Discarded.
Contrast Flow Duration(s)	(0018,1047)	3	Not Used. Discarded.
Contrast/Bolus Ingredient	(0018,1048)	3	Not Used. Discarded.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Not Used. Discarded.

A.5.10 SOP Common Module

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	Always sent
SOP Instance UID	(0008,0018)	1	Always sent
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Creation Date	(0008,0012)	3	Not Used. Discarded
Instance Creation Time	(0008,0013)	3	Not Used. Discarded
Instance Creator UID	(0008,0014)	3	Not Used. Discarded

A.5.11 Overlay Plane Module

Attribute Name	Tag	Type	Notes
Overlay Data	(60xx,3000)	1C	Only for SC & Standalone Overlay IOD Definitions
Overlay Rows	(60xx,0010)	1	Not Used. Discarded
Overlay Columns	(60xx,0011)	1	Not Used. Discarded
Overlay Type	(60xx,0040)	1	Not Used. Discarded
Origin	(60xx,0050)	1	Not Used. Discarded
Overlay Bits Allocated	(60xx,0100)	1	Not Used. Discarded
Bit Position	(60xx,0102)	1	Not Used. Discarded
Overlay Data	(60xx,3000)	1C	Not Used. Discarded
Overlay Description	(60xx,0022)	3	Not Used. Discarded
Overlay Subtype	(60xx,0045)	3	Not Used. Discarded
Overlay Label	(60xx,1500)	3	Not Used. Discarded
ROI Area	(60xx,1301)	3	Not Used. Discarded
ROI Mean	(60xx,1302)	3	Not Used. Discarded
ROI Standard Deviation	(60xx,1303)	3	Not Used. Discarded
Overlay Descriptor - Gray	(60xx,1100)	3	Not Used. Discarded
Overlay Descriptor - Red	(60xx,1101)	3	Not Used. Discarded
Overlay Descriptor - Green	(60xx,1102)	3	Not Used. Discarded
Overlay Descriptor - Blue	(60xx,1103)	3	Not Used. Discarded
Overlays - Gray	(60xx,1200)	3	Not Used. Discarded
Overlays - Red	(60xx,1201)	3	Not Used. Discarded

Overlays - Green	(60xx,1202)	3	Not Used. Discarded
Overlays - Blue	(60xx,1203)	3	Not Used. Discarded

A.5.12 VOI LUT Module

Attribute Name	Tag	Type	Notes
VOI LUT Sequence	(0028,3010)	3	Not used. Discarded
>LUT Descriptor	(0028,3002)	1C	Not used. Discarded
>LUT Explanation	(0028,3003)	3	Not used. Discarded
>LUT Data	(0028,3006)	1C	Not used. Discarded
Window Center	(0028,1050)	3	Always sent for secondary capture(one value) For CT and MR images value is calculated from histogram of pixel data. The middle point between maximum and minimum pixel value is used.
Window Width	(0028,1050)	1C	Always sent for secondary capture(one value) For CT and MR images value is calculated from histogram of pixel data. The difference between maximum and minimum pixel value is used.
Window Center & Width Explanation	(0028,1055)	3	Not used. Discarded

A.5.13 Frame of Reference Module

Attribute Name	Tag	Type	Notes
Frame of Reference UID	(0020,0052)	1	Always sent
Position Reference Indicator	(0020,1040)	2	Value as entered at the user interface.

A.5.14 SC Equipment Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	3	Modality of original image (MR or CT)

A.5.15 Overlay Identification Module

Attribute Name	Tag	Type	Notes
Overlay Number	(0020,0022)	2	The image number of the image this overlay is for
Overlay Date	(0008,0024)	3	Date of overlay
Overlay Time	(0008,0034)	3	Time of overlay

A.5.16 Requested Procedure Module

Attribute Name	Tag	Type	Notes
Requested Procedure ID	(0040,1001)	1C	
Referenced Study Sequence	(0008,1110)	3	
>Referenced Study Sequence Class UID	(0008,1150)	3	

>Referenced Study Sequence Instance UID	(0008,1155)	3	
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A.5.17 Scheduled Procedure Step Module

Attribute Name	Tag	Type	Notes
Scheduled Procedure Step Description	(0040,0007)	3	
Scheduled Procedure Action Item Code Sequence	(0040,0008)	3	MR does not use
Scheduled Procedure Step ID	(0040,0009)	1C	

Appendix B Private Data Elements

Enclosed is a listing of private data elements used in this implementation for CT/MR Image IOD definition.

