MyLab

Ultrasound Scanner

DICOM Conformance Statement

Document Version 4.0

Date 19 OCT 2005

1 CONFORMANCE STATEMENT OVERVIEW

MyLab is an Ultrasound scanner made by ESAOTE S.p.A.; its software is based upon the Windows® XP Operating System. This DICOM® Conformance Statement (DCS) specifies the conformance to the DICOM standard[1] for the ESAOTE MyLab system.

The MyLab implements the necessary DICOM services to send acquired Ultrasound images to a network storage device, to print them to a networked hardcopy device, or to save them on a CD-R or USB connected removable device.

Table 1 provides an overview of the network services supported by MyLab.

Table 1
NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Image Storage	Yes	No
Ultrasound Multiframe Image Storage	Yes	No
Secondary Capture Image Storage	Yes	No
Print Management		
Basic Grayscale Print Management	Yes	No
Basic Color Print Management	Yes	No

Table 2 provides an overview of the Media Storage Application Profiles supported by MyLab.

Table 2
MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk – Recordable		
Ultrasound Spatial Calibration Single and Multiframe CD-R Interchange (STD-US-SC-MF-CDR)	Yes	No
USB connected removable device		
General Purpose USB Media Interchange with JPEG (STD-GEN-USB-JPEG)	Yes	No

[1] DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

2 TABLE OF CONTENTS

3 INTRODUCTION

3.1 REVISION HISTORY

Table 3
REVISION HISTORY

Document Revision	Date of Issue	Author	Description	SW Releases
1.0	September 29, 2004	Luigi Pampana-Biancheri, Andrea Spada, Alessio Frusciante, Daniele Mazzeranghi	From the PS3.2-2004 template, produced by EDMG and revised by the SW Engineers.	STD 1.04
2.0	December 13, 2004	Alessio Frusciante	Revision for release 2.0	STD 2.01
3.1	May 13, 2005	Luigi Pampana-Biancheri	Revision for release 3.1: different JPEG compressions, Verification SCU, SC images, private attributes.	STD 3.10 004-060
3.2	June 23, 2005	Alessio Frusciante	Revision for release 3.2.	STD 1.21 005-069 STD 1.21 005-070 STD 3.21 005-070
4.0	October 19, 2005	Luigi Pampana-Biancheri	Revision for release 3.3: Added DICOM printing capability.	STD 4.01 007-087 STD 4.01 006-088 STD 4.01 006-088 VET 4.01 006-088

This document applies to all the software releases of the MyLab, up to the current one: always check for the latest revision of it. Foot page notes will appear indicating the differences among the various software releases, if any.

In the Table 3 we describe the history of the revisions of the present document, together with the latest software releases covered by them.

For any other information, or for the latest version of this document, please contact us:

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3.2 AUDIENCE

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

3.3 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 information.

The scope of this Conformance Statement is to facilitate communication with MyLab and other vendors' Medical equipments. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [DICOM]. However, by itself, it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

— The comparison of different conformance statements is the first step towards assessing interconnectivity between Esaote and non-Esaote equipments.

— Test procedures should be defined to validate the desired level of connectivity.

— The DICOM standard will evolve to meet the users' future requirements. Esaote is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue their delivery.

The DICOM functionalities given by the ESAOTE MyLab are implemented by means of the EDMG Library, a DICOM software library which has been developed by the Esaote DICOM Management Group (EDMG), in order to offer to all the Esaote modalities and applications a common DICOM platform. The EDMG library relies in turn on the MergeCOM-3™ Advanced DICOM Toolkit ("DICOM by Merge").

3.4 DEFINITIONS, TERMS AND ABBREVIATIONS

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ASCE	Association Control Service Element
DIT	Directory Information Tree (LDAP)
DN	Distinguished Name (LDAP)
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
IOD	(DICOM) Information Object Definition
ISO	International Standard Organization
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format

MPPS Modality Performed Procedure Step

MSPS Modality Scheduled Procedure Step

R Required Key Attribute

O Optional Key Attribute

PDU DICOM Protocol Data Unit

RDN Relative Distinguished Name (LDAP)

SCU DICOM Service Class User (DICOM client)

SCP DICOM Service Class Provider (DICOM server)

SOP DICOM Service-Object Pair

U Unique Key Attribute

Some of the tables have a "**Presence of …**" column in which the following abbreviations are used, unless specified:

VNAP Not Always Present (attribute sent zero length if no value is present)

ANAP Not Always Present

ALWAYS Always Present

EMPTY Attribute is sent without a value

The abbreviations used in the "**Source**" column:

MWL the attribute value source is the Modality Worklist

USER the attribute value comes from the User input

AUTO the attribute value is generated automatically

CONFIG the attribute value is a configurable parameter

PROFILE the attribute value is a parameter found in the profile chosen for the selected printer

3.5 REFERENCES

[DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.16, 2003 and following editions.

3.6 IMPLEMENTATION IDENTIFYING INFORMATION

The Implementation Class UID and Implementation Version Name for all the Application Entities can change according to the software release, and are described in the Table 4, that describes also the EDMG and MergeCOM-3™ Advanced DICOM Toolkit releases present in the various MyLab software releases.

Table 4
IMPLEMENTATION IDENTIFYING INFORMATION

MyLab Software release	Model	EDMG Sw Release	MergeCOM-3 Sw Release	Implementation Class UID	Implementation Version Name
STD 4.01 007-087	**MyLab 50**	**5.5.0.0**	**3.2.0**	**1.3.76.2.2.2**	**MYLAB_3.3.104**
STD 4.01 006-088	**MyLab 25**	**5.5.0.0**	**3.2.0**	**1.3.76.2.2.2**	**MYLAB_3.3.104**
STD 4.01 006-088	**MyLab 30**	**5.5.0.0**	**3.2.0**	**1.3.76.2.2.2**	**MYLAB_3.3.104**
VET 4.01 006-088	**MyLab 30 Vet**	**5.5.0.0**	**3.2.0**	**1.3.76.2.2.2**	**MYLAB_3.3.104**

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

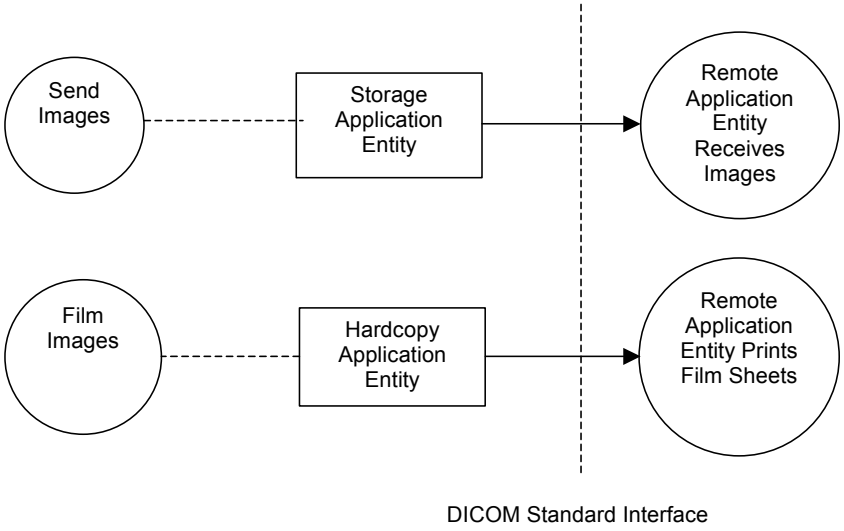

Figure 1
APPLICATION DATA FLOW DIAGRAM

— The Storage Application Entity sends images to a remote AE. It is associated with the local real-world activity “Send Images”. “Send Images” is performed upon user request for each study when closing it, or for specific studies selected from the had disk database.

