Dicompass Camera

DICOM Conformance Statement

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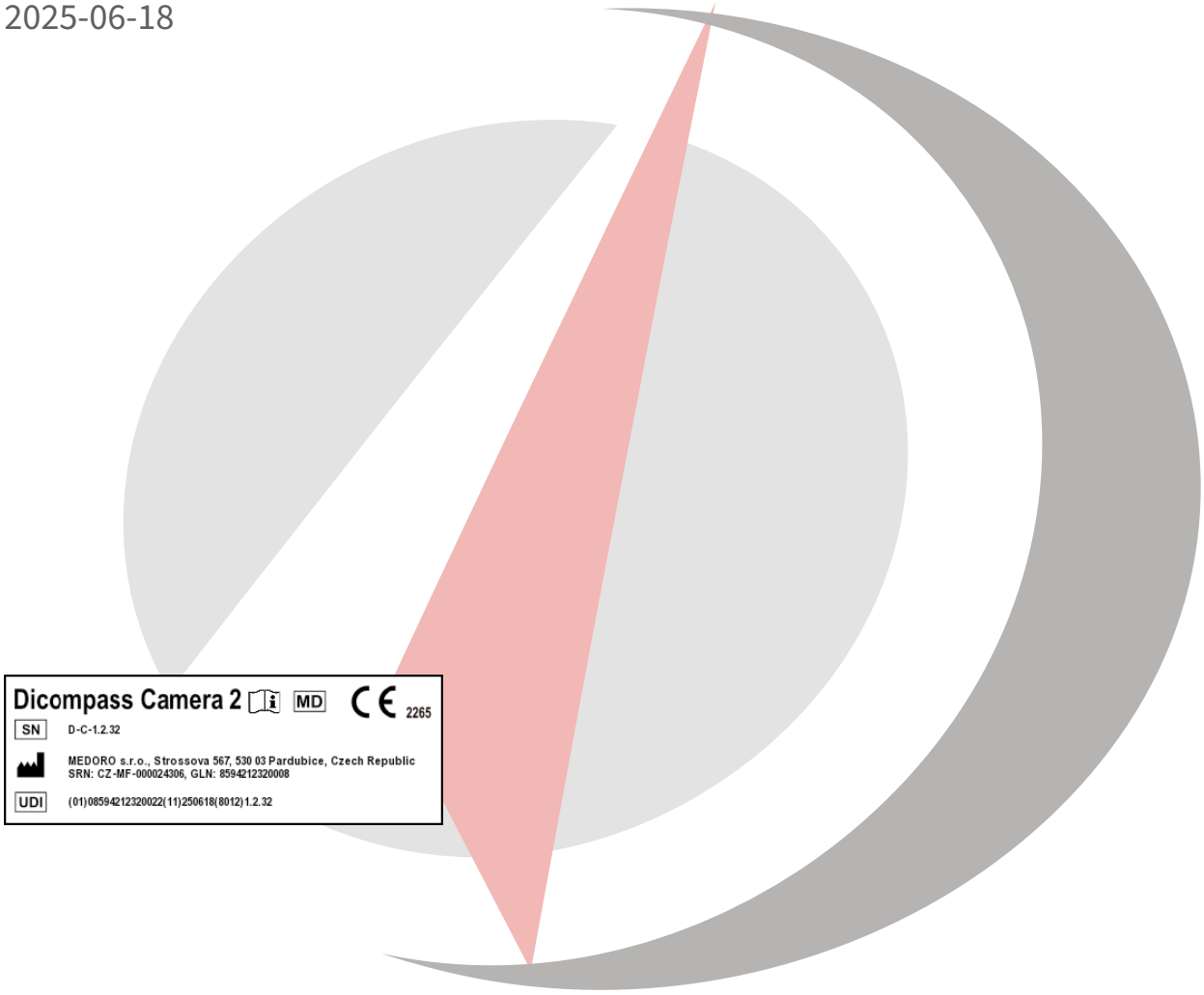

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1 Conformance Statement Overview

Dicompass Camera is a networked computer system used for archiving, managing and viewing DICOM objects. It allows external systems to send DICOM objects to it for permanent storage, retrieve information about such objects, and retrieve the DICOM objects themselves.

