

DICOM CONFORMANCE STATEMENT

PRODUCT DETAILS

Product Type:
Data Management Software

Product Name:
TOMTEC-ARENA TTA2

MANUFACTURER

TOMTEC IMAGING SYSTEMS
Edisonstrasse 6
85716 Unterschleissheim

USED STANDARDS

Digital Imaging and Communications in Medicine (DICOM), DICOM V3.0

We declare under sole responsibility that the product listed above is in compliance with DICOM Version 3.0

Unterschleissheim, 2018-04-03

A handwritten signature in blue ink, appearing to read 'R. Baumann'.

ROLF BAUMANN
CTO

1 Conformance Statement Overview

The TOMTEC-ARENA is a self-contained networked computer system used for archiving and re-viewing diagnostic medical images. It allows external systems to send images to it for permanent storage. It also supports querying a remote system for a list of DICOM objects that may then be retrieved to the local system.

SOP Class	SCU	SCP	Display
Other			
Verification SOP Class	Yes	Yes	N/A
Query/Retrieve			
Patient Root Query/Retrieve Information Model - FIND	Yes	No	N/A
Patient Root Query/Retrieve Information Model - MOVE	Yes	No	N/A
Study Root Query/Retrieve Information Model - FIND	Yes	No	N/A
Study Root Query/Retrieve Information Model - MOVE	Yes	No	N/A
Patient/Study Only Query/Retrieve Information Model - FIND (Retired)	Yes	No	N/A
Patient/Study Only Query/Retrieve Information Model - MOVE (Retired)	Yes	No	N/A
Transfer			
Ultrasound Multi-frame Image Storage (Retired)	Yes	Yes	Yes
Ultrasound Multi-frame Image Storage	Yes	Yes	Yes
Ultrasound Image Storage (Retired)	Yes	Yes	Yes
Ultrasound Image Storage	Yes	Yes	Yes
Enhanced US Volume Storage	Yes	Yes	Yes
Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	Yes	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	Yes	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes	Yes
Enhanced XA Image Storage	Yes	Yes	Yes
IVOCT Image Storage - For Presentation	Yes	Yes	Yes
IVOCT Image Storage - For Processing	Yes	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes	Yes
Raw Data Storage	Yes	Yes	Yes
Text SR Storage - Trial (Retired)	Yes	Yes	Yes
Audio SR Storage - Trial (Retired)	Yes	Yes	Yes
Detail SR Storage - Trial (Retired)	Yes	Yes	Yes

SOP Class	SCU	SCP	Display
Comprehensive SR Storage - Trial (Retired)	Yes	Yes	Yes
Basic Text SR Storage	Yes	Yes	Yes
Enhanced SR Storage	Yes	Yes	Yes
Comprehensive SR Storage	Yes	Yes	Yes
Encapsulated PDF Storage	Yes	Yes	Yes
Toshiba US Private Data Storage	Yes	Yes	Yes
Hitachi Line Data 103	Yes	Yes	Yes
Hitachi Line Data 105	Yes	Yes	Yes
Hitachi Line Data 110	Yes	Yes	Yes
Private HP Live 3D 01	Yes	Yes	Yes
Private HP Live 3D 02	Yes	Yes	Yes
Private Philips 3D Sub Page Store	Yes	Yes	Yes
Workflow			
Storage Commitment Push Model SOP Class	Yes	No	N/A

Table 1.1: Network Services

The SOP Classes are categorized as follows:

UID Value	UID Name	Category
1.2.840.10008.1.1	Verification SOP Class	Other
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve Information Model - MOVE	Query/Retrieve
1.2.840.10008.5.1.4.1.2.3.1	Patient/Study Only Query/Retrieve Information Model - FIND (Retired)	Query/Retrieve
1.2.840.10008.5.1.4.1.2.3.2	Patient/Study Only Query/Retrieve Information Model - MOVE (Retired)	Query/Retrieve
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve Information Model - FIND	Query/Retrieve
1.2.840.10008.5.1.4.1.2.1.2	Patient Root Query/Retrieve Information Model - MOVE	Query/Retrieve
1.2.840.10008.5.1.4.1.2.1.1	Patient Root Query/Retrieve Information Model - FIND	Query/Retrieve
1.2.840.10008.5.1.4.1.1.88.2	Audio SR Storage - Trial (Retired)	Transfer
1.2.840.10008.5.1.4.1.1.7.1	Multi-frame Single Bit Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.7.2	Multi-frame Grayscale Byte Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.7.3	Multi-frame Grayscale Word Secondary Capture Image Storage	Transfer

