



Varian System Server

**DICOM Conformance Statement
Treatment Daemon Supplement**

Abstract This document provides additional DICOM Conformance information about the Treatment Daemon 11.0. It is a supplement to the Varian System Server DICOM Conformance Statement (DCS) and can only be understood in conjunction with the main document

Manufacturer and European Representative	Manufacturer:	European Representative:
	Varian Medical Systems, Inc. Ltd. 3100 Hansen Way, Bldg. 4A Palo Alto, CA 94304-1030, U.S.A.	Varian Medical Systems UK Ltd. Gatwick Road, Crawley West Sussex RH10 9RG United Kingdom

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|--|--|
| ■ North America (North America and Canada) | support-americas@varian.com |
| ■ Central & South America | soporte.al@varian.com |
| ■ Europe (Europe, Middle East, Africa) | support-emea@varian.com |
| ■ Australia (Australian, New Zealand, Australasia) | support-anz@varian.com |
| ■ China / Asia (China, Asia) | support-china@varian.com |
| ■ Japan | support-japan@varian.com |
| ■ Brachy Therapy Systems | brachyhelp@varian.com |

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Contents

Contents	5
List of Figures	6
List of Tables	6
1. Introduction.....	7
1.1 Audience.....	7
1.2 Overview.....	7
1.3 Remarks	8
1.4 References	8
1.5 Abbreviations and Definitions	8
2. Networking	9
2.1 Implementation Model	9
2.1.1 Application Data Flow.....	9
2.1.2 Functional Definition of AE's.....	10
2.1.3 Sequencing of Real World Activities.....	10
2.2 AE Specifications.....	10
2.2.1 Treatment Daemon Application Entity	10
2.3 Network Interfaces.....	16
2.4 Configuration	17
2.4.1 AE Title/Presentation Address Mapping.....	17
2.4.2 Parameters	17
3. Media Interchange	18
4. Support of Character Sets	19
4.1 Overview.....	19
5. Security	20
5.1 Security Profiles.....	20
5.2 Association Level Security	20
5.2.1 Treatment Daemon.....	20
5.3 Application Level Security	20
Appendix A Specialization.....	22
Appendix B Object Matching Criteria	23
Appendix C IOD Details	24
Appendix D Extended Interface.....	25

List of Figures

Figure 2-1: SCP Role Application Data Flow Diagram 9

List of Tables

Table 1-1: Network Services 8

Table 2-1: DICOM Implementation Class and Version for Treatment Daemon Application Entity 11

Table 2-2: Operational Modes of Treatment Daemon Application 12

Table 2-3: Study Root C-FIND SCP Supported Elements for Treatment Daemon 14

Table 2-4: Query Level in a C-FIND Response for C-FIND Request with private Query Level
TREATMENTSUMREC 14

Table 2-5: Value of Attributes of a Setup Field in RT Plan depending on Operational Mode 15

Table 2-6: Presence of Nodes in XML Extended Interface depending on Operational Mode 16

Table 2-7: AE Title Configuration Table 17

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	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	No	Yes
Spatial Registration Storage	Yes	Yes
Positron Emission Tomography Image Storage	Yes	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
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 Microsoft Windows platforms.

1.3 Remarks

See [2], section 1.3 Remarks

1.4 References

- [1] Digital Imaging and Communications in Medicine (DICOM), Parts 1-18 (2009)
National Electrical Manufacturers Association (NEMA)
Rosslyn, VA
United States of America
- [2] Varian System Server DICOM Conformance Statement
B VA11001D3CS
Baden, Switzerland
- [3] On-Board Imager 1.4 DICOM Conformance Statement
B KC1406D3CS
Baden, Switzerland

1.5 Abbreviations and Definitions

See [2], section 1.5 Abbreviations and Definitions.

