SonomedEscalon™

User Guide

DICOM CONFORMANCE STATEMENT

Updated 29 April 2024

Scope

Product Models VuMAX HD, VuPad, and Master-Vu A

Application Software Release versions 4.0.0.0 and later

1 Conformance Statement Overview

The VuMAX HD, VuPad, and Master-Vu A ophthalmic ultrasound systems possess optional DICOM services to retrieve user filtered worklists from a DICOM worklist server, store acquired images and reports to a DICOM server, and/or inform the worklist server of exam status.

Table 1 Networking Services

SOP Classes (UID Name)	UID Value	User of Service (SCU)	Provider of Service (SCP)
Transfer			
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Yes	No
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Yes	No
Encapsulated PDF Storage SOP Class	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Workflow Management			
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

Note: VuMAX HD, VuPad, and Master-Vu A do not support DICOM Media Services; however DICOM files can be exported to the file system for the SOP Transfer Classes listed above.

2 Table of Contents

3 Introduction

3.1 Revision History

Table 2 Revision History

Revision Date	Software Version	Overview of Change
15 August 2022	Release 1.5.0.0 to 3.2.0.0	New document describing DICOM services
2 April 2023	Release 4.0.0.0 and later	Update to reflect expanded DICOM services
29 April 2024	Release 4.0.0.0 and later	Update to provide clarification and improve usability of document

3.2 Audience

This document is written for the people that need to understand how VuMAX HD, VuPad, and Master-Vu A will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. Integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between VuMAX HD, VuPad, and Master-Vu A and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. The user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 Term and Definitions

Informal definitions are provided for the following terms that may be used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.
Application Entity (AE)	An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.
Application Entity Title (AET)	The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.
Application Context	The specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association	A network communication channel set up between Application Entities.
Attribute	A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).
Information Object Definition (IOD)	The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.
Joint Photographic Experts Group (JPEG)	A set of standardized image compression techniques, available for use by DICOM applications.
Media Application Profile	The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)
Module	A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.
Negotiation	First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.
Presentation Context	The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.
Protocol Data Unit (PDU)	A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.
Security Profile	A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data
Service Class Provider (SCP)	Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).
Service Class User (SCU)	Role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)
Service/Object Pair Class (SOP Class)	The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.
Service/Object Pair Instance (SOP Instance)	An information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag	A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private(manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]
Transfer Syntax	The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; anISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.
Value Representation (VR)	The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 Abbreviations

The following abbreviations may be used in this Conformance Statement.

AE	Application Entity
AET	Application Entity Title
CAD	Computer Aided Detection
CDA	Clinical Document Architecture
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
CR	Computed Radiography
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DIT	Directory Information Tree (LDAP)
DN	Distinguished Name (LDAP)
DNS	Domain Name System
DX	Digital X-ray
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System

HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
IO	Intra-oral X-ray
IOL	Intraocular Lens
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
LUT	Look-up Table
MAR	Medication Administration Record
MPEG	Moving Picture Experts Group
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OAM	Ophthalmic Axial Measurement
OP	Ophthalmic Photography
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RDN	Relative Distinguished Name (LDAP)
RF	Radiofluoroscopy
RIS	Radiology Information System.

RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
US	Ultrasound
VL	Visible Light
VR	Value Representation
XA	X-ray Angiography

3.6 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* - which one is the *Service Class User* (SCU - client) and which is the *Service Class Provide*r (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation information*).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a

Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.7 References

VuMAX HD, VuPad, and Master-Vu A User Guides specify how to set the DICOM communication settings. The settings are also listed in 4.4 **Configuration**.

