GE Medical Systems

Technical Publications

DIRECTION 2286012–100

Revision 4

Innova 2000 Conformance Statement for DICOM V3.0 sm

do not duplicate

ATTENTION

LES APPAREILS À RAYONS X SONT DANGEREUX À LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti. Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.

Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles–mêmes.

Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 26 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X–RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x–ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator. Excessive exposure to x–radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.

Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o incompetentes. Una exposición excesiva a la radiación X puede causar daños al organismo.

Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas incompetentes o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.

Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 26: Recomendaciónes de la Comisión Internacional sobre la Protección Radiológica y normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sichereitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle. Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.

Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daßunbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen können.

Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 26 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und anderer nationaler Normenbehörden.

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WARNING

DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD

If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.

This Service Manual is available in English only.

Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

ATTENTION

NE PAS TENTER D'INTERVENIR SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS

Ce Manuel de service n'est disponible qu'en anglais.

Si le technicien du client a besoin de ce manuel dans une autre langue que l'anglais, c'est au client qu'il incombe de le faire traduire.

Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.

ATENCION

NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.

Este Manual de Servicio sólo existe en inglés.

Si algún proveedor de servicios ajeno a GEMS solicita un idioma que no sea el inglés, es responsabilidad del cliente ofrecer un servicio de traducción.

La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

WARNUNG

ERSUCHEN SIE NICHT DIESE ANLAGE ZU WARTEN, OHNE DIESE SERVICEANLEITUNG GELESEN UND VERSTANDEN ZU HABEN.

Diese Serviceanleitung existiert nur in englischer Sprache.

Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.

Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.

ATENÇAO

NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA

Este Manual de Assistência Técnica só se encontra disponível em Inglês.

Se qualquer outro serviço de assistência técnica, que não a GEMS, solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução.

O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a‘ choques elétricos, mecânicos ou outros.

AVVERTENZA

SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO

Il presente manuale di manutenzione è disponibile soltanto in inglese.

Se un addetto alla manutenzione esterno alla GEMS richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.

Non tenere conto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all'addetto alla manutenzione, all'utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.

警告

・このサービスマニュアルには英語版しかありません。
・ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
・このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。
・この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

CHAPTER 1 – INTRODUCTION

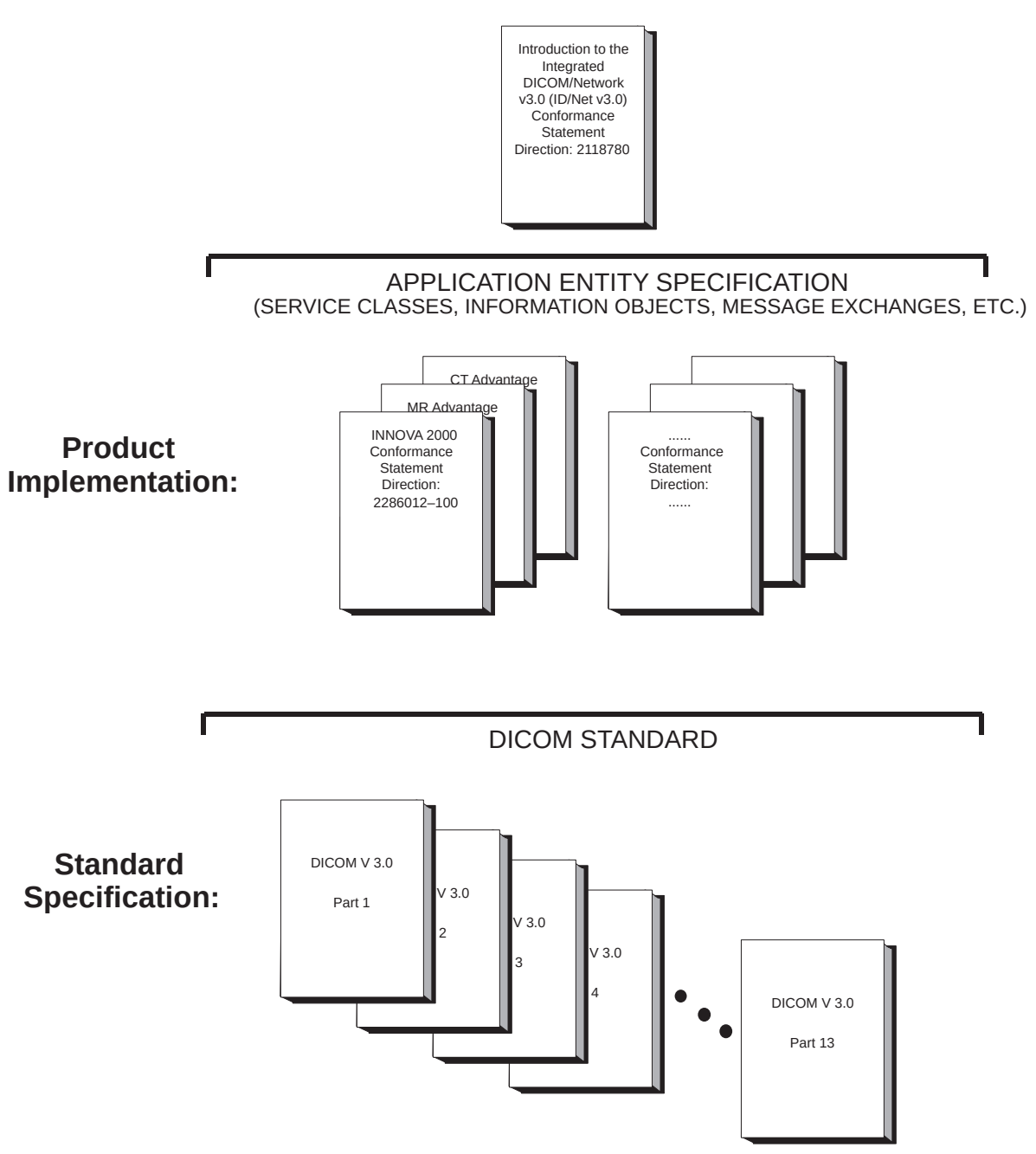
1 OVERVIEW

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

- Chapter 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement
- Chapter 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.
- Chapter 3 (X–Ray Angiography Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a X–Ray Angiography Information Object.
- Chapter 4 (Secondary capture Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary capture Information Object.
- Chapter 5 (Modality Worklist Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM v3.0 implementation. It is entitled:

INNOVA 2000 version 2

Conformance Statement for DICOM v3.0

Direction **2286012–100**

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

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)

Conformance Statement

Direction: 2118780.

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

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

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

For the convenience of software developers, there is "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published GEMS Product Conformance Statements will be received. The collector Direction is:

ID/Net v3.0 Conformance Statements

Direction: 2117016

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

NEMA Publication

1300 North 17th Street

Suite 1847

Rosslyn, VA 22209

USA

Phone: (703) 841–3200

3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM v3.0 Standards and with the terminology and concepts which are used in those Standards.

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

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

4 SCOPE AND FIELD OF APPLICATION

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

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

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

5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter–operation will be successful**. The **user (or user’s agent)** needs to proceed with caution and address at least four issues:

- **Integration** – The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non–GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user’s** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** – Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications. Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non–GE device, as well as when images acquired on non–GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** – GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **To be informed of the evolution of the implementation described in this document, the User is advised to regularly check the GE Internet Server, accessible via anonymous ftp (GE Internet Server Address: ftp.med.ge.com, 192.88.230.11).**
- **Interaction** – It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

6 REFERENCES

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

The information object implementation refers to DICOM PS 3.3 (Information Object Definition).

7 DEFINITIONS

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

8 SYMBOLS AND ABBREVIATIONS

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

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CHAPTER 2 – NETWORK CONFORMANCE STATEMENT

1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features on GE INNOVA 2000 product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

The INNOVA 2000 provides sophisticated image processing and storage functions. INNOVA 2000 will provide support for DICOM 3.0 to achieve interoperability across equipment produced by different vendors.

This section details the roles and the DICOM Service Classes the INNOVA 2000 supports.

The INNOVA 2000 DICOM implementation allows:

- The user to copy INNOVA images acquired through the system to a remote DICOM Application Entity, using the Standard Storage DICOM Service as a Service Class User
- The user to check the application level communication from the INNOVA DICOM Server to a remote DICOM Application Entity. To this aim the INNOVA 2000 uses the Verification DICOM Service Class as a Service Class User
- The user to get from the Radiology Information System (RIS) the list of procedure to be performed. This is done using the Modality Worklist Query DICOM Service as a Service Class User.
- A remote Application Entity to check the application level communication with the INNOVA 2000. This is done by providing the Verification DICOM Service Class as a Service Class Provider.

