TOSHIBA

DICOM
CONFORMANCE STATEMENT
FOR
MODEL REP-7000IT
(MIIMS0016EA)

TOSHIBA MEDICAL SYSTEMS CORPORATION

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1 CONFORMANCE STATEMENT OVERVIEW

The REP-7000IT is a self-contained networked computer system used for archiving diagnostic medical images. It allows external systems to send images to it for permanent storage. The system conforms to the DICOM standard to allow the sharing of medical information with other digital imaging systems.

Table1-1
SUPPORTED NETWORKING DICOM SERVICE (SOP) CLASSES

SOP Classes	Initiator of Service (SCU)	Provider of Service (SCP)
Verification		
Verification	Yes	Yes
Image Transfer		
CR Image Storage	Yes	Yes
CT Image Storage	Yes	Yes
US Multi-frame Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
US Image Storage	Yes	Yes
SC Image Storage	Yes	Yes
XA Image Storage	Yes	Yes
RF Image Storage	Yes	Yes
NM Image Storage	Yes	Yes
PET Image Storage	Yes	Yes
Digital X-Ray Image Storage - For Presentation	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes
VL Photographic Image Storage	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	Yes	Yes

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3 INTRODUCTION

3.1 AUDIENCE

This document is intended for hospital staff, health system integrators, software designers, service staff, and implementers. It is assumed that the reader has a working understanding of DICOM.

3.2 REMARKS

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of the intended information.

The scope of this Conformance Statement is to facilitate communication between the REP-7000IT and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself, this Conformance Statement does not guarantee the desired interoperability and successful interconnectivity.

The user should be aware of the following important issues:

— Comparison of the different conformance statements is the first step towards assessing the interconnectivity between the REP-7000IT and other equipment.
— Test procedures should be defined to validate the desired level of connectivity.
— The DICOM standard is evolving to meet the future requirements of users. Toshiba Medical Systems Corporation is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue them.

3.3 DEFINITIONS, TERMS, AND ABBREVIATIONS

AE	Application Entity
CR	Computed Radiography
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IE	Information Entity
IOD	Information Object Definition
ISO	International Standards Organization
MR	Magnetic Resonance
NM	Nuclear Medicine
PDU	Protocol Data Unit
PET	Positron Emission Tomography
RF	X-Ray Radiofluoroscopy
SC	Secondary Capture
SCP	Service Class Provider

SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
US	Ultrasound
VM	Value Multiplicity
VR	Value Representation
XA	X-Ray Angiography

3.4 REFERENCES

[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2004

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

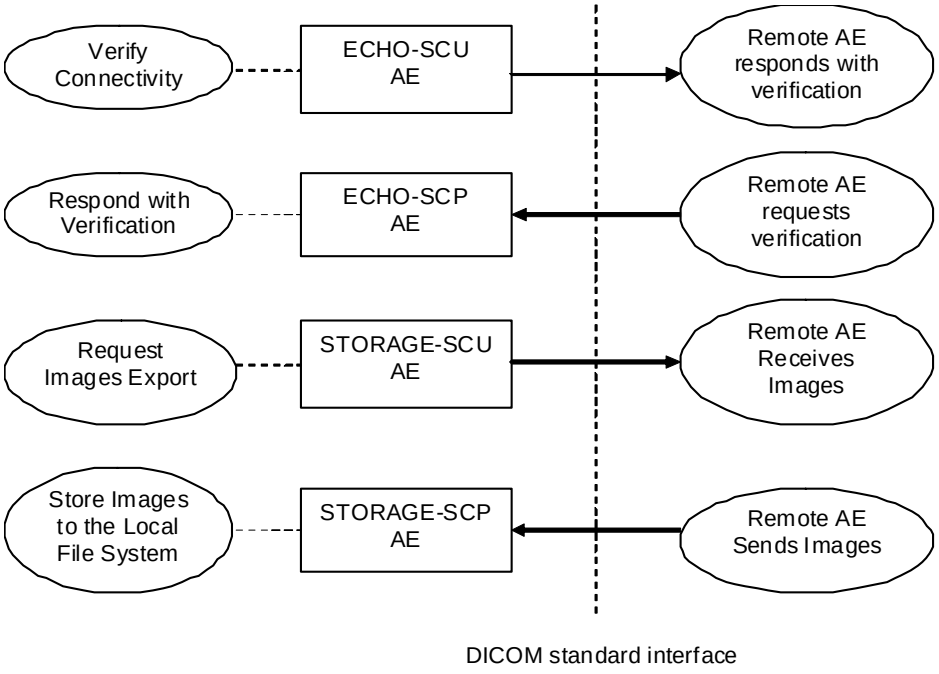

Figure 4.1-1
REP-7000IT DICOM DATA FLOW DIAGRAM

All application entities detailed in the application data flow diagram are Windows Server 2003 applications.

