

# DICOM Conformance Statement

## Sectra RIS

Sectra RIS (Europe/Pacific), Version 16.1, June 2014



# SECTRA

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# About this document

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## **Feedback**

As part of our commitment to provide the highest quality products and services, we would like to encourage feedback on the quality of this documentation.

If you think we can improve this document in any way, then please send your suggestions to <info@sectra.se>.

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# 1 Introduction

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The following topics are included in this chapter:

- [Related documents](#)
- [Products and architecture](#)
- [DICOM Standard](#)

This document describes the DICOM support of Sectra RIS in general and Sectra RIS DICOM Service (CDS) in particular.

## 1.1 Related documents

- [1] [Digital Imaging and Communications in Medicine \(DICOM\), NEMA Standard Publications PS 3.1-20 and Supplements.](#)
- [2] [Installation Guide Sectra RIS](#)
- [3] [Installation Guide Sectra RIS CDS \(RIS DICOM Service\)](#)
- [4] [System Requirements Sectra RIS](#)

**Note:** Depending on the Sectra solution you are running, referenced documents may or may not be available to you.

## 1.2 Products and architecture

The architecture and components of Sectra RIS are described in [Installation Guide Sectra RIS](#) [2].

All server components are installed on Microsoft Windows, see [System Requirements Sectra RIS](#) [4].

## 1.3 DICOM Standard

This document should be read together with the DICOM standard [Digital Imaging and Communications in Medicine \(DICOM\), NEMA Standard Publications PS 3.1-20 and Supplements.](#) [1]. Definitions and terms are used in this document according to the DICOM standard. It is assumed that the reader is familiar with the DICOM standard.

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## 2 Implementation Model

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The following topics are included in this chapter:

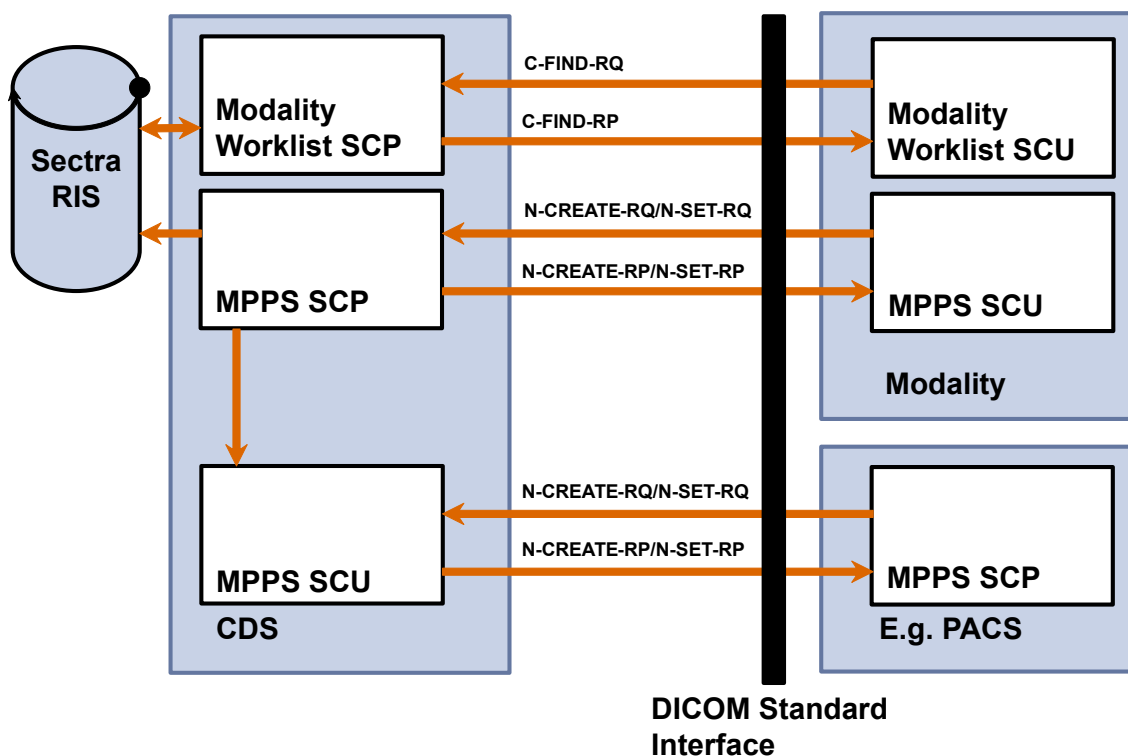
- [Application Data Flow Diagram](#)
- [Functional Definitions of AEs](#)
- [Sequencing of Real-World Activities](#)

