
DICOM

Conformance Statement

HD5 1.0

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0.1**REVISION HISTORY**

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1 CONFORMANCE STATEMENT OVERVIEW

The Philips HD5 1.0 Ultrasound system implements the necessary DICOM® services to download worklists from an information system, save acquired US Images and Structured Reports to a network storage device, CD or DVD, print to a networked hardcopy device and inform the information system about the work actually done.

Table 1 provides an overview of the supported network services.

**Table 1
NETWORK SERVICES**

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Image Storage	Yes*	No
Ultrasound Multiframe Image Storage	Yes*	No
Storage Commitment Push Model	Yes*	No
Comprehensive SR	Yes*	No
Workflow Management		
Modality Worklist	Yes*	No
Modality Performed Procedure Step	Yes*	No
Print Management		
Basic Grayscale Print Management	Yes*	No
Basic Color Print Management	Yes*	No

* Purchasable option.

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Table 2 specifies the Media Storage Application Profiles supported.

**Table 2
MEDIA SERVICES**

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk - Recordable		
STD-US-SC-MF ⁽¹⁾ -CD-R for Ultrasound images, compressed and uncompressed	Yes / Yes	Yes
STD-GEN-CDR for Structured Reports	Yes / Yes	No
DVD		
STD-US-SC-MF ⁽¹⁾ -DVD for Ultrasound images, compressed and uncompressed	Yes / Yes	Yes
STD-GEN-DVD for Structured Reports	Yes / Yes	No

(1) Note that the "MF" designator includes both Single Frame (SF) and Multi-frame (MF) ultrasound images.

**Table 3
Supported STRUCTURED REPORT Templates**

Concept Name
OB-GYN Ultrasound Procedure Report (Template ID 5000)
Adult Echocardiography Procedure Report (Template ID 5200)

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3 INTRODUCTION

3.1 AUDIENCE

This document is intended for hospital staff, health care system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.2 REMARKS

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between Philips Medical Systems and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself it is not guaranteed to ensure the desired interoperability and successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity between Philips Medical Systems and non - Philips Medical Systems equipment.
- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM standard will evolve to meet the users' future requirements. Philips Medical Systems is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

IMPORTANT NOTE TO THE READER

Interoperability

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment. It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

Validation

Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement. Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

New versions of the DICOM Standard

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to

discontinue its delivery. The user should ensure that any non-Philips provider linking to Philips equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

3.3 DEFINITIONS, TERMS AND ABBREVIATIONS

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ASCE	Association Control Service Element
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
DICOM	Digital Imaging and Communications in Medicine
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
LOINC	Logical Observation Identifiers Names and Codes
MPPS	Modality Performed Procedure Step
MSPS	Modality Scheduled Procedure Step
MWL	Modality Worklist
R	Required Key Attribute
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
PDE	Patient Data Entry
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair
SNOMED	Systematized Nomenclature of Medicine (SRT)
U	Unique Key Attribute
US	Ultrasound

3.4 REFERENCES

[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2008

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

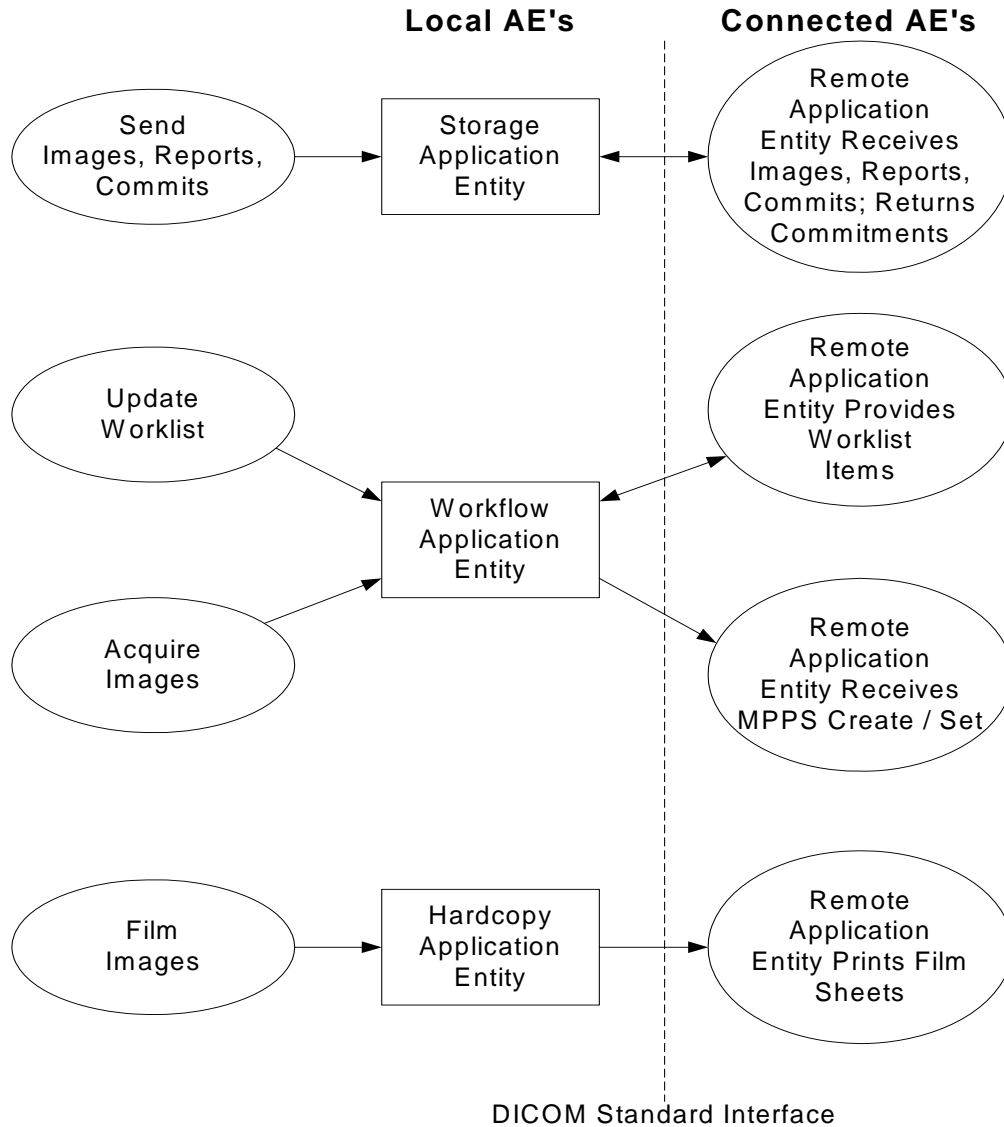


Figure 1
APPLICATION DATA FLOW DIAGRAM

- The **Storage Application Entity** sends **Images** to one or two remote AEs and **Structured Reports** to a single remote AE. Acquisition of images is associated with the local real-world activity "Freeze" then "Acquire" for single frame and "Acquire" for loops or clips. Sending or exporting of images depends on user configuration, either "Send as you go", or "Batch" when End Study is pressed, or Manual. An exam may be sent by user selection from "Review". A storage commitment server is configured for one of the two image

storage servers. A separate commit server is configured for SRs. If the remote AE is configured for Storage Commitment, the Storage AE will request Storage Commitment after End Exam. If a commitment response is successfully obtained, there will be no job remaining in the queue (viewed using CNTL-J) signaling the Auto-delete function that the exam qualifies for deletion.

- The **Workflow Application Entity** receives Worklist information from and sends MPPS information to a remote AE. It is associated with the local real-world activities “Refresh Worklist” or automatic polling and “Acquire” images. When either the “Refresh Worklist” or automatic polling are performed, the Workflow Application Entity queries a remote AE for worklist items and provides the set of worklist items matching the query request.
- Modality Performed Procedure Step (MPPS) messages are sent from the system under the following circumstances:
 - MPPS N-Create, Status = IN PROGRESS:
 - Closing the Patient Data Entry screen will result in automated creation of an MPPS Instance managed by a remote AE.
 - MPPS N-Set, Status = COMPLETE
 - Completion of the MPPS is performed as the result of an operator action of ending the exam.
 - MPPS N-Set, Status = DISCONTINUED
 - “Cancel” exam causes the “Discontinued” status to be sent.
- The ability to **Append** images and SRs to an ended exam is available. There are two fundamental methods to perform append:
 - Append from Image Review
 - Select an Ended study from the Patient Directory.
 - Select the study; choose “Open Study”.
 - Append from Patient Selection
 - Select the exam from the Patient Worklist Directory.
- The **Hardcopy Application Entity** prints images on a remote AE (Printer or print server). It is associated with the local real-world activity Acquire when a DICOM Printer is configured in the current preset, or “DICOM print” is selected with Right Button on the Exam in the system Patient Directory. Either user action creates a print queue containing one or more virtual film sheets composed from images acquired by the user. It creates and sends fully rendered pages already containing the user’s selected formatting choices. Only a single image object per sheet is sent to the printer. This print object is rather large compared to sending individual Image Box objects to the printer. If the user has both a BW and Color DICOM printer configured and selected, and is using “Send as you go”, the images containing no Color Flow or Chroma data will be sent to the BW printer, all others will be sent to the Color printer.
- Exam data is sent to all selected Store, Print and Workflow destinations simultaneously in accordance with system configuration of “Send as you go” or “Batch” at End of Exam or Manual.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of Storage Application Entity

The existence of a Network Store queue with associated network destination will activate the Storage AE. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer is started. If the association cannot be opened, the related queue’s Status is set to RETRY as displayed in the Job Manager (CNTL-J). The user may need to cancel the queue, and then restart manually. After the automatic retries have failed, the job is set to Failed. The user may select “Retry Job” to attempt to send. Deleting a job does not remove the data, as it is still present on the system. Only the request to transfer the data is removed. Once any communication issues have been resolved, retry may be selected or if the jobs were deleted, they may be queued again from the Review directory.

4.1.2.2 Functional Definition of Workflow Application Entity

“Refresh Now” attempts to download a Modality Worklist from a Modality Worklist server with studies matching the search criteria by sending a C-Find Request containing user-definable Query parameters. Query parameters are

stored in the “Advanced” tab adjacent to the MWL SCP selection in the “Servers and Roles” setup page. 10 Customizable Queries may be used, 5 are factory defaults.

Settings that may be customized are:

Query Title, Start Date or Date Range, AE Title (This system, Any or Another specific), and Modality (Ultrasound only or All Modalities). When the Workflow AE establishes an Association to a remote AE, a MWL C-Find-Rq message is sent to the MWL server. The server will transfer all matching worklist items via the open Association. The results of a successful Worklist Update will overwrite the data in the Worklist display.

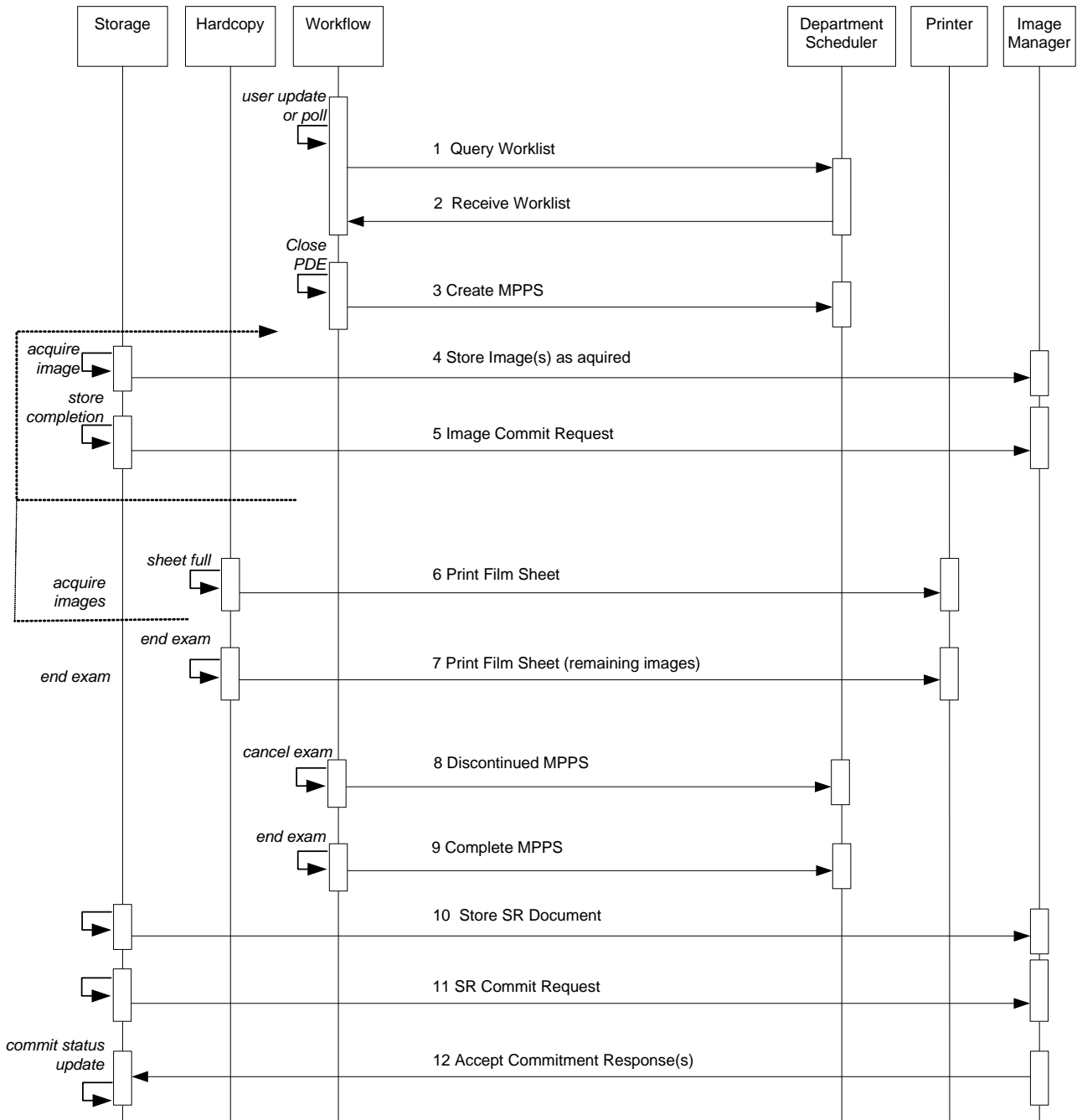
There is no queue management for Worklist.

The Workflow AE performs the creation of a MPPS Instance automatically when the PDE is closed causing an MPPS N-Create-Rq message to be sent to the MPPS server containing the status of “IN PROGRESS”. At the end of the exam, when “Completed” or “Cancel” are selected, an MPPS N-Set- Rq message is sent containing “COMPLETED” or “DISCONTINUED” respectively. MPPS message queues are listed in the Job Manager (CNTL-J) window.

4.1.2.3 Functional Definition of Hardcopy Application Entity

The existence of a print queue will activate the Hardcopy AE. An association is established with the printer(s) and the printer’s status determined. If the printer is operating normally, the film sheet print requests will be sent. If the printer is not operating normally, the print queue will set to a “Failed” state and can be restarted by the user via the queue management interface. In the case that a user has both a BW and a Color DICOM printer configured, during an exam with “Send as you go Print/Capture” selected, the images that contain color data, i.e., Color Flow Doppler or Chroma, will be sent to the Color printer only, and all other images sent only to the BW printer. There is an embedded retry mechanism that retries User Recoverable errors for up to 1 hour, waiting 20 seconds between attempts.

Sequencing of Real-World Activities



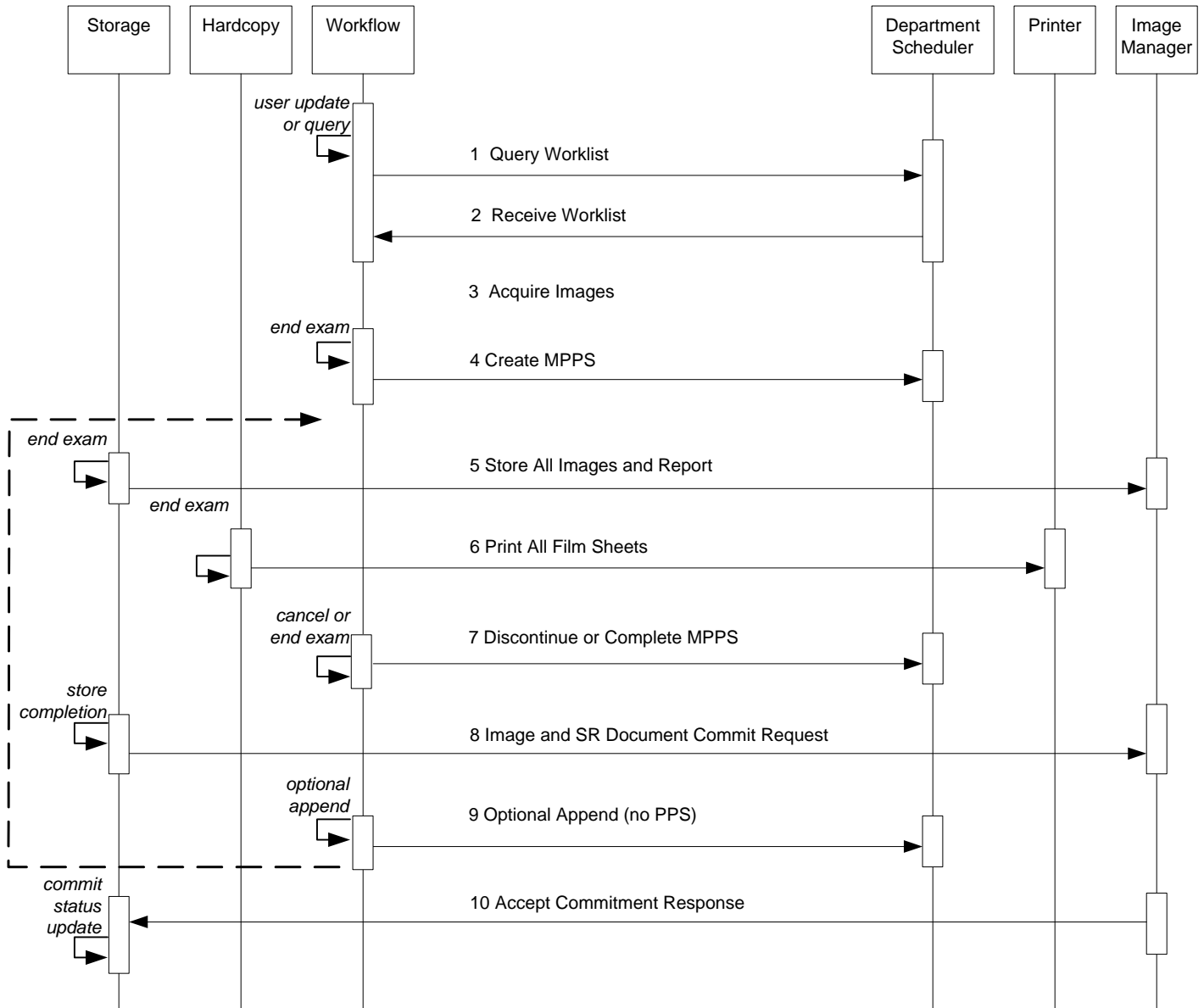
Note: Step 8 may occur prior to acquisition of the first image.