1.1 Network Services

The following tables provide an overview of the supported network services:

1.1.1 Transfer

Table 1: Transfer

SOP Classes	User	Provider
Basic Text SR Storage	yes	no
Secondary Capture Image Storage	yes	no
Video Endoscopic Image Storage	yes	no
Video Microscopic Image Storage	yes	no
Video Photographic Image Storage	yes	no
VL Endoscopic Image Storage	yes	no
VL Microscopic Image Storage	yes	no
VL Photographic Image Storage	yes	no

1.1.2 Query/Retrieve

Table 2: Query/Retrieve

SOP Classes	User	Provider
Patient Root Query/Retrieve Information Model - FIND	yes	no
Study Root Query/Retrieve Information Model - FIND	yes	no

1.1.3 Workflow Management

Table 3: Workflow Management

SOP Classes	User	Provider
Modality Worklist Information Model - FIND	yes	no

2 Introduction

2.1 Revision History

Table 4: Revision History

Version	Date of Issue	Description
1.0	2018-10-03	Initial Draft

2.2 Audience

This document is written for the people that need to understand how *Dicompass Camera* 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.

2.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between *Dicompass Camera* 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.

2.4 Terms and Definition

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).

CAMERA

CAMERA refers to *Dicompass Camera*

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.

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 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.

Security Profile

A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application 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/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 Networking

3.1 Implementation Model

The core component of CAMERA is a Flutter Application, which provides DICOM services over the DICOM Upper Layer protocol (DUL) and user interface services.

3.1.1 Application Data Flow

3.1.1.1 CAMERA Application Entity **CAMERA Application Entity**:

- Stores created images and videos in DICOM format into configured PACS.
- Processes queries for Patient, Study, Series and Instance information and it also processes retrieval requests, sending the requested objects to the retrieve destination AE.
- User can invoke:
  - Query request to other applications entities
  - Modality Worklist request to other applications entities
  - Verification request to other applications entities

3.1.2 Functional Definitions of AEs

3.1.2.1 CAMERA Application Entity CAMERA Application Entity implements:

Storage Service Classes

As a **SCU** it sends stored Composite Objects to remote application entities. The request can be invoked from user interface.

Query/Retrieve Service Classes

As a **SCU** it can query data from remote AEs. The request can be invoked from user interface by a user.

Workflow Management Service Classes

As a Modality Worklist **SCU** it can query remote application entities. The request can be invoked from user interface by a user.

3.2 AE Specification

3.2.1 CAMERA Application Entity

3.2.1.1 SOP Classes The CAMERA Application Entity provides Standard Conformance to the following SOP Classes :

Table 5: Storage SOP Classes for CAMERA Application entity {#tbl:dpgw_storage_sopclasses}

SOP Class Name	SOP Class UID	User	Provider
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	yes	no
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	yes	no
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	yes	no
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	yes	no
Video PhotographicImage Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	yes	no
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	yes	no
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	yes	no
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	yes	no

Table 6: Query/Retrieve SOP Classes for CAMERA Application Entity

SOP Class Name	SOP Class UID	User	Provider
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	yes	no
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	yes	no

Table 7: Workflow management SOP Classes for CAMERA Application Entity

SOP Class Name	SOP Class UID	User	Provider
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	yes	no

Table 8: Verification SOP Classes for CAMERA Application Entity

SOP Class Name	SOP Class UID	User	Provider
Verification	1.2.840.10008.1.1	yes	yes

3.2.1.2 Association Policies The CAMERA Application Entity can both accept and propose Association Requests. The CAMERA Application Entity accepts Association Requests for the Verification Services. It proposes Associations for the Verification, Storage, Query/Retrieve and Modality Worklist Services.

SOP Class extended negotiation is not supported.

Max PDU size offered and accepted is 16384.

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

Table 9: DICOM Application Context for CAMERA Application Entity

	UID
Application Context Name	1.2.840.10008.3.1.1.1

3.2.1.2.1 Number Of Associations The CAMERA Application Entity can support multiple simultaneous Associations requested by peer AEs. The maximum total number of simultaneous Associations is not limited.

CAMERA Application Entity spawns a new thread for each connection request from remote AE or for every outgoing Association (Verification, Storage, Query/Retrieve and Modality Worklist Services). Therefore, CAMERA can have multiple simultaneous connections, and there are no inherent limitations on the number of simultaneous associations.

3.2.1.2.2 Asynchronous Nature Asynchronous communication is not supported.

3.2.1.2.3 Implementation of Identifying Information The implementation information for the CAMERA Application Entity is:

Table 10: DICOM Implementation Class and Version for CAMERA Application Entity

Key	Value
Implementation Class UID	1.2.826.0.1.3680043.8.1053.7
Implementation Version Name	DcmCam-A.BB.CC

where A.BB.CC is the release number of CAMERA.

