GE Heathcare

Technical Publications

Direction 5179057DHF
Revision 2

Ventri 1.0
DICOM CONFORMANCE STATEMENT

LIST OF REVISIONS

REV	DATE	DESCRIPTION	PAGES	APPR.
1	Oct. 2009	Ventri Release	All	M. Mesh
2	Nov. 2010	Use new template. Update Private Data Dictionary	All	M. Mesh

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CONFORMANCE STATEMENT OVERVIEW

The Ventri DICOM implementation allows the user to send Nuclear Medicine image data, acquired through the front-end acquisition system , and Secondary Capture Objects, created as reports of several Quality Control (QC) operations to another DICOM station.

The Ventri DICOM implementation supports storage commitment for the already transferred data. This guarantees the user that the acquired data is safely archived for future use.

The Ventri DICOM implementation also supports receiving Worklist information from a remote AE.

The Ventri DICOM implementation supports receiving one Scheduled procedure step per study instance. Similarly, Ventri supports scheduling locally one protocol to be performed for a study.

The Ventri DICOM implementation also provides a verification mechanism by which a remote AE can verify application-level communication with Ventri DICOM Server. Also provided is a mechanism by which Ventri user can verify application-level communication with a remote AE.

Table 0.1 provides an overview of the network services supported by Ventri .

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Secondary Capture Image Storage	Yes	No
Nuclear Medicine Image Storage	Yes	No
Workflow Management		
Storage Commitment Push Model SOP Class	Yes	No
Modality Worklist Information Model – FIND SOP Class	Yes	No

1. INTRODUCTION

1.1 OVERVIEW

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

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

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

Section 3 (NM Image Information Object Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a NM Image Information Object.

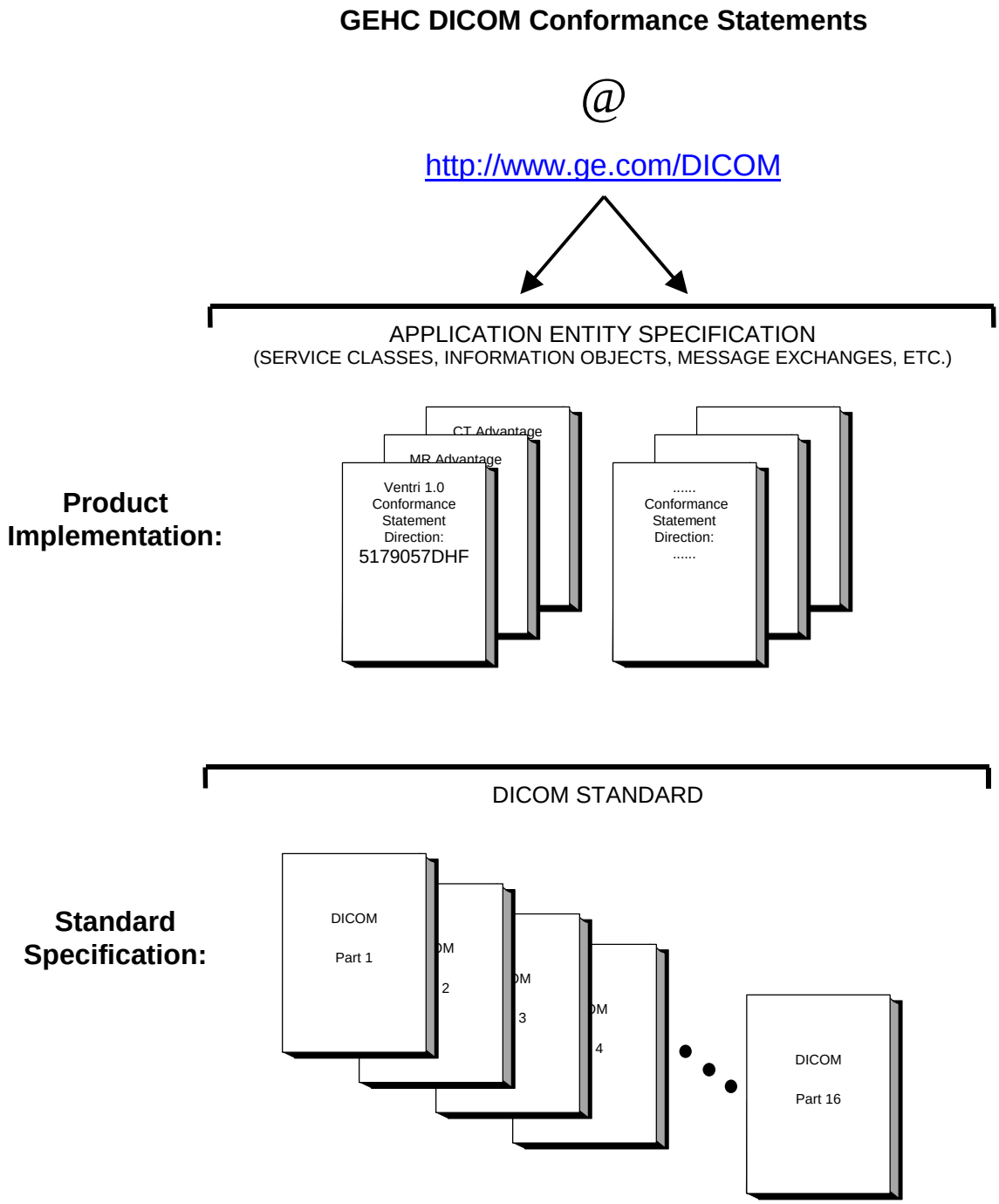
Section 4 (Secondary Capture Image Information Object Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a SC Image Information Object.

Section 5 (Modality Worklist Information Model), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section 6 (Storage Commitment PUSH Model Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Storage Commitment service.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

> ***Ventri 1.0***
> *Conformance Statement for DICOM*
> *Direction* 5179057DHF

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC 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 regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

> DICOM Secretariat
> NEMA
> 1300 N. 17th Street, Suite 1752
> Rosslyn, VA 22209
> USA
> Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

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

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC 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 GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1.5 IMPORTANT REMARKS

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

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

- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

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

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

NEMA PS3	Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

1.7 DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities.* Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another

Application Entity (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (Modality Worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), Little Endian Explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
CSE	Customer Service Engineer
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
HIS	Hospital Information System
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition

ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SDO	Series Data Object
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
US	Ultrasound
VM	Value Multiplicity
VR	Value Representation

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Ventri compliance to DICOM requirements for **Networking** features.

The Ventri systems provide sophisticated acquisition, image processing and storage functions of nuclear image data acquired through the front end acquisition system. In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, Ventri system will provide support for DICOM.

This section details the roles and DICOM Service Classes supported by the Ventri.

The Ventri DICOM implementation allows the user to send Nuclear Medicine image data, acquired through the front-end acquisition system, and Secondary Capture Objects, created as reports of several Quality Control (QC) operations, to another DICOM station. In this situation Ventri provides the DICOM C-STORE service as a service class user (SCU).

The Ventri DICOM implementation supports storage commitment for the already transferred data. This guarantees the user that the acquired Nuclear Medicine image data and Secondary capture Objects are safety archived for future use. In this situation Ventri provides the DICOM Storage Commitment Service as Service Class User (SCU).

The Ventri DICOM implementation supports receiving Worklist information from a remote AE. Receiving Worklist information is associated with the real world activity: Modality Worklist Query. When a query is performed the remote AE Worklist items matching the query request are received.

The Ventri DICOM implementation supports receiving one Scheduled procedure step per study instance. Similarly, Ventri supports scheduling locally one protocol to be performed for a study.

The Ventri DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the Ventri DICOM Server. Also provided is a mechanism by which a Ventri user can verify application-level communication with a remote DICOM AE. In these situations, Ventri provides the DICOM C-ECHO service as both a SCP and SCU, respectively.

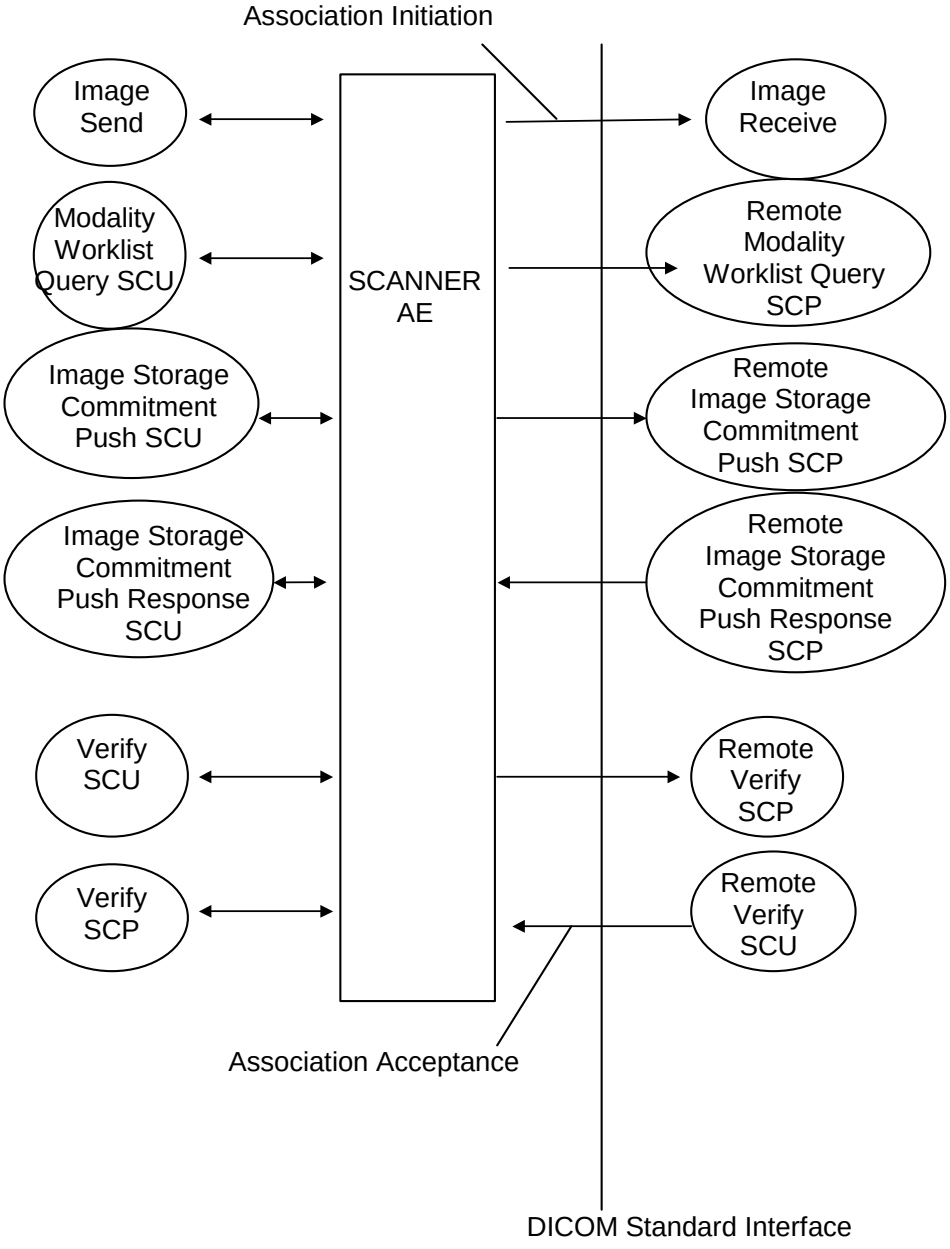
2.2 IMPLEMENTATION MODEL

All DICOM functionality on the Ventri is logically provided by the SCANNER Application Entity (AE). The SCANNER AE is commanded to perform DICOM services through the use of the Ventri user interface (UI). The SCANNER AE also listens on a pre-defined port for incoming connections from remote DICOM AE.

