Technical Publications

Direction *2277062-200*
Revision 1

VIVID3 version 2.x CONFORMANCE STATEMENT for DICOM V3.0

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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 GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 3 (Media Storage Conformance Statement), which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Media Storage features.

Section 4 (Ultrasound Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of an Ultrasound Medicine Information Object.

Section 5 (Ultrasound Multi-Frame Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of an Ultrasound Multi-Frame Information.

Section 6 (SC Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Object**.**

Section 7 (Basic Directory Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Basic Directory Information Object**.**

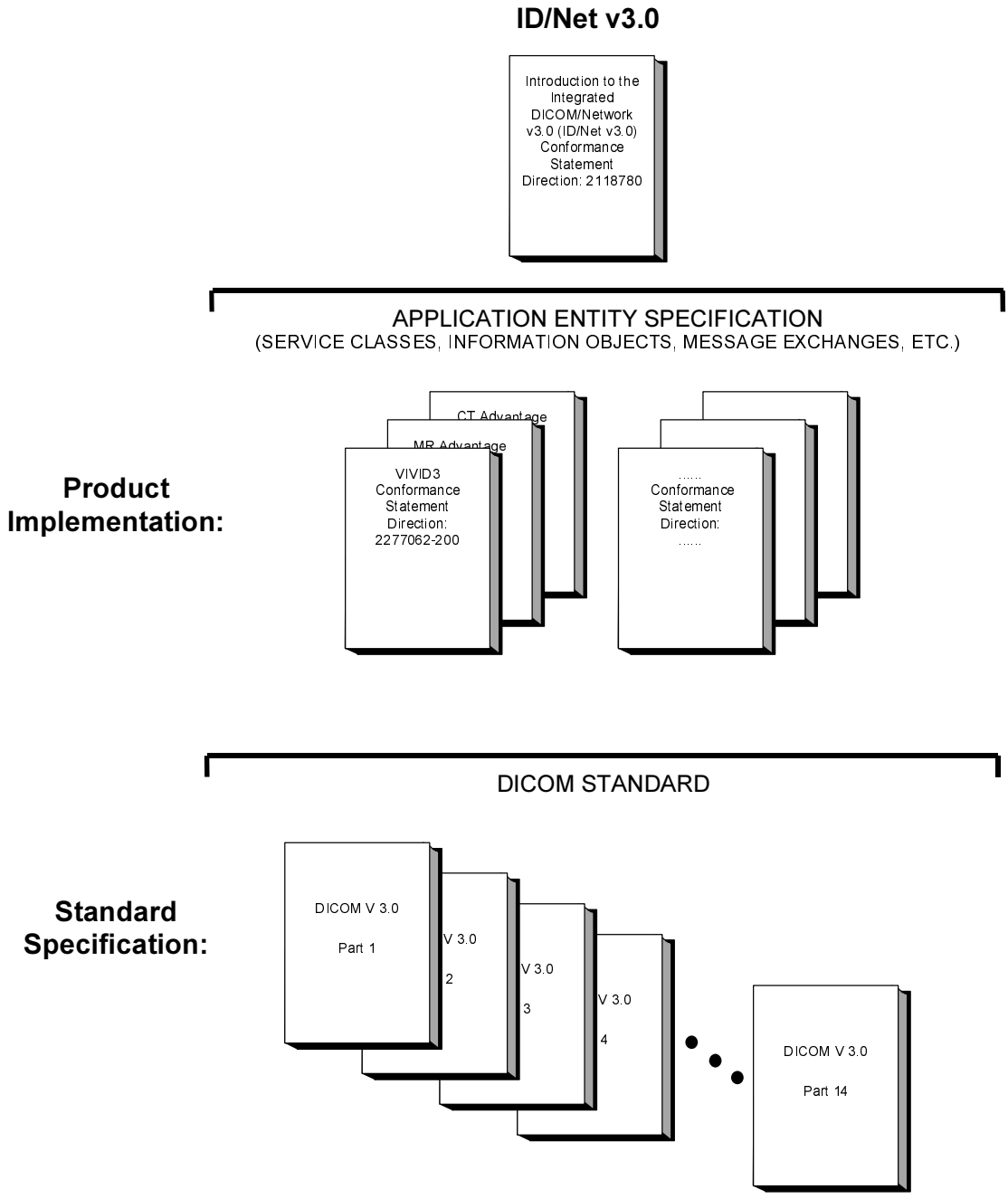
Section 8 (Modality Worklist Information Model), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section 9 (Modality Performed Procedure Step SOP Class Definition), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of Modality Performed Procedure Step Service.

Section 10 (Storage Commitment Push Model SOP Class Definition), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Storage Commitment Push Model Service.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



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

VIVID3 version 2.x
Conformance Statement for DICOM v3.0
Direction 2277062-200

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

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

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

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

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

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

ID/Net v3.0 Conformance Statements
Direction: 2117016

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

NEMA Publication
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209
USA
Phone: (703) 841-3200

1.3 INTENDED AUDIENCE

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

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

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

1.4 SCOPE AND FIELD OF APPLICATION

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

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

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

1.5 IMPORTANT REMARKS

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

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.
- Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.
- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices, which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements**. The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **To be informed of the evolution of the implementation described in this document, the User is advised to regularly check the GE Internet Server.**
- **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

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

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

1.7 DEFINITIONS

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

1.8 SYMBOLS AND ABBREVIATIONS

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

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant **Networking** features for VIVID3 *version 2.x*. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.

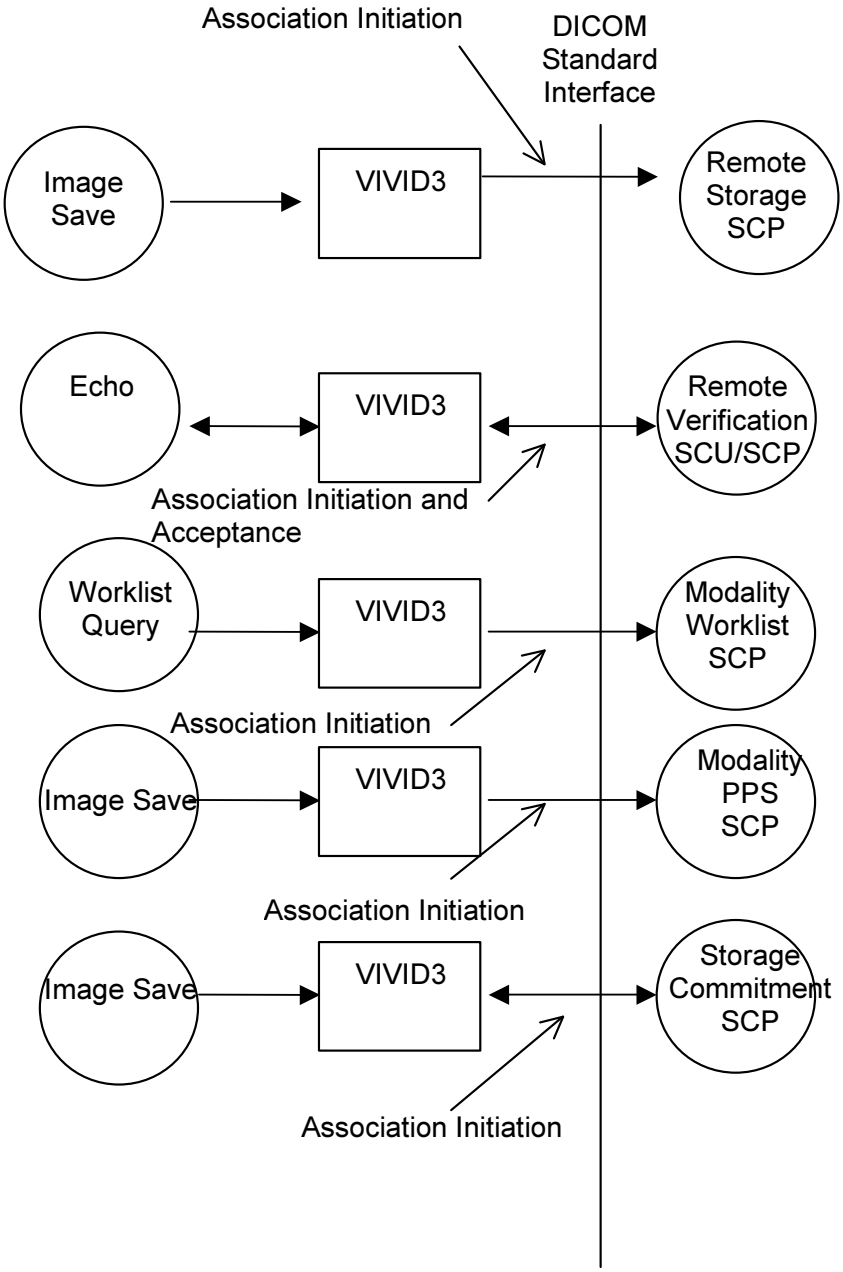
VIVID3 is an Ultrasound scanner running on a commercial computer. It allows for the following DICOM functionality:

- Sending and receiving Echo messages to and from DICOM Verification server and client.
- Exporting DICOM images to a server or saving the DICOM images to DICOM media format.
- Querying and retrieving DICOM Modality Worklist from a Worklist server.
- Sending start and end of examination to a DICOM Modality Performed Procedure Step server.
- Sending storage commitment requests (and receiving replies) to a DICOM Storage Commitment SCP.

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

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



There are three local real-world activities that occur in VIVID3 - **Image Save, Echo, and Worklist Query**.

Image save initiates a connection with the server and transmits the images to the server. If Modality Performed Procedure Step is configured N-CREATE and N-SET messages will be sent for the exam. If Storage Commitment is configured a commitment request will be sent for the images.

Echo initiates a connection with the DICOM server, posts a Verification request and closes the connection. It also responds to incoming Verification requests.

Worklist Query initiates a connection with the DICOM server, performs a query and retrieves the matching entries to the scanner.

2.2.2 Functional Definition of AE's

Application Entity VIVID3 supports the following functions:

- Initiates a DICOM association to send images.
- Transmits DICOM images to the DICOM Storage SCP.
- Initiates a DICOM verification to assist in network diagnostics.
- Responds to DICOM verification requests from other devices.
- Initiates a DICOM worklist query to receive worklist info.
- Initiates a DICOM association to notify start of examination.
- Initiates a DICOM association to notify end of examination.
- Initiates a DICOM association to request storage commitment of images.
- Responds to replies for storage commitment requests of images.

2.2.3 Sequencing of Real-World Activities

Image save:

- VIVID3 initiates a DICOM association with the selected archive device AE when the operator requests an image to be sent. The initial association negotiation list depends on the configuration setting. The association negotiation lists is described in 2.3.1.2.1.2.
- The images are then transferred to the Storage SCP (DICOM servers) using the C-STORE command. Multiple images are sent on the same DICOM association according to the configuration of the connection in the Config Setup. For example, if the images are within one exam and the reopening setting is study/series then all images are sent on the same connection. If the reopening setting is image, then the connection is reopened between sending every image
- If Storage Commitment is configured a commitment request will be sent for the images.
- If Modality Performed Procedure Step is configured N-CREATE and N-SET messages will be sent to a Modality Performed Procedure Step Instance.

Echo:

- The AE uses the C-ECHO to verify the communication path to a remote.
- AE **Echo** initiates a connection with the DICOM SCP, posts a Verification request and closes the connection. It also responds to incoming Verification requests (for service use).

Worklist Query:

- VIVID3 initiates a DICOM association to one specific SCP, using the C-FIND command to query and retrieve the worklist information.