- The ECHO-SCU AE can send verification requests to the specified DICOM destination.
- The ECHO-SCP AE receives associations from Remote AE for verification, and automatically responds based on the success status.
- The STORAGE-SCU AE can send Composite SOP Instances. It sends DICOM images to the specified DICOM destination.
- The STORAGE-SCP AE can receive incoming DICOM images and can add them to the REP-7000IT database. It can respond to external C-STORE archive requests as a Service Class Provider (SCP). The STORAGE-SCP AE currently only supports image type Composite SOP instances.

4.1.2 Function Definitions of AEs

4.1.2.1 Functional Definition of STORAGE-SCU Application Entity

The manual operations activate the STORAGE-SCU AE. An Association request is sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer is started.

4.1.2.2 Functional Definition of STORAGE-SCP Application Entity

The STORAGE-SCP AE waits for other applications to connect to the presentation address set for the application entity title. When an application connects, the STORAGE-SCP AE expects the application to be a DICOM application. The STORAGE-SCP AE accepts associations with Presentation Contents for Storage SOP Class. Any images received with this presentation context are added to the database.

4.1.3 Real World Operation Sequencing

There are no special restrictions on sequencing between application entities in the REP-7000IT.

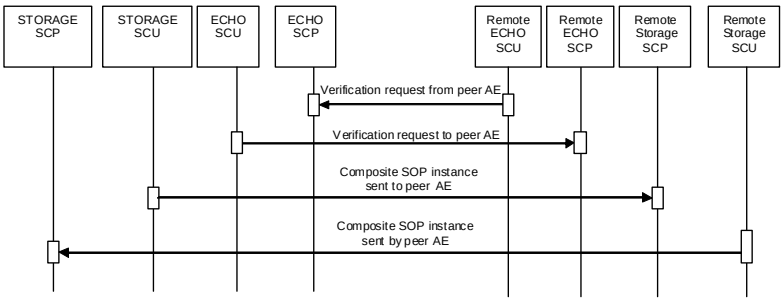

Figure 4.1-2
SEQUENCING CONSTRAINTS

4.2 AE SPECIFICATIONS

4.2.1 STORAGE-SCU Application Entity Specification

4.2.1.1 SOP Classes

The STORAGE-SCU AE provides Standard Conformance to the following DICOM SOP classes:

Table 4.2-1
SOP CLASSES FOR STORAGE-SCU AE

SOP Class	SOP Class UID	SCU	SCP
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	Yes	No
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	No
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Yes	No
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	No
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	No
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Yes	No
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Yes	No
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Yes	No
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.4	Yes	No
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.13	Yes	No

4.2.1.2 Association Establishment Policies

4.2.1.2.1 General

The STORAGE-SCU AE can form associations via user control. The STORAGE-SCU AE can only request the starting of an association. It cannot accept association start requests from external application entities.

The DICOM Standard Application Context Name for DICOM is always proposed.

Table 4.2-2
DICOM APPLICATION CONTEXTS FOR STORAGE-SCU AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The maximum number of simultaneous Associations cannot be changed.

Table 4.2-3
NUMBERS OF ASSOCIATIONS AS A SCU FOR STORAGE-SCU AE

Maximum Number of Simultaneous Associations	1

4.2.1.2.3 Asynchronous Nature

The STORAGE-SCU AE does not support asynchronous communications (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before new operation can be initiated.

Table 4.2-4
ASYNCHRONOUS NATURE AS A SCU FOR STORAGE-SCU AE

Maximum Number of outstanding Asynchronous Transactions	1

4.2.1.2.4 Implementation Identifying Information

Table 4.2-5
DICOM IMPLEMENTATION CLASS AND VERSION FOR STORAGE-SCU AE

Implementation Class UID	1.2.392.200036.9116.7.23.10
Implementation Version Name	TM_OT_TFS7K_1.0

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity - Send Images

4.2.1.3.1.1 Destination and Sequencing of Activity

When the STORAGE-SCU AE is started in order to transmit an image, the STORAGE-SCU AE initiates a new association. The association request is sent to the specified AE, and when the requested presentation context negotiation has been completed, image transmission starts. Transmission of all specified images with one association can be attempted, but is not always possible. When all images are sent, the association is terminated. If there are errors during transmission for an association, image transmission will be halted. The STORAGE-SCU AE does not automatically reattempt image transmission. Note that the STORAGE-SCU AE uses the DICOM storage service class, and does not support sending of unrequested SOP instances.

