	s5	Control #
	DICOM Conformance Statement	804209-003/003

**DICOM Conformance Statement
s5 Intravascular Ultrasound System**



	s5	Control # 804209-003/003
	DICOM Conformance Statement	

TABLE OF CONTENTS

DICOM CONFORMANCE STATEMENT	1
S5 INTRAVASCULAR ULTRASOUND SYSTEM	1
1 CONFORMANCE STATEMENT OVERVIEW	4
2 INTRODUCTION	5
2.1 DEFINITIONS	5
2.2 REFERENCE DOCUMENTS	6
3 NETWORKING	7
3.1 IMPLEMENTATION MODEL	7
3.1.1 Application Data Flow Diagram	7
3.1.1.1 Archive to Network Real-World Activity	8
3.1.1.2 Query Worklist Real-World Activity	8
3.1.1.3 Check Server Real-World Activity	9
3.1.2 Functional Definitions of AE's	9
3.1.2.1 Storage SCU AE	9
3.1.2.2 Worklist SCU AE	9
3.1.3 Sequencing of Real-World Activities	9
3.2 AE SPECIFICATIONS	10
3.2.1 Storage AE Specification	10
3.2.1.1 Association Establishment Policies	10
3.2.1.2 Association Initiation by Real-World Activity	11
3.2.1.3 Proposed Presentation Contexts to an Storage Server	13
3.2.1.4 Storage AE Behavior to C-Store Status	16
3.2.2 Worklist AE Specification	17
3.2.2.1 Association Establishment Policies	17
3.2.2.2 Association Initiation by Real-World Activity	17
3.2.2.3 Proposed Presentation Contexts to an Worklist Server	19
3.2.2.4 Worklist AE Behavior to C-FIND Status	19
3.2.2.5 Worklist Request Attributes	20
3.3 COMMUNICATION PROFILES	23
3.3.1 TCP/IP Stack Supported	23
3.3.2 Physical Network Interface	23
3.4 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS	23
3.4.1 Standard Extended/Specialized/Private SOPs	23
3.4.2 Private Transfer Syntaxes	24
3.5 CONFIGURATION	24
3.5.1 AE Title/Presentation Address Mapping	24
3.5.2 Configurable Parameters for DICOM Networking	24
3.5.2.1 Configurable Parameters for the Network Location	24
3.5.2.2 Configurable Parameters per Defined Remote Storage Server	24
3.5.2.3 Configurable Parameters per Defined Remote Worklist Server	25
4 MEDIA INTERCHANGE	26
4.1 IMPLEMENTATION MODEL	26
4.1.1 Application Data Flow Diagram	26
4.1.2 Functional definitions of AE's	26
4.1.3 Sequencing of Real World Activities	26
4.1.4 Implementation Class and Version	26
4.2 AE SPECIFICATION	27
4.2.1 Media AE Specification	27
4.2.1.1 Application Entity Title	27
4.2.1.2 DICOM File Meta Information	27
4.2.1.3 DICOMDIR Information	28
4.2.1.4 Real World Activities	29
4.3 AUGMENTED AND PRIVATE APPLICATION PROFILES	29

	s5	Control # 804209-003/003
	DICOM Conformance Statement	


4.3.1	Augmented Application Profiles	29
4.3.2	Private Application Profiles.....	29
4.4	MEDIA CONFIGURATION	29
5	SUPPORT OF EXTENDED CHARACTER SETS	30

LIST OF TABLES

Table 2.1-1	Networking Services	4
Table 2.1-2	UID Values.....	4
Table 2.1-3	Media Services	4
Table 3.2-1	Storage AE SOP Class Support	10
Table 3.2-2	Storage AE Proposed Presentation Contexts to an Storage Server	13
Table 3.2-3	Ultrasound Multi-frame Image SOP Class	13
Table 3.2-4	Storage AE Behavior to C-Store Status	16
Table 3.2-5	Worklist AE SOP Class Support.....	17
Table 3.2-6	Worklist AE Proposed Presentation Contexts to a Worklist Server	19
Table 3.2-7	Worklist AE Behavior to C-FIND Status	19
Table 3.2-8	Modality Worklist Communication Failure Behavior	20
Table 3.2-9	Worklist Request Identifier.....	21
Table 3.2-10	Patient Based Query Attributes	22
Table 3.2-11	Broad Query Attributes	22
Table 3.4-1	Volcano Extended and Private Elements	23
Table 3.5-1	Compression Settings.....	24
Table 4.2-1	Application Profiles, Activities, and Roles.....	27
Table 4.2-2	Supported IODS, SOP Classes and Transfer Syntaxes	27
Table 4.2-3	DICOM Part 10 File Meta Information	27
Table 4.2-4	DICOMDIR Attributes	28

LIST OF FIGURES

Figure 3-1	Networking Implementation Model.....	8
Figure 3-2	Sequencing Constraints	9
Figure 3-3	Sequencing of Activity - Archive to Network	11
Figure 3-4	Sequencing of Activity - Check Server	12
Figure 3-5	Sequencing of Activity - Worklist Search.....	18
Figure 3-6	Sequence of Activity - Check Worklist Server	19
Figure 4-1	Media Storage Implementation Model.....	26

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

1 CONFORMANCE STATEMENT OVERVIEW

The s5 System implements the necessary DICOM services to query a Worklist from an information system and transfer acquired images to a Network storage server device.

Table 2.1-1 provides an overview of the network services supported by the Volcano s5 System.

Table 2.1-1 Networking Services

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Multi-frame Image Storage	Yes	No
Workflow Management		
Modality Worklist	Yes	No
General		
Verification	Yes	No

The SOP Classes supported by the Volcano s5 system are categorized in Table 2.1-2

Table 2.1-2 UID Values


UID Value	UID Name	Category
1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image Storage	Transfer
1.2.840.10008.5.1.4.31	Modality Worklist Information Model – FIND	Workflow Management
1.2.840.10008.1.1	Verification	General

The s5 System implements the necessary DICOM services to write acquired images to a DVD Exchange Media. Table 2.1-3 provides an overview of the Media Storage Application Profiles and roles supported by the Volcano s5 System.

Table 2.1-3 Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
DVD		
Ultrasound (STD-US-SC-MF-DVD)	FSC	No ¹

Note 1: The s5 system will only read DVD media that was created by a Volcano s5 system.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

2 INTRODUCTION

This document describes the Volcano s5 Intravascular 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 s5 system is an Intravascular Ultrasound (IVUS) imaging device. The DICOM feature of the s5 system provides a means to send images to DICOM storage servers and DVD Exchange Media

This document is written with respect to ACR-NEMA DICOM standard, version 3.0 - 2004.


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 Volcano s5 via its DICOM feature.

2.1 DEFINITIONS


AE	Application Entity
ANSI	American National Standards Institute
CIS	Cardiology Information System
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DISTA	DICOM Study Transfer Agent
DVD	Digital Versatile Disc
FSC	File Set Creator
FSU	File Set Updater
FSR	File Set Reader
HIS	Hospital Information System
IE	Information Entity
IOD	Information Object Definition
IVUS	Intravascular Ultrasound
KHz	Kilohertz
LUT	Look Up Table
PACS	Picture Archive and Communication System
PDU	Protocol Data Unit
SCU	Service Class User (Client)
SCP	Service Class Provider (Server)

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

SOP	Service – Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
IVUS	Intravascular Ultrasound
VOI	Value Of Interest
VH	Virtual Histology
VR	Value Representation

2.2 REFERENCE DOCUMENTS

ACR-NEMA DICOM Standard Version 3.0 – 2004

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

3 NETWORKING

3.1 IMPLEMENTATION MODEL

The s5 DICOM feature incorporates the DICOM 3.0 standard for networked image store functions. Images are transferred from the s5 IVUS system using standard network connections to be processed on a DICOM compatible storage device.

The s5 allows multiple remote Worklist and Storage devices to be configured. Worklist is queried from the default Worklist server, selected in the DICOM/Network Worklist Server Configuration menu. Images are transferred to the default remote DICOM storage server, selected in the DICOM/Network Storage Server Configuration menu.

