DICOM Conformance Statement PIUR tUS Infinity

Approval

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Document History

Revision	Description of change/update
3.0	• New SOP classes added: Comprehensive SR (chapter 8.1.1.5 and chapter 8.3.1) and Encapsulated PDF Storage (chapter 8.1.1.6) • Updated PACS configuration parameters (Table 7) • Added matching key attributes for the Modality Worklist (chapter 4.1.2.5.1) • Updates due to release of product version 3.2
4.0	• New SOP classes added: Enhanced US Volume Storage (chapter 8.1.1.7) • Updates due to release of product version 4.1
5.0	• Description of Telehealth Application added (chapters: 4.1.1 Application Data Flow Diagram, 4.1.2.5.2 Query Attributes, 8.2 Data Dictionary of Private Attributes) • Updates due to release of product version 4.2 (for MPR streams: 8.5 Standard Extended/Specialized/Private SOP Classes)
6.0	• New SOP class added: Segmentation Storage (chapter 8.1.1.8) • Updates due to release of product version 4.3 • Added Carotid SR report description (chapter 8.3.1.2) and General Imaging SR report description (chapter 8.3.1.3)
7.0	• Update the Thyroid SR (chapter 8.3.1.1) • Added private tags (chapter 8.2) • Updates due to release of product version 4.4

1 Conformance Statement Overview

The product PIUR tUS Infinity implements the necessary DICOM services to send acquired US images, compound volumes, screenshots 2D and 3D, SR and encapsulated PDF reports to a network storage device and to download worklists from an information system.

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Transfer			
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes-Option (see Note 1)
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes-Option (see Note 1)
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	No
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	No
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	No
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Yes	No
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes-Option (see Note 1)	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes-Option (see Note 1)	No
Workflow Management			
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No

Table 1: Network services

Note

Support for the Telehealth Application is a separately licensable option

2 Table of Contents

3 Introduction

3.1 Audience

This document is written for the people that need to understand how PIUR tUS will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.2 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between PIUR tUS and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.3 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax
The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE)
An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title (AET)
The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context
The specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association
A network communication channel set up between Application Entities.

Attribute
A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower-level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD)
The specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Module
A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation
First phase of Association establishment that allows Application Entities to agree on the types of
data to be exchanged and how that data will be encoded.

Presentation Context
The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU)
A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Service Class Provider (SCP)
Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU)
Role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).

Service/Object Pair Class (SOP Class)
The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair Instance (SOP Instance)
An information object; a specific occurrence of information exchanged in a SOP Class. Examples: A specific x-ray image.

Tag
A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element].

Transfer Syntax
The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID)
A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR)
The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.4 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial

network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* - which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP-server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition* and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

3.5 Abbreviations

AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
MWL	Modality Worklist
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
R	Required (Key Attribute)
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
US	Ultrasound
VR	Value Representation

3.6 References

Piur tUS service manual that specifies how to set the DICOM communication parameters.