The DICOM standard, NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, is available free at http://medical.nema.org

4 Networking

4.1 Implementation Model

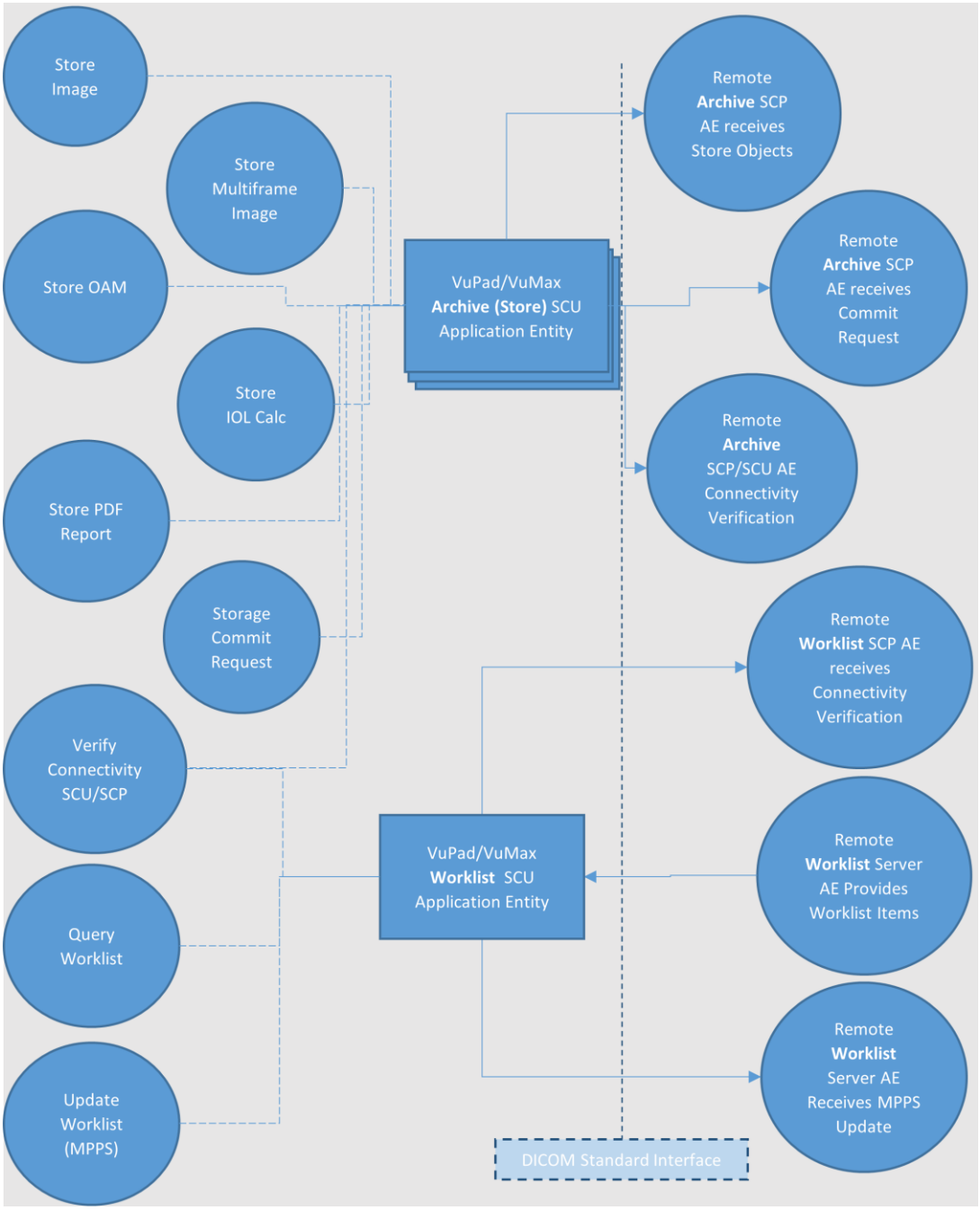
VuPad and VuMAX HD are divided into two Application Entities

1. Archive (aka Store) SCU AE
2. Worklist SCU AE

There can be many Archive AE's configured (but only one is more likely), and one Worklist AE.

4.1.1 Application Data Flow

Figure 1 Application Data Flow



4.1.2 Functional Definition of AE's

4.1.2.1 Functional Definition of Archive (Store) SCU Application Entity

The Archive AE is a user of Store DICOM services to store images, multiframe images, IOL calculations, axial length measurements, and PDF reports on a DICOM store SCP server.

The Archive AE also optionally uses Storage Commitment DICOM services to request the DICOM Store SCP server commit to the storage of the stored item.

The Archive AE also uses Verification DICOM services to determine the conformance and connectivity of a DICOM Store SCP server.

