Canon

DICOM CONFORMANCE STATEMENT

FOR

DIAGNOSTIC ULTRASOUND SYSTEM

Viamo c100
MODEL TUS-VC100 V1.1

CANON MEDICAL SYSTEMS CORPORATION

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1. CONFORMANCE STATEMENT OVERVIEW

The TUS-VC100 Ultrasound system implements the necessary DICOM services, which are downloading worklist from RIS, saving US images to a network storage device and printing images to a network hardcopy device.

Table 1-1

NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Image Storage	Yes	No
Ultrasound Multi-frame Image Storage	Yes	No
Workflow Management		
Modality Worklist Information Model – Find	Yes	No
Modality Performed Procedure Step	Yes	No
Print Management		
Basic Grayscale Print Management	Yes	No
Basic Color Print Management	Yes	No

Table 1-2

MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
USB Media		
General Purpose USB Media	Yes	Yes

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3. INTRODUCTION

3.1 REVISION HISTORY

Table 3.1-1   REVISION HISTORY

REV.	Date of Issue	Author	Description
	October 2017	TMSC	Initial Version
*A	January 2018	Canon Medical Systems	Change of company name

3.2 AUDIENCE

This document is written for the people who need to understand TUS-VC100 how to integrate it into their healthcare facility. The readers are expected to have a good understanding of DICOM.

3.3 REMARKS

The scope of this DICOM Conformance Statement is on how to integrate other DICOM products conveniently. It should be understood with DICOM Standard. DICOM by itself does not guarantee interoperability.

◇ Comparing DICOM Conformance Statement is the first step to estimate the interconnectivity and interoperability between the modality and other DICOM compliant device.

◇ Define and execute test procedure to verify the interoperability with the specific DICOM compatible products.

3.4 TERMS AND DEFINITIONS

Here listed the terminology involved in this Conformance Statement. But DICOM Standard is the authority of defining 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.

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 – 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), 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 (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: US Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

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.

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 (SOP) Class – the specification of the network or media transfer (service) oaf particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific ultrasound 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) [PixelData], (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; an ISO-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 BASIC 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 sections not a substitute for training about DICOM, but 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 initiate 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 Provider* (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 , analyses, and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*(IOD), 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.

3.6 ABBREVIATIONS

AE   Application Entity
AET   Application Entity Title
CD-R   Compact Disk Recordable
DHCP   Dynamic Host Configuration Protocol
DICOM Digital Imaging and Communications in Medicine
DNS   Domain Name System
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
JPEG   Joint Photographic Experts Group
MPEG   Moving Picture Experts Group
MWL   Modality Worklist
O   Optional (Key Attribute)
PACS   Picture Archiving and Communication System
PDU   Protocol Data Unit
R   Required (Key Attribute)
RIS   Radiology Information System.
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
VR   Value Representation

3.7 REFERENCE

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

4. NETWORKING

4.1   IMPLEMENTATION MODEL

4.1.1 APPLICATION DATA FLOW
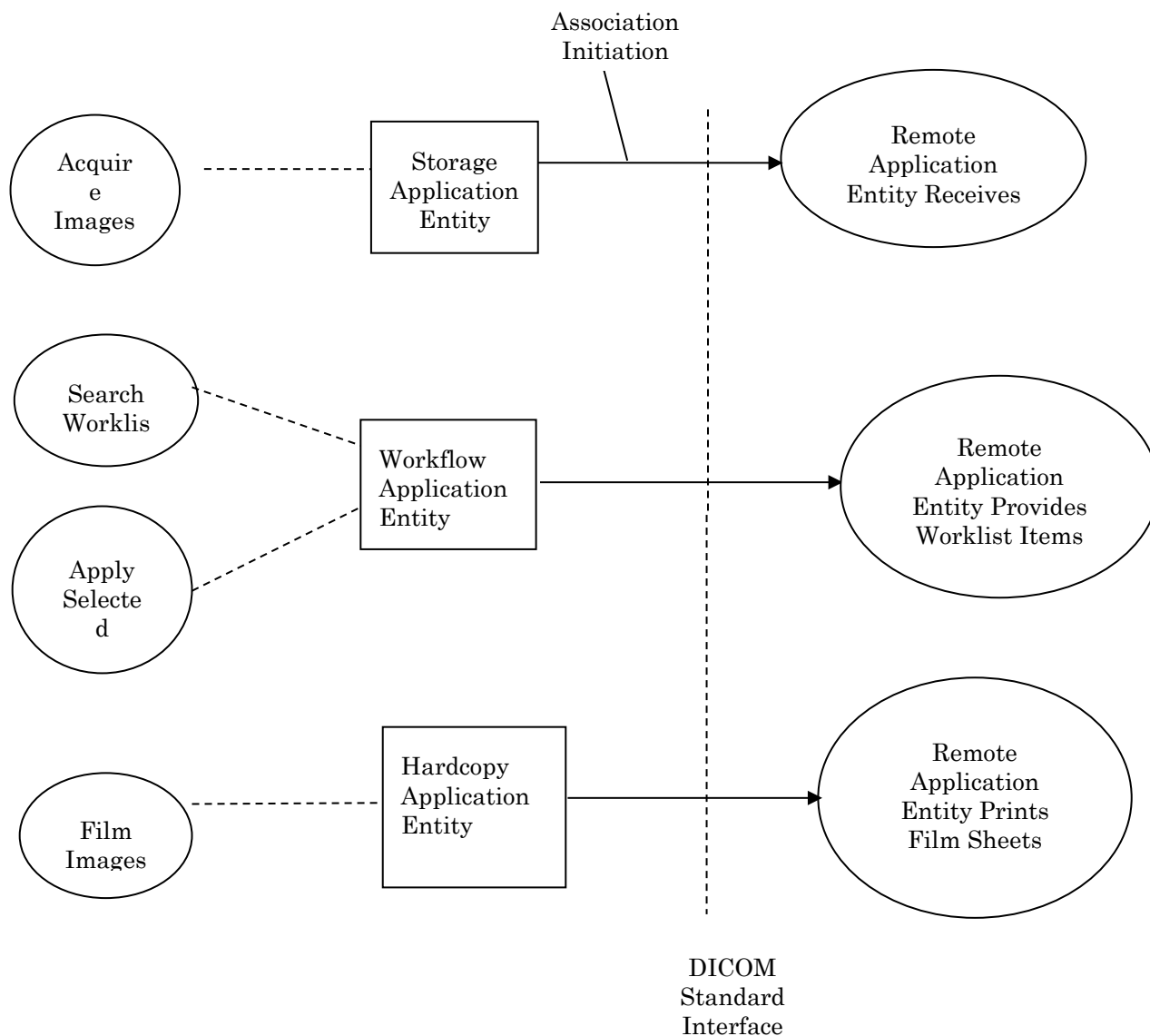
Figure 4.1-1   APPLICATION DATA FLOW DIAGRAM

--- The Storage Application Entity sends images to a remote AE. It is associated with the local real-world activity "Send Images" for "Manual" mode. Or it can be send automatically for "Follow" or "Batch" mode. For "Batch" mode, the image transfer will be started after "End Exam". And for "Manual" mode, the image transfer will be started by user request.

--- The Workflow Application Entity receives Worklist information. It is associated with the local real-world activities "Update Worklist" and "Apply Selected Patient". When the "Update Worklist" local real-world activity is performed , the Workflow Application Entity queries a remote AE for worklist items and provides the set of worklist items matching the query request. "Update Worklist" is performed as a result of an operator request or can be performed automatically at specific time intervals.

