GE Medical Systems, LLC

Technical Publications

Direction 2388702DRS
Revision 0

Signa Product Line
DICOM CONFORMANCE STATEMENT

Supported products:

- Signa EXCITE 1.5T
- Signa EXCITE 3T
- Signa EXCITE OpenSpeed
- Signa EXCITE Ovation

Operating Documentation

Revisions

Revision #	***Date***	***Comments***
0	*6/27/2003*	*Initial revision based on 2317752 Rev 3.0 and 2317751 Rev 3.0*

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WARNING

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

1 SECTION 1 - INTRODUCTION

1.0 Overview

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

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

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

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

Section 5, Enhanced Modality Worklist Conformance Statement, is the DICOM Conformance Statement related to the DICOM MWL implementation on the covered systems.

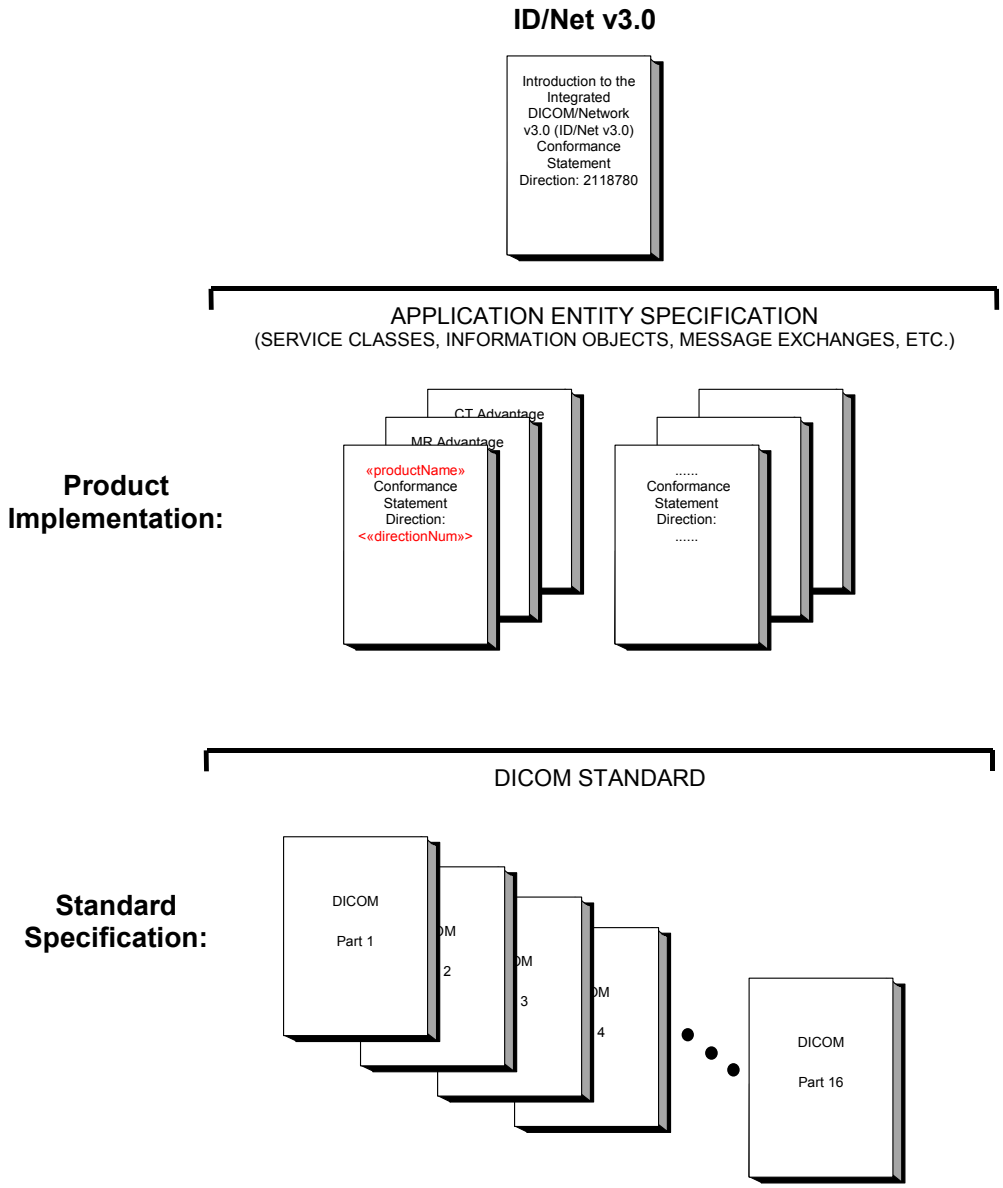
Section 6, PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT, is the DICOM Conformance Statement related to the DICOM PPS implementation on the covered systems.

Section 7, Storage Commitment , is the DICOM Conformance Statement related to the DICOM storage commitment implementation on the covered systems.

1.0.1 Overall Conformance Statement Documentation Structure

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

Illustration 1-1 **DOCUMENTATION STRUCTURE**



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

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

This document specifies the DICOM implementation supported by the following products:

- Signa EXCITE 1.5T
- Signa EXCITE 3T
- Signa EXCITE OpenSpeed
- Signa EXCITE Ovation

It is entitled:

Signa Horizion Lx
DICOM Conformance Statement
Direction 2388702DRS

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

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

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

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

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

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

ID/Net v3.0 Conformance Statements
Direction 2117016

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

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

1.0.2 Intended Audience

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

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

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

1.1 Scope and Field of Application

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements Direction 2118780,* to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to insure proper processing and interpretation of GE medical image data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

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

Included in this Conformance Statement are Module Definitions which define all data elements used by the GEMS implementation. If the user encounters unspecified private data elements while parsing a GE Data Set, the user is well advised to ignore those data elements (per the DICOM 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.

1.2 Important Remarks

The use of these Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to 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), 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 Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM**. In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans future evolution of the DICOM standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE products are enhanced to support these changes.

- **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.

1.3 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.*

1.4 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.*

1.5 Symbols and Abbreviations

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

2 SECTION 2 - NETWORK CONFORMANCE STATEMENT

2.0 INTRODUCTION

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

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

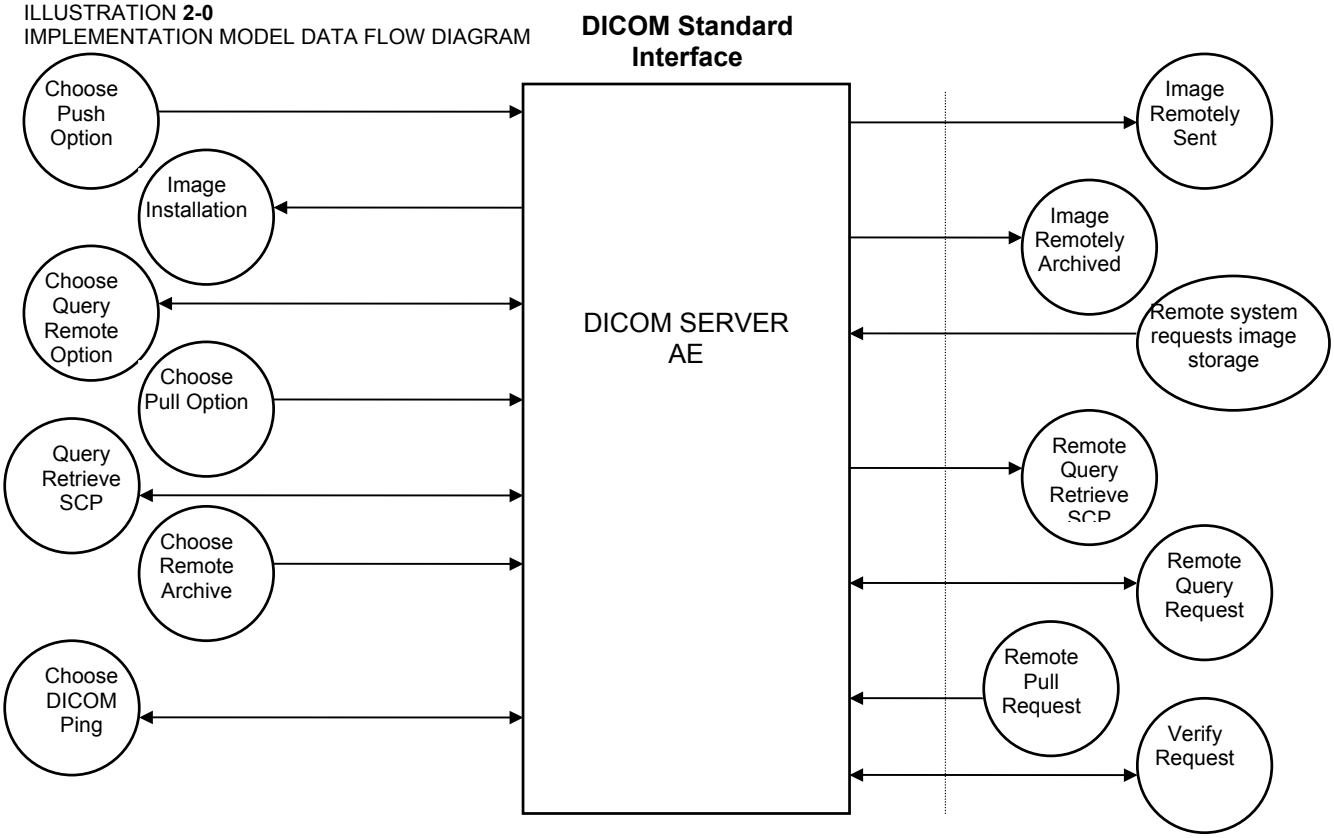
Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

2.1 IMPLEMENTATION MODEL

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

2.1.1 Application Data Flow Diagram

ILLUSTRATION **2-0**
IMPLEMENTATION MODEL DATA FLOW DIAGRAM



There are 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 "Send examination", "Send series" or "Send image" from the "Network" pulldown menu on the local database manager to send the image(s) to a selected destination.

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

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

The *Choose Archive save Option* Real-World activity consists of an operator choosing a remote DICOM AE that supports Storage Commitment as provider as the archive device and selecting one or more exam or series from the local database and choosing either *Save Exam* or *Save Series* from the archive menu. The images to be committed are sent to the remote provider entity first. The Commitment request for the transferred image instances is sent after the complete image transfer. The Commitment response can come on same association or on a different association. Refer to Section 7 for details on the Storage Commitment implementation.

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

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

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

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

2.1.2 Functional Definition of AE's

DICOM Server Application Entity initiates the following operations:

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

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

- *Verification*: If a C-ECHO-RQ message is received, the DICOM Server AE will send back a C-ECHO-RSP message with a status of "success".

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

2.1.3 Sequencing of Real-World Activities

2.1.3.1 Query Remote

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

2.1.3.2 Storage Commitment

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

2.2 AE SPECIFICATIONS

2.2.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM 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 SOP class	1.2.840.10008.1.20.1

This Application Entity provides Standard Conformance to the following DICOM 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

2.2.1.1 Association Establishment Policy

2.2.1.1.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1

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

Maximum Length PDU	36 kbytes

SOP class Extended Negotiation is not supported.

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

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

2.2.1.1.2 Number of Associations

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

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

A single association is used to send the commitment request. This waits for the response from commitment provider on the same association for a configurable amount of time. It will also accept an association for receiving the response from commitment provide at any time.

2.2.1.1.3 Asynchronous Nature

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

2.2.1.1.4 Implementation Identifying Information

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

The Implementation UIDs for the GEMS Implementation by product is:

Product Name	Implementation UID

Excite 1.5T	1.2.840.113619.6.135
Excite 3T	1.2.840.113619.6.155
Excite OpenSpeed	1.2.840.113619.6.153
Excite Ovation	1.2.840.113619.6.154

2.2.1.2 Association Initiation by Real-World Activity

2.2.1.2.1 Push Image(s) to Remote AE

2.2.1.2.1.1 Associated Real-World Activity

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

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

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

2.2.1.2.1.2 Proposed Presentation Contexts

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

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

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

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

Presentation Context Table - Proposal					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		

CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
Secondary Capture	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Implicit VR Little Endian Implicit VR Big Endian(GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None
Stand-alone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

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

2.2.1.2.1.2.1 SOP Specific Conformance Statement for Image Storage SOP Classes

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

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

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

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

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

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

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

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

When DICOM Server AE initiates an association to issue a C-STORE, the image will be transmitted by the DICOM Server AE with the same elements as was originally received or created locally. Note, to retain all private elements in non-GE images, the image must have been originally received using Explicit Little Endian transfer syntax.

