SonoSite, Inc. **Bothell, Washington**

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M-Turbo and S Series DICOM Conformance Statement

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Conformance Statement Overview

The Turbo Ultrasound System implements the necessary DICOM services to download work lists from an information system, save acquired images to a network storage device and request storage commitment for them, print to a networked hardcopy device, inform an information system of exam status via MPPS, and store DICOM files onto removable media.

Table 1-1 provides an overview of the network services supported by the Turbo Ultrasound System.

Table 1-1 NETWORKING SERVICES

NETWORKING SOP CLASSES	USER OF SERVICE (SCU)	PROVIDER OF SERVICE (SCP)
TRANSFER		
Ultrasound Image Storage	Yes	No
Ultrasound Image Storage (Retired)	Yes	No
Ultrasound Multi-frame Image Storage	Yes	No
Secondary Capture Image Storage	Yes	No
WORKFLOW MANAGEMENT		
Modality Worklist	Yes	No
Storage Commitment	Yes	No
Modality Performed Procedure Step	Yes	No
PRINT MANAGEMENT		
Basic Grayscale Print Management	Yes	No
Basic Color Print Management	Yes	No
GENERAL		
Verification	Yes	Yes

Table 1.1-2 provides an overview of the media storage services supported by the Turbo Ultrasound System.

Table 1.1-2 MEDIA STORAGE SERVICES

SOP CLASSES	ROLE
Media Storage Directory Stroage	FSC
Ultrasound Image Storage	FSC
Ultrasound Multi-frame Image Storage	FSC

1 INTRODUCTION

This document describes the SonoSite Turbo® Ultrasound System's conformance to the ACR-NEMA DICOM (Digital Imaging and Communications in Medicine) standard and satisfies the DICOM requirement for a vendor conformance specification.

The Turbo system is an ultrasound imaging device. The DICOM options of the Turbo system provide a means to query the Information System for scheduled procedures using Modality Worklist, send procedure status messages to RIS via MPPS, send images to printers, storage servers and removable USB media, and request Storage Commitment for images stored to PACS.

Throughout this document DICOM storage servers will be referred to as archivers. For a device to be classified as an archiver it must be capable of receiving DICOM store commands. Archivers are primarily comprised of PACS.

This document is written with respect to ACR-NEMA DICOM version number 3.0 - 2007.

1.1 DICOM BACKGROUND

The DICOM information exchange specification provides a definitive structure of commands and information that allow for the inter-communication of medical imaging devices. Developed by the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA), the DICOM standard strives to promote communication of image information through the use of a standardized set of command classes and information semantics.

The DICOM standard defines classes of information that are common to many modalities of medical imaging. However, to meet the specific needs of information content for such a diverse range of information, the DICOM specification defines structures for a multitude of medical data. To alleviate the need for applications to implement every aspect of the DICOM specification, a list of conformance tables for every modality was created to define the minimum set of information necessary for data exchanges. A requirement of the DICOM specification is to maintain a compliance document that outlines a subset of DICOM services and data classes that are supported by a device. The purpose of this document is to define a subset of DICOM for the exchange of information with the SonoSite Turbo via its DICOM feature.

1.2 DEFINITIONS

AE	Application Entity
ANSI	American National Standards Institute
CW	Continuous Wave
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
FSC	File Set Creator
HIS	Hospital Information System
IE	Information Entity
IOD	Information Object Definition
kHz	Kilohertz
LUT	Look Up Table

MPPS	Modality Performed Procedure Step
PACS	Picture Archive and Communication System
PW	Pulsed Wave
PDU	Protocol Data Unit
PPS	Performed Procedure Step
RGB	Red, Green, Blue
RIS	Radiology Information System
SC	Secondary Capture
SCU	Service Class User (Client)
SCP	Service Class Provider (Server)
SOP	Service – Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
US	Ultrasound
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VOI	Value Of Interest
VR	Value Representation

1.3 REFERENCE DOCUMENTS

ACR-NEMA DICOM Standard Version 3.0 – 2007

2 IMPLEMENTATION MODEL

The Turbo DICOM feature incorporates the DICOM 3.0 standard for networked image printing, image storage, MPPS, Storage Commitment, and Modality Worklist functions. Scheduled Procedures are queried from the HIS/RIS Worklist SCP and presented to the operator for selection. At the beginning and end of a procedure, MPPS messages are sent to the information system relaying the exam status. Performed Procedures[1] are transferred from the Turbo ultrasound system using standard network connections to be processed on a centralized printer or stored on a DICOM compatible archiver. Upon completion of image transfer, Storage Commitment is requested for transferred images.

The behavior of how images are sent depends on which Transfer Images setting is selected during DICOM setup of locations. Two selections are offered, "During the exam" (in-progress transfer mode) or "End of exam" (batch transfer mode).

For batch transfer mode, Turbo allows up to four archivers, two printers and one Worklist server to be selected at any given time. The devices are selected using DICOM Setup mode with all selected archive and print devices being placed into a destination list.

For in-progress transfer mode, Turbo allows only one archive device, no printer and one Worklist server to be selected at any given time. Like batch transfer mode, the devices are selected using DICOM Setup mode with all selected devices annotated in the destination list.

A maximum of 200 Scheduled Procedures Steps may be queried from the selected Modality Worklist SCP. The Worklist is persisted to non-volatile memory so that it can be accessed during portable exams. Both manual and automatic queries are supported. Automatic queries are user configurable and are performed in the background at periodic intervals.

During an exam all saved images are written to internal storage. For batch transfer mode, when the exam completes all images associated with it are marked as Archive Pending for transfer to each device in the current destination list. If a network connection is present then transfer begins immediately.

Performed Procedures are Archived to devices in the destination list sequentially, starting with the first selected archiver and ending with the last selected printer. Exam images are sent to each destination device in batch transfer mode; an association is opened, all exam images are transferred in acquisition order, and the association is closed. Once an exam is successfully transferred to a device then all images in the exam are marked as Archive Complete to that destination and Storage Commitment is requested for the images. Archiving then continues with the next device in the destination list. Once all devices in the destination list have successfully received each exam image then the Exam Archive is complete.

For in-progress transfer mode, images are transferred immediately after acquisition, followed by request for Storage Commitment, provided there is a network connection present.

Acquired images are sent to the destination archive device; an association is opened if closed, the acquired image is transferred and the association is left open at the end of image transfer. The association is left open in anticipation of transferring another acquired image. If another image is not acquired within nominally 30 seconds, then the association is closed to preserve network resources. Any additional images acquired during the exam are sent on a subsequent association(s) using the sequence described above.

[1] Performed Procedures may consist of Images and clips.

When a Get Status is performed the current destination list is used in the same manner as with Exam Archive. For batch transfer mode, the devices are accessed sequentially, starting with the first selected archiver and ending with the last selected printer. For each device an association is opened, status is returned, and the association is closed. Status is obtained from printer devices using an N-Get Status, and from archiver, MPPS, Storage Commitment and Worklist devices using DICOM Verify (C-Echo). Once status is successfully returned from all devices in the destination list then Get Status is complete.

When a Get Status is performed during in-progress transfer mode, the archive device association is opened if closed, a C-Echo Request is issued and the C-Echo response status is reported. The association remains open while in DICOM Setup mode. Once DICOM Setup mode is exited the rules used for image acquisition apply to closing the association. This behavior allows an in-progress transfer with an open association to remain open through the Get Status process and allows subsequent image acquisition to be sent on the same association when acquisition constraints are met.

One or more completed exams may be selected from the exam list to have their images saved as DICOM files to the selected USB medium.

The user may choose to "Append" a completed exam. On the Turbo system, this is treated as a new Series in the same Study as the original exam. The appended exam shows up as a separate line item in the Patient List form.

2.1 APPLICATION DATA FLOW DIAGRAM

The diagram in Figure 2-1 represents the relationship between the ultrasound system's real-world activities (circles on the left), the local AE's built into Turbo (boxes in the center), and the remote AE's built into the devices Turbo communicates with using DICOM (boxes on the right).

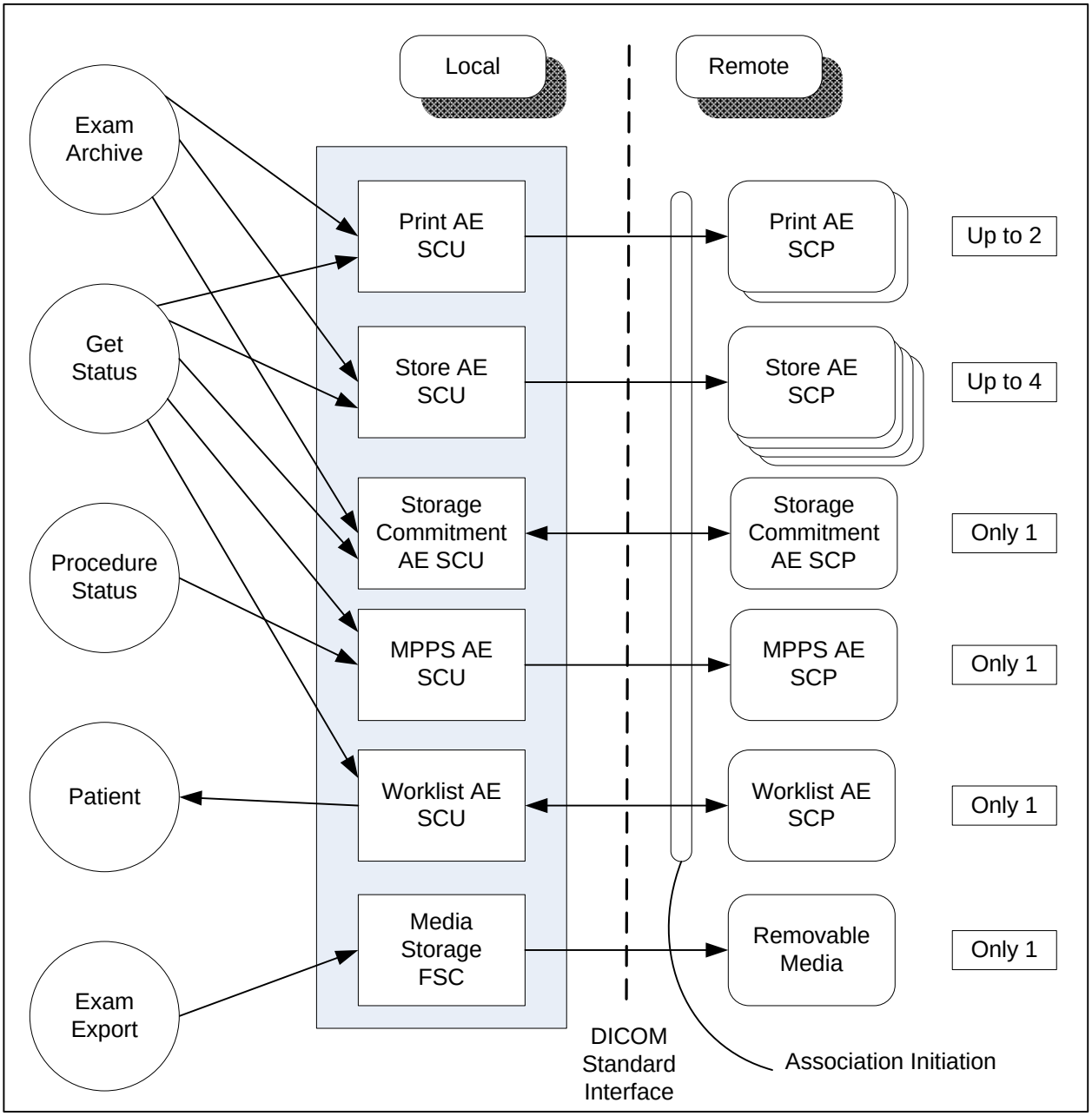

Figure 2-1 Implementation Model

The following are the conditions that invoke real-world activities associated with AE's.