— The Hardcopy Application Entity prints images on a remote AE (DICOM Printer). It is associated with the local real-world activity “Film Images”. “Film Images” creates a print-job within the print queue containing one virtual film sheet composed from images selected by the user.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of Storage Application Entity

It is possible to activate the Storage Application Entity both when closing the current study, and from the database panel.

When closing the current study, a panel will allow the User to decide if and where to archive the images, selecting among “ARCHIVE TO DB” (on the local Hard Disk), “ARCHIVE TO CD” (the CD-R), “ARCHIVE TO USB” and “ARCHIVE TO DICOM SERVER”. Selecting “DB” will store the acquired images in the local database, while selecting “CD” or “USB” or “DICOM SERVER” will store or send them in DICOM format to the selected destination (without keeping a copy in the local database).

From the local database panel, pressing the “DICOM” soft-key, a “DICOM PROCEDURE” panel will appear, allowing to choose between the following destinations: “CD” (the CD-R), “USB” and “DICOM SERVER”, storing or sending the selected studies (previously archived to the local database, see above), in DICOM format, to the selected destination.

When activating the above described functions choosing “DICOM SERVER”, the SOP Instances associated with the selected study (or studies) will be collected into one send job. The existence of a send job queue entry with associated network destination will activate the Storage AE. An association request will be sent to the destination AE and upon successful negotiation of a Presentation Context the image transfer will be started. If the association cannot be opened, the related send job will be set to an error state and it will be

possible to restarted it later by the user via job control interface. The Storage AE will not try to initiate another association for this send job automatically.

4.1.2.2 Functional Definition of Hardcopy Application Entity

It is possible to activate the Hardcopy Application Entity both for printing images from the current Study, and for printing a set of images from the local database. In any case, the images belonging to the current Study will not be mixed in the same print-job with the images belonging to older Studies.

On the MyLab keyboard, according to the model, there are two or three print keys labeled “1”, “2” and “3” (if present); each one can be assigned to a given DICOM printing profile, that is to a given configuration for a given DICOM printer.

Pressing one of the assigned print keys will add the current visualized image to queue that will be used to compose the film sheet that will be printed according to the selected printing profile. There are different and separated queues for images belonging to the current Study (real-time display, and images selected from the “EXAM REV” environment), and for the images belonging to older Studies (images selected from the “ARCHIVE REV” environment).

When activating the above described keys, the preformatted grayscale or color image (according to the color capability of the corresponding printer) will be added to the print-job being prepared for the selected printing profile. When the number of images requested to fill the film sheet for that printing profile is reached, an association request will be sent to the destination AE, and upon successful negotiation of a Presentation Context the data transfer will be started. If the association cannot be opened, or if some fatal error occurs, the related print-job will be set to an error state, and it will be possible to restart it later by the user via job control interface. The Hardcopy AE will not try to initiate another association for this print-job automatically.

4.1.3 Sequencing of Real-World Activities

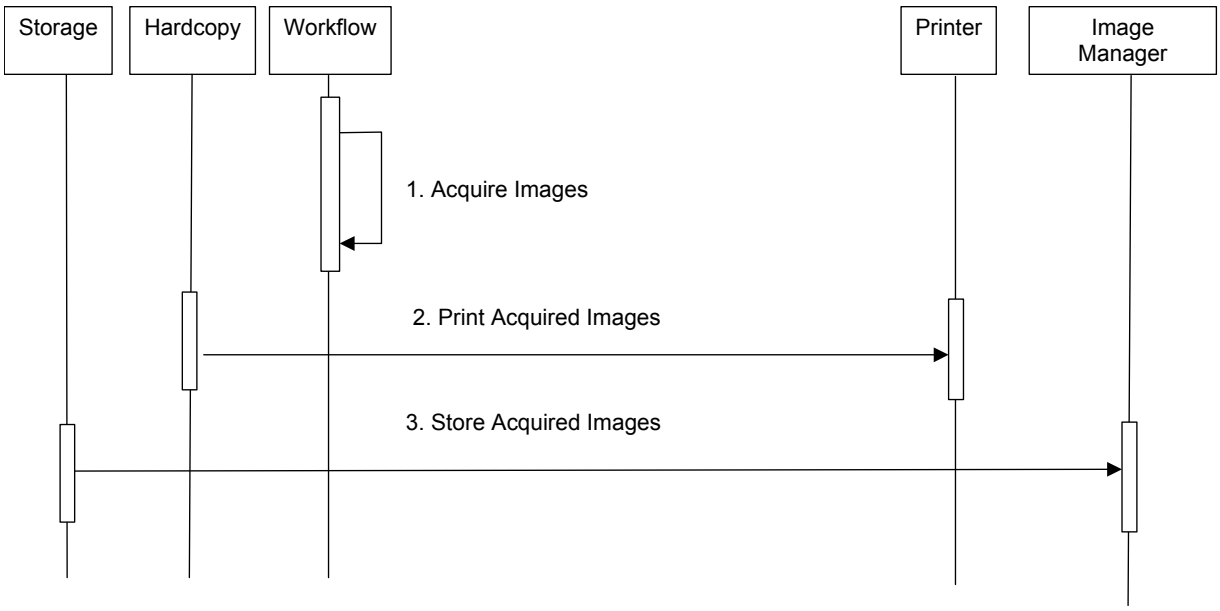

Figure 2
SEQUENCING CONSTRAINTS

Under normal conditions the sequencing constraints illustrated in Figure 2 apply:

1. Acquire Images.
2. Print acquired images (optional step).
3. Store acquired images.

Other workflow situations will have other sequencing constraints. Printing could equally take place after the acquired images have been stored. Printing could be omitted completely if no printer is connected or hardcopies are not required.

4.2 AE SPECIFICATIONS

4.2.1 Storage Application Entity Specification

4.2.1.1 SOP Classes

MyLab provides Standard Conformance to the following SOP Classes:

Table 5
SOP CLASSES FOR AE STORAGE

SOP Class Name	SOP Class UID	SCU	SCP
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	No
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
Verification	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM is always proposed:

Table 6
DICOM APPLICATION CONTEXT FOR AE STORAGE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

MyLab initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other remains pending until the active job is completed or failed.

Table 7
NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE

Maximum number of simultaneous Associations	Unlimited

MyLab does not accept Associations.

4.2.1.2.3 Asynchronous Nature

MyLab does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 8
ASYNCHRONOUS NATURE AS A SCU FOR AE STORAGE

Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4 Implementation Identifying Information

See section 3.6.

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Connectivity Verification

4.2.1.3.1.1 Description and Sequencing of Activities

The Storage AE is invoked to perform a verification by the Storage SCP server configuration interface. The job consists of data describing the the destination.

If a response to the C-ECHO-RQ is not received within a timeout, the Association will be aborted and an error will be reported to the User.