2. Networking

2.1 Implementation Model

2.1.1 Application Data Flow

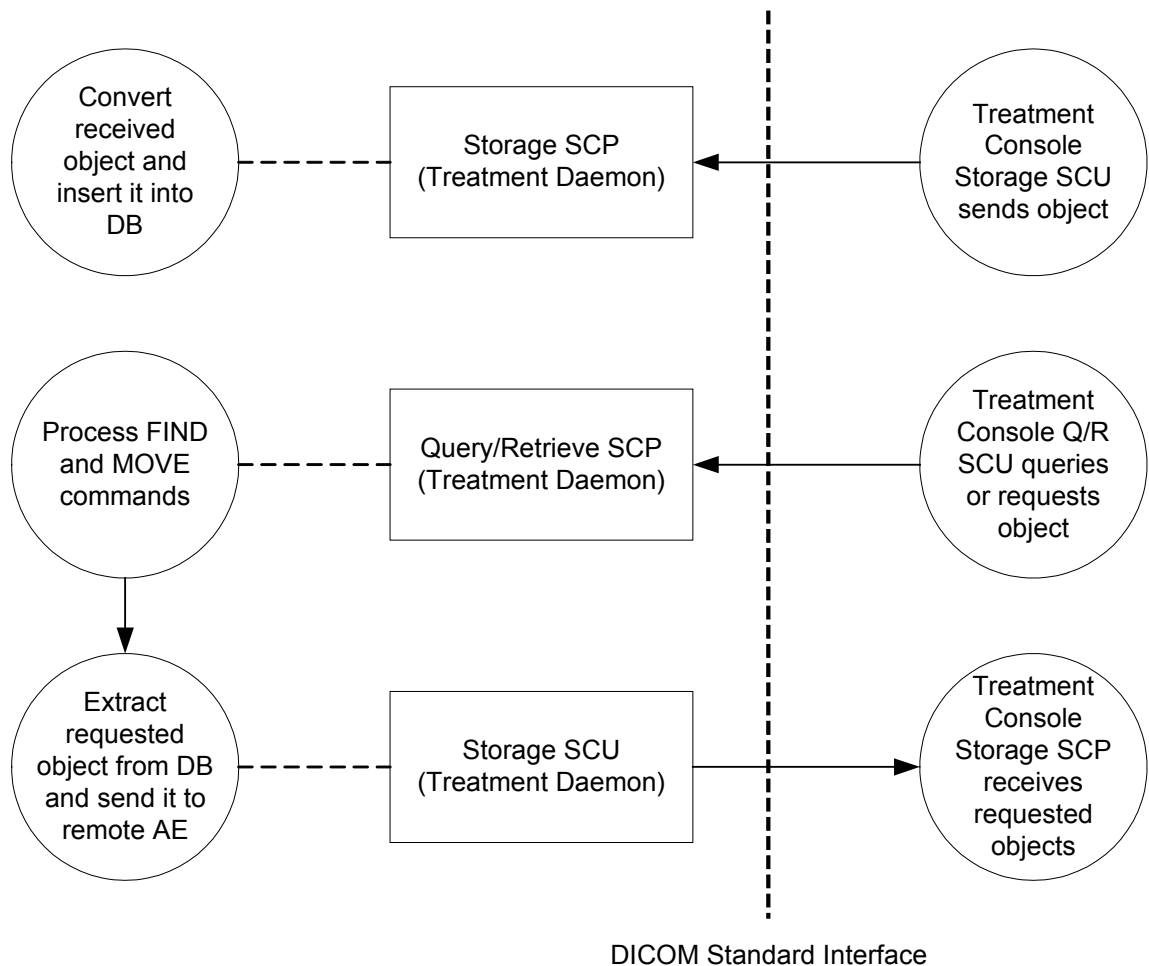


Figure 2-1: SCP Role Application Data Flow Diagram

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 2.2.3.2.1 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 (ARIA 10.0 Mode / Default Mode)	1.2.246.352.70.2.1.82.4.1
Implementation Class UID (ARIA 10.0 QA Mode)	1.2.246.352.70.2.1.82.4.2
Implementation Class UID (ARIA 11.0 Mode / Default Mode)	1.2.246.352.70.2.1.82.5.1
Implementation Class UID (ARIA 11.0 QA Mode)	1.2.246.352.70.2.1.82.5.2
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 operational modes:

- Vision 6.5 Mode
- ARIA 8.0 Mode
- ARIA 8.8 Mode
- ARIA 8.8 QA Mode
- ARIA 10.0 Mode
- ARIA 10.0 QA Mode
- ARIA 11.0 Mode
- ARIA 11.0 QA 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
1.2.246.352.70.2.1.60.3	ARIA 8.8 Mode
1.2.246.352.70.2.1.70.1	ARIA 8.8 Mode

1.2.246.352.70.2.1.81.4.1	ARIA 10.0 Mode
1.2.246.352.70.2.1.81.4.2	ARIA 10.0 QA Mode
1.2.246.352.70.2.1.81.5.1	ARIA 11.0 Mode
1.2.246.352.70.2.1.81.5.2	ARIA 11.0 QA Mode
All other Implementation Class UIDs	Default Mode (behaves identical to ARIA 11.0 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 at most two user-configured Application Entities.

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 Classes.

2.2.1.4.1.4 SOP Specific Conformance for RT Image Storage

See [2], section 2.2.3.4.1.4 SOP Specific Conformance for RT Image Storage.

2.2.1.4.1.5 SOP Specific Conformance for certain Image Storage SOP Classes

See [2], section 2.2.3.4.1.5 SOP Specific Conformance for certain Image Storage SOP Classes.

2.2.1.4.1.6 SOP Specific Conformance for RT Structure Set Storage

See [2], section 2.2.3.4.1.6 SOP Specific Conformance for RT Structure Set Storage.

2.2.1.4.1.7 SOP Specific Conformance for RT Dose Storage

See [2], section 2.2.3.4.1.7 SOP Specific Conformance for RT Dose Storage.

2.2.1.4.1.8 SOP Specific Conformance for RT Plan Storage

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

2.2.1.4.1.8.1 Data Handling

See [2], section 2.2.3.4.1.8.1 Data Handling

2.2.1.4.1.8.2 Import Preconditions

See [2], section 2.2.3.4.1.8.2 Import Preconditions.

2.2.1.4.1.8.3 Approval Status Requirements

See [2], section 2.2.3.4.1.8.3 Approval Status Requirements.

2.2.1.4.1.8.4 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.

2.2.1.4.1.9 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.

2.2.1.4.2 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

See [2], section 2.2.3.4.2.3 SOP Specific Conformance for all Query/Retrieve SOP Classes.

2.2.1.4.2.4 SOP Specific Conformance for Study Root Query SOP Classes

2.2.1.4.2.4.1 Matching Behavior

See [2], section 2.2.3.4.2.4.1 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	
ARIA 10.0 Mode	
ARIA 10.0 QA Mode	
ARIA 11.0 Mode	
ARIA 11.0 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 Study Root Retrieval SOP Classes

See [2], section 2.2.3.4.2.5 SOP Specific Conformance for Study Root Retrieval SOP Classes.

2.2.1.4.2.6 SOP Specific Conformance for RT Structure Set Move

See [2], section 2.2.3.4.2.6 SOP Specific Conformance for RT Structure Set Move

2.2.1.4.2.7 SOP Specific Conformance for RT Dose Move

See [2], section 2.2.3.4.2.7 SOP Specific Conformance for RT Dose Move

2.2.1.4.2.8 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.

Setup Fields

Setup fields are used for pre-plan verification procedures. For specific conformance definitions, see [3]. Note that the use of setup fields for most use cases will be retired in the 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 InterfaceAppendix 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 (QA) / 10.0 (QA) / 11.0 (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 (QA) / 10.0 (QA) / 11.0 (QA)	Absent
	Default	
>>>> CustomAddOn	Vision 6.5	Present for Block, Compensator and stand-alone Trays.
	ARIA 8.0 / 8.8 (QA) / 10.0 (QA) / 11.0 (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

2.2.1.4.2.9 SOP Specific Conformance for RT Image Move

See [2], section 2.2.3.4.2.9 SOP Specific Conformance for RT Image Move.

2.2.1.4.2.10 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 4.1 Overview.

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

5.3.1 Treatment Daemon

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

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Appendix A Specialization

See [2], section Appendix A Specialization.

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.

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