



Varian System Server

**DICOM Conformance Statement Treatment
Daemon Supplement**

Abstract This document provides additional DICOM Conformance information about the Treatment Daemon 8.2/8.6. It is a supplement to the Varian System Server DICOM Conformance Statement (DCS) and can only be understood in conjunction with the main document

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1. Introduction

1.1 Audience

This document is intended for the following groups of persons:

- Customers and hospital staff who want to interface with the Treatment Daemon
- System integrators of medical equipment,
- Other vendors offering interfacing via DICOM,
- Marketing and sales persons.

It is assumed, that the reader is familiar with the DICOM standard.

The document is structured firmly along the template definition as specified in Part 2 of the DICOM standard.

1.2 Overview

This document is the DICOM Conformance Statement for the Treatment Daemon. It is a supplement to the Varian System Server DICOM Conformance Statement [2] and can only be understood in combination with it. The Treatment Daemon shares the same code base as the DB Daemon (see [2]). This Conformance Statement supplement only describes the differences between Treatment Daemon and DB Daemon. Everything stated about DB Daemon also applies to Treatment Daemon, unless it contradicts statements made in this document.

Table 1-1 provides an overview of the network services supported by Treatment Daemon.

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage	Yes	Yes
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Ultrasound Image Storage	No	Yes
Secondary Capture Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	No	Yes
Spatial Registration Storage	No	Yes
Positron Emission Tomography Image Storage	No	Yes
RT Image Storage	Yes	Yes
RT Dose Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
RT Beams Treatment Record Storage	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
RT Plan Storage	Yes	Yes
RT Treatment Summary Record Storage	Yes	No
RT ION Plan Storage	Yes	Yes
RT Ion Beams Treatment Record Storage	Yes	Yes
Tracking Protocol (Private)	Yes	Yes
Tracking Waveform (Private)	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND	No	Yes
Study Root Query/Retrieve Information Model – MOVE	No	Yes

Table 1-1: Network Services

The following products are in the scope of this Conformance Statement:

- Treatment Daemon

The Varian System Server product family runs on Windows XP and Windows Server 2003 platforms.

1.3 Remarks

See [2], section 1.3 Remarks.

1.4 References

- [1] Digital Imaging and Communications in Medicine (DICOM), Parts 1-18 (2008)
National Electrical Manufacturers Association (NEMA)
Rosslyn, VA
United States of America
- [2] Varian System Server DICOM Conformance Statement
B VA8804D3CS
Baden, Switzerland
- [3] On-Board Imager 1.4 DICOM Conformance Statement
B KC1406D3CS
Baden, Switzerland

1.5 Abbreviations and Definitions

This section provides the definitions of terms, acronyms, and abbreviations which are used throughout the document. An arrow sign (→) left of a word indicates that it can be looked up in this table.

AE	Application Entity (→DICOM term)
ALWAYS	Attribute Always Present with a value
ANAP	Attribute Not Always Present
Daemon	Collective term for Windows services accepting →DICOM Associations
DB	Database
DICOM	Digital Imaging and Communications in Medicine, a standard on image communications in medical applications
DIMSE	DICOM Message Service element
DNS	Domain Name System
EMPTY	Attribute is sent without a value
Export	Describes the process of converting an object, that is stored on the Varian System Database, from internal data representation to →DICOM format and writing it to a DICOM sink. Opposite of →Import.
IE	Information Entity
Import	Describes the process of reading an object from a →DICOM source, converting it to an internal data representation and eventually saving it to the Varian System Database. Opposite of →Export.
IOD	Information Object Definition (→DICOM term)
Management System	Collective term including →Daemon and →RadOnc Client
Multi-frame Image	Image that contains multiple two-dimensional pixel planes
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit (→DICOM term)
RadOnc	Radiation Oncology Client Applications, including Eclipse
SCU	Service Class User (→DICOM term)
SCP	Service Class Provider (→DICOM term)
SOP	Service-Object-Pair, a definition of an information object (like an image) and of a service (like storage) that can be performed for the object (→DICOM term)
TCP/IP	Transmission Control Protocol / Internet Protocol, a widely used computer networking protocol
UID	Unique Identifier used to identify an object by a worldwide unique identifier (→DICOM term)
VNAP	Value Not Always Present (attribute sent zero length if no value is present)
VR	Value Representation, a data encoding method in →DICOM