--- The Hardcopy Application Entity prints image on a remote AE(Printer).It is associated with the local real-world activity "DICOM Print" for "Manual" mode in Image View, "Acquire Image" for "Follow" mode and "End Exam" for "Batch" mode.

4.1.2 Functional Definitions of AEs

4.1.2.1   Functional Definition of Storage Application Entity

The existence of a send job with associated network destination will activate the Storage AE. An association request is sent to the destination AEs and upon successful negotiation of a Presentation Context, the image transfer is started. If the association cannot be opened, the related send job is set to an error state and can be restarted by the user. The workflow is as follow,

- ⌑ Modality will select the default storage device configured in Setup/DICOM menu. There will be only one default remote device with the same service type.
- ⌑ Send a Verification to check the remote destination is online.
- ⌑ The image transfer task will be added to the task manager.
    - ✓ Send an association request to the destination AE.
    - ✓ The image transfer task started upon a successful negotiation of a Presentation Context.

Storage invoking time is depended on the Modes configured in Setup/DICOM menu. There are three modes to configure,

Follow – Storage invoked on each image acquired.

Batch –Storage invoked only at "End Exam"

Manual – Storage invoked when user pressed "Send" button on Archive Dialog.

4.1.2.2   Functional Definition of Workflow Application Entity

Worklist Update attempts to download a Worklist from a remote node. If the Workflow 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 limit of items is reached. The results will be displayed in a separate list, which will be cleared with the next Worklist Update. By default, Worklist Update use "US" for Modality, current date for Scheduled Procedure Step Start Date and blank for Scheduled Station AE Title as matching keys.

Additional Search Parameters include:

- ⌑ On Startup and Every x minutes. (x is between 1 to 60; Default value is 5)
- ⌑ Scheduled Station AE Title
    - ✓ Any
    - ✓ This System
    - ✓ Another
- ⌑ Scheduled Procedure Step Start Date
    - ✓ Today(Default)
    - ✓ Range (Prior x Days; Next y Days; x,y are both between 1 to 60)
    - ✓ Past Week
    - ✓ Past Month
    - ✓ Custom

4.1.2.3   Functional Definition of Hardcopy Application Entity

The existence of a print-job in the print queue will activate the Hardcopy AE. An association is established with the printer and the printer's status determined. If the printer is operating normally, the film sheets described within the print-job will be printed. Changes in printer status will be detected (e.g.out of film) and reported to the user. If the printer is not operating normally, the print-job will set to an error state at Task Manager. The workflow is as follow,

- ✧ Modality select the default Print SCP configured in Setup/DICOM menu

✧ Send a Verification to ensure the remote AE is online.

♦ Add a print task to task manager according to the Mode with the same feature as Storage, which is "Follow" for Acquire, "Batch" for End Exam and "Manual" for the Real-World Activity "DICOM Print".
    ✓ Send an Association to the Remote Hardcopy AE
    ✓ The print start upon a successful negotiation of a Presentation Context.

4.1.3 Sequencing of Real-World Activities
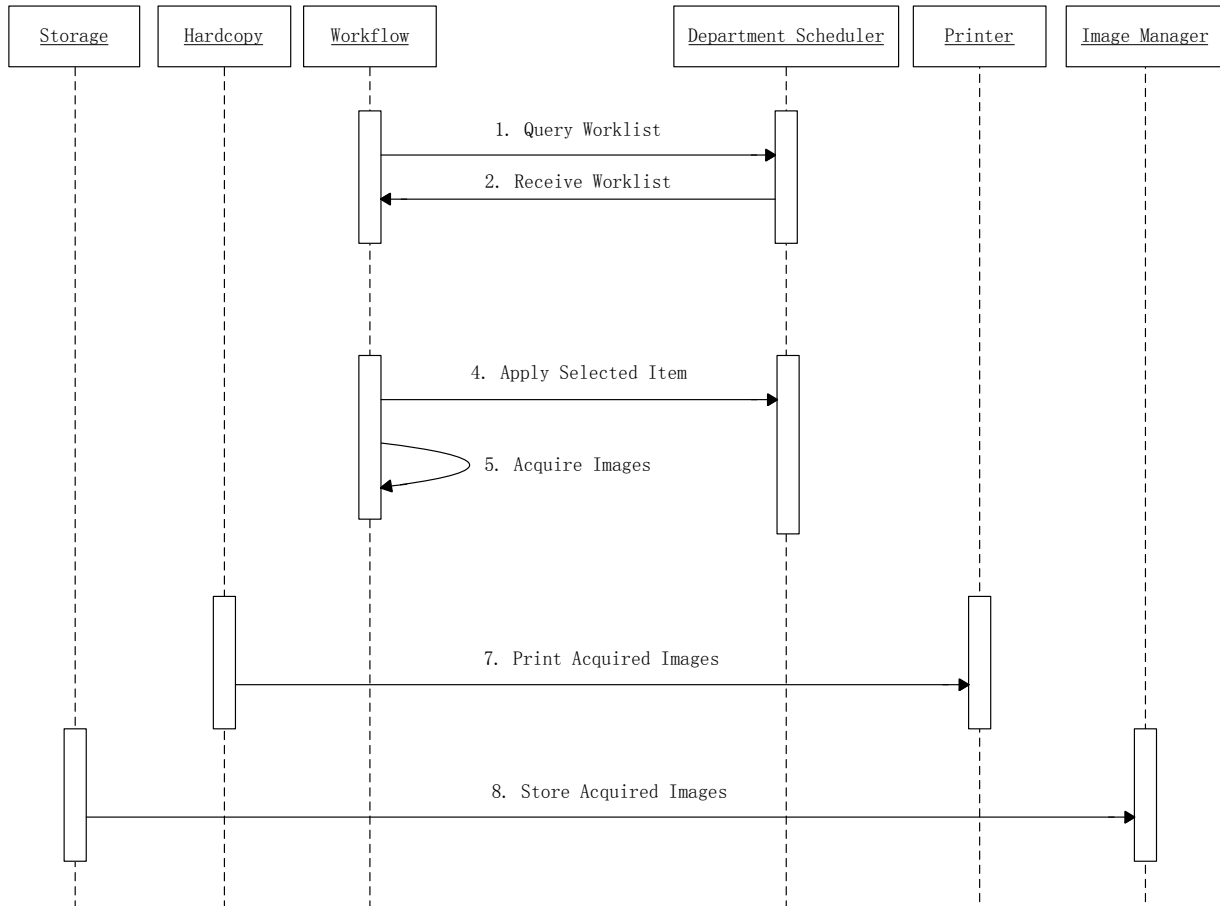
Figure 4.1-2 SEQUENCING CONSTRAINTS

Under normal scheduled workflow conditions the sequencing constraints are illustrated in **Figure 4.1-2** apply:
1. Query Worklist
2. Receive Worklist of Modality Scheduled Procedure Steps (MSPS)
3. Select Workitem (MSPS) from Worklist
4. Apply Selected Items
5. Acquire Images
6. Complete Acquisition
7. Print Acquired Images (optional step)
8. Store Acquired Images

4.2 AE Specifications

4.2.1 Storage Application Entity Specification

4.2.1.1 SOP Classes

TUS-VC100 provides Standard Conformance to the following SOP Classes:

Table 4.2-1

SOP Classes for AE Storage

SOP Classes	SOP Class UID	SCU	SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-2

DICOM Application Context for AE Storage

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

TUS-VC100 initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other remains pending until the active job is completed or failed.