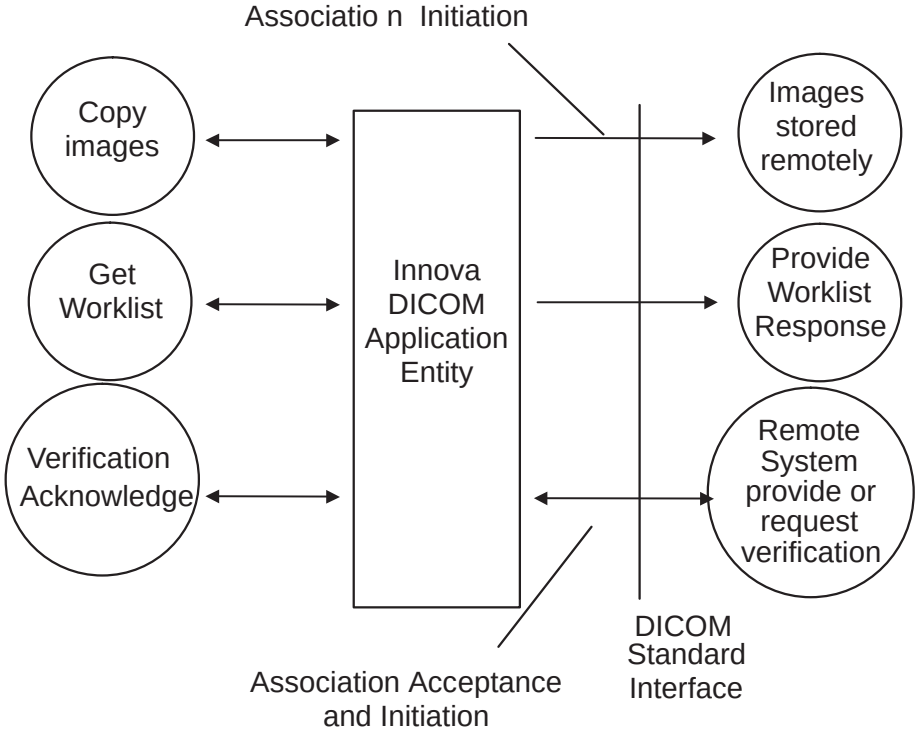
The details of the DICOM conformance related to other Information Objects and Information Models supported by this product are included in subsequent sections of this DICOM Conformance Statement.

2 IMPLEMENTATION MODEL

2-1 Application Data Flow Diagram

All DICOM functionality on the INNOVA 2000 product is provided by the DL DICOM Server AE.

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



The INNOVA DICOM Application Entity is an application which handles DICOM protocol communication. INNOVA DICOM AE is automatically brought up when the INNOVA system is powered on.

All remote DICOM AE must be manually configured on the INNOVA, usually at the software installation time, by a GE Field Engineer.

There are three local Real World activities: Copy Images, Get Worklist and Verification which can cause the INNOVA DICOM AE to initiate a DICOM association.

Copy Image consists of an operator selecting one or several images through the User Interface known as ”Browser” and ”Viewer”. Selection of Remote System and visualization of the transfer status is done in a specific screen. The remote workstation can be any DICOM HIS/RIS system supporting XA modality.

Get Worklist activity consists of an operator request for the transfer of a list of procedure to be performed on the INNOVA 2000 acquisition system from a remote HIS/RIS system. Remote Station can be any DICOM compliant workstation.

Query keys can be entered for the following items:

- Patient Name
- Patient ID
- Accession number
- Procedure ID

The system can be configured to query for its own modality (XA) or AE Title.

A date or a date range for the query can also be specified.

2-2 Functional Definition of AE's

The INNOVA DICOM Application Entity supports the following three SCU functions

1. Copy images:
   - Access to patient demographics and pixel Data in the local database
   - Build a DICOM Dataset
   - Initiate a DICOM Association to send the image(s).
2. Get worklist:
   - Build a DICOM formatted basic worklist management data request
   - Initiate a DICOM Association to send the request
   - Wait for worklist response(s)
   - Access to the local database to add new patient / exam demographic data
   - Close the association
3. Verification:
   - Initiate a DICOM Association
   - Close the Association

The INNOVA DICOM Application Entity also serves a default SCP function, the Verification Service Class, independently from others SCU functions.

2-3 Sequencing of Real–World Activities

Not Applicable.

3 AE SPECIFICATIONS

3-1 INNOVA DICOM AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
X–Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31
Verification SOP Class	1.2.840.10008.1.1

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an **SCP** :

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

3-1-1 Association Establishment Policies

3-1-1-1 General

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

Application Context Name	1.2.840.10008.3.1.1.1

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

The maximum length PDU for an association initiated by the INNOVA DICOM Application Entity is:

Maximum Length PDU	1024 Kbytes

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 5

The user information Items sent by this product are :

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

3-1-1-2 Asynchronous Nature

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

3-1-1-3 Implementation Identifying Information

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

INNOVA 2 Implementation UID	1.2.840.113619.6.122

The Implementation Version Name for this DICOM v3.0 Implementation is:

INNOVA 2 Implementation Version Name	INNOVA_DL_11.xx

3-1-2 Association Initiation Policy

3-1-2-1 Real–World Activity Copy Images

3-1-2-1-1 Associated Real–World Activity

The operator must select a destination in the User Interface towards which the images will be transferred.

Then one of the two following scenarios is possible:

1. The operator selects data to be sent to the destination though the User Interface. Once these selections are done, the user clicks on the “Network” button to initiate a “Copy images” operation. The INNOVA DICOM AE will then initiate a DICOM association with the selected destination and transfer the selected images on this association.
2. If system is configured for autoarchive, the INNOVA DICOM AE will automatically initiate a DICOM association with the selected destination to transfer any new image created on the system.

3-1-2-1-2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
X–Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X–Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

3-1-2-1-2-1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

This implementation can perform multiple C–STORE operation over a single association.

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

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

Upon receiving a C–STORE confirmation containing a status other than Successful or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request over a different association.

Establishing an association supports an “Association Timer”. This timer starts when the association request is sent and stops when the Association response is received. The time out value is 10 seconds.

Note: A session timer exists to secure the transfer of a complete database between INNOVA DICOM AE and the remote Storage SCP station. The session timer starts with the transfer of the first image and terminates when the time out value is reached.

If any of the above time outs expires, the association is closed and the operation in progress is considered to be failed.

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A7xx	Out of resources	“Send” operation failed	(0000,0902)
	0122	SOP Class not Supported	“Send” operation failed	(0000,0902)
Error	Cxxx	Cannot Understand	“Send” operation failed	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	“Send” operation failed	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	“Send” operation failed	None
	B007	Data Set does not match SOP Class	“Send” operation failed	None
	B006	Elements Discarded	“Send” operation failed	None
Success	0000		“Send” operation successful	None

3-1-2-2 Real–World Activity Verification Acknowledge

3-1-2-2-1 Associated Real–World Activity

The operator must select a destination in the User Interface and press the “Verification” button. These operations will cause:

- the INNOVA DICOM Application Entity to initiate a DICOM association
- the INNOVA DICOM Application Entity to emit a C–ECHO command to check if the remote AE is available

3-1-2-2-2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
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

3-1-2-2-2-1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The INNOVA DICOM AE provides standard conformance to the DICOM Verification SOP class.

3-1-2-3 Real–World Activity Get Worklist

3-1-2-3-1 Associated Real–World Activity

The worklist transfer can be initiated either automatically when the DL application starts, or manually by either clicking the “Refresh” button in the Patient Browser interface or the “Refresh now” button in the “Define Worklist Settings” screen.

These operation will cause:

- the INNOVA Application Entity to initiate a DICOM association
- the INNOVA DL application to build the C–FIND request
- the INNOVA Application Entity to emit the C–FIND request
- the INNOVA Application Entity to receive the C–FIND Reponse(s)
- the INNOVA Application Entity to close the association
- the possibility for the user to add a new item to the local database

3-1-2-3-2 Proposed Presentation Context Table

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

3-1-2-3-2-1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model – FIND SOP Class

Following are the status codes that are more specifically processed when receiving messages from a **Modality Worklist** SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A700	Out of resources	A message is displayed; with text “Last query failed”	(0000,0902)
	0122	SOP Class not Supported	A message is displayed; with text “Last query failed”	(0000,0902)
Failed	A900	Identifier does not match SOP Class	A message is displayed; with text “Last query failed”	(0000,0901) (0000,0902)
	Cxxx	Unable to process	A message is displayed; with text “Last query failed”	(0000,0901) (0000,0902)
Cancel	FE00	Matching terminated due to cancel	A message is displayed; with text “Canceled”	None
Success	0000	Matching is complete – No final identifier is supplied	Worklist matches are displayed.	None
Pending	FF00	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	None	None
	FF01	Matches are continuing – Warning that one or more Optional Keys were not supported for existence for this Identifier	None	None

3-1-3 Association Acceptance Policy

The INNOVA DICOM AE places no limitation on who may connect to it.

Any remote AE can open an association to the INNOVA DICOM AE for the purpose of application level communication verification.

3-1-3-1 Real–World Activity Verification Acknowledge

3-1-3-1-1 Associated Real–World Activity

The INNOVA DICOM AE is always listening to associations. No operator action is required to respond to a Verification request from any DICOM node.