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow Diagram

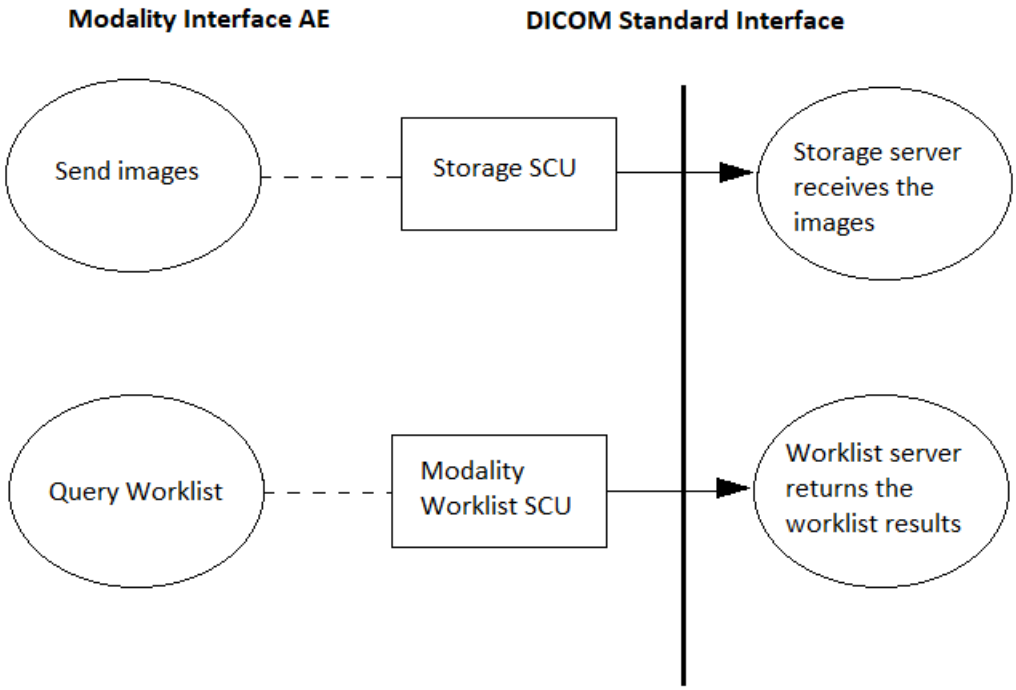

Figure 1: Implementation Model

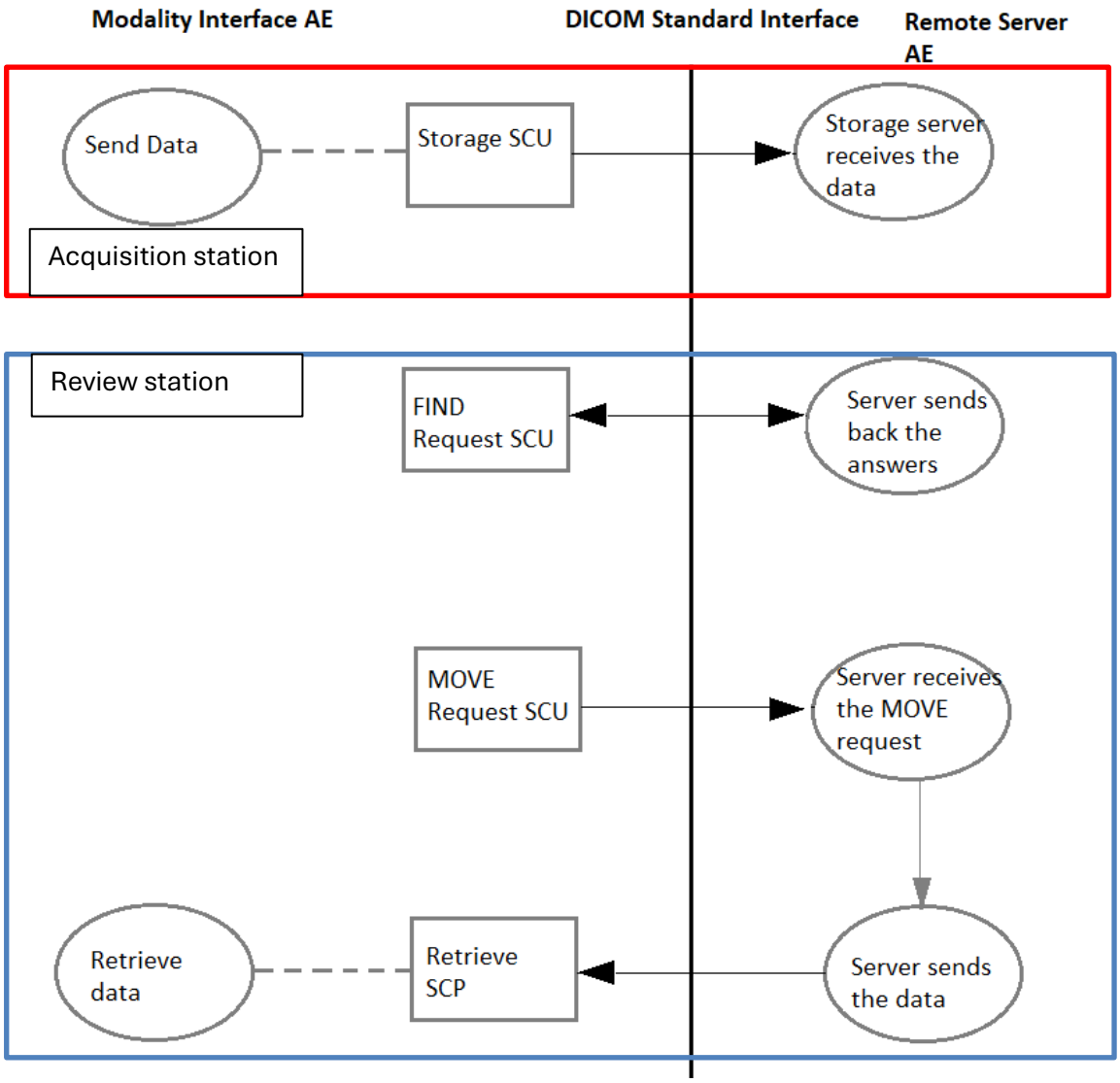

Figure 2: Implementation Model – Telehealth Application

4.1.2Functional Definition of Application Entity

4.1.2.1 STORAGE-SCU

STORAGE-SCU is activated through the user interface when a user selects instances from the local database or the currently displayed instance, and requests that they be sent to the configured remote AE. The instances can also be automatically sent after acquisition if the Autosend is configured.

4.1.2.2 Modality Worklist-SCU

Modality Worklist-SCU is activated through the user interface when a user wants to register a patient through a Worklist and query the configured remote AE.

4.1.2.3 FIND Request -SCU

If the user clicks on the Query button (only available with the Telehealth Application license), a Find Request will be sent to the configured remote AE server.

4.1.2.4 MOVE Request -SCU

If the user clicks on the Import button (only available with the Telehealth Application license), a Move Request will be sent to the configured remote AE server.

4.1.2.5 STORAGE-SCP

STORAGE-SCP thread runs for the Telehealth Review station in the background and receives the data sent by the configured remote AE. The user can press a button to query the configured remote AE and import the available data.

4.1.2.5.1 Matching Key Attributes

The Modality Worklist supports as matching key the following attributes of the Scheduled Procedure Step Module:

Attribute Name	Tag	Matching Key Type	Matching Type
Modality	(0008, 0060)	Required: US (fixed value)	Single value matching
Scheduled Procedure Step Start Date	(0040, 0002)	Optional	Single value matching

Table 2: Matching Key Attributes of the Scheduled Procedure Step Module

An additional local free-text filter can be applied locally before displaying the query results: a text string can be matched against the last name, the first name, the birth date and hospital ID of the patient and only the matching results will be displayed.

4.1.2.5.2 Query Attributes

4.1.2.5.2.1 Study Level

This section defines the query keys at the Study Level of the Study Root Query/Retrieve Information Model that are used by the Review Station of the Telehealth application.

To be able to retrieve only the study data that are performed in the Acquisition Station of the Telehealth Application, the query data are filtered by Study Instance UID (1.2.40.0.34.3.1.1145.9*) If the PACS server does not support the wildcard matching on the Study Instance UID, the filtering is performed locally by the client before displaying the query results.

Attribute Name	Tag	Displayed	SCU use
Study Instance UID	(0020, 000D)	No	Unique key. Matching key (wildcard matching) with the value: 1.2.40.0.34.3.1.1145.9*
Patient Name	(0010, 0010)	Yes	Optional Matching/Requested
Patient ID	(0010, 0010)	Yes	Optional Matching/Requested
Patient Birth Date	(0010, 0030)	Yes	Requested
Patient Sex	(0010, 0040)	Yes	Requested
Study Date	(content, 0020)	Yes	Optional Matching/Requested
Study Time	(0008, 0030)	Yes	Requested
Accession Number	(0008, 0050)	Yes	Requested

Table 3 STUDY level attributes for the STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL

4.1.3 Sequencing of Real-World Activities

All SCU activities are sequentially initiated in the user interface, and another SCU activity or Modality Worklist-SCU activity cannot be initiated until the prior activity has completed.

4.1.4 File Meta Information for Implementation Class and Version

File Meta Information Version: 00\01

Implementation Class UID: 1.2.276.0.7230010.3.0.3.6.9

Implementation Version Name: OFFIS_DCMTK_369

4.2 Application Entity Specifications

4.2.1 SOP Classes and Transfer Syntaxes

PIUR tUS will propose Presentation Contexts as shown in the following tables:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
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

Table 4: Presentation Contexts for Verification

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-hierarchical, 1st Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-hierarchical, 1st Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None

Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-hierarchical, 1st Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	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
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	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
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian JPEG Lossless, Non-hierarchical, 1st Order Prediction	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2.4.70	SCU	None
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	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 1.2.840.10008.1.2.4.70	SCU	None

		JPEG Lossless, Non-hierarchical, 1st Order Prediction			

Table 5: Presentation Contexts for STORAGE-SCU

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	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

Table 6: Presentation Contexts for Modality Worklist Information Model – FIND

4.3 Network Interfaces

4.3.1 Physical Network Interface

The application is indifferent to the physical medium over which TCP/IP executes, which is dependent on the underlying operating system and hardware.

4.4 Configuration

PIUR tUS is configured in the Options screen or by writing the corresponding configuration files. Details are written in the service manual.