2.3 AE SPECIFICATIONS

2.3.1 VIVID3 AE Specification

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

SOP Class Name	SOP Class UID
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification SOP Class	1.2.840.10008.1.1
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1

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

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

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 negotiation is included in all association establishment requests.

Maximum Length PDU	32768

The SOP Class Extended Negotiation is not supported.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

2.3.1.1.2 Number of Associations

The VIVID3 AE will initiate multiple DICOM associations.

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 v3.0 Implementation is:

VIVID3 **Implementation UID**	**1.2.840.113619.6.85**

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

VIVID3 **Implementation Version Name**	**VIVID3_2_X**

Note: The Implementation Version Name may change in the future without modification of this document.

2.3.1.2 Association Initiation Policy

The VIVID3 AE attempts to establish a new association with a remote device due to three Real-World Activities:

- Image save initiated by the operator for a specific image or group of images, sending messages to Modality Performed Procedure Step and send request for Storage Commitment.
- Verification, which verifies application level communication between peer DICOM AE's for service purposes.
- Worklist initiated by the operator for receiving worklist info.

2.3.1.2.1 Real-World Activity A ('Image save' Operation)

2.3.1.2.1.1 Associated Real-World Activity

Upon a request by the operator (manual or automatic), images will be sent to a DICOM Storage SCP.

2.3.1.2.1.2 Proposed Presentation Context Tables

The Proposed Presentation Context Table depends on compression according to the following table:

Presentation Context Table – Proposed

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Presentation Context Table: Compression set to None					
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Presentation Context Table: Compression set to RLE					
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Run Length Encoding, RLE Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Run Length Encoding, RLE	1.2.840.10008.1.2.5	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Run Length Encoding, RLE	1.2.840.10008.1.2.5	SCU	None
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	Run Length Encoding, RLE	1.2.840.10008.1.2.5	SCU	None
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	Run Length Encoding, RLE	1.2.840.10008.1.2.5	SCU	None
Presentation Context Table: Compression set to JPEG					
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Run Length Encoding, RLE Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG Baseline	1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG Baseline	1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6	JPEG Baseline	1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Multi-frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	JPEG Baseline	1.2.840.10008.1.2.4.50	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

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

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received

Refused	A7xx	Out of resources	association is terminated; image not transferred	(0000,0902)
	0122	SOP Class not Supported	association is terminated; image not transferred	(0000,0902)
Error	Cxxx	Cannot Understand	association is terminated; image not transferred	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	association is terminated; image not transferred	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	treated as a '**Successful**' response	(0000,0901) (0000,0902)
	B007	Data Set does not match SOP Class	treated as a '**Successful**' response	(0000,0901) (0000,0902)
	B006	Elements Discarded	treated as a '**Successful**' response	(0000,0901) (0000,0902)
Success	0000			None

This operation also sends a Storage Commitment Request, with the following proposed presentation context. The result from the SCP is expected on another Real-World Activity 'Commitment Result'.

Presentation Context Table Proposed					
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	1.2.840.10008.1.2	SCU	None

This operation also sends messages to a Modality Performed Procedure Step SCP, with the following proposed presentation context.

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

2.3.1.2.2 Real-World Activity B ('Echo' Operation)

The user may initiate a DICOM Verification Request in the Config screen.

Associations will be released upon the receipt of each C-ECHO confirmation. In the event that the SCP does not respond for some reason would the Vivid 3 system time out expire and close the association

2.3.1.2.2.1 Associated Real-World Activity

The user may initiate a DICOM Verification Request in the Config screen.

Associations will be released upon the receipt of each C-ECHO confirmation.

2.3.1.2.2.2 Proposed Presentation Context Table

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

2.3.1.2.2.3 Transfer Syntax Selection Policies

The selected transfer syntax is based on the proposed transfer syntax list. The priorities are first, Implicit VR Little Endian, then Explicit VR Little Endian and Explicit VR Big Endian.

2.3.1.2.3 Real-World Activity C ('Worklist Query' Operation)

2.3.1.2.3.1 Associated Real-World Activity

The user may initiate a DICOM Worklist Query in Search screen, which will send a C-FIND-RQ to the Worklist SCP.

Associations will be released upon the receipt of C-FIND-RSP confirmation.

2.3.1.2.3.2 Proposed Presentation Context Tables

Presentation Context Table – Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Basic Modality Worklist Information Model – FIND SOP Class	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.3 Association Acceptance Policy

The AE accepts an association only when VIVID3 receives a Verification Request from another network device.

2.3.1.3.1 Real-World Activity B – ('Echo' operation)

2.3.1.3.1.1 Associated Real-World Activity

An incoming Verification Request will cause the AE to accept the association and respond with a Verification Response.

2.3.1.3.1.2 Accepted Presentation Context Table

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

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for Verify SOP Class

The AE provides standard conformance to the Verification SOP Class as an SCP.

2.3.1.3.1.3 Presentation Context Acceptance Criterion

No criterion.

2.3.1.3.1.4 Transfer Syntax Selection Policies

The selected transfer syntax is based on the proposed transfer syntax list. The priority order is Explicit VR Big Endian, Explicit VR Little Endian and Implicit VR Little Endian.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

2.4.2 OSI Stack

OSI stack not supported

2.4.2.1 International Standardized Profile (ISP)

ISP not supported.

2.4.2.2 API

Not applicable to this product.

2.4.2.3 Physical Media Support

The DICOM implementation is indifferent to the Physical medium over which TCP/IP executes. Please refer to product documentation for more information.

2.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the product's operating system. Please refer to product documentation for more information.

2.4.3.1 API

Not applicable to this product.

2.4.4 Point-to-Point Stack

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

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

If so configured, the scanner will send ultrasound raw data information in private data elements designated by the Private Creator element:

Element Name	Tag	VR	VM	Description
Private Creator	7FE1,00xx	LO	1	GEMS_Ultrasound_MovieGroup_001

This means that all private tags starting with 7FE1,xx will belong to the GEMS_Ultrasound_MovieGroup_001.

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

The Local AE title is configurable through the Config Setup screen, see below.

2.6.2 Configurable Parameters

Network:
- Local IP address
- Local IP netmask
- Local routing table information

Local:
- Local AE Title
- Local Listening Port Number for Verification and Storage Commitment

Verification:
- The AE Title, IP address and port number of the SCP
- Max retries, Retry interval, Retry timeout

Modality Worklist :
- The AE Title, IP address and port number of the SCP
- Max retries, Retry interval, Retry timeout
- Refresh interval. (Maximum delay time between data retrievals)
- Disabling/enabling and setting constant values for query fields
- Maximum number of downloaded entries

Storage:
- The AE Title, IP address and port number of the SCP
- Max retries, Retry interval, Retry timeout
- Enable/disable raw data

- Frame rate reduction
- Enable/disable negotiation of image settings
- Enable/disable multi-frame
- Compression selection
- Compression quality
- Color support
- Association strategies: one association per image or one association per exam

MPPS:

- The AE Title, IP address and port number of the SCP
- Max retries, Retry interval, Retry timeout

Storage Commitment:

- The AE Title, IP address and port number of the SCP
- Max retries, Retry interval, Retry timeout
- The associated Storage service
- Whether an N-ACTION-RQ is sent on a per image basis or a per study basis
- Number of days to keep unanswered request

2.7 SUPPORT OF EXTENDED CHARACTER SETS

VIVID3 will support the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character set. Any incoming SOP instance that is encoded using another extended character set will not be displayed.

3. MEDIA STORAGE CONFORMANCE STATEMENT

3.1 INTRODUCTION

This section of the conformance statement (CS) specifies the VIVID3 compliance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles, which are supported by this product.

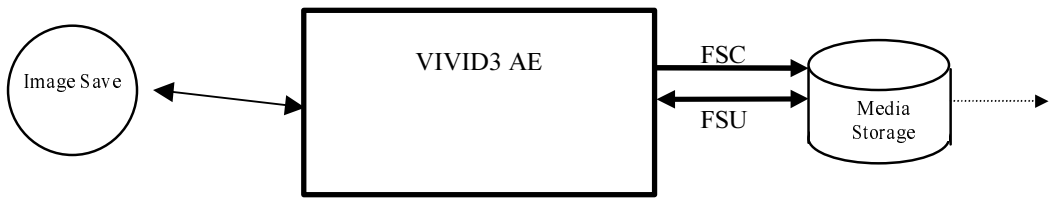
VIVID3 is able to export images to DICOM media.

3.2 IMPLEMENTATION MODEL

3.2.1 Application Data Flow Diagram

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

ILLUSTRATION 3–1
SPECIFIC AE APPLICATION MODEL



VIVID3 can initialize Media by acting as an FSC to create a new DICOM File-set on either 1.2 GB MOD, 2.4 GB MOD or CDR. The SOP instances written to media must be one of the instances supported by VIVID3. A pre-existing File-set will be updated with the information in DICOM files copied to media.

3.2.2 Functional Definition of AE's

VIVID3 can perform these functions:

- Create a new DICOM File-set on media
- Update DICOM File-set by adding new SOP instances to the File-set

3.2.3 Sequencing Requirements

None applicable

3.2.4 File Meta Information Options (See PS3.10)

The File Meta-Information for this implementation is:

File Meta-Information Version	1
VIVID3 Implementation UID	1.2.840.113619.6.85
Implementation Version Name	VIVID3_2_X

Note: The Implementation Version Name and may change in the future without modification of this document.

3.3 AE SPECIFICATIONS

3.3.1 VIVID3 AE Specification

The VIVID3 Application Entity provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The application Profiles and roles are listed below.

Supported Application Profile	Real World Activity	Role	Description
STD-US-CC-SF-CDR, STD-US-CC-SF-MOD12, STD-US-CC-SF-MOD23, STD-US-CC-MF-CDR, STD-US-CC-MF-MOD12, STD-US-CC-MF-MOD23	Image Save	FSC/ FSU	Interchange

3.3.1.1 File Meta Information for the VIVID3 Application Entity

The Source Application Entity is set from the VIVID3 local AE title. The local AE is configurable.

Following are the default value set in the File Meta Information for this AE Title:

Source Application Entity Title	VIVID3

3.3.1.2 Real-World Activities for the VIVID3 Application Entity

3.3.1.2.1 Real-World Activity "Image save"

"Image save" saves a DICOM SOP instance to media and updates DICOM File Set.

3.3.1.2.1.1 Media Storage Application Profile for the Real-World Activity "Image save":

For the list of Application Profiles that invoke this AE for "Image save" Real-World Activity, see the Table in Section 3.3.1 "VIVID3 AE Specification" where the table describing the profiles and real-world activities is defined.

3.3.1.2.1.1.1 Options

Following are the SOP Classes supported by the Real-World Activity "Image save":

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
DICOM Media Storage Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Run Length Encoding, RLE JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50
Ultrasound Multi-frame Image Storage(retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Run Length Encoding, RLE JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Run Length Encoding, RLE JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50
Ultrasound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Run Length Encoding, RLE JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Run Length Encoding, RLE JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50

3.4 AUGMENTED AND PRIVATE APPLICATION PROFILES

No augmented/private profile is implemented.

3.5 EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS OF SOP CLASSES AND TRANSFER SYNTAXES

If so configured, the scanner will send ultrasound raw data information in private data elements designated by the Private Creator element:

Element Name	Tag	VR	VM	Description
Private Creator	7FE1,00xx	LO	1	GEMS_Ultrasound_MovieGroup_001

This means that all private tags starting with 7FE1,xx will belong to the GEMS_Ultrasound_MovieGroup_001.

3.6 CONFIGURATION

The following parameters are configurable:

- Location of DICOMDIR
- Enable/disable raw data
- Frame rate reduction
- Enable/disable negotiation of image settings
- Enable/disable multi-frame
- Compression selection
- Compression quality
- Color support

3.7 SUPPORT OF EXTENDED CHARACTER SETS

VIVID3 will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets. Any incoming SOP instance that is encoded using another extended character set will not be read/written.

