

MILLENSYS



**DICOM Conformance Statement
for
MIWL SERVER**

Basic Modality Worklist SCP
Modality Performed Procedure Step SCP

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MILLENSYS Contacts

- **Main Office**

Address :

36 Ahmed El-Zomor Street, Nasr City, Cairo, Egypt

Telephone/Fax :

+20 2 22713860

+20 2 22754867

+20 2 22879403

- **Internet :**

Web site:

www.millensys.com

- **Email :**

Sales Department

sales@millensys.com

Support Department

support@millensys.com

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Vision Tools User Guide. 

Document Information

Author	Eng.Ahmed Hussein	Tel: +20 2 22754867 E-Mail: a_hussein@millensys.com
Editing&layout	Eng.Hossam Rady	Tel: +20 2 22713860 E-Mail: h_rady@millensys.com
For questions regarding the technical content of this document, please contact:	Eng.Ahmed Hussein	Tel: +20 2 22754867 E-Mail: a_hussein@millensys.com

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1. Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement

1.1 Overview

This conformance statement refers to a Vision Tools family of products (Diagnostic and Viewing workstation) that are based on the same communication software. This document refers to each of the above products as a *System*. Unless otherwise indicated.

1.2 Scope and Field of Application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Millensys. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment.

The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Millensys equipment into an environment of medical devices. This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM].

1.3 Intended Audience

This Conformance Statement is intended for:

- I- (Potential) customers.
- II- System integrators of medical equipment.
- III- Marketing staff interested in system functionality.
- IV- Software designers implementing DICOM interfaces.

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

1.3.1 Integration

The integration of any device into a system of interconnected devices goes beyond the scope of the DICOM 3.0 standard and this conformance statement when *interoperability* is desired. The responsibility for analyzing the applications requirements and developing a solution that integrates the MillenSys equipment with other vendors' systems is the user's and should not be underestimated.

1.3.2 Validation

Testing the complete range of possibilities between the MillenSys devices and non-MillenSys devices, before the connection is declared operational, is deemed to be a necessity. The user should ensure that any non-MillenSys provider accepts full responsibility for all validation required for their connection with the MillenSys devices. The accuracy of image data once it has crossed the interface between MillenSys and non-MillenSys devices as well as the stability of the image data for the intended applications is the responsibility of the non-MillenSys provider.

1.3.3 Future Evolution

As the DICOM 3.0 standard evolves to meet the user's growing requirements and to incorporate new features and technologies, MillenSys will follow the evolution of the standard. This evolution of the standard may require changes to MillenSys devices that have implemented DICOM 3.0. The user should ensure that any non-MillenSys provider, who connects with MillenSys devices, also plans future evolution of the DICOM standard. A refusal to do so may reflect in the loss of functionality and/or connectivity between the different products.

1.4 References

The Digital Imaging and Communications in Medicine (DICOM) standard (NEMA PS 3.X):

National Electrical Manufacturers Association (NEMA),
Publication Sales 1300 N. 17th Street, Suite 1847, Rosslyn, Va. 22209,
United States of America.

1.5 Definitions

- **Association Establishment** - An Association Establishment is the first phase of communication between two DICOM Application Entities (AEs). The AEs use the Association Establishment to negotiate how data will be encoded and the type of data to be exchanged.
- **Called Application Entity Title** - The Called AE Title defines the intended receiver of an Association.

- **Calling Application Entity Title** - The Calling AE Title defines the requestor of an Association.
- **DICOM Message Service Element (DIMSE)** - A DIMSE defines the services and protocols utilized by an Application Entity to exchange messages.
- **Information Object Definition (IOD)** - An IOD is the data model which is an abstraction of the real-world information. This data model defines the nature and attributes relevant to the class of real-world objects represented.
- **Service Class Provider (SCP)** - A SCP plays the **server** role to perform operations and invoke notifications during an Association. An example of a Storage Class Provider would be an image storage device. In this case, the image storage device is storing the image that was sent by a Service Class User.
- **Service Class User (SCU)** - A SCU plays the **client** role to invoke operations and perform notifications during an Association. An example of a SCU would be an image acquisition device. In this case, the image acquisition device will create and send DICOM image by requesting that a SCP store the image.
- **Service/Object Pair (SOP) Class** - A SOP Class is defined by the union of an Information Object Definition and set of DIMSE Services. A DICOM Application Entity may support one or more SOP Classes. Each SOP Class is uniquely identified by a SOP Class UID.
- **SOP Instance** - A specific occurrence of a Information Object.
- **Transfer Syntax** – The Transfer Syntax is a set of encoding rules that allow DICOM Application Entities to negotiate the encoding techniques (e.g data element structure, byte ordering, compression) they are able to support. The Transfer Syntax is negotiated during Association Negotiation.
- **Unique Identifier (UID)** – A UID is a globally unique, ISO compliant, ASCII – numeric string. It guarantees uniqueness across multiple countries, sites, vendors and equipment.