**FIGURE 2A:
SEQUENCING CONSTRAINTS –SEND AS YOU GO CONFIGURATION**

Figures 2a and 2b illustrate normal scheduled workflow conditions.

- Printing to DICOM printers may occur independent of any other DICOM activity.
- All selected store, print and workflow devices are sent data during the exam when configured for “Send as you go” or at “Batch” at end of exam or Manually.
- Selecting a study from Review for export will send to all selected devices.

Other workflow situations (e.g. unscheduled procedure steps) will have other sequencing constraints. Printing or storage could equally take place after image acquisition. Printing could be omitted completely if no printer is connected or hardcopies are not required.



**FIGURE 2B:
SEQUENCING CONSTRAINTS – CLOSE STUDY CONFIGURATION**

4.2 AE SPECIFICATIONS

4.2.1 Storage Application Entity Specification

4.2.1.1 SOP Classes

HD5 1.0 provides Standard Extended Conformance to the following SOP Classes:

Table 3
SOP CLASSES FOR AE STORAGE

SOP Class Name	SOP Class UID	SCU	SCP
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Comprehensive Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

4.2.1.2 Association Establishment Policy

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4
DICOM APPLICATION CONTEXT FOR AE STORAGE

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

The PDU size is configurable with a minimum size of 100 and a maximum size of 16,000.
The default PDU size is 16,000.

4.2.1.2.2 Number of Associations

HD5 1.0 initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Three 'Archive' destinations may be selected simultaneously, but only one job will be active at a time, the other(s) remain pending until the active job is completed or failed.

Table 5
NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE

Maximum number of simultaneous Associations	5, 1 for each configured storage device
---	---

One Primary Storage Server, one Secondary Storage Server, one Storage Commitment Server, one SR Storage Server and one SR Storage Commitment Server.

HD5 1.0 accepts Associations for N-EVENT-REPORT notifications for the Storage Commitment Push Model SOP Class.

Table 6
NUMBER OF ASSOCIATIONS ACCEPTED FOR AE STORAGE

Maximum number of simultaneous Associations	1
---	---

4.2.1.2.3 Asynchronous Nature

HD5 1.0 does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 7
ASYNCHRONOUS NATURE AS A SCU FOR AE STORAGE

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 8
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE

Implementation Class UID	1.3.46.670589.14.9001.100
Implementation Version Name	HD5 1.0

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Store Images, Loops and Structured Reports

4.2.1.3.1.1 Description and Sequencing of Activities

A user may select exams or individual images from Review and request them to be sent to multiple destinations (up to 2). Reports may not be selected individually, but are sent when “Close Study” is pressed, or when an entire study is selected from the Review Directory. When the “Send as you go” option is active, the queue is serviced continuously during the exam. There is a default 5-minute timeout for “Send as you go,” after which the association is closed. Any additional images acquired during the exam will be sent on a subsequent association.

If the C-STORE Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related Job is switched to a failed state. It can be restarted any time by user interaction.

When a system configured with selected network destinations is used without the network connected, it is considered in “Portable” mode. Each network status Icon will be Yellow with status of “Pending” for each study acquired while the network was not connected. When returning from portable, reconnecting the network cable will initiate transfer again.

If a device is configured for Storage Commitment service, the Storage AE will transmit a separate Storage Commitment request (N-ACTION) for images and one for the report, over two separate Associations. The Storage AE can only receive an N-EVENT-REPORT request in a separate subsequent association initiated by the SCP employing PDU 54H SCP/SCU Role Negotiation in the SCP’s Association Request. It cannot receive N-Event-Report-Rq messages on the same association as the N-Action-Rq.

Structured reports will contain all supported measurements and calculations created by HD5 1.0 even if they are not selected for display in the on-system report.

OB-GYN study types generate OB-GYN Ultrasound Procedure Reports and the Adult Echo Study creates Adult Echocardiography Reports. Note that there can be more than one report instance per exam, so long as they are from different study types.

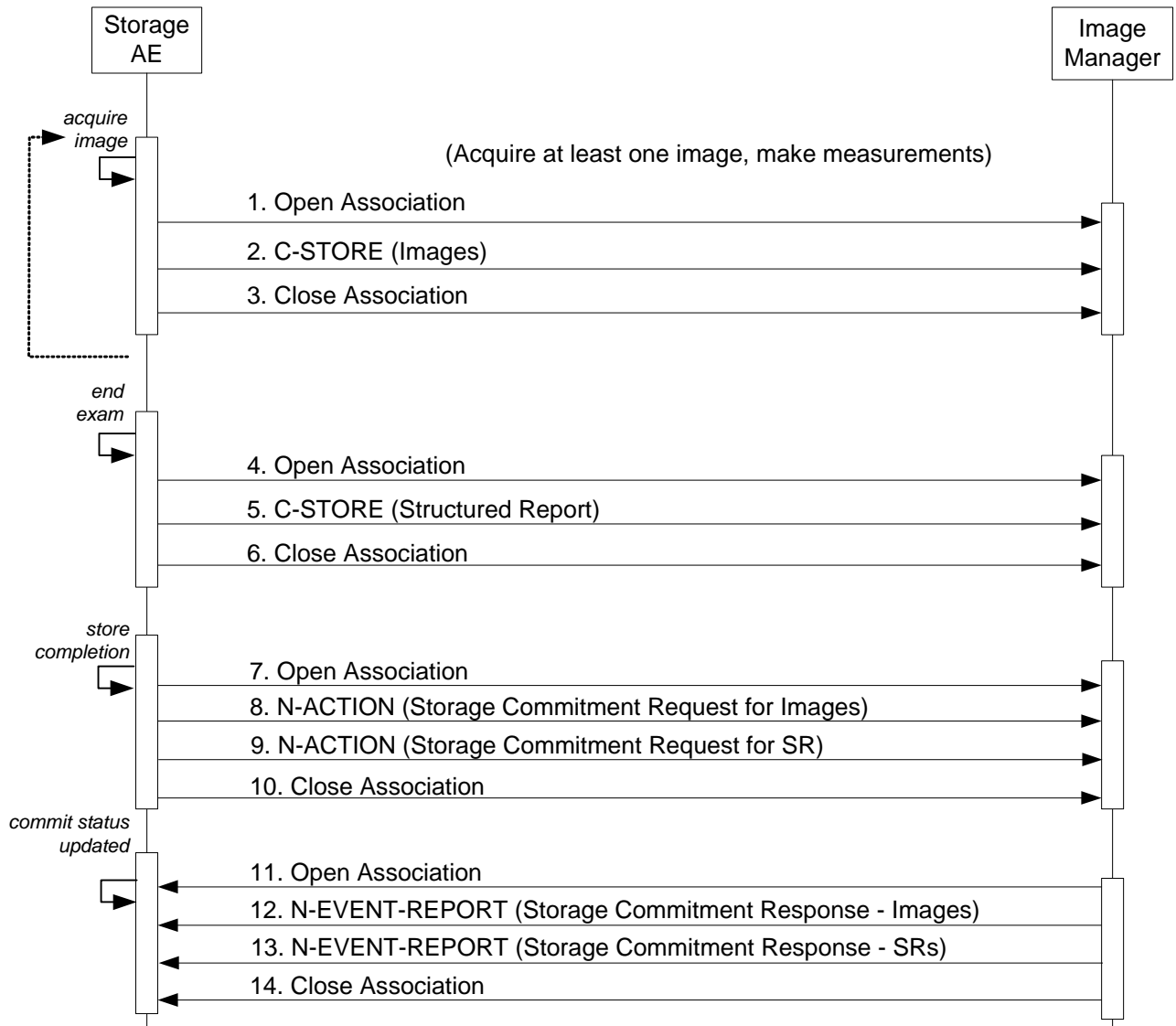


Figure 3
SEQUENCING OF ACTIVITY – SEND IMAGES AND STRUCTURED REPORT

The sequence of interactions between the Storage AE and an Image Manager is illustrated in Figure 3 for the “Store” configuration option “Send as you go.” The alternative option, “Close Study” differs only in the removal of the loop symbol on the ‘acquire images’ activity

4.2.1.3.1.2 Proposed Presentation Contexts

HD5 1.0 is capable of proposing the Presentation Contexts shown in the following table:

**Table 9
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY SEND IMAGES AND SR**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian*	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossy Baseline	1.2.840.10008.1.2.4.50		
		RLE Lossless	1.2.840.10008.1.2.5		
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossy Baseline	1.2.840.10008.1.2.4.50		
		RLE Lossless	1.2.840.10008.1.2.5		
Comprehensive Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.33	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

*The following applies to both US Image and US Multiframe Images
JPEG used if image Photometric Interpretation is:

YBR_FULL_422

RLE Lossless is used if image formats are any of:

Palette Color, RLE Compressed

RGB, RLE Compressed

MONOCHROME2, RLE Compressed

Implicit Little Endian (ILE) transfer Syntax is used when:

Palette Color, Uncompressed ILE

RGB, Uncompressed ILE

MONOCHROME2, Uncompressed ILE

Explicit Little Endian (ELE) transfer syntax is used when:

Palette Color, Uncompressed ELE

RGB, Uncompressed ELE

MONOCHROME2, Uncompressed ELE

Storage Commitment N-Action Requests are only sent to devices that are configured as the Storage Commitment server, associated with the Primary or Secondary Storage SCPs that images are sent to. SRs are sent to their own configured SCP and are Storage Commitment for SRs are handled separately from images.

4.2.1.3.1.3 SOP Specific Conformance for Image and Comprehensive Structured Report Storage SOP Classes

All Image and Comprehensive Structured Report Storage SOP Classes supported by the Storage AE exhibit the same behavior, except where stated, and are described together in this section.

Table 10 describes C-Store response behavior.

**Table 10
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP successfully stored the SOP Instance. If all SOP Instances succeed, the job is marked as complete.
*	*	Any other status code.	The Association is aborted using A-ABORT and the transfer fails. The status is logged.

The behavior of Storage AE during communication failure is summarized in Table 11.

**Table 11
STORAGE COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	Same as Service Status "Refused" in Table 10 above.
Association aborted by the SCP or network layers	Same as Service Status "Refused" in Table 10 above.

The contents of US Image, US Multi-frame Storage and Comprehensive Structured Report Storage SOP Instances conform to the DICOM IOD definitions described in Section 8.1.

**4.2.1.3.1.4 SOP Specific Conformance for Storage Commitment Push Model SOP Class
4.2.1.3.1.4.1 Storage Commitment Operations (N-ACTION)**

The Storage AE will request storage commitment for the configured device.

Table 12 summarizes the behavior of Storage AE when receiving response status codes.

**Table 12
STORAGE COMMITMENT N-ACTION RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The system waits for the N-Event-Report.
*	*	Any other status code.	The commit status remains incomplete for all objects.

Table 13 summarizes the behavior of Storage AE during communication failure.

**Table 13
STORAGE COMMITMENT COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	Same as non-success status in Table 12.
Association aborted by the SCP or network layers	Same as non-success status in Table 12.

4.2.1.3.1.4.2 Storage Commitment Tags (N-ACTION)

The Storage AE will request storage commitment using the following tags

NOTE: Storage Commitment may only be automatically requested by the system at the end of a study.

**Table 13a
STORAGE COMMITMENT N-ACTION-REQUEST MESSAGE CONTENTS**

Action Type Name	Action Type ID	Attribute	Tag	Requirement Type SCU
Request Storage Commitment	1	Transaction UID	(0008,1195)	1
		Referenced SOP Sequence	(0008,1199)	1
		>Referenced SOP Class UID	(0008,1150)	1
		>Referenced SOP Instance UID	(0008,1155)	1

4.2.1.3.1.4.3 Storage Commitment Notifications (N-EVENT-REPORT)

The Storage AE can receive an N-EVENT-REPORT notification received from the SCP via Reverse-role negotiation.

Table 14 summarizes the behavior of Storage AE when receiving Event Types within the N-EVENT-REPORT.

**Table 14
STORAGE COMMITMENT N-EVENT-REPORT BEHAVIOUR**

Event Type Name	Event Type ID	Behavior
Storage Commitment Request Successful	1	The commit status is set to complete for each object.
Storage Commitment Request Complete – Failures Exist	2	The commit status remains incomplete. The commit comment for each object is logged.

The reasons for returning specific status codes in an N-EVENT-REPORT response are summarized in Table 15.

**Table 15
STORAGE COMMITMENT N-EVENT-REPORT RESPONSE STATUS REASONS**

Service Status	Further Meaning	Error Code	Reasons
Success	Success	0000	The storage commitment result has been successfully received.

4.2.1.3.1.4.4 Storage Commitment Tags (N-EVENT-REPORT)

Tags supported for receiving an N-Event-Report message.

Table 15a lists the tags that are supported within the N-EVENT-REPORT.

**Table 15a
STORAGE COMMITMENT N-EVENT-REPORT MESSAGE CONTENTS**

Event Type Name	Event Type ID	Attribute	Tag	Requirement Type SCU
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	None
		<i>Retrieve AE Title</i>	<i>(0008,0054)</i>	<i>None</i>
		<i>Storage Media File-Set ID</i>	<i>(0088,0130)</i>	<i>None</i>
		<i>Storage Media File-Set UID</i>	<i>(0088,0140)</i>	<i>None</i>
		Referenced SOP Sequence	(0008,1199)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None
		> <i>Retrieve AE Title</i>	<i>(0008,0054)</i>	<i>None</i>
		> <i>Storage Media File-Set ID</i>	<i>(0088,0130)</i>	<i>None</i>
		> <i>Storage Media File-Set UID</i>	<i>(0088,0140)</i>	<i>None</i>
Storage Commitment Request Complete – Failures Exist	2	Transaction UID	(0008,1195)	None
		<i>Retrieve AE Title</i>	<i>(0008,0054)</i>	<i>None</i>
		<i>Storage Media File-Set ID</i>	<i>(0088,0130)</i>	<i>None</i>
		<i>Storage Media File-Set UID</i>	<i>(0088,0140)</i>	<i>None</i>
		Referenced SOP Sequence	(0008,1199)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None
		> <i>Retrieve AE Title</i>	<i>(0008,0054)</i>	<i>None</i>
		> <i>Storage Media File-Set ID</i>	<i>(0088,0130)</i>	<i>None</i>
		> <i>Storage Media File-Set UID</i>	<i>(0088,0140)</i>	<i>None</i>
		Failed SOP Sequence	(0008,1198)	None
		>Referenced SOP Class UID	(0008,1150)	None
		>Referenced SOP Instance UID	(0008,1155)	None
>Failure Reason	(0008,1197)	None		

* Italics indicate attributes supported if present.

4.2.1.4 Association Acceptance Policy

4.2.1.4.1 Activity – Receive Storage Commitment Response

4.2.1.4.1.1 Description and Sequencing of Activities

The Storage AE accepts associations for pending responses to a Storage Commitment Request only using SCP/SCU Role Negotiation; explicitly stating that the association is initiated by the SCP to the SCU. Any other will be rejected.

4.2.1.4.1.2 Accepted Presentation Contexts

Table 17 summarizes Presentation Contexts that the Storage AE accepts.

**Table 17
ACCEPTABLE PRESENTATION CONTEXTS FOR
ACTIVITY RECEIVE STORAGE COMMITMENT RESPONSE**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.1.3 SOP Specific Conformance for Storage Commitment Push Model SOP Class

4.2.1.4.1.3.1 Storage Commitment Notifications (N-EVENT-REPORT)

Upon receipt of an N-EVENT-REPORT the timer associated with the Transaction UID will be canceled.

Table 14 summarizes the behavior of Storage AE when receiving Event Types within the N-EVENT-REPORT.

Table 15 summarizes the reasons for returning specific status codes in an N-EVENT-REPORT response.

4.2.2 Workflow Application Entity Specification

4.2.2.1 SOP Classes

HD5 1.0 provides Standard Conformance to the following SOP Classes:

**Table 18
SOP CLASSES FOR AE WORKFLOW**

SOP Class Name	SOP Class UID	SCU	SCP
MWL Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

4.2.2.2 Association Establishment Policy

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 19
DICOM APPLICATION CONTEXT FOR AE WORKFLOW

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

4.2.2.2.2 Number of Associations

HD5 1.0 initiates one Association at a time for a Worklist request.

