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Raffaello Conformance Statement for DICOM V3.0

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0 DOCUMENT VERSIONS

Version	Date	Author	Changes
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1.11	04/01/10	IMS s.r.l.	Fix on Appendix A


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2 INTRODUCTION

This is a conformance statement for the RAFFAELLO program which is part of the full field digital mammography system IMS Giotto Image MD/SD/SDL/3D/3DL, of the biopsy option for the analog mammography system Giotto Image (Biopsy Digit-AM) and of the CONFIRMX.

The Offis DCMTK Toolkit is used to implement and provide DICOM services.

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3 IMPLEMENTATION MODEL

3.1 Application Data Flow Diagram

The application data flow diagram is shown in Figure 1.1-1 and 1.1-2. The figures represent the diagram for each application entity (DMAIN AE is split into two different figures (1.1-1a, 1.1-1b)).

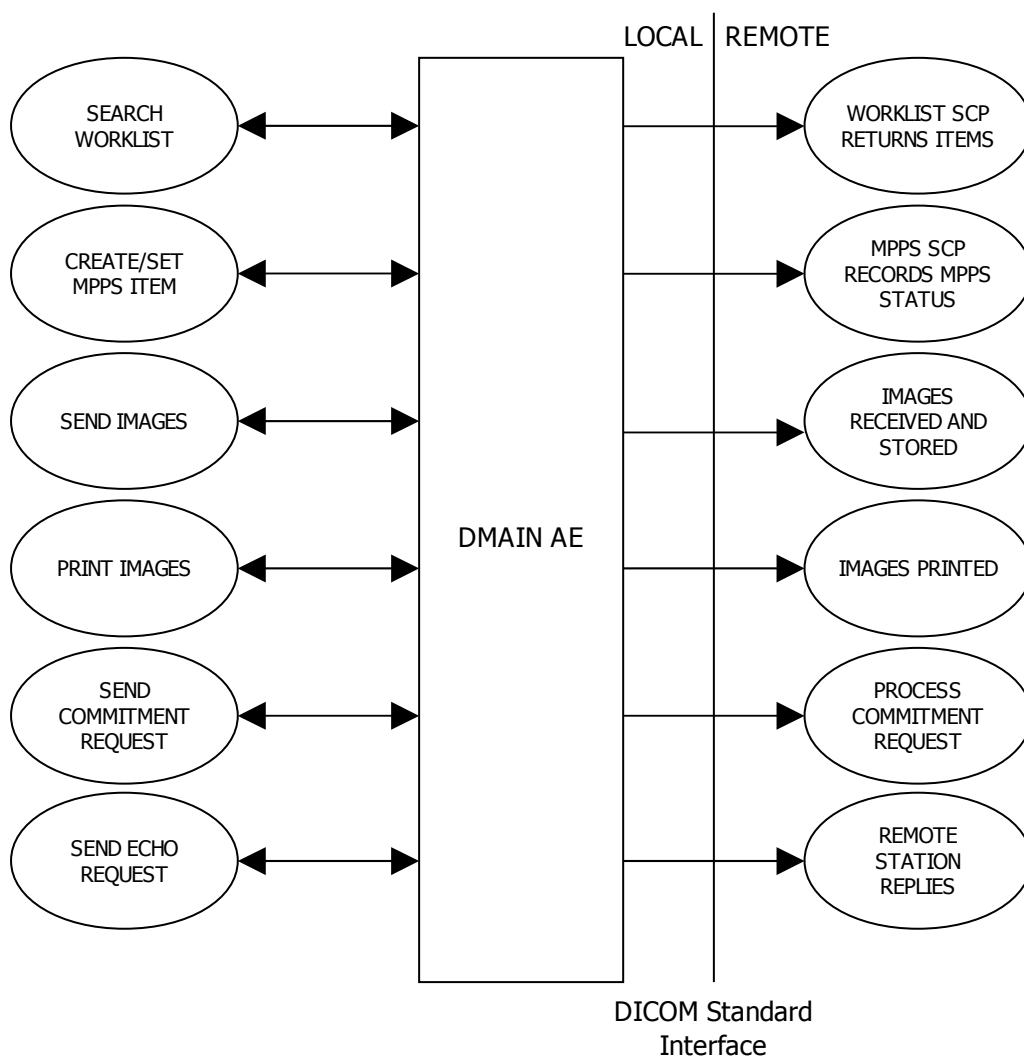



Figure 1.1-1a – Application data flow diagram for DMAIN AE (continues on next page)

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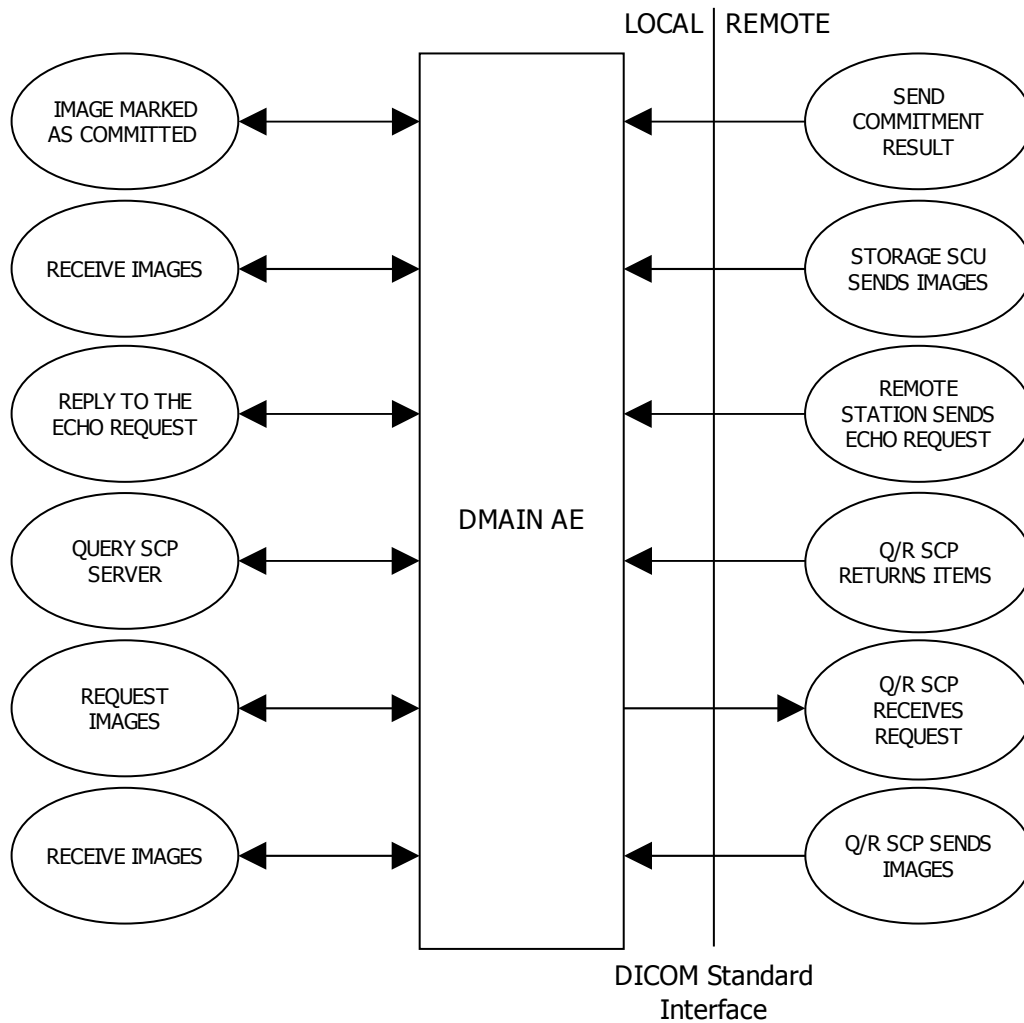



Figure 1.1-1b – Application data flow diagram for DMAIN AE (continues from previous page)

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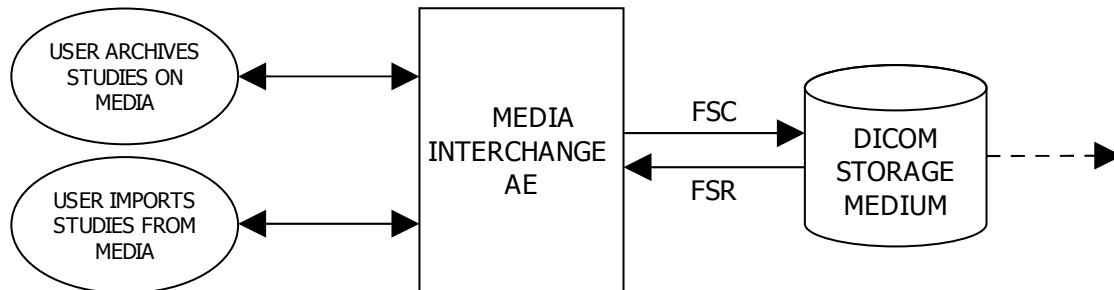


Figure 1.1-2 – Application data flow diagram for MEDIA INTERCHANGE AE

As it is clear from the diagrams, the RAFFAELLO application is composed by two different Application Entities (DMAIN and MEDIA INTERCHANGE).