1.6 Acronyms, Abbreviations and Symbols

- | | |
|------------------|---|
| ▪ ACC | American College of Cardiology |
| ▪ ACR | American College of Radiology |
| ▪ ASCII | American Standard Code for Information Interchanges |
| ▪ AE | Application Entity |
| ▪ ANSI | American National Standards Institute |
| ▪ DICOM | Digital Imaging and Communication in Medicine |
| ▪ DIMSE | DICOM Message Service Element |
| ▪ DIMSE-C | DICOM Message Service Element - Composite |
| ▪ DIMSE-N | DICOM Message Service Element - Normalized |
| ▪ HIS | Hospital Information System |

- **HL7** Health Level 7
- **IE** Information Entity
- **IOD** Information Object Definition
- **ISO** International Standard Organization
- **NEMA** National Electric Manufacturers Association
- **PDU** Protocol Data Unit
- **RIS** Radiology Information System
- **SCP** Service Class Provider
- **SCU** Service Class User
- **SOP** Service Object Pair
- **TCP/IP** Transmission Control Protocol/Internet Protocol
- **UID** Unique Identifier
- **MPPS** Modality Performed Procedure Step

2. Implementation Model

MIWL SERVER includes the following components:

- Verification Class, MIWL SERVER supports also verification requests from remote systems. This may be helpful for service engineers.
- Basic Modality Worklist Management, After a DICOM C-Find request is sent to MIWL SERVER, the program will return the requested information from the internal database.
- Modality Performed Procedure Step Management, MIWL SERVER will accept the DICOM N-Create, N-Set Commands, to create and update the database about the completion of the exams (ex: created and changed).

2.1 Verification

2.1.1 Application Data Flow Diagram

Figure 1: Application data flow diagram of verification SCP

2.1.2 Functional Definitions of AE's

The Echo function provides an easy way to determine if the remote AE is available. When C-Echo Function is used, an association which includes a Presentation Context for Verification Class is proposed. A successful response indicates that the remote AE is available.

2.2 Basic Modality Worklist

2.2.1 Application Data Flow Diagram

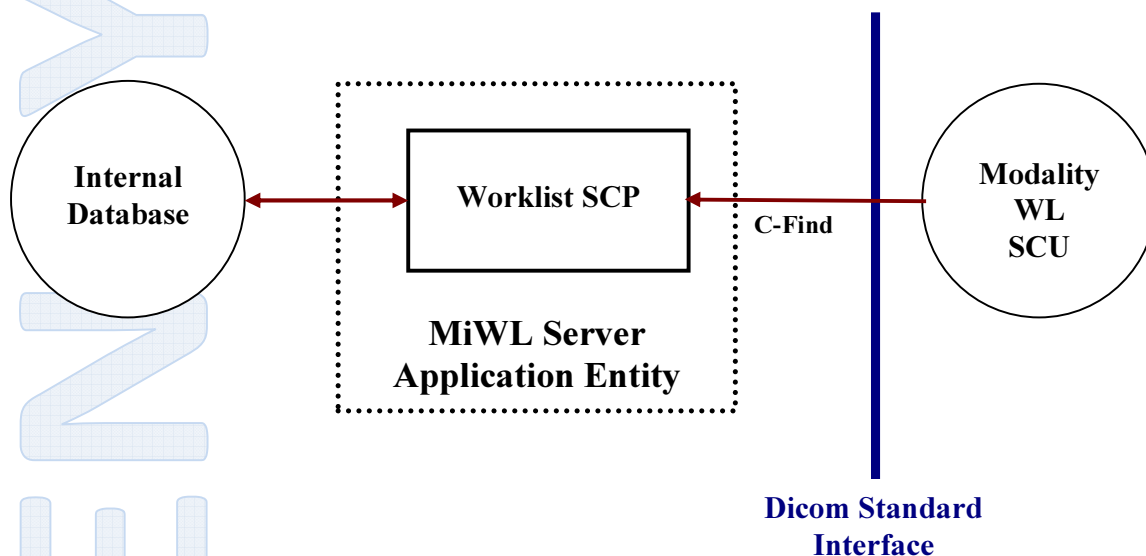


Figure 2: Application data flow diagram of Worklist SCP

2.2.2 Functional Definitions of AE's

2.2.2.1 Worklist SCP

When using MIWL SERVER C-Find SCP, the modality will request information about the scheduled exams information from the server. The server will perform an internal search depending on the type of the C-Find Request, then the results is sent back for the modality.

