

**DICOM CONFORMANCE
STATEMENT
FOR
DC-3/DC-3T DIAGNOSTIC
ULTRASOUND SYSTEM**

mindray

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1. Purpose

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard by the DC-3/DC-3T ultrasound imaging system software. It is intended to provide the reader with the knowledge of how to integrate this product within a DICOM compliant hospital network. It details the DICOM Service Classes, Information Objects, and Communication Protocols which are supported by this product as follows:

Table 1 DICOM SOP CLASSES

SOP CLASSES	USER OF SERVICE (SCU)	PROVIDER OF SERVICE (SCP)
IMAGE TRANSFER (STORAGE)		
Ultrasound Image Storage	Yes	No
Ultrasound Multi-frame Image Storage	Yes	No
WORKFLOW MANAGEMENT		
Modality Worklist Information Model – Find	Yes	No
PRINT MANAGEMENT		
Basic Color Print Management	Yes	No
Basic Grayscale Print Management	Yes	No
GENERAL		
Verification	Yes	No

If the readers are unfamiliar with DICOM, it is recommended that they read the DICOM Specification (referenced below) prior to reading this conformance statement. Also note that this document is formatted according to the DICOM Specification, Part 2: Conformance.

1.1 References

ACR-NEMA Digital Imaging and Communications in Medicine, DICOM V3.0.

1.2 Definitions

- AE- An application that supports DICOM communication with other DICOM applications.
- Association Establishment - An Association Establishment is the first phase of communication between two DICOM Application Entities. The AEs use the Association Establishment to negotiate how data will be encoded and the type of data to be exchanged.
- Called Application Entity Title - The Called AE Title defines the intended receiver of an Association.
- Calling Application Entity Title - The Calling AE Title defines the requestor of an Association.
- DICOM Message Service Element (DIMSE) - A DIMSE defines the services and protocols utilized by an Application Entity to exchange messages.
- Information Object Definition (IOD) - An IOD is a data model which is an abstraction of real-world information. This data model defines the nature and attributes relevant to the class of real world objects represented.
- Service Class Provider (SCP) - A Service Class Provider plays the "server" role to perform operations and invoke notifications during an Association. An example of a Storage Service Class Provider would be an image storage device. In this case, the image storage device is storing the image that was sent by a Service Class User.
- Service Class User (SCU) - A Service Class User plays the "client" role to invoke operations and perform notifications during an Association. An example of a Storage Service Class User would be an image acquisition device. In this case, the image acquisition device will create and send a DICOM image by requesting that a Service Class Provider store that image.
- Service/Object Pair (SOP) Class - A SOP Class is defined by the union of an Information Object Definition and a set of DIMSE Services. A DICOM Application Entity may support one or more SOP Classes. Each SOP Class is uniquely identified by a SOP Class UID.
- SOP Instance - A specific occurrence of a Information Object.
- Transfer Syntax - The Transfer Syntax is a set of encoding rules that allow DICOM Application Entities to negotiate the encoding techniques (e.g., data element structure, byte ordering, compression) they are able to support. The Transfer Syntax is negotiated during Association Negotiation.

- Unique Identifier (UID) - A Unique Identifier is a globally unique, ISO compliant, ASCII-numeric string. It guarantees uniqueness across multiple countries, sites, vendors, and equipment.
- Application Profile - A Media Storage Application Profile defines a selection of choices at the various layers of the DICOM Media Storage Model which are applicable to a specific need or context in which the media interchange is intended to be performed.
- File - A File is an ordered string of zero or more bytes, where the first byte is at the beginning of the file and the last byte is at the end of the File. Files are identified by a unique File ID and may be written, read, and/or deleted.
- File Meta Information - The File Meta Information includes identifying information on the encapsulated Data Set. It is a mandatory header at the beginning of every DICOM File.
- DICOM File Format - The DICOM File Format provides a means to encapsulate in a File the Data Set representing a SOP Instance related to a DICOM Information Object.
- Physical Media - A piece of material with recording capabilities for streams of bits. Characteristics of a Physical Media include form factor, mechanical characteristics, recording properties and rules for recording and organizing bit streams in accessible structures.

1.3 Acronyms, Abbreviations, and Symbols

The following acronyms and abbreviations are used in this document. ACC
American College of Cardiology

- ACR: American College of Radiology
- ASCII: American Standard Code for Information Interchange
- AE: Application Entity
- ANSI: American National Standards Institute
- DICOM: Digital Imaging and Communications in Medicine
- DIMSE: DICOM Message Service Element
- DIMSE-C: DICOM Message Service Element-Composite
- DIMSE-N: DICOM Message Service Element-Normalized
- FSC: File-Set Creator
- FSR: File-Set Reader
- FSU: File-Set Updater
- HIS: Hospital Information System
- HL7: Health Level 7
- IE: Information Entity

- IOD: Information Object Definition
- ISO: International Standard Organization
- JIRA: Japan Industries Association of Radiological Systems
- NEMA: National Electrical Manufacturers Association
- PDU: Protocol Data Unit
- RIS: Radiology Information System
- SCP: Service Class Provider
- SCU: Service Class User
- SOP: Service Object Pair
- TCP/IP: Transmission Control Protocol/Internet Protocol
- UID: Unique Identifier

2. Implementation Model

2.1 Verification

The Verification service class defines an application level class of service which allows the service engineer to verify the ability of an application on a Remote DICOM device to respond to DICOM messages.

In the DC-3/DC-3T AE, Verification is located on the DICOM service preset dialog where the user can configure the information of remote service provider, and invoke the Verification Service to the appointed SCP. According to the response, the result of “Successful” or “Unsuccessful” is returned to the user.