The Archive AE also uses Verification DICOM services as an SCP to determine the conformance and connectivity of a DICOM Store server as an SCU. The Archive AE can be only temporarily enabled as a SCP Verification server while the user is setting/reviewing Archive AE parameters for Storage Commitment.

Multiple Archive AEs can be added to the list of Archives each with their own local and remote AE configuration.

4.1.2.1.1 Archive AE Store Objects SCU

The Archive AE invokes a C-STORE DICOM service with an SOP Instance which meets the requirements of the corresponding IOD. The SCU recognizes the status of the C-STORE service and takes appropriate action upon the success or failure of the service.

4.1.2.1.2 Archive AE Storage Commitment SCU

The Archive AE invokes a N-ACTION DICOM service Storage Commitment Request with a set of SOP Instances to request the SCP the safekeeping of a set of SOP Instances. The SCU recognizes the status of the N-Action service and takes appropriate action upon the success or failure of the service. This confirms only the receipt of the N-ACTION commitment request.

The Archive AE then allows for the receipt of a N-EVENT-REPORT from a new association initiated by the Storage Server SCP, with role negotiation such that the Storage Server SCP is the SCP in the new association. The SCU recognizes the status of the N-EVENT-REPORT and takes appropriate action upon the success or failure of the storage commitment. If the Storage Server SCP status indicates it will not commit to the storage, the Archive AE will not mark the object as archived for that specific Archive AE.

Note that the Storage Server SCP may be set up to be a different AE than the Storage Commitment Server SCP by the user. For each Storage Server SCP setup, the user can enable the option *Use Different Server for Storage Commitment* and then specify the communication parameters for the Storage Commitment Server AE. In that case the N-ACTION is sent to the Storage Commitment Server SCP and not the Storage Server SCP as described above.

4.1.2.1.3 Archive AE Verification SCU

The Archive AE provides standard conformance to the Verification SOP Class as an SCU. If a C-ECHO response was successfully received with a 0000 (Success) status code, the remote AE is considered verified. Otherwise, a C000 (Error – Cannot Understand) status code or incomplete communication will be considered as not verified.

4.1.2.1.4 Archive AE Verification SCP

The Archive AE provides standard conformance to the Verification SOP Class as an SCP. It will return a C-ECHO response of 0000 (Success) status code if the remote AE is considered verified. Otherwise, a C000 (Error – Cannot Understand) status code or incomplete communication will be sent as not verified.

Note that the Archive AE Verification SCP will only be active while the user is in the Archive EA Storage setup screen and the Test Server Association button is highlighted.

4.1.2.2 Functional Definition of Worklist SCU Application Entity

The Worklist AE is user of Worklist Find DICOM service to request a worklist based on user specified filters including start/end date, patient last name, first name, ID, Modality (US, OT, IOL, ALM), Accession Number, and/or Requested Procedure ID.

The Worklist AE is user of Create DICOM services to create an IN PROGRESS MPPS (Modality Performed Procedure Step) that references the Study, of a user selected requested worklist procedure. Once the procedure is complete, the Worklist AE then uses the Set service to update the status of the MPPS to COMPLETED.

The Worklist AE also uses Verification DICOM services to determine the conformance and connectivity of the DICOM Worklist SCP server.

4.1.2.2.1 Worklist AE Modality Worklist SCU

The Worklist AE creates a C-FIND request when initiated by the user to the Worklist SCP AE and presents the results containing the Requested Procedure, Imaging Service Request, Visit and Patient as a Worklist to the user for selection of a worklist item to fulfill.

4.1.2.2.2 Worklist AE Performed Procedure Step SCU

The N-Create operation is used to create an IN PROGRESS MPPS on the worklist server for a selected worklist item to fulfill.

The N-SET operation is used by the Worklist SCU AE to request that the SCP update selected Attribute values for a specific Modality Performed Procedure Step SOP Instance. This operation shall be invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance created from the worklist.

4.2 AE Specifications

4.2.1 Archive (Store) SCU Application Entity

The Archive (Store) Application Entity has the option to perform the Storage Commitment Push Model SOP. When the Storage Commitment option is enabled, the Archive AE allows for the specification of a Storage Commitment server that is different from the Storage Server specified to store SOP instances from the Archive AE.