RAFFAELLO supports the following DICOM SOP Classes:


- DICOM Modality Worklist as SCU (DMAIN AE)
- DICOM Modality Performed Procedure Step as SCU (DMAIN AE)
- DICOM Store as SCU (DMAIN AE)
- DICOM Print as SCU (DMAIN AE)
- DICOM Storage Commitment as SCU (DMAIN AE)
- DICOM Verification as SCU (DMAIN AE)
- DICOM Store as SCP (DMAIN AE; also DQUERY AE can act as a DICOM Store SCP but only during Query/Retrieve operations)
- DICOM Verification as SCP (DMAIN AE)
- DICOM Query/Retrieve as SCU (DQUERY AE or DMAIN AE)
- DICOM Media Interchange as FSC and FSR (MEDIA INTERCHANGE AE)

3.2 Functional Definition of Application Entities (AE)

DMAIN AE:

When the user clicks on the “Worklist” button, a dialog box is shown and the user can search the scheduled procedure steps inserted in a remote RIS (supporting Modality Worklist SCP) using different filters (e.g. scheduled station, scheduled date). Then the scheduled procedure steps are shown in a list control contained in the dialog box; if the user clicks on one item and then pushes the “New Study” button, the patient info dialog will appear showing all the fields (present in the scheduled procedure step) already filled.

When the user starts an image acquisition procedure by clicking on the “New Study” or “Other Images”, if the system is configured to send the Modality Performed Procedure Step notifications, it can send a Modality Performed Procedure Step N-CREATE message to

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the Modality Performed Procedure Step SCP. When the acquisition procedure is closed (through the "Close Study" button), the N-GET message will be sent with a status of COMPLETED (or DISCONTINUED if no images have been acquired or if the user aborted the procedure).

When the user clicks on the "DICOM Store" (or "DICOM Print") buttons, a dialog box appears showing all the DICOM Store (or DICOM Print) configured stations and all the available options. After the user selects the desired station and options, he can push the "Store" (or "Print") button to send the selected images and/or the mammo CAD SR results.

During image acquisition (when present), when a study is closed, if the workstation is configured to support automatic printing or storing of images, the acquired images are sent to the configured (Storage or Print) stations.

If one of the Storage SCP stations is configured also to be a Storage Commitment SCP, then a request for the commitment is sent to the Storage Commitment SCP. Upon receiving of the commitment of the sent images, the images are marked with the "Committed" flag in the RAFFAELLO database.

The Printer N-GET message is sent periodically from the Raffaello to the configured printers and the status of each printer is displayed in the Raffaello status bar.


It is also possible to send the Verification message to check the DICOM connection with a remote SCP (DICOM Verification as SCU).

The DMAIN AE acts also as a DICOM Storage SCP station and it allows to receive mammographic images and Mammography CAD results. When an image or CAD result is received from the DMAIN AE, then it is inserted automatically in the RAFFAELLO database; this application entity also replies to the Verification messages (acting as a Verification SCP station).

The DMAIN AE also implements Query/Retrieve. If the DMAIN AE is configured to be used for Query/Retrieve, when the user clicks on the "Query/Retrieve" button, the "Query/Retrieve" dialog will appear and the user is allowed to query a remote DICOM Query/Retrieve SCP station and retrieve the related images.

The parameters to be set during installation by a field engineer for this Application Entity are:

- the local AE TITLE (the same for SCU and SCP);
- the listening port (used to accept incoming associations for Verification SCP, Storage SCP and Storage Commitment SCU);
- all the parameters of the remote Storage SCP's (AE Title, port and network address);
- all the parameters of the remote Print SCP's (AE Title, port and network address);
- all the parameters of the remote Modality Worklist SCP (AE Title, port and network address).
- all the parameters of the remote Modality Performed Procedure Step SCP (AE Title, port and network address).

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- all the parameters of the remote Query/Retrieve SCP's (AE Title, port and network address).

MEDIA INTERCHANGE AE:

When the user clicks on the "DICOM CD" button, the user is allow to create a new media containing the selected studies or to import studies from an existing media. Supported media for interchange are CD-R, CD-ROM (only to import from), DVD-R and DVD+R.

3.3 Sequencing of Real-World Activities

Not applicable.

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4 AE SPECIFICATIONS


4.1 DMAIN AE

The DMAIN AE, in conjunction with Offis DCMTK Toolkit, provides Standard Conformance to the following DICOM V3.0 Service Object Pair (SOP) Classes as a Service Class User (SCU):

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.31	Modality Worklist Information Model – FIND
1.2.840.10008.3.1.2.3.3	Modality Performed Procedure Step
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography Image Storage – For Presentation
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography Image Storage – For Processing
1.2.840.10008.5.1.1.9	Basic Grayscale Print Management (META)
1.2.840.10008.5.1.1.1	Basic Film Session
1.2.840.10008.5.1.1.2	Basic Film Box
1.2.840.10008.5.1.1.4	Basic Grayscale Image Box
1.2.840.10008.5.1.1.16	Printer
1.2.840.10008.5.1.1.23	Presentation LUT
1.2.840.10008.1.20.1.1	Storage Commitment Push Model
1.2.840.10008.1.1	Verification
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve Information Model – FIND
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve Information Model – MOVE

The DMAIN AE, in conjunction with Offis DCMTK Toolkit, provides standard conformance to the following DICOM V3.0 Service Object Pair (SOP) Classes as a Service Class Provider (SCP):

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography Image Storage – For Presentation
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography Image Storage – For Processing
1.2.840.10008.5.1.4.1.1.88.50	Mammography CAD SR Storage
1.2.840.10008.1.1	Verification

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4.1.1 Association Establishment Policies

4.1.1.1 General

The DMAIN AE will initiate an association when:

- a local operator queries a remote information system to retrieve modality and patient data (DICOM Modality Worklist as an SCU).
- a local operator opens or closes an image acquisition procedure and the notification is sent to the remote MPPS SCP (DICOM Modality Performed Procedure Step as an SCU).
- a local operator requests to send images over the network to a remote Storage Service Class provider (DICOM Storage as an SCU).
- a local operator requests to print images over the network to a remote DICOM Basic Print provider (DICOM Print as an SCU).
- Raffaello requires an update of the printer status (DICOM Printer N-Get as an SCU).
- a local operator requests the verification of a remote Storage or Print SCP (DICOM Verification as an SCU).
- a local operator queries a remote archive for images or other instances and possibly retrieves them.

The DMAIN AE will wait for an association until

- it receives an N-EVENT-REPORT request sent by the Storage Commitment SCP (SCP acts as association requestor and the SCU as association acceptor).
- it receives a store request; then the corresponding images or CAD results are saved to files on disk and inserted in the local database of the Raffaello application.
- it receives a verification request; then it replies to the SCU with a successful message.


The maximum PDU size is configurable from a minimum of 4096 bytes. The default value is 28672 bytes.

4.1.1.2 Number of Associations

The DMAIN AE opens a single association when acting as a Modality Worklist SCU, Modality Performed Procedure Step SCU or Query/Retrieve SCU.

The DMAIN AE opens one different association for each image to be sent, to be printed or for each Printer N-GET request. The storage commitment request will always be sent in the same association of the image storage and it will always contain only one image UID. For each remote AE, the DMAIN AE will only open 1 associations at the same time when sending storage (and storage commitment, if configured) or print messages.

The DMAIN AE allows the remote Storage Commitment SCP station or the remote Storage SCU station to open multiple simultaneous associations. The maximum number of

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simultaneous associations it will support is configurable by a field engineer during installation.

4.1.1.3 Asynchronous Nature

The DMAIN AE does not support asynchronous communication (multiple outstanding transactions over a single association).

4.1.1.4 Implementation Identifying Information

The Implementation Class Unique Identifier (UID) for the DMAIN AE is:

1.2.276.0.7230010.3.0.3.5.4


4.1.2 Association Initiation by Real-World Activity

1. Search Worklist
2. Open/Close Acquisition Procedure
3. Send Images
4. Print Images
5. Update Printer Status
6. Send Commitment Request
7. Send Echo Request
8. Query SCP Server
9. Request Images Or CAD Results

4.1.2.1 Real-World Activity: "Search Worklist"

4.1.2.1.1 Associated Real-World Activity for "Search Worklist"

When the user clicks on the "Worklist" button from the RAFFAELLO database and then on the "Search Worklist" button, the DMAIN AE initiates an association and performs a C-FIND request using the search criteria selected in the user interface; the association is closed when all the response items are received from the remote SCP.