2.2.1 Application Data Flow Diagram

The network application model for the Ventri is shown in the following Illustration :

ILLUSTRATION 2–1
VENTRI NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM



2.2.2 Functional Definition of AE's

The Ventri SCANNER Application Entity (AE) initiates the following functions:

- *Store*: Initiates a DICOM association in order to send images to a remote AE. If the remote AE accepts a presentation context applicable to the image(s) being sent, the SCANNER AE will send the images via the C-STORE service.

- *Storage commitment:* Initiates a DICOM association in order to request a storage commitment from a remote AE. If the remote AE supports storage commitment the SCANNER server will request a storage commitment for the image(s) previously sent successfully via the N-ACTION-RQ.

- *Verify*: Initiates a DICOM association in order to send a verification message to a remote AE via a C-ECHO-RQ message.

- *Modality Work List (MWL)*: Initiates a DICOM association in order to query the work list from a remote AE. If the remote AE accepts a presentation context applicable to the modality work list request being sent, the SCANNER AE will receive appropriate MWL responses via the C-FIND service.

The Ventri SCANNER AE responds to the following functions:

- *Verify*: Responds to incoming C-ECHO-RQ messages by returning a C-ECHO-RSP message with a status of "Success."

- *Storage Commitment Response*: Responds to incoming N-EVENT_REPORT messages arriving from Remote AE with the status of storage commitment for images previously requested by SCANNER AE.

2.2.3 Sequencing of Real-World Activities

The Ventri SCANNER AE queries the remote station for the Modality Worklist; performs acquisition according to local schedules or by Worklist procedures; stores images; and then requests Storage Commitment for previously stored images.

2.3 AE SPECIFICATIONS

2.3.1 SCANNER AE Specification

The SCANNER Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the SCANNER AE is:

Maximum Length PDU	28672 (Not Configurable)

The SOP Class Extended Negotiation is not supported.

2.3.1.1.2 Number of Associations

The SCANNER AE (SCU) will initiate a single DICOM association to perform a single image send to a remote node. One association is opened per image both in manual send and in auto-send. Multiple Send operations can be performed. The Image Storage Commitment Request (SCU) initiates a new single association for all the images that were successfully stored on the remote AE. SCANNER AE can initiate a maximum of 5 simultaneous associations to remote nodes.

The SCANNER AE (SCP) can accept multiple DICOM associations opened simultaneously to service verifications. The SCANNER AE can support a maximum of 5 simultaneous associations initiated by remote nodes.

2.3.1.1.3 Asynchronous Nature

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

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Ventri Implementation UID	1.2.840.113619.2.216
Ventri Implementation Version Name	MergeCOM3_321

2.3.1.2 Association Initiation Policy

When the SCANNER Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The SCANNER AE proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

The SCANNER AE initiates a new association in the following cases:

- Due to an image send operation being initiated from the Ventri user interface, or by auto send option.
- Due to a storage commitment request operation being initiated from the Ventri user interface upon successful image transfer or by auto send option
- Due to a Verify operation initiated to determine whether the remote DICOM station is operational.
- Due to Modality Worklist request being initiated from the Ventri user interface.

2.3.1.2.1 Real-World Activity Image Send

2.3.1.2.1.1 Associated Real-World Activity

The operator must both select image(s) to be transferred from the Patient Browser and select a destination by pressing the destination button. Once image(s) selections have been made, the operator pushes the transfer Destination button to initiate an image send operation. The SCANNER AE will then initiate an association(s) with the remote AE in order to send the selected image(s) – one image per association – and will accept and interpret responses received from the remote AE.

The UI will indicate the status of the image(s),series or Study being transferred. The level of logging depends on data selection in the Patient Browser. The status can be one of PENDING, SUCCESS, or FAILURE. The associated error messages due to a failed status can be found in system log

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by SCANNER AE for Image Send Activity					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for All Storage SOP Classes

The Ventri SCANNER AE implementation includes optional data elements in the SOP Instances as described in Sections 3 and 4.

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

All the operations used by this SOP class support an **Association Timer**. This timer is started when the association request is sent, and is stopped when the respective response is received. The default time-out value is 15 seconds and is not configurable.

All the operations used by this SOP class support a **Session Timer**. This timer is started when the association is established, and stopped when the association is ended. The default time-out value is 3000 seconds. and is not configurable.

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

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

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700-A7FF	Refused: Out of resources	The message " JOB_FAILED: error sending image" is displayed in Transfer Log.

	A900-A9FF	Error: Data Set does not match SOP Class	The message " JOB_FAILED: error sending image" is displayed in Transfer Log
	C000-CFFF	Error: Cannot Understand	The message " JOB_FAILED: error sending image" is displayed in Transfer Log
	0122	SOP Class Not Supported	The message " JOB_FAILED: error sending image" is displayed in Transfer Log
Warning	B000	Coercion of Data Elements	The message “JOB_SUCCEEDED” posted to the Transfer Log.
	B006	Elements Discarded	The message “JOB_SUCCEEDED” posted to the Transfer Log.
	B007	Data Set does not match SOP Class	The message “JOB_SUCCEEDED” posted to the Transfer Log.
Success	0000		The message “JOB_SUCCEEDED” posted to the Transfer Log.
*	*	Any other status code.	The message " JOB_FAILED: error sending image" is displayed in Transfer Log.

2.3.1.2.2 Real-World Activity Modality Worklist Query SCU

2.3.1.2.2.1 Associated Real-World Activity

SCANNER AE queries the remote AE for a Modality Worklist (MWL) in the following cases:

- When Ventri application is started, MWL query is automatically performed for updating entries displayed in the Ventri “To Do List”.
- User opens “Filter...” button in Ventri UI. MWL Filter dialog is opened, user defines relevant MWL matching keys and presses on “Query” button.
- Users requires MWL query using latest MWL matching keys defined by pressing on “Refresh” button in the Ventri UI.
- Users requires MWL query using latest MWL matching keys defined to map of the MWL Requested or Scheduled Procedures to the Ventri acquisition protocols.

2.3.1.2.2.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by SCANNER AE for Modality Worklist Query SCU Activity					
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 Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model - FIND SOP Class

The SCANNER includes matching keys in the Modality Worklist queries as described in Section 5.

If Modality Worklist query failed, the user receives a notification message.

All the operations used by this SOP class support an **Association Timer**. This timer is started when the association request is sent, and is stopped when the respective response is received. The default time-out value is 15 seconds, and is not configurable.

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 360 seconds.

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

Sending C-FIND CANCEL is not supported by the SCANNER AE.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources	User receives a notification message. Only locally scheduled studies or studies which acquisition is in progress are displayed in the Ventri “To Do List”
	A900	Error: Identifier does not match SOP Class	User receives a notification message. Only locally scheduled studies or studies which acquisition is in progress are displayed in the Ventri “To Do List”
	C000-CFFF	Error: Unable to process	User receives a notification message. Only locally scheduled studies or studies which acquisition is in progress are displayed in the Ventri “To Do List”
	0122	SOP Class Not Supported	User receives a notification message. Only locally scheduled studies or studies which

			acquisition is in progress are displayed in the Ventri "To Do List"
Cancel	FE00	Matching terminated due to cancel	User receives a notification message. Only locally scheduled studies or studies which acquisition is in progress are displayed in the Ventri "To Do List"
Success	0000	Matching is complete - No final identifier is supplied	
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	"MWL query is in progress" notification is displayed along with MWL query progress indicator.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier	"MWL query is in progress" notification is displayed along with MWL query progress indicator.
*	*	Any other status code.	User receives a notification message. Only locally scheduled studies or studies which acquisition is in progress are displayed in the Ventri "To Do List"

2.3.1.2.3 Real-World Activity **Image Storage Commitment Push SCU**

2.3.1.2.3.1 Associated Real-World Activity

The operator must select image(s) to be transferred from the Patient Browser. Once these selections have been made, the operator pushes the "Destination" button to initiate an image send operation. The SCANNER will then initiate the multiple associations with the remote AE in order to send the selected image(s) and will accept responses from the remote AE.

If the destination is configured as storage commitment capable or the destination is configured to use other storage commitment capable devices, the SCANNER will initiate one separate association with the remote storage commitment capable AE in order to request a storage commitment for all the successfully transferred image(s).

The UI shows the status of the storage commitment request progress. The status can be either PENDING, SUCCESS, or FAILURE. The associated error messages due to a failure can be found in the system log.

The system does not support any configurable delay before issuing the N-Action Request.

2.3.1.2.3.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by SCANNER AE for Image Storage Commitment Push SCU Activity					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU

The storage commitment request (N-ACTION) can perform a storage commitment request for multiple images over a single association. A new association is initiated for the storage commitment request for every group of successfully transferred image(s).

Upon receiving a N-ACTION confirmation containing a “Successful” status, the next N_ACTION_RQ operation is performed for the new association.

Upon receiving a N-ACTION confirmation containing a “Refused” status, the association is terminated. The reason for termination is recorded in the system log file.

Upon receiving a N-ACTION confirmation containing a status other than the DICOM standard defined values, the current request is considered to be a failure and will terminate the association. The reason for termination is recorded in the system log file.

The SCANNER AE uses DICOM network storage services to transfer SOP Instances which are to be committed.

The SCANNER AE may request Storage Commitment for Instances of any of the Composite SOP Classes it supports as an SCU (see Section 2.3.1.2.1.2).

The Storage Commitment Information Object is described in Section 6.

All the operations used by this SOP class support an Association Timer. This timer is started when the association request is sent, and is stopped when the respective response is received. The default time-out value is 15 seconds, and is not configurable.

All the operations used by this SOP class support a Session Timer. This timer is started when the association is established, and stopped when the association is ended. The default time-out value is 360 seconds and is not configurable.

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

Following are the status codes that are more specifically processed when receiving N-Action responses from a Storage Commitment SCP equipment:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	0119	Class-instance conflict	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log

	0112	No such SOP Instance	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log
	0110	Processing failure	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log
	0213	Resource limitation	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log
	0122	Referenced SOP Class Not Supported	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log
	0131	Duplicate Transaction UID	The message "JOB_FAILED: error storage commitment" is displayed in Transfer Log
Success	0000		The message " JOB_IN_PROGRESS: Waiting for commitment" is displayed in Transfer Log.
*	*	Any other status code.	The message " JOB_FAILED: error storage commitment" is displayed in Transfer Log

As part of the storage commitment implementation, Remote AE (SCP) will initiate an association to this implementation and will send an N-EVENT-REPORT. The attribute of the N-EVENT-REPORT message will include an indication on all images for which a commitment has succeeded and those for which it has failed.