Sectra RIS DICOM Service (CDS) is a Windows based service application that allows modalities to query Sectra RIS for patient demographic data such as Patient ID, name, date of birth etc. and to communicate Modality Performed Procedure Steps (MPPS) to Sectra RIS.

Sectra RIS DICOM Service is abbreviated CDS and Modality Performed Procedure Step is abbreviated MPPS throughout the remainder of this document.

### 2.1 Application Data Flow Diagram

590px Frame Drawing Template (Full PDF column width)



CDS may act SCP for Modality Worklist queries (Modality Worklist Management SOP Class) and both SCP and SCU for MPPS (Modality Performed Procedure Step SOP Class). The Modality Worklist SCP responds to C-Find requests containing matching key attributes from the modality and returns one or more C-FIND Responses containing return key attributes. The MPPS SCP responds only with a status code (i.e. no dataset). The MPPS SCU relays MPPS datasets received from the modality MPPS SCP.

## 2.2 Functional Definitions of AEs

### 2.2.1 Summary of SOP Classes Supported as SCP

**Table 2.1** Supported SOP classes as SCP

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Modality Worklist Information Model FIND	1.2.840.10008.5.1.4.31
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

### 2.2.2 Summary of Supported Transfer Syntaxes as SCP

**Table 2.2** Supported Transfer Syntaxes

Transfer Syntax Name	Transfer Syntax UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

### 2.2.3 Summary of SOP Classes Supported as SCU

**Table 2.3** Supported SOP classes as SCU

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

### 2.2.4 Summary of Supported Transfer Syntaxes as SCU

**Table 2.4** Supported Transfer Syntaxes

Transfer Syntax Name	Transfer Syntax UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

## 2.3 Sequencing of Real-World Activities

Not applicable.



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## 3 Modality Worklist (MWL) SCP Specification

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The following topics are included in this chapter:

- [Association Establishment Policies](#)
- [Association Initiation Policy](#)
- [Association Acceptance Policy](#)

### 3.1 Association Establishment Policies

#### 3.1.1 General

The maximum PDU length that the MWL SCP AE will handle is configurable. The default value is 256 Kbytes.

#### 3.1.2 Number of Associations

By default, the MWL SCP AE can handle 128 simultaneous associations at a time. This number is configurable.

#### 3.1.3 Asynchronous Nature

The MWL SCP supports multiple outstanding transactions over a single association.

**Table 3.1** Asynchronous nature as a SCP for Modality Worklist

Setting	Default value
Maximum number of outstanding asynchronous transactions	1024 (configurable)

#### 3.1.4 Implementation Identifying Information

The MWL SCP AE will provide the following implementation identifying information:

Parameter	Value
Implementation Class UID	1.2.752.24.5.5.1.1.0.0
Implementation version name	SectraDcmtk

## 3.2 Association Initiation Policy

The MWL SCP will not initiate any associations.

## 3.3 Association Acceptance Policy

It is possible to configure whether unrecognized AE titles shall be allowed or not. By default, the MWL SCP will reject associations from applications that do not address it properly, i.e. specify an incorrect called AE title.

The MWL SCP accepts associations for the following events:

- Verification of the DICOM communication between a remote system and the MWL SCP AE.
- MWL C-Find query.

### 3.3.1 Real-World Activity: Verification

#### 3.3.1.1 Associated Real-World Activity

A remote system wants to verify the DICOM communication with the MWL SCP AE.