Exam Archive

- For batch transfer mode, End Exam with one or more images saved on internal storage. Exam end occurs when the Delta key is pressed while configured to End Exam, or when Patient setup mode is entered and End Exam is pressed or any of the patient fields are changed and the saves committed or when New is pressed and you exit Patient setup.
- For in-progress transfer mode after an image acquisition is complete. Image acquisition occurs after the Save key is pressed for single images or the Save Clip key is pressed for clips. The Save Image and Save Clip functions may also be configured for operation with footswitches through system preset setup. The functionality would be the same as using a key for the desired operation.
- System startup with one or more images flagged as Archive Pending.
- Upon completion of image transfer, Storage Commitment is requested for transferred images.

Get Status

- Operator Verify command in DICOM Setup mode.

Procedure Status

- User starts a new procedure, thereby setting the procedure step to IN PROGRESS. Upon procedure completion status is set to COMPLETE or DISCONTINUED.

Patient

- User enters Patient Setup screen, enters search criteria, and presses the Query key. The Worklist screen is entered and a list of matching Scheduled Procedures Steps are returned and displayed.

Exam Export

- User selects one or more completed exams from the exam list and the images for those exams are written to the selected removable media.

2.2 FUNCTIONAL DEFINITIONS OF AE'S

Print

This AE handles all aspects of the Print Management SCU.

Steps taken to Get Printer Status:

A-ASSOCIATE
N-CREATE Film Session
N-CREATE Film Box
N-GET Status
N-DELETE Film Box
N-DELETE Film Session
A-RELEASE

Steps taken to Send Exam to Printer:

A-ASSOCIATE
N-CREATE Film Session SOP Instance
For each film sheet
{
    N-CREATE Film Box SOP Instance
    For each image on film sheet
    {
        N-SET Image Box SOP Instance
        If not last image on sheet

N-GET PRINTER SOP Instance - Status
}
N-ACTION PRINT, Film Box SOP Instance
N-DELETE Film Box SOP Instance
}
N-DELETE Film Sheet SOP Instance
A-RELEASE

Store
This AE handles sending ultrasound images to an archiver using the DICOM store SCU services.
Steps taken to Get Archiver Status:
A-ASSOCIATE
C-ECHO command
A-RELEASE

Steps taken to Send Exam to Archiver, batch transfer mode:
A-ASSOCIATE
for each exam image or clip
{
C-STORE Image SOP Instance
}
A-RELEASE

Steps taken to Send Exam to Archiver, in progress transfer mode:
A-ASSOCIATE
for each image or clip acquired within timeout period AND not end of exam
{
C-STORE Image SOP Instance
}
A-RELEASE

Modality Performed Procedure Step
This AE handles sending procedure status to an MPPS SCP using the DICOM MPPS SCU services.

Steps taken to get MPPS SCP Status:
A-ASSOCIATE
C-ECHO command
A-RELEASE

Steps taken to send IN PROGRESS status at start of procedure:
A-ASSOCIATE
N-CREATE MPPS SOP Instance
A-RELEASE

Steps taken to send COMPLETE or DISCONTINUED at end of procedure:
A-ASSOCIATE
N-SET MPPS SOP Instance status update
A-RELEASE

Storage Commitment
This AE handles the requesting of storage commitment for images sent to an archiver using the DICOM Storage Commitment (Push Model) SCU services.

Steps taken to get Storage Commitment SCP Status:

A-ASSOCIATE
C-ECHO command
A-RELEASE

Steps taken to send list of SOP Instances for commitment request:

A-ASSOCIATE
N-ACTION commitment request
A-RELEASE

Steps taken to receive list of committed SOP Instances (role reversal):

A-ASSOCIATE
N-EVENT-REPORT commitment response
A-RELEASE

Worklist

This AE handles querying a Worklist SCP for a list of scheduled procedures using the DICOM Modality Worklist SCU services.

Steps taken to Get Worklist Status:

A-ASSOCIATE
C-ECHO command
A-RELEASE

Steps taken to Query a Worklist SCP:

A-ASSOCIATE
SEND C-FIND Request command
{
RECEIVE C-FIND Response
} While C-FIND status == pending AND responses <= 200
A-RELEASE

2.3 SEQUENCING OF REAL-WORLD ACTIVITIES

All real world activities that initiate communication to remote AE's operate asynchronously with respect to each other and Workflow activities.

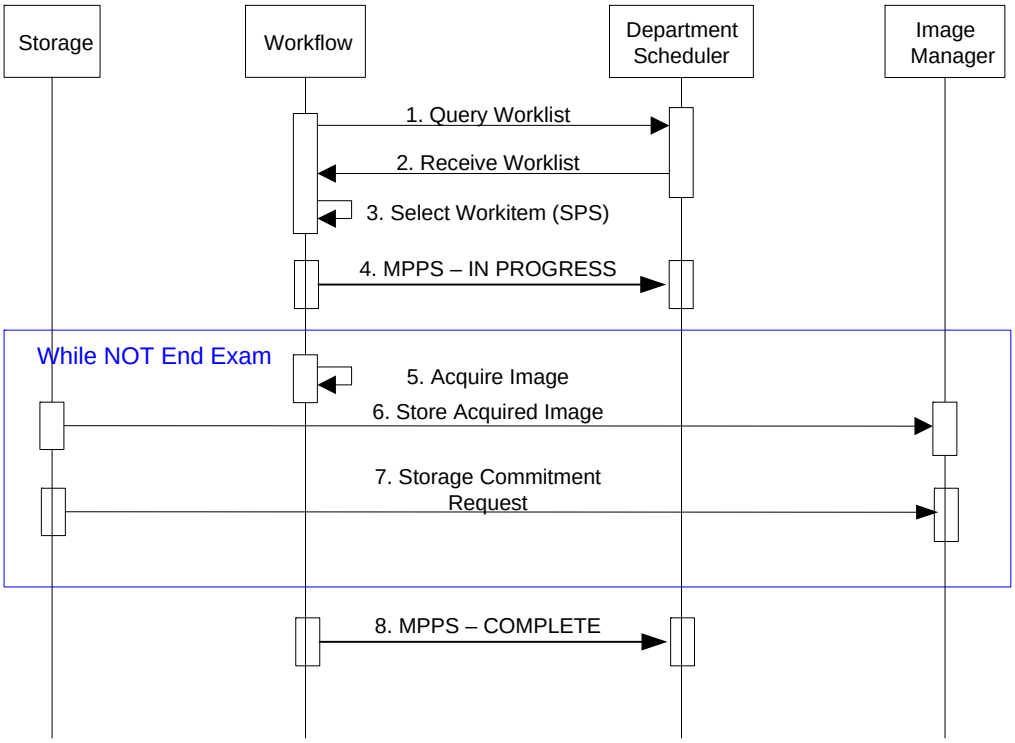

Figure 2-2 Sequencing Constraints - "During the Exam" Configuration

Under normal scheduled workflow conditions the sequencing constraints illustrated apply:

1. Worklist Query is initiated.
2. List of Scheduled Procedure Steps (SPS) are returned.
3. SPS item is selected from the Worklist and the Exam begins.
4. MPPS IN PROGRESS message sent.
5. Image or Clip is acquired.
6. Association is opened with the Image Manager and the acquired image is stored. Subsequent image acquisitions are stored under the same association, if the acquisition completes within 30 seconds of the last Store operation. After 30 seconds of inactivity, the association is closed.
7. Storage Commitment is requested for sent images.
8. MPPS COMPLETED (or DISCONTINUED) message sent.

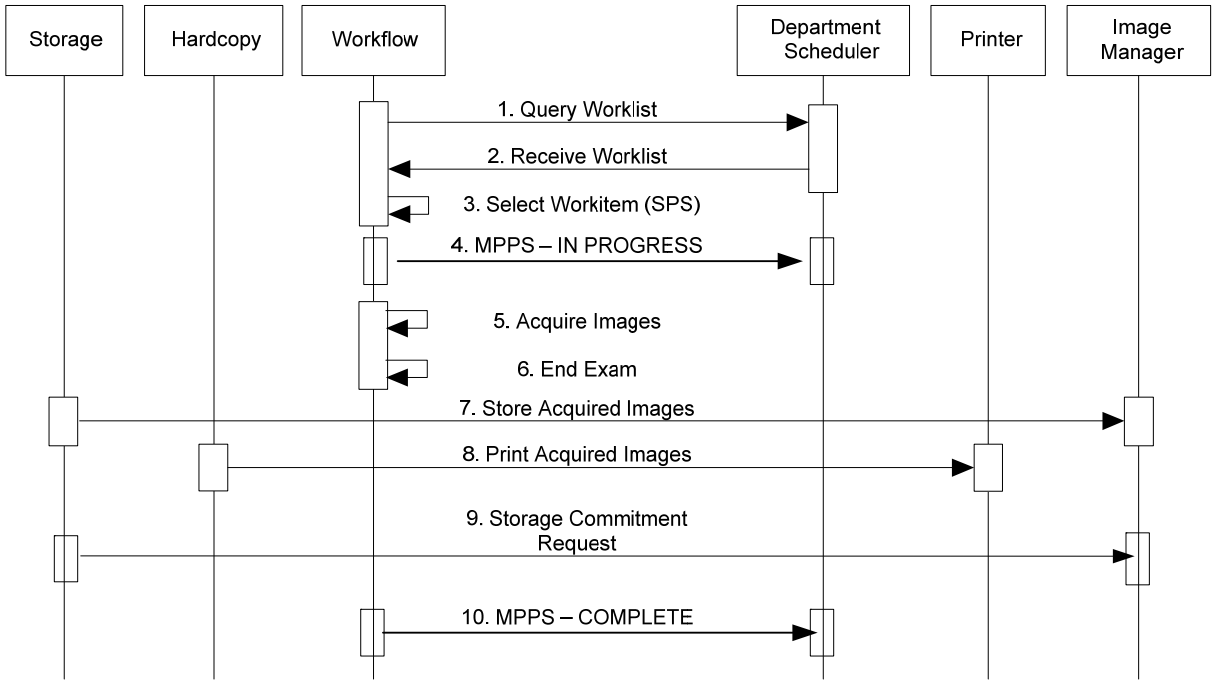

Figure 2-3 Sequencing Constraints - "End of Exam" Configuration

Under normal scheduled workflow conditions the sequencing constraints illustrated apply:

1. Worklist Query is initiated.
2. List of Scheduled Procedure Steps (SPS) are returned.
3. SPS item is selected from the Worklist and the Exam begins.
4. MPPS IN PROGRESS message sent.
5. Images and Clips are acquired.
6. Exam is ended.
7. Image SOP instances acquired during the exam are stored to the Image Manager.
8. Acquired images are Printed.
9. Storage Commitment request is made for stored images.
10. MPPS COMPLETE (or DISCONTINUED) message sent.