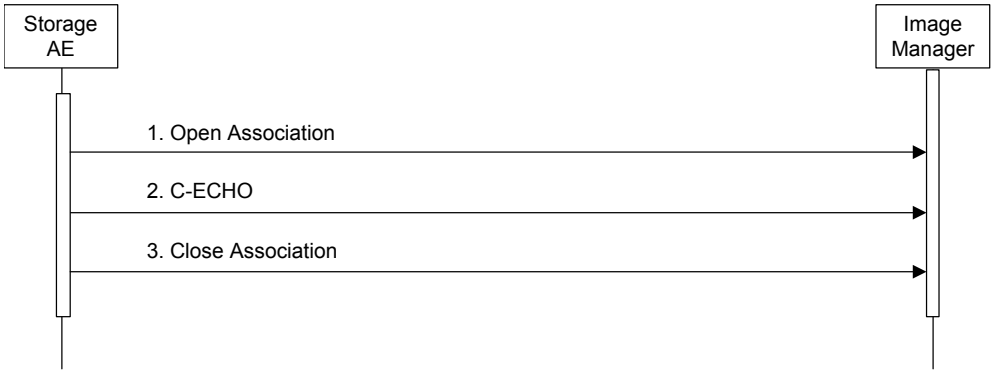

Figure 3
SEQUENCING OF ACTIVITY – CONNECTIVITY VERIFICATION

4.2.1.3.1.2 Proposed Presentation Context Table

The MyLab is capable of proposing the Presentation Contexts as shown in the following table:

Table 9
PROPOSED PRESENTATION CONTEXT FOR CONNECTIVITY VERIFICATION

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Negot**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	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

4.2.1.3.1.3 SOP Specific Conformance for Connectivity Verification

The MyLab provides standard conformance to the DICOM Verification Service Class as an SCU. The status code for the C-ECHO is as follows:

Table 10
C-ECHO RESPONSE STATUS HANDLING BEHAVIOUR

Code	Status	Meaning
0000	Success	The C-ECHO request is accepted.

4.2.1.3.2 Activity – Send Images

4.2.1.3.2.1 Description and Sequencing of Activities

The Storage AE is invoked to send images by the job control interface that is responsible for processing network archival tasks. The job consists of data describing the instances marked for storage and the destination. An internal daemon process triggered by a job initiates the procedure to store the instances related to this job. If the process successfully establishes an Association to a remote Application Entity, it will transfer the instances, one after another, via the open Association. If the job contains multiple instances, then multiple C-STORE requests will be issued over the same Association. Status of the transfer is reported through the job control interface. If the Association cannot be established, or one or more C-STORE Responses from the remote Application contain a status other than Success, the related send job is switched to a failed state, deleting from it the images that were successfully sent; it can be restarted at any time by user interaction.

If a response is not received within a timeout, the Association will be aborted and the sending of the current instances will be considered failed.

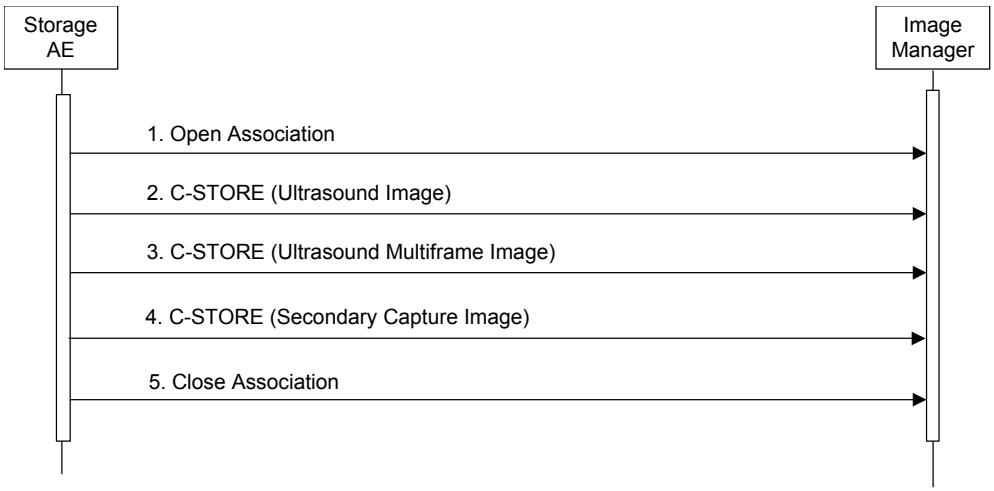

Figure 4
SEQUENCING OF ACTIVITY – SEND IMAGES

A possible sequence of interactions between the Storage AE and an Image Manager (e.g. a storage or archive device supporting the Storage and Storage Commitment SOP Classes as an SCP) is illustrated in Figure 4.2-1:

1. The Storage AE opens an association with the Image Manager
2. An acquired US or US-MF image, or a Secondary Capture image is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
3. Another US or US-MF or Secondary Capture image is transmitted to the Image Manager using a C-STORE request and the Image Manager replies with a C-STORE response (status success).
4. The Storage AE closes the association with the Image Manager.

NOTE: Many other message sequences are possible depending on the number of images to be stored.

4.2.1.3.2.2 Proposed Presentation Contexts

MyLab is capable of proposing the Presentation Contexts shown in the following table:

Table 11
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY SEND IMAGES

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
Secondary Capture Image Storage [2]	1.2.840.10008.5.1.4.1.1.7	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None

Presentation Context for images will only propose the JPEG lossy Baseline (Process 1), because the images are internally stored only in JPEG lossy Baseline (Process 1) format.

If the Presentation Context is not accepted, an error is generated. The job failure is logged and reported to the user via the job control application.

4.2.1.3.2.3 SOP Specific Conformance Image SOP Classes

All Image SOP Classes supported by the Storage AE exhibit the same behavior, except where stated, and are described together in this section.

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

Table 12
STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the SOP Instance. If all SOP Instances in a send job have status success then the job is marked as complete.
Refused	Out of Resources	A700-A7FF	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application. This is a transient failure.
Error	Data Set does not match SOP Class	A900-A9FF	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
Error	Cannot Understand	C000-CFFF	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job

[2] The Secondary Capture objects are generated to export the report with the performed measures in a human readable way. The sending of Secondary Capture images can be disabled from the User's Interface by selecting "EXPORT TO BIOPACS" in the REPORT EXPORT configuration panel: in this case the report will be put in the proprietary attributes of the US and US-MF images, and the Secondary Capture images will not be sent.

			control application.
Warning	Coercion of Data Elements	B000	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
Warning	Data Set does not match SOP Class	B007	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
Warning	Elements Discarded	B006	The send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
*	*	Any other status code.	The send job is marked as failed. The status code is logged and the job failure is reported to the user via the job control application.

The behavior of Storage AE during communication failure is summarized in the Table below:

Table 13
STORAGE COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	The connection is aborted and the send job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.
Association aborted by the SCP or network layers	The send job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.

A failed send job can be restarted by user interaction: only the failed images will be re-sent.

The contents of US and US Multiframe Image Storage SOP Instances created by MyLab conform to the DICOM US and US Multiframe Image IOD definition and are described in section 8.1.

4.2.2 Hardcopy Application Entity Specification

4.2.2.1 SOP Classes

The MyLab provides Standard Conformance to the following SOP Classes:

Table 14
SOP CLASSES FOR AE HARDCOPY

SOP Class Name	SOP Class UID	SCU	SCP
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	Yes	No

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 15
DICOM APPLICATION CONTEXT FOR AE HARDCOPY

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations

It is possible to simultaneously configure many hardcopy devices, and for each one of them it is possible to configure many different printing profiles. According to the MyLab model, two or three of these printing profiles (belonging to the same or to different hardcopy devices) can be assigned to the print keys “1”, “2” and “3” (if present) of the MyLab keyboard.

There are two different printing environments, one for the images belonging to the current Study (and displayed in the real-time environment, or selected and displayed from the “EXAM REV.” environment), and another for the images belonging to older Studies (and displayed from the “ARCHIVE REV.” environment).

Every time a print key is pressed, the current image is added to the current film according to the print key and the environment, so it is possible to simultaneously compose up to four (or six, according to the model) films; whenever a film composing is completed, a print-job is prepared and the MyLab initiates the related Association.

Table 16
NUMBER OF ASSOCIATIONS INITIATED FOR AE HARDCOPY

Maximum number of simultaneous Associations	Unlimited.

MyLab does not accept Associations.

4.2.2.2.3 Asynchronous Nature

The MyLab does not support asynchronous communication (multiple outstanding transactions over a single Association).