2.2.1.2.2 Query Remote AE

2.2.1.2.2.1 Associated Real-World Activity

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

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

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

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

2.2.1.2.2.2 Proposed Presentation Contexts

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

2.2.1.2.2.2.1 SOP Specific Conformance Statement for C-FIND SCU

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

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

"" is any date,
"yyyymmdd-" is any date on or after that year/month/day,
"-yyyymmdd" is any date on or before that year/month/day,
"yyyymmdd-yyyymmdd" is any date on or between those dates,
"yyyymmdd" is only on that date.

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

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

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

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

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

Table 2.2.1.2.2.2.1-1: Requested Study Level Keys

Description	Type	Tag	Value
Study date	R	0008,0020	Zero length for any Study date, or "yyyymmdd-yyyymmdd" matches inclusive range of 'from-to' Study dates. 'From' or 'To' date can be zero length meaning that side of the range is any date.
Study time	R	0008,0030	Zero length
Accession number	R	0008,0050	Zero length for any Accession number, or Accession number matches this value
Patient’s name	R	0010,0010	Zero length for any Patient name, or Patient's name matches this value
Patient id	R	0010,0020	Zero length for any Patient id, or Patient id matches this value
Study id	R	0020,0010	Zero length for any Study

Description	Type	Tag	Value
			id, or Study id matches this value
Study Instance UID	U	0020,000D	Zero length for Study level query. Study Instance UID of study for which matches are requested at a lower level
Study description	O	0008,1030	Zero length
Private Creator Identification	P	0009,0010	GEMS_IDEN_01
Suite Id	P	0009,1002	Zero Length

Table 2.2.1.2.2.2.1-2: Requested Series Level Keys

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

Table 2.2.1.2.2.2.1-3: Requested Image Level Keys

Description	Type	Tag	Value
Image number	R	0020,0013	Zero length
Image Instance UID	U	0008,0018	Zero length
Image type	O	0008,0008	Zero length
Rows	O	0028,0010	Zero length
Columns	O	0028,0011	Zero length
Image position	O	0020,0032	Zero length
Image orientation	O	0020,0037	Zero length
Slice thickness	O	0018,0050	Zero length
Slice spacing	O	0018,0088	Zero length
Gantry tilt	O	0018,1120	Zero length
Convolution kernel	O	0018,1210	Zero length
Reconstruction diameter	O	0018,1100	Zero length
Data collection diameter	O	0018,0090	Zero length
Flip angle	O	0018,1314	Zero length
Echo number	O	0018,0086	Zero length
Echo time	O	0018,0081	Zero length
Inversion time	O	0018,0082	Zero length
Repetition time	O	0018,0080	Zero length
Private Creator Identification	P	0019,0010	GEMS_ACQU_01
Dfov Rect	P	0019,101E	Zero Length
Midscan Time	P	0019,1024	Zero Length
Azimuth	P	0019,1026	Zero Length

Description	Type	Tag	Value
Number of Echo	P	0019,107E	Zero Length
Private Creator Identification	P	0021,0010	GEMS_RELA_01
Scout Anref	P	0021,104A	Zero Length
Private Creator Identification	P	0027,0010	GEMS_IMAG_01
Location RAS	P	0027,1040	Zero Length
Location	P	0027,1041	Zero Length
Center R Coordinate	P	0027,1042	Zero Length
Center A Coordinate	P	0027,1043	Zero Length
Table Start Location	P	0027,1050	Zero Length
Table End Location	P	0027,1051	Zero Length
RAS Letter for Side of Image	P	0027,1052	Zero Length
RAS Letter for Anterior/Posterior	P	0027,1053	Zero Length
RAS Letter for Scout Start Location	P	0027,1054	Zero Length
RAS Letter for Scout End Location	P	0027,1055	Zero Length
Image Dimension X	P	0027,1060	Zero Length
Image Dimension Y	P	0027,1061	Zero Length

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

2.2.1.2.3 Get Image(s) from Remote AE

2.2.1.2.3.1 Associated Real-World Activity

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

2.2.1.2.3.2 Proposed Presentation Contexts

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

2.2.1.2.3.2.1 SOP Specific Conformance Statement for C-MOVE SCU

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

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

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

2.2.1.2.4 DICOM Ping to Remote AE

2.2.1.2.4.1 Associated Real-World Activity

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

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

2.2.1.2.4.2 Presentation Context Table

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

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

2.2.1.2.4.2.1 SOP Specific Conformance Statement to Verification SOP Class

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

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

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

2.2.1.2.5 Save exam/series to Remote AE

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

2.2.1.2.6 Auto Archive exam/series to Remote AE

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

2.2.1.3 Association Acceptance Policy

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

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

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

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

2.2.1.3.1 Receive Image(s)

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

2.2.1.3.1.1 Associated Real-World Activity

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

The acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Receive Image(s) is given in the following Presentation Context Table

Table 2.2.1.3.1.2-1: Presentation Contexts for Image Receive

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

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

2.2.1.3.1.1.1 SOP Specific Conformance to Storage SOP Classes

The DICOM Server AE conforms to the SOP's of the Storage Service Class at level 1 (base).

Type 3 elements will be discarded unless explicitly stated otherwise (reference *Appendix A IOD Definitions*). Private elements will be discarded from the image when receiving images containing non-GE private data elements.

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

Image Reception

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

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

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

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

A800 (SOP Class not supported)

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

Images may be deleted when instructed to do so by the user. Thus the duration of the storage of the image is determined by the users of the Signa Excite 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 non-GE Created MR or CT Images

Images received from non GE products are installed as the appropriate image object. Their private data elements will be maintained if the negotiated transfer syntax is Explicit Little Endian. Also if any critical fields (mandatory) are missing, then the image will not be installed.

2.2.1.3.2 Verification Request from Remote AE

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

2.2.1.3.2.1 Associated Real-World Activity

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

2.2.1.3.2.2 Presentation Context Table

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

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

2.2.1.3.2.2.1 SOP Specific Conformance to Verification SOP Class

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

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

2.2.1.3.3 Query Request from Remote AE

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

2.2.1.3.3.1 Associated Real-World Activity

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

2.2.1.3.3.2 Presentation Context Table

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

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

2.2.1.3.3.2.1 SOP Specific Conformance to C-FIND SCP

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

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

Table 2.2.1.3.3.2.1-1 Supported study level keys

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

Table 2.2.1.3.3.2.1-2 Supported series level keys

Description	Type	Tag	Usage
Modality	R	0008,0060	Matched
Series number	R	0020,0011	Matched
Series Instance UID	U	0020,000E	Matched
Series description	O	0008,103E	Returned
Manufacturer	O	0008,0070	Returned
Images in series	O	0020,1002	Returned

Table 2.2.1.3.3.2.1-3 Supported image level keys

Description	Type	Tag	Usage
Image number	R	0020,0013	Matched
Image Instance UID	U	0008,0018	Matched
Image type	O	0008,0008	Returned
Rows	O	0028,0010	Returned
Columns	O	0028,0011	Returned
Image position	O	0020,0032	Returned
Image orientation	O	0020,0037	Returned
Slice thickness	O	0018,0050	Returned
Slice spacing	O	0018,0088	Returned
Gantry tilt	O	0018,1120	Returned
Convolution kernel	O	0018,1210	Returned
Reconstruction diameter	O	0018,1100	Returned
Data collection diameter	O	0018,0090	Returned
Flip angle	O	0018,1314	Returned
Echo number	O	0018,0086	Returned
Echo time	O	0018,0081	Returned
Inversion time	O	0018,0082	Returned
Repetition time	O	0018,0080	Returned
Trigger time	O	0018,1060	Returned
Private Creator Identification	P	0019,0010	GEMS_ACQU_01
Dfov Rect	P	0019,101E	Returned

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

Description	Type	Tag	Usage
Midscan Time	P	0019,1024	Returned
Azimuth	P	0019,1026	Returned
Number of Echo	P	0019,107E	Returned
Private Creator Identification	P	0021,0010	GEMS_RELA_01
Scout Anref	P	0021,104A	Returned
Private Creator Identification	P	0027,0010	GEMS_IMAG_01
Location RAS	P	0027,1040	Returned
Location	P	0027,1041	Returned
Center R Coordinate	P	0027,1042	Returned
Center A Coordinate	P	0027,1043	Returned
Table Start Location	P	0027,1050	Returned
Table End Location	P	0027,1051	Returned
RAS Letter for Side of Image	P	0027,1052	Returned
RAS Letter for Anterior/Posterior	P	0027,1053	Returned
RAS Letter for Scout Start Location	P	0027,1054	Returned
RAS Letter for Scout End Location	P	0027,1055	Returned
Image Dimension X	P	0027,1060	Returned
Image Dimension Y	P	0027,1061	Returned

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

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

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

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

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

Except sequence matching all other matchings are supported. (i.e. wildcard ("*", "?") and range ("-") matching is supported as defined in DICOM PS3.4 Section C.2 *Query/Retrieve Information Model Definition*.)

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

2.2.1.3.4 Retrieve Request From Remote AE

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

2.2.1.3.4.1 Associated Real-World Activity

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

2.2.1.3.4.2 Presentation Context Table

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

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

2.2.1.3.4.2.1 SOP Specific Conformance to C-MOVE SCP

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

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

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

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

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

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

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

2.2.1.3.4.3 Presentation Context Acceptance Criteria

No criterion.

2.2.1.3.4.4 Transfer Syntax Selection Policy

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

2.3 COMMUNICATION PROFILES

2.3.1 Supported Communication Stacks (parts 8,9)

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

2.3.2 TCP/IP Stack

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

2.3.2.1 Physical Media Support

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

2.4 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.4.1 Specialized Information Object Definition

Following is a list of additional private attributes for (0008,0008) and (0018,0022) defined for a standard MR IOD. For incoming third-party DICOM images the values in these elements are retained without modification.

(0008,0008) Image Types (private attributes for 3rd and 4th values)

Acquisition Data Types:
ORIGINAL\PRIMARY\OTHER
ORIGINAL\PRIMARY\OTHER\SUBTRACTION
ORIGINAL\PRIMARY\EPI\NONE
ORIGINAL\PRIMARY\T2\NONE
ORIGINAL\PRIMARY\PROPELLER\NONE
ORIGINAL\PRIMARY\DIFFUSION\NONE
DERIVED\PRIMARY\PROJECTION IMAGE\COLLAPSE
DERIVED\PRIMARY\PROJECTION IMAGE\VASCULAR

Post Processed Data Types:
DERIVED\PRIMARY\ADC\ADC
DERIVED\PRIMARY\CMB\CMB
DERIVED\PRIMARY\EADC\EADC
DERIVED\PRIMARY\PROJECTION IMAGE\IVI
DERIVED\PRIMARY\VAR\VAR
DERIVED\SECONDARY\COMBINED **(SCPT object)**
DERIVED\SECONDARY\PROCESSED **(Modality object)**
DERIVED\SECONDARY\OTHER\SCREEN SAVE
DERIVED\SECONDARY\PJN **(MR object)**
DERIVED\SECONDARY\PJN\MIP
DERIVED\SECONDARY\PJN\HD MIP
DERIVED\SECONDARY\PJN\MIN IP
DERIVED\SECONDARY\PJN\RAYSUM
DERIVED\SECONDARY\PJN\INTEGRAL
DERIVED\SECONDARY\REFORMATTED
DERIVED\SECONDARY\REFORMATTED\MIP
DERIVED\SECONDARY\REFORMATTED\MIN IP
DERIVED\SECONDARY\REFORMATTED\AVERAGE
DERIVED\SECONDARY\REFORMATTED\VOLREN
DERIVED\SECONDARY\3D **(SCPT object)**

DERIVED\SECONDARY\3D\SURFACE
DERIVED\SECONDARY\3D\MIP
DERIVED\SECONDARY\3DHD MIP
DERIVED\SECONDARY\3D\MIN IP
DERIVED\SECONDARY\3D\VOLREN
DERIVED\SECONDARY\3D\RAYSUM
DERIVED\SECONDARY\3D\INTEGRAL
DERIVED\SECONDARY\SCREEN SAVE **(SCPT object)**
DERIVED\SECONDARY\SCREEN SAVE\MIP
DERIVED\SECONDARY\SCREEN SAVE\MIN IP
DERIVED\SECONDARY\SCREEN SAVE\AVERAGE
DERIVED\SECONDARY\SCREEN SAVE\VOLREN
DERIVED\SECONDARY\REFORMATTED **(Modality)**