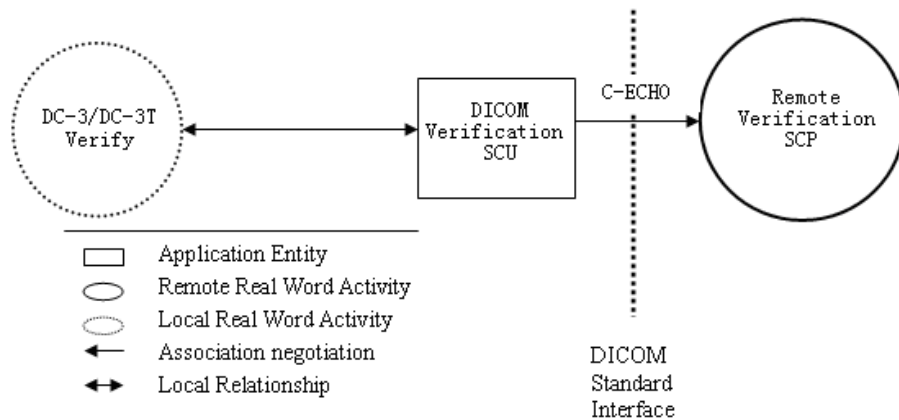


Figure 1 Verification Model

2.1.1 Sequence of Real World Activities

2.1.1.1 Features

- Service user requests to verify the activation of the Remote DICOM SCPs.
- The DC-3/DC-3T acts as the SCU for Verification.

2.1.1.2 Operation

- Operation 1
 - Step 1: Open the DICOM service preset dialog box.
 - Step 2: Select one deployed remote DICOM service (One DICOM server may provide more than one DICOM service, and the verification is aimed at the remote service).
 - Step 3: Request Verification to the selected remote service.

2.2 Storage

Storage SCU establishes an association for Storage of DICOM Composite Information Objects in the Remote Real World Activity.

2.2.1 Application Data Flow Diagram

The DC-3/DC-3T implementation acts as the SCU for the Storage service.

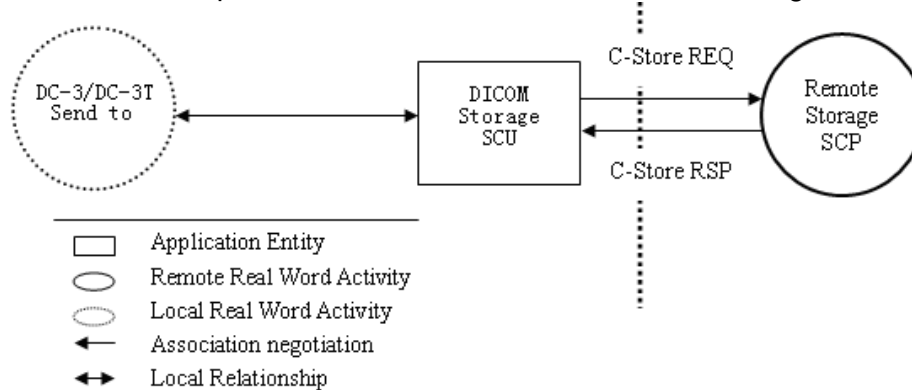


Figure 2 Storage Module

2.2.2 Functional Definitions of Application Entities

The DC-3/DC-3T is used to transmit images to a Remote DICOM device. It performs the following tasks:

- Builds DICOM US, and US Multi-frame Image Information Objects.
- Establishes DICOM association with the Remote DICOM service.
- Stores DICOM US, and US Multi-frame Information Objects on the Remote DICOM device.

2.2.3 Sequence of Real World Activities

2.2.3.1 Features

- The DC-3/DC-3T acts as the SCU for Storage Service.
- When Storage service is running, the operator can also use other services, such as print service or WORKLIST service.
- The operator can select one or more storage SCPs configured in DICOM Service Preset.
- When the operator invokes DICOM storage, regardless of how many images or whether the images are single-frame or multi-frame, the DC-3/DC-3T creates only one association for all the images.
- Storage service requests are placed in a queue and executed one by one in the background.
- The operator can cancel the image Storage job in the DICOM task

management dialog.

- When the study or image transmission fails, an error message is displayed to the user.
- The user can send the images during one examination, or save the images and send them at any time.
- The DC-3/DC-3T information model is divided to 3 levels: patient, exam (study and series are uniformed to exam) and image. The operator can invoke the storage service in any level respectively.

2.2.3.2 Operation

The operations for storage service are described below:

- Operation 1
 - Step 1: Select the images from thumbnail menu.
 - Step 2: Press “Send to” button and select DICOM Storage service.
- Operation 2
 - Step 1: End Exam/ New Patient.
 - Step 2: Automatically send the images of the last exam to the default storage service SCPs which are set to be default in the DICOM service preset dialog.
- Operation 3
 - Step 1: Open the system preset dialog and switch to the key configuration tab page.
 - Step 2: Set the shortcut key which means sending image to the default DICOM storage SCPs.
 - Step 3: During the examining, the user can press the Send key to send image to default DICOM storage service SCPs.
- Operation 4
 - Step 1: Select patients, exams or images in the iStation Dialog, press “Send to”. There are two “Send to” buttons, and the upper one is to send the selected patients/exams and the lower one is for the selected images belong to the same exam.
 - Step 2: Send all images of the selected levels.
- Operation 5
 - Step 1: Open the review dialog
 - Step 2: Select the images and press the “Send To” button to choose the storage SCPs.

Note: The operator can enable either of the Operation 2 and disable in the user preset.

2.3 Modality Worklist Management (MWL)

Patient information can be automated by using the WORKLIST service. In the patient information dialog, press the “WORKLIST” button and then the WORKLIST dialog will be shown. If the default WORKLIST SCP is set, the query request is invoked automatically. The user can set the following matching key attributes: Patient Name, Patient ID, Accession Number, Requested Procedure ID, and Exam Date. The query result is listed in the table of the WORKLIST dialog.

2.3.1 Application Data Flow Diagram

The DC-3/DC-3T implementation acts as the SCU for the MWL service.