2. Networking

2.1 Implementation Model

2.1.1 Application Data Flow

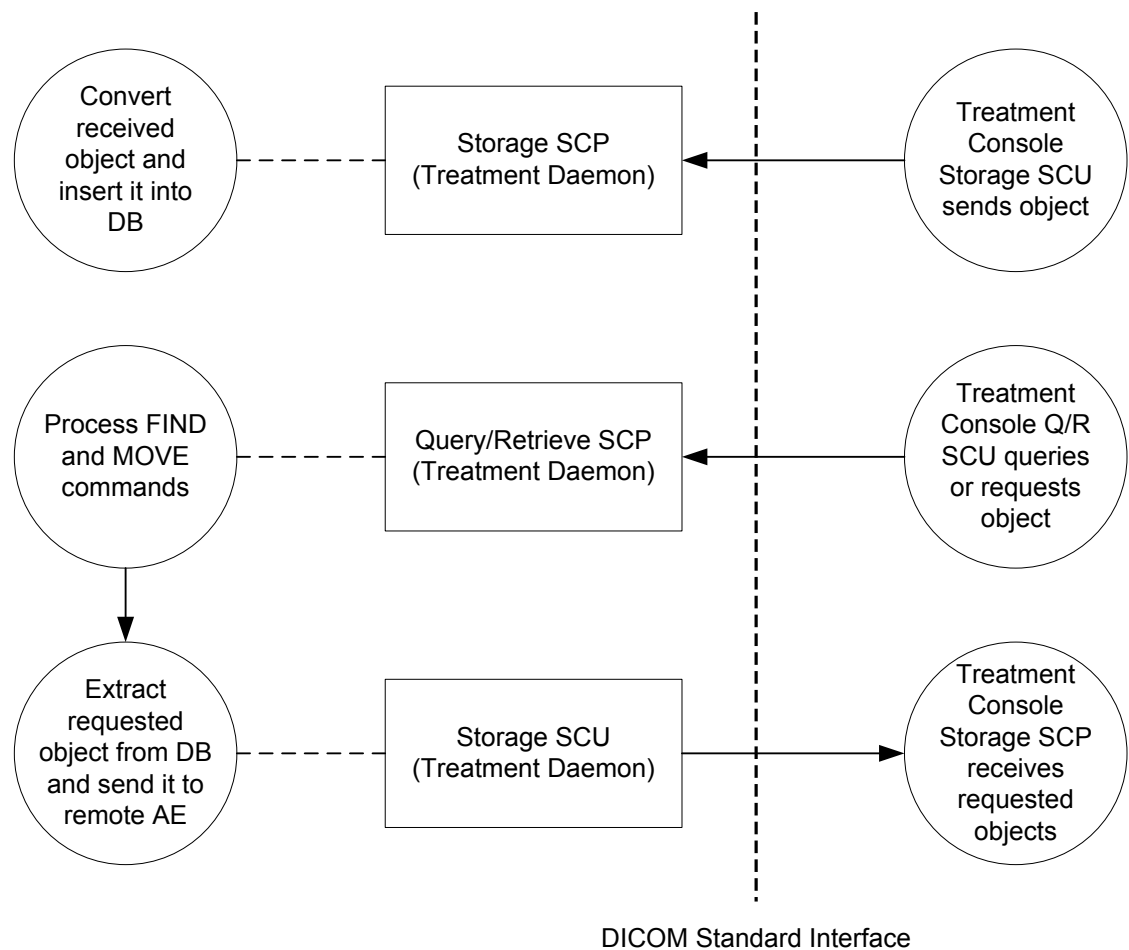


Figure 2-1: SCP Role Application Data Flow Diagram

Treatment Daemon Storage SCP Application Entity

The Treatment Daemon works as a Storage SCP. It is connected to the Varian System Database and inserts received objects directly to the DB. Treatment Daemon's Storage SCP is invoked by a remote Storage SCU at the Treatment Console.

Treatment Daemon Query/Retrieve SCP Application Entity

The Treatment Daemon works as a Query/Retrieve SCP. It provides access to all DICOM objects stored on Varian System Database. Treatment Daemon's Query/Retrieve SCP is invoked by a remote Query/Retrieve SCU at the Treatment Console searching for and retrieving objects.

