



CARESTREAM HEALTH

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1 INTRODUCTION

1.1 Overview

CARESTREAM Image Suite is a self-contained radiographic imaging system designed to meet the need of small clinics for radiographic image capture, processing, review, report, archiving, and printing. The CARESTREAM Image Suite hardware consists of one radiographic image capture device attached to a PC workstation with either a standard or a high-resolution monitor. The capture device can be a POC scanner or a CR Classic scanner. This document describes the following modules of *CARESTREAM Image Suite* product:

- Print Management Service Module (Print SCU)
- Storage Service Module (Storage SCU/SCP)
- Storage Commitment Service Module (Storage Commitment SCU/SCP)
- Basic Worklist Service Module (MWL SCU)

The following DICOM SOP Classes are supported:

SOP Class Name	SOP Class UID	Service Class Role
Verification SOP Class	1.2.840.10008.1.1	SCP
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	SCU
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCU/SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCU/SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCU/SCP
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	SCU/SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCU/SCP
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	SCU/SCP
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	SCU

1.2 About This Document

This document provides the DICOM Conformance Statement for the *CARESTREAM Image Suite* implementation of the DICOM-3.0 standard. This DICOM Conformance Statement defines the subset of options selected from those offered by the DICOM v3.0 standard. Copies of the DICOM v3.0 standard may be obtained by written request or phone by contacting:

National Electrical Manufacturers Association

1300 N. 17th Street
Rosslyn, Virginia 22209 USA

It is assumed that the reader of this document is familiar with the DICOM v3.0 standard and with the terminology and concepts, which are used in the standard.

1.3 Important Remarks

The use of this Conformance Statement, in conjunction with the DICOM v3.0 standard, is intended to facilitate communication with *CARESTREAM Image Suite*. However, by itself, it is not sufficient to ensure that inter-operation will be successful. The user needs to proceed with caution and be aware of at least the following issues:

- It is the user's responsibility to analyze the applications requirements and to design a solution that integrates the *CARESTREAM Image Suite* properly with the network. The integration of any DICOM compliant device into an existing network goes beyond the scope of the standard.
- Testing the complete range of possible interactions between the *CARESTREAM Image Suite* and other devices should not be overlooked by the user. This includes the accuracy of the image data once it has crossed the interface between the workstation and the other device, and the suitability of the image data for the intended applications. Such a validation is required before any clinical use is performed.
- Evolution of the DICOM v3.0 standard may require changes to devices, which have implemented it, such as the *CARESTREAM Image Suite*. The user should ensure that other DICOM products in the network are also updated as the standard evolves.

If the user encounters unspecified private data elements while parsing a data set coming from the *CARESTREAM Image Suite*, the user is well advised to ignore those data elements (per the DICOM v3.0 standard). Unspecified private data element information is subject to change without notice.

1.4 Definitions, Acronyms, abbreviations

AE	Application Entity
CR	Computed Radiography
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
IOD	Information Object Definition
OSI	Open Systems Interconnection
PACS	Picture Archive and Communication System
PDU	Protocol Data Unit

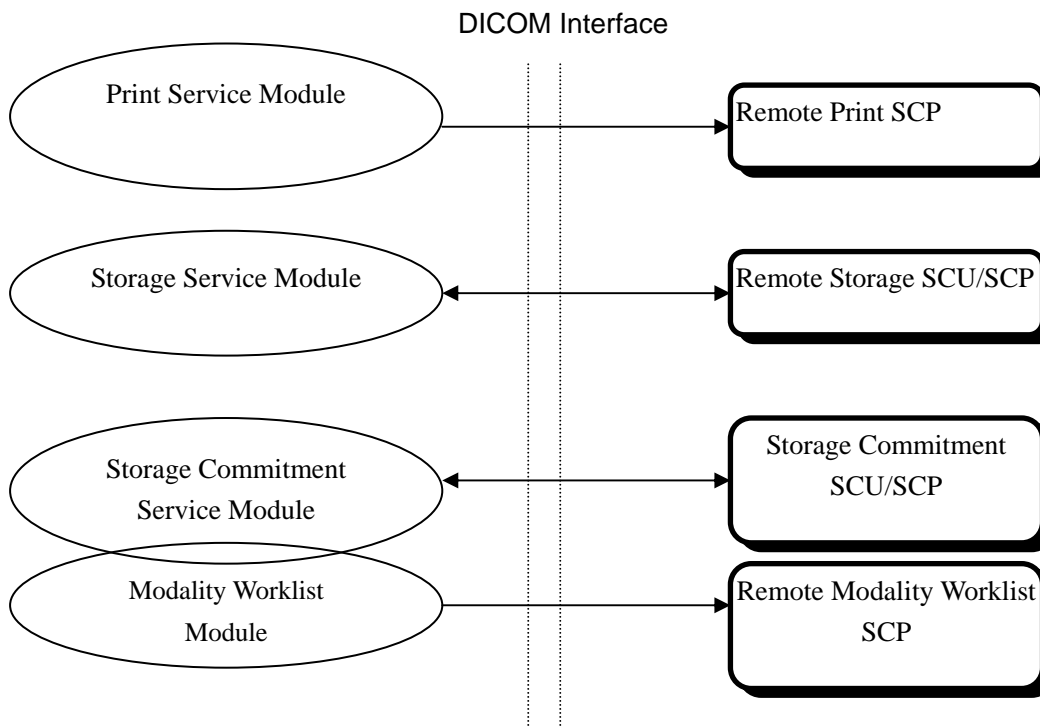
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
PSM	Print service module
SSM	Storage service module
MWL	Modality Worklist