2.3 Modality Performed Procedure Step

2.3.1 Application Data Flow Diagram

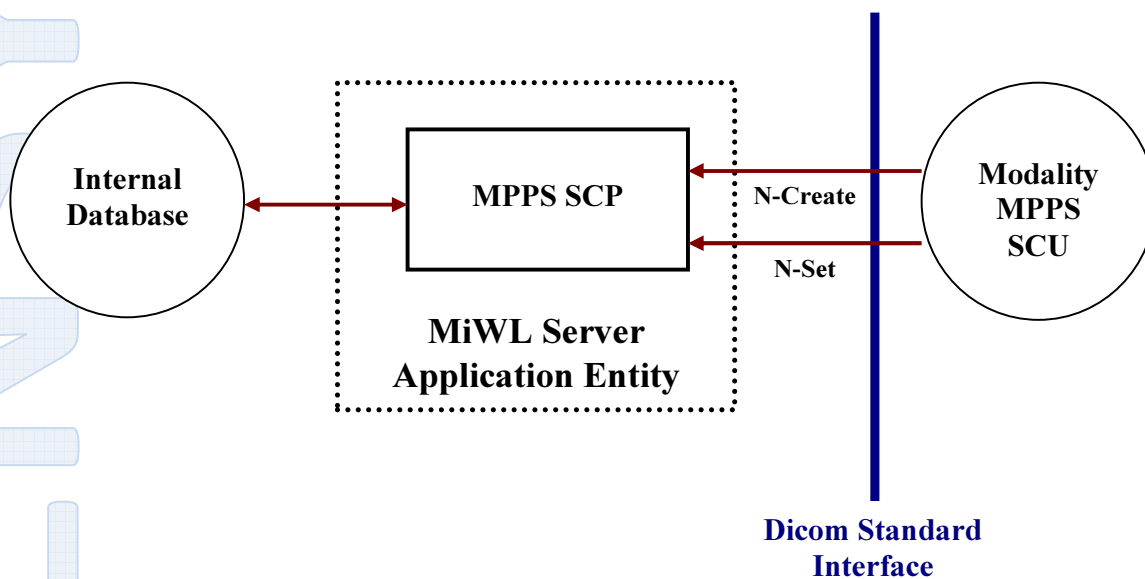


Figure 3: Application data flow diagram of MPPS SCP

2.3.2 Functional Definitions of AE's

When MiWL Server accepts the DIMSE N-CREATE or N-SET association, the remote AE transmits the DICOM information within the N-CREATE/N-SET message to MiWL Server. The received data is stored in the Internal Database.

3. AE Specifications

3.1 AE Verification Specification

The MiWL Server Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as a SCP.

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

Table 2: Supported SOP Classes as SCP by the MiWL Server

3.1.1 Association Acceptance Policy

3.1.1.1 General

The configuration of the MIWL SERVER DICOM application defines the Application Entity Titles, the port numbers and of course the host name and net address.

3.1.1.2 Number of Association

There is no limit (beyond system resources) on the number of MIWL SERVER. AE's that can be active simultaneously.

3.1.1.3 Asynchronous Nature

The MIWL SERVER DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

3.1.1.4 Implementation Identifying Information

The MIWL SERVER DICOM software provides a single Implementation Class UID of

- <" 1.2.826.0.1.3680043.2.773">
- and an Implementation Version Name of
- <"MIWL SERVER 1.X">.

3.1.2 Association Acceptance Policy

The MIWL SERVER DICOM Service Tool application attempts accept a new association for

- DIMSE C-ECHO Service operation.

3.1.2.1 Real-World Activity - Verification SCP

3.1.2.1.1 Associated Real-World Activity

MIWL SERVER accepts associations from systems to verify application level communication using the C-ECHO Service Element.

3.1.2.1.2 Presentation Contexts Table

The MIWL SERVER DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCP	None

Table 3: Acceptance Presentation Context Verification

3.1.2.1.3 SOP Specific Conformance Statement - Verification SCP

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

3.1.2.2 Real-World Activity – Request For Modality Worklist

3.1.2.2.1 Associated Real-World Activity

MiWL Server accepts associations from systems that wish to have an up-to-date Modality Worklist using the C-FIND command.