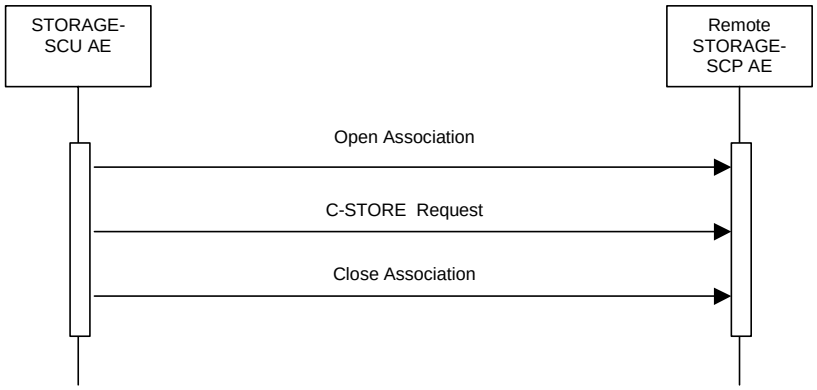

Figure. 4.2-1
SEQUENCING OF ACTIVITY – SEND IMAGES

The following sequencing restrictions, illustrated in figure 4.2-1, apply to the STORAGE-SCU AE:

1. The STORAGE-SCU AE opens a new Association with the specified destination AE.
2. The STORAGE-SCU AE sends the indicated Composite SOP instances.
3. The STORAGE-SCU AE closes the Association.

4.2.1.3.1.2 Proposed Presentation Contexts

The STORAGE-SCU AE is capable of proposing the Presentation Contexts shown in the following table:

Table 4.2-6
PROPOSED PRESENTATION CONTEXTS BY STORAGE-SCU AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
XA Image	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**			
Storage		Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70		
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**			
		JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70		
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.13	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None

Note: The chart above shows the default actions of The STORAGE-SCU AE submitted SOP classes and transfer syntax. The STORAGE-SCU AE can be configured to submit context subsets and additional presentation contexts.

4.2.1.3.1.3 SOP Specific Conformance for Storage SOP Classes

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

Table 4.2-7
STORAGE-SCU AE C-STORE RESPONSE HANDLING BEHAVIOR

Service Status	Detailed Meaning	Error Code	Action
Success	Success	0000	Success indication message is output to the Service Logs. No message is posted to the User Interface.
Error	Failure	Status codes other than the above	Several retries are performed, but if errors continue to be detected, it is considered as a permanent failure. The association is terminated when the error occurs. A failure message is output to the Service Log. No messages are sent to the user interface.

4.2.1.4 Association Acceptance Policy

The STORAGE-SCU AE does not accept associations.

4.2.2 ECHO-SCU Application Entity Specifications

4.2.2.1 SOP Class

The ECHO-SCU AE provides Standard Conformance to the following DICOM SOP classes:

Table 4.2-8
SOP CLASSES FOR ECHO-SCU AE

SOP Class	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	No

4.2.2.2 Association Establishment Policies

4.2.2.2.1 General

The ECHO-SCU AE can form associations via user control. The ECHO-SCU AE can only request the starting of an association. It cannot accept association start requests from external application entities. The DICOM Standard Application Context Names for DICOM is always accepted.

Table 4.2-9
DICOM APPLICATION CONTEXTS FOR ECHO-SCU AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations

The maximum number of simultaneous associations cannot be changed.

Table 4.2-10
NUMBERS OF ASSOCIATIONS AS A SCU FOR ECHO-SCU AE

Maximum Number of Simultaneous Associations	1

4.2.2.2.3 Asynchronous Nature

The ECHO -SCU AE does not support asynchronous communication (multiple incomplete transactions on a single association). All association requests must be completed and confirmed before new actions can be performed.

Table 4.2-11
ASYNCHRONOUS NATURE AS A SCU FOR ECHO-SCU AE

Maximum Number of Outstanding Asynchronous Transactions	1

4.2.2.2.4 Implementation Identification Information

Table 4.2-12
DICOM IMPLEMENTATION CLASS AND VERSION FOR ECHO-SCU AE

Implementation Class UID	1.2.392.200036.9116.7.23.10
Implementation Version Name	TM_OT_TFS7K_1.0

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity - Verify Connectivity

4.2.2.3.1.1 Destination and Sequencing of Activity

The ECHO-SCU AE initiates association through user control.