4. ULTRASOUND (US) INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 - IOD Implementation

4.3 - IOD Entity-Relationship Model

4.4 - IOD Module Table

4.5 - IOD Module Definition

4.2 US IOD IMPLEMENTATION

This section defines the implementation of US image information object.

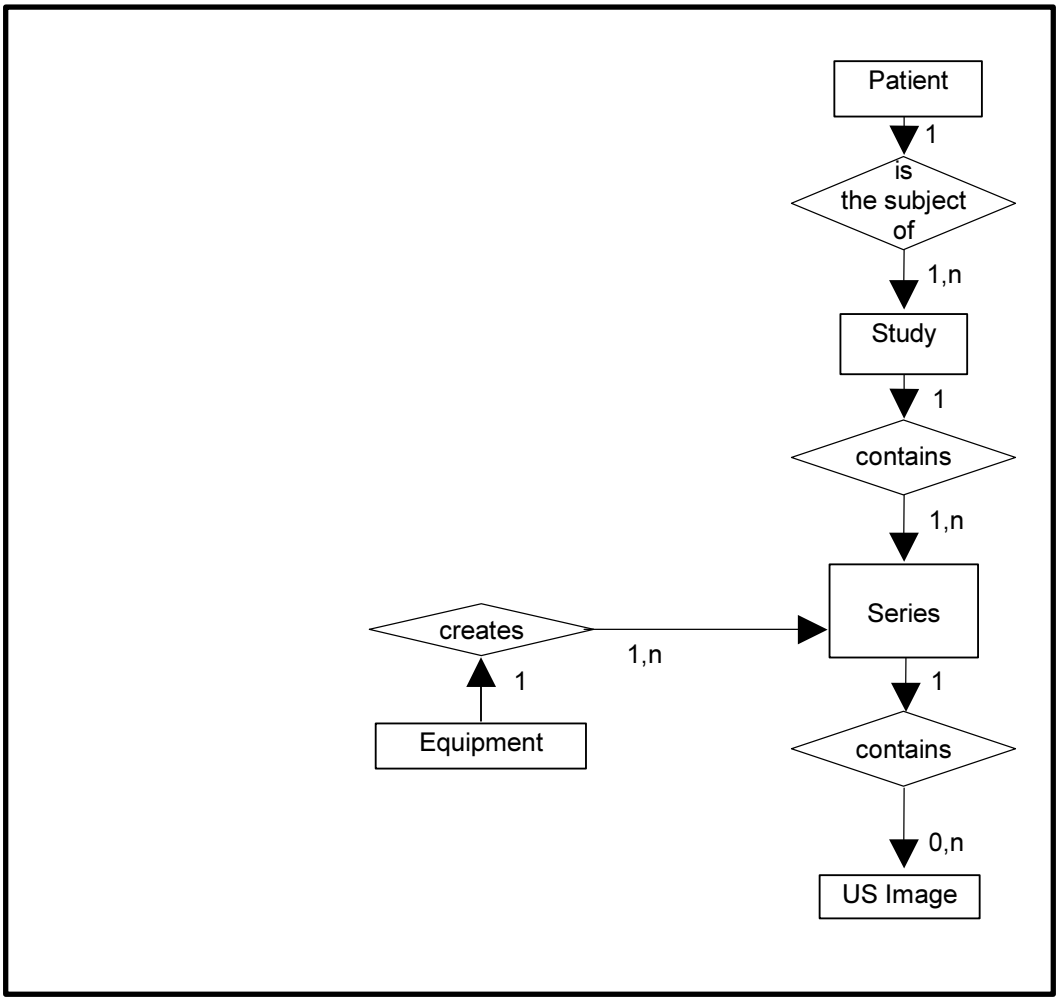
4.3 US ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the US Image interoperability schema is shown in Illustration 4.3-1. In this figure, the following diagrammatic convention is established to represent the information organization:

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 4.3-1
US IMAGE ENTITY RELATIONSHIP DIAGRAM



4.3.1 Entity Descriptions

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

4.3.2 VIVID3 Mapping of DICOM Entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO VIVID3 ENTITIES

DICOM	VIVID3 Entity
Patient	Patient
Study	Exam
Series	Exam
Image	Image
Curve	Not used

4.4 IOD MODULE TABLE

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

Table 4.4-1 identifies the defined modules within the entities, which comprise the DICOM v3.0 US IOD. Modules are identified by Module Name.

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

Only the single frame US Image IOD is described here.

TABLE 4.4-1
US IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
	Patient Study	4.5.2.2
Series	General Series	4.5.3.1
Frame of Reference	Frame of Reference	Not used
	US Frame of Reference	Not used
Equipment	General Equipment	4.5.4.1
Image	General Image	4.5.5.1
	Image Pixel	4.5.5.2
	Contrast/Bolus	4.5.5.3
	Palette Color Lookup Table	4.5.5.4
	US Region Calibration	4.5.7.1
	US Image	4.5.7.2
	Overlay Plane	Not used
	VOI LUT	4.5.5.5
	SOP Common	4.5.6.1
Curve	Not used	

The Image and Curve IEs are mutually exclusive. Each SOP Instance using this IOD shall contain exactly one of these IODs.

4.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the US 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. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

4.5.1 Common Patient Entity Modules

4.5.1.1 Patient Module

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

TABLE 4.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	May be entered from User Interface. Taken from worklist if it is there.
Patient ID	(0010,0020)	2	May be entered from User Interface. Taken from worklist if it is there.
Patient's Birth Date	(0010,0030)	2	May be entered from User Interface. Taken from worklist if it is there.
Patient's Sex	(0010,0040)	2	May be entered from User Interface. Taken from worklist if it is there.
Referenced Patient Sequence	(0008,1120)	3	Taken from worklist if it is there.
>Referenced SOP Class UID	(0008,1150)	1C	Taken from worklist if it is there.
>Referenced SOP Instance UID	(0008,1155)	1C	Taken from worklist if it is there.
Patient's Birth Time	(0010,0032)	3	Taken from worklist if it is there.
Other Patient Ids	(0010,1000)	3	Taken from worklist if it is there.
Other Patient Names	(0010,1001)	3	Not used
Ethnic Group	(0010,2160)	3	Taken from worklist if it is there.
Patient Comments	(0010,4000)	3	Taken from worklist if it is there.

4.5.2 Common Study Entity Modules

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

4.5.2.1 General Study Module

This section specifies the attributes that describe and identify the Study performed upon the Patient.

TABLE 4.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Uniquely generated by the equipment. Taken from worklist if it is there.
Study Date	(0008,0020)	2	Is set to examination date
Study Time	(0008,0030)	2	Is set to examination time
Referring Physician's Name	(0008,0090)	2	May be entered from User Interface. Taken from worklist if it is there.

Study ID	(0020,0010)	2	May be entered from User Interface. Taken from worklist if it is there (from Requested Procedure Id)
Accession Number	(0008,0050)	2	May be entered from User Interface. Taken from worklist if it is there.
Study Description	(0008,1030)	3	Taken from worklist if it is there (from Requested Procedure Description).
Physician(s) of Record	(0008,1048)	3	Taken from worklist if it is there (from Names of Intended Recipients of Result)
Name of Physician(s) Reading Study	(0008,1060)	3	Not used
Referenced Study Sequence	(0008,1110)	3	Taken from worklist if it is there.
>Referenced SOP Class UID	(0008,1150)	1C	Taken from worklist if it is there.
>Referenced SOP Instance UID	(0008,1155)	1C	Taken from worklist if it is there.

4.5.2.2 Patient Study Module

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

TABLE 4.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Not used
Patient's Age	(0010,1010)	3	Not used
Patient's Size	(0010,1020)	3	May be entered from User Interface. The unit is inch or centimeters depending on VIVID3 configuration setup. Taken from worklist if it is there.
Patient's Weight	(0010,1030)	3	May be entered from User Interface. The unit is lbs. or kg depending on VIVID3 configuration setup. Taken from worklist if it is there.
Occupation	(0010,2180)	3	Not used
Additional Patient's History	(0010,21B0)	3	May be entered from User Interface (in Referral reason). Taken from worklist if it is there.

4.5.3 Common Series Entity Modules

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

4.5.3.1 General Series Module

This section specifies the attributes that identify and describe general information about the Series within a Study.

TABLE 4.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Defined Term "US" used. When reading SC all modalities are accepted.
Series Instance UID	(0020,000E)	1	Uniquely generated by the equipment
Series Number	(0020,0011)	2	Internal number which is incremented for each new exam within a study.
Laterality	(0020,0060)	2C	Not used
Series Date	(0008,0021)	3	Is set to Series date
Series Time	(0008,0031)	3	Is set to Series time
Performing Physicians' Name	(0008,1050)	3	May be entered from User Interface. Taken from worklist if it is there (from Scheduled Performing Physician's Name)
Protocol Name	(0018,1030)	3	Not used
Series Description	(0008,103E)	3	May be entered from User Interface (in Diagnosis).
Operator's Name	(0008,1070)	3	May be entered from User Interface. Default is login id. Taken from worklist if it is there.
Referenced Study Component Sequence	(0008,1111)	3	Taken from worklist if it is there.
>Referenced SOP Class UID	(0008,1150)	1C	Taken from worklist if it is there.
>Referenced SOP Instance UID	(0008,1155)	1C	Taken from worklist if it is there.
Body Part Examined	(0018,0015)	3	Not used
Patient Position	(0018,5100)	2C	Not used
Smallest Pixel Value in Series	(0028,0108)	3	Not used
Largest Pixel Value in Series	(0028,0109)	3	Not used
Request Attributes Sequence	(0040,0275)	3	Used if Modality Worklist and/or Modality Performed Procedure Step is enabled.
>Requested Procedure ID	(0040,1001)	1C	Taken from worklist if it is there.
>Scheduled Procedure Step ID	(0040,0009)	1C	Taken from worklist if it is there.
>Scheduled Procedure Step Description	(0040,0007)	3	Taken from worklist if it is there.
>Scheduled Action Item Code Sequence	(0040,0008)	3	Taken from worklist if it is there.
>Include 'Code Sequence Macro'			
Performed Procedure Step ID	(0040,0253)	3	Used if Modality Performed Procedure Step is enabled.
Performed Procedure Step Start Date	(0040,0244)	3	Used if Modality Performed Procedure Step is enabled.
Performed Procedure Step Start Time	(0040,0245)	3	Used if Modality Performed Procedure Step is enabled.

Performed Procedure Step Description	(0040,0254)	3	Used if Modality Performed Procedure Step is enabled.
Performed Action Item Sequence	(0040,0260)	3	Taken from worklist if it is there (from Scheduled Action Item Code Sequence)

4.5.4 Common Equipment Entity Modules

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

4.5.4.1 General Equipment Module

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

TABLE 4.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Is set to "GE Ultrasound Israel"
Institution Name	(0008,0080)	3	Is set to configured Institution Name.
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Is set to configured Station Name.
Institutional Department Name	(0008,1040)	3	May be entered from User Interface. Default is configured Department name.
Manufacturer's Model Name	(0008,1090)	3	Is set to "VIVID3".
Device Serial Number	(0018,1000)	3	Not used
Software Versions	(0018,1020)	3	Is set to VIVID3 software version
Spatial Resolution	(0018,1050)	3	Not used
Date of Last Calibration	(0018,1200)	3	Not used
Time of Last Calibration	(0018,1201)	3	Not used
Pixel Padding Value	(0028,0120)	3	Not used

4.5.5 Common Image Entity Modules

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

4.5.5.1 General Image Module

This section specifies the attributes that identify and describe an image within a particular series.

