Technical Publication

**Direction 2296445-100
Revision 0**

**LightSpeed Ultra 3.1 Conformance
Statement**

for DICOM v3.0 (ID/Net v3.0)

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Revision: A

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REVISON HISTORY

REV.	DATE	REASON FOR CHANGE
0	May 2002	Removed many private group/elements that were not being written to CT image header.
		Added private group 51 which supports the VES application.

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Revision: A

TABLE OF CONTENTS

Revision: A

Revision: A

Revision: A

Revision: A

Revision: A

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Revision: A

1   SECTION 1 - INTRODUCTION

1.1   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 Application. This product uses DICOM Print SCU to print the images to DICOM Compliant Printers.

Section 5, *DICOM Storage Commitment SCU*, is the DICOM v3.0 Conformance Statement related to DICOM Storage Commitment SCU Application. This product uses DICOM Storage Commitment Push Model to store the images using remote DICOM entity which is Storage Commitment SCP.

Section 6, HIS/RIS(Modality Worklist) The ModalityWorklist option for LightSpeed Ultra allows a user to query for and display DICOM modality worklist information.ModalityWorklist is providing the DICOM C-FIND service as a service class user (SCU).

Section 7, Performed Procedure Step. The PPS option for LightSpeed Ultra, allows a Modality Performed Procedure Step to be communicated to the Hospital/Radiology information system. The PPS feature is providing the DICOM Modality Performed Procedure Step service as a service class user (SCU).

Appendix A, specifies the CT/MR IOD information object.

Appendix B, specifies the private data element definition for CT/MR IOD.

Appendix C, specifies the DICOMDIR directory information.

1.2   Overall Conformance Statement Documentation Structure

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

Revision: A

GE Medical Systems   **LightSpeed Ultra CONFORMANCE STATEMENT**
REV 0   **2296445-100**
ILLUSTRATION 1-1

ID/Net v3.0

Introduction to the
Integrated
DICOM/Network
v3.0 (ID/Net v3.0)
Conformance
Statement
Direction: 2118780
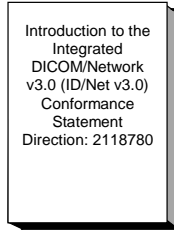
APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

**Product
Implementation:**

CT Advantage

MR Advantage

Lightspeed Ultra
Conformance
Statement
Direction:
2296445-100

......
Conformance
Statement
Direction:
......
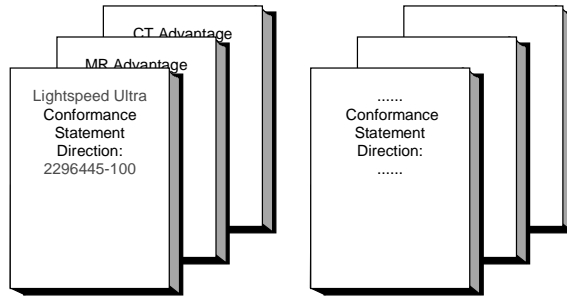
DICOM STANDARD

**Standard
Specification:**

DICOM V 3.0

Part 1

V 3.0

2

V 3.0

3

V 3.0

4

DICOM V 3.0

Part 16
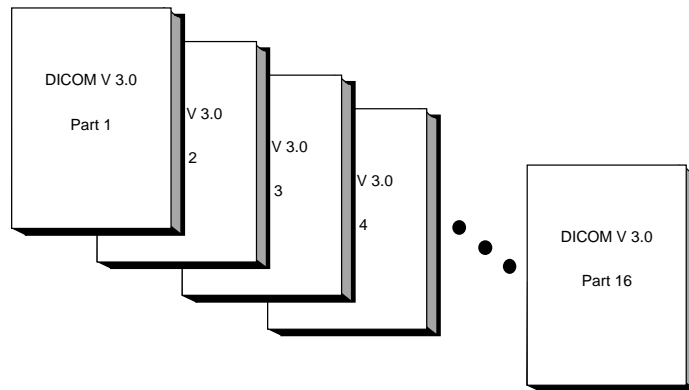
This document specifies the DICOM v3.0 implementation supported by the LightSpeed Ultra. It is entitled:

>LightSpeed *Ultra Conformance Statement for DICOM v3.0 (ID/Net v3.0), Direction 2296445-100*

This Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GE

15

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 ID/Net v3.0 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 more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

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

1.3   Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM 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*

1.4   Scope and Field of Application

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements Direction 2118780,* to provide an unambiguous specification for GE ID/Net v3.0 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 GE ID/Net v3.0 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 GE ID/Net v3.0 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.

1.5   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. ID/Net v3.0 is based on DICOM v3.0 as specified in each ID/Net 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 ID/Net DICOM Conformance

Revision: A

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.

- **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.

1.6   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.*

1.7   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.*

1.8   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.*

Revision: A

2 SECTION 2 - NETWORK CONFORMANCE STATEMENT

2.1   INTRODUCTION

This Conformance Statement (CS) specifies the LightSpeed Ultra compliance to DICOM v3.0. It details the DICOM Service Classes and roles which are supported by this product.

The LightSpeed Ultra 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.

2.2   IMPLEMENTATION MODEL

All DICOM functionality on the LightSpeed Ultra 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.

2.2.1   Application Data Flow Diagram

ILLUSTRATION **2-0**
IMPLEMENTATION MODEL DATA FLOW DIAGRAM
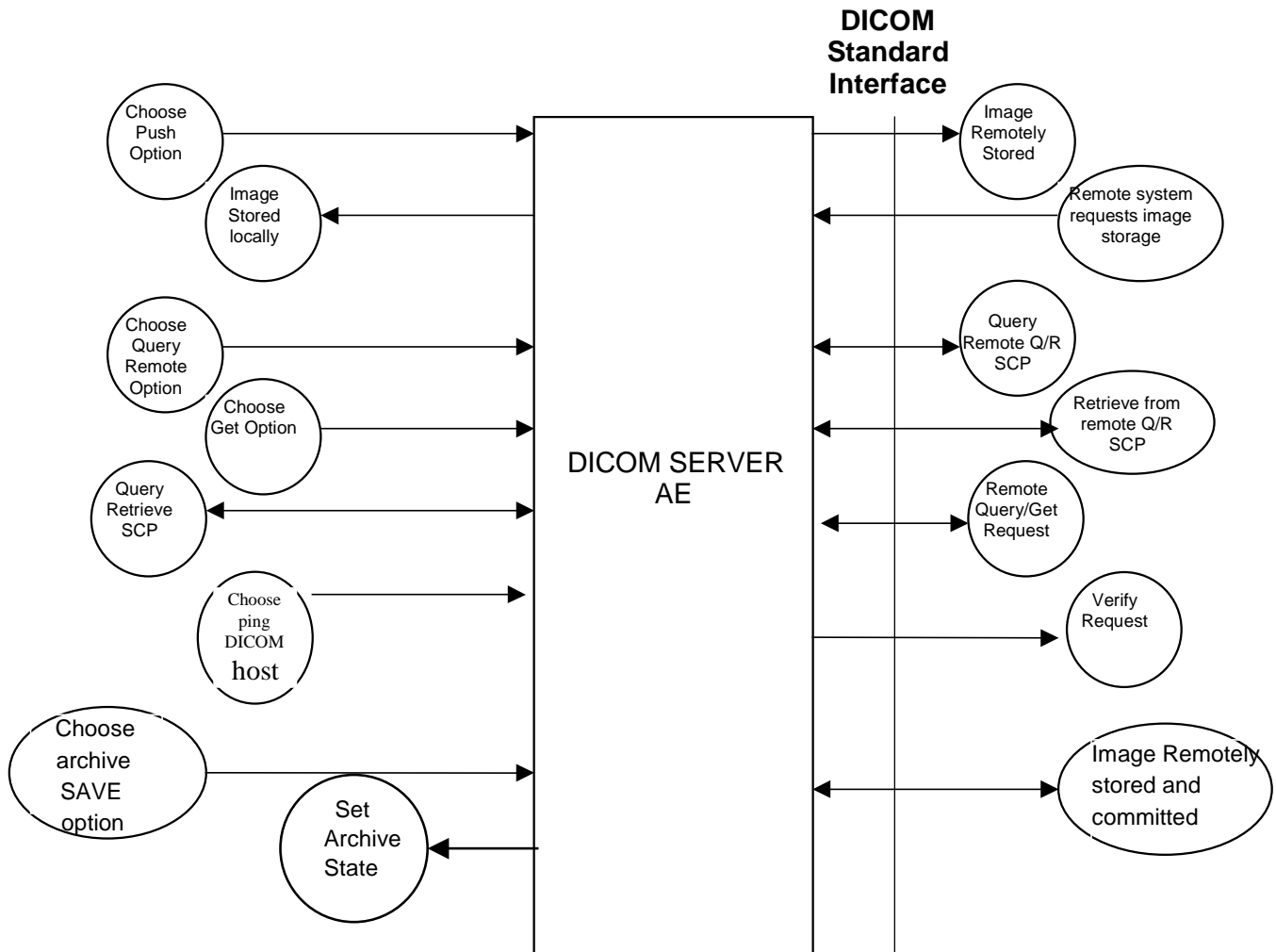
There are five Real-World Activities that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate a DICOM association to a remote DICOM Application Entity.

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 "Push Examination", "Push Series" or "Push 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

20

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 "Get"" 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".

Real-World Activity, *Choose "Ping DICOM host" Option*, consists of an operator selecting "Ping DICOM host" from the "Network" pull down menu. This will cause the DICOM Server AE to initiate a "*DICOM Verification Request*" to the remote AE, to verify the remote system activeness.

The *Choose "storage commitment" Option* Real-World activity consists of an operator configuring the remote node as an "*archive node*" . Select "choose media" option under "Archive" pull down menu. Select "Remote Node" in that menu. Select one or more study, series or image in the local database manager and choose either *"Save Exam"* or "*Save Series*"" from the "Archive" pull down menu. This will cause the DICOM server AE to send the image(s) to the selected destination and wait for the storage commitment from the remote node. The remote node should be a storage commitment provider.

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 LightSpeed Ultra 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.

2.2.2   Functional Definition of AE's

DICOM Server Application Entity initiates the following operations:
- *Ping DICOM Host(Verification)*: The DICOM Server initiates an association and sends a C-ECHO-RQ message to the remote DICOM AE, the remote DICOM Server will send back a C-ECHO-RSP message with a status of "success".
- *Push:* Initiate an association to a Remote AE to send image(s). If the Remote AE accepts the presentation context applicable to the image(s) being sent, the DICOM Server AE will send the image(s) by invoking C-STORE-RQ operation for each image on the same association.
- *Query:* 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.

Revision: A

- *Get:* Send a C-MOVE-RQ request to a Remote AE after successful association establishment. The DICOM Server AE's Storage SCP will receive the images over a separate association.

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.

2.2.3 Sequencing of Real-World Activities

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

2.3 AE SPECIFICATIONS

2.3.1 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
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	1.2.840.10008.1.20.1

Revision: A

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
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

2.3.1.1 Association Establishment Policy

2.3.1.1.1 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	51 Kbytes

SOP class Extended Negotiation is not supported.

Maximum PDU Length of Zero (0) is not supported. The association request will be rejected when a request with "Maximum PDU length of zero" is received.

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 Syntax.

The user information items sent by this product are:
- Maximum PDU Length and,
- Implementation UID

2.3.1.1.2 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 store or respond to an echo.

2.3.1.1.3 Asynchronous Nature

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

2.3.1.1.4 Implementation Identifying Information

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

The Implementation UID for this ID/Net v3.0 Implementation is:

LightSpeed Ultra Implementation UID	1.2.840.113619.6.55

2.3.1.2 Association Initiation by Real-World Activity

This AE attempts to initiate a new association due to a " Ping DICOM Host" or "Push" operation initiated by the user. A new association is also initiated when the user performs a "Query Remote" operation or issues a retrieve operation by performing a "Get" operation at Study/Series/Image level.

2.3.1.2.1 Push Image(s) to Remote AE
2.3.1.2.1.1 Associated Real-World Activity

The operator must first select a destination by choosing "Select 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 "Push Examination", "Push Series", or "Push 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.

2.3.1.2.1.2 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.

Table 2.2.1.2.1.2-1   Proposed Presentation Contexts for DICOM Server AE and Real-World activities Push, Query, Pull(Get Images) and Verification(Dicom Ping) SCUs

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) Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

		Explicit VR Big Endian			
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 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
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Note: Other Abstract Syntax and Transfer Syntax names may be offered when establishing an association. These are private syntax which may be ignored. See section 2.4.

2.3.1.2.1.2.1 SOP Specific Conformance Statement C_STORE SCU

This implementation can perform multiple C-STORE operations over a single association.

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 or received and stops when the association is established. The time-out is 900 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 900 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 60 minutes.

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

Note: The time-outs are configurable.

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

1. If the image is stored locally on the LightSpeed Ultra in DICOM format ("Dicm" 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).

2. If the image is stored locally on the LightSpeed Ultra 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).

2.3.1.2.2 Query Remote AE

2.3.1.2.2.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. To do custom queries select "***Yes***" for "***Custom search***" option.

Note:
Custom queries can be done on the following fields *"Last Name contains", "Exam Number", "Patient Id", "Accession Number".*

To initate a Query select "***Receive***" from "***Network***" pull-down menu.

Note:
If *"Custom Search"* option is set then a small GUI will show up. Operator will be able to enter custom query fields. Entering values in *"Last Name contains"* field will initiate wild card query for patient name.

The *"Query"* operation will cause the DICOM Server AE to initiate an association to the selected Remote AE when the *"Query Remote Host"* entry is selected from the *"Network"* pull-down menu. Once a 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.

2.3.1.2.2.2 Proposed Presentation Contexts

When the Real-World activity *"Query"* or *"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-FIND related contexts are applicable to this activity.

2.3.1.2.2.2.1 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 all studies in the Remote database.

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

Each C-FIND SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 900 seconds and 60 minutes respectively.

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 it fails to parse. Tables 2.3.1.2.2.2.1-1 - 2.3.1.2.2.2.1-3 shows the various fields that are requested at the Study, Series, and Image levels of the C-FIND request.

Query results are filtered based on the Modality field. Only CT/MR images are supported.