For the connection to the PACS server and to the Worklist server, the following parameters must be configured:

Parameter Name	Value	Meaning
PacsEntityAeTitle	AE Title	Remote PACS server AE title
PacsHostname	IP address	Remote PACS server IP address
PacsPort	Port number	Port number used by the remote PACS server for the connection
PiurClientAeTitlePacs	AE Title	PIUR tUS AE title for the connection to the remote PACS server

PiurClientPortPacs	Port number	Port number used by PIUR tUS to connect to the remote PACS server
WorklistServerAeTitle	AE Title	Remote Worklist server AE title
Hostname	IP address	Remote Worklist server IP address
Port	Port number	Port number used by the remote Worklist server for the connection
PiurClientAeTitleWorklist	AE Title	PIUR tUS AE title for the connection to the remote Worklist server
PiurClientPortWorklist	Port number	Port number used by PIUR tUS to connect to the remote Worklist server
FilterTimeFrame	Scheduled Procedure Step Start Date	If not empty, the Scheduled Procedure Step Start Date is used as matching key for the Worklist query (only "today" and "last 7 days" as parameters are supported)
CompressedDICOM	true/false	If true, the image file data will be sent to PACS or exported as lossless compressed data.
PacsInfoLog	true/false	If true, the info log for the connection to the remote PACS server or Worklist server will be written. If false, only the errors will be logged.

Table 7: PACS configuration parameters

5 Media Interchange

DICOM media interchange is not supported. When exporting the original sweeps, the compound volume and the screenshots 2d and 3d as DICOM files, the files are simply stored in the file system in the location that the user selects.

6 Support of Extended Character Sets

PIUR tUS supports ISO_IR 192 character set (Unicode UTF-8) and ISO_IR 100 character set (Latin1).

7 Security Profiles

No security profiles are supported.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instances

8.1.1.1 Common Secondary Capture Image Modules

All the created SOP instances have the following attributes:

Tag	Attribute Name	VR	Value	Presence of Value
(0010,0010)	Patient's Name	PN	From the database or from the Worklist	Always
(0010,0020)	Patient ID	LO	From the database or from the Worklist	Always
(0010,0030)	Patient's Birth Date	DA	From the database or from the Worklist	Always
(0010,0040)	Patient's Sex	CS	From the database or from the Worklist	Always

Table 8: Patient Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0020)	Study Date	DA	From the database or from the Worklist	Always
(0008,0030)	Study Time	TM	From the database or from the Worklist	Always
(0008,0050)	Accession Number	SH	From the Worklist	Always, may be empty
(0008,0090)	Referring Physician Name	PN	From the Worklist	Always, may be empty
(0020,000D)	Study Instance UID	UI	From the database or generated automatically	Always
(0020,0010)	Study ID	SH	From the database or generated automatically	Always

Table 9: General Study Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0020,0011)	Series Number	IS	Generated automatically	Always
(0020,000E)	Series Instance UID	UI	From the database or generated automatically	Always
(0008,0021)	Series Date	DA	From the database	Always
(0008,0031)	Series Time	TM	From the database	Always
(0008,0060)	Modality	CS	Depending on the type of data: US, OT, DOC, SR	Always
(0008,1050)	Performing Physician Name	PN	From the Worklist	Always, may be empty

Table 10: General Series Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0040,1002)	Reason for the Requested Procedure	LO	From the Worklist	Always, may be empty

Table 11: Requested Procedure Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0070)	Manufacturer	LO	PIUR	Always
(0008,0080)	Institution Name	LO	User input (saved in the configuration Setting)	Always
(0008,0081)	Institution Address	ST	User input (saved in the configuration Setting)	Always
(0008,1010)	Station Name	SH	User input (saved in the configuration Setting)	Always
(0008,1090)	Manufacturer Model Name	LO	PIUR tUS	If the SOP class is Enhanced US Volume Storage
(0018,1000)	Device Serial Number	LO	Infinity	If the SOP class is Enhanced US Volume Storage
(0018,1020)	Software Versions	LO	4.1	If the SOP class is Enhanced US Volume Storage

Table 12: General Equipment Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0064)	Conversion Type	CS	WSD	Always

Table 13: SC Equipment Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0016)	SOP Class UID	UI	Secondary Capture Image Storage, Multiframe True Color Secondary Capture Image Storage, Multiframe Grayscale Byte Secondary Capture Image Storage, Comprehensive SR, Encapsulated PDF Storage, Enhanced US Volume Storage	Always
(0008,0018)	SOP Instance UID	UI	Generated automatically	Always
(0008,0005)	Specific Character Set	CS	ISO_IR 192/ISO_IR 100	Always
(0008,0012)	Instance Creation Date	DA	Generated automatically	Always
(0008,0013)	Instance Creation Time	TM	Generated automatically	Always

Table 14: SOP Common Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0008)	Image Type	CS	DERIVED\\PRIMARY \\VOLUME\\RESAMPLED (for the volume data) DERIVED\\PRIMARY (for the sweeps and screenshots)	For the volume data, sweeps and screenshots
(0008,2218)	Anatomic Region Sequence Attribute	SQ	Left lobe of thyroid/Right lobe of thyroid	For Enhanced US Volume

(0020,0013)	Instance Number	IS	Sequential number increased for each instance within a series	Always
(0020,0020)	Patient Orientation	CS	From the image	Always, may be empty
(0008,0022)	Acquisition Date	DA	From the image	It is present if the image is a screenshot
(0008,0023)	Content Date	DA	Current date	Always
(0008,0032)	Acquisition Time	TM	From the image	It is present if the image is a screenshot
(0008,0033)	Content time	TM	Current date	Always
(0028,0301)	Burned-In Annotation	CS	YES for screenshots 3D, NO for original sweeps	It is present if the image is a screenshot 3D or an original sweep
(2050,0020)	Presentation LUT Shape	CS	From the image	It is present if the image is an original sweep

Table 15: General Image Module of the created SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,0002)	Samples Per Pixel	US	From the image	Always
(0028,0004)	Photometric Interpretation	CS	From the image: RGB, MONOCHROME2	Always
(0028,0006)	Planar Configuration	US	From the image	Only if the image is a color image
(0028,0010)	Rows	US	From the image	Always
(0028,0011)	Column	US	From the image	Always
(0028,0100)	Bits Allocated	US	From the image	Always

(0028,0101)	Bits Stored	US	From the image	Always
(0028,0102)	High Bit	US	From the image	Always
(0028,0103)	Pixel Representation	US	From the image	Always

Table 16: Image Pixel Module of the SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,2111)	Derivation Description	ST	Lossless JPEG compression, selection value 1, point transform 0	Only if the image is exported as compressed
(0008,9215)	Derivation Code Sequence	SQ	Include Table 18: Derivation Code Sequence Macro Attributes	Only if the image is exported as compressed

Table 17: General Reference Module of the SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0100)	Code Value	SH	121327	Only if the image is exported as compressed
(0008,0102)	Coding Scheme Designator	SH	DCM	Only if the image is exported as compressed
(0008,0104)	Code Meaning	LO	Full fidelity image	Only if the image is exported as compressed

Table 18: Derivation Code Sequence Macro Attributes

8.1.1.2 SC Image IOD

Following there are the specific attributes used for SC Image:

Tag	Attribute Name	VR	Value	Presence of Value
(0028,0030)	Pixel Spacing	DS	From the image	Only if it is a compound volume