B.1 CT Image IOD Private Data Elements Definition

B.1. 1 Private Creator Identification (GEMS_IDEN_01)

Attribute Name	Tag	VR	VM
Full fidelity	(0009,1001)	LO	1
Suite id	(0009,1002)	SH	1
Product id	(0009,1004)	SH	1
Image actual date	(0009,1027)	SL	1
Service id	(0009,1030)	SH	1
Mobile location number	(0009,1031)	SH	1
Equipment UID	(0009,10E3)	UI	1
Genesis Version - now	(0009,10E6)	SH	1
Exam Record checksum	(0009,10E7)	UL	1
Actual series data time stamp	(0009,10E9)	SL	1

B.1. 2 Private Creator Identification (GEMS_PATI_01)

Attribute Name	Tag	VR	VM
Patient Status	(0011,1010)	SS	1

B.1. 3 Private Creator Identification (GEMS_ACQU_01)

Attribute Name	Tag	VR	VM
Number of cells I in Detector	(0019,1002)	SL	1
Cell number at Theta	(0019,1003)	DS	1
Cell spacing	(0019,1004)	DS	1
Horiz. Frame of ref.	(0019,100F)	DS	1
Series contrast	(0019,1011)	SS	1
Start number for baseline	(0019,1013)	SS	1
End number for baseline	(0019,1014)	SS	1
Start number for enhanced scans	(0019,1015)	SS	1
End number for enhanced scans	(0019,1016)	SS	1
Series plane	(0019,1017)	SS	1
First scan ras	(0019,1018)	LO	1
First scan location	(0019,1019)	DS	1
Last scan ras	(0019,101A)	LO	1
Last scan loc	(0019,101B)	DS	1
Display field of view	(0019,101E)	DS	1
Table speed	(0019,1023)	DS	1
Mid scan time	(0019,1024)	DS	1
Mid scan flag	(0019,1025)	SS	1
Degrees of azimuth	(0019,1026)	SL	1
Gantry period	(0019,1027)	DS	1

X-Ray On position	(0019,102A)	DS	1
X-Ray Off position	(0019,102B)	DS	1
Number of triggers	(0019,102C)	SL	1
Angle of first view	(0019,102E)	DS	1
Trigger frequency	(0019,102F)	DS	1
Scan FOV type	(0019,1039)	SS	1
Stat recon flag	(0019,1040)	SS	1
Compute type	(0019,1041)	SS	1
Segment number	(0019,1042)	SS	1
Total segments requested	(0019,1043)	SS	1
Interscan delay	(0019,1044)	DS	1
View compression factor	(0019,1047)	SS	1
Total no. of ref channels	(0019,104A)	SS	1
Data size for scan data	(0019,104B)	SL	1
Recon post proc. flag	(0019,1052)	SS	1
CT water number	(0019,1057)	SS	1
CT bone number	(0019,1058)	SS	1
Number of channels (1...512)	(0019,105E)	SL	1
Increment between channels	(0019,105F)	SL	1
Starting view	(0019,1060)	SL	1
Number of views	(0019,1061)	SL	1
Increment between views	(0019,1062)	SL	1
Dependant on #views processed	(0019,106A)	SS	1
Field of view in detector cells	(0019,106B)	SS	1
Value of back projection button	(0019,1070)	SS	1
Set if fatq estimates were used	(0019,1071)	SS	1
Z chan avg over views	(0019,1072)	DS	1
Avg of left ref chans over views	(0019,1073)	DS	1
Max left chan over views	(0019,1074)	DS	1
Avg of right ref chans over views	(0019,1075)	DS	1
Max right chan over views	(0019,1076)	DS	1
Reference channel used	(0019,10DA)	SS	1
Back projector coefficient	(0019,10DB)	DS	1
Primary speed correction used	(0019,10DC)	SS	1
Overrange correction used	(0019,10DD)	SS	1
Dynamic Z alpha value	(0019,10DE)	DS	1