2 IMPLEMENTATION MODEL

The *CARESTREAM Image Suite* uses the DICOM protocol to implement the following services:

- Deliver images to remote printers for image printing (Acts as Print Management Service Class User)
- Receive and store image files from various modalities or other systems (Acts as Storage Service Class Provider)
- Transmit image files to other PACS system or data bases (Acts as Storage Service Class User)
- Receive N-ACTION request for asking Storage Commitment from remote Storage Commitment SCU and return N-EVENT to report the storage completion (Acts as Storage Commitment Class Provider)
- Send N-ACTION request to other PACS system for asking Storage Commitment after sending images (Acts as Storage Commitment Class User)
- Send modality worklist queries with matching keys to get worklist required (Acts as Modality Worklist Service Class User)

2.1 Implementation model Diagram



2.2 Functional Definitions

When the Print Service Module runs, it will read the print jobs' information created by CARESTREAM Image Suite and deliver the related images and job information to remote printers as a print SCU.

The Storage Service Module, which acts as SCP, waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, Storage Service Module expects it to be a DICOM application. It will accept associations with Presentation Contexts for SOP Classes of the Storage Service Class. It will receive images on these Presentation Contexts and write them to standard DICOM files. The Storage service module will also respond to DICOM associations containing verification requests. If it acts as SCU, the Storage Service Module will read image data and establish an association to other DICOM application entity, which acts as SCP.

Storage Commitment Module will act as both SCU and SCP. If it acts as Storage Commitment Service Class Provider, it will wait for another application to send N-ACTION requests and check whether the storage is completed. It then creates a new association and returns the N-EVENT reports to Storage Commitment SCU. If it acts as Storage Commitment Service Class User, it will send the N-ACTION request to other image storage acting as SCP. At the meanwhile, it will initiate a new port to wait response from other image store to confirm the storage completion.

Modality Worklist Service Module will act as Modality Worklist Service Class User, it shall send C-FIND requests to other Modality Worklist SCP application and receives patient/study information and inserts into table for auto-matching. (Verify and correct wrong information from DICOM tags by comparing the patient/study information from Modality Worklist)

2.3 Sequencing of Real-World Activities

Print Service Module (PSM):

1. PSM initiates a DICOM association.
2. The remote Print SCP selects the appropriate Abstract and Transfer Syntax's from those proposed by PSM
3. PSM sends a N-CREATE command to create a film session.
4. The remote Print SCP returns "Success".
5. PSM sends a N-CREATE command to create a film box.
6. The remote Print SCP returns "Success"
7. PSM sends N-SET commands to set image boxes on the film box.
8. The remote Print SCP returns "Success"
9. Repeat step 5-8 to set all film boxes and image boxes.
10. PSM sends a N-ACTION command to print.
11. The remote Print SCP returns "Success"
12. PSM sends a N-DELETE command to delete current film box
13. The remote Print SCP returns "Success"
14. PSM sends a N-DELETE command to delete current film session
15. The remote Print SCP returns "Success"
16. PSM releases the association

Storage Service Module (SSM):

SCP

1. The remote AE initiates a DICOM association.
2. The storage service AE selects the appropriate Abstract and Transfer Syntax's from those proposed by the remote AE.
3. The remote AE initiates a C-STORE to send the IOD.
4. The storage service AE responds with a C-Store-RSP upon receipt of the IOD.

SCU

1. SSM initiates a DICOM association
2. SSM sends corresponding Abstract and Transfer Syntax based on the image modality type
3. The remote AE returns "Success"
4. SSM initiates a C-STORE to send the IOD
5. The remote AE returns "Success" once it receives the images successfully
6. SSM releases the association

3 AE SPECIFICATIONS

The Print Service Module in *CARESTREAM Image Suite* system provides Standard

Conformance to the following SOP Classes as an SCU.