Table 4.2-3

Number of Associations as an Association Initiator for AE Storage

Maximum number of simultaneous Associations	1

Table 4.2-4

Number of Associations as an Association Acceptor for AE Storage

Maximum number of simultaneous Associations	Unlimited

4.2.1.2.3 Asynchronous Nature

TUS-VC100 does not support asynchronous communications.

Table 4.2-5

Asynchronous Nature as an Association Initiator for AE Storage

Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-6

DICOM Implementation Class and Version for AE Storage

Implementation Class UID	1.3.6.1.4.1.25403.1.1.1
Implementation Version Name	Dicom 0.1

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Send Images

4.2.1.3.1.1 Description and Sequencing of Activities

A user can select images and request them to be sent to a destination. Each request is forwarded to the job queue and processed individually. For "Follow" or "Batch" mode, each marked instance or marked set of instances will be forwarded to the task manager for a pre-configured target destination automatically. The "Batch" mode send is triggered by End Exam. If the process establishes an Association to a remote Application Entity successfully, it will transfer each marked instance one after another via the open Association. Status of the transfer is reported through the job control interface. Only one job will be active at a time.

The Storage AE attempts to initiate a new Association in order to issue a C-STORE request. If the job contains multiple images then multiple C-STORE requests will be issued over the same Association.
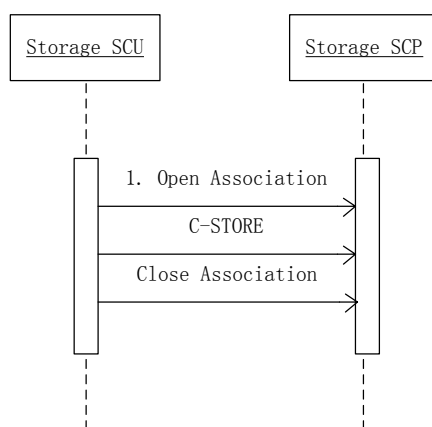
Figure 4.2-1   SEQUENCING OF ACTIVITY – SEND IMAGES

A possible sequence of interoperations between the Storage AE and Image Manager is illustrated in Figure 4.2-1

1. The Storage AE opens an association with the Image Manager

2. An acquired US image is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).

3. The Storage AE closes the association with the Image Manager.

4.2.1.3.1.2 Proposed Presentation Contexts

Table 4.2-7

Proposed Presentation Contexts for Activity Send Images

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Ultrasound Image Storage	1.2.840.10008 .5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008 .5.1.4.1.1.3.1	JPEG Lossy Baseline	1.2.840.10008.1.2.4.50	SCU	None
Verification	1.2.840.10008 .1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

Presentation Contexts for Ultrasound Image Storage or Ultrasound Multi-frame Image Storage will only be proposed if the Send Job contains instances for these SOP Classes.

4.2.1.3.1.3 SOP Specific Conformance for Image &Comprehensive Structured Report Storage SOP Classes

The behavior of Storage AE when encountering status codes in a C-STORE response is summarized in the Table below:

Table 4.2-8

Storage C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully returned all matching information.
Failed	Refused: Out of Resources	A7XX	The send job marked as failed.
	Data Set does not match SOP Class	A9XX	
	Cannot understand	CXXX	

Table 4.2-9

Storage Communication Failure Behavior

Exception	Behavior
Timeout	Abort the association with A-Abort. And The Send Job is marked as Failed.
Association Aborted	The Send Job is marked as Failed.

4.2.1.3.1.4　SOP Specific Conformance for Verification SOP Class

The behavior of Verification when encountering status codes in a C-ECHO response is summarized in the Table below:

Table 4.2-10

VERIFICATION C-ECHO RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	Verification Status is set to 'Success'
*	*	Any other code	Verification Status is set to 'Failed'

4.2.2 Workflow Application Entity Specification

4.2.2.1   SOP Classes

TUS-VC100 provides Standard Conformance to the following SOP Classes:

Table 4.2-11

SOP Classes for AE Workflow

SOP Classes	SOP Class UID	SCU	SCP
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No

4.2.2.2   Association Policies

4.2.2.2.1   General

Table 4.2-12

DICOM Application Context for AE Workflow

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2   Number of Associations

Table 4.2-13

Number of Associations Initiated for AE Workflow

Maximum number of simultaneous Associations	1

4.2.2.2.3   Asynchronous Nature

TUS-VC100 does not support asynchronous communications

Table 4.2-14

Asynchronous Nature as a SCU for AE Workflow

Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4   Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-15

DICOM Implementation Class and Version for AE Workflow

Implementation Class UID	1.3.6.1.4.1.25403.1.1.1
Implementation Version Name	Dicom 0.1

4.2.2.3   Association Initiation Policy

4.2.2.3.1   Activity – Worklist Update

4.2.2.3.1.1   Description and Sequencing of Activities

The request for a Worklist Update is initiated by user interaction, i.e. pressing the button "Search" in Patient Information Dialog or automatically at specific time intervals, configurable by the user.
With automated worklist queries (including "Worklist Update") the TUS-VC100 always requests all items for a Scheduled Procedure Step Start Date (actual date), Modality (US) and
Scheduled Station AE Title. Query for the Scheduled Station AE Title is configurable by a Service Engineer.
Upon initiation of the request, the TUS-VC100 will build an Identifier for the C-FIND request, will initiate an Association to send the request and will wait for Worklist responses. The results will be displayed in a separate list, which will be cleared with the next Worklist update.

The sequencing between Modality Worklist SCU and Modality Worklist SCP is shown as following,
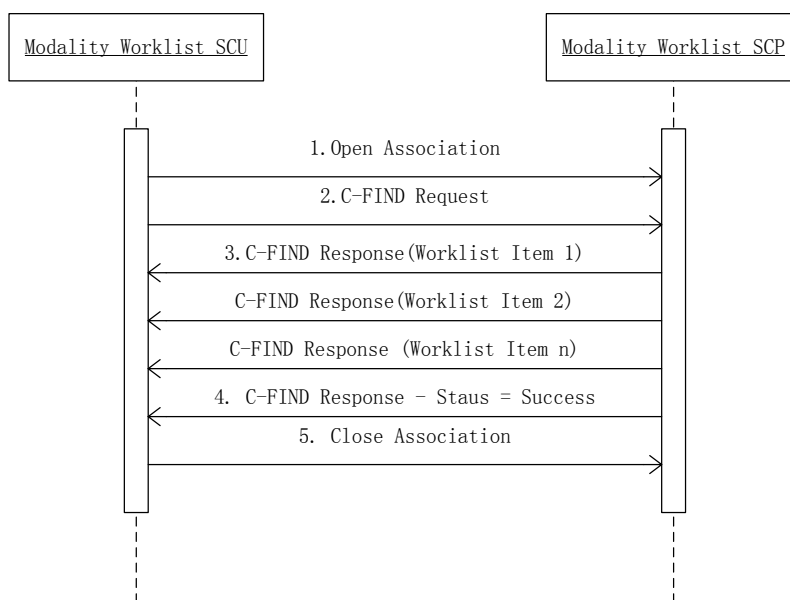
Figure 4.2-2   Sequencing of Activity – Worklist Update

A possible sequence of interactions between the Workflow AE and a Departmental Scheduler is illustrated in the Figure above:
1. The Worklist AE opens an association with the Departmental Scheduler
2. The 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.
   The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 3 Worklist items match the Worklist Query.
5. The Worklist AE closes the association with the Departmental Scheduler.