The receipt of a N-EVENT-REPORT on an association that SCANNER has initiated is not supported. The Remote AE (SCP) must initiate a new association in order to send the new N-EVENT-REPORT (see Section 2.3.1.3.2.2.1).

2.3.1.2.4 Real-World Activity Verify SCU

2.3.1.2.4.1 Associated Real-World Activity

Service personnel invoke the DICOM Station Configuration Utility from Ventri UI. The user selects any of defined remote DICOM AE and presses on “Refresh status” button. The SCANNER AE initiates an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

2.3.1.2.4.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by SCANNER AE for Verify SCU Activity					
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	SCU	None

2.3.1.2.4.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

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

All the operations used by this SOP class support an Association Timer. This timer is started when the association

request is sent, and is stopped when the respective response is received. The default time-out value is 15 seconds and is not configurable.

2.3.1.3 Association Acceptance Policy

The SCANNER AE places no limitation on whom may connect to it. The maximum number of associations accepted in parallel is limited to 5.

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

As part of the storage commitment implementation, the SCANNER AE Server responds to N-EVENT-REPORT received from the remote AE.

2.3.1.3.1 Real-World Activity Verify SCP

2.3.1.3.1.1 Associated Real-World Activity

The SCANNER AE is always listening for associations. No operator action is required to respond to a Verification request.

The real-world activity associated with the Verification request is to send a C-ECHO-RSP message with a status of "Success" to the requesting AE.

2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by SCANNER AE for Verify SCP Activity					
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 Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The SCANNER AE provides standard conformance to the DICOM verification service class.

Ventri does not perform any check of Calling AE Titles allowing any remote AE to do verification of SCANNER AE status.

2.3.1.3.2 Real-World Activity Image Storage Commitment Push Response SCU

2.3.1.3.2.1 Associated Real-World Activity

As part of the storage commitment implementation, Remote AE (SCP) initiates an association to this implementation and sends an N-EVENT-REPORT. The attribute of the N-EVENT-REPORT message includes an indication on all images for which a commitment has succeeded and those for which it has failed.

The receipt of an N-EVENT-REPORT on an association that SCANNER AE has initiated is not supported. The Remote AE (SCP) must initiate a new association in order to send the new N-EVENT-REPORT.

On reception of a successful N-EVENT-REPORT-RQ notification from the Storage Commitment Provider, the images

are flagged as committed in the database.

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by SCANNER AE for Image Storage Commitment Push Response SCU Activity					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

2.3.1.3.2.2.1 SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU

The SCANNER AE will only accept the SCU role (which must be proposed via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class.

Upon receiving a Storage Commitment N-EVENT-REPORT (Storage Commitment Result), the SCANNER AE will validate the Transaction UID against its list of outstanding Storage Commitment Request Transaction UIDs. If it matches an outstanding Request, the AE will mark all SOP Instances for which a success status is indicated with an Archived flag, shown on the user interface as “Archive” Icon. User shall explicitly request deleting Images , which are not marked as “Archived”.

If the Storage Commitment Result indicates any failure status, the error will be written to the error log. Any retry must be manually reinitiated as a new Storage Commitment Request (see Section 2.3.1.2.3). The list of specific Failure Reason Codes that this AE will be able to process is described in Section 6.1.2.1

Following are the status codes the Application may send back in the N-EVENT-REPORT response command to the Storage Commitment SCP Equipment that sent the N-EVENT-REPORT request:

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	0110	Processing failure	This status code is sent if SCANER AE failed to understand N_EVENT_RESPONSE message	None
Success	0000		Send in case that SCANER AE successfully processed N_EVENT_RESPONSE message	None

2.3.1.3.2.3 Presentation Context Acceptance Criterion

The SCANNER AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

2.3.1.3.2.4 Transfer Syntax Selection Policies

Within each Presentation Context, SCANNER AE will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian

2. Implicit VR Little Endian

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the Windows XP (SP3) Operating System.

2.4.2 Physical Media Support

The product is provided with a 10/100 Mb/s auto-sensing Ethernet interface. Additional or alternate network interfaces may be available.

2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

2.5.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to all supported SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements. The extensions are defined in Section 3 and Section 4

2.5.1.2 Private SOP Classes

Ventri does not implement any Private SOP Classes.

2.5.2 Private Transfer Syntaxes

Ventri does not implement any Private transfer syntax.

2.6 CONFIGURATION

The Ventri system is configured by GE Healthcare Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer but are not accessible through the Ventri user interface.

2.6.1 AE Title/Presentation Address Mapping

2.6.2 Configurable Parameters

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

- Local AE Title
- Listening Port Number (default value is 104)

Note: PDU length and any time-outs are not configurable for Ventri. The configuration of IP routers and subnet mask is available on a OS level.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title

- Remote IP Address
- Listening TCP/IP Port Number
- Remote AE functionality flags:
  - Send destination
  - Auto-send destination
  - Modality Worklist Provider
  - Storage Commit Server only
  - Storage Commitment on (AE Title of one of previously defined Storage Commitment Servers)

Note: All configurations must be performed by a GE Field Engineer. The DICOM configuration items are configurable or re-configurable by a Field Service Engineer but are not accessible through the Ventri user interface.

2.7 SUPPORT OF EXTENDED CHARACTER SETS

The Ventri supports only a single single-byte extended character set ISO_IR 100 (Latin alphabet Number 1) supplementary set.

The product user interface will allow the user to enter characters from the console keyboard that are within ASCII or the configured extended character set. Even if any such extended characters are included in SOP Instances or in query identifier matching fields, the product specifies ISO_IR 100 (Latin alphabet Number 1) extended character set in Specific Character Set (0008,0005).

The product will accept, as a Modality Worklist SCU, Scheduled Procedure Step Identifiers with any value of Specific Character Set (0008,0005). It will map that Specific Character Set value without change into the images created pursuant to that Scheduled Procedure Step. Text attributes of the Scheduled Procedure Step Identifier, including Patient and Physician names, that include extended characters will be displayed as described above.

2.8 CODES AND CONTROLLED TERMINOLOGY

2.8.1 Fixed Coded Terminology

The product uses the fixed (non-configurable, non-extensible) coded terminology in Image SOP, as described in Section 3.

The Ventri DICOM implementation is capable of supporting arbitrary coding schemes for Procedure and Protocol Codes. During installation, a service technician will establish a mapping between the site-specific codes and the Protocol Names used internally to identify acquisition protocols. A remote AE station configured to act as Worklist provider is configured to map according to one of the DICOM tags:

- (0040,0007) - Scheduled Procedure Step Description
- (0032,1060) - Requested Procedure Code Sequence
- (0040,0008) - Scheduled Protocol Code Sequence

2.8.2 Mapped Coded Terminology

The product does not use any mapped coded terminology

2.8.3 Configurable Coded Terminology

The product does not use any configurable coded terminology

2.9 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. NM INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM NM Image IOD to represent the information included in NM Images produced by this implementation. Corresponding attributes are conveyed using the module construct.

3.2 VENTRI MAPPING OF DICOM ENTITIES

The VENTRI maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 3-1
MAPPING OF DICOM ENTITIES TO VENTRI ENTITIES

DICOM IE	VENTRI Entity
Patient	Patient
Study	Study
Series	Series
Image	Dataset

3.3 IOD MODULE TABLE

The Nuclear Medicine Information Object Definition comprises the modules of the following table, plus Private attributes. Private attributes are described in Section 3.5.

TABLE 3-2
NM IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	N/A
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
	Standard Extended Study	Used	3.4.2.3
	Clinical Trial Study	Not Used	N/A
Series	General Series	Used	3.4.3.1
	Clinical Trial Series	Not Used	N/A
	Standard Extended Series	Used	3.4.3.2
	NM/PET Patient Orientation	Used	3.4.3.3
	Private Series	Used	3.4.3.4
Frame of Reference	Frame of Reference	Used for images where Image Type (0008, 0008) Value 3 is TOMO or GATED TOMO	3.4.4.1

Equipment	General Equipment	Used	3.4.5.1
Image	General Image	Used	3.4.6.1
	Image Pixel	Used	3.4.6.2
	Acquisition Context	Used for Cardiac SPECT images only	3.4.6.3
	Device	Not Used	N/A
	Specimen	Not Used	N/A
	NM Image Pixel	Used	3.4.6.4
	Multi-frame	Used	3.4.6.5
	NM Multi-frame	Used	3.4.6.6
	NM Image	Used	3.4.6.7
	NM Isotope	Used	3.4.6.8
	NM Detector	Used	3.4.6.9
	NM Tomo-Acquisition	Used for images where Image Type (0008,0008) Value 3 is TOMO or GATED TOMO	3.4.6.10
	NM Multi-gated Acquisition	Used for images where Image Type (0008,0008) Value 3 is GATED or GATED TOMO	3.4.6.11
	NM Phase	Used for images where Image Type (0008,0008) Value 3 is DYNAMIC	3.4.6.12
	Overlay Plane	Not Used	N/A
	Multi-frame Overlay	Not Used	N/A
	VOI LUT	Used	3.4.6.13
	SOP Common	Used	3.4.6.14
	Private Image	Used	3.4.6.15
	Private Image TOMO	Used for images where Image Type (0008,0008) Value 3 is TOMO or GATED TOMO	3.4.6.16
	Private Image Multi-Gated	Used for images where Image Type (0008,0008) Value 3 is GATED or GATED TOMO	3.4.6.17
	Private Image GSPECT	Used for images where Image Type (0008,0008) Value 3 is GATED TOMO	3.4.6.18

3.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the NM 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 when generating the instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

Ventri private attributes are defined in private modules, each of which follow the related Standard module. Private data element tags are assigned following the rules given in Part 5 of the DICOM v3.0 Standard, and are identified using the (gggg, xxee) format, where xx represents a reserved block of element numbers within the group gggg.

Note that any element not listed in table(s) means that it is not supported (not stored in the created images).

3.4.1 Patient Entity Modules

3.4.1.1 Patient Module

TABLE 3-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010, 0010)	2	Patient's full name. (*) Compound from user Last Name and First Name for locally scheduled protocols(**) (***)
Patient ID	(0010, 0020)	2	Primary hospital identification number or code for the patient. (*) (**) (***)
Issuer of Patient ID	(0010, 0021)	3	Not used
Issuer of Patient ID Qualifiers Sequence	(0010, 0024)	3	Not used
Patient's Birth Date	(0010, 0030)	2	Birth date of the patient. (*) (**) (***) Sent as ZERO LENGTH value if value is not received neither from MWL nor from user input. Cannot be modified by user if received from MWL
Patient's Sex	(0010, 0040)	2	Sex of the named patient. (*) (**) Enumerated Values: M = male F = female O = other
Other Patient IDs	(0010, 1000)	3	Not used
Other Patient IDs Sequence	(0010, 1002)	3	Not used

Note 1 : *(*) - Attributes copied from the Worklist if the study source was actually copied from a Worklist query result.*

Note 2 : *(**) - Attributes copied from the user input for Locally scheduled Protocols*

Note 3 : *(***) - Cannot be modified by user if received from MWL*

3.4.2 Study Entity Modules

3.4.2.1 General Study Module

TABLE 3-4
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.(*)(***) Generated by the system for Locally Scheduled protocols
Study Date	(0008,0020)	2	Date the Study started. Taken from the SPS Start date of the first Scan in the study – Tag (0040, 0002). (*) (***)
Study Time	(0008,0030)	2	Time the Study started . Taken from the SPS Start Time of the first SPS in the study – Tag (0040, 0002). (*) (***)
Referring Physician's Name	(0008,0090)	2	Name of the patient's referring physician (*) (**) Only Last and First Names received from MWL are displayed in UI and stored in image. Sent as ZERO LENGTH value if value is not received neither from MWL nor from user input. User can modify value received from MWL
Study ID	(0020,0010)	2	User or equipment generated Study identifier. Automatically assigned to the name of the first Protocol in the study.
Accession Number	(0008,0050)	2	A RIS generated number that identifies the order for the Study.(*) (**) Sent as ZERO LENGTH value if value is not received neither from MWL nor from user input. User can modify value received from MWL
Study Description	(0008,1030)	3	Study Description. Automatically assigned to the full name of the first protocol in the study
Name of Physician(s) Reading Study	(0008,1060)	3	Names of the physician(s) reading the Study.(**) First Name and/or Last Name are copied from user input if entered, otherwise not sent.