3-1-3-1-2 Accepted Presentation Context Table

Presentation Context Table – Accepted					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

3-1-3-1-2-1 SOP Specific Conformance Statement for Verification SOP Class

INNOVA DICOM Application provides standard conformance to the DICOM Verification Service Class

4 COMMUNICATION PROFILES

4-1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

4-2 OSI Stack

OSI stack not supported

4-3 TCP/IP Stack

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

4-3-1 API

Not applicable to this product.

4-3-2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI)

Note: For more information about the Physical Media available on INNOVA 2000, please refer to the Product Data Sheet.

4-4 Point–to–Point Stack

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

5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

None

5-1 Standard Extended /Specialized/Private SOPs

6 CONFIGURATION

GEMS Field Service Engineers configure the INNOVA 2000 system. The DICOM configuration items below are configurable or re–configurable by a Field Service Engineer but are not accessible through the INNOVA 2000 user interface.

6-1 AE Title/Presentation Address Mapping

The INNOVA 2000 DICOM SERVER AE allows for the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different sub net (using routing). GEMS Field Service Engineers perform this configuration.

6-2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title
- Local IP Address
- Local IP Netmask

Note: The local listening port number is not configurable for this product, and is equal to 4002.

The following fields are configurable for the DICOM AE used as worklist SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

Note: A GE Field Engineer must perform all the above configurations.

The following fields are configurable for every remote DICOM AE used as storage SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number
- Array size of the pixel data to be transferred (512x512, or any size up to 1024).

7 SUPPORT OF EXTENDED CHARACTER SETS

The INNOVA 2000 will support only the ISO_IR 100 (ISO 8859–1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming worklist entry that is encoded using another extended character set will display as if it were IS0_IR 100, and any SOP Instances created for these entries will reference ISO_IR 100.

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CHAPTER 3 – X–RAY ANGIOGRAPHY (XA) INFORMATION OBJECT IMPLEMENTATION

1 INTRODUCTION

This section specifies the use of the DICOM XA Image IOD to represent the information included in X–Ray Angiography images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

2 IOD Description

3 IOD Entity–Relationship Model

4 IOD Module Table

5 IOD Module Definition

2 XA IOD IMPLEMENTATION

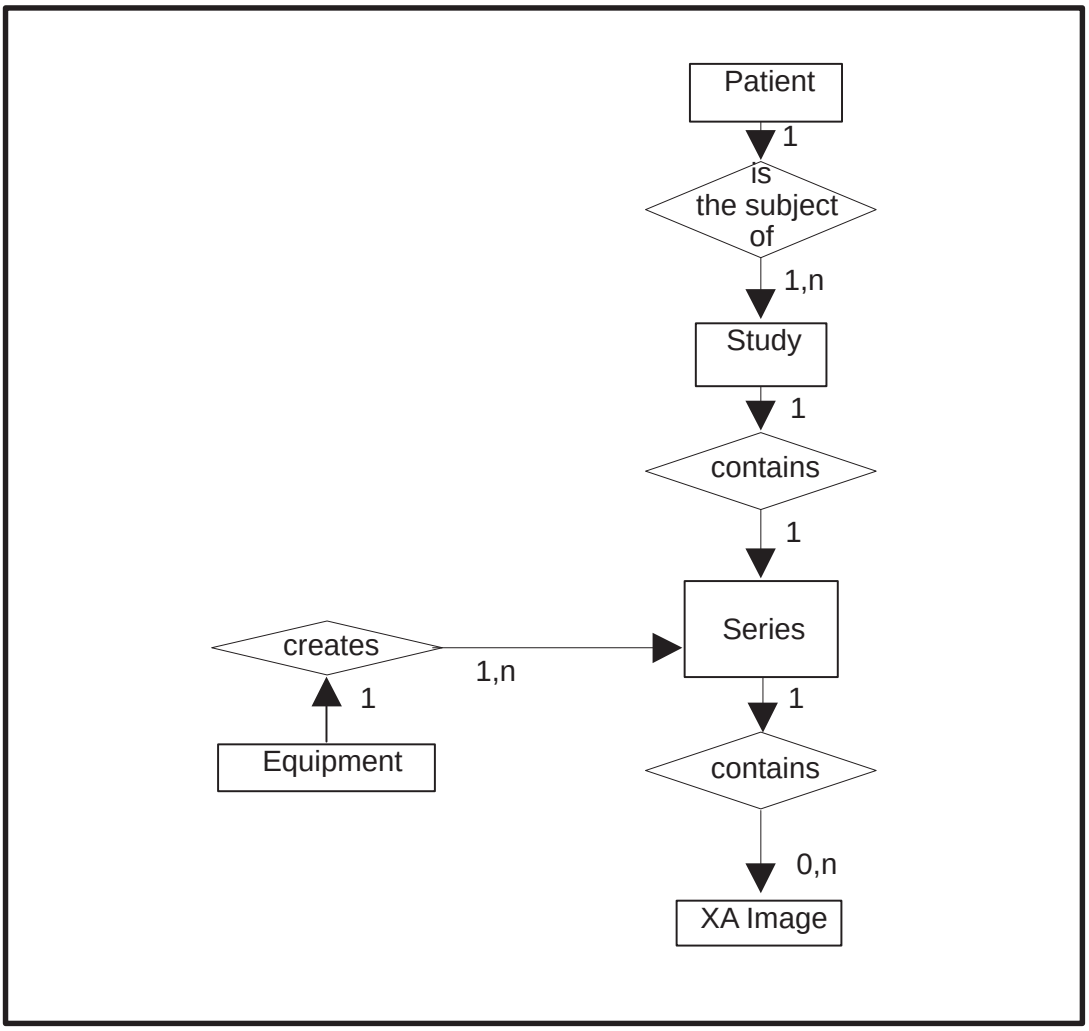
3 XA ENTITY–RELATIONSHIP MODEL

The Entity–Relationship diagram for the XA Image interoperability schema is shown in illustration 1 **.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Study to Series has 1 Series for each Study.

Illustration 1 – XA IMAGE ENTITY RELATIONSHIP DIAGRAM



3-1 ENTITY DESCRIPTIONS

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

3-1-1 Patient Entity Description

3-1-2 Study Entity Description

3-1-3 Series Entity Description

3-1-4 Equipment Entity Description

3-1-5 XA Image Entity Description

3-1-6 Overlay Entity Description

3-1-7 VOI Lookup Table Entity Description

3-1-8 Modality Lookup Table Entity Description

3-1-9 Curve Entity Description

3-2 INNOVA 2000 Mapping of DICOM entities

Table 1 – Mapping of DICOM Entities to INNOVA 2000 Entities

DICOM	INNOVA 2000 Entity
Patient	Patient
Study	Exam
Series	Exam
Image	Sequence
Frame	Not Applicable

4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 XA IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 2 identifies the defined modules within the entities which comprise the DICOM v3.0 XA IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

Table 2 – XA IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	5–1–1
Study	General Study	5–2–1
	Patient Study	5–2–2
Series	General Series	5–3–1
Equipment	General Equipment	5–4–1
Image	General Image	5–5–1
	Image Pixel	5–5–2
	Contrast/Bolus	5–5–3
	Cine	5–5–4
	Multi–frame	5–5–5

Entity Name	Module Name	Reference
	Frame Pointers	5–5–6
	Mask	5–5–7
	Display Shutter	5–5–8
	Device	5–5–9
	Therapy	5–5–10
	X–Ray Image	5–10–1
	X–Ray Acquisition	5–10–2
	X–Ray Collimator	5–10–3
	X–Ray Table	5–10–4
	XA Positioner	5–10–5
	Overlay Plane	5–6–1
	Multi–frame Overlay	5–6–2
	Curve	5–7–1
	Modality LUT	5–8–2
	VOI LUT	5–8–1
	SOP Common	5–9–1
	Gerenal Frame	6

5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the XA Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

5-1 Common Patient Entity Modules

5-1-1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

Table 3 – PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From user interface or worklist. When from user interface, value contains only last_name(32 chars)^first_name(31 chars). When from worklist, equals first component group.
Patient ID	(0010,0020)	2	From worklist or user interface.
Patient's Birth Date	(0010,0030)	2	From user interface or worklist.
Patient's Sex	(0010,0040)	2	From user interface or worklist. "M", "F" or "O".

5-2 Common Study Entity Modules

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

5-2-1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

Table 4 – GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Restricted to 64 characters, internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix of innova 2000 System within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and re–entrance.
Study Date	(0008,0020)	2	Date the exam was first started.
Study Time	(0008,0030)	2	HHMMSS.XXX, restricted to 10 characters.
Referring Physician's Name	(0008,0090)	2	From user interface or worklist. When from user interface, value contains only one component (max 64 characters). When from worklist, equals first component group.
Study ID	(0020,0010)	2	From user interface or worklist.
Accession Number	(0008,0050)	2	From user interface or worklist.

Attribute Name	Tag	Type	Attribute Description
Study Description	(0008,1030)	3	From user interface or worklist. When from worklist, filled in with Scheduled Procedure Step Description (0040, 0007).
Name of Physician(s) Reading Study	(0008,1060)	3	From user interface, value contains only one component.