Treatment Daemon Storage SCU Application Entity

Treatment Daemon's Storage SCU is invoked by Treatment Daemon's Query/Retrieve SCP to transfer requested objects to a remote Storage SCP at the Treatment Console.

2.1.2 Functional Definition of AE's

2.1.2.1 Functional Definition of Treatment Daemon Application Entity

The Treatment Daemon Application Entity is running continuously as a service and is responsible for handling incoming association requests of other Application Entities. It accepts Storage and Query/Retrieve requests of SOP Classes listed in Table 1-1. Received objects are stored directly to the DB, queries for objects are answered based on objects stored in the DB, and requested objects are extracted from the DB and sent to the requestor. However, only "copies" of objects are exported, they will not be removed from the database.

Storage SCP and Query/Retrieve SCP services are supported in parallel by the same Application Entity which technically is identical to the same instance of the DB Daemon service.

Multiple Treatment Daemons can be running in parallel when configured as different Application Entities.

2.1.3 Sequencing of Real World Activities

Not applicable because importing and exporting objects can happen in any sequence and independent of each other.

2.2 AE Specifications

2.2.1 Treatment Daemon Application Entity

2.2.1.1 SOP Classes

See [2], section 2.2.3.1 SOP Classes.

2.2.1.2 Association Policies

2.2.1.2.1 General

See [2], section 2.2.1.2.1 General.

2.2.1.2.2 Number of Associations

See [2], section 2.2.3.2.2 Number of Associations.

2.2.1.2.3 Asynchronous Nature

See [2], section 2.2.3.2.3 Asynchronous Nature.

2.2.1.2.4 Implementation Identifying Information

Treatment Daemon may run in different operational modes to provide backwards compatibility. The mode to use will be defined along the incoming implementation UID (for details see section 2.2.1.2.4.1).

The implementation information for this Application Entity is defined in the following table. The selected Implementation Class UID used by Treatment Daemon for initiating associations (e.g. for issuing C-STORE commands as sub-operation while performing a C-MOVE command) is as follows:

Implementation Class UID (Vision 6.5 Mode)	1.2.246.352.70.2.1.10
Implementation Class UID (ARIA 8.0 Mode)	1.2.246.352.70.2.1.12
Implementation Class UID (ARIA 8.8 Mode)	1.2.246.352.70.2.1.18
Implementation Class UID (ARIA 8.8 QA Mode)	1.2.246.352.70.2.1.20
Implementation Class UID (Default Mode)	1.2.246.352.70.2.1.18
Implementation Version Name	(not used)

Table 2-1: DICOM Implementation Class and Version for Treatment Daemon Application Entity

2.2.1.2.4.1 Operational Mode

Treatment Daemon can run in following three operational modes:

- Vision 6.5 Mode
- ARIA Mode
- Default Mode

Operational mode is selected automatically during Association Negotiation depending on the Implementation Class UID of the Association Requesting peer. The following table shows which accepted Implementation Class UID triggers what operational mode of Treatment Daemon.

Accepted Implementation Class UID	Operational Mode
1.2.246.352.70.2.1.9	Vision 6.5 Mode
1.2.246.352.70.2.1.11	ARIA 8.0 Mode
1.2.246.352.70.2.1.17	ARIA 8.8 Mode
1.2.246.352.70.2.1.19	ARIA 8.8 QA Mode
1.2.246.352.70.2.1.60.1	ARIA 8.0 Mode
All other Implementation Class UIDs	Default Mode (behaves identical to ARIA 8.8 Mode)

Table 2-2: Operational Modes of Treatment Daemon Application

2.2.1.3 Association Initiation Policy

The Treatment Daemon Application Entity does not initiate Associations.

2.2.1.4 Association Acceptance Policy

Treatment Daemon restricts access to exactly one user-configured Application Entity.

2.2.1.4.1 Activity – Receive Storage Request

2.2.1.4.1.1 Description and Sequencing of Activities

See [2], section 2.2.3.4.1.1 Description and Sequencing of Activities.

2.2.1.4.1.2 Accepted Presentation Contexts

See [2], section 2.2.3.4.1.2 Accepted Presentation Contexts.

2.2.1.4.1.3 SOP Specific Conformance for all Storage SOP Classes

See [2], section 2.2.3.4.1.3 SOP Specific Conformance for all Storage SOP Classes.