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4.1.2.1.2 Proposed Presentation Contexts for "Search Worklist"

The presentation contexts that are proposed by DMAIN AE for the FIND operation are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist – FIND	1.2.840.10008. 5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		


4.1.2.1.2.1 SOP Specific Conformance for Modality Worklist – FIND

The DMAIN AE will encode queries and interpret responses only with the following Specific Character Set (0008,0005):

Attribute Name	Tag	Value
Specific Character Set	(0008,0005)	ISO_IR 100

The DMAIN AE provides standard conformance as an SCU to the Modality Worklist Service Class and uses the following elements for this SOP class:

Description / Name	Tag	Matching Key Type	Return Key Type
SOP Common			
Specific Character Set	(0008,0005)	O	1C
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	1
>Scheduled Station AE Title	(0040,0001)	R	1
>Scheduled Procedure Step Start Date	(0040,0002)	R	1
>Scheduled Procedure Step Start Time	(0040,0002)	R	1
>Modality	(0008,0060)	R	1
>Scheduled Performing Physician's Name	(0040,0006)	R	2
>Scheduled Procedure Step Description	(0040,0007)	O	1C
>Scheduled Station Name	(0040,0010)	O	2


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>Scheduled Protocol Code Sequence	(0040,0008)	O	1C
>>Code Value	(0008,0100)	O	1
>>Code Scheme Designator	(0008,0102)	O	1
>>Code Meaning	(0008,0104)	O	3
>Scheduled Procedure Step ID	(0040,0009)	O	1
Requested Procedure			
Requested Procedure ID	(0040,1001)	O	1
Requested Procedure Description	(0032,1060)	O	1C
Requested Procedure Code Sequence	(0032,1064)	O	1C
>Code Value	(0008,0100)	O	1
>Code Scheme Designator	(0008,0102)	O	1
>Code Meaning	(0008,0104)	O	3
Study Instance UID	(0020,000D)	O	1
Referenced Study Sequence	(0008,1110)	O	2
>Referenced SOP Class UID	(0008,1150)	O	1
>Referenced SOP Instance UID	(0008,1155)	O	1
Imaging Service Request			
Accession Number	(0008,0050)	O	2
Referring Physician's Name	(0008,0090)	O	2
Patient Identification			
Patient's Name	(0010,0010)	R	1
Patient ID	(0010,0020)	R	1
Patient Demographic			
Patient's Birth Date	(0010,0030)	O	2
Patient's Sex	(0010,0040)	O	2

4.1.2.2 Real-World Activity: "Open/Close Acquisition Procedure"

4.1.2.2.1 Associated Real-World Activity for "Open/Close Acquisition Procedure"

When the user starts an image acquisition procedure by clicking on the "New Study" or "Other Images", if the system is configured to send the Modality Performed Procedure Step notifications, it can send a Modality Performed Procedure Step N-CREATE message to the Modality Performed Procedure Step SCP. When the acquisition procedure is closed (through the "Close Study" button), the N-SET message will be sent with a status of COMPLETED (or DISCONTINUED if no images have been acquired if the user aborted the procedure). In both cases a new association is opened and it is closed when the corresponding message is sent.

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4.1.2.2.2 Proposed Presentation Contexts for "Open/Close Acquisition Procedure"


The presentation contexts that are proposed by DMAIN AE for the "Open/Close Acquisition Procedure" real-world activity are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		


4.1.2.2.2.1SOP Specific Conformance for Modality Performed Procedure Step

The following table provides a description of the MPPS N-CREATE and N-SET (final) request identifiers sent by the DMAIN AE. Empty cells in the N-CREATE and N-SET (final) columns indicate that the attribute is not sent. An "x" indicates that an appropriate value will be sent. A "NULL" attribute will be sent with zero length.


Attribute Name	Tag	N-CREATE	N-SET (final)
Specific Character Set	(0008,0005)	ISO_IR 100	
Scheduled Step Attribute Sequence	(0040,0270)	x (see below)	
>Study Instance UID	(0020,000D)	x	
>Referenced Study Sequence	(0008,1110)	x (or NULL if the attribute is not retrieved from the worklist)	
>Accession Number	(0008,0050)	x (or NULL if the attribute is not retrieved from the worklist)	
>Requested Procedure ID	(0040,1001)	x (or NULL if the attribute is not retrieved from the worklist)	

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>Requested Procedure Description	(0032,1060)	x (or NULL if the attribute is not retrieved from the worklist)	
>Scheduled Procedure Step ID	(0040,0009)	x (or NULL if the attribute is not retrieved from the worklist)	
>Scheduled Procedure Step Description	(0040,0007)	x (or NULL if the attribute is not retrieved from the worklist)	
>Scheduled Protocol Code Sequence	(0040,0008)	x (or NULL if the attribute is not retrieved from the worklist)	
Patient's Name	(0010,0010)	x	
Patient ID	(0010,0020)	x	
Patient's Birth Date	(0010,0030)	x	
Patient's Sex	(0010,0040)	x	
Referenced Patient Sequence	(0008,1120)	NULL	
Performed Procedure Step ID	(0040,0253)	x	
Performed Station AE Title	(0040,0241)	x	
Performed Station Name	(0040,0242)	NULL	
Performed Location	(0040,0243)	NULL	
Performed Procedure Step Start Date	(0040,0244)	x (copied from study date)	
Performed Procedure Step Start Time	(0040,0245)	x (copied from study time)	
Performed Procedure Step Status	(0040,0252)	IN PROGRESS	COMPLETED or DISCONTINUED
Performed Procedure Step Description	(0040,0254)	x (copied from study description)	
Performed Procedure Type Description	(0040,0255)	NULL	

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Procedure Code Sequence	(0008,1032)	x (copied from Requested Procedure Code Sequence in the worklist or NULL if the attribute is not retrieved from the worklist)	
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)		x (sent only if the status is DISCONTINUED)
Performed Procedure Step End Date	(0040,0250)	NULL	x
Performed Procedure Step End Time	(0040,0251)	NULL	x
Modality	(0008,0060)	MG	
Study ID	(0020,0010)	x	
Performed Protocol Code Sequence	(0040,0260)	NULL	
Performed Series Sequence	(0040,0340)	NULL	x (see below)
>Performing Physician's Name	(0008,1050)		x
>Protocol Name	(0018,1030)		x
>Operator's Name	(0008,1070)		x
>Series Instance UID	(0020,000E)		x
>Series Description	(0008,103E)		NULL
>Retrieve AE Title	(0008,0054)		NULL
>Referenced Image Sequence	(0008,1140)		x (or NULL if no images have been acquired)
>>Referenced SOP Class UID	(0008,1150)		x
>>Referenced SOP Instance UID	(0008,1155)		x
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)		NULL
Total Number of Exposures	(0040,0301)		x (only if Radiation Dose option is enabled)

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Entrance Dose in mGy	(0040,8302)		x (it's the sum for all the exposures) (only if Radiation Dose option is enabled)
Organ Dose	(0040,0316)		x (it's the sum for all the exposures) (only if Radiation Dose option is enabled)
Exposure Dose Sequence	(0040,030E)		x (only if Radiation Dose option is enabled)
>KVp	(0018,0060)		x (only if Radiation Dose option is enabled)
>X-Ray Tube Current in μ A	(0018,8151)		x (only if Radiation Dose option is enabled)
>Exposure Time	(0018,1150)		x (only if Radiation Dose option is enabled)
>Filter Type	(0018,1160)		x (only if Radiation Dose option is enabled)
>Filter Material	(0018,7050)		x It's not present if Filter Type (0018,1160) has value: NONE (only if Radiation Dose option is enabled)

4.1.2.3 Real-World Activity: "Send Images Or CAD Results"

4.1.2.3.1 Associated Real-World Activity for "Send Images"

There are two different situations in which this real-world activity is initiated:

- When the user selects some studies/series/images, clicks on the "DICOM Store" button from the RAFFAELLO database and then selects the remote AE, the DMAIN AE initiates an association for each image or CAD results contained in the selected

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studies/series/images list. Every association is closed when the image or CAD result has been sent (successfully or not) to the remote SCP. A storage commitment request is sent to the remote SCP before closing the association if the remote storage station is configured to support storage commitment (see paragraph 4.1.2.6 for details).

- When the user closes an examination, for each acquired image, the DMAIN AE initiates an association to every storage station configured for automatic storing of images and CAD results. Every association is closed when the image or CAD result has been sent (successfully or not) to the remote SCP. A storage commitment request is sent to the remote SCP before closing the association if the remote storage station is configured to support storage commitment (see paragraph 4.1.2.6 for details).

4.1.2.3.2 Proposed Presentation Contexts for "Send Images or CAD Results"

The presentation contexts that are proposed by DMAIN AE for the "Send Images or CAD Results" real-world activity are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.1.1.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

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4.1.2.3.2.1 SOP Specific Conformance for Digital Mammography Image Storage – For Presentation SOP Class

The DMAIN AE will react in the following ways to the different C-STORE response status:

- Refused: the SCU will show in the "Queue Manager" the FAILED status for the image to be sent.
- Error: the SCU will show in the "Queue Manager" the FAILED status for the image to be sent.
- Warning: the SCU will show in the "Queue Manager" the SUCCESS status for the image to be sent.
- Success: the SCU will show in the "Queue Manager" the SUCCESS status for the image to be sent.

The DMAIN AE will not attempt any extended negotiation.

The attributes of the Storage SOP Instances which are created by the Raffaello application are listed in (chapter 9).

4.1.2.3.2.2 SOP Specific Conformance for Digital Mammography Image Storage – For Processing SOP Class

Same as SOP Specific Conformance for Digital Mammography Image Storage – For Presentation SOP Class.

4.1.2.3.2.3 SOP Specific Conformance for Mammography CAD SR Storage Class


Same as SOP Specific Conformance for Digital Mammography Image Storage – For Presentation SOP Class.