5-2-2 Patient Study Module

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

Table 5 – PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Either from User Interface or calculated from Patient's Birth Date (0010,0030). Three digits followed by one letter: In Years (Y), Months (M), Weeks (W) or Days (D).
Patient's Size	(0010,1020)	3	From user interface or worklist.
Patient's Weight	(0010,1030)	3	From user interface or worklist.

5-3 Common Series Entity Modules

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

5-3-1 General Series Module

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

Table 6 – GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	XA
Series Instance UID	(0020,000E)	1	Restricted to 64 characters, internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix of innova 2000 System within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and re–entrance.
Series Number	(0020,0011)	2	1
Series Date	(0008,0021)	3	Equals study date (0008, 0020)
Series Time	(0008,0031)	3	Equals study time (0008, 0030)
Performing Physicians' Name	(0008,1050)	3	From user interface or worklist. When from worklist, equals first value of Scheduled performing physician's name (0040, 0006)

Attribute Name	Tag	Type	Attribute Description
Protocol Name	(0018,1030)	3	CARDIAC
Series Description	(0008,103E)	3	From user interface.
Operators' Name	(0008,1070)	3	From User Interface, restricted to 64 characters, contains only one compoment.

5-4 Common Equipment Entity Modules

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

5-4-1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

Table 7 – GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	GE MEDICAL SYSTEMS
Institution Name	(0008,0080)	3	From "Service User Interface", configured at the installation of the system. Restricted to 64 characters.
Institution Address	(0008,0081)	3	From "Service User Interface", configured at the installation of the system. Restricted to 1024 characters.
Station Name	(0008,1010)	3	AE–title of the Innova system as configured in the Service User Interface.
Manufacturer's Model Name	(0008,1090)	3	DL
Device Serial Number	(0018,1000)	3	From internal configuration of the machine
Software Versions	(0018,1020)	3	DL application version.

5-5 Common Image Entity Modules

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

5-5-1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

Table 8 – GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Internally generated, starting at 1, incremented with each new sequence.
Patient Orientation	(0020,0020)	2C	See 5–5–1–1–1
Image Type	(0008,0008)	3	See 5–5–1–1–2

Attribute Name	Tag	Type	Attribute Description
Acquisition Date	(0008,0022)	3	YYYYMMDD, restricted to 8 characters, date the sequence was acquired.
Acquisition Time	(0008,0032)	3	HHMMSS.HHMMSS.XXX, restricted to 10 characters, time the sequence was acquired
Image Comments	(0020,4000)	3	From User Interface, restricted to 64 characters.
Lossy Image Compression	(0028,2110)	3	See 5–5–1–1–3

5-5-1-1 General Image Attribute Descriptions

5-5-1-1-1 Patient Orientation

Always zero length.

5-5-1-1-2 Image Type

Always ORIGINAL/PRIMARY/SINGLE PLANE.

5-5-1-1-3 Lossy Image Compression

Always 00. No lossy compression in this version of the product.

5-5-2 Image Pixel Module

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

Table 9 – IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	Depends on the size of the FOV (imaged region of the X–ray detector), and the re–sampling applied during the DICOM conversion. Possible values are 512, 608, 736, 864 and 1000.
Columns	(0028,0011)	1	Depends on the size of the FOV (imaged region of the X–ray detector), and the re–sampling applied during the DICOM conversion. Possible values are 512, 608, 736, 864 and 1000.
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7

Attribute Name	Tag	Type	Attribute Description
Pixel Representation	(0028,0103)	1	0x0000
Pixel Data	(7FE0,0010)	1	

5-5-3 Contrast/Bolus Module

This section specifies the Attributes that describe the contrast /bolus used in the acquisition of the Image.

Table 10 – CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	No value, Zero length.

5-5-4 Cine Module

The table in this section specifies the Attributes of a Multi–frame Cine Image.

Table 11 – CINE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	Nominal time (in msec) between frames.
Start Trim	(0008,2142)	3	1
Stop Trim	(0008,2143)	3	Last frame of the multi–frame image.
Recommended Display Frame Rate	(0008,2144)	3	Number of frames per second (truncated to integer)
Cine Rate	(0018,0040)	3	Number of frames per second (truncated to integer)
Frame Delay	(0018,1066)	3	00

5-5-5 Multi–Frame Module

This section specifies the Attributes of a Multi–frame pixel data Image.

Table 12 – MULTI–FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	
Frame Increment Pointer	(0028,0009)	1	See 5–5–5–1 for further explanation.

5-5-5-1 Multi–Frame Attribute Descriptions

5-5-5-1-1 Number Of Frames And Frame Increment Pointer

Frame Increment Pointer (0028,0009) points to Frame Time (0018, 1063)

5-5-6 Frame Pointers Module

This section specifies the attributes of a Frame Pointer Module.

Table 13 – FRAME POINTERS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Representative Frame Number	(0028,6010)	3	Calculated as ”number of frames (0028,0008)” divided by 2.

5-5-7 Mask Module

The mask module is not sent.

5-5-8 Display Shutter Module

Table 14 – DISPLAY SHUTTER MODULE

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	RECTANGULAR
Shutter Left Vertical Edge	(0018,1602)	1C	Internally generated by acquisition system.
Shutter Right Vertical Edge	(0018,1604)	1C	Internally generated by acquisition system.
Shutter Upper Horizontal Edge	(0018,1606)	1C	Internally generated by acquisition system.
Shutter Lower Horizontal Edge	(0018,1608)	1C	Internally generated by acquisition system.

5-5-9 Device Module

The table in this section describes the Attributes of devices (e.g., catheters, markers, baskets) which are associated with a study and/or image.

Table 15 – DEVICE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Calibration frame	(0019,XX81)	3	frame on which the calibration was performed (May not be sent).
Calibration object	(0019,XX82)	3	Sphere, catheter or segment (only one) (May not be sent).
Calibration object size mm	(0019,XX83)	3	Size (diameter, distance...) in mm (May not be sent).
Calibration factor	(0019,XX84)	3	Calib factor in mm/pix (May not be sent).
Calibration date	(0019,XX85)	3	Date of the calibration of the image (May not be sent).
Calibration time	(0019,XX86)	3	Time of the calibration of the image (May not be sent).
Calibration accuracy	(0019,XX87)	3	In % with respect to the calibration factor (May not be sent).
Calibration extended	(0019,XX88)	3	YES/NO (May not be sent).
Calibration image original	(0019,XX89)	3	If calib extended, the image number of the original calibration (May not be sent).

Attribute Name	Tag	Type	Attribute Description
Calibration frame original	(0019,XX8A)	3	If extended calibration, the frame number of the original calibration (May not be sent).
Calibration nb points uif	(0019,XX8B)	3	0,1 or 2 (May not be sent).
Calibration points row	(0019,XX8C)	3	Location of the points that define the calibration object, given as row (May not be sent).
Calibration points column	(0019,XX8D)	3	Location of the points that define the calibration object, given as column (May not be sent).
Calibration mag ratio	(0019,XX8E)	3	Ratio between the SID over the distance from source to the center of the calibration object (> 1.0) (May not be sent).
Calibration sw version	(0019,XX8F	3	String containing algorithm generation, algorithm version and algorithm release. A new release does not change the algorithm, only change code structure (I/O, code optimization...) (May not be sent)
Extend calib sw version	(0019,XX90)	3	String contaning algorithm generation, algorithm version and algorithm release. A new release does not change the algorithm, only change code structure (I/O, code optimization...) (May not be sent).
Calibration return code	(0019,XX91)	3	code returned by the calibration algorithm (May not be sent).

5-5-10 Therapy Module

This module is not sent.

5-6 Common Overlay Modules

5-6-1 Overlay plane module

This module is not sent.

5-6-2 Multi–frame Overlay Module

This module is not sent.

5-7 Common Curve Modules

5-7-1 Curve module

This module is not sent.

5-8 Common Lookup Table Modules

5-8-1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

Table 16 – VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Value of the acquisition.
Window Width	(0028,1051)	1C	Value of the acquisition.

5-8-2 Modality LUT module

This module is not sent.

5-9 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5-9-1 SOP Common Module

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

Table 17 – SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.12.1
SOP Instance UID	(0008,0018)	1	Restricted to 64 characters, internally generated as follows: ”registered prefix for GEMS” + ”.2. Registered prefix of innova 2000 System within GEMS” + ”.a.b.c” encoded mac address of the DL host +”.x.y.z” unique id protected against reinstallation and re–entrance.
Specific Character Set	(0008,0005)	1C	ISO_IR 100

5-10 X–Ray Modules

This Section describes Modules used in one or more X–Ray IODs. These Modules contain Attributes that are specific to X–Ray images.