(0018,0022) Scan Options : Defined Terms

NONE	RAMP_AP_GEMS
CINE_GEMS	RAMP_IS_GEMS
CL_GEMS	RAMP_LR_GEMS
CS_GEMS	RAMP_PA_GEMS
DEP_GEMS	RAMP_RL_GEMS
EDR_GEMS	RAMP_SI_GEMS
EPI_GEMS	RT_GEMS
FAST_GEMS	RTR_GEMS
FC_FREQ_AX_GEMS	SAT_GEMS
FC_SLICE_AX_GEMS	SEQ_GEMS
FILTERED_GEMS	SQPIX_GEMS
FT_GEMS	SS_GEMS
GRAPH_GEMS	TRF_GEMS
IIC_GEMS	VASCANGIO_GEMS
IRP_GEMS	VASCPC_GEMS
MP_GEMS	VASCPC_GEMS
MT_GEMS	VASCTOF_GEMS
NF_GEMS	VASCTOF_GEMS
NPW	VB_GEMS
POMP_GEMS	

2.4.2 Private SOP Classes

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

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

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

2.4.3 Private Transfer Syntax

The following private SOP transfer syntax is defined:

Transfer Syntax Name	UID
Implicit VR Big Endian	1.2.840.113619.5.2

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

2.4.4 Private Data Elements

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

2.5 CONFIGURATION

2.5.1 AE Title/Presentation Address Mapping

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

2.5.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address (must match value of item in section 4.10.2)
- Local IP Netmask (must match value of item in section 4.10.2)
- Max PDU length
- Time-outs, which are set for all hosts, are configurable in dcs.cfg:
  note: * denotes any SOP class (time in sec)
  * Association time-out - *bi_assoc_tio*
  * Inactivity time-out - *bi_store_tio*
  * Session timeout - *bi_session_tio*
  * Move operation time-out - *bi_move_tio*
  * Find time-out - *bi_find_tio*

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

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

2.6 SUPPORT OF EXTENDED CHARACTER SETS

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

2.7 CODES AND CONTROLLED TERMINOLOGY

The product uses coded terminology as defined below.

2.7.1 Mapped Coded Terminology

The product maps, without change, coded terminology values supplied in Modality Worklist Scheduled Procedure Steps into Image SOP Instance and Modality Performed Procedure Step attributes, as described in Section 6.9.

2.8 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.
It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3 MEDIA STORAGE CONFORMANCE STATEMENT

3.0 Introduction

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

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

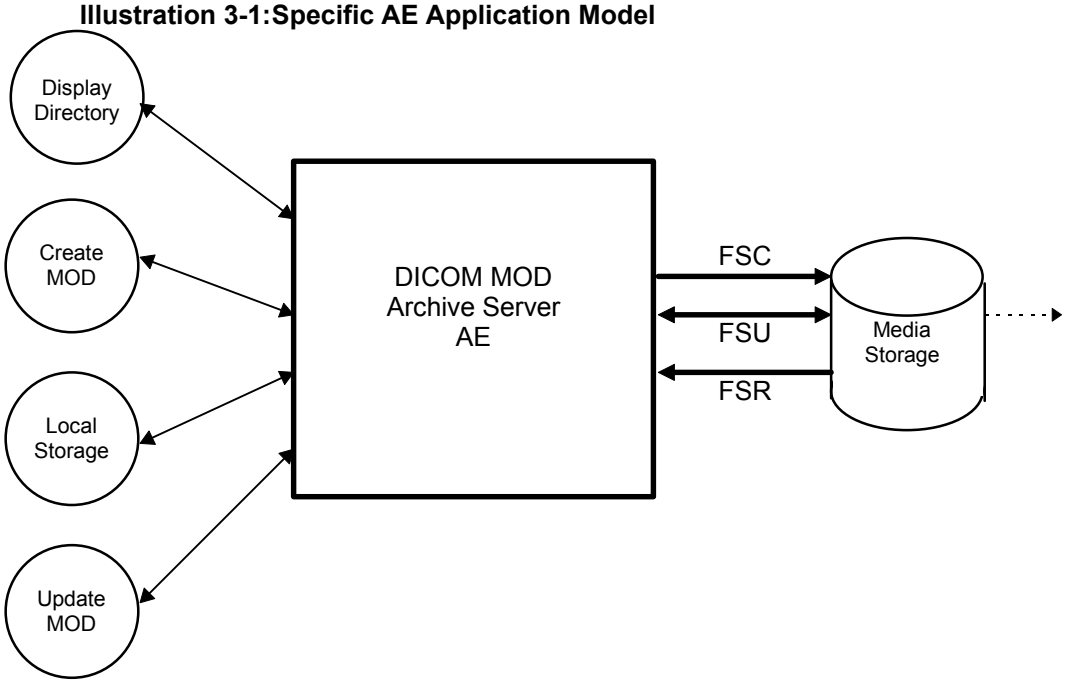
3.1 Implementation Model: MOD Archive Server

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

3.1.1 Application Data Flow Diagram

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

Illustration 3-1:Specific AE Application Model



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

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

3.1.2 Functional Definitions of AE's

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

The MOD Archive Application can perform these functions:

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

3.1.3 Sequencing of Real World Activities

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

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

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

There are no other sequencing requirements.

3.1.4 File Meta Information for Implementation Class and Version

The File Meta-Information for this implementation is:

File Meta-Information Version	1

Product Name	Implementation UID
Excite 1.5T	1.2.840.113619.6.135
Excite 3T	1.2.840.113619.6.155
Excite OpenSpeed	1.2.840.113619.6.153
Excite Ovation	1.2.840.113619.6.154

Implementation Version Name	<Software Release Build (varies)>

3.2 AE Specifications

3.2.1 MOD Archive Specification

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

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

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

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

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

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

3.2.1.1 File Meta Information for the Application Entity

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

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

3.2.1.2 Real World Activities

3.2.1.2.1 Real World Activity: Create MOD Request

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

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

3.2.1.2.1.1 Application Profiles for the RWA: Create MOD

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

3.2.1.2.2 Real World Activity: Display Directory

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

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

3.2.1.2.2.1 Media Storage Application Profile for the RWA: Display Directory

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

There are no extensions or specialization's.

3.2.1.2.2.2 Options:

None applicable.

3.2.1.2.3 Real World Activity: Copy to Local Storage

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

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

3.2.1.2.3.1 Application Profiles for the RWA: Copy to Local Storage

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

3.2.1.2.3.2 Options:

None applicable.

3.2.1.2.4 Real World Activity: Update MOD

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

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

3.2.1.2.4.1 Application Profiles for the RWA: Update MOD Request

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

3.2.1.2.4.2 Options:

None applicable.

3.3 Standard, Augmented and Private Application Profiles

3.3.1 Class and Profile Identification

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

The identifier for this class is CTMR-MOD.

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

Table 3.3.1-1: CT/MR MOD Profiles

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

3.3.2 Clinical Contexts

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

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

3.3.2.1 Roles and Service Class Options

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

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

3.3.2.1.1 File Set Creator

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

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

3.3.2.1.2 File Set Reader

The role of File Set Reader is used by the Application Entities which receive a transferred File Set. Typical entities using this role would include display workstations and archive systems which receive a patient record

transferred from another institution. File Set Readers shall be able to read all the SOP Classes defined for the specific Application Profile for which a Conformance Statement is made using all the defined Transfer Syntaxes.

3.3.2.1.3 File Set Updater

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

3.3.3 Standard Application Profiles

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

3.3.3.1 STD-CTMR-MOD12 Class Profile

3.3.3.1.1 SOP Classes and Transfer Syntaxes

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

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

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

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

M : Mandatory O : Optional

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

3.3.3.1.2 Physical Media and Media Formats

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

3.3.3.1.3 Logical Format

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

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

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

3.3.3.1.4 Directory Information in DICOMDIR

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

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

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

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

3.3.3.1.4.1 Additional Keys

None.

3.3.3.1.5 Other Parameters

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

3.3.3.1.5.1 Image Attribute Values

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

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

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

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

3.3.3.1.5.1.1 Attribute Value Precedence

None.

3.3.3.2 STD-CTMR-MOD23 Class Profile

3.3.3.2.1 SOP Classes and Transfer Syntaxes

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

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

3.3.3.2.2 Physical Media and Media Formats

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

3.3.3.2.3 Logical Format

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

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

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

3.3.3.2.4 Directory Information in DICOMDIR

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

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

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

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

3.3.3.2.4.1 Additional Keys

None.

3.3.3.2.5 Other Parameters

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

3.3.3.2.5.1 Image Attribute Values

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

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

3.3.3.2.5.2 Attribute Value Precedence

None.

3.3.4 Private Application Profiles

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

3.3.4.1 PRI-CTMR-MOD12 Class Profile

3.3.4.1.1 SOP Classes and Transfer Syntaxes

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

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

NOTE:
The MOD Archive Application chooses the JPEG Lossless compression (selection value 1) as the default

transfer syntax for storing images on the media. But the transfer syntax is selectable on a per media basis at install time using a method defined by the Application.

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

3.3.4.1.2 Physical Media and Media Formats

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

3.3.4.1.3 Logical Format

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

3.3.4.1.4 Directory Information in DICOMDIR

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

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

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

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

3.3.4.1.5 Additional Keys

None.

3.3.4.1.6 Other Parameters

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

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

3.3.4.1.6.1 Image Attribute Values

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

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

3.3.4.1.6.2 Attribute Value Precedence

None.

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

3.4.1 Extensions, Specialization's and Privatization's of SOP Classes

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

3.4.1.1 SOP Specific Conformance Statement for CT SOP Class

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

3.4.1.2 SOP Specific Conformance Statement for MR SOP Class

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

3.4.2 Private Transfer Syntax Specification

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

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

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

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

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

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

3.5 Configuration

The MOD Archive Application will have only 2.6GB drive installed.

Table 3.5-1 : Supported Profiles for various Drive Configurations

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

Support of Extended Character Sets

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

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

4 PRINT SCU CONFORMANCE

4.0 Introduction

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

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

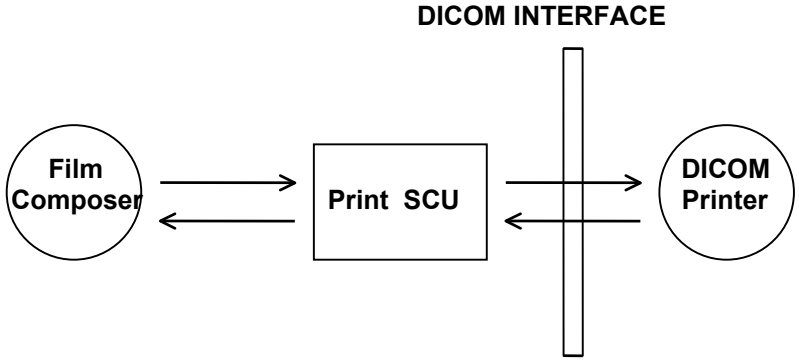
Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering scheme. Please refer to that part of the standard while reading this section.

4.1 IMPLEMENTATION MODEL : PRINT SCU

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

4.1.1 Application Data Flow Diagram

DICOM print SCU Implementation model



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

4.1.2 Functional Definition of AE's

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

4.1.3 Sequencing of Real-World Activities

User has to select the DICOM printer from Film Composer Interface.
The images to be printed shall be dragged and dropped into film composer slots from Viewing applications either manually or automatically.
In case of manual drag and drop user has to press Print Button to print the images .
The Print SCU will start the Print Session. The Print Session involves establishing association with printer followed by the next sequence of activities.
The Print SCU gets the Printer status using N-GET service. If the Printer returns FAILURE status the print session will be terminated and the requester will be notified of the printer status.
The film session is created using N-CREATE service. In case of error return the print session will be terminated. The attribute values for the Film session will be specified with the film session request.
The film box is created using N-CREATE service. The print session will be terminated if the printer fails to create the film box. The film box attribute values will be sent in the film box create request.
The image attributes for the images to be printed in this session will be set using the N-SET service. If the printer fails to accommodate the images in the image set to be printed the print session will be terminated.
The film will be printed using the N-ACTION service. Only film box printing is supported. In case of error the print session will be terminated.
Film box instance will be deleted using the N-DELETE service.
The SCU does not wait for N-EVENT-REPORT from Printer after deleting the film box instance. The N-EVENT-REPORT received when the association is still active are handled but the data received will be ignored.
Finally the association will be terminated and if all the above operations are successful the requester will be notified of the successful print session. This just indicates the images to be printed have been successfully sent to the printer.