2.2.1.4.1.3.1 Presentation Context Acceptance Criterion

See [2], section 2.2.3.4.1.3.1 Presentation Context Acceptance Criterion.

2.2.1.4.1.3.2 Transfer Syntax Selection Policies

See [2], section 2.2.3.4.1.3.2 Transfer Syntax Selection Policies.

2.2.1.4.1.3.3 Response Status

See [2], section 2.2.3.4.1.3.3 Response Status.

2.2.1.4.1.4 Private Extended Response Status

Treatment Daemon Application Entity Extends the C-STORE Response Message with a private sequence of log entries created by the Application Entity while processing the corresponding C-STORE Request.

For details about this private Log Entry Sequence see section A.2.1.1.

2.2.1.4.1.5 SOP Specific Conformance for RT Plan Storage

See [2], section 2.2.3.4.1.8 SOP Specific Conformance for RT Plan Storage.

2.2.1.4.1.5.1 Handling of Concurrent Editing

Even though it should not be an issue anymore with ARIA, Treatment Daemon is still checking for an incoming plan whether the same plan (Minor Plan Revision) or a referenced predecessor plan (Major Plan Revision) already exists on the DB. If this is the case, and the plan residing on the DB has been changed since it had last been sent out via this Treatment Daemon, a concurrency warning will be returned.

A concurrency warning is sent as a C-STORE Response with Error Code (0000,0900) 0000 (Service Status Success) and Error Comment (0000,0902) containing one of the following strings, depending on the circumstances:

- [37] Concurrent minor plan changes of somebody else are lost.

Suggested User Message: The Plan was modified by another application concurrently. Modifications to the plan from the other application are lost.

Explanation: While a minor plan modification has been performed at the treatment workstation, another minor plan modification has been applied on the management system. Since the local changes on the management system have been saved first, they got lost because they have been overridden by the Treatment Daemon.

- [37] Concurrent major plan change. Saved to predecessor plan now.

Suggested User Message: Changes saved to predecessor plan only. Consolidate changes in the new plan.

Explanation: A new plan revision has been created on the management system while a minor plan change has been performed at the treatment workstation. As a result the minor plan change is based on a plan revision which is now a former (outdated) plan revision and therefore changes are applied to the now outdated and not to the current revision.

- [37] Concurrent plan changes are not consolidated in new plan.

Suggested User Message: The plan was modified by another application concurrently. Modifications to the plan from the other application are not consolidated in the new plan.

Explanation: While a major plan modification has been performed at the treatment workstation, a minor plan modification has been applied on the management system. The major plan modification is saved as a new plan revision and therefore minor changes performed at the management system are not incorporated in this latest plan revision.

2.2.1.4.1.6 SOP Specific Conformance for RT Beams Treatment Record Storage and RT Ion Beams Treatment Record Storage

See [2], section 2.2.3.4.1.9 SOP Specific Conformance for RT Beams Treatment Record Storage and RT Ion Beams Treatment Record Storage.

2.2.1.4.1.6.1 Connecting Treatment Records to a Field and Session

Treatment records are connected automatically to a corresponding SessionField object (on the DB) referencing a Session which has the lowest session number among those with status "Active" or "Partially Completed – Active".

2.2.1.4.2 Activity – Handling Query and Retrieval Requests

2.2.1.4.2.1 Description and Sequencing of Activities

See [2], section 2.2.3.4.2.1 Description and Sequencing of Activities

2.2.1.4.2.2 Accepted Presentation Contexts

See [2], section 2.2.3.4.2.2 Accepted Presentation Contexts.

2.2.1.4.2.3 SOP Specific Conformance for all Query/Retrieve SOP Classes

2.2.1.4.2.3.1 Presentation Context Acceptance Criterion

See [2], section 2.2.3.4.2.3.1 Presentation Context Acceptance Criterion.

2.2.1.4.2.3.2 Transfer Syntax Selection Policies

See [2], section 2.2.3.4.2.3.2 Transfer Syntax Selection Policies.

2.2.1.4.2.4 SOP Specific Conformance for Study Root Query SOP Classes

2.2.1.4.2.4.1 Matching Behavior

The following additional Query Keys are supported as compared to DB Daemon:

Name	Tag	VR	Type	Types of Matching
Composite Object Level (Query Level PLAN)				
Plan Type	(3257,1001)	CS	O	S, U (see Note 1)

Table 2-3: Study Root C-FIND SCP Supported Elements for Treatment Daemon

Note 1 This Element is used only for performing the find operation and is never returned.