Note: In the following tables the Type field has the following meaning:
R - Required   **U** - Unique   **O** - Optional   **P** - Private

Table 2.3.1.2.2.2.1-1: Requested Study Level Keys

Description	Type	Tag	Value
Study date	R	0008,0020	Zero length
Study time	R	0008,0030	Zero length
Accession number	R	0008,0050	Zero length, or value specified in custom query
Patient's name	R	0010,0010	Zero length, or value specified in custom query
Patient id	R	0010,0020	Zero length, or value specified in custom query
Study id	R	0020,0010	Zero length, or value specified in custom query
Study Instance UID	U	0020,000D	Zero length
Study description	O	0008,1030	Zero length
Private Creator Identification	P	0009,00xx	GEMS_IDEN_01
Suite Id	P	0009,xx02	Zero Length

Table 2.3.1.2.2.2.1-2: Requested Series Level Keys

Description	Type	Tag	Value
Study Instance UID	U	0020,000D	Study Instance UID from Study level query response
Modality	R	0008,0060	Zero length
Series number	R	0020,0011	Zero length
Series Instance UID	U	0020,000E	Zero length

Description	Type	Tag	Value
Series description	O	0008,103E	Zero length
Manufacturer	O	0008,0070	Zero length
Images in series	O	0020,1002	Zero length

Table 2.3.1.2.2.2.1-3: Requested Image Level Keys

Description	Type	Tag	Value
Study Instance UID	U	0020,000D	Study Instance UID from Study level query response
Series Instance UID	U	0020,000E	Series Instance UID from Series level query response
Instance number	R	0020,0013	Zero length
SOP 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
Trigger time	O	0018,1060	Zero length
Private Creator Identification	P	0019,00xx	GEMS_ACQU_01
Dfov Rect	P	0019,xx1E	Zero Length
Midscan Time	P	0019,xx24	Zero Length
Azimuth	P	0019,xx26	Zero Length
Number of Echo	P	0019,xx7E	Zero Length
Private Creator Identification	P	0021,00xx	GEMS_RELA_01
Scout Anref	P	0021,xx4A	Zero Length
Private Creator Identification	P	0027,00xx	GEMS_IMAG_01
Location RAS	P	0027,xx40	Zero Length
Location	P	0027,xx41	Zero Length
Center R Coordinate	P	0027,xx42	Zero Length
Center A Coordinate	P	0027,xx43	Zero Length
Table Start Location	P	0027,xx50	Zero Length
Table End Location	P	0027,xx51	Zero Length
RAS Letter for Side of Image	P	0027,xx52	Zero Length
RAS Letter for Anterior/Posterior	P	0027,xx53	Zero Length
RAS Letter for Scout Start Location	P	0027,xx54	Zero Length
RAS Letter for Scout End Location	P	0027,xx55	Zero Length
Image Dimension X	P	0027,xx60	Zero Length

28

Description	Type	Tag	Value
Image Dimension Y	P	0027,xx61	Zero Length

2.3.1.2.3 Get Image(s) from Remote AE

2.3.1.2.3.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select 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.

2.3.1.2.3.2 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.

2.3.1.2.3.2.1 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 900 seconds, 300 seconds and 60 minutes 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.

2.3.1.2.4 Real-World Activity: Verify (DICOM Ping)

2.3.1.2.4.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname.

The operator must then select the "*Ping DICOM host*" form "*Network*" pull-down menu.

The DICOM server will initiate an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

Revision: A

2.3.1.2.4.2 Proposed Presentation Context Table

Refer to the Table 2.2.1.2.1.2-1 for the Proposed Presentation Contexts for DICOM Server AE and Real-World activity Verification

2.3.1.2.4.2.1 SOP Specific DICOM Conformance C_ECHO SCU

The LightSpeed Ultra 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 900 seconds, 30 seconds and 60 minutes respectively

2.3.1.2.5 Real-World Activity: Storage Commitment

2.3.1.2.5.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. Select the "*Update*" option, if the hostname is already present. Set the "*Archive Node*" option to "*Yes*". If the remote host is not present add the remote host in the local database with "*Archive Node*" option set to "*Yes*".

Note :
The remote node should be a Storage Commitment SCP.

The operator must then select " Archive " pull-down menu on the local database manager. Select "*Select Media*" option menu. Select "*Remote Node*" in the menu.

Note :
The remote node option on the archive menu will be present only if a remote node is configured as an archive node.

The operator then selects one or more study, series, or images in the local database manager and then chooses either "Save Examination", "Save Series", or "Save Image" from the "Archive" pull-down menu on the local database manager.

Note:
Also refer to section 5.3.1.3

2.3.1.2.5.2 Proposed Presentation Context Table

Refer to section 5.3.1.4

2.3.1.2.5.3 SOP Specific Conformance Statement Storage Commitment SCU

Refer to section 5.3.1.4

2.3.1.3 Association Acceptance Policy

Revision: A

The DICOM Server AE places limitations on who may connect to it .

If the Remote AE needs to "Push Images" or "Query/Retrieve Images", to the local system then it has to be configured in the Local system to do the same.

To configure a remote AE choose "Select Remote Host" in the "network" pull down menu. Select the Remote Host and choose "Update" option, if the Remote AE is already present. If the Remote AE is not present choose "Add" option to add the Remote AE.

Set "Push Images" option to "Yes" , if the Remote AE needs to push images to the Local system

Set "Query/Retrieve" option to "Yes", if the Remote AE needs to "Query/Retrieve" the local system.

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.

2.3.1.3.1 Receive Image(s)

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

2.3.1.3.1.1 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 LightSpeed Ultra.

2.3.1.3.1.2 Presentation Context Table

Table 2.2.1.3.1.2-1:   Accepted Presentation Contexts for DICOM Server AE and Real-World Activity Receive Image(s)

Presentation Context Table - Accepted					
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 Implicit VR Big Endian (GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCP	None

31

		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
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
		Implicit VR Big Endian (GE Private)	1.2.840.113619.5.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Implicit VR Big Endian (GE Private)	1.2.840.113619.5.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Note: The SCP does not have a default acceptance policy if more than one acceptable transfer syntax is proposed by the SCU. It is the responsibility of the SCU to make a selection from more than one transfer sentences accepted.

2.3.1.3.1.2.1   SOP Specific Conformance to C_STORE SCP

The DICOM Server AE conforms to the SOP's of the Storage Service Class at level 1 (base). Private elements will be discarded from the image when receiving images containing non-GE private data elements. All of the **standard** type elements (1,1c,2,2c,3) will be retained.

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 LightSpeed Ultra system.

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

- A800 (SOP Class not supported)

Revision: A

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 LightSpeed Ultra 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 LightSpeed Ultra 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,xx01) 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:
1. the translator will do its best to convert the image and will use default values where DICOM fields are missing
2. If certain critical information is not provided then the image will be stored as a Secondary Capture

It is strongly suggested that if GE private element (0009,xx01) is present then all GE private elements originally associated with the image be preserved.

Note :
        The images created on LightSpeed Ultra system will be stored as DICOM images with GE Big endian (Private transfer syntax) on the system.
        The private element (0009,xx01) will have the value "CT_LIGHTSPEED".

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.

2.3.1.3.2 Verification Request from Remote AE

Revision: A

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

2.3.1.3.2.1 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.

2.3.1.3.2.2 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

2.3.1.3.2.2.1 SOP Specific Conformance to C_ECHO SCP

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 900 seconds, 30 seconds and 60 minutes respectively.

2.3.1.3.3 Query Request from Remote AE

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

2.3.1.3.3.1 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.

2.3.1.3.3.2 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

2.3.1.3.3.2.1   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 900 seconds, 900 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.

Note: In the following tables the type field has the following meaning:
R - Required **U** - Unique   **O** - Optional **P** - Private

Table 2.3.1.3.3.2.1-1 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
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
Suite Id	P	0009,0002	Returned

Table 2.3.1.3.3.2.1-2 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
Manufacturer	O	0008,0070	Returned
Images in series	O	0020,1002	Returned

Table 2.3.1.3.3.2.1-3 Supported image level keys

Description	Type	Tag	Usage
Instance number	R	0020,0013	Matched
SOP Instance UID	U	0008,0018	Matched
Image type	O	0008,0008	Returned
Rows	O	0028,0010	Returned
Columns	O	0028,0011	Returned

Description	Type	Tag	Usage
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
Dfov Rect	P	0019,001E	Returned
Midscan Time	P	0019,0024	Returned
Azimuth	P	0019,0026	Returned
Number of Echo	P	0019,007E	Returned
Scout Anref	P	0021,004A	Returned
Location RAS	P	0027,0040	Returned
Location	P	0027,0041	Returned
Center R Coordinate	P	0027,0042	Returned
Center A Coordinate	P	0027,0043	Returned
Table Start Location	P	0027,0050	Returned
Table End Location	P	0027,0051	Returned
RAS Letter for Side of Image	P	0027,0052	Returned
RAS Letter for Anterior/Posterior	P	0027,0053	Returned
RAS Letter for Scout Start Location	P	0027,0054	Returned
RAS Letter for Scout End Location	P	0027,0055	Returned
Image Dimension X	P	0027,0060	Returned
Image Dimension Y	P	0027,0061	Returned

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.

Sequence matching is not supported.

Range matching is supported for attributes of type date and time.

Only hierarchical query is supported.

Revision: A

2.3.1.3.4 Retrieve Request From Remote AE

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

2.3.1.3.4.1 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.

2.3.1.3.4.2 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	SCP	None

2.3.1.3.4.2.1 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 900 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

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 another GE Medical Systems product.

2.3.1.3.4.3 Presentation Context Acceptance Criteria

No criterion.

2.3.1.3.4.4 Transfer Syntax Selection Policy

All protocols detailed above in the tables are supported, no priority selection is given.

2.4   COMMUNICATION PROFILES

2.4.1   Supported Communication Stacks (parts 8,9)

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

2.4.2   TCP/IP Stack

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

2.4.2.1   Physical Media Support

Ethernet v2.0, IEEE 802.3. Auto senses 10/100 Base T Ethernet connection.

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

Revision: A

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Specialized Information Object Definition

Following is a list of additional private attributes defined for a standard **CT IOD**.

(0008,0008)   Value 3: CT Image IOD specific specializations
               AXIAL
               LOCALIZER
               SEGMENTED
               REFORMATTED
               PROCESSED
               COMBINED

               Value 4 : CT Image implementation specific
               MIN IP
               MIP
               AVERAGE
               VOLREN
               INTEGRAL
               HD MIP
               RAYSUM
               SURFACE
               MINMAX

(0018,0022)   Scan Options : Defined Terms
               AXIAL MODE
               DYNAMIC MODE
               SCOUT MODE
               AXIAL MODE
               STATIC XRON MODE
               STATIC XROFF MODE
               TUBE HEAT MODE
               DAS MODE
               TUBE CAL MODE
               BIOPSY MODE
               CINE
               HELICAL
               ROTGENCAL MODE

2.5.2 Private SOP's

ID/Net v2.0 Private IOD's are based upon the April 1993 draft version of the DICOM v3.0. ID/Net v2.0 IOD's are supported for backward compatibility.

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

Presentation Context Table - Accepted / Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
GE Private DICOM MR Image Information Object	1.2.840.113619.4.2	Implicit VR Little Endian	1.2.840.10008.1.2	Both	None

39

(ID/Net v2.0 compatible)					
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

2.5.3 Private Data Elements

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

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

The LightSpeed Ultra 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 "Select Remote Host" from the "Network" pull-down menu from the local database manager.

2.6.2 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

40

- Time-outs, which are set for all hosts, are configurable in dcs.cfg:
  *Association time-out   - *bi_assoc_tio*
  *Session timeout   - *bi_session_tio*
  *Create timeout   - *bi_ncreate_tio*

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

Note: The local port on which the LightSpeed Ultra system receives DICOM incoming TCP connections is port **4006**.

2.7   SUPPORT OF EXTENDED CHARACTER SETS

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

Revision: A

3 MEDIA STORAGE CONFORMANCE STATEMENT

3.1   Introduction

This section specifies the LightSpeed Ultra conformance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles which are supported by this product.

3.2   Implementation Model : MOD Archive Server

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

3.2.1   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, and Secondary Capture IODs.

ILLUSTRATION 3-1:
SPECIFIC AE APPLICATION MODEL

Revision: A
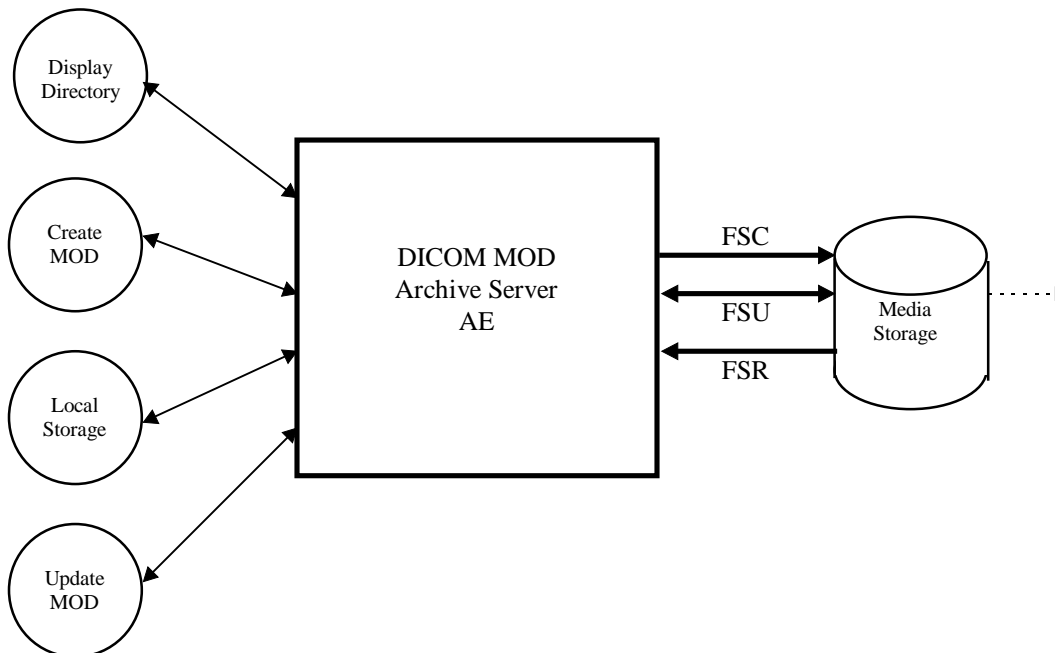
The product has a local storage that may contain various SOP instances. These may have been obtained by original creation, network transfer (DICOM or proprietary), or by reading removable media from other devices. The origin of SOP instances is outside the scope of this claim.

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.

3.2.2   Functional Definitions of AE's

This product has only one media interchange Application Entity: the MOD Archive Server AE.

The MOD Archive Server 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")

3.2.3   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 DICOM SOP instances in the File-set.

There are no other sequencing requirements.

3.2.4   File Meta Information for Implementation Class and Version

The File Meta-Information for this implementation is:

File Meta-Information Version	1
Implementation UID	1.2.840.113619.6.55
Implementation Version Name	1.0

Revision: A

3.3   AE Specifications

3.3.1   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 3.1-1.

Table 3.1-1: Application Profile, Activities and Roles for MOD Update

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

As an FSU role, the system will produce directory sequences for each SOP instance that is added to the File-set consistent with the AUG-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.