4.2 AE SPECIFICATIONS

4.2.1 DICOM Print SCU AE Specification

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

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

4.3 Association Establishment Policy

4.3.1 General

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

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

Application Context Name	**1.2.840.10008.3.1.1.1**

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

Maximum Length PDU	**10 kbytes**

4.3.2 Number of Associations

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

4.3.3 Asynchronous Nature

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

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

The Implementation UID for this GEMS Implementation is:

Product Name	Implementation UID
Excite 1.5T	1.2.840.113619.6.135
Excite 3T	1.2.840.113619.6.155
Excite OpenSpeed	1.2.840.113619.6.153
Excite Ovation	1.2.840.113619.6.154

4.4 Association Establishment Policy

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

4.5 Real World Activity

Associated Real-World Activity - "Print"

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

4.6 Proposed Presentation Contexts

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

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Print Job SOP Class	1.2.840.10008.5.1.1.14	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Printer SOP Class	1.2.840.10008.5.1.1.16	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

4.7 SOP Specific Conformance Statement

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

Mandatory Print SOP Classes supported by Print SCU :

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

Optional Print SOP Classes supported by Print SCU :

NAME	UID
Print Job SOP Class	1.2.840.10008.5.1.14

4.7.1 Basic Film Session SOP Class

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

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

The following table shows the attribute values supported by the N-CREATE operation. Although these attributes are optional for the SCU, we provide values for all of these optional attributes. 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.

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 = HIGH
Medium Type	(2000, 0030)	CLEAR FILM BLUE FILM PAPER	Set in Configuration File
Film Destination	(2000, 0040)	MAGAZINE PROCESSOR	Set in Configuration File

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

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

4.7.2 Basic Film box SOP Class

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

N-CREATE - Requests the Print SCP to create an instance of Film Box.
N-ACTION - Requests the Print SCP to print the Film Box onto Printer.
N-DELETE - Requests the Print SCP to delete the Film Box Instance.

The Following Attribute values are supported.

Attribute	DICOM Tag	Valid Range	Default Value
Image Display Format	(2010, 0010)	STANDARD/C,R Printer Dependent	Set in User Interface
Reference Film Session Sequence	(2010, 0500)		
Film Orientation	(2010, 0040)	PORTRAIT	Set in Configuration File
Film Size ID	(2010, 0050)	(zero length), “14INX17IN”	Set in Configuration File
Magnification type	(2010, 0060)	BILINEAR CUBIC REPLICATE NONE	Set in Configuration File
Trim	(2010, 0140)	YES/NO/Not Sent	NO
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/Not Sent	Set in Configuration File
Empty image density	(2010, 0110)	BLACK/WHITE/Not Sent	Set in Configuration File
Min density	(2010, 0120)	0-4095, Not Sent	Set in Configuration File

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

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

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

4.7.3 Basic Grayscale Image Box SOP Class

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

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

The Following Attribute values are supported.

Attribute	DICOM Tag	Valid Range	Default Value
Image Position	(2020, 0010)	Based on Image Display Format	No Default Value
Preformatted Grayscale Image Sequence	(2020,0110)		
>Samples per pixel	(0028, 0002)	1	1
>Photometric Interpretation	(0028, 0004)	MONOCHROME2	MONOCHROME2
>Rows	(0028, 0010)	Image Dependent	Image Dependent
>Columns	(0028, 0011)	Image Dependent	Image Dependent
>Pixel Aspect Ratio	(0028, 0034)	1/1	1/1
>Bits Allocated	(0028, 0100)	8	8
>Bits Stored	(0028, 0101)	8	8
>High Bit	(0028, 0102)	7	7
>Pixel Representation	(0028, 0103)	0 (unsigned integer)	0 (unsigned integer)
Polarity	(2020, 0020)	NORMAL	NORMAL

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

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

4.7.4 Printer SOP Class

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

The Print SCU issues the request to retrieve following attributes.

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

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

If Printer status (2110,0010) is NORMAL, the film is printed.
If Printer status (2110,0010) is FAILURE the print job is terminated. The Printer Status Info (2110,0020) attribute is not processed.
If Printer status (2110,0010) is WARNING one of three things will happen:
a) If the Printer Status Info (2110,0020) is “SUPPLY LOW” the status is displayed to the user and the print job continues.
b) If the Printer Status Info (2110,0020) is “RECEIVER FULL” or “SUPPLY EMPTY”, or “FILM JAM” the status is displayed to the user and the print job is aborted.
c) For all other Printer Status Info (2110,0020) values, the status is ignored and the print job continues.

4.7.5 Print Job SOP Class

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

Attribute Name	DICOM Tag	Default Value
Execution Status	(2100, 0020)	Printer Shall return Value
Execution Status Info	(2100, 0030)	Printer Shall return Value
Printer Name	(2000, 0020)	Printer Shall return Value
Creation Date	(2100, 0040)	Printer Shall return Value
Creation Time	(2100, 0050)	Printer Shall return Value
Printer Name	(2110, 0030)	Printer Shall return Value
Originator	(2100, 0070)	Printer Shall return Value

4.8 Association Acceptance Policy

The Print SCU does not accept associations.

4.9 COMMUNICATION PROFILES

4.9.1 Supported Communication Stacks (parts 8,9)

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

4.9.2 TCP/IP Stack

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

4.9.3 API

Not Applicable

4.9.4 Physical Media Support

Ethernet v2.0, IEEE 802.3.

4.9.5 Standard Extended/Specialized/Private SOPs

None.

4.10 AE Title/Presentation Address Mapping

4.10.1 The Local AE title

The local AE title is derived from the system hostname by appending "_DCP" to the hostname. The result is "<hostname>_DCP".

4.10.2 Configurable Parameters

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

The following fields are configurable for the DICOM Print SCU AE:
Local IP Address (must match value in section 2.5.2)
Local IP Netmask (must match value in section 2.5.2)
Max PDU length
Time-outs, which are set for all hosts, are configurable in the dprint.cfg file. The following table lists the parameters and default values:

Timeout Description	Default Value	Configuration Parameter Name
Assocation Time out	120 seconds	bi_assoc_tio
Session Time out	1200 seconds	bi_session_tio
Echo Time out	200 seconds	bi_echo_tio
N-SET Time out	300 seconds	bi_nset_tio
N-ACTION Time out	300 seconds	bi_naction_tio
N-CREATE Time out	300 seconds	bi_ncreate_tio
N-DELETE Time out	300 seconds	bi_ndelete_tio
N-GET Time out	100 seconds	bi_nget_tio

The following DICOM print parameters are configurable. The valid ranges are shown in earlier sections of this document.

Attribute Name	DICOM Tag
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)

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

4.10.3 Support of Extended Character Set

The Print SCU does not support any Extended Character Set.

5 Enhanced Modality Worklist Conformance Statement

5.0 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The overall content of this specification is an enhancement to the existing capability. The contents of this section are:

5.1IMPLEMENTATION MODEL

5.2AE SPECIFICATIONS

5.3MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

5.4MODALITY WORKLIST INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

5.5INFORMATION MODEL MODULE

5.6INFORMATION MODEL KEYS

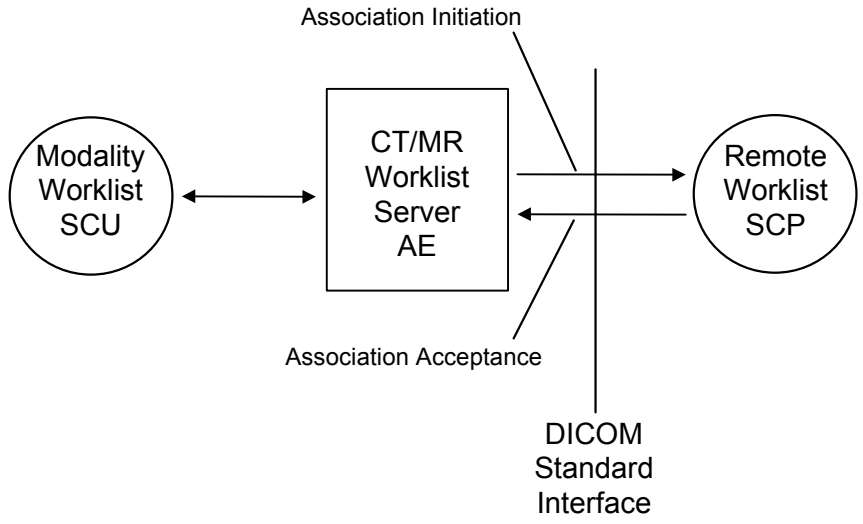
5.7PRIVATE DATA DICTIONARY

5.1 IMPLEMENTATION MODEL

All Modality Worklist DICOM functionality provided by the GE Medical System *MRI System* 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 Scanner's user interface.

5.1.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following illustration:



5.1.2 Functional Definition of AE's

The 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 worklist, query remote AE's and return the results to the user interface.
The Worklist Server AE initiates the following functions:

- *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.

5.1.3 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 attributes corresponding to operator selected returned worklist responses will be included in the Modality Performed Procedure Step related to the responses.
5. A subset of attributes corresponding to operator selected returned worklist responses will be included in acquired DICOM images related to the responses.

5.2 AE SPECIFICATIONS

5.2.1 Worklist Server AE Specification

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

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

5.2.1.1 Association Establishment Policies

5.2.1.1.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for 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.
The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID

5.2.1.1.2 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.

5.2.1.1.3 Asynchronous Nature

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

5.2.1.1.4 Implementation Identifying Information

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

The Implementation UID for this GEMS Implementation is:

Modality Worklist Implementation UID	**1.2.840.113619.6.52**

5.2.1.2 Association Initiation Policy

The Worklist Server AE initiates a new association due to an update operation being initiated from the Signa Excite user interface. The association is closed upon receipt of the final query response from the remote AE. The association can also be closed by the Worklist Server AE upon receipt of error status from the remote AE or upon expiration of association or session timers (see section 2.3.1.2.1.2.1 for more information).

5.2.1.2.1 Real-World Activity: Worklist Query

5.2.1.2.1.1 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 MR
- Scheduled Station AE Title, (0040,0001) - set to Station name AE title

This Modality:
- Modality, (0008,0060) - set to MR
- 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)

Note that the All Scanners query above can return worklist items for modalities other than MR if such items exist. The system will warn the operator and disallow selection if a dissimilar modality is selected from the worklist.
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 that number of days both before and after can be specified in the same query and that each always includes today.

All Days:

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

Note that selecting All Scanners and All Days with no worklist specific fields specified results in an unconstrained worklist query. The response to an unconstrained worklist query can differ between different modality worklist SCP implementations. Consult the modality worklist SCP manufacturer if difficulties occur when attempting unconstrained queries.

Worklist specific fields targeted to retrieve a single or very small set of related entries may also be specified. These fields may be used for a query combined with scanner and scheduled time to provide a very specific query to the worklist server. The specific fields are specified below:

Patient Name (0010,0010)

Matching with leading and trailing wildcards is allowed on either Patient Last Name or Patient First Name (user selectable), zero length matches all values.

Patient ID (0010,0020)

Zero length or single value matching only of value entered.

Requested Procedure ID (0040,1001)

Leading and trailing wildcard matching for value entered.

Assession Number (0008,0050)

Leading and trailing wildcard matching for value entered.

5.2.1.2.1.2 Proposed Presentation Context

Table 5-1 Proposed Presentation Context, shows the proposed presentation contexts for the Worklist Server AE after real-world activity "Worklist Query" has been initiated:

Table 5-1 Proposed Presentation Context

Presentation Context Table – Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended**
Name	**UID**	**Name List**	**UID List**		**Negotiation**
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

5.2.1.2.1.2.1 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 response is discarded and the next response (if any) is considered.
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. Any previously received worklist items are discarded. 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.