Table 20
NUMBER OF ASSOCIATIONS INITIATED FOR AE WORKFLOW

Maximum number of simultaneous Associations	2
---	---

4.2.2.2.3 Asynchronous Nature

HD5 1.0 does not support asynchronous communication.

Table 21
ASYNCHRONOUS NATURE AS A SCU FOR AE WORKFLOW

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 22
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE WORKFLOW

Implementation Class UID	1.3.46.670589.14.9001.100
Implementation Version Name	HD5 1.0

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity – Worklist Update

4.2.2.3.1.1 Description and Sequencing of Activities

Worklist queries for Modality (US) or <All> modalities may be initiated by the user or will occur at a preset interval set as one of the following:

- User may press “Refresh Now” to send a query: using the Start Date, Modality and AE Title selections made in the Modality Worklist Customizable Queries configuration page.
- The user may configure the system to search for studies scheduled for its AE Title, or it may be set to search for a different AE Title’s studies, or all.
- The system may be set* to periodically poll the worklist server. Default is 10 minutes, adjustable in one minute increments from 1 to 32,767 minutes.

* Follow Setup > System > DICOM > DICOM Preset > Change Settings for current preset > Modify in Servers & Roles > MWL SCP – Advanced > MWL Polling Frequency.

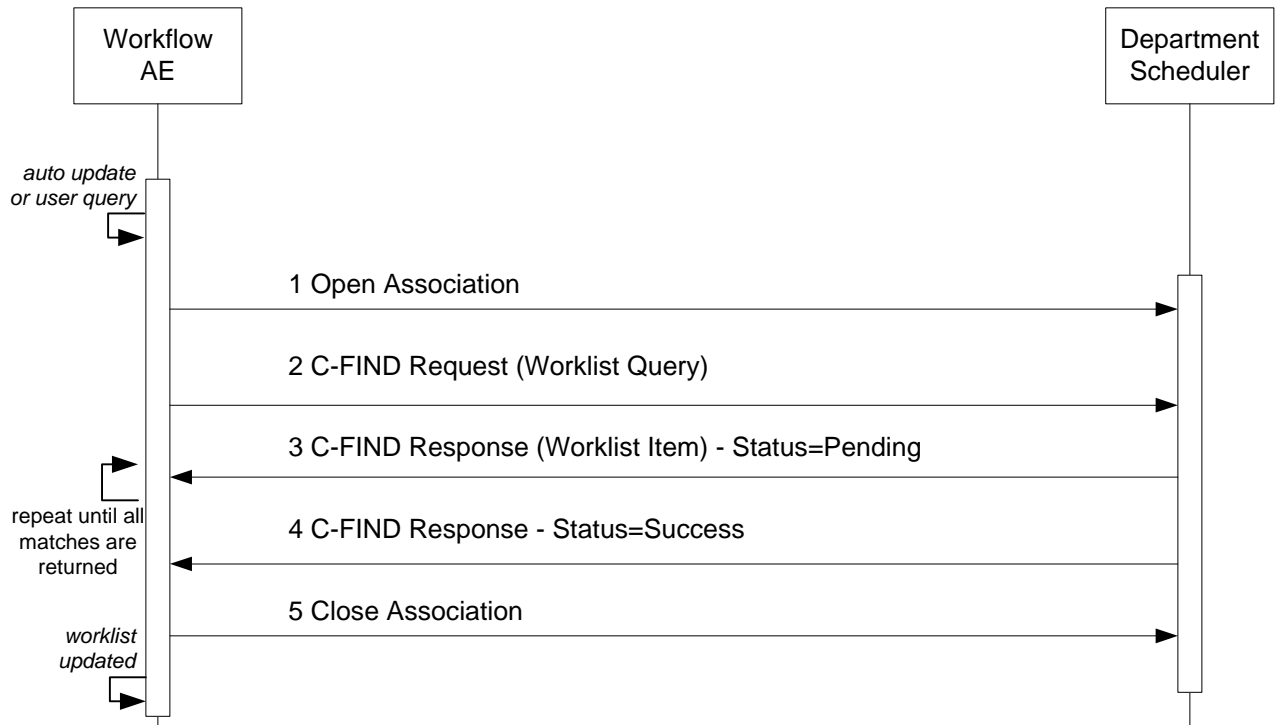


Figure 5
SEQUENCING OF ACTIVITY – WORKLIST

UPDATE

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g. a device such as a RIS or HIS which supports the MWL SOP Class as an SCP) is illustrated in Figure 5:

4.2.2.3.1.2 Proposed Presentation Contexts

HD5 1.0 will propose Presentation Contexts as shown in the following table:

Table 23
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY WORKLIST UPDATE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

4.2.2.3.1.3 SOP Specific Conformance for Modality Worklist

Table 24 summarizes the behavior of HD5 1.0 when encountering status codes in a MWL C-FIND response.

A message “query failed” will appear on the user interface if HD5 1.0 receives any other SCP response status than “Success” or “Pending.”

**Table 24
MODALITY WORKLIST C-FIND RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The system replaced the worklist from the response.
Refused	Out of Resources	A700	The Association is aborted using A-ABORT. The worklist is not replaced.
Failed	Identifier does not match SOP Class	A900	Same as “Refused” above.
Failed	Unable to Process	C000 – CFFF	Same as “Refused” above.
Cancel	Matching terminated due to Cancel request	FE00	The retrieved items are ignored.
Pending	Matches are continuing	FF00	Continue.
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported	FF01	Continue.
*	*	Any other status code.	Same as “Refused” above.

Table 25 summarizes the behavior of HD5 1.0 during communication failure.

**Table 25
MODALITY WORKLIST COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	Same as Service Status “Refused” in the table above.
Association aborted by the SCP or network layers	Same as Service Status “Refused” in the table above.

Table 26 describes the HD5 1.0 Worklist Matching Keys and requested attributes.

Unexpected attributes returned in a C-FIND response are ignored.

Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored.

Table 26
Worklist Matching Keys

Module Name Attribute Name	Tag	VR	M	R	D	IOD
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	SQ		x		
> Scheduled Station AE Title	(0040,0001)	AE	S, *	x		x
> Scheduled Procedure Step Start Date	(0040,0002)	DA	S, R, *	x	x	x
> Scheduled Procedure Step Start Time	(0040,0003)	TM		x		x
> Scheduled Procedure Step End Date	(0040,0004)	DA		x		
> Scheduled Procedure Step End Time	(0040,0005)	TM		x		
> Modality	(0008,0060)	CS	S, *	x		x
> Scheduled Performing Physician's Name ¹	(0040,0006)	PN		x		x
> Scheduled Procedure Step Description ²	(0040,0007)	LO		x	x	
> Scheduled Protocol Code Sequence ³	(0040,0008)	SQ		x		x
> Scheduled Station Name	(0040,0010)	SH		x		
> Scheduled Procedure Step Location ⁴	(0040,0011)	SH		x	x	x
> Pre-Medication	(0040,0012)	LO		x		
> Scheduled Procedure Step ID	(0040,0009)	SH		x		x
> Requested Contrast Agent	(0032,1070)	LO		x		
> Scheduled Procedure Step Status	(0040,0020)	CS		x		x
> Comments on the Scheduled Procedure Step	(0040,0400)	LT		x		
Requested Procedure						
Requested Procedure ID ⁵	(0040,1001)	SH		x		x
Reason for the Requested Procedure ⁶	(0040,1002)	LO		x		
Requested Procedure Description	(0032,1060)	LO		x		x
Study Instance UID	(0020,000D)	UI		x		x
Referenced Study Sequence	(0008,1110)	SQ		x		x
Requested Procedure Code Sequence	(0032,1064)	SQ		x		x
Names of Intended Recipients of Results	(0040,1010)	PN		x		
Requested Procedure Comments	(0040,1400)	LT		x		
Imaging Service Request						
Accession Number ⁷	(0008,0050)	SH		x	x	x
Requesting Physician	(0032,1032)	PN		x		x
Requesting Service	(0032,1033)	LO		x		x
Referring Physician's Name ⁸	(0008,0090)	PN		x	x	x
Reason for the Imaging Service Request ⁹	(0040,2001)	LO		x	x	
Imaging Service Request Comments	(0040,2400)	LT		x		
Module Name Attribute Name	Tag	VR	M	R	D	IOD
Visit Admission						
Current Patient Location ¹⁰	(0038,0300)	LO		x	x	x
Patient Identification						
Patient's Name	(0010,0010)	PN		x	x	x
Patient ID	(0010,0020)	LO		x	x	x
Other Patient IDs ¹¹	(0010,1000)	LO		x	x	x

Patient Demographic						
Patient's Birth Date ¹²	(0010,0030)	DA		x	x	x
Patient's Birth Time ¹²	(0010,0032)	TM		x	x	
Patient's Sex ¹³	(0010,0040)	CS		x	x	x
Patient's Age ¹⁴	(0010,1010)	AS				
Patient Size ¹⁵	(0010,1020)	DS		x	x	x
Ethnic Group	(0010,2160)	SH		x		x
Patient's Weight ¹⁶	(0010,1030)	DS		x	x	
Patient Comments	(0010,4000)	LT		x	x	x
Referenced Patient Sequence	(0008,1120)	SQ		x		
Patient Medical						
Medical Alerts	(0010,2000)	LO		x		
Additional Patient's History	(0010,21B0)	LT		x		
Pregnancy Status	(0010,21C0)	US		x		

* = Wildcard matching

The above table should be read as follows:

- Module Name: The name of the associated module for supported worklist attributes.
- Attribute Name: Attributes supported to build an HD5 1.0 Worklist Request Identifier.
- Tag: DICOM tag for this attribute.
- VR: DICOM VR for this attribute.
- M: Matching keys for (automatic) Worklist Update. An "S" indicates that XX supply an attribute value for Single Value Matching or additional specific tags indicated by "(S)". See ¹ below.
- R: Return keys. An "x" indicates that HD5 1.0 supply this attribute as a Return Key with zero length for Universal Matching.
- Q: Interactive Query Key. An "x" " indicates that HD5 1.0 supplies this attribute as matching key, if entered in the Patient Search dialog.
- D: Displayed keys. An "x" indicates that this worklist attribute is displayed to the user in the Patient Data Entry screen or Worklist Directory.
- IOD: An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

Notes:

- 1 Scheduled Performing Physician's Name is set in MPPS, sets the "Performed by" field in the Patient ID screen.
- 2 Scheduled Procedure Step Description is set in MPPS and images. May be used to set "Description" field in the Patient Selection screen and is mapped to "Study Description" in images. 2nd Configuration choice for "Study Description" in images.
- 3 Returned Scheduled Protocol Code Sequence contents are mapped to Scheduled Action Item Code Sequence and Performed Action Item Code Sequence in MPPS. If Code Meaning is present it is the 3rd Configuration option for Study description in images.
- 4 Scheduled Procedure Step Location sets the "Location: field in the Patient Selection Screen.
- 5 Requested Procedure Description value is set in the "Description" field of the Patient Selection screen and "Study Description" of the Patient ID screen. Manual entry to Study Description field is also sent in Image and MPPS messages.
- 6 May be used to set "Indication" field on Patient Selection screen. 1st choice, configurable.

7	Displayed on Patient ID screen and sent in MPPS and Images.
8	Sets the "Referring Physician" in Patient ID and Patient Selection screens.
9	May be used to set "Indication" field on Patient Selection screen. 2 nd choice, configurable.
10	Sets "Location" field of the Patient Selection screen. (Check, this may not be true.)
11	Displayed in "Alternate ID Number" field of Patient ID screen. Sent only in Images.
12	Birth Date and Birth Time can populate the 'DOB' field of Patient ID screen. Birth Date only is sent in MPPS messages.
13	Populates the "Gender" field in the Patient Selection screen.
14	Populates the "Age" field in the Patient Selection screen.
15	Populates "Height" fields in "Patient ID" and "Patient Selection" screens.
16	Populates "Weight" fields in "Patient ID" and "Patient Selection" screens.

4.2.2.3.2 Activity –Acquire Images

4.2.2.3.2.1 Description and Sequencing of Activities

An Association to the configured MPPS SCP system is established immediately after the first image is acquired to send the MPPS N-Create message with status of "IN PROGRESS".

The "Close Study" button causes a "COMPLETED" status in the N-Set message. An exam for which an MPPS Instance is sent with a state of "COMPLETED" can no longer be updated. However, the exam may be appended.

The "Cancel Exam" function causes a "DISCONTINUED" message. An exam for which an MPPS Instance is sent with a state of "DISCONTINUED" can also no longer be updated. However, the exam may be appended.

The system supports creation of "unscheduled cases" by allowing MPPS Instances to be communicated for locally registered Patients.

The system performs a single Performed Procedure Step at a time per Scheduled Procedure Step.

HD5 1.0 will initiate an Association to issue an:

- N-CREATE request according to the CREATE Modality Performed Procedure Step SOP Instance operation or a
- N-SET request to finalize the contents and state of the MPPS according to the SET Modality Performed Procedure Step Information operation.

The opening of a study marks the beginning of a new Modality Performed Procedure Step (MPPS). At this time, a MPPS record is created on the MPPS SCP through the use of the N-CREATE service. If the MPPS SCP is unavailable at this time, the request is queued and will be sent when the MPPS SCP is available.

When the user ends the scheduled procedure by closing the study and saving any changes, the MPPS status is "Completed". Alternatively, the user may choose to cancel acquisition, the study is saved in local storage and the MPPS status becomes "Discontinued". At this time, the Study Management AE attempts to modify the MPPS on the MPPS SCP through the use of the N-SET service. If the MPPS SCP is unavailable, the request is queued and will be sent when the MPPS SCP is available.

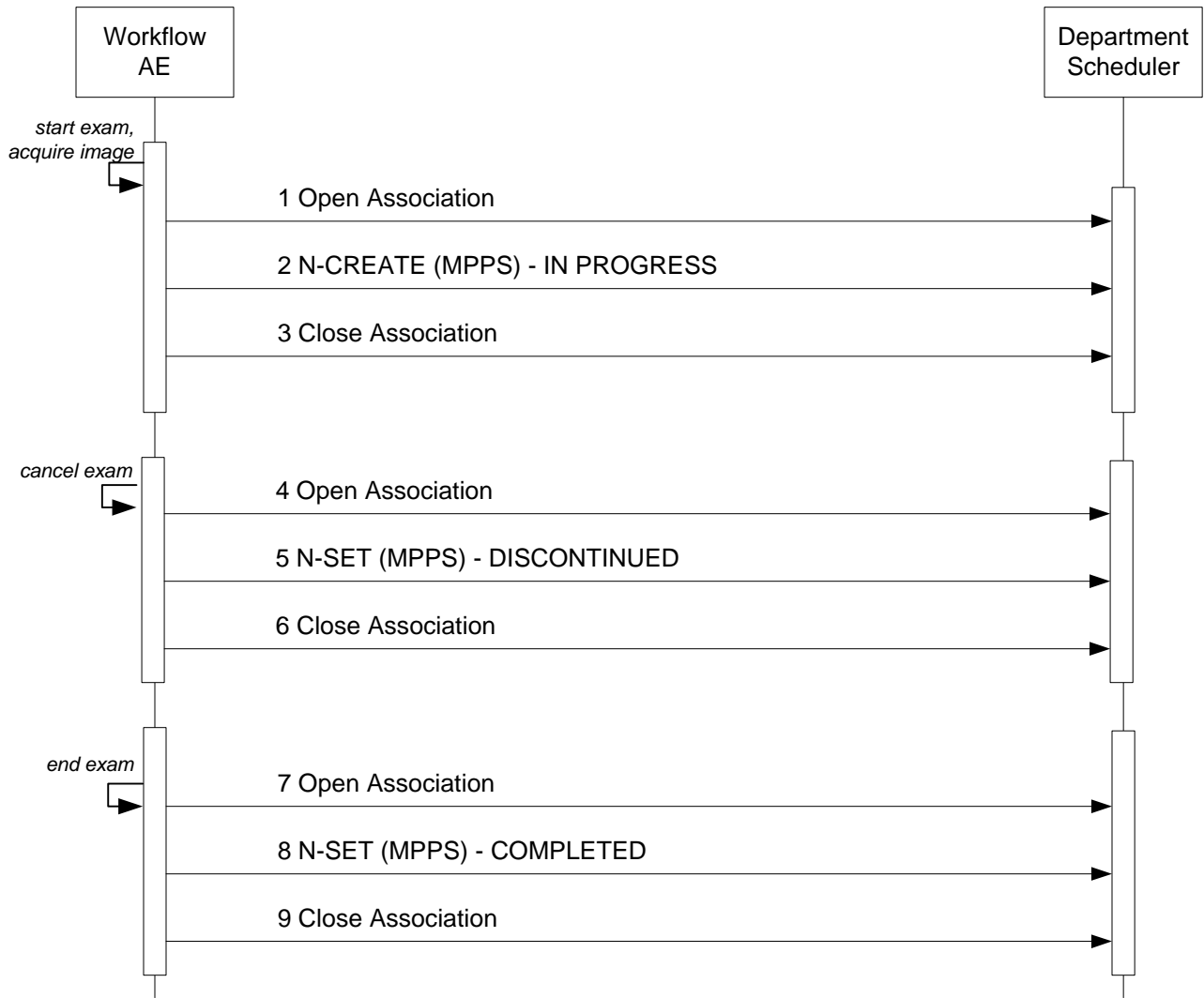


Figure 6
SEQUENCING OF ACTIVITY – ACQUIRE IMAGES

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler (e.g. a device such as a RIS or HIS which supports the MPPS SOP Class as an SCP) is illustrated in Figure 6.
 Note: The Cancel and End Exam commands are mutually exclusive. They are both represented here for illustration purposes only. Actual workflow uses one or the other for a given exam.

4.2.2.3.2 Proposed Presentation Contexts

HD5 1.0 will propose Presentation Contexts as shown in the following table:

**Table 27
PROPOSED PRESENTATION CONTEXTS FOR REAL-WORLD ACTIVITY ACQUIRE IMAGES**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.2.3.2.3 SOP Specific Conformance for MPPS

Table 28 summarizes the behavior of HD5 1.0 when encountering status codes in an MPPS N-CREATE or N-SET response.