TABLE 4.5-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Internal value which is incremented for each captured image, within a series (within a study),
Patient Orientation	(0020,0020)	2C	Not used
Image Date	(0008,0023)	2C	Set from Image date
Image Time	(0008,0033)	2C	Set from Image time

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	3	Value “ORIGINAL/PRIMARY”
Acquisition Number	(0020,0012)	3	Not used
Acquisition Date	(0008,0022)	3	Not used
Acquisition Time	(0008,0032)	3	Not used
Referenced Image Sequence	(0008,1140)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
>Referenced Frame Number	(0008,1160)	3	Not used
Derivation Description	(0008,2111)	3	May contain additional derivation information if Image Type is DERIVED.
Source Image Sequence	(0008,2112)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
>Referenced Frame Number	(0008,1160)	3	Not used
Images in Acquisition	(0020,1002)	3	Not used
Image Comments	(0020,4000)	3	Not used
Quality Control Image	(0028,0300)	3	Not used
Burned In Annotation	(0028,0301)	3	Not used
Lossy Image Compression	(0028,2110)	3	Set to 01 if images is lossy compressed.
Lossy Image Compression Ratio	(0028,2112)	3	Used if lossy compressed.

4.5.5.2 Image Pixel Module

This section specified the attributes that describe the pixel data of the image.

TABLE 4.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Value of ‘1’ if Photometric Interpretation element value has value ‘MONOCHROME2’ Value of ‘3’ when Photometric Interpretation element value has value ‘RGB’, 'YBR_FULL' or 'YBR_FULL_422'
Photometric Interpretation	(0028,0004)	1	Defined Values used: “MONOCHROME2” , “RGB”, “YBR_FULL” or “YBR_FULL_422”
Rows	(0028,0010)	1	Value depends on scanning mode and configuration setup
Columns	(0028,0011)	1	Value depends on scanning mode and configuration setup.

Attribute Name	Tag	Type	Attribute Description
Bits Allocated	(0028,0100)	1	Value always = 0008H.
Bits Stored	(0028,0101)	1	Value always = 0008H.
High Bit	(0028,0102)	1	Value always = 0007H.
Pixel Representation	(0028,0103)	1	Defined Value '0' - unsigned integer.
Pixel Data	(7FE0,0010)	1	Pixel Data of image.
Planar Configuration	(0028,0006)	1C	Enumerated value 0000H Enumerated Value, color-by-pixel, if Photometric Interpretation element value has value 'RGB'. Enumerated value 0001H, color-by-plane if Photometric Interpretation element value has value 'YBR_FULL' or, 'YBR_FULL_422' (if image is RLE compressed)
Pixel Aspect Ratio	(0028,0034)	1C	Not used
Smallest Image Pixel Value	(0028,0106)	3	Not used
Largest Image Pixel Value	(0028,0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used

4.5.5.3 Contrast/Bolus Module

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

TABLE 4.5-8
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Not used
Contrast/Bolus Agent Sequence	(0018,0012)	3	Not used
>Include 'Code Sequence Macro'			
Contrast/Bolus Route	(0018,1040)	3	Not used
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Not used
>Include 'Code Sequence Macro'			
>Additional Drug Sequence	(0018,002A)	3	Not used
>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Volume	(0018,1041)	3	Not used
Contrast/Bolus Start Time	(0018,1042)	3	Not used
Contrast/Bolus Stop Time	(0018,1043)	3	Not used
Contrast/Bolus Total Dose	(0018,1044)	3	Not used
Contrast Flow Rate(s)	(0018,1046)	3	Not used
Contrast Flow Duration(s)	(0018,1047)	3	Not used
Contrast/Bolus Ingredient	(0018,1048)	3	Not used
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Not used

4.5.5.4 Palette Color Lookup Table Module

This section specifies the attributes that describe the Lookup table data for images with Palette Color photometric interpretation.

TABLE 4.5-9
PALETTE COLOR LOOKUP MODULE

Attribute Name	Tag	Type	Attribute Description
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used
Palette Color Lookup Table UID	(0028,1199)	3	Not used
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used
Segmented Red Palette Color Lookup Table Data	(0028,1221)	1C	Not used
Segmented Green Palette Color Lookup Table Data	(0028,1222)	1C	Not used
Segmented Red Palette Color Lookup Table Data	(0028,1223)	1C	Not used

4.5.5.5 VOI LUT Module

This section specifies the attributes that identify and describe the VOI LUT Module

TABLE 4.5-10
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Not used
>LUT Descriptor	(0028,3002)	3	Not used
>LUT Explanation	(0028,3003)	3	Not used
>LUT Data	(0028,3006)	3	Not used
Window Center	(0028,1050)	3	Value set to 127 if Photometric Interpretation has value MONOCHROME2.
Window Width	(0028,1051)	3	Value set to 256 if Photometric Interpretation has value MONOCHROME2.
Window Center & Width Explanation	(0028,1055)	3	Not used

4.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.6.1 SOP Common Module

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

TABLE 4.5-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Set to "1.2.840.10008.5.1.4.1.1.3.1" "1.2.840.10008.5.1.4.1.1.3" "1.2.840.10008.5.1.4.1.1.6.1" "1.2.840.10008.5.1.4.1.1.6" or "1.2.840.10008.5.1.4.1.1.7"
SOP Instance UID	(0008,0018)	1	Uniquely generated by the equipment
Specific Character Set	(0008,0005)	1C	Set to "ISO_IR 100" if extended characters are used. Image Read: images using other extended character set than "ISO_IR 100" are rejected.
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used
Instance Number	(0020,0013)	3	Not used

4.5.7 US Modules

This Section describes US Series, Equipment, and Image Modules. These Modules contain attributes that are specific to US Image IOD.

4.5.7.1 US Region Calibration Module

US Region Calibration Module is used to describe multiple regions. Note: if a multi-frame image has been acquired with different calibration, the US Region Calibration Module will not be used.

TABLE 4.5-12
US REGION CALIBRATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Sequence of Ultrasound Regions	(0018,6011)	1	
>Region Location Min x_0	(0018,6018)	1	ULS Group region TopLeft.x
>Region Location Min y_0	(0018,601A)	1	ULS Group region TopLeft.y
>Region Location Max x_1	(0018,601C)	1	ULS Group region RightBottom.x
>Region Location Max y_1	(0018,601E)	1	ULS Group region RightBottom.y
>Physical Units X Direction	(0018,6024)	1	Enumerated Values supported: 0003H cm 0004H seconds
>Physical Units Y Direction	(0018,6026)	1	Values supported: 0003H cm 0004H seconds 0005H Hertz 0007H cm/sec
>Physical Delta X	(0018,602C)	1	Varies with scanning mode
>Physical Delta Y	(0018,602E)	1	Varies with scanning mode
>Reference Pixel x_0	(0018,6020)	3	Used to define baseline position in Doppler mode
>Reference Pixel y_0	(0018,6022)	3	Used to define baseline position in Doppler mode
>Ref. Pixel Physical Value X	(0018,6028)	3	Varies with scanning mode
>Ref. Pixel Physical Value Y	(0018,602A)	3	Varies with scanning mode
>Region Spatial Format	(0018,6012)	1	Enumerated Values supported: 0001H 2D 0002H M-Mode 0003H Spectral
>Region Data Type	(0018,6014)	1	Enumerated Values supported: 0001H Tissue 0003H PW Spectral Doppler 0004H CW Spectral Doppler
>Region Flags	(0018,6016)	1	Bit 0 = OPAQUE Bit 1 = PROTECT Bit 2 Depends on Doppler scale type
>Pixel Component Organization	(0018,6044)	1C	Pixel component calibration data does not exist for any region
>Pixel Component Mask	(0018,6046)	1C	Not used

Attribute Name	Tag	Type	Attribute Description
>Pixel Component Range Start	(0018,6048)	1C	Not used
>Pixel Component Range Stop	(0018,604A)	1C	Not used
>Pixel Component Physical Units	(0018,604C)	1C	Not used
>Pixel Component Data Type	(0018,604E)	1C	Not used
>Number of Table Break Points	(0018,6050)	1C	Not used
>Table of X Break Points	(0018,6052)	1C	Not used
>Table of Y Break Points	(0018,6054)	1C	Not used
>Number of Table Entries	(0018,6056)	1C	Not used
>Table of Pixel Values	(0018,6058)	1C	Not used
>Table of Parameter Values	(0018,605A)	1C	Not used
>Transducer Frequency	(0018,6030)	3	Supported
>Pulse Repetition Frequency	(0018,6032)	3	Supported
>Doppler Correction Angle	(0018,6034)	3	Not used
>Steering Angle	(0018,6036)	3	Not used
>Doppler Sample Volume X Position	(0018,6038)	3	Not used
>Doppler Sample Volume Y Position	(0018,603A)	3	Not used
>TM-Line Position x_0	(0018,603C)	3	Not used
>TM-Line Position y_0	(0018,603E)	3	Not used
>TM-Line Position x_1	(0018,6040)	3	Not used
>TM-Line Position y_1	(0018,6042)	3	Not used

4.5.7.2 US Image Module

This section specifies the attributes that describe ultrasound images.

TABLE 4.5-13
US IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples Per Pixel	(0028,0002)	1	Value of '1' if Photometric Interpretation element value has value 'MONOCHROME2' Value of '3' when Photometric Interpretation element value has value 'RGB' or 'YBR_FULL' or 'YBR_FULL_422'
Photometric Interpretation	(0028,0004)	1	Defined Values used: "MONOCHROME2", "RGB", "YBR_FULL" or "YBR_FULL_422"
Bits Allocated	(0028,0100)	1	Value always = 0008H
Bits Stored	(0028,0101)	1	Value always = 0008H
High Bit	(0028,0102)	1	Value always = 0007H
Planar Configuration	(0028,0006)	1	Enumerated value 0000H Enumerated Value, color-by-pixel, if Photometric Interpretation element value has value 'RGB'. Enumerated value 0001H, color-by-plane if Photometric Interpretation element value has value 'YBR_FULL' or 'YBR_FULL_422' (if image is RLE compressed).
Pixel Representation	(0028,0103)	1	Always 0000H = unsigned integer.
Frame Increment Pointer	(0028,0009)	1C	Export: Set to Frame Time if the image is multiframe IOD, Not used if the image is a single frame IOD.
Image Type	(0008,0008)	2	Value "ORIGINAL/PRIMARY" .
Lossy Image Compression	(0028,2110)	1C	Set to 01 if image is compressed using JPEG Baseline compression.
Number of Stages	(0008,2124)	2C	Number of stages in stress protocol. Sent if image is acquired in a stress test.
Number of Views in Stage	(0008,212A)	2C	Number of views in this stage of a stress protocol. Sent if image is acquired in a stress test.
Ultrasound Color Data Present	(0028,0014)	3	Not used
Referenced Overlay Sequence	(0008,1130)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Referenced Curve Sequence	(0008,1145)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used