If the Storage Commitment option is enabled, this AE can also temporarily during setup act as a SCP for the Verification SOP to confirm communication receipt from the specified Storage Commitment Server.

4.2.1.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes:

Table 3 SOP Classes for Archive (Store) Application Entity

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes*
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Multi-Frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Yes	No
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Yes	No
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

*SCP Verification can only be enabled temporality while on the Archive AE setup screen for Storage Commitment setup testing.

4.2.1.2 Association Policies

4.2.1.2.1 General

The Application Context Name for DICOM 3.0 is the only Application Context proposed.

Table 4 DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The number of simultaneous associations results in two since the AE “Worklist” and “Archive (Store)” can run in parallel and utilize the same remote AE.

Table 5 Number of Associations as an Association Initiator for Archive AE

Maximum Number of Simultaneous Associations	2

Table 6 Number of Associations as an Association Acceptor for Archive AE

Maximum Number of Simultaneous Associations	0

4.2.1.2.3 Asynchronous Nature

VuMAX HD, VuPad, and Master-Vu A do not support negotiation of multiple outstanding transactions.

4.2.1.2.4 Implementation Identifying Information

Table 7 DICOM Implementation Class and Version for Archive AE

Implementation Class UID	2.16.840.1.114338.2
Implementation Version Name	1.0

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Verification (SCU)

4.2.1.3.1.1 Description and Sequencing of Activities

The Archive AE provides standard conformance to the Verification SOP Class as an SCU. Upon user request to verify connectivity, the C-ECHO request is sent, the results of which are presented to the user.

4.2.1.3.1.2 Proposed Presentation Contexts

Table 8 Proposed Presentation Contexts for Archive AE Verification (SCU)

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	Default (SCU)	No
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
All SOPs used by the application. The results of the presentation context acceptance are used to inform/warn the user of the supported SOPs of the remote AE. See Table 1 Networking Services for the complete list		Proposed Presentation Contexts as listed in each activity's Proposed Presentation Context tables for the Storage AE and Worklist AE activities.		Default (SCU)	No

4.2.1.3.1.3 SOP Specific Conformance for Verification

Archive AE Verification (SCU) provides standard conformance to the Verification Service Class.

The C-ECHO DIMSE-C service is the mechanism used to verify communications between remote DICOM AEs.

Table 9 DICOM Command Response Status Handling Behavior - Verification

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The success is reported to the user
*	*	other code	The failure is reported to the user

Table 10 DICOM Command Communication Failure Behavior

Exception	Behavior
Timeout	The timeout is reported to the user.

4.2.1.3.2 Activity – Storage (SCU)

4.2.1.3.2.1 Description and sequencing of Activities

The Archive AE provides standard conformance to the Storage SOP Classes as an SCU. Upon user request (directly or indirectly as a background service) to store one or more SOP instances, it will initiate a new association for each instance it attempts to transfer to the remote AE.

The results of the storage of the SOP instance will be presented to the user (directly, or indirectly as a log).

4.2.1.3.2.2 Proposed Presentation Contexts

For Storage SCU the transfer syntax proposed to the server is as listed below.

For image export to file, the transfer syntax (compression) is determined by the Archive AE Image Setting for each Archive AE in the Archive list on the Configure screen Archive/DICOM tab.

Table 11 Proposed Presentation Contexts for Archive AE Store (SCU)

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Used for export to file for Setting: **None**	1.2.840.10008.1.2.1	SCU	No
		Explicit JPEG baseline lossy compression Used for export to file for Setting: **Jpeg**	1.2.840.10008.1.2.4.50		
		JPEG 2000 Image Compression Used for export to file for Setting: **Jpeg 2000**	1.2.840.10008.1.2.4.91		
		Jpeg Lossless Non Hierarchical First Order Prediction Process 14 Selection Value 1 Used for export to file for Setting: **Jpeg Lossless**	1.2.840.10008.1.2.4.70		
		Jpeg 2000 Image Compression Lossless Only Used for export to file for Setting: **Jpeg 2000 Lossless**	1.2.840.10008.1.2.4.90		
		RLE Lossless Image Compression Used for export to file for Setting: **Rle**	1.2.840.10008.1.2.5		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Same as Ultrasound Multi-Frame Image Storage		SCU	No
Multi-Frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Same as Ultrasound Multi-Frame Image Storage		SCU	No