5-10-1 X–Ray Image Module

Table 18 – TX–Ray Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1C	00181063H = Frame Time (0018,1063);
Lossy Image Compression	(0028,2110)	1C	00
Image Type	(0008,0008)	1	ORIGINAL\PRIMARY\SINGLE PLANE
Pixel Intensity Relationship	(0028,1040)	1	DRM
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Bits Allocated	(0028,0100)	1	8.
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028, 0103)	1	0x0000

5-10-2 X–Ray Acquisition Module

Table 19 – X–Ray Acquisition Module

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	2	No value, zero length
Radiation Setting	(0018,1155)	1	GR
X–Ray Tube Current	(0018,1151)	2C	No value, zero length
Exposure Time	(0018,1150)	2C	No value, zero length
Radiation Mode	(0018,115A)	3	PULSED
Intensifier Size	(0018,1162)	3	204.8
Field of View Shape	(0018,1147)	3	RECTANGLE
Field of View Dimension(s)	(0018,1149)	3	From user selection in the User Interface of the acquisition system. Possible values are 121, 147, 172, and 200 mm.
Imager Pixel Spacing	(0018,1164)	3	0.2 \ 0.2
Field of View Origin	(0018,7030)	3	Depends on the size of the FOV (imaged region of the X–ray detector).
Spatial change	(0019,XX93)	3	True if table or gantry moved during acquisition (May not be sent).
fov_dim_double	(0019,XX0B)	3	Value in floating point resolution, whose truncature is (0018,1149). Possible values are 121.6, 147.2, 172.8, and 200.0 mm.
Detector rot angle	(0019,XX92)	3	(May not be sent).

Attribute Name	Tag	Type	Attribute Description
usr_spa_flt_strgth	(0019,XX17)	3	The strength of the spatial filters selected by the user during the image Review. Values from 1 to 10.
usr_zoom_factor	(0019,XX18)	3	1
lbd_cm_pc_dtort	(0019,XX24)	3	”0.0”. Coefficient of the pincushion distortion model of the Image Intensifier, in cm–1. This model allows to correct the position of a point of the image as function of the distance to the center of the image.
slope_lv_regress	(0019,XX25)	3	”0.85”. Slope coefficient (unitless) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge’s method from the contour of the left ventricle traced by an expert.
int_lv_regress	(0019,XX26)	3	”4.72”. Intercept coefficient (in cm3) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge’s method from the contour of the left ventricle traced by an expert.
def_spa_flt_family	(0019,XX31)	3	The family of the spatial filters applied during the image acquisition. 0, 1 or 2.
def_spa_flt_strgth	(0019,XX32)	3	The strength of the spatial filters applied during the image acquisition. Values from 1 to 10.
def_bright_contr	(0019,XX4E)	3	The brightness/contrast applied during the image acquisition. Brightness from 0.0 to 100.0, Contrast from –100.0 to 100.0
user_bright_contr	(0019,XX4F)	3	The brightness/contrast modified by the user during the image review. Brightness from 0.0 to 100.0, Contrast from –100.0 to 100.0

5-10-3 X–Ray Collimator

Table 20 – X–Ray Collimator Module

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	RECTANGULAR
Collimator Left Vertical Edge	(0018,1702)	1C	Internally generated by the acquisition system.
Collimator Right Vertical Edge	(0018,1704)	1C	Internally generated by the acquisition system.
Collimator Upper Horizontal Edge	(0018,1706)	1C	Internally generated by the acquisition system.
Collimator Lower Horizontal Edge	(0018,1708)	1C	Internally generated by the acquisition system.

5-10-4 X–Ray Table Module

Table 21 – X–Ray Table Module Attributes

Attribute Name	Tag	Type	Attribute Description
Table Motion	(0018,1134)	2	Will be DYNAMIC if table moves in at least one direction.
Table Vertical Increment	(0018,1135)	2C	Value will be filled in if Table Motion is DYNAMIC. For STATIC, will be sent as no value, zero length.
Table Longitudinal Increment	(0018,1137)	2C	Value will be filled in if Table Motion is DYNAMIC. For STATIC, will be sent as no value, zero length.
Table Lateral Increment	(0018,1136)	2C	Value will be filled in if Table Motion is DYNAMIC. For STATIC, will be sent as no value, zero length.
Table Angle	(0018,1138)	3	0.0

5-10-5 XA Positioner Module

Table 22 – XA Positioner Module Attributes

Attribute Name	Tag	Type	Attribute Description
Distance Source to Patient	(0018,1111)	3	Internally generated by the acquisition system.
Distance Source to Detector	(0018,1110)	3	Internally generated by the acquisition system.
Estimated Radiographic Magnification Factor	(0018,1114)	3	Calculated from (0018,1110) and (0018,1111)
Positioner Motion	(0018,1500)	2C	Will be DYNAMIC if Pivot or C–ARM moves. If no motion, or if L only moves, will be sent as STATIC.
Positioner Primary Angle	(0018,1510)	2	For multi–frame images, value of the first frame.

Attribute Name	Tag	Type	Attribute Description
Positioner Secondary Angle	(0018,1511)	2	For multi–frame images, value of the first frame
Positioner Primary Angle Increment	(0018,1520)	2C	Value of the RAO/LAO increments relative to fist frame. If positioner motion is STATIC, will be sent zero length.
Positioner Secondary Angle Increment	(0018,1521)	2C	Value of the CRA/CAU increments relative to first frame.If positioner motion is STATIC, will be sent zero length.
angle_value_1	(0019,XX01)	3	Positioner angle for L arm in degrees
angle_value_2 (positive)	(0019,XX02)	3	Positioner angle forPivot arm in degrees
angle_value_3 (positive)	(0019,XX03)	3	Positioner angle for C arm in degrees
angle_label_1	(0019,XX04)	3	L
angle_label_2	(0019,XX05)	3	CAU, CRA
angle_label_3	(0019,XX06)	3	LAO, RAO

6 PRIVATE GENERAL FRAME MODULE

Attribute Name	Tag	Type	Attribute Description
frame_sequence	(0025,XX0A)	3	Sequence with 1 item containing data of related to the acquisition of the first frame.
>frame_id	(0025,XX02)	3	Frame identification inside the frame sequence, starting at 1.
>dist_src_to_det	(0025,XX03)	3	Equivalent to (0018,1110) but for each frame of the multi–frame image.
>dist_src_to_pat	(0025,XX04)	3	Equivalent to (0018,1111) but for each frame of the multi–frame image.
>dist_src_to_skin	(0025,XX05)	3	SSD: source–to–Skin distance measured from the focal spot to the reference point where the PatientDoseLimit is defined.
>table_vert_pos	(0025,XX1B)	3	Absolute Vertical position of the table with respect to the table referential for each frame of the multi–frame image. Down moving is positive.
>table_long_pos	(0025,XX1C)	3	
>kvp_actual	(0025,XX1F)	3	Equivalent to (0018,0060) but for each frame of the multi–frame image.
>mas_actual	(0025,XX20)	3	Equivalent to (0018,1151) but for each frame of the multi–frame image.
>pw_actual	(0025,XX21)	3	Equivalent to (0018,1150) but for each frame of the multi–frame image.
>tgt_entr_dose	(0025,XX27)	3	Exposure optimization conditions (nGy).
>cnr_cmd	(0025,XX28)	3	Exposure optimization conditions (%).

Attribute Name	Tag	Type	Attribute Description
>contrast_cmd	(0025,XX29)	3	Exposure optimization conditions (LSB).
>ept_actual	(0025,XX2A)	3	Exposure optimization conditions (cm).
>spect_flt_znb	(0025,XX2B)	3	Z number of the spectral filter.
>Table_long_pos	(0025,XX1C)	3	Absolute Longitudinal position of the table with respect to the table referential for each frame of the multi–frame image
>Table_lat_pos	(0025,XX1D)	3	Absolute Lateral position of the table with respect to the table referential for each frame of the multi–frame image

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Table 23 – Private Creator Identification (GEMS_DL_IMG_01)

Attribute Name	Tag	VR	VM
Calibration frame	(0019,XX81)	US	1
Calibration object	(0019,XX82)	CS	1
Calibration object size mm	(0019,XX83)	DS	1
Calibration factor	(0019,XX84)	FL	1
Calibration date	(0019,XX85)	PA	1
Calibration time	(0019,XX86)	TM	1
Calibration accuracy	(0019,XX87)	US	1
Calibration extended	(0019,XX88)	CS	1
Calibration image original	(0019,XX89)	US	1
Calibration frame original	(0019,XX8A)	US	1
Calibration nb points uif	(0019,XX8B)	US	1
Calibration points row	(0019,XX8C)	US	1–N
Calibration points column	(0019,XX8D)	US	1–N
Calibration mag ratio	(0019,XX8E)	FL	1
Calibration sw version	(0019,XX8F	LO	1
Extend calib sw version	(0019,XX90)	LO	1
Calibration return code	(0019,XX91)	IS	1
spatial_change	(0019,XX0B)	CS	1–2
fov_dim_double	(0019,XX93)	DS	1
detector_rot_angle	(0019,XX92)	DS	1
def_spa_flt_family	(0019,XX31)	IS	1

Attribute Name	Tag	VR	VM
def_spa_flt_strgth	(0019,XX32)	IS	1
def_bright_contr	(0019,XX4E)	DS	2
user_bright_contr	(0019,XX4F)	DS	2