B.1. 4 Private Creator Identification (GEMS_REL_01)

Attribute Name	Tag	VR	VM
Series from which Prescribed	(0021,1003)	SS	1
Genesis Version - now	(0021,1005)	SH	1
Series Record checksum	(0021,1007)	UL	1
Genesis version - Now	(0021,1018)	SH	1
Acqrecon record checksum	(0021,1019)	UL	1
Screen Format	(0021,1037)	SS	1
Anatomical reference for scout	(0021,104A)	LO	1
Tube focal spot position	(0021,1090)	SS	1
Biopsy position	(0021,1091)	SS	1
Biopsy T location	(0021,1092)	FL	1
Biopsy ref location	(0021,1093)	FL	1

B.1. 5 Private Creator Identification (GEMS_STDY_01)

Attribute Name	Tag	VR	VM
Start time(secs) in first axial	(0023,1070)	FD	1
No. of updates to header	(0023,1074)	SL	1
Indicates if the study has complete info (DICOM/genesis)	(0023,107D)	SS	1

B.1. 6 Private Creator Identification (GEMS_SERS_01)

Attribute Name	Tag	VR	VM
Last pulse sequence used	(0025,1006)	SS	1
Images in Series	(0025,1007)	SL	1
Landmark Counter	(0025,1010)	SL	1
Number of Acquisitions	(0025,1011)	SS	1
Series Complete Flag	(0025,1017)	SL	1
Number of images archived	(0025,1018)	SL	1
Last image number used	(0025,1019)	SL	1
Primary Receiver Suite and Host	(0025,101A)	SH	1

B.1. 7 Private Creator Identification (GEMS_IMAG_01)

Attribute Name	Tag	VR	VM
Image archive flag	(0027,1006)	SL	1
Scout Type	(0027,1010)	SS	1
Vma mamp	(0027,101C)	SL	1
Vma phase	(0027,101D)	SS	1
Vma mod	(0027,101E)	SL	1
Vma clip	(0027,101F)	SL	1
Smart scan ON/OFF flag	(0027,1020)	SS	1
Foreign Image Revision	(0027,1030)	SH	1
Plane Type	(0027,1035)	SS	1
RAS letter of image location	(0027,1040)	SH	1
Image location	(0027,1041)	FL	1
Center R coord of plane image	(0027,1042)	FL	1
Center A coord of plane image	(0027,1043)	FL	1
Center S coord of plane image	(0027,1044)	FL	1
Normal R coord	(0027,1045)	FL	1
Normal A coord	(0027,1046)	FL	1
Normal S coord	(0027,1047)	FL	1
R Coord of Top Right Corner	(0027,1048)	FL	1
A Coord of Top Right Corner	(0027,1049)	FL	1
S Coord of Top Right Corner	(0027,104A)	FL	1
R Coord of Bottom Right Corner	(0027,104B)	FL	1
A Coord of Bottom Right Corner	(0027,104C)	FL	1
S Coord of Bottom Right Corner	(0027,104D)	FL	1
Table start location	(0027,1050)	FL	1
Table end location	(0027,1051)	FL	1
RAS letter for side of image	(0027,1052)	SH	1
RAS letter for anterior/posterior	(0027,1053)	SH	1
RAS letter for scout start loc	(0027,1054)	SH	1
RAS letter for scout end loc	(0027,1055)	SH	1

B.1. 8 Private Creator Identification (GEMS_IMPS_01)

Attribute Name	Tag	VR	VM
Lower range of Pixels1	(0029,1004)	SL	1
Lower range of Pixels1	(0029,1005)	DS	1
Lower range of Pixels1	(0029,1006)	DS	1
Lower range of Pixels1	(0029,1007)	SL	1
Lower range of Pixels1	(0029,1008)	SH	1
Lower range of Pixels1	(0029,1009)	SH	1
Lower range of Pixels1	(0029,100A)	SS	1
Version of the hdr struct	(0029,1026)	SS	1
Advantage comp. Overflow	(0029,1034)	SL	1

B.1. 9 Private Creator Identification (GEMS_PARM_01)