Note 1 : *(*) - Attributes copied from the Worklist if the study source was actually copied from a Worklist query result.*

Note 2 : *(**) - Attributes copied from the user input for Locally scheduled Protocols*

Note 3 : *(***) - Cannot be modified by user if received from MWL*

3.4.2.2 Patient Study Module

TABLE 3-5
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Description of the admitting diagnosis (diagnoses) (**) Not sent if value is not received from user input.
Patient's Age	(0010,1010)	3	Age of the Patient Calculated from Patient Birth Date if Patient Birth Date is not empty. Cannot be updated if Patient Birth Date is entered from MWL .
Patient's Size	(0010,1020)	3	Length or size of the Patient, in meters.(*) (**) Not sent if value is not received neither from MWL nor from user input. User can modify value received from MWL
Patient's Weight	(0010,1030)	3	Weight of the Patient, in kilograms.(*) (**) Not sent if value is not received neither from MWL nor from user input. User can modify value received from MWL

Note 1 : *(*) - Attributes copied from the Worklist if the study source was actually copied from a Worklist query result.*

Note 2 : *(**) - Attributes copied from the user input for Locally scheduled Protocols*

3.4.2.3 Standard Extended Study Module

TABLE 3-6
STANDARD EXTENDED STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Requested Procedure Comments	(0040, 1400)	3	User-defined Study notes
Scheduled Study Location	(0032, 1020)	3	Study status , Set to “acquired”.

3.4.3 Series Entity Modules

3.4.3.1 General Series Module

TABLE 3-7
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. Defined Terms used for data created on this system: NM = Nuclear Medicine
Series Instance UID	(0020,000E)	1	Internally generated unique identifier of the Series.
Series Number	(0020,0011)	2	A number that identifies this Series.
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined (*) (**) Enumerated Values: R = right L = left
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed. Always sent as “CrystalThickness 3”
Series Description	(0008,103E)	3	Description of the Series Defined by the acquired Scan name.
Operators' Name	(0008,1070)	3	Name(s) of the operator(s) supporting the Series (**)
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined (*) (**) Defined Terms used on this system: ABDOMEN ANKLE ARM BREAST CHEST CLAVICLE COCCYX CSPINE ELBOW EXTREMITY FOOT HAND HEAD

			HEART HIP JAW KNEE LEG LSPINE NECK PELVIS SHOULDER SKULL SSPINE TSPINE
Performed Procedure Step ID	(0040,0253)	3	Equipment generated identifier of the protocol carried out within this step. Sent only for TOMO and GATED TOMO images.
Performed Procedure Step Description	(0040,0254)	3	Name of Acquisition Sequence performed, e.g. “TETomo”. Sent only for TOMO and GATED TOMO images.

Note 1: *(*) - Not sent if value is not received from user input.*

Note 2: *(**) - Attributes copied from the user input for Locally scheduled Protocols*

3.4.3.2 Standard Extended Series Module

TABLE 3-8
STANDARD EXTENDED SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Position	(0018, 5100)	3	Patient position descriptor relative to the Equipment: The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine FFP = Feet First-Prone FFS = Feet First-Supine Attribute is copied from the user input for locally scheduled Protocols

3.4.3.3 NM/PET Patient Orientation Module

TABLE 3-9
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Always sent as ZERO Length Sequence
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Always sent as ZERO Length Sequence

3.4.3.4 Private Series Module

TABLE 3-10
PRIVATE SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Series Data Sequence	(0033, xx70)	GEMS_XELPRV_01	Sequence of items contains information about acquisition parameters represented by SDO. May contain 0 or more items. Each item describes specific parameters set.
>Object Type	(0033, xx08)	GEMS_XELPRV_01	Contains string "SERIES DATA"
>Modified Flag	(0033, xx10)	GEMS_XELPRV_01	Default value = 0 (Not Modified)
>Name	(0033, xx11)	GEMS_XELPRV_01	SDO Name
>Database Object Unique ID	(0033, xx16)	GEMS_XELPRV_01	Database SDO ID. Contains value of SDO UID tag (0033, xx72) generated at time of SDO creation.
>Date	(0033, xx17)	GEMS_XELPRV_01	SDO Creation date
>Time	(0033, xx18)	GEMS_XELPRV_01	SDO Creation time
>SeriesDataFlags	(0033, xx19)	GEMS_XELPRV_01	Default value = 0
>ProtocolName	(0033, xx1A)	GEMS_XELPRV_01	Name of Protocol created SDO
>RelevantDataUID	(0033, xx1B)	GEMS_XELPRV_01	UID(s) of SOP Instance(s) relative to SDO
>BulkData	(0033, xx1C)	GEMS_XELPRV_01	SDO parameter(s) stored as binary buffer(s)
>IntData	(0033, xx1D)	GEMS_XELPRV_01	List of SDO parameters stored as integers
>Double Data	(0033, xx1E)	GEMS_XELPRV_01	List of SDO parameters stored as doubles
>String Data	(0033, xx1F)	GEMS_XELPRV_01	List of SDO parameters stored as list of strings
>BulkDataFormat	(0033, xx20)	GEMS_XELPRV_01	Format of bulk parameters; contains information about name and size of bulk buffers
>IntDataFormat	(0033, xx21)	GEMS_XELPRV_01	Format of integer parameters; contains information about name and number of integers in list
>DoubleDataFormat	(0033, xx22)	GEMS_XELPRV_01	Format of double parameters; contains information about name and number of doubles in list
>StringDataFormat	(0033, xx23)	GEMS_XELPRV_01	Format of string parameters; contains information about name and number of strings in list
>Description	(0033, xx24)	GEMS_XELPRV_01	User or equipment generated SDO description
>SDO Private SOP Class UID	(0033, xx71)	GEMS_XELPRV_01	SDO Private SOP Class UID- "1.2.840.113619.4.17"
>SDO Instance UID	(0033, xx72)	GEMS_XELPRV_01	Internally generated SDO SOP Instance UID;

3.4.4 Frame Of Reference Entity Modules

3.4.4.1 Frame Of Reference Module

This section specifies the Attributes necessary to uniquely identify a Frame Of Reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

The Ventri systems group spatially and/or temporally related Images in the same Series.

This module is used for TOMO and GATED TOMO scan types. Not available for STATIC, GATED and DYNAMIC scans.

TABLE 3-11
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020, 0052)	1C	Frame of Reference UID.
Position Reference Indicator	(0020, 1040)	2C	Always sent as ZERO Length value

3.4.5 Equipment Entity Modules

3.4.5.1 General Equipment Module

TABLE 3-12
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances. Default Value "GE MEDICAL SYSTEMS”
Institution Name	(0008,0080)	3	Institution where the equipment that produced the composite instances is located. Always taken from system configuration
Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment that produced the composite instances is located. Always taken from system configuration
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that produced the composite instances is located. Always taken from system configuration
Manufacturer's Model Name	(0008,1090)	3	Manufacturer’s model name of the equipment that produced the composite instances. Always set to VENTRI
Device Serial Number	(0018,1000)	3	Manufacturer’s serial number of the equipment that produced the composite instances. Always taken from system configuration
Software Versions	(0018,1020)	3	Manufacturer’s designation of software version of the equipment that produced the composite

			instances Software/Hardware versions of current release e.g. <1.004.050.14\ HARDWARE_VERSION_1>
Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the acquisition equipment for high contrast objects for the data gathering and reconstruction technique chosen. Always taken from system configuration. Default value is 5.
Date of Last Calibration	(0018,1200)	3	Date when the image acquisition device calibration was last changed in any way. Always taken from system configuration
Time of Last Calibration	(0018,1201)	3	Time when the image acquisition device calibration was last changed in any way. Always taken from system configuration

3.4.6 Image Entity Modules

3.4.6.1 General Image Module

TABLE 3-13
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	A number that identifies this image. Sent as ZERO Length value
Content Date	(0008,0023)	2C	The date the image pixel data creation started
Content Time	(0008,0033)	2C	The time the image pixel data creation started
Image Type	(0008,0008)	3	See 3.4.6.7.1.
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started
Quality Control Image	(0028,0300)	3	Indicates whether or not this image is a quality control or phantom image. Enumerated Values: YES NO

3.4.6.2 Image Pixel Module

TABLE 3-14
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	See 3.4.6.4
Photometric Interpretation	(0028,0004)	1	See 3.4.6.4
Rows	(0028,0010)	1	Number of rows in the image.
Columns	(0028,0011)	1	Number of columns in the image
Bits Allocated	(0028,0100)	1	See 3.4.6.4
Bits Stored	(0028,0101)	1	See 3.4.6.4
High Bit	(0028,0102)	1	See 3.4.6.4
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H = unsigned integer. 0001H = 2's complement
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the Image.
Smallest Image Pixel Value	(0028,0106)	3	The minimum actual pixel value encountered in this image.
Largest Image Pixel Value	(0028,0107)	3	The maximum actual pixel value encountered in this image.

3.4.6.3 Acquisition Context Module

TABLE 3-15
ACQUISITION CONTEXT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Acquisition Context Sequence	(0040,0555)	2	A sequence of Items that describes the conditions present during the acquisition of the data of the SOP Instance. The Acquisition context sequence is empty when acquisition context in scan is left "UNKNOWN", otherwise contains 1 item.
>Concept Name Code Sequence	(0040,A043)	1	A concept that constrains the meaning of (i.e. defines the role of) the Observation Value.
>>Include 'Code Sequence Macro'			(1090554, DCM, "Patient State") is sent
>Concept Code Sequence	(0040,A168)	1C	This is the Value component of a Name/Value pair when the Concept implied by Concept Name Code Sequence (0040,A043) is a Coded Value. This sequence contains one item
>>Include 'Code Sequence Macro'			DCID (3101) NM Procedural State Values is supported as defined in TID 3470: The following values are used: • (F-01604 ,SRT ,"Resting State")

	• (109092 ,DCM ,"Reinjection State") • (109093 ,DCM ,"Redistribution State") • (109094 ,DCM ,"Delayed Redistribution State") Value (109091,DCM, "Cardiac Stress State") is used as an extended value

3.4.6.4 NM Image Pixel Module

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

TABLE 3-16
NM IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. The value shall be 1.
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data Enumerated Values supported : MONOCHROME2
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Enumerated Values supported : 16.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Value equal to Bit Allocated (0028,0100)
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Value equal to Bit Stored (0028,0101) - 1
Pixel Spacing	(0028,0030)	2	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing, in mm.