Note:
        Early installed base systems may require an upgrade to properly act as FSU or FSR of the STD-CTMR-MOD{12,23} profile. See Section 3.4.2.1.

3.3.1.1   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**

3.3.1.2   Real World Activities

3.3.1.2.1   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 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 3.1-1. These SOP instances are written to the media and a corresponding DICOMDIR sequence record is created.

3.3.1.2.1.1 Application Profiles for the RWA: Create MOD

The Create MOD RWA applies to the STD-CTMR and AUG-CTMR Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

3.3.1.2.1.2 Options:

Following are the SOP Class, Photometric Interpretation, and Transfer Syntax combinations created by this AE as an FSC/FSU.

Table 3.3.1.2.1.2-1 : IODs and Transfer Syntaxes supported for RWA: Create MOD

SOP Class	SOP Class UID	Photometric Interpretation Value	Transfer Syntax	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	-	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
CT Image	1.2.840.10008.5.1.4.1.1.2	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
CT Image	1.2.840.10008.5.1.4.1.1.2	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2
MR Image	1.2.840.10008.5.1.4.1.1.4	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
MR Image	1.2.840.10008.5.1.4.1.1.4	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2

Notes:

The Media Archive Server AE does not support writing images using the Explicit VR Little Endian Transfer Syntax as an FSC/FSU of the STD-CTMR profiles.

The Media Archive Server AE does not support writing Secondary Capture Palette Color images as an FSC/FSU of the STD-CTMR profiles.

The default Transfer Syntax for writing images is JPEG Lossless. Use of Explicit VR Big Endian Transfer Syntax may be configured by a field service engineer.

3.3.1.2.2 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 Series in the File-set that have Modality value of "CT" or "MR".

3.3.1.2.2.1 Application Profiles for the RWA: MOD Display Directory

The MOD Display Directory RWA applies to all Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

3.3.1.2.2.2 Options:

None applicable.

3.3.1.2.3 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.

Note:
        The MOD Display Directory Real-World Activity will filter out Series that do not match the Modality value of "CT" or "MR"; hence any SOP Instances in non-CT/MR series will not be able to be copied to local storage.

3.3.1.2.3.1 Application Profiles for the RWA: Copy to Local Storage

The MOD Copy to Local Storage RWA applies to all Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

3.3.1.2.3.2 Options:

Following are the SOP Class, Photometric Interpretation, and Transfer Syntax combinations read by this AE as an FSR for copy to local storage.

Table 3.3.1.2.3.2-1 : IODs and Transfer Syntaxes supported for RWA: Copy to Local Storage

SOP Class	SOP Class UID	Photometric Interpretation Value	Transfer Syntax	Transfer Syntax UID
CT Image	1.2.840.10008.5.1.4.1.1.2	MONOCHROME2	Explicit VR Little Endian	1.2.840.10008.1.2.1

Revision: A

CT Image	1.2.840.10008.5.1.4.1.1.2	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
CT Image	1.2.840.10008.5.1.4.1.1.2	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2
MR Image	1.2.840.10008.5.1.4.1.1.4	MONOCHROME2	Explicit VR Little Endian	1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
MR Image	1.2.840.10008.5.1.4.1.1.4	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	MONOCHROME2	Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	MONOCHROME2	JPEG Lossless Process 14 (selection value 1)	1.2.840.10008.1.2.4.70
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	MONOCHROME2	Explicit VR Big Endian	1.2.840.10008.1.2.2

3.3.1.2.4   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 3.1-1. 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.

3.3.1.2.4.1   Application Profiles for the RWA: Update MOD Request

The Update MOD Request RWA applies to the STD-CTMR and AUG-CTMR Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

3.3.1.2.4.2 Options:

See Section 3.3.1.2.1.2.

Revision: A

3.4   Augmented and Private Application Profiles

3.4.1   Augmented Application Profiles

3.4.1.1   AUG-CTMR-MOD12 and AUG-CTMR-MOD23 Application Profiles

The AUG-CTMR-MOD12 and AUG-CTMR-MOD23 Application Profiles (hereinafter denoted AUG-CTMR) are augmentations of the corresponding STD-CTMR Application Profiles.

3.4.1.1.1   SOP Classes and Transfer Syntaxes

The AUG-CTMR Application Profiles add the following SOP Classes and Transfer Syntaxes to the STD-CTMR Profile:

Table 3.4.1.1.1-1 : Additional IODs and Transfer Syntaxes for AUG-CTMR Application Profiles

Information Object Definition	SOP Class UID	Transfer Syntax and UID	FSC Req.	FSR Req.	FSU Req.
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	O	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	O	O
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	O	O

3.4.1.1.2   Directory Information in DICOMDIR

The modality attribute (0008,0060) value in the DICOMDIR Series records shall be CT or MR.

3.4.1.1.3   Other Parameters

3.4.1.1.3.1   Image Attribute Values

The attributes listed in Table 3.3.3.1.5.1-1 used within the Image files shall take the values specified.

Table 3.3.3.1.5.1-1: AUG-CTMR Profiles Required Image Attribute Values

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).

3.4.2 Private Application Profiles

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

3.4.2.1 PRI-CTMR-MOD12 Private Application Profile

The PRI-CTMR-MOD12 Application Profile specifies the media interchange of CT and MR objects using an improper JPEG compression process. This process, formerly used in some GE products but now retired, resulted in interoperability problems when SOP Instances were decoded using readily available industry decompression routines. In most respects, this profile is identical to the STD-CTMR-MOD12 Application Profile.

3.4.2.1.1 Roles and Service Class Options

Since the process that created media with this profile is now retired, the only Role allowed is File-Set Reader.

3.4.2.1.2 SOP Classes and Transfer Syntax

The PRI-CTMR-MOD12 Application Profile is defined for the SOP Classes and corresponding Transfer Syntax of the following table:

Table 3.4.2.1.2-1 : IODs and Transfer Syntaxes for PRI-CTMR-MOD12 Application Profile

Information Object Definition	SOP Class UID	Transfer Syntax and UID	FSC Req.	FSR Req.	FSU Req.
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	O	-
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	O	-
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	O	-

Note:

The Transfer Syntax specified in Table 3.4.2.1.2-1 is the one declared in the File Meta-Information Header, but in fact an improper encoding of that Transfer Syntax is used in the image objects. See 3.4.2.1.5.1.

3.4.2.1.3 Physical Media and Media Formats

The PRI-CTMR-MOD12 Application Profile requires the 130mm 1.2GB 512 Byte per Sector Magneto-Optical Rewriteable physical media with the PC File System, as defined in PS3.12.

3.4.2.1.4 Directory Information in DICOMDIR

Revision: A

The PRI-CTMR-MOD12 Application Profile uses the same Directory Information as the STD-CTMR-MOD12 Profile, except that the Frame of Reference UID (0020,0052) key Attribute of the IMAGE Directory Records is not present.

Notes:
   The absence of the Frame of Reference UID Attribute in the IMAGE Directory Record is used by the product as an indication that the referenced SOP Instance has been encoded by the improper JPEG encoder.

3.4.2.1.5 Other Parameters

3.4.2.1.5.1 Image Attribute Values

The Pixel Data (7FE0,0010) of SOP Instances stored with Transfer Syntax JPEG Lossless Process 14 (selection value 1), UID 1.2.840.10008.1.2.4.70, are improperly encoded as follows:

- In the JPEG 'SOS' (0xFFDA) header, the entropy coding table selector codes are 0x11. (They should be 0x00.) This is the key indication that the pixel data has been encoded by the improper JPEG encoder.
- The 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 computation of the pixel value difference to be entropy encoded is computed as (Predictor - value). (It should be calculated as (value - Predictor).)

3.5   Extensions, Specializations and Privatization of SOP Classes and Transfer Syntax

3.5.1   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.

3.5.1.1   SOP Specific Conformance Statement for CT SOP Class

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

3.5.1.2   SOP Specific Conformance Statement for MR SOP Class

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

3.6   Configuration

The MOD Archive Application may have either a 1.2GB or a 2.3GB drive installed.

Revision: A

Table 3.5-1 : Supported Profiles for various Drive Configurations

Disk Drive Installed	Profiles Supported
1.2GB Optical Disk Drive	PRI-CTMR-MOD12
	STD-CTMR-MOD12
2.3GB-Optical Disk Drive	PRI-CTMR-MOD12
	STD-CTMR-MOD12
	STD-CTMR-MOD23

3.7 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.

Revision: A

4   PRINT SCU   CONFORMANCE

4.1 Introduction

This conformance statement specifies the LightSpeed Ultra conformance to the DICOM Print SCU Application Profile. The LightSpeed Ultra product uses DICOM Print SCU to print images on DICOM Compliant Printers.

4.2   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.

4.2.1   Application Data Flow Diagram

DICOM print SCU Implementation model

DICOM INTERFACE

Film Composer → PRINT SCU → DICOM Printer
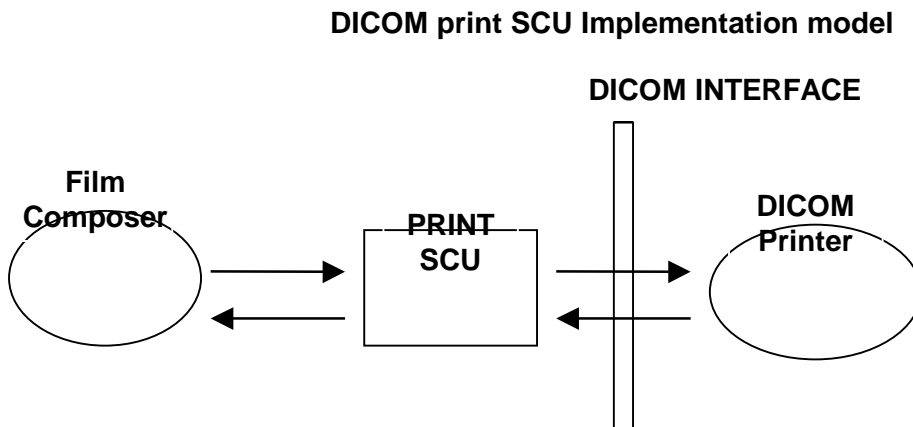
The Film Composer is the User interface and this is used to initiate the local real world activity. The user issues the print request using Film Composer. Film composer allows printer selection and it composes the pre-formatted film file. This film file is interpreted by Print SCU and it sends the appropriate messages to DICOM print SCP running on a DICOM printer.

4.2.2   Functional Definition of AE's

DICOM Print SCU Establishes the Association to the requested printer for printing the composed film.

4.2.3   Sequencing of Real-World Activities

Revision: A

- The DICOM printer is installed through a camera installation process. The DICOM printer is selected from the Film Composer Interface for Manual Filming. Autofilming is enabled using the camera setup via the camera installation process.
- Images may be acquired for printing in the following manner:
  - Images to be printed may be manually dropped from Viewing applications into the manual film composer slots.
  - Images to be printed may be automatically dropped from Viewing applications into the manual film composer slots.
  - Images to be printed may be manually dropped from Viewing applications into the auto film composer slots.
  - Image series to be printed may be automatically dropped from the PrintSeries application into the manual film composer slots.
  - Images to be printed may be automatically dropped from the Scanning Application into the auto film composer slots.
- Based upon the filming mode (and the attributes) used to acquire images into the film composer, films will be automatically printed when the film session is full, or the user must press the Print Button to print the images.
- The Print SCU retrieves the Print SCP status by using the N-GET service of Printer SOP Class. If the printer returns a FAILURE status the print session will be terminated. The printer status is not read.
- The film session is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film session.
- The film box is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film box.
- The images are placed on the film box by using the N-SET. If the printer fails to place the image on the film box, the print session will be terminated.
- The film will be printed using the N-ACTION. Only film box printing is supported. If the printer fails to print the film, the print session will be terminated.
- After the successful N-ACTION, the film box will be deleted using the N-DELETE. Any N-EVENT-REPORTS given to the PRINT SCU will be received but the data is ignored. After the film box is deleted, the association will be closed.
- Upon the successful completion of the above sequencing and the association is closed, the user will be notified of the successful print session.

4.3   AE SPECIFICATIONS

4.3.1   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**

4.3.1.1 Association Establishment Policy

4.3.1.1.1 General

The Film Composer provides options to indicate the printer AE title and Printer host name. These parameters are used by the Print SCU to 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	16 Kbytes

4.3.1.1.2 Number of Associations

The Print SCU will initiate only one association with printer. Multiple associations are not supported.

4.3.1.1.3 Asynchronous Nature

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

4.3.1.1.4 Implementation identifying information

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

The Implementation UID for this ID/Net v3.0 Implementation is:

LightSpeed Ultra Implementation UID	1.2.840.113619.6.55

4.3.1.2 Association Establishment Policy

Print SCU initiates the association with the Printer.

4.3.1.2.1 Real World Activity

4.3.1.2.1.1 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 the 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 the user presses the "Print" Button, the Film composer communicates this request to

Print SCU which then tries to establish the association with the requested printer and transmits the images for printing.

4.3.1.2.1.2 Proposed Presentation Contexts

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

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Verification SOP Class	1.2.840.10008.1.1	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Printer SOP Class	1.2.840.10008.5.1.1.16	DICOM Implict 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

Note: Certain Presentation Contexts may be negotiated that are not used during the association. See the following sections for the DICOM Print services performed by the LightSpeed Ultra.

4.3.1.2.2 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.

The Print SOP Classes supported by Print SCU :

NAME	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP	1.2.840.10008.5.1.1.4
Printer SOP Class	1.2.840.10008.5.11.16

 The Print SCU does not support any optional SOP Classes.

 Note: The asterisk (*) preceding some of the SOP attributes in the following sections indicates optional SCP attributes. The SCU is aware of these optional attributes and will not fail on the receipt of a response without the optional attributes; the limitation being that this information is not available for the User. Some SCP's will terminate the association with a failure upon the receipt of an optional attribute it does not support.

4.3.1.2.2.1 Basic Film Session SOP Class

Revision: A

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 / MED / LOW	Set in Configuration file (Default value is HIGH)
* Medium Type	(2000, 0030)	CLEAR FILM BLUE FILM PAPER	Set in Configuration File
* Film Destination	(2000, 0040)	MAGAZINE PROCESSOR	Set in Configuration File

Note: * denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film session the following action will be taken by Print SCU:
0x213 "Resource Limitation" message will be sent.
All other status "Failure" message will be sent.
In all the cases the print session will be terminated.

4.3.1.2.2.2 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)	0-4094	Set in Configuration File
*Trim	(2010, 0140)	NO	NO

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

Note: * denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film box following action will be taken by Print SCU.

0x213   "Resource Limitation" message will be sent.

0x106   "Unsupported Film Format" message will be sent.

All other status "Failure" message will be sent

In all the cases the print session will be terminated.

If Failure status is returned during N-ACTION operation of Film box following action will be taken by Print SCU.

0xC602   "Unable to Create Print Job" message will be sent.