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Ophthalmic Axial Measurements Storage	1.2.840.10008.5.1.4.1.1.78.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	No
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian*	1.2.840.10008.1.2.1		
Intraocular Lens Calculations Storage	1.2.840.10008.5.1.4.1.1.78.8	Same as Ophthalmic Axial Measurements Storage		SCU	No
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1			SCU	No
Storage Commitment Push Model	1.2.840.10008.1.20.1			SCU	No

*For SOPs that are not images, export to file uses Explicit VR Little Endian. For image file export the Image Compression setting is used.

4.2.1.3.2.3 SOP Specific Conformance for Storage

Archive AE Storage SCU provides standard conformance for the SOP Storage Service classes listed above.

Table 12 DICOM Command Response Status Handling Behavior - Storage

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Only errors are reported to the user. Success is implied.
Error	Error: Cannot Understand	C000	Reported to user
Class Not Supported	Operation / Activity is Not Supported	0122	Reported to user

Table 13 DICOM Command Communication Failure Behavior

Exception	Behavior
Timeout	The timeout is reported to the user.

4.2.1.4 Association Acceptance Policy

Archive (Store) AE only temporarily accepts associations while the user is on the Archive AE settings screen with Test Server Association button enabled. This is to help verify the communication for the Storage Commitment service when the Storage Server SCP AE (the remote AE) creates an association to send the N-EVENT-REPORT to the Storage SCU AE (this AE). It will accept all transfer syntaxes listed in this document.

4.2.2 Worklist SCU Application Entity

4.2.2.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes:

Table 14 SOP Classes for Worklist Application Entity

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	No
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes	No

4.2.2.2 Association Policies

The Worklist AE association polices are the same as the Archive Association Polices. *See 4.2.1.2 Association Policies*

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity – Verification (SCU)

The Worklist AE association initiation policy for Verification is the same as the Archive AE Verification Policies. *See 4.2.1.3.1 Activity – Verification (SCU)*

4.2.2.3.2 Activity – Query Modality Worklist (SCU)

4.2.2.3.2.1 Description and sequencing of Activities

The Worklist AE provides standard conformance to the Worklist Find SOP Class as an SCU. Upon user request to search the remote Worklist AE, it will initiate a new association, providing filter data supplied by the user, to receive a worklist from the remote worklist AE.

The worklist result is shown to the user, or an error message.

4.2.2.3.2.2 Proposed Presentation Contexts

Table 15 Proposed Presentation Contexts for Worklist AE Worklist FIND (SCU)

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	No
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.2.3.2.3 SOP Specific Conformance for Modality Worklist

Worklist AE Find SCU provides standard conformance for Modality Worklist Information Model – FIND SOP.

Table 16 DICOM Command Response Status Handling Behavior – Worklist AE Find

Service Status	Further Meaning	Error Code	Behavior
Success	Matches are complete	0000	Results shown to user
Pending	Matches are in progress	FF00, FF01	Results collected, not shown to user until complete
*	*	(other)	Reported to user as error

Table 17 DICOM Command Communication Failure Behavior – Worklist AE Find

Exception	Behavior
Timeout	The timeout is reported to the user

Matching Types:

- U Universal Matching
- S Single Value Matching
- * Wildcard Matching
- CDT Combined Date Time Matching

Table 18 Supported Search or Matching Tags

Description	Tag	Matching Type
Patient's Name	(0010,0010)	U*
Patient ID	(0010,0020)	U*
Requested Procedure ID	(0040,1001)	U*
Scheduled Procedure Step Sequence	(0040,0100)	
>Scheduled Procedure Step Start Date	(0040,0002)	U CDT
>Scheduled Procedure Step Start Time	(0040,0003)	U CDT
>Modality	(0008,0060)	U*
>Scheduled Procedure Step ID	(0040,0009)	U*
Accession Number	(0008,0050)	U*