4.2.2.3.1.2   Proposed Presentation Contexts

Table 4.2-16

Proposed Presentation Contexts for Activity Worklist Update

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.1000 8.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

4.2.2.3.1.3   SOP Specific Conformance for Modality Worklist

The behavior of TUS-VC100 when encountering status codes in a Modality Worklist C-FIND response is summarized in the Table below. If any other SCP response status than "Success" or "Pending" is received by TUS-VC100, a message "query failed "will appear on the user interface.

Table 4.2-17
Modality Worklist C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the operation successfully.
*	*	Any Other Code	The Worklist Query Failed, report to the user.

Table 4.2-18

Modality Worklist Communication Failure Behavior

Exception	Behavior
Timeout	Abort the association with A-Abort. And the Worklist query job is marked as failed.
Association Aborted	The Worklist query job is marked as Failed.

Table 4.2-19

Worklist Request Identifier

Attribute Name	Tag	VR	M	R	Q	D	IOD
SOP Common							
Specific Character Set	(0008,0005)	CS		x			
Scheduled Procedure Step							
Scheduled Procedure Step Sequence	(0040,0100)	SQ		x			
>Scheduled Station AE Title	(0040,0001)	AE	(S)	x	x		
>Scheduled Procedure Step Start Date	(0040,0002)	DA	S	x	x	x	
>Scheduled Procedure Step Start Time	(0040,0003)	TM	S	x		x	
>Modality	(0008,0060)	CS		x	x		
>Scheduled Performing Physician's Name	(0040,0006)	PN		x			x
>Scheduled Procedure Step Description	(0040,0007)	LO		x			x
>Scheduled Station Name	(0040,0010)	SH		x			
>Scheduled Procedure Step Location	(0040,0011)	SH		x			
>Scheduled Protocol Code Sequence	(0040,0008)	SQ		x			x
>Scheduled Procedure Step Status	(0040,0020)	CS		x			
>Comments on the Scheduled Procedure Step	(0040,0400)	LT					
Requested Procedure							
Requested Procedure ID	(0040,1001)	SH		x		x	x
Reason for the Requested Procedure	(0040,1002)	LO		x			x
Requested Procedure Description	(0032,1060)	LO		x			x
Study Instance UID	(0020,000D)	UI		x			x
Requested Procedure Priority	(0040,1003)	SH		x			
Requested Procedure Location	(0040,1005)	LO		x			x
Requested Procedure Comments	(0040,1400)	LT		x			x
Imaging Service Request Comments	(0040,2400)	LT		x			x
Requested Procedure Code Sequence	(0032,1064)	SQ		x			x
Imaging Service Request							
Accession Number	(0008,0050)	SH		x		x	x
Requesting Physician	(0032,1032)	PN		x			x
Referring Physician's Name	(0008,0090)	PN		x		x	x
Patient Identification							
Patient's Name	(0010,0010)	PN		x		x	x
Patient ID	(0010,0020)	LO		x		x	x
Patient Demographic							
Patients Birth Date	(0010,0030)	DA		x		x	x
Patients Birth Time	(0010,0032)	DA		x		x	x
Patient's Sex	(0010,0040)	CS				x	x

Patient' Size	(0010,1020)	DS		x		x	x
Patient' Weight	(0010,1030)	DS		x		x	x

The above table should be read as follows:

Module Name: The name of the associated module for supported worklist attributes.
Attribute Name: Attributes supported to build a Worklist Request Identifier.

Tag: DICOM tag for this attribute.
VR: DICOM VR for this attribute.
M: Matching keys for (automatic) Worklist Update. A "S" means Single Value Matching, a "R" will indicate Range Matching and a "*" will denote wildcard matching. It can be configured if "Scheduled Station AE Title" is additionally supplied "(S)" and if Modality is set to US.
R: Return keys. An "x" will indicate that TUS-VC100 will supply this attribute as Return Key with zero length for Universal Matching.
Q: Interactive Query Key. An "x" will indicate that TUS-VC100 will supply this attribute as matching key, if entered in the Worklist dialog. For example, the Patient Name can be entered thereby restricting Worklist responses to Procedure Steps scheduled for the patient.
D: Displayed keys. An "x" indicates that this worklist attribute is displayed to the user during a patient registration dialog. For example, Patient Name will be displayed when registering the patient prior to an examination.
IOD: An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

The default Query Configuration is set to "Modality" (US) and "Date" (date of today).Optionally, additional matching for the own AET is configurable.

4.2.2.3.2   Activity –Apply Worklist Item

4.2.2.3.2.1   Description and Sequencing of Activities

A possible sequence of interactions between the Workflow AE and Department Scheduler is illustrated in **Figure 4.2.2**

1.   The Worklist AE opens an association with the Department Scheduler.

2.   The Worklist AE closes the association with the Departmental Scheduler.

3.   All images are acquired and stored in the local database.

4.   The Worklist AE closes the association with the Departmental Scheduler.

4.2.3 Hardcopy Application Entity Specifications

4.2.3.1 SOP Classes

TUS-VC100 provides Standard Conformance to the following SOP Classes:

Table 4.2-20

SOP Classes for AE Hardcopy

SOP Classes	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-21

DICOM Application Context for AE Hardcopy

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2 Number of Associations

TUS-VC100 initiates one Association at a time for each configured hardcopy device. Multiple hardcopy devices can be configured.

Table 4.2-22

Number of Associations Initiated for AE Hardcopy

Maximum number of simultaneous Associations	(number of configured hardcopy devices)

4.2.3.2.3 Asynchronous Nature

TUS-VC100 does not support asynchronous communications

Table 4.2-23

Asynchronous Nature as a SCU for AE Hardcopy

Maximum number of outstanding asynchronous transactions	1

I

4.2.3.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-24

DICOM Implementation Class and Version for AE Hardcopy

Implementation Class UID	1.3.6.1.4.1.25403.1.1.1
Implementation Version Name	DICOM 0.1