UID Value	UID Name	Category
1.2.840.10008.5.1.4.1.1.7.4	Multi-frame True Color Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.12.1.1	Enhanced XA Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.14.1	IVOCT Image Storage - For Presentation	Transfer
1.2.840.10008.5.1.4.1.1.14.2	IVOCT Image Storage - For Processing	Transfer
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.66	Raw Data Storage	Transfer
1.2.840.10008.5.1.4.1.1.88.1	Text SR Storage - Trial (Retired)	Transfer
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.88.3	Detail SR Storage - Trial (Retired)	Transfer
1.2.840.10008.5.1.4.1.1.88.4	Comprehensive SR Storage - Trial (Retired)	Transfer
1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR Storage	Transfer
1.2.840.113543.6.6.1.3.10002	Private HP Live 3D 02	Transfer
1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR Storage	Transfer
1.2.840.10008.5.1.4.1.1.104.1	Encapsulated PDF Storage	Transfer
1.2.840.10008.5.1.4.1.1.6.2	Enhanced US Volume Storage	Transfer
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)	Transfer
1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.3	Ultrasound Multi-frame Image Storage (Retired)	Transfer
1.3.46.670589.2.5.1.1	Private Philips 3D Sub Page Store	Transfer
1.2.392.200036.9116.7.8.1.1.1	Toshiba US Private Data Storage	Transfer
1.2.392.200039.103.9.2	Hitachi Line Data 103	Transfer
1.2.392.200039.105.9.2	Hitachi Line Data 105	Transfer
1.2.392.200039.110.9.2	Hitachi Line Data 110	Transfer
1.2.840.113543.6.6.1.3.10001	Private HP Live 3D 01	Transfer
1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR Storage	Transfer
1.2.840.10008.1.20.1	Storage Commitment Push Model SOP Class	Workflow Management

Table 1.2: UID Values

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3 Introduction

3.1 Audience

This document is written for the people that need to understand how TOMTEC-ARENA 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 TOMTEC-ARENA 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 the first step towards assessing interconnectivity between TOMTEC-ARENA and other DICOM conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.

3.3 Definitions, Terms and Abbreviations

Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to aService/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist InformationModel 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 (Type2), 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.
Joint Photographic Experts-Group (JPEG)	A set of standardized image compression techniques, available for use by DICOM applications.
Media Application Profile	The specification of DICOM information objects and encoding exchanged on removable media(e.g., CDs)
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 ApplicationEntities; 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.
Security Profile	A set of mechanisms, such as encryption, user authentication, or digital signatures, used by anApplication Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data
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/retrieveSCP), 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 (SOPClass)	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 StorageService, 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) [PixelData], (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 ImplicitVR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.4 References

[DICOM]

NEMA PS3.1 2014c / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://medical.nema.org/>)

4 Networking

4.1 Implementation Model

4.1.1 Application Data Flow

The division of TOMTEC-ARENA into the separate DICOM Application Entities represents a somewhat arbitrary partitioning of functionality.

For the purpose of this document they are organized in this manner so as to detail their independent logical functionality.

By default TOMTEC-ARENA is configured so that the

- STORAGE-SCP AE
- STORAGE-SCU AE
- QUERY-RETRIEVE-SCU AE

share the same Application Entity Title (by default TTASRV).

The STORAGE-SCP AE can receive incoming DICOM images and add them to the TOMTEC-ARENA database. It can respond to external C-ECHO requests.

The STORAGE-SCP AE can receive Composite SOP Instances.

The STORAGE-SCU AE can send Composite SOP Instances.

It can send Storage and Verification Requests to a Remote AE to get confirmation of ownership and responsibility for a specific Composite SOP Instance.

The STORAGE-SCU AE functions as a C-STORE SCU and a user can request that images are sent to a Remote AE.

The QUERY-RETRIEVE-SCU AE can send C-FIND and C-MOVE requests. It handles queries for Patient, Study, Series, and Image data, and also sends Image retrieval requests to a Remote AE.

The QUERY-RETRIEVE-SCU AE functions as a C-FIND SCU and a C-MOVE SCU and a user can send queries and retrieval requests to a Remote AE.