#### 3.3.1.2 Accepted Presentation Contexts

The proposed abstract syntaxes and transfer syntaxes are found by investigating [Table 2.1, “Supported SOP classes as SCP”](#) and [Table 2.2, “Supported Transfer Syntaxes”](#). Role is SCP and no extended negotiation is supported.

#### 3.3.1.3 SOP Specific Conformance to Verification SOP class

The MWL SCP AE provides standard conformance to the DICOM Verification Service Class.

#### 3.3.1.4 Presentation Context Acceptance Criterion

There are no specific rules for acceptance.

#### 3.3.1.5 Transfer Syntax Selection Policies

The transfer syntax selection is done according to the order in [Table 2.2, “Supported Transfer Syntaxes”](#), but is configurable.

### 3.3.2 Real-World Activity: Worklist Query

#### 3.3.2.1 Associated Real-World Activity

A remote system requests a worklist using the C-FIND command.

### 3.3.2.2 Accepted Presentation Contexts

The proposed abstract syntaxes and transfer syntaxes are found by investigating [Table 2.1, “Supported SOP classes as SCP”](#) and [Table 2.2, “Supported Transfer Syntaxes”](#). Role is SCP. Extended negotiation is not supported.

### 3.3.2.3 SOP Specific Conformance to FIND SOP classes

The MWL SCP AE provides conformance to the DICOM FIND SOP classes as SCP. [Table 3.2, “Matching and default Return Attributes as SCP”](#) contains the currently supported Matching key attributes and default Return attributes. For each modality registered in Sectra RIS Database, it is possible to configure what attributes shall be supported with a value from Sectra RIS (provided that it is included in the worklist query) and also what information each attribute shall contain. However, the information is restricted to what information is stored and available in Sectra RIS Database. Attributes included in the worklist query that are not configured in Sectra RIS to contain a value will be returned with an empty value unless the standard states otherwise.

If unsupported matching key(s) are found in the worklist query a pending response status of xFF01 (Pending Warning) will be returned, otherwise xFF00 (Pending). In case the query results in no matching, a response of x0 (Success) is sent.

**Table 3.2** Matching and default Return Attributes as SCP

Tag	VR	Attribute Name	Matching	Comments
{0008,0005}	CS	Specific Character Set		Configurable.
{0008,0050}	SH	Accession Number	Single value	
{0008,0090}	PN	Referring Physician's name		
{0010,0010}	PN	Patients Name	Single value or wild card	
{0010,0020}	LO	PatientID	Single value or wild card	
{0010,0030}	DA	PatientsBirthDate		
{0010,0040}	CS	PatientsSex		
{0010,2000}	LO	MedicalAlerts		
{0020,000d}	UI	StudyInstanceUID		
{0032,1032}	PN	RequestingPhysician		
{0032,1060}	LO	RequestedProcedureDescription		
{0032,1064}}	SQ	Requested ProcedureCodeSequence	Sequence	
> {0008,0100}	SH	CodeValue		
> {0008,0102}	SH	CodingSchemeDesignator		
> {0008,0103}	SH	CodingSchemeVersion		
> {0008,0104}	LO	CodeMeaning		
{0040,0100}	SQ	ScheduledProcedureStepSequence	Sequence	
> {0008,0060}	CS	Modality	Single value or wild card	
> {0040,0001}	AE	ScheduledStationAETitle	Single value, multiple value or wild ward	
> {0040,0002}	DA	ScheduledProcedureStepStartDate	Single value or range	
> {0040,0003}	TM	ScheduledProcedureStepStartTime	Single value or range	
> {0040,0007}	LO	ScheduledProcedureStepDescription		
> {0040,0008}	SQ	ScheduledProtocolCodeSequence	Sequence	
>> {0008,0100}	SH	CodeValue		
>> {0008,0102}	SH	CodingSchemeDesignator		
>> {0008,0103}	SH	CodingSchemeVersion		
>> {0008,0104}	LO	CodeMeaning		
> {0040,0009}	SH	ScheduledProcedureStepID		
> {0040,0010}	SH	ScheduledStationName	Single value, multiple value or wild card	
> {0040,0020}	CS	ScheduledProcedureStepStatus		SCHEDULED or ARRIVED
{0040,1001}	SH	RequestedProcedureID	Single value or wild card	

Tag	VR	Attribute Name	Matching	Comments
{0040,1003}	SH	RequestedProcedurePriority		MEDIUM or HIGH

#### 3.3.2.4 Presentation Context Acceptance Criterion

The intersection between the proposed and acceptable Presentation Contexts is taken for the established association.