4.2.3.3   Association Initiation Policy

4.2.3.3.1   Activity – Film Images

4.2.3.3.1.1   Description and Sequencing of Activities

The User can perform image printing by pressing "DIOCM Print" at Archive dialog. The first frame of multi-frame images will be printed. And support two print types which are RGB and grayscale can be configured in the Print DICOM Setting Dialog at Setup/DICOM menu.

```
        ┌─────────────┐                    ┌─────────────┐
        │ Hardcopy AE │                    │   Printer   │
        └─────────────┘                    └─────────────┘
               │                                  │
               │  1.Open Association              │
               │─────────────────────────────────▶
               │  2.N-Create Film Session         │
               │─────────────────────────────────▶
               │  3.N-Create Film Box             │
               │─────────────────────────────────▶
               │  4.N-Set Image Box               │
               │─────────────────────────────────▶
               │  5.N-Action(Film Box)            │
               │─────────────────────────────────▶
               │                              ⤾ 6.Print Film
               │  7.Delete Film Box               │
               │─────────────────────────────────▶
               │  8.Release Association           │
               │─────────────────────────────────▶
               │                                  │
```
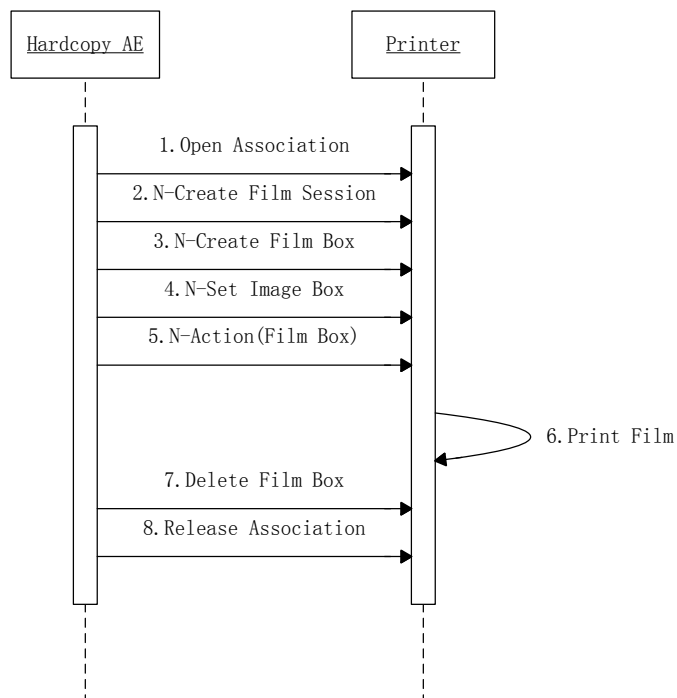
Figure 4.2-3   SEQUENCINGOF ACTIVITY –FILM IMAGES

A typical sequence of DIMSE messages sent over an association between Hardcopy AE and a Printer is illustrated in **Figure 4.2-3**:
1. Hardcopy AE opens an association with the Printer
2. N-CREATE on the Film Session SOP Class creates a Film Session.
3. N-CREATE on the Film Box SOP Class creates a Film Box linked to the Film Session. A single Image Box will be created as the result of this operation.
4. N-SET on the Image Box SOP Class transfers the contents of the film sheet to the printer.
5. N-ACTION on the Film Box SOP Class instructs the printer to print the Film Box .
6. The printer prints the requested number of film sheets
7. N-DELETE on the Film Session SOP Class deletes the complete Film Session SOP Instance hierarchy.
8. Hardcopy AE closes the association with the Printer.

4.2.3.3.1.2   Proposed Presentation Contexts
TUS-VC100 is capable of proposing the Presentation Contexts shown in the Table below:

Table 4.2-25

Proposed Presentation Contexts for Activity Film Images

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.1000 8.5.1.1.9	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None
Basic Color Print Management Meta	1.2.840.1000 8.5.1.1.18	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None

4.2.3.3.1.3   SOP Specific Conformance for Print SOP Class
The general behavior of Hardcopy AE during communication failure is summarized in the Table below.
This behavior is common for all SOP Classes supported by Hardcopy AE.

Table 4.2-26

Hardcopy Communication Failure Behavior

Exception	Behavior
Timeout	Abort the association with A-Abort. And The Print Job is marked as Failed.
Association aborted by the SCP or network layers	The Print Job is marked as Failed.

4.2.3.3.1.4   SOP Specific Conformance for the Film Session SOP Class
Hardcopy AE supports the following DIMSE operations for the Film Session SOP Class:
N-Create
N-Delete
Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.4.1   Film Session SOP Class Operation (N-Create)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 4.2-27

Film Session SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number Of Copies	(2000,0010)	IS	1~99	ALWAYS	User
Print Priority	(2000,0020)	CS	HIGH, MED or LOW	ALWAYS	User
Medium Type	(2000,0030)	CS	PAPER, CLEAR FILM, BLUE FILM, MAMMO CLEAR FILM or MAMMO BLUE FILM	ALWAYS	User
Film Destination	(2000,0040)	CS	MAGAZINE or PROCESSOR	ALWAYS	User

The behavior of Hardcopy AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 4.2-28

Film Session SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other code	The Association is aborted using A-ABORT and the print-job is marked as failed.

4.2.3.3.1.4.2   Film Session SOP Class Operations (N-DELETE)

The behavior of Hardcopy AE when encountering status codes in a N-DELETE response is summarized in the Table below:

Table 4.2-29

Printer SOP Class N-DELETE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other code	The Association is aborted using A-ABORT and the print-job is marked as failed.

Modality will request SCP to delete the Film Session SOP Instance hierarchy.

4.2.3.3.1.5   SOP Specific Conformance for the Film Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Presentation LUT SOP Class:
    N-Create
    N-Action
Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.5.1 Film Box SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 4.2-30

Film Box SOP Class N-CREATE Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	CS	"STANDARD¥1, 1" , "STANDARD¥1, 2" , "STANDARD¥2, 2" , "STANDARD¥2, 3" , "STANDARD¥3, 3" , "STANDARD¥3, 4" , "STANDARD¥3, 5" , "STANDARD¥4, 4" , "STANDARD¥4, 5", "STANDARD¥4, 6"	ALWAYS	User
Referenced Film Session Sequence	(2010,0500)	SQ		ALWAYS	Auto
> Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	Auto
> Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	Auto
Film Orientation	(2010,0040)	CS	PORTRAIT ,LANDSCAPE	ALWAYS	User
Film Size ID	(2010,0050)	CS	8INX10IN, 8_5INX11IN, 10INX12IN, 10INX14IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, A4, A3	ALWAYS	User
Magnification Type	(2010,0060)	CS	REPLICATE, BILINEAR, CUBIC, NONE	ALWAYS	User
Max Density	(2010,0130)	US	0~	Not Applied	User
Configuration Information	(2010,0150)	ST	Refer to Print SCP's Conformance Statement	Not Applied	User
Smoothing Type	(2010,0080)	CS	None, Cubic	ALWAYS	User
Border Density	(2010,0100)	CS	BLACK or WHITE	ALWAYS	User
Empty Image Density	(2010,0110)	CS	BLACK or WHITE	ALWAYS	User
Min Density	(2010,0120)	US	0~	Not Applied	User

The behavior of Hardcopy AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 4.2-31

Film Box SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other code	The Association is aborted using A-ABORT and the print-job is marked as failed.

4.2.3.3.1.5.2 Film Box SOP Class Operation (N-ACTION)

An N-ACTION Request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in an N- ACTION response is not evaluated.

The behavior of Hardcopy AE when encountering status codes in a N-ACTION response is summarized in the Table below:

Table 4.2-32

Film Box SOP Class N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other code	The Association is aborted using A-ABORT and the print-job is marked as failed.