Table 24 – Private Creator Identification (DLX_SERIES_01)

Attribute Name	Tag	VR	VM
angle_value_1	(0019,XX01)	DS	1
angle_value_2	(0019,XX02)	DS	1
angle_value_3	(0019,XX03)	DS	1
angle_label_1	(0019,XX04)	CS	1
angle_label_2	(0019,XX05)	CS	1
angle_label_3	(0019,XX06)	CS	1
usr_spa_flt_strgth	(0019,XX17)	IS	1
usr_zoom_factor	(0019,XX18)	IS	1
lbd_cm_pc_dtort	(0019,XX24)	DS	1
slope_lv_regress	(0019,XX25)	DS	1
int_lv_regress	(0019,XX26)	DS	1

Table 25 – Private Creator Identification (GEMS_DL_FRAME_01)

Attribute Name	Tag	VR	VM
frame_sequence	(0025,XX0A)	SQ	1
>frame_id	(0025,XX02)	IS	1
>dist_src_to_det	(0025,XX03)	DS	1
>dist_src_to_pat	(0025,XX04)	DS	1
>dist_src_to_skin	(0025,XX05)	DS	1
>table_vert_pos	(0025,XX1B)	DS	1
>table_long_pos	(0025,XX1D)	DS	1
>table_long_pos	(0025,XX1C)	DS	1
>kvp_actual	(0025,XX1F)	DS	1
>mas_actual	(0025,XX20)	DS	1
>pw_actual	(0025,XX21)	DS	1
>tgt_entr_dose	(0025,XX27)	DS	1
>cnr_cmd	(0025,XX28)	DS	1
>contrast_cmd	(0025,XX29)	DS	1
>ept_actual	(0025,XX2A)	DS	1
>spect_flt_znb	(0025,XX2B)	IS	1

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CHAPTER 4 – SC INFORMATION OBJECT IMPLEMENTATION

1 INTRODUCTION

This section specifies the use of the DICOM SC Image IOD to represent the information included in SC images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

2 IOD Description

3 IOD Entity–Relationship Model

4 IOD Module Table

5 IOD Module Definition

2 SC IOD IMPLEMENTATION

3 SC ENTITY–RELATIONSHIP MODEL

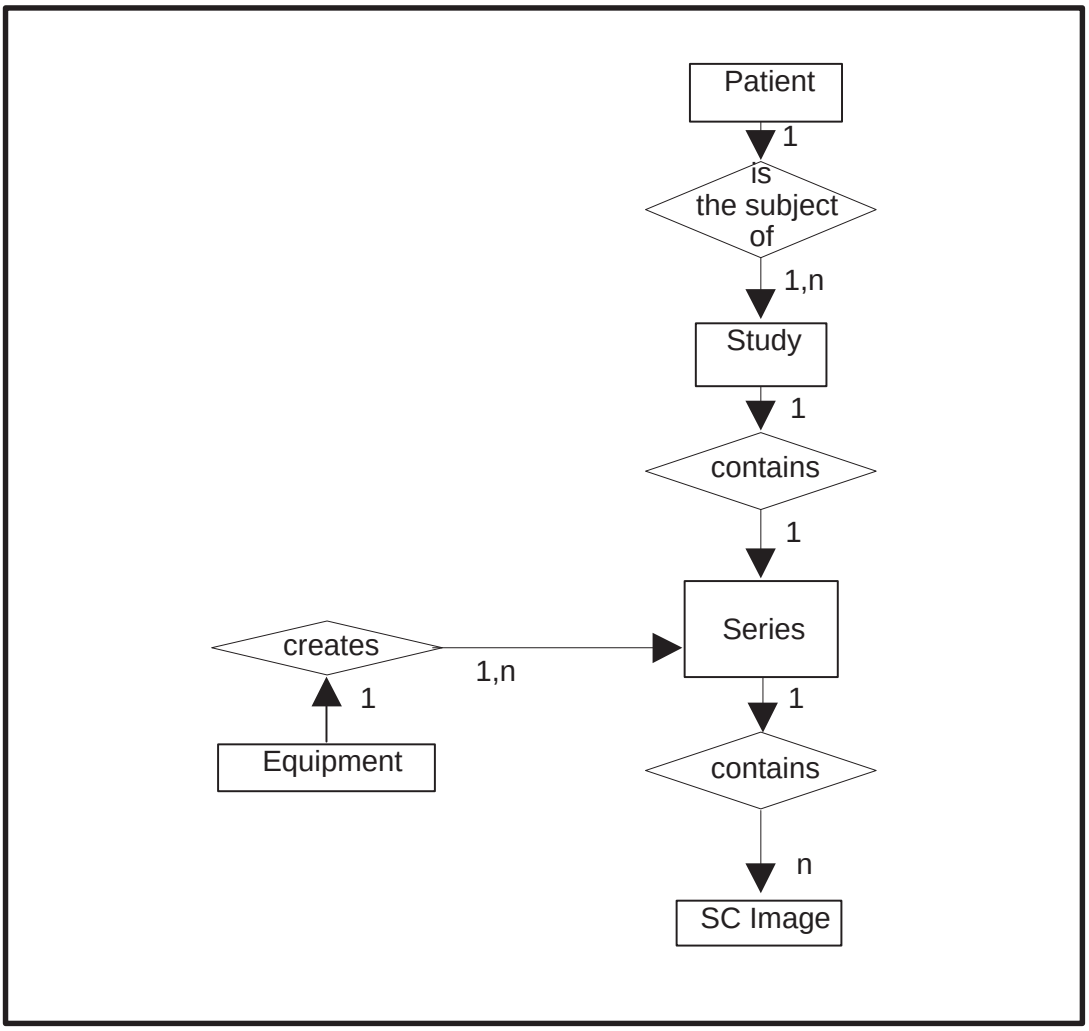
The Entity–Relationship diagram for the SC Image interoperability schema is shown in illustration 2 **.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Study to Series has 1 Series for each Study.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Study to Series has 1 Series for each Study.

Illustration 2 – SC IMAGE ENTITY RELATIONSHIP DIAGRAM



3-1 ENTITY DESCRIPTIONS

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

3-1-1 Patient Entity Description

3-1-2 Study Entity Description

3-1-3 Series Entity Description

3-1-4 Equipment Entity Description

3-1-5 SC Image Entity Description

3-1-6 Overlay Entity Description

3-1-7 VOI Lookup Table Entity Description

3-2 INNOVA 2000 Mapping of DICOM entities

Table 26 – Mapping of DICOM Entities to INNOVA 2000 Entities

DICOM	<Name of the Product> Entity
Patient	Patient
Study	Exam
Series	Exam
Image	Photo
Frame	Not Applicable

4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 SC IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 27 identifies the defined modules within the entities which comprise the DICOM v3.0 SC IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

Table 27 – SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	5–1–1
Study	General Study	5–2–1
	Patient Study	5–2–2
Series	General Series	5–3–1
Equipment	General Equipment	5–4–1
	SC Equipment	5–9–1
Image	General Image	5–5–1
	Image Pixel	5–5–2
	SC Image	5–9–2
	Overlay Plane	5–6–1
	Modality LUT	5–7–2
	VOI LUT	5–7–1
	SOP Common	5–8–1

Entity Name	Module Name	Reference
	XA Positioner	5–10–1
	Photo QCA	

5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

5-1 Common Patient Entity Modules

5-1-1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

Table 28 – PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From user interface or worklist. When from user interface, value contains only last_name(32 chars)^first_name(31 chars). When from worklist, equals first component group.
Patient ID	(0010,0020)	2	From worklist or user interface.
Patient's Birth Date	(0010,0030)	2	From user interface or worklist.
Patient's Sex	(0010,0040)	2	From user interface or worklist. "M", "F" or "O".

5-2 Common Study Entity Modules

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

5-2-1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

Table 29 – GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Restricted to 64 characters, internally generated as follows: ”registered prefix for GEMS” + ”.2. Registered prefix of innova 2000 System within GEMS” + ”.a.b.c” encoded mac address of the DL host +”.x.y.z” unique id protected against reinstallation and re–entrance.
Study Date	(0008,0020)	2	Date the exam was first started.
Study Time	(0008,0030)	2	HHMMSS.XXX, restricted to 10 characters.
Referring Physician’s Name	(0008,0090)	2	From user interface or worklist. When from user interface, value contains only one component (max 64 characters). When from worklist, equals first component group.
Study ID	(0020,0010)	2	From user interface or worklist.
Accession Number	(0008,0050)	2	From user interface or worklist.
Study Description	(0008,1030)	3	From user interface or worklist. When from worklist, filled in with Scheduled Procedure Step Description (0040, 0007).
Name of Physician(s) Reading Study	(0008,1060)	3	From user interface, value contains only one component.

5-2-2 Patient Study Module

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

Table 30 – PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient’s Age	(0010,1010)	3	Either from User Interface or calculated from Patient’s Birth Date (0010,0030). Three digits followed by one letter: In Years (Y), Months (M), Weeks (W) or Days (D).
Patient’s Size	(0010,1020)	3	From user interface or worklist.
Patient’s Weight	(0010,1030)	3	From user interface or worklist.