All other status "Failure" message will be sent.

In all the cases the print session will be terminated.

If Failure status is returned during N-DELETE operation of Film box following action will be taken by Print SCU.

All the return status   "Failure" message will be sent and the print session will be terminated.

Revision: A

4.3.1.2.2.3 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
Pre-formatted 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

Note: * denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-SET operation of Image Box following action will be taken by Print SCU.
0xC605   "Resources temporarily not available" message will be sent.
All other status   "Failure" message will be sent.
In all the cases the print session will be terminated.

4.3.1.2.2.4 Printer SOP Class

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.

Print SCU issues the request to retrieve the following attributes:

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

The Print SCU issues the N-GET service to retrieve the printer status. The status is 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.
   For all other Printer Status Info (2110, 0020) values, the status is ignored and the print job continues.

4.3.1.2.2.5 Print Job SOP Class

Print SCU looks for 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 using N-GET .

Attribute Name	DICOM Tag	Default Value
Execution Status	(2100, 0020)	Value returned by Print SCP
Execution Status info	(2100, 0030)	Value returned by Print SCP
Print Priority	(2000, 0020)	Value returned by Print SCP
Creation Date	(2100, 0040)	Value returned by Print SCP
Creation Time	(2100, 0050)	Value returned by Print SCP
Printer Name	(2110, 0030)	Value returned by Print SCP
Originator	(2100, 0070)	Value returned by Print SCP

4.3.1.3 Association Acceptance Policy

The Print SCU does not accept associations.

4.4   COMMUNICATION PROFILES

Revision: A

4.4.1   Supported Communication Stacks (parts 8,9)

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

4.4.1.1   TCP/IP Stack

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

4.4.1.1.1   API

Not Applicable

4.4.1.1.2   Physical Media Support

Ethernet v2.0, IEEE 802.3**.**

4.5   Standard Extended/Specialized/Private SOPs

None.

4.6   Configuration

4.6.1   AE Title/Presentation Address Mapping

The Local AE title is "hostname_DCP", where "hostname" is the unique hostname within the network.

The LightSpeed Ultra 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 Service Desktop camera installation utility.

4.6.2   Configurable Parameters

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

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

- Local IP Address
- Local IP Netmask
- Max PDU length
- The following DICOM print parameters are configurable. The valid ranges are shown in earlier sections of this conformance statement.
  - Medium Type (2000, 0030)

- Film Destination (2000, 0040)
- Magnification Type (2010, 0060)
- Min Density (2010, 0120)
- Max Density (2010, 0130)
- Empty Image Density (2010, 0110)
- Border Density (2010, 0100)
- Configuration Information (2010, 0150)
- Smoothing Type (2010, 0080)

- The following network timers are supported and are configurable. When these timers expire the association is terminated. The default values are:
  - Association Time out = 600 seconds
  - Session Time out = 3000 seconds (total time for open association)
  - N-SET Time out = 300 seconds
  - N-ACTION Time out = 300 seconds
  - N-CREATE Time out = 300 seconds
  - N-DELETE Time out = 300 seconds
  - N-GET Time out = 100 seconds

- Time-outs, which are set for all hosts, are configurable in dprint.cfg:
  - *Association time-out   - *bi_assoc_tio*
  - *Session timeout   - *bi_session_tio*
  - *Create timeout   - *bi_ncreate_tio*

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

4.7   Support of Extended Character Set

The Print SCU does not support any Extended Character Set.

Revision: A

5 Storage Commitment Conformance

5.1 Introduction

This section of the DICOM conformance statement specifies LightSpeed Ultra compliance to the Storage Commitment Push Model SOP Class.

5.2 Implementation Model

5.2.1 Application data flow diagram

Illustration 5-0 is a subset of Illustration 2-0 showing the data flow diagram for Storage Commitment.

ILLUSTRATION 5-0

APPLICATION DATA FLOW DIAGRAM
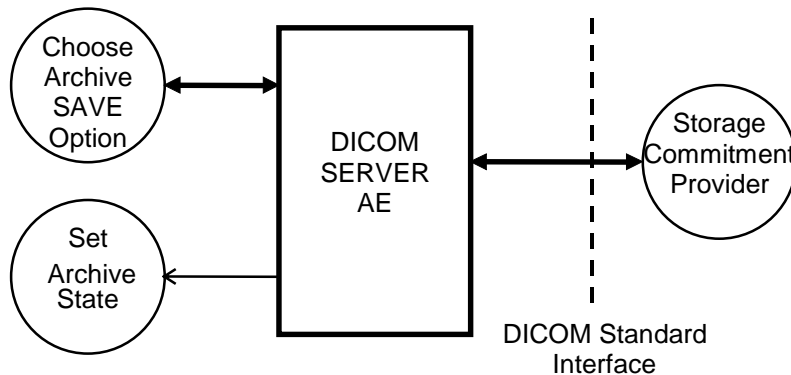
There is only one Real-World activity that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate an association to a remote DICOM entity that is a Service Class Provider (SCP) of the Storage Commitment SOP class.

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.

The Real-World activity *Set Archive State* is performed by the DICOM Server AE to respond to an incoming Storage Commitment response from the remote DICOM AE.

5.2.2 Functional definitions

DICOM Server AE initiates the following operations:
- Negotiates and establishes association with remote Storage Commitment Provider
- Sends the selected images to the remote DICOM AE.
- Closes the association.
- If all the images are transferred without failures the following steps will be executed. If there are any failures the job will marked as failed and the Storage Commitment request will not be sent.
- Establishes a new association for sending the commitment request. Here note that a storage Commitment request does not imply that the acquisition of images is complete.
- Receives the response on same association or on a different association.
- Updates the archive flag information for successful instances. The archive flag is shared with the local archive and the two can not be distinguished.

5.2.3 Sequencing of real-world activities

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.

5.3 AE Specifications

5.3.1 DICOM Server AE specifications

In addition to the SOP Classes defined in Section 3.3.1, the DICOM Server AE provides Standard Conformance to the following SOP class as an SCU:

SOP class name	SOP class UID
Storage Commitment Push model SOP class	1.2.840.10008.1.20.1

5.3.1.1 Association establishment policies

The association establishment policies for the DICOM Server AE are described in Section 3.3.1.1.

5.3.1.2 Association initiation policy

An association is initiated by the Storage SCU to the provider to send the images to be committed. A separate association is established to send the commitment request.

5.3.1.3 Real World Activity

5.3.1.3.1 Associated Real World Activity - "Save exam/series"

See Section 2.3.1.2.1. The user selects the exam/series to be archived. 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.

Revision: A

5.3.1.3.2 Associated Real World Activity - "Auto Archive exam/series"

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.

5.3.1.4 Proposed Presentation Contexts

The Proposed Presentation Context table for the DICOM Storage Commitment SCU is as shown in following Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name	UID		Negotiation
Storage Commitment Push Model	1.2.840.10008.1.20.1	DICOM Implict VR Little Endian	1.2.840.10008.1.2	SCU	None

The Storage Commitment SCU can send the commitment request for following DICOM 3.0 SOP classes.

NAME	UID
CT Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.2
MR Image storage SOP Class	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Storage SOP Class	1.2.840.10008.5.1.4.1.1.7

5.3.1.5 Request Processing

The images in the selected exam/series are sent to the remote commitment provider entity using   DICOM C-STORE operations. If there are any failures in the image transfers the Storage commitment request will not be sent. The corresponding job will be marked as failed and user will be notified of the status of job.

If all the images are successfully transferred then the commitment request will be sent on a different association with the list of sop instances.

If the N-Action request fails, the job will be marked as failed otherwise following sequence of actions will take place.

The SCU waits for **N-Action-Rsp** from provider on the same association for a configurable amount of time. If it does not receive **N-Action-Rsp** during this time it will close the association. It changes the Job state to "Wait" indicating the job is waiting for the response from commitment provider. The job will be marked as failed if the response is not received by *stop job time*. Stop job time is the maximum duration the job can wait for responses.

Revision: A

A New transaction uid will be created for each retry by user. The old transaction uid is not applicable for these requests.

The Following DIMSE service Elements are supported for the Storage Commitment request and response processing.

N-ACTION - Requests the remote Storage Commitment SCP to commit to storing the image instances.

N-EVENT-REPORT - The response sent by the remote Storage Commitment SCP.

The following attributes are sent as part of the **DATA Set** for the **N-Action request**.

Attribute	Tag	Value
Transaction UID	(0008,1195)	Transaction UID
Referenced SOP Sequence	(0008,1199)	
>SOP Class UID	(0008,1150)	
>SOP Instance UID	(0008,1155)	

- Referenced Study Component sequence attribute is not sent.
- Storage Media File-Set ID and Storage Media File-Set UID attributes are not supported.

5.3.1.6 Response Processing

Once the N-EVENT REPORT response is received, the following actions will be taken depending on the status of response.

5.3.1.6.1 Commit response with SUCCESS status

The Archive flag information in the browser for all the successful instances will be updated. The status will be changed to "Y" .

The job queue entry will be removed

Note :
- The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP

Attribute	Tag	Value
Transaction UID	(0008,1195)	Value received from SCP
Referenced SOP Sequence	(0008,1199)	Value received from SCP
>SOP Class UID	(0008,1150)	Value received from SCP
>SOP Instance UID	(0008,1155)	Value received from SCP

Revision: A

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

5.3.1.6.2 Commit response with FAILURE status

The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP

Attribute	Tag	Value
Transaction UID	(0008,1195)	Value received from SCP
Failed SOP Sequence	(0008,1199)	Value received from SCP
>SOP Class UID	(0008,1150)	Value received from SCP
>SOP Instance UID	(0008,1155)	Value received from SCP
>Failure Reason	(0008,1197)	Value received from SCP

In case of complete/partial failure the user will be notified about the status and the job entry will be paused. There is no attempt made to retry automatically the failed sop instances. However the user can manually retry the failed jobs. Such requests will be treated as new requests. This will go through the whole sequence of operations once again.

The failure reason is ignored.

Failed SOP instances will have their archive flag information unaltered.

Note :
The archive status flag in the browser is a shared flag with local archive. When the status is "Y", it means that the images are archived but doesn't specify whether on local archive device or remote archive device. It is left to the user's discretion whether the local sop instances (with their archive flag set to "Y") are to be deleted.

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

5.3.1.7 Association Acceptance Policy

A single association will be accepted at any time to receive Storage Commitment responses.

Revision: A

6   Modality Work List Conformance

6.1   INTRODUCTION

This section of the DICOM Conformance Statement specifies the LightSpeed Ultra compliance to DICOM conformance requirements for the Modality Worklist features on this GEMS product.

The Modality Worklist option for LightSpeed Ultra allows a user to query for and display DICOM modality worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the scanner. In this situation, Modality Worklist is providing the DICOM C-FIND service as a service class user (SCU).

6.2   IMPLEMENTATION MODEL

All DICOM functionality provided by the Modality Worklist feature is logically provided by the Worklist Server DICOM AE. The Worklist Server DICOM AE is commanded to perform DICOM modality worklist query services through the use of the LightSpeed Ultra user interface.

6.2.1   Application Data Flow Diagram

ILLUSTRATION 6-0

MODALITY WORKLIST DATA FLOW DIAGRAM
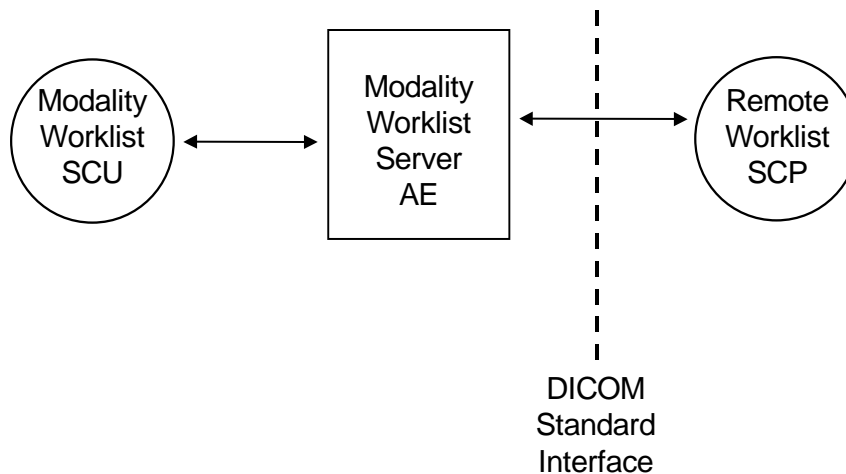
6.2.2   Functional definitions

The ModalityWorklist Worklist Server AE is implemented as an application process on the scanner host computer. It runs as a daemon serving requests from the user interface to obtain modality worklists, query remote AE's and return the results to the user interface.

The ModalityWorklist Worklist Server AE initiates the following functions:

Revision: A

- *Query*: Initiates a DICOM association in order to query a remote AE. If the remote AE accepts a presentation context applicable to modality worklist, the Worklist Server AE will issue a modality worklist query request via the C-FIND service.

6.2.3   Sequencing of Real-World Activities

1. The user or the system initiates a modality worklist query (as a modality worklist SCU) to the modality worklist SCP with a given set of query parameters.
2. The modality worklist SCP returns responses which match the query parameters.
3. Items from the returned worklist responses are presented to the user.
4. A subset of the returned worklist responses are included in acquired DICOM images related to the responses.

6.3   AE SPECIFICATIONS

6.3.1   Worklist Server AE Specification

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

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

6.3.1.1   Association Establishment Policies

6.3.1.1.1   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 an association initiated by the DICOM Worklist Server is:

Maximum Length PDU	50 Kbytes

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 1.

6.3.1.1.2   Number of Associations

The Worklist Server AE (SCU) will initiate only one DICOM association at a time to perform a modality worklist query of a single remote AE.

6.3.1.1.3   Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

68

Revision: A

6.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

ModalityWorklist for LightSpeed Ultra Implementation UID	1.2.840.113619.6.50

6.3.1.2 Association Initiation Policy

The Worklist Server AE initiates a new association due to an update operation being initiated from the Lightspeed Ultra user interface.

6.3.1.2.1 Real-World Activity: Worklist Query

5.3.1.7.1.1 Associated Real-World Activity

The operator of the system initiates a query for a modality worklist by either opening the Schedule screen or by opening the Schedule screen and pressing the Update button. The choice of which of these two behaviors occurs is user configurable. The Worklist Server will then initiate an association with the remote AE in order to query for the worklist.

A user can configure a number of parameters which directly control the worklist query request. The user can request worklist items that are intended for the scanner the user is working at, all items that apply to the modality of the scanner the user is working at or all worklist items available. These selections and their affects on worklist query parameters are given below:

This Scanner:

- Modality, (0008,0060) - set to CT
- Scheduled Station AE Title, (0040,0001) - set to local AE title

This Modality:

- Modality, (0008,0060) - set to CT
- Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

All Scanners:

- Modality, (0008,0060) - zero-length (universal matching)
- Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

The scheduled dates of procedures of interest can be specified for query by selecting a specific date range. The date ranges available are Today, Days Before Today, Days After Today and All Days. These selections and their affects on worklist query parameters are given below:

Today:

Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD, where this date is the current date.