Table 17
ASYNCHRONOUS NATURE AS A SCU FOR AE HARDCOPY

Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity can be found in Table 4.

4.2.2.2.5 Printer configuration

The Service personnel, when configuring the MyLab for a given DICOM printer, must select a suitable printer configuration profile, according to the brand/model of the printer. In the printer configuration profile, compiled using the DICOM Conformance Statement of the printer, for every attribute that can be put in the N-CREATE of the Film Session SOP Class, in the N-CREATE of the Film Box SOP Class, and in the N-SET on the Image Box SOP Class, there is the complete list of accepted values, and the most suitable one (or a flag that says not to send this attribute, for the optional ones).

The Service personnel, according to the User’s needs, must decide in which format(s) to print with that printer, preparing one or more printing profiles, in which some of the pre-defined attributes can be changed among the ones present in the pre-defined printer configuration profile, while for the others the most suitable one (or none) will be sent, according to the printer configuration profile. One of the configuration parameters is the color capability: for printers that accept both the Basic Grayscale and Basic Color Print Management Meta SOP Class, the Service personnel can decide in which way to print.

There is also a generic printer configuration profile, in which all the non-mandatory information (excepted the attributes directly managed from the User's interface) is marked not to be sent: this printer configuration profile can be used with unknown printers, leaving the printer software the burden to chose the most correct configuration parameters.

To use a configured printing profile, the User must tie it to one of the special print keys of the MyLab keyboard (labeled "1", "2", or "3" if present).

4.2.2.3 Association Initiation Policy

4.2.2.3.1.1 Activity – Connectivity Verification

4.2.2.3.1.2 Description and Sequencing of Activities

The Hardcopy AE is invoked to perform a verification by the Print SCP configuration interface. The job consists of data describing the destination.

If a response to the C-ECHO-RQ is not received within a timeout, the Association will be aborted and an error will be reported to the User.

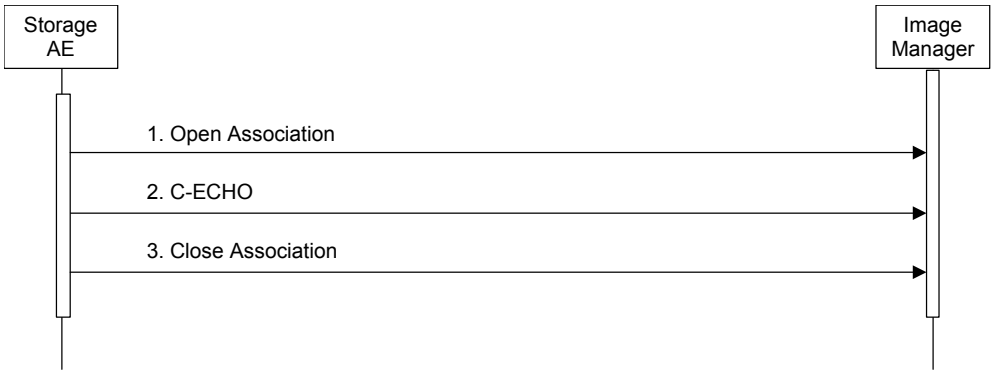

Figure 5
SEQUENCING OF ACTIVITY – CONNECTIVITY VERIFICATION

4.2.2.3.1.3 Proposed Presentation Context Table

The MyLab is capable of proposing the Presentation Contexts as shown in the following table:

Table 18
PROPOSED PRESENTATION CONTEXT FOR CONNECTIVITY VERIFICATION

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Negot
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	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

4.2.2.3.1.4 SOP Specific Conformance for Connectivity Verification

The MyLab provides standard conformance to the DICOM Verification Service Class as an SCU. The status code for the C-ECHO is as follows:

Table 19
C-ECHO RESPONSE STATUS HANDLING BEHAVIOUR

Code	Status	Meaning
0000	Success	The C-ECHO request is accepted.

4.2.2.3.2 Activity – Film Images

4.2.2.3.2.1 Description and Sequencing of Activities

A user composes images onto one film sheet by pressing the printing key for every image that can be added to the related printing layout; when the number of allowed images has been reached, or by selecting the "PRINT NOW TO DICOM PRINTER" entry in the pop-up menu related to the desired printing layout, the print-job is forwarded to the job queue and processed individually. Pressing the "RESET ADDED IMAGES" entry in the above pop-up menu will delete all the already added images from the current print-job.

The Hardcopy AE is invoked by the job control interface that is responsible for processing network tasks. The job consists of data describing the images and graphics to be printed as well as the requested layout and other parameters. The film sheet is sent image by image. If no association to the printer can be established, or some error occurs, the print-job is switched to a failed state and the user informed.

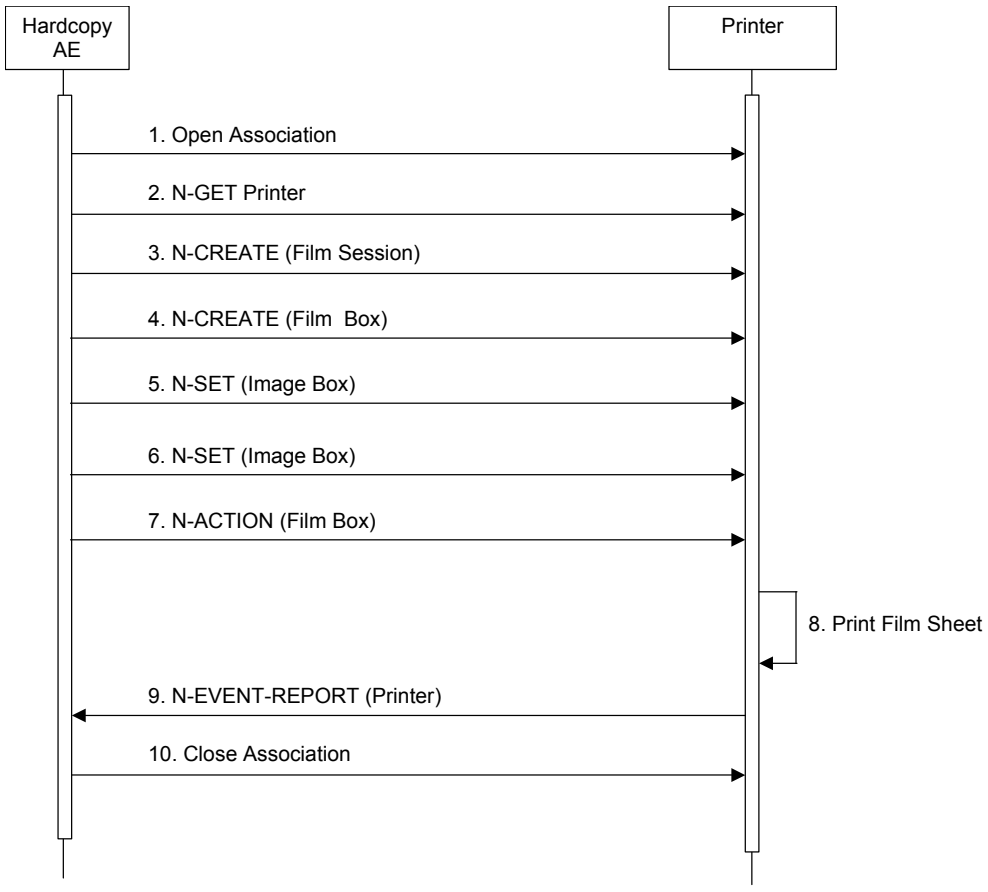

Figure 6
SEQUENCING OF ACTIVITY – FILM IMAGES

A typical sequence of DIMSE messages sent over an association between Hardcopy AE and a Printer is illustrated in Figure 6:

1. Hardcopy AE opens an association with the Printer, using the Basic Grayscale or Basic Color Print Management META SOP Class according to the configuration of the printing layout.
2. N-GET on the Printer SOP Class is used to obtain current printer status information. If the Printer reports a status of FAILURE, the print-job is switched to a failed state and the user informed.
3. N-CREATE on the Film Session SOP Class creates a Film Session.
4. N-CREATE on the Film Box SOP Class creates a Film Box linked to the Film Session.
5. N-SET on the Image Box SOP Class transfers the contents of the first image to the printer.
6. N-SET on the Image Box SOP Class transfers the contents of the other various images to the printer, or delete the unwanted ones from the Film Box.
7. N-ACTION on the Film Box SOP Class instructs the printer to print the Film Box already composed.
8. The printer prints the requested number of film sheets
9. The Printer asynchronously reports its status via N-EVENT-REPORT notification (Printer SOP Class). The printer can send this message at any time. Hardcopy AE does not require the N-EVENT-REPORT to be sent. Hardcopy AE is capable of receiving an N-EVENT-REPORT notification at any time during an association. If the Printer reports a status of FAILURE, the print-job is switched to a failed state and the user informed.
10. Hardcopy AE closes the association with the Printer

Status of the print-job is reported through the job control interface. If any Response from the remote Application contains a status other than Success or Warning, the Association is aborted and the related Job is switched to a failed state.

4.2.2.3.2.2 Proposed Presentation Contexts

The MyLab is capable of proposing the Presentation Contexts shown in the Table below:

Table 20
PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY FILM IMAGES

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	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
Basic Color Print Management Meta	1.2.840.10008.5.1.1.18	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

4.2.2.3.2.3 Common SOP Specific Conformance for all Print SOP Classes

The general behavior of Hardcopy AE during communication failure is summarized in the Table below. This behavior is common for all SOP Classes supported by Hardcopy AE.

Table 21
HARDCOPY COMMUNICATION FAILURE BEHAVIOR

Exception	Behavior
Timeout	The Association is aborted. The reason is logged and reported to the user.
Association aborted by the SCP or network layers	The Association is aborted. The reason is logged and reported to the user.

4.2.2.3.2.4 SOP Specific Conformance for the Printer SOP Class

Hardcopy AE supports the following DIMSE operations and notifications for the Printer SOP Class:

— N-GET

— N-EVENT-REPORT

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.2.3.2.5 Printer SOP Class Operations (N-GET)

Hardcopy AE uses the Printer SOP Class N-GET operation to obtain information about the current printer status. The attributes obtained via N-GET are listed in the Table below:

Table 22
PRINTER SOP CLASS N-GET REQUEST ATTRIBUTES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Printer Status	(2110,0010)	CS	Provided by Printer	ALWAYS	Printer
Printer Status Info	(2110,0020)	CS	Provided by Printer	ALWAYS	Printer
Printer Name	(2110,0030)	LO	Provided by Printer (for logging purposes)	ALWAYS	Printer
Manufacturer	(0008,0070)	LO	Provided by Printer (for logging purposes)	ALWAYS	Printer
Manufacturer's Model Name	(0008,1090)	LO	Provided by Printer (for logging purposes)	ALWAYS	Printer
Software Version(s)	(0018,1020)	LO	Provided by Printer (for logging purposes)	ALWAYS	Printer

The Printer Status information is evaluated as follows:

1. If Printer status (2110,0010) is NORMAL, the print-job continues to be printed.
2. If Printer status (2110,0010) is FAILURE, the print-job is marked as failed. The contents of Printer Status Info (2110,0020) is logged and reported to the user.
3. If Printer status (2110,0010) is WARNING, the print-job continues to be printed. The contents of Printer Status Info (2110,0020) is logged.

The behavior of Hardcopy AE when encountering status codes in a N-GET response is summarized in the Table below:

Table 23
PRINTER SOP CLASS N-GET RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The request to get printer status information was success.
*	*	Any other status code.	The Association is aborted. The status meaning is logged and reported to the user.

4.2.2.3.2.6 Printer SOP Class Notifications (N-EVENT-REPORT)

Hardcopy AE is capable of receiving an N-EVENT-REPORT request at any time during an association.

The behavior of Hardcopy AE when receiving Event Types within the N-EVENT-REPORT is summarized in the Table below:

Table 24
PRINTER SOP CLASS N-EVENT-REPORT BEHAVIOUR

Event Type Name	Event Type ID	Behavior
Normal	1	The print-job continues to be printed.
Warning	2	The print-job continues to be printed. The contents of Printer Status Info (2110,0020) is logged.
Failure	3	The print-job is marked as failed. The contents of Printer Status Info (2110,0020) is logged and reported to the user.
*	*	An invalid Event Type ID will cause a status code of 0113H to be returned in a N-EVENT-REPORT response.

The reasons for returning specific status codes in a N-EVENT-REPORT response are summarized in the Table below:

Table 25
PRINTER SOP CLASS N-EVENT-REPORT RESPONSE STATUS REASONS

Service Status	Further Meaning	Error Code	Reasons
Success	Success	0000	The notification event has been successfully received.
Failure	No Such Event Type	0113H	An invalid Event Type ID was supplied in the N-EVENT-REPORT request.
Failure	Processing Failure	0110H	An internal error occurred during processing of the N-EVENT-REPORT. A short description of the error will be returned in Error Comment (0000,0902).

4.2.2.3.2.7 SOP Specific Conformance for the Film Session SOP Class

Hardcopy AE supports the following DIMSE operations for the Film Session SOP Class:

— N-CREATE

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.2.3.2.8 Film Session SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 26
FILM SESSION SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	(2000,0010)	IS	Chosen by the User among the values in the Printer Profile.	ALWAYS	USER
Print Priority	(2000,0020)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Medium Type	(2000,0030)	CS	Chosen by the User among the values in the Printer Profile.	ANAP	USER
Film Destination	(2000,0040)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Film Session Label	(2000,0050)	LO	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Memory Allocation	(2000,0060)	IS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Owner ID	(2100,0160)	SH	Pre-defined value from the Printer Profile.	ANAP	PROFILE

The behavior of Hardcopy AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 27
FILM SESSION SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
Warning	Attribute Value Out of Range	0116H	The N-CREATE operation is considered successful and the user is notified that there was a warning. The status meaning and additional information in the Response identifying the attributes out of range will be logged (i.e. Elements in the Modification List/Attribute List).
Warning	Attribute List Error	0107H	The N-CREATE operation is considered successful and the user is notified that there was a warning. The status meaning and additional information in the Response identifying the attributes will be logged (i.e. Elements in the Attribute Identifier List).
*	*	Any other status code.	The Association is aborted and the print-job is marked as failed and the user is notified that there was an error. The status meaning is logged.

4.2.2.3.2.9 SOP Specific Conformance for the Film Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Presentation LUT SOP Class:

— N-CREATE

— N-ACTION

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.2.3.2.10 Film Box SOP Class Operations (N-CREATE)

The attributes supplied in an N-CREATE Request are listed in the Table below:

Table 28
FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	CS	Chosen by the User among the STANDARD\c,r values in the Printer Profile.	ALWAYS	USER
Film Orientation	(2010,0040)	CS	Chosen by the User among the values in the Printer Profile.	ANAP	USER
Film Size ID	(2010,0050)	CS	Chosen by the User among the values in the Printer Profile. Always present even if “SKIP” is present in the Printer Profile.	ALWAYS	USER
Magnification Type	(2010,0060)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Smoothing Type	(2010,0080)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Border Density	(2010,0100)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Empty Image Density	(2010,0110)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Max Density	(2010,0130)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Min Density	(2010,0120)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Trim	(2010,0140)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Configuration Information	(2010,0150)	ST	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Referenced Film Session Sequence	(2010,0500)	SQ		ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	From created Film Session SOP Instance	ALWAYS	AUTO
Requested Resolution ID	(2020,0050)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE

The behavior of Hardcopy AE when encountering status codes in a N-CREATE response is summarized in the Table below:

Table 29
FILM BOX SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully.
*	*	Any other status code.	The Association is aborted and the print-job is marked as failed. The status meaning is logged and reported to the user.