When a C-FIND Request with a non-standard Query Level of "TREATMENTSUMREC" or "TREATMENTSUMMARYRECORD" is received the C-FIND Responses will contain the following values for Query Level, depending on Operational Mode of Treatment Daemon.

Operational Mode	Value of Query Level
Vision 6.5 Mode	TREATMENTSUMMARYRECORD
ARIA 8.0 Mode	TREATMENTSUMREC
ARIA 8.8 Mode	
ARIA 8.8 QA Mode	
Default Mode	

Table 2-4: Query Level in a C-FIND Response for C-FIND Request with private Query Level TREATMENTSUMREC

2.2.1.4.2.4.2 Response Status

See [2], section 2.2.3.4.2.4.2 Response Status.

2.2.1.4.2.5 SOP Specific Conformance for RT Plan Move

See [2], section 2.2.3.4.2.8 SOP Specific Conformance for RT Plan Move.

Planned Verification Image

Because the size of a verification image to be taken is not known in advance (this depends on the imager used), a width and height of zero pixels is assumed. As a consequence, the RT Image Position (3002,0012), in Planned Verification Image Sequence (300A,00CA), describes directly the position of the image receptor's center. This is because these coordinates are the same as those of the upper left hand corner of an image with zero number of pixels in x and y directions.

Planned Verification Image

Setup fields are used for pre-plan verification procedures. For specific conformance definitions, see [3]. Note that use of setup fields for most use cases will be retired in future, as DICOM Worklist is taken into use along the standard specification.

Operational Mode

Presence and value of certain Attributes as well as nodes in XML Extended Interface (see Extended Interface, Appendix D) depends on Operational Mode of Treatment Daemon (see 2.2.1.2.4.1). Representation of following information differs depending on Operational Mode:

- Beam type; whether a beam is a Treatment or a Setup Field
- Custom code of compensator and block

The following table shows values of standard Attributes in an RT Plan IOD used for Setup Fields.

Attribute Name	Tag	Operational Mode	Comment
RT Beams Module			
>Treatment Delivery Type	(300A,00CE)	Vision 6.5	Value: TREATMENT
		ARIA 8.0/8.8/8.8 QA	Value: SETUP
		Default	

Table 2-5: Value of Attributes of a Setup Field in RT Plan depending on Operational Mode

The following table shows which nodes are exported in XML Extended Interface depending on Operational Mode. Node "FieldType" is used in Vision 6.5 Mode to distinguish between Treatment and Setup Fields. Node "CustomAddOn" and its child nodes contain additional information for blocks and compensators as well as information for stand-alone trays that do not hold beam modifying accessories but serve as a dongle instead to enable for example high-dose treatment techniques etc.

Node Name	Operational Mode	Comment
>>>> FieldType	Vision 6.5	Present. Possible values are TREATMENT and SETUP.
	ARIA 8.0/8.8/8.8 QA	Absent
	Default	
>>>> CustomAddOn	Vision 6.5	Present for Block, Compensator and stand-alone Trays.
	ARIA 8.0/8.8/8.8 QA	Present only for stand-alone Trays, never written for Blocks and Compensators.
	Default	

Table 2-6: Presence of Nodes in XML Extended Interface depending on Operational Mode

2.2.1.4.2.6 SOP Specific Conformance for RT Beams Treatment Record Find

When a C-FIND Request with a non-standard Query Level of “TREATMENTRECORD” is received, the C-FIND Responses will contain filled out Attributes as listed in [2], Table 2-45 (Study Root C-FIND SCP Supported Elements for DB Daemon).

The information contained in the C-FIND responses is intended to be useful for a treatment machine to determine the treatment status of the current fraction if dose has been delivered only partially. It is sufficient for knowing for each beam of a plan whether dose has been applied completely or partially, and in the latter case for knowing exactly where dose delivery has been interrupted on the last treatment session. Therefore, supporting those return keys eliminate the need to retrieve all associated treatment record, when the delivery device does not need those details.

Attributes Referenced SOP Class UID (0008,1150) shall contain RT Plan or RT Ion Plan SOP Class UID, Referenced SOP Instance UID (0008,1155) shall contain the SOP Instance UID of the plan for which RT Beams Treatment Record information shall be retrieved.

