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MicroMAXX DICOM Conformance Statement

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Revision: G

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CHAPTER 1

Introduction

About this document

This document describes the SonoSite MicroMAXX® 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 MicroMAXX system is an ultrasound imaging device. The DICOM option of the MicroMAXX system provides a means to query the Information System for scheduled procedures using DICOM Modality Worklist, and to send images to DICOM printers and DICOM storage servers.

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 -2003.

Changes in this version

Revision	Description of Change
G	Include support for ISO_IR 144 (Cyrillic) character set
F	Update for Instance Number description
E	Pre-release update
D	UNRELEASED
C	Updates for "During the exam" transfer
B	Pre-release update
A	Initial release (associated with C3 MicroMAXX)

Conformance Statement Overview

The MicroMAXX Ultrasound System implements the necessary DICOM services to download work lists from an information system, save acquired images to a network storage device and print to a networked hardcopy device.

Table 1-1 provides an overview of the network services supported by the MicroMAXX 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
Print Management		
Basic Grayscale Print Management	Yes	No
Basic Color Print Management	Yes	No
General		
Verification	Yes	No

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 MicroMAXX via its DICOM feature.

Definitions

AE	Application Entity
ANSI	American National Standards Institute
CF	Compact Flash
CW	Continuous Wave
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
HIS	Hospital Information System
IE	Information Entity
IOD	Information Object Definition
JPEG	An image compression technique created by the Joint Photographic Experts Group
kHz	Kilohertz
LUT	Look Up Table
Monochrome2	A color format for images in which the pixel values are grayscale values with a range of 0-255, 0 represents a Black pixel and 255 represents a White pixel.
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association US trade organization, members of which defined the first version of the DICOM standard together with the ACR.
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

Transfer Syntax	Encoding specification of DICOM messages, negotiated while setting up an association. Examples of different transfer syntaxes are Little Endian or Big Endian, Implicit or Explicit VR, or a compression scheme (such as RLE or JPEG).
UID	Unique Identifier
US	Ultrasound
UTC	Coordinated Universal Time
VOI	Value Of Interest
VR	Value Representation

Reference Documents

ACR-NEMA DICOM Standard Version 3.0 – 2003.

CHAPTER 2

Implementation Model

The MicroMAXX DICOM feature incorporates the DICOM 3.0 standard for networked image printing, image storage and Modality Worklist functions. Scheduled Procedures are queried from the HIS/RIS Worklist SCP and presented to the operator for selection. Performed Procedures[1] are transferred from the MicroMAXX ultrasound system using standard network connections to be processed on a centralized printer or stored on a DICOM compatible archiver.

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, MicroMAXX 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, MicroMAXX 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 compact flash. 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. 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 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.