Days Before Today and Days After Today:

Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD-YYYYMMDD, where this date range represents the specified number of days before today and/or after today. Note

Revision: A

that number of days both before and after can be specified in the same query and that each always includes today.

<u>All Days</u>:

Scheduled Procedure Step Start Date (0040,0002) - zero-length (universal matching)

5.3.1.7.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the Worklist Server AE after real-world activity "Worklist Query" has been initiated:

Presentation Context Table - Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiatio n**
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

6.3.1.2.1.1.1 SOP Specific DICOM Conformance Statement for the Worklist SOP Class

If the remote AE does not support the proposed Presentation Context, an appropriate error is logged and the operator is notified.

This implementation can receive multiple C-FIND results over a single association. Only one association is opened at a time.

Each C-FIND response received from the remote AE is parsed to verify the length/type of the items in the response (see section 2.3.1.2.1.2.2 for more information). Upon detecting any error in the response data, the Worklist Server AE will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained.

On receipt of any error from the remote AE, the Worklist Server will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Warnings received from the remote AE are ignored.

Each C-FIND operation supports a configurable "Association Timer." This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 30 seconds.

Each C-FIND operation supports a configurable "Session Timer." This timer starts when an association is established and stops when the association is ended. The default time-out value is 3600 seconds.

If any of the above timers expires, the association is aborted (A-ABORT) and the operation in progress is considered to be failed. Any previously received worklist items are discarded.

6.3.1.2.1.1.2 Record Acceptance Policy

70

The Lightspeed Ultra implementation adheres to strict value checking of incoming query responses from the remote AE. Each response received is examined to verify that all Type 1 attributes are present with non-zero length, that all Type 2 attributes are present (possibly with zero length) and that the data for all attributes is consistent with respect to the attributes' value representation (VR).

Any inconsistencies in the response data, with respect to the categories described above, are considered errors. Upon detecting any such errors in the response data, the Worklist Server AE will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Note that the absence of requested Type 3 attributes is not considered an error.

Fields considered Type 1 by the Worklist Server include:

- (0010,0010), Patient Name
- (0010,0020), Patient ID
- (0020,000D), Study Instance UID
- (0040,0001), Scheduled Station AE Title
- (0040,0002), Scheduled Procedure Step Start Date [1]
- (0040,0003), Scheduled Procedure Step Start Time [1]
- (0040,0009), Scheduled Procedure Step ID
- (0040,1001), Requested Procedure ID

[1] Start Date must be of the form YYYYMMDD, exactly eight numeric characters, and Start Time must be of the form HHMMSS, exactly six numeric characters.

Fields considered Type 2 by Worklist Server include:

- (0008,0050), Accession Number
- (0008,0060), Modality
- (0008,0090), Referring Physician Name
- (0010,0030), Patient Date of Birth
- (0010,0040), Patient Sex
- (0010,1030), Patient Weight in kg
- (0010,2000), Medical Alerts
- (0010,2110), Contrast Allergies
- (0010,21C0), Pregnancy Status
- (0032,1032), Requesting Physician
- (0032,1070), Requested Contrast Agent
- (0038,0010), Admission ID
- (0038,0050), Special Needs
- (0038,0300), Current Patient Location
- (0038,0500), Patient State
- (0040,0006), Performing Physician
- (0040,0010), Scheduled Station Name
- (0040,0011), Scheduled Procedure Step Location
- (0040,0012), Pre-order Medication

71

- (0040,1003), Requested Procedure Priority
- (0040,1004), Patient Transport Arrangements
- (0040,3001), Confidentiality Constraint

6.3.1.3 Association Acceptance Policy

The Worklist Server AE does not respond to attempts by a remote AE to open an association.

6.4 COMMUNICATION PROFILES

6.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

6.4.2 OSI Stack

The OSI Communication Stack is not supported by this implementation.

6.4.3 TCP/IP Stack

The TCP/IP Communication Stack is inherited from the IRIX operating system.

6.4.3.1 API

Not applicable to this product.

6.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

6.4.4 Point-to-Point Stack

The Point-to-Point Communication Stack is not supported by this implementation.

6.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

6.5.1 Standard Extended /Specialized/Private SOPs

ModalityWorklist for Lightspeed Ultra does not implement any private transfer SOP classes.

6.5.2 Private Transfer Syntaxes

ModalityWorklist for Lightspeed Ultra does not implement any private transfer syntaxes.

6.6 CONFIGURATION

The ModalityWorklist feature is configured by GEMS Field Service engineers. The DICOM configuration items below are configurable or re-configurable by a

Revision: A

Field Service Engineer and are not accessible by users through the Lightspeed Ultra user interface.

6.6.1   AE Title/Presentation Address Mapping

ModalityWorklist allows for the configuration of the following parameters which pertain to the remote AE.

- Remote AE (HIS/RIS) IP address - IP address used to contact the remote AE
- Remote AE (HIS/RIS) IP port - IP port used to contact the remote AE

These parameters define where worklist queries will be directed. Configuration of these parameters is performed by GEMS Field Service engineers using the ModalityWorklist installation facilities.

6.6.2   Configurable Parameters

The following parameters are configurable for the DICOM Worklist Server AE:

- Local (Worklist Server) AE Title (automatically set to host name of scanner)
- Local IP address
- Local IP netmask
- Local IP gateway

The following parameters are configurable by changing their values in the configuration file **/usr/g/config/WLdcm.cfg**. Note that these parameters typically need not be changed. Furthermore, no support is provided for retaining changed settings: the values will require changing again after a system software upgrade.

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period
- C-FIND time-out period

6.7   SUPPORT OF EXTENDED CHARACTER SETS

ModalityWorklist will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

6.8   Modality Worklist INFORMATION MODEL Definition

6.8.1   ModalityWorklist Mapping of DICOM Entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO MODALITY WORKLIST ENTITIES

DICOM	Modality Worklist Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam

Visit	Exam
Patient	Patient

6.8.2 Information Model MODULE TABLE

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM v3.0 PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

TABLE 3.4-1
MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	3.5.2.1
	Scheduled Procedure Step	3.5.2.2
Requested Procedure	Requested Procedure	3.5.3.1
Imaging Service Request	Imaging Service Request	3.5.4.1
Visit	Visit Identification	3.5.5.1
	Visit Status	3.5.5.2
	Visit Relationship	3.5.5.3
	Visit Admission	3.5.5.4
Patient	Patient Relationship	3.5.6.1
	Patient Identification	3.5.6.2
	Patient Demographic	3.5.6.3
	Patient Medical	3.5.6.4

6.8.3 INFORMATION Model Keys

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions contain the attributes which are present in a C-FIND request message sent by the Worklist Server AE to a remote AE. It should be noted that they are the same as those defined in the DICOM v3.0 Standard, PS 3.4 (Service Class Specifications) and include:

- Name
- Tag group and element numbers
- Expected Matching Key Type: R-required, O-optional
- Expected Return Key Type:
  - 1 - non-zero value required
  - 1C - conditionally of type 1
  - 2 - required to be present, possibly with zero-length value
  - 3 - optional

- Mapped into The Image - whether this data is mapped into subsequently acquired images
- Notes - clarification of this implementation's use/treatment of this attribute

All data elements in the following Module descriptions are requested by the Worklist Server AE. Values of data elements that are not mapped into images, and are not otherwise dealt with (displayed on the user interface, etc.), are not used and are, thus, discarded upon receipt. See Table B-1 for further information.

Data elements for which values can be sent for matching purposes are described as such. Data elements for which values are not sent are sent with zero length and universal matching will apply. This is the default case if no other description to the contrary is provided.

6.8.4 Supported Matching

The following are the types of matching that can be request by the implementation:

- Single Value matching
- Universal Matching
- Range of date/time

6.8.5 Scheduled Procedure Step Entity

6.8.5.1 SOP Common Module

TABLE 3.5-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Specific Character Set	(0008,0005)	O	1C	No	Matching for this item is supported only for the character set ISO_IR 100. This value is always sent and therefore, must be returned.

6.8.5.2 Scheduled Procedure Step Module

TABLE 3.5-2
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	

Revision: A

>Scheduled Station AE Title	(0040,0001)	R	1	No	Matching is supported as follows: either no AE title is supplied (universal matching), or the scanner's Worklist Server AE title is supplied for matching; this is user selectable.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching is supported as one of the following; this is user selectable: • all days, • today only, • today and a number of days before today, • today and a number of days after today, • today and a number of days before today and a number of days after today. Number of days before/after is specified by the user. Returned values must be exactly 8 numeric characters in YYYYMMDD format.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	This attribute is sent with zero-length. Returned values must be exactly 6 numeric characters in HHMMSS format.
>Modality	(0008,0060)	R	1	Yes	Matching is supported as follows: either no Modality is supplied (universal matching), or the scanner's Modality is supplied for matching; this is user selectable.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	No	This attribute is sent with zero-length.
>Scheduled Procedure Step Description	(0040,0007)	O	1C	Yes	
>Scheduled Station Name	(0040,0010)	O	2	No	
>Scheduled Procedure Step Location	(0040,0011)	O	2	No	
>Scheduled Action Item Code Sequence	(0040,0008)	O	1C	No	
>>Code Value	(0008,0100)	O	1C	No	
>>Coding Scheme Designator	(0008,0102)	O	1C	No	
>>Code Meaning	(0008,0104)	O	3	No	
>Pre-Medication	(0040,0012)	O	2C	No	
>Scheduled Procedure Step ID	(0040,0009)	O	1	Yes	
>Requested Contrast Agent	(0032,1070)	O	2C	No	Displayed on "More Info..." screen.

Revision: A

6.8.6   Requested Procedure Entity

6.8.6.1   Requested Procedure Module

TABLE 3.5-3
REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Requested Procedure ID	(0040,1001)	O	1	Yes	User can enter the value for Requested Procedure Id prior to query. If user has entered the value then that value will be sent as part of the query. The value returned in the response shall be mapped to the image.
Requested Procedure Description	(0032,1060)	O	1C	Yes	Truncated to 22 characters.
Requested Procedure Code Sequence	(0032,1064)	O	1C	No	
>Code Value	(0008,0100)	O	1C	No	
>Coding Scheme Designator	(0008,0102)	O	1C	No	
>Code Meaning	(0008,0104)	O	3	No	
Study Instance UID	(0020,000D)	O	1	Yes (Based on User option)	User (Modality) will be able to configure the following. If the user has set the option to "Use MWL Study UID", then study Instance UID will be copied into the final DICOM image header. If this option is not set then a new Study instance UID is generated locally on the scanner.
Referenced Study Sequence	(0008,1110)	O	2	No	
>Referenced SOP Class UID	(0008,1150)	O	1C	No	
>Referenced SOP Instance UID	(0008,1155)	O	1C	No	
Requested Procedure Priority	(0040,1003)	O	2	No	
Patient Transport Arrangements	(0040,1004)	O	2	No	
Requested Procedure Location	(0040,1005)	O	3	No	
Confidentiality Code	(0040,1008)	O	3	No	

6.8.7   Imaging Service Request Entity

6.8.7.1   Imaging Service Request Module

TABLE 3.5-4
IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Accession Number	(0008,0050)	O	2	Yes	User will be able to enter value for Accession Number prior to query to be sent as part of C-FIND request. Supports maximum of 16 characters.
Requesting Physician	(0032,1032)	O	2	No	
Referring Physician's Name	(0008,0090)	O	2	Yes	Truncated to 32 characters
Requesting Service	(0032,1033)	O	3	No	

6.8.8   Visit Entity

6.8.8.1   Visit Identification

TABLE 3.5-5
VISIT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Admission ID	(0038,0010)	O	2	No	
Institution Name	(0008.0080)	O	3	No	

6.8.8.2   Visit Status

TABLE 3.5-6
VISIT STATUS MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Current Patient Location	(0038,0300)	O	2	No	Displayed on "More Info..." screen.

6.8.8.3   Visit Relationship

TABLE 3.5-7
VISIT RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Referenced Patient Sequence	(0008,1120)	O	2	No	
>Referenced SOP Class UID	(0008,1150)	O	2	No	
>Referenced SOP Instance UID	(0008,1155)	O	2	No	

6.8.8.4   Visit Admission

No data elements are requested from the Visit Admission Module.

6.8.9   Patient Entity

6.8.9.1   Patient Relationship

No data elements are requested from the Patient Relationship Module.

6.8.9.2   Patient Identification

TABLE 3.5-8
PATIENT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient's Name	(0010,0010)	R	1	Yes	This attribute is sent with zero-length. Supports upto 32 characters. See also **Note1**.
Patient ID	(0010,0020)	R	1	Yes	This attribute is sent with zero-length. Supports upto 16 characters.

Note 1 :
- *Modality Worklist server supports 32 characters for patient Name*
- *Supports DICOM format for patient Name (with "^" as delimiters)*
- *If patient name in worklist has more than 32 characters then*
    - *Worklist will be accepted by the server*
    - *Worlist Browser will display only the first 32 characters*
    - *"More Info" screen will display the full patient name*
    - ***Only the FIRST 32** characters is copied into the final DICOM image header*

- Patient Demographic

TABLE 3.5-9
PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient's Birth Date	(0010,0030)	O	2	Yes	This value is also used to calculate the Patient's Age.
Patient's Sex	(0010,0040)	O	2	Yes	
Patient's Weight	(0010,1030)	O	2	Yes	Limited to maximum value of 999 kg.
Confidentiality constraint on patient data	(0040,3001)	O	2	No	
Patient's Size	(0010,1020)	O	3	No	
Patient's Address	(0010,1040)	O	3	No	
Patient's Telephone Numbers	(0010,2154)	O	3	No	

6.8.9.3 Patient Medical

TABLE 3.5-10
PATIENT MEDICAL MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient State	(0038,0500)	O	2	No	
Pregnancy Status	(0010,21C0)	O	2	No	Displayed on "More Info..." screen.
Medical Alerts	(0010,2000)	O	2	No	Displayed on "More Info..." screen.
Contrast Allergies	(0010,2110)	O	2	No	Displayed on "More Info..." screen.
Special Needs	(0038,0050)	O	2	No	Displayed on "More Info..." screen.
Additional Patient History	(0010,21B0)	O	3	Yes	Displayed on "More Info..." screen.

6.9 Private data dictionary

The ModalityWorklist implementation does not define any Private Attributes within the Modality Worklist Information Model.

6.10 C-FIND Request Message

This section provides a detailed description of the C-FIND request message data that is provided to the remote AE during a worklist query operation. The dump in Table D-1 below lists, in exact message order, the fields transferred as part of the C-FIND request message for a typical query.