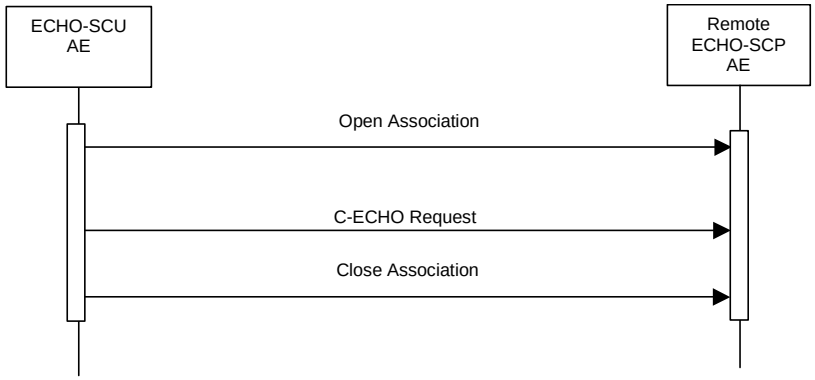

Figure. 4.2-2
SEQUENCING OF ACTIVITY – ECHO

The following sequencing restrictions, illustrated in figure 4.2-2, apply when the ECHO-SCU AE:

1. The ECHO-SCU AE opens a new association with the specified destination AE.
2. The ECHO -SCU AE sends C-ECHO requests.
3. The ECHO -SCU AE closes the Association.

4.2.2.3.1.2 Proposed Presentation Context

The ECHO-SCU AE is capable of proposing the Presentation Contexts shown in the following table:

Table 4.2-13
PROPOSED PRESENTATION CONTEXTS BY THE ECHO-SCU AE

Presentation Context Table					
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

4.2.2.3.1.3 SOP Specific Conformance for Verification SOP Class

The REP-7000IT monitors the status, and service log files can be used to diagnose problems that may occur. If an error occurs in DICOM transmission, an appropriate message will be entered into the service log.
The ECHO-SCU AE performs the following actions based on the status code values in the C-ECHO responses from the destination C-ECHO SCP:

Table 4.2-14
ECHO-SCU AE C-ECHO RESPONSE STATUS ACTIONS

Service Status	Detailed Meaning	Error Code	Action
Success	Success	0000	No message is posted to the User Interface.
Error	Failure	Status codes other than the above	Several retries are performed, it is considered as a permanent failure. The association is terminated when the error occurs. A failure message is output to the Service Log. No messages are sent to the user interface.

4.2.2.4 Association Acceptance Policy

The ECHO-SCU AE does not accept associations.

4.2.3 STORAGE-SCP Application Entity Specifications

4.2.3.1 SOP Classes

The STORAGE-SCP AE provides Standard Comformance to the following DICOM SOP classes:

Table 4.2-15
SOP CLASSES FOR STORAGE-SCP AE

SOP Class	SOP Class UID	SCU	SCP
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.4	No	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.13	No	Yes

4.2.3.2 Association Establishment Policies

4.2.3.2.1 General

The STORAGE-SCP AE can accept association requests. The STORAGE-SCP AE accepts association requests for the archive service.
The DICOM Standard Application Context Name for DICOM is always accepted.

Table 4.2-16
DICOM APPLICATION CONTEXTS FOR STORAGE-SCP AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2 Number of Associations

The STORAGE-SCP AE can support multiple simultaneous associations requested by peer AEs. When accepting associations, the STORAGE-SCP AE starts a sub-process to handle archive service requests. The maximum number of sub-processes, that is, the maximum number of associations that can be processed simultaneously, is configurable. The default maximum value is 5. This maximum number of simultaneous associations can be the absolute value or the maximum value for each external application

entity making requests. The flexibility of the second option stops a hang-up in transmission with an external AE with unstable connectivity from preventing association with the client AE.

Table 4.2-17
NUMBER OF SIMULTANEOUS ASSOCIATIONS AS A SCP FOR STORAGE-SCP AE

Maximum Number of Simultaneous Associations Requested by peer AEs.	15 (Configurable)

Note: This value is a thing of all SCP. When other SCP activates, this value decreases.

4.2.3.2.3 Asynchronous Nature

The REP-7000IT AE does not support asynchronous communications (multiple incomplete transactions on a single association).

Table 4.2-18
ASYNCHRONOUS NATURE A SCP FOR STORAGE-SCP

Maximum Number of Outstanding Asynchronous Transactions	1

4.2.3.2.4 Implementation Identification Information

The implementation information for the Application Entity is:

Table 4.2-19
DICOM IMPLEMENTATION CLASS AND VERSION FOR STORAGE-SCP AE

Implementation Class UID	1.2.392.200036.9116.7.23.10
Implementation Version Name	TM_OT_TFS7K_1.0

4.2.3.3 Association Initiation Policy

The STORAGE-SCP AE does not initiate association.