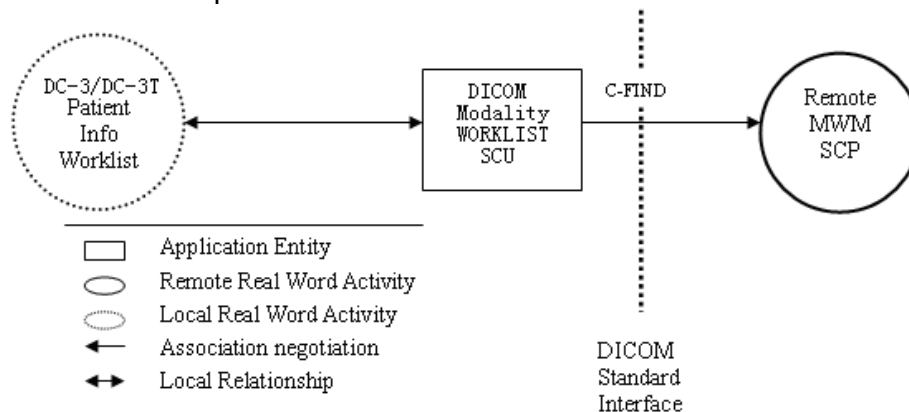


Figure 3 Modality Worklist Model

2.3.2 Functional Definitions of Application Entities

The DC-3/DC-3T is used to transmit requests for retrieval of MWL information from a Remote DICOM device. It therefore performs the following tasks:

- Establishes DICOM association with the Remote DICOM device.
- Performs query request of DICOM MWL scheduled procedures from the Remote DICOM device.
- Retrieves DICOM MWL scheduled procedures from the Remote DICOM device.

2.3.3 Sequence of Real World Activities

2.3.3.1 Features

- The DC-3/DC-3T acts as the SCU for the MWL.
- The operator requests retrieval of MWL information automatically or manually.
- Receives the list of matched patients.
- When the retrieval fails, the DC-3/DC-3T displays an error message and asks the user to attempt again or cancel the request.

- The DC-3/DC-3T closes the association upon the completion of each query.
- The DC-3/DC-3T support both of the Broad Query and Patient Specific as defined by the Integrating the Healthcare Enterprise (IHE).
- The query result from the SCP which may include many items that represent patients information will be shown all together.
- Users can view the details of the results.
- After one query, the DC-3/DC-3T will remember the result until a new query is finished. Before the new query is finished the last result will be shown on the WORKLIST dialog.

2.3.3.2 Operation

The operations for WORKLIST service are described below:

Step 1: Open the patient information dialog.

Step 2: Press the “WORKLIST” button.

Step 3: Process the WORKLIST broad query automatically if a WORKLIST SCP is set to be default in the DICOM preset.

Step 4: The WORKLIST dialog is shown and the query result is listed in a table.

Step 5: The user sets some matching key attributes, and presses “Search” button. The specific query is processed.

Step 6: The query result is listed.

2.4 Print

The images are created and stored in the DC-3/DC-3T AE. The user can print the appointed images of the exams. When requested, uncompressed single frame images will be printed to the DICOM print service SCPs. The DC-3/DC-3T can process the gray-scale and color images.

2.4.1 Application Data Flow Diagram

The DC-3/DC-3T implementation acts as the SCU for the DICOM Print service.

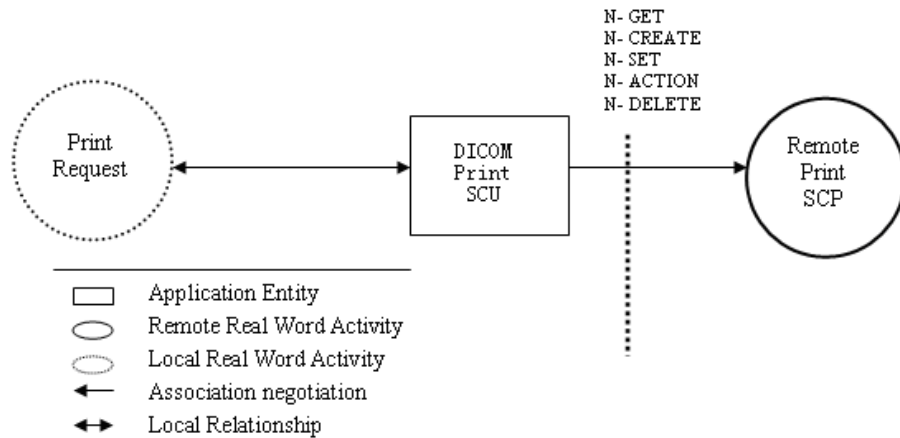


Figure 4 Print Module

2.4.2 Functional Definitions of Application Entities

The DC-3/DC-3T is able to print images on a Remote DICOM device. It performs the following tasks:

- Opens an association with the print service SCPs.
- N-GET message on the Printer SOP Class is used to obtain current printer status information.
- N-CREATE message on the Film Session SOP Class creates a Film Session.
- N-CREATE message on the Film Box SOP Class creates a Film Box linked to an appointed Film Session.
- N-SET message on the Image Box SOP Class transmits the contents of the film sheet to the SCP.
- N-ACTION message on the Film Box SOP Class instructs the SCP to execute the print job.
- N-DELETE message on the Film Box SOP Class instructs the SCP to delete the Film Box.
- Closes the association.

The following figure describes the process sequence.