Table 19: SC Image Module of the created SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,1050)	Window Center	DS	From the image	If it is a compound volume or original sweeps
(0028,1051)	Window Width	DS	From the image	If it is a compound volume or original sweeps
(0028,1056)	VOI LUT Function	CS	From the image	If it is a compound volume or original sweeps

Table 20: VOI LUT Module of the created SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,1052)	Rescale Intercept	DS	From the image	Only if it is a compound volume
(0028,1053)	Rescale Slope	DS	From the image	Only if it is a compound volume
(0028,1054)	Rescale Type	LO	From the image	Only if it is a compound volume

Table 21: Modality LUT Module of the created SC Image SOP instances

8.1.1.3 Multi-frame True Color SC Image IOD

Following there are the specific attributes used for Multi-frame True Color SC Image:

Tag	Attribute Name	VR	Value	Presence of Value
(0018,2003)	Frame Primary Angle Vector	DS	4 degree for screenshots 3D	If the image is a screenshot 3D

Table 22: SC Multi-frame Vector Module of the created Multi-frame True Color SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,0008)	Number Of Frames	IS	From the image	Always
(0028,0009)	Frame Increment Pointer	AT	From the image	Always

Table 23: Multi-frame Module of the created Multi-frame True Color SC Image SOP instances

8.1.1.4 Multi-frame Grayscale Byte SC Image IOD

Following there are the specific attributes used for Multi-frame Grayscale Byte SC Image:

Tag	Attribute Name	VR	Value	Presence of Value
(0018,2003)	Frame Primary Angle Vector	DS	4 degree for screenshots 3D	If the image is a screenshot 3D

Table 24: SC Multi-frame Vector Module of the created Multi-frame Grayscale Byte SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,0008)	Number Of Frames	IS	From the image	Always
(0028,0009)	Frame Increment Pointer	AT	From the image	Always

Table 25: Multi-frame Module of the created Multi-frame Grayscale Byte SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0018,1065)	Frame Time Vector	DS	From the image	Always

Table 26: Cine Module of the created Multi-frame Grayscale Byte SC Image SOP instances

Tag	Attribute Name	VR	Value	Presence of Value
(0028,1052)	Rescale Intercept	DS	From the image	Always
(0028,1053)	Rescale Slope	DS	From the image	Always
(0028,1054)	Rescale Type	LO	From the image	Always

Table 27: Modality LUT Module of the created Multi-frame Grayscale Byte SC Image SOP instances

8.1.1.5 Comprehensive Structured Report IOD

The private template ACR_TIRADS_1 is used to create the Structured Report of the ACR TIRADS Thyroid analysis

Name	Root Template ID	Mapping Resource	SR Storage SOP Class UID
Thyroid Scan Study report	ACR_TIRADS_1	99PIUR	1.2.840.10008.5.1.4.1.1.88.33

Table 28: Supported SR Root Templates

The Comprehensive Structured Report IOD is defined in the following table:

IE	Module	Reference	Usage
Patient	Patient	Table 8: Patient Module of the created SOP instances	M
Study	General Study	Table 9: General Study Module of the created SOP instances	M
Series	SR Document Series	Table 10: General Series Module of the created SOP instances	M
Equipment	General Equipment	Table 12: General Equipment Module of the created SOP instances	M
			M
Document	SR Document General	Table 30: SR Document General Module	M
	SR Document Content	Table 31: SR Document Content Module	
	SOP Common	Table 14: SOP Common Module of the created SOP instances	M

Table 29 : Comprehensive Structured Report IOD Modules

Tag	Attribute Name	VR	Value	Presence of Value
(0020,0013)	Instance Number	IS	1	Always
(0040,A491)	Completion Flag	CS	PARTIAL/ COMPLETE	Always
(0040,A493)	Verification Flag	CS	UNVERIFIED/VERIFIED	Always
(0008,0023)	Content Date	DA		Always

(0008,0033)	Content Time	TM		Always
(0040,A372)	Performed Procedure Code Sequence	SQ		Always, may be empty

Table 30: SR Document General Module

Tag	Attribute Name	VR	Value	Presence of Value
(0040,A504	Content Template Sequence	SQ		Always
(0008,0105)	Mapping Resource	CS	99PIUR	Always
(0040,DB00)	Template Identifier	CS	ACR_TIRADS_1	Always
(0040,A050)	Continuity of Content	CS	SEPARATE	Always
(0040,A040)	Value Type	CS	According to TID ACR_TIRADS_1	Always
(0040,A043)	Concept Name Code Sequence	SQ	According to TID ACR_TIRADS_1	Always
(0040,A160)	Text Value	UT	According to TID ACR_TIRADS_1	Always
(0040,A300)	Measured Value Sequence	SQ	According to TID ACR_TIRADS_1	Always
(0040,A30A)	Numeric Value	DS	According to the analysis results	Always
(0040,08EA)	Measurement Units Code Sequence	SQ	According to the analysis results	Always
(0008,0100)	Code Value	SH	According to TID ACR_TIRADS_1	Always
(0008,0102)	Coding Scheme Designator	SH	According to TID ACR_TIRADS_1	Always

(0008,0104)	Code Meaning	LO	According to TID ACR_TIRADS_1	Always
(0040,A168)	Concept Code Sequence	SQ	According to TID ACR_TIRADS_1	Always

Table 31: SR Document Content Module

8.1.1.6 Encapsulated PDF Storage IOD

The Encapsulated PDF Storage IOD is defined in the following table:

IE	Module	Reference	Usage
Patient	Patient	Table 8: Patient Module of the created SOP instances	M
Study	General Study	Table 9: General Study Module of the created SOP instances	M
Series	Encapsulated Document Series	Table 10: General Series Module of the created SOP instances	M
Equipment	General Equipment	Table 12: General Equipment Module of the created SOP instances	M
	SC Equipment	Table 13: SC Equipment Module of the created SOP instances	M
Encapsulated Document	Encapsulated Document	Table 33: Encapsulated Document Module	M
	SOP Common	Table 14: SOP Common Module of the created SOP instances	M

Table 32: Encapsulated PDF IOD Modules

Tag	Attribute Name	VR	Value	Presence of Value
(0020,0013)	Instance Number	IS	1	Always
(0008,0023)	Content Date	DA		Always, may be empty
(0008,0033)	Content Time	TM		Always, may be empty
(0008,002A)	Acquisition DateTime	DT		Always, may be empty
(0028,0301)	Burned In Annotation	CS	YES	Always
(0042,0010)	Document Title	ST		Always, may be empty
(0040,A043)	Concept Name Code Sequence	SQ		Always, may be empty
(0042,0012)	MIME Type of Encapsulated Document	LO	application/pdf	Always
(0042,0011)	Encapsulated Document	OB		Always

Table 33: Encapsulated Document Module

8.1.1.7 Enhanced US Volume Storage IOD

The Enhanced US Volume Storage IOD Modules are defined in the following table:

Information Entity	Module	Reference	Usage
Patient	Patient	Table 8: Patient Module of the created SOP instances	M
Patient	Clinical Trial Subject	Not used	U
Study	General Study	Table 9: General Study Module of the created SOP instances	M
Study	Patient Study	Not used	U
Study	Clinical Trial Study	Not used	U
Series	General Series	Table 10: General Series Module of the created SOP instances	M
Series	Enhanced US Series	Table 35 : Enhanced US Series Module	M
Series	Clinical Trial Series	Not used	U
Frame of Reference	Frame of Reference	Table 36: Frame of Reference Module	M
Frame of Reference	Ultrasound Frame of Reference	Table 37: Ultrasound Frame of Reference Module	M
Frame of Reference	Synchronization	Table 38: Synchronization Module	M
Equipment	General Equipment	Table 12: General Equipment Module of the created SOP instances	M
Equipment	Enhanced General Equipment	Table 39: Enhanced General Equipment Module	M
Acquisition	General Acquisition	Table 46: General Acquisition Module	M
Image	General Image	Table 15: General Image Module of the created SOP instances	M

Image	General Reference	Not used	U
Image	Image Pixel	Table 16: Image Pixel Module of the SOP instances	M
Image	Enhanced Contrast/Bolus	Not used	C
Image	Multi-frame Functional Groups	Table 40: Multi-frame Functional Groups Module	M
Image	Multi-frame Dimension	Table 43: Multi-frame Dimension Module	M
Image	Cardiac Synchronization	Not used	C
Image	Respiratory Synchronization	Not used	C
Image	Device	Not used	U
Image	Acquisition Context	Table 44: Acquisition Context Module	M
Image	Specimen	Not used	U
Image	Enhanced Palette Color Lookup Table	Not used	U
Image	Enhanced US Image	Table 45: Enhanced US Image Module	M
Image	IVUS Image	Not used	C
Image	Excluded Intervals	Not used	U
Image	ICC Profile	Not used	U
Image	SOP Common	Table 14: SOP Common Module of the created SOP instances (Table 14)	M
Image	Common Instance Reference	Not used	C
Image	Frame Extraction	Not used	C

Table 34: Enhanced US Volume Storage Modules

Table for the Enhanced US Series Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0060)	Modality	CS	US	Always

Table 35 : Enhanced US Series Module

Table for the Frame of Reference Module: the attributes in this table are inserted also in the Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7), in the Multi-frame Grayscale Byte Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7.2), and in the Multi-frame True Color Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7.4)

Tag	Attribute Name	VR	Value	Presence of Value
(0020,0052)	Frame of Reference UID	UI	UID of the frame of reference	Always
(0020,1040)	Position Reference Indicator	LO	empty	Always

Table 36: Frame of Reference Module

Table for the Ultrasound Frame of Reference Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0020,9312)	Volume Frame of Reference UID	UI	UID of the volume frame of reference (equal to study UID)	Always
(0020,9307)	Ultrasound Acquisition Geometry	CS	PATIENT	Always
(0020,930C)	Patient Frame of Reference Source	CS	ESTIMATED	Always
(0020,9309)	Volume to Transducer Mapping Matrix	FD	Identity matrix	Always

Table 37: Ultrasound Frame of Reference Module

Table for the Synchronization Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0020,0200)	Synchronization Frame of Reference UID	UI	1.2.840.10008.15.1.1 (UTC Synchronization UID)	Always
(0018,1800)	Acquisition Time Synchronized	CS	Y	Always
(0018,106A)	Synchronization Trigger	CS	EXTERNAL	Always

Table 38: Synchronization Module

Table for the Enhanced General Equipment Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0070)	Manufacturer	LO	PIUR	Always
(0008,1090)	Manufacturer's Model Name	LO	PIUR tUS	Always
(0018,1000)	Device Serial Number	LO	Infinity	Always
(0018,1020)	Software Versions	LO	4.1	Always

Table 39: Enhanced General Equipment Module

Table for the Multi-frame Functional Groups Module: the attributes in this table are inserted also in the Multi-frame Grayscale Byte Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7.2), and in the Multi-frame True Color Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7.4)

Tag	Attribute Name	VR	Value	Presence of Value
(5200,9229)	Shared Functional Groups Sequence	SQ	See Table 41: Shared Functional Groups Attributes	Always
(5200,9230)	Per-Frame Functional Groups Sequence	SQ	See Table 42: Per-Frame Functional Groups Attributes	Always

(0020,0013)	Instance Number	IS	0 (we have only one volume)	Always
(0008,0023)	Content Date	DA	The date the image pixel data creation started	Always
(0008,0033)	Content Time	TM	The time the image pixel data creation started	Always
(0028,0008)	Number of Frames	IS	The number of frames of the acquisition	Always

Table 40: Multi-frame Functional Groups Module

Tag	Attribute Name	VR	Value	Presence of Value
(0028, 9110)	Pixel Measures Sequence	SQ	Pixel spacing and slice thickness	Always
(0028, 9132)	Frame VOI LUT Sequence	SQ	Window Center (127.5), Window Width (255), VOI LUT Function (linear)	Always
(0018, 9807)	Image Data Type Sequence	SQ	DataType: TISSUE INTENSITY	Always
(0018, 9806)	US Image Description Sequence	SQ	Image Description Item (volumetric properties: VOLUME)	Always
(0020, 930f)	Plane Orientation Volume Sequence	SQ	Orientation of the plane	Always

Table 41: Shared Functional Groups Attributes

Tag	Attribute Name	VR	Value	Presence of Value
(0020, 9116)	Plane Orientation Sequence	SQ	Image Orientation Patient Item	Always

(0020, 9113)	Plane Position Sequence	SQ	Image Position Patient Item	Always
(0020, 9111)	Frame Content Sequence	SQ	Temporal Position Index Item (Ordinal number (starting from 1) of the frame in the set of frames with different temporal positions)	Always

Table 42: Per-Frame Functional Groups Attributes

Table for the Multi-frame Dimension Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0020, 9221)	Dimension Organization Sequence	SQ	Dimension Organization UID Item	Always
(0020,9311)	Dimension Organization Type	CS	3D (spatial multi-frame image of parallel planes - 3D volume set)	Always for Enhanced US Volume, for the Segmentation Storage is not present
(0020,9222)	Dimension Index Sequence	SQ	There are three Dimension Index Items: 1. (0020,9128): Temporal position Index 2. (0020,9301): Image Position (Volume); 3. (0018,9808): Data Type	Always for Enhanced US Volume, for the Segmentation Storage is empty

Table 43: Multi-frame Dimension Module

Table for the Acquisition Context Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0040, 0555)	Acquisition Context Sequence	SQ	Empty	Always