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9

The Storage Service Module in CARESTREAM Image Suite provides Standard Conformance to the following SOP Classes as both a Storage SCP and SCU:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1

The Modality Worklist Module in *CARESTREAM Image Suite* system provides Standard Conformance to the following SOP Classes as both a Modality Worklist SCU:

Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31
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3.1 Print to DICOM Printers

3.1.1 Association Establishment Policies

3.1.1.1 General

CARESTREAM Image Suite will initiate a new association to send images to remote printer for printing and the maximum PDU size is 64Kbytes (Film output)

3.1.1.2 Number of Associations

The Print Service Module acting as Print SCU will attempt only one association establishment at one time. All the print jobs are transmitted to printer in sequence.

3.1.1.3 Asynchronous Nature

The Print Service Module will only allow a single outstanding operation on an association. It will not perform asynchronous operations in one session.

3.1.1.4 Implementation Identifying Information

The Print Service Module provides an Implementation Class UID, which is “1.2.840.113564.86.2” and an Implementation version name of “**IMAGESUITE_1.0**”.

3.1.2 Association Initiation Policy

3.1.2.1 Associated Real-World Activity

Print Service Module attempts to initiate a new association for each print job it attempts to transfer.

3.1.2.2 Proposed Presentation Contexts

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Basic Grayscale Print Management	1.2.840.1000 8.5.1.1.9	Implicit Little Endian	1.2.840.10008. 1.2	SCU	None

3.1.2.3 SOP Specific Conformance Statement for Basic Print Management Meta SOP Class

The Meta SOP Class is defined by the following set of supported SOP Classes:

SOP Class	SOP Class UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23

3.1.2.3.1 Printer SOP Class

3.1.2.3.2 DIMSE Service N-GET

Attribute	SCU Usage	Tag	Expected Values
Printer Status	U	(2110,0010)	NORMAL WARNING FAILURE

Attribute	SCU Usage	Tag	Expected Values
Printer Status Info	U	(2110,0020)	Any valid string including the following. for NORMAL conditions: "NORMAL" for WARNING conditions: "RECEIVER FULL", "FILM JAM", "PRINTER NOT RDY", "PROCESSOR DOWN", "CHECK PROCESSOR", "PROC NOT READY", "NO RECEIVE MGZ", "NO SUPPLY MGZ", "NO TONER", "NO STATE", "CHECK RIBBON", "PRINTER BUSY", "OFFLINE", "PRINTER STOPPED", "CHECK SUPPLY MAG", "COVER OPEN", "PRINTER OFFLINE", "EXPOSURE FAILURE", "CHECK R MAG", "PROC NOT RDY", "STATE UNKNOWN", "CHECK INK CART", "INK OUT", "QUEUED", "SUPPLY EMPTY", "SUPPLY LOW", "BAD RECEIVE MGZ", "BAD SUPPLY MGZ", "FILM TRANSP ERR", "CHECK CHEMISTRY", "CHECK SORTER", "CHEMICALS LOW", "CHEMICALS EMPTY",

Attribute	SCU Usage	Tag	Expected Values
Printer Status Info (continued from previous page)			"FINISHER EMPTY", "FINISHER ERROR", "FINISHER LOW", "CHECK PROC", "PRINTER BUSY", "PROC DOWN", "PROC INIT", "PROC OVERFLOW FL", "PROC OVERFLOW HI", "PRINTER DOWN", "PRINTER INIT", "CALIBRATING", "CALIBRATION ERR", "ELEC CONFIG ERR", "ELEC DOWN", "ELEC SW ERROR", "EXPOSURE FAILURE", "REQ MED NOT INST", "REQ MED NOT AVAI", "RIBBON ERROR", "NO RIBBON", "UNKNOWN" for FAILURE conditions: "FATAL", "INVALID PAGE DES", "INSUFFIC MEMORY", "FATAL ERROR", "CHECK PRINTER", "PRINTER DOWN", "NO RESPONSE", "RIBBON MISMATCH", "TIME OUT", "UNKNOWN STATUS"
Printer Name	U	(2110,0030)	Ignored
Manufacturer	U	(0008,0070)	Ignored
Manufacturer Model Name	U	(0008,1090)	Ignored
Device Serial Number	U	(0018,1000)	Ignored
Software Version	U	(0018,1020)	Ignored
Date of Last Calibration	U	(0018,1200)	Ignored
Time of Last Calibration	U	(0018,1201)	Ignored

3.1.2.3.3 Basic Film Session SOP Class

3.1.2.3.3.1 DIMSE Service N-CREATE

Attribute	SCU Usage	Tag	Possible Values
Number of Copies	U	(2000,0010)	1-> 99
Print Priority	U	(2000,0020)	High, Med, Low
Medium Type	U	(2000,0030)	CLEAR FILM, BLUE FILM, MAMMO BLUE FILM
Film Destination	U	(2000,0040)	MAGAZINE, PROCESSOR, BIN_n
Film Session Label	U	(2000,0050)	Up to 64 characters maybe provided

3.1.2.3.3.2 DIMSE Service N-ACTION

The Print service module uses the N-ACTION to instruct the SCP to print all films in the session. For Print SCP that conforms to the N-ACTION specification in Part 4 section H.4.1.2.4 of the DICOM standard.