3.1.2.2.2 Presentation Contexts Table

The MiWL Server will accept the presentation contexts as given in the next table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID		
Basic Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Table 4: Supported Presentation Context for the WL service

3.1.2.2.3 SOP Specific Conformance Statement

Return Key Attributes of the Worklist C-FIND

The MIWL SERVER DICOM worklist SCP supports worklist queries with return key attributes of all types. The following tables describe the return keys that the SCP support

Attribute name	Tag	Return Key Type	Notes
Sop Common			
Specific Character Set	(0008,0005)	1C	
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0008,0005)	1	-
> Scheduled Station AE Title	(0040,0100)	1	Matching Key
> Scheduled procedure Step Start Date	(0040,0001)	1	Matching Key
> Scheduled procedure Step Start Time	(0040,0002)	1	Matching Key
>Modality	(0008,0060)	1	Matching Key
>Scheduled Performing Physician Name	(0040,0006)	2	Matching Key
>Scheduled Procedure Step Description	(0040,0007)	1C	

>Scheduled Station Name	(0040,0010)	2	Matching Key
>Scheduled Procedure Step Location	(0040,0011)	2	Matching Key
>Pre-Medication	(0040,0012)	2C	Always empty
>Scheduled Procedure Step ID	(0040,0009)	1	Matching Key
Requested Procedure ID			
Requested Procedure ID	(0040,1001)	1	Matching Key
Requested Procedure Description	(0032,1060)	1C	Matching Key
Study Instance UID	(0020,000D)	1	Matching Key
Requested Procedure Priority	(0040,1003)	2	Always empty
Patient Transport Arrangement	(0040,1004)	2	Always empty
Imaging Service Request			
Accession Number	(0008,0050)	2	Matching Key
Requesting Physician	(0032,1032)	2	Matching Key
Referring Physician's Name	(0008,0090)	2	Matching Key
Visit Identification			
Admission ID	(0038,0010)	2	Matching Key
Visit Status			
Current Patient Location	(0038,0300)	2	Always empty
Patient Identification			
Patient's Name	(0010,0010)	1	Matching Key
Patient's ID	(0010,0020)	1	Matching Key
Patient Demographic			
Patient's Birth Date	(0010,0030)	2	Matching Key
Patient's Sex	(0010,0040)	2	Matching Key
Patient's Weight	(0010,1030)	2	Always empty
Confidentiality Constraint on Patient Data	(0040,3001)	2	Always empty
Patient Medical			
Patient State	(0038,0500)	2	Always empty
Pregnancy Status	(0010,21C0)	2	Always empty
Medical Alerts	(0010,2000)	2	Always empty
Contrast Allergies	(0010,2100)	2	Always empty
Special Needs	(0038,0050)	2	Always empty

Table 5: Scheduled Procedure Step, Patient Identification, Imaging Service Request, Patient Demographics, Visit Status, Visit Identification Return keys

The worklist SCP Uses the following status codes as return for requests:

- **Success (0000):** Success.
- **Refused (A702):** Unable to perform sub operation (due to failure of a C-STORE).
- **Refused (A700):** General refusal status.
- **Warning (B000):** General warning status.
- **Failure (C000):** General failure status.

3.1.2.3 Real-World Activity – Receive Modality Performed Procedure Step Request

3.1.2.3.1 Associated Real-World Activity

MiWL Server accepts associations from systems that send N-CREATE ,N-SET MPPS.

3.1.2.3.2 Presentation Contexts Table

The MiWL Server will accept the presentation contexts as given in the next table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID		
Modality performed procedure step sop class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCP	None

Table 6: Supported Presentation Context for the MPPS service

3.1.2.3.3 SOP Specific Conformance Statement

Attribute name	Tag	Req Type N-CREATE SCU/SCP	Req Type N-SET SCU/SCP
Specific Character Set	(0008,0005)	1C/1C	
Performed Procedure Step Information			
Performed Procedure Step ID	(0040,0253)	1/1	-
Performed Procedure Step AE Title	(0040,0241)	1/1	-
Performed Procedure Step Start Date	(0040,0244)	1/1	-
Performed Procedure Step Start Time	(0040,0245)	1/1	-
Performed Procedure Step Status	(0040,0252)	1/1	3/1
Performed Procedure Step End Date	(0040,0250)	2/2	3/1
Performed Procedure Step End Time	(0040,0251)	2/2	3/1
Performed Procedure Step	(0040,0254)	2/2	3/2