Attribute Name	Tag	VR	VM
Window value	(0043,1010)	US	1
Total input views	(0043,1011)	US	1
X-Ray chain	(0043,1012)	SS	3
Decon kernel parameters	(0043,1013)	SS	5
Calibration parameters	(0043,1014)	SS	3
Total output views	(0043,1015)	SS	3
Number of overranges	(0043,1016)	SS	5
IBH image scale factors	(0043,1017)	DS	1
BBH coefficients	(0043,1018)	DS	3
Number of BBH chains to blend	(0043,1019)	SS	1
Starting channel number	(0043,101A)	SL	1
Ppscan parameters	(0043,101B)	SS	1
GE image integrity	(0043,101C)	SS	1
Level value	(0043,101D)	SS	1
Delta start time	(0043,101E)	DS	1
Max overranges in a view	(0043,101F)	SL	1
Avg overranges all views	(0043,1020)	DS	1
Corrected after glow terms	(0043,1021)	SS	1
Reference channels	(0043,1025)	SS	6
No views ref chans blocked	(0043,1026)	US	6
Scan pitch ratio	(0043,1027)	SH	1
Unique image iden	(0043,1028)	OB	1
Histogram tables	(0043,1029)	OB	1
User defined data	(0043,102A)	OB	1
Private Scan Options	(0043,102B)	SS	4
RA cord of target recon center	(0043,1031)	DS	2
Trigger on position	(0043,1040)	FL	4
Degree of rotation	(0043,1041)	FL	4
DAS trigger source	(0043,1042)	SL	4
DAS fpa gain	(0043,1043)	SL	4
DAS output source	(0043,1044)	SL	4
DAS ad input	(0043,1045)	SL	4
DAS cal mode	(0043,1046)	SL	4
DAS cal frequency	(0043,1047)	SL	4
DAS reg xm	(0043,1048)	SL	4
DAS auto zero	(0043,1049)	SL	4
Starting channel of view	(0043,104A)	SS	4

DAS xm pattern	(0043,104B)	SL	4
TGGC trigger mode	(0043,104C)	SS	4
Start scan to Xray on delay	(0043,104D)	FL	4
Duration of xray on	(0043,104E)	FL	4
Slop_int 10...slop_int 17	(0043,1060)	IS	8

B.1.10 Private Creator Identification (GEMS_HELIOS_01)

Attribute Name	Tag	VR	VM
Number of Macro rows in detector	(0045, 1001)	LO	1
Macro width at ISO center	(0045, 1002)	FL	1
DAS Type	(0045, 1003)	SS	1
DAS gain	(0045, 1004)	SS	1
DAS temperature	(0045, 1005)	SS	1
Table direction whether moving in or moving out	(0045, 1006)	CS	1
Z smoothing factor	(0045, 1007)	FL	1
View weighting mode	(0045, 1008)	SS	1
Sigma row number. Which rows were used	(0045, 1009)	SS	2
Minimum das value found in the scan data	(0045, 100A)	FL	1
Maximum offset shift value used	(0045, 100B)	FL	1
Number of views shifted	(0045, 100C)	SS	1
Z tracking flag	(0045, 100D)	SS	1
Mean Z error	(0045, 100E)	FL	1
Z tracking maximum error	(0045, 100F)	FL	1
Starting view for row 2a	(0045, 1010)	SS	1
Number of views in row 2a	(0045, 1011)	SS	1
Starting view for row 1a	(0045, 1012)	SS	1
Sigma mode	(0045, 1013)	SS	1
Number of views in row 1a	(0045, 1014)	SS	1
Starting view for row 2b	(0045, 1015)	SS	1
Number of views in row 2b	(0045, 1016)	SS	1
Starting view for row 1b	(0045, 1017)	SS	1
Number of views in row 1b	(0045, 1018)	SS	1
Air filter calibration date	(0045, 1019)	SS	1
Air filter calibration time	(0045, 101A)	SS	1
Phantom calibration date	(0045, 101B)	SS	1
Phantom calibration time	(0045, 101C)	SS	1
Z slope calibration date	(0045, 101D)	SS	1
Z slope calibration time	(0045, 101E)	SS	1
Crosstalk calibration date	(0045, 101F)	SS	1
Crosstalk calibration time	(0045, 1020)	SS	1
Itebone option flag	(0045, 1021)	SS	1
Peristaltic flag option	(0045, 1022)	SS	1