3 AE SPECIFICATIONS

3.1 PRINT AE – SPECIFICATION

The Print AE provides conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-1 Print AE SOP Class Support

SOP Class Name	SOP Class UID	Conformance Level
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Standard
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Standard
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Gray Image Box SOP Class	1.2.840.10008.5.1.1.4	Standard
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard

3.1.1 ASSOCIATION ESTABLISHMENT POLICIES

The Print AE will initiate an association to a device in response to the following real-world activities; Archive Exam, Review Archive and Get Status. The Grayscale and Color SOP Print Management Service Class connections will be done on separate associations, but the associations will never be concurrent.

3.1.1.1 GENERAL

Maximum PDU size offered to SCP: 32,768 bytes
This is the maximum PDU size the Print AE can receive and is the value offered for the maximum PDU size in the Association Request command. Once the Association is open if the Print AE receives a PDU that is larger than this value then the Association will be aborted.

Minimum PDU size accepted from SCP: 1,024 bytes
This is the minimum PDU size the Print AE can be configured to send. If the Print AE receives a maximum PDU size in the Association Accept response that is smaller than this value then the Association will be aborted immediately.

Maximum PDU size sent by SCU: 32,768 bytes
This is the maximum PDU size the Print AE can be configured to send. The maximum PDU size sent on any Print AE Association will be the smaller of the configured value and the maximum PDU size received in the Association Accept response.

3.1.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations for the Print AE: 1

3.1.1.3 ASYNCHRONOUS NATURE

The Print AE will not use asynchronous operations.

3.1.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID: "1.2.840.114340.3"
Implementation Version name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.1.2 ASSOCIATION INITIATION BY REAL-WORLD ACTIVITY

The Print AE will open associations to the printers listed in the current destination list in response to the following real-world activities; Archive Exam, Review Archive, and Get Status.

3.1.2.1 ASSOCIATION INITIATION BY: ARCHIVE EXAM

The Archive Exam real-world activity will cause the Print AE to open associations to each printer listed in the current destination list.

3.1.2.2 ASSOCIATION INITIATION BY: REVIEW ARCHIVE

The Archive command real-world activity while in Review mode will cause the Print AE to open associations to each printer listed in the current destination list.

3.1.2.3 ASSOCIATION INITIATION BY: GET STATUS

The Get Status real-world activity will cause the Print AE to open associations to each printer listed in the current destination list.

3.1.3 PROPOSED PRESENTATION CONTEXTS

3.1.3.1 PROPOSED PRESENTATION CONTEXTS TO A GRAY PRINT SERVER

Table 3-2 Print AE Proposed Presentation Contexts to a Gray Print Server

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Gray Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.1.3.2 PROPOSED PRESENTATION CONTEXTS TO A COLOR PRINT SERVER

Table 3-3 Print AE Proposed Presentation Contexts to a Color Print Server

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Basic Print Management Meta SOP Classes

3.1.3.3 BASIC GRAYSCALE PRINT MANAGEMENT META SOP CLASS

The Print AE provides Standard Conformance to the Basic Grayscale Print Management Meta SOP Class as an SCU. This implies standard conformance to the set of SOP classes in Table 3-4.

DICOM Specified SCU Usage: M = Mandatory
U = User option
C = Conditional
MC = Mandatory if Condition met

Table 3-4 Basic Grayscale Print Management Meta SOP Class

SOP Class Name	SCU Usage	Reference
Basic Film Session SOP Class	M	3.1.4
Basic Film Box SOP Class	M	3.1.5
Basic Grayscale Image Box SOP Class	M	3.1.6.1
Printer SOP Class	M	3.1.7

3.1.3.4 BASIC COLOR PRINT MANAGEMENT META SOP CLASS

The Print AE provides Standard Conformance to the Basic Grayscale Print Management Meta SOP Class as an SCU. This implies standard conformance to the set of SOP classes in Table 3-5.

Table 3-5 Basic Color Print Management Meta SOP Class

SOP Class Name	SCU Usage	Reference
Basic Film Session SOP Class	M	3.1.4
Basic Film Box SOP Class	M	3.1.5
Basic Color Image Box SOP Class	M	3.1.6.2
Printer SOP Class	M	3.1.7

3.1.4 BASIC FILM SESSION SOP CLASS

The Basic Film Session IOD describes the presentation parameters which are common for all the films of a film session. The DIMSE services that are applicable to the IOD are shown in Table 3-6. The attributes which apply to the N-Create DIMSE service are described in Table 3-7. Attributes not listed are not used.

Table 3-6 Basic Film Session DIMSE Service Group

DIMSE Service Element	SCU Usage	Description
N-Create	M	Creates film session
N-Set	U	Not used
N-Delete	U	Deletes film session. Used at end of exam.
N-Action	U	Not used

Table 3-7 Basic Film Session N-Create Attribute List

Attribute Name	Tag	SCU Usage	Description
Number of Copies	(2000,0010)	U	Configurable in DICOM Setup mode 1-N, Default=1, N defined by printer type

Attribute Name	Tag	SCU Usage	Description
Print Priority	(2000,0020)	U	Configurable in DICOM Setup mode LOW, MED, HIGH, Default=MED
Medium Type	(2000,0030)	U	Configurable in DICOM Setup mode Valid settings defined by printer type PAPER, BLUE FILM, CLEAR FILM
Film Destination	(2000,0040)	U	Configurable in DICOM Setup mode Valid settings defined by printer type MAGAZINE, PROCESSOR

3.1.5 BASIC FILM BOX SOP CLASS

The Basic Film Box IOD is an abstraction of the presentation of one film of the film session. It describes the presentation parameters which are common for all images on a given sheet of film. The DIMSE services that are applicable to the IOD are shown in Table 3-8. The attributes which apply to the N-Create DIMSE service are described in Table 3-9. Attributes not listed are not used.

Table 3-8 Basic Film Box DIMSE Service Group

DIMSE Service Element	SCU Usage	Description
N-Create	M	Creates film box
N-Action	M	Print. Used when film box is full and at end of exam if one or more images in film box.
N-Delete	U	Deletes film box. Used after each film is printed.
N-Set	U	Not used

Table 3-9 Basic Film Box N-Create Attribute List

Attribute Name	Tag	SCU Usage	Description
Image Display Format	(2010,0010)	M	Configurable in DICOM Setup mode Valid settings defined by printer type STANDARD\1,1 STANDARD\1,2 STANDARD\2,1 STANDARD\2,3 STANDARD\3,2 STANDARD\3,3 STANDARD\3,4 STANDARD\4,3 STANDARD\3,5 STANDARD\5,3 STANDARD\4,5 STANDARD\5,4 STANDARD\5,6 STANDARD\6,5
Referenced Film Session Sequence	(2010,0500)	M	Used
>Referenced SOP Class UID	(0008,1150)	M	1.2.840.10008.5.1.1.1
>Referenced SOP Instance UID	(0008,1155)	M	Provided by SCP (Printer)
Film Orientation	(2010,0040)	U	Configurable in DICOM Setup mode Valid settings defined by printer type PORTRAIT, LANDSCAPE

Attribute Name	Tag	SCU Usage	Description
Film Size ID	(2010,0050)	U	Configurable in DICOM Setup mode Valid settings defined by printer type 8INX10IN 24CMX24CM 8_5INX11IN 24CMX30CM 10INX12IN A3 10INX14IN A4 11INX14IN 12INX18IN 11INX17IN 35CMX43CM 14INX14IN 14INX17IN
Magnification Type	(2010,0060)	U	Configurable in DICOM Setup mode NONE, BILINEAR, CUBIC, REPLICATE, and 'Do not send tag'
Max Density	(2010,0130)	U	Configurable in DICOM Setup mode Valid values defined by printer type
Configuration Information	(2010,0150)	U	Configurable in DICOM Setup mode Valid strings defined by printer type
Border Density	(2010,0100)	U	Configurable in DICOM Setup mode Min Density to Max Density
Empty Image Density	(2010,0110)	U	Configurable in DICOM Setup mode Min Density to Max Density
Min Density	(2010,0120)	U	Configurable in DICOM Setup mode Valid values defined by printer type

3.1.6 BASIC IMAGE BOX SOP CLASSES

3.1.6.1 BASIC GRAYSCALE IMAGE BOX SOP CLASS

The Basic Grayscale Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. It describes the presentation parameters and image pixel data which apply to a single image on a sheet of film. The DIMSE services that are applicable to the IOD are shown in Table 3-10. The attributes which apply to the N-Set DIMSE service are described in Table 3-11. Attributes not listed are not used.