4.1.2.4 Real-World Activity: "Print Images"

4.1.2.4.1 Associated Real-World Activity for "Print Images"

There are two different situations in which this real-world activity is initiated:

- When the user selects some studies/series/images, clicks on the "DICOM Print" button from the RAFFAELLO database and then selects the remote AE, the DMAIN AE initiates an association for each image contained in the selected study/series/image list. Every association is closed when the image has been sent (successfully or not) to the remote SCP.
- When the user closes an examination, for each acquired image the DMAIN AE initiates an association to every print station configured for automatic storing of images. Every

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association is closed when the image has been sent (successfully or not) to the remote SCP.

4.1.2.4.2 Proposed Presentation Contexts for "Print Images"


The presentation contexts that are proposed by DMAIN AE for the "Print Images" real-world activity are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Presentation LUT	1.2.840.10008.5.1.1.23	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.1.2.4.2.1 SOP Specific Conformance for Basic Grayscale Print Management Meta SOP Class

DMAIN AE supports the following SOP Classes contained in the for Basic Grayscale Print Management Meta SOP Class:

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.1.1	Basic Film Session
1.2.840.10008.5.1.1.2	Basic Film Box
1.2.840.10008.5.1.1.4	Basic Grayscale Image Box
1.2.840.10008.5.1.1.16	Printer

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4.1.2.4.2.1.1 Attributes and DIMSE Service Elements for Basic Film Session SOP Class

DIMSE Service Element	Usage SCU
N-CREATE	M
N-SET	Not used
N-DELETE	Not used
N-ACTION	U

N-CREATE attributes sent to the SCP:


Attribute Name	Tag	Notes
Number of Copies	(2000,0010)	Set in the print dialog (default is 1)
Print Priority	(2000,0020)	Set in the print dialog (default is MEDIUM)
Medium type	(2000,0030)	Set in the print dialog (default is set during installation)
Film Destination	(2000,0040)	Set in the print dialog (default is set during installation)

4.1.2.4.2.1.2 Attributes and DIMSE Service Elements for Basic Film Box SOP Class

DIMSE Service Element	Usage SCU
N-CREATE	M
N-SET	Not used
N-DELETE	Not used
N-ACTION	Not used

N-CREATE attributes sent to the SCP:


Attribute Name	Tag	Notes
Image Display Format	(2010,0010)	Fixed to STANDARD\1,1
Referenced Film Session Sequence	(2000,0500)	
>Referenced SOP Class UID	(0008,1150)	Fixed to 1.2.840.10008.5.1.1.1
>Referenced SOP Instance UID	(0008,1155)	Given from the Film Session N_CREATE Response
Film Orientation	(2010,0040)	PORTRAIT or LANDSCAPE according

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		to the image dimensions and to the AutoOrientation parameter set during installation
Film Size ID	(2010,0050)	Set in the print dialog (default is set during installation)
Magnification Type	(2010,0060)	Fixed during installation
Border Density	(2010,0100)	Fixed during installation (will have the same value as Max Density (2010,0130))
Empty Image Density	(2010,0110)	Fixed during installation (will have the same value as Max Density (2010,0130))
Max Density	(2010,0130)	Fixed during installation
Smoothing Type	(2010,0080)	Fixed during installation
Min Density	(2010,0120)	Fixed during installation
Trim	(2010,0140)	Fixed during installation (may be not sent by configuration file setting)
Configuration Information	(2010,0150)	Fixed during installation. If it is empty, it is not sent
Illumination	(2010,015E)	Fixed during installation, sent only if Presentation LUT is configured for the selected remote AE Title
Reflected Ambient Light	(2010,0160)	Fixed during installation, sent only if Presentation LUT is configured for the selected remote AE Title
Referenced Presentation LUT Sequence	(2050,0500)	Sent only if Presentation LUT is configured for the selected remote AE Title
>Referenced SOP Class UID	(0008,1150)	1.2.840.10008.5.1.1.23
>Referenced SOP Instance UID	(0008,1155)	Given from the Presentation LUT N_CREATE Response

4.1.2.4.2.1.3 Attributes and DIMSE Service Elements for Basic Grayscale Image Box SOP Class

DIMSE Service Element	Usage SCU
N-SET	M


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N-SET attributes sent to the SCP:

Attribute Name	Tag	Notes
Image Position	(2020,0010)	Fixed to 1
Basic Grayscale Image Sequence	(2020,0110)	
>Samples Per Pixel	(0028,0002)	Fixed to 1
>Photometric Interpretation	(0028,0004)	Fixed to MONOCHROME2
>Rows	(0028,0010)	Variable according to the image
>Columns	(0028,0011)	Variable according to the image
>Bits Allocated	(0028,0100)	16 for single images, 8 for DICOM Screenshot (always 8 if the 8bit parameter is set during installation)
>Bits Stored	(0028,0101)	12 for single images, 8 for DICOM Screenshot (always 8 if the 8bit parameter is set during installation)
>High Bit	(0028,0102)	11 for single images, 7 for DICOM Screenshot (always 7 if the 8bit parameter is set during installation)
>Pixel Representation	(0028,0103)	Fixed to 0
>Pixel Data	(7FE0,0010)	Data Matrix
Configuration Information	(2010,0150)	Fixed during installation (the same as in the FilmBox). If it is empty, it is not sent
Requested Image Size	(2020,0030)	Sent only if configured. The requested image size is sent only when a single image is printed and the DICOM image contains the Imager Pixel Spacing (0018,1164) attribute.

4.1.2.4.2.1.4 Attributes and DIMSE Service Elements for Printer SOP Class

DIMSE Service Element	Usage SCU
N-EVENT-REPORT	M
N-GET	U

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N-EVENT_REPORT attributes handled from the SCU:

Event Type Name	Event Type ID	Attribute	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

N-GET attributes received from the SCP:

Attribute Name	Tag	Notes
Printer Status	(2110,0010)	
Printer Status Info	(2110,0020)	

The N-GET message is sent before each image is printed. The image is not sent if the printer status is FAILURE. The N-GET message is also sent periodically from the DMAIN AE and the results are reported in the status bar of the Raffaello application (see 4.1.2.5).

4.1.2.4.2.2 SOP Specific Conformance for Presentation LUT SOP Class


4.1.2.4.2.2.1 Attributes and DIMSE Service Elements for Presentation LUT SOP Class

DIMSE Service Element	Usage SCU
N-CREATE	M
N-DELETE	Not used

N-CREATE attributes sent to the SCP:

Attribute Name	Tag	Notes
Presentation LUT Shape	(2050,0020)	Fixed to IDENTITY

The N-CREATE message of the Presentation LUT SOP Class is sent only if it is configured during installation. In this case the Illumination, Reflected Ambient Light and Referenced Presentation LUT Sequence attributes are sent in the Film Box N-CREATE message.

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4.1.2.5 Real-World Activity: "Update Printer Status"

4.1.2.5.1 Associated Real-World Activity for "Update Printer Status"

This real-world activity is initiated when the Raffaello periodically requests the status of each configured printer. The user can also request an update of the printer status for one printer.

4.1.2.5.2 Proposed Presentation Contexts for "Update Printer Status"

The presentation contexts that are proposed by DMAIN AE for the "Print Images" real-world activity are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		


4.1.2.5.2.1 SOP Specific Conformance for Basic Grayscale Print Management Meta SOP Class

DMAIN AE supports the following SOP Classes contained in the for Basic Grayscale Print Management Meta SOP Class:

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.1.16	Printer

4.1.2.5.2.1.1 Attributes and DIMSE Service Elements for Printer SOP Class

DIMSE Service Element	Usage SCU
N-EVENT-REPORT	M
N-GET	U

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N-EVENT_REPORT attributes handled from the SCU:

Event Type Name	Event Type ID	Attribute	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

N-GET attributes received from the SCP:

Attribute Name	Tag	Notes
Printer Status	(2110,0010)	
Printer Status Info	(2110,0020)	

The N-GET message is sent upon user request or periodically and the results are reported in the status bar of the Raffaello application.

4.1.2.6 Real-World Activity: "Send Commitment Request"


4.1.2.6.1 Associated Real-World Activity for "Send Commitment Request"

When a remote host is also known as a Storage Commitment Service Class Provider and the DMAIN AE sends successfully an image to this remote host, in the same association it also sends the storage commitment request. The association is closed when the storage commitment request has been sent (successfully or not) to the remote SCP.

4.1.2.6.2 Proposed Presentation Contexts for "Send Commitment Request"

The presentation contexts that are proposed by DMAIN AE for the "Send Commitment Request" real-world activity are:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

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4.1.2.6.2.1 SOP Specific Conformance for Storage Commitment Push Model SOP Class

The DMAIN AE will not attempt any extended negotiation.

The DMAIN AE will request Storage Commitment only for the following SOP Class UID:

SOP Class Name	SOP Class UID
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.1.1.2
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.1.1.2.1

The DMAIN AE will wait forever for an N-EVENT-REPORT message in another association invoked by the SCP (See the real world activity “Image Marked As Committed” for details).