B.2 MR Image IOD Private Data Elements Definition

B.2. 1 Private Creator Identification (GEMS_IDEN_01)

Attribute Name	Tag	VR	VM
Full fidelity	(0009,1001)	LO	1
Suite id	(0009,1002)	SH	1
Product id	(0009,1004)	SH	1

Image actual date	(0009,1027)	SL	1
Service id	(0009,1030)	SH	1
Mobile location number	(0009,1031)	SH	1
Equipment UID	(0009,10E3)	UI	1
Genesis Version - now	(0009,10E6)	SH	1
Exam Record checksum	(0009,10E7)	UL	1
Actual series data time stamp	(0009,10E9)	SL	1

B.2. 2 Private Creator Identification (GEMS_PATI_01)

Attribute Name	Tag	VR	VM
Patient Status	(0011,1010)	SS	1

B.2. 3 Private Creator Identification (GEMS_ACQU_01)

Attribute Name	Tag	VR	VM
Horiz. Frame of ref.	(0019,100F)	DS	1
Series contrast	(0019,1011)	SS	1
Last pseq	(0019,1012)	SS	1
Series plane	(0019,1017)	SS	1
First scan ras	(0019,1018)	LO	1
First scan location	(0019,1019)	DS	1
Last scan ras	(0019,101A)	LO	1
Last scan loc	(0019,101B)	DS	1
Display field of view	(0019,101E)	DS	1
Acquisition Duration	(0019,105A)	FL	1
Second echo	(0019,107D)	DS	1
Number of echoes	(0019,107E)	SS	1
Table delta	(0019,107F)	DS	1
Contiguous	(0019,1081)	SS	1
Peak SAR	(0019,1084)	DS	1
Monitor SAR	(0019,1085)	SS	1
Cardiac repetition time	(0019,1087)	DS	1
Images per cardiac cycle	(0019,1088)	SS	1
Actual receive gain analog	(0019,108A)	SS	1
Actual receive gain digital	(0019,108B)	SS	1
Delay after trigger	(0019,108D)	DS	1
Swappf	(0019,108F)	SS	1
Pause Interval	(0019,1090)	SS	1
Pulse Time	(0019,1091)	DS	1
Slice offset on freq axis	(0019,1092)	SL	1
Center Frequency	(0019,1093)	DS	1
Transmit Gain	(0019,1094)	SS	1
Analog receiver gain	(0019,1095)	SS	1
Digital receiver gain	(0019,1096)	SS	1
Bitmap defining CVs	(0019,1097)	SL	1
Center freq. Method	(0019,1098)	SS	1
Pulse seq. Mode	(0019,109B)	SS	1
Pulse seq. Name	(0019,109C)	LO	1
Pulse seq. Date	(0019,109D)	DT	1
Internal pulse seq. Name	(0019,109E)	LO	1
Transmitting coil	(0019,109F)	SS	1

Surface Coil Type	(0019,10A0)	SS	1
Extremity Coil flag	(0019,10A1)	SS	1
Raw data run number	(0019,10A2)	SL	1
Calibrated Field strength	(0019,10A3)	UL	1
SAT fat/water/bone	(0019,10A4)	SS	1
Receive bandwidth	(0019,10A5)	DS	1
User data	(0019,10A7)	DS	1
User data	(0019,10A8)	DS	1
User data	(0019,10A9)	DS	1
User data	(0019,10AA)	DS	1
User data	(0019,10AB)	DS	1
User data	(0019,10AC)	DS	1
User data	(0019,10AD)	DS	1
User data	(0019,10AE)	DS	1
User data	(0019,10AF)	DS	1
User data	(0019,10B0)	DS	1
User data	(0019,10B1)	DS	1
User data	(0019,10B2)	DS	1
User data	(0019,10B3)	DS	1
User data	(0019,10B4)	DS	1
User data	(0019,10B5)	DS	1
User data	(0019,10B6)	DS	1
User data	(0019,10B7)	DS	1
User data	(0019,10B8)	DS	1
User data	(0019,10B9)	DS	1
User data	(0019,10BA)	DS	1
User data	(0019,10BB)	DS	1
User data	(0019,10BC)	DS	1
User data	(0019,10BD)	DS	1
Projection angle	(0019,10BE)	DS	1
Saturation planes	(0019,10C0)	SS	1
Surface coil intensity	(0019,10C1)	SS	1
SAT location R	(0019,10C2)	SS	1
SAT location L	(0019,10C3)	SS	1
SAT location A	(0019,10C4)	SS	1
SAT location P	(0019,10C5)	SS	1
SAT location H	(0019,10C6)	SS	1
SAT location F	(0019,10C7)	SS	1
SAT thickness R/L	(0019,10C8)	SS	1
SAT thickness A/P	(0019,10C9)	SS	1
SAT thickness H/F	(0019,10CA)	SS	1
Prescribed flow axis	(0019,10CB)	SS	1
Velocity encoding	(0019,10CC)	SS	1
Thickness disclaimer	(0019,10CD)	SS	1
Prescan type	(0019,10CE)	SS	1
Prescan status	(0019,10CF)	SS	1
Raw data type	(0019,10D0)	SH	1
Projection Algorithm	(0019,10D2)	SS	1
Projection algorithm	(0019,10D3)	SH	1
Fractional echo	(0019,10D5)	SS	1
Prep pulse	(0019,10D6)	SS	1
Cardiac phases	(0019,10D7)	SS	1
Variable echoflag	(0019,10D8)	SS	1