All errors and failures detected by the Worklist Server AE are logged to the log file **/usr/g/hisris/wlsErrors**.

5.2.1.2.1.2.2 Record Acceptance Policy

The *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 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 immediately discard the item containing the error (not including it in any resulting displayed worklist items.) Any received valid worklist items are retained.
Note that the absence of requested Type 2 or Type 3 attributes is not considered an error.
Attributes considered Type 1 by the Worklist Server AE include:

- (0010,0010), Patient's Name
- (0010,0020), Patient ID
- (0020,000D), Study Instance UID
- (0040,0001), Scheduled Station AE Title
- (0040,0002), Scheduled Procedure Step Start Date
- (0040,0003), Scheduled Procedure Step Start Time
- (0040,0009), Scheduled Procedure Step ID
- (0040,1001), Requested Procedure ID
- (0008,0060), Modality

5.2.1.3 Association Acceptance Policy

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

5.3 MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

In order to serve as a Service Class Provider (SCP) of the Modality Worklist Service Class, a DICOM Application Entity (AE) possesses information about the attributes of a number of managed worklist items. These items are organized into Modality Worklist Information Modules. In this Service Class, the Information Model plays a role similar to an Information Object Definition of most other DICOM Service Classes.

5.4 MODALITY WORKLIST INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Figure 5-1 Modality Worklist Information Model E/R DIAGRAM. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization:

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

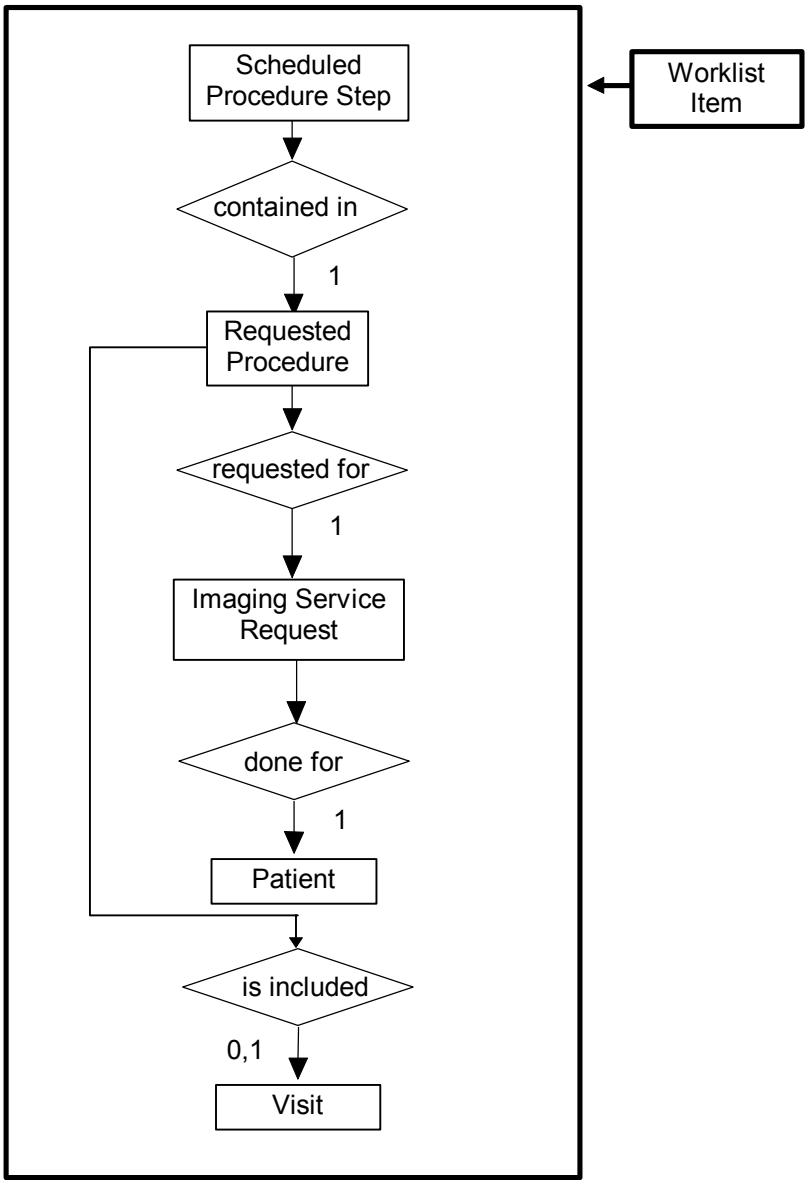


Figure 5-1
Modality Worklist Information Model E/R DIAGRAM

5.4.1 ENTITY DESCRIPTIONS

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.

5.4.1.1 Scheduled Procedure Step

A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service that is specified by the Procedure Plan for a Requested Procedure. It specifies one or more Action Items (events) involving equipment (i.e. imaging modality equipment), human resources, location and time (i.e. start time, stop time, duration).

5.4.1.2 Requested Procedure Entity Description

A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider.

5.4.1.3 Imaging Service Request Entity Description

An Imaging Service Request is a set of one or more Requested Procedures selected from a list of Procedure Types. An Imaging Service Request is submitted by one authorized imaging service requester to one authorized imaging service provider in the context of one Service Episode.

5.4.1.4 Visit Entity Description

A Visit is the context in which the treatment or management of an arbitrary subset of a Patient's medical conditions occurs. A Visit is limited to the description of a Patient's activities at a single facility.

5.4.1.5 Patient Entity Description

A Patient is a person receiving, or registered to receive, healthcare services.

5.4.2 MR Systems Mapping of DICOM Entities

Table 5-2
Mapping of DICOM Entities to MR Systems Entities

DICOM	MR *Systems* Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

5.5 INFORMATION MODEL MODULE

Within an entity of the DICOM Modality Worklist Information Model, attributes are grouped together into related set of attributes called modules. A module facilitates the understanding of the semantics concerning the attributes and how the attributes relate to one another. A module grouping does not infer any encoding of information into datasets.
Table 2-3 identifies the defined modules within the entities which comprise the DICOM Modality Worklist Information Model. Modules are identified by Module Name.
See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

Table 5-3
Modality Worklist Information Model Modules

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	5.6.2.1
	Scheduled Procedure Step	5.6.2.2
Requested Procedure	Requested Procedure	5.6.3.1
Imaging Service Request	Imaging Service Request	5.6.4.1
Visit	Visit Identification	5.6.5.1
	Visit Status	5.6.5.2
	Visit Relationship	5.6.5.3
	Visit Admission	5.6.5.4
Patient	Patient Relationship	5.6.6.1
	Patient Identification	5.6.6.2
	Patient Demographic	5.6.6.3
	Patient Medical	5.6.6.4

5.6 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 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.
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.

5.6.1 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

5.6.2 Scheduled Procedure Step Entity

5.6.2.1 SOP Common Module

Table 5-4 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	The value of "ISO_IR 100" is always sent in the query, however the returned value is ignored.

5.6.2.2 Scheduled Procedure Step Module

Table 5-5 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	
>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 Station Name is supplied for matching; this is user selectable. Displayed on "More Info" Screen.
>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. The number of days before/after is specified by the user. Displayed on "More Info" Screen.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	Displayed on "More Info" Screen.

>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. Displayed on "More Info" Screen.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	No	Displayed on "More Info" Screen.
>Scheduled Procedure Step Description	(0040,0007)	O	1C	Yes	Displayed on "More Info" Screen.
>Scheduled Station Name	(0040,0010)	O	2	No	not used
>Scheduled Procedure Step Location	(0040,0011)	O	2	No	Displayed on "More Info" Screen.
>Scheduled Action Item Code Sequence	(0040,0008)	O	1C	No	
>>Code Value	(0008,0100)	O	1C	No	For MR systems, when a procedure step is selected from the schedule, the returned value is used to automatically select and download a protocol for MR systems (if the appropriate mapping has been established). See the MR system documentation for further details Displayed on "More Info..." screen.
>>Coding Scheme Designator	(0008,0102)	O	1C	No	Displayed on "More Info..." screen.
>>Code Meaning	(0008,0104)	O	3	No	Displayed on "More Info..." screen.
>Pre-Medication	(0040,0012)	O	2C	No	
>Scheduled Procedure Step ID	(0040,0009)	O	1	Yes	Displayed on "More Info..." screen.
>Requested Contrast Agent	(0032,1070)	O	2C	No	Displayed on "More Info..." screen.

5.6.3 Requested Procedure Entity

5.6.3.1 Requested Procedure Module

Table 5-6 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	Displayed on "More Info..." screen.
Requested Procedure Description	(0032,1060)	O	1C	Yes	MR truncates to 22 characters in image header, saved as exam description. Displayed Fully on "More Info..." screen.
Requested Procedure Code Sequence	(0032,1064)	O	1C	No	Displayed on "More Info..." screen.
>Code Value	(0008,0100)	O	1C	No	Displayed on "More Info..." screen.
>Coding Scheme Designator	(0008,0102)	O	1C	No	Displayed on "More Info..." screen.
>Code Meaning	(0008,0104)	O	3	No	Displayed on "More Info..." screen.
Study Instance UID	(0020,000D)	O	1	Yes	Displayed on "More Info..." screen.

Referenced Study Sequence	(0008,1110)	O	2	No	
>Referenced SOP Class UID	(0008,1150)	O	1C	No	not used
>Referenced SOP Instance UID	(0008,1155)	O	1C	No	not used
Requested Procedure Priority	(0040,1003)	O	2	No	not used
Requested Procedure Comments	(0040,1400)	O	3	No	Displayed on “More Info...” screen.
Name of Intended recipients of results	(0040,1010)	O	3	No	Displayed on “More Info...” screen.
Patient Transport Arrangements	(0040,1004)	O	2	No	not used
Requested Procedure Location	(0040,1005)	O	3	No	not used
Confidentiality Code	(0040,1008)	O	3	No	not used

5.6.4 Imaging Service Request Entity

5.6.4.1 Imaging Service Request Module

Table 5-7 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	Displayed on “More Info...” screen.
Requesting Physician	(0032,1032)	O	2	No	Displayed on “More Info...” screen.
Referring Physician's Name	(0008,0090)	O	2	Yes	MR Truncates to 32 characters in image header. Displayed on “More Info...” screen.
Imaging Service Request Comments	(0040,2400)	O	3	No	Displayed on “More Info...” screen.
Requesting Service	(0032,1033)	O	3	No	Displayed on “More Info...” screen.

5.6.5 Visit Entity

5.6.5.1 Visit Identification

Table 5-8 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	not used
Institution Name	(0008.0080)	O	3	No	not used

5.6.5.2 Visit Status

Table 5-9 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.

5.6.5.3 Visit Relationship

Table 5-10 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	not used
>Referenced SOP Instance UID	(0008,1155)	O	2	No	not used

5.6.5.4 Visit Admission

No data elements are requested from the Visit Admission Module.

5.6.6 Patient Entity

5.6.6.1 Patient Relationship

No data elements are requested from the Patient Relationship Module.

5.6.6.2 Patient Identification

Table 5-11 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	Matching is supported as follows: either no Patient's Name is supplied (universal matching), the patient's last (family) name specified on the scanner's Preferences screen is supplied, or the Patient's first name for matching; this is user selectable. Wild card matching is implemented for leading and trailing characters. Patient Name is displayed on the "Patient Information" screen.
Patient ID	(0010,0020)	R	1	Yes	Matching is supported using single value matching from the scanner's Preferences page. Patient ID is displayed on the "Patient Information" screen.
Other Patient ID's	(0010,1000)	O	3	No	Displayed on "More Info..." screen.

5.6.6.3 Patient Demographic

Table 5-12 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	Displayed on the "Patient Information" screen.
Patient's Sex	(0010,0040)	O	2	Yes	Displayed on the "Patient Information" screen.
Patient's Weight	(0010,1030)	O	2	No	Limited to maximum value of 999 kg. Displayed on "More Info..." screen. Weight is an operator entry requirement for MR on the "Patient Information" screen.
Confidentiality constraint on patient data	(0040,3001)	O	2	No	Not used
Patient's Size	(0010,1020)	O	3	No	Not used
Patient's Address	(0010,1040)	O	3	No	Not used
Patient's Telephone Numbers	(0010,2154)	O	3	No	Not used

Patient Comments	(0010,4000)	O	3	No	Displayed on “More Info...” screen.
Ethnic Group	(0010,2160)	O	3	No	Displayed on “More Info...” screen.