Attribute Name	Tag	Type	Attribute Description
Stage Name	(0008,2120)	3	Name of stage of stress test. Sent if image is acquired in a stress test. The name is defined in the User Interface.
Stage Number	(0008,2122)	3	Number of stage, starting at one. Sent if image is acquired in a stress test.
View Number	(0008,2128)	3	Number of view, starting at one. Sent if image is acquired in a stress test.
Number of Event Timers	(0008,2129)	3	Not used
Event Elapsed Time(s)	(0008,2130)	3	Not used
Event Timer Name(s)	(0008,2132)	3	Not used
Anatomic Region Sequence	(0008,2218)	3	Not used
>Include 'Code Sequence Macro'			
>Anatomic Region Modifier Sequence	(0008,2220)	3	Not used
>>Include 'Code Sequence Macro'			
Primary Anatomic Structure Sequence	(0008,2228)	3	Not used
>Include 'Code Sequence Macro'			
>Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not used
>>Include 'Code Sequence Macro'			
Transducer Position Sequence	(0008,2240)	3	Not used
>Include 'Code Sequence Macro'			
>Transducer Position Modifier Sequence	(0008,2242)	3	Not used
>>Include 'Code Sequence Macro'			
Transducer Orientation Sequence	(0008,2244)	3	Not used
>Include 'Code Sequence Macro'			
>Transducer Orientation Modifier Sequence	(0008,2246)	3	Not used
>>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
Trigger Time	(0018,1060)	3	Not used
Nominal Interval	(0018,1062)	3	Not used
Beat Rejection Flag	(0018,1080)	3	Not used
Low R-R Value	(0018,1081)	3	Not used
High R-R Value	(0018,1082)	3	Not used
Heart Rate	(0018,1088)	3	Set to heart rate
Output Power	(0018,5000)	3	Not used
Transducer Data	(0018,5010)	3	Not used
Transducer Type	(0018,6031)	3	Not used
Focus Depth	(0018,5012)	3	Not used
Preprocessing Function	(0018,5020)	3	Not used
Mechanical Index	(0018,5022)	3	Not used
Bone Thermal Index,	(0018,5024)	3	Not used
Cranial Thermal Index	(0018,5026)	3	Not used
Soft Tissue Thermal Index	(0018,5027)	3	Not used
Soft Tissue-focus Thermal Index	(0018,5028)	3	Not used
Soft Tissue-surface Thermal Index	(0018,5029)	3	Not used
Depth of Scan Field	(0018,5050)	3	Not used
Image Transformation Matrix	(0018,5210)	3	Not used
Image Translation Vector	(0018,5212)	3	Not used
Overlay Subtype	(60xx,0045)	3	Not used

5. ULTRASOUND MULTIFRAME (US MF) INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

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

4.2 - IOD Implementation

5.3 - IOD Entity-Relationship Model

4.4 - IOD Module Table

4.5 - IOD Module Definition

5.2 US MF IOD IMPLEMENTATION

This section defines the implementation of US Multi-Frame image information object.

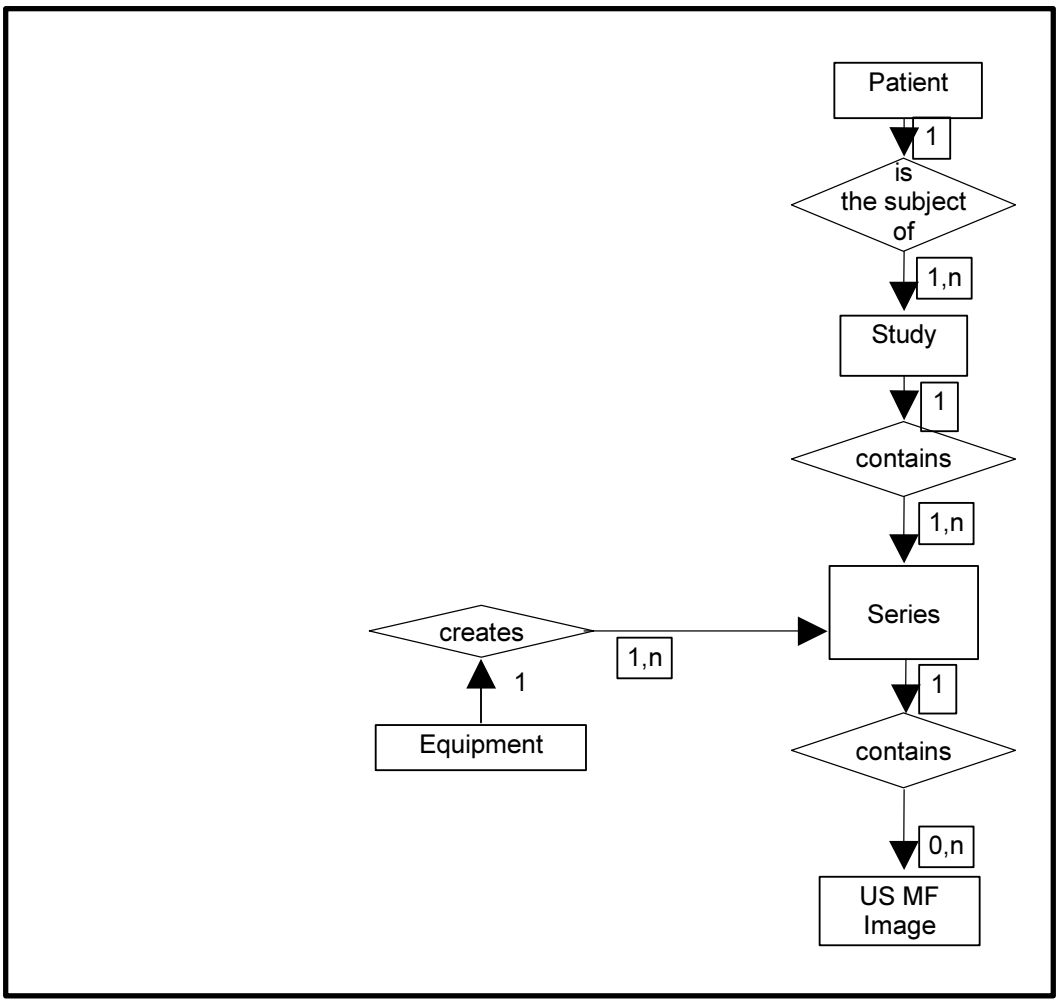
5.3 US MF ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the US MF Image interoperability schema is shown in Illustration 4.3-1. In this figure, the following diagrammatic convention is established to represent the information organization:

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 5.3-1
US MULTIFRAME IMAGE ENTITY RELATIONSHIP DIAGRAM



5.3.1 Entity Descriptions

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

5.3.2 VIVID3 Mapping of DICOM entities

TABLE 5.3-1
MAPPING OF DICOM ENTITIES TO VIVID3 ENTITIES

DICOM	VIVID3 **Entity**
Patient	Patient
Study	Exam
Series	Exam
Image	Image
Curve	Not used

5.4 IOD MODULE TABLE

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

Table 4.4-1 identifies the defined modules within the entities, which comprise the DICOM v3.0 US Multi-Frame IOD. Modules are identified by Module Name.

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

Only the US Multi-Frame Image IOD is described here. If supported the US Multi-Frame Image IOD should be described here or elsewhere. It is used in a different SOP Class however and may not be supported by all implementations.

TABLE 5.4-1
US MULTI-FRAME IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
	Patient Study	4.5.2.2
Series	General Series	4.5.3.1
Frame of Reference	Frame of Reference	Not used
	US Frame of Reference	Not used
Equipment	General Equipment	4.5.4.1
Image	General Image	4.5.5.1
	Image Pixel	4.5.5.2
	Contrast/Bolus	4.5.5.3
	Cine	5.5.1.1
	Multi-frame	5.5.1.2
	Palette Color Lookup Table	4.5.5.4
	US Region Calibration	4.5.7.1
	US Image	4.5.7.2
	Overlay Plane	Not used
	VOI LUT	4.5.5.5
	SOP Common	4.5.6.1
Curve	Not used	

The Image and Curve IEs are mutually exclusive. Each SOP Instance using this IOD shall contain exactly one of these IODs.

5.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the US Multi-Frame 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. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

5.5.1 Common Image Modules

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

5.5.1.1 Cine Module

TABLE 5.5-2
CINE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	Is set to the interframe time
Frame Time Vector	(0018,1065)	1C	Not used
Start Trim	(0008,2142)	3	Not used
Stop Trim	(0008,2143)	3	Not used
Recommended Display Frame Rate	(0008,2144)	3	Not used
Cine Rate	(0018,0040)	3	Not used
Frame Delay	(0018,1066)	3	Not used
Effective Duration	(0018,0072)	3	Not used
Actual Frame Duration	(0018,1242)	3	Not used
Preferred Playback Sequencing	(0018,1244)	3	Not used

5.5.1.2 Multi-frame Module

TABLE 5.5-3
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Is set to the interframe time
Frame Increment Pointer	(0028,0009)	1	Is set to Frame Time (0018,1063)

6. BASIC DIRECTORY INFORMATION OBJECT IMPLEMENTATION

6.1 INTRODUCTION

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

6.2 - IOD Implementation

7.3 - IOD Entity-Relationship Model

6.4 - IOD Module Table

6.5 - IOD Module Definition

6.2 BASIC DIRECTORY IOD IMPLEMENTATION

This section defines the implementation of Basic Directory information object.

6.3 BASIC DIRECTORY ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Basic Directory interoperability schema is shown in Illustration 6.3-1. In this figure, the following diagrammatic convention is established to represent the information organization:

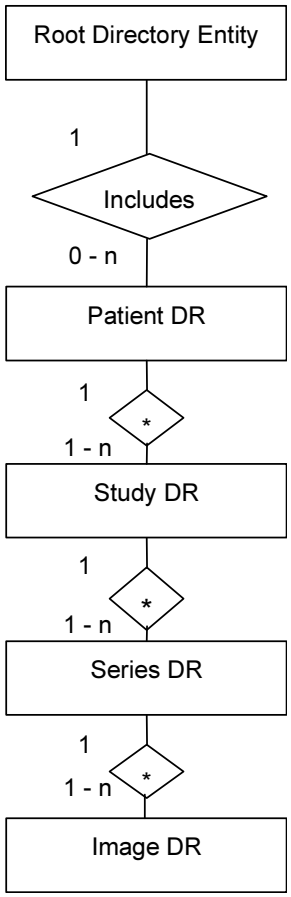
- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

6.3.1 VIVID3 Mapping of DICOM entities

TABLE 6.3-1
MAPPING OF DICOM ENTITIES TO VIVID3 ENTITIES

DICOM	VIVID3
Patient	Patient
Study	Exam
Series	Exam
Image	Image

ILLUSTRATION 6.3-1
BASIC DIRECTORY ENTITY RELATIONSHIP DIAGRAM



6.4 IOD MODULE TABLE

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

Table 6.4-1 identifies the defined modules within the entities, which comprise the Basic Directory IOD. Modules are identified by Module Name.

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

TABLE 6.4-1
BASIC DIRECTORY IOD MODULES

Entity Name	Module Name	Reference
File Set Identification	File Set Identification	6.5.1.1
Directory Information	Directory Information	6.5.2.1

The Directory Information Module is created if it does not already exist on the storage media. If it already exists, the existing information is not changed regarding patient, study, series or image data.

An existing Directory Information Module may have been obtained from application entities using removable media. These instances are external to this conformance claim and the origin of the SOP instances is outside the scope of this claim.