The DMAIN AE does not support the optional Storage Media File-Set ID & UID Attributes in the N-ACTION command.

4.1.2.7 Real-World Activity: “Send Echo Request”


4.1.2.7.1 Associated Real-World Activity for “Send Echo Request”

The DMAIN AE initiates one association when the operator opens the DICOM Configuration tool, selects a remote storage or print station and clicks on the “Verify” button. Every association is closed when the echo request has been sent (successfully or not) to the remote SCP.

4.1.2.7.2 Proposed Presentation Contexts for “Send Echo Request”

The presentation contexts that are proposed by DMAIN AE for the “Send Echo Request” real-world activity are:

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

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4.1.2.7.3 SOP Specific Conformance for Verification SOP Class

The DMAIN AE provides standard conformance to the DICOM Verification SOP Class as a Service Class User (SCU).

4.1.2.8 Real-World Activity: "Query SCP Server"

4.1.2.8.1 Associated Real-World Activity for "Query SCP Server"

When the user clicks on the "Query/Retrieve" button from the RAFFAELLO application, the "Query/Retrieve Dialog" appears; when the user clicks on the "Query" button, the DMAIN AE initiates an association. Then the DMAIN AE performs a C-FIND operation using the filters selected in the dialog. The association is closed when all the response items are received from the remote SCP.

4.1.2.8.2 Proposed Presentation Contexts for "Query SCP Server"

The presentation contexts that are proposed by DMAIN AE for the C-FIND operation are:


Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.1.2.8.2.1 SOP Specific Conformance for Study Root Query/Retrieve Information Model – FIND

The DMAIN AE provides standard conformance as an SCU to the Study Root Query/Retrieve Information Model – FIND.

The DMAIN AE will not generate Relational Queries.

The DMAIN AE will encode queries and interpret responses only with the following Specific Character Set (0008,0005):

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Attribute Name	Tag	Value
Specific Character Set	(0008,0005)	ISO_IR 100

4.1.2.9 Real-world Activity: "Request Images Or CAD Results"

4.1.2.9.1 Associated Real-World Activity for "Request Images Or CAD Results"

When the user selects some studies/series/images/instances from the "Query/Retrieve Dialog" and then clicks on the "Move" button, the DMAIN AE initiates an association. Then the DMAIN AE begins listening as an SCP Storage server and performs a C-MOVE operation to retrieve the selected items. The association is closed when the move operation has completed.

4.1.2.9.2 Proposed Presentation Contexts for "Request Images Or CAD Results"

The presentation contexts that are proposed by DMAIN AE for the C-MOVE operation are:


Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.1.2.9.2.1 SOP Specific Conformance for Study Root Query/Retrieve Information Model – MOVE

The DMAIN AE provides standard conformance as an SCU to the Study Root Query/Retrieve Information Model – MOVE.

4.1.3 Association Acceptance Policy

The DMAIN AE can accept an association as a Storage SCP, and in this case it will receive any mammographic images or CAD results transmitted on that association and store the images or CAD results on the local Raffaello database.

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The DMAIN AE places no limitations on who may connect to it, while the maximum number of simultaneous associations it will support is configurable by the user.

The DMAIN AE can also accept an association for Storage Commitment notification, N-EVENT-REPORT, **as an SCU**. The Storage Commitment Service Class Provider initiating the association must use the role selection negotiation.

4.1.4 Association Acceptance by Real-World Activity

1. Image Marked As Committed
2. Receive Images Or CAD Results
3. Reply To The Echo Request

4.1.4.1 Real World Activity "Image Marked As Committed"


The DMAIN AE accepts an association if it receives a valid association request from a Storage Commitment SCP station.

4.1.4.1.1 Associated Real-World Activity for "Image Marked As Committed"

The DMAIN AE waits for any association. No operator action is required to receive a storage commitment notification.

After receiving the N-EVENT-REPORT from the Storage Commitment Service Class Provider, the DMAIN AE writes a message into the log file and sets a flag into the database for each image successfully committed.

The DMAIN AE always replies the Storage Commitment Service Class Provider with a N_ACTION_SUCCESS response.

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4.1.4.1.2 Presentation Context Table for "Image Marked As Committed "

Accepted presentation context table for the DMAIN AE and "Image Marked As Committed":

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.1.4.1.2.1 SOP Specific Conformance for the DMAIN AE for Storage Commitment Push Model

The DMAIN AE will not attempt any extended negotiation.

After receiving a N-EVENT-REPORT primitive (Storage Commitment Result):

- If a success status is received, the image is marked in the database as "Committed" and the Raffaello application can safely delete this image (if configured to behave in this way).
- If a failure status is received, no actions are taken and the image is not sent again to the SCP station.


After receiving the N-EVENT-REPORT from the Storage Commitment Service Class Provider, the DMAIN AE writes a message into the log file and sets a flag into the database for each image successfully committed.

The Storage Commitment AE replies the Storage Commitment Service Class Provider always with a N_ACTION_SUCCESS response.

4.1.4.1.3 Presentation Context Acceptance Criterion

The acceptable Presentation Contexts which the DMAIN AE may accept are specified in the table shown in paragraph 4.1.4.1.2.

The DMAIN AE will examine proposed Presentation Contexts in the order proposed. The first acceptable Presentation Context determines the Abstract Syntax which will be used

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for the association. Later Proposed Presentation Contexts may be accepted if they have the same Abstract Syntax and allow a different Transfer Syntax.

4.1.4.1.4 Transfer Syntax Selection Policies

Transfer syntaxes are accepted in the following order:

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

4.1.4.2 Real-World Activity "Receive Images Or CAD Results"


4.1.4.2.1 Associated Real-World Activity for "Receive Images Or CAD Results"

The Real-World Activity associated with the C-STORE operation is the storage of the image or of the CAD results on the local Raffaello database.

The DMAIN AE will issue a failure status if it is unable to store the image on disk.

4.1.4.2.2 Presentation Context Table for "Receive Images Or CAD Results"

Only the presentation contexts listed in the following table will be accepted by the DMAIN AE for the Real-World Activity "Receive Images Or CAD Results":

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Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Digital Mammography Image Storage – For Presentation	1.2.840.10008.5.1.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Digital Mammography Image Storage – For Processing	1.2.840.10008.5.1.1.1.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.1.4.2.2.1 SOP Specific Conformance for Storage SOP Classes


The DMAIN AE provides conformance to the DICOM Storage SOP Classes as a Service Class Provider (SCP) at level 2 (Full).

No elements are discarded by the DMAIN AE. In the event of a successful C-STORE operation, the image has successfully been inserted into the local Raffaello database.

The DMAIN AE does not perform any validation of the data beyond the DICOM Command. DMAIN AE is a “trusting” application.

If the DMAIN AE returns one of the following status codes, then the C-STORE was unsuccessful:

- A700 (Out of Resources) - Indicates that there was not enough disk space to store the image. Recovery from this condition is left to the user of the DMAIN AE.
- C000 (Unable to process) - Indicates that the DMAIN AE could not import the received image into the Raffaello database.

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4.1.4.2.3 Presentation Context Acceptance Criterion

The acceptable Presentation Contexts which the DMAIN AE may accept are specified in the table shown in paragraph 4.1.4.2.2.

The DMAIN AE will examine proposed Presentation Contexts in the order proposed. The first acceptable Presentation Context determines the Abstract Syntax which will be used for the association. Later Proposed Presentation Contexts may be accepted if they have the same Abstract Syntax and allow a different Transfer Syntax.

4.1.4.2.4 Transfer Syntax Selection Policies

Transfer syntaxes are accepted in the following order:

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

4.1.4.3 Real-World Activity "Reply To The Echo Request"

4.1.4.3.1 Associated Real-World Activity for "Reply To The Echo Request"


The Real-World Activity associated with the C-ECHO operation is the reply to the remote workstation.

The DMAIN AE will always issue a successful status.

4.1.4.3.2 Presentation Context Table for "Reply To The Echo Request"

Only the presentation contexts listed in the following table will be accepted by the DMAIN AE for the Real-World Activity "Reply To The Echo Request":

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

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4.1.4.3.2.1 SOP Specific Conformance for Verification SOP Class

The DMAIN AE provides standard conformance to the DICOM Verification SOP Class as a Service Class Provider (SCP).

4.1.4.3.3 Presentation Context Acceptance Criterion

The acceptable Presentation Contexts which the DMAIN AE may accept are specified in the table shown in paragraph 4.1.4.3.2.

The DMAIN AE will examine proposed Presentation Contexts in the order proposed. The first acceptable Presentation Context determines the Abstract Syntax which will be used for the association. Later Proposed Presentation Contexts may be accepted if they have the same Abstract Syntax and allow a different Transfer Syntax.

4.1.4.3.4 Transfer Syntax Selection Policies


Transfer syntaxes are accepted in the following order:

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

4.2 MEDIA INTERCHANGE AE

The MEDIA INTERCHANGE AE provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

Supported AP	Real World Activity	Roles	SC Option
STD-GEN-CD	User Request Archiving On Media	FSC	Interchange
	User Imports Studies From Media	FSR	Interchange
STD-GEN-DVD	User Request Archiving On Media	FSC	Interchange
	User Imports Studies From Media	FSR	Interchange

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4.2.1 File Meta Information for the MEDIA INTERCHANGE AE

The source Application Entity Title is configurable by a field engineer.