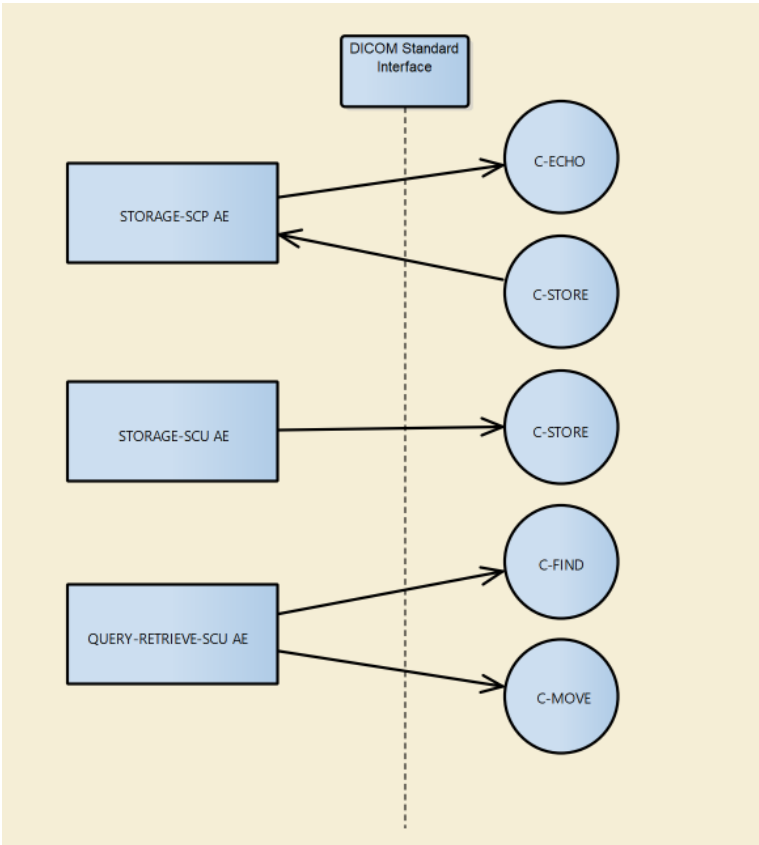


Figure 4.1: Application Data Flow

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of STORAGE-SCP AE Specification

The STORAGE-SCP AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the STORAGE-SCP AE expects it to be a DICOM application.

The STORAGE-SCP AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Storage Service Classes. Any images received on such Presentation Contexts will be added to the TOMTEC-ARENA database.

4.1.2.2 Functional Definition of STORAGE-SCU AE Specification

The STORAGE-SCU AE 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 a remote AE (selected from a pre-configured list).

Additionally the STORAGE-SCU AE is used to transfer instances to remote AEs automatically.

Depending on the configuration the STORAGE-SCU AE will request a N-EVENT-REPORT notification to confirm the ownership and responsibility of the send instances from the remote AE.

4.1.2.3 Functional Definition of QUERY-RETRIEVE-SCU AE Specification

The QUERY-RETRIEVE-SCU is activated through the user interface when a user selects a remote AE to query (from a pre-configured list), then initiates a query. The AE uses hierarchical queries and the extended negotiation is not supported. Queries are performed recursively from the study through the series and instance levels until all matching instances have been listed.

Additionally the user can send a C-MOVE request to request the transfer of selected instances from the remote AE to the STORAGE-SCP AE.

4.2 AE Specification

4.2.1 STORAGE-SCP AE Specification

4.2.1.1 SOP Classes

The STORAGE-SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

SOP Class Name	SOP Class UID	SCU
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	Yes
IVOCT Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.14.1	Yes
IVOCT Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.14.2	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes
Text SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.1	Yes
Audio SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.2	Yes
Detail SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.3	Yes
Comprehensive SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.4	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes
Toshiba US Private Data Storage	1.2.392.200036.9116.7.8.1.1.1	Yes
Hitachi Line Data 103	1.2.392.200039.103.9.2	Yes
Hitachi Line Data 105	1.2.392.200039.105.9.2	Yes
Hitachi Line Data 110	1.2.392.200039.110.9.2	Yes
Private HP Live 3D 01	1.2.840.113543.6.6.1.3.10001	Yes

SOP Class Name	SOP Class UID	SCU
Private HP Live 3D 02	1.2.840.113543.6.6.1.3.10002	Yes
Private Philips 3D Sub Page Store	1.3.46.670589.2.5.1.1	Yes

Table 4.1: SOP Classes for STORAGE-SCP AE

These are the Transfer Syntaxes supported.

Name	UID
JPEGLSLossless	1.2.840.10008.1.2.4.80
JPEGLossless	1.2.840.10008.1.2.4.70
JPEGLosslessNonHierarchical14	1.2.840.10008.1.2.4.57
JPEG2000LosslessOnly	1.2.840.10008.1.2.4.90
DeflatedExplicitVRLittleEndian	1.2.840.10008.1.2.1.99
RLELossless	1.2.840.10008.1.2.5
JPEGBaseline1	1.2.840.10008.1.2.4.50
JPEGExtended24	1.2.840.10008.1.2.4.51
JPEGLSLossyNearLossless	1.2.840.10008.1.2.4.81
JPEG2000	1.2.840.10008.1.2.4.91
MPEG2	1.2.840.10008.1.2.4.100

Table 4.2: Transfer Syntaxes for STORAGE-SCP AE

In addition the following transfer syntaxes are supported for the C-ECHO SCP included in this AE.