In this particular dump, no values are specified for the Scheduled Procedure Step Start and End Dates (the attributes are sent with zero length). In DICOM this is interpreted as meaning all dates (i.e. universal matching). The Modality is also not specified in this particular dump, meaning all modalities. Note that the user, through the use of the LightSpeed Ultra user interface, can submit a worklist query that will cause non-zero values to be sent for these attributes.

TABLE D-1
C-FIND REQUEST MESSAGE DUMP

```
(0008,0000) UL    108                     #    4,  1  IdentifyingGroupLength
(0008,0005) CS    [ISO_IR 100]            #   12,  1  SpecificCharacterSet
(0008,0050) SH    (no value available) #    0,  0  AccessionNumber
(0008,0080) LO    (no value available) #    0,  0  InstitutionName
(0008,0090) PN    (no value available) #    0,  0  ReferringPhysicianName
(0008,1110) SQ    (Sequence with explicit Length #=1) #   24,  1  ReferencedStudySequence
 (fffe,e000) na    (Item with explicit Length  #=2) #   16,  1  Item
  (0008,1150) UI   (no value available) #    0,  0  ReferencedSOPClassUID
  (0008,1155) UI   (no value available) #    0,  0  ReferencedSOPInstanceUID
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #    0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #    0,  1  SequenceDelimitationItem
(0008,1120) SQ    (Sequence with explicit Length #=1) #   24,  1  ReferencedPatientSequence
 (fffe,e000) na    (Item with explicit Length  #=2) #   16,  1  Item
  (0008,1150) UI   (no value available) #    0,  0  ReferencedSOPClassUID
  (0008,1155) UI   (no value available) #    0,  0  ReferencedSOPInstanceUID
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #    0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #    0,  1  SequenceDelimitationItem
(0010,0000) UL    96                      #    4,  1  PatientGroupLength
(0010,0010) PN    (no value available) #    0,  0  PatientName
(0010,0020) LO    (no value available) #    0,  0  PatientID
(0010,0030) DA    (no value available) #    0,  0  PatientBirthDate
(0010,0040) CS    (no value available) #    0,  0  PatientSex
(0010,1000) LO    (no value available) #    0,  0  Other Patient IDs
(0010,1020) DS    (no value available) #    0,  0  PatientSize
(0010,1030) DS    (no value available) #    0,  0  PatientWeight
(0010,1040) LO    (no value available) #    0,  0  PatientAddress
(0010,2000) LO    (no value available) #    0,  0  MedicalAlerts
(0010,2110) LO    (no value available) #    0,  0  ContrastAllergies
(0010,2154) SH    (no value available) #    0,  0  PatientTelephoneNumber
(0010,2160) SH    (no value available) #    0,  0  Ethinc Group
(0010,21b0) LT    (no value available) #    0,  1  AdditionalPatientHistory
(0010,21c0) US    (no value available) #    0,  0  PregnancyStatus
(0010,4000) LT    (no value available) #    0,  0  Patient Comments
(0020,0000) UL    8                       #    4,  1  ImageGroupLength
(0020,000d) UI    (no value available) #    0,  0  StudyInstanceUID
(0032,0000) UL    64                      #    4,  1  StudyGroupLength
(0032,1032) PN    (no value available) #    0,  0  RequestingPhysician
(0032,1033) LO    (no value available) #    0,  0  RequestingService
(0032,1060) LO    (no value available) #    0,  0  RequestedProcedureDescription
(0032,1064) SQ    (Sequence with explicit Length #=1) #   32,  1  RequestedProcedureCodeSequence
 (fffe,e000) na    (Item with explicit Length  #=3) #   24,  1  Item
  (0008,0100) SH   (no value available) #    0,  0  CodeValue
  (0008,0102) SH   (no value available) #    0,  0  CodingSchemeDesignator
  (0008,0104) LO   (no value available) #    0,  0  CodeMeaning
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding)  #    0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #    0,  1  SequenceDelimitationItem
(0038,0000) UL    32                      #    4,  1  VisitGroupLength
(0038,0010) LO    (no value available) #    0,  0  AdmissionID
(0038,0050) LO    (no value available) #    0,  0  SpecialNeeds
(0038,0300) LO    (no value available) #    0,  0  CurrentPatientLocation
(0038,0500) LO    (no value available) #    0,  0  PatientState
```

```
(0040,0000) UL   192                  #    4, 1 ModalityWorklistGroupLength
(0040,0100) SQ   (Sequence with explicit Length #=1) #  136, 1 ScheduledProcedureStepSequence
 (fffe,e000) na   (Item with explicit Length #=12) #  128, 1 Item
  (0008,0060) CS   (no value available) #    0,  0 Modality
  (0032,1070) LO   (no value available) #    0,  0 RequestedContrastAgent
  (0040,0001) AE   (no value available) #    0,  0 ScheduledStationAETitle
  (0040,0002) DA   (no value available) #    0,  0 ScheduledProcedureStepStartDate
  (0040,0003) TM   (no value available) #    0,  0 ScheduledProcedureStepStartTime
  (0040,0006) PN   (no value available) #    0,  0 ScheduledPerformingPhysiciansName
  (0040,0007) LO   (no value available) #    0,  0 ScheduledProcedureStepDescription
  (0040,0008) SQ   (Seq with explicit Length #=1) #   32, 1 ScheduledActionItemCodeSequence
   (fffe,e000) na   (Item with explicit Length #=3) #   24, 1 Item
    (0008,0100) SH   (no value available) #    0,  0 CodeValue
    (0008,0102) SH   (no value available) #    0,  0 CodingSchemeDesignator
    (0008,0104) LO   (no value available) #    0,  0 CodeMeaning
   (fffe,e00d) na   (ItemDelimitationItem for re-encoding) #    0, 1 ItemDelimitationItem
  (fffe,e0dd) na   (SequenceDelimitationItem for re-enc.) #    0, 1 SequenceDelimitationItem
  (0040,0009) SH   (no value available) #    0,  0 ScheduledProcedureStepID
  (0040,0010) SH   (no value available) #    0,  0 ScheduledStationName
  (0040,0011) SH   (no value available) #    0,  0 ScheduledProcedureStepLocation
  (0040,0012) LO   (no value available) #    0,  0 PreMedication
 (fffe,e00d) na   (ItemDelimitationItem for re-encoding) #    0, 1 ItemDelimitationItem
(fffe,e0dd) na   (SequenceDelimitationItem for re-enc.) #    0, 1 SequenceDelimitationItem
(0040,1001) SH   (no value available) #    0,  0 RequestedProcedureID
(0040,1003) SH   (no value available) #    0,  0 RequestedProcedurePriority
(0040,1004) LO   (no value available) #    0,  0 PatientTransportArrangements
(0040,1005) LO   (no value available) #    0,  0 RequestedProcedureLocation
(0040,1008) LO   (no value available) #    0,  0 ConfidentialityCode
(0040,1010) PN   (no value available) #    0,  0 Names of Intended Recipients
(0040,1400) LT   (no value available) #    0,  0 Requested Procedure Comments
(0040,2400) LT   (no value available) #    0,  0 Imaging Service Request Comm.
(0040,3001) LO   (no value available) #    0,  0 ConfidentialityConstraintOnPatientData
```

If the query is for a particular date range, the ScheduledProcedureStepStartDate will be filled with a valid date range. If either the start or end date are left blank by the user, they will simply be blank in the query.

Below is an example of a date range for August 30, 1997 through October 12, 1997.

```
(0040,0002) DA   [19970830-19971012]  #   18, 1 ScheduledProcedureStepStartDate
```

Below is an example of a date range for August 30, 1997 through the end of time.

```
(0040,0002) DA   [19970830-]  #   18, 1 ScheduledProcedureStepStartDate
```

Below is an example of a date range from the beginning of time through August 30, 1997.

```
(0040,0002) DA   [-19970830]  #   18, 1 ScheduledProcedureStepStartDate
```

If the query is for records for this modality, the Modality will be filled in as follows:

```
(0008,0060) CS   [CT]                 #    2, 1 Modality
```

If the query is for records for this Scanner, the Modality will be filled in with CT as above and the Scheduled Station AE Title will be filled in with the value configured for this system. For example, this station was configured as CTRoom1.

```
(0040,0001) AE   [CTRoom1]            #    8, 1 ScheduledStationAETitle
```

User will be able to enter the values for "Accession Number" prior to the query. If value is entered then that value will be sent as part of the query. For example, if "1234" is entered then

```
(0008,0050) SH   [1234] #    4, 1 AccessionNumber
```

User will be able to enter the values for "Requested Procedure Id" prior to the query. If value is entered then that value will be sent as part of the query. For example, if "3456" is entered then

```
(0040,1001) SH   [3456] #    4, 1 RequestedProcedureID
```

6.11 Use of Specific DICOM Data

This section details the use of the DICOM data returned by remote AEs during worklist queries. The LightSpeed ULTRA user interface fields which display the data, along with the data's mapping into resulting acquired and transferred DICOM images, is presented in following table D-2.

TABLE D-2
SPECIFIC DATA USAGE

DICOM Worklist Data Element	Patient Schedule Screen Field	LightSpeed Ultra DICOM Image Data Element
Accession Number (0008,0050)	Req Number	Accession Number Supports maximum of 16 characters.
Patient ID (0010,0020)	Patient ID	Patient ID Supports maximum of 16 characters.
Patient Name (0010,0010)	Patient Name	Patient Name Supports maximum of 32 characters.
Patient's Birth Date (0010,0030)	Patient Age (Patient Birth Date user to calculate age)	Patient Birth Date
Patient's Sex (0010,0040)	Sex	Patient's Sex
Patient's Weight (0010,1030)	Weight in Kg	Patient's Weight
Referring Physician's Name (0008,0090)	Referring Physician	Referring Physician's Name
Requested Procedure Description (0032,1060)	Exam Description	Study Description.
Scheduled Procedure Step Start Date (0040,0002)	Date	Not available.
Scheduled Procedure Step Start Time (0040,0003)	Time	Not available.
Study Instance UID (0020,000d)	Study instance UID (only displayed on the "More Info..." screen)	Study Instance UID , **if User has set the preference to "Use MWL Study UID".**
Requested Procedure Id (0040,1001)	Requested Proc ID	Requested Procedure Id.

Pregnancy Status (0010,21C0)	Pregnancy Status (only displayed on the "More Info..." screen)	Not available.
Medical Alerts (0010,2000)	Medical Alerts (only displayed on the "More Info..." screen)	Not available.
Contrast Allergies (0010,2110)	Contrast Allergies (only displayed on the "More Info..." screen)	Not available.
Special Needs (0038,0050)	Special Needs (only displayed on the "More Info..." screen)	Not available.
Requested Contrast Agent (0032,1070)	Requested Contrast Agent (only displayed on the "More Info..." screen)	Not available.
Current Patient Location (0038,0300)	Current Patient Location (only displayed on the "More Info..." screen)	Not available.
Additional Patient History (0010,21B0)	Additional Patient History (only displayed on the "More Info..." screen)	Patient History.

Note that the display of a specific data item on the "More Info..." screen is contingent on the item being enabled for display. Depending on the preferences of each specific site, data can either be displayed or not. A GE field service engineer can assist in setting these site preferences.

6.12 Setting User Preferences

6.12.1 Setting "Use MWL Study UID" Option

Setting this option to "**Yes**" will copy the **Study Instance UID** from work-list into the final **DICOM Image header**. If this option is set to "**No**" then a new study instance uid will be generated locally.

- Click on "Patient Schedule"
- Click on "Preferences" button
- Set the option "Use Study Instance UID", to either "**Yes**" or "**No**"

6.12.2 Setting Custom Query Option

This option will allow the user to enter values for "Accession Number" and / or " Requested Procedure Id" , which are used for Custom Query.
- Click on "Patient Schedule"
- Click on "Preferences" button
- Set the option "**Show Update Parameters** ", to "**Yes"**
- To do a query click on "Update" button
- A User Interface will show, which has provision to enter values for
  - Accession Number
  - Requested Procedure Id

7 PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT

7.1   INTRODUCTION

This section of the DICOM Conformance Statement specifies the LightSpeed Ultra compliance to DICOM conformance requirements for the Performed Procedure Step feature on this GEMS product.

The PPS option for LightSpeed Ultra allows a Modality Performed Procedure Step to be communicated to the Hospital/Radiology information system. The PPS feature is providing the DICOM Modality Performed Procedure Step service as a service class user (SCU).

This feature works in conjunction with DICOM Modality Worklist feature, if installed. However the conformance of this feature is independent of Modality worklist feature. For information on conformance of the Modality WorkList feature, please refer to the section 6.

7.2   IMPLEMENTATION MODEL

The DICOM 'Performed Procedure Step' service is provided by the PPS Server DICOM AE. The PPS Server DICOM AE is commanded to perform Performed Procedure Step services either automatically or through the user interface.

7.2.1   APPLICATION DATA FLOW DIAGRAM

ILLUSTRATION 7-0

MODALITY PERFORMED PROCEDURE STEP DATA FLOW DIAGRAM
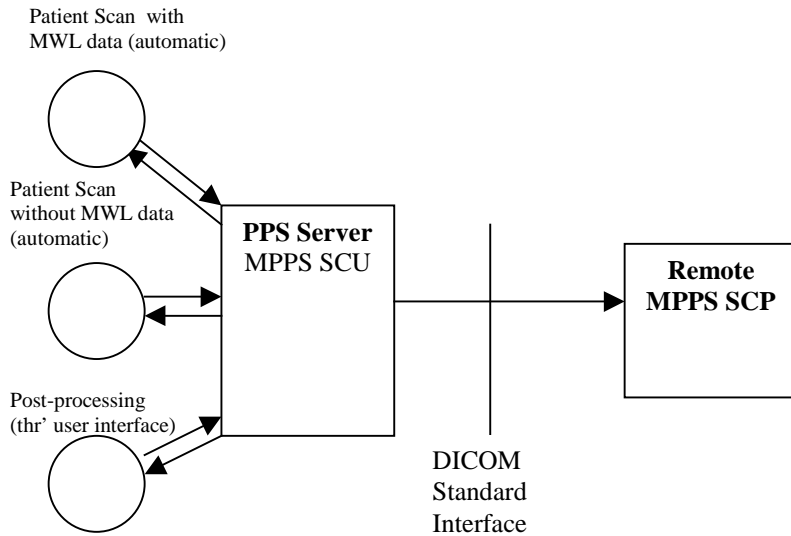
7.2.2   Functional Definition of AEs

The PPS Server AE is implemented as an application process on the scanner host computer. It runs as a daemon serving requests from other applications to

send the PPS information to the remote AE and return the results to the requesting application.

The PPS Server AE initiates the following functions.