No Private Information is used in the Application Profile Meta Information.

4.2.2 Real-world Activities for the MEDIA INTERCHANGE AE

4.2.2.1 Real-World Activity "User Archives Studies On Media"

When a study is selected in the browser list of the Raffaello application, the user can create a new DICOM file set by clicking the DICOM CD button and then on the Burn CD button. The Directory Information Module is always created and the Basic Directory IOD Definition Model is made from standard tags of type 1 or 2 and from the Study Instance UID.

The Media Interchange AE acts as File-Set Creator (FSC) using the Interchange Option.

4.2.2.1.1 Media Storage Application Profile for "User Archives Studies On Media"

The Application Profiles supported by this Real-World Activity are the following:

Supported AP	Roles	SC Option
STD-GEN-CD	FSC	Interchange
STD-GEN-DVD	FSC	Interchange

There are no extensions or specializations.


4.2.2.2 Real-World Activity "User Imports Studies From Media"

The user can browse a DICOM file set from a DICOM Storage Medium by clicking the DICOM CD button and then the Import CD button. At this point a new Dialog Window is displayed on the screen where there is the list of the studies burned on the media: the user may select one or more studies to import them into the local database by clicking the Import Studies button.

The Media Interchange AE acts as File-Set Creator (FSR) using the Interchange Option.


4.2.2.2.1 Media Storage Application Profile for "User Import Studies From Media"

The Application Profiles supported by this Real-World Activity are the following:

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Supported AP	Roles	SC Option
STD-GEN-CD	FSR	Interchange
STD-GEN-DVD	FSR	Interchange

There are no extensions or specializations.

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5 COMMUNICATION PROFILES

5.1 Supported Communication Stacks


RAFFAELLO provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8.

5.2 TCP/IP Stack

RAFFAELLO uses the Offis DCMTK Toolkit to communicate over the TCP/IP protocol stack on any physical interconnection media supporting the TCP/IP stack. The tool kit inherits the TCP/IP stack from the operating system upon which it executes.

5.2.1 Physical Media Support

The RAFFAELLO is indifferent to the physical medium over which TCP/IP executes; it inherits this from the operating system on which it exists.

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6 EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

6.1 Standard Extended/Specialized/Private SOPs


None supported.

6.2 Private Transfer Syntaxes

None supported.

6.3 Augmented And Private Application Profiles

No augmented or private application profiles are implemented by this application.

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7 CONFIGURATION


7.1 AE Title/Presentation Address Mapping

Every AE (local or remote) can be configured by the operator by selecting the "DICOM Configuration" item from the "Tools" menu.

These information are used by the Offis DCMTK Toolkit to communicate over the TCP/IP protocol stack.


7.2 Configurable Parameters

It is possible to configure some lower level parameters to improve or modify network performances. Before modifying any parameters, you shall contact IMS s.r.l. for advice.

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8 SUPPORT OF EXTENDED CHARACTER SETS

The RAFFAELLO application provides support for the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) extended character set.

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9 APPENDIX A – DIGITAL MAMMOGRAPHY X-RAY IMAGE IOD

9.1 Introduction


This section specifies the use of the DICOM Digital Mammography X-ray (MG) Image IOD to represent the information included in MG images produced by this implementation.

This appendix describes both the mammography image IOD (Digital Mammography Image Storage – For Presentation and Digital Mammography Image Storage – For Processing) showing clearly when some differences are present.

9.2 IOD Module Table

The following table shows all the standard and private modules supported by the images produced by this implementation:

IE	Module	Usage	Reference
Patient	Patient	M	9.3.1.1
	Specimen Identification	U (Not used)	---
	Clinical Trial Subject	U (Not Used)	---
Study	General Study	M	9.3.2.1
	Patient Study	U	9.3.2.2
	Clinical Trial Study	U (Not Used)	---
Series	General Series	M	9.3.3.1
	Clinical Trial Series	U (Not Used)	---
	DX Series	M	9.3.3.2
	Mammography Series	M	9.3.3.3
Frame Of Reference	Frame Of Reference	C (Not Used)	---
Equipment	General Equipment	M	9.3.4.1
Image	General Image	M	9.3.5.1
	Image Pixel	M	9.3.5.2
	Contrast / Bolus	U (Not Used)	---
	Display Shutter	U (Not Used)	---
	Device	U (Not Used)	---
	Therapy	U (Not Used)	---
	DX Anatomy Imaged	M	9.3.5.3
	DX Image	M	9.3.5.4
	DX Detector	M	9.3.5.5

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	X-Ray Collimator	U (Not Used)	---
	DX Positioning	U	9.3.5.6
	X-Ray Tomo Acquisition	U (Not Used)	---
	X-Ray Acquisition Dose	U	9.3.5.7
	X-Ray Generation	U	9.3.5.8
	X-Ray Filtration	U	9.3.5.9
	X-Ray Grid	U	9.3.5.10
	Mammography Image	M	9.3.5.11
	Overlay Plane	C (Not Used)	---
	Curve	U (Not Used)	---
	VOI LUT	C	9.3.5.12
	Image Histogram	U (Not Used)	---
	Acquisition Context	M	9.3.5.13
	SOP Common	M	9.3.5.14
IMS Private Biopsy	General IMS Private Biopsy	Private	9.3.6.1
IMS Private Mammography	General IMS Private Mammography	Private	9.3.7.1

9.3 Information Entities

9.3.1 Patient Information Entity

9.3.1.1 Patient Module

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	The value is loaded from HIS/RIS or is entered by the user
Patient ID	(0010,0020)	2	The value is loaded from HIS/RIS or is entered by the user
Patient's Birth Date	(0010,0030)	2	The value is loaded from HIS/RIS or is entered by the user
Patient's Sex	(0010,0040)	2	The value is loaded from HIS/RIS or is entered by the user

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9.3.2 Study Information Entity

9.3.2.1 General Study Module

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	The value is loaded from HIS/RIS or it is generated by the system
Study Date	(0008,0020)	2	The system set it to today's date when generating a new study
Study Time	(0008,0030)	2	The system set it to current time when generating a new study
Referring Physician's name	(0008,0090)	2	The value is loaded from HIS/RIS or it is entered by the user
Study ID	(0020,0010)	2	The value is loaded from HIS/RIS (from the Requested Procedure ID field) or is generated by the system
Accession Number	(0008,0050)	2	The value is not NULL only if retrieved from HIS/RIS or it is entered by the user
Study Description	(0008,1030)	3	The value is loaded from HIS/RIS (from the Requested Procedure Description field) or it is entered by the user
Procedure Code Sequence	(0008,1032)	3	The value is loaded from HIS/RIS (from the Requested Procedure Code Sequence field), otherwise is absent
Referenced Study Sequence	(0008,1110)	3	The value is loaded from HIS/RIS, otherwise is absent

9.3.2.2 Patient Study Module


Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	The value is generated by the system

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9.3.3 Series Information Entity

9.3.3.1 General Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Fixed to MG
Series Instance UID	(0020,000E)	1	Generated by the system
Series Number	(0020,0011)	2	Generated by the system
Series Date	(0008,0021)	3	The system set it to today's date when generating a new serie
Series Time	(0008,0031)	3	The system set it to current time when generating a new serie
Performing Physician's Name	(0008,1050)	3	The value is loaded from HIS/RIS or it is entered by the user
Protocol Name	(0018,1030)	3	Generated by the system
Operator's Name	(0008,1070)	3	The value is entered by the user
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Set if and only if the modality is configured to send MPPS messages.
>Referenced SOP Class UID	(0008,1150)	1C	Fixed to 1.2.840.10008.3.1.2.3.3
>Referenced SOP Instance UID	(0008,1155)	1C	Generated by the system
Body Part Examined	(0018,0015)	3	Fixed to BREAST
Request Attributes Sequence	(0040,0275)	3	Only one item is set only when the study information has been picked from the worklist, otherwise it will be set to NULL
>Requested Procedure ID	(0040,1001)	1	Value is taken from the worklist information
>Requested Procedure Description	(0032,1060)	3	Value is taken from the worklist information
>Scheduled Procedure Step ID	(0040,0009)	1	Value is taken from the worklist information
>Scheduled Procedure Step Description	(0040,0007)	3	Value is taken from the worklist information
>Scheduled Protocol Code Sequence	(0040,0008)	3	Value is taken from the worklist information
Performed Procedure Step ID	(0040,0253)	3	Generated by the system
Performed Procedure Step Start Date	(0040,0244)	3	Generated by the system

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Performed Procedure Step Start Time	(0040,0245)	3	Generated by the system
Performed Procedure Step Description	(0040,0254)	3	Generated by the system

9.3.3.2 DX Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Set in General Series Module
Presentation Intent Type	(0008,0068)	1	FOR PROCESSING in MG For Processing images FOR PRESENTATION in MG For Presentation images
Referenced Performed Procedure Step Sequence	(0008,1111)	1C	Set in General Series Module if the modality is configured to send MPPS messages.