Name	UID
ExplicitVRLittleEndian	1.2.840.10008.1.2.1
ExplicitVRBigEndianRetired	1.2.840.10008.1.2.2
ImplicitVRLittleEndian	1.2.840.10008.1.2

Table 4.3: Transfer Syntaxes for ECHO-SCP AE

By altering the configuration it is possible to support additional or fewer SOP Classes and Transfer Syntaxes

4.2.1.2 Association Establishment Policies

4.2.1.2.1 General

The STORAGE-SCP AE can both accept and propose Association Requests.

The DICOM standard Application Context Name for DICOM 3.0 is always accepted and proposed:

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

Table 4.4: DICOM Application Context for STORAGE-SCP AE

4.2.1.2.2 Number of Associations

The STORAGE-SCP AE can support multiple simultaneous Associations requests. Each time the STORAGE-SCP AE receives an Association, a thread will be spawned to process the Verification or Storage requests.

Maximum number of simultaneous Associations	100 (Configurable)
---	--------------------

Table 4.5: DICOM Application Context for STORAGE-SCP AE

4.2.1.2.3 Asynchronous Nature

The STORAGE-SCU AE does not support asynchronous communication (multiple outstanding transactions over a single Association).

All Association requests must be completed and acknowledged before a new operation can be initiated.

Maximum number of outstanding asynchronous transactions	1
---	---

Table 4.6: Asynchronous Nature as a SCP for STORAGE-SCP AE

4.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation Class UID	1.2.276.0.48.20000.2
Implementation Version Name	TomTecArena v2

Table 4.7: DICOM Implementation Class and Version for STORAGE-SCP AE

Note that the TOMTEC-ARENA AEs use the same Implementation Version Name and the same Implementation Class UID. The Version Name is updated with each new release of the product software, as the different AE versions are never released independently.

4.2.2 STORAGE-SCU AE Specification

4.2.2.1 SOP Classes

The STORAGE-SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

SOP Class Name	SOP Class UID	SCU
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	Yes
IVOCT Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.14.1	Yes
IVOCT Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.14.2	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes
Text SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.1	Yes

SOP Class Name	SOP Class UID	SCU
Audio SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.2	Yes
Detail SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.3	Yes
Comprehensive SR Storage - Trial (Retired)	1.2.840.10008.5.1.4.1.1.88.4	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes
Toshiba US Private Data Storage	1.2.392.200036.9116.7.8.1.1.1	Yes
Hitachi Line Data 103	1.2.392.200039.103.9.2	Yes
Hitachi Line Data 105	1.2.392.200039.105.9.2	Yes
Hitachi Line Data 110	1.2.392.200039.110.9.2	Yes
Private HP Live 3D 01	1.2.840.113543.6.6.1.3.10001	Yes
Private HP Live 3D 02	1.2.840.113543.6.6.1.3.10002	Yes
Private Philips 3D Sub Page Store	1.3.46.670589.2.5.1.1	Yes

Table 4.8: SOP Classes for STORAGE-SCU AE

These are the default Transfer Syntaxes supported.

Name	UID
JPEGLSLossless	1.2.840.10008.1.2.4.80
JPEGLossless	1.2.840.10008.1.2.4.70
JPEGLosslessNonHierarchical14	1.2.840.10008.1.2.4.57
JPEG2000LosslessOnly	1.2.840.10008.1.2.4.90
DeflatedExplicitVRLittleEndian	1.2.840.10008.1.2.1.99
RLELossless	1.2.840.10008.1.2.5
JPEGBaseline1	1.2.840.10008.1.2.4.50
JPEGExtended24	1.2.840.10008.1.2.4.51
JPEGLSLossyNearLossless	1.2.840.10008.1.2.4.81
JPEG2000	1.2.840.10008.1.2.4.91
MPEG2	1.2.840.10008.1.2.4.100

Table 4.9: Transfer Syntaxes for STORAGE-SCU AE

By altering the configuration it is possible to support additional or fewer SOP Classes and Transfer Syntaxes.

4.2.2.2 Association Establishment Policies

4.2.2.2.1 General

The STORAGE-SCP AE can both accept and propose Association Requests.

The DICOM standard Application Context Name for DICOM 3.0 is always accepted and proposed is the same as for the STORAGE-SCP AE. See table 4.4

4.2.2.2.2 Number of Associations

The STORAGE-SCP AE can support multiple simultaneous Associations requested by peer AEs. Each time the STORAGE-SCP AE receives an Association, a thread will be spawned to process the Verification or Storage requests.