The updated attributes are shown in Table 30 below. The “N-CREATE Usage” column shows the attributes transmitted when the status of the study changes to “IN_PROGRESS”. The “N-SET Usage” column shows the attributes transmitted when the status of the study changes to “COMPLETED” or “DISCONTINUED”.

Note: The following fields are copied from the selected MWL entry to the Patient ID screen:

- | | |
|--------------------|--|
| Accession Number, | Patient’s Birth Date, |
| Patient’s Name, | Patient’s Sex, |
| Patient’s ID, | Referring Physician’s Name, |
| Other Patient IDs, | Scheduled Performing Physician’s Name, |
| Patient’s Size, | Study description |
| Patient’s Weight, | |

Usually, the performing physician will accept the information in the Patient ID Screen, as is, however the physician / operator has the option of editing the information before starting the study. If the physician edits this information then the MPPS N-CREATE command that is sent to the MPPS server on study start will use the edited information and not the original MWL information.

**Table 28
MPPS N-CREATE / N-SET RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Failure	Processing Failure – Performed Procedure Step Object may no longer be updated	0110	The Association is aborted.
Warning	Attribute Value Out of Range	0116H	The error message is displayed.
*	*	Any other status code.	Same as “Failure” above.

Table 29 summarizes the behavior of HD5 1.0 during communication failure.

Table 29
MPPS COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	Same as "Failure" above.
Association aborted by the SCP or network layers	Same as "Failure" above.

Table 30 provides a description of the MPPS N-CREATE and N-SET request identifiers. Empty cells in the N-CREATE and N-SET columns indicate that the attribute is not sent.

Table 30
MPPS N-CREATE / N-SET REQUEST IDENTIFIER

Attribute Name	Tag	VR	N-CREATE	N-SET
Specific Character Set	(0008,0005)	CS	See Section 6 for details.	
Modality	(0008,0060)	CS	US	
Referenced Patient Sequence	(0008,1120)	SQ	If available from MWL, else NULL	
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.3.1.2.1.1 No value sent for unscheduled study.	
>Referenced SOP Instance UID	(0008,1155)	UI	No value sent for unscheduled study.	
Patient's Name	(0010,0010)	PN	As received from MWL or entered in PDE.	
Patient ID	(0010,0020)	LO	From Modality Worklist or user input to the "MRN" field. MWL value may be edited.	
Patient's Birth Date	(0010,0030)	DA	Same as above, except "Patient's Birth Date" field.	
Patient's Sex	(0010,0040)	CS	Same as above, except "Gender" field.	
Study ID	(0020,0010)	SH	From Modality Worklist. MWL value may not be edited. If no MWL, null	
Performed Station AE Title	(0040,0241)	AE	AE Title from configuration (Changing AE Title requires power cycle to be used.)	
Performed Station Name	(0040,0242)	SH	Same as "Performed Station AE Title tag above.	
Performed Location	(0040,0243)	SH	If available from MWL, else NULL	
Performed Procedure Step Start Date	(0040,0244)	DA	Actual start date (on close of PDE screen)	
Performed Procedure Step Start Time	(0040,0245)	TM	Actual start time (on close of PDE screen)	
Procedure Code Sequence	(0008,1032)	SQ	Mapped from Requested	As received from MWL

Attribute Name	Tag	VR	N-CREATE	N-SET
			Procedure Code Sequence (0032,1064) from MWL No value sent for unscheduled study.	No value sent for unscheduled study.
>Code Value	(0008,0100)	SH	As received from MWL No value sent for unscheduled study.	As received from MWL No value sent for unscheduled study.
>Coding Scheme Designator	(0008,0102)	SH	As received from MWL No value sent for unscheduled study.	As received from MWL No value sent for unscheduled study.
>Coding Scheme Version	(0008,0103)	SH	As received from MWL No value sent for unscheduled study.	As received from MWL No value sent for unscheduled study.
>Code Meaning	(0008,0104)	LO	As received from MWL No value sent for unscheduled study.	As received from MWL No value sent for unscheduled study.
Performed Procedure Step End Date	(0040,0250)	DA	Zero length	Actual end date
Performed Procedure Step End Time	(0040,0251)	TM	Zero length	Actual end time
Performed Procedure Step Status	(0040,0252)	CS	IN PROGRESS	COMPLETED or DISCONTINUED
Performed Procedure Step ID	(0040,0253)	SH	From MWL. If no MWL, auto generated.	
Performed Procedure Step Description	(0040,0254)	LO	From MWL. If no MWL, from "Study Description" field in PDE.	
Performed Procedure Type Description	(0040,0255)	LO	If present in MWL, else "Indication" field in PDE.	
Performed Protocol Code Sequence	(0040,0260)	SQ	Zero length, or mapped from MWL Scheduled Protocol Code Sq (0040,0008)	Same
Scheduled Step Attributes Sequence	(0040,0270)	SQ		
>Accession Number	(0008,0050)	SH	From MWL or user PDE input. MWL value may be edited.	
>Referenced Study Sequence	(0008,1110)	SQ	One item per item in the MWL Reference Study Sequence. Absent if unscheduled.	
>>Referenced SOP Class UID	(0008,1150)	UI	Same value as in of the Reference Study Sequence in the MWL	
>>Referenced SOP Instance UID	(0008,1155)	UI	Same value as in of the Reference Study Sequence in the MWL	

Attribute Name	Tag	VR	N-CREATE	N-SET
>Study Instance UID	(0020,000D)	UI	Same value as in MWL attribute or auto generated	
>Requested Procedure Description	(0032,1060)	LO	Same value as in MWL attribute, 1 st Choice, from "Study Description" in PDE, else NULL	
>Scheduled Procedure Step Description	(0040,0007)	LO	Same value as in MWL attribute, else NULL	
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	Same value as in MWL attribute, else NULL	
>Scheduled Procedure Step ID	(0040,0009)	SH	Same value as in MWL attribute, else NULL	
>Requested Procedure ID	(0040,1001)	SH	Same value as in MWL attribute, else NULL	
Performed Series Sequence	(0040,0340)	SQ		One item per acquired series
>Retrieve AE Title	(0008,0054)	AE	Zero Length	Same
>Series Description	(0008,103E)	LO	Zero Length	Same
>Performing Physician's Name	(0008,1050)	PN	From the "Performed by" field in PDE	From the "Performed by" field in PDE
>Operator's Name	(0008,1070)	PN	Suspect From the "Performed by" field in PDE	Same
>Referenced Image Sequence	(0008,1140)	SQ	Zero Length	Zero Length
>Protocol Name	(0018,1030)	LO	"CLR Standard"	"CLR Standard"
>Series Instance UID	(0020,000E)	UI	Auto Generated	Same
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	SQ	Zero Length	Zero Length

4.2.2.4 Association Acceptance Policy

The Workflow Application Entity does not accept Associations.

4.2.3 Hardcopy Application Entity Specification

4.2.3.1 SOP Classes

HD5 1.0 provides Standard Conformance to the following SOP Classes:

Table 31
SOP CLASSES FOR AE HARDCOPY

SOP Class Name	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No

The Print Meta SOP Classes are defined by the following set of supported SOP Classes:

- Basic Film Session SOP Class
- Basic Film Box SOP Class
- Basic Grayscale (or Color) Image Box SOP Class
- Printer SOP Class

4.2.3.2 Association Establishment Policy

4.2.3.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 32
DICOM APPLICATION CONTEXT FOR AE HARDCOPY

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

4.2.3.2.2 Number of Associations

HD5 1.0 initiates one Association at a time for each configured hardcopy device. Multiple hardcopy devices can be configured.

Table 33
NUMBER OF ASSOCIATIONS INITIATED FOR AE HARDCOPY

Maximum number of simultaneous Associations	2
---	---

4.2.3.2.3 Asynchronous Nature

HD5 1.0 does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 34
ASYNCHRONOUS NATURE AS A SCU FOR AE HARDCOPY

Maximum number of outstanding asynchronous transactions	1
---	---

4.2.3.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 35
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE HARDCOPY

Implementation Class UID	1.3.46.670589.14.9001.100
Implementation Version Name	HD5 1.0

4.2.3.3 Association Initiation Policy

4.2.3.3.1 Activity – Film Images

4.2.3.3.1.1 Description and Sequencing of Activities

The system composes images onto film sheets and sends print requests to job queue.

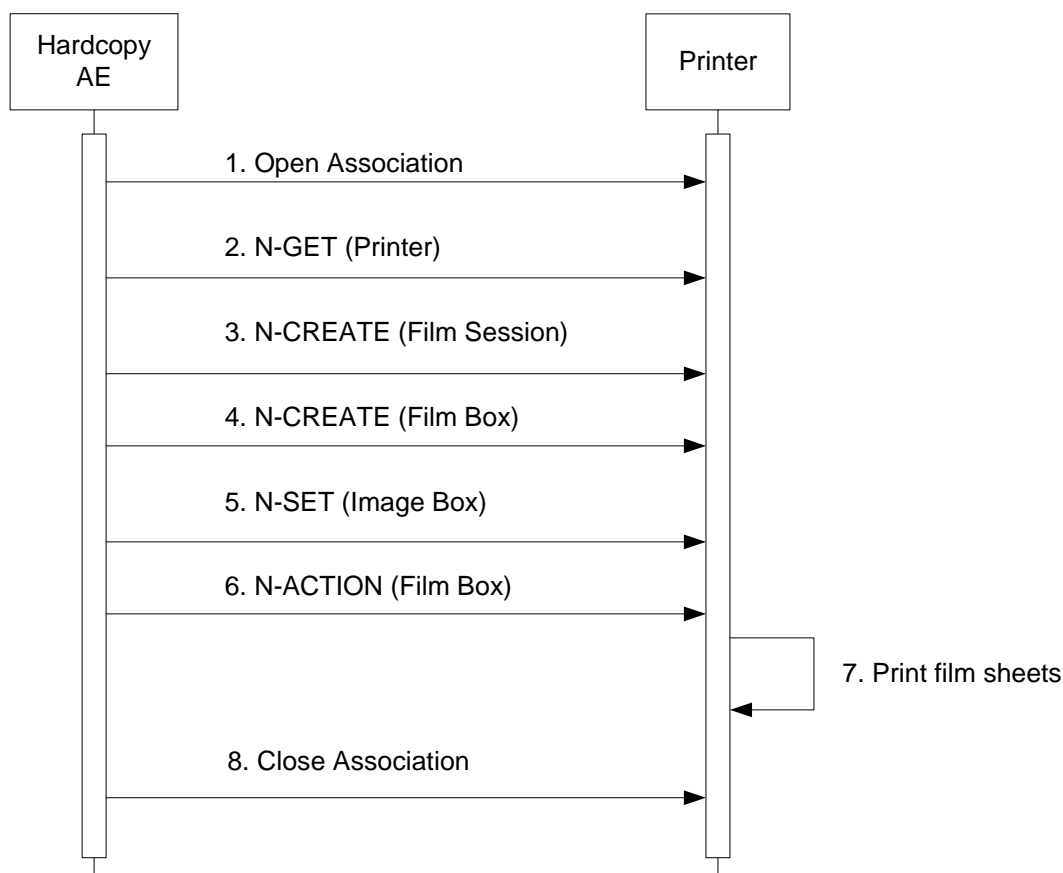


Figure 7
SEQUENCING OF ACTIVITY – PRINT IMAGES

Figure 7 illustrates a typical sequence of DIMSE messages sent over an association between Hardcopy AE and a Printer. Two DICOM Printers may be simultaneously configured, one for BW and one for Color prints.

If both BW and Color printers are configured and selected, the user may choose to automatically send BW prints only to the BW printer and color prints only to the color printer. This feature may only be used while configured for “Send as you go”, during the exam. Re-selecting the exam after it has been ended will send all images to both printers. If less than a full page is sent, then the remaining blank spaces will be sent black.

Status of the print-job is reported through the Job Manager (CNTL-J). Only one job will be active at a time for each separate hardcopy device. If any Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related Job is switched to a failed state. It can be restarted any time by user interaction.

4.2.3.3.1.2 Proposed Presentation Contexts

Table 36 shows the Presentation Contexts HD5 1.0 is capable of proposing.

**Table 36
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY FILM IMAGES**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.3.3.1.3 Common SOP Specific Conformance for all Print SOP Classes

Table 37 summarizes the general behavior of Hardcopy AE during communication failure. This behavior is common for all SOP Classes supported by Hardcopy AE.

**Table 37
HARDCOPY COMMUNICATION FAILURE BEHAVIOR**

Exception	Behavior
Timeout	The Association is aborted and reported as "Failed."
Association aborted by the SCP or network layers	"Network Communication Failure" is reported.

4.2.3.3.1.4 SOP Specific Conformance for the Printer SOP Class

Hardcopy AE supports the following DIMSE operations and notifications for the Printer SOP Class:

— N-GET

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.4.1 Printer SOP Class Operations (N-GET)

Hardcopy AE uses the Printer SOP Class N-GET operation to obtain information about the current printer status. Table 38 lists the attributes obtained via N-GET.

**Table 38
PRINTER SOP CLASS N-GET RESPONSE ATTRIBUTES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Printer Status	(2110,0010)	CS	Provided by Printer	ALWAYS	Printer
Printer Status Info	(2110,0020)	CS	Provided by Printer	ALWAYS	Printer

The Printer Status information is evaluated as follows:

1. If Printer status (2110,0010) is NORMAL, the print-job continues to be printed.
2. If Printer status (2110,0010) is FAILURE, the print-job is marked as failed.
3. If Printer status (2110,0010) is WARNING, the print-job continues to be printed.

Table 39 summarizes the behavior of Hardcopy AE when encountering status codes in an N-GET response.

**Table 39
PRINTER SOP CLASS N-GET RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The request to get printer status information was success.
*	*	Any other status code.	Same as Timeout above.

4.2.3.3.1.4.2 Printer SOP Class Notifications (N-EVENT-REPORT)

Hardcopy AE is capable of receiving an N-EVENT-REPORT request at any time during an association.

Table 40 summarizes the behavior of Hardcopy AE when receiving Event Types within the N-EVENT-REPORT.

**Table 40
PRINTER SOP CLASS N-EVENT-REPORT BEHAVIOUR**

Event Type Name	Event Type ID	Behavior
Normal	1	The print-job continues to be printed.
Warning	2	The print-job. For user-recoverable warnings, the job fails and a 1-hour retry period starts, retrying every 20 seconds.
Failure	3	The print-job is marked as failed.
*	*	Status code of 0113H

Table 41 summarizes the reasons for returning specific status codes in a N-EVENT-REPORT response.

**Table 41
PRINTER SOP CLASS N-EVENT-REPORT RESPONSE STATUS REASONS**

Service Status	Further Meaning	Error Code	Reasons
Success	Success	0000	The notification event has been successfully received.
Failure	No Such Event Type	0113H	An invalid Event Type ID was supplied in the N-EVENT-REPORT request.
Failure	Processing Failure	0110H	An internal error occurred during processing of the N-EVENT-REPORT. A short description of the error will be returned in Error Comment (0000,0902).

4.2.3.3.1.5 SOP Specific Conformance for the Film Session SOP Class

Hardcopy AE supports the following DIMSE operations for the Film Session SOP Class:

— N-CREATE

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.5.1 Film Session SOP Class Operations (N-CREATE)

Table 42 lists the attributes supplied in an N-CREATE Request.

**Table 42
FILM SESSION SOP CLASS N-CREATE REQUEST ATTRIBUTES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	(2000,0010)	IS	Default 1. Range is 1 – 99.	ALWAYS	USER
Print Priority	(2000,0020)	CS	HIGH	ALWAYS	AUTO
Medium Type	(2000,0030)	CS	BLUE FILM, CLEAR FILM or PAPER and 'Printer Specific' options*	ALWAYS	USER
Film Destination	(2000,0040)	CS	MAGAZINE or PROCESSOR and 'Printer Specific' options *	ALWAYS	USER
Film Session Label	(2000,0050)	LO	Philips Medical Systems	ALWAYS	AUTO

*Dependent on the specific printer selected

Table 43 summarizes the behavior of Hardcopy AE when encountering status codes in a N-CREATE response.

**Table 43
FILM SESSION SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	Attribute Value Out of Range	0116H	System continues operations.
Warning	Attribute List Error	0107H	Same as above.
*	*	Any other status code.	The Association is aborted and the print-job fails.

4.2.3.3.1.7 SOP Specific Conformance for the Film Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Film Box SOP Class:

- N-CREATE
- N-ACTION

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.7.1 Film Box SOP Class Operations (N-CREATE)

Table 47 lists the attributes supplied in an N-CREATE Request.

**Table 47
FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	ST	STANDARD\1,1	ALWAYS	AUTO
Referenced Film Session Sequence	(2010,0500)	SQ	Sequence of Items	ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	AUTO
Film Orientation	(2010,0040)	CS	PORTRAIT or LANDSCAPE	ALWAYS	USER
Film Size ID	(2010,0050)	CS	Default – 8INX10IN and DICOM Defined Terms: 8INX10IN, 8_5INX11IN, 10INX12IN, 10INX14IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, A4, A3 and 'Printer Specific' options.	ALWAYS	AUTO/USER
Magnification Type	(2010,0060)	CS	NONE, CUBIC, BILINEAR, REPLICATE, 'Printer Specific' options	ANAP	AUTO/USER
Border Density	(2010,0100)	CS	Black	ANAP	AUTO/USER
Empty Image Density	(2010,0110)	CS	Black	ANAP	AUTO/USER
Min Density	(2010,0120)	US	User editable 0-999	ANAP	AUTO/USER
Max Density	(2010,0130)	US	User editable 0-999	ALWAYS	AUTO/USER
Trim	(2010,0140)	CS	NO	ALWAYS	AUTO
Configuration Information	(2010,0150)	ST	DICOM supports a "config ID#" or a "config string". Check "Printer Catalog" for appropriate data.	ALWAYS	AUTO/USER

Table 48 summarizes the behavior of Hardcopy AE when encountering status codes in a N-CREATE response.