Concatenated SAT	(0019,10D9)	DS	1
User data	(0019,10DF)	DS	1
User data	(0019,10E0)	DS	1
Velocity Encode Scale	(0019,10E2)	DS	1
Fast phases	(0019,10F2)	SS	1
Transmission gain	(0019,10F9)	DS	1

B.2. 4 Private Creator Identification (GEMS_REL_01)

Attribute Name	Tag	VR	VM
Series from which Prescribed	(0021,1003)	SS	1
Genesis Version – now	(0021,1005)	SH	1
Series Record checksum	(0021,1007)	UL	1
Genesis version – Now	(0021,1018)	SH	1
Acq recon record checksum	(0021,1019)	UL	1
Table start location	(0021,1020)	DS	1
Series from which prescribed	(0021,1035)	SS	1
Image from which prescribed	(0021,1036)	SS	1
Screen Format	(0021,1037)	SS	1
Locations in acquisition	(0021,104F)	SS	1
Graphically prescribed	(0021,1050)	SS	1
Rotation from source x rot	(0021,1051)	DS	1
Rotation from source y rot	(0021,1052)	DS	1
Rotation from source z rot	(0021,1053)	DS	1
Image position	(0021,1054)	SH	3
Image orientation	(0021,1055)	SH	6
Integer slop	(0021,1056)	SL	1
Integer slop	(0021,1057)	SL	1
Integer slop	(0021,1058)	SL	1
Integer slop	(0021,1059)	SL	1
Integer slop	(0021,105A)	SL	1
Float slop	(0021,105B)	DS	1
Float slop	(0021,105C)	DS	1
Float slop	(0021,105D)	DS	1
Float slop	(0021,105E)	DS	1
Float slop	(0021,105F)	DS	1
Auto window/level alpha	(0021,1081)	DS	1
Auto window/level beta	(0021,1082)	DS	1
Auto window/level window	(0021,1083)	DS	1
To window/level level	(0021,1084)	DS	1

B.2. 5 Private Creator Identification (GEMS_STDY_01)

Attribute Name	Tag	VR	VM
Number of series in Study	(0023,1001)	SL	1
Number of unarchived Series	(0023,1002)	SL	1
Reference image field	(0023,1010)	SS	1
Summary image	(0023,1050)	SS	1
Start time(secs) in first axial	(0023,1070)	FD	1
No. of updates to header	(0023,1074)	SL	1
Indicates if study has complete info (DICOM/genesis)	(0023,107D)	SS	1

B.2. 6 Private Creator Identification (GEMS_SERS_01)

Attribute Name	Tag	VR	VM
Last pulse sequence used	(0025,1006)	SS	1
Images in Series	(0025,1007)	SL	1
Landmark Counter	(0025,1010)	SL	1
Number of Acquisitions	(0025,1011)	SS	1
Indicates no. of updates to header	(0025,1014)	SL	1
Series Complete Flag	(0025,1017)	SL	1
Number of images archived	(0025,1018)	SL	1
Last image number used	(0025,1019)	SL	1
Primary Receiver Suite and Host	(0025,101A)	SH	1