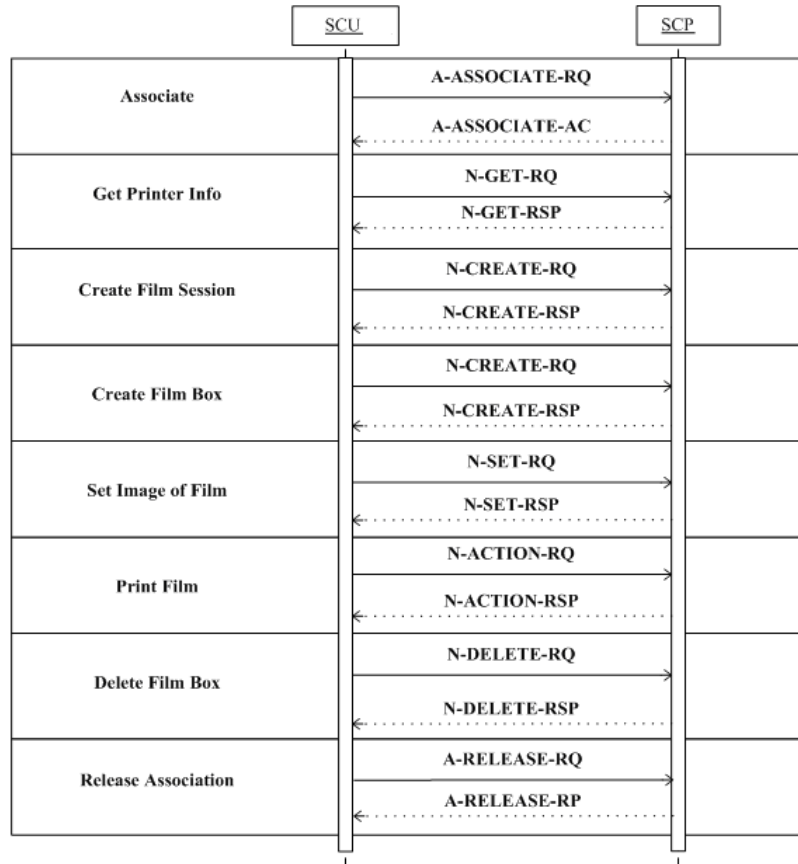


Figure 5 Process of the Print Service

2.4.3 Sequence of Real World Activities

2.4.3.1 Features

- The user specifies some print parameters in the print service preset dialog: Number of Copies, Media Type, Film Size, Photometric Interpretation, Image Display Format, Film Destination, Film Orientation, Priority, Minimum Density, Maximum Density and Configuration Information.
- The user can select one or more images once.
- The user can select one or more exams once and the images belonging to these exams will be printed. The images in a film must belong to the same exam.
- Print requests are placed on a queue, and are executed one by one in the background.
- When the print request fails, the DC-3/DC-3T displays an error message.
- The user can cancel the image print requests and retry the failed requests.
- The multi-frame images are not able to be printed.

2.4.3.2 Operation

The operations for print service are described below:

- Operation 1
 - Step 1: Select the images from thumbnail menu.
 - Step 2: Press “Send to” button and select DICOM print service.
- Operation 2
 - Step 1: End Exam/ New Patient.
 - Step 2: Automatically send the images of the last exam to the default print service SCP which is set to be default in the DICOM service preset dialog.
- Operation 3
 - Step 1: Open the system preset dialog and switch to the key configuration tab page.
 - Step 2: Set the shortcut key which means sending image to the default DICOM storage SCP.
 - Step 3: During the examining, the user can press the Send key to send image to default DICOM storage service SCP.
- Operation 4
 - Step 1: Select patients, exams or images in the iStation Dialog, press “Send to”. There are two “Send to” buttons, and the upper one is to send the selected patients/exams and the lower one is for the selected images belong to the same exam.
 - Step 2: Send all images of the selected levels.
- Operation 5
 - Step 1: Open the review dialog
 - Step 2: Select the images and press the “Send To” button to choose the storage SCPs.

Note: The operator can enable either of the Operation 2 and disable in the user preset. The default print service SCP is unique.

3. AE Specifications

3.1 Network AE Specification

The DC-3/DC-3T AE provides Standard Conformance to the following DICOM SOP Classes as an SCU:

Table 2 DICOM SOP Classes as an SCU

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Modality WORKLIST Information Model-Find	1.2.840.10008.5.1.4.31
Basic Grayscale Print Management	1.2.840.10008.5.1.1.9
Basic Color Print Management	1.2.840.10008.5.1.1.18
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Printer SOP Class	1.2.840.10008.5.1.1.16

3.1.1 Association Establishment Policies

3.1.1.1 General

The DC-3/DC-3T 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 DC-3/DC-3T system is:

- Maximum PDU Offered: 65536

3.1.1.2 Number of Associations

The DC-3/DC-3T initiates one/several Association(s) at a time, one for each transfer request being processed. Only one Storage job will be active at a time, the others remain pending until the active job is completed or failed. Only one print job will be active at a time, the others remain pending until the active job is completed or failed.

3.1.1.3 Asynchronous Nature

The DC-3/DC-3T AE (initiation/acceptance) does not support asynchronous communication (multiple outstanding transactions over a single association).

3.1.1.4 Implementation Identifying Information

The DC-3/DC-3T will specify the following Implementation Identifying Information:

Implementation Class UID:1.2.156.112536.0001.2105.0.1.0.0

Implementation Version Name: MINDRAY_V1.0

3.1.2 Association Initiation by Real World Activity

The DC-3/DC-3T AE initiates an association when the following activity is chosen by the operator:

- Verification: Verify that a Remote DICOM service is present on the network.
- Storage: Create and store a US, or US Multi-frame image to a Remote DICOM device.
- MWL: Retrieve MWL information from a Remote DICOM device.
- Print: Print images to a remote print service SCP.

3.1.2.1 Real World Activity - Verification SCU

3.1.2.1.1 Associated Real World Activity

The associated Real World Activity is a C-ECHO request initiated by the DC-3/DC-3T. If the process successfully establishes an association with a remote DICOM device, it will send the C-ECHO request via the open association to verify that the Remote DICOM device is responding to DICOM messages.

3.1.2.1.2 Proposed Presentation Contexts

The DC-3/DC-3T supports the following Presentation Contexts for Verification.

Table 3 Presentation Contexts for Verification

Proposed Presentation Contexts					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.1.2.1 SOP Specific Conformance Statement

The Application conforms to the definition of a Verification SCU in accordance with the DICOM Standard.

3.1.2.2 Real World Activity – Storage SCU

3.1.2.2.1 Associated Real World Activity

The associated Real World Activity is a C-STORE request that has been initiated. If the C-STORE response from the remote Application contains an error status, the association is aborted.