Table 3-10 Basic Grayscale Image Box DIMSE Service Group

DIMSE Service Element	SCU Usage	Description
N-Set	M	Updates Image Box

Table 3-11 Basic Grayscale Image Box N-Set Attribute List

Attribute Name	Tag	SCU Usage	Description
Image Position	(2020,0010)	M	1-N, N=Film Box Image Count
Basic Grayscale Image Sequence	(2020,0110)	M	Used
>Samples Per Pixel	(0028,0002)	M	1
>Photometric Interpretation	(0028,0004)	M	MONOCHROME2
>Rows	(0028,0010)	M	480
>Cols	(0028,0011)	M	640
>Bits Allocated	(0028,0100)	M	8
>Bits Stored	(0028,0101)	M	8
>High Bit	(0028,0102)	M	7
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0,0010)	M	Grayscale Pixel Data

3.1.6.2 BASIC COLOR IMAGE BOX SOP CLASS

The Basic Color Image Box IOD is an abstraction of the presentation of an image and image related data in the image area of a film. It describes the presentation parameters and image pixel data which apply to a single image on a sheet of film. The DIMSE services that are applicable to the IOD are shown in Table 3-12. The attributes which apply to the N-Set DIMSE service are described in Table 3-13.

Table 3-12 Basic Color Image Box DIMSE Service Group

DIMSE Service Element	SCU Usage	Description
N-Set	M	Updates Image Box

Table 3-13 Basic Color Image Box N-Set Attribute List

Attribute Name	Tag	SCU Usage	Description
Image Position	(2020,0010)	M	1-N, N=Film Box Image Count
Basic Color Image Sequence	(2020,0111)	M	Used
>Samples Per Pixel	(0028,0002)	M	3
>Photometric Interpretation	(0028,0004)	M	RGB
>Planar Configuration	(0028,0006)	M	1=Color-by-plane
>Rows	(0028,0010)	M	480
>Cols	(0028,0011)	M	640
>Bits Allocated	(0028,0100)	M	8

Attribute Name	Tag	SCU Usage	Description
>Bits Stored	(0028,0101)	M	8
>High Bit	(0028,0102)	M	7
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0,0010)	M	RGB Pixel Data

3.1.7 PRINTER SOP CLASS

The Printer IOD is an abstraction of the hard copy printer and is the basic Information Entity to monitor the status of the printer. The DIMSE services that are applicable to the IOD are shown in Table 3-14. The attributes which apply to the N-Get DIMSE service are described in Table 3-15. Attributes not listed are not used.

Table 3-14 Printer SOP Class DIMSE Service Group

DIMSE Service Element	SCU Usage	Description
N-Event-Report	M	Ignored and not handled.
N-Get	U	Get Printer Status

Table 3-15 Printer SOP Class N-Get Attribute List

Attribute Name	Tag	SCU Usage	Description
Printer Status	(2110,0010)	U	NORMAL, WARNING, FAILURE WARNING and FAILURE are reported to user
Printer Status Info	(2110,0020)	U	Reported to user

3.2 STORE AE – SPECIFICATION

The Store AE provides conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-16 Store AE SOP Class Support

SOP Class Name	SOP Class UID	Conformance Level
Verification	1.2.840.10008.1.1	Standard
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Standard
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Standard
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Standard
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Standard

3.2.1 ASSOCIATION ESTABLISHMENT POLICIES

The Store AE will initiate an association to a device in response to the following real-world activities; Archive Exam or Image Acquisition, Review Archive, and Get Status.

3.2.1.1 GENERAL

Maximum PDU size offered to SCP: 32,768 bytes
This is the maximum PDU size the Store AE can receive and is the value offered for the maximum PDU size in the Association Request command. Once the Association is open if the Store AE receives a PDU that is larger than this value then the Association will be aborted.

Minimum PDU size accepted from SCP: 1,024 bytes
This is the minimum PDU size the Store AE can be configured to send. If the Store AE receives a maximum PDU size in the Association Accept response that is smaller than this value then the Association will be aborted immediately.

Maximum PDU size sent by SCU: 32,768 bytes
This is the maximum PDU size the Store AE can be configured to send. The maximum PDU size sent on any Store AE Association will be the smaller of the configured value and the maximum PDU size received in the Association Accept response.

3.2.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations for the Store AE: 1

3.2.1.3 ASYNCHRONOUS NATURE

The Store AE will not use asynchronous operations.

3.2.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID: "1.2.840.114340.3"
Implementation Version name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.2.2 ASSOCIATION INITIATION BY REAL-WORLD ACTIVITY

The Store AE will open associations to the storage devices listed in the current destination list in response to the following real-world activities; Archive Exam or Image Acquisition, Review Archive, and Get Status.

3.2.2.1 ASSOCIATION INITIATION BY: ARCHIVE EXAM

The Archive Exam real-world activity if configured for batch transfer mode will cause the Store AE to open associations to each storage device listed in the current destination list.

3.2.2.2 ASSOCIATION INITIATION BY: IMAGE ACQUISITION

The Image Acquisition real-world activity if configured for in-progress transfer mode will cause the Store AE to open an association to the selected storage device .

3.2.2.3 ASSOCIATION INITIATION BY: REVIEW ARCHIVE

The Archive command real-world activity while in Review mode will cause the Store AE to open associations to each storage device listed in the current destination list.

3.2.2.4 ASSOCIATION INITIATION BY: GET STATUS

The Get Status real-world activity will cause the Store AE to open associations to each archiver listed in the current destination list.

3.2.3 PROPOSED PRESENTATION CONTEXTS TO AN ARCHIVER

Table 3-17 Store AE Proposed Presentation Contexts to an Archiver

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian JPEG Baseline (Process 1) [1]	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian Explicit VR Little Endian JPEG Baseline (Process 1) [1]	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

[1] This Transfer Syntax is the only one proposed if JPEG Compression is configured.

3.2.3.1 VERIFICATION SOP CLASS

The Store AE provides standard conformance to the Verification SOP Class as an SCU. The remote SCP must support Verification in the same association as the Store Command (C-Store).

3.2.3.2 ULTRASOUND IMAGE STORAGE SOP CLASS

The Ultrasound Image Storage SOP Class uses the Common Composite Image IOD Modules as shown in Table 3-18

Table 3-18 US Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	3.2.4.1	M
	Clinical Trial Subject	Not Used	U
Study	General Study	3.2.4.2	M
	Patient Study	3.2.4.3	U
	Clinical Trial Study	Not Used	U
Series	General Series	3.2.4.4	M
	Clinical Trial Series	Not Used	U
Frame Of Reference	Frame Of Reference	Not Used	U
	Synchronization	Not Used	U
Equipment	General Equipment	3.2.4.5	M
Image	General Image	3.2.4.7	M
	Image Pixel	0	M
	Contrast/Bolus	Not Used	C
	Palette Color Lookup Table	Not Used	C
	US Region Calibration	3.2.4.10	U
	US Image	3.2.4.11	M
	Overlay Plane	Not Used	U
	VOI LUT	3.2.4.12	U
	SOP Common	3.2.4.13	M

3.2.3.3 ULTRASOUND MULTI-FRAME IMAGE STORAGE SOP CLASS

The Ultrasound Multi-Frame Image Storage SOP Class uses the Common Composite Image IOD Modules as shown in Table 3-19.

Table 3-19 US Multi-Frame Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	3.2.4.1	M
	Clinical Trial Subject	Not Used	U
Study	General Study	3.2.4.2	M
	Patient Study	3.2.4.3	U
	Clinical Trial Study	Not Used	U
Series	General Series	3.2.4.4	M
	Clinical Trial Series	Not Used	U
Frame Of Reference	Frame Of Reference	Not Used	U
	Synchronization	Not Used	U
Equipment	General Equipment	3.2.4.5	M
Image	General Image	3.2.4.7	M
	Image Pixel	0	M
	Contrast/Bolus	Not Used	C
	Cine	3.2.4.8	M
	Multi-Frame	3.2.4.9	M
	Frame Pointers	Not Used	U
	Palette Color Lookup Table	Not Used	C
	US Region Calibration	3.2.4.10	U
	US Image	3.2.4.11	M
	VOI LUT	3.2.4.12	U
	SOP Common	3.2.4.13	M

3.2.3.4 ULTRASOUND IMAGE STORAGE SOP CLASS (RETIRED)

The Ultrasound Image Storage SOP Class (Retired) uses the Common Composite Image IOD.

3.2.3.5 SECONDARY CAPTURE IMAGE STORAGE SOP CLASS

The Secondary Capture Image Storage SOP Class uses the Common Composite Image IOD Modules as shown in Table 3-20.

Table 3-20 SC Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	3.2.4.1	M
	Clinical Trial Subject	Not Used	U
Study	General Study	3.2.4.2	M
	Patient Study	3.2.4.3	U
	Clinical Trial Study	Not Used	U
Series	General Series	3.2.4.4	M
	Clinical Trial Series	Not Used	U
Equipment	General Equipment	3.2.4.5	U
	SC Equipment	3.2.4.6	M
Image	General Image	3.2.4.7	M
	Image Pixel	0	M

IE	Module	Reference	Usage
	SC Image	Not Used	M
	Overlay Plane	Not Used	U
	Modality LUT	Not Used	U
	VOI LUT	3.2.4.12	U
	SOP Common	3.2.4.13	M

3.2.4 COMMON COMPOSITE IMAGE IOD MODULE

The section defines the Modules that are common to the Ultrasound, Ultrasound (Retired), and Secondary Capture Storage SOP Classes.

3.2.4.1 PATIENT MODULE

Table 3-21 specifies the attributes used from the Patient Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame, and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-21 Patient Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Name [1]	(0010,0010)	2	From Worklist or manually entered on Patient Setup screen (Last, First and Middle fields). All 5 Person Name Components are preserved when name comes from Worklist.
Patient ID [1]	(0010,0020)	2	From Worklist or manually entered on Patient Setup screen (ID field)
Patient's Birth Date [1]	(0010,0030)	2	From Worklist or manually entered on Patient Setup screen (Date of birth fields)
Patient's Sex [1]	(0010,0040)	2	From Worklist or manually entered on Patient Setup screen (Gender pick list)
Other Patient IDs	(0010,1000)	3	From Worklist
Ethnic Group	(0010,2160)	3	Manually entered on Patient Setup screen. Only sent for IMT Exam Types.

[1] This attribute cannot be modified by the user when coming from DICOM Worklist.

3.2.4.2 GENERAL STUDY MODULE

Table 3-22 specifies the attributes used from the General Study Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame, and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-22 General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From Worklist or automatically generated
Study Date	(0008,0020)	2	Procedure start date
Study Time	(0008,0030)	2	Procedure start time
Referring Physician's Name	(0008,0090)	2	From Worklist or manually entered on Patient Setup screen (Referring Dr. field) Note: Only last name component will be sent when manually entered.
Study ID	(0020,0010)	2	From Worklist (mapped from Requested Procedure ID attribute) or manually entered for unscheduled procedures. If no value is provided via worklist or manual entry, then a value will be automatically generated.
Accession Number [2]	(0008,0050)	2	From Worklist or manually entered on Patient Setup screen (Accession field)
Study Description	(0008,1030)	3	From Worklist [1] or selected manually on Patient Setup screen (Procedure Type pick list)
Referenced Study Sequence	(0008,1110)	3	From Worklist. Not sent if procedure was unscheduled.
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Mapped from Worklist Requested Procedure Code Sequence, if performed. Not sent if procedure was unscheduled.
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	
Name of Physician(s) Reading Study	(0008,1060)	3	Entered on Patient Setup screen. (Reading Dr. field) Note: Only last name component will be sent when manually entered

[1] Mapped from Scheduled Procedure Step Description (0040,0007) if it exists. Otherwise, Study Description is set to value of Requested Procedure Description (0032,1060) if it exists. If Requested Procedure Description (0032,1060) is also empty, Study Description is set to Requested Procedure Code Sequence (0032,1064) Code Meaning (0008,0104).