Table 19 Supported Return Values

Description	Tag
Accession Number	(0008,0050)
Referring Physician's Name	(0008,0090)
Patient's Name	(0010,0010)
Patient ID	(0010,0020)
Issuer of Patient ID	(0010,0021)
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Patient's Weight	(0010,1030)
Study Instance UID	(0020,000D)
Requesting Physician	(0032,1032)
Requested Procedure Description	(0032,1060)
Requested Procedure Code Sequence (=Scheduled Protocol Code Sequence)	(0032,1064)
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
>Code Meaning	(0008,0104)
Scheduled Procedure Step Sequence	(0040,0100)
> Modality	(0008,0060)
>Scheduled Station AE Title	(0040,0001)
>Scheduled Procedure Step Start Date	(0040,0002)
>Scheduled Procedure Step Start Time	(0040,0003)
>Scheduled Performing Physician's Name	(0040,0006)
>Scheduled Procedure Step Description	(0040,0007)
>Scheduled Protocol Code Sequence	(0040,0008)
>>Code Value	(0008,0100)
>>Coding Scheme Designator	(0008,0102)
>>Code Meaning	(0008,0104)
>Scheduled Procedure Step ID	(0040,0009)
>Scheduled Procedure Step Location	(0040,0011)
Requested Procedure Priority	(0040,1003)
Requested Procedure ID	(0040,1001)

4.2.2.3.3 Activity – Modality Performed Procedure Step (SCU)

4.2.2.3.3.1 Description and Sequencing of Activities

For Modality Performed Procedure Step activities, the Worklist AE can communicate with the Worklist SCP, or with an MPPS SCP, as determined by the *Use Separate Server for MPPS* setting of the Worklist AE.

The Worklist AE uses the N-CREATE SCU operation to create an IN PROGRESS MPPS from a user selected work item in the worklist. This operation is invoked through the use of the DIMSE N-CREATE Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance.

The Worklist AE uses the N-SET SCU operation to update the status (from IN PROGRESS to DISCONTINUED or COMPLETED) for a specific Modality Performed Procedure Step SOP Instance based on the status of the requested procedure. This operation is invoked through the use of the DIMSE N-SET Service used in conjunction with the appropriate Modality Performed Procedure Step SOP Instance.