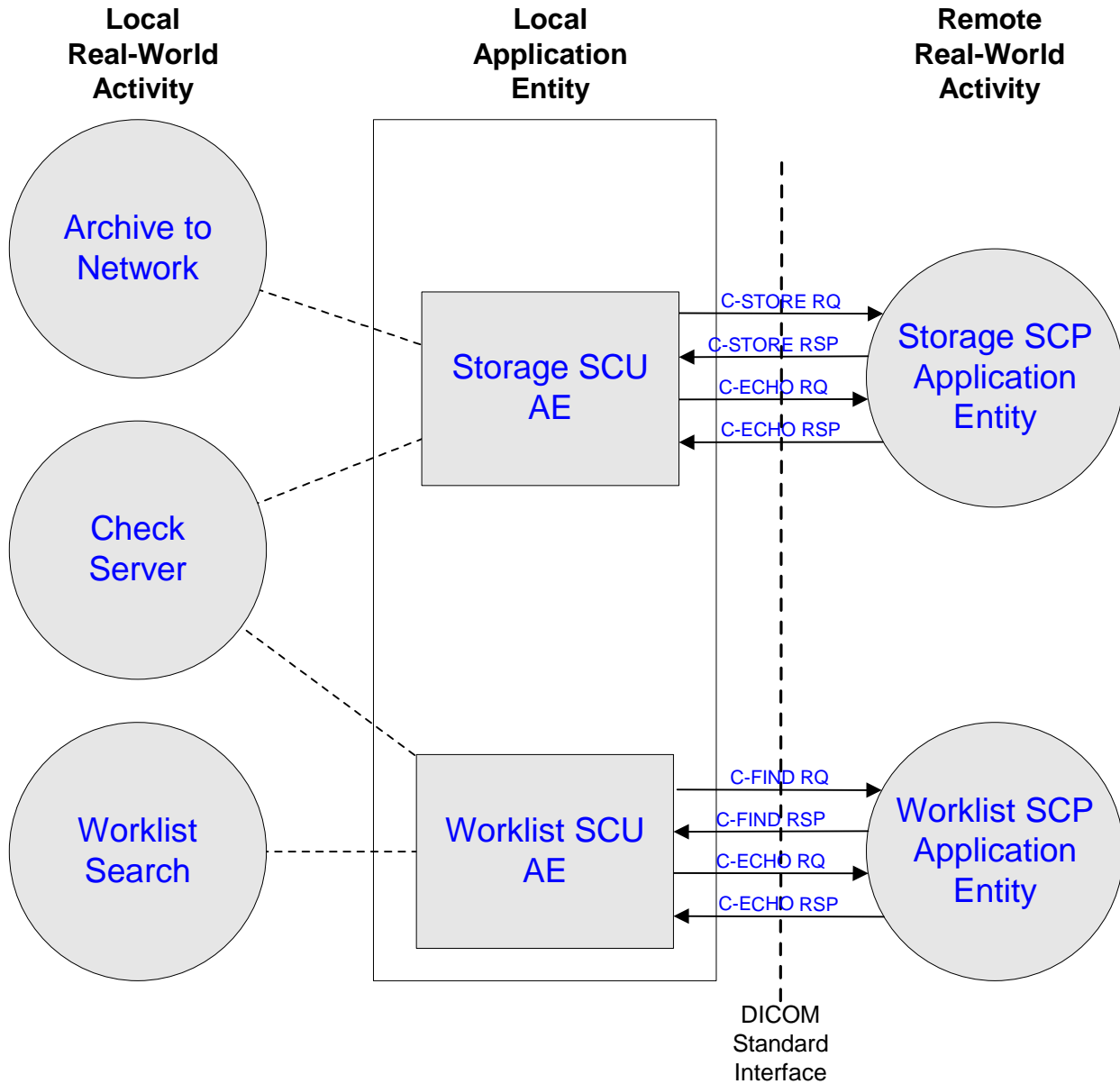
After a successful Archive to Network operation, the transferred cases are marked as Archived and are subject to automatic deletion.

Verification status is obtained from storage servers using DICOM Verify (C-Echo).

3.1.1 APPLICATION DATA FLOW DIAGRAM

The diagram in Figure 3-1 represents the relationship between the IVUS system's real-world activities (circles on the left), the local AE's built into the s5 (boxes in the center), and the remote AE's built into the devices that the s5 communicates with using DICOM (boxes on the right).

Figure 3-1 Networking Implementation Model



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

3.1.1.1 ARCHIVE TO NETWORK REAL-WORLD ACTIVITY

Archive to Network real-world activity occurs when the user selects one or more cases in the s5 Archive dialog and then initiates the Archive to Network function. Each case is transferred to the remote storage server in a separate DICOM Association. Cases are transferred to the default remote storage server, which is selected through the "Select Server" drop down box located in the DICOM/Network configuration menu.

3.1.1.2 QUERY WORKLIST REAL-WORLD ACTIVITY

Query Worklist real-world activity occurs when the user selects the Search button located in the Worklist dialog. A list of matching Worklist items are returned from the current selected Worklist server.

3.1.1.3 CHECK SERVER REAL-WORLD ACTIVITY

The Check Server real-world activity occurs when the user selects the Check button in the DICOM / Network - Worklist Server configuration menu. A C-ECHO operation is performed on the currently selected remote DICOM Storage Server in the "Select Server" drop down box.

3.1.2 FUNCTIONAL DEFINITIONS OF AE'S

3.1.2.1 STORAGE SCU AE

This s5 Storage SCU Application Entity handles getting status from (Check Server) and sending IVUS images to a remote storage server (Archive to Network) using the DICOM C-STORE SCU services. An association request is sent to the remote storage AE and upon successful negotiation of a Presentation Context the image transfer is started. If the association cannot be opened, an error is reported to the user and the transfer fails. The Storage AE will not try to initiate another association for this transfer automatically.

3.1.2.2 WORKLIST SCU AE

This s5 Worklist SCU Application Entity handles getting status from (Check Server) and querying a remote Modality Worklist server using the DICOM Worklist SCU services. Worklist Search attempts to download a list of Scheduled Procedure Steps from a remote Worklist AE. If the Worklist AE establishes an Association to a remote AE, it will transfer all Worklist items via the open Association. During receiving the Worklist response items are counted and the query processing is canceled if the configurable maximum limit of items is exceeded. The results will be displayed in a list, which will be cleared with the next Worklist Search operation. An automatic Worklist query is initiated when the system is first powered on. All subsequent queries must be initiated manually by the user. The current Worklist is persisted between system power cycles to allow Worklist access in the event that a network connection is not available.

3.1.3 SEQUENCING OF REAL-WORLD ACTIVITIES

All real world activities that initiate communication to remote AE's operate synchronously with respect to each other and other s5 system operations.

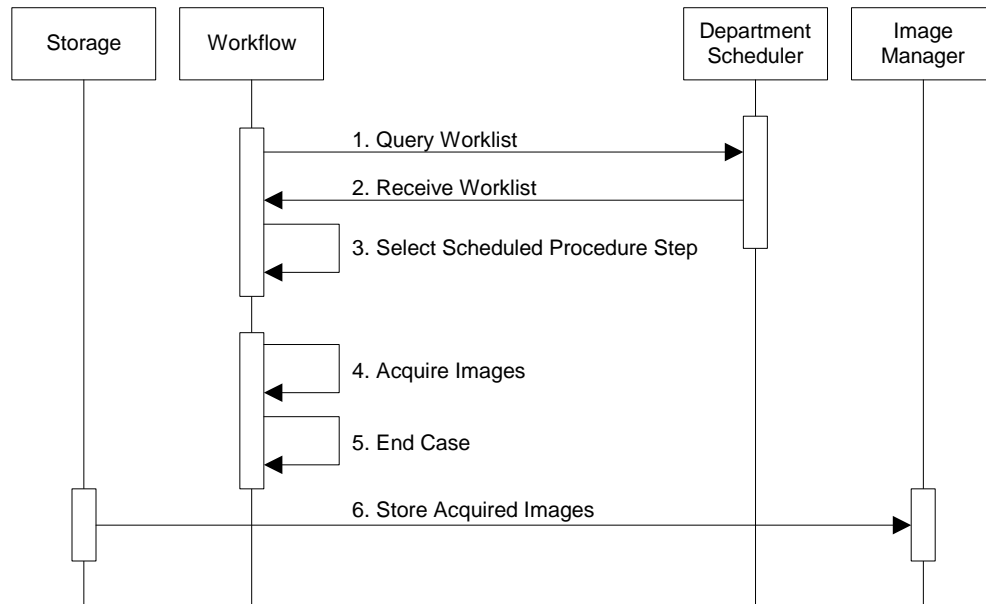



Figure 3-2 Sequencing Constraints

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

Under normal scheduled workflow conditions the sequencing constraints illustrated in Figure 3-2 Sequencing Constraints apply:

1. Query Worklist
2. Receive Worklist of Modality Scheduled Procedure Steps (SPS)
3. Select Work item (SPS) from Worklist
4. Acquire Images
5. Complete acquisition (End Case)
6. Store acquired images instances

If the Image Manager is configured as an archive device the Storage AE will request Storage Other workflow situations (e.g. unscheduled procedure steps) will have other sequencing constraints.