Configuration is the same as for the STORAGE-SCP AE. See table 4.5

4.2.2.2.3 Asynchronous Nature

The STORAGE-SCU AE does not support asynchronous communication (multiple outstanding transactions over a single Association).

Configuration is the same as for the STORAGE-SCP AE. See table 4.6

4.2.2.2.4 Implementation Identifying Information

The implementation information for this Application Entity is the same as for the STORAGE-SCP AE. See table 4.7

4.2.3 QUERY-RETRIEVE-SCU AE Specification

4.2.3.1 SOP Classes

The QUERY-RETRIEVE-SCU AE provides Standard Conformance to the following DICOM V3.0 SOP Classes:

SOP Class Name	SOP Class UID	SCU
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes
Patient/Study Only Query/Retrieve Information Model - FIND (Retired)	1.2.840.10008.5.1.4.1.2.3.1	Yes
Patient/Study Only Query/Retrieve Information Model - MOVE (Retired)	1.2.840.10008.5.1.4.1.2.3.2	Yes

Table 4.10: SOP Classes for QUERY-RETRIEVE-SCU AE

These are the default Transfer Syntaxes supported.

Name	UID
ExplicitVRLittleEndian	1.2.840.10008.1.2.1
ExplicitVRBigEndianRetired	1.2.840.10008.1.2.2
ImplicitVRLittleEndian	1.2.840.10008.1.2

Table 4.11: Transfer Syntaxes for STORAGE-SCP AE

By altering the configuration it is possible to support additional or fewer SOP Classes and Transfer Syntaxes

4.2.3.2 Association Establishment Policies

4.2.3.2.1 General

The QUERY-RETRIEVE-SCU AE can both accept and propose Association Requests.

The DICOM standard Application Context Name for DICOM 3.0 is always accepted and proposed is the same as for the STORAGE-SCP AE. See table 4.4

4.2.3.2.2 Number of Associations

The QUERY-RETRIEVE-SCU AE can support multiple simultaneous Associations requested by peer AEs. Each time the QUERY-RETRIEVE-SCU AE receives an Association, a thread will be spawned to process the Verification or Storage requests

Configuration is the same as for the STORAGE-SCP AE. See table 4.5

4.2.3.2.3 Asynchronous Nature

The STORAGE-SCU AE does not support asynchronous communication (multiple outstanding transactions over a single Association).

Configuration is the same as for the STORAGE-SCP AE. See table 4.6

4.2.3.2.4 Implementation Identifying Information

The implementation information for this Application Entity is the same as for the STORAGE-SCP AE. See table 4.7

4.3 Network Interface

4.3.1 Physical Network Interface

TOMTEC-ARENA is indifferent to the physical medium over which TCP/IP executes. It inherits this from the Java Runtime Environment provided with the installation.

4.3.2 Additional Protocols

DNS can be used for address resolution. If a DNS server is not used all addresses have to be specified as IPv4/IPv6 addresses.

4.3.2.1 IPv4 and IPv6 Support

The TOMTEC-ARENA supports both IPv4 and IPv6. It does not utilize any of the optional configuration identification or security features of IPv6.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation by Installation Personnel.

Application Entity	Role	Default AE Title	Default TCP/IP Port
STORAGE-SCU AE	SCU	TTASRV	50145
STORAGE-SCP AE	SCP	TTASRV	50145
QUERY-RETRIEVE-SCU AE	SCP	TTASRV	50145

Table 4.12: Default Application Entity Characteristics

- AE title.
- Hostname or IP address (or both). Use "localhost" (127.0.0.1) for the complete local system. If the AE should only be associated with a specific network adapter, don't specify the host name and use the IP address of this network adapter.
- Port number.

4.4.1.2 Remote AE Title/Presentation Address Mapping

The mapping of external AE Titles to TCP/IP addresses and ports is configurable and set at the time of installation by installation personnel.

One or more remote AE's may be configured. The following AE specific information must be available to configure a remote AE:

- AE title.
- Hostname or IP address (or both).
- Port number.

4.4.2 Parameters

Parameter	Configurable	Default Value
General Parameters		
PDU Size	No	16kB
Connection Timeout	Yes	none
Request Timeout	Yes	none
Accept Timeout	Yes	none
Release Timeout	Yes	none
Response Timeout	Yes	none
Retrieve Timeout	Yes	none
Idle Timeout	Yes	none
AE Specific Parameters (all AEs)		
SOP Class support	No	All supported SOP Classes always proposed and accepted
Transfer Syntax support	No	All supported Transfer Syntaxes always proposed and accepted

Table 4.14: Configuration Parameters Table

5 Media Interchange

5.1 Implementation Model

The implementation model identifies the DICOM Application Entities for Media in specific implementation and relates the Application Entities to Real-World Activities.