6.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Basic Directory 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. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

6.5.1 Common File Set identification Modules

6.5.1.1 File Set identification Module

TABLE 6.5-1
FILE-SET IDENTIFICATION MODULE

Attribute Name	Tag	Type	Attribute Description
File-set ID	(0004,1130)	2	Has NULL value
File-set Descriptor File ID	(0004,1141)	3	Not used
Specific Character Set of File-set Descriptor File	(0004,1142)	1C	Not used

6.5.2 Common Directory Information Modules

6.5.2.1 Directory Information Module

TABLE 6.5-2
DIRECTORY INFORMATION MODULE

Attribute Name	Tag	Type	Attribute Description
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	Is set
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	Is set
File-set Consistency Flag	(0004,1212)	1	FSC/FSU: Has the value 0000H: no known inconsistencies

Attribute Name	Tag	Type	Attribute Description
Directory Record Sequence	(0004,1220)	2	Is created by FSC
>Offset of the Next Directory Record	(0004,1400)	1C	Is set
>Record In-use Flag	(0004,1410)	1C	FSC/FS: Is set to FFFFH FSR: A value of 0000H: imply skipping this record Read: A value of 0000H: the record is skipped
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	Is set
>Directory Record Type	(0004,1430)	1C	The values support by FSC and FSU are PATIENT STUDY SERIES IMAGE
>Private Record UID	(0004,1432)	1C	Not used
>Referenced File ID	(0004,1500)	1C	Is set if Directory Record Type is IMAGE Contains 1 to 3 elements: The first is Patient name (if not NULL) Exam date (if not NULL) <modality>+<incremental number> The elements are: - truncated to 8 characters - mapped to upper case characters - illegal characters are mapped to underscore _
>MRDR Directory Record Offset	(0004,1504)	1C	A MRDR is not created by an FSC or FSU.
>Referenced SOP Class UID in File	(0004,1510)	1C	Is set to the SOP class UID in File
>Referenced SOP Instance UID in File	(0004,1511)	1C	Is set to the SOP instance UID in File
>Referenced Transfer Syntax UID in File	(0004,1512)	1C	Is set to the Transfer Syntax UID in File
>Record Selection Keys			See 6.5.3.

6.5.3 Definition of Specific Directory Records

6.5.3.1 Patient Directory Record Definition

TABLE 6.5-3
PATIENT KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Is filled in by FSC and FSU as in chapter 4.
Patient's Name	(0010,0010)	2	Is filled in by FSC and FSU as in chapter 4.
Patient ID	(0010,0020)	1	Is filled in by FSC and FSU as in chapter 4.
Patient's Birth Date	(0010,0030)	3	Is filled in by FSC and FSU as in chapter 4.
Patient's Sex	(0010,0040)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced Patient Sequence	(0008,1120)	3	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Class UID	(0008,1150)	1C	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Instance UID	(0008,1155)	1C	Is filled in by FSC and FSU as in chapter 4.
Patient's Birth Time	(0010,0032)	3	Is filled in by FSC and FSU as in chapter 4.
Other Patient Ids	(0010,1000)	3	Is filled in by FSC and FSU as in chapter 4.
Other Patient Names	(0010,1001)	3	Is filled in by FSC and FSU as in chapter 4.
Ethnic Group	(0010,2160)	3	Is filled in by FSC and FSU as in chapter 4.
Patient Comments	(0010,4000)	3	Is filled in by FSC and FSU as in chapter 4.

6.5.3.2 Study Directory Record Definition

TABLE 6.5-4
STUDY KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Is filled in by FSC and FSU as in chapter 4.
Study Instance UID	(0020,000D)	1C	Is filled in by FSC and FSU as in chapter 4.
Study Date	(0008,0020)	1	Is filled in by FSC and FSU as in chapter 4.
Study Time	(0008,0030)	1	Is filled in by FSC and FSU as in chapter 4.
Referring Physician's Name	(0008,0090)	2	Is filled in by FSC and FSU as in chapter 4.

Key	Tag	Type	Attribute Description
Study ID	(0020,0010)	1	Is filled in by FSC and FSU as in chapter 4. If empty a Study Id is created by the equipment.
Accession Number	(0008,0050)	2	Is filled in by FSC and FSU as in chapter 4.
Study Description	(0008,1030)	2	Is filled in by FSC and FSU as in chapter 4.
Physician(s) of Record	(0008,1048)	3	Is filled in by FSC and FSU as in chapter 4.
Name of Physician(s) Reading Study	(0008,1060)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced Study Sequence	(0008,1110)	3	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Class UID	(0008,1150)	1C	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Instance UID	(0008,1155)	1C	Is filled in by FSC and FSU as in chapter 4.
Admitting Diagnoses Description	(0008,1080)	3	Is filled in by FSC and FSU as in chapter 4.
Patient's Age	(0010,1010)	3	Is filled in by FSC and FSU as in chapter 4.
Patient's Size	(0010,1020)	3	Is filled in by FSC and FSU as in chapter 4.
Patient's Weight	(0010,1030)	3	Is filled in by FSC and FSU as in chapter 4.
Occupation	(0010,2180)	3	Is filled in by FSC and FSU as in chapter 4.
Additional Patient's History	(0010,21B0)	3	Is filled in by FSC and FSU as in chapter 4.

6.5.3.3 Series Directory Record Definition

TABLE 6.5-5
SERIES KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Is filled in by FSC or FSU as contained in the image message, if one of the tags contains extended characters
Modality	(0008,0060)	1	Is filled in by FSC and FSU as in chapter 4.
Series Instance UID	(0020,000E)	1	Is filled in by FSC and FSU as in chapter 4.
Series Number	(0020,0011)	1	Is filled in by FSC and FSU as in chapter 4.
Icon Image Sequence	(0088,0200)	3	Not used.
Series Date	(0008,0021)	3	Is filled in by FSC and FSU as in chapter 4.

Key	Tag	Type	Attribute Description
Series Time	(0008,0031)	3	Is filled in by FSC and FSU as in chapter 4.
Performing Physicians' Name	(0008,1050)	3	Is filled in by FSC and FSU as in chapter 4.
Protocol Name	(0018,1030)	3	Is filled in by FSC and FSU as in chapter 4.
Series Description	(0008,103E)	3	Is filled in by FSC and FSU as in chapter 4.
Operator's Name	(0008,1070)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced Study Component Sequence	(0008,1111)	3	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Class UID	(0008,1150)	1C	Is filled in by FSC and FSU as in chapter 4.
>Referenced SOP Instance UID	(0008,1155)	1C	Is filled in by FSC and FSU as in chapter 4.
Request Attributes Sequence	(0040,0275)	3	Is filled in by FSC and FSU as in chapter 4.
>Requested Procedure ID	(0040,1001)	1C	Is filled in by FSC and FSU as in chapter 4.
>Scheduled Procedure Step ID	(0040,0009)	1C	Is filled in by FSC and FSU as in chapter 4.
>Scheduled Procedure Step Description	(0040,0007)	3	Is filled in by FSC and FSU as in chapter 4.
>Scheduled Action Item Code Sequence	(0040,0008)	3	Is filled in by FSC and FSU as in chapter 4.
>Include 'Code Sequence Macro'			Is filled in by FSC and FSU as in chapter 4.
Performed Procedure Step ID	(0040,0253)	3	Is filled in by FSC and FSU as in chapter 4.
Performed Procedure Step Start Date	(0040,0244)	3	Is filled in by FSC and FSU as in chapter 4.
Performed Procedure Step Start Time	(0040,0245)	3	Is filled in by FSC and FSU as in chapter 4.
Performed Procedure Step Description	(0040,0254)	3	Is filled in by FSC and FSU as in chapter 4.
Performed Action Item Sequence	(0040,0260)	3	Is filled in by FSC and FSU as in chapter 4.

Key	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Is filled in by FSC and FSU as in chapter 4.
Institution Name	(0008,0080)	3	Is filled in by FSC and FSU as in chapter 4.
Station Name	(0008,1010)	3	Is filled in by FSC and FSU as in chapter 4.
Institutional Department Name	(0008,1040)	3	Is filled in by FSC and FSU as in chapter 4.
Manufacturer's Model Name	(0008,1090)	3	Is filled in by FSC and FSU as in chapter 4.
Software Versions	(0018,1020)	3	Is filled in by FSC and FSU as in chapter 4.

6.5.3.4 Image Directory Record Definition

TABLE 6.5-6
IMAGE KEYS

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Is filled in by FSC and FSU as in chapter 4.
Instance Number	(0020,0013)	1	Is filled in by FSC and FSU as in chapter 4.
Icon Image Sequence	(0088,0200)	3	Not used
Image Date	(0008,0023)	3	Is filled in by FSC and FSU as in chapter 4.
Image Time	(0008,0033)	3	Is filled in by FSC and FSU as in chapter 4.
Image Type	(0008,0008)	3	Is filled in by FSC and FSU as in chapter 4.
Rows	(0028,0010)	3	Is filled in by FSC and FSU as in chapter 4.
Columns	(0028,0011)	3	Is filled in by FSC and FSU as in chapter 4.
Number Of Frames	(0028,0008)	3	Is filled in by FSC and FSU as in chapter 4.
Photometric Interpretation	(0028,0004)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced Transfer Syntax UID in File	(0004,1512)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced SOP Instance UID in File	(0004,1511)	3	Is filled in by FSC and FSU as in chapter 4.
Referenced SOP Class in File	(0004,1510)	3	Is filled in by FSC and FSU as in chapter 4.
Contrast/Bolus Agent	(0018,0010)	2	Is filled in by FSC and FSU as in chapter 4.
Lossy Image Compression	(0028,2110)	3	Is filled in by FSC and FSU as in chapter 4.

Lossy Image Compression Ratio	(0028,2112)	3	Is filled in by FSC and FSU as in chapter 4.

6.5.3.4.1 Private Directory Record Definition

Not used.

6.5.3.5 Multi-Referenced File Directory Record Definition

Not used.

6.6 PRIVATE DATA DICTIONARY

If so configured, the scanner will send ultrasound raw data information in private data elements designated by the Private Creator element:

Element Name	Tag	VR	VM	Description
Private Creator	7FE1,00xx	LO	1	GEMS_Ultrasound_MovieGroup_001

This means that all private tags starting with 7FE1,xx will belong to the GEMS_Ultrasound_MovieGroup_001.

7. MODALITY WORKLIST INFORMATION MODEL DEFINITION

7.1 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The contents of this section are:

7.2 - Information Model Description

8.3 - Information Model Entity-Relationship Model

7.4 - Information Model Module Table

7.5 - Information Model Keys

7.2 MODALITY WORKLIST INFORMATION MODEL DESCRIPTION

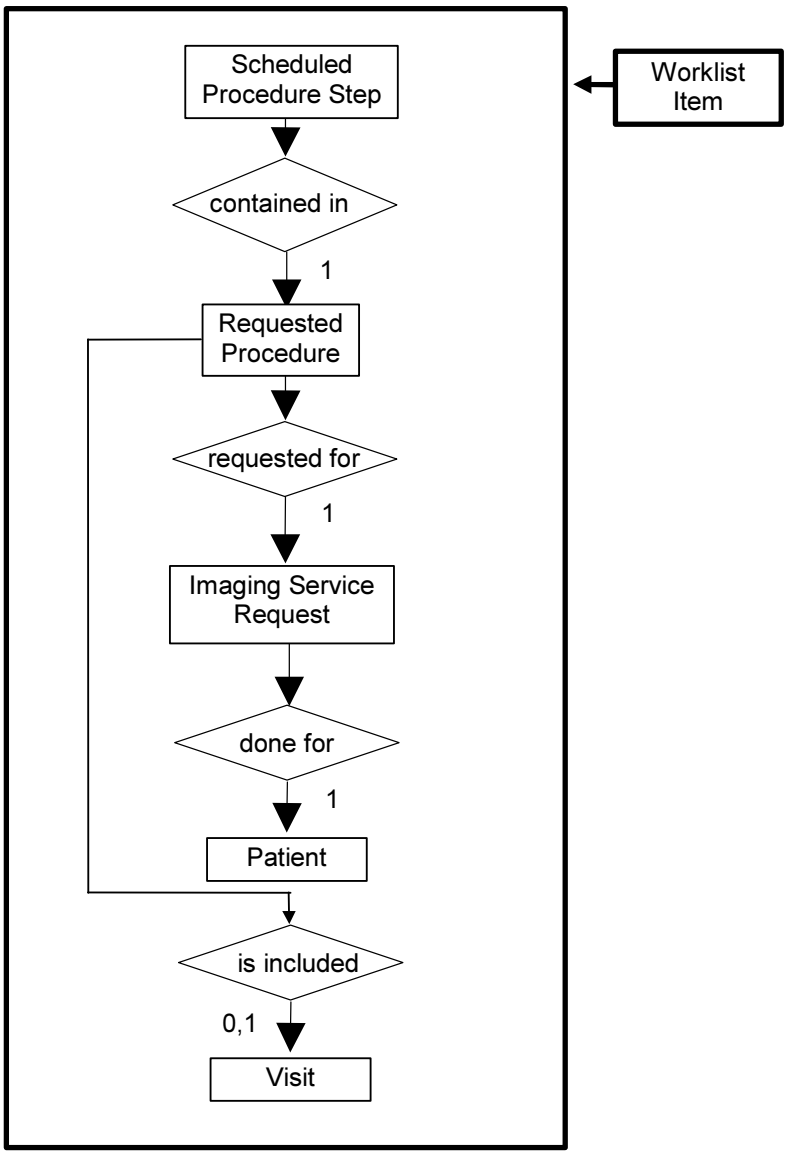
This section defines the implementation of Modality Worklist Information Model.