3.1.2.3.3.3 DIMSE Service N-SET

All attributes supported in the N-CREATE are used with this command.

3.1.2.3.3.4 DIMSE Service N-DELETE

Once a Film Session is deleted, another will not be created on the same association. The association will be released.

3.1.2.3.4 Basic Film Box SOP Class

3.1.2.3.4.1 DIMSE Service N-CREATE

Attribute	SCU Usage	Tag	Possible Values
Image Display Format	M	(2010,0010)	STANDARD\C,R For LANDSCAPE Film Orientation,(C,R) may = (1,2) (2,1) (2,2) (3,2) (4,2) (3,3) (4,3) (5,3) (4,4) (5,4) (6,4) (6,5) (7,5) For PORTRAIT Film Orientation,(C,R) may = (1,1) (1,2) (2,2) (2,3) (2,4) (3,3) (3,4) (3,5) (4,4) (4,5) (4,6) (5,6) (5,7)

Attribute	SCU Usage	Tag	Possible Values
Referenced Film Session Sequence	M	(2010,0500)	
>Referenced SOP Class UID	M	(0008,1150)	
>Referenced SOP Instance UID	M	(0008,1155)	
Referenced Basic Image Box Sequence	-	(2010,0510)	Not used
Referenced Basic Annotation Box Sequence	-	(2010,0520)	Not used
Film Orientation	U	(2010,0040)	PORTRAIT, LANDSCAPE
Film Size ID	U	(2010,0050)	4INX6IN 8INX10IN 10INX12IN 14INX14IN 14INX17IN
Magnification Type	U	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Max Density	U	(2010,0130)	0-399(Value will be within the activity calibration range of the Printer and will be less than or equal to the Border Density(2010,0080))
Annotation Display Format ID	U	(2010,0030)	Not used
Smoothing Type	U	(2010,0080)	NORMAL ENHANCED ENHANCED1 0-15
Border Density	U	(2010,0100)	BLACK, WHITE, i, where i may = 1-399(if integer value specified, value must be less than or equal to Max Density(2010,0130))
Empty Image Density	U	(2010,0110)	BLACK, WHITE, i, where i may = 1-399(if integer value specified, value must be less than or equal to Max Density(2010,0130))
Min Density	U	(2010,0120)	0-399(Value must be less than Max Density)
Trim	U	(2010,0140)	YES and No
Illumination	U	(2010,015E)	Positive integer in units of cd/m2, required for p-value print
Reflected Ambient light	U	(2010,0160)	Positive integer in units of cd/m2, required for p-value print

3.1.2.3.4.2 DIMSE Service N-ACTION

The Print service module uses the N-ACTION to instruct the SCP to print the current film in the

session.

3.1.2.3.4.3 DIMSE Service N-SET

All attributes supported in the N-CREATE are used with this command.

3.1.2.3.4.4 DIMSE Service N-DELETE

The Print service module uses the N-DELETE to delete the current film in the session.

3.1.2.3.5 Basic Grayscale Image Box SOP Class

3.1.2.3.5.1 DIMSE Service N-SET

Attribute	SCU Usage	Tag	Possible Values
Image Position	M	(2020,0010)	All values within the range of Image Display Format
Preformatted Grayscale Image Sequence	M	(2010,0110)	
>Samples Per Pixel	M	(0028,0002)	1
>Photometric Interpretation	M	(0028,0004)	MONOCHROME1, MONOCHROME2 (If the image is scanned from Classic CR or POC CR, MONOCHROME2 is set. Otherwise this value will be read from the image file.)
>Rows	M	(0028,0010)	Minimum Value 64 Maximum Values: Known for all Carestream printers, configurable for others. The aspect ratio is used with the printer's page extents, display format, etc., to calculate this value.
>Columns	M	(0028,0011)	Same as Rows (0028,0010)
>Bits Allocated	M	(0028,0100)	8
>Bits Stored	M	(0028,0101)	8
>High Bit	M	(0028,0102)	Bits Stored – 1
>Pixel Representation	M	(0028,0103)	0000H(unsigned integer)
>Pixel Data	M	(7FE0,0010)	All values consistent with Bits Stored
Magnification Type	U	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE Note: Is always the same as the Magnification Type specified for the Film Box
Polarity	U	(2020,0020)	NORMAL, REVERSE