5.1.1 Application Data Flow Diagram

The TOMTEC-ARENA is capable of importing/exporting studies to/from DICOM media.

5.1.2 Functional Definition of AEs

The TOMTEC-ARENA implements the following functions for DICOM media.

- Write a DICOM file-set onto the medium and create a DICOMDIR.
- Read a DICOMDIR from the medium.
- Read selected images from the medium

5.1.2.1 Media Import - FSR

The Media Import application entity reads a user-selected PS 3.10 compliant DICOM file (generally a DICOMDIR) from the local file system or from PS 3.12 compliant DICOM media.

5.1.2.2 Media Export - FSC

The Media Export application entity is able to create a new DICOMDIR. Furthermore, DICOM image or structured report instances can also be stored to media on user interaction.

5.1.3 Sequencing of Real World Activities

Not applicable.

5.2 AE Specifications

All FSR activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed.

5.2.1 Media Import

The Media Import application entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class.

5.2.1.1 Activity: Read DICOMDIR from DICOM Media

Studies can be imported from DICOM Media import locations by user interaction using the import functionality. The list of studies contained in the DICOMDIR is read and displayed. The user can then select one or more studies to be imported into the TOMTEC-ARENA database.

5.2.2 Media Export

The Media Export AE implements the Interchange Option of the DICOM Media Storage functionality. It does not support the Directory Information Module. It can play the following roles at handling with file sets:

- File Set Creator (FSC) role,

The Media Export functionality provides Standard Conformance to the DICOM Media Storage Service (PS.3.10). It generates a File-Set under the STD-US class of Application Profiles (PS.3.11). It provides standard conformance to the SOP Classes presented in Table 5.2-6 according to the DICOM V3.0 Standard (PS.3 3).

5.2.2.1 File Meta Information for the Application Entity

5.2.2.2 Real-World Activities

Activity: Export Study or some Study Components to DICOM Media

Studies can be exported by selecting the study and choosing the Export option in the study selection dialog.

6 Transformation of DICOM to CDA

Not applicable for TOMTEC-ARENA .

7 Support of Character Sets

TOMTEC-ARENA supports a couple of extended character sets defined in the DICOM 3.0 standard, including singlebyte and multi-byte character sets as well as code extension techniques using ISO 2022 escapes.

Support extends to correctly decoding and displaying the correct symbol for all names and strings found in the DICOMDIR, in storage instances from media and received over the network, and in the local database. No specific support for sorting of strings other than in the default character set is provided in the browsers.

7.1 Character Sets

Character Set Description	Defined Term
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Latin alphabet No. 4	ISO_IR 110
Latin alphabet No. 5	ISO_IR 148
ASCII	ISO_IR 6
UTF-8	ISO_IR 192
Cyrillic	ISO_IR 144
Arabic	ISO_IR 127
Greek	ISO_IR 126
Hebrew	ISO_IR 138
Chinese	GB18030
Default repertoire	ISO 2022 IR 6
Japanese	ISO 2022 IR 13
Japanese	ISO 2022 IR 87
Japanese	ISO 2022 IR 149
Japanese	ISO 2022 IR 159

Table 7.2: Supported DICOM Character Sets

8 Security

TOMTEC-ARENA does not support any specific security measures.

- Application level security: not supported.
- Association level security: any Calling AE Titles and/or IP addresses may open an Association for Verification.

Only AE Titles that own a license and are known to TOMTEC-ARENA will be allowed to open an association for storage purposes.

9 Annexes

9.1 IOD Contents

9.1.1 Created SOP Instance(s)

This section specifies each IOD created by this application.

This section specifies each IOD created (including Private IOD's). It should specify the Attribute Name, tag, VR, and Value. The Value should specify the range and source (e.g. User input, Modality Worklist, automatically generated, etc.). For content items in templates, the range and source of the concept name and concept values should be specified. Whether the value is always present or not shall be specified.

Abbreviations used for the tables are:

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

ANAP Attribute Not Always Present

ALWAYS Always Present with a value

EMPTY Attribute is sent without a value

Abbreviations used for the source of the data values in the tables are:

USER the attribute value source is from user input.

AUTO the attribute value is generated automatically.

COPY the attribute value is copied from the values of the original DICOM file.

CONFIG the attribute value source is a configurable parameter.