Description			
Performed Procedure Type Description	(0040,0255)	2/2	3/2
Performed Station Name	(0040,0242)	2/2	-
Performed Procedure Step Relationship Module			
>Study Instance UID	(0040,0270)	1/1	-
>Referenced Study Sequence	(0008,1110)	3/3	-
>>Referenced SOP Class UID	(0008,1150)	1C/1C	-
>>Referenced SOP Instance UID	(0008,1155)	1C/1C	-
>Accession Number	(0008,0050)	2/2	-
>Requested Procedure ID	(0040,1001)	2/2	-
>Requested Procedure Description	(0032,1060)	2/2	-
>Scheduled Procedure Step ID	(0040,0009)	2/2	-
>Scheduled Procedure Step Description	(0040,0007)	2/2	-
Patient's Name	(0010,0010)	2/2	-
Patient ID	(0010,0020)	2/2	-
Patient's Birth Date	(0010,0030)	2/2	-
Patient's Sex	(0010,0040)	2/2	-
Image Acquisition Results			
Modality	(0008,0060)	1/1	-
Study ID	(0020,0010)	2/2	-
Performed Series	(0040,0340)	2/2	3/1
>Performing Physician's	(0008,1050)	2C/2	2C/2
>Protocol Name	(0018,1030)	1C/1	1C/1
>Operator's Name	(0008,1070)	2C/2	2C/2
>Series Instance UID	(0020,000E)	1C/1	1C/1
>Series Description	(0008,103E)	2C/2	2C/2
>Retrieve AE Title	(0008,0054)	2C/2	2C/2
>Referenced Image Sequence	(0008,1140)	2C/2	2C/2
>>Referenced SOP Class UID	(0008,1150)	1C/1	1C/1
>>Referenced SOP Instance UID	(0008,1155)	1C/1	1C/1
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C/2	2C/2
>>Referenced SOP Class UID	(0008,1150)	1C/1	1C/1
>>Referenced SOP Instance UID	(0008,1155)	1C/1	1C/1

Table 7: MPPS SOP Class N-CREATE, N-SET State Final

In the event of an successful N-CREATE and N-SET operation, MiWL Server saves all UIDs identifying the received performed procedure step in the Internal Database and uses

the Study Instance UID and the patient information for trying to build a link between the performed procedure step and a scheduled procedure step/study object in the Database. The SCP behaviour as a result of receiving the Performed Procedure Step information consists of storing the data assigned to the PPS SOP Instance in the Internal Database.

MiWL Server returns one of the following status codes to indicate an successful-unsuccesful N-CREATE/N-SET:

- **Success (0000):** Matching is complete - No final identifier is supplied.
- **Warning (0106):** Invalid Attribute Value.
- **Warning (0110):** Processing Failed.
- **Warning (0121):** Missing attribute Value.
- **Failed (A900):** Identifier does not match SOP Class.
- **Failed (Cxxx):** Unable to process.

4. Communication Profile

4.1 Supported Communication Stacks

The MIWL SERVER DICOM application provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.1.1 OSI Stack

Not Supported.

4.1.2 TCP/IP Stack

The MIWL SERVER DICOM application uses the TCP/IP stack from the Windows NT system upon which it executes.

4.1.2.1 API

The MIWL SERVER DICOM application is based on a TCP/IP socket interface.

4.1.2.2 Physical Media Support

The MIWL SERVER DICOM application is indifferent to the physical medium over which TCP/IP executes; it inherits this from the Windows NT system upon which it executes

Supported physical media includes:

- IEEE 802.3-1995(Fast Ethernet) 100BASE-TX.
- IEEE 802.3-1995 10BASE-TX.

4.1.3 Point-to-Point Stack

Not Supported.

5. Configuration

5.1 AE Title / Presentation Address Mapping

To ensure unique identification the hostname should be part of the AE Titles (e.g. Mi_myhost).

The string can be up to 16 characters long and must not contain any extended characters, only 7 bit ASCII characters (excluding control characters) are allowed according to DICOM standard.

5.1.1 Local AE Titels and Presentation Addresses

The local AETs can be configured using the Service application.

The following AETs can be entered:

- One common AET for Verification ,Basic Modality Worklist and MPPS AEs SCP.

5.1.2 Remote AE Titles and Presentation Addresses

For remote AETs, host names, IP addresses and port numbers can be configured using the Service application. For each AET a list of supported services can also be configured.

5.2 Configurable Parameters

5.2.1 Time out Parameters

The Service application can be used to set all the following time out constants to a certain value depending on user input

- Time-out for accepting/rejecting an association request.

- Time-out for responding to an association open/close request.
- Time-out for accepting a message over network.
- Time-out for waiting for data between TCP/IP-packets.
- Time-out for waiting for receiving request\response for Verification ,Basic Modality Worklist and MPPS SCUs.

5.3 Default Parameters

- maximal PDU size is set to 16384 Bytes