- *Start PPS*: Initiates a DICOM association in order to create a DICOM Modality Performed Procedure Step SOP instance in the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to create the SOP instance in the remote AE via the N-CREATE service.
- *Complete PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'COMPLETED'.
- *Discontinue PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'DISCONTINUED'.

7.2.3 Sequencing of Real-World Activities

7.2.3.1 PPS from acquisition system with MWL data

The system has a Modality Worklist Server AE installed. Worklist information is obtained from HIS/RIS system through the use of Basic Worklist Management Service. Use of the information retrieved in the creation of Image SOP instance is described in the Modality Worklist Conformance section. Use of the information retrieved in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. The system retrieves necessary information related to the Scheduled Procedure Step from Modality Worklist Server. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.
- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user. ***The DICOM association is closed.***
- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.
- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created**. The N-SET is sent over a new DICOM association**
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section. **PPS messages N-CREATE (if applicable) and N-SET will be sent over the same DICOM association**
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.2.3.2 PPS from acquisition system without MWL data

The system either does not have a Modality Worklist Server AE installed or a Modality Worklist Server AE installed but no Worklist information is obtained from HIS/RIS system for the current procedure that is being performed. The information required for performing the procedure is supplied through the user interface of the system. The use of this information in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.
- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.
- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.
- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created.
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.
- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section.
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.2.3.3 PPS from post-processing system

- The user initiates post-processing on the images generated through acquisition.

- The system creates a Modality performed Procedure Step instance locally in the system. If the source image instances has the Scheduled Procedure Step information, it is copied into the image instances created. Also the system includes the necessary information related to the Modality Performed Procedure Step into the image instance.
- At the end of (one or more) post-processing, the user initiates 'Complete PPS' or 'Discontinue PPS' through the user interface provided. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE (which is actually a replica of the locally created MPPS SOP instance).
- The remote AE returns response indicating the success/failure of the request execution. If the response indicates success, PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created, with the additional information.
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.3   AE SPECIFICATION

7.3.1   PPS Server AE Specification

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

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

7.3.1.1   Association Establishment Policies

7.3.1.1.1   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 from an association initiated by the PPS Server AE is:

Maximum Length PDU	128 Kbytes

The SOP Class Extended negotiation is not supported.

The maximum number of presentation negotiation items that will be proposed is 1.

7.3.1.1.2   Number of Associations

The PPS Server will initiate only one DICOM association at any time to perform a PPS operation to the remote AE.

7.3.1.1.3   Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

7.3.1.1.4 Implementation Identifying information

The implementation UID for this DICOMv3.0 Implementation is:

PPS Feature for LightSpeed Ultra Implementation UID	1.2.840.113619.6.55

7.3.1.2 Association Initiation Policy

The PPS Server AE initiates a new association for every PPS operation initiated.

7.3.1.2.1 Real-World Activity: Performed Procedure Step creation and update

5.3.1.7.1.3 Associated Real-World Activity

The real-world activities are mentioned in section 7.*2.3 Sequencing of Real-World Activities*. Each of the real world activity results in either creating a new Performed procedure Step SOP instance at the remote SCP or updating an already created Performed Procedure Step SOP instance as per the DICOM v3.0 standard.

5.3.1.7.1.4 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the PPS Server AE after any of the real-world activity listed in section 7.*2.3 Sequencing of Real-World Activities*, is initiated.

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

7.3.1.2.1.1.1 SOP Specific DICOM Conformance Statement for MPPS SOP class

If the remote AE does not support the proposed Presentation context, an appropriate error message logged. Only one association is opened at a time.

All the operations used by this SOP class support an association timer, which is configurable. The timer is started when a request (association request, N-CREATE request or N-SET request) is send and stopped when the respective response is received. The default time-out value is 300 seconds.

All the operations used by this SOP class support a "Session Timer". This timer is started when the association is established and stopped when association is ended. The default time-out value is 3000 seconds.

If any of the above timers expires the association is aborted and the operation in-progress is considered FAILED.

In any case an operation (N-CREATE or N-SET) fails, system updates the state to enable operator to manually invoke the operation at any later time.

7.3.1.3 Association Acceptance Policy

The PPS Server AE does not respond to attempts by remote AE to open an association.

7.4 COMMUNICATION PROFILES

7.4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

7.4.2 OSI Stack

The OSI Communication stack is not supported by this implementation.

7.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the IRIX operating system.

7.4.3.1 API

Not Applicable to this product.

7.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

7.4.4 Point-to-Point Stack

The Point-to-Point Stack is not supported by this implementation.

7.5 EXTENSIONS/SPECIALIZATION/PRIVATIZATION

7.5.1 Standard Extended/Specialized/Private SOPs

PPS for LightSpeed Ultra does not implement any private SOP classes.

7.5.2 Private Transfer Syntaxes

PPS for LightSpeed Ultra does not implement any private Transfer Syntaxes.

7.6 CONFIGURATION

The PPS feature is configured by GEMS Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by the Field Service Engineer and are not accessible by users through the LightSpeed Ultra's user interface.

7.6.1 AE Title/Presentation address Mapping

PPS allows for the configuration of the following parameters which pertain to the remote AE.

- Remote MPPS AE IP Address - IP Address used to contact the remote MPPS AE
- Remote AE (HIS/RIS) IP Port - IP Port used to contact the remote MPPS AE
- Remote MPPS AE Title - Application Entity Title used to contact the remote MPPS AE

These parameters define where the MPPS requests will be directed. Configuration of these parameters is performed by GEMS Field Service engineers, using the installation facilities.

7.6.2 Configurable Parameters

The following are configurable for the PPS Server AE:

- Local (PPS Server AE) AE Title (The default is host name of the scanner appended with string "_PPS")
- Local IP Address
- Local IP net-mask
- Local IP gateway

The following parameters are configurable, but need change only in case of a system software upgrade:

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period

7.7 SUPPORT OF EXTENDED CHARACTER SETS

PPS feature for LightSpeed Ultra does not support any extended character set.

7.8 N-CREATE & NSET REQUEST MESSAGE

PPS Feature for LightSpeed Ultra supports all named attributes listed in Table F.7.2.1 in PS3.4 of DICOM standard. That is, attributes that are not explicitly referenced by name in the table are not supported. (Example is last row in the table reads "All other attributes from Radiation Dose Module and Billing and Material Code Module". The attributes referenced here are not supported).

For the MPPS associated with an acquisition, the following attributes are copied from the Modality Worklist SCU into the MPPS request Message, if procedure performed corresponds to the SPS information retrieved through the Modality Worklist.

LightSpeed Ultra supports the selection of **single** or **multiple** SPS for a scan. The following are applicable.

- Single SPS selection results in single PPS message
- Multiple SPS selection results in single PPS message
- Multiple SPS selection is allowed **only if they all correspond to same patient id**

- A maximum of 10 SPS's can be selected
- Referenced Study Sequence - a maximum of five Item's is supported. *This attribute will be present only if SPS information is available from Modality Worklist SCU.*
- At the end of acquisition the user might choose to 'Defer PPS' and later choose to 'Complete PPS' or 'Discontinue PPS' from the user interface provided in the system. In this case, the date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of acquisition)
- Mapping of SPS data to **MPPS SOP instance** is explained in section 7.10
- Mapping of specific SPS data to **CT DICOM IMAGE HEADER** , for PPS is explained in section 7.11

For the MPPS associated with a post-processing the following restrictions apply on the attributes listed below.
- Referenced Study Sequence – The sequence is not sent in the MPPS message
- Scheduled Step Attribute Sequence – a maximum of ONE item is supported. The attribute will be send only if SPS information is available in the image instance.
- Referenced Patient Sequence – This sequence is not added
- Scheduled action Item Code Sequence – The sequence is not send in the MPPS message
- Performed Procedure Step Start date & Performed Procedure Step start time – The exam date and exam time that is the Start date and Start Time of the associated Study Component (Exam) is used, not the actual time when post-processing started.
- Performed Procedure Step end date & Performed Procedure Step end time - The date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of post-processing).
- Procedure Code Sequence – This sequence is sent with ZERO items in the MPPS message
- Performed Action Item Code Sequence – This sequence is sent with ZERO items in the MPPS message.
- Referenced Standalone SOP Instance Sequence – The sequence is sent with ZERO items in the MPPS message.

7.9 ERROR HANDLING AND RECOVERY

PPS Server AE does not define any extended error codes. The standard error codes are handled. On a response with status 'success' for the N-CREATE or N-SET request, the system updates the state and indicates the same on the user interface. On a response with status other than 'success' the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface. If the request has failed or response is not received before the association timeout, the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface.

If the operation is 'Failed', detailed message is logged into system log-file and system provides an alternative mechanism to retry the failed operation through

the user interface to ensure that transient failures do not affect the feature performance.

7.10 USE OF SPECIFIC DICOM DATA

The following table gives specific usage of some of attributes in the MPPS SOP instance created, with reference to each of the real-world scenarios mentioned in 7.2.3 of this document.

Attribute Name	Tag	Usage in MPPS Instance		
		Acquisition with MWL data	**Acquisition without MWL data**	**Post-Processing**
Specific Character Set	(0008,0005)	Not used, but copied into image header	Not used	Not used, but copied into image header
Scheduled Step Attribute Sequence	(0040,0270)	Only one item		Only one item
>Study Instance UID	(0020,000D)	Copied from SPS, if option to copy is selected or else created at the scanner	Created at the scanner	Copied from source image
>Referenced Study Sequence	(0008,1110)	Copied from SPS, if selected	Not sent as part of image header	Not sent as part of image header
>Accession Number	(0008,0050)	Copied from SPS, if selected	User input on the scanner	Copied from source image
>Placer Order Number/Imaging Service Request	(0040,2016)	Not sent as part of image header	Not sent as part of image header	Not sent as part of image header
>Filler Order Number/Imaging Service Request	(0040,2017)	Not sent as part of image header	Not sent as part of image header	Not sent as part of image header
>Requested Procedure ID	(0040,1001)	Copied from SPS, if selected	User input on the scanner	Copied from source image
>Requested Procedure Description	(0032,1060)	Copied from SPS, if selected	Not used	Not sent as part of image header
>Placer Order Number/Procedure	(0040,1006)	Not sent as part of image header	Not used	Not sent as part of image header
>Filler Order Number/Procedure	(0040,1007)	Not sent as part of image header	Not used	Not sent as part of image header

Attribute Name	Tag	Usage in MPPS Instance		
		Acquisition with MWL data	**Acquisition without MWL data**	**Post-Processing**
>Scheduled Procedure ID	(0040,0009)	Copied from SPS, if selected	Not used	Copied from source image
>Scheduled Procedure Step Description	(0040,0007)	Copied from SPS, if selected	Not used	Copied from source image
>Scheduled Action Item Code Sequence	(0040,0008)	Copied from SPS, if selected	Not used	Not sent as part of image header
Patient's Name	(0010,0010)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient ID	(0010,0020)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient's Birth Date	(0010,0032)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient's Sex	(0010,0040)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Referenced Patient Sequence	(0008,1120)	Copied from SPS, if selected	Not used	No item
Performed Procedure Step ID	(0040,0253)	Created at the scanner. Will have the following *"PPS_ID_<exam number"*	Created at the scanner. Will have the following *"PPS_ID_<exam number"*	New generated, may not be unique
Performed Station AE Title	(0040,0241)	Local system host-name	Local system host-name	Local system host-name
Performed Station Name	(0040,0242)	Local system suite id	Local system suite id	Local system host-name
Performed Location	(0040,0243)	Local system suite id	Local system suite id	Not used
Performed Procedure Step Start Date	(0040,0244)	Same as exam start date	Same as exam date	Same as exam date
Performed Procedure Step Start Time	(0040,0245)	Same as exam start time	Same as exam time	Same as exam time
Performed Procedure Step Description	(0040,0254)	Copied from SPS, if selected	Not sent as part of image header	Not sent as part of image header
Performed Procedure Step status	(0040,0252)	See Note 1.	See Note 1.	See Note 1.
Performed Procedure Type Description	(0040,0255)	Not sent as part of image header	Not sent as part of image header	Not sent as part of image header
Procedure Code Sequence	(0008,1032)	Not sent as part	Not sent as part of	Not sent as part of

Attribute Name	Tag	Usage in MPPS Instance		
		Acquisition with MWL data	**Acquisition without MWL data**	**Post-Processing**
Sequence		of image header	image header	image header
Performed Procedure Step End Date	(0040,0250)	Date when all images got installed	Date when all images got installed	The date "Complete PPS" or "Discontinue PPS" is invoked, not the actual end of post-processing
Performed Procedure Step End Time	(0040,0251)	Time when all images got installed	Time when all images got installed	The time "Complete PPS" or "Discontinue PPS" is invoked, not the actual end of post-processing
Modality	(0008,0060)	Value "CT" is stored in image header	Value "CT" is stored in image header	Value "CT" is stored in image header
Study ID	(0020,0010)	Same as exam number	Same as exam number	Copied from source image
Performed Action Item Code Sequence	(0040,0260)	Copied from SPS, if selected	Not used	Not used
Performed Series Sequence	(0040,0340)	One item for each series created	One item for each series created	One item for each series created with post-processing
>Performing Physician's Name	(0008,1050)	Copied from SPS, if selected	User input on the scanner	Not sent as part of image header
>Protocol Name	(0018,1030)	The name of the protocol selected on the scanner	The name of the protocol selected on the scanner	Copied from source image
>Operator's Name	(0008,1070)	Copied from SPS, if selected	User input on the scanner	Not sent as part of image header
>Retrieve AE Title	(0008,0054)	Local system host-name	Local system host-name	host-name of the system
>Referenced Image Sequence	(0008,1140)	One item for each image created within the series	One item for each image created within the series	One item for each image generated by post-processing
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Not sent as part of image header	Not sent as part of image header	Not sent as part of image header
>All other attributes from Performed Series Sequence (which Table F.7.2.1 of DICOM standard PS3.4 does not		Not sent as part of image header	Not sent as part of image header	Not sent as part of image header

Attribute Name	Tag	Usage in MPPS Instance		
		Acquisition with MWL data	**Acquisition without MWL data**	**Post-Processing**
explicitly list)				
All other attributes from Radiation Dose Module and Billing and Material Code Module (which Table F.7.2.1 of DICOM standard PS3.4 does not explicitly list)		Not sent as part of image header	Not sent as part of image header	Not sent as part of image header

Note 1:

- When PPS start (N-CREATE) message is sent, this element will have the value "INPROGRESS"
- When PPS end (N-SET) message is sent, this element will have either "COMPLETE" or "DISCONTINUE" based on user selection