3.4.6.5 Multi-Frame Module

TABLE 3-17
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image.
Frame Increment Pointer	(0028,0009)	1	See 3.4.6.6.1 for further specialization.

3.4.6.6 NM Multi-frame Module

TABLE 3-18
NM MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1	See 3.4.6.6.1 for further specialization.
Energy Window Vector	(0054,0010)	1C	Defines energy set window to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Energy Window Vector (0054,0010).
Number of Energy Windows	(0054,0011)	1	Number of energy set windows in SOP Instance. Supported values: 1 ,2, 3 or 4
Detector Vector	(0054,0020)	1C	Defines detector to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Energy Window Vector (0054,0020).
Number of Detectors	(0054,0021)	1	Number of detectors in SOP Instance. Supported values: 1 or 2.
Phase Vector	(0054,0030)	1C	Defines phase to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Phase Vector (0054,0030).
Number of Phases	(0054,0031)	1C	Number of phases in SOP Instance. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Phase Vector (0054,0030). Supported values: 1, 2, 3, 4 or 5.
Rotation Vector	(0054,0050)	1C	Defines rotation to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Rotation Vector (0054,0050).
Number of Rotations	(0054,0051)	1C	Number of Rotations in SOP Instance. Always set to 1. Sent if Image Type (0008,0008), Value 3 is TOMO or GATED TOMO.
R-R Interval Vector	(0054,0060)	1C	Defines R-R Interval to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for R-R Interval Vector (0054,0060).
Number of R-R Intervals	(0054,0061)	1C	Number of R-R Intervals in SOP Instance. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for R-R Interval Vector (0054,0060).
Time Slot Vector	(0054,0070)	1C	Defines time slot, within cardiac cycle, to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Time Slot Vector (0054,0070).
Number of Time Slots	(0054,0071)	1C	Number of time slots in SOP Instance. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Time Slot

			Vector (0054,0070).
Angular View Vector	(0054,0090)	1C	Defines angular view number to which each frame belongs. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Angular View Vector (0054,0090).
Time Slice Vector	(0054,0100)	1C	Defines frame numbers within each phase. Sent if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Angular View Vector (0054,0100).

3.4.6.6.1 Frame Increment Pointer

The Frame Increment Pointer (0028,0009) defines which frame index vectors are present in the NM Image instance. The Frame Increment Pointer is supported per the DICOM specification for all image types defined in Table 3-19.

TABLE 3-19
ENUMERATED VALUES FOR FRAME INCREMENT POINTER

Image Type (0008,0008), Value 3	Frame Increment Pointer (0028,0009)
STATIC	0054H 0010H \ 0054H 0020H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020).
DYNAMIC	0054H 0010H \ 0054H 0020H \ 0054H 0030H \ 0054H 0100H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Phase Vector (0054,0030), Time Slice Vector (0054,0100)
GATED	0054H 0010H \ 0054H 0020H \ 0054H 0060H \ 0054H 0070H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070)
TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), Angular View Vector (0054,0090)
GATED TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0060H \ 0054H 0070H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Angular View Vector (0054,0090).

3.4.6.7 NM Image Module

TABLE 3-20
NM IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 3.4.6.7.1 for specialization.
Image ID	(0054,0400)	3	User or equipment generated Image identifier. Taken from Scan name
Counts Accumulated	(0018,0070)	2	Sum of all gamma events for all frames in the image.

Acquisition Termination Condition	(0018,0071)	3	Description of how the data collection was stopped. (*) Defined Terms are used: CNTS = counts MANU = manual TIME = time TRIG = physiological trigger
Actual Frame Duration	(0018,1242)	1C	Elapsed time for data acquisition in msec. Sent when the Image Type (0008,0008), Value 3, is equal to STATIC.
Count Rate	(0018,1243)	3	Maximum count rate achieved during the acquisition in counts/sec
Corrected Image	(0028,0051)	3	Defined Terms are used: UNIF = flood corrected COR = center of rotation corrected ATTN = attenuation corrected SCAT = scatter corrected NRGY = energy corrected LIN = linearity corrected CLN = count loss normalization

***Note1**: (*) – Attribute value is taken from user input*

3.4.6.7.1 Image Type

The following values of Image Type (0008,0008) are be sent :

Value 1 shall have the following Enumerated Values:

- ORIGINAL identifies an Original Image

Value 2 shall have the following Enumerated Value:

- PRIMARY identifies a Primary Image

The following Enumerated Values of Value 3 are created:

- STATIC - Identifies a Static Image
- DYNAMIC - Identifies a Dynamic Image
- GATED - Identifies a Multi-Gated Image
- TOMO - Identifies a Tomographic (SPECT) Image
- GATED TOMO - Identifies a Multi-gated Tomographic Image

The following Enumerated Values of Value 4 are created:

- EMISSION - Transmission source is NOT active during image acquisition

3.4.6.8 NM Isotope Module

This section contains Attributes that describe the isotope administered for the acquisition.

TABLE 3-21
NM ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Energy Window Information Sequence	(0054,0012)	2	Sequence of Items that describe the energy window groups used. May contain from 1 to 4 Items. The number of items shall be equal to Number of Energy Windows (0054,0011)
>Energy Window Range Sequence	(0054,0013)	3	Sequence describing window energy limits. May contain from 1 to 4 items.
>> Energy Window Lower Limit	(0054,0014)	3	The lower limit of the energy window in KeV.
>> Energy Window Upper Limit	(0054,0015)	3	The upper limit of the energy window in KeV.
Radiopharmaceutical Information Sequence	(0054,0016)	2	Information on radiopharmaceutical(s) used. May contain from 1 to 3 items
> Radionuclide Code Sequence	(0054,0300)	2	Sequence that identifies the radionuclide. Always sent with 0 items.
> Radiopharmaceutical Route	(0018,1070)	3	Route of injection. (*)
> Radiopharmaceutical Volume	(0018,1071)	3	Volume of injection in cubic cm. (*)
> Radiopharmaceutical Start Time	(0018, 1072)	3	Time of start of injection. (*)
> Radionuclide Total Dose	(0018,1074)	3	Total amount of radionuclide injected in MBq. (*)
> Radiopharmaceutical	(0018,0031)	3	Name of the radiopharmaceutical. Taken from user input.
> Administration Route Code Sequence	(0054,0302)	3	Sequence that identifies the Administration Route. Always sent as ZERO Length.
Intervention Drug Information Sequence	(0018,0026)	3	Sequence of Items that describes the intervention drugs used. Zero or more Items may be included in this sequence.
>Intervention Drug Name	(0018,0034)	3	Name of intervention drug. (*)
>Intervention Drug Code Sequence	(0018,0029)	3	Sequence that identifies the interventional drug. Always sent as ZERO Length.
> Administration Route Code Sequence	(0054,0302)	3	Sequence that identifies the Administration Route. Always sent as ZERO Length
>Intervention Drug Start Time	(0018, 0035)	3	Time of administration of the intervention drug, using the same time base as for the Acquisition Start Time (0008,0032). (*)
>Intervention Drug Stop Time	(0018, 0027)	3	Time of completion of administration of the intervention drug, using the same time base as for the Acquisition Start Time (0008,0032). (*)
>Intervention Drug Dose	(0018,0028)	3	Intervention drug dose, in mg. (*)

***Note1**: (*) – Attribute value is taken from user input if it's not empty, otherwise is not sent*

3.4.6.9 NM Detector Module

TABLE 3-22
NM DETECTOR MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Detector Information Sequence	(0054,0022)	2	Sequence of Items that describe the detectors used. May contain 1 or 2 Items.
> Collimator/Grid Name	(0018,1180)	3	Label describing the collimator used, e.g. LEGP LEHR, etc.
> Collimator Type	(0018,1181)	2	Collimator type. Defined Terms: PARA = Parallel (default) PINH = Pinhole FANB = Fan-beam CONE = Cone-beam SLNT = Slant hole ASTG = Astigmatic DIVG = Diverging NONE = No collimator UNKN = Unknown
> Focal Distance	(0018,1182)	2	Focal distance, in mm. Default value is 0.
> Zoom Center	(0028,0032)	3	The amount of offset from (0,0) applied to each pixel in the image before application of the zoom factor, specified by a numeric pair (*). Default Value: 0.0\ 0.0.
> Zoom Factor	(0028,0031)	3	The amount of magnification applied to each pixel in the image.(*). Default value is 1.0/1.0
> Start Angle	(0054,0200)	3	Position of the detector about the patient for the start of the acquisition, in degrees. (*) Sent if Image Type (0008,0008), Value 3, is other then TOMO, GATED TOMO.
> Image Orientation (Patient)	(0020,0037)	2	The direction cosines of the first row and the first column with respect to the patient. Set for first frame in dataset
> Image Position (Patient)	(0020,0032)	2	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm. Set for first frame in dataset

***Note1**: (*) – Attribute value is taken from user input*

3.4.6.10 NM Tomo Acquisition Module

This module is present when the Image Type (0008,0008) Value 3, is equal to TOMO and GATED TOMO.

TABLE 3-23
NM TOMO ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Rotation Information Sequence	(0054,0052)	2	Sequence of Items that describe TOMO rotational groups. Contain only 1 item.
> Start Angle	(0054,0200)	1	Position of the detector about the patient for the start of the acquisition, in degrees. (*)
> Angular Step	(0018,1144)	1	The angular scan arc step between views of the TOMO acquisition, in degrees (*)
> Rotation Direction	(0018,1140)	1	Direction of rotation of the detector about the patient. (*) Enumerated Values: CW = clockwise (decreasing angle) CC = counter-clockwise (increasing angle).
> Scan Arc	(0018,1143)	1	The effective angular range of the scan data in degrees. (*) The value is always positive.
> Actual Frame Duration	(0018,1242)	1	Nominal acquisition time per angular position, in msec.
> Radial Position	(0018,1142)	3	Radial distance of the detector from the center of rotation, in mm. Sent as list – one value per angular view.
> Number of Frames in Rotation	(0054,0053)	1	Number of angular views in this rotation.(*)
> Table Traverse	(0018,1131)	3	Location of the patient table (or gantry relative to the table) in mm.
> Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation.
Type of Detector Motion	(0054,0202)	3	Describes the detector motion during acquisition.(*) Enumerated Values: STEP AND SHOOT = Interrupted motion, acquire only while stationary. CONTINUOUS = Gantry motion and acquisition are simultaneous and continuous. ACQ DURING STEP = Interrupted motion, acquisition is continuous.

***Note1**: (*) – Attribute value is taken from user input.*

3.4.6.11 NM Multi-gated Acquisition Module

This module is present when the Image Type (0008,0008) Value 3, is equal to GATED or GATED TOMO.