7.3 MODALITY WORKLIST INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Illustration 0-2. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box.
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.
- In the event that a duplicate Study Instance UID is received, only the last record of the duplicate will be displayed.

ILLUSTRATION 0-2
MODALITY WORKLIST INFORMATION MODEL E/R DIAGRAM



7.3.1 Entity Descriptions

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

7.3.1.1 Scheduled Procedure Step

Schedule Procedure Step is implemented in a basic form to allow for the user to retrieve a subset of attributes.

7.3.1.2 Requested Procedure Entity Description

Requested Procedure Step is implemented in a basic form to allow for the user to retrieve a subset of attributes.

7.3.1.3 Imaging Service Request Entity Description

Image Service is implemented in a basic form to allow for the user to retrieve a subset of attributes.

7.3.1.4 Visit Entity Description

Visit Entity is not implemented on VIVID3

7.3.1.5 Patient Entity Description

Patient Entity Description is implemented in a basic form to allow for the user to retrieve a subset of attributes.

7.3.2 VIVID3 Mapping of DICOM entities

TABLE 7.3-1
MAPPING OF DICOM ENTITIES TO VIVID3 ENTITIES

DICOM	VIVID3 Entity
Scheduled Procedure Step	Not Applicable
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Not Applicable
Patient	Patient

7.4 INFORMATION MODEL MODULE TABLE

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

Table 7.4-1 identifies the defined modules within the entities that comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

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

TABLE 7.4-1
MODALITY WORKLIST INFORMATION MODEL MODULES

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	7.5.2.21
	Scheduled Procedure Step	7.5.2.22
Requested Procedure	Requested Procedure	7.5.3.1
Imaging Service Request	Imaging Service Request	7.5.4.1
Visit	Visit Identification	7.5.5.1
	Visit Status	7.5.5.2
	Visit Relationship	7.5.5.3
	Visit Admission	Not Used
Patient	Patient Relationship	Not Used
	Patient Identification	7.5.6.1
	Patient Demographic	7.5.6.2
	Patient Medical	7.5.6.3

7.5 INFORMATION MODEL KEYS

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

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

7.5.1 Supported Matching

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

- Single Value Matching.
- Wild Card Matching.
- Range of date.

All non-required matching fields can be configured to be either enabled, enabled with a constant value or disabled. The constant value will be used as entered by user. The required fields are: Patient's Name, Patient's Id, Patient's Birth Date, Patient's Sex, Accession Number, Requested Procedure Id, Scheduled Performing Physician's Name, Scheduled Procedure Step Start Date, Scheduled Procedure Step Start Time, Scheduled Station AE Title and Modality. These will always be matched with empty fields, i.e. matching all values.

7.5.2 Scheduled Procedure Step Entity

7.5.2.1 SOP Common Module

TABLE 7.5-1
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Specific Character Set	(0008,0005)	O	1C	Yes/Yes	Matching is supported if the query contains matching keys in other than the default character repertoire.

7.5.2.2 Scheduled Procedure Step Module

TABLE 7.5-2
SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No/No	Matching is supported.
>Scheduled Station AE Title	(0040,0001)	R	1	No/No	Matching is supported.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No/No	Matching is supported.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1	No/No	Matching is supported.
>Modality	(0008,0060)	R	1	Yes/Yes (but always "US")	Matching is supported.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	Yes/Yes (to Performing Physician's Name)	Matching is supported.
>Scheduled Procedure Step Description	(0040,0007)	O	1C	Yes/Yes	Matching is supported.
>Scheduled Station Name	(0040,0010)	O	2	No/No	Matching is supported.
>Scheduled Procedure Step Location	(0040,0011)	O	2	No/No	Matching is supported.
>Requested Contrast Agent	(0032,1070)	O	2C	Yes/Yes	Not used.

>Scheduled Procedure Step ID	(0040,0009)	O	1	Yes/Yes	Matching is supported.
>Scheduled Action Item Code Sequence	(0040,0008)	O	1C	No/No	Matching is supported.

7.5.3 Requested Procedure Entity

7.5.3.1 Requested Procedure Module

TABLE 7.5-3
REQUESTED PROCEDURE MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Requested Procedure ID	(0040,1001)	O	1	Yes/Yes (to Requested Procedure ID and Study ID)	Matching is supported.
Requested Procedure Description	(0032,1060)	O	1C	Yes/Yes (to Study Description and Requested Procedure Description)	Matching is supported.
Requested Procedure Code Sequence	(0032,1064)	O	1C	No/Yes	Matching is supported.
Requested Procedure Comments	(0040,1400)	O	3	No/No	Matching is supported.
Study Instance UID	(0020,000D)	O	1	Yes/Yes	Matching is supported.
Referenced Study Sequence	(0008,1110)	O	2	Yes/Yes	Matching is supported.
>Referenced SOP Class UID	(0008,1150)	O	1C	Yes/Yes	Matching is supported.
>Referenced SOP Instance UID	(0008,1155)	O	1C	Yes/Yes	Matching is supported.
Names of Intended Recipients of Results	(0040,1010)	O	3	Yes/No (to Physician(s) of Record)	Matching is supported.

7.5.4 Imaging Service Request Entity

7.5.4.1 Imaging Service Request Module

TABLE 7.5-4
IMAGING SERVICE REQUEST MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Accession Number	(0008,0050)	O	2	Yes/Yes	Matching is supported.
Referring Physician's Name	(0008,0090)	O	2	Yes/No	Matching is supported.
Imaging Service Request Comments	(0040,2400)	O	3	No/No	Matching is supported.
Requesting Physician	(0032,1032)	O	2	No/No	Matching is supported.
Requesting Service	(0032,1033)	O	3	No/No	Matching is supported.

7.5.5 Visit Entity

7.5.5.1 Visit Identification

TABLE 7.5-5
VISIT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Admission ID	(0038,0010)	O	2	No/No	Matching is supported.
Institution Name	(0008,0080)	O	3	No	No

7.5.5.2 Visit Status

TABLE 7.5-6
VISIT STATUS MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching

Current Patient Location	(0038,0300)	O	2	No/No	Matching is supported.

7.5.5.3 Visit Relationship

TABLE 7.5-7
VISIT RELATIONSHIP MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Referenced Patient Sequence	(0008,1120)	O	2	Yes/Yes	Matching is supported.
>Referenced SOP Class UID	(0008,1150)	O	2	Yes/Yes	Matching is supported.
>Referenced SOP Instance UID	(0008,1155)	O	2	Yes/Yes	Matching is supported.

7.5.6 Patient Entity

7.5.6.1 Patient Identification

TABLE 7.5-8
PATIENT IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Patient's Name	(0010,0010)	R	1	Yes/Yes	Matching is supported.
Patient ID	(0010,0020)	R	1	Yes/Yes	Matching is supported.
Other Patient Ids	(0010,1000)	O	3	Yes/No	Matching is supported.

7.5.6.2 Patient Demographic

TABLE 7.5-9
PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Patients Birth Date	(0010,0030)	O	2	Yes/Yes	Matching is supported.
Patients Birth Time	(0010,0032)	O	3	Yes/No	Matching is supported.

Patient's Sex	(0010,0040)	O	2	Yes/Yes	Matching is supported
Patient's Size	(0010,1020)	O	3	Yes/No	Matching is supported.
Patient's Weight	(0010,1030)	O	2	Yes/No	Matching is supported.
Patient's Address	(0010,1040)	O	3	Yes/No	No
Patient's Telephone Numbers	(0010,2154)	O	3	Yes/No	No
Ethnic Group	(0010,2160)	O	3	Yes/Yes	Matching is supported.
Patient Comments	(0010,4000)	O	3	Yes/No	Matching is supported.

7.5.6.3 Patient Medical

TABLE 7.5-10
PATIENT MEDICAL MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image/MPPS	Matching
Additional Patient History	(0010,21B0)	O	3	Yes/No	Matching is supported.
Contrast Allergies	(0010,2210)	O	2	No/No	Matching is supported.
Medical Alerts	(0010,2000)	O	2	No/No	Matching is supported.
Pregnancy Status	(0010,21C0)	O	2	No/No	Matching is supported.

8. MODALITY PERFORMED PROCEDURE STEP SOP CLASS DEFINITION

8.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Modality Performed Procedure Step SOP Class, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behavior.

8.2 MODALITY PERFORMED PROCEDURE STEP SOP CLASS DEFINITION

8.2.1 IOD Description

This is the description of the DICOM tags to be sent for Modality Performed Procedure Step SOP class:

Modality Performed Procedure Step Sop Class N-CREATE, N-SET and Final State Attributes

Attribute Name	Tag	Req. Type N-CREATE	Req. Type N-SET
Performed Procedure Step Relationship			
Scheduled Step Attribute Sequence	(0040,0270)	1	Not allowed
>Study Instance UID	(0020,000D)	1	Not allowed
>Referenced Study Sequence	(0008,1110)	2, supported	Not allowed
>>Referenced SOP Class UID	(0008,1150)	1C, supported	Not allowed
>>Referenced SOP Instance UID	(0008,1155)	1C, supported	Not allowed
>Accession Number	(0008,0050)	2, supported	Not allowed
>Placer Order Number/Imaging Service Request	(0040,2016)	3, not supported	Not allowed
>Filler Order Number/Imaging Service Request	(0040,2017)	3, not supported	Not allowed
>Requested Procedure ID	(0040,1001)	2, supported	Not allowed
>Requested Procedure Description	(0032,1060)	2, supported	Not allowed
>Scheduled Procedure Step ID	(0040,0009)	2, supported	Not allowed
>Scheduled Procedure Step Description	(0040,0007)	2, supported	Not allowed
>Scheduled Action Item Code Sequence	(0040,0008)	2, supported	
>Include 'Code Sequence Macro'			
Patient's Name	(0010,0010)	2, supported	Not allowed
Patient ID	(0010,0020)	2, supported	Not allowed
Patient's Birth Date	(0010,0032)	2, supported	Not allowed
Patient's Sex	(0010,0040)	2, supported	Not allowed
>Referenced Patient Sequence	(0008,1120)	2, supported	Not allowed