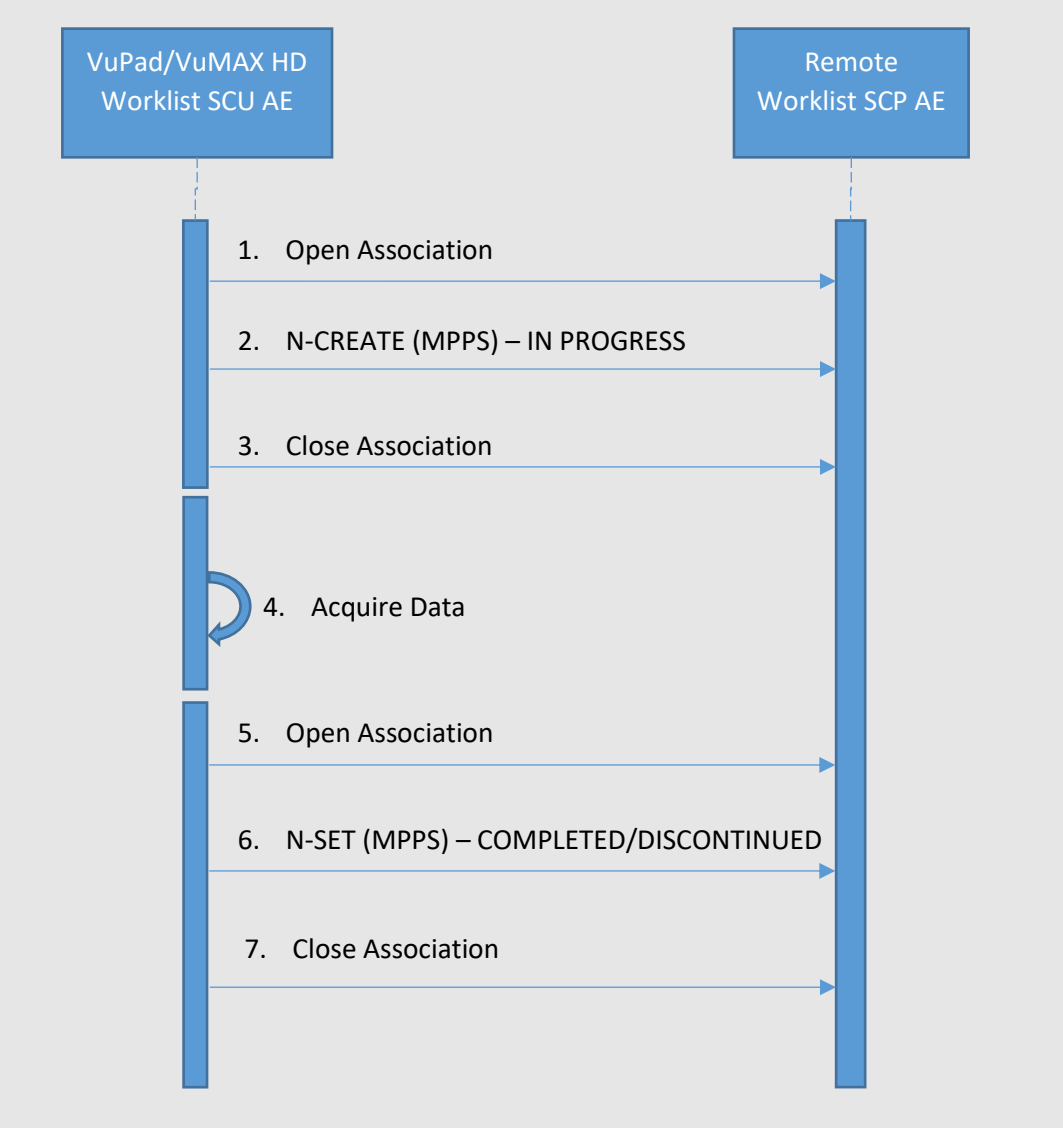


Figure 2 Sequencing of Activity - Worklist AE SCU MPPS

4.2.2.3.3.2 Proposed Presentation Contexts

Table 20 Proposed Presentation Contexts for Worklist AE MPPS (SCU)

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	No
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.2.3.3.3 SOP Specific Conformance for Modality Performed Procedure Step

Worklist AE Find SCU provides standard conformance for Modality Worklist Information Model – FIND SOP.

Table 21 DICOM Command Response Status Handling Behavior – Worklist AE MPPS

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Only errors are reported to the user. Success is implied by display of search results
Other	Status other than success	Not 0000	Reported to user

Table 22 DICOM Command Communication Failure Behavior – Worklist AE MPPS

Exception	Behavior
Timeout	The timeout is reported to the user

4.2.2.4 Association Acceptance Policy

Worklist AE does not accept associations.

4.3 Network Interfaces

4.3.1 Physical Network Interface

VuPad and VuMAX HD support Ethernet and Wi-Fi networking.

4.3.2 Additional Protocols

VuMAX HD, VuPad, and Master-Vu A do not support additional protocols.

4.3.3 IPv4 and IPv6 Support

VuPad and VuMAX HD support IPv4 only.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

VuPad and VuMAX HD store all configuration mapping in the local database.

4.4.1.1 Local AE Titles

The mapping of local AE Titles to ports and TCP/IP addresses is configurable.

The Archive AE configuration is in the Archive/DICOM tab of the Configure screen, Archives list.

Multiple Archive AEs can be added to the Archive list, each with their own configuration. Each Archive AE can have their own selection of the types of SOP instances to receive, or use the common settings.

The Worklist AE configuration is in the Archive/DICOM tab of the Configure screen, Configure Worklist pop up.

Table 23 Local AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
Archive (Store) AE	VUMAX	104
Worklist AE	VUMAX	104

4.4.1.2 Remote AE Titles/Presentation Address Mapping

The mapping of remote AE Titles to ports and TCP/IP addresses is configurable.

The Remote Archive AE configuration is in the Archive/DICOM tab of the Configure screen, Archives list.

Multiple Remote Archive AEs can be added to the Archive list, each with their own AE names, and addresses and along with the local Archive AE configuration.