Table 44: Acquisition Context Module

Table for the Enhanced US Image Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0008)	Image Type	CS	DERIVED\PRIMARY\VOLUME\RESAMPLED	Always
(0028,0002)	Samples Per Pixel	US	1 (the volume have always 1 channel and is a gray value image)	Always
(0028,0004)	Photometric Interpretation	CS	MONOCHROME2	Always
(0028,0100)	Bits Allocated	US	8	Always
(0028,0101)	Bits Stored	US	8	Always
(0028,0102)	High Bit	US	7	Always
(0028,0103)	Pixel Representation	US	0 (unsigned)	Always
(0020,9311)	Dimension Organization Type	CS	3D	Always
(0028,0301)	Burned-In Annotation	CS	NO	Always
(0028,2110)	Lossy Image Compression	CS	00 (the image has not been subjected to lossy compression)	Always
(2050,0020)	Presentation LUT Shape	CS	IDENTITY	Always
(0028,1052)	Rescale Intercept	DS	0	Always
(0028,1053)	Rescale Slope	DS	1	Always
(0008,2112)	Source Image Sequence	SQ	The referenced sweep Uid Item	Always
(0018,9809)	Transducer Scan Pattern Code Sequence	SQ	Line scan pattern Item	Always
(0018,980D)	Transducer Geometry	SQ	Linear ultrasound transducer geometry Item	Always

	Code Sequence			
(0018,980E)	Transducer Beam Steering Code Sequence	SQ	Fixed beam direction Item	Always
(0018,980F)	Transducer Application Code Sequence	SQ	External Transducer Item	Always
(0018,5022)	Mechanical Index	DS	0.69028210639954	Always
(0018,5024)	Bone Thermal Index	DS	0.58661860227585	Always
(0018,5026)	Cranial Thermal Index	DS	1.31036484241486	Always
(0018,5027)	Soft Tissue Thermal Index	DS	0.58661860227585	Always
(0018,9801)	Depth(s) of Focus	FD	Image depth/2	Always
(0018,5050)	Depth of Scan Field	IS	Image depth	Always

Table 45: Enhanced US Image Module

Table for the General Acquisition Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,002A)	Acquisition Date Time	DT	The date and time of the acquisition	Always
(0018,9073)	Acquisition Duration	FD	The duration of the acquisition	Always

Table 46: General Acquisition Module

8.1.1.8 Segmentation Storage IOD

The Segmentation Storage IOD Modules are defined in the following table:

Information Entity	Module	Reference	Usage
Patient	Patient	Table 8: Patient Module of the created SOP instances	M

Patient	Clinical Trial Subject	Not used	U
Study	General Study	Table 9: General Study Module of the created SOP instances	M
Study	Patient Study	Not used	U
Study	Clinical Trial Study	Not used	U
Series	General Series	Table 10: General Series Module of the created SOP instances	M
Series	Segmentation Series	Table 48: Segmentation Series Module	M
Series	Clinical Trial Series	Not used	U
Frame of Reference	Frame of Reference	Table 36: Frame of Reference Module	C
Equipment	General Equipment	Table 12: General Equipment Module of the created SOP instances	M
Equipment	Enhanced General Equipment	Table 39: Enhanced General Equipment Module	M
Segmentation	General Image	Table 15: General Image Module of the created SOP instances	M
Segmentation	Image Pixel	Table 16: Image Pixel Module of the SOP instances	M
Segmentation	Segmentation Image	Table 49: Segmentation Image Module	M
Segmentation	Multi-frame Functional Groups	Table 40: Multi-frame Functional Groups Module	M
Segmentation	Multi-frame Dimension	Table 43: Multi-frame Dimension Module	M
Segmentation	Specimen	Not used	U
Segmentation	SOP Common	Table 14: SOP Common Module of the created SOP instances	M

Segmentation	Common Instance Reference	Table 50: Common Instance Reference Module	C
Segmentation	Frame Extraction	Not used	C

Table 47: Segmentation Storage Modules

Table for the Segmentation Series Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0060)	Modality	CS	SEG	Always
(0020,0011)	Series Number	IS	The number of the series	Always
(0008,1111)	Referenced Performed Procedure Step Sequence	SQ	None	Not present
(0008,1150)	Referenced SOP Class UID	UI	Enhanced US Volume Storage (1.2.840.10008.5.1.4.1.1.6.2) or Secondary Capture Image Storage (1.2.840.10008.5.1.4.1.1.7)	Always
(0008,1155)	Referenced SOP Instance UID	UI	The UID of the Referenced Instances	Always

Table 48: Segmentation Series Module

Table for the Segmentation Image Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,0008)	Image Type	CS	DERIVED\PRIMARY	Always
(0020,0013)	Instance Number	IS	A number that identifies the SOP Instance: since we always have only one volume, we set it to 0	Always
(0070,0080)	Content Label	CS	THYROID_LOBE	Always
(0070,0081)	Content Description	LO	Thyroid lobe segmentation label	Always

(0028,0002)	Samples Per Pixel	US	1	Always
(0028,0004)	Photometric Interpretation	CS	MONOCHROME2	Always
(0028,0100)	Bits Allocated	US	8	Always
(0028,0101)	Bits Stored	US	8	Always
(0028,0102)	High Bit	US	7	Always
(0028,0103)	Pixel Representation	US	0	Always
(0028,2110)	Lossy Image Compression	CS	00	Always
(0062,0001)	Segmentation Type	CS	FRACTIONAL	Always
(0062,0010)	Segmentation Fractional Type	CS	OCCUPANCY	Always
(0062,000E)	Maximum Fractional Value	US	1	Always
(0062,0002)	Segment Sequence	SQ	Describes the segments that are contained within the data.	Always

Table 49: Segmentation Image Module

Table for the Common Instance Reference Module:

Tag	Attribute Name	VR	Value	Presence of Value
(0008,1115)	Referenced Series Sequence	SQ	Sequence of Items each of which includes the Attributes of one Series	Always
(0020,000E)	Series Instance UID	UI	Unique identifier of the Series containing the referenced Instances	Always
(0008,114A)	Referenced Instance Sequence	SQ	Sequence of Items each providing a reference to an Instance that is part of the Series defined by Series Instance	Always

			UID (0020,000E) in the enclosing Item	
(0020,000D)	Study Instance UID	UI	Unique identifier of the Study containing the referenced Instances	Always

Table 50: Common Instance Reference Module

8.2 Data Dictionary of Private Attributes

The Private Attributes added to the created SOP instances are listed in the Tables below:

Tag	Attribute Name	VR	VM
(0051, 0010)	Private Creator "PIURTUS"	LO	1
(0051, 1010)	PIUR Patient UID	LO	1
(0051, 1012)	PIUR Study UID	LO	1
(0051, 1016)	PIUR Hospital name (system location)	LO	1
(0051, 1020)	PIUR Series UID	LO	1
(0051, 1021)	PIUR Sweep UID	LO	1
(0051, 1022)	Date and time of the creation of the patient	LO	1
(0051, 1030)	PIUR Image Type	LO	1