5.6.6.4 Patient Medical

Table 5-13 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. MR truncates in image header to 60 characters

5.7 PRIVATE DATA DICTIONARY

The *MR Implementation* does not define any private attributes within the Modality Worklist Information Model. Private attributes received from a remote AE are discarded.

6 PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT

6.0 INTRODUCTION

The PPS option for the MR *Implementation* 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).

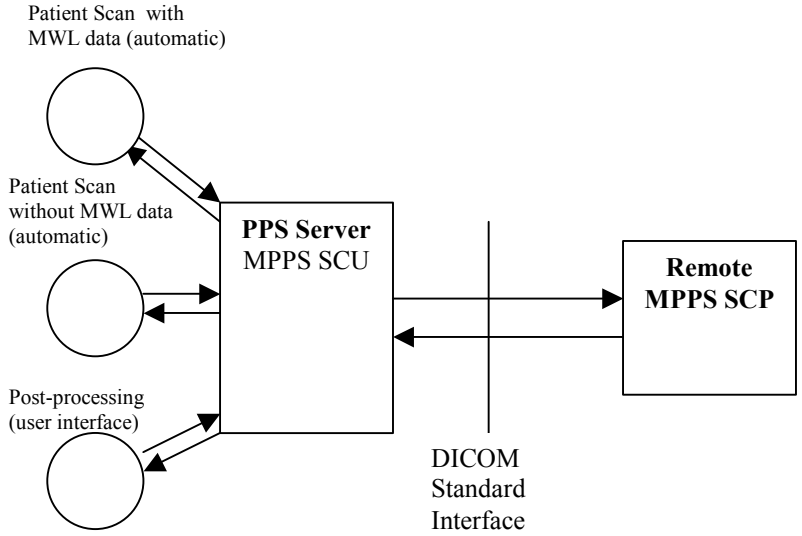
This capability works in conjunction with DICOM Modality Work-list feature. However the conformance of this capability is independent of Modality work-list feature. For information on conformance of Modality Work-List to DICOM standard please refer to the appropriate section of this document.

6.1 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.

6.1.1 APPLICATION DATA FLOW DIAGRAM

The basic Application models for the feature are shown in the following illustration:



6.1.2 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'.

6.1.3 Sequencing of Real-World Activities

6.1.3.1 PPS from acquisition system with MWL data

The system has a Modality Work-list Server AE installed. Work-List information is obtained from HIS/RIS system through the use of Basic Work-list Management Service. Use of the information retrieved in the creation of Image SOP instance is described in section 2 of this document. Use of the information retrieved in MPPS SOP instances is described later in this document.

- Once a worklist entry is selected for scanning, the system retrieves necessary information related to the Scheduled Procedure Step from the Modality Work-list Server as mapped in *Table 6-1 Use of Specific DICOM Data.*
- The system initiates a 'Start PPS' when starting a scan, i.e. when the scan button is selected. The 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 with the status set to "in-progress".
- 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.
- Images created by the scanner will be marked as "INPR" on the browser if the N-CREATE message is successfully sent to the MPPS SCP.
- Images created by the scanner will not be marked on the browser if the N-Create message was not successfully sent. The N-CREATE message may be manually sent later by the operator in the browser.

At the end of image acquisition, system initiates an N-Set message based on the operator's choice on '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'.
If the operator selects PPS complete from the end exam pop-up:

- The 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 message includes the necessary information related to the Performed procedure Step as specified in *Table 6-1 Use of Specific DICOM Data*.
- 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. If the response indicates success, the PPS status on the browser will be set to complete. If the response indicates a failure, the PPS state in the browser will not be changed. The operator may manually re-send the message later for completion.
- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created as identified in *Table 6-1 Use of Specific DICOM Data*.

At the end of the exam, if the user chooses 'Defer PPS', no message is sent. The user may manually choose to sent the N-Set message with either an "Complete or a "discontinue" later from the image browser. The Defer PPS" is to provide the operator with the option to manually add post processing images or remove acquisition images from the exam image list later.

If the operator chooses Discontinue at the end of the exam, then the PPS N-Set message sent to the PPS SCP will send a status of DISCONTINUE. The PPS state on the image browser will be updated with "DISC".

6.1.3.2 PPS from acquisition system without MWL data

The system either does not have a Modality Work-list Server AE installed or a Modality Work-list Server AE installed but no Work-List 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 information is stored in a worklist entry. The information mapping is specified in *Table 6-1 Use of Specific DICOM Data* From this point on the sequencing of events are equivalent to the real-world activities for PPS from the acquisition system *with* MWL data. This is described in section 3.2.3.1.

6.1.3.3 No PPS from acquisition system with/without MWL data

The system does not have a Modality PPS Server AE connection available or is off-line for the current procedure that is being performed. The information required for performing the procedure is supplied either through the Modality Worklist Server or the user interface of the system.

- The system does not initiate a 'Start PPS' before starting a scan, i.e. when the image acquisition is started.
- 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, user may select, from the user interface, either a 'Complete PPS', 'Discontinue PPS' or 'Defer PPS'. If Discontinue is selected, then the images created will be marked as discontinued. No MPPS transaction will be allowed. If Defer PPS or Complete PPS is selected, then the images will not be marked. No transaction or event will occur.

6.1.3.4 PPS for Images Created 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.

6.2 AE SPECIFICATION

6.2.1 PPS Server AE Specification

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

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

6.2.1.1 Association Establishment Policies

6.2.1.1.1 General

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

Application Context Name	**1.2.840.10008.3.1.1.1**

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU 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.

The user information items sent by this AE are

- Maximum PDU Length
- Implementation UID

6.2.1.1.2 Number of Associations

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

6.2.1.1.3 Asynchronous Nature

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

6.2.1.1.4 Implementation Identifying Information

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

The Implementation UID for this GEMS Implementation is:

Modality Preformed Procedure Step Implementation UID	**1.2.840.113619.6.141**

6.2.1.2 Association Initiation Policy

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

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

6.2.1.2.1.1 Associated Real-World Activity

The real-world activities are mentioned in section *6.1.3 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 standard.

6.2.1.2.1.2 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 *6.1.3 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

6.2.1.2.1.2.1 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.

6.2.1.3 Association Acceptance Policy

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

6.3 COMMUNICATION PROFILES

6.3.1 Supported Communication Stacks (PS 3.8)

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

6.3.2 OSI Stack

The OSI Communication stack is not supported by this Implementation.

6.3.3 TCP/IP Stack

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

6.3.3.1 API

Not Applicable to this product.

6.3.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

6.3.4 Point-to-Point Stack

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

6.4 EXTENSIONS/SPECIALIZATION/PRIVATIZATION

6.4.1 Standard Extended/Specialized/Private SOPs

PPS for the *MR Implementation* does not implement any private SOP classes.

6.4.2 Private Transfer Syntaxes

PPS for *MR Implementation* does not implement any private Transfer Syntaxes.

6.5 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 scanner's user interface.

6.5.1 AE Title/Presentation address Mapping

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

Remote AE (HIS/RIS) IP Address (the remote AE's network address)
Remote AE (HIS/RIS) IP Port (the remote AE's listen port)

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.

6.5.2 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 by changing their values in the configuration file **/usr/g/hisris/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:

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

6.6 SUPPORT OF EXTENDED CHARACTER SETS

PPS feature for the MR IMPLIMENTATION only supports the ISO_IR 100 extended character set.

6.7 N-CREATE & NSET REQUEST MESSAGE

PPS Feature for THE MR Implementation 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 Work-list SCU into the MPPS request Message, if procedure performed corresponds to the SPS information retrieved through the Modality Work-list.

- Referenced Study Sequence - a maximum of three items are supported. This attribute will be present only if SPS information is available from Modality Work-list 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).

For the MPPS associated with images created from a post-processing the following restrictions apply on the attributes listed below.

- Referenced Study Sequence – Copied from the originating image
- Scheduled Step Attribute Sequence – a maximum of 3 items are 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 – Copied from the originating image.
- 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 current Study Component (Exam) is used if the current state of the PPS is in-progress. Otherwise it is when the PPS in-progress is set for the post-processing image creation.
- 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.

6.8 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.

6.9 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 section 6.1.3 of this document. If the attribute is not supported by this implementation, but is a type 2, then the attribute will be sent with a zero length.

Table 6-1
Use of Specific DICOM Data

Attribute Name	Tag	Usage in MPPS Instance			Image header/notes
		Acquisition with MWL data	Acquisition without MWL data	Secondary Capture with PPS Acquisition Images	
Performed Procedure Step Relationship Module Attributes					
Scheduled Step Attribute Sequence	(0040,0270)	MWL SCP data	Only one item	Copied from source image	MR maps only one per exam.
>Study Instance UID	(0020,000D)	MWL SCP data	Local Unique ID	Copied from source image	Yes
>Referenced Study Sequence	(0008,1110)	MWL SCP data	Not used	Copied from source image	ENCODED
>>Referenced SOP Class UID	(0008,1150)	MWL SCP data	Not used	Copied from source image	Yes
>>Referenced SOP Instance UID	(0008,1155)	MWL SCP data	Not used	MWL,HIS	Yes
>Accession Number	(0008,0050)	MWL SCP data	User Entered or 0, if not entered	Copied from source image	Yes
>Requested Procedure ID	(0040,1001)	MWL SCP data	0	Copied from source image	Yes
>Requested Procedure Description	(0032,1060)	MWL SCP data	0	Copied from source image	Yes
>Scheduled Procedure Step ID	(0040,0009)	MWL SCP data	0	Copied from source image	Yes
>Scheduled Procedure Step Description	(0040,0007)	MWL SCP data	0	Copied from source image	Yes
>Scheduled Action Item Code Sequence	(0040,0008)	Encoded	0	Not used	No
>>Code Value	(0008,0100)	MWL, HIS, New, to be supported for PPS.	Not used	Not used	No
>>Coding Scheme designator	(0008,0102)	MWL, HIS, New, to be supported for PPS.	Not used	Not used	No
>>Code Meaning	(0008,0104)	MWL, HIS, New, to be supported for PPS.	Not used	Not used	No
Patient's Name	(0010,0010)	MWL SCP data	User Entered or 0 length, if not entered	Copied from source image	Yes
Patient ID	(0010,0020)	MWL SCP data	User Entered or 0 length, if not entered	Copied from source image	Yes

Attribute Name	Tag	Usage in MPPS Instance			Image header/notes
		Acquisition with MWL data	Acquisition without MWL data	Secondary Capture with PPS Acquisition Images	
Patient's Birth Date	(0010,0030)	MWL SCP data	User Entered or 0 length, if not entered	Copied from source image	Yes
Patient's Sex	(0010,0040)	MWL SCP data	User Entered or 0 length, if not entered	Copied from source image	Yes
Referenced Patient Sequence	(0008,1120)	MWL SCP data	Not used	Not used	No
>Referenced SOP Class UID	(0008,1150)	MWL SCP data	Not used	Not used	No
>Referenced Instance UID	(0008,1155)	MWL SCP data	Not used	Not used	No
Performed Procedure Step Information Module					
Performed Procedure Step ID	(0040,0253)	Same as Exam Number	Same as Exam Number	Copied from host if part of same procedure step or New generated, may not be unique	Yes
Performed Station AE Title	(0040,0241)	Local Station Name	Local Station Name	Should be the bi_aptitle or defaulted to <host_name>pps	Yes
Performed Station Name	(0040,0242)	Local Station Name	Local Station Name	Should be the bi_aptitle or defaulted to <host_name>pps	Yes
Performed Location	(0040,0243)	Suite ID	Suite ID	Not used	No
Performed Procedure Step Start Date	(0040,0244)	Date when scan starts for 1st series in exam.	Date when scan starts for 1st series in exam.	Same as exam date, if the procedure step current status is in progress. Otherwise the date for "IN PROGRESS" IS SET	No
Performed Procedure Step Start Time	(0040,0245)	Time when scan starts for 1st series in exam.	Time when scan starts for 1st series in exam.	Same as exam time, if the procedure step current status is in progress. otherwise the time "IN PROGRESS" IS SET"	No