4.2.3.4 Association Acceptance Policy

4.2.3.4.1 Activity - Store Images to the Local File System

4.2.3.4.1.1 Description and Sequencing of Activity

The STORAGE-SCP AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

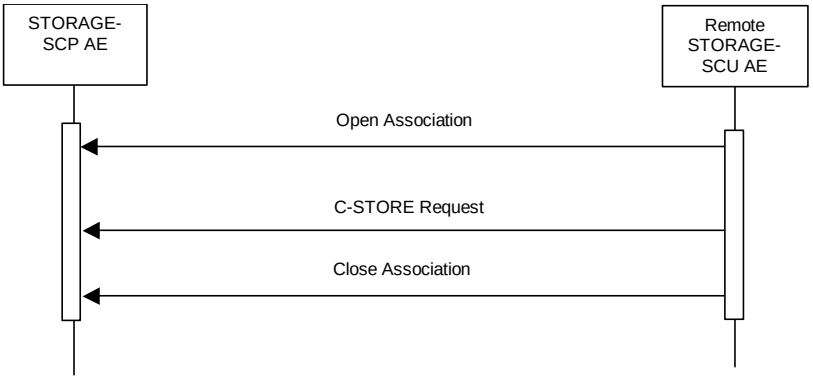

Figure. 4.2-3
SEQUENCING OF ACTIVITY – RECEIVE IMAGE REQUEST

The following sequencing constraints illustrated in Figure 4.2-3 apply to the STORAGE-SCP AE:

1. The Remote AE opens an Association with the STORAGE-SCP AE.
2. The Remote AE requests Storege of Composite SOP Instance(s).
3. The Remote AE closes the Association.

4.2.3.4.1.2 Accepted Presentation Contexts

The default Behavior of the STORAGE-SCP AE supports the Implicit VR Little Endian, Explicit VR Little Endian, Explicit VR Big Endian and JPEG Lossless compression Transfer Syntaxes for all Associations.

Table 4.2-20
ACCEPTED PRESENTATION CONTEXTS BY STORAGE-SCP AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**			
		Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70		
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**			
		Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70		
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.13	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCP	None

4.2.3.4.1.3 SOP Specific Conformance for Storege SOP Classes

The associated Activity with the Storage service is the storage of medical image data received over the network on a designated hard disk. The Storage SCP AE will return a failure status if it is unable to store the images on to the hard disk.

The Storage SCP AE is Level 0 conformant as a Storage SCP.

Table 4.2-21
STORAGE-SCP AE C-STORE RESPONSE STATUS RETURN REASONS

Service Status	Detailed Meaning	Error Code	Reason
Success	Success	0000	The composite SOP instances were successfully received, confirmed, and saved in the system database.
Error	Data Set Does Not Match SOP Class	A900	The data set was not encoded with a valid specified SOP instance. For example, "Abstract Syntax Unsupported", "Transfer Syntax Unsupported". An error message is written to the service log.
	Unclear	C000	The STORAGE-SCP AE could not translate the data set into element syntax. For example, "No Disk Space", "No Management Key Space", "Management Key Error". An error message is written to the service log.

4.2.4 ECHO-SCP Application Entity Specifications

4.2.4.1 SOP Class

The ECHO-SCP AE provides Standard Comformance to the following DICOM SOP classes:

Table 4.2-22
SOP CLASSES FOR ECHO-SCP AE

SOP Class	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes

4.2.4.2 Association Establishment Policies

4.2.4.2.1 General

The ECHO-SCP AE can accept association requests.
DICOM Standard Application Context Names for DICOM are always accepted.

Table 4.2-23
DICOM APPLICATION CONTEXTS FOR ECHO-SCP AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.4.2.2 Number of Associations

The maximum number of simultaneous associations can be configured.

Table 4.2-24
NUMBER OF SIMULTANEOUS ASSOCIATIONS AS A SCP FOR ECHO-SCP AE

Maximum Number of Simultaneous Associations	15

Note: This value is a thing of all SCP. When other SCP activates, this value decreases.

4.2.4.2.3 Asynchronous Nature

The ECHO-SCP AE does not support asynchronous communications (multiple incomplete transactions on a single association). All association requests must be completed and confirmed before new actions can be performed.

Table 4.2-25
ASYNCHRONOUS NATURE FOR ECHO-SCP

Maximum Number of Outstanding Asynchronous Transactions	1

4.2.4.2.4 Implementation Identification Information

The implementation information for the Application Entity is:

Table 4.2-26
DICOM IMPLEMENTATION CLASS AND VERSION FOR ECHO-SCP AE

Implementation Class UID	1.2.392.200036.9116.7.23.10
Implementation Version Name	TM_OT_TFS7K_1.0

4.2.4.3 Association Initiation Policy

The ECHO-SCP AE does not initiate association.

4.2.4.4 Association Acceptance Policy

4.2.4.4.1 Activity - Respond with Verification

4.2.4.4.1.1 Description and Sequencing of Activity

The ECHO-SCP AE accepts Associations. It can be configured to only accept Associations with certain hosts (using TCP/IP address) and/or Application Entity Titles.