4.2.3.3.1.6 SOP Specific Conformance for the Image Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Image Box SOP Class:
　N-SET
Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.3.3.1.6.1 Image Box SOP Class Operation (N-SET)

The attributes supplied in an N-SET Request are listed in the Table below:

Table 4.2-33

Basic Grayscale Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1 - n	ALWAYS	Auto
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	Auto
> Samples Per Pixel	(0028,0002)	US	1	ALWAYS	Auto
>Rows	(0028,0010)	US	The Height of Image	ALWAYS	Auto
>Columns	(0028,0011)	US	The Width of Image	ALWAYS	Auto
> Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	Auto
> Bits Allocated	(0028,0100)	US	8	ALWAYS	Auto
> Bits Stored	(0028,0101)	US	8	ALWAYS	Auto
> High Bit	(0028,0102)	US	7	ALWAYS	Auto
> Pixel Representation	(0028,0103)	US	0	ALWAYS	Auto

> Pixel Data	(7FE0,0010)	OB	Pixels of rendered film sheet	ALWAYS	Auto

Table 4.2-34

Basic Color Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)	US	1 - n	ALWAYS	Auto
Basic Color Image Sequence	(2020,0111)	SQ		ALWAYS	Auto
> Samples Per Pixel	(0028,0002)	US	3	ALWAYS	Auto
>Rows	(0028,0010)	US	The Height of Image	ALWAYS	Auto
>Columns	(0028,0011)	US	The Width of Image	ALWAYS	Auto
> Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	Auto
>Planar Configuration	(0028,0006)	US	0	ALWAYS	Auto
> Bits Allocated	(0028,0100)	US	8	ALWAYS	Auto
> Bits Stored	(0028,0101)	US	8	ALWAYS	Auto
> High Bit	(0028,0102)	US	7	ALWAYS	Auto
> Pixel Representation	(0028,0103)	US	0	ALWAYS	Auto
> Pixel Data	(7FE0,0010)	OB	Pixels of rendered film sheet	ALWAYS	Auto

The behavior of Hardcopy AE when encountering status codes in a N-SET response is summarized in the Table below:

Table 4.2-35

Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other code	The Association is aborted using A-ABORT and the print-job is marked as failed.

4.3   Network Interfaces

4.3.1 Physical Network Interface

TUS-VC100 supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

Table 4.3-1

Supported Physical Network Interfaces

Ethernet 10/100/1000baseT

4.3.2 Additional Protocols

DHCP can be used to obtain TCP/IP network configuration information (e.g., own IP address, subnet mask, default gateway, DNS server, etc).

DNS can be used for address resolution.

4.3.3 IPv4 and IPv6 Support

This product only supports IPv4 connections.

4.4   Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1   Local AE Titles

All DICOM Services use the AE Titles and TCP/IP Ports configured via the Setup/DICOM menu.

Table 4.4-1

AE TITLE CONFIGURATION TABLE

Application Entity	Default AE Title	Default TCP/IP Port
Storage	No Default	104
Workflow	No Default	107
Hardcopy	No Default	109

4.4.1.2   Remote AE Title/Presentation Address Mapping

Configuration of the remote AET, port number, host-names, IP addresses and capabilities shall be specified in the Setup/DICOM menu. And user can do verification with the Remote AE by "Verify" button.

4.4.1.2.1   Storage

Steps of adding Storage SCP
1. Press "Add" button on Setup/DICOM menu.
2. Select "Storage" service type on the Servicing Setting Dialog.
3. Set AE Title, Port numbers, Host(IP Address) and Alias value.
4. Modify the time out value and Mode type if the user wants to.

4.4.1.2.2   Workflow

Only a single remote Modality Worklist SCP can be defined.
Steps of adding Modality Worklist SCP
1. Press "Add" button on Setup/DICOM menu
2. Select "Worklist" service type on the Servicing Setting Dialog.
3. Set AE Title, Port numbers, Host (IP Address) and Alias value.
4. Modify the time out value and Mode type if the user wants to.

4.4.1.2.3   HardCopy

Multiple remote Print SCPs can be defined. Steps of adding Printer SCP
1. Press "Add" button on Setup/DICOM menu
2. Select "Print" service type on the Servicing Setting Dialog.
3. Set AE Title, Port numbers, Host (IP Address) and Alias value.
4. Modify the time out value and Mode type if the user wants to.

4.4.2 Parameters

A large number of parameters related to acquisition and general operation can be configured using the Setup/DICOM menu. The Table below only shows those configuration parameters relevant to DICOM communication.

Table 4.4-2

Configuration Parameters Table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
AE Title(Local System)	Yes	No Default
Station Name	Yes	Blank
Port Number	Yes	104
Read/Write Timeout	Yes	1000
Storage Parameters		
Transfer Mode	Yes	Batch
Modality Worklist Parameters		
Automatic Worklist Updates	Yes	10 Minutes
Scheduled Station AE Title	Yes	Any
Scheduled Modality	Yes	"US"
Start Date	Yes	Today
Print Parameters		
Transfer Mode	Yes	Batch
Print Type	Yes	Grayscale
Medium Type	Yes	PAPER
Format	Yes	1X1
Film Size	Yes	8 IN x 10 IN
Orientation	Yes	PROTRAIT
Destination	Yes	MAGAZINE
Magnification	Yes	REPLICATE
Smoothing Type	Yes	BLANK
Border Density	Yes	BLACK
Empty Density	Yes	BLACK
Priority	Yes	HIGH
Min Density	Yes	BLANK
Max Density	Yes	BLANK
Copies	Yes	1
Configuration Info	Yes	BLANK

5. Media Interchange

5.1 Implementation Model

5.1.1 Application Data Flow

— Not Supported CD-R and DVD+R.
— The Offline-Media AE updates instances from a USB Storage medium. It is associated with the local real-world activity "Add Instances" performed upon user request.
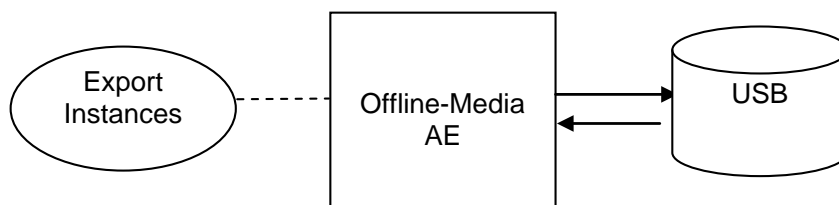
Figure 5.1-1 Application Data Flow

5.1.2 Functional Definition of AEs

5.1.2.1 Functional Definition of Offline-Media Application Entity

The Offline-Media AE is performed upon user request for selected instances to/from an offline DICOM USB medium. It therefore performs the following tasks:

Export:
— Builds DICOM Information Objects.
— Creates a DICOMDIR file that represents the contents of the DICOM Information Objects to be recorded.
— Records DICOM Information Objects and the DICOMDIR file to the USB medium.

5.1.3 Sequencing of Real-World Activities

5.1.3.1 Activity – Export Instances

Operator requests to create new File-set(s) onto a USB medium. The requests are placed in a queue and are executed in the background.

The operations for "Export Instances" are described below:

Step-1: Select the instances on the local storage device to be created to the medium.
Step-2: Request to copy to the medium.

5.1.4 File Meta Information Options

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

Table 5.1-1
DICOM Implementation Class and Version for Media Storage

File Meta Information Version	1
Implementation Class UID	1.2.392.200036.9116.6.25.1000.1
Implementation Version Name	TM_UL_DCM_V1.0

5.2   AE Specifications

5.2.1 Offline-Media Application Entity Specification

The Offline-Media AE provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

Table 5.2-1

Application Profiles, Activities and Roles for Offline-Media

Application Profiles Supported	Real World Activity	Role
AUG-GEN-USB1	Export to USB	FSC

5.2.1.1   File Meta Information for the Application Entity

The Source Application Entity Title is the local AE title of Storage SCP.

5.2.1.2   Real-World Activities

5.2.1.2.1   Activity – Export Instance

The Offline-Media AE acts as an FSC using the interchange option when requested to export SOP Instances from the local database to a USB medium.

5.2.1.2.1.1   Media Storage Application Profiles

The Offline-Media AE supports the AUG-GEN-USB1 Application Profiles.