5-3 Common Series Entity Modules

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

5-3-1 General Series Module

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

Table 31 – GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	XA
Series Instance UID	(0020,000E)	1	Restricted to 64 characters, internally generated as follows: ”registered prefix for GEMS” + ”.2. Registered prefix of innova 2000 System within GEMS” + ”.a.b.c” encoded mac address of the DL host +”.x.y.z” unique id protected against reinstallation and re–entrance.
Series Number	(0020,0011)	2	1
Series Date	(0008,0021)	3	Equals study date (0008, 0020). May not be sent.
Series Time	(0008,0031)	3	Equals study time (0008, 0030). May not be sent.
Performing Physicians’ Name	(0008,1050)	3	From user interface or worklist. When from worklist, equals first value of Scheduled performing physician’s name (0040, 0006).
Protocol Name	(0018,1030)	3	CARDIAC.
Series Description	(0008,103E)	3	From user interface.
Operators’ Name	(0008,1070)	3	From User Interface, restricted to 64 characters, contains only one compoment. May not be sent.

5-4 Common Equipment Entity Modules

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

5-4-1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

Table 32 – GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	GE MEDICAL SYSTEMS
Institution Name	(0008,0080)	3	From ”Service User Interface”, configured at the installation of the system. Restricted to 64 characters.
Institution Address	(0008,0081)	3	From ”Service User Interface”, configured at the installation of the system. Restricted to 1024 characters.
Station Name	(0008,1010)	3	AE–title of the Innova system as configured in the Service User Interface.
Manufacturer’s Model Name	(0008,1090)	3	DL. May not be sent.
Device Serial Number	(0018,1000)	3	From internal configuration of the machine. May not be sent.
Software Versions	(0018,1020)	3	DL application version. May not be sent.

5-5 Common Image Entity Modules

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

5-5-1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

Table 33 – GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Internally generated, starting at 1, incremented with each new photo.
Patient Orientation	(0020,0020)	2C	See 5–5–1–1–1.
Image Type	(0008,0008)	3	See 5–5–1–1–2.
Acquisition Date	(0008,0022)	3	Date the original sequence was acquired.
Acquisition Time	(0008,0032)	3	Time the original sequence was acquired.
Derivation Description	(0008,2111)	3	See 5–5–1–1–3.
Source Image Sequence	(0008,2112)	3	See 5–5–1–1–3.
>Referenced SOP Class UID	(0008,1150)	1C	1.2.840.10008.5.1.4.1.1.12.1
>Referenced SOP Instance UID	(0008,1155)	1C	SOP Instance UID of the origial sequence.

Attribute Name	Tag	Type	Attribute Description
Image Comments	(0020,4000)	3	From User Interface, restricted to 64 characters.
Lossy Image Compression	(0028,2110)	3	See 5–5–1–1–4.

5-5-1-1 General Image Attribute Descriptions

5-5-1-1-1 Patient Orientation

Always zero length.

5-5-1-1-2 Image Type

Always DERIVED\SECONDARY

5-5-1-1-3 Derivation Description and Source Image Sequence

Derivation Description (0008,2111) not sent. Source Image Sequence is always sent.

5-5-1-1-4 Lossy Image Compression

Always 00.

5-5-2 Image Pixel Module

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

Table 34 – IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	1024
Columns	(0028,0011)	1	1024
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0x0000 (Unsigned integer)
Pixel Data	(7FE0,0010)	1	

5-6 Common Overlay Modules

5-6-1 Overlay plane module

This module is not sent.

5-7 Common Lookup Table Modules

5-7-1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

Table 35 – VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Value of the acquisition.
Window Width	(0028,1051)	1C	Value of the acquisition.

5-7-2 Modality LUT module

The Modality LUT module is not sent.

5-8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5-8-1 SOP Common Module

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

Table 36 – SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008,0018)	1	Restricted to 64 characters, internally generated as follows: ”registered prefix for GEMS” + ”.2. Registered prefix of innova 2000 System within GEMS” + ”.a.b.c” encoded mac address of the DL host +”.x.y.z” unique id protected against reinstallation and re–entrance.
Specific Character Set	(0008,0005)	1C	ISO_IR 100

5-9 SC Modules

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

5-9-1 SC Equipment Module

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

Table 37 – SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	WSD = Workstation
Modality	(0008,0060)	3	XA
Secondary Capture Device Manufacturer	(0018,1016)	3	GE MEDICAL SYSTEMS
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	DL

5-9-2 SC Image Module

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

Table 38 – SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Date the SC image was captured
Time of Secondary Capture	(0018,1014)	3	Time the SC image was captured

5-10 Other Modules

5-10-1 XA Positioner Module

Table 39 – XA Positioner Module Attributes

Attribute Name	Tag	Type	Attribute Description
Positioner Primary Angle	(0018,1510)	2	LAO/RAO angle for the SC image.
Positioner Secondary Angle	(0018,1511)	2	CRA/CAU angle for the SC image.

5-10-2 Photo QCA Module

Table 40 – PHOTO QCA Module Attributes

Attribute Name	Tag	Type	Attribute Description
Analysis Views	(0009,XX00)	1	Enumerated type containing one of the following values: PRE, POST and PRE_POST.
Segment	(0009,XX10)	2	ACC segment name.Defined terms:Proximal RCARCA OstiumMid RCADistal RCARight PDARight LV–BRLMCALMCA OstiumProximal LADMid LADDistal LAD1st Diagonal2nd Diagonal1st Septal-Proximal CircumflexMid Circumflex1st Marginal2nd Marginal3rd MarginalDistal CircumflexL
Pre Catheter Name	(0009,XX11)	2C	User description of pre–procedure catheter. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Catheter Size	(0009,XX12)	1C	Size of pre–procedure catheter in millimeters. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Reference Diameter	(0009,XX13)	1C	Pre–procedure Reference Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Minimum Lumen Diameter	(0009,XX14)	1C	Pre–procedure Minimum Lumen Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Average Diameter	(0009,XX15)	2C	Pre–procedure Average Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).

Attribute Name	Tag	Type	Attribute Description
Pre Stenosis Length	(0009,XX16)	2C	Pre–procedure Stenosis Length, in millimeters. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Stenosis %	(0009,XX17)	2C	Pre–procedure Stenosis as a percentage. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Pre Geometric Area Reduction %	(0009,XX18)	2C	Pre–procedure Geometric Area Reduction as a percentage. Required if Analysis Type (0009,XX00) is ”PRE” or ”PRE_POST”. (May not be sent).
Post Catheter Name	(0009,XX21)	2C	User description of post–procedure catheter. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).
Post Catheter Size	(0009,XX22)	1C	Size of post–procedure catheter in millimeters. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).
Post Reference Diameter	(0009,XX23)	1C	Post–procedure Reference Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).
Post Minimum Lumen Diameter	(0009,XX24)	1C	Post–procedure Minimum Lumen Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).
Post Average Diameter	(0009,XX25)	2C	Post–procedure Average Diameter, in millimeters. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).
Post Stenosis Length	(0009,XX26)	2C	Post–procedure Stenosis Length, in millimeters. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).

Attribute Name	Tag	Type	Attribute Description
Post Stenosis %	(0009,XX27)	2C	Post–procedure Stenosis as a percentage. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent)
Post Geometric Area Reduction %	(0009,XX28)	2C	Post–procedure Geometric Area Reduction as a percentage. Required if Analysis Type (0009,XX00) is ”POST” or ”PRE_POST”. (May not be sent).

6 PRIVATE DATA DICTIONARY

Table 41 – Private Creator Identification (GEMS_XXXX_NN)

Attribute Name	Tag	VR	VM
Analysis Views	(0009,XX00)	CS	1
Segment	(0009,XX10)	LO	1
Pre Catheter Name 2C	(0009,XX11)	LO	1
Pre Catheter Size	(0009,XX12)	DS	1
Pre Reference Diameter	(0009,XX13)	DS	1
Pre Minimum Lumen Diameter	(0009,XX14)	DS	1
Pre Average Diameter	(0009,XX15)	DS	1
Pre Stenosis Length	(0009,XX16)	DS	1
Pre Stenosis %	(0009,XX17)	IS	1
Pre Geometric Area Reduction %	(0009,XX18)	IS	1
Post Catheter Name	(0009,XX21)	LO	1
Post Catheter Size	(0009,XX22)	DS	1
Post Reference Diameter	(0009,XX23)	DS	1
Post Minimum Lumen Diameter	(0009,XX24)	DS	1
Post Average Diameter	(0009,XX25)	DS	1
Post Stenosis Length	(0009,XX26)	DS	1
Post Stenosis %	(0009,XX27)	IS	1
Post Geometric Area Reduction %	(0009,XX28)	IS	1

Table 42 – Private Creator Identification (GEMS_ XXXX _NN)