**Table 48
FILM BOX SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.

Service Status	Further Meaning	Error Code	Behavior
Warning	Requested Max Density outside of printer's operating range	B605H	The N-CREATE operation is considered successful but the status meaning is logged.
*	*	Any other status code.	The Association is aborted and the job failed.

4.2.3.3.1.7.2 Film Box SOP Class Operations (N-ACTION)

The Hardcopy AE issues an N-ACTION Request to instruct the Print SCP to print the contents of the Film Box.

Table 49 summarizes the behavior of Hardcopy AE when encountering status codes in an N-ACTION response.

**Table 49
FILM BOX SOP CLASS N-ACTION RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. The film has been accepted for printing.
Warning	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B603H	The Association is aborted and the job is failed.
Failure	Unable to create Print Job SOP Instance; print queue is full.	C602	Same as B603H above.
*	*	Any other status code.	Same as B603H above.

4.2.3.3.1.8 SOP Specific Conformance for the Image Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Image Box SOP Class:

— N-SET

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.8.1 Image Box SOP Class Operations (N-SET)

Table 50 lists the attributes supplied in an N-SET Request.

**Table 50
IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1	ALWAYS	AUTO
Polarity	(2020,0020)	CS	NORMAL	ALWAYS	AUTO
Basic Grayscale Image Sequence	(2020,0110)	SQ	Used for BW (Monochrome2) print	ALWAYS*	AUTO
Basic Color Image Sequence	(2020,0111)	SQ	Used for Color (RGB) print	ALWAYS*	AUTO
>Samples Per Pixel	(0028,0002)	US	1 for Monochrome2 3 for RGB	ALWAYS	AUTO

>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2 RGB	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	"01" for Color-by-plane "00" for Color-by-Pixel, Used only for RGB print.	ANAP	USER
>Rows	(0028,0010)	US	Depends on film size, number of rows for entire sheet of film "Default is 5216"	ALWAYS	See Printer Catalog
>Columns	(0028,0011)	US	Depends on film size, number of columns for entire sheet of film "Default is 4096"	ALWAYS	See Printer Catalog
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OW	Pixels of rendered film sheet.	ALWAYS	AUTO

* Mutually exclusive attributes

Table 51 summarizes the behavior of Hardcopy AE when encountering status codes in a N-SET response.

**Table 51
IMAGE BOX SOP CLASS N-SET RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Failure	Insufficient memory in printer to store the image.	C605	The Association is aborted and the job is failed.
*	*	Any other status code.	Same as C605 above.

4.2.3.4 Association Acceptance Policy

The Hardcopy Application Entity does not accept Associations.

4.2.4 Verification Application Entity specification

4.2.4.1 SOP Class

HD5 1.0 provides Standard Conformance to the following SOP Class:

Table 51.1
SOP CLASSES FOR AE VERIFICATION

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	Yes

4.2.4.2 Association Establishment Policy

4.2.4.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 51.2
DICOM APPLICATION CONTEXT FOR AE VERIFICATION

Application Context Name	1.2.840.10008.3.1.1.1
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4.2.4.2.2 Number of Associations

HD5 1.0 initiates one Association at a time for a Verification request.

Table 51.31
NUMBER OF ASSOCIATIONS INITIATED FOR AE VERIFICATION

Maximum number of simultaneous Associations	Up to 10, one for each configured remote device
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Table 51.32
NUMBER OF ASSOCIATIONS ACCEPTED FOR AE VERIFICATION

Maximum number of simultaneous Associations	Unlimited, however, calling AE must be already configured in HD5 1.0.
---	---

51.2.4.2.4 Asynchronous Nature

HD5 1.0 does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 51.4
ASYNCHRONOUS NATURE AS A SCU FOR AE VERIFICATION

Maximum number of outstanding asynchronous transactions	1
---	---

51.2.4.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 51.5
DICOM IMPLEMENTATION CLASS AND VERSION FOR AE VERIFICATION

Implementation Class UID	1.3.46.670589.14.9001.100
Implementation Version Name	HD5 1.0

4.2.4.3 Association Initiation Policy
4.2.4.3.1 Activity – Verify as SCU and SCP
4.2.4.3.2 Description and Sequencing of Activities

SCU: The user can verify the existence of a DICOM server on the hospitals network, through a button in the 'DICOM Setup' screen. When the user presses this button, HD5 1.0 will initiate the association.

Only one association is established for each verification attempt. However, the proposed presentation contexts not only includes the 'Verification SOP class' but also includes all the SOP classes that HD5 1.0 could possibly be connected to as Servers. This is done in order to retrieve the capabilities of the remote Server.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU /SCP	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None
US Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5	SCU	None
Comprehensive Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.33	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.3.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta	1.2.840.10008.5.1.1.1.8	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Presentation LUT	1.2.840.10008.5.1.1.2.3	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

HD5 1.0 initiates an Association in order to issue:

- C-ECHO request according to the Verification SOP Class.

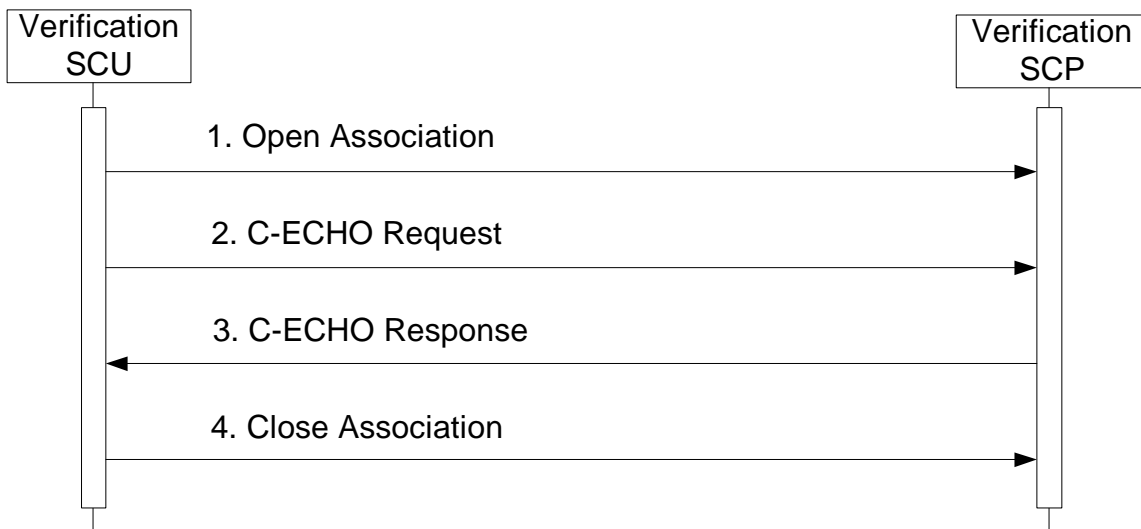


Figure 8a
SEQUENCING OF ACTIVITY – ISSUE VERIFY

SCP: The system listens on the port configured on the “This System” configuration screen for Verification requests initiated by other remote devices. The calling device AE must already be configured as a remote device in HD5 1.0 or the association is rejected.

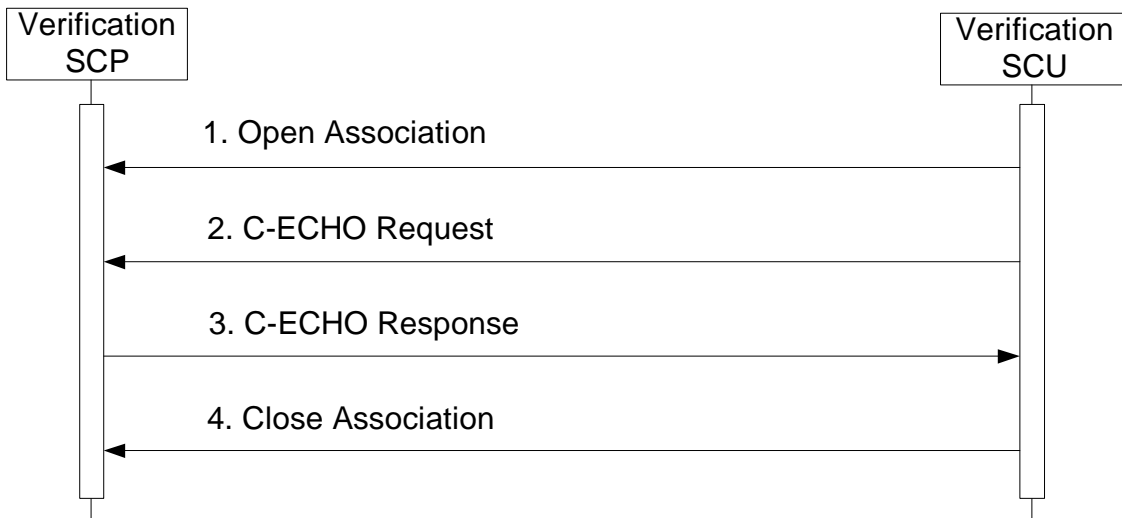


Figure 8b
SEQUENCING OF ACTIVITY – RECEIVE VERIFY

4.2.4.3.3 Proposed Presentation Contexts

HD5 1.0 will propose Presentation Contexts as shown in the following table:

**Table 51.6
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY VERIFICATION**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU /SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.4.3.4 SOP Specific Conformance for Verification

Table 51.7 summarizes the behavior of HD5 1.0 when receiving status codes in a C-ECHO response.

A message will appear on the user interface if HD5 1.0 receives any other SCP response status than "Success."

**Table 51.7
VERIFICATION C-ECHO RESPONSE STATUS HANDLING BEHAVIOR**

Service Status	Further Meaning	Error Code	Behavior
Success		0000	Device Status is set to: Verified
Refused	Out of Resources	A700	Device Status is set to: Not Verified
Failed	Unable to Process	C000 – CFFF	Same as "Refused" above.
*	*	Any other status code.	Same as "Refused" above.

4.2.4.3.4.1 Verification SOP Class Operations (C-ECHO)

4.2.4.3.5 Association Acceptance Policy

4.2.4.3.5.1 Verification SOP Class Notifications

Association Negotiation Request message contents for each DICOM device:

Device Type	SOP Classes Requested	Additional Notes
DICOM Archive Server	US Image Storage US Multi-frame Storage Storage Commitment Comprehensive Structured Report Storage	
DICOM Commit Server	Storage Commitment	
DICOM PPS Server	Modality Performed Procedure Step	
DICOM Worklist Server	Modality Worklist	MWL query settings are located in Setups > System > DICOM > DICOM Preset > Change Settings for current preset > Modify in Roles > MWL SCP – Advanced > Set Modality Worklist Query page. Search window of the Patient Data Entry screen.
DICOM Structured Report Server	Comprehensive Structured Report Storage	

SR Storage Commit SCP	Storage Commitment	
DICOM BW Printer	Basic Grayscale META Print	All bw printers configure this entry. If the printer supports both BW and Color, then this must be configured to allow BW on that printer.
DICOM Color Printer	Basic Color META Print	May be the same printer if color is also supported.

4.3 PHYSICAL NETWORK INTERFACES

4.3.1 Supported Communication Stacks

4.3.1.1 TCP/IP Stack

The HD5 1.0 provides DICOM TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.3.2 Physical Network Interface

HD5 1.0 supports a single network interface. The following physical network interface is available:

**Table 52
SUPPORTED PHYSICAL NETWORK INTERFACE**

Ethernet 10/100BaseT, RJ-45, UTP, STP; AutoDetect Speed, Full or Half Duplex
--

4.4 CONFIGURATION

AE Title/Presentation Address Mapping

The Devices Configuration section allows the following device types to be configured:

Device Type	Supported SOPs
DICOM Archive Server	Ultrasound Store Ultrasound Multi-frame Store Comprehensive Structured Report Store Storage Commitment Push Model
DICOM Commit Server	Storage Commitment Push Model
DICOM PPS Server	Modality Performed Procedure Step
DICOM Worklist Server	Modality Work List
DICOM Structured Report Server	Comprehensive Structured Report Store
DICOM BW Printer	Basic Grayscale Print Meta
DICOM Color Printer	Basic Color Print Meta

4.4.1.1 Local AE Title

All local DICOM Presets use the same AE Title and TCP/IP Port configured via the Network Settings in DICOM setup. The system listens on the configured Port only for Verification requests and Storage Commitment N-Event reports. The system supports Static Addressing or DHCP to receive its IP Address, Subnet Mask and Default Gateway address.

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Titles, IP Addresses and Port numbers of remote applications are manually configured using the DICOM setup screen. The remote system's IP Address may be entered manually if known or the Host Name of the remote device may be entered and resolved by the DNS if the network includes this service.

4.4.1.2.2 Workflow

Setup is used to set the AE Title, port-number and IP Address the remote MWL SCP.
Multiple MWL SCPs may be defined, but only a single remote MWL SCP can be selected at a time.

All default MWL queries use Modality = US.

This may be changed to <All Modalities> in the MWL Query definition page.

AE Title may be selected as Any, This System, or Another as a query value.

Automated queries may be set for a specific time interval, 1- 99,999 minutes.

Automated queries use Today, All Dates or Date Range,
(0-99 day(s)/hour(s) plus today, plus the next 0-99 day(s).)

Setup is used to set the AE Title, port-number and IP Address of the remote MPPS SCP.
Multiple MPPS SCPs may be defined, but only a single remote MPPS SCP can be selected at a time.

4.4.1.2.3 Hardcopy

Setup is used to set the AE Titles, Port numbers and IP Addresses for the remote Print SCPs.

Multiple remote Print SCPs can be defined.

One Grayscale and one Color Print SCP may be selected at a time.

5 MEDIA STORAGE

5.1 IMPLEMENTATION MODEL

5.1.1 Application Data Flow

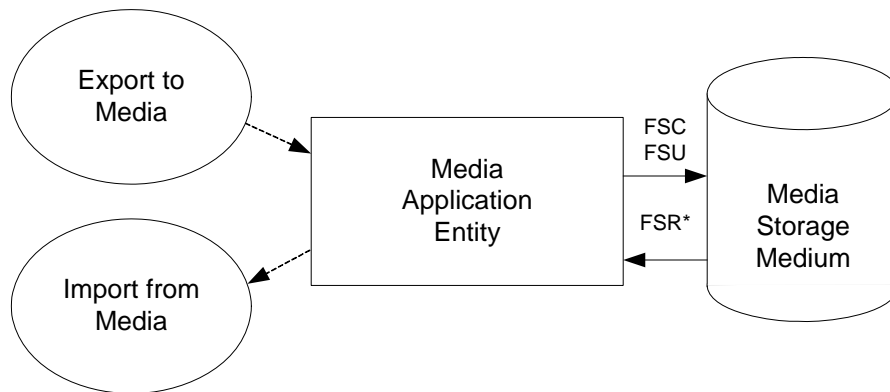


Figure 9
APPLICATION DATA FLOW DIAGRAM FOR MEDIA STORAGE

- The Media Application Entity exports Images and Structured Reports to a disk Storage medium. It is associated with the local real-world activity “Export to Media”. “Export to Media” is performed upon user request for selected patients, studies, series or instances (images, or Structured Reports). Throughout this section, the term “Media” refers to any of the media listed below which is in use.

HD5 1.0 will support the use of most writable media including CD-R, CD-RW, DVD-R, DVD+R, DVD-RW and DVD+RW. DICOM structure will be the same regardless of media used.

5.1.2 Functional Definition of AEs

5.1.2.1 Functional Definition of Media Application Entity

Using “Export Studies” will pass the currently selected patients’ exams or individually selected images to the Media Application Entity. The SOP Instances associated with the selection will be collected into one or more export jobs. The contents of each export job will be written to the installed media. If the capacity of a disk is exceeded, the user is provided a dialog, stating capacity exceeded and to insert another disk.

5.1.3 Sequencing of Real-World Activities

At least one image must exist and be selected before the Media Application Entity can be invoked. The operator can insert new media at any time. The Media Application Entity will wait indefinitely for media to be inserted before starting to write to the device.

5.1.4 File Meta Information Options

The implementation information written to the File Meta Header in each file is:

Table 65
DICOM IMPLEMENTATION CLASS AND VERSION FOR MEDIA STORAGE

Implementation Class UID	1.3.46.670589.14.9001.100
Implementation Version Name	HD5 1.0

5.2 AE SPECIFICATIONS

5.2.1 Media Application Entity Specification

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

**Table 66
APPLICATION PROFILES, ACTIVITIES AND ROLES FOR OFFLINE-MEDIA**

Application Profiles Supported	Real World Activity	Role	SC Option
STD-US-SC-SF&MF-CDR	Send to...Media	FSC,	Interchange
STD-US-SC-SF&MF-DVD		FSC, U**	
STD-US-SC-SF&MF-CDR	Send to ... Hard Disk	R*	
STD-US-SC-SF&MF-DVD			

* File Set Reader functionality is limited only to media created by other HD5 1.0 systems.

** Update functionality requires DVD+RW

5.2.1.1 File Meta Information for the Application Entity

The File-Set Identifier included in the File Meta Header is "Data Not Stored".

5.2.1.2 Real-World Activities

5.2.1.2.1 Activity – Send to Media

The Media Application Entity acts as an FSC using the interchange option when requested to export SOP Instances from the local database to media.

The contents of the export job will be written together with a corresponding DICOMDIR to media. The user can cancel an export job in the job queue. Writing in multi-session format to CDs and DVDs is supported. Each export job is written as one session.

5.2.1.2.2 Activity – Import from Media

The Media Application Entity acts as an FSR using the interchange option when requested to import SOP Instances from media to the local database.