Attribute	SCU Usage	Tag	Possible Values
Smoothing Type	U	(2010,0080)	NORMAL, ENHANCED, ENHANCED1 Valid only for Magnification Type CUBIC. 0 – 15 Must be the same as the Smoothing Type specified for the Film Box.
Requested Image Size	U	(2020,0030)	Width of Image Box in millimeters (fractional millimeters supported) 0.00 indicates “Maximize film utilization while maintaining Image aspect ratio”. If this value exceeds the available dimensions of the Image Box, it will be accepted only if the Requested Decimate/Crop Behavior value is NOT set to FAIL. An icon will be added to the page indicating that the Requested Image Size was not achieved. A maximum magnification factor is 0.01 and maximum magnification factor of 20 is imposed to achieve the requested image size. If it's not equal to 0.00, it's true size printing.
Requested Decimate/Crop Behavior	U	(2020,0040)	FAIL: If the Image Size exceeds the printable area, the Image will be rejected. If it's true size printing, FAIL will be assigned.

3.1.2.3.6 Presentation LUT SOP Class

3.1.2.3.6.1 DIMSE Service N-CREATE

Attribute	SCU Usage	Tag	Possible Values
Presentation LUT Shape	M	(2050,0020)	IDENTITY (Only for P-value printing)

3.1.3 Association Acceptance Policy

Print Service Module never accepts an association.

3.2 Acquire and Forward Images

The Storage Service Module in CARESTREAM Image Suite provides Standard Conformance to the following SOP Classes as both a Storage SCP and SCU:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1

3.2.1 Association Establishment Policies

3.2.1.1 General

CARESTREAM Image Suite will initiate new association to send images to Remote DICOM destinations and the maximum PDU size is 64Kbytes (Manual image transfer or auto-forwarding on rules). *CARESTREAM Image Suite* can also accept associations from other DICOM modalities to receive images and store them in the local storage system.

3.2.1.2 Number of Associations

The Storage Service Module can accept any number of associations, only limited by physical resources such as memory and disk space. It should be noted that system response time will degrade, and could possibly adversely effect a time-out period on other remote AE's. If the Storage Service Module acts as Storage SCU, it will only establish one association with one destination AE and send image files in sequence. But for various destinations, it will create multiple threads and send images concurrently with one association for one destination.

3.2.1.3 Asynchronous Nature

The Storage Service Module acting as both SCU/SCP will only allow a single outstanding operation on an association. Therefore the Storage Service Module will not perform asynchronous operations window negotiation.

3.2.1.4 Implementation Identifying Information

The Storage Service Module in *CARESTREAM Image Suite* will provide an Implementation Class UID, which is “1.2.840.113564.86.2” and an Implementation version name of “IMAGESUITE_1.0”.

3.2.2 Association Initiation Policy

CARESTREAM Image Suite initiates associations for the following activities:

- Sending images to Remote DICOM Application (Automatically or manually forwarding images)
- Accept associations and receive images to store (Image acquisition)

3.2.2.1 Associated Real-World Activity

The Storage Service Module attempts to initiate a new association to send images to other DICOM archive by using a C-STORE command. It will attempt to store the images to same peer system on a same association. If the peer system rejects the association, *CARESTREAM Image Suite* will attempt to initialize another association with the abstract syntax and transfer syntax of the DICOM file in the sending queue. After storing, the association will not be released until it's idle for 10 seconds by default. (No images will be stored on the association.)

3.2.2.2 Proposed Presentation Contexts

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG2000 lossless only	1.2.840.10008.1.2.4.90	SCU	None
		JPEG2000	1.2.840.10008.1.2.4.91	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG2000 lossless only	1.2.840.10008.1.2.4.90	SCU	None
		JPEG2000	1.2.840.10008.1.2.4.91	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG2000 lossless only	1.2.840.10008.1.2.4.90	SCU	None
		JPEG2000	1.2.840.10008.1.2.4.91	SCU	None
Ultrasound Multi-frame 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	SCU	None
		JPEG2000 lossless only	1.2.840.10008.1.2.4.90	SCU	None
		JPEG2000	1.2.840.10008.1.2.4.91	SCU	None
Ultrasound 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	SCU	None
		JPEG2000 lossless only	1.2.840.10008.1.2.4.90	SCU	None
		JPEG2000	1.2.840.10008.1.2.4.91	SCU	None
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.3 Association Acceptance Policy

When the Storage Service Module accepts an association, it receives any images transmitted on that association and storage the images on disk in the file system with the standard DICOM file format. The Storage service determines whether to accept the connection by checking the calling AE title. The acceptable calling AE titles are configurable.