7.11 USE OF SPECIFIC DICOM DATA

Attribute Name	Tag	Usage in CT DICOM Image Header
Patient Level		
Patient Name	(0010,0010)	Copied from SPS, if selected
Patient ID	(0010,0020)	Copied from SPS, if selected
Patient Birthdate	(0010,0020)	Copied from SPS, if selected
Patient Sex	(0010,0040)	Copied from SPS, if selected
Referenced Patient Sequence	(0008,1150)	Copied from SPS, if selected
>Ref. SOP class uid	(0008,1150)	
>Ref. SOP Instance uid	(0008,1155)	
Study Level		
Study Instance UID	(0020,000D)	Copied from SPS, if selected
Study ID	(0020,0010)	Copied from SPS, if selected
Referring Physicians name	(0008,0090)	Copied from SPS, if selected
Accession Number	(0008m0050)	If multiple SPS's are selected, then accession number from the first selection (determined by the user) is used
Referenced Study Sequence	(0008,1110)	Copied from SPS, if selected
>Ref. SOP class uid	(0008,1150)	
>Ref. SOP Instance uid	(0008,1155)	
Series Level		
Modality	(0008,1060)	Value "CT" is copied
Protocol Name	(0018,1030)	Name of the selected protocol is copied
Operator Name	(0008,0090)	Copied from SPS, if selected
Referenced Study Component Sequence	(0008,1111)	Will be present only if SPS , obtained form HIS/RIS is selected for scanning
>Ref. SOP class uid	(0008,1150)	Value of MPPS SOP class UID

>Ref. SOP Instance uid	(0008,1155)	Scanner generated unique UID
Requested Attribute Sequence	(0040,0275)	Will be present only if SPS , obtained form HIS/RIS is selected for scanning. If multiple SPS's are selected then this will contain multiple items one for each SPS. For all other cases this element will not be present
>Requested Procedure Id	(0040,1001)	Copied from SPS, if selected
>Scheduled Procedure Step Id	(0040,0009)	Copied from SPS, if selected
> Scheduled Procedure Step description	(0040,0007)	Copied from SPS, if selected
>Scheduled Action Item Code Sequence	(0040,0008)	Copied from SPS, if selected
Performed Procedure Step Id	(0040,0253)	Created at the scanner. The string "**_PPS_ID_\<examnumber\>_**" is used.
Performed Procedure Step start date	(0040,0244)	Same as exam start date
Performed Procedure Step start time	(0040,0245)	Same as exam start time
Performed Procedure Step description	(0040,0254)	Exam description is used

APPENDIX A:

8 Optional/Conditional Modules/Attributes (IOD Definitions)

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

NOTE: *All other modules which are mandatory and attributes which are type 1 & 2 in nature per the DICOM standard are supported by this implementation but are not explicitly listed here.*

8.1   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
	VOI LUT	A.5.11	U
	SOP Common	A.5.9	M

A.1.2   CT Image Module

Attribute Name	Tag	Type	Notes
KV	(0018,0060)	2	Value always sent.
Acquisition Number	(0020,0012)	2	Value always sent.
Scan Options	(0018,0022)	3	Value always sent.
Data 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 axial.
Exposure Time	(0018,1150)	3	Value always sent.
X-Ray 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: **SMOOTH** **SOFT** **STANDARD** **DETAIL** **BONE** **EDGE** **SHARP** **LUNG**

CAUTION

It is possible for the operator of CT LightSpeed QX/i system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.

A.1.2.1 Implementation Specific details

- For all CT Images created by LightSpeed ULTRA patient birth date element (0010,0030) is sent, if the operator has entered the details. If the operator has not entered the details it will be sent as a "Zero length element"
- The length of Accession number element (0008,0050) is a maximum of 16 characters
- Window Center (0028,1050) and Window Width (0028,1051) are sent for all CT Images created by LightSpeed ULTRA
- Based on whether contrast was used or not the following applies for CT Images created by LightSpeed ULTRA

Mode	(0018,0010)	(0018,1040)
No Contrast	Not sent	Not sent
Oral Contrast	Oral Contrast Agent name	The string "Oral"
IV Contrast	IV Contrast agent name	The String "IV"
Oral and IV contrast	Oral contrast agent " & " IV Contrast	The string "Oral & IV"

	agent	

- Supported field length for DICOM fields

DICOM Tag	Field Name	Field Length
(0008, 0050)	Accession Number	16 characters
(0010, 0010)	Patient Name	32 characters
(0010, 0020)	Patient Id	16 characters

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.2.2 MR Image Module

Attribute Name	Tag	Type	Notes
Scan Options	(0018,0021)	2	Always sent.
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 <u>not</u> **SK**.
Echo Time	(0018,0081	2	Sent.
Inversion Time	(0018,0082)	2C	Sent.
Echo Train Length	(0018,0091)	2	Sent.
Trigger Time	(0018,1060)	2C	Sent.
Angio Flag	(0018,0025)	3	
Number Of Averages	(0018,0083)	3	
Imaging Frequency	(0018,0084)	3	
Imaged Nucleus	(0018,0085)	3	Zero-length element is sent.
Echo Number	(0018,0086)	3	
Magnetic Field Strength	(0018,0087)	3	Image strength, if 0, NOT sent.
Spacing Between	(0018,0088)	3	

Slices			
Percent Sampling	(0018,0093)	3	
Percent Phase Field of View	(0018,0094)	3	
Pixel Bandwidth	(0018,0095)	3	
Nominal Interval	(0018,1062)	3	
Heart Rate	(0018,1088)	3	If 0, NOT sent.
Cardiac Number of Images	(0018,1090)	3	If 0, NOT sent.
Trigger Window	(0018,1094)	3	If 0, NOT sent.
Reconstruction Diameter	(0018,1100)	3	
Receiving Coil	(0018,1250)	3	
Transmitting Coil	(0018,1251)	3	
Acquisition Matrix	(0018,1310)	3	
Phase Encoding Direction	(0018,1312)	3	
Flip Angle	(0018,1314)	3	
Variable Flip Angle Flag	(0018,1315)	3	
SAR	(0018,1316)	3	
Temporal Resolution	(0020,0110)	3	

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
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 CT/MR/SC IOD Common Module Definitions

A.4.1 Patient Module

Attribute Name	Tag	Type	Notes
Patient's Name	(0010,0010)	2	As entered at user interface or from worklist. *Supports 5 different*

			components delimited by "^". Supports a maximum length of 32 characters including the delimiter .
Patient ID	(0010,0020)	2	As entered at user interface or from worklist.
Patient's Birth Date	(0010,0030)	2	Always sent zero length.
Patient's Sex	(0010,0040)	2	Always sent.

A.4.2 General Study Module

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	Generated uniquely for each exam. Value from worklist, if present, is not filled in here.
Study Date	(0008,0020)	2	Generated for each exam and always sent.
Study Time	(0008,0030)	2	Generated for each exam and always sent.
Accession Number	(0008,0050)	2	Value from user interface or worklist sent.
Referring Physician's Name	(0008,0090)	2	Value from user interface sent.
Study ID	(0020,0010)	2	Value from user interface or worklist sent.
Study Description	(0008,1030)	3	Value from user interface sent.
Name of Physician(s) Reading Study	(0008,1060)	3	Sent if entered at the user interface.

A.4.3 Patient Study Module

Attribute Name	Tag	Type	Notes
Patient's Age	(0010,1010)	3	Calculated from Date of Birth entered at user interface.
Patient's Weight	(0010,1030)	3	Value from user interface.
Additional Patient's History	(0010,21b0)	3	Value from user interface.

A.4.4 General Series Module

Attribute Name	Tag	Type	Notes
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 Physician's Name	(0008,1050)	3	
Protocol Name	(0008,1030)	3	Sent if entered at user interface.
Series Description	(0008,103E)	3	Value from user interface is sent.
Operators Name	(0008,1070)	3	Value from user interface is sent.
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

A.4.5 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.
Station Name	(0008,1010)	3	Sent. Value is configurable.
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 "05" for this version - does not distinguish individual software releases.
Spatial Resolution	(0018,1050)	3	Sent only for MR images.
Pixel Padding Value	(0028,0120)	3	Sent.

A.4.6 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.

A.5.7 Image Plane Module

Attribute Name	Tag	Type	Notes
Slice Thickness	(0018,0050)	2	Value always sent.
Image Slice Location	(0020,1041)	3	Value always sent.

A.5.8 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 Route	(0018,1040)	3	Sent if contrast exam, as entered in user interface.

A.5.9   SOP Common Module

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100

A.5.10   Overlay Plane Module

Attribute Name	Tag	Type	Notes
Overlay Data	(60xx,3000)	1C	Only for SC & Standalone Overlay IOD Definitions

A.5.11   VOI LUT Module

Attribute Name	Tag	Type	Notes
Window Center	(0028,1050)	3	Window Center for display. Always sent.
Window Width	(0028,1051)	1C	Window Width for display. Always sent.

A.5.12   Frame of Reference Module

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

CAUTION	**It is possible for the operator of CT LightSpeed QX/i system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.**

A.5.14   SC Equipment Module

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

APPENDIX B: PRIVATE DATA ELEMENTS

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
Equipment UID	(0009,10E3)	UI	1

Note :

For all images created by LightSpeed ULTRA system, (0009,xx01) element will have the value "CT_LIGHTSPEED".

B.1.2   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
First scan ras	(0019,1018)	LO	1
Last scan ras	(0019,101A)	LO	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

Attribute Name	Tag	VR	VM
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
Segment number	(0019,1042)	SS	1
Total segments requested	(0019,1043)	SS	1
View compression factor	(0019,1047)	SS	1
Recon post proc. Flag	(0019,1052)	SS	1
Dependent on #views processed	(0019,106A)	SS	1

B.1.3 Private Creator Identification (GEMS_RELA_01)

Attribute Name	Tag	VR	VM
Series from which Prescribed	(0021,1003)	SS	1
Series Presribed From	(0021,1035)	SS	1
Image Prescribed From	(0021,1036)	SS	1
Biopsy position	(0021,1091)	SS	1
Biopsy T location	(0021,1092)	FL	1
Biopsy ref location	(0021,1093)	FL	1

B.1.4 Private Creator Identification (GEMS_STDY_01)

Attribute Name	Tag	VR	VM
Start time(secs) in first axial	(0023,1070)	FD	1

B.1.5 Private Creator Identification (GEMS_IMAG_01)

Attribute Name	Tag	VR	VM
Scout Type	(0027,1010)	SS	1
Vma mamp	(0027,101C)	SL	1
Vma mod	(0027,101E)	SL	1
Vma clip	(0027,101F)	SL	1
Smart scan ON/OFF flag	(0027,1020)	SS	1
Plane Type	(0027,1035)	SS	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
Table start location	(0027,1050)	FL	1
Table end location	(0027,1051)	FL	1

B.1.6 Private Creator Identification (GEMS_PARM_01)

Attribute Name	Tag	VR	VM
Window value	(0043,1010)	US	1
X-ray chain	(0043,1012)	SS	3
Number of overranges	(0043,1016)	SS	5
Delta start time	(0043,101E)	DS	1
Max overranges in a view	(0043,101F)	SL	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
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

Attribute Name	Tag	VR	VM
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
Start scan to X-ray on delay	(0043,104D)	FL	4
Duration of X-ray on	(0043,104E)	FL	4

B.1.7 Private Creator Identification(GEMS_HELIOS_01)

Attribute Name	Tag	VR	VM
Number of Macro Rows in Detector	(0045, 1001)	SS	1
Macro width at ISO Center	(0045, 1002)	FL	1
DAS type	(0045, 1003)	SS	1
DAS gain	(0045, 1004)	SS	1
DAS Temprature	(0045, 1005)	SS	1
Table Direction	(0045, 1006)	CS	1
Z smoothing Factor	(0045, 1007)	FL	1
View Weighting Mode	(0045, 1008)	SS	1
Sigma Row number	(0045, 1009)	SS	1
Minimum DAS value	(0045, 100A)	FL	1
Maximum Offset Value	(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 Error	(0045, 100F)	FL	1
Start View 2A	(0045, 1010)	SS	1
Number of Views 2A	(0045, 1011)	SS	1
Start View 1A	(0045, 1012)	SS	1
Sigma Mode	(0045, 1013)	SS	1
Number of Views 1A	(0045, 1014)	SS	1
Start View 2B	(0045, 1015)	SS	1
Number Views 2B	(0045, 1016)	SS	1
Start View 1B	(0045, 1017)	SS	1
Number of Views 1B	(0045, 1018)	SS	1
Iterbone Flag	(0045, 1021)	SS	1
Perisstaltic Flag	(0045, 1022)	SS	1
CardiacReconAlgorithm	(0045, 1030)	CS	1
AvgHeartRateForImage	(0045, 1031)	CS	1
TemporalResolution	(0045, 1032)	FL	1
PctRpeakDelay	(0045, 1033)	CS	1

B.1.8 Private Creator Identification (GEMS_CT_CARDIAC_001)

Attribute Name	Tag	VR	VM
CT Cardiac Sequence	(0049, 1001)	SQ	1
HeartRateAtConfirm	(0049, 1002)	CS	1
AvgHeartRatePriorToConfirm	(0049, 1003)	FL	1
MinHeartRatePriorToConfirm	(0049, 1004)	CS	1
MaxHeartRatePriorToConfirm	(0049, 1005)	CS	1

StdDevHeartRatePriorToConfirm	(0049, 1006)	FL	1
NumHeartRateSamplesPriorToConfirm	(0049, 1007)	US	1
AutoHeartRateDetectPredict	(0049, 1008)	CS	1
SystemOptimizedHeartRate	(0049, 1009)	CS	1
EkgMonitorType	(0049, 100A)	ST	1
NumReconSectors	(0049, 100B)	CS	1
RpeakTimeStamps	(0049, 100C)	FL	256

B.1.9 Private Creator Identification (GEMS_CT_VES_01)

Attribute Name	Tag	VR	VM
CTVESSequence	(0051,1001)	SQ	1
VESaccessionNumber	(0008,0050)	SH	1
VESprocedureCodeSequence	(0008,1032)	SQ	1
VESactionItemCodeValue	(0008,0100)	SH	1
VESactionItemCodeScheme	(0008,0102)	SH	1
VESactionItemCodeMeaning	(0008,0104)	LO	1
VESreferenceStudySequence	(0008,1110)	SQ	1
VESRefStudySequenceSopClassUid	(0008,1150)	UI	1
VESRefStudySequenceSopInstanceUid	(0008,1155)	UI	1
VESstudyInstanceUID	(0020,000D)	UI	1
VESrequestedProcedureDescription	(0032,1060)	LO	1
VESrequestedProcedureID	(0040,1001)	SH	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_RELA_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

APPENDIX C:

C 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 Basic Directory IOD Definition

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

C.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	Present only in IMAGE Directory Record
Referenced SOP Class UID in file	(0004,1510)	1C	Present only in IMAGE Directory Record
Referenced SOP Instance UID in File	(0004,1511)	1C	Present only in IMAGE Directory Record
Referenced Transfer Syntax UID in File	(0004,1512)	1C	Present only in IMAGE Directory Record

C.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.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.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.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.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.

End of Document

Revision: A