#### 3.3.2.5 Transfer Syntax Selection Policies

The transfer syntax selection is done according to the order in [Table 2.2, “Supported Transfer Syntaxes”](#), but is configurable.

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## 4 MPPS SCP Specification

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The following topics are included in this chapter:

- [Association Establishment Policies](#)
- [Association Initiation Policy](#)
- [Association Acceptance Policy](#)

### 4.1 Association Establishment Policies

#### 4.1.1 General

The maximum PDU length that the MPPS SCP AE will handle is configurable. The default value is 256 Kbytes.

#### 4.1.2 Number of Associations

By default, the MPPS SCP AE can handle 128 simultaneous associations at a time. This number is configurable.

#### 4.1.3 Asynchronous Nature

The MPPS SCP supports multiple outstanding transactions over a single association.

**Table 4.1** Asynchronous nature as a SCP for Modality Worklist

Setting	Default value
Maximum number of outstanding asynchronous transactions	1024 (configurable)

#### 4.1.4 Implementation Identifying Information

The MPPS SCP AE will provide the following implementation identifying information:

Parameter	Value
Implementation Class UID	1.2.752.24.5.5.1.1.0.0
Implementation version name	SectraDcmtk

## 4.2 Association Initiation Policy

The MPPS SCP will not initiate any associations.

## 4.3 Association Acceptance Policy

It is possible to configure whether unrecognized AE titles shall be allowed or not. By default, the MPPS SCP will reject associations from applications that do not address it, i.e. specify an incorrect called AE title.

The MPPS SCP accepts associations for the following events:

- Verification of the DICOM communication between a remote system and the MPPS SCP.
- Request to Create (N-CREATE) or Update (N-SET) a Performed Procedure Step.

### 4.3.1 Real-World Activity: Verification

#### 4.3.1.1 Associated Real-World Activity

A remote system wants to verify the DICOM communication with the MPPS SCP AE.

#### 4.3.1.2 Accepted Presentation Contexts

The proposed abstract syntaxes and transfer syntaxes are found by investigating [Table 2.1, “Supported SOP classes as SCP”](#) and [Table 2.2, “Supported Transfer Syntaxes”](#). Role is SCP and no extended negotiation is supported.

#### 4.3.1.3 SOP Specific Conformance to Verification SOP class

The MPPS SCP AE provides standard conformance to the DICOM Verification Service Class.

#### 4.3.1.4 Presentation Context Acceptance Criterion

There are no specific rules for acceptance.

#### 4.3.1.5 Transfer Syntax Selection Policies

The transfer syntax selection is done according to the order in [Table 2.2, “Supported Transfer Syntaxes”](#), but is configurable.

### 4.3.2 Real-World Activity: Performed Procedure Step Creation/Update

#### 4.3.2.1 Associated Real-World Activity

A remote system wants to create a new or update an existing Performed Procedure Step using the N-CREATE or N-SET commands.

#### 4.3.2.2 Accepted Presentation Contexts

The proposed abstract syntaxes and transfer syntaxes are found by investigating [Table 2.1, “Supported SOP classes as SCP”](#) and [Table 2.2, “Supported Transfer Syntaxes”](#). Role is SCP. Extended negotiation is not supported.

#### 4.3.2.3 SOP Specific Conformance to MPPS SOP Class

The MPPS SCP AE provides conformance to the DICOM MPPS SOP Class as SCP. [Table 4.2, “Use of Dicom Data in the MPPS SOP Instance”](#) describes the usage of specific attributes in the MPPS SOP Instance.