Attribute Name	Tag	Usage in MPPS Instance			Image header/notes
		Acquisition with MWL data	Acquisition without MWL data	Secondary Capture with PPS Acquisition Images	
Performed Procedure Step Status	(0040,0252)	"In Progress" at start of exam "Discontinue" if selected by operator at end of exam "Complete" if selected at end of exam	"In Progress" at start of exam "Discontinue" if selected by operator at end of exam "Complete" if selected at end of exam	"In Progress" at end of image creation "Discontinue" if selected by operator with a previous InProgress status "Complete" if selected by operator with a previous InProgress status	Not used
Performed Procedure Step Description	(0040,0254)	Exam Description	Not Entered	filled in by application if new or copied from originating image	Exam description (MWL data only)
Performed Procedure Type Description	(0040,0255)	Not Entered	Not Entered	Not entered	No
Procedure Code Sequence	(0008,1032)	Scheduled Procedure Code Sequence from MWL SOP	Not used	Not used	No
>Code Value	(0008,0100)	MWL SCP data	Not used	Not used	No
Code Meaning Designator	(0008,0102)	MWL SCP data	Not used	Not used	No
Performed Procedure Step End Date	(0040,0250)	The date "Complete PPS" or "Discontinue PPS" is set	The date "Complete PPS" or "Discontinue PPS" is set	The date "Complete PPS" or "Discontinue PPS" is invoked, not the actual end of post-processing	No
Performed Procedure Step End Time	(0040,0251)	The time "Complete PPS" or "Discontinue PPS" is set	The time "Complete PPS" or "Discontinue PPS" is set	The time "Complete PPS" or "Discontinue PPS" is invoked, not the actual end of post-processing	No
Imaging Acquisition Results Module					
Modality	(0008,0060)	MR	MR	Copied from source image	Yes
Study ID	(0020,0010)	Value obtained from MWL data.	Exam Number set by system	Copied from source image	Yes
Performed Action Item Code Sequence	(0040,0260)	encoded	encoded	Encoded	Encoded
>Code Value	(0008,0100)	Protocol mapped AI Code value	Protocol mapped AI Code value	Copied from source image	Yes

Attribute Name	Tag	Usage in MPPS Instance			Image header/notes
		Acquisition with MWL data	Acquisition without MWL data	Secondary Capture with PPS Acquisition Images	
>Coding Scheme Designator	(0008,0102)	Protocol mapped AI Scheme Designator from MWL	Protocol mapped AI Scheme Designator from MWL	Copied from source image	Yes
>Code Meaning	(0008,0104)	Protocol mapped AI Scheme Designator from MWL	Not used	Not used	No
Performed Series Sequence	(0040,0340)	One item for each series created with Acquisition	One item for each series created with Acquisition	One item for each series created with post-processing	No
>Performing Physician's Name	(0008,1050)	Not used	Not used	Not used	No
>Operator's Name	(0008,1070)	Operator entry	Operator entry	Not used	Yes
>Series Instance UID	(0020,000E)	System generated UID	System generated UID	System generated UID	Yes
>Series Description	(0008,103E)	Operator entry or system generated	Operator entry or system generated	Operator entry or system generated	Yes
>Protocol Name	(0018,1030)	Protocol name that were used for acquisition and planned for post-processing	Protocol name that were used for acquisition	Copied from source image and Added by post processing application	No
>Retrieve AE Title	(0008,0054)	Archive AE title If auto-archive was set otherwise, null	Archive AE title If auto-archive was set otherwise, null	Not Used	No
>Referenced Image Sequence	(0008,1140)	One item for each image generated by Acquisition	One item for each image generated by Acquisition	One item for each image generated by post-processing	No
>>Referenced SOP Class UID	(0008,1150)	Image SOP Class UID	Image SOP Class UID	Image SOP Class UID	No
>>Referenced SOP Instance UID	(0008,1155)	Image SOP Instance UID	Image SOP Instance UID	Image SOP Instance UID	No
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Not used	Not used	Not used	No

7 Storage Commitment Conformance

7.0 Introduction

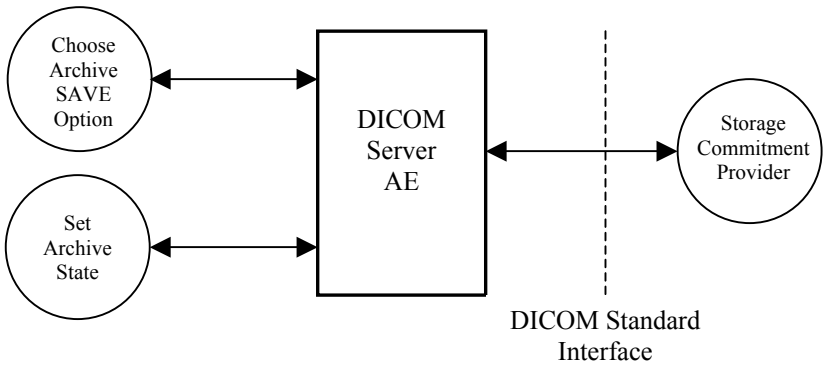
The MR system implements the DICOM Storage Commitment Push Model SOP Class. This system supports Storage Commitment as an SCU only.

7.1 Implementation Model

7.1.1 Application data flow diagram

Illustration 7-0 below shows the data flow diagram for Storage Commitment operation.

Illustration 7-0: 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.

7.1.2 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.

7.1.3 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.

7.2 AE Specifications

7.2.1 DICOM Server AE specifications for Storage Commitment

In addition to the SOP Classes defined in Section 2.2.1, 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

7.2.1.1 Association establishment policies

The association establishment policies for the DICOM Server AE are described in Section 2.2.1.1.

7.2.1.2 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.

7.2.1.3 Real World Activity

7.2.1.3.1 Associated Real World Activity - ”Save exam/series”

See Section 2.2.1.2.1. 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.

7.2.1.3.2 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.

7.2.1.4 Proposed Presentation Contexts

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

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

The Storage Commitment SCU can send the commitment request for the 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

7.2.2 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.

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**.

The following attrubutes are sent as part of the DATA Set for the N-Action request

STORAGE COMMITMENT MODULE FOR N-ACTION

Attribute Name	Tag	SCU Use
Transaction UID	(0008,1195)	Generated for each retry
Storage Media File-Set ID	(0088,0130)	Not supported
Storage Media File-Set UID	(0088,0140)	Not supported
Referenced SOP Sequence	(0008,1199)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Storage Media File-Set ID	(0088,0130)	Not supported
>Storage Media File-Set UID	(0088,0140)	Not supported

7.2.3 Response Processing

Once the N-EVENT REPORT response is received, the following actions will be taken depending on the status of response. The following table lists the attributes supported for the N-Event-Report from the SCP

STORAGE COMMITMENT MODULE FOR N-EVENT-REPORT

Attribute Name	Tag	SCU Use	Success Case	Failure Case
Transaction UID	(0008,1195)	Value received from SCP	*	*
Retrieve AE Title	(0008,0054)	Not used		
Storage Media File-Set ID	(0088,0130)	Not used		
Storage Media File-Set UID	(0088,0140)	Not used		
Referenced SOP Sequence	(0008,1199)	Value received from SCP	*	
>Referenced SOP Class UID	(0008,1150)	Value received from SCP	*	
>Referenced SOP Instance UID	(0008,1155)	Value received from SCP	*	
>Retrieve AE Title	(0008,0054)	Not used		
>Storage Media File-Set ID	(0088,0130)	Not used		
>Storage Media File-Set UID	(0088,0140)	Not used		
Failed SOP Sequence	(0008,1198)	Value received from SCP		*
>Referenced SOP Class UID	(0008,1150)	Value received from SCP		*
>Referenced SOP Instance UID	(0008,1155)	Value received from SCP		*
>Failure Reason	(0008,1197)	Value received from SCP		*

7.2.3.1 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.

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

7.2.3.2 Commit response with FAILURE status

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.

7.2.4 Association Acceptance Policy

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

Appendix A IOD Definitions

Enclosed is a listing of only the Optional/Conditional modules/attributes used by this implementation for MR and SC IODs. Refer to the appropriate CT DICOM Conformance Statement for details on the CT IOD.

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

A.1 MR Specific IOD Definition

A.1.1 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.1.2 MR Image Module

Attribute Name	Tag	Type	Notes
Scan Options	(0018,0022)	2	Always sent. (even if value is zero length)
MR Acquisition Type	(0018,0023)	2	2D or 3D depending on acquisition type.
Repetition Time	(0018,0080)	2C	Sent if Scanning Sequence is **EP** and Sequence Variant is not **SK**.
Echo Time	(0018,0081)	2	Always Sent. (even if value is zero length)
Inversion Time	(0018,0082)	2C	Always Sent. (even if value is zero length)
Echo Train Length	(0018,0091)	2	Always Sent. (even if value is zero length)
Trigger Time	(0018,1060)	2C	Always Sent. (even if value is zero length)
Angio Flag	(0018,0025)	3	Always sent 'Y' or 'N'
Number Of Averages	(0018,0083)	3	Always sent (even if value is zero length)
Imaging Frequency	(0018,0084)	3	Always sent (even if value is zero length)
Imaged Nucleaus	(0018,0085)	3	Zero-length element is sent.
Echo Number	(0018,0086)	3	Always sent. (even if value is zero length)
Magnetic Field Strength	(0018,0087)	3	Sent if available, else not sent
Spacing Between Slices	(0018,0088)	3	Always sent (even if value is zero length)
Percent Sampling	(0018,0093)	3	Always sent (even if value is zero length)
Percent Phase Field of View	(0018,0094)	3	Always sent (even if value is zero length)
Pixel Bandwidth	(0018,0095)	3	Sent if available, else not sent
Nominal Interval	(0018,1062)	3	Sent if available, else not sent
Heart Rate	(0018,1088)	3	Sent if available, else not sent
Cardiac Number of Images	(0018,1090)	3	Sent if available, else not sent
Trigger Window	(0018,1094)	3	Sent if available, else not sent

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

A.2 SC Specific IOD Definition

A.2.1 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.3 MR/SC IOD Common Module Definitions

A.3.1 Patient Module

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

A.3.2 General Study Module

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

Attribute Name	Tag	Type	Notes
>Referenced SOP Class UID	(0008,1150)	1C	Value from the worklist
>Referenced SOP Instance UID	(0008,1155)	1C	Value from the worklist

A.3.3 Patient Study Module

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

A.3.4 General Series Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	MR
Series Instance UID	(0020,000E)	1	Locally Generated UID
Series Number	(0020,0011)	2	Generated sequentially, always sent.
Laterality	(0020,0060)	2C	Always sent zero-length.
Series Date	(0008,0021)	3	Generated for each series and always sent.
Series Time	(0008,0031)	3	Generated for each series and always sent.
Performing Physicians' Name	(0008,1050)	3	Not Used.
Protocol Name	(0018,1030)	3	Sent if entered at user interface. Limited to 24 characters.
Series Description	(0008,103E)	3	Value from user interface is sent.
Operators' Name	(0008,1070)	3	Value from user interface is sent. Limited to 4 characters.
Referenced Study Component Sequence	(0008,1111)	3	Value used for performed procedure step
>Referenced SOP Class UID	(0008,1150)	1C	Value used for performed procedure step
>Referenced SOP Instance UID	(0008,1155)	1C	Value used for performed procedure step
Body Part Examined	(0018,0015)	3	Not Used.
Patient Position	(0018,5100)	2C	Sent. As selected by operator when patient is positioned:
Smallest Pixel Value in Series	(0028,0108)	3	Not Used.
Largest Pixel Value in Series	(0028,0109)	3	Not Used.
Performed Procedure Step ID	(0040,0253)	3	
Performed Procedure Step Description	(0040,0254)	3	
Request Attribute Sequence	(0040,0275)	3	Only sent if PPS option is used
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Requested Procedure ID	(0040,1001)	1C	

A.3.5 General Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	Always sent as "GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	Sent. Value is configurable. Limited to 32 characters.
Institution Address	(0008,0081)	3	Not Used.
Station Name	(0008,1010)	3	Sent. Value is configurable. Limited to 8 characters
Institutional Department Name	(0008,1040)	3	Not Used.
Manufacturers Model Name	(0008,1090)	3	Sent if present in image.
Device Serial Number	(0018,1000)	3	Sent if present in image.
Software Versions	(0018,1020)	3	Always sent as "09" for this version - does not distinguish individual software releases.
Spatial Resolution	(0018,1050)	3	Sent only for legacy GE MR images.
Date of Last Calibration	(0018,1200)	3	Not Used.
Time of Last Calibration	(0018,1201)	3	Not Used.
Pixel Padding Value	(0028,0120)	3	Always sent.