The Patient Directory UI presents the directory of the system or the offline media. Selected exams are transferred from the media to the system for review. Objects transferred to the system retain their original SOP Instance UIDs.

Note: Structured Reports may not be read back into the HD5 1.0.

5.2.1.2.3 Activity – Update to Media

The Media Application Entity acts as an FSU using the interchange option when requested to export SOP Instances from the local database to media upon which DICOM data already resides.

The system user selects exams from the system's directory for transfer to media that already contains data. The DICOMDIR is updated allowing access to original and new data.

DVD +RW media may be erased at any time, removing all previously recorded data.

5.2.1.2.3.1 Media Storage Application Profiles

See Table 66 for supported Application Profiles.

5.2.1.2.3.2 Options

The Media Application Entity supports the SOP Classes and Transfer Syntaxes listed in Table 67.

**Table 67
IODS, SOP CLASSES AND TRANSFER SYNTAXES FOR OFFLINEMEDIA**

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
US Image Storage*	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5
US Multi-frame Image Storage*	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian JPEG Lossy Baseline RLE Lossless	1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5
Comprehensive Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.33	Explicit VR Little Endian	1.2.840.10008.1.2.1

* See details listed in Table 9.

6 SUPPORT OF CHARACTER SETS

All HD5 1.0 DICOM applications support the

ISO_IR 100 Latin Alphabet No. 1

ISO-IR 87 Japanese Kanji (ideographic), Hiragana (phonetic) and Katakana (phonetic)

ISO-IR 13 Japanese Katakana (phonetic)

ISO-IR 159 Supplementary Kanji (ideographic)

ISO-IR 144 Russian Cyrillic

6.1 SUPPORT FOR RUSSIAN AND JAPANESE MARKETS

HD5 1.0 uses "Code-extension techniques" to encode Japanese stroke based characters and Russian Cyrillic characters in DICOM tags with value representations of SH, LO, ST, LT, UT, and PN.

The technique requires two things in a DICOM file that contains these characters:

1. Add the Optional Specific Character Set tag (0008,0005) and set the value to the list of identifiers for all the non-standard character sets that will appear in any string in the file separated by backslashes. For example:
For Japanese systems: (0008,0005) = "ISO 2022 IR 13\ISO 2022 IR 87\ISO 2022 IR 159\ISO 2022 IR 100"
For Russian systems: (0008,0005) = "ISO 2022 IR 144\ISO 2022 IR 100"
For English systems: (0008,0005) = "ISO 2022 IR 100"
2. Embed escape sequences in the strings that contain Asian or Cyrillic characters to cause the DICOM interpreting code to switch from one character set to another.

The escape sequences to be used are defined as:

"<ESC>\$B"	ISO - IR 87 Japanese Kanji (ideographic), Hiragana (phonetic), Katakana (phonetic)
"<ESC>(B"	ISO - IR 6 ASCII - DICOM default character set
"<ESC>\$(D"	ISO - IR 159 Supplementary Kanji (ideographic)
"<ESC>(J"	ISO - IR 144 Russian Cyrillic

6.2 ADDITIONAL SUPPORT FOR JAPANESE MARKETS

Japanese markets will have additional fields to the Patient ID screen so that the user can enter the Roman, Ideographic, and Phonetic representations of a patient's name.

The DICOM patient name field, tag (0010,0010) of type PN, is a single string field that contains up to five components (last, first, middle, title, honorific) in up to three language variants (Roman, Ideographic, and Phonetic.) The format of the patient name field is:

```
“Roman-last^Roman-first^Roman-middle^Roman-prefix^Roman-suffix=  
Ideographic-last^Ideographic-first^Ideographic-middle^Ideographic-prefix^Ideographic-suffix=  
Phonetic-last^Phonetic-first^Phonetic-middle^Phonetic-prefix^Phonetic-suffix”
```

In the above string the five components are separated with the '^' Ascii character and the three language variants are separated by the '=' Ascii character. The only required component is the Roman Last name. All other components are optional. Trailing '^' and '=' characters can be excluded.

When this string is encoded in a DICOM image file or DICOMDIR directory file, the escape sequences appropriate for the character sets used are inserted into the string for storage as a single-byte string. On media import the escape sequences are removed.

6.3 SUPPORT FOR CHINESE MARKETS

The current DICOM standard as of this release of HD5 1.0 does not support Chinese character sets. HD5 1.0 however provides support for Chinese customers so that they can enter text using Chinese characters.

If the system is set up for Chinese, then (unlike for Japanese markets) the user can enter just one version of the patient name. This would make Chinese systems work in the same way as Russian, English, French, Italian, and Spanish systems. The Chinese user will be able to enter the patient name using a combination of Chinese and Roman characters – all of the characters will appear wherever the system displays the patient name (image, report, Search for Study window, etc.).

Since the DICOM Standard does not offer support for Chinese characters, all Chinese characters entered into the Patient ID screen will be lost if a user exports or backs up a study to media. This will be noticed when the study is imported back into the system; upon import, each Chinese character will be replaced with a question mark (“?”) character. The question marks will make it obvious to the user that the characters were lost.

If the user enters a patient name that consists entirely of Chinese characters, then the name will come back as “??????”. In this case, the user will have to identify the study in the “Import Study” and “Search for Study” windows by the MRN. If the user enters a patient name that consists of a combination of Roman and Chinese characters, then Roman characters will be preserved, and the name will come back as something like “Lee ????????”. This will give users who like to back up their studies the flexibility of entering a patient name with a combination of Roman and Chinese characters, and have at least part of the name come back during import.

Note that the original Chinese name will be “burned into” study images that are exported to media. These Chinese characters will remain on the images when the studies are imported back into the system.

7 SECURITY

DICOM security is not implemented on the HD5 1.0 at this time.

HD5 1.0 incorporates an internal firewall that only accepts incoming traffic on the designated listening port, as configured in the DICOM... > Change Settings for current preset > This System tab.

8 ANNEXES

8.1 CREATED IOD INSTANCES

Table 69 specifies the attributes of an Ultrasound Image transmitted by the HD5 1.0 storage application.

Table 70 specifies the attributes of a Comprehensive Structured Reports transmitted by the HD5 1.0 storage application.

The following tables use a number of abbreviations. The abbreviations used in the “Presence of ...” column are:

- VNAP Value Not Always Present (attribute sent zero length if no value is present)
- ANAP Attribute Not Always Present
- ALWAYS Always Present
- EMPTY Attribute is sent without a value

The abbreviations used in the “Source” column:

- MWL the attribute value source Modality Worklist
- USER the attribute value source is from User input
- AUTO the attribute value is generated automatically
- MPPS the attribute value is the same as the Modality Performed Procedure Step service
- CONFIG the attribute value source is a configurable parameter

8.1.1 US or US Multi-frame Image IOD

**Table 69
IOD OF CREATED US OR US MULTIFRAME SOP INSTANCES**

IE	Module	Reference	Presence of Module
Patient	Patient	Table 71	ALWAYS
Study	General Study	Table 72	ALWAYS
	Patient Study	Table 73	ALWAYS
Series	General Series	Table 74	ALWAYS
Equipment	General Equipment	Table 75	ALWAYS
Image	General Image	Table 76	ALWAYS
	Pixel Plane	Table 76-a	ANAP
	Image Pixel	Table 77	ALWAYS
	Cine	Table 78	Only if Multi-frame
	Multi-frame	Table 79	Only if Multi-frame
	US Region Calibration	Table 80	ANAP
	US Image	Table 81	ALWAYS
	VOI LUT	Table 82	Only if Single frame
	SOP Common	Table 83	ALWAYS

8.1.2 Comprehensive Structured Report IOD

Table 70
IOD OF CREATED COMPREHENSIVE STRUCTURED REPORT SOP INSTANCES

IE	Module	Reference	Presence of Module
Patient	Patient	Table 71	ALWAYS
Study	General Study	Table 72	ALWAYS
	Patient Study	Table 73	ALWAYS
Series	SR Document Series	Table 84	ALWAYS
Equipment	General Equipment	Table 75	ALWAYS
Document	SR Document General	Table 85	ALWAYS
	SR Document Content	Table 86	ALWAYS
	SOP Common	Table 87	ALWAYS

8.1.3 Common Modules

Table 71
PATIENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	Same attribute of MWL or PDE input	ALWAYS	MWL/ USER
Patient ID	(0010,0020)	LO	From MWL, user input (MRN field) or system generated.	ALWAYS	MWL/ USER/ AUTO
Patient's Birth Date	(0010,0030)	DA	Same attribute of MWL or PDE input	VNAP	MWL/ USER
Patient's Sex	(0010,0040)	CS	Same attribute of MWL or PDE input User Input may be: M = male F = female O = other If "Unknown", an empty string is sent.	VNAP	MWL/ USER
Other Patient IDs	(0010,1000)	LO	PDE input to Alternate ID number.	VNAP	USER

**Table 72
GENERAL STUDY MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Same value as in MWL or auto generated	ALWAYS	MWL/ AUTO
Study Date	(0008,0020)	DA	Study's Start Date (0040,0244).	ALWAYS	MWL/ AUTO
Study Time	(0008,0030)	TM	Study's Start Time (0040,0245).	ALWAYS	MWL/ AUTO
Referring Physician's Name	(0008,0090)	PN	Only Last, First and Middle names from MWL, sent as "Last, First, Middle" in the Last name field; or PDE input.	VNAP	MWL/ USER
Study ID	(0020,0010)	SH	Auto-generated	ALWAYS	AUTO
Accession Number	(0008,0050)	SH	Same attribute of MWL or user PDE input.	VNAP	MWL/ USER
Study Description	(0008,1030)	LO	Configurable by the user through setup. Can either be a fixed list or (for users with a MWL server), can be obtained from the MWL Server. The string used will be the first non-empty string from the following list: Requested Procedure description (0032,1060) Scheduled Procedure Step description (0040,0007) Scheduled Procedure Step, "Code Meaning" (0008,0104) Reason for the requested procedure (0040,1002) Reason for imaging service request (0040,2001)	VNAP	MWL/ USER

**Table 73
PATIENT STUDY MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient Size	(0010,1020)	DS	Same value as MWL attribute or PDE input	VNAP	MWL/ USER
Patient's Weight	(0010,1030)	DS	Same value as MWL attribute or PDE input	VNAP	MWL/ USER
Additional Patient's History	(0010,21B0)	LT	Input from the PDE	VNAP	USER

**Table 74
GENERAL SERIES MODULE OF CREATED IMAGE SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	"US"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Auto-generated	ALWAYS	AUTO
Series Number	(0020,0011)	IS	A number unique within the Study.	ALWAYS	AUTO
Performing Physician's Name	(0008,1050)	PN	User entry in the 'Performed by' field of the Patient ID screen or mapped from Scheduled Performing Physician's Name (0040,0006) from MWL. If the user does not enter a value, this tag is not sent.	VNAP/ANAP	MWL/ USER
Operator's Name	(0008,1070)	PN	User entry in the 'Performed by' field of the Patient ID screen or mapped from Scheduled Performing Physician's Name (0040,0006) from MWL. If the user does not enter a value, this tag is not sent.	VNAP/ANAP	MWL/ USER

**Table 75
GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Philips Healthcare	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	From Setups configuration (requires power cycle)	VNAP	CONFIG

8.1.4 US or Multiframe Image Modules

**Table 76
GENERAL IMAGE MODULE OF CREATED US SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Generated by device, increments from "1" in each series	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	The system sends this tag empty	VNAP	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss>	ALWAYS	AUTO
Image Type	(0008,0008)	CS	ORIGINAL/PRIMARY/<Analysis Type*> for uncompressed, DERIVED/PRIMARY/ < Analysis Type *> if compressed	ALWAYS	CONFIG

Attribute Name	Tag	VR	Value	Presence of Value	Source
Acquisition Date	(0008,0022)	DT	The system uses the same value as the Content Date, tag (0008,0023).	ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM	The system uses the same value as the Content time, tag (0008,0033).	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	CS	"01" if image is lossy compressed, "00" if not.	ALWAYS	AUTO
Image Comments	(0020,4000)	LT	Not used with images. For reports, contains: "Report Version x Page x of x"	ANAP	AUTO

* Analysis Type selection is determined by the analysis package associated with the transducer / preset selection.

**Table 76-a
IMAGE PLANE MODULE FOR SINGLE AND MULTI-FRAME 2D IMAGES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Pixel Spacing	(0028,00300)	DS	Physical distance in the patient between the center of each pixel, specified by a numeric pair – adjacent row spacing (delimiter) adjacent column spacing in mm	ANAP	CONFIG

**Table 77
IMAGE PIXEL MODULE OF CREATED US OR US MULTIFRAME SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	1 for Monochrome2, Palette Color otherwise, 3 for RGB or YBR	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	Uncompressed: Monochrome2, Palette Color or RGB Compressed: YBR_FULL_422	ALWAYS	AUTO
Rows	(0028,0010)	US	2D B/W & Color stills/loops acquired with top & right border: 564 2D B/W & Color stills/loops acquired without borders: 520 2D B/W & Color quad-sized loops from stress: 245 Reports: 564	ALWAYS	CONFIG
Columns	(0028,0011)	US	2D B/W & Color stills/loops acquired with top & right border: 800 2D B/W & Color stills/loops acquired without	ALWAYS	CONFIG

Attribute Name	Tag	VR	Value	Presence of Value	Source
			borders: 688 2D B/W & Color quad-sized loops from stress: 320 Reports: 800		
Bits Allocated	(0028,0100)	US	Based on the 'Image Format' that is set by the user in DICOM Setup. Palette Color Mode: 2D B&W: 8 bits 2D Color, Reports: 16 bits RGB Mode: 2D B&W: 8 bits 2D Color, Reports: 8 bits YBR_FULL_422 Mode: 2D B&W: 8 bits 2D Color, Reports: 8 bits MONOCHROME2 Mode: 8 bits	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	Always the same numbers as Bits Allocated.	ALWAYS	AUTO
High Bit	(0028,0102)	US	The High Bit is always 1 less than Bits Allocated	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	"0" pixels are Unsigned integers	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OW / OB	The pixel data of the DICOM image.	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	Must be present when image is RGB. Value is "0". Palette Color Images: Not present RGB Images: Always zero (color-by-pixel) YBR: Images: Always zero (color-by-pixel) MONOCHROME2 Images: Not present	ALWAYS	AUTO
Pixel Aspect Ratio	(0028,0034)	IS	Always 1/1.	ALWAYS	AUTO
Red Palette Color Lookup Table Descriptor	(0028,1101)	US	Used only for 2D and REPORT acquired as image. B&W stills & loops: 256, 0, 16 Color stills & loops: 0, 0, 16 REPORT (acquired as image): xx, 0, 16 where 'xx' is a variable value.	ANAP	CONFIG
Green Palette Color Lookup Table Descriptor	(0028,1102)	US	Used only for 2D and REPORT acquired as image. B&W stills & loops: 256, 0, 16	ANAP	CONFIG

Attribute Name	Tag	VR	Value	Presence of Value	Source
			Color stills & loops: 0, 0, 16 (acquired as image): where 'xx' is a variable value.	REPORT xx, 0, 16	
Blue Palette Color Lookup Table Descriptor	(0028,1103)	US	Used only for 2D and REPORT acquired as image. B&W stills & loops: 256, 0, 16 Color stills & loops: 0, 0, 16 REPORT (acquired as image): 16 where 'xx' is a variable value.	ANAP	CONFIG
Red Palette Color Lookup Table Data	(0028,1201)	OW	Only used for 2D	ANAP	CONFIG
Green Palette Color Lookup Table Data	(0028,1202)	OW	Only used for 2D	ANAP	CONFIG
Blue Palette Color Lookup Table Data	(0028,1203)	OW	Only used for 2D	ANAP	CONFIG

**Table 78
CINE MODULE OF CREATED US MULTIFRAME SOP**

Attribute Name	Tag	VR	Value	Presence of Value*	Source
Recommended Display Frame Rate	(0008,2144)	IS	Used for Multi-frame	ALWAYS	AUTO
Cine Rate	(0018,0040)	IS	Used for Multi-frame	ALWAYS	AUTO
Effective Series Duration	(0018,0072)	DS	Used for Multi-frame	ALWAYS	AUTO
Frame Time	(0018,1063)	DS	Nominal time (in msec) per individual frame. Present if Frame Increment Pointer (0028,0009) points to Frame Time. Note: If you export a study to removable media using Average Frame Time, on import back into the system only the images up to but not including the loop will be imported. However the study on media is fine and can be imported onto a PACS without any problems.	ALWAYS	CONFIG
Frame Time Vector	(0018,1065)	DS	An array that contains the real time increments (in msec) between frames for a Multi-frame image. Present if Frame Increment Pointer (0028,0009) points to Frame Time Vector.	ALWAYS	CONFIG

* This module is only used for Multiframe Images. All Multi-frames ALWAYS use these attributes.

Table 79
MULTI-FRAME MODULE OF CREATED US MULTIFRAME SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value*	Source
Number of Frames	(0028,0008)	IS	# of frames in object	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	Configurable by the user in DICOM Setup. If the user selects a loop timing preference where each frame in a loop has the same duration then Frame Increment Pointer takes the value 0018,1063 (Frame Time). If the user selects a loop timing preference where each frame in a loop has the different duration then Frame Increment Pointer takes the value 0018,1065 (Frame Time Vector).	ALWAYS	CONFIG

* This module is only used for Multiframe Images. All Multiframes ALWAYS use these attributes.