3.2 AE SPECIFICATIONS

3.2.1 STORAGE AE SPECIFICATION

The s5 Storage AE provides conformance to the DICOM V3.0 SOP Classes listed in Table 3.2-1 as an SCU.

Table 3.2-1 Storage AE SOP Class Support

SOP Class Name	SOP CLASS UID	CONFORMANCE LEVEL
Verification	1.2.840.10008.1.1	Standard
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Standard

3.2.1.1 ASSOCIATION ESTABLISHMENT POLICIES

The Storage AE will initiate an association to a device in response to the following real-world activities; Archive to Network.

3.2.1.1.1 GENERAL

The Volcano s5 system uses TCP/IP. The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU offered for an association initiated by the Volcano s5 system is:

Maximum PDU size offered to SCP	65536 bytes
---------------------------------	-------------

The following DICOM Application Context Name UID is proposed and recognized:

DICOM Application context name:	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

3.2.1.1.2 NUMBER OF ASSOCIATIONS


Number of simultaneous associations:	1
--------------------------------------	---

3.2.1.1.3 ASYNCHRONOUS NATURE

The Storage AE will not use asynchronous operations.

3.2.1.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID:	2.16.840.1.113977.2
Implementation Version name:	VOL_DISTA_2.0

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

Note: “113977” is registered by Volcano (previously registered by EndoSonics) with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.2.1.2 ASSOCIATION INITIATION BY REAL-WORLD ACTIVITY

The Storage AE will open an association to the currently selected remote storage server device in response to the following real-world activities; Archive To Network, and Check Status.

3.2.1.2.1 ASSOCIATION INITIATION BY: ARCHIVE TO NETWORK

The Archive to Network real-world activity will cause the Storage AE to open an association with the current selected remote storage server. The current storage server is selected in the “Select Server” list located in the DICOM/Network Configuration menu. In the s5 Archive dialog, the user can select one or more cases (Studies) for transfer to a single DICOM Storage destination. A separate association is opened for each Study/Series transferred. If the Study/Series contains multiple images then multiple C-STORE requests will be issued over the same Association.

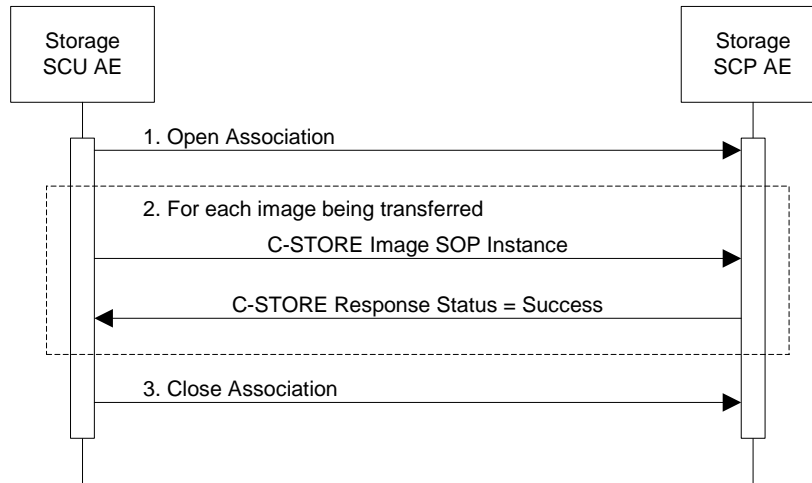


Figure 3-3 Sequencing of Activity - Archive to Network

A possible sequence of interactions between the s5 Storage AE and a remote Storage AE (e.g. Image Manager) is illustrated in Figure 3-1:

1. The Storage AE opens an association with the Image Manager
2. Acquired images are transferred, one at a time, to the Image Manager using C-STORE requests. The Image Manager replies with a C-STORE response (Status Success) for each successful image transfer.
3. The Storage AE closes the association with the Image Manager.

3.2.1.2.2 ASSOCIATION INITIATION BY: CHECK STATUS

The Check Status real-world activity will cause the Storage AE to open an association with the current selected remote storage server, in the “Select Server” list located in the DICOM/Network Configuration menu.

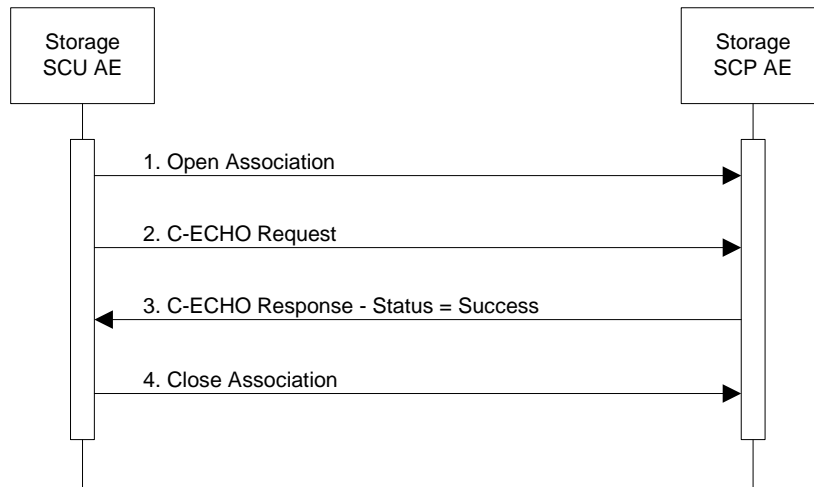



Figure 3-4 Sequencing of Activity - Check Server

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

3.2.1.3 PROPOSED PRESENTATION CONTEXTS TO AN STORAGE SERVER

Each time an association is initiated, the Association Initiator proposes a number of Presentation Contexts to be used on that association. Table 3.2-2 shows the Presentation Contexts proposed by the s5 Storage AE during an Archive to Network operation.

Table 3.2-2 Storage AE Proposed Presentation Contexts to an Storage Server

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

3.2.1.3.1 VERIFICATION SOP CLASS

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

3.2.1.3.2 ULTRASOUND MULTI-FRAME IMAGE STORAGE SOP CLASS

The Ultrasound Image Storage SOP Class uses the Common Composite Image IOD Modules as shown in Table 3.2-3.

Table 3.2-3 Ultrasound Multi-frame Image SOP Class

Module:	Attribute name:	Tag:	Type:	Notes:
Patient	Patient's Name	(0010,0010)	2	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
	Patient ID	(0010,0020)	2	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
	Patient's Birth Date	(0010,0030)	2	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
	Patient's Sex	(0010,0040)	2	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
General Study	Study Instance UID	(0020,000D)	1	Copied from Worklist. Internally generated if procedure was unscheduled.
	Study Date	(0008,0020)	2	Date the IVUS procedure began.
	Study Time	(0008,0030)	2	Time the IVUS procedure began.
	Referring Physician's Name	(0008,0090)	2	Copied from Worklist. Sent as zero length if procedure was unscheduled.
	Study ID	(0020,0010)	2	Copied from Worklist "Requested Procedure ID" or entered in Patient dialog.
	Accession Number	(0008,0050)	2	Copied from Worklist or entered in Patient dialog.
	Study Description	(0008,1030)	3	Copied from Worklist "Scheduled Procedure Step Description" or set to "IVUS Procedure" if procedure was unscheduled.
	Referenced Study Sequence	(0008,1110)	3	Copied 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	Copied from Worklist "Requested Procedure Code Sequence". Not sent if procedure was unscheduled.
	>Code Value	(0008,0100)	1C	
	>Coding Scheme Designator	(0008,0102)	1C	