3.2.3.1 Associated Real-World Activity

The associated Real-World Activity associated with C-STORE operation is the storage of the image on the disk of the system upon which *CARESTREAM Image Suite* is running. The Storage Service Module will issue a failure status if it is unable to storage the image on disk.

3.2.3.2 Acceptable Presentation Contexts

Any of the Presentation Contexts shown in the following table are acceptable for Storage service module to receive images.

Presentation Context Table – Accepted					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
All Storage SOP Classes as above	1.2.840.10008.5.1.4.x.x.x	Implicit VR Little Endian	1.2.840.1000 8.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.1000 8.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.1000 8.1.2.2	SCP	None
		JPEG baseline	1.2.840.1000 8.1.2.4.50	SCP	None
		JPEG lossless, non-hierarchical, first-order prediction	1.2.840.1000 8.1.2.4.70	SCP	None

Presentation Context Table – Accepted					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
		RLE compression	1.2.840.1000 8.1.2.5	SCP	None
		JPEG2000 lossless only	1.2.840.1000 8.1.2.4.90	SCP	None
		JPEG2000	1.2.840.1000 8.1.2.4.91	SCP	None
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.1000 8.1.2	SCP	None

3.2.3.3 SOP Specific Conformance

3.2.3.3.1 SOP Specific Conformance to Verification SOP Class

The Storage Service Module provides standard conformance to the DICOM Verification Service Class.

3.2.3.3.2 SOP Specific Conformance to Storage SOP Classes

The Storage Service Module conforms to the SOP's of the Storage Service Class at Level 2(Full). No elements are discarded or coerced by the Storage service module. In the event of a successful C-STORE operation, the Image has successfully been written to disk as a standard windows file. The duration of the image storage is determined by the *CARESTREAM Image Suite* system.

3.2.3.3.3 SOP Specific Conformance to Computed Radiography

Image Storage

Computed Radiography Image SOP Class

SOP Class	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1

Computed Radiography Image SOP Class – Supported Attributes

Attribute Name	Tag	DICOM Type	Supported Values
Patient Module			
Patient Name	(0010,0010)	2	
Patient ID	(0010,0020)	2	
Patient Birth Date	(0010,0030)	2	
Patient Sex	(0010,0040)	2	
Patient Comments	(0010,4000)	3	
General Study			
Study Instance UID	(0020,000D)	1	
Study Date	(0008,0020)	2	
Study Time	(0008,0030)	2	
Referring Physician Name	(0008,0090)	2	
Study ID	(0020,0010)	2	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	3	
Patient Study			
Admitting Diagnoses Description	(0008,1080)	3	
Patient's Age	(0010,1010)	3	
Patient's Size	(0010,1020)	3	
Patient's Weight	(0010,1030)	3	
Occupation	(0010,2180)	3	
Additional Patient's History	(0010,21B0)	3	
General Series			
Modality	(0008,0060)	1	CR
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	2	
Laterality	(0020,0060)	2C	L R
Series Date	(0008,0021)	3	
Protocol Name	(0008,1030)	3	
Series Time	(0008,0031)	3	
Operator Name	(0008,1070)	3	
Performed Procedure Step Start Date	(0040,0244)	3	
Performed Procedure Step Start Time	(0040,0245)	3	
CR Series			

Attribute Name	Tag	DICOM Type	Supported Values
Body Part Examined	(0018,0015)	2	
View Position	(0018,5101)	2	
General Equipment			
Manufacturer	(0008,0070)	2	Carestream Health
Institution Name	(0008,0080)	3	
Institution Address	(0008,0081)	3	
Station Name	(0008,1010)	3	
Manufacturer Model Name	(0008,1090)	3	
Device Serial Number	(0018,1000)	3	
Software Versions	(0018,1020)	3	1.0
General Image			
Instance Number	(0020,0013)	2	1
Patient Orientation	(0020,0020)	2C	
Image Type	(0008,0008)	3	
Content Date	(0008,0023)	2C	
Content Time	(0008,0033)	2C	
Acquisition Date	(0008,0022)	3	
Acquisition Time	(0008,0032)	3	
Derivation Description	(0008,2111)	3	
Acquisition Number	(0020,0012)	3	
Images In Acquisition	(0020,1002)	3	
Image Comments	(0020,4000)	3	
Presentation LUT Shape	(2050,0020)	3	IDENTITY
Lossy Image Compression	(0028,2110)	3	00 = No Compression
Image Plane			
Pixel Spacing	(0028,0030)	3	
Image Pixel			
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Planar Configuration	(0028,0006)	1C	
Rows	(0028,0010)	1	
Columns	(0028,0011)	1	
Pixel Aspect Ratio	(0028,0034)	1C	1/1
Bits Allocated	(0028,0100)	1	16
Bits Stored	(0028,0101)	1	12
High Bit	(0028,0102)	1	11
Pixel Representation	(0028,0103)	1	0
Smallest Image Pixel Value	(0028,0106)	1	0
Largest Image Pixel Value	(0028,0107)	1	4095