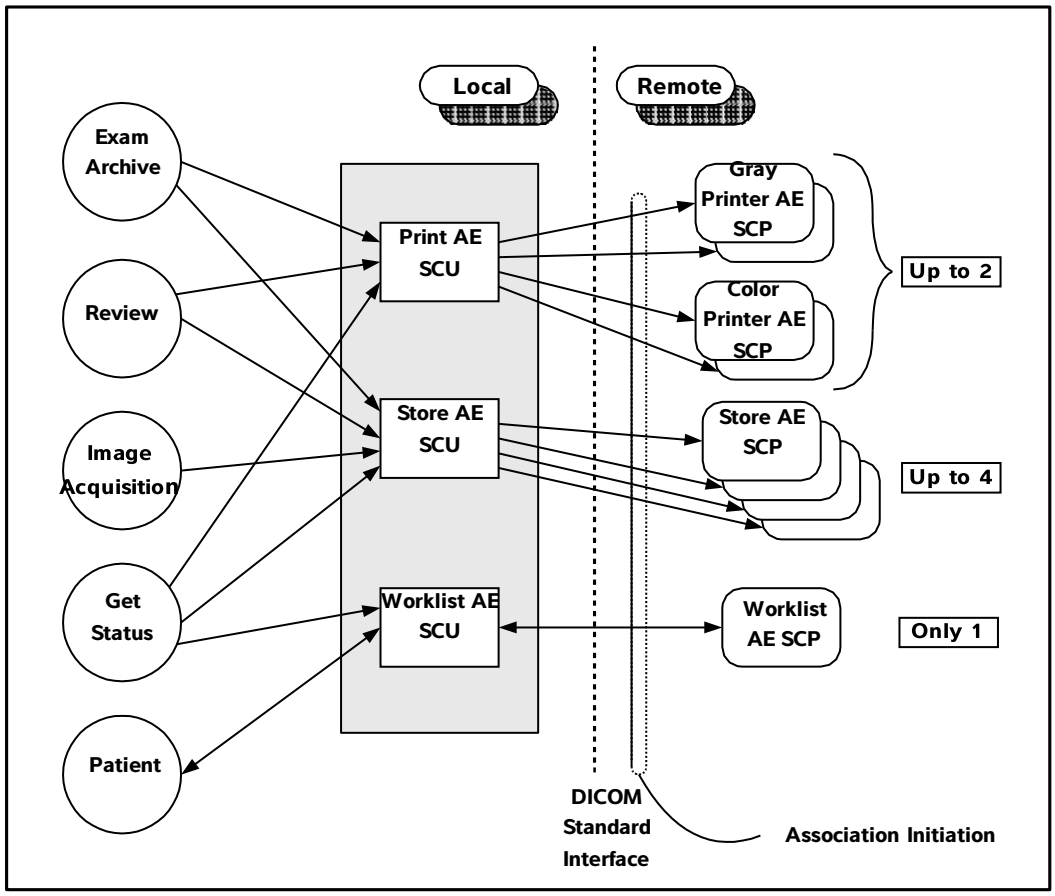
When a Get Status is performed the current destination list is used in the same manner as with Exam Archive. For batch transfer mode, the devices are accessed sequentially, starting with the first selected archiver and ending with the last selected printer. For each device an association is opened, status is returned, and the association is closed. Status is obtained from printer devices using an N-Get Status, and from archiver 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.

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 MicroMAXX (boxes in the center), and the remote AE's built into the devices MicroMAXX 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 CF card. Exam end occurs when the Delta key is pressed while configured to End Exam, or when Patient setup mode is entered and either End Exam is pressed or any of the patient fields are changed and the saves committed.
- System startup with an inserted CF card that contains one or more images with Archive Pending.
- Insertion of a CF card that contains one or more images with Archive Pending.

Image Acquisition

- 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.

Review

- User enters Review mode, selects one or more Patient Exams, and selects Archive.

Get Status

- Operator Verify command in DICOM Setup mode.

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.

Functional Definition 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
{
    C-STORE Image SOP Instance
}
A-RELEASE
```

Steps taken to Send Exam to Archiver, in progress transfer mode:

```
A-ASSOCIATE
for each exam image acquired within timeout period AND not end of exam
```

{

C-STORE Image SOP Instance

}

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 WorklistSCP:

A-ASSOCIATE

SEND C-FIND Requestcommand

{

RECEIVE C-FIND Response

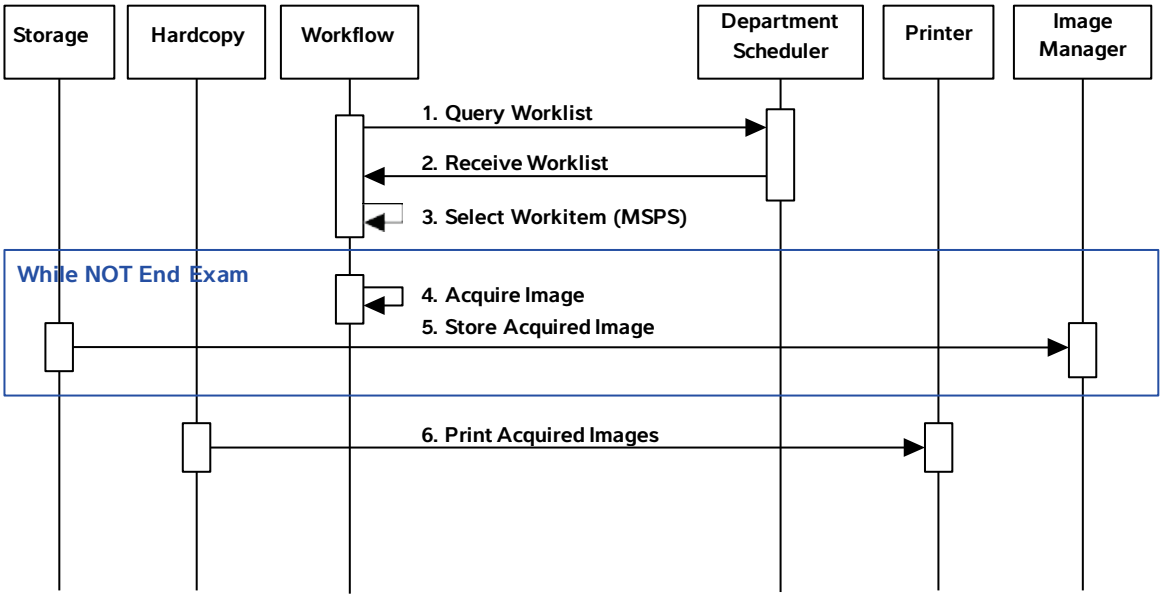
} While C-FIND status == pending AND response <= 200

A-RELEASE

Sequencing of Real-World Activities

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

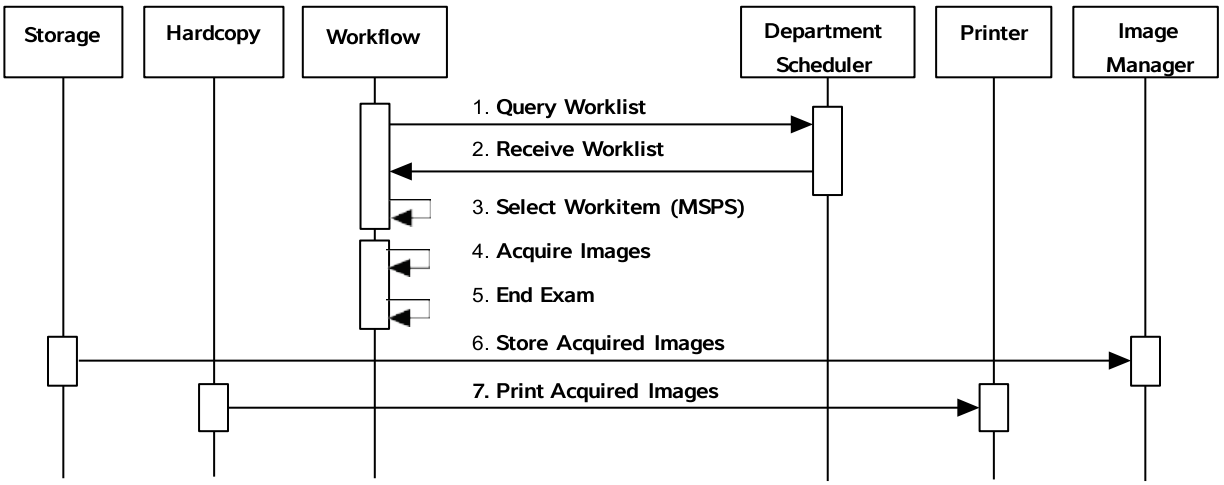
Figure 2-2 Sequencing Constraints - "During the Exam" Configuration



Under normal scheduled workflow conditions the sequencing constraints illustrated apply:

1. Worklist Query in initiated.
2. List of Modality Scheduled Procedure Steps (MSPS) are returned.
3. MSPS item is selected from the Worklist and the Exam begins.
4. Image or Clip is acquired.
5. 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.
6. Acquired images are Printed.

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



Under normal scheduled workflow conditions the sequencing constraints illustrated apply:

1. Worklist Query in initiated.
2. List of Modality Scheduled Procedure Steps (MSPS) are returned.
3. MSPS item is selected from the Worklist and the Exam begins.
4. Images and Clips are acquired.
5. Exam is ended.
6. Image SOP instances acquired during the exam are stored to the Image Manager.
7. Acquired images are Printed.

CHAPTER 3

AE Specifications

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

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.

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.

Number of Associations

Number of simultaneous associations for the Print AE: 1

Asynchronous Nature

The Print AE does not use asynchronous operations.

Implementation Identifying Information

Implementation Class UID: "1.2.840.114340.3"

Implementation Version name: "Tiller_SV400"

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.

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.

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.

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.

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.

Proposed Presentation Contexts

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

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

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	3.1.5
Basic Film Box SOP Class	M	3.1.6

Table 3-4: Basic Grayscale Print Management Meta SOP Class

SOP Class Name	SCU Usage	Reference
Basic Grayscale Image Box SOP Class	M	3.1.7.1
Printer SOP Class	M	3.1.8

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	3.1.5
Basic Film Box SOP Class	M	3.1.6
Basic Color Image Box SOP Class	M	3.1.7.2
Printer SOP Class	M	3.1.8

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
Print Priority	(2000,0020)	U	Configurable in DICOM Setup mode LOW, MED, HIGH, Default=MED

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

Attribute Name	Tag	SCU Usage	Description
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

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)

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

Attribute Name	Tag	SCU Usage	Description
Film Orientation	(2010,0040)	U	Configurable in DICOM Setup mode Valid settings defined by printer type PORTRAIT, LANDSCAPE
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

Basic Image Box SOP Classes

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

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

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

Attribute Name	Tag	SCU Usage	Description
>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	RGB Pixel Data

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

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

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.

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.

Number of Associations

Number of simultaneous associations for the Store AE: 1

Asynchronous Nature

The Store AE will not use asynchronous operations.

Implementation Identifying Information

Implementation Class UID: "1.2.840.114340.3"

Implementation Version name: "Tiller_SV400"

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.

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.

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.