Attribute Name	Tag	Req. Type N-CREATE	Req. Type N-SET
>>Referenced SOP Class UID	(0008,1150)	1C, supported	Not allowed
>>Referenced SOP Instance UID	(0008,1155)	1C, supported	Not allowed
Performed Procedure Step Information			
Performed Procedure Step ID	(0040,0253)	1	Not allowed
Performed Station AE Title	(0040,0241)	1	Not allowed
Performed Station Name	(0040,0242)	2, supported	Not allowed
Performed Location	(0040,0243)	2, supported (Institution Name, truncated if necessary to 16 characters)	Not allowed
Performed Procedure Step Start Date	(0040,0244)	1	Not allowed
Performed Procedure Step Start Time	(0040,0245)	1	Not allowed
Performed Procedure Step Status	(0040,0252)	1	3, supported
Performed Procedure Step Description	(0040,0254)	2, supported	3, supported
Performed Procedure Type Description	(0040,0255)	2, always empty	3, not supported
Procedure Code Sequence	(0008,1032)	2, supported	3, supported
>Include 'Code Sequence Macro'			
Performed Procedure Step End Date	(0040,0250)	2, always empty	3, supported
Performed Procedure Step End Time	(0040,0251)	2, always empty	3, supported
Image Acquisition Results			
Modality	(0008,0060)	1	Not allowed
Study ID	(0020,0010)	2, supported	Not allowed
Performed Action Item Code Sequence	(0040,0260)	2, supported	3, supported
>Include 'Code Sequence Macro'			
Performed Series Sequence	(0040,0340)	2, always empty	3, supported
>Performing Physician's Name	(0008,1050)	2C (Required if Sequence Item is present)	2C (Required if Sequence Item is present)
>Protocol Name	(0018,1030)	1C (Required if Sequence Item is present)	1C (Required if Sequence Item is present)
>Operator's Name	(0008,1070)	2C (Required if Sequence Item is present)	2C (Required if Sequence Item is present)
>Series Instance UID	(0020,000E)	1C (Required if Sequence Item is present)	1C (Required if Sequence Item is present)

Attribute Name	Tag	Req. Type N-CREATE	Req. Type N-SET
>Series Description	(0008,103E)	2C (Required if Sequence Item is present)	2C (Required if Sequence Item is present)
>Retrieve AE Title	(0008,0054)	2C (Required if Sequence Item is present)	2C (Required if Sequence Item is present)
>Referenced Image Sequence	(0008,1140)	2C (Required if Sequence Item is present)	2C (Required if Sequence Item is present)
>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)	1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)	1C (Required if Sequence Item is present)
>Referenced Frame Number	(0008,1160)	3, not supported	3, not supported

8.2.2 Operations

8.2.2.1 Action Information

TABLE 8.2-11
MODALITY PERFORMED PROCEDURE STEP - ACTION INFORMATION

Request Type	Attribute	Tag	Requirement Type SCU
N-CREATE	Scheduled Step Attribute Sequence	(0040,0270)	1
	>Study Instance UID	(0020,000D)	1
	>Referenced Study Sequence	(0008,1110)	2, supported
	>>Referenced SOP Class UID	(0008,1150)	1C, supported
	>>Referenced SOP Instance UID	(0008,1155)	1C, supported
	>Accession Number	(0008,0050)	2, supported
	>Placer Order Number/Imaging Service Request	(0040,2016)	3, not supported
	>Filler Order Number/Imaging Service Request	(0040,2017)	3, not supported
	>Requested Procedure ID	(0040,1001)	2, supported
	>Requested Procedure Description	(0032,1060)	2, supported
	>Scheduled Procedure Step ID	(0040,0009)	2, supported
	>Scheduled Procedure Step Description	(0040,0007)	2, supported
	Scheduled Action Item Code Sequence	(0040,0008)	2, supported
	>Include 'Code Sequence Macro'		
	Patient's Name	(0010,0010)	2, supported
	Patient ID	(0010,0020)	2, supported
	Patient's Birth Date	(0010,0032)	2, supported
	Patient's Sex	(0010,0040)	2, supported
	Performed Procedure Step ID	(0040,0253)	1

	Performed Station AE Title	(0040,0241)	1
	Performed Station Name	(0040,0242)	2, supported
	Performed Location	(0040,0243)	2, supported (Institution Name, truncated if necessary to 16 characters)
	Performed Procedure Step Start Date	(0040,0244)	1
	Performed Procedure Step Start Time	(0040,0245)	1
	Performed Procedure Step Status	(0040,0252)	1
	Performed Procedure Step Description	(0040,0254)	2, always empty
	Performed Procedure Type Description	(0040,0255)	2, always empty
	Procedure Code Sequence	(0008,1032)	2, supported
	>Include 'Code Sequence Macro'		
	Performed Procedure Step End Date	(0040,0250)	2, always empty
	Performed Procedure Step End Time	(0040,0251)	2, always empty
	Modality	(0008,0060)	1
	Study ID	(0020,0010)	2, supported
	Performed Action Item Code Sequence	(0040,0260)	2, supported
	>Include 'Code Sequence Macro'		
	Performed Series Sequence	(0040,0340)	2, always empty
	>Performing Physician's Name	(0008,1050)	2C (Required if Sequence Item is present)
	>Protocol Name	(0018,1030)	1C (Required if Sequence Item is present)
	>Operator's Name	(0008,1070)	2C (Required if Sequence Item is present)
	>Series Instance UID	(0020,000E)	1C (Required if Sequence Item is present)

	>Series Description	(0008,103E)	2C (Required if Sequence Item is present)
	>Retrieve AE Title	(0008,0054)	2C (Required if Sequence Item is present)
	>Referenced Image Sequence	(0008,1140)	2C (Required if Sequence Item is present)
	>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)
	>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)
	>Referenced Frame Number	(0008,1160)	3, not supported
N-SET	Performed Procedure Step Status	(0040,0252)	3, supported
	Performed Procedure Step Description	(0040,0254)	3, supported
	Performed Procedure Type Description	(0040,0255)	3, not supported
	Procedure Code Sequence	(0008,1032)	3, supported
	>Include 'Code Sequence Macro'		
	Performed Procedure Step End Date	(0040,0250)	3, supported
	Performed Procedure Step End Time	(0040,0251)	3, supported
	Performed Action Item Code Sequence	(0040,0260)	3, supported
	>Include 'Code Sequence Macro'		
	Performed Series Sequence	(0040,0340)	3, supported
	>Performing Physician's Name	(0008,1050)	2C (Required if Sequence Item is present)
	>Protocol Name	(0018,1030)	1C (Required if Sequence Item is present)
	>Operator's Name	(0008,1070)	2C (Required if Sequence Item is present)
	>Series Instance UID	(0020,000E)	1C (Required if Sequence Item is present)

	>Series Description	(0008,103E)	2C (Required if Sequence Item is present)
	>Retrieve AE Title	(0008,0054)	2C (Required if Sequence Item is present)
	>Referenced Image Sequence	(0008,1140)	2C (Required if Sequence Item is present)
	>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)
	>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)
	>Referenced Frame Number	(0008,1160)	3, not supported

8.2.2.2 Service Class User Behavior

VIVID3 sends N-CREATE when first image in examination is saved to a DICOM Storage SCP.

VIVID3 sends N-SET after the exam is ended. The N-SET will include all acquired images' UIDs and the status of COMPLETED or DISCONTINUED.

8.2.2.3 Status Codes

No Service Class specific status values are defined for the N-ACTION Service. See PS 3.7 for general response status codes.

9. STORAGE COMMITMENT PUSH MODEL SOP CLASS DEFINITION

9.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Storage Commitment Push Model SOP Class, the optional attributes and service elements supported, the valid range of values for mandatory and optional attributes, and the status code behavior.

9.2 STORAGE COMMITMENT PUSH MODEL SOP CLASS DEFINITION

9.2.1 IOD Description

9.2.1.1 STORAGE COMMITMENT MODULE

TABLE 9.2-1
STORAGE COMMITMENT MODULE

Attribute Name	Tag	Attribute Description
Transaction UID	(0008,1195)	Uniquely generated by the equipment
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)	Supported
>Referenced SOP Class UID	(0008,1150)	Supported
>Referenced SOP Instance UID	(0008,1155)	Supported
>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 Study Component Sequence	(0008,1111)	Not used
>Referenced SOP Class UID	(0008,1150)	Not used
>Referenced SOP Instance UID	(0008,1155)	Not used
Failed SOP Sequence	(0008,1198)	Supported
>Referenced SOP Class UID	(0008,1150)	Supported
>Referenced SOP Instance UID	(0008,1155)	Supported
>Failure Reason	(0008,1197)	Supported

TABLE 9.2-2
FAILURE REASON VALUES AND SEMANTICS

Failure Reason	Meaning	SCU Behavior	SCP Behavior
0110H	Processing failure	The request will be put in a holding queue for the user to manually retry the request.	N/A
0112H	No such object instance	The request will be put in a holding queue for the user to manually retry the request.	N/A
0213H	Resource limitation	The request will be put in a holding queue for the user to manually retry the request.	N/A
0122H	Referenced SOP Class not supported	The request will be put in a holding queue for the user to manually retry the request.	N/A
0119H	Class / Instance conflict	The request will be put in a holding queue for the user to manually retry the request.	N/A
0131H	Duplicate transaction UID	The request will be put in a holding queue for the user to manually retry the request.	N/A

9.2.2 DIMSE Service Group

DIMSE Service Element	Usage SCU/SCP
N-EVENT-REPORT	M/M
N-ACTION	M/M

9.2.3 Operations

9.2.3.1 Action Information

TABLE 9.2-3
STORAGE COMMITMENT REQUEST - ACTION INFORMATION

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU/SCP
Request Storage Commitment	1	Transaction UID	(0008,1195)	1/1
		Storage Media File-Set ID	(0088,0130)	Not used
		Storage Media File-Set UID	(0088,0140)	Not used
		Referenced SOP Sequence	(0008,1199)	1/1
		>Referenced SOP Class UID	(0008,1150)	1/1
		>Referenced SOP Instance UID	(0008,1155)	1/1
		>Storage Media File-Set ID	(0088,0130)	Not used
		>Storage Media File-Set UID	(0088,0140)	Not used
		Referenced Study Component Sequence	(0008,1111)	Not used
		>Referenced SOP Class UID	(0008,1150)	Not used
		>Referenced SOP Instance UID	(0008,1155)	Not used

9.2.3.2 Service Class User Behavior

VIVID3 sends the N-ACTION primitive (Storage Commitment Request) after successful image save to a DICOM Storage SCP. A configuration setting decides if the request will be sent for each image or for all images in an examination.

VIVID3 may request storage commitment for all generated SOP Class UIDs:

Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

The Referenced Study Component Sequence Attribute is not supported.

The Transaction UID is valid a configurable number of days. If no answer is received, the request will be removed without warning the user.

The optional Storage Media File-Set ID & UID Attributes in the N-ACTION are not supported.

On receipt of an unsuccessful N-ACTION Response Status Code from the SCP, the request will be put in a holding queue for the user to manually retry the request. Through Spooling.

9.2.3.3 Status Codes

No Service Class specific status values are defined for the N-ACTION Service. See PS 3.7 for general response status codes.

9.2.4 Notifications

9.2.4.1 Event Information

TABLE 9.2-4
STORAGE COMMITMENT RESULT - EVENT INFORMATION

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU/SCP
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	-/1
		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)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>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
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	-/1
		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)	-/1C
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>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)	-/1
		>Referenced SOP Class UID	(0008,1150)	-/1
		>Referenced SOP Instance UID	(0008,1155)	-/1
		>Failure Reason	(0008,1197)	-/1

9.2.4.2 Service Class User Behavior

If a successful answer is received, the request will be removed without warning the user.

If a non-successful answer is received, the request will be removed without warning the user after a configurable number of days.

9.2.4.3 Status Codes

No Service Class specific status values are defined for the N-EVENT-REPORT Service. See PS 3.7 for general response status code.