Attribute Name	Tag	DICOM Type	Supported Values
Pixel Data	(7FE0,0010)	1	
CR Image			
Imager Pixel Spacing	(0018,1164)	3	
Contrast/Bolus			
Contrast/Bolus Agent	(0018,0010)	2	
VOI LUT			
Window Center	(0028,1050)	1C	2048
Window Width	(0028,1051)	1C	4096
SOP Common			
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1 .1
SOP Instance UID	(0008,0018)	1	
Specific Character Set	(0008,0005)	1C	

3.3 Query Modality Worklist

The Query Modality Worklist in *CARESTREAM Image Suite* system provides Standard Conformance to the following SOP Classes as a Modality Worklist SCU:

Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31
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3.3.1 Association Establishment Policies

3.3.1.1 General

CARESTREAM Image Suite will initiate new associations to query modality worklist from remote DICOM system and the maximum PDU size is 64Kbytes (MWL auto-matching)

3.3.1.2 Number of Associations

Basic Worklist Service Module acting as MWL SCU will establish only one association for each query and only one C-FIND request in one session.

3.3.1.3 Asynchronous Nature

Modality Worklist SCU Module will also only send one query request and receive response on one association.

3.3.1.4 Implementation Identifying Information

The Modality Worklist Module in *CARESTREAM Image Suite* will provide an Implementation Class UID, which is “1.2.840.113564.86.2” and an Implementation version name of “IMAGESUITE_1.0”.

3.3.2 Association Initiation Policy

CARESTREAM Image Suite initiates associations to send C-FIND request to get the modality worklist from the Remote DICOM System which will act as MWL SCP.

3.3.2.1 Associated Real-World Activity

3.3.2.2 Proposed Presentation Contexts

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Modality Worklist Information Model – FIND	1.2.840.1000 8.5.1.4.31	Implicit VR, Little Endian	1.2.840.10 008.1.2	SCU	None

3.3.2.2.1 SOP Specific Conformance Statement – MWL SCU

The Modality Worklist Module shall initiate Matching Key list and Return Key list; all supported keys are listed below:

Keys Requested in the MWL SCU				
Name	Tag	Type	VR	VM
Patient ID	(0010, 0020)	Return Key	LO	1
Patient’s Birth Date	(0010, 0030)	Return Key	DA	1
Patient’s Name	(0010, 0010)	Return Key	PN	1
Patient’s Sex	(0010, 0040)	Return Key	CS	1

Keys Requested in the MWL SCU				
Name	Tag	Type	VR	VM
Other Patient IDs	(0010, 1000)	Return Key	PN	1-n
Accession Number	(0008, 0050)	Return Key	SH	1
Referring Physician's Name	(0008, 0090)	Return Key	PN	1
Requested Procedure Code Sequence	(0032, 1064)		SQ	1
>Code Value	(0008, 0100)	Return Key	SH	1
>Code Meaning	(0008, 0104)	Return Key	LO	1
Visit Status ID	(0038, 0008)	Return Key	CS	1
Scheduled Procedure Step Sequence	(0040, 0100)		SQ	1
>Scheduled Station AE Title	(0040, 0001)	Query Key	AE	1
>Modality	(0008, 0060)	Query Key	CS	1
>Requested Contrast Agent	(0032, 1070)	Return Key	LO	1
>Scheduled Procedure Step Start Date	(0040, 0002)	Query Key	DA	1
>Scheduled Procedure Step Start Time	(0040, 0003)	Query Key	TM	1
>Scheduled Protocol Code Sequence	(0040, 0008)		SQ	1
>>Code Value	(0008, 0100)	Return Key	SH	1
Study Instance UID	(0020, 000D)	Return Key	UI	1
Requested Procedure ID	(0040, 1001)	Return Key	SH	1
Requested Procedure Description	(0032, 1060)	Return Key	LO	1
Current Patient Location	(0038, 0300)	Return Key	LO	1
Requested Procedure Location	(0040, 1005)	Return Key	LO	1

3.3.3 Association Acceptance Policy

The Modality Worklist module of CARESTREAM Image Suite does not accept any association because it works only as the SCU role.

3.3.4 Procedure Mapping

CARESTREAM Image Suite can get the body part from the mapping value of the procedure code. For the procedure mapping to function properly CARESTREAM Image Suite must receive the correct code in the code value (0008,0100) element of the requested procedure code sequence (0032,1064).