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.

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.

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.

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

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		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	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)*	1.2.840.10008.1.2 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
* This Transfer Syntax is the only one proposed if JPEG Compression is configured.					

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).

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

Table 3-18: US Image IOD Modules

IE	Module	Reference	Usage
	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	3.2.4.8	M
	Contrast/Bolus	Not Used	C
	Palette Color Lookup Table	Not Used	C
	US Region Calibration	3.2.4.11	U
	US Image	3.2.4.12	M
	Overlay Plane	Not Used	U
	VOI LUT	3.2.4.13	U
	SOP Common	3.2.4.14	M

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

Table 3-19: US Multi-Frame Image IOD Modules

IE	Module	Reference	Usage
Image	General Image	3.2.4.7	M
	Image Pixel	3.2.4.8	M
	Contrast/Bolus	Not Used	C
	Cine	3.2.4.9	M
	Multi-Frame	3.2.4.10	M
	Frame Pointers	Not Used	U
	Palette Color Lookup Table	Not Used	C
	US Region Calibration	3.2.4.11	U
	US Image	3.2.4.12	M

Ultrasound Image Storage SOP Class (Retired)

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

Secondary Capture Image Storage SOP Class (Retired)

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	3.2.4.8	M
	SC Image	Not Used	M
	Overlay Plane	Not Used	U

Table 3-20: SC Image IOD Modules

IE	Module	Reference	Usage
Image	Modality LUT	Not Used	U
	VOI LUT	3.2.4.13	U
	SOP Common	3.2.4.14	M

Common Composite Image IOD Modules

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

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*	(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*	(0010,0020)	2	From Worklist or manually entered on Patient Setup screen (ID field)
Patient's Birth Date*	(0010,0030)	2	From Worklist or manually entered on Patient Setup screen (Date of birth fields)
Patient's Sex*	(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.
* This attribute cannot be modified by the user when coming from DICOM Worklist.			

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. Otherwise sent as zero length sequence.
>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.

Patient Study Module

Table 3-23 specifies the 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 or manually entered on Patient Setup screen (Indications field).

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 (Sonographer field). The Sonographer'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

Table 3-24: General Series Module Attributes

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

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	"MicroMAXX"
Software Versions	(0018,1020)	3	ARM Firmware Version

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"

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

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.

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).

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 MicroMAXX 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	Automatically generated
>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

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 MicroMAXX 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

Table 3-32: US Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
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
Image Type	(0008,0008)	2	RGB ="ORIGINAL\PRIMARY\\nnnn" YBR_FULL_422 or MONOCHROME2 = "DERIVED\PRIMARY\\nnnn" nnnn=bit map designating the imagemode: 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.
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	

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

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

Store AE Behavior to C Store Status

Table 3-35 describes 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.

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

Association Establishment Practices

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

- The user initiates a manual Update Worklist (Broad Query).