In the case of receiving an N-CREATE message where the modality does not provide a SOP Instance UID for the new Performed Procedure Step, the MPPS SCP will create one.

It is possible to configure whether the MPPS SCP shall return an error (x112) if the study in the MPPS SOP Instance does not exist in Sectra RIS Database. If it is configured to verify studies, the MPPS SCP will not perform the requested actions unless the modality uses the values provided by the CDS MWL SCP.

It is possible to configure (for each modality) what DICOM tag CDS should use when verifying MPPS messages. Possible tags are:

- Study Instance UID (default)
- Accession Number
- Study Id
- Requested Procedure ID

The MPPS SCP responds only with a status code (i.e. no attribute list) and possibly with a failure class instance if an error has occurred.



**Table 4.2** Use of Dicom Data in the MPPS SOP Instance

Tag	Attribute Name	Req.Type N-CREATE	Req.Type N-SET	Stored In RIS
{0008,0005}	Specific Character Set	3	-	
{0040,0270}	Scheduled Step Attribute Sequence	1	-	
>{0020,000D}	Study Instance UID	1C <sup>1</sup>	-	
>{0008,0110}	Referenced Study Sequence	3	-	
>>{0008,1150}	Referenced SOP Class UID	3	-	
>>{0008,1155}	Referenced SOP Instance UID	3	-	
>{0008,0050}	Accession Number	1C <sup>2</sup>	-	
>{0040,2016}	Placer Order Number/Imaging service request	3	-	
>{0040,2017}	Filler Order Number/Imaging service request	3	-	
>{0040,1001}	Requested Procedure ID	1C <sup>3</sup>	-	
>{0032,1060}	Requested Procedure Description	3	-	
>{0040,0009}	Scheduled Procedure Step ID	3	-	
>{0040,0007}	Scheduled Procedure Step Description	3	-	
>{0040,0008}	Scheduled Protocol Code Sequence	3	-	
>>{0008,0100}	Code Value	3	-	
>>{0008,0102}	Coding Scheme Designator	3	-	
>>{0008,0103}	Coding Scheme Version	3	-	
>>{0008,0104}	Code Meaning	3	-	
{0010,0010}	Patient's Name	3	-	
{0010,0020}	Patient ID	3	-	
{0010,0030}	Patient's Birth Date	3	-	
{0010,0040}	Patient's Sex	3	-	
{0008,1120}	Referenced Patient Sequence	3	-	
>{0008,1150}	Referenced SOP Class UID	3	-	
>{0008,1155}	Referenced SOP Instance UID	3	-	
{0040,0253}	Performed Procedure Step ID	1	-	
{0040,0241}	Performed Station AE Title	1	-	
{0040,0242}	Performed Station Name	3	-	
{0040,0243}	Performed Location	3	-	

<sup>1</sup>May be required depending on configuration, see [section 3.3.2 Real-World Activity: Worklist Query](#)<sup>2</sup>May be required depending on configuration, see [section 3.3.2 Real-World Activity: Worklist Query](#)<sup>3</sup>May be required depending on configuration, see [section 3.3.2 Real-World Activity: Worklist Query](#)