B.2. 7 Private Creator Identification (GEMS_IMAG_01)

Attribute Name	Tag	VR	VM
Image archive flag	(0027,1006)	SL	1
Scout Type	(0027,1010)	SS	1
Foreign Image Revision	(0027,1030)	SH	1
Imaging Mode	(0027,1031)	SS	1
Pulse Sequence	(0027,1032)	SS	1
Imaging Options	(0027,1033)	SL	1
Plane Type	(0027,1035)	SS	1
Oblique Plane	(0027,1036)	SL	1
RAS letter of image location	(0027,1040)	SH	1
Image location	(0027,1041)	FL	1
Center R coord of plane image	(0027,1042)	FL	1
Center A coord of plane image	(0027,1043)	FL	1
Center S coord of plane image	(0027,1044)	FL	1
Normal R coord	(0027,1045)	FL	1
Normal A coord	(0027,1046)	FL	1
Normal S coord	(0027,1047)	FL	1
R Coord of Top Right Corner	(0027,1048)	FL	1
A Coord of Top Right Corner	(0027,1049)	FL	1
S Coord of Top Right Corner	(0027,104A)	FL	1
R Coord of Bottom Right Corner	(0027,104B)	FL	1
A Coord of Bottom Right Corner	(0027,104C)	FL	1
S Coord of Bottom Right Corner	(0027,104D)	FL	1
Image dimension - X	(0027,1060)	FL	1
Image dimension - Y	(0027,1061)	FL	1
Number of Excitations	(0027,1062)	FL	1

B.2. 8 Private Creator Identification (GEMS_IMPS_01)

Attribute Name	Tag	VR	VM
Lower range of Pixels1	(0029,1015)	SL	1
Lower range of Pixels1	(0029,1016)	SL	1
Lower range of Pixels2	(0029,1017)	SL	1
Upper range of Pixels2	(0029,1018)	SL	1
Len of tot hdr in bytes	(0029,101A)	SL	1
Version of the hdr struct	(0029,1026)	SS	1
Advantage comp. Overflow	(0029,1034)	SL	1
Advantage comp. Underflow	(0029,1035)	SL	1

B.2. 9 Private Creator Identification (GEMS_PARM_01)

Attribute Name	Tag	VR	VM
Bitmap of prescan options	(0043,1001)	SS	1
Gradient offset in X	(0043,1002)	SS	1
Gradient offset in Y	(0043,1003)	SS	1
Gradient offset in Z	(0043,1004)	SS	1
Img is original or unoriginal	(0043,1005)	SS	1
Number of EPI shots	(0043,1006)	SS	1
Views per segment	(0043,1007)	SS	1
Respiratory rate, bpm	(0043,1008)	SS	1
Respiratory trigger point	(0043,1009)	SS	1
Type of receiver used	(0043,100A)	SS	1
Peak rate of change of gradient field	(0043,100B)	DS	1
Limits in units of percent	(0043,100C)	DS	1
PSD estimated limit	(0043,100D)	DS	1
PSD estimated limit in tesla per second	(0043,100E)	DS	1
Saravghead	(0043,100F)	DS	1
Window value	(0043,1010)	US	1
GE image integrity	(0043,101C)	SS	1
Level value	(0043,101D)	SS	1
Unique image iden	(0043,1028)	OB	1
Histogram tables	(0043,1029)	OB	1
User defined data	(0043,102A)	OB	1
Private Scan Options	(0043,102B)	SS	4
Effective echo spacing	(0043,102C)	SS	1
String slop field 1	(0043,102D)	SH	1
String slop field 2	(0043,102E)	SH	1
Raw data type	(0043,102F)	SS	1
Raw data type	(0043,1030)	SS	1
RA cord of target recon center	(0043,1031)	DS	2
Raw data type	(0043,1032)	SS	1
Neg_scanspacing	(0043,1033)	FL	1
Offset Frequency	(0043,1034)	IS	1
User_usage_tag	(0043,1035)	UL	1
User_fill_map_MSW	(0043,1036)	UL	1
User_fill_map_LSW	(0043,1037)	UL	1
User25...User48	(0043,1038)	FL	24
Slop_int_6...slop_int_9	(0043,1039)	IS	4
Slop_int_10...slop_int_17 Slop_int_11: reserved field Slop_int_15: Current Station # Slop_int_16: Total # of Stations	(0043,1060)	IS	8
Scanner Study Entity UID	(0043,1061)	UI	1
Scanner Study ID	(0043,1062)	SH	1
Scanner Table Entry	(0043,106f)	DS	3