9.3.3.3 Mammography Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Set in General Series Module
Request Attributes Sequence	(0040,0275)	3	Set in General Series Module

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9.3.4 Equipment Information Entity


9.3.4.1 General Equipment Module

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Fixed to IMS s.r.l.
Institution Name	(0008,0080)	3	Programmable during system installation
Institution Address	(0008,0081)	3	Programmable during system installation
Station Name	(0008,1010)	3	Programmable during system installation
Manufacturer's Model Name	(0008,1090)	3	Fixed to GIOTTO IMAGE MD, GIOTTO IMAGE SD or GIOTTO IMAGE SDL, BIOPSY DIGIT-AM according to the model
Device Serial Number	(0018,1000)	3	Serial Number of the Giotto unit (set during installation)
Software Versions	(0018,1020)	3	Version of the Raffaello software which generated the image
Pixel Padding Value	(0028,0120)	3	Set only in FOR PRESENTATION images (there is a debug option to set in FOR PROCESSING image too)


9.3.5 Image Information Entity

9.3.5.1 General Image Module

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Generated by the system

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Patient Orientation	(0020,0020)	2C	<p>For mammography images, according to the view position: RCC:.....P\L RMLO, LSIO:.....P\FL RML, LLM:.....P\F RAT, LLMO:.....P\FR LFB:.....P\R LCC*:.....A\R LMLO*, RSIO*:...A\FR LML*, RLM*:.....A\F LAT*, RLMO*:.....A\FL RFB*:.....A\L</p> <p>Images who have views marked by * have been rotated by 180° during acquisition.</p> <p>For biopsy images, according to the view position: RCC, LCC:.....L/A RMLO, LSIO:.....FL/A RML, LLM:.....F/A RAT, LLMO:.....FR/A LFB, RFB:.....R/A LAT, RMLO:.....HR/A LML, RLM:.....H/A LMLO, RSIO:.....HL/A</p> <p>Biopsy images have been rotated by 90° to the left during acquisition</p>
Content Date	(0008,0023)	2C	Same as acquisition date
Content Time	(0008,0033)	2C	Same as acquisition time
Image Type	(0008,0008)	3	<p>If the image is directly acquired: ORIGINAL\PRIMARY\ If the image is reprocessed by user: DERIVED\SECONDARY\ </p>
Acquisition Date	(0008,0022)	3	Acquisition date
Acquisition Time	(0008,0032)	3	Acquisition Time
Source Image Sequence	(0008,2112)	3	Set in MG For Presentation images and refers to the raw (For Processing) image from which the image is derived

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>Referenced SOP Class UID	(0008,1150)	1C	Fixed to 1.2.840.10008.5.1.4.1.1.1.2.1
>Referenced SOP Instance UID	(0008,1155)	1C	SOP Instance UID of the raw image
>Spatial Locations Preserved	(0028,135A)	3	Fixed to YES
Burned In Annotations	(0028,0301)	3	YES if the user choose to send images with burned in annotations, otherwise NO
Lossy Image Compression	(0028,2110)	3	Fixed to 00

9.3.5.2 Image Pixel Module

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Fixed to 1
Photometric Interpretation	(0028,0004)	1	MONOCHROME1 in MG For Processing Images. MONOCHROME2 in MG For Presentation Images. Biopsy images are MONOCHROME1 even if they are MG For Presentation Images
Rows	(0028,0010)	1	According to the image dimensions (different for mammography and biopsy images)
Columns	(0028,0011)	1	According to the image dimensions (different for mammography and biopsy images)
Bits Allocated	(0028,0100)	1	Fixed to 16
Bits Stored	(0028,0101)	1	13 in MG For Processing Images. 12 in MG For Presentation Images. 13 for biopsy images (even if they are MG For Presentation Images)
High Bit	(0028,0102)	1	12 in MG For Processing Images. 11 in MG For Presentation Images. 13 for biopsy images (even if they are MG For Presentation Images)
Pixel Representation	(0028,0103)	1	Fixed to 0000H
Pixel Data	(7FE0,0010)	1	Data Matrix

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Pixel Aspect Ratio	(0028,0034)	1C	Fixed to 1\1
Pixel Padding Range Limit	(0028,0121)	3	Set only in FOR PRESENTATION images (there is a debug option to set in FOR PROCESSING image too)

9.3.5.3 DX Anatomy Imaged Module


Attribute Name	Tag	Type	Attribute Description
Image Laterality	(0020,0062)	1	L or R. Selected on Giotto console
Anatomic Region Sequence	(0008,2218)	2	Includes one and only one item
>Code Value	(0008,0100)	1C	Fixed to T-04000
>Coding Scheme Designator	(0008,0102)	1C	Fixed to SRT
>Code Meaning	(0008,0104)	1C	Fixed to Breast

9.3.5.4 DX Image Module

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Set in General Image Module
Acquisition Device Processing Description	(0018,1400)	3	Set in MG For Presentation images and refers to processing version used
Samples per Pixel	(0028,0002)	1	Set in Image Pixel Module
Photometric Interpretation	(0028,0004)	1	Set in Image Pixel Module
Bits Allocated	(0028,0100)	1	Set in Image Pixel Module
Bits Stored	(0028,0101)	1	Set in Image Pixel Module
High Bit	(0028,0102)	1	Set in Image Pixel Module
Pixel Representation	(0028,0103)	1	Set in Image Pixel Module
Pixel Intensity Relationship	(0028,1040)	1	LIN in MG For Processing Images. LOG in MG For Presentation Images. LIN for biopsy images (even if they are MG For Presentation Images).
Pixel Intensity Relationship Sign	(0028,1041)	1	1 in MG For Processing Images. -1 in MG For Presentation Images. 1 for biopsy images (even if they are MG For Presentation Images).


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Rescale Intercept	(0028,1052)	1	Fixed to 0
Rescale Slope	(0028,1053)	1	Fixed to 1
Rescale Type	(0028,1054)	1	Fixed to US
Presentation LUT Shape	(2050,0020)	1	INVERSE in MG For Processing Images. IDENTITY in MG For Presentation Images. INVERSE for biopsy images (even if they are MG For Presentation Images).
Lossy Image Compression	(0028,2110)	1	Set in General Image Module
Patient Orientation	(0020,0020)	1	Set in General Image Module
Window Center	(0028,1050)	1	Set during image creation only for FOR PRESENTATION images (multiple values can be configured to have different Window-Level presets).
Window Width	(0028,1051)	1	Set during image creation only for FOR PRESENTATION images (multiple values can be configured to have different Window-Level presets).
Window Center & Width Explanation	(0028,1055)	3	Set during image creation only for FOR PRESENTATION images (multiple values can be configured to have different Window-Level presets).

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9.3.5.5 DX Detector Module

Attribute Name	Tag	Type	Attribute Description
Detector Type	(0018,7004)	2	Fixed to DIRECT
Detector Configuration	(0018,7005)	3	Fixed to AREA
Detector ID	(0018,700A)	3	Detector ID string (fixed during detector installation)
Date Of Last Detector Calibration	(0018,700C)	3	According to the date of the used calibration files
Detector Binning	(0018,701A)	3	Fixed to 1\1
Detector Element Physical Size	(0018,7020)	3	Both values are filled with the detector pixel dimensions (0.085 for GIOTTO IMAGE MD/SD/SDL, 0.050 for BIOPSY DIGIT-AM).
Detector Element Spacing	(0018,7022)	3	Same as Detector Element Physical Size (0018,7020)
Field of View Shape	(0018,1147)	3	Fixed to RECTANGLE
Field of View Dimension	(0018,1149)	3	According to the dimensions of the image
Imager Pixel Spacing	(0018,1164)	1	Both values are filled with the pixel dimensions on the detector surface (0.0814 for GIOTTO IMAGE MD/SD/SDL, 0.048 for BIOPSY DIGIT-AM).
Pixel Spacing	(0028,0030)	1C	This attribute is present only if the acquisition station is configured to set this value: this is done to allow some PACS or RWS stations to use this value to measure distances; when it is set, it has the same value than Imager Pixel Spacing (0018,1164).