3.1.2.2.2 Proposed Presentation Contexts

The DC-3/DC-3T supports the following Presentation Contexts for Storage.

Table 4 Presentation Contexts for Storage

Proposed Presentation Contexts					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG Lossy, Baseline Sequential with Huffman Coding (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		JPEG Lossy, Baseline Sequential with Huffman Coding (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

The following table provides the list of attributes requested in the Storage. Conventions used for the Value(s) and Comments section are:

MWL – the attribute value source is Modality WORKLIST

USER – the attribute value source is from User input

AUTO – automatically generated the DC-3/DC-3T system

CONFIG - the attribute value source is a configurable parameter

Table 5 Storage IOD Attributes

Module: Patient Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0010,0010)	PN	2	Patient's Name	MWL/USER
(0010,0020)	LO	2	Patient ID	MWL/USER
(0010,0030)	DA	2	Patient's Birth Date	MWL/USER, default is set to zero length
(0010,0040)	CS	2	Patient's Sex	MWL/USER, default is set to zero length
(0010,4000)	LT	3	Patient Comments	MWL/USER, default is set to zero length, default is set to zero length
(0010,2160)	SH	3	Ethnic Group	MWL
Module: General Study Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0008,0020)	DA	2	Study Date	AUTO
(0008,0030)	TM	2	Study Time	AUTO
(0008,0050)	SH	2	Accession Number	MWL/USER, default is set to zero length
(0008,0090)	PN	2	Referring Physician's Name	MWL/USER, default is set to zero length
(0008,1030)	LO	3	Study Description	MWL/USER, default is set to zero length
(0020,000D)	UI	1	Study Instance UID	MWL/AUTO
(0020,0010)	SH	2	Study ID	AUTO
Module: Patient Study Module (U)				
(0010,1010)	AS	3	Patient's Age	MWL/USER, default is set to zero length If the user set Patient Birth Date, it will be calculated automatically.
(0010,1020)	DS	3	Patient's Size	MWL/USER, default is set to zero length
(0010,1030)	DS	3	Patient's Weight	MWL/USER, default is set to zero length
Module: General Series Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0008,0060)	CS	1	Modality	"US"
(0008,0021)	DA	3	Series Date	AUTO - set to Study Date

(0008,0031)	TM	3	Series Time	AUTO - set to Study Time
(0008,1070)	PN	3	Operators' Name	MWL/USER, default is set to zero length
(0018,5100)	CS	2C	Patient Position	Set to zero length
(0020,000E)	UI	1	Series Instance UID	AUTO
(0020,0011)	IS	2	Series Number	AUTO
(0020,0060)	CS	2C	Laterality	Set to zero length
Module: General Equipment Module (O)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0008,0070)	LO	2	Manufacturer	MINDRAY
(0008,0080)	LO	3	Institution Name	CONFIG
(0008,1010)	SH	3	Station Name	CONFIG
(0008,1040)	LO	3	Institutional Department Name	CONFIG
(0008,1090)	LO	3	Manufacturer's Model Name	DC-3
(0018,1020)	LO	3	Software Version(s)	AUTO
(0018,1000)	LO	3	Device Serial Number	The Ethernet card Mac Address
Module: General Image Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0008,0023)	DA	2C	Content Date	AUTO
(0008,0033)	TM	2C	Content Time	AUTO
(0020,0013)	IS	2	Instance Number	AUTO
(0020,0020)	CS	2C	Patient Orientation	Set to zero length
Module: US Image Module (M)				
(0008,0008)	CS	3	Image Type	ORIGINAL/PRIMARY
(0028,0002)	US	1	Samples per Pixel	1 or 3
(0028,0004)	CS	1	Photometric Interpretation	RGB, for color images; MONOCHROME2, if the image is grayscale;

				YBR_FULL, if the image is sent using JPEG.
(0028,0100)	US	1	Bits Allocated	0x0008
(0028,0101)	US	1	Bits Stored	0x0008
(0028,0102)	US	1	High Bit	0x0007
(0028,0103)	US	1	Pixel Representation	0x0000
(0028,0006)	US	1C	Planar Configuration	0x0000=0
(0028,2110)	CS	3	Lossy Image Compression	Not used if image is uncompressed; Only support JPEG baseline process1 and set it to "01"
Module: Image Pixel Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0028,0010)	US	1	Rows	600
(0028,0011)	US	1	Columns	800
(7FE0,0010)	OW	1	Pixel Data	
Module: SOP Common Module (M)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0008,0005)	CS	1C	Specific Character Set	ISO_IR 100
(0008,0016)	UI	1C	SOP Class UID	1.2.840.10008.5.1.4.1.1.6.1 or 1.2.840.10008.5.1.4.1.1.3.1
(0008,0018)	UI	1C	SOP Instance UID	AUTO
(0008,0012)	DA	3	Instance Creation Date	AUTO
(0008,0013)	TM	3	Instance Creation Time	AUTO
Module: US Region Calibration Module (U)				
Attribute	VR	Type	Attribute Name	Value(s) and Comments
(0018,6011)	SQ	1	Sequence of Ultrasound Regions	
> (0018,6012)	US	1	Region Spatial Format	Set by the system
> (0018,6014)	US	1	Region Data Type	Set by the system
>	UL	1	Region Flags	Set by the system

(0018,6016)				
> (0018,6018)	UL	1	Region Location Min x0	Set by the system
> (0018,601A)	UL	1	Region Location Min Y0	Set by the system
> (0018,601C)	UL	1	Region Location Max X1	Set by the system
> (0018,601E)	UL	1	Region Location Max Y1	Set by the system
> (0018,6024)	US	1	Physical Units X Direction	Set by the system
> (0018,6026)	US	1	Physical Units Y Direction	Set by the system
> (0018,602C)	FD	1	Physical Delta X	Set by the system
> (0018,602E)	FD	1	Physical Delta Y	Set by the system
Module: Cine Module (M) Used for US Multi-Frame Images Only				
(0018,1063)	DS	1C	Frame Time	AUTO
Module: Multi-Frame Module (M) Used for US Multi-Frame Images Only				
(0028,0008)	IS	1	Number of Frames	AUTO
(0028,0009)	AT	1	Frame Increment Pointer	0018 1063 = Frame Time

3.1.2.2.1 SOP Specific Conformance Statement

The Application conforms to the definition of a Storage SCU in accordance with the DICOM Standard.