2.3 Network Interfaces

See [2], section 2.3 Network Interfaces.

2.4 Configuration

2.4.1 AE Title/Presentation Address Mapping

2.4.1.1 Local AE Titles

The Treatment Daemon Application Entity use the AE Title and TCP/IP port numbers configured via the Daemon Configuration Wizard application.

Application Entity	Default AE Title	Default TCP/IP Port
Treatment Daemon	No Default	57345 (configurable)

Table 2-7: AE Title Configuration Table

2.4.1.2 Remote AE Title/Presentation Address Mapping

See [2], section 2.4.1.2.5 DB Daemon, with following difference:

Calling AE Title verification is always switched on and not configurable.

2.4.2 Parameters

See [2], section 2.4.2 Parameters: Section “General Parameters” and “DB Daemon Specific Parameters” in Table 2-49 (Configuration Parameters) also apply to Treatment Daemon

3. Media Interchange

Not applicable.

4. Support of Character Sets

4.1 Overview

See [2], section 4 Support of Character Sets

5. Security

5.1 Security Profiles

No Security Profiles are supported

5.2 Association Level Security

5.2.1 Treatment Daemon

The Treatment Daemon Application Entity always checks following values when determining whether to accept Association Open Requests:

- Called AE Title
- Calling AE Title
- IP address of Association Request originator

The Treatment Daemon Application Entity optionally checks following values when determining whether to accept Association Open Requests:

- Implementation UID

5.3 Application Level Security

See [2], section 5.3.2 File Daemon and DB Daemon

Appendix A Specialization

A.1 IOD Contents

See [2], section Appendix A.1 IOD Contents.

A.2 Data Dictionary of Private Attributes

See [2], section Appendix A.2 Data Dictionary of Private Attributes

A.2.1 Private Attributes used by Treatment Daemon Application Entity

The following table contains a list of private Attributes that are used only in Treatment Daemon Application Entities.

Tag	Name	VR	VM
(3301,1000)	Log Entry Sequence	SQ	0..n
(3301,1001)	Entry Number	SL	1
(3301,1002)	Section Number	SL	1
(3301,1003)	Error Level	CS	1
(3301,1004)	Log Level	CS	1
(3301,1005)	Log Text	ST	1

Table A-1: Private Attributes used by Treatment Daemon Application Entity

A.2.1.1 Log Entry Sequence

Table A-2 below shows the Attributes of private Log Entry Sequence as sent with C-STORE Response Messages.

Attribute Name	Tag	T	Description
Log Entry Sequence	(3301,1000)	3	Introducing private sequence of log messages.
> Entry Number	(3301,1001)	1	Arbitrary number, increasing with order of log entries. Number is unique within Log Entry Sequence.
> Section Number	(3301,1002)	1	Log section number.

Attribute Name	Tag	T	Description
> Error Level	(3301,1003)	1	Enumerated Values: SUCCESS: Indicates a successful operation. Normally used in conjunction with an empty Log Text. INFORMATION: Standard log entry. WARNING_ERROR: Log entry warning about an exceptional case. Should be reviewed by user. REJECT_ERROR: Log entry reporting an error that ultimately leads to the failure of the whole operation.
> Log Level	(3301,1004)	1	Enumerated Values: SIMPLE_LOG: Simple user log message. NORMAL_LOG: Detailed user log message. DETAILED_LOG: Detailed log messages intended only for advanced users or engineers.
> Log Text	(3301,1005)	2	Human-readable log message text.

Table A-2: Private Log Entry Sequence in C-STORE Response

A.3 Coded Terminology and Templates

See [2], section Appendix A.3 Coded Terminology and Templates

A.4 Grayscale Image Consistency

See [2], section Appendix A.4 Grayscale Image Consistency.

A.5 Standard Extended/Specialized/Private SOP Classes

See [2], section Appendix A.5 Standard Extended/Specialized/Private SOP Classes

A.6 Private Transfer Syntaxes

See [2] section Appendix A.6 Private Transfer Syntaxes.

Appendix B Object Matching Criteria

See [2], section Appendix B Object Matching Criteria.

Appendix C IOD Details

See [2], section Appendix C IOD Details.

Appendix D Extended Interface

See [2], section Appendix D Extended Interface.