9.1.1.1 List of created SOP Classes

SOP Class Name	SOP Class UID	Modality
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	OT
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	OT

SOP Class Name	SOP Class UID	Modality
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	SR
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	DOC

Table 9.1: List of created SOP Classes

9.1.1.2 Secondary Capture IOD

Information Entity	Module	Reference	Presence of Module
Patient	Patient	Table 9.6	ALWAYS
Study	General Study	Table 9.8	ALWAYS
Study	Patient Study	Table 9.7	ALWAYS
Series	General Series	Table 9.9	ALWAYS
Equipment	General Equipment	Table 9.10	ALWAYS
Equipment	SC Equipment	Table 9.10	ALWAYS
Image	General Image	Table 9.11	ALWAYS
Image	Image Pixel	Table 9.11	ALWAYS
Image	US Image	Table 9.11	ALWAYS
Image	SOP Common	Table 9.11	ALWAYS

Table 9.2: IOD of Created Secondary Capture SOP Instance

9.1.1.3 Multi-Frame true Color Secondary Capture IOD

Information Entity	Module	Reference	Presence of Module
Patient	Patient	Table 9.6	ALWAYS
Study	General Study	Table 9.8	ALWAYS
Study	Patient Study	Table 9.7	ALWAYS
Series	General Series	Table 9.9	ALWAYS

Information Entity	Module	Reference	Presence of Module
Equipment	General Equipment	Table 9.10	ALWAYS
Equipment	SC Equipment	Table 9.10	ALWAYS
Image	General Image	Table 9.11	ALWAYS
Image	Image Pixel	Table 9.11	ALWAYS
Image	Cine	Table 9.11	ALWAYS
Image	Multiframe	Table 9.11	ALWAYS
Image	US Image	Table 9.11	ALWAYS
Image	SOP Common	Table 9.11	ALWAYS

Table 9.3: IOD of Created Multi-Frame Color secondary Capture SOP Instance

9.1.1.4 Comprehensive Structured Report IOD

Information Entity	Module	Reference	Presence of Module
Patient	Patient	Table 9.6	ALWAYS
Study	General Study	Table 9.8	ALWAYS
Study	Patient Study	Table 9.7	ALWAYS
Series	General Series	Table 9.9	ALWAYS
Equipment	General Equipment	Table 9.10	ALWAYS
Equipment	SC Equipment	Table 9.10	ALWAYS

Table 9.4: IOD of Created Comprehensive Structured Report SOP Instance

9.1.1.5 Encapsulated PDF IOD

Information Entity	Module	Reference	Presence of Module
Patient	Patient	Table 9.6	ALWAYS
Study	General Study	Table 9.8	ALWAYS

Information Entity	Module	Reference	Presence of Module
Study	Patient Study	Table 9.7	ANAP
Series	Encapsulated Document Series	Table 9.9	ALWAYS
Equipment	General Equipment	Table 9.10	ALWAYS
Equipment	SC Equipment	Table 9.10	ALWAYS
Encapsulated Document	Encapsulated Document	Table 9.13	ALWAYS
Encapsulated Document	SOP Common	Table 9.13	ALWAYS

Table 9.5: IOD of created Encapsulated PDF SOP Instance

9.1.1.6 Attribute Content by Module

Attribute Name	Tag	Value	Presence of Value
Patient's Name	(0010,0010)	COPY	VNAP
Patient ID	(0010,0020)	COPY	VNAP
Issuer of Patient ID	(0010,0021)	COPY	VNAP
Patient's Birth Date	(0010,0030)	COPY	VNAP
Patient's Sex	(0010,0040)	COPY	VNAP
Patient's Birth Time	(0010,0032)	COPY	VNAP
Other Patient IDs	(0010,1000)	COPY	VNAP
Other Patient Names	(0010,1001)	COPY	VNAP
Patient Comments	(0010,4000)	COPY	VNAP

Table 9.6: Patient Module of created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Patient's Age	(0010,1010)	COPY	ANAP
Patient's Size	(0010,1020)	COPY	ANAP

Attribute Name	Tag	Value	Presence of Value
Patient's Weight	(0010,1030)	COPY	ANAP

Table 9.7: Patient Study Module of created SOP Instances

Attribute Name	Tag	Value	Presence of Value
Study Instance UID	(0020,000D)	COPY	ALWAYS
Study Date	(0008,0020)	COPY	ALWAYS
Study Time	(0008,0030)	COPY	ALWAYS
Referring Physician's Name	(0008,0090)	COPY	VNAP
Study ID	(0020,0010)	COPY	VNAP
Accession Number	(0008,0050)	COPY	VNAP
Admission ID	(0038,0010)	COPY	VNAP
Study Description	(0008,1030)	COPY	VNAP
Name of Physician(s) Reading Study	(0008,1060)	COPY	VNAP