[2] This attribute cannot be modified by the user when coming from DICOM Worklist.

3.2.4.3 PATIENT STUDY MODULE

Table 3-23 defines attributes used from the Patient Study Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame, and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-23 Patient Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Size	(0010,1020)	3	Only sent for Cardiac Exam types.
Patient's Weight	(0010,1030)	3	Only sent for Cardiac Exam types.
Additional Patient's History	(0010,21B0)	3	From Worklist of manually entered on Patient Setup screen (Indications field).

3.2.4.4 GENERAL SERIES MODULE

Table 3-24 specifies the attributes used from the General Series Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-24 General Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"US"
Series Instance UID	(0020,000E)	1	Automatically generated
Series Number	(0020,0011)	2	"1"
Laterality	(0020,0060)	2C	Zero Length
Series Date	(0008,0021)	3	Procedure start date
Series Time	(0008,0031)	3	Procedure start time
Protocol Name	(0018,1030)	3	Zero length
Series Description	(0008,103E)	3	Same as Performed Procedure Step Description
Operator's Name	(0008,1070)	3	Entered on Patient Setup screen (User field). The User's initials are transmitted in the last name component
Request Attributes Sequence	(0040,0275)	3	Only sent if the procedure originated from a Worklist Scheduled Procedure Step
>Requested Procedure ID	(0040,1001)	1C	From Worklist
>Scheduled Procedure Step ID	(0040,0009)	1C	From Worklist
>Scheduled Procedure Step Description	(0040,0007)	3	From Worklist
>Scheduled Protocol Code Sequence	(0040,0008)	3	From Worklist
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	From Worklist (mapped from Scheduled Procedure Step ID) or Generated by TURBO
Performed Procedure Step Start Date	(0040,0244)	3	Procedure start date
Performed Procedure Step Start Time	(0040,0245)	3	Procedure start time
Performed Procedure Step Description	(0040,0254)	3	Mapped from Worklist SPS description, if performed, or selected manually on Patient Setup screen (Procedure Type pick list)
Performed Protocol Code Sequence	(0040,0260)	3	Mapped From Worklist Scheduled Protocol Code sequence, if performed. Otherwise sent as zero length sequence.
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	

Attribute Name	Tag	Type	Attribute Description
>Code Meaning	(0008,0104)	1C	

3.2.4.5 GENERAL EQUIPMENT MODULE

Table 3-25 specifies the attributes used from the General Equipment Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-25 General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	"SonoSite, Inc."
Institution Name	(0008,0080)	3	Entered on Patient Setup screen (Institution)
Station Name	(0008,1010)	3	Host Name for current location
Manufacturer's Model Name	(0008,1090)	3	Model name (maps to product line)
Software Versions	(0018,1020)	3	ARM Firmware Version

3.2.4.6 SC EQUIPMENT MODULE

Table 3-26 describes the attributes used from the SC Equipment Module. These attributes are used by the Secondary Capture Image Storage SOP Class. Attributes not listed are not used.

Table 3-26 SC Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	"WSD"
Modality	(0008,0060)	3	"US"

3.2.4.7 GENERAL IMAGE MODULE

Table 3-27 specifies the attributes used from the General Image Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-27 General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	A number that identifies this image
Patient Orientation	(0020,0020)	2C	Zero Length
Content Date	(0008,0023)	2C	Image acquisition date
Content Time	(0008,0033)	2C	Image acquisition time
Derivation Description	(0008,2111)	3	"RGB to MONOCHROME2 conversion" - Sent for MONOCHROME2 images "RGB to JPEG Baseline 1 conversion" – Sent for JPEG Lossy compressed images.
Lossy Image Compression	(0028,2110)	3	01=Lossy Compressed - Only sent for MONOCHROME2 and JPEG Lossy Compressed images.
Lossy Image Compression Ratio	(0028,2112)	3	Set to 3 for MONOCHROME2 images. The approximate compression ratio is sent for JPEG Lossy Compressed images.

IMAGE PIXEL MODULE

Table 3-28 specifies the attributes used from the Image Pixel Module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-28 Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	MONOCHROME2=1, RGB=3, YBR_FULL_422 = 3
Photometric Interpretation	(0028,0004)	1	Configurable in DICOM Setup mode. Valid settings defined by archiver type and Transfer Syntax being used. MONOCHROME2, RGB or YBR_FULL_422
Rows	(0028,0010)	1	480
Columns	(0028,0011)	1	640
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Used – Basic Offset Table is set to zero length for encapsulated multi-frame images.
Planar Configuration	(0028,0006)	1C	0=Color-by-pixel - Only sent for RGB and YBR_FULL_422 images

3.2.4.8 CINE MODULE

Table 3-29 specifies the attributes used from the Cine module. The Ultrasound Multi-Frame Image IOD uses these attributes. Attributes not listed are not used.

Table 3-29 Cine Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	Nominal time (in msec) per individual frame.

3.2.4.9 MULTI-FRAME MODULE

Table 3-30 specifies the attributes used from the Cine module. The Ultrasound Multi-Frame Image IOD uses these attributes.

Table 3-30 Multi-frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image.
Frame Increment Pointer	(0028,0009)	1	Always set to 00181063H (Frame Time).

3.2.4.10 US REGION CALIBRATION MODULE

Table 3-31 specifies the attributes used from the US Region Calibration Module. These attributes are used by Ultrasound, Ultrasound Multi-frame and Ultrasound (Retired) Image Storage SOP instances created by the Turbo system. Attributes not listed are not used.

Table 3-31 US Region Calibration Attributes

Attribute Name	Tag	Type	Attribute Description
Sequence of Ultrasound Regions	(0018,6011)	1	Used
>Region Location Min x_0	(0018,6018)	1	Automatically generated
>Region Location Min y_0	(0018,601A)	1	Automatically generated
>Region Location Max x_1	(0018,601C)	1	Automatically generated
>Region Location Max y_1	(0018,601E)	1	Automatically generated
>Physical Units X Direction	(0018,6024)	1	
>Physical Units Y Direction	(0018,6026)	1	Automatically generated
>Physical Delta X	(0018,602C)	1	Automatically generated
>Physical Delta Y	(0018,602E)	1	Automatically generated
>Reference Pixel x_0	(0018,6020)	3	Only sent in Spectral Doppler regions.
>Reference Pixel y_0	(0018,6022)	3	Only sent in Spectral Doppler regions.
>Ref. Pixel Physical Value X	(0018,6028)	3	Only sent in Spectral Doppler regions.
>Ref. Pixel Physical Value Y	(0018,602A)	3	Only sent in Spectral Doppler regions.
>Region Spatial Format	(0018,6012)	1	Automatically generated
>Region Data Type	(0018,6014)	1	Automatically generated
>Region Flags	(0018,6016)	1	Automatically generated

3.2.4.11 US IMAGE MODULE

Table 3-32 specifies the attributes used from the US Image Module. These attributes are used by Ultrasound, Ultrasound Multi-frame and Ultrasound (Retired) Image Storage SOP instances created by the Turbo system. Attributes not listed are not sent.

Table 3-32 US Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples Per Pixel	(0028,0002)	1	MONOCHROME2=1, RGB=3, YBR_FULL_422 = 3
Photometric Interpretation	(0028,0004)	1	Configurable in DICOM Setup mode Valid settings defined by archiver type and Transfer Syntax being used. MONOCHROME2, RGB or YBR_FULL_422
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Planar Configuration	(0028,0006)	1C	0=Color-by-pixel - Only sent for RGB and YBR_FULL_422 images
Pixel Representation	(0028,0103)	1	0

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	2	RGB = "ORIGINAL\PRIMARY\<ExamType>\nnnn" YBR_FULL_422 or MONOCHROME2 = "DERIVED\PRIMARY\<ExamType>\nnnn" Possible values for <ExamType>: ABDOMINAL BREAST CHEST ENDOCAVITARY ENDORECTAL ENDOVAGINAL EPICARDIAL FETAL HEART GYNECOLOGY HEPATIC IMT INTRACARDIAC INTRAOPERATIVE INTRAVASCULAR MUSCULOSKELETAL NEONATAL HEAD NERVE OBSTETRICAL OPHTHALMIC ORBITAL PEDIATRIC PELVIC RETROPERITONEAL SCROTAL SMALL PARTS SUPERFICIAL TEE THYROID TRANSCRANIAL TTE US BIOPSY VASCULAR VENOUS nnnn=bit map designating the image mode: 0001 = 2D Imaging 0002 = M-Mode 0004 = CW Doppler 0008 = PW Doppler 0010 = Color Doppler 0100 = Color Power Mode
Lossy Image Compression	(0028,2110)	1C	01=Lossy Compressed - Only sent for MONOCHROME2 and JPEG Lossy Compressed images.

Attribute Name	Tag	Type	Attribute Description
Ultrasound Color Data Present	(0028,0014)	3	00=Color data not present in image 01=Color data is present in image Not sent with Ultrasound (Retired) Images.
Heart Rate	(0018,1088)	3	
Transducer Data	(0018,5010)	3	

3.2.4.12 VOI LUT MODULE

Table 3-33 specifies the attributes used from the VOI LUT module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-33 VOI LUT Module Attributes

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	128 - Only sent with Monochrome2
Window Width	(0028,1051)	1C	256 - Only sent with Monochrome2

3.2.4.13 SOP COMMON MODULE

Table 3-34 specifies the attributes used from the SOP Common module. These attributes are used by the Ultrasound, Ultrasound (Retired), Ultrasound Multi-frame and Secondary Capture Image Storage SOP Classes. Attributes not listed are not used.

Table 3-34 SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Automatically generated
SOP Instance UID	(0008,0018)	1	Automatically generated
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Number	(0020,0013)	3	A number that identifies this image

3.2.5 STORE AE BEHAVIOR TO C-STORE STATUS

Table 3-35describes the behavior for C-Store response status returned from the Storage SCP. All image SOP classes supported by the Store AE exhibit the same behavior.