- The user initiates a specific Worklist Query (Patient Based Query).
- 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.

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.

Number of Associations

Number of simultaneous associations for the Modality Worklist AE: 1

Asynchronous Nature

The Modality Worklist AE will not use asynchronous operations.

Implementation Identifying Information

Implementation Class UID: "1.2.840.114340.3"

Implementation Version name: "Tiller_SV400"

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.

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.

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.

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.

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.

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.

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

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.

Verification SOP Class

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

Modality Worklist Attributes

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	Always US
Scheduled Station AE-Title	(0040,0001)	R	Configurable – Sent as either : ▸ MICROMAXX's AE Title ▸ Universal Matching
Scheduled Procedure Step Start Date	(0040,0002)	R	Configurable – Sent as either: ▸ Today's date ▸ Yesterday, Today and Tomorrow date range ▸ Universal Matching

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	Always "US" (Ultrasound)
Scheduled Station AE-Title	(0040,0001)	R	Configurable – Sent as either : ▸ MicroMaxx's AE Title ▸ Universal Matching
Scheduled Procedure Step Start Date	(0040,0002)	R	Configurable – Sent as either: ▸ Today's date ▸ Yesterday, Today and Tomorrow date range ▸ 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.

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

Table 3-40: Return Key Attributes

Attribute Name	Tag	Type	Notes
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	Displayed in UI as Procedure Type[1]
>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.
Requested Procedure Description[4]	(0032,1060)	1C	Displayed on Patient Setup screen as Procedure Type[2]
Requested Procedure Code Sequence	(0032,1064)	1C	
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning[4]	(0008,0104)	3	Displayed on Patient Setup screen as Procedure Type[3]
Referenced Study Sequence	(0008,1110)	2	

Table 3-40: Return Key Attributes

Attribute Name	Tag	Type	Notes
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

[1] If a value exists for Scheduled Procedure Step Description (0040,0007). Otherwise, Procedure Type is set to value of [2] Requested Procedure Description (0032,1060) if it exists. If Requested Procedure Description (0032,1060) is also empty, Procedure Type is set to [3] Requested Procedure Code Sequence (0032,1064) Code Meaning (0008,0104).

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

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.

CHAPTER 4

Communication Profiles

TCP/IP Stack

The TCP/IP protocol is used.

CHAPTER 5

Extensions/Specializations/Privatizations

Standard Extended/Specialized/Private SOPs

None.

Private Transfer Syntaxes

None.

CHAPTER 6

Configuration

AE Title/Presentation Address Mapping

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

Configurable Parameters

MicroMAXX Configurable Parameters per Network Location

The MicroMAXX system can be configured to operate in multiple network locations. The MicroMAXX 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 MicroMAXX 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)
- Alternate 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)

Configurable Parameters per Remote Device Instance

Every archiver, printer, and Modality Worklist device that MicroMAXX 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

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 — Ultrasound only (US) used for Broad & Patient Based Queries
- Scheduled Station AE Title — This MICROMAXX 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)

CHAPTER 7

Support of Extended Character Sets

The MicroMAXX 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 byond 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), and ISO_IR 144 (Cyrillic) are supported by the MicroMAXX 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.

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