s5

DICOM Conformance Statement

Control # 804209-003/003

	>Code Meaning	(0008,0104)	1C	
Patient Study	Patient's Age	(0010,1010)	3	
	Additional Patient's History	(0010,21B0)	3	Entered in Patient dialog - History Checklist
General Series	Modality	(0008,0060)	1	Set to either IVUS or US (configurable)
	Series Instance UID	(0020,000E)	1	s5 generated UID
	Series Number	(0020,0011)	2	Set to 1
	Laterality	(0020,0060)	2C	Zero length
	Series Date	(0008,0021)	3	Date the series was created
	Series Time	(0008,0031)	3	Time the series was created
	Performing Physicians' Name	(0008,1050)	3	Copied from Worklist "Scheduled Performing Physician's Name" or entered in Patient dialog.
	Series Description	(0008,103E)	3	Set to "IVUS"
	Request Attributes Sequence	(0040,0275)	3	Copied from Worklist. Not sent if procedure was unscheduled.
	>Scheduled Procedure Step Description	(0040,0007)	3	
	>Scheduled Procedure Step ID	(0040,0009)	1C	
	>Requested Procedure ID	(0040,1001)	1C	
	Performed Procedure Step ID	(0040,0253)	3	Copied from Worklist "Scheduled Procedure Step ID" or set to 1 if procedure was unscheduled.
	Performed Procedure Step Start Date	(0040,0244)	3	Same as Study Date
	Performed Procedure Step Start Time	(0040,0245)	3	Same as Study Time
Performed Procedure Step Description	(0040,0254)	3	Same as Study Description	
Synchronization	Synchronization Frame of Reference UID	(0020,0200)	1	Always set to "2.16.840.1.113977.530408". Only included if Modality (0008,0060) is IVUS.
	Synchronization Trigger	(0018,106A)	1	Set to "NO TRIGGER". Only included if Modality (0008,0060) is IVUS.
	Acquisition Time Synchronized	(0018,1800)	1	Set to "N". Only included if Modality (0008,0060) is IVUS.
General Equipment	Manufacturer	(0008,0070)	2	Set to "Volcano Corp"
	Institution Name	(0008,0080)	3	Entered in the patient information dialog
	Station Name	(0008,1010)	3	The s5 computer host name
	Manufacturer's Model Name	(0008,1090)	3	Set to "s5"
	Device Serial Number	(0018,1000)	3	s5 system serial number.
	Software Versions	(0018,1020)	3	s5 software version \ DICOM toolkit version.
General Image	Instance Number	(0020,0013)	2	Set to between 1 to n images in series
	Patient Orientation	(0020,0020)	2C	Set to Zero length
	Content Date	(0008,0023)	2C	Image creation date.
	Content Time	(0008,0033)	2C	Image creation time.
	Referenced Image Sequence	(0008,1140)	3	Used by VH Images to reference related Grayscale Video Loop Image.
	>Referenced SOP Class UID	(0008,1150)	1C	Always set to "1.2.840.10008.5.1.4.1.1.3.1"
	>Referenced SOP Instance UID	(0008,1155)	1C	UID of the reference Grayscale Video Loop Image
	>Referenced Frame Number	(0008,1160)	3	Matching frame numbers
	Derivation Description	(0008,2111)	3	Set to "JPEG Lossy". Only included if JPEG Lossy Compression is used
	Source Image Sequence	(0008,2112)	3	Only included with Static images from VL, to reference the Source Video Loop image.
	>Referenced SOP Class UID	(0008,1150)	1C	Always set to "1.2.840.10008.5.1.4.1.1.3.1"
	>Referenced SOP Instance UID	(0008,1155)	1C	UID of the Source Video Loop
	>Referenced Frame Number	(0008,1160)	3	Source Video Loop frame number.
	Image Comments	(0020,4000)	3	Case Explorer - User entered image labels.
	Lossy Image Compression Ratio	(0028,2112)	3	Only included if JPEG Lossy Compression has been applied to the image.
Lossy Image Compression Method	(0028,2114)	3	Set to ISO_10918_1. Only included if JPEG Lossy Compression has been applied to the image.	
Image Pixel	Rows	(0028,0010)	1	Set to 500
	Columns	(0028,0011)	1	Set to 500
	Pixel Data	(7FE0,0010)	1	
Cine	Frame Time Vector	(0018,1065)	1C	Increments (in msec) between frames. 1 for each frame in the image.




s5

DICOM Conformance Statement

Control # 804209-003/003

	Start Trim	(0008,2142)	3	Segment of Interest starting frame number. Only included for Video Loop images.
	Stop Trim	(0008,2143)	3	Segment of Interest ending frame number. Only included for Video Loop images
	Recommended Display Frame Rate	0008,2144)	3	Recommended display rate in frames/second. Only sent for Video Loops.
	Cine Rate	(0018,0040)	3	Number of frames per second. Only sent for Video Loops.
Multi-frame	Number of Frames	(0028,0008)	1	Set to 1 for still images, or 2-n for Video Loops
	Frame Increment Pointer	(0028,0009)	1	Set to (0018,1065) - Frame Time Vector
Frame Pointers	Frame Numbers Of Interest	(0028,6020)	3	Used for Case Explorer bookmarks. Only included if bookmarks are used.
	Frame Of Interest Description	(0028,6022)	3	Case Explorer - User entered bookmark text. Only included if bookmarks are used.
	Frame of Interest Type	(0028,6023)	3	Set to "BOOKMARK" or "MLA". Only included if bookmarks are used.
Palette Color Lookup Table	Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Set to 256\0\16. Only included for PALETTE COLOR images
	Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Set to 256\0\16. Only included for PALETTE COLOR images
	Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Set to 256\0\16. Only included for PALETTE COLOR images
	Red Palette Color Lookup Table Data	(0028,1201)	1C	Only included for PALETTE COLOR images
	Green Palette Color Lookup Table Data	(0028,1202)	1C	Only included for PALETTE COLOR images
	Blue Palette Color Lookup Table Data	(0028,1203)	1C	Only included for PALETTE COLOR images
US Region Calibration	Sequence of Ultrasound Regions	(0018,6011)	1	
	>Region Location Min x0	(0018,6018)	1	Set to 0
	>Region Location Min y0	(0018,601A)	1	Set to 0
	>Region Location Max x1	(0018,601C)	1	Set to 499
	>Region Location Max y1	(0018,601E)	1	Set to 499
	>Physical Units X Direction	(0018,6024)	1	Set to 0003H = cm
	>Physical Units Y Direction	(0018,6026)	1	Set to 0003H = cm
	>Physical Delta X	(0018,602C)	1	In centimeters per pixel
	>Physical Delta Y	(0018,602E)	1	In centimeters per pixel
	>Region Spatial Format	(0018,6012)	1	Set to 0001H - 2D (tissue or flow)
	>Region Data Type	(0018,6014)	1	Set to 0001H - Tissue
	>Region Flags	(0018,6016)	1	Set to 0002H - High priority/Protected
US Image	Samples Per Pixel	(0028,0002)	1	Set to 1 for PALETTE COLOR, 3 for RGB or YBR_FULL_422
	Photometric Interpretation	(0028,0004)	1	Set to YBR_FULL_422, PALETTE COLOR, or RGB
	Bits Allocated	(0028,0100)	1	Set to 8
	Bits Stored	(0028,0101)	1	Set to 8
	High Bit	(0028,0102)	1	Set to 7
	Planar Configuration	(0028,0006)	1C	Set to 0 = color-by-pixel. Only included if Photometric Interpretation = RGB or YBR_FULL_422
	Pixel Representation	(0028,0103)	1	Set to 0 = unsigned integer
	Frame Increment Pointer	(0028,0009)	1C	Set to (0018,1065) - Frame Time Vector
	Image Type	(0008,0008)	2	Set to ORIGINAL\PRIMARY\INTRAVASCULAR\nnnn. Value 4: 0001 = Grayscale, 0101 = ChromaFlo, 0201 = VH
	Lossy Image Compression	(0028,2110)	1C	Set to 01. Only included if JPEG Lossy Compression has been applied to the image.
	Ultrasound Color Data Present	(0028,0014)	3	Set to 1 for ChromaFlo and VH Images, otherwise 0
	Acquisition Date time	(0008,002A)	1C	Date and time that 1st frame of image was acquired.
	IVUS Acquisition	(0018,3100)	1C	Set to MOTOR_PULLBACK, MANUAL_PULLBACK for Video Loops, or SELECTIVE for still images. Only included if Modality (0008,0060) is IVUS.
	IVUS Pullback Rate	(0018,3101)	1C	Set to 0.5 or 1.0 mm per second. Only Included if IVUS Acquisition (0018,3100) is MOTOR_PULLBACK, and Modality (0008,0060) is IVUS.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	