3.1.2.2.3 Error Handling

The following table indicates the possible response status codes, which a SCP may return the following the SCU's C-STORE-RSP command.

A successful C-STORE operation will allow the AE to continue to the next action desired by the user. If received any of the refused, error status, the DC-3/DC-3T (SCU) will give up the next action and abort the association. The DC-3/DC-3T will continue when received a Warning Status.

The user can press "Retry" in the DICOM task management dialog to restart

the failed service.

Table 6 C-Store Status Response

Service Status	Further Meaning	Protocol Codes
Refused	Out of resources.	A7xx
Error	Data set does not match SOP Class	A9xx
	Cannot understand	Cxxx
Warning	Coercion of Data Elements	B000
	Data Set does not match SOP Class	B007
	Elements Discarded	B006
Success		0000

3.1.2.3 Real World Activity – MWL SCU

3.1.2.3.1 Associated Real World Activity

The DC-3/DC-3T will issue a C-FIND request in order to retrieve information concerning a Remote DICOM device.

3.1.2.3.2 Proposed Presentation Contexts

The DC-3/DC-3T supports the following Presentation Contexts for MWL.

Table 7 Presentation Contexts for MWL

Proposed Presentation Contexts					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model Find	1.2.840.1000 8.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

Following are the types of matching that can be requested by the implementation:

- Single Value Matching.
- Wild Card Matching.
- Range of date.

The following table provides the list of attributes requested in the Modality Worklist Query and the convention used for Matching Keys is:

S - Single Value Matching

* - Wild Carded Matching

DA – Date Range Matching

X - Return keys. An " X " indicates that DC-3/DC-3T supplies this attribute as a Return Key with zero length for Universal Matching.

DI – Display to the user

Table 8 Modality Worklist Data element

Module: Patient Identification Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0010,0010)	PN	Patient's Name	S, *	X (DI)
(0010,0020)	LO	Patient ID	S	X(DI)
(0010,1000)	LO	Other Patient IDs		X (DI)
Module: Patient Demographic Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0010,0030)	DA	Patient's Birth Date		X(DI)
(0010,0040)	CS	Patient's Sex		X(DI)
(0010,1020)	DS	Patient's Size		X (DI)
(0010,1030)	DS	Patient's Weight		X (DI)
(0010,4000)	LT	Patient Comments		X (DI)
(0010,2160)	SH	Ethnic Group		X (DI)
Module: Patient Medical Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0010,2000)	LO	Medical Alerts		X
(0010,2110)	LO	Contrast Allergies		X
(0010,21C0)	US	Pregnancy Status		X
(0010,21B0)	US	Additional Patient's History		X
(0010,21D0)	DA	Last Menstrual Date		X (DI)
Module: Visit Relationship Module (M)				

Attribute	VR	Attribute Name	Matching keys	Return keys
(0008,1120)	SQ	Referenced Patient Sequence		X
Module: Visit Identification Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0038,0010)	LO	Admission ID		X
Module: Visit Status Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0038,0300)	LO	Current Patient Location		X
Module: Visit Admission Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0008,1080)	LO	Admitting Diagnosis Description		X
Module: Scheduled Procedure Step Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0040,0100)	SQ	Scheduled Procedure Step Sequence		X
>(0008,0060)	CS	Modality	US	
>(0032,1070)	LO	Requested Contrast Agent		X
>(0040,0001)	AE	Scheduled Station AE Title	configurable and the default set to your AE title	X (DI)
>(0040,0002)	DA	Scheduled Procedure Step Start Date	configurable and the default set to today's date	X(DI)
>(0040,0003)	TM	Scheduled Procedure Step Start Time		X (DI)
>(0040,0004)	DA	Scheduled Procedure Step End Date		X

>(0040,0005)	TM	Scheduled Procedure Step End Time		X
>(0040,0006)	PN	Scheduled Performing Physician's Name		X (DI)
>(0040,0007)	LO	Scheduled Procedure Step Description		X(DI)
>(0040,0008)	SQ	Scheduled Protocol Code Sequence		X (DI)
> >(0008,0100)	SH	Code Value		X (DI)
> >(0008,0102)	SH	Coding Scheme Designator		X (DI)
> >(0008,0103)	SH	Coding Scheme Version		X (DI)
> >(0008,0104)	LO	Code Meaning		X (DI)
>(0040,0009)	SH	Scheduled Procedure Step ID		X (DI)
>(0040,0010)	SH	Scheduled Station Name		X
>(0040,0011)	SH	Scheduled Procedure Step Location		X
>(0040,0012)	LO	Pre-Medication		X
> (0040,0020)	CS	Scheduled Procedure Step Status		X
> (0040,0400)	LT	Comments on the Scheduled Procedure Step		X
Module: Requested Procedure Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0008,1110)	SQ	Referenced Study		X

		Sequence		
> (0008,1150)	UI	Referenced SOP Class UID		X
> (0008,1155)	UI	Referenced SOP Instance UID		X
(0020,000D)	UI	Study Instance UID		X (DI)
(0032,1060)	LO	Requested Procedure Description		X (DI)
(0032,1064)	SQ	Requested Procedure Code Sequence		X (DI)
> (0008,0100)	SH	Code Value		X (DI)
> (0008,0102)	SH	Coding Scheme Designator		X (DI)
>(0008,0103)	SH	Coding Scheme Version		X (DI)
>(0008,0104)	LO	Code Meaning		X (DI)
(0040,1001)	SH	Requested Procedure ID	S	X (DI)
(0040,1010)	PN	Names of Intended Recipients of Results		X
(0040,1400)	LT	Requested Procedure Comments		X
Module: Imaging Service Request Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0008,0050)	SH	Accession Number	S	X(DI)
(0008,0090)	PN	Referring Physician's Name		X (DI)
(0032,1032)	PN	Requesting Physician		X (DI)

(0032,1033)	LO	Requesting Service		X
(0040,2400)	LT	Imaging Service Request Comments		X
Module: SOP Common Module (M)				
Attribute	VR	Attribute Name	Matching keys	Return keys
(0008,0005)	CS	Specific Character Set		X
Module: Additional Attributes Module (M)				
(0008,0032)	TM	Acquisition Time		X

3.1.2.3.2.1 SOP Specific Conformance Statement

The Application conforms to the definition of an MWL SCU in accordance with the DICOM Standard.