5.2.1.2.1.1.1   Options

The Offline-Media AE supports the SOP Classes and Transfer Syntaxes listed in **Table 5.3-1**

Activity – Import Instances

The Offline-Media AE acts as an FSR using the interchange option when requested to import SOP Instances from a USB medium to the local database.

5.2.1.2.1.2   Media Storage Application Profiles

The Offline-Media AE supports the AUG-GEN-USB1 Application Profiles.

5.2.1.2.1.2.1   Options

The Offline-Media AE supports the SOP Classes and Transfer Syntaxes listed in **Table 5.3-1**

5.2.1.2.2 Activity – Add Instances

The Offline-Media AE acts as an FSU using the interchange option when requested to add SOP Instances from the local database to a USB medium.

5.2.1.2.2.1 Media Storage Application Profiles

The Offline-Media AE supports the AUG-GEN-USB1 Application Profiles.

5.2.1.2.2.1.1 Options

The Offline-Media AE supports the SOP Classes and Transfer Syntaxes listed in **Table 5.3-1.**

5.3 Augmented and Private Application Profiles

5.3.1 Augmented Application Profiles

5.3.1.1 Augmented Application Profiles – AUG-GEN-USB1

5.3.1.1.1 SOP Class Augmentations

The Augmented Application Profiles support the following SOP Classes and Transfer Syntaxes:

Table 5.3-1

IODs, SOP Classes and Transfer Syntaxes for Offline Media

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	1.2.840.10008.1.2.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy Baseline	1.2.840.10008.1.2.4.50

5.3.1.1.2 Directory Augmentations

Not applicable.

5.3.1.1.3 Other Augmentations

Not applicable.

5.3.2 Private Application Profiles

Not applicable.

5.4 MEDIA CONFIGURATION

Not applicable.

6. Support of Character Sets

This product supports the following character set:
ISO_IR 192（Unicode）

7. Security

This product does not support any specific security measures.

It is assumed that TUS-VC100 is used within a secured environment. It is assumed that a secured environment includes at a minimum:

a) Firewall or router protections to ensure that only approved external hosts have network access to the product .
b) Firewall or router protections to ensure that the product Series only has network access to approved external hosts and services.
c) Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN).

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

8. Annexes

8.1   IOD Contents

8.1.1   Created SOP Instances

Table 8.1-1 specifies the attributes of an Ultrasound Image transmitted by the TUS-VC100 storage application.

The following tables use a number of abbreviations. The abbreviations used in the "Presence of …"column are:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value

The abbreviations used in the "Source" column:

MWL	the attribute value source Modality Worklist
USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
CONFIG	the attribute value source is a configurable parameter

NOTE: All dates and times are encoded in the local configured calendar and time. Date, Time and Time zone are configured Setup/General Menu.

8.1.1.1 8.1.1.1 US Image IOD

Table 8.1-1

IOD of Created US SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8.1-3	ALWAYS
Study	General Study	Table 8.1-4	ALWAYS
	Patient Study	Table 8.1-5	ALWAYS
Series	General Series	Table 8.1-6	ALWAYS
Equipment	General Equipment	Table 8.1-7	ALWAYS
Image	General Image	Table 8.1-8	ALWAYS
	Image Pixel	Table 8.1-9	ALWAYS
	US Region Calibration	Table 8.1-10	ALWAYS
	US Image	Table 8.1-13	ALWAYS
	VOI LUT	Table 8.1-11	Only if Photometric Interpretation (0028,0004) is MONOCHROME2
	SOP Common	Table 8.1-12	ALWAYS

8.1.1.2 8.1.1.1 US Multi-frame Image IOD

Table 8.1-2

IOD of Created US Multi-frame Image SOP Instances

IE	Module	Reference	Presence of Module
Patient	Patient	Table 8.1-3	ALWAYS
Study	General Study	Table 8.1-4	ALWAYS
	Patient Study	Table 8.1-5	ALWAYS
Series	General Series	Table 8.1-6	ALWAYS
Equipment	General Equipment	Table 8.1-7	ALWAYS
Image	General Image	Table 8.1-8	ALWAYS
	Image Pixel	Table 8.1-9	ALWAYS
	Cine	Table 8.1-15	ALWAYS
	Multi-Frame	Table 8.1-16	ALWAYS
	US Region Calibration	--	Not Present
	US Image	Table 8.1-14	ALWAYS
	VOI LUT	Table 8.1-11	Only if Photometric Interpretation (0028,0004) is MONOCHROME2
	SOP Common	Table 8.1-12	ALWAYS

8.1.1.3 Common Modules

Table 8.1-3

Patient Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	From Modality Worklist or user input. Values supplied via Modality Worklist will been received	VNAP	MWL/USER
Patient ID	(0010,0020)	LO	From Modality Worklist or user input. Maximum 64 characters.	VNAP	MWL/USER
Patient's Birth Date	(0010,0030)	DA	From Modality Worklist or user input	VNAP	MWL/USER
Patient's Birth Time	(0010,0032)	DA	From Modality Worklist or user input	VNAP	MWL
Patient's Sex	(0010,0040)	DA	From Modality Worklist or user input	VNAP	MWL/USER

Table 8.1-4

General Study Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	From Modality Worklist or generated by device	ALWAYS	MWL/AUTO
Study Date	(0008,0020)	DA	<yyyymmdd>	ALWAYS	AUTO
Study Time	(0008,0030)	TM	<hhmmss>	ALWAYS	AUTO
Referring Physician's Name	(0008,0090)	PN	From Modality Worklist or user input	VNAP	MWL/USER
Study ID	(0020,0010)	SH	Requested Procedure ID from Worklist or User Input	VNAP	MWL/USER
Accession Number	(0008,0050)	SH	From Modality Worklist or user input	VNAP	MWL/USER
Study Description	(0008,1030)	LO	Comment text box in study list. Maximum 1024 characters.	VNAP	USER
Referenced Study Sequence	(0008,1110)	SQ	From Modality Worklist	VNAP	MWL
>Referenced SOP ClassUID	(0008,1150)	UI	From Modality Worklist	VNAP	MWL
>Referenced SOPInstance UID	(0008,1155)	UI	From Modality Worklist	VNAP	MWL

Table 8.1-5

Patient Study Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Admitting Diagnosis Description	(0008,1080)	LO	From Modality Worklist	VNAP	MWL
Patient's Age	(0010,1010)	AS	Calculated from DoB input on base of actual Date	ANAP	AUTO
Patient's Weight	(0010,1030)	DS	From Modality Worklist or user input	VNAP	MWL/ USER
Patient's Size	(0010,1020)	DS	From Modality Worklist or user input	VNAP	MWL/ USER

Table 8.1-6

General Series Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	US	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated by device	ALWAYS	AUTO
Series Number	(0020,0011)	IS	1	ALWAYS	AUTO
Series Date	(0008,0021)	DA	<yyyymmdd>	ALWAYS	AUTO
Series Time	(0008,0031)	TM	<hhmmss>	ALWAYS	AUTO
Performing Physician's Name	(0008,1050)	PN	Physician field in Study list. Maximum64characters.	VNAP	USER
Protocol Name	(0018,1030)	LO	Study Type in Patient Information	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ	Zero or 1 item will be present	ALWAYS	AUTO
>Requested Procedure ID	(0040,1001)	SH	From Modality Worklist	VNAP	MWL
>Scheduled Procedure Step Description	(0040,0007)	LO	From Modality Worklist	VNAP	MWL
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	From Modality Worklist	VNAP	MWL