3.4 Receive/Send Storage Commitment Request

The Storage Commitment Module in *CARESTREAM Image Suite* system provides Standard Conformance to the following classes as both a Storage Commitment SCP and SCU. To modalities and other DICOM systems, it will act as Storage Commitment SCP to receive Storage Commitment N-ACTION request and return N-EVENT-REPORT response to the SCU, while it will also act as a SCU, after sending images to the Remote DICOM System, it will send N-ACTION request and receive N-EVENT-REPORT as SCU. Both the SCU and SCP of the

storage commitment are only responding on a different association.

Storage Commitment Push Model	1.2.840.10008.1.20.1
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3.4.1 Association Establishment Policies

3.4.1.1 General

CARESTREAM Image Suite accepts association from remote DICOM Systems or modalities to provide Storage Commitment Service. As Storage Commitment SCP, it will initiate a new association to send an N-EVENT-REPORT to SCU in response to the N-ACTION request. If it is acting as Storage Commitment SCU, it will send the N-ACTION request on the separate association to the Remote DICOM System. Its maximum PDU size is 64Kbytes. The reference SOP class UID will always be 1.2.840.10008.5.1.4.1.1.1 (CR Image SOP Class).

3.4.1.2 Number of Associations

The Storage Commitment Service Module will send N-ACTION request on one association to ask commitment for storage completion. Then it will close the association and initiate a new port to listen and accept another association to receive N-EVENT-REPORT message from SCP. It is the same when it acts as SCP. After receiving an N-ACTION request, it will close the association and initiate a new association to notify remote SCU application the completion of storage.

3.4.1.3 Asynchronous Nature

The Storage Commitment Module only allows a single outstanding operation on one association.

3.4.1.4 Implementation Identifying Information

The Storage Commitment Module in *CARESTREAM Image Suite* provides an Implementation Class UID, which is "1.2.840.113564.86.2" and an Implementation version name of "IMAGESUITE_1.0".

3.4.2 Association Initiation Policy

CARESTREAM Image Suite initiates associations for the following activities:

- Sending N-ACTION request to confirm the completion of storage (Storage Commitment support)
- Sending N-EVENT-REPORT for answering to Storage Commitment requests (Provide Storage Commitment SCP)

3.4.2.1 Associated Real-World Activity

After finishing sending images, the Storage Commitment Server acting as SCU initiates a association to send N-ACTION request to the Remote DICOM System which archives the images for long-term storage. Then it closes the association and initiates a new port waiting for a N-EVENT-REPORT from the Remote DICOM System. It does not support the optional Storage Medial File-Set ID & UID Attributes in the N-ACTION. Once the SCU receives the N-EVENT-REPORT primitive (Storage Commitment Result), it allows the system to remove the images in the local storage system if necessary, otherwise, it notifies the user and the related images will remain until they are sent again manually and the SCU receives the success status.

3.4.2.2 Proposed Presentation Contexts

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Storage Commitment Push Model	1.2.840.1000 8.1.20.1	Implicit Little Endian	1.2.840.10008. 1.2	SCU	None

3.4.3 Association Acceptance Policy

3.4.3.1 Associated Real-World Activity

When CARESTREAM Image Suite works as storage commitment SCP, The commitment means that image has been saved safely.

3.4.3.2 Acceptable Presentation Contexts

Any of the Presentation Contexts shown in the following table are acceptable for Storage service module to receive images.

Presentation Context Table - Accepted					
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Abstract Syntax		Transfer Syntax		Role	Expanded Negotiation
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

3.4.3.2.1 SOP Specific Conformance – Storage Commitment Push

Model SOP Class

The Storage Commitment Module opens a new association for sending the N-EVENT-REPORT message back to the Remote DICOM System that requested the Storage Commitment. The N-EVENT-REPORT message is sent on a different association other than the N-ACTION operation.

The Storage Commitment Module may receive Storage Commitment requests before receiving & saving related images. In this case, the SCP will wait for 60 seconds by default if the sops still don't arrive; N-EVENT-REPORT messages are sent and return the failure status.

4 COMMUNICATION PROFILES

4.1 Supported Communication Stacks (parts 8,9)

All modules mentioned here in the *CARESTREAM Image Suite* provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8.

4.2 OSI Stack

The OSI Stack is not supported.

4.3 TCP/IP Stack

The Print and Storage service modules inherit their TCP/IP stack from the Windows XP system upon which they execute.

4.3.1 Physical Media Support

The Print and Storage service modules are indifferent to the physical medium over which TCP/IP executes. They inherit this from the Windows XP system upon which they execute.

4.4 DICOM Parameters

- DICOM port number.

- Application entity title.
- Time-out.

5 Support of Extended Character Sets

Note: "ISO_IR 100" is supported. ISO-IR 6 will be supported by default.