3.1.2.3.3 Error Handling

The following table indicates the possible response status codes, which a SCP may return following the SCU's C-FIND-RSP command.

Table 9 C-FIND Status Response

Service Status	Further Meaning	Protocol Codes
Refused	Out of resources	A700
Failed	Identifier Does Not Match SOP Class	A900
	Unable to process	Cxxx
Cancel	Matching terminated due to Cancel request	FE00
Success	Matching is complete - No final Identifier is supplied.	0000
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence for this Identifier.	FF01

3.1.2.4 Real World Activity - Print

3.1.2.4.1 Associated Real World Activities

Individual images or entire exams can be printed to the selected DICOM print device. An association is established for a film sheet. The association is closed when the print job is finished. If any response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related print job is switched to a failed state. It can be restarted at any time by the user. Only one job will be active at a time for each separate DICOM print service.

3.1.2.4.2 Proposed Presentation Contexts

The DC-3/DC-3T supports the following Presentation Contexts for print.

Table 10 Presentation Contexts for print

Proposed Presentation Contexts					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Grayscale Print Management Meta	1.2.840.1008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta	1.2.840.1008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.4.2.1 SOP Specific Conformance to Basic Grayscale Print Management Meta SOP Class

The DC-3/DC-3T provides standard conformance of the Grayscale Meta SOP classes as an SCU.

Table 11 SOP CLASSES FOR PRINT AE

SOP Class Name	SOP Class UID	Conformance Level
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard

3.1.2.4.2.1.1 SOP Specific Conformance to Basic Film Session SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Film Session SOP Class:

Table 12 Basic Film Session DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Used
N-Set	U	Not used

DIMSE Operations	SCU Usage	Description
N-Delete	U	Not used
N-Action	U	Not used

Table 13 FILM SESSION SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Number of Copies	(2000,0010)	U	[1, 100]
Print Priority	(2000,0020)	U	LOW, MED, HIGH
Medium Type	(2000,0030)	U	PAPER, BLUE FILM, CLEAR FILM
Film Destination	(2000,0040)	U	MAGAZINE, PROCESSOR

3.1.2.4.2.1.2 SOP Specific Conformance to Basic Film Box SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Film Box SOP Class

Table 14 Basic Film Box DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Used
N-Action	M	Used
N-Delete	U	Used
N-Set	U	Not used

Table 15 FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Image Display Format	(2010,0010)	M	STANDARD\1,1 STANDARD\2,2 STANDARD\2,3 STANDARD\3,3 STANDARD\3,4 STANDARD\3,5 STANDARD\4,4 STANDARD\4,5 STANDARD\5,6
Referenced Film Session Sequence	(2010,0500)	M	Used
>Referenced SOP Class UID	(0008,1150)	M	Used
>Referenced SOP Instance UID	(0008,1155)	M	Used
Film Orientation	(2010,0040)	U	PORTRAIT, LANDSCAPE

Attribute Name	Tag	SCU Usage	Description
Film Size ID	(2010,0050)	U	8INX10IN 8_5INX11IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM A4 A3
Magnification Type	(2010,0060)	U	NONE
Max Density	(2010,0130)	U	Configurable,[0, 65535]
Min Density	(2010,0120)	U	Configurable,[0, 65535]
Configuration Information	(2010,0150)	U	Number of chars: [0, 1024]

3.1.2.4.2.1.3 SOP Specific Conformance to Basic Image Box SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Image Box SOP Class

Table 16 Basic Image Box DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Not Used
N-Action	M	Not Used
N-Delete	U	Not Used
N-Set	U	Used

Table 17 Image BOX SOP CLASS N-SET REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Magnification Type	(2010,0060)	U	NONE
Max Density	(2010,0130)	U	Configurable
Min Density	(2010,0120)	U	Configurable

3.1.2.4.2.1.4 SOP Specific Conformance to Printer SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Printer SOP Class.

Table 18 Printer SOP DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Get	M	Used

Table 19 Printer SOP CLASS N-GET REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Manufacturer	(0008,0070)	U	Used
Manufacturer's Model Name	(0008,1090)	U	Used
Device Serial Number	(0018,1000)	U	Used
Software Version(s)	(0018,1020)	U	Used
Date of Last Calibration	(0018,1200)	U	Used
Time of Last Calibration	(0018,1201)	U	Used
Printer Status	(2110,0010)	U	Used
Printer Status Info	(2110,0020)	U	Used
Printer Name	(2110,0030)	U	Used

3.1.2.4.2.2 SOP Specific Conformance to Basic Color Print Management Meta SOP Class

The DC-3/DC-3T provides standard conformance of the color Meta SOP classes as an SCU.