Table 51 : Private attributes for all the SOP instances

Tag	Attribute Name	VR	VM
(0051, 1031)	Name of the ultrasound system	LO	1
(0051, 1032)	Name of the transducer	LO	1
(0051, 1033)	Imaging depth	FD	1
(0051, 1034)	Name of the tracker	LO	1
(0051, 1035)	Temporal calibration	FD	1
(0051, 1036)	Geometrical calibration	OD	1
(0051, 1037)	Tracking time stamps	OD	1
(0051, 1038)	Video time stamps	OD	1

(0051, 1039)	Tracking matrixes data	OD	1
(0051, 1040)	Device Number	LO	1

Table 52 : Private attributes for the Dicom files of the original sweeps created in the Telehealth Acquisition Station

Tag	Attribute Name	VR	VM
(0051, 0014)	PIUR Screenshot ID	LO	1
(0051, 1015)	PIUR Screenshot display text	LO	1

Table 53 : Private attributes for the Dicom files of the 2D screenshot created in the Telehealth Acquisition Station

8.3 Coded Terminology and Templates

8.3.1 DICOM SR Templates

8.3.1.1 Thyroid study report

This section describes the contents of the Thyroid study report (Template Identifier ACR_TIRADS_1)

This template provides a CONTAINER with a structure for reporting the ACR TI-RADS measurements of the thyroid.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	("126000", "DCM", " Imaging Measurement Report")	1	M		
2	>	HAS CONCEPT MOD	CODE	("121049", "DCM", "Language of Content Item and Descendants")	1	M		("eng", "RFC5646", "English")
3	>	CONTAINS	CONTAINER	(126010,DCM, "Imaging Measurements")	1	M		
4	>>	CONTAINS	CONTAINER	(125007,DCM, "Measurement Group")	1-N	M		

5	>>>	HAS OBS CONTEXT	TEXT	(112039,DCM, "Tracking Identifier")	1	M		"Measurement group xx"
6	>>>	HAS OBS CONTEXT	UIDREF	(112040,DCM, "Tracking Unique Identifier")	1	M		
7	>>>	CONTAINS	CODE	(121071,DCM, "Finding")	1	M		(91723000,SCT," Anatomical Structure")
8	>>>	HAS CONCEPT MOD	CODE	("363698007", "SCT", "Finding Site")	1	M		(69748006,SCT," Thyroid") (40867004,SCT,"Isthmus of thyroid gland")
9	>>>	HAS CONCEPT MOD	CODE	("272741003", "SCT", "Laterality")	1	MC	IFF Finding Site = Thyroid	**Piur Value** / **DICOM code** Right / ("24028007", "SCT", "Right") Left / ("7771000", "SCT", "Left") None / ("66459002", "SCT", "Unilateral")
10	>>>	CONTAINS	NUM	("118565006", "SCT", "Volume")	1	MC	IFF Finding Site = Thyroid	UNITS = ("ml", "UCUM", "ml")
11	>>>	CONTAINS	NUM	("410668003", "SCT,""Length")	1	M		UNITS = ("cm", "UCUM", "centimeter")
12	>>>	CONTAINS	NUM	(121207,DCM, "Height")	1	MC	IFF Finding Site = Thyroid	UNITS = ("cm", "UCUM", "centimeter")

13	>>>	CONTAINS	NUM	(103355008,SCT,"Width")	1	MC	IFF Finding Site = Thyroid	UNITS = ("cm", "UCUM", "centimeter")
14	>>>	CONTAINS	CONTAINER	(27925004,SCT,"Nodule")	0-N	C	IFF Finding Site = Thyroid	
15	>>>>	HAS CONCEPT MOD	TEXT	(106233006,SCT,"Topographical modifier")	0-N	MC	IFF Row 14	Right side: R1,…,Rn Left side: L1,…,Ln Isthmus: I1,…,In
16	>>>>	HAS CONCEPT MOD	TEXT	("PIUR-005", "99PIUR", "Nodule index")	0-N	MC	IFF Row 14	Right side: Nodule R1,…, Nodule Rn Left side: Nodule L1,…, Nodule Ln Isthmus: Nodule I1,…, Nodule In
17	>>>>	HAS CONCEPT MOD	TEXT	(38717003,SCT,"Longitudinal")	0-N	MC	IFF Row 14	"Superior" "Inferior" "Midline"
18	>>>>	HAS CONCEPT MOD	TEXT	(62824007,SCT,"Transversal")	0-N	MC	IFF Row 14	"Medial" "Lateral"
19	>>>>	CONTAINS	TEXT	("RID50503", "RADLEX", "TI-RADS assessment")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"TR1" "TR2" "TR3" "TR4" "TR5"
20	>>>>	CONTAINS	TEXT	("PIUR-003", "99PIUR",	0-N	MC	IFF Row 14 and IFF	

				"ACR TI-RADS Total points")			Tirads Analysis was not skipped	
21	>>>>	CONTAINS	TEXT	("121077", "DCM", "Conclusion")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"No FNA, no follow up recommended"
								"Follow up recommended"
								"FNA recommended"
22	>>>>	CONTAINS	NUM	("118565006", "SCT", "Volume")	0-N	MC	IFF Row 14	UNITS = ("ml", "UCUM", "ml")
23	>>>>	CONTAINS	NUM	(”410668003”, ”SCT,”"Length ")	0-N	MC	IFF Row 14	UNITS = ("cm", "UCUM", "centimeter")
24	>>>>	CONTAINS	NUM	(121207,DCM, "Height")	0-N	MC	IFF Row 14	UNITS = ("cm", "UCUM", "centimeter")
25	>>>>	CONTAINS	NUM	(103355008,SCT,"Width")	0-N	MC	IFF Row 14	UNITS = ("cm", "UCUM", "centimeter")
26	>>>>	CONTAINS	NUM	("PIUR-021", "99PIUR", "Cystic volume")	0-N	MC	IFF Row 14	UNITS = ("ml", "UCUM", "ml")
27	>>>>	CONTAINS	NUM	("81827009", "SCT", "Diameter")	0-N	MC	IFF Row 14	UNITS = ("cm", "UCUM", "centimeter")
28	>>>>	CONTAINS	TEXT	("RID39409", "RADLEX", "composition")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	”cystic"
								”spongiform”
								"mixed cystic and solid"
								"solid"

29	>>>>	CONTAINS	TEXT	("110849", "DCM", "Echogenicity")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"anechoic" "hyperechoic or isoechoic" "hypoechoic" "very hypoechoic"
30	>>>>	CONTAINS	TEXT	("300842002", "SCT", "Shape")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"wider-than-tall" "taller-than-wide"
31	>>>>	CONTAINS	TEXT	("111037", "DCM", "Margins")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"smooth margin" "Ill-defined" "Lobulated or irregular" "extrathyroidal extension"
32	>>>>	CONTAINS	TEXT	("PIUR-007", "99PIUR", "Echogenic foci")	0-N	MC	IFF Row 14 and IFF Tirads Analysis was not skipped	"None or large comet-tail artifacts" "macrocalcifications" "peripheral calcifications" "punctate echogenic foci"
33	>	CONTAINS	TEXT	("55112-7", "LN", "Summary")	1	M		
34	>	CONTAINS	TEXT	(PIUR-050,99PIUR,"Primary indication")	1	M		