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9.3.5.6 DX Positioning Module

Attribute Name	Tag	Type	Attribute Description
View Position	(0018,5101)	3	According to parameters set on the Giotto console
View Code Sequence	(0054,0220)	3	Includes one and only one item
>Code Value	(0008,0100)	1C	According to parameters set on the Giotto console and DICOM standard
>Coding Scheme Designator	(0008,0102)	1C	Always SRT
>Code Meaning	(0008,0104)	1C	According to DICOM standard
>View Modifier Code Sequence	(0054,0222)	3	Includes all the modifiers, if no modifiers are present, it is set to NULL
>>Code Value	(0008,0100)	1C	According to parameters set on the Giotto console and DICOM standard
>>Coding Scheme Designator	(0008,0102)	1C	Always SRT
>>Code Meaning	(0008,0104)	1C	According to DICOM standard
Estimated Radiographic Magnification Factor	(0018,1114)	3	According to the magnification technique used on the Giotto
Positioner Type	(0018,1508)	3	Fixed to MAMMOGRAPHIC
Positioner Primary Angle	(0018,1510)	3	According to Giotto position
Positioner Secondary Angle	(0018,1511)	3	According to Giotto position (NULL if the inclination angle sensor is not installed)
Detector Primary Angle	(0018,1530)	3	Fixed to 0
Detector Secondary Angle	(0018,1531)	3	According to Giotto position (0 for mammographic images, it can be different for biopsy images)
Body Part Thickness	(0018,11A0)	3	According to compressor height
Compression Force	(0018,11A2)	3	According to compression force

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9.3.5.7 X-Ray Acquisition Dose Module

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	3	According to the exposure
X-Ray Tube Current	(0018,1151)	3	According to the exposure
X-Ray Tube Current in μ A	(0018,8151)	3	According to the exposure
Exposure Time	(0018,1150)	3	According to the exposure
Exposure	(0018,1152)	3	According to the exposure
Exposure in μ As	(0018,1153)	3	According to the exposure
Body Part Thickness	(0018,11A0)	3	Set in DX Positioning Module
Organ Dose	(0040,0316)	3	According to the exposure
Organ Exposed	(0040,0318)	3	Fixed to BREAST
Entrance Dose in mGy	(0040,8302)	3	According to the exposure
Anode Target Material	(0018,1191)	3	According to the exposure
Filter Material	(0018,7050)	3	According to the exposure
Relative X-Ray Exposure	(0018,1405)	3	According to the acquired image (ranging from 0 to 10000)

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9.3.5.8 X-Ray Generation Module


Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	3	Set in X-Ray Acquisition Dose Module
X-Ray Tube Current	(0018,1151)	3	Set in X-Ray Acquisition Dose Module
X-Ray Tube Current in μ A	(0018,8151)	3	Set in X-Ray Acquisition Dose Module
Exposure Time	(0018,1150)	3	Set in X-Ray Acquisition Dose Module
Exposure	(0018,1152)	3	Set in X-Ray Acquisition Dose Module
Exposure in μ As	(0018,1153)	3	Set in X-Ray Acquisition Dose Module
Exposure Control Mode	(0018,7060)	3	According to the exposure technique: MANUAL AUTOMATIC
Focal Spot	(0018,1190)	3	According to the exposure
Anode Target Material	(0018,1191)	3	Set in X-Ray Acquisition Dose Module

9.3.5.9 X-Ray Filtration Module

Attribute Name	Tag	Type	Attribute Description
Filter Type	(0018,1160)	3	Fixed to STRIP
Filter Material	(0018,7050)	3	Set in X-Ray Acquisition Dose Module

9.3.5.10 X-Ray Grid Module

Attribute Name	Tag	Type	Attribute Description
Grid	(0018,1166)	3	Fixed to FOCUSED\RECIPROCATING or NONE according to the presence of the grid

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9.3.5.11 Mammography Image Module

Attribute Name	Tag	Type	Attribute Description
Positioner Type	(0018,1508)	1	Set in DX Positioning Module
Positioner Primary Angle	(0018,1510)	3	Set in DX Positioning Module
Positioner Secondary Angle	(0018,1511)	3	Set in DX Positioning Module
Image Laterality	(0020,0062)	1	Set in DX Anatomy Imaged Module
Organ Exposed	(0040,0318)	1	Set in X-Ray Acquisition Dose Module
Implant Present	(0028,1300)	3	YES if implant is present, NO otherwise (this parameter is set by the user when patient parameters are inserted)
Anatomic Region Sequence	(0008,2218)	1	Set in DX Anatomy Imaged Module
View Code Sequence	(0054,0220)	1	Set in DX Positioning Module

9.3.5.12 VOI LUT Module


Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	1	Set in DX Image Module
Window Width	(0028,1051)	1	Set in DX Image Module

9.3.5.13 Acquisition Context Module

Attribute Name	Tag	Type	Attribute Description
Acquisition Context Sequence	(0040,0555)	2	Fixed to a NULL value

9.3.5.14 SOP Common Module

Attribute Name	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Fixed to ISO_IR 100: Latin Alphabet No.1
SOP Class UID	(0008,0016)	1	According to DICOM standard
SOP Instance UID	(0008,0018)	1	Generated by the system

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9.3.6 IMS Private Biopsy Information Entity

9.3.6.1 General IMS Private Biopsy Module


This module is a private module: the private identification code string of this module is "IMS s.r.l. Biopsy Private Code" and the private group number is 0x1269.

Attribute Name	Tag	Type	VR	VM	Attribute Description
Biopsy Image	(1269,yy01)	3	IS	1	1 if the image is acquired during a biopsy examination, 0 otherwise. All the other attributes of this module are present only if this attribute is present and equal to 1
Biopsy Markers X	(1269,yy10)	3	IS	1-n	List of the x positions of the markers in the current image
Biopsy Markers Y	(1269,yy11)	3	IS	1-n	List of the y positions of the markers in the current image
Biopsy Markers Number	(1269,yy12)	3	IS	1-n	List of the markers numbers in the current image
Biopsy Area Left Border	(1269,yy20)	3	IS	1	Left border of the biopsy active area
Biopsy Area Right Border	(1269,yy21)	3	IS	1	Right border of the biopsy active area
Biopsy Area Top Border	(1269,yy22)	3	IS	1	Top border of the biopsy active area
Biopsy Area Bottom Border	(1269,yy23)	3	IS	1	Bottom border of the biopsy active area
Biopsy Number	(1269,yy24)	3	IS	1	Biopsy multiplicity


9.3.7 IMS Private Mammography Information Entity

9.3.7.1 General IMS Private Mammography Module

This module is a private module: the private identification code string of this module is "IMS s.r.l. Mammography Private Code" and the private group number is 0x1271.

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Attribute Name	Tag	Type	VR	VM	Attribute Description
Threshold 1	(1271,yy01)	3	IS	1	
Threshold 2	(1271,yy02)	3	IS	1	
Segmentation Left Border	(1271,yy10)	3	IS	1	
Segmentation Right Border	(1271,yy11)	3	IS	1	
Segmentation Top Border	(1271,yy12)	3	IS	1	
Segmentation Bottom Border	(1271,yy13)	3	IS	1	
Compressor Status	(1271,yy20)	3	IS	1	
Collimator Type	(1271,yy21)	3	IS	1	
Biopsy Specimen	(1271,yy22)	3	IS	1	
Printer Segmentation	(1271,yy30)	3	IS	1	
Printer 8x10 Format	(1271,yy31)	3	IS	1	Only present if the Printer Segmentation (1271,yy30) is 1
Printer 8x10 Size X	(1271,yy32)	3	FD	1	Only present if Printer 8x10 Format (1271,yy31) is 1
Printer 8x10 Size Y	(1271,yy33)	3	FD	1	Only present if Printer 8x10 Format (1271,yy31) is 1
8x10 Area Left Border	(1271,yy34)	3	IS	1	Only present if Printer 8x10 Format (1271,yy31) is 1
8x10 Area Right Border	(1271,yy35)	3	IS	1	Only present if Printer 8x10 Format (1271,yy31) is 1
8x10 Area Top Border	(1271,yy36)	3	IS	1	Only present if Printer 8x10 Format (1271,yy31) is 1
8x10 Area Bottom Border	(1271,yy37)	3	IS	1	Only present if Printer 8x10 Format (1271,yy31) is 1
Rotation And Inclination Sensor Presence	(1271,yy38)	3	LO	1	
Window Center For "For Processing" Images	(1271,yy39)	3	US	1-n	
Window Width For "For Processing" Images	(1271,yy40)	3	US	1-n	
Window Center & Width Explanation For "For Processing" Images	(1271,yy41)	3	LO	1-n	
Processing Information	(1271,yy42)	3	LT	1	Set in "For Presentation" images

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Filename	(1271,yy43)	3	LT	1	Is the filename of the file from which the image may be imported by the Raffaello file import function. Not present otherwise
Contrast View	(1271,yy44)	3	LT	1	Image created by Raffaello Contrast View
Threshold 3	(1271,yy45)	3	IS	1	Set in "For Presentation" images
Threshold 4	(1271,yy46)	3	IS	1	Set in "For Presentation" images
Threshold 5	(1271,yy47)	3	IS	1	Set in "For Presentation" images
Threshold 6	(1271,yy48)	3	IS	1	Set in "For Presentation" images
Threshold 7	(1271,yy49)	3	IS	1	Set in "For Presentation" images
Threshold 8	(1271,yy50)	3	IS	1	Set in "For Presentation" images
Threshold 9	(1271,yy51)	3	IS	1	Set in "For Presentation" images
Threshold 9	(1271,yy52)	3	IS	1	Set in "For Presentation" images
Scaling Factor For Proc.	(1271,yy53)	3	IS	1	Scaling factor for processing
ConfirmX Image	(1271,yy54)	3	IS	1	If true this image is by ConfirmX
Background counts	(1271,yy55)	3	IS	1	Background counts for raw images
WL Roi Area X	(1271,yy56)	3	IS	1	Points area coordinates
WL Roi Area Y	(1271,yy57)	3	IS	1	Points area coordinates
2 nd Processing Image	(1271,yy60)	3	IS	1	If 1, this image is a 2 nd processing image
S Filter	(1271,yy61)	3	IS	1	1 if S filter is applied, 0 or absent if not applied
U Filter	(1271,yy62)	3	IS	1	1 if U filter is applied, 0 or absent if not applied