Table 80
US REGION CALIBRATION MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Sequence of Ultrasound Regions	(0018,6011)	SQ	A sequence is present for each region on the system display.	ANAP	AUTO
>Region Spatial Format	(0018,6012)	US	Enumerated Value. 2D (tissue or flow) = 0001H M-Mode (tissue or flow) = 0002H Spectral (CW or PW Doppler) = 0003H ECG (waveform) = 0004H	ALWAYS	AUTO
>Region Data Type	(0018,6014)	US	Enumerated Value. Tissue = 0001H (2D only, M-Mode = 0000H) PW Spectral Doppler = 0003H (0000H) CW Spectral Doppler = 0004H (0000H) ECG (waveform) = 000AH	ALWAYS	AUTO
>Region Flags	(0018,6016)	UL	Bit mask. See DICOM PS3.3 C.8.5.5.1.3:	ALWAYS	AUTO
>Region Location Min x ₀	(0018,6018)	UL	Top Left position of region.	ALWAYS	AUTO
>Region Location Min y ₀	(0018,601A)	UL	Top Left position of region	ALWAYS	AUTO
>Region Location Max x ₁	(0018,601C)	UL	Bottom Right position of region	ALWAYS	AUTO
>Region Location Max y ₁	(0018,601E)	UL	Bottom Right position of region	ALWAYS	AUTO
>Reference Pixel X ₀	(0018,6020)	SL	The X pixel value of baseline, Doppler only	ANAP	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
>Reference Pixel Y0	(0018,6022)	SL	The Y pixel value of baseline, Doppler only	ANAP	AUTO
>Physical Units X Direction	(0018,6024)	US	Enumerated Value. 2D Image = 0003H = CM M-mode / Doppler = 0004H = SEC	ALWAYS	AUTO
>Physical Units Y Direction	(0018,6026)	US	Enumerated Value. 2D Image = 0003H = CM M-mode = 0003H = CM Doppler = 0007H = CM / SEC	ALWAYS	AUTO
>Reference Pixel Physical Value X	(0018,6028)	FD	For each region, the X coordinate of the reference point for measurements within that region.	ALWAYS	AUTO
>Reference Pixel Physical Value Y	(0018,602A)	FD	For each region, the Y coordinate of the reference point for measurements within that region.	ALWAYS	AUTO
>Physical Delta X	(0018,602C)	FD	The physical value per pixel increment	ALWAYS	AUTO
>Physical Delta Y	(0018,602E)	FD	The physical value per pixel increment	ALWAYS	AUTO

**Table 81
US IMAGE MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples Per Pixel	(0028,0002)	US	1 for Monochrome2, Palette Color otherwise, 3 for RGB or YBR	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	Uncompressed: Monochrome2, Palette Color or RGB Compressed: YBR_FULL_422	ALWAYS	CONFIG
Bits Allocated	(0028,0100)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	See 'Image Pixel Module'	ALWAYS	AUTO
High Bit	(0028,0102)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	See 'Image Pixel Module'	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	"0" Pixels are Unsigned integers	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	(0018,1063) "Frame Time" or (0018,1065) "Frame Time Vector"	ANAP	AUTO
Image Type	(0008,0008)	CS	See 'General Image Module'	ALWAYS	CONFIG
Lossy Image Compression	(0028,2110)	CS	"01" if image is lossy compressed, "00" if not.	ALWAYS	AUTO
Ultrasound Color Data Present	(0028,0014)	US	0 or 1	ALWAYS	AUTO
Acquisition Datetime	(0008,002A)	DT	The date and time that the acquisition of data that resulted in this image started.	ALWAYS	AUTO

Table 82
VOI LUT MODULE OF CREATED US SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Window Center	(0028,1050)	DS	2^{n-1} where n is the number of bits per pixel n = 8 Center = 128 n = 16 Center = 32768 Attribute only present with MONOCHROME2.	ANAP	AUTO
Window Width	(0028,1051)	DS	2^n where n is the number of bits per pixel n = 8 Width = 256 n = 16 Width = 65336 Attribute only present with MONOCHROME2.	ANAP	AUTO

Table 83
SOP COMMON MODULE OF CREATED US IMAGE OR US MULTIFRAME IMAGE SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.6.1 for US Image 1.2.840.10008.5.1.4.1.1.3.1 for US Multi-frame Image	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by device	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	"ISO_IR_100", unless required by characters used	ALWAYS	AUTO

8.1.5 Comprehensive Structured Report Modules

Table 84
SR DOCUMENT SERIES MODULE OF CREATED COMPREHENSIVE SR SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	"SR"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Auto-generated	ALWAYS	AUTO
Series Number	(0020,0011)	IS	A number unique within the Study starting with 2.	ALWAYS	AUTO
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	Identifies the MPPS SOP Instance to which this image is related	ALWAYS	MPPS
>Referenced SOP Class UID	(0008,1150)	UI	PPS SOP Class = "1.2.840.10008.3.1.2.3.3"	ALWAYS	MPPS
> Referenced SOP Instance UID	(0008,1155)	UI	PPS Instance UID of the PPS generating this document	ALWAYS	MPPS

Table 85
SR DOCUMENT GENERAL MODULE OF CREATED COMPREHENSIVE SR SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Unique number starting with zero.	ALWAYS	AUTO
Completion Flag	(0040,A491)	CS	PARTIAL	ALWAYS	AUTO
Verification Flag	(0040,A493)	CS	UNVERIFIED	ALWAYS	AUTO
Content Date	(0008,0023)	DA	Date content created.	ALWAYS	AUTO
Content Time	(0008,0033)	TM	Time content created.	ALWAYS	AUTO
Referenced Request Sequence	(0040,A370)	SQ	Identifies Requested Procedures being fulfilled (completely or partially) by creation of this Document.	ANAP	AUTO
>Study Instance UID	(0020,000D)	UI	Same value as in MWL or auto generated	ALWAYS	MWL/ AUTO
>Referenced Study Sequence	(0008,1110)	SQ	1 item per item in MWL, absent if unscheduled	ANAP	MWL
>Accession Number	(0008,0050)	SH	Same attribute of MWL or user PDE input.	VNAP	MWL/ USER
>Placer Order Number/Imaging Service Request	(0040,2016)	LO	Order Number of Imaging Service Request assigned by placer	VNAP	MWL
>Filler Order Number/Imaging Service Request	(0040,2017)	LO	Order Number of Imaging Service Request assigned by filler	VNAP	MWL
>Requested Procedure ID	(0040,1001)	SH	1 item per item in MWL, absent if unscheduled	ANAP	MWL
>Requested Procedure Description	(0032,1060)	LO	1 item per item in MWL, absent if unscheduled	ANAP	MWL
>Requested Procedure Code Sequence	(0032,1064)	SQ	1 item per item in MWL, absent if unscheduled	ANAP	MWL

Table 86
SR DOCUMENT CONTENT MODULE OF CREATED COMPREHENSIVE SR SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Content Template Sequence	(0040,A504)	SQ		ALWAYS	AUTO
>Template Identifier	(0040,DB00)	CS	The Root Content Item identifies TID 5000 (OB-GYN), 5200 (Echo).	ALWAYS	AUTO
>Mapping Resource	(0008,0105)	CS	DCMR	ALWAYS	AUTO
Content Sequence	(0040,A730)	SQ		ALWAYS	AUTO
>Relationship Type	(0040,A010)	CS	See Template ID 5000 for OB-GYN Template ID 5200 for Adult Echo.	ALWAYS	AUTO
<i>Document Relationship Macro Table</i>			See Template ID 5000 for OB-GYN and Template ID 5200 for Adult Echo.	ANAP	AUTO
<i>Document Content Macro</i>			See Template ID 5000 for OB-GYN and Template ID 5200 for Adult Echo.	ALWAYS	AUTO
Value Type	(0040,A040)	CS	CONTAINER, always first tag of SR	ALWAYS	AUTO
Concept Name Code Sequence	(0040,A043)	SQ		ALWAYS	AUTO
>Code Value	(0008,0100)		125000, 125200	ALWAYS	AUTO
>Coding Scheme Designator	(0008,0102)		DCM	ALWAYS	AUTO
>Code Meaning	(0008,0104)		“OB-GYN Ultrasound Procedure Report”, “Adult Echocardiography Procedure Report”	ALWAYS	AUTO
Continuity of Content	(0040,A050)	CS	SEPARATE	ALWAYS	AUTO
<i>Numeric Measurement Macro</i>			See Template ID 5000 for OB-GYN and Template ID 5200 for Adult Echo.	ALWAYS	AUTO
<i>Code Macro</i>			See Template ID 5000 for OB-GYN and Template ID 5200 for Adult Echo.	ALWAYS	AUTO

Table 87
SOP COMMON MODULE OF CREATED COMPOSITE SR SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.88.33	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by device	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	“ISO_IR_100”, unless required by characters used	ALWAYS	Config

8.2 USED FIELDS IN RECEIVED IOD BY APPLICATION

The HD5 1.0 storage applications do not receive SOP Instances.

8.3 ATTRIBUTE MAPPING

Table 88 summarizes the relationships between attributes received via MWL, stored in acquired images and communicated via MPPS.

**Table 88
ATTRIBUTE MAPPING BETWEEN MODALITY WORKLIST, IMAGE AND MPPS**

Modality Worklist	Image IOD	MPPS IOD
Patient's Name	Patient's Name	Patient's Name
Patient ID	Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex	Patient's Sex
Patient's Weight	Patient's Weight	
Referring Physician's Name	Referring Physician's Name	
----	----	Scheduled Step Attributes Sequence
Study Instance UID	Study Instance UID	>Study Instance UID
Referenced Study Sequence	Referenced Study Sequence	>Referenced Study Sequence
Accession Number	Accession Number	>Accession Number
----	Request Attributes Sequence	----
Requested Procedure ID	>Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description	>Requested Procedure Description	>Requested Procedure Description
Scheduled Procedure Step ID	>Scheduled Procedure Step ID	>Scheduled Procedure Step ID
Scheduled Procedure Step Description	>Scheduled Procedure Step Description > Study Description > Series Description > Performed Procedure Step Description	>Scheduled Procedure Step Description
Scheduled Protocol Code Sequence	>Scheduled Protocol Code Sequence	----
----	Performed Protocol Code Sequence	Performed Protocol Code Sequence
----	Study ID – Requested Procedure ID from MWL, else generated	Study ID – Requested Procedure ID from MWL, else generated
----	Performed Procedure Step ID	Performed Procedure Step ID
----	Performed Procedure Step Start Date	Performed Procedure Step Start Date
----	Performed Procedure Step Start Time	Performed Procedure Step Start Time
----	Performed Procedure Step Description	Performed Procedure Step Description

Modality Worklist	Image IOD	MPPS IOD
----	----	Performed Series Sequence
Requested Procedure Code Sequence	Procedure Code Sequence	Procedure Code Sequence
----	Referenced Performed Procedure Step Sequence	----
----	>Referenced SOP Class UID	SOP Class UID
----	>Referenced SOP Instance UID	SOP Instance UID
----	Protocol Name	Protocol Name

8.4 COERCED/MODIFIED FIELDS

The MWL AE will truncate attribute values received in the response to a MWL Query if the value length is longer than the maximum length permitted by the attribute's VR.

8.5 CONTROLLED TERMINOLOGY

The Workflow AE is capable of supporting arbitrary coding schemes for Procedure and Protocol Codes. The contents of Requested Procedure Code Sequence (0032,1064) and Scheduled Protocol Code Sequence (0040,0008) supplied in Worklist Items will be mapped to Image IOD and MPPS attributes as described in Table 88.

Structured Reporting uses codes supplied by DCMR (DICOM Code Mapping Resource, PS 3-16), LOINC(Logical Observation Names and Codes), SRT (SNOMED – Systematized Nomenclature of Medicine) and 99PMSBLUS (Philips Private Codes for Ultrasound).

8.6 GRAYSCALE IMAGE CONSISTENCY

8.7 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

8.7.1 Standard Extended / Specialized / Private SOPs

The US or US Multi-frame Image Storage SOP Classes are extended to create a Standard Extended SOP Class by addition of standard and private attributes to the created SOP Instances as documented in section 8.1.

8.8 PRIVATE TRANSFER SYNTAXES

There are no Private Transfer Syntaxes.

APPENDIX A – Structured Reports

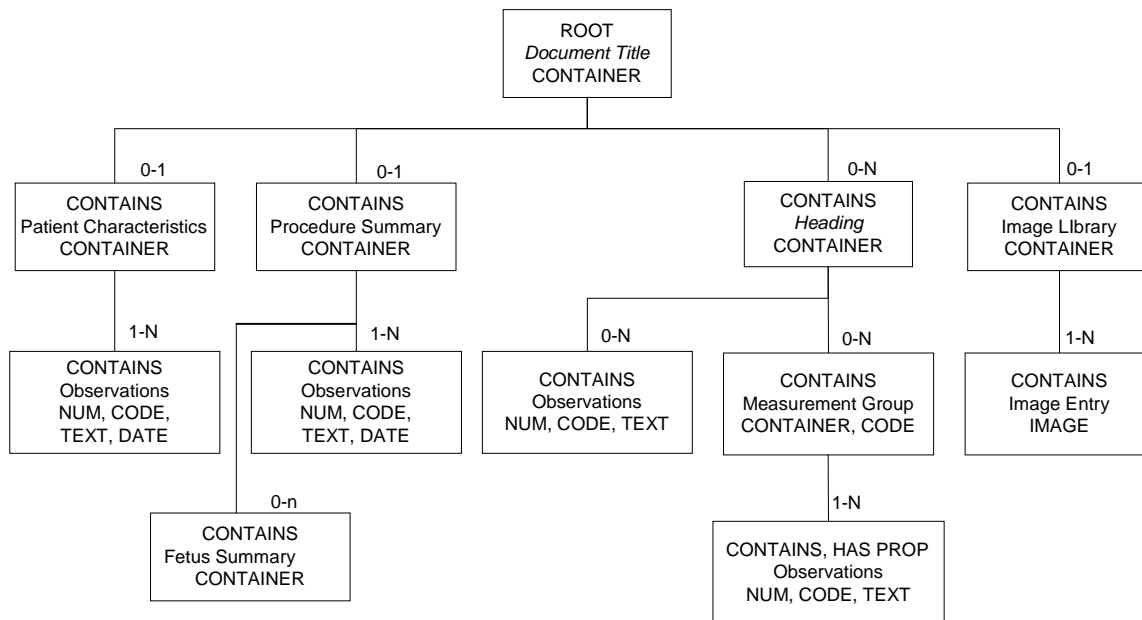
A.1 STRUCTURED REPORTS

A.1.1 Introduction

HD5 1.0 implements Structured Report Templates TID 5000 (OB-GYN) and TID 5200 (Echo) from DICOM Part 16. This Appendix describes the manner that HD5 1.0 measurements appear in DICOM reports.

Part 17 of the DICOM Standard includes tree diagrams showing graphic examples of the structure of each template.

Briefly, an SR document will contain only the measurements, calculations and observations made during the exam. Its exact structure is therefore determined by two main components, the measurements that are available within the context of the template and its referenced Templates and Context groups, and those measurements and calculations that are implemented on the system creating the report. Supplementing these constraints are private and user defined measurements and calculations, which may be added if the Root Container Template is extensible.



Note that all the concepts defined privately by Philips have the CSD value as '99PMSBLUS'.

A.1.2 Cardiac Measurements

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
ACS	Aortic Valve	LN	17996-0	Aortic Valve Cusp Separation	MMode
Ao root diam	Aorta	LN	18015-8	Aortic Root Diameter	2D/MMode
LVIDd	Left Ventricle	LN	29436-3	Left Ventricle Internal End Diastolic Dimension	2D/MMode
LVIDs	Left Ventricle	LN	29438-9	Left Ventricle Internal Systolic Dimension	2D/MMode
AI max vel	Aortic Valve	LN	11726-7	Peak Velocity	
Ao dec slope	Aortic Valve	LN	20216-8	Deceleration Slope	
Ao dec time	Aortic Valve	LN	20217-6	Deceleration Time	
Ao max PG	Aortic Valve	LN	20247-3	Peak Gradient	
Ao mean PG	Aortic Valve	LN	20256-4	Mean Gradient	
Ao P1/2t	Aortic Valve	LN	20280-4	Pressure Half-Time	
Ao V2 max	Aortic Valve	LN	11726-7	Peak Velocity	
Ao V2 VTI	Aortic Valve	LN	20354-7	Velocity Time Integral	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
Aortic HR		LN	8867-4	Heart rate	
Asc Ao	Aorta	LN	18012-5	Ascending Aortic Diameter	2D
AVA(I,D)	Aortic Valve	SRT	G-038E	Cardiovascular Orifice Area	
AVA(V,D)	Aortic Valve	SRT	G-038E	Cardiovascular Orifice Area	
BSA		LN	8277-6	Body Surface	
CO(bp-el)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(Bullet)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(Cubed)	Left Ventricle	SRT	F-32100	Cardiac Output	2D/MMode
CO(LVOT)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(MOD-bp)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(mod-Simp)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(MOD-sp2)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(MOD-sp4)	Left Ventricle	SRT	F-32100	Cardiac Output	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
CO(sp-el)	Left Ventricle	SRT	F-32100	Cardiac Output	
CO(Teich)	Left Ventricle	SRT	F-32100	Cardiac Output	2D/MMode
Duct Art	Patent Ductus Arteriosis	99PMSBLUS	C99201-02	Ductus Arteriosis Dimension	2D
EDV (MOD-sp2)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	2D
EDV (MOD-sp4)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	2D
EDV (bp-el)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	
EDV (Bullet)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	
EDV (Cubed)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	2D/MMode
EDV (MOD-bp)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
EDV (mod-Simp)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	
EDV (sp-el)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	
EDV (Teich)	Left Ventricle	LN	18026-5	Left Ventricular End Diastolic Volume	2D/MMode
EF (bp-el)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (Bullet)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (Cubed)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	2D/MMode
EF (MOD-bp)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (mod-Simp)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (MOD-sp2)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
EF (MOD-sp4)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (sp-el)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	
EF (Teich)	Left Ventricle	LN	18043-0	Left Ventricular Ejection Fraction	2D/MMode
EPSS	Mitral valve	LN	18036-4	Mitral Valve EPSS, E wave	MMode
ESV (bp-el)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	
ESV (Bullet)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	
ESV (Cubed)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	2D/MMode
ESV (MOD-bp)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	
ESV (mod-Simp)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
ESV (MOD-sp2)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	2D
ESV (MOD-sp4)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	2D
ESV (sp-el)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	
ESV (Teich)	Left Ventricle	LN	18148-7	Left Ventricular End Systolic Volume	2D/MMode
FS	Left Ventricle	LN	18051-3	Left Ventricular Fractional Shortening	2D/MMode
IVSd	Left Ventricle	LN	18154-5	Interventricular Septum Diastolic Thickness	2D/MMode
IVSs	Left Ventricle	LN	18158-6	Interventricular Septum Systolic Thickness	2D/MMode
LA dimension	Left Atrium	LN	29469-4	Left Atrium Antero-posterior Systolic Dimension	2D/MMode
LA/AO	Left Atrium	LN	17985-3	Left Atrium to Aortic Root Ratio	2D/MMode
Left diam	Left Heart	99PMSBLUS C99200-03		Left Heart Diameter	2D