Table 54: ACR_TIRADS_1 Template Table Field Definition

8.3.1.2 Carotid study report

This section describes the contents of the Carotid study report (Template Identifier CAROTID_1)

This template provides a CONTAINER with a structure for reporting the measurements of the plaque analysis.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint	
1			CONTAINER	("24616-5", "LN", "US Carotid Arteries Report")	1	M			
2	>	HAS CONCEPT MOD	CODE	("121049", "DCM", "Language of Content Item and Descendants")	1	M		("eng", "RFC5646", "English")	
3	>	CONTAINS	CONTAINER	("59776-5", "LN", "Findings")	1	M			
4	>>	CONTAINS	CODE	("363698007", "SCT", "Finding Site")	1	M		("45048000", "SCT", "Neck")	
5	>	CONTAINS	CONTAINER	(""32062004", "SCT", "Common carotid artery")	1	M			
6	>>	CONTAINS	CODE	("272741003", "SCT", "Laterality")	1-2	M		**Piur Value**	**DICOM code**
								Right	("24028007", "SCT", "Right")
								Left	

								("7771000", "SCT", "Left") None ("66459002", "SCT", "Unilateral")
7	>>	CONTAINS	CONTAINER	Depending on the laterality: ("I65.21", "ICD-10", "Occlusion and stenosis of right carotid artery") / ("I65.22", "ICD-10", "Occlusion and stenosis of left carotid artery") / ("I65.2", "ICD-10", "Occlusion and stenosis of carotid artery")	1-N	M		
8	>>>	CONTAINS	CONTAINER	("121071", "DCM", "Finding")	1-N	MC	IFF Row 7	
9	>>>>	CONTAINS	TEXT	("PIUR-041", "99PIUR", "Carotid analysis name")	1-N	MC	IFF Row 7	user-defined name for the analysis
	>>>>		CODE	("370129005", "SCT",		MC	IFF Row 7	("122474", "DCM",

10		CONTAINS		"Measurement Method")	1-N			"Densitometric method") ("122655", "DCM", "NASCET") ("122656", "DCM", "ECST")
11	>>>>	CONTAINS	NUM	("408715008", "SCT", "Lumen Diameter Stenosis")	1-N	MC	IIF Measurement Method IS NASCET OR ECST	Percent value of the Stenosis UNITS = ("%", "UCUM", "%")
12	>>>>	CONTAINS	NUM	("PIUR-040", "99PIUR", "Carotid vessel area")	1-N	MC	IIF Measurement Method IS Densitometric method	UNITS = ("cm2", "UCUM", "cm2")
13	>>>>>	INFERRED FROM	NUM	("PIUR-004", "99PIUR", "Measurement accuracy")	1-N	MC	IFF Row 12	UNITS = ("cm2", "UCUM", "cm2")
14	>>>>	CONTAINS	NUM	("397415007", "SCT", "Vessel lumen cross-sectional area")	1-N	MC	IIF Measurement Method IS Densitometric method	UNITS = ("cm2", "UCUM", "cm2")
15	>>>>>	INFERRED FROM	NUM	("PIUR-004", "99PIUR", "Measurement accuracy")	1-N	UC	IFF Row 14	UNITS = ("cm2", "UCUM", "cm2")

16	>>>>	CONTAINS	NUM	("408714007", "SCT", "Lumen Area Stenosis")	1-N	MC	IIF Measurement Method IS Densitometric method	UNITS = ("%", "UCUM", "%")
17	>>>>	CONTAINS	TEXT	("PIUR-042", "99PIUR", "GSM")	1-N	MC	IIF Measurement Method IS Densitometric method	Gray scale median, gray scale first quartile, gray scale third quartile
18	>	CONTAINS	TEXT	("55112-7", "LN", "Summary")	1	M		

Table 55: CAROTID_1 Template Table Field Definition

8.3.1.3 General Imaging report

This section describes the contents of the General Imaging report (Template Identifier GI_1)

This template provides a CONTAINER with a structure for reporting the measurements of an object segmentation.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	("126000", "DCM", "Imaging Measurement Report")	1	M		
2	>	HAS CONCEPT MOD	CODE	("121049", "DCM", "Language of Content Item and Descendants")	1	M		("eng", "RFC5646", "English")
3	>	CONTAINS	CONTAINER	("59776-5", "LN", "Findings")	1	M		

4	>>	CONTAINS	CONTAINER	("121071", "DCM", "Finding")	1-N	U		
5	>>>	CONTAINS	CONTAINER	("PIUR-030", "99PIUR", "Segmentation object")	1-N	MC	IFF Row 4	
6	>>>>	CONTAINS	TEXT	("PIUR-031", "99PIUR", "Object name")	1-N	MC	IFF Row 4	
7	>>>>	CONTAINS	NUM	("118565006", "SCT", "Volume")	1-N	MC	IFF Row 4	UNITS = ("ml", "UCUM", "ml")
8	>>>>>	INFERRED FROM	NUM	("PIUR-004", "99PIUR", "Measurement accuracy")	1-N	UC	IFF Row 4	UNITS = ("ml", "UCUM", "ml")
9	>>>>	CONTAINS	NUM	("81827009", "SCT", "Diameter")	1-N	MC	IFF Row 4	UNITS = ("cm", "UCUM", "centimeter")
10	>>>>>	INFERRED FROM	NUM	("PIUR-004", "99PIUR", "Measurement accuracy")	1-N	UC	IFF Row 4	UNITS = ("cm", "UCUM", "centimeter")
11	>	CONTAINS	TEXT	("55112-7", "LN", "Summary")	1	M		

Table 56: GI_1 Template Table Definition

8.4 Grayscale Image Consistency

No support for the DICOM Grayscale Standard Display Function.

8.5 Standard Extended/Specialized/Private SOP Classes

For compound volume, the following standard extensions are used in the Secondary Capture Image IOD:

Tag	Attribute Name	VR	VM
(0008, 9206)	Volumetric Properties	CS	1
(0018, 0050)	Slice Thickness	DS	1
(0020, 0032)	Image Position (Patient)	DS	3
(0020, 0037)	Image Orientation (Patient)	DS	6
(0020,0052)	Frame of Reference	UI	1
(0020,1040)	Position Reference Indicator	LO	1

Table 57: SC Image IOD standard extensions

For the MPR streams of the compound volume, the following standard extensions are used in the Multiframe Grayscale Byte Secondary Capture Image IOD:

Tag	Attribute Name	VR	VM
(0018, 0050)	Slice Thickness	DS	1
(0020,0052)	Frame of Reference	UI	1
(0020,1040)	Position Reference Indicator	LO	1

Table 58: Multiframe Grayscale Byte Secondary Capture Image IOD standard extensions

8.6 Private Transfer Syntaxes

No private transfer syntaxes are used.

9 Indexes

9.1 Index of Tables

9.2 Index of Figures