Tag	Attribute Name	Req.Type N-CREATE	Req.Type N-SET	Stored In RIS
{0040,0244}	Performed Procedure Step Start Date	1	-	
{0040,0245}	Performed Procedure Step Start Time	1	-	
{0040,0252}	Performed Procedure Step Status	1	3	Yes
{0040,0254}	Performed Procedure Step Description	3	3	
{0040,0255}	Performed Procedure Type Description	3	3	
{0008,1032}	Procedure Code Sequence	3	3	
>{0008,0100}	Code Value	3	3	
>{0008,0102}	Coding Scheme Designator	3	3	
>{0008,0103}	Coding Scheme Version	3	3	
>{0008,0104}	Code Meaning	3	3	
{0040,0250}	Performed Procedure Step End Date	3	3	
{0040,0251}	Performed Procedure Step End Time	3	3	
{0040,0280}	Comments on the Performed Procedure Step	3	3	
{0040,0281}	Performed Procedure Step Discontinuation Reason Code Sequence	3	3	
>{0008,0100}	Code Value	3	3	
>{0008,0102}	Coding Scheme Designator	3	3	
>{0008,0103}	Coding Scheme Version	3	3	
>{0008,0104}	Code Meaning	3	3	
{0008,0060}	Modality	3	-	
{0020,0010}	Study ID	1C <sup>4</sup>	-	
{0040,0260}	Performed Protocol Code Sequence	3	3	
>{0008,0100}	Code Value	3	3	
>{0008,0102}	Coding Scheme Designator	3	3	
>{0008,0103}	Coding Scheme Version	3	3	
>{0008,0104}	Code Meaning	3	3	
{0040,0340}	Performed Series Sequence	3	3	
>{0008,1050}	Performing Physician's Name	3	3	
>{0018,1030}	Protocol Name	3	3	
>{0008,1070}	Operator's Name	3	3	
>{0020,000E}	Series Instance UID	3	3	
>{0008,103E}	Series Description	3	3	

<sup>4</sup>May be required depending on configuration, see [section 3.3.2 Real-World Activity: Worklist Query](#)

Tag	Attribute Name	Req.Type N-CREATE	Req.Type N-SET	Stored In RIS
>(0008,0054)	Retrieve AE Title	3	3	
>(0008,1140)	Referenced Image Sequence	3	3	
>>(0008,1150)	Referenced SOP Class UID	3	3	
>>(0008,1155)	Referenced SOP Instance UID	3	3	
>(0040,0220)	Referenced Non-Image Composite SOP Instance Sequence	3	3	
>>(0008,1150)	Referenced SOP Class UID	3	3	
>>(0008,1155)	Referenced SOP Instance UID	3	3	
	All other attributes from Performed Series Sequence	3	3	
	All other attributes from Billing and Material Code Module	3	3	
(0008,2229)	Anatomic Structure, Space or Region Sequence	3	3	
>(0008,0100)	Code Value	3	3	Yes
>(0008,0102)	Coding Scheme Designator	3	3	Yes
>(0008,0103)	Coding Scheme Version	3	3	
>(0008,0104)	Code Meaning	3	3	Yes
(0040,0300)	Total Time of Fluoroscopy	3	3	Yes
(0040,0301)	Total Number of Exposures	3	3	Yes
(0018,1110)	Distance Source to Detector (SID)	3	3	Yes
(0040,0306)	Distance Source to Entrance	3	3	Yes
(0040,0302)	Entrance Dose	3	3	Yes
(0040,8302)	Entrance Dose in mGy	3	3	Yes
(0040,0303)	Exposed Area	3	3	Yes
(0018,115E)	Image Area Dose Product	3	3	Yes
(0040,0310)	Comments on Radiation Dose	3	3	Yes
(0040,030E)	Exposure Dose Sequence	3	3	
>(0018,115A)	Radiation Mode	3	3	Yes
>(0018,0060)	KVp	3	3	Yes
>(0018,8151)	X-Ray Tube Current in $\mu$ A	3	3	Yes
>(0018,1150)	Exposure Time	3	3	Yes
>(0018,1160)	Filter Type	3	3	Yes
>(0018,7050)	Filter Material	3	3	Yes

Tag	Attribute Name	Req.Type N-CREATE	Req.Type N-SET	Stored In RIS
>(0040,0310)	Comments on Radiation Dose	3	3	Yes
(0040,0316)	Organ Dose	3	3	Yes

#### 4.3.2.4 Presentation Context Acceptance Criterion

There are no specific rules for acceptance.

#### 4.3.2.5 Transfer Syntax Selection Policies

The transfer syntax selection is done according to the order in [Table 2.2, “Supported Transfer Syntaxes”](#), but is configurable.

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# 5 MPPS SCU Specification

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The following topics are included in this chapter:

- [Association Establishment Policies](#)
- [Association Initiation Policy](#)

## 5.1 Association Establishment Policies

### 5.1.1 General

The maximum PDU length that the MPPS SCU AE will handle is configurable. The default value is 128 Kbytes.