The Remote Worklist AE configuration is in the Archive/DICOM tab of the Configure screen, Configure Worklist pop up.

Table 24 Remote AE Title Configuration Table

Remote Application Entity	Hostname	Default AE Title	Default TCP/IP Port
Remote Archive (Store) AE	axispacs	AXIS	104
Remote Worklist AE	axispacs	AXIS	104

4.4.2 Parameters

VuPad and VuMAX HD store all configuration mapping in the local database.

Table 25 Archive and Worklist AE Parameters

Parameter	Location	Name	Configurable (Yes/No)	Range	Default Value
For each remote Archive AE					
Archive Type	Configure > Archive/DICOM Tab > Add/Edit Archive	DICOM	No		DICOM
Name Archive name as shown to user		Name	Yes		DICOM 1
Remote Hostname IP address or network name of remote AE		Hostname	Yes		axispacs
Remote TCP Port TCP Port for remote AE		TCP Port	Yes		104
Remote AE Title		AE Title	Yes		AXIS
Local TCP Port TCP Port for local AE		Local TCP Port	Yes		104
Local AE Title		Local AE Title	Yes		VUMAX
Connect Timeout Time-out waiting for acceptance or rejection Response to an Association Open Request (Application Level timeout)		Connect Timeout (ms)	Yes		10000 msec
Send Timeout Time-out for send completion (Application Level timeout)		Send Timeout (ms)	Yes		60000 msec
Custom DICOM Export Settings		Use Custom DICOM Export Settings	Yes	True/False	False
DICOM Storage Commitment		Use DICOM Storage Commitment	Yes	True/False	False
Storage Commitment Retry		Storage Commitment Retry	Yes	True/False	False
Storage Commitment Retry Count		Retry Count	Yes		1
Storage Commitment Retry Interval		Retry Interval (sec)	Yes		10 sec

Parameter	Location	Name	Configurable (Yes/No)	Range	Default Value
Batch Storage Commitment		Batch Storage Commitment	Yes	True/False	False
Different Server for Storage Commitment		Use Different Server for Storage Commitment	Yes	True/False	False
Image Settings for all Image SOPs	Configure > Export Tab > File Formats Tab > Move Size and Frame Size	Movie Size	Yes	Small {1024x768} Medium {1152x720} Large {1728x1080}	Large
		Image Size	Yes		Large
		Frame Quality	Yes* *if type is not None	0.00 to 1.00	0.85
	Configure > Export Tab > DICOM Tab > Image Compression	Compression Type	Yes	None Rle Jpeg Jpeg2000 JpegLossless Jpeg2000Lossless	Jpeg
Worklist AE					
Remote Hostname IP address or network name of remote AE	Configure > Archive/DICOM Tab > Configure Worklist	Hostname	Yes		axispacs
Remote TCP Port TCP Port for remote AE		TCP Port	Yes		104
Remote AE Title		AE Title	Yes		AXIS
Local TCP Port TCP Port for local AE		Local TCP Port	Yes		104
Local AE Title		Local AE Title	Yes		VUMAX
Connect Timeout Time-out waiting for acceptance or rejection Response to an Association Open Request (Application Level timeout)		Connect Timeout (ms)	Yes		10000 msec
Send Timeout Time-out for send completion (Application Level timeout)		Send Timeout (ms)	Yes		60000 msec

5 Media Interchange

VuMAX HD, VuPad, and Master-Vu A do not support Media Interchange.

6 Support of Characters Sets

VuMAX HD, VuPad, and Master-Vu A supports the following character sets in addition to the DICOM defaults:

Table 26 Supported Specific Character Set

Character Set Description	Defined Term
UTF-8	ISO_IR 192

7 Security

Sonomed Escalon assumes that VuMAX HD, VuPad, and Master-Vu A are being utilized in a secured environment managed by a third party.

8 Annexes

8.1 IOD Contents

8.1.1 Coerced/Modified Fields

VuMAX HD, VuPad, and Master-Vu A does not modify or coerce DICOM fields received.

8.2 Private Transfer Syntaxes

VuMAX HD, VuPad, and Master-Vu A does not support Private Transfer Syntaxes