	IVUS Pullback Start Frame Number	(0018,3103)	1C	Set to 1. Only Included if IVUS Acquisition (0018,3100) value is MOTOR_PULLBACK, and Modality (0008,0060) is IVUS.
	IVUS Pullback Stop Frame Number	(0018,3104)	1C	Last frame acquired. Only Included if IVUS Acquisition (0018,3100) is MOTOR_PULLBACK, and Modality (0008,0060) is IVUS.
	Transducer Data	(0018,5010)	3	Catheter name, model and Serial number
	Depth of Scan Field	(0018,5050)	3	Set to 1/2 the grayscale image diameter
	Transducer Type	(0018,6031)	3	Set to IV_PHASED
SOP Common	SOP Class UID	(0008,0016)	1	Always Ultrasound Multi-frame Image Storage SOP Class "1.2.840.10008.5.1.4.1.1.3.1"
	SOP Instance UID	(0008,0018)	1	s5 generated UID
	Specific Character Set	(0008,0005)	1C	Always set to ISO_IR 100

3.2.1.4 STORAGE AE BEHAVIOR TO C-STORE STATUS

The s5 C-STORE response behavior to returned status codes is detail in Table 3.2-4. All errors and warnings are logged to the system event log.

Table 3.2-4 Storage AE Behavior to C-Store Status

Service Status	Further Meaning	Status Codes	Storage 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.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

3.2.2 WORKLIST AE SPECIFICATION

The s5 Worklist AE provides conformance to the DICOM V3.0 SOP Classes listed in Table 3.2-5 as an SCU.

Table 3.2-5 Worklist AE SOP Class Support

SOP Class Name	SOP CLASS UID	CONFORMANCE LEVEL
Verification	1.2.840.10008.1.1	Standard
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Standard

3.2.2.1 ASSOCIATION ESTABLISHMENT POLICIES

The Worklist AE will initiate an association to a device in response to the following real-world activities; Worklist Search & Check Status.

3.2.2.1.1 GENERAL

The Volcano s5 system uses TCP/IP. The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU offered for an association initiated by the Volcano s5 system is:

Maximum PDU size offered to SCP	65536 bytes
---------------------------------	-------------

The following DICOM Application Context Name UID is proposed and recognized:

DICOM Application context name:	1.2.840.10008.3.1.1.1
---------------------------------	-----------------------

3.2.2.1.2 NUMBER OF ASSOCIATIONS

Number of simultaneous associations:	1
--------------------------------------	---

3.2.2.1.3 ASYNCHRONOUS NATURE

The Worklist AE will not use asynchronous operations.

3.2.2.1.4 IMPLEMENTATION IDENTIFYING INFORMATION

Implementation Class UID:	2.16.840.1.113977.2
Implementation Version name:	VOL_DISTA_2.0

Note: “113977” is registered by Volcano (previously registered by EndoSonics) with ANSI. Version name will be used initially as shown, but is subject to change with new versions of the DICOM capable application software.

3.2.2.2 ASSOCIATION INITIATION BY REAL-WORLD ACTIVITY

The Worklist AE will open an association to the currently selected remote Worklist server device in response to the following real-world activities; Worklist - Search, and Check Status.

3.2.2.2.1 ASSOCIATION INITIATION BY: WORKLIST SEARCH

The Worklist Search real-world activity will cause the Worklist AE to open an association with the current selected remote storage server, in the “Select Server” list located in the DICOM/Network Worklist Server Configuration menu.

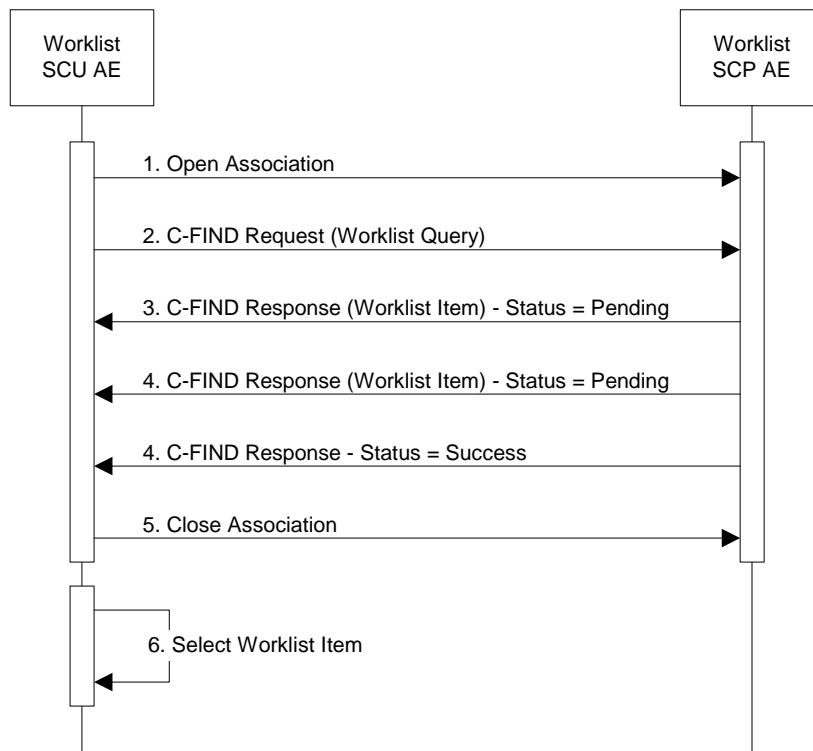


Figure 3-5 Sequencing of Activity - Worklist Search

A possible sequence of interactions between the Worklist AE and a Departmental Scheduler (e.g. a device such as a CIS or HIS which supports the Modality Worklist SOP Class as an SCP) is illustrated in the Figure 3-1 above:

1. The s5 Worklist AE opens an association with the remote Worklist AE (e.g. Departmental Scheduler).
2. The s5 Worklist AE sends a C-FIND request to the Departmental Scheduler containing the Worklist Query attributes.
3. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
4. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
5. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
6. The s5 Worklist AE closes the association with the Departmental Scheduler.
7. The user selects a Worklist Item from the Worklist and prepares to acquire new images.

3.2.2.2.2 ASSOCIATION INITIATION BY: CHECK STATUS

The Check Status real-world activity will cause the Worklist AE to open associations with the current selected remote Worklist server, in the “Select Server” list located in the DICOM/Network Worklist Configuration menu.

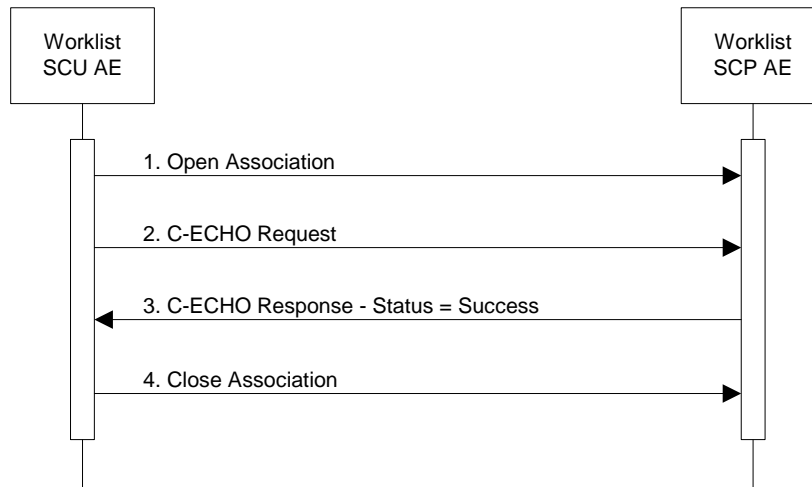


Figure 3-6 Sequence of Activity - Check Worklist Server

3.2.2.3 PROPOSED PRESENTATION CONTEXTS TO AN WORKLIST SERVER

Each time an association is initiated, the Association Initiator proposes a number of Presentation Contexts to be used on that association. Table 3.2-6 shows the Presentation Contexts proposed by the s5 Worklist AE during an Worklist Search operation.