TABLE 3-24
NM MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	3	Heart beat duration sorting has been applied. Enumerated Values: Y = yes N = no
PVC Rejection	(0018,1085)	3	Description of type of arrhythmic beat rejection criteria used. Always sent as "Reject beats out of pvc window"
Skip Beats	(0018,1086)	3	Number of beats skipped after a detected arrhythmia
Heart Rate	(0018,1088)	3	Average number of heart beats per minute for the collection period for these frames
Gated Information Sequence	(0054,0062)	2C	Sequence of Items that describe R-R intervals. Sent if the Frame Increment Pointer (0028,0009) contains the Tag for R-R Interval Vector (0054,0060) Contains only 1 item if presents
> Trigger Time	(0018,1060)	3	Time interval measured in msec from the start of the R-wave to the beginning of the data taking.
> Cardiac Framing Type	(0018,1064)	3	Description of type of framing performed.
> Data Information Sequence	(0054,0063)	2	Sequence of Items that describe gating criteria. Contains only 1 item
>> Frame Time	(0018,1063)	1	Nominal time per individual frame in msec
>> Low R-R Value	(0018,1081)	3	R-R interval lower limit for beat rejection, in msec
>> High R-R Value	(0018,1082)	3	R-R interval upper limit for beat rejection, in msec
>> Intervals Acquired	(0018,1083)	3	Number of heartbeats that fall within Low R-R Value (0018,1081) and High R-R Value (0018,1082), and were therefore accepted and contribute gamma events to this R-R Interval.
>> Intervals Rejected	(0018,1084)	3	Number of heartbeats that fall outside Low R-R (0018,1081) and High R-RValue (0018,1082), and do not contribute gamma events to this R-R Interval.
>> Time Slot Information Sequence	(0054,0072)	2C	Sequence of Items that describe Time Slot Information. Sent as ZERO Length if the Frame Increment Pointer (0028,0009) contains the Tag for Time Slot Vector (0054,0070), otherwise is not sent.
>>> Time Slot Time	(0054,0073)	3	Not Used

3.4.6.12 NM Phase Module

This section contains Attributes that describe dynamic phases of a dynamic acquisition image performed on the patient. This module is present when the Image Type (0008,0008) Value 3, is equal to DYNAMIC. New phase may be defined by user from Scan setup. Default number of phases is 1.

TABLE 3-25
NM PHASE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Phase Information Sequence	(0054,0032)	2C	Sequence of Items that describes each dynamic phase. Sent if the Frame Increment Pointer (0028,0009) contains the Tag for Phase Vector (0054,0030). May contain 1 to 5 items, if presents.
> Phase Delay	(0054,0036)	1	Time paused between the last frame of the previous phase and the first frame of this phase, in msec. (*) Set to 0 for 1st phase.
> Actual Frame Duration	(0018,1242)	1	Nominal time of acquisition per individual frame, in msec.(*)
> Pause Between Frames	(0054,0038)	1	Time paused between each frame of this phase (in msec).(*)
> Number of Frames in Phase	(0054,0033)	1	Number of frames in this phase. (*)

Note1: (*) – *Attribute value is taken from user input*

3.4.6.13 VOI LUT Module

TABLE 3-26
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	1	Window Center for display. Only single value is present. Calculated from actually acquired maximal and minimal pixel values.
Window Width	(0028,1051)	1	Window Width for display. Only single value is present. Calculated from actually acquired maximal and minimal pixel values

3.4.6.14 SOP Common Module

TABLE 3-27
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. Always set to "1.2.840.10008.5.1.4.1.1.20"
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance. Internally generated.
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Defined Terms include for locally created

			images: ISO_IR 100 = Latin Alphabet No. 1 For images created from MWL, the value is copied from value provided in MWL, if not empty, otherwise ISO_IR 100 is used. Always included into image.
Instance Number	(0020,0013)	3	See 3.4.6.1 for more specialization

3.4.6.15 Private Image Module

TABLE 3-28
PRIVATE IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Rate Vector	(0009, xx01)	"QUASAR_INTERNAL_USE"	Rate for each frame
Count Vector	(0009, xx02)	"QUASAR_INTERNAL_USE"	Counts accumulated for each frame
Time Vector	(0009, xx03)	"QUASAR_INTERNAL_USE"	Time for each frame
Camera Shape	(0009, xx08)	"QUASAR_INTERNAL_USE"	Camera Shape: H mode, L mode
Sequence Type	(0009,xx13)	"QUASAR_INTERNAL_USE"	Acquired Sequence Type
Sequence Name	(0009,xx14)	"QUASAR_INTERNAL_USE"	Acquired Sequence Name
Image Type	(0009,xx1B)	"QUASAR_INTERNAL_USE"	Image type string as passed in the scan request
Stop Reason	(0009,xx1D)	"QUASAR_INTERNAL_USE"	Defines condition that image was installed to db
Auto-Processing Application	(0009,xx1E)	QUASAR_INTERNAL_USE	Auto-Processing Application Description. Sent if Auto-processing is defined for protocol
Patient Unique Key	(0009,xx39)	"QUASAR_INTERNAL_USE"	Patient unique key
Collimator SQ	(0037,xx10)	"QUASAR_INTERNAL_USE"	Contains information of collimators parameters. May contain 0 or 1 item.
>Hole Diameter	(0037,xx1B)	"QUASAR_INTERNAL_USE"	Collimator hole diameter
>Hole Length	(0037,xx30)	"QUASAR_INTERNAL_USE"	Collimator hole length
>Collimator Thickness	(0037,xx40)	"QUASAR_INTERNAL_USE"	Collimator thickness
>Septal Thickness	(0037,xx50)	"QUASAR_INTERNAL_USE"	Collimator Septal thickness
>Intrinsic Resolution	(0037,xx60)	"QUASAR_INTERNAL_USE"	Collimator intrinsic resolution
>Blurring Slope	(0037,xx70)	"QUASAR_INTERNAL_USE"	Collimator blurring slope

Radio Nuclide Name	(0011,xx0D)	"GEMS_GENIE_1"	Name of radionuclide used.
Dataset Name	(0011,xx12)	"GEMS_GENIE_1"	List of dataset names
Source Translator	(0013,xx11)	"GEMS_GENIE_1"	Internal code of product DICOM implementation. Enumerated Value = 11.
Bed Position	(0027,xx11)	"APEX_PRIVATE"	Linear position of table.

3.4.6.16 Private Image Tomo Module

This module is present when the Image Type (0008,0008) Value 3, is equal to TOMO or GATED TOMO

TABLE 3-29
PRIVATE IMAGE TOMO MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Angle Vector	(0009,xx07)	"QUASAR_INTERNAL_USE"	Angle for each TOMO frame. For each frame is tells what is the angle of the detector
Raw Time Vector	(0009,xx1A)	"QUASAR_INTERNAL_USE"	Raw time vector
Send Joined Flag	(0009,xx23)	"QUASAR_INTERNAL_USE"	Defines if image shall be joined on send. Set to 1 - for Tomo and GATED TOMO images, for other image types is not sent.

3.4.6.17 Private Image Multi-Gated Module

This module is present when the Image Type (0008,0008) Value 3, is equal to GATED or GATED TOMO

TABLE 3-30
PRIVATE IMAGE MULTI-GATED MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Triggers Modification Flag	(0033,xx30)	"GEMS_GENIE_1"	Triggers Modification Flag
Number of triggers	(0033,xx33)	"GEMS_GENIE_1"	Number of triggers
Trigger size	(0033,xx34)	"GEMS_GENIE_1"	Size of one Trigger data slot
Trigger Data size	(0033,xx35)	"GEMS_GENIE_1"	Size of Trigger Data size
Trigger Data	(0033,xx36)	"GEMS_GENIE_1"	Buffer with trigger data information
Starting Heart Rate	(0009, xx37)	“GEMS_GENIE_1”	Heart rate at start of acquisition.

3.4.6.18 Private Image GSPECT Module

This module is present when the Image Type (0008,0008) Value 3, is equal to GATED TOMO

TABLE 3-31
PRIVATE IMAGE GSPECT MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Average RR Time Vector	(0009, xx15)	"QUASAR_INTERNAL_USE"	Average r-r time vector
Low Limit Vector	(0009, xx16)	"QUASAR_INTERNAL_USE	Low window limit vector

		"	
High Limit Vector	(0009, xx17)	"QUASAR_INTERNAL_USE "	High window limit vector
Begin Index Vector	(0009, xx18)	"QUASAR_INTERNAL_USE "	Begin index vector: link to heart beat vector
End Index Vector	(0009, xx19)	"QUASAR_INTERNAL_USE "	End index vector: link to heart beat vector

3.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended NM SOP Instances as Type 3 data elements.

3.5.1 Standard Attributes

The Product supports the following attributes, not specified in the NM IOD, in SOP Instances as Type 3 data elements.

TABLE 3-32
STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Study	Requested Procedure Comments	(0040, 1400)	User-defined Study notes
	Scheduled Study Location	(0032, 1020)	Study status , Set to “acquired”.
Series	Patient Position	(0018, 5100)	Patient position descriptor relative to the Equipment

3.5.2 Private Group QUASAR_INTERNAL_USE

TABLE 3-33
PRIVATE GROUP QUASAR_INTERNAL_USE

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0009, 00xx)	LO	1	QUASAR_INTERNAL_USE
Rate Vector	(0009, xx01)	UL	1-n	Rate for each frame
Count Vector	(0009, xx02)	UL	1-n	Counts accumulated for each frame
Time Vector	(0009, xx03)	UL	1-n	Time for each frame
Angle Vector	(0009, xx07)	UL	1-n	Angle for each TOMO frame.
Camera Shape	(0009, xx08)	US	1	Camera Shape
Sequence Type	(0009, xx13)	ST	1	Acquired Sequence Type
Sequence Name	(0009, xx14)	ST	1	Acquired Sequence Name
Average RR Time Vector	(0009, xx15)	UL	1-n	Average r-r time vector
Low Limit Vector	(0009, xx16)	UL	1-n	Low window limit vector
High Limit Vector	(0009, xx17)	UL	1-n	High window limit vector
Begin Index Vector	(0009, xx18)	UL	1-n	begin index vector: link to heart beat vector
End Index Vector	(0009, xx19)	UL	1-n	end index vector: link to heart beat vector
Raw Time Vector	(0009, xx1A)	UL	1-n	Raw time vector
Image Type	(0009, xx1B)	LO	1	Image type string as passed in the scan request
Stop Reason	(0009, xx1D)	US	1	Defines condition that image was installed to db
Auto-Processing Application	(0009, xx1E)	ST	1	Auto-Processing Application Description
Send Joined Flag	(0009, xx23)	US	1	Defines if image shall be joined on send. Not sent for images other then TOMO and GATED TOMO

Patient Unique Key	(0009, xx39)	UI	1	Patient unique key
Private Creator Identification	(0037,00xx)	LO	1	QUASAR_INTERNAL_USE
Collimator SQ	(0037,xx10)	SQ	1	Contains information of collimators parameters.
Hole Diameter	(0037,xx1B)	LO	1	Collimator hole diameter
Hole Length	(0037,xx30)	LO	1	Collimator hole length
Collimator Thickness	(0037,xx40)	LO	1	Collimator thickness
Septal Thickness	(0037,xx50)	LO	1	Collimator Septal thickness
Intrinsic Resolution	(0037,xx60)	LO	1	Collimator intrinsic resolution
Blurring Slope	(0037,xx70)	LO	1	Collimator blurring slope