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
Left max vel	Left Heart	99PMSBLUS	C99200-01	Left Heart Maximum Velocity	
LV V1 max	Left Ventricle	LN	11726-7	Peak Velocity	
LV V1 VTI	Left Ventricle	LN	20354-7	Velocity Time Integral	
LVAd ap2	Left Ventricle	SRT	G-0375	Left Ventricular Diastolic Area	2D
LVAd ap4	Left Ventricle	SRT	G-0375	Left Ventricular Diastolic Area	2D
LVAd apical	Left Ventricle	SRT	G-0375	Left Ventricular Diastolic Area	2D
LVAd sax epi	Left Ventricle	SRT	G-0379	Left Ventricle Epicardial Diastolic Area, psax pap view	2D
LVAd sax MV	Left Ventricle	SRT	G-0375	Left Ventricular Diastolic Area, psax at the Mitral Valve	2D
LVAd sax PM	Left Ventricle	SRT	G-0375	Left Ventricular Diastolic Area, psax at the Papillary Muscle	2D
LVAs ap2	Left Ventricle	SRT	G-0374	Left Ventricular Systolic Area	2D
LVAs ap4	Left Ventricle	SRT	G-0374	Left Ventricular Systolic Area	2D
LVAs apical	Left Ventricle	SRT	G-0374	Left Ventricular Systolic Area	2D

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name	CSD	CV	CM		
LVA _{sax MV}	Left Ventricle	SRT	G-0374	Left Ventricular Systolic Area, psax at the Mitral Valve	2D
LVA _{sax PM}	Left Ventricle	SRT	G-0374	Left Ventricular Systolic Area, psax at the Papillary Muscle	2D
LVL _{d apical}	Left ventricle	LN	18077-8	Left Ventricle Diastolic Major Axis	2D
LVL _{s apical}	Left ventricle	LN	18076-0	Left Ventricle Systolic Major Axis	2D
Lvmass(AL) _d	Left Ventricle	LN	18087-7	Left Ventricle Mass	2D
Lvmass(C) _d	Left Ventricle	LN	18087-7	Left Ventricle Mass	2D
LVOT area	Left Ventricle	SRT	G-038E	Cardiovascular Orifice Area	2D
LVOT diam	Left ventricle	SRT	G-038F	Cardiovascular Orifice Diameter	2D
LVPW _d	Left Ventricle	LN	18152-9	Left Ventricle Posterior Wall Diastolic Thickness	2D/MMode
LVPW _s	Left Ventricle	LN	18156-0	Left Ventricle Posterior Wall Systolic Thickness	2D/MMode
Max PG (AI)	Aortic Valve	LN	20247-3	Peak Gradient	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
Max PG (MR)	Mitral valve	LN	20247-3	Peak Gradient	
Max PG (PI)	Pulmonic Valve	LN	20247-3	Peak Gradient	
Max vel (TR)	Tricuspid Valve	LN	11726-7	Peak Velocity	
MM HR	Left Ventricle	LN	8867-4	Heart rate	
MR alias vel	Mitral valve	99PMSBLUS	C12222-02	Alias Velocity	
MR ERO	Mitral Valve	SRT	G-038E	Cardiovascular Orifice Area	
MR flow rate	Mitral Valve	LN	34141-2	Peak Instantaneous Flow Rate	
MR max vel	Mitral valve	LN	11726-7	Peak Velocity	
MR PISA	Mitral Valve	99PMSBLUS	C12207-06	Mitral Valve Flow Area	
MR PISA radius	Mitral valve	99PMSBLUS	C12222-01	Flow Radius	2D
MR RF	Mitral Valve	SRT	G-0390-4	Regurgitant Fraction	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
MR volume	Mitral Valve	LN	33878-0	Volume Flow	
MR VTI	Mitral valve	LN	20354-7	Velocity Time Integral	
MV A point	Mitral valve	LN	17978-8	Mitral Valve A-Wave Peak Velocity	
MV dec slope	Mitral valve	LN	20216-8	Deceleration Slope	
MV dec time	Mitral valve	LN	20217-6	Deceleration Time	
MV Diam 1	Mitral valve	SRT	G-038F	Cardiovascular Orifice Diameter	2D
MV Diam 2	Mitral valve	SRT	G-038F	Cardiovascular Orifice Diameter	2D
MV E point	Mitral valve	LN	18037-2	Mitral Valve E-Wave Peak Velocity	
MV E/A	Mitral Valve	LN	18038-0	Mitral Valve E to A Ratio	
MV E-F slope	Mitral valve	LN	18040-6	Mitral Valve E-F Slope	MMode
MV excursion	Mitral valve	99PMSBLUS	C12207-01	Mitral Valve D-E Excursion	MMode
MV Flow Area	Mitral Valve	99PMSBLUS	C12207-06	Mitral Valve Flow Area	2D

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
MV Max PG	Mitral valve	LN	20247-3	Peak Gradient	
MV Mean PG	Mitral valve	LN	20256-4	Mean Gradient	
MV P1/2t	Mitral Valve	LN	20280-4	Pressure Half-Time	
MV P1/2t max v	Mitral valve	99PMSBLUS	C12222-03	Pressure Half-Time Peak velocity	
MV V2 Max	Mitral valve	LN	11726-7	Peak Velocity	
MV V2 VTI	Mitral valve	LN	20354-7	Velocity Time Integral	
MVA(P1/2t)	Mitral Valve	SRT	G-038E	Cardiovascular Orifice Area	
PA dec slope	Pulmonic Valve	LN	20216-8	Deceleration Slope	
PA dec time	Pulmonic Valve	LN	20217-6	Deceleration Time	
PA max PG	Pulmonic Valve	LN	20247-3	Peak Gradient	
PA P1/2t	Pulmonary Valve	LN	20280-4	Pressure Half-Time	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name	CSD	CV	CM		
PI max vel	Pulmonic Valve	LN	11726-7	Peak Velocity	
Qp:Qs	Cardiac Shunt Study	LN	29462-9	Pulmonary-to-Systemic Shunt Flow Ratio	
Q-to-PV close	Pulmonic Valve	LN	20295-2	Time from Q wave to Pulmonic Valve Closes	MMode
Q-to-TV open	Tricuspid Valve	LN	20296-0	Time from Q wave to Tricuspid Valve Opens	MMode
RA Press	Right Atrium	LN	18070-3	Right Atrium Systolic Pressure	
Right diam	Right Heart	99PMSBLUS	C99200-04	Right Heart Diameter	2D
Right max vel	Right Heart	99PMSBLUS	C99200-02	Right Heart Maximum Velocity	
RVDd	Right Ventricle	LN	20304-2	Right Ventricular Internal Diastolic Dimension	2D/MMode
RVSP(TR)	Right Ventricle	SRT	G-0380	Right Ventricular Peak Systolic Pressure	
SV(bp-el)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(Bullet)	Left Ventricle	SRT	F-32120	Stroke Volume	

Measurement/ Calculation		DICOM Mapping			Imaging Mode
Name		CSD	CV	CM	
SV(Cubed)	Left Ventricle	SRT	F-32120	Stroke Volume	2D/MMode
SV(LVOT)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(MOD-bp)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(mod-Simp)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(MOD-sp2)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(MOD-sp4)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(MV)	Mitral Valve	SRT	F-32120	Stroke Volume	
SV(sp-el)	Left Ventricle	SRT	F-32120	Stroke Volume	
SV(Teich)	Left Ventricle	SRT	F-32120	Stroke Volume	2D/MMode

A.1.3 OB Measurements

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
2 Beat Pk-to-Pk	99PMSBLUS	C12019-01	Peak-to-Peak time interval over two beats	
AC	LN	11979-2	Abdominal Circumference	
ADap	LN	11818-2	Anterior-Posterior Abdominal Diameter	
ADtrv	LN	11862-0	Transverse Abdominal Diameter	
AFI	LN	11627-7	Amniotic Fluid Index	
BPD	LN	11820-8	Biparietal Diameter	
CD	LN	11863-8	Trans Cerebellar Diameter	
CI(BPD,OFD)	LN	11823-2	Cephalic Index	
Cist Mag	LN	11860-4	Cisterna Magna length	
CLAV	LN	11962-8	Clavicle length	
CRL	LN	11957-8	Crown Rump Length	
Ductus Venosus	99PMSBLUS	C12141-01	Ductus Venosus	
PI	LN	12008-9	Pulsatility Index	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
Ductus Venosus	99PMSBLUS	C12141-01	Ductus Venosus	
RI	LN	12023-8	Resistivity Index	
Ear	99PMSBLUS	C12005-01	Ear Length	
EDC(AUA)	LN	11781-2	EDD from average ultrasound age	
EFW (AC,BPD)Hadl	LN	11738-2	EFW by AC, BPD, Hadlock 1984	
EFW (AC,BPD)Sh	LN	11739-0	EFW by AC and BPD, Shepard 1982	
EFW (AC,BPD,FL)Hadl	LN	11735-8	EFW by AC, BPD, FL, Hadlock 1985	
EFW (AC,FL)Hadl	LN	11751-5	EFW by AC, FL, Hadlock 1985	
EFW (AC,HC,FL)Hadl	LN	11746-5	EFW by AC, FL, HC, Hadlock 1985	
EFW (B,H,A,F)Hadl	LN	11732-5	EFW by AC, BPD, FL, HC, Hadlock 1985	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
EFW (BPD,AD,FL)Tokyo	LN	33144-7	EFW by BPD, APAD, TAD, FL, Tokyo 1987	
EFW (BPD,FTA,FL)Osaka	LN	33140-5	EFW by BPD, FTA, FL, Osaka 1990	
Fetal HR	LN	11948-7	Fetal Heart Rate	
FIB	LN	11964-4	Fibula length	
FL	LN	11963-6	Femur Length	
FL/AC	LN	11871-1	FL/AC	
FL/BPD	LN	11872-9	FL/BPD	
Foot	LN	11965-1	Foot length	
FTA traced	99PMSBLUS	C12005-02	Fetal Trunk Cross Sectional Area	
GA(AC)Hadlock	LN	11892-7	AC, Hadlock 1984	
GA(AC) Hansmann	LN	33073-8	AC, Hansmann 1985	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
GA(AC)Merz	99PMSBLUS	C12013-16	AC, Merz 1991	
GA(BPD)Hadlock	LN	11902-4	BPD, Hadlock 1984	
GA(BPD) Hansmann	LN	33538-0	BPD, Hansmann 1986	
GA(BPD)Jeanty	LN	11905-7	BPD, Jeanty 1984	
GA(BPD)Merz	99PMSBLUS	C12013-17	BPD, Merz 1991	
GA(BPD)Osaka	LN	33082-9	BPD, Osaka 1989	
GA(BPD)Tokyo	LN	33085-2	BPD, Tokyo 1986	
GA(CRL) Hansmann	LN	33540-6	CRL, Hansmann 1986	
GA(CRL)Jeanty	LN	11917-2	CRL, Jeanty 1984	
GA(CRL)Osaka	LN	33093-6	CRL, Osaka 1989	
GA(CRL)Rempen	LN	33094-4	CRL, Rempen 1991	
GA(CRL)Robinson	LN	11914-9	CRL, Robinson 1975	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
GA(CRL)Tokyo	LN	33096-9	CRL, Tokyo 1986	
GA(FL)Hadlock	LN	11920-6	FL, Hadlock 1984	
GA(FL)Hansmann	LN	33541-4	FL, Hansmann 1986	
GA(FL)Jeanty	LN	11923-0	FL, Jeanty 1984	
GA(FL)Merz	LN	33542-2	FL, Merz 1988	
GA(FL)Osaka	LN	33101-7	FL, Osaka 1989	
GA(FL)Tokyo	LN	33103-3	FL, Tokyo 1986	
GA(FTA)Osaka	LN	33138-9	Fetal Trunk Cross-Sectional Area, Osaka 1989	
GA(GS)Hansmann	LN	33106-6	GA, Hansmann 1982	
GA(GSD)Rempen	LN	11929-7	GS, Rempen1991	
GA(GSD)Tokyo	LN	33108-2	GS, Tokyo 1986	
GA(HC)Hadlock	LN	11932-1	HC, Hadlock 1984	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
GA(HC)Hansmann	LN	33543-0	HC, Hansmann 1986	
GA(HC)Merz	LN	33115-7	HC, Merz 1988	
GA(HL)Jeanty	LN	11936-2	Humerus, Jeanty 1984	
GA(HL)Osaka	LN	33117-3	Humerus Length, Osaka 1989	
GA(LMP)	LN	11885-1	Gestational Age by LMP	
GA(MSD)Hellman	LN	11928-9	GS, Hellman 1969	
GA(OFD) Hansmann	LN	33120-7	OFD, Hansmann 1986	
GA(SL)Tokyo	LN	33127-2	Spine Length, Tokyo, 1989	
GA(TC)Nimrod	LN	33135-5	TCD, Nimrod 1986	
GA(TL)Jeanty	LN	11941-2	Tibia, Jeanty 1984	
GA(TTD) Hansmann	99PMSBLUS	C12013-18	Transverse Thoracic Diameter, Hansmann 1986	
GA(UL)Jeanty	LN	11944-6	Ulna, Jeanty 1984	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
GSD1	LN	11850-5	Gestational Sac Diameter	
GSD2	LN	11850-5	Gestational Sac Diameter	
GSD3	LN	11850-5	Gestational Sac Diameter	
HC	LN	11984-2	Head Circumference	
HC/AC	LN	11947-9	HC/AC	
HL	LN	11966-9	Humerus length	
HrtC	99PMSBLUS	C12005-03	Heart Circumference	
HrtC/TC	99PMSBLUS	C12004-01	HrtC/TC	
IOD	LN	33070-4	Inner Orbital Diameter	
Lat V	LN	12171-5	Lateral Ventricular width	
M Phalanx 5	99PMSBLUS	C12005-04	Length of the Middle Phalanx of the 5th Digit	
NUCH	LN	12146-7	Nuchal Fold thickness	
OFD	LN	11851-3	Occipital-Frontal Diameter	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
OOD	LN	11629-3	Outer Orbital Diameter	
Orbit 1	99PMSBLUS	C12007-01	Diameter Of the First Orbit	
Orbit 2	99PMSBLUS	C12007-02	Diameter Of the Second Orbit	
QUAD1	LN	11624-4	First Quadrant Diameter	
QUAD2	LN	11626-9	Second Quadrant Diameter	
QUAD3	LN	11625-1	Third Quadrant Diameter	
QUAD4	LN	11623-6	Fourth Quadrant Diameter	
Renal AP	99PMSBLUS	C12005-05	Renal Width	
Renal L	99PMSBLUS	C12005-06	Renal Length	
RL	LN	11967-7	Radius length	
SL	LN	33071-2	Spine Length	
TC	LN	11988-3	Thoracic Circumference	
TDap	99PMSBLUS	C12005-07	Anterior-Posterior Thoracic Diameter	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
TDtrv	LN	11864-6	Transverse Thoracic Diameter	
TL	LN	11968-5	Tibia length	
TTD	99PMSBLUS	C12005-08	Transverse Trunk Diameter	
UL	LN	11969-3	Ulna length	
Umbilical	SRT	T-F1810	Umbilical Artery	
PI	LN	12008-9	Pulsatility Index	
Umbilical	SRT	T-F1810	Umbilical Artery	
RI	LN	12023-8	Resistivity Index	
Umbilical	SRT	T-F1810	Umbilical Artery	
S/D	LN	12144-2	Systolic to Diastolic Velocity Ratio	
Umbilical	SRT	T-F1810	Umbilical Artery	
SV	LN	11726-7	Systolic Velocity	

A.1.4 GYN Measurements

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
Cervix	LN	11961-0	Cervix Length	
Endometrium	LN	12145-9	Endometrium Thickness	
L follicle (1–16) Dist	LN	11793-7	Follicle diameter	
L Follicle Vol (1–16)	SRT	G-D705	Volume	
LOH	LN	11857-0	Left Ovary Height	
LOL	LN	11840-6	Left Ovary Length	
LOV	LN	12164-0	Left Ovary Volume	
LOW	LN	11829-9	Left Ovary Width	
R follicle (1–16) Dist	LN	11793-7	Follicle diameter	
R Follicle Vol (1–16)	SRT	G-D705	Volume	
ROH	LN	11858-8	Right Ovary Height	
ROL	LN	11841-4	Right Ovary Length	

Measurement/ Calculation		DICOM Mapping		
Name	CSD	CV	CM	
ROV	LN	12165-7	Right Ovary Volume	
ROW	LN	11830-7	Right Ovary Width	
UTH	LN	11859-6	Uterus Height	
UTL	LN	11842-2	Uterus Length	
UTV	LN	33192-6	Uterus Volume	
UTW	LN	11865-3	Uterus Width	

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