Table 9.8: Study Module of created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Modality	(0008,0060)	Table 9.1	ALWAYS
Series Instance UID	(0020,000E)	AUTO using 1.2.276.0.48 as prefix	ALWAYS
Series Number	(0020,0011)	AUTO	ALWAYS
Series Date	(0008,0021)	AUTO	ALWAYS
Series Time	(0008,0031)	AUTO	ALWAYS

Table 9.9: Series Module of created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Manufacturer	(0008,0070)	TOMTEC	ALWAYS
Institution Name	(0008,0080)	CONFIG (Hospital Name)	ANAP
Station Name	(0008,1010)	TTA	ALWAYS
Institutional Department Name	(0008,1040)	CONFIG (Department)	ANAP
Manufacturer's Model Name	(0008,1090)	TTA2LOT30.01	ALWAYS
Software Versions	(0018,1020)	TTA2.30.01:123456	ALWAYS
Conversion Type	(0008,0064)	WSD	ALWAYS

Table 9.10: Equipment Module for created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Content Date	(0008,0023)	Generated	ALWAYS
Content Time	(0008,0033)	Generated	ALWAYS
Photometric Interpretation	(0028,0004)	RGB, YBR_FULL_422	ALWAYS
Private Creator	(7FDF,0050)	TomTec	VNAP
Bookmark Information VR:OB VM:1	(7FDF,5050)	proprietary data	VNAP
Bookmark Content VR:OB VM:1	(7FDF,5051)	proprietary data	VNAP

Table 9.11: Image Module for created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Specific Character Set	(0008,0005)	ISO_IR 100, ISO_IR 192	ALWAYS
SOP Class UID	(0008,0016)	Table 9.1	ALWAYS

Attribute Name	Tag	Value	Presence of Value
SOP Instance UID	(0008,0018)	AUTO using 1.2.276.0.48 as prefix	ALWAYS
Instance Creation Date	(0008,0012)	Generated	ALWAYS
Instance Creation Time	(0008,0013)	Generated	ALWAYS

Table 9.12: Common Module for created SOP Instance

Attribute Name	Tag	Value	Presence of Value
Instance Number	(0020,0013)	AUTO	ALWAYS
Content Date	(0008,0023)	AUTO	ALWAYS
Content Time	(0008,0033)	AUTO	ALWAYS
Acquisition DateTime	(0008,002A)	AUTO	ALWAYS
Burned In Annotation	(0028,0301)	YES	ALWAYS
Document Title	(0042,0010)	Title of Report	VNAP
Concept Name Code Sequence	(0040,A043)	Coded Representation of Title	ALWAYS
>Code Value	(0008,0100)	REPORT	ALWAYS
>Coding Scheme Designator	(0008,0102)	99TOMTEC	ALWAYS
>Code Meaning	(0008,0104)	TOMTEC Report	ALWAYS
Source Instance Sequence	(0042,0013)		VNAP
>Referenced SOP Class UID	(0008,1150)	AUTO	VNAP
>Referenced SOP Instance UID	(0008,1155)	AUTO	VNAP
Verification Flag	(0040,A493)	VERIFIED / UN-VERIFIED	ALWAYS
MIME Type of Encapsulated Document	(0042,0012)	application/pdf	ALWAYS
Encapsulated Document	(0042,0011)	Encapsulated Document Stream	ALWAYS
Private Creator	(7FDF,0040)	TomTec_Rep	VNAP

Attribute Name	Tag	Value	Presence of Value
Report Data Information VR:OB VM:1	(7FDF,4050)	proprietary data	VNAP
Report Data Content VR:OB VM:1	(7FDF,4051)	proprietary data	VNAP

Table 9.13: Encapsulated Document Module for created SOP Instance

9.2 Data Dictionary of Private Attributes

Attribute Name	Tag	Value
Private Creator	(7FDF,0050)	TomTec
Bookmark Information VR:OB VM:1	(7FDF,5050)	proprietary data
Bookmark Content VR:OB VM:1	(7FDF,5051)	proprietary data
Private Creator	(7FDF,0040)	TomTec_Rep
Report Data Information VR:OB VM:1	(7FDF,4050)	proprietary data
Report Data Content VR:OB VM:1	(7FDF,4051)	proprietary data

Table 9.14: Data Dictionary of Private Attributes

9.3 Coded Terminology and Templates

TOMTEC-ARENA does not use any codes or controlled terminology.

9.4 Grayscale Image Consistency

TOMTEC-ARENA does not make use of the DICOM Greyscale Standard Display Function.

9.5 Standard Extended/Specialized/Private SOP Classes

Not applicable to TOMTEC-ARENA .

9.6 Private Transfer Syntaxes

TOMTEC-ARENA does not use any private transfer syntaxes.

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