Attribute Name	Tag	VR	VM
src_frame_number	(0019,XX52)	IS	1

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CHAPTER 5 – MODALITY WORKLIST INFORMATION MODEL DEFINITION

1 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 contents of this section are:

2 Information Model Description

3 Information Model Entity–Relationship Model

4 Information Model Module Table

5 Information Model Keys

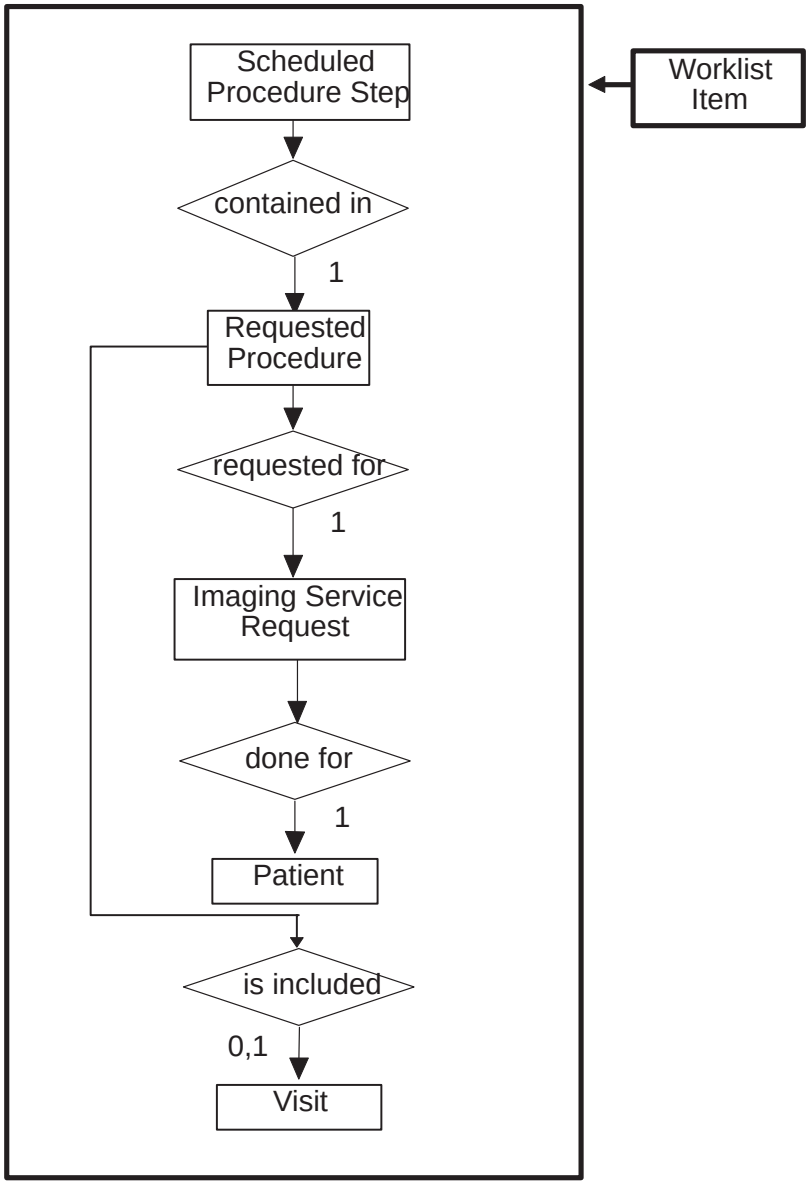
2 MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

3 MODALITY WORKLIST INFORMATION MODEL ENTITY–RELATIONSHIP MODEL

The Entity–Relationship diagram for the Modality Worklist Information Model schema is shown in illustration 3. 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.

Illustration 3 – Modality Worklist Information Model E/R DIAGRAM



3-1 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.

3-1-1 Scheduled Procedure Step

3-1-2 Requested Procedure Entity Description

3-1-3 Imaging Service Request Entity Description

3-1-4 Visit Entity Description

3-1-5 Patient Entity Description

3-2 INNOVA 2000 Mapping of DICOM entities

Table 43 – Mapping of DICOM Entities to Innova 2000 Entities

DICOM	INNOVA 2000 Entity
Scheduled Procedure Step	
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	
Patient	Patient

4 INFORMATION MODEL MODULE TABLE

Within an entity of the DICOM v3.0 Modality Worklist Information Model, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 44 identifies the defined modules within the entities which comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

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

Table 44 – MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	5–2–1
	Scheduled Procedure Step	5–2–2
Requested Procedure	Requested Procedure	5–3–1
Imaging Service Request	Imaging Service Request	5–4–1
Visit	Visit Identification	5–5–1
	Visit Status	5–5–2
	Visit Relationship	5–5–3
	Visit Admission	5–5–4
Patient	Patient Relationship	5–6–1
	Patient Identification	5–6–2
	Patient Demographic	5–6–3
	Patient Medical	5–6–4

5 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 are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard PS 3.4 (Service Class Specifications).

5-1 Supported Matching

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

- Single Value matching
- Universal Matching
- Wild Card Matching
- Range of date, Range of Time

5-2 Scheduled Procedure Step Entity

5-2-1 SOP Common Module

Table 45 – SOP Common Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Specific Character Set	(0008,0005)	O	1C	No	Matching on this tag is not supported. ISO IR_100 is always assumed.

5-2-2 Scheduled Procedure Step Module

Table 46 – 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. The matching value is the AE–Title of the Innova system.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching value can be configured for date or date range.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	Requested, zero length.
>Modality	(0008,0060)	R	1	No	This is requested either as zero length or as XA, user configurable.

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
>Scheduled Performing Physician's Name	(0040,0006)	R	2	Yes	Requested, zero length. After user confirmation, the first value can be mapped into Performing Physician (0008, 1050)
>Scheduled Procedure Step Description	(0040,0005)	O	1C	No	After user confirmation, can be mapped into Study description (0008, 1030)
>Scheduled Action Item Code Sequence	(0040,0008)	O	1C	No	
>>Code Value	(0008,0100)	O	1C	No	
>>Coding Scheme Designator	(0008,0102)	O	1C	No	
>>Code Meaning	(0008,0104)	O	3	No	
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	

5-3 Requested Procedure Entity

5-3-1 Requested Procedure Module

Table 47 – 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	This information can be mapped into Study ID (0020,0010) after user confirmation.
Requested Procedure Description	(0032,1060)	O	1C	No	
Requested Procedure Code Sequence	(0032,1064)	O	1C	No	
>Code Value	(0008,0100)	O	1C	No	
>Coding Scheme Designator	(0008,0102)	O	1C	No	
>Code Meaning	(0008,0104)	O	3	No	
Study Instance UID	(0020,000D)	O	1	Yes	If one SPS is selected, or if multiple SPSs with the same Study Instance UID are selected, the value is mapped in the images. Else, a Study Instance UID is generated by the implementatoin.
Referenced Study Sequence	(0008,1110)	O	2	No	

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
>Referenced SOP Class UID	(0008,1150)	O	1C	No	
>Referenced SOP Instance UID	(0008,1155)	O	1C	No	

5-4 Imaging Service Request Entity

5-4-1 Imaging Service Request Module

Table 48 – 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	Matching is supported, user entered value is sent.
Referring Physician's Name	(0008,0090)	O	2	Yes	Requested, zero length. The first person name component group is mapped in the image. No truncation is performed. Values may be trucnated *for display only*

5-5 Visit Entity

5-5-1 Visit Identification

No attribute from this module is requested in the modality worklist query.

5-5-2 Visit Status

No attribute from this module is requested in the modality worklist query.

5-5-3 Visit Relationship

No attribute from this module is requested in the modality worklist query.

5-5-4 Visit Admission

No attribute from this module is requested in the modality worklist query.

5-6 Patient Entity

5-6-1 Patient Relationship

No attribute from this module is requested in the modality worklist query.

5-6-2 Patient Identification

Table 49 – 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, user entered value is sent. Wild-cards are appened in the query at the end of the components (first name and last name). The first person name compo-nent group returned is mapped in the image. No truncation is performed. Values may be trucnated *for display only*
Patient ID	(0010,0020)	R	1	Yes	Matching is supported, user entered value is sent.

5-6-3 Patient Demographic

Table 50 – Patient Demographic Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patients Birth Date	(0010,0030)	O	2	Yes	
Patient's Sex	(0010,0040)	O	2	Yes	
Patient's Weight	(0010,1030)	O	2	Yes	
Patient's Size	(0010,1020)	O	3	Yes	

5-6-4 Patient Medical

No attribute from this module is requested in the modality worklist query.

6 PRIVATE DATA DICTIONARY

No private data dictionary is used by the worklist implementation

REVISION HISTORY

REV	DATE	REASON FOR CHANGE	PAGES
0	27 October 2000	Initial release	40
1	18 January 2001	Manual updatedl for M3	40
2	07 June 2001	Manual updated for M4a	42
3	05 November 2001	Manual updated for M4b, Chap. 4 Secondary Capture (SC) added.	62
4	18 October 2002	Manual updated with modifications to all chapters and an additional fifth chapter added (worklist)	72

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