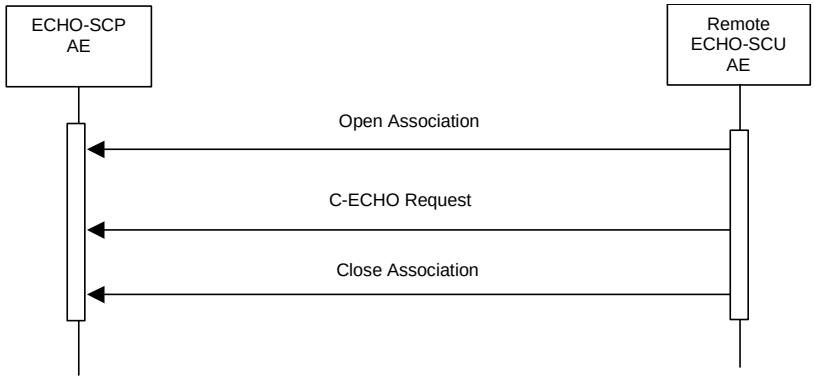

Figure. 4.2-4
SEQUENCING OF ACTIVITY – RECEIVE ECHO REQUEST

The following sequencing constraints illustrated in Figure 4.2-4, apply to the ECHO-SCP AE:

1. The Remote AE opens an Association with the ECHO-SCP AE.
2. The Remote AE requests Echo.
3. The Remote AE closes the Association.

4.2.4.4.2 Accepted Presentation Contexts

The default Behavior of the ECHO-SCP AE supports the Implicit VR Little Endian Transfer Syntaxes for all Associations. The ECHO-SCP AE accepts the presentation contexts listed below:

Table 4.2-27
ACCEPTED PRESENTATION CONTEXTS BY ECHO-SCP AE

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name**	**UID**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

4.2.4.4.3 SOP Specific Conformance for Verification SOP Classes

The REP-7000IT monitors the status, and service log files can be used to diagnose problems that may occur. If an error occurs in DICOM transmission, an appropriate message will be entered into the service log. In some cases, an error message may be displayed on the user interface.
The ECHO-SCP AE performs the following actions based on the status code values in the C-ECHO responses from the peer ECHO SCU:

Table 4.2-28
ECHO-SCP AE C-ECHO RESPONSE STATUS RETURN REASONS

Service Status	Detailed Meaning	Error Code	Reason
Success	Success	0000	
Error	Does Not Match SOP Class	A900	An error message is written to the Service Log.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The REP-7000IT 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 1000baseT
Ethernet 100baseT
Ethernet 10baseT

4.3.2 Additional Protocols

The REP-7000IT conforms to the System Management Profiles listed in Table 4.3-2. All requested transactions for the listed profiles and actors are supported. It does not support any optional transactions.

Table 4.3-2
SUPPORTED SYSTEM MANAGEMENT PROFILES

Profile Name	Actor	Protocol Used	Additional Transactions	Security Support
Network Address Management	DHCP Client	DHCP	N/A	
	DNS Client	DNS	N/A	

4.3.2.1 DHCP

DHCP can be used to obtain TCP/IP network configuration information. The network parameters obtainable via DHCP are shown in Table 4.3-3. The Default Value column of the table shows the default used if the DHCP server does not provide a value. Values for network parameters set in the Service/Installation tool take precedence over values obtained from the DHCP server. Support for DHCP can be configured via the Service/Installation Tool. The Service/Installation tool can be used to configure the machine name. If DHCP is not in use, TCP/IP network configuration information can be manually configured via the Service/Installation Tool.

Table 4.3-3
SUPPORTED DHCP PARAMETERS

DHCP Parameters	Default Value
IP Address	None
Hostname	Requested machine name
List of NTP servers	Empty list
List of DNS servers	Empty list
Routers	Empty list
Static routes	None
Domain name	None

Subnet mask	Derived from IP address (see service manual)
Broadcast address	Derived from IP address (see service manual)
Default router	None
Time offset	Site configureable (from Time zone)
MTU	Network Hardware Dependent
Auto-IP permission	Not permitted

If the DHCP server refuses to renew a lease on the assigned IP address all active DICOM Associations will be aborted.

4.3.2.2 DNS

DNS can be used for address resolution. If DHCP is not in use or the DHCP server does not return any DNS server addresses, the identity of a DNS server can be configured via the Service/Installation Tool. If a DNS server is not in use, local mapping between hostname and IP address can be manually configured via the Service/Installation Tool.

4.4 CONFIGURATION

4.4.1 AE Title / Presentation Address Mapping

4.4.1.1 Local AE Titles

All local applications use the AE Titles and TCP/IP Ports configured via the Service Tool. The Field Service Engineer can configure the TCP Port via the Service Tool.