Table 3-35 Store AE Behavior to C-Store Status

Service Status	Further Meaning	Status Codes	Store AE Behavior
Success		0000	Continue without user notification
Refused	Out of Resources	A7xx	Association terminated. User notified.
Error	Data Set does not match SOP Class	A9xx	Association terminated. User notified.
	Cannot understand	Cxxx	Association terminated. User notified.
Warning	Coercion of data elements	B000	Ignored - Message logged.
	Data set does not match SOP class	B007	Ignored - Message logged.
	Elements discarded	B006	Ignored - Message logged.

3.3 MODALITY WORKLIST AE – SPECIFICATION

The Modality Worklist AE provides conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-36 Modality Worklist AE SOP Class Support

SOP Class Name	SOP Class UID	Conformance Level
Verification	1.2.840.10008.1.1	Standard
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Standard

3.3.1 ASSOCIATION ESTABLISHMENT POLICIES

The Modality Worklist AE will initiate an association to a device in response to the following real-world activities;

1. The user initiates a manual Update Worklist (Broad Query).
2. The user initiates a specific Worklist Query (Patient Based Query).
3. The system initiates an Automatic Worklist Query (Broad Query).

In all cases a C-FIND command is issued to the Modality Worklist server. After the requested data is returned, the association is closed.

3.3.1.1 GENERAL

Maximum PDU size offered to SCP: 32,768 bytes
This is the maximum PDU size the Modality Worklist AE can receive and is the value offered for the maximum PDU size in the Association Request command. Once the Association is open if the Modality Worklist AE receives a PDU that is larger than this value then the Association will be aborted.

Minimum PDU size accepted from SCP: 1,024 bytes
This is the minimum PDU size the Modality Worklist AE can be configured to send. If the Modality Worklist AE receives a maximum PDU size in the Association Accept response that is smaller than this value then the Association will be aborted immediately.

Maximum PDU size sent by SCU: 32,768 bytes
This is the maximum PDU size the Modality Worklist AE can be configured to send. The maximum PDU size sent on any Modality Worklist AE Association will be the smaller of the configured value and the maximum PDU size received in the Association Accept response.

3.3.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations for the Modality Worklist AE: 1

3.3.1.3 ASYNCHRONOUS NATURE

The Modality Worklist AE will not use asynchronous operations.

3.3.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID: "1.2.840.114340.3"
Implementation Version name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.3.2 ASSOCIATION INITIATION BY REAL-WORLD ACTIVITY

The Modality Worklist AE will open associations to the configured Worklist SCP in response to the following real-world activities; Update Worklist, Query Worklist, Automatic Worklist Query, and Get Status.

3.3.2.1 ASSOCIATION INITIATION BY: UPDATE WORKLIST

The Update Worklist real-world activity initiated in Worklist screen will cause the Modality Worklist AE to open an association with the Worklist SCP, configured in the current Location.

3.3.2.2 ASSOCIATION INITIATION BY: WORKLIST QUERY

The Query Worklist command real-world activity initiated in Patient Setup screen will cause the Modality Worklist AE to open an association with the Worklist SCP, configured in the current Location.

3.3.2.3 ASSOCIATION INITIATION BY: AUTOMATIC WORKLIST QUERY

The Automatic Worklist Query real-world activity initiated by the system at periodic intervals will cause the Modality Worklist AE to open an association with the Worklist SCP, configured in the current Location.

3.3.2.4 ASSOCIATION INITIATION BY: GET STATUS

The Get Status real-world activity will cause the Modality Worklist AE to open an association to the Modality Worklist SCP configured in the current Location.

3.3.3 PROPOSED PRESENTATION CONTEXTS TO A WORKLIST SERVER

Table 3-37 Modality Worklist AE Proposed Presentation Contexts to a Worklist Server

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.3.3.1 MODALITY WORKLIST INFORMATION MODEL – FIND SOP CLASS

The Modality Worklist AE provides standard conformance to the Modality Worklist Information Model - FIND SOP Class as an SCU.

3.3.3.2 VERIFICATION SOP CLASS

The Modality Worklist AE provides standard conformance to the Verification SOP Class as an SCU.

3.3.4 MODALITY WORKLIST ATTRIBUTES

3.3.4.1 BROAD WORKLIST QUERY MATCHING KEY ATTRIBUTES

Table 3-38 specifies the Matching Key attributes used by Automatic Worklist C-FIND requests and manual Update Worklist C-FIND requests for Broad queries initiated by the user from the Worklist screen.

Table 3-38 Broad Worklist Query Matching Key Attributes

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	R	Selectable from list provided by User Interface
Scheduled Station AE-Title	(0040,0001)	R	Configurable – Sent as either ; 1) TURBO's AE Title 2) Universal Matching.
Scheduled Procedure Step Start Date	(0040,0002)	R	Configurable – Sent as either; 1) Today's date 2) Yesterday, Today and Tomorrow date range 3) Universal Matching

3.3.4.2 PATIENT BASED QUERY MATCHING KEY ATTRIBUTES

Table 3-39 specifies the Matching Key attributes used for Worklist C-FIND requests for Patient Based queries initiated by the user from the Patient Setup screen.

Table 3-39 Patient Based Query Matching Key Attributes

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	R	Selectable from list provided by User Interface
Scheduled Station AE-Title	(0040,0001)	R	Configurable – Sent as either ; 1) Turbo's AE Title 2) Universal Matching.

Attribute Name	Tag	Type	Notes
Scheduled Procedure Step Start Date	(0040,0002)	R	Configurable – Sent as either; 1) Today's date 2) Yesterday, Today and Tomorrow date range 3) Universal Matching
Patient's Name	(0010,0010)	R	Entered on Patient Setup screen. A wild card is appended to Last, First and Middle name component.
Patient ID	(0010,0020)	R	Entered on Patient Setup screen. Single value matching only.
Accession Number	(0008,0050)	O	Entered on Patient Setup screen.
Requested Procedure ID	(0040,1001)	O	Entered on Patient Setup screen.

3.3.4.3 RETURN KEY ATTRIBUTES

Table 3-40 specifies the Return Key attributes that are included in all Worklist C-FIND requests.

Table 3-40 Return Key Attributes

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	
Accession Number[4]	(0008,0050)	2	Displayed on Patient Setup screen
Referring Physician's Name	(0008,0090)	2	Displayed on Patient Setup screen
Patient's Name[4]	(0010,0010)	1	Displayed on Patient Setup screen. All 5 name components are preserved but only Last, First and Middle name components are displayed.
Patient ID[4]	(0010,0020)	1	Displayed on Patient Setup screen
Patients Birth Date	(0010,0030)	2	Displayed on Patient Setup screen
Patient's Sex	(0010,0040)	2	Displayed on Patient Setup screen
Other Patient IDs	(0010,1000)	3	
Additional Patient History	(0010,21B0)	3	Displayed on Patient Setup screen as Indications
Admitting Diagnoses Description	(0008,1080)	3	Displayed on Patient Setup screen as Indications if Additional Patient History is not returned.
Last Menstrual Date	(0010,21D0)	2	Displayed on Patient Setup screen with OB/GYN exam type only.
Scheduled Procedure Step Sequence	(0040,0100)	1	
>Modality	(0008,0060)	1	
>Scheduled Station AE Title	(0040,0001)	1	
>Scheduled Procedure Step Start Date	(0040,0002)	1	
>Scheduled Procedure Step Start Time	(0040,0003)	1	
>Scheduled Procedure Step Description[4]	(0040,0007)	1C	
>Scheduled Protocol Code Sequence	(0040,0008)	1C	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Scheduled Procedure Step ID	(0040,0009)	1	
Requested Procedure ID[4]	(0040,1001)	1	Displayed on Patient Setup screen.

Attribute Name	Tag	Type	Notes
Requested Procedure Description[4]	(0032,1060)	1C	
Requested Procedure Code Sequence	(0032,1064)	1C	
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning[4]	(0008,0104)	3	
Referenced Study Sequence	(0008,1110)	2	
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

[4] This attribute from Worklist may be truncated when displayed in the Turbo User Interface. However, the value contained in the attribute is preserved in full fidelity.

3.3.5 WORKLIST AE BEHAVIOR TO C-FIND STATUS

Table 3-41 specifies the response status codes, which an SCP may return following the SCU's C-FIND request, along with the Worklist AE's associated behavior. Only those status responses that indicate some form of error condition are presented to the user. Related fields are not used.

Table 3-41 Worklist AE Behavior to C-FIND Status

Service Status	Further Meaning	Status Codes	Worklist AE Behavior
Refused	Out of resources	A700	The association is terminated. The user is notified of the failure.
Failed	Identifier does not match SOP Class	A900	The association is terminated. The user is notified of the failure.
	Unable to process	Cxxx	The association is terminated. The user is notified of the failure.
Cancel	Matching terminated due to Cancel request	FE00	The association is terminated. The user is notified that the query was incomplete.
Success	Matching is complete - No final Identifier is supplied.	0000	The Modality Worklist AE will continue operation without user notification.
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00	The Modality Worklist AE will continue operation without user notification.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	FF01	The Modality Worklist AE will continue operation without user notification.

3.4 MEDIA EXPORT AE – SPECIFICATION

3.4.1 INTRODUCTION

This section of the conformance statement specifies the Turbo compliance to DICOM Media Storage. It details the roles supported by this product.

Turbo is able to export DICOM images to removable USB media stick memory. Any reference to USB in this document refers to "USB media stick memory".

3.4.2 IMPLEMENTATION MODEL

The Media Export AE saves single and multi-frame US images to a USB storage device. It is associated with the local real-world activity "Export to USB". "Export to USB" is performed upon user request for selected patient series.

3.4.2.1 APPLICATION DATA FLOW

Figure 3-1 Media Export Data Flow

3.4.2.2 FUNCTIONAL DEFINITION OF THE AE

Turbo can perform the following functions:

- Create a new DICOM file-set on the USB medium
- Add to an existing DICOM file-set previously created by the Turbo system

3.4.2.3 SEQUENCING OF REAL-WORLD ACTIVIITIES

Not applicable.

3.4.2.4 FILE META INFORMATION OPTIONS (SEE PS 3.10)

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

Implementation Class UID: "1.2.840.114340.3"
Implementation Version Name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.4.3 AE SPECIFICATIONS

3.4.3.1 FILE META INFORMATION FOR THE APPLICATION ENTITY

The Source Application Entity Title included in the file header is configurable. The default value set in the File Meta Information for this AE is: "DICOM Media".