3.2.1.2.4 Association Initiation Policies CAMERA Application Entity initiates the association:

- To send composite instances
  - result of image or video acquisition to transfer objects to another application entity
- To query/retrieve a remote application entity
  - query/retrieve proxy request to remote application entity as a reaction to user action
- To send verification requests
  - User action to verify remote application entity
- To send Modality Worklist requests
  - User action to display worklist items

Real-word activity - sub-operation of Retrieve request, Prefetch or Autorouting service instruction

Sequencing of Activities

1. CAMERA Application Entity builds a list of SOP Instance UIDs to send

2. Collects Abstract and Transfer syntaxes of those SOP Instances
3. Initiates an Association to a destination Application Entity
4. Sends SOP Instances to a destination using C-Store
5. If triggered by C-Move request, CAMERA notifies C-Move requester about C-Store status for every C-Store notification
6. Closes the Association

Proposed Presentation Contexts

For each Abstract Syntax, CAMERA Application Entity proposes one or two Presentation Contexts:

- one Presentation Context (Abstract Syntax, Implicit VR Little Endian Transfer Syntax) for SOP Instances stored locally in Implicit VR Little Endian Transfer Syntax
- two Presentation Contexts (Abstract Syntax, Implicit VR Little Endian Transfer Syntax) and (Abstract Syntax, all other Transfer Syntaxes collected for that Abstract Syntax) for SOP Instances stored locally not in Implicit VR Little Endian Transfer Syntax

The set of the proposed Abstract Syntaxes is a minimal subset of supported Abstract Syntaxes needed to transfer of all SOP Instances to be sent.

Table 11: Transfer Syntaxes for Storage SOP Classes {#tbl:dpgw_storage_ts}

Transfer Syntax Name	Transfer Syntax UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102
MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103
HEVC/H.265 Main Profile / Level 5.1	1.2.840.10008.1.2.4.107

Table 12: Proposed Presentation Contexts by the CAMERA Application Entity

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax	Role	Extended Negotiation
Storage SOP Class Name in table Storage SOP Classes for CAMERA Application Entity	Storage SOP Class UID in table Storage SOP Classes for CAMERA Application Entity	Transfer Syntax in table Transfer Syntaxes for Storage SOP Classes for CAMERA Application Entity	SCU	None

SOP Specific Conformance for SOP Classes

Warnings or Errors in the C-Store response from the SCP are ignored and CAMERA Application Entity will continue to send SOP Instances. In case of error (network timeout, TCP/IP error, ...) CAMERA Application Entity will abort the Association with an A-ABORT.

Real-word activity - C-Find Proxy instruction to query remote Application Entity

Sequencing of Activities

CAMERA Application Entity:

1. Accepts an association from source AE
2. Initiates an Association to query remote AE
3. Receives C-Find request from source AE
4. Sends C-Find request to remote AE
5. Receives C-Find responses from remote AE and sends responses to the source AE
6. Closes the Association to remote AE

Proposed Presentation Contexts

CAMERA Application Entity proposes to the remote AE the same Presentation Contexts as received in Association from source AE.

SOP Specific Conformance for SOP Classes

CAMERA Application Entity provides standard conformance. The keys from source C-Find request are copied to remote C-Find request and can be modified by configuration scripts. Depending on configuration, CAMERA AE is able to modify or filter response data, before sending it to source AE.

Real-word activity - WUI user instruction to query remote Application Entity for worklist records (MWL C-Find)

Sequencing of Activities

CAMERA Application Entity:

1. Initiates an Association to query remote AE
2. Sends MWL C-Find request to remote AE
3. Receives MWL C-Find responses from remote AE
4. Closes the Association to remote AE

Proposed Presentation Contexts

Table 13: Proposed Presentation Contexts MWL C-Find

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax	Role	Extended Negotiation
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian 1.2.840.10008.1.2	SCU	None

SOP Specific Conformance for SOP Classes

CAMERA Application Entity provides standard conformance.