Table 4.4-1
DEFAULT APPLICATION ENTITY CHARACTERISTICS

Application Entity	Role	Default AE Title	Default TCP/IP Port
STORAGE-SCU	SCU	TM_OT_TFS_7001	Not Applicatable
ECHO-SCU	SCU		
STORAGE-SCP	SCP		104
ECHO-SCP	SCP		

STORAGE-SCU, ECHO-SCU, STORAGE-SCP and ECHO-SCP application entities are configured to use the same AE title.

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Titles, host names and port numbers of remote applications are configured using the Service Tool.

4.4.2 Parameters

Table 4.4-2
CONFIGURATION PARAMETERS

Parameters	Configurable	Default Value
General Parameters		
Max PDU Receive Size	Yes [1-999999]	129 Kbytes
Max PDU Send Size		
Time-out waiting for a acceptance or rejection response to an Association Request (Application Level Timeout)	Yes [1-999999]	30 Sec
Time-out waiting for a response to an Association release request (Application Level Timeout)	Yes [1-999999]	15 sec
Time-out waiting for completion of a TCP/IP connect request (Low-level timeout)	Yes [1-999999]	15 sec
Time-out awaiting a Response to a DIMSE Request (Low-Level Timeout)	Yes [1-999999]	15 sec
Time-out for waiting for data between TCP/IP-packets (Low Level Timeout)	Yes [1-999999]	15 sec
STORAGE-SCU AE Parameters		
Maximum number of simultaneously initiated Associations by the Storage SCU AE	No	1
Supported Transfer Syntaxes (separately configurable for each remote AE)	No	-
STORAGE-SCP AE Parameters		
Maximum number of simultaneously accepted Associations by the Storage SCP AE (Can be configured to be a maximum total number or a maximum per external SCU AE)	Yes	15
Max PDU Receive Size	Yes	129Kbytes
Supported Transfer Syntaxes (separately configurable for each remote AE)	Yes	Cf. Table4.2-20

5 MEDIA INTERCHANGE

The REP-7000IT does not support Media Storage.

6 SUPPORT OF EXTENDED CHARACTER SETS

ALL REP-7000IT applications support the following:

ISO_IR 6 (Basic G0 set)
ISO_IR 13 (Japanese katakana)
ISO_IR 14 (Japanese romaji)
ISO_IR 87 (Japanese kanji, hiragana, and katakana)

The REP-7000IT can also receive and transmit images containing character sets other than those listed above, but the image viewer bundled with REP-7000IT can correctly display only the character sets listed above.

7 SECURITY

7.1 SECURITY PROFILE

Not compliant.

7.2 ASSOCIATION LEVEL SECURITY

The STORAGE-SCP AE and the ECHO-SCP can both be configured to check the following DICOM values when determining whether to accept Association Open Requests:

Calling AE Title

Called AE Title

Application Contexts

The Each SCP AE can be configured to accept Association Requests from only a limited list of Calling AE Titles. The SCP AEs can have different lists. The Each SCP AE can be configured to check that the Association requestor specifies the correct Called AE Title for the SCP.

In addition the IP address of the requestor can be checked. The SCP AEs can be constrained to only accept Association Requests from a configured list of IP addresses.

8 ANNEXES

8.1 COERCED/MODIFIED FIELDS

8.1.1 STORAGE-SCP AE Element Use

SOP Instances conforming to the following Composite Image SOP Classes are fully supported for display on the system workstations.

Table 8.1-1
SUPPORTED COMPOSITE IMAGE SOP CLASSES FOR DISPLAY

CR Image Storage
CT Image Storage
US Multi-frame Image Storage
MR Image Storage
US Image Storage
SC Image Storage
XA Image Storage
RF Image Storage
NM Image Storage
PET Image Storage
Digital X-Ray Image Storage - For Presentation
Digital Mammography X-Ray Image Storage - For Presentation
VL Endoscopic Image Storage
VL Photographic Image Storage
Digital Intra-oral X-Ray Image Storage - For Presentation

Table 8.1-2
SIGNIFICANT ELEMENTS IN RECEIVED COMPOSITE SOP INSTANCES

Module	Attribute Name	Tag ID	Type	Significance
Patient	Patient ID	(0010,0020)	Mand	The received Patient ID is confirmed. The value is stored in the database.
General Study	Study Instance UID	(0020,000D)	Mand	Must be supplied. The value is stored in the database.
General Series	Series Instance UID	(0020,000E)	Mand	Must be supplied. The value is stored in the database.
SOP Common	SOP Instance UID	(0008,0018)	Mand	Must be supplied. If a duplicate SOP Instance UID is received, the Patient ID, Study Instance UID, and Series Instance UID are checked for duplication. If they are the same, the existing image is overwritten by the received image. If they are not the same, the UID of the received image is modified and the image is saved.