3.5.3 Private Group GEMS_GENIE_1

TABLE 3-34
PRIVATE GROUP GEMS_GENIE_1

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0009,00xx)	LO	1	GEMS_GENIE_1
Starting Heart Rate	(0009,xx37)	SL	1	Heart rate at start of acquisition.
Private Creator Identification	(0011,00xx)	LO	1	GEMS_GENIE_1
Radio Nuclide Name	(0011,xx0D)	LO	1	Name of radionuclide used.
Dataset Name	(0011,xx12)	LO	1-n	List of Dataset names.
Private Creator Identification	(0013,00xx)	LO	1	GEMS_GENIE_1
Source Translator	(0013,xx11)	SL	1	Internal code of product DICOM implementation. Enumerated Value = 11.
Private Creator Identification	(0033,00xx)	LO	1	GEMS_GENIE_1
Triggers Modification Flag	(0033,xx30)	SL	1	Triggers Modification Flag
Number of triggers	(0033,xx33)	SL	1	Number of triggers
Trigger size	(0033,xx34)	SL	1	Size of one Trigger data slot
Trigger Data size	(0033,xx35)	SL	1	Size of Trigger Data size
Trigger Data	(0033,xx36)	OB	1	Buffer with trigger data information

3.5.4 Private Group GEMS_XELPRV_01

TABLE 3-35
PRIVATE GROUP GEMS_XELPRV_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0033, 00xx)	LO	1	GEMS_XELPRV_01
Object Type	(0033, xx08)	CS	1	Object Type. Contains string "SERIES DATA "
Modified Flag	(0033, xx10)	SL	1	Default value = 0 (Not Modified)

Name	(0033, xx11)	LO	1	SDO Name
Database Object Unique ID	(0033, xx16)	LO	1	Database UID of SDO; contains value of SDO UID tag (0033, xx72) generated at time of object creation
Date	(0033, xx17)	SH	1	SDO Creation date
Time	(0033, xx18)	SH	1	SDO Creation time
SeriesDataFlags	(0033, xx19)	UL	1	SDO Flags. Default value = 0
ProtocolName	(0033, xx1A)	LO	1	Name of Protocol created SDO
RelevantDataUID	(0033, xx1B)	LO	1	UID(s) of SOP Instance(s) relative to SDO
BulkData	(0033, xx1C)	OB	1	SDO parameter(s) stored as binary buffer(s)
IntData	(0033, xx1D)	SL	1-n	List of SDO parameters stored as integers
Double Data	(0033, xx1E)	FD	1-n	List of SDO parameters stored as doubles
String Data	(0033, xx1F)	OB	1	List of SDO parameters stored as list of strings
BulkDataFormat	(0033, xx20)	OB	1	Format of bulk parameters; contains information about name and size of bulk buffers
IntDataFormat	(0033, xx21)	OB	1	Format of integer parameters; contains information about name and number of integers in list
DoubleDataFormat	(0033, xx22)	OB	1	Format of double parameters; contains information about name and number of doubles in list
StringDataFormat	(0033, xx23)	OB	1	Format of string parameters; contains information about name and number of strings in list
Description	(0033, xx24)	LT	1	User or equipment generated SDO description
Series Data Sequence	(0033, xx70)	SQ	1	Sequence of item contains information about acquisition parameters. May contain from 1 to n Items. Each Items describes specific parameters set.
SDO Private SOP Class UID	(0033, xx71)	UI	1	SDO Private SOP Class UID- "1.2.840.113619.4.17"
SDO Instance UID	(0033, xx72)	UI	1	SDO Instance UID; Internally generated
SDO Instance UID	(0033, xx72)	UI	1	SDO Instance UID; Internally generated

3.5.5 Private Group APEX_PRIVATE

TABLE 3-36
PRIVATE GROUP APEX_PRIVATE

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0027,00xx)	LO	1	APEX_PRIVATE
Bed Position	(0027,xx11)	DS	1	Linear position of table.

4. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

4.1 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.

Screen Save images created on the Ventri system, as reports of several Quality Control Operations (Daily QC, Weekly QC, etc.), are sent as DICOM Secondary Capture images.

Only single frame Secondary Capture Image IOD is supported.

4.2 VENTRI MAPPING OF DICOM ENTITIES

The Ventri maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 4-1
MAPPING OF DICOM ENTITIES TO VENTRI ENTITIES

DICOM IE	Ventri Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

4.3 IOD MODULE TABLE

The Secondary Capture Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 4.5.

TABLE 4-2
SC IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	4.4.1.1
	Clinical Trial Subject	Not Used	N/A
Study	General Study	Used	4.4.2.1
	Patient Study	Not Used	N/A
	Standard Extended Study	Used	4.4.2.2
	Clinical Trial Study	Not Used	N/A
Series	General Series	Used	4.4.3.1
	Clinical Trial Series	Not Used	N/A
Equipment	General Equipment	Used	4.4.4.1
	SC Equipment	Used	4.4.4.2
Image	General Image	Used	4.4.5.1
	Image Pixel	Used	4.4.5.2
	Device	Not Used	N/A
	Specimen	Not Used	N/A
	SC Image	Used	4.4.5.3
	Overlay Plane	Not Used	N/A
	Modality LUT	Not Used	N/A
	VOI LUT	Not Used	N/A
	SOP Common	Used	4.4.5.4
	Standard Extended Image	Used	4.4.5.5
	Private SC Image	Used	4.4.5.6

4.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM 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 when generating the instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

4.4.1 Patient Entity Modules

4.4.1.1 Patient Module

TABLE 4-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Contains type of user that performed the QC protocol. For example, "Service^^^^ ". Cannot be modified from UI.
Patient ID	(0010,0020)	2	Description of QC test performed. For example, "NM Daily QC", "Uniformity Test", "COR Test", etc.
Patient's Birth Date	(0010,0030)	2	Execution date of the QC Test
Patient's Sex	(0010,0040)	2	Always sent as empty string

4.4.2 Study Entity Modules

4.4.2.1 General Study Module

TABLE 4-4
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study. Internally generated by the system.
Study Date	(0008,0020)	2	Date the Study started.
Study Time	(0008,0030)	2	Time the Study started
Referring Physician's Name	(0008,0090)	2	Name of the patient's referring physician. Sent as empty string.
Study ID	(0020,0010)	2	Equipment generated Study identifier. Contains Camera name taken from Configuration.
Accession Number	(0008,0050)	2	Accession Number. Sent as an empty string
Study Description	(0008,1030)	3	Not Used

4.4.2.2 Study Standard Extended Module

TABLE 4-5
STUDY STANDARD EXTENDED ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Scheduled Study Location	(0032, 1020)	3	Study status , Set to “acquired”.

4.4.3 Series Entity Modules

4.4.3.1 General Series Module

TABLE 4-6
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	See 4.4.4.2
Series Instance UID	(0020,000E)	1	Internally generated unique identifier of the Series.
Series Number	(0020,0011)	2	A number that identifies this Series. Set as ZERO LENGTH value.
Series Description	(0008,103E)	3	Description of the Series Defined by the name of QC report.

4.4.4 Equipment Entity Modules

4.4.4.1 General Equipment Module

This module is used to describe information of the equipment generating the current derived instance.

TABLE 4-7
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the SC instances. Default Value "GE MEDICAL SYSTEMS”

4.4.4.2 SC Equipment Module

TABLE 4-8
SC EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Conversion Type	(0008,0064)	1	Specify Defined Terms used: SI = Scanned Image
Modality	(0008,0060)	3	SC Images created by Ventri generally have this attribute set to the value found in the original image. Defined Terms: NM = Nuclear Medicine

4.4.5 Image Entity Modules

4.4.5.1 General Image Module

TABLE 4-9
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	A number that identifies this image. Sent as ZERO Length value.
Content Date	(0008,0023)	2C	The date the SC Image pixel data creation started
Content Time	(0008,0033)	2C	The time the SC image pixel data creation started
Image Type	(0008,0008)	3	See 4.4.5.1.1

4.4.5.1.1 Image Type

The following Enumerated Value of Value 1 is supported:

- DERIVED identifies a Derived Image

The following Enumerated Value of Value 2 is supported:

- SECONDARY identifies a Secondary Image

4.4.5.2 Image Pixel Module

TABLE 4-10
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. Always set to 3
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data Defined Terms supported: RGB
Rows	(0028,0010)	1	Number of rows in the image. Always set to 878
Columns	(0028,0011)	1	Number of columns in the image Always set to 1004
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Enumerated Values supported : 8

Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Value equal to Bit Allocated (0028,0100)
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Value equal to Bit Stored (0028,0101) - 1
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H = unsigned integer.
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the Image.
Planar Configuration	(0028,0006)	1C	Enumerated Values: 0000H = color-by-pixel

4.4.5.3 SC Image Module

TABLE 4-11
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Pixel Spacing	(0028,0030)	1C	Not sent. Secondary Capture images created by product are not calibrated images, contain screen captures of QC result tables.

4.4.5.4 SOP Common Module

TABLE 4-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. Always set to "1.2.840.10008.5.1.4.1.1.7"
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance. Internally generated.

4.4.5.5 Standard Extended Image Module

TABLE 4-13
IMAGE STANDARD EXTENDED ATTRIBUTES

Attribute Name	Tag	Use
Counts Accumulated	(0018,0070)	Sent as ZERO Length

4.4.5.6 Private SC Image Module

TABLE 4-14
PRIVATE SC MODULE ATTRIBUTES

Attribute Name	Tag	Private Creator ID	Attribute Description
Dataset Name	(0011, xx12)	"GEMS_GENIE_1"	List of Dataset names

4.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended SC SOP Instances as Type 3 data elements.

4.5.1 Standard Attributes

The Product supports the following attributes, not specified in the SC IOD, in SOP Instances as Type 3 data elements.

TABLE 4-15
STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Study	Scheduled Study Location	(0032, 1020)	Study status , Set to “acquired”.
Image	Counts Accumulated	(0018,0070)	

4.5.2 Private Group GEMS_GENIE_1

Private Group GEMS_GENIE_1 is modeled as part of the Image Information Entity.

TABLE 4-16
PRIVATE GROUP GEMS_GENIE_1

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0009, 00xx)	LO	1	GEMS_GENIE_1
Dataset Name	(0011, xx12)	LO	1-n	List of Dataset names.

4.6 STANDARD EXTENDED AND PRIVATE CONTEXT GROUPS

The Ventri does not support any coded terminology.

5. MODALITY WORKLIST QUERY IMPLEMENTATION

5.1 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.

5.2 VENTRI MAPPING OF DICOM ENTITIES

The Ventri maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 5-1
MAPPING OF DICOM ENTITIES TO VENTRI ENTITIES

DICOM	Ventri Entity
Scheduled Procedure Step	Protocol
Requested Procedure	Study
Imaging Service Request	Study
Visit	Study
Patient	Patient

Matching Requested Procedure Step to Ventri protocol is done according to predefined configuration.