Table 3.2-6 Worklist AE Proposed Presentation Contexts to a Worklist Server

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiatio
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
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

3.2.2.3.1 VERIFICATION SOP CLASS


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

3.2.2.4 WORKLIST AE BEHAVIOR TO C-FIND STATUS

The s5 C-FIND response behavior to returned status codes is detail in Table 3.2-7. All errors and warnings are logged to the system event log.

Table 3.2-7 Worklist AE Behavior to C-FIND Status

Service Status	Further Meaning	Status Codes	Worklist AE Behavior
Success	Matching is complete	0000	The SCP has completed the matches. Worklist items are available for display.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

Failure	Out of resources	A700	The Association is aborted using A-ABORT and the Worklist query is marked as incomplete. The status meaning is logged and the error is reported to the user.
	Identifier does not match SOP class	A900	The Association is aborted using A-ABORT and the Worklist query is marked as failed. The status meaning is logged and the error is reported to the user.
	Unable to process	C001	The Association is aborted using A-ABORT and the Worklist query is marked as incomplete. The status meaning is logged and the error is reported to the user.
Cancel	Matching terminated due to cancel request	FE00	The query may be cancelled by the user, or due to the maximum number of Worklist results being exceeded. Worklist items received prior to the cancel are available for display and further processing. The Association is closed and the Worklist query is marked as incomplete. The status is logged.
Pending	Matching is continuing	FF00	The Worklist item contained in the Identifier is collected for later display or further processing.
	Matching is continuing – Current match is supplied and any optional keys were supported in the same matter as required keys	FF01	The Worklist item contained in the Identifier is collected for display or further processing. The status meaning is logged only once for each C-FIND operation.
*	*	Any other status code.	The Association is aborted using A-ABORT and the Worklist is marked as incomplete. The status meaning is logged and the error is reported to the user.

The behavior of Worklist AE during communication failure is summarized in Table 3.2-8.

Table 3.2-8 Modality Worklist Communication Failure Behavior

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the Worklist query marked as incomplete. The reason is logged and reported to the user.
Association aborted by the SCP or network layers	Worklist query marked as incomplete. The reason is logged and reported to the user.

3.2.2.5 WORKLIST REQUEST ATTRIBUTES

Table 2.1-2 provides a description of the s5 Modality Worklist Request Identifier and specifies the attributes that are copied into the images. Unexpected attributes returned in a C-FIND response are ignored.

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made to filter out possible duplicate entries.



	s5				Control # 804209-003/003
	DICOM Conformance Statement				

Table 3.2-9 Worklist Request Identifier

Attribute Name:	Tag:	VR:	s5					Notes:
			Matching Key	Return Key	Patient Dialog	Worklist	Image IOD	
SOP Common								
Specific Character Set	(0008,0005)	CS		X				Only the Default repertoire and ISO_IR 100 character sets are supported.
Patient Identification								
Patient's Name	(0010,0010)	PN	X	X	X	X	X	Wild card matching
Patient ID	(0010,0020)	LO	X	X	X	X	X	SVM only.
Patient Demographic								
Patients Birth Date	(0010,0030)	DA		X	X		X	
Patient's Sex	(0010,0040)	CS		X	X		X	
Scheduled Procedure Step								
Scheduled Procedure Step Sequence	(0040,0100)	SQ		X				
>Modality	(0008,0060)	CS	X	X		X		May be set to either IVUS, XA, US, CT, MR or zero length (universal matching)
>Scheduled Station AE Title	(0040,0001)	AE	X	X		X		Set to either s5 system AE Title or zero length (universal matching)
>Scheduled Procedure Step Start Date	(0040,0002)	DA	X	X		X		Set to user specified date range: Today, 3 days, or All Dates (universal matching)
>Scheduled Procedure Step Start Time	(0040,0003)	TM		X		X		
>Scheduled Performing Physician's Name	(0040,0006)	PN		X	X		X†	†Copied to Performing Physician's Name.
>Scheduled Procedure Step Description	(0040,0007)	LO		X		X	X†	†Copied to Request Attributes Code Sequence & Study Description.
>Scheduled Procedure Step ID	(0040,0009)	SH		X			X†	†Copied to Request Attributes Code Sequence.
Requested Procedure								
Requested Procedure ID	(0040,1001)	SH	X	X	X	X	X†	SVM only. †Copied to Request Attributes Code Sequence & Study ID. See (IHE-5)
Requested Procedure Description	(0032,1060)	LO		X			X†	†Copied to Study Description if SPS Description in not available.
Requested Procedure Code Sequence	(0032,1064)	SQ		X			X†	†Copied to Procedure Code Sequence.
>Code Value	(0008,0100)	SH		X			X	
>Coding Scheme Designator	(0008,0102)	SH		X			X	
>Code Meaning	(0008,0104)	LO		X	X		X†	†Copied to Study Description if SPS or RP Description is not available.
Study Instance UID	(0020,000D)	UI		X			X	
Referenced Study Sequence	(0008,1110)	SQ		X			X†	†Shall be absent when a procedure is unscheduled (IHE-18)
>Referenced SOP Class UID	(0008,1150)	UI		X			X	
>Referenced SOP Instance UID	(0008,1155)	UI		X			X	
Imaging Service Request								
Accession Number	(0008,0050)	SH	X	X	X	X	X	SVM only.
Referring Physician's Name	(0032,1033)	PN		X			X	

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

Legend:	
Matching Key	X indicates that this attribute is used as a matching key for Worklist queries
Return Key	X in this column indicates a Return Key attribute.
Patient Dialog	X in this column indicates that this attribute is displayed in the Patient Information dialog
Worklist	X in this column indicates that this attribute is displayed in the Worklist.
Image IOD	X in this column indicates this attribute is returned to the PACS in the Image IODs.
†	See Notes
SVM	Single Value Matching.

3.2.2.5.1 PATIENT BASED MODALITY WORKLIST QUERY ATTRIBUTES

The values for the attributes listed in Table 3.2-10 may be entered in the Worklist dialog to facilitate Patient Based Modality Worklist queries. Corresponding values from the Patient Information dialog are copied into the query fields when the Worklist dialog is entered. Valid data must be entered in at least one Patient Based query field if universal matching is used for all Broad query parameters.

Table 3.2-10 Patient Based Query Attributes


Attribute Name:	Tag:	Description:
Patient's Name	(0010,0010)	A wildcard "*" is appended to the end of each component of the structured Patient Name to facilitate matching with both structured and unstructured Patient Names.
Patient ID	(0010,0020)	Single Value Matching only.
Requested Procedure ID	(0040,1001)	Single Value Matching only.
Accession Number	(0008,0050)	Single Value Matching only.

3.2.2.5.2 BROAD MODALITY WORKLIST QUERY ATTRIBUTES

The attributes listed in Table 3.2-11 may be configured in the Worklist dialog to facilitate Broad Modality Worklist queries. Changes made to these Broad query parameters persist between power cycles.

Table 3.2-11 Broad Query Attributes

Attribute Name:	Tag:	Description:
Modality	(0008,0060)	May be configured to use either IVUS, XA, US, CT, MR or zero length (universal matching).
Scheduled Station AE Title	(0040,0001)	May be configure to use either s5 Worklist AE Title or zero length (universal matching). The s5 Worklist SCU AE Title is configured in the DICOM / Networking configuration dialog.
Scheduled Procedure Step Start Date	(0040,0002)	May be configure to use the following date ranges: - Today - 3 Days (yesterday, today and tomorrow) - All dates (universal matching)

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

3.3 COMMUNICATION PROFILES

All Volcano s5 system application entities utilize the DICOM 3.0 TCP/IP communication support as defined in PS3.8 (Part 8) of the DICOM 3.0 Standard.

3.3.1 TCP/IP STACK SUPPORTED

The TCP/IP protocol is used. The local AE Port number is always set to 104. However, the s5-VH system does not support any services as an SCP.

3.3.2 PHYSICAL NETWORK INTERFACE

Standard representations of IEEE 802.3 10BaseT/100BaseT ("twisted pair") are supported.

3.4 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS


3.4.1 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOPs

The s5 system Extends the Ultrasound Multi-frame Image IOD to include the attributes listed in Table 3.4-1.