Table 8.1-7

General Equipment Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	TOSHIBA_MEC_US	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	Institute Address	ALWAYS	AUTO
Institution Address	(0008,0081)	ST		ALWAYS	CONFIG
Station Name	(0008,1010)	SH	From Configuration	VNAP	CONFIG

Manufacturer's Model Name	(0008,1090)	LO	TUS-VC100 Series	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	Serial Number	ALWAYS	AUTO
Software Version	(0018,1020)	LO	V1.1 SP0000*	ALWAYS	AUTO

Table 8.1-8

General Image Module of Created US SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	"1"	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS		EMPTY	AUTO
Image Type	(0008,0008)	CS	ORIGINAL¥PRIMARY¥{B/M/D/AM/Two/UD/UDBM/BD/BM}	EMPTY	AUTO

Table 8.1-9

Image Pixel Module of Created US SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples Per Pixel	(0028,0002)	US	"3" for RGB or YBR_FULL_422 "1" for MONOCHROM2	ALWAYS	AUTO
Rows	(0028,0010)	US	US="600","512" US-MF="512"	ALWAYS	AUTO
Columns	(0028,0011)	US	US="824","700" US-MF="640"	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	US="RGB" or "MONOCHROM2"	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	"0",present only if (0028,0002) = 3	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB	The Pixel Data itself does not contain any burned-in annotation.	ALWAYS	AUTO

Table 8.1-10

US Region Calibration Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Sequence of Ultrasound Regions	(0018,6011)	SQ		ANAP	AUTO
>Region Spatial Format	(0018,6012)	US		ALWAYS	AUTO
>Region Data Type	(0018,6014)	US		ALWAYS	AUTO
>Region Flags	(0018,6016)	UL		ALWAYS	AUTO
>Region Location Min x0	(0018,6018)	UL		ALWAYS	AUTO
>Region Location Min y0	(0018,601A)	UL		ALWAYS	AUTO
>Region Location Max x1	(0018,601C)	UL		ALWAYS	AUTO
>Region Location Max y1	(0018,601E)	UL		ALWAYS	AUTO
>Reference Pixel x0	(0018,6020)	SL		ALWAYS	AUTO
>Reference Pixel y0	(0018,6022)	SL		ALWAYS	AUTO
>Physical Units X Direction	(0018,6024)	US		ALWAYS	AUTO
>Physical Units Y Direction	(0018,6026)	US		ALWAYS	AUTO
>Reference Pixel Physical Value X	(0018,6028)	FD		ALWAYS	AUTO
>Reference Pixel Physical Value Y	(0018,602A)	FD		ALWAYS	AUTO
>Physical Delta X	(0018,602C)	FD		ALWAYS	AUTO
>Physical Delta Y	(0018,602E)	FD		ALWAYS	AUTO

Table 8.1-11

VOI LUT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Window Center	(0028,1050)	DS		ANAP	AUTO
Window Width	(0028,1051)	DS		ANAP	AUTO

Table 8.1-12

SOP Common Module of Created US SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Specific Character Set	(0008,0005)	CS	ISO_IR 192	ALWAYS	AUTO
SOP ClassUID	(0008,0016)	UI	US = "1.2.840.10008.5.1.4.1.1.6.1" US-MF= "1.2.840.10008.5.1.4.1.1.3.1"	ALWAYS	AUTO
SOPInstance UID	(0008,0018)	UI	Generated by device	ALWAYS	AUTO

8.1.1.5　US Image Modules

Table 8.1-13

US Image Module of Created US Image SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples Per Pixel	(0028,0002)	US	"3" for RGB "1" for MONOCHROM2	ALWAYS	AUTO
Rows	(0028,0010)	US	US=600/512	ALWAYS	AUTO
Columns	(0028,0011)	US	US=824/700	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	US="RGB" or "MONOCHROM2"	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	"0",present only if (0028,0002) = 3	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO

8.1.1.6　US Multi-Frame Image Modules

Table 8.1-14

US Image Module of Created US Multi-Frame Image SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	"3" for YBR_FULL_422 "1" for MONOCHROM2	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	US-MF= "YBR_FULL_422" or "MONOCHROM2"	ALWAYS	AUTO
Rows	(0028,0010)	US	US-MF="512"	ALWAYS	AUTO
Columns	(0028,0011)	US	US-MF="640"	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	"0",present only if (0028,0002) = 3	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO

Table 8.1-15

Cine Module of Created US-Multi-Frame Image SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame Time	(0018,1063)	DS	Only if multi-frame.	ANAP	AUTO
Cine Rate	(0018,0040)	IS	Only if multi-frame	ANAP	AUTO

Table 8.1-16

Multi-Frame Module of Created US Multi-Frame Image SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Frames	(0028,0008)	IS	Only if multi-frame	ANAP	AUTO
Frame Increment Pointer	(0028,0009)	AT	<0018,1063>	ALWAYS	AUTO

8.1.2 Used Fields in received IOD by application

The TUS-VC100 storage application does not receive SOP Instances. The usage of attributes received via Modality Worklist is described in section 4.2.2.3.1.3.

8.1.3 Attribute mapping

The relationships between attributes received via Modality Worklist, stored in acquired images.

Table 8.1-17

ATTRIBUTE MAPPING BETWEEN MODALITY WORKLIST, IMAGE

Modality Worklist	Image IOD
Patient Name	Patient Name
Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex
Patient's Weight	Patient's Weight
Referring Physician's Name	Referring Physician's Name
----	----
Study Instance UID	Study Instance UID
Referenced Study Sequence	Referenced Study Sequence
Accession Number	Accession Number
----	Request Attributes Sequence
Requested Procedure ID	>Requested Procedure ID
Requested Procedure Description	
Scheduled Procedure Step ID	> Scheduled Procedure Step ID
Scheduled Procedure Step Description	> Scheduled Procedure Step Description
Scheduled Protocol Code Sequence	> Scheduled Protocol Code Sequence
----	Performed Protocol Code Sequence
----	Study ID
----	Performed Procedure Step ID
----	Performed Procedure Step Start Date
----	Performed Procedure Step Start Time
----	Performed Procedure Step Description
----	Comments on the Performed Procedure Step

----	----
Scheduled Performing Physician's Name	Performing Physician's Name
Requested Procedure Code Sequence	----
----	Referenced Study Component Sequence
----	>Referenced SOP Class UID
----	>Referenced SOP Class UID
----	Protocol Name

8.1.4 Coerced/Modified Fields

The Modality Worklist AE will truncate attribute values received in the response to a Modality Worklist Query if the value length is longer than the maximum length permitted by the attribute's VR.

8.2 Data Dictionary of Private Attributes

No private attributes are supported.

8.3 Coded Terminology and Templates

The Workflow AE is capable of supporting arbitrary coding schemes for Procedure and Protocol Codes. The contents of Requested Procedure Code Sequence (0032,1064) and Scheduled Protocol Code Sequence (0040,0008) supplied in Worklist Items will be mapped to Image IOD.

8.4 Grayscale Image Consistency

No Grayscale Image.

8.5 Standard Extended / Specialized / Private SOP Classes

No Specialized or Private SOP Classes are supported.

8.6 Private Transfer Syntaxes

No Private Transfer Syntaxes are supported