Appendix C DICOMDIR Directory Information

C.1 DICOMDIR Directory Information

Enclosed here is a listing of only the optional (conditional) modules and optional attributes used by this implementation in the DICOMDIR definition. All standard attributes as defined in Part 3 Addendum (Basic Directory Information Object) are supported by this implementation but not listed here.

C.1.1 Basic Directory IOD Definition

Module	Reference	Usage	Notes
Directory Information	B.X.3.2.1 (DICOM PS3.10)	U	

C.1.2 Directory Information Module

Attribute Name	Tag	Type	Notes
Offset of the Next Directory Record	(0004,1400)	1C	
Record In-use Flag	(0004,1410)	1C	
Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	
Directory Record Type	(0004,1430)	1C	PATIENT, STUDY, SERIES and IMAGE
Referenced File ID	(0004,1500)	1C	Only found in IMAGE Directory Record
Referenced SOP Class UID in file	(0004,1510)	1C	Only found in IMAGE Directory Record
Referenced SOP Instance UID in File	(0004,1511)	1C	Only found in IMAGE Directory Record
Referenced Transfer Syntax UID in File	(0004,1512)	1C	Only found in IMAGE Directory Record

C.1.3 Directory Record Selection Keys

As indicated in table C.1.2, the PRI-CTMR-MOD12 application profile will have only the Patient, Study, Series and Image directory record types. Given below are the list of attributes supported under each of these directories.

C.1.3.1 Patient Keys

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Patient's Name	(0010,0010)	2	
Patient ID	(0010,0020)	1	

C.1.3.2 Study Keys

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Study Date	(0008,0020)	1	
Study Time	(0008,0030)	1	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	2	
Study Instance UID	(0020,000D)	1C	
Study ID	(0020,0010)	1	

C.1.3.3 Series Keys

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Image Type	(0008,0008)	3	
Modality	(0008,0060)	1	
Manufacturer's Id	(0008,0070)	3	
Series Description	(0008,103E)	3	
Manuf. Model Name	(0008,1090)	3	
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	1	

C.1.3.4 Image Keys

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
SOP Instance UID	(0008,0018)	3	Redundant to (0004,1511)
Referenced Image Sequence	(0008,1140)	1C	Not included
Sequence Variant	(0018,0021)	3	
Slice Thickness	(0018,0050)	3	
Repetition Time	(0018,0080)	3	
Echo Time	(0018,0081)	3	
Inversion Time	(0018,0082)	3	
Number of Averages	(0018,0083)	3	
Echo Number	(0018,0086)	3	MRI profile only
Spacing Between Slices	(0018,0088)	3	
Data Collection Diameter	(0018,0090)	3	
Contrast/Bolus Route	(0018,1040)	3	
Trigger Time	(0018,1060)	3	
Reconstruction Diameter	(0018,1100)	3	
Gantry/Detector Tilt	(0018,1120)	3	
Convolution Kernel	(0018,1210)	3	
Flip Angle	(0018,1314)	3	
Image Number	(0020,0013)	1	
Image Position (Patient)	(0020,0032)	1C	
Image Orientation (Patient)	(0020,0037)	1C	
Frame of Reference UID	(0020,0052)	1C	Absent from PRI-CTMR-MOD12
Slice Location	(0020,1041)	3	
Samples Per Pixel	(0028,0002)	R	
Photometric Interpretation	(0028,0004)	R	Absent from all profiles
Rows	(0028,0010)	1	
Columns	(0028,0011)	1	
Pixel Spacing	(0028,0030)	1C	
Bits Allocated	(0028,0100)	R	
Bits Stored	(0028,0101)	R	MRI - Absent from profiles
High Bit	(0028,0102)	R	MRI - Absent from profiles