3.4.3.2 REAL-WORLD ACTIVITIES

3.4.3.2.1 REAL-WORLD ACTIVITY – "EXPORT TO USB"

"Export to USB" saves the selected DICOM SOP instances to the USB medium and creates a DICOM File Set. If a DICOM File Set created by the Turbo exists on the medium, any new files selected for export will be added to the existing files. The Media Export AE acts as a File Set Creator when requested to export SOP instances from the internal storage to a USB medium. If there is insufficient space on the medium, the user will be prompted with an informative message.

Limitations: The user cannot review or manipulate DICOM files written to the USB medium on the system.

3.4.3.2.1.1 Media Storage Application Profile for the real-world activity "Export to USB"

Not applicable [FUTURE]

3.4.3.2.1.1.1 Options

This Application Entity supports the SOP Classes and Transfer Syntaxes listed below in Table 3-42:

Table 3-42 SOP Classes and Transfer Syntaxes for Media Export

Abstract Syntax		Transfer Syntax	
Name	**UID**	**Name List**	**UID List**
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian JPEG Baseline (Process 1)	1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian JPEG Baseline (Process 1)	1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.50

Sec. 3.2.4 Common Composite Image IOD Module describes image module usage by Turbo.

3.4.4 AUGMENTED AND PRIVATE APPLICATION PROFILES

Not applicable.

3.4.5 MEDIA CONFIGURATION

The Application Entity Titles configurable for Media Services are listed below:

Application Entity: “Media Export” Default AE Title: “DICOM Media”

3.4.6 MEDIA STORAGE SOP CLASS

The following diagram illustrates the relationship between directory entities in the Basic Directory module produced by Turbo. It is based on the basic DICOM entity relationship model.

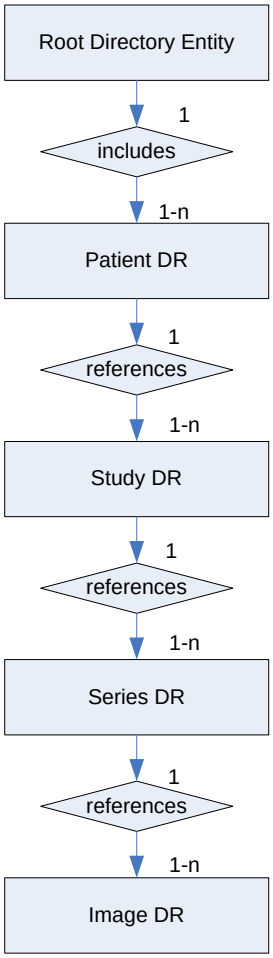

Figure 3-2 TURBO Directory Entity Relationship Diagram

The Media Storage SOP Class uses the Basic Directory IOD Modules as shown in Table 3-43.

Table 3-43 Basic Directory IOD Modules

Module	Reference	Usage
File-set Identification	3.2.4.1	M
Directory Information	3.4.7.2	U

3.4.7 INFORMATION MODULE DEFINITIONS

3.4.7.1 FILE-SET IDENTIFICATION MODULE

Table 3-44 specifies the attributes used from the File-set Identification Module.

Table 3-44 File-Set Identification Module

Attribute Name	Tag	Type	Attribute Description
File-set ID	(0004,1130)	2	"SONO_EXPORT"
File-set Descriptor ID	(0004,1141)	3	Not Used
Specific Character Set of File-set Descriptor File	(0004,1142)	1C	Not Used

3.4.7.2 DIRECTORY INFORMATION MODULE

Table 3-45 specifies the attributes used from the Directory Information Module.

Table 3-45 Directory Information Module

Attribute Name	Tag	Type	Attribute Description
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	See PS 3.3
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	See PS 3.3
File-set Consistency Flag	(0004,1212)	1	See PS 3.3
Directory Record Sequence	(0004,1220)	2	See PS 3.3
>Offset of the Next Directory Record	(0004,1400)	1C	See PS 3.3
>Record In-use Flag	(0004,1410)	1C	Turbo sets all created records to 0xFFFF
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	See PS 3.3
>Directory Record Type	(0004,1430)	1C	Turbo Supported Values: PATIENT, STUDY, SERIES, IMAGE
>Referenced File ID	(0004,1500)	1C	See PS 3.3
>Referenced SOP Class UID in File	(0004,1510)	1C	See PS 3.3
>Referenced SOP Instance UID in File	(0004,1511)	1C	See PS 3.3
>Referenced Transfer Syntax in UID in File	(0004,1512)	1C	See PS 3.3

3.4.7.2.1 PATIENT KEYS

Table 3-46 specifies the additional keys used for directory records of type PATIENT.

Table 3-46 PATIENT KEYS

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Reference 3.2.4.1
Patient ID	(0010,0020)	1	Reference 3.2.4.1

3.4.7.2.2 STUDY KEYS

Table 3-47 specifies the additional keys used for directory records of type STUDY.

Table 3-47 STUDY KEYS

Attribute Name	Tag	Type	Attribute Description
Study Date	(0008,0020)	1	Reference 3.2.4.2
Study Time	(0008,0030)	1	Reference 3.2.4.2
Study Description	(0008,1030)	2	Reference 3.2.4.2
Study Instance UID	(0020,000D)	1C	Reference 3.2.4.2
Study ID	(0020,0010)	1	Reference 3.2.4.2
Accession Number	(0008,0050)	2	Reference 3.2.4.2

3.4.7.2.3 SERIES KEYS

Table 3-48 specifies the additional keys used for directory records of type SERIES.

Table 3-48 SERIES KEYS

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Reference 3.2.4.4
Series Instance UID	(0020,000E)	1	Reference 3.2.4.4
Series Number	(0020,0011)	1	Reference 3.2.4.4

3.4.7.2.4 IMAGE KEYS

Table 3-49 specifies the additional keys used for directory records of type IMAGE.

Table 3-49 IMAGE KEYS

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Reference 3.2.4.7

3.5 STORAGE COMMITMENT AE – SPECIFICATION

The Storage Commitment AE provides conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-50 Storage Commitment AE SOP Class Support

SOP Class Name	SOP Class UID	Conformance Level
Verification	1.2.840.10008.1.1	Standard
Storage Commitment Push Model	1.2.840.10008.1.20.1	Standard

3.5.1 ASSOCIATION ESTABLISHMENT POLICIES

The Storage Commitment AE will initiate an association to a device in response to the following real-world activities:

1. All images have been transferred for an exam (batch mode transfer).
2. An image has been transferred for an exam (in-progress mode transfer).
3. The user manually selects to (re) issue commitment request for a particular exam.
4. After system startup, archived but un-committed images exist.

In all cases a N-ACTION command is issued to the Storage Commitment server. After the request has been made, the association is closed.

The Storage Commitment AE will respond to an association request from a device in response to the following real-world activities:

1. Storage Commitment SCP responds to commitment request with N-EVENT-REPORT.

3.5.1.1 GENERAL

Maximum PDU size offered to SCP: 32,768 bytes
This is the maximum PDU size the Storage Commitment AE can receive and is the value offered for the maximum PDU size in the Association Request command. Once the Association is open if the Storage Commitment AE receives a PDU that is larger than this value then the Association will be aborted.

Minimum PDU size accepted from SCP: 1,024 bytes
This is the minimum PDU size the Storage Commitment AE can be configured to send. If the Storage Commitment AE receives a maximum PDU size in the Association Accept response that is smaller than this value then the Association will be aborted immediately.

Maximum PDU size sent by SCU: 32,768 bytes
This is the maximum PDU size the Storage Commitment AE can be configured to send. The maximum PDU size sent on any Storage Commitment AE Association will be the smaller of the configured value and the maximum PDU size received in the Association Accept response.

3.5.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations for the Storage Commitment AE: 1

3.5.1.3 ASYNCHRONOUS NATURE

The Storage Commitment AE will not use asynchronous operations.

3.5.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID: "1.2.840.114340.3"
Implementation Version name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.5.1.5 SCU BEHAVIOR

The Turbo system accepts N-EVENT-REPORTS only on separate associations.
The Turbo system provides visual indication of successful Storage Commitment, but does not automatically delete committed images from the system.

3.5.2 PROPOSED PRESENTATION CONTEXTS TO A STORAGE COMMITMENT SERVER

Table 3-51 Storage Commitment AE Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.5.2.1 STORAGE COMMITMENT PUSH MODEL SOP CLASS

The Storage Commitment AE provides standard conformance to the Storage Commitment Push Model SOP Class as an SCU.

3.5.2.2 VERIFICATION SOP CLASS

The Storage Commitment AE provides standard conformance to the Verification SOP Class as both SCU and SCP.

3.5.3 STORAGE COMMITMENT ATTRIBUTES

Table 3-52 Storage Commitment Request - Action Information

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

Table 3-53 Storage Commitment Result – Event Information

Event Type Name	Event Type ID	Attribute	Tag	Notes
Storage Commitment Request Successful	1	Transaction UID	(0008,1195)	
		Referenced SOP Sequence	(0008,1199)	
		>Referenced SOP Class UID	(0008,1150)	
		>Referenced SOP Instance UID	(0008,1155)	
Storage Commitment Request Complete - Failures Exist	2	Transaction UID	(0008,1195)	
		Referenced SOP Sequence	(0008,1199)	
		>Referenced SOP Class UID	(0008,1150)	
		>Referenced SOP Instance UID	(0008,1155)	
		Failed SOP Sequence	(0008,1198)	
		>Referenced SOP Class UID	(0008,1150)	
		>Referenced SOP Instance UID	(0008,1155)	
		>Failure Reason	(0008,1197)	

3.6 MODALITY PERFORMED PROCEDURE STEP (MPPS) AE – SPECIFICATION

The MPPS AE provides conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-54 MPPS AE SOP Class Support

SOP Class Name	SOP Class UID	Conformance Level
Verification	1.2.840.10008.1.1	Standard
Modality Peformed Procedure Step	1.2.840.10008.3.1.2.3.3	Standard

3.6.1 ASSOCIATION ESTABLISHMENT POLICIES

The MPPS AE will initiate an association to a device in response to the following real-world activities:

1. The user begins a new procedure.
2. The user completes (or discontinues) a procedure.
3. The system has queued up procedures whose status has not yet been transmitted to the MPPS SCP.

In the case of beginning a procedure an N-CREATE command is issued to the MPPS SCP. In the case of completing/discontinuing a procedure, an N-SET is issued to the MPPS SCP. After the message has been made, the association is closed.

3.6.1.1 GENERAL

Maximum PDU size offered to SCP: 32,768 bytes
This is the maximum PDU size the MPPS AE can receive and is the value offered for the maximum PDU size in the Association Request command. Once the Association is open if the MPPS AE receives a PDU that is larger than this value then the Association will be aborted.