A.3.6 General Image Module

Attribute Name	Tag	Type	Notes
Image Number	(0020,0013)	2	Generated sequentially, always sent.
Patient Orientation	(0020,0020)	2C	Not Used.
Image Date	(0008,0023)	2C	Generated for each image, always sent.
Image Time	(0008,0033)	2C	Generated for each image, always sent.
Image Type	(0008,0008)	3	Always sent.
Acquisition Number	(0020,0012)	3	Generated for each acquisition, always sent.
Acquisition Date	(0008,0022)	3	Generated for each acquisition, always sent.
Acquisition Time	(0008,0032)	3	Generated for each acquisition, always sent.
Referenced Image Sequence	(0008,1140)	3	Sent for GRx prescribed series images, 1-4 referenced images may be provided
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Not Used.
Source Image Sequence	(0008,2112)	3	Not Used.
>Referenced SOP Class UID	(0008,1150)	1C	Not Used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not Used.
Images in Acquisition	(0020,1002)	3	Not Used.
Image Comments	(0020,4000)	3	Not Used.
Lossy Image Compression	(0028,2110)	3	Not Used.

A.3.7 Image Plane Module

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

A.3.8 Image Pixel Module

Attribute Name	Tag	Type	Notes

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Value always sent.
Photometric Interpretation	(0028,0004)	1	Value always sent.
Rows	(0028,0010)	1	Value always sent.
Collumns	(0028,0011)	1	Value always sent.
Bits Allocated	(0028,0100)	1	Value always sent.
Bits Stored	(0028,0101)	1	Value always sent.
High Bit	(0028,0102)	1	Value always sent.
Pixel Presentation	(0028,0103)	1	Value always sent.
Pixel Data	(7FE0,0010)	1	Value always sent.
Planar Configuration	(0028,0006)	1C	Not Used.
Pixel Aspect Ratio	(0028,0034)	1C	Not Used.
Smallest Image Pixel Value	(0028,0106)	3	Not Used.
Largest Image Pixel Value	(0028,0107)	3	Not Used.
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not Used.
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not Used.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not Used.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not Used.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not Used.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not Used.

A.3.9 Contrast Bolus Module

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

Attribute Name	Tag	Type	Notes
>>Coding Scheme Designator	(0008,0102)	1C	Not Used.
>>Code Meaning	(0008,0104)	3	Not Used.
Contrast/Bolus Volume	(0018,1041)	3	Not Used.
Contrast/Bolus Start Time	(0018,1042)	3	Not Used.
Contrast/Bolus Stop Time	(0018,1043)	3	Not Used.
Contrast/Bolus Total Dose	(0018,1044)	3	Not Used.
Contrast Flow Rate(s)	(0018,1046)	3	Not Used.
Contrast Flow Duration(s)	(0018,1047)	3	Not Used.
Contrast/Bolus Ingredient	(0018,1048)	3	Not Used.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Not Used.

A.3.10 SOP Common Module

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

A.3.11 Overlay Plane Module

The overlay plane module is discarded from MR and CT images, for Secondary Capture images the attributes are supported per the following table.

Attribute Name	Tag	Type	Notes
Overlay Data	(60xx,3000)	1C	Only for SC IOD Definitions
Overlay Rows	(60xx,0010)	1	Only for SC IOD Definitions
Overlay Columns	(60xx,0011)	1	Only for SC IOD Definitions
Overlay Type	(60xx,0040)	1	Only for SC IOD Definitions
Origin	(60xx,0050)	1	Only for SC IOD Definitions
Overlay Bits Allocated	(60xx,0100)	1	Only for SC IOD Definitions
Bit Position	(60xx,0102)	1	Only for SC IOD Definitions
Overlay Description	(60xx,0022)	3	Not Used. Discarded
Overlay Subtype	(60xx,0045)	3	Not Used. Discarded
Overlay Label	(60xx,1500)	3	Not Used. Discarded
ROI Area	(60xx,1301)	3	Not Used. Discarded
ROI Mean	(60xx,1302)	3	Not Used. Discarded
ROI Standard Deviation	(60xx,1303)	3	Not Used. Discarded
Overlay Descriptor - Gray	(60xx,1100)	3	Not Used. Discarded
Overlay Descriptor - Red	(60xx,1101)	3	Not Used. Discarded
Overlay Descriptor - Green	(60xx,1102)	3	Not Used. Discarded
Overlay Descriptor - Blue	(60xx,1103)	3	Not Used. Discarded
Overlays - Gray	(60xx,1200)	3	Not Used. Discarded
Overlays - Red	(60xx,1201)	3	Not Used. Discarded
Overlays - Green	(60xx,1202)	3	Not Used. Discarded
Overlays - Blue	(60xx,1203)	3	Not Used. Discarded

A.3.12 VOI LUT Module

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

A.3.13 Frame of Reference Module

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

A.3.14 SC Equipment Module

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

Appendix B *Private Data Elements*

Enclosed is a listing of private data elements used in this implementation for MR Image IOD definition. Note that not all private elements will exist in every image. Note Attributes marked with ♠ will only exist in legacy GE MR images.

Refer to the appropriate CT DICOM Conformance statement for details on the CT Private elements.

B.1 MR Image IOD Private Data Elements Definition

B.1. 1 Private Creator Identification (GEMS_IDEN_01)

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

B.1. 2 Private Creator Identification (GEMS_PATI_01)

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

B.1. 3 Private Creator Identification (GEMS_ACQU_01)

Attribute Name	Tag	VR	VM
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

Attribute Name	Tag	VR	VM
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 0	(0019,10A7)	DS	1
User data 1	(0019,10A8)	DS	1
User data 2	(0019,10A9)	DS	1
User data 3	(0019,10AA)	DS	1
User data 4	(0019,10AB)	DS	1
User data 5	(0019,10AC)	DS	1
User data 6	(0019,10AD)	DS	1
User data 7	(0019,10AE)	DS	1
User data 8	(0019,10AF)	DS	1
User data 9	(0019,10B0)	DS	1
User data 10	(0019,10B1)	DS	1
User data 11	(0019,10B2)	DS	1
User data 12	(0019,10B3)	DS	1
User data 13	(0019,10B4)	DS	1
User data 14	(0019,10B5)	DS	1
User data 15	(0019,10B6)	DS	1
User data 16	(0019,10B7)	DS	1
User data 17	(0019,10B8)	DS	1
User data 18	(0019,10B9)	DS	1
User data 19	(0019,10BA)	DS	1
User data 20	(0019,10BB)	DS	1
User data 21	(0019,10BC)	DS	1
User data 22	(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

Attribute Name	Tag	VR	VM
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 phase number	(0019,10D7)	SS	1
Variable echoflag	(0019,10D8)	SS	1
Concatenated SAT	(0019,10D9)	DS	1
User data 23	(0019,10DF)	DS	1
User data 24	(0019,10E0)	DS	1
Velocity Encode Scale	(0019,10E2)	DS	1
Fast phases	(0019,10F2)	SS	1
Transmit gain	(0019,10F9)	DS	1

B.1. 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
Num 3D slabs	(0021,1056)	SL	1
Locs per slab	(0021,1057)	SL	1
Overlaps	(0021,1058)	SL	1
Image Filtering	(0021,1059)	SL	1
Diffusion direction	(0021,105A)	SL	1
Ihtagfa	(0021,105B)	DS	1

Attribute Name	Tag	VR	VM
Ihtagor	(0021,105C)	DS	1
Ihbspti	(0021,105D)	DS	1
RTIA_timer	(0021,105E)	DS	1
Fps	(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
Auto window/level level	(0021,1084)	DS	1

B.1. 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.1. 6 Private Creator Identification (GEMS_SERS_01)

Attribute Name	Tag	VR	VM
Last pulse sequence used	(0025,1006)	SS	1
Images in Series	(0025,1007)	SL	1
Landmark Counter	(0025,1010)	SL	1
Number of Acquisitions	(0025,1011)	SS	1
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
Protocol Data Block	(0025,101B)	OB	1

B.1. 7 Private Creator Identification (GEMS_IMAG_01)

Attribute Name	Tag	VR	VM
Image archive flag	(0027,1006)	SL	1
Scout Type	(0027,1010)	SS	1
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

Attribute Name	Tag	VR	VM
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.1. 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.1. 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

Attribute Name	Tag	VR	VM
Effective echo spacing	(0043,102C)	SS	1
Filter Mode (String slop field 1 in legacy GE MR images)	(0043,102D)	SH	1
String slop field 2	(0043,102E)	SH	1
Image Type (real, imaginary, phase, magnitude)	(0043,102F)	SS	1
Vas collapse flag	(0043,1030)	SS	1
RA cord of target recon center ♠	(0043,1031)	DS	2
Vas flags	(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
User data 25...User data 48	(0043,1038)	FL	24
Slop_int_6... slop_int_9 6: b_value 7: private imaging options 2 8: ihtagging 9: ihtagspc	(0043,1039)	IS	4
Slop_int_10...slop_int_17 10: ihfcineim 11: ihfcinent 12: Reserved 13: oprtarr 14: averages 15: Current Station # 16: Total # of Stations 17: Reserved	(0043,1060)	IS	8
Scanner Study Entity UID	(0043,1061)	UI	1
Scanner Study ID	(0043,1062)	SH	1
Scanner Table Entry (single gradient coil systems only) Scanner Table Entry + Gradient Coil Selected	(0043,106f)	DS	3 or 4
Paradigm Name	0043,1070	LO	1
Paradigm Description	0043,1071	ST	1
Paradigm UID	0043,1072	UI	1
Experiment Type	0043,1073	US	1
#rest volumes	0043,1074	US	1
#active volumes	0043,1075	US	1
#dummy scans	0043,1076	US	1
Application Name	0043,1077	SH	1
Application Version	0043,1078	SH	1
Slices Per Volume	0043,1079	US	1
Expected Time Points	0043,107A	US	1
Regressor Values	0043,107B	FL	1..n
Delay after slice group	0043,107C	FL	1
Recon mode flag word	0043,107D	US	1
PACC specific information	0043,107E	LO	1..n
Grad Shim Values	0043,107F	DS	1..n

B.1. 10 Private Creator Identification (BrainWave: 1.2.840.113819.3)

Attribute Name	Tag	VR	VM
DICOM Implementation UID	2001,1010	UI	1
DICOM Implementation Version	2001,1011	SH	1
Within-DICOM-Implementation SOP Instance UID	2001,1012	UI	1
Application Name	2001,1013	SH	1
Application Version	2001,1014	SH	1
Referenced Series UID	2001,1021	UI	1-n
Number of Objects Averaged	2001,1031	US	1
Number of Expected Time Points	2001,1041	US	1
Number of Slices Per Volume	2001,1051	US	1
Experiment Type	2001,1061	US	1
Paradigm UID	2001,1071	UI	1
Paradigm Name	2001,1072	LO	1
Paradigm Description	2001,1073	ST	1
Regressor Values	2001,1081	FL	1-n
Number of Degrees of Freedom	2001,1086	US	1
Z Threshold	2001,108A	FL	1
p Threshold	2001,108B	FL	1

B.1. 11 Private Creator Identification (GEMS_MR_RAW_01)

Attribute Name	Tag	VR	VM
rdb_hdr_rec	7001,1001	OB	1
rdb_hdr_per_pass_tab	7001,1002	OB	1
rdb_hdr_unlock_raw	7001,1003	OB	1
rdb_hdr_data_acq_tab	7001,1004	OB	1
rdb_hdr_nex_tab	7001,1005	OB	1
rdb_hdr_nex_abort_tab	7001,1006	OB	1
rdb_hdr_tool	7001,1007	OB	1
rdb_raw_data	7001,1008	OB	1
SSP save	7001,1009	OB	1
UDA save	7001,100A	OB	1

Appendix C DICOMDIR Directory Information

C.1 DICOMDIR Directory Information

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

C.1.1 Basic Directory IOD Definition

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

C.1.2 Directory Information Module

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

C.1.3 Directory Record Selection Keys

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

C.1.3.1 Patient Keys

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

C.1.3.2 Study Keys

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

Study ID	(0020,0010)	1	

C.1.3.3 Series Keys

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

C.1.3.4 Image Keys

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

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