8.1.2 STORAGE-SCU AE Element Modification

The following table contains a list of all elements that can have a value modified by the STORAGE-SCU at the time of export using the Storage Services depending on the capabilities of the receiver:

Table 8.1-3
SIGNIFICANT ELEMENTS IN EXPORTED COMPOSITE SOP INSTANCES

Module	Attribute Name	Tag ID	Value
General Image Module	Derivation Description	(0008,2111)	Set the compression algorithm and its parameters.
	Lossy Image Compression	(0028,2110)	Set '01'.
	Lossy Image Compression Ratio	(0028,2112)	Set the compression ratio.
Image Module	Image Type	(0008,0008)	Values 1 and 2 are modified. (Need Only at Lossy Data) Value1: DERIVED Value2: SECONDARY

8.1.3 Elements Modifiable by Field Mapping

The Field Mapping function can change values of received image elements.

The following table contains a list of all elements that can have a value modified by the Field Mapping function:

Table 8.1-4
IMPORTANT ELEMENTS OF SOP INSTANCES THAT CAN BE CHANGED BY FIELD MAPPING

Module	Attribute Name	Tag ID	Comments
Patient Module	Patient's Name	(0010,0010)	
	Patient ID	(0010,0020)	
	Patient's Birth Date	(0010,0030)	
	Patient's Sex	(0010,0040)	
	Other Patient IDs	(0010,1000)	
Patient Demographic Module	Military Rank	(0010,1080)	
	Branch of Service	(0010,1081)	
General Study Module	Study Date	(0008,0020)	
	Study Time	(0008,0030)	
	Accession Number	(0008,0050)	
	Referring Physician Name	(0008,0090)	
	Study Description	(0008,1030)	
	Name of Physicians Reading Study	(0008,1060)	
	Study Instance UID	(0020,000D)	
	Study ID	(0020,0010)	
Patient Study Module	Admitting Diagnosis Description	(0008,1080)	
	Patient's Age	(0010,1010)	
	Additional Patient History	(0010,21B0)	
Study Classification Module	Study Status ID	(0032,000A)	
	Study Priority ID	(0032,000C)	
	Study Comments	(0032,4000)	

Requested Procedure Module	Confidentiality Code	(0040,1008)	
General Series Module	Modality	(0008,0060)	
	Series Date	(0008,0021)	
	Series Time	(0008,0031)	
	Series Description	(0008,103E)	
	Performing Physician Name	(0008,1050)	
	Operator's Name	(0008,1070)	
	Body Part Examined	(0018,0015)	
	Series Instance UID	(0020,000E)	
	Series Number	(0020,0011)	
	Requested Procedure ID	(0040,1001)	
General Equipment Module	Manufacturer	(0008,0070)	
	Institution Name	(0008,0080)	
	Station Name	(0008,1010)	
	Institutional Department Name	(0008,1040)	
	Manufacturer Model Name	(0008,1090)	
General Image Module	Image Type	(0008,0008)	
	Instance Number	(0020,0013)	
Visit Status Module	Current Patient Location	(0038,0300)	
Study Scheduling Module	Reason for Study	(0032,1030)	
	Requesting Physician	(0032,1032)	
	Requesting Service	(0032,1033)	
SOP Common Module	Specific Character Set	(0008,0005)	
	SOP Class UID	(0008,0016)	
	SOP Instance UID	(0008,0018)	
General Image	Acquisition Date	(0008,0022)	

Module	Acquisition Time	(0008,0032)	
	Acquisition Number	(0020,0012)	
CR Image Module	KVP	(0018,0060)	
	Distance Source to Patient	(0018,1111)	
	Exposure	(0018,1152)	
CT Image Module	KVP	(0018,0060)	
	Distance Source to Patient	(0018,1111)	
	Exposure	(0018,1152)	
MR Image Module	Echo Time	(0018,0081)	
	Echo Numbers	(0018,0086)	
	Slice Spacing	(0018,0088)	
XA Position Module	Distance Source to Patient	(0018,1111)	
X-Ray Acquisition Module	KVP	(0018,0060)	
	Exposure	(0018,1152)	
X-Ray Acquisition Dose Module	KVP	(0018,0060)	
	Distance Source to Patient	(0018,1111)	
	Exposure	(0018,1152)	
X-Ray Generation Dose Module	KVP	(0018,0060)	
	Exposure	(0018,1152)	
Frame of Reference Module	Frame of Reference UID	(0020,0052)	
Multi-Frame Module	Number of Frames	(0028,0008)	
Image Plan Module	Slice Thickness	(0018,0050)	
	Image Position Patient	(0020,0032)	
	Image Orientation Patient	(0020,0037)	
	Slice Location	(0020,1041)	
	Pixel Spacing	(0028,0030)	
Image Pixel Macro Module	Photometric Interpretation	(0028,0004)	
	Rows	(0028,0010)	

	Columns	(0028,0011)	
	Bits Allocated	(0028,0100)	
	Bits Stored	(0028,0101)	