Minimum PDU size accepted from SCP: 1,024 bytes
This is the minimum PDU size the MPPS AE can be configured to send. If the MPPS AE receives a maximum PDU size in the Association Accept response that is smaller than this value then the Association will be aborted immediately.

Maximum PDU size sent by SCU: 32,768 bytes
This is the maximum PDU size the MPPS AE can be configured to send. The maximum PDU size sent on any MPPS AE Association will be the smaller of the configured value and the maximum PDU size received in the Association Accept response.

3.6.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations for the MPPS AE: 1

3.6.1.3 ASYNCHRONOUS NATURE

The MPPS AE will not use asynchronous operations.

3.6.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID: "1.2.840.114340.3"
Implementation Version name: "Tiller_SV500"

Note: "114340" is registered by SonoSite with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.6.2 PROPOSED PRESENTATION CONTEXTS TO AN MPPS SERVER

Table 3-55 MPPS AE Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
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

3.6.2.1 MPPS SOP CLASS

The MPPS AE provides standard conformance to the Modality Performed Procedure Step SOP Class as an SCU.

3.6.2.2 VERIFICATION SOP CLASS

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

3.6.3 MPPS INFORMATION MODEL ATTRIBUTES

Table 3-56 MPPS SOP Class N-CREATE and N-SET Attributes

Attribute Name	Tag	Req. Type N-CREATE	Req. Type N-SET	Notes
Scheduled Step Attribute Sequence	(0040,0270)	1	Not allowed	
>Study Instance UID	(0020,000D)	1	Not allowed	
>Referenced Study Sequence	(0008,1110)	2	Not allowed	From Worklist
>>Referenced SOP Class UID	(0008,1150)	1	Not allowed	
>>Referenced SOP Instance UID	(0008,1155)	1	Not allowed	
>Accession Number	(0008,0050)	2	Not allowed	
>Requested Procedure ID	(0040,1001)	2	Not allowed	
>Requested Procedure Code Sequence	(0032,1064)	3	Not allowed	From Worklist
>>Code Value	(0008,0100)	1	Not allowed	
>>Coding Scheme Designator	(0008,0102)	1	Not allowed	
>>Code Meaning	(0008,0104)	1	Not allowed	
>Requested Procedure Description	(0032,1060)	2	Not allowed	
>Scheduled Procedure Step ID	(0040,0009)	2	Not allowed	
>Scheduled Procedure Step Description	(0040,0007)	2	Not allowed	
>Scheduled Protocol Code Sequence	(0040,0008)	2	Not allowed	From Worklist

>>Code Value	(0008,0100)	1	Not allowed	
>>Coding Scheme designator	(0008,0102)	1	Not allowed	
>>Code Meaning	(0008,0104)	3	Not allowed	
Patient's Name	(0010,0010)	2	Not allowed	
Patient ID	(0010,0020)	2	Not allowed	
Patient's Birth Date	(0010,0030)	2	Not allowed	
Patient's Sex	(0010,0040)	2	Not allowed	
Referenced Patient Sequence	(0008,1120)	2	Not allowed	Empty
Performed Procedure Step ID	(0040,0253)	1	Not allowed	Internally Generated "SONOPPSxxxxxxx"
Performed Station AE Title	(0040,0241)	1	Not allowed	
Performed Station Name	(0040,0242)	2	Not allowed	
Performed Location	(0040,0243)	2	Not allowed	
Performed Procedure Step Start Date	(0040,0244)	1	Not allowed	
Performed Procedure Step Start Time	(0040,0245)	1	Not allowed	
Performed Procedure Step Status	(0040,0252)	1	3	
Performed Procedure Step Description	(0040,0254)	2	3	N-CREATE only
Performed Procedure Type Description	(0040,0255)	2	3	N-CREATE only
Procedure Code Sequence	(0008,1032)	2	3	N-CREATE only
>Code Value	(0008,0100)	1	1	
>Coding Scheme Designator	(0008,0102)	1	1	
>Code Meaning	(0008,0104)	3	3	
Performed Procedure Step End Date	(0040,0250)	2	3	
Performed Procedure Step End Time	(0040,0251)	2	3	
Modality	(0008,0060)	1	Not allowed	"US"
Study ID	(0020,0010)	2	Not allowed	
Performed Protocol Code Sequence	(0040,0260)	2	3	N-CREATE only
>Code Value	(0008,0100)	1	1	
>Coding Scheme Designator	(0008,0102)	1	1	
>Code Meaning	(0008,0104)	3	3	
Performed Series Sequence	(0040,0340)	2	3	
>Performing Physician's	(0008,1050)	2	2	

Name				
>Protocol Name	(0018,1030)	1	1	Internally Generated "SONOPPSxxxxxxx"
>Operators' Name	(0008,1070)	2	2	
>Series Instance UID	(0020,000E)	1	1	
>Series Description	(0008,103E)	2	2	
>Retrieve AE Title	(0008,0054)	2	2	
>Referenced Image Sequence	(0008,1140)	2	2	
>>Referenced SOP Class UID	(0008,1150)	1	1	
>>Referenced SOP Instance UID	(0008,1155)	1	1	
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	2	2	Empty

4 COMMUNICATION PROFILES

4.1 TCP/IP STACK

The TCP/IP protocol is used.

5 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

5.1 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOPS

SonoSite uses the tag range of (0019,XXXX) for private tags in US Image Storage objects. These tags include additional report and image metadata intended for use by SonoSite applications, and are included only when the "Include private tags" option is selected on the system.

Table 5-1 Private Tags

Tag	VR	Attribute Description
(0019,0010)	LO	Private Data
(0019,1010)	UT	Private Data (only present in first image in series)
(0019,1020)	UT	Private Data (only present in first image in series)
(0019,1030)	UT	Private Data (only present in first image in series)
(0019,1040)	UT	Private Data (only present in first image in series)
(0019,1050)	UT	Private Data
(0019,1060)	UT	Private Data

5.2 PRIVATE TRANSFER SYNTAXES

None

6 CONFIGURATION

6.1 AE TITLE/PRESENTATION ADDRESS MAPPING

The Turbo AE Title and Turbo networking parameters are configurable in DICOM Setup Mode. Port number 104 is the default used for DICOM communication with the Turbo.

6.2 CONFIGURABLE PARAMETERS

6.2.1 TURBO CONFIGURABLE PARAMETERS PER NETWORK LOCATION

The Turbo system can be configured to operate in multiple network locations. The Turbo local device settings and remote device settings (e.g. Printers/Archivers/Worklist) can be configured for each location. These parameters are intended to be configured by a network/DICOM administrator.

Configurable Turbo Networking and DICOM parameters:

- DHCP (default = disabled)
- Hostname (Name field)
- DICOM AE Title
- IP Address (disabled if DHCP is selected)
- Subnet Mask (disabled if DHCP is selected)
- Default Gateway (disabled if DHCP is selected)
- Network Write Timeout
- Network Read Timeout
- Network speed (Auto, 100Mb/10Mb, Full/Half duplex)
- Transfer Images (End of exam, During the exam)
- Port (default = 104)
- Wireless properties (see Turbo User Guide for detailed configuration information)

6.2.2 CONFIGURABLE PARAMETERS PER REMOTE DEVICE INSTANCE

`Every archiver, printer, and Modality Worklist device` that Turbo is setup to communicate with has a set of parameters that are configurable in Setup mode. These parameters are intended to be configured by a network/DICOM administrator.

Configurable parameters for each device instance:

- DICOM AE Title
- Hostname (Name field)
- IP Address
- Port Number

Configurable parameters for each Archiver device instance:

- SOP Class — Ultrasound / Ultrasound Retired / Secondary Capture
- SOP Class — Ultrasound Multi-frame (enable/disable)
- Photometric Interpretation — Monochrome2 / RGB / YBR_FULL_422 (used for JPEG Baseline)
- Transfer Syntax — ELE/ILE or JPEG Baseline (applies to US and US-MF images only)
- Send Images Only — Selection
- Max Retries
- Retry Interval
- Inclusion of private tags

Configurable parameters for each Printer device:

- Photometric Interpretation — Monochrome2 / RGB
- Magnification — Bilinear, Cubic, Replicate, None, Do not send
- Number of Copies — 1 to Max Number of Copies, Default=1
- Print Priority — LOW / MED / HIGH
- Film Size ID — Function of Printer Films and Printer Displays for printer type
- Medium Type — Function of Printer Films for printer type and selected Film Size ID
- Film Destination — Function of Printer Films for printer type
- Image Display Format — Function of Printer Displays for printer type and selected Film Size
- Film Orientation — Function of Printer Displays for printer type and selected Film Size ID and Image Display Format
- Border Density — Min Density Available to Max Density Available for printer type
- Empty Image Density — Min Density Available to Max Density Available for printer type
- Min Density — Min Density Available to Max Density Available for printer type
- Max Density — Min Density Available to Max Density Available for printer type
- Configuration Information — String selected from list of Configuration Strings for printer type
- Max Retries
- Retry Interval

Configurable parameters for the Worklist SCP device instance:

- Automatic Query Enable — On/Off
- Automatic Query Interval — Selection = 30 minutes, 1, 2, 4 , 8, 12, 24 hours
- Automatic Query Start Time — Selection = 0:00 to 23:00 hours
- Modality — Selectable from list in user interface
- Scheduled Station AE Title — This TURBO system only or universal matching (used for Broad & Patient Based Queries)
- SPS Date — Today; "Yesterday, Today & Tomorrow"; or universal matching (Used for Broad & Patient Based Queries)

6.2.3 OTHER CONFIGURABLE PARAMETERS

These settings apply independent of network configuration:

- Photometric Interpretation (removable media) — Monochrome2 / RGB / YBR_FULL_422

7 SUPPORT OF EXTENDED CHARACTER SETS

The Turbo system supports the ISO 8859 Latin 1 (ISO-IR 100) character set family and (on a Russian Language system only) ISO 8859-5 Cyrillic (ISO-IR 144).

The Specific Character Set key attribute (0008,0005), a type 1C attribute, may be returned by an SCP if that device supports any character set encodings beyond the ISO_IR 6. If the tag is not present in the Worklist query result, the default (i.e. ISO_IR 6, i.e. ASCII) is assumed. If the tag is present, only ISO_IR 6 (ASCII), ISO_IR 100 (Latin Alphabet # 1), or ISO_IR 144 (Cyrillic) are supported by the Turbo system. All other character set encodings are unsupported and will cause the system to issue a C-Find Cancel. All query results data acquired up to the first detection of an unsupported character set encoding are retained and presented to the user.