4.2.2.3.2.11 Film Box SOP Class Operations (N-ACTION)

An N-ACTION Request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in an N-ACTION response is not evaluated.

The behavior of Hardcopy AE when encountering status codes in a N-ACTION response is summarized in the Table below:

Table 30
FILM BOX SOP CLASS N-ACTION RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. The film has been accepted for printing.
*	*	Any other status code.	The Association is aborted and the print-job is marked as failed. The status meaning is logged and reported to the user.

4.2.2.3.2.12 SOP Specific Conformance for the Image Box SOP Class

Hardcopy AE supports the following DIMSE operations for the Image Box SOP Class:

— N-SET

Details of the supported attributes and status handling behavior are described in the following subsections.

4.2.2.3.2.13 Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET Request are listed in the Tables below, one for the Basic Grayscale Image Box SOP Class, and one for the Basic Color Image Box SOP Class:

Table 31
BASIC GRAYSCALE IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Magnification Type	(2010,0060)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Smoothing Type	(2010,0080)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Min Density	(2010,0120)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Max Density	(2010,0130)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Configuration Information	(2010,0150)	ST	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Image Position	(2020,0010)	US	According to the place in the Film Box	ALWAYS	AUTO
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
>Rows	(0028,0010)	US	According to the dimension of the preformatted image (the same for all the images in the same film)	ALWAYS	AUTO
>Columns	(0028,0011)	US	According to the dimension of the preformatted image (the same for all the images in the same film)	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0000H = unsigned integer.	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixels of rendered image	ALWAYS	AUTO
Polarity	(2020,0020)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Requested Image Size	(2020,0030)	DS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Requested Decimate/Crop Behavior	(2020,0040)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE

Table 32
BASIC COLOR IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Magnification Type	(2010,0060)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Smoothing Type	(2010,0080)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Min Density	(2010,0120)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Max Density	(2010,0130)	US	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Configuration Information	(2010,0150)	ST	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Image Position	(2020,0010)	US	According to the place in the Film Box	ALWAYS	AUTO
Basic Color Image Sequence	(2020,0111)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	AUTO
>Rows	(0028,0010)	US	According to the dimension of the preformatted image (the same for all the images in the same film)	ALWAYS	AUTO
>Columns	(0028,0011)	US	According to the dimension of the preformatted image (the same for all the images in the same film)	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0000H = unsigned integer.	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixels of rendered image	ALWAYS	AUTO
Polarity	(2020,0020)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Requested Image Size	(2020,0030)	DS	Pre-defined value from the Printer Profile.	ANAP	PROFILE
Requested Decimate/Crop Behavior	(2020,0040)	CS	Pre-defined value from the Printer Profile.	ANAP	PROFILE

The behavior of Hardcopy AE when encountering status codes in a N-SET response is summarized in the Table below:

Table 33
IMAGE BOX SOP CLASS N-SET RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed the operation successfully. Image successfully stored in Image Box.
*	*	Any other status code.	The Association is aborted and the print-job is marked as failed. The status meaning is logged and reported to the user.

4.2.2.4 Association Acceptance Policy

The Hardcopy Application Entity does not accept Associations.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The MyLab supports a single network interface. One or both of the following physical network interfaces will be available depending on installed hardware options:

Table 34
SUPPORTED PHYSICAL NETWORK INTERFACES

Ethernet 100baseT
Ethernet 10baseT

4.3.2 Additional Protocols

The MyLab conforms to the System Management Profiles listed in the Table below. All requested transactions for the listed profiles and actors are supported. Support for optional transactions are listed in the Table below:

Table 35
SUPPORTED SYSTEM MANAGEMENT PROFILES

Profile Name	Actor	Protocols Used	Optional 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 default Windows XP DHCP client is used, if enabled by the System Administrator: please refer to the Windows XP documentation for further details.

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 the DNS servers can be configured by the System Administrator. If a DNS server is not in use, the numeric IP addresses need to be used.

4.4 CONFIGURATION

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

All local applications use the AE Title and TCP/IP address, configured by the Service personnel. Not being SCP of any SOP Class, MyLab does not have any TCP port to be configured. The Default AE Title is “MYLAB”.

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Titles, host names or IP addresses, and TCP port numbers of remote applications are configured by the Service Personnel.

4.4.1.2.1 Storage

The MyLab Service Personnel must set the AE Title, port-number, host-name for the remote Storage SCP, enabling it.

4.4.1.2.2 Hardcopy

The MyLab Service Personnel must set the AE Title, port-number, host-name and printer profile for the remote Print SCP, enabling it. For every configured printer, one or more printing profile can be created, and tied to one of the printing keys.

4.4.2 Parameters

A large number of parameters related to acquisition and general operation can be configured using the Service/Installation Tool. The Table below only shows those configuration parameters relevant to DICOM communication. See the MyLab Service Manual for details on general configuration capabilities.

Table 36
CONFIGURATION PARAMETERS TABLE

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Max PDU Receive Size	No	**28672** Bytes
Max PDU Send Size (larger PDUs will never be sent, even if the receiver supports a larger Max PDU Receive Size. If the receiver supports a smaller Max PDU Receive Size then the Max PDU Send Size will be reduced accordingly for the duration of the Association. Max PDU Receive Size information is exchanged during DICOM Association Negotiation in the Maximum Length Sub-Item of the A-ASSOCIATION-RQ and A-ASSOCIATE-AC)	No	**28672** Bytes
Time-out waiting for a acceptance or rejection response to an Association Request (Application Level Timeout)	No	**60 s**
Time-out waiting for a response to an Association release request (Application Level Timeout)	No	**60 s**
Time-out waiting for completion of a TCP/IP connect request (Low-level timeout)	No	**15 s**
Time-out awaiting a Response to a DIMSE Request (Low-Level Timeout)	No	**30 s**
Time-out for waiting for data between TCP/IP-packets (Low Level Timeout)	No	**60 s**
Storage Parameters		
Storage SCU time-out waiting for a response to a C-STORE-RQ	No	**30 s**
Number of times a failed send job may be retried	No	0 (Failed send jobs are not retried)
Delay between retrying failed send jobs	No	
Maximum number of simultaneously initiated Associations by the Storage AE	No	Unlimited

5 MEDIA INTERCHANGE

5.1 IMPLEMENTATION MODEL

5.1.1 Application Data Flow

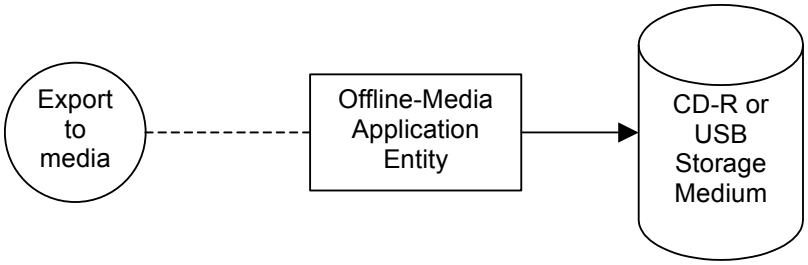

Figure 5.1-1
APPLICATION DATA FLOW DIAGRAM FOR MEDIA STORAGE

— Offline-Media Application Entity exports images to a CD-R or a USB Storage medium. It is associated with the local real-world activity “Archive”. “Archive” (to CD-R or to USB) is performed upon user request for each study when closing it, or for specific studies selected from the had disk database.