Table 3.4-1 Volcano Extended and Private Elements

Type:	Attribute name:	Tag:	VR:	Notes:
Extended	Pixel Spacing	(0028,0030)	DS	In millimeters
	Private Creator	(0029,0010)	LO	Set to "VOLCANO-PCDE 1.0:"
Private	Pullback Rate	(0029,1000)	DS	Set to 0.5 or 1.0 mm/Second. Only Included if IVUS Acquisition is a Motorized Pullback.
	B Gain	(0029,1001)	FD	In dB
	B Persistence Index	(0029,1002)	US	Set to 0.
	B ROI Diameter	(0029,1003)	FD	In mm.
	CF Sensitivity Index	(0029,1004)	US	Only included in ChromaFlo is on.
	CF ROI Diameter	(0029,1005)	FD	In mm. Only included in ChromaFlo is on.
	Frame Capture Interleave Rate	(0029,1006)	US	1 - 3
	Ringdown Subtraction	(0029,1007)	US	0 = Disabled, 1 = Manual, 2 = Adaptive
	Graticule Spacing	(0029,1008)	US	in mm.
	PIM Serial Number	(0029,1010)	SH	Set to zero length.
	Color Palette	(0029,1011)	OB	Only included for JPEG compressed images
	Measurement Data	(0029,1012)	UT	XML encoded Measurement data. Only included if Modality (0008,0060) is IVUS.
	Annotation Data	(0029,1013)	UT	XML encoded Annotation data. Only included if Modality (0008,0060) is IVUS.
	Segments of Interest	(0029,1014)	UT	XML encoded Segments of Interest. Only included if Modality (0008,0060) is IVUS.
	Still Image Number	(0029,1015)	US	Still Image number, from live or VL. Not included if image is a video loop.
	Video Loop Number	(0029,1016)	US	VL number or source VL number for Still Images from VL. Not included if image is a still from live.
	Catheter Boot Mode	(0029,0030)	SS	1 – 4
	VH Tree Version	(0029,0031)	LO	Only included for VH images and if Modality (0008,0060) is IVUS.
VH Graph Configuration	(0029,0032)	LO	Only included for VH images and if Modality (0008,0060) is IVUS.	

Pixel Spacing (0028,0030) information is included to allow measurements on DICOM review stations that do not support Ultrasound Region of Calibration.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

Note: The Volcano Extended and Private attributes are standard extended SOP Class attributes and are not part of the US Multi-Frame Image IOD. As such, these attributes are optional (Type 3), and their support is not required by SCPs.

3.4.2 PRIVATE TRANSFER SYNTAXES

None

3.5 CONFIGURATION

3.5.1 AE TITLE/PRESENTATION ADDRESS MAPPING

The s5 AE Title and s5 networking parameters are configurable in DICOM/Network Configuration menu.

3.5.2 CONFIGURABLE PARAMETERS FOR DICOM NETWORKING

This section describes the configurable parameters used by the s5 Storage AE when performing an Archive to Network operation. These parameters are intended to be configured by the site Network/DICOM administrator or Volcano service personnel.

3.5.2.1 CONFIGURABLE PARAMETERS FOR THE NETWORK LOCATION

The s5 system can be configured to operate in a single network location. The s5 local device settings and remote device settings can be configured through the s5 DICOM/Network Configuration menu.

CONFIGURABLE S5 NETWORKING AND DICOM PARAMETERS:

- Use DHCP (default = disabled)
- Host Name (Name field)
- IP Address (disabled if DHCP is selected)
- Subnet Mask (disabled if DHCP is selected)
- Default Gateway (disabled if DHCP is selected)
- Storage SCU AE Title – Calling Application Entity Title used by the s5 system for all Storage C-STORE operations
- Worklist SCU AE Title – Calling Application Entity Title used by the s5 system for all Worklist C-FIND operations
- Network Read/Write Timeout, in seconds

3.5.2.2 CONFIGURABLE PARAMETERS PER DEFINED REMOTE STORAGE SERVER

Every storage server device that the s5 is setup to communicate with has a set of parameters that are configurable in s5 DICOM/Network Configuration menu.

CONFIGURABLE NETWORK PARAMETERS FOR EACH STORAGE DEVICE INSTANCE:


- Server name – Alias used to identify the remote server
- Host Name – Remote server's Computer Name
- IP Address – Remote server's Computer IP address

CONFIGURABLE DICOM PARAMETERS FOR EACH STORAGE DEVICE INSTANCE:

- AE Title – Remote Storage Server's called Application Entity Title
- Port Number – Listening port number used by the Remote Storage Server
- Response Timeout – C-STORE SCP Response timeout, in seconds
- US Modality – Sets Modality (0008,0060) attribute to US when checked. Otherwise set to IVUS.
- Compression – See Table 3.5-1 for compression setting information

Table 3.5-1 Compression Settings

Compression Setting	Photometric Interpretation	Transfer Syntax	Compression Ratio (approx)
---------------------	----------------------------	-----------------	----------------------------

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

No Compression	PALETTE COLOR or RGB	ILE / ELE	N/A
JPEG High Quality	YBR_FULL_422	JPEG Baseline (Process 1)	9:1
JPEG Medium Quality	YBR_FULL_422	JPEG Baseline (Process 1)	20:1
JPEG High Compression	YBR_FULL_422	JPEG Baseline (Process 1)	30:1

3.5.2.3 CONFIGURABLE PARAMETERS PER DEFINED REMOTE WORKLIST SERVER

Every Worklist server device that the s5 is setup to communicate with has a set of parameters that are configurable in s5 DICOM/Network Worklist Configuration menu. These parameters are intended to be configured by a network/DICOM administrator or Volcano service personnel.

CONFIGURABLE NETWORK PARAMETERS FOR EACH WORKLIST DEVICE INSTANCE:


- Server name – Alias used to identify the remote server
- Host Name – Remote server’s Computer Name
- IP Address – Remote server’s Computer IP address

CONFIGURABLE DICOM PARAMETERS FOR EACH WORKLIST DEVICE INSTANCE:

- AE Title – Remote Worklist Server’s called Application Entity Title
- Port Number – Listening port number used by the Remote Worklist Server
- Response Timeout – C-FIND SCP Response timeout, in seconds

CONFIGURABLE DICOM PARAMETERS FOR ALL WORKLIST DEVICE INSTANCES:

- Max Results – This specifies the maximum number of Worklist query C-FIND results accepted by the s5. When this limit is exceeded, a C-CANCEL-FIND request is sent to the Worklist server and all further C-FIND results are discarded.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

4 MEDIA INTERCHANGE

The Volcano s5 system is a device that generates Intravascular Ultrasound images that can be saved to DVD-R (DVD-Recordable) media using DICOM standard protocols and definitions. The applications described refer to the s5 DICOM off-line media storage implementation acting as FSC for the specific application profiles and the related SOP Class instances. The Volcano s5 system acts as a File Set Reader for discs that were created on Volcano s5 system.

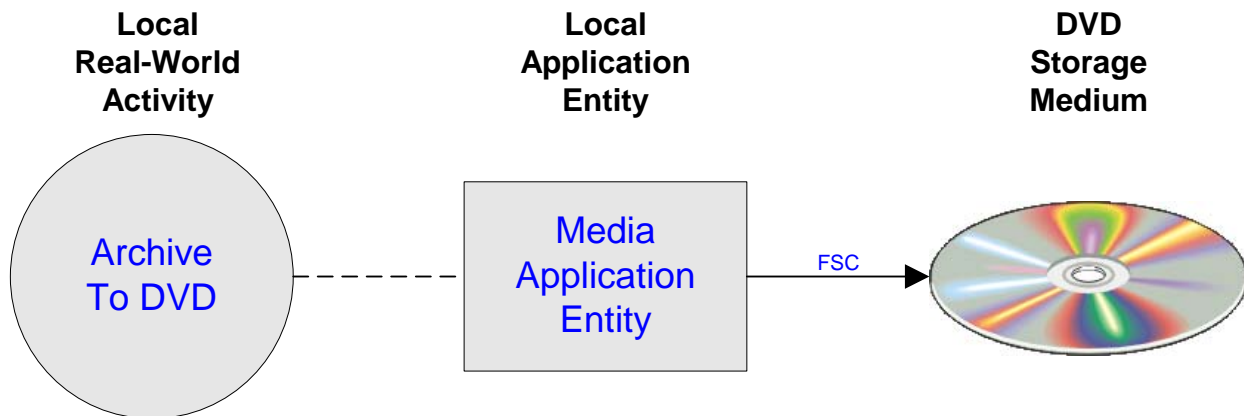
After a successful Archive to DVD operation, the transferred cases are marked as Archived and are subject to automatic deletion.