Table 20 SOP CLASSES FOR PRINT AE

SOP Class Name	SOP Class UID	Conformance Level
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic color Image Box SOP Class	1.2.840.10008.5.1.1.4	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard

3.1.2.4.2.2.1 SOP Specific Conformance to Basic Film Session SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Film Session SOP Class:

Table 21 Basic Film Session DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Used
N-Set	U	Not used
N-Delete	U	Not used
N-Action	U	Not used

Table 22 FILM SESSION SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Number of Copies	(2000,0010)	U	[1, 100]

Attribute Name	Tag	SCU Usage	Description
Print Priority	(2000,0020)	U	LOW, MED, HIGH
Medium Type	(2000,0030)	U	PAPER, BLUE FILM, CLEAR FILM
Film Destination	(2000,0040)	U	MAGAZINE, PROCESSOR

3.1.2.4.2.2 SOP Specific Conformance to Basic Film Box SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Film Box SOP Class

Table 23 Basic Film Box DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Used
N-Action	M	Used
N-Delete	U	Used
N-Set	U	Not used

Table 24 FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Image Display Format	(2010,0010)	M	STANDARD\1,1 STANDARD\2,2 STANDARD\2,3 STANDARD\3,3 STANDARD\3,4 STANDARD\3,5 STANDARD\4,4 STANDARD\4,5 STANDARD\5,6
Referenced Film Session Sequence	(2010,0500)	M	Used
>Referenced SOP Class UID	(0008,1150)	M	Used
>Referenced SOP Instance UID	(0008,1155)	M	Used
Film Orientation	(2010,0040)	U	PORTRAIT, LANDSCAPE

Attribute Name	Tag	SCU Usage	Description
Film Size ID	(2010,0050)	U	8INX10IN 8_5INX11IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM A4 A3
Magnification Type	(2010,0060)	U	NONE
Max Density	(2010,0130)	U	Configurable,[0, 65535]
Min Density	(2010,0120)	U	Configurable,[0, 65535]
Configuration Information	(2010,0150)	U	Number of chars: [0, 1024]

3.1.2.4.2.2.3 SOP Specific Conformance to Basic Image Box SOP Class

The DC-3/DC-3T supports the following DIMSE operations for the Image Box SOP Class

Table 25 Basic Image Box DIMSE operations

DIMSE Operations	SCU Usage	Description
N-Create	M	Not Used
N-Action	M	Not Used
N-Delete	U	Not Used
N-Set	U	Used

Table 26 Image BOX SOP CLASS N-SET REQUEST ATTRIBUTES

Attribute Name	Tag	SCU Usage	Description
Magnification Type	(2010,0060)	U	NONE
Max Density	(2010,0130)	U	Configurable
Min Density	(2010,0120)	U	Configurable

3.1.2.4.2.3 Error Handling

The following table indicates the possible response status codes, which a SCP may return following the SCU's response command. If received any of the refused, error status, the DC-3/DC-3T (SCU) will give up the next action and abort the association. The DC-3/DC-3T will continue when receives a Warning Status.

The user can press "Retry" in the DICOM task management dialog to restart the failed print job.

Table 27 Supported Error Codes for Print Classes

Service Status	Further Meaning	Protocol Codes
Success	Printing successful	0000
Warning	All	B60x
Failed	Printing not successful	C60x

4. Communications Profiles

4.1 Supported Communication Stacks

This system provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 OSI Stack

Not applicable to this product.

4.3 TCP/IP Stack

TCP/IP networking protocol is used, with static IP addressing. The TCP/IP stack is inherited from the product's operating system.

4.3.1 Physical Media Support

10BaseT and 100BaseT are supported.

4.4 Point to Point Stack

Not applicable to this product.

5. Extensions/Specialization/Privatization

5.1 Standard Extended / Specialized / Private SOPs

None.

5.2 Private Transfer Syntaxes

None.

6. Configuration

The Configuration Utility allows the service engineer to set and maintain configuration parameters of local and remote DICOM application entities.

6.1. AE Title/Presentation Address Mapping

This mapping (including IP and port numbers) is defined during the system Network Configuration procedure.

6.2. Configurable Parameters

- Calling AE Titles
- Called AE Titles
- Disable arbitrary Transfer Syntaxes to be proposed at the Association negotiation
- Disable generation of Icon Image sequence
- Disable generation of DICOM overlays (“burn-in” instead)

Local:

- Station name
- Station Location
- IP address
- Subnet Mask
- Gateway
- AE Title
- PORT
- Maximum PDU size.

Remote Server:

- Device Name
- IP address

Remote Storage Service SCP:

- The Service name, AE Title and port
- Timeout
- Max retries, Retry interval, Allow multi-frame, Use Implicit transfer

- Syntax only (In this version, these four parameters are not usable.)
- Compressed or Uncompressed

Remote Modality WORKLIST Service SCP:

- The Service name, AE Title and port
- Timeout
- Max retries, Retry interval (In this version, these two parameters are not usable.)
- Scheduled Station AE Title

Remote Print Service SCP:

- The Service name, AE Title and port
- Timeout
- Max retries, Retry interval (In this version, these two parameters are not usable.)
- Media Type: PAPER,CLEAR FILM,BLUE FILM
- Film Size:
 - 8INX10IN
 - 8_5INX11IN
 - 10INX12IN
 - 10INX14IN
 - 11INX14IN
 - 11INX17IN
 - 14INX14IN
 - 14INX17IN
 - 24CMX24CM
 - 24CMX30CM
 - A4
 - A3
- Settings: RGB, MONOCHROME2
- Display Format:
 - STANDARD\1,1
 - STANDARD\2,2
 - STANDARD\2,3
 - STANDARD\3,3
 - STANDARD\3,4
 - STANDARD\3,5
 - STANDARD\4,4
 - STANDARD\4,5
 - STANDARD\5,6
- Destination: MAGAZINE, PROCESSOR
- Number of Copies
- Film Orientation: LANDSCAPE,PORTRAIT
- Max Density

- Min Density
- Priority: HIGH,MED,LOW
- Configuration Info

6.3. Un-Configurable Parameters

The DC-3/DC-3T supports the standard Value Representation for the Date format – yyyyymmdd, it does not support the format yyyy.mm.dd

7. Support of Extended Character Sets

This Product supports the following character sets:

- ISO-IR 100(Latin alphabet No.1) Supplementary set of ISO 8859.