5.1.2 Functional Definition of AEs

5.1.2.1 Functional Definition of Offline-Media Application Entity

It is possible to activate the Offline-Media Application Entity entry both when closing the current study, and from the database panel.

When closing the current study, a panel will allow the User to decide if and where to archive the images, selecting among “ARCHIVE TO DB” (on the local Hard Disk), “ARCHIVE TO CD” (the CD-R), “ARCHIVE TO USB” and “ARCHIVE TO DICOM SERVER”. Selecting “DB” will store the acquired images in the local database, while selecting “CD” or “USB” or “DICOM SERVER” will store or send them in DICOM format to the selected destination (without keeping a copy in the local database).

From the local database panel, pressing the “DICOM” soft-key, a “DICOM PROCEDURE” panel will appear, allowing to choose between the following destinations: “CD” (the CD-R), “USB” and “DICOM SERVER”, storing or sending the selected studies (previously archived to the local database, see above), in DICOM format, to the selected destination.

When activating the above described functions choosing “CD” or “USB”, the SOP Instances associated with the selected study (or studies) will be collected into one export job. The existence of an export job queue entry will activate the Offline-Media AE.

If the required medium is not present, or cannot be accessed, the related export job will be set to an error state and it will be possible to restarted it later by the user via job control interface. The Offline-Media AE will not try to export again the instances automatically.

5.1.3 Sequencing of Real-World Activities

The operator can insert a new CD-R, or a USB storage media (according to the case), at any time before the Offline-Media Application Entity activation. The CD-R will be formatted, while the USB storage media must be previously formatted using another computer.

Please note that the USB storage media, to meet the DICOM standard, must be formatted selecting the FAT (and not FAT32) File System. For example, this is an option of the standard Windows XP Operating System formatting utility.

5.1.4 File Meta Information Options

See section 3.6 for the implementation information written to the File Meta Header in each file.

5.2 5.2 AE SPECIFICATIONS

5.2.1 Offline-Media Application Entity Specification

The Offline-Media Application Entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

Table 37
APPLICATION PROFILES, ACTIVITIES AND ROLES FOR OFFLINE-MEDIA

Application Profiles Supported	Real World Activity	Role	SC Option
STD-US-SC-MF-CDR	Export to CD-R	FSC	Interchange
STD-GEN-USB-JPEG	Export to USB	FSC	Interchange

5.2.1.1 File Meta Information for the Application Entity

The Source Application Entity Title included in the File Meta Header is configurable (see section 5.4).

5.2.1.2 Real-World Activities

5.2.1.2.1 Activity – Export to CD-R or USB

The Offline-Media Application Entity acts as an FSC using the interchange option when requested to export SOP Instances from the local database to a CD-R or USB medium.

5.2.1.2.1.1 Media Storage Application Profiles

The Offline-Media Application Entity support the STD-US-SC-MF-CDR and the STD-GEN-USB-JPEG Application Profiles.

Please note that, to strictly follow the STD-US-SC-MF-CDR application profile, the SC image export must be disabled, see note [3].

5.2.1.2.1.1.1 Options

The Offline-Media Application Entity supports the SOP Classes and Transfer Syntaxes listed in the Table below:

Table 38
IODS, SOP CLASSES AND TRANSFER SYNTAXES FOR OFFLINE MEDIA

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50
Ultrasound Multiframe Image Storage	1.2.840.10008.5.1.4.1.1.3.1	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50
Secondary Capture Image Storage [3]	1.2.840.10008.5.1.4.1.1.7	JPEG lossy Baseline (Process 1)	1.2.840.10008.1.2.4.50

[3] The Secondary Capture objects are generated to export the report with the performed measures to a Storage SCP in a human readable way. The media storage of Secondary Capture images can be disabled from the User's Interface by selecting "EXPORT TO BIOPACS" in the REPORT EXPORT configuration panel: in this case the report will be put in the proprietary attributes of the US and US-MF images, and the Secondary Capture images will not be stored on media.

5.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

MyLab does not support any augmented for private application profiles.

5.4 MEDIA CONFIGURATION

All local applications use the AE Title configured by the Service personnel. The Application Entity Title configurable for Media Services is the same used for the network storage.

6 SUPPORT OF CHARACTER SETS

All MyLab DICOM applications support the

ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)

7 SECURITY

MyLab does not support any specific security measures.

It is assumed that MyLab is used within a secured environment. It is assumed that a secured environment includes at a minimum:

a. Firewall or router protections to ensure that only approved external hosts have network access to MyLab.
b. Firewall or router protections to ensure that MyLab only has network access to approved external hosts and services.
c. Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

8 ANNEXES

8.1 IOD CONTENTS

8.1.1 Created SOP Instances

Table 39 specifies the attributes of an US or US-MF Image transmitted by the MyLab storage application.

The following tables use a number of abbreviations. The abbreviations used in the “Presence of …” column are:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value

The abbreviations used in the “Source” column:

USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
CONFIG	the attribute value source is a configurable parameter

NOTE: All dates and times are encoded in the local configured calendar and time. Date, Time and Time zone are configured using the Service/Installation Tool.

8.1.1.1 US and US Multiframe Image IOD

Table 39
IOD OF US AND US MULTIFRAME CREATED SOP INSTANCES

IE	Module	Reference	Presence of Module
Patient	Patient	Table 40	ALWAYS
Study	General Study	Table 41	ALWAYS
	Patient Study	Table 42	ALWAYS
Series	General Series	Table 43	ALWAYS
Equipment	General Equipment	Table 44	ALWAYS
	SC Equipment	Table 45	ANAP, only if SC.
Image	General Image	Table 46	ALWAYS
	Image Pixel	Table 47	ALWAYS
	US Region Calibration	Table 48	ANAP, only if US or US-MF (not present when depth changes are applied when acquiring US-MF)
	Cine	Table 49	ANAP, only if US-MF
	Multi-Frame	Table 50	ANAP, only if US-MF
	US Image	Table 51	ANAP, only if US or US-MF
	SC Image	= = =	EMPTY, can be present only for SC, but no attributes of this module are present.
	SOP Common	Table 52	ALWAYS

	Private Application	Table 53	ANAP, present only if “EXPORT TO BIOPACS” is selected in the the REPORT EXPORT configuration panel.

8.1.1.2 Common Modules

Table 40
PATIENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient’s Name	(0010,0010)	PN	From user input, only the first three components (some possibly empty).	VNAP	USER
Patient ID	(0010,0020)	LO	From user input.	VNAP	USER
Patient’s Birth Date	(0010,0030)	DA	From user input.	VNAP	USER
Patient’s Sex	(0010,0040)	CS	From user input (*M* or *F*).	VNAP	USER

Table 41
GENERAL STUDY MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Generated by device.	ALWAYS	AUTO
Study Date	(0008,0020)	DA	<yyyymmdd>	ALWAYS	AUTO
Study Time	(0008,0030)	TM	<hhmmss>	ALWAYS	AUTO
Accession Number	(0008,0050)	SH	From user input.	VNAP	USER
Referring Physician’s Name	(0008,0090)	PN	From user input.	VNAP	USER
Study ID	(0020,0010)	SH	Generated by the device.	ALWAYS	AUTO
Study Description	(0008,1030)	LO	Always empty.	VNAP	USER

Table 42
PATIENT STUDY MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Admitting Diagnoses Description	(0008,1080)	LO	From user input.	VNAP	USER
Patient's Age	(0010,1010)	AS	From user input.	VNAP	USER
Patient's Size	(0010,1020)	DS	From user input, can be empty according to the selected application.	VNAP	USER
Patient’s Weight	(0010,1030)	DS	From user input, can be empty according to the selected application.	VNAP	USER