4.1 IMPLEMENTATION MODEL

4.1.1 APPLICATION DATA FLOW DIAGRAM

The diagram in Figure 3-1 represents the relationship between the IVUS system's real-world activities (circles on the left), the local AE's built into s5 (boxes in the center), and the DICOM Exchange Media that the s5 creates.

Figure 4-1 Media Storage Implementation Model



4.1.2 FUNCTIONAL DEFINITIONS OF AE'S

4.1.3 SEQUENCING OF REAL WORLD ACTIVITIES

Multiple cases may be archived to DVD Exchange Media at a time. The operator must have inserted a new (blank) DVD media before invocation of the "Archive to DVD" function. If no DVD media is available, the inserted media is not DVD, or the media is not blank, the export job will be canceled.

The Archive to DVD Real-World Activity operates as a foreground task. No other s5 system functions are available while the media is being created.


After the media has been created, a verification step may be performed to insure that data was successfully written to the media.

4.1.4 IMPLEMENTATION CLASS AND VERSION

The s5 implementation information written to the File Meta Header in each file is:

Implementation Class UID: 2.16.840.1.113977.2

Implementation Version Name: VOL_DISTA_2.0

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

4.2 AE SPECIFICATION

4.2.1 MEDIA AE SPECIFICATION

The s5 DVD Media Application Entity provides standard conformance to the DICOM Media Storage Service and File Format Class (PS 3.10) and the Media Storage Application Profile (PS 3.11).

The s5 DVD Media Application Entity supports the Application Profiles listed in Table 4.2-1

Table 4.2-1 Application Profiles, Activities, and Roles

Application Profile	Identifier	Real-World Activity	Role	SC Option
Ultrasound	STD-US-SC-MF-DVD	Archive to DVD	FSC	Interchange

The s5 DVD Media AE supports the IODS, SOP classes and Transfer Syntaxes listed in Table 4.2-2

Table 4.2-2 Supported IODS, SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
DICOM Media Storage Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2
		JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

4.2.1.1 APPLICATION ENTITY TITLE


The Application Entity Title used is VOL_MEDIA_STORE

4.2.1.2 DICOM FILE META INFORMATION

Table 4.2-3 denotes the DICOM file meta attributes included in the DICOMDIR and Ultrasound Image objects (DICOM Part 10 files) that are created by the Volcano s5 system. These attribute are stored in addition to the attributes listed in Table 3.2-3 Ultrasound Multi-frame Image SOP Class and Table 3.4-1 Volcano Extended and Private Elements for US-MF SOP instances.

Table 4.2-3 DICOM Part 10 File Meta Information

Attribute Name	Tag	Notes
File Preamble	N/A	All bytes are set to 00H
DICOM Prefix	N/A	Set to DICOM Prefix "DICM"
Meta Element Group Length	(0002,0000)	
File Meta Information Version	(0002,0001)	Set to 0001H
Media Storage SOP Class UID	(0002,0002)	1.2.840.10008.5.1.4.1.1.3.1
Media Storage SOP Instance UID	(0002,0003)	s5 generated UID
Transfer Syntax UID	(0002,0010)	Set to Explicit VR Little Endian 1.2.840.10008.1.2.1
Implementation Class UID	(0002,0012)	Set to "2.16.840.1.113977.2"
Implementation Version Name	(0002,0013)	Set to "VOL_DISTA_2.0"
Source Application Entity Title	(0002,0016)	Set to "VOL_MEDIA_STORE"


	s5	Control # 804209-003/003
	DICOM Conformance Statement	

4.2.1.3 DICOMDIR INFORMATION

Table 4.2-4 denotes the DICOM attributes included in the DICOMDIR file that is created by the Volcano s5 system. These attribute are stored in addition to the meta attributes listed in Table 3.2-5.

Table 4.2-4 DICOMDIR Attributes

Attribute Name	Tag	Type	Notes
File Set ID	(0004,1130)	2	s5 generated Volume label of media.
Offset Of The First Directory Record Of The Root Directory Entity	(0004,1200)	1	
Offset Of The Last Directory Record Of The Root Directory Entity	(0004,1202)	1	
File Set Consistency Flag	(0004,1212)	1	Set to 000H
Directory Record Sequence	(0004,1220)	2	
> Offset Of The Next Directory Record	(0004,1400)	1C	
> Record In Use Flag	(0004,1410)	1C	Set to FFFFH
> Offset Of Referenced Lower Level Directory Entity	(0004,1420)	1C	
> Directory Record Type	(0004,1430)	1C	Set to PATIENT, STUDY, SERIES or IMAGE
> Specific Character Set	(0008,0005)	1C	Set to "ISO_IR 100"
Patient Keys			Directory Record Type = PATIENT
> Patient's Name	(0010,0010)	2	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
> Patient ID	(0010,0020)	1	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
> Patient's Birth Date	(0010,0030)	3	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
> Patients Sex	(0010,0040)	3	Copied from Worklist or entered in Patient dialog if procedure was unscheduled.
Study Keys			Directory Record Type = STUDY
> Study Date	(0008,0020)	1	Date the IVUS procedure began.
> Study Time	(0008,0030)	1	Time the IVUS procedure began.
> Accession Number	(0008,0050)	2	Copied from Worklist or entered in Patient dialog.
> Study Description	(0008,1030)	2	Copied from Worklist "Scheduled Procedure Step Description" or set to "IVUS Procedure" if procedure was unscheduled.
> Study Instance UID	(0020,000d)	1C	Copied from Worklist. Internally generated if procedure was unscheduled.
> Study ID	(0020,0010)	1	Copied from Worklist "Requested Procedure ID" or entered in Patient dialog.
Series Keys			Directory Record Type = SERIES
> Modality	(0008,0060)	1	Either IVUS or US. (configurable)
> Series Description	(0008,103e)	3	Set to "IVUS"
> Series Instance UID	(0020,000e)	1	s5 generated UID
> Series Number	(0020,0011)	1	Set to 1
Image Keys			Directory Record Type = IMAGE
> Referenced File ID	(0004,1500)	1C	Set to "CASE $nnnn$ FILE $nnnn$ "
> Referenced SOP Class UID In File	(0004,1510)	1C	Set to "1.2.840.10008.5.1.4.1.1.3.1" Always Ultrasound Multi-frame Image Storage
> Referenced SOP Instance UID In File	(0004,1511)	1C	
> Referenced Transfer Syntax UID In	(0004,1512)	1C	Little Endian Explicit or JPEG Baseline

	s5		Control # 804209-003/003
	DICOM Conformance Statement		

File			(Process 1) if compression is selected.
> Image Type	(0008,0008)	3	ORIGINAL\PRIMARY\INTRAVASCULAR\vn\nn. Value 4: 0001 = Grayscale, 0101 = ChromaFlo, 0201= VH
> Content Date	(0008,0023)	3	Image creation date.
> Content Time	(0008,0033)	3	Image creation time.
> Instance Number	(0020,0013)	1	Image number from 1-n in order of acquisition
> Image Comments	(0020,4000)	3	From Case Explorer
> Number Of Frames	(0028,0008)	3	1-n

4.2.1.4 REAL WORLD ACTIVITIES

4.2.1.4.1 ARCHIVE TO DVD

Archive to DVD real-world activity occurs when the user selects a case in the s5 Archive menu and then initiates the Archive to DVD function. Multiple cases may be archived to a single DVD media at one time. The s5 Media AE will act as a FSC using the Interchange option when storing images and data to DVD media.

4.2.1.4.1.1 APPLICATION PROFILE SPECIFIC CONFORMANCE

There are no extensions or specializations.

4.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

4.3.1 AUGMENTED APPLICATION PROFILES

none


4.3.2 PRIVATE APPLICATION PROFILES

none

4.4 MEDIA CONFIGURATION

The compression type used for DVD image storage can be configured through the DICOM/Network Configuration menu.

- US Modality – Sets Modality (0008,0060) attribute to US when checked. Otherwise set to IVUS.
- Compression – See Table 3.5-1 for the available selections and additional information.

	s5	Control # 804209-003/003
	DICOM Conformance Statement	

5 SUPPORT OF EXTENDED CHARACTER SETS

The Volcano s5 system supports the ISO 8859 Latin 1 (ISO-IR 100) character set family.