### 5.1.2 Number of Associations

The MPPS SCU will only initiate one association at a time.

### 5.1.3 Asynchronous Nature

The MPPS SCU supports asynchronous operations, but will only use a single outstanding operation on an association.

### 5.1.4 Implementation Identifying Information

The MPPS SCU AE will provide the following implementation identifying information:

Parameter	Value
Implementation Class UID	1.2.752.24.5.5.1.1.0.0
Implementation version name	SectraDcmtk

## 5.2 Association Initiation Policy

The MPPS SCU will initiate an association when an MPPS message arrives from a modality, provided that CDS is configured to relay MPPS messages.

## 5.2.1 Real-World Activity: Relay MPPS

### 5.2.1.1 Description and Sequencing of Activities

The MPPS SCP AE receives an MPPS message from a modality. CDS examines whether one or more remote AEs shall have the message relayed. If so, the MPPS SCU will initiate associations with the remote AE(s) and relay the message. The relay is done in a sequential order.

### 5.2.1.2 Proposed Presentation Contexts

The proposed abstract syntaxes and transfer syntaxes are found by investigating [Table 2.3, “Supported SOP classes as SCU”](#) and [Table 2.4, “Supported Transfer Syntaxes”](#). Role is SCU. Extended negotiation is not supported.

### 5.2.1.3 SOP Specific Conformance to MPPS SOP Class

The MPPS SCP AE provides conformance to the DICOM MPPS SOP Class as SCU. The MPPS messages are relayed in their original state without CDS making any modifications.

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# 6 Communication Profiles

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The following topics are included in this chapter:

- [Supported Communication Stacks](#)
- [TCP/IP Stack](#)
- [OSI Stack](#)
- [Point-To-Point Stack](#)

## 6.1 Supported Communication Stacks

All application entities described in this conformance statement provide DICOM 3.0 TCP/IP Network Communication Support as defined in part eight of the DICOM Standard.

## 6.2 TCP/IP Stack

The server inherits the TCP/IP stack built into the operating system under which it runs, see [chapter 2 Implementation Model](#).

### 6.2.1 Physical Media Support

CDS is neutral to the physical medium over which TCP/IP executes.

## 6.3 OSI Stack

Not supported.

## 6.4 Point-To-Point Stack

Not supported.

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## **7 Extensions / Specializations / Privatizations**

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Not applicable.



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# 8 Configuration

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The following topics are included in this chapter:

- [AE Title/Presentation Address Mapping](#)

The behavior and settings of CDS are not to be altered by the users of either Sectra RIS or connected modalities. All questions regarding configuration issues should be referred to the system administrators.

## 8.1 AE Title/Presentation Address Mapping

MWL/MPPS SCU should by default use the same configuration parameters (AE, Host and Port) for both MWL SCP and MPPS SCP. It is however possible to configure them to use separate ports.

### 8.1.1 Local AE Titles and Presentation Addresses

The local AE title is `SECTRA_RIS` using port 4007 by default, but is configurable. See [Installation Guide Sectra RIS CDS \(RIS DICOM Service\) \[3\]](#) for further description.

### 8.1.2 Remote AE Titles and Presentation Addresses

Configuring remote AE titles and port numbers is described in [Installation Guide Sectra RIS CDS \(RIS DICOM Service\) \[3\]](#).

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## 9 Support of Character Sets

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Supported extended character sets:

- ISO\_IR 100 (ISO-8859-1)

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This product may be covered by U.S. patents 6,005,917; 6,226,393; 6,411,729; 6,763,257; 7,162,623; 7,532,214; 7,660,461; 7,689,539; 7,830,381; 7,936,930; 7,940,270; 7,992,100; 8,041,129; 8,051,386; 8,131,033; 8,295,620; Japanese patent 3646122; European patents 0818971; 1046374; and Swedish patents 0203545; 0300951. Patents Pending in the U.S. and other countries.

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