The configuration contains the following tags:

- (0040,0007) – Scheduled Procedure Step Description
- (0032,1060) – Requested Procedure Description
- (0040,0008) – Scheduled Protocol Code Sequence - Code Meaning

The default configuration is (0040,0007) – Scheduled Procedure Step Description
If Scheduled Protocol Code Sequence - tag (0040,0008) - is selected for mapping, the protocol will be mapped according to the value of Code Meaning - tag (0008,0104).

5.3 WORKLIST QUERY MODULE TABLE

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

TABLE 5-2
MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	5.4.1.1
	Scheduled Procedure Step	5.4.1.2
Requested Procedure	Requested Procedure	5.4.2.1
Imaging Service Request	Imaging Service Request	5.4.3.1
Visit	Visit Identification	5.4.4.1
	Visit Status	5.4.4.2
	Visit Relationship	Not Used
	Visit Admission	Not Used
Patient	Patient Relationship	Not Used
	Patient Identification	5.4.5.1
	Patient Demographic	5.4.5.2
	Patient Medical	5.4.5.3

5.4 WORKLIST QUERY MODULE DEFINITIONS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the query key attributes contained within the Modality Worklist Information Model.

Note that in all tables below information in "**Mapped into Instance"** column is referenced to NM images only (not SC objects).

5.4.1 Common Scheduled Procedure Step Entity Modules

5.4.1.1 SOP Common Module

TABLE 5-3
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Specific Character Set	(0008,0005)	O	1C	Yes	Always included in the MWL request.

5.4.1.1.1 Specific Character Set

The SCANNER AE will use any Specific Character Set value returned in a Scheduled Procedure Step Identifier in the images created pursuant to that Scheduled Procedure Step. Text attributes, including Patient and Physician names, that include non-ASCII characters will be displayed as described in Section 2.7

5.4.1.2 Scheduled Procedure Step Module

TABLE 5-4
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	Only one item is supported
>Scheduled Station AE Title	(0040,0001)	R	1	No	Single Value matching is used.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1 *	Yes	Specified as range of date of the form: from Date - To Date. Range Matching allowed (when defined in MWL Filter dialog only), not stored for other MWL requests: refresh of MWL query is performed for Current date only. Mapped to Study Date (0008,0020) Cannot be modified in UI if received from MWL
>Scheduled Procedure Step Start Time	(0040,0003)	R	1 *	Yes	Matching is not supported. Mapped to Study Time (0008,0030) Cannot be modified in UI if received from MWL.
>Modality	(0008,0060)	R	1 *	No	Single value and Wildcard value matching is allowed. Possible Values: NM, CT, *
>Scheduled Performing Physician's Name	(0040,0006)	R	2	No	Wildcard matching is allowed by Last Name and First Name separately. User may enter matching values for Last Name and/or First Name separately in UI. The value sent in MWL request is created according to the following template : < Last Name>^< First Name>
>Scheduled Procedure Step Description	(0040,0007)	O	1C*	No	Always included in the MWL request. May be used for Protocol Mapping. Never displayed and stored in database for mapped protocols.
>Scheduled Station Name	(0040,0010)	O	2	No	Always included in the MWL request, but not used for mapping.
>Scheduled Procedure Step Location	(0040,0011)	O	2	No	Always included in the MWL request
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	No	Always included in the MWL request as ZERO Length Sequence.
>>Code Value	(0008,0100)	O	1	No	Not requested explicitly

>>Coding Scheme Designator	(0008,0102)	O	1	No	Not requested explicitly
>>Coding Scheme Version	(0008,0103)	O	3	No	Not requested explicitly
>>Code Meaning	(0008,0104)	O	3 *	No	Not requested explicitly , but returned non-empty value may be used for Protocol Mapping Never displayed and stored in database for mapped protocols.
>Pre-Medication	(0040,0012)	O	2C	No	Always included in the MWL request
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	Always included in the MWL request.
>Requested Contrast Agent	(0032,1070)	O	2C	No	Always included in the MWL request.
>Scheduled Procedure Step Status	(0040,0020)	O	3	No	Always included in the MWL request.

Note: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available

5.4.2 Common Requested Procedure Entity Modules

5.4.2.1 Requested Procedure Module

TABLE 5-5
REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Requested Procedure ID	(0040,1001)	O	1 *	No	Single value and Wildcard value matching is allowed.
Requested Procedure Description	(0032,1060)	O	1 *	No	Always included in the MWL request. Matching is not supported . May be used for Protocol Mapping. Never displayed and stored in image for mapped protocols. If protocol is not mapped - displayed in "Scheduled Study" column in ToDo List.
Requested Procedure Code Sequence	(0032,1064)	O	1	No	Always included in the MWL request as ZERO Length Sequence
Study Instance UID	(0020,000D)	O	1	Yes	Always included in the MWL request.
Referenced Study Sequence	(0008,1110)	O	2	No	Always included in the MWL request as ZERO Length Sequence
Requested Procedure Priority	(0040,1003)	O	2	No	Always included in the MWL request.
Patient Transport Arrangements	(0040,1004)	O	2	No	Always included in the MWL request.

Requested Procedure Location	(0040,1005)	O	3	No	Always included in the MWL request.
Names of Intended Recipients of Results	(0040,1010)	O	3	No	Always included in the MWL request.
Reason for the Requested Procedure	(0040,1002)	O	3	No	Always included in the MWL request
Requested Procedure Comments	(0040,1400)	O	3*	Yes	May be modified in UI.

Note: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available

5.4.3 Common Imaging Service Request Entity Modules

5.4.3.1 Imaging Service Request Module

TABLE 5-6
IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Accession Number	(0008,0050)	O	2 *	Yes	Single Value and Wildchar matching may be requested for this data element
Requesting Physician	(0032,1032)	O	2	No	Always included in the MWL request.
Referring Physician's Name	(0008,0090)	O	2 *	Yes	Always included in the MWL request Only First Name and Last Name are displayed on screen and stored in image; User can modify value arrived from MWL.
Requesting Service	(0032,1033)	O	3	No	Always included in the MWL request.
Imaging Service Request Comments	(0040,2400)	O	3	No	Always included in the MWL request

Note: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available

5.4.4 Common visit Entity Modules

5.4.4.1 Visit Identification

TABLE 5-7
VISIT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Admission ID	(0038,0010)	O	2	No	Always included in the MWL request

Institution Name	(0008,0080)	O	3	No	Value from MWL response is not stored in the image – used value from System configuration instead.

5.4.4.2 Visit Status

TABLE 5-8
VISIT STATUS MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Current Patient Location	(0038,0300)	O	2	No	Always included in the MWL request

5.4.5 Common Patient Entity Modules

5.4.5.1 Patient Identification

TABLE 5-9
PATIENT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Patient's Name	(0010,0010)	R	1 *	Yes	Single Value or Wildchar matching is allowed Last name and First Name separately; Only First Name and Last Name are displayed on screen and stored into image. User cannot modify value received from MWL
Patient ID	(0010,0020)	R	1 *	Yes	Single Value matching is allowed for this data element. Wildcard is interpreted as legal character. User cannot modify value received from MWL
Other Patient IDs	(0010,1000)	O	3	No	Always included in the MWL request
Issuer of Patient ID	(0010,0021)	O	3	No	Not Used
Other Patient IDs Sequence	(0010,1002)	O	3	No	Not Used
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	O	3	No	Not Used

Note: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available

5.4.5.2 Patient Demographic

TABLE 5-10
PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Patients Birth Date	(0010,0030)	O	2 *	Yes	Always included in the MWL request User cannot modify value received from MWL
Patient's Sex	(0010,0040)	O	2 *	Yes	Always included in the MWL request User cannot modify value received from MWL
Patient's Weight	(0010,1030)	O	2*	Yes	Always included in the MWL request User can modify value received from MWL
Patient's Size	(0010,1020)	O	2*	Yes	Always included in the MWL request User can modify value received from MWL
Patient's Age	(0010,1010)	O	3	No	Not Requested Value calculated from Patient Birth Date is displayed on screen stored into image.
Patient's Birth Time	(0010,0032)	O	3	No	Always included in the MWL request

Note: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available

5.4.5.3 Patient Medical

TABLE 5-11
PATIENT MEDICAL MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into Instance	Note
Patient State	(0038,0500)	O	2	No	Always included in the MWL request
Pregnancy Status	(0010,21C0)	O	2	No	Always included in the MWL request
Medical Alerts	(0010,2000)	O	2	No	Always included in the MWL request
Contrast Allergies	(0010,2110)	O	2	No	Always included in the MWL request
Special Needs	(0038,0050)	O	2	No	Always included in the MWL request
Additional Patient History	(0010,21B0)	O	3	No	Always included in the MWL request

6. STORAGE COMMITMENT PUSH MODEL IMPLEMENTATION

6.1 STORAGE COMMITMENT PUSH MODEL INFORMATION OBJECT DEFINITION

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the attributes contained within the Storage Commitment Information Object.

The Storage Commitment Information Object is used both for N-ACTION Storage Commitment Requests by the SCU and N-EVENT-REPORT Storage Commitment Notifications by the SCP.

6.1.1 STORAGE COMMITMENT MODULE FOR N-ACTION

TABLE 6-1
STORAGE COMMITMENT MODULE FOR N-ACTION

Attribute Name	Tag	SCU Use
Transaction UID	(0008,1195)	Internally generated.
Storage Media File-Set ID	(0088,0130)	Not used
Storage Media File-Set UID	(0088,0140)	Not used
Referenced SOP Sequence	(0008,1199)	May contain 1 or more items
>Referenced SOP Class UID	(0008,1150)	1.2.840.10008.5.1.4.1.1.20 Nuclear Medicine Image Storage SOP Class UID. 1.2.840.10008.5.1.4.1.1.7 - Secondary Capture Image Storage SOP Class UID
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the Image which Storage Commitment is required for.
>Storage Media File-Set ID	(0088,0130)	Not used
>Storage Media File-Set UID	(0088,0140)	Not used

6.1.2 STORAGE COMMITMENT MODULE FOR N-EVENT-REPORT

TABLE 6-2
STORAGE COMMITMENT MODULE FOR N-EVENT-REPORT

Attribute Name	Tag	SCU Use
Transaction UID	(0008,1195)	Used to identify the N-ACTION Request which N-EVENT-REPORT is relevant to.
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)	Used to identify the images which storage commitment was successful and mark them as Archived.

>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>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)	Used to identify the images which storage commitment was failed to prevent marking them as Archived.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Failure Reason	(0008,1197)	See Section 6.1.2.1 for the list of processed values.

6.1.2.1 Processing of Failure Reason when received in a N-EVENT-REPORT

When receiving a N-EVENT-REPORT request with a Event Type ID equal to 2, meaning that Storage Commitment is complete, but failure exists, following is the set of value that this Storage Commitment SCU AE is able to process:

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Transfer failure is logged
0112H	No such object instance	Transfer failure is logged
0213H	Resource limitation	Transfer failure is logged
0122H	Referenced SOP Class not supported	Transfer failure is logged
0119H	Class / Instance conflict	Transfer failure is logged
0131H	Duplicate transaction UID	Transfer failure is logged
*	Any other failure reason	Transfer failure is logged