Table 43
GENERAL SERIES MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	*US*	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated by device.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	Generated by device.	ALWAYS	AUTO
Laterality	(0020,0060)	CS	Always empty.	EMPTY	AUTO
Series Date	(0008,0021)	DA	<yyyymmdd>	ALWAYS	AUTO
Series Description	(0008,103E)	LO	Generated by device according to the selected application.	ALWAYS	AUTO
Operators' Name	(0008,1070)	PN	Generated by device according to the login used to access the software: normally "*Eco User*".	ALWAYS	AUTO

Table 44
GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	*ESAOTE*	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	The CENTER name input in the GENERAL PRESET configuration panel.	VNAP	CONFIG
Manufacturer's Model Name	(0008,1090)	LO	*7300001*	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	Generated by device.	ALWAYS	AUTO
Software Version(s)	(0018,1020)	LO	Generated by device.	ALWAYS	AUTO

Table 45
SC EQUIPMENT MODULE OF CREATED SC SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	*SD*.	ALWAYS	AUTO

Table 46
GENERAL IMAGE MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Generated by the device.	ALWAYS	AUTO
Content Date	(0008,0023)	DA	<yyyymmdd>	ALWAYS	AUTO
Content Time	(0008,0033)	TM	<hhmmss>	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	Always empty.	EMPTY	AUTO
Image Type	(0008,0008)	CS	For JPEG lossy compressed images the first two fields are DERIVED\SECONDARY. The third and fourth are specified according to the standard for the US images. For the SC images the third field is the same of the corresponding US and US-MF images, the fourth field is absent.	ALWAYS	AUTO
Acquisition Date	(0008,0022)	DA	<yyyymmdd>	ALWAYS	AUTO
Acquisition Time	(0008,0032)	TM	<hhmmss>	ALWAYS	AUTO
Derivation Description	(0008,2111)	ST	Generated by the device for JPEG lossy compressed images.	ANAP	AUTO
Lossy Image Compression Ratio	(0028,2112)	DS	Generated by the device for JPEG lossy compressed images [4].	ANAP	AUTO
Lossy Image Compression	(0028,2110)	CS	*01* for JPEG lossy compressed images.	ANAP	AUTO
Lossy Image Compression Method	(0008,2114)	CS	*ISO_10918_1* for JPEG lossy compressed images.	ANAP	AUTO

[4] The User can select among three different compression factors.

Table 47
IMAGE PIXEL MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	*YBR_FULL_422* for JPEG lossy compressed images.	ALWAYS	AUTO
Rows	(0028,0010)	US	600	ALWAYS	AUTO
Columns	(0028,0011)	US	800	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0000H	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OW	For the US and US-MF images, the Pixel Data contain burned-in text annotation (data describing the image acquisition parameters) and graphics. For the SC images, the Pixel Data contain the text of the report with the measures in a human readable format.	ALWAYS	AUTO

Table 48
US REGION CALIBRATION MODULE OF CREATED US AND US-MF SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Sequence of Ultrasound Regions	(0018,6011)	SQ		ALWAYS	AUTO
>Region Spatial Format	(0018,6012)	US	Generated by the device.	ALWAYS	AUTO
>Region Data Type	(0018,6014)	US	Generated by the device.	ALWAYS	AUTO
>Region Flags	(0018,6016)	UL	Generated by the device.	ALWAYS	AUTO
>Region Location Min x_0	(0018,6018)	UL	Generated by the device.	ALWAYS	AUTO
>Region Location Min y_0	(0018,601A)	UL	Generated by the device.	ALWAYS	AUTO
>Region Location Max x_1	(0018,601C)	UL	Generated by the device.	ALWAYS	AUTO
>Region Location Max y_1	(0018,601E)	UL	Generated by the device.	ALWAYS	AUTO
>Physical Units X Direction	(0018,6024)	US	Generated by the device.	ALWAYS	AUTO
>Physical Units Y Direction	(0018,6026)	US	Generated by the device.	ALWAYS	AUTO
>Physical Delta X	(0018,602C)	FD	Generated by the device.	ALWAYS	AUTO

>Physical Delta Y	(0018,602E)	FD	Generated by the device.	ALWAYS	AUTO
>Reference Pixel x_0	(0018,6020)	SL	Generated by the device.	ALWAYS	AUTO
>Reference Pixel y_0	(0018,6022)	SL	Generated by the device.	ALWAYS	AUTO
>Ref. Pixel Physical Value X	(0018,6028)	FD	Generated by the device.	ALWAYS	AUTO
>Ref. Pixel Physical Value Y	(0018,602A)	FD	Generated by the device.	ALWAYS	AUTO

Table 49
CINE MODULE OF CREATED US-MF SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Frame Time	(0018,1063)	DS	Only if US-MF image, generated by the device.	ANAP	AUTO

Table 50
MULTI-FRAME MODULE OF CREATED US-MF SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Frames	(0028,0008)	IS	Only if US-MF image, generated by the device.	ANAP	AUTO

Table 51
US IMAGE MODULE OF CREATED US AND US-MF SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Heart Rate	(0018,1088)	IS	Calculated by the device. Can be zero if impossible to determine.	ALWAYS	AUTO
Frame Increment Pointer	(0028,0009)	AT	Contains the tag of the Frame Time attribute, (0018,1063). Only for US-MF images.	ANAP	AUTO
R Wave Time Vector	(0018,6060)	FL	Calculated by the device. Only for US-MF images.	ANAP	AUTO

Table 52
SOP COMMON MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Specific Character Set	(0008,0005)	CS	*ISO_IR 100*	ALWAYS	AUTO
SOP Class UID	(0008,0016)	UI	According to the SOP Class (US, US-MF or SC)	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated by the device.	ALWAYS	AUTO

Table 53
PRIVATE APPLICATION MODULE OF CREATED US AND US-MF SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Private Creator	(6161,0010)	LO	*ReportEsa*	ALWAYS	AUTO
Report in ESAOTE proprietary format	(6161,1030)	OB	Variable length: contains the report in ESAOTE internal proprietary format.	ALWAYS	AUTO
Private Creator	(6161,0011)	LO	*XMLReport*	ALWAYS	AUTO
Report in ESAOTE proprietary XML format	(6161,1130)	OB	Variable length: contains the report with the measures in ESAOTE XML internal format.	ALWAYS	AUTO

8.1.2 Used Fields in received IOD by application

The MyLab storage application does not receive SOP Instances.

8.2 DATA DICTIONARY OF PRIVATE ATTRIBUTES

The Private Attributes added to created SOP Instances are listed in the Table below. The MyLab system reserves blocks of private attributes in group 6161. Further details on usage of these private attributes are contained in Section 8.1.

Table 54
DATA DICTIONARY OF PRIVATE ATTRIBUTES

Tag	Attribute Name	VR	VM
(6161,0010)	Private Creator	LO	1
(6161,1030)	Report in ESAOTE proprietary format	OB	1
(6161,0011)	Private Creator	LO	1
(6161,1130)	Report in ESAOTE proprietary XML format	OB	1

8.3 CODED TERMINOLOGY AND TEMPLATES

Not applicable.

8.4 STANDARD EXTENDED / SPECIALIZED / PRIVATE SOP CLASSES

No Specialized or Private SOP Classes are supported.

8.4.1 US, US Multiframe and Secondary Capture Image Storage SOP Classes

The US, US Multiframe and Secondary Capture Image Storage SOP Classes are extended to create Standard Extended SOP Classes by addition of standard and private attributes to the created SOP Instances as documented in Section 8.1.

8.5 PRIVATE TRANSFER SYNTAXES

No Private Transfer Syntaxes are supported.