Used keys in query:

Table 14: MWL C-Find requested keys

Attribute name	Tag
Accession Number	(0008,0050)
Referring Physician's Name	(0008,0090)
Patient's Name	(0010,0010)
Patient ID	(0010,0020)
Patient's Birth Date	(0010,0030)
Patient's Birth Time	(0010,0032)
Patient's Sex	(0010,0040)
Patient's Age	(0010,1010)
Patient's Size	(0010,1020)
Patient Weight	(0010,1030)
Study Instance UID	(0020,000D)
Requesting Physician	(0032,1032)
Requested Procedure Description	(0032,1060)
Scheduled Procedure Step Sequence	(0040,0100)
> Modality	(0008,0060)
> Scheduled Station AE Title	(0040,0001)
> Scheduled Procedure Step Start Date	(0040,0002)
> Scheduled Performing Physician's Name	(0040,0006)
> Scheduled Procedure Step Description	(0040,0007)
> Scheduled Procedure Step ID	(0040,0009)
Requested Procedure ID	(0040,1001)

Real-word activity - User instruction to verify remote Application Entity

Sequencing of Activities

CAMERA Application Entity:

1. Initiates an Association to verify remote AE
2. Sends C-Echo command to remote AE
3. Receives C-Echo response from remote AE
4. Closes the Association to remote AE

Proposed Presentation Contexts

Table 15: Proposed Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax	Role	Extended Negotiation
Verification	1.2.840.10008.1.1	Implicit VR Little Endian 1.2.840.10008.1.2	SCU	None

SOP Specific Conformance for SOP Classes

CAMERA Application Entity provides standard conformance.

3.2.1.2.5 Association Acceptance Policy CAMERA Application Entity accepts associations from any Application Entities. CAMERA Application Entity accepts associations:

- to verify communication

Real-word activity - communication verification request (C-Echo)

Sequencing of Activities

The CAMERA Application Entity accepts an association from remote AE to verify communication.

Accepted Presentation Contexts

Table 16: Accepted Presentation Context (C-Echo)

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax	Role	Extended Negotiation
Verification	1.2.840.10008.1.1	Implicit VR Little Endian 1.2.840.10008.1.2	SCP	None

SOP Specific Conformance for SOP Classes

CAMERA Application Entity provides standard conformance.

3.3 Network Interfaces

3.3.1 Physical Network Interfaces

Dicompass Camera is indifferent to the physical medium over which TCP/IP executes. It inherits this from the Dart SDK Virtual Environment.

3.3.2 Supported communication stacks

DICOM Upper Layer as defined in Part 8 of the Standard over TCP/IP is supported.

3.3.3 Additional Protocols

Dicompass Camera uses the DNS resolution provided by the underlying operating system and Dart SDK Virtual Environment.

3.4 Configuration

3.4.1 AE Title/Presentation address mapping

3.4.1.1 Local AE Titles The local AE Title and TCP port are configurable in main application configuration file.

Table 17: Default AE Title configuration

AE	Default AE Title	Default TCP/IP Port	Default TLS TCP/IP port
CAMERA Application Entity	DCAM	10104	-

3.4.1.2 Remote AE Titles Remote AE Titles, TCP/IP addresses and ports can be configured in Dicompass Camera UI.

3.4.2 Parameters

General parameters for both CAMERA.

Table 18: Configuration parameters table

Parameter	Configurable	Default Value
Maximum PDU size the AE can send/receive	no	16384
Time-out waiting for response to TCP/IP connect request (low-level timeout)	yes	1s
Time-out for socket read (low-level timeout)	yes	28800s
Time-out waiting after opening TCP/IP connection for Association Open Request (Application Level timeout)	yes	60s
Time-out waiting for acceptance or rejection Response to an Association Open Request (Application Level timeout)	yes	60s
General DIMSE level time-out values	yes	600s
DIMSE level time-out for an open C-MOVE request	yes	600s
Size constraint in maximum object size	no	2GB
Time-out an association may remain idle	yes	1800s
SOP Class support	yes	Listed in Storage SOP Classes for CAMERA Application Entity
Transfer Syntax support	yes	Listed in Transfer Syntaxes for Storage SOP Classes for CAMERA Application Entity

4 Media Interchange

Dicompass Camera does not support Media Storage.

5 Support of Character Sets

Dicompass Camera supports following character sets:

- ISO_IR 6
- ISO_IR 100
- ISO_IR 101
- ISO_IR 192

Dicompass Camera supports code extension techniques.

6 Security

6.1 Security Profiles

6.2 Application level security

Dicompass Camera can be configured to require user entering credentials (user name & password or PIN) to log in into application.

7 Annexes

7.1 Data Dictionary of private Attributes

Table 19: Private Attributes

Tag	Name	VR	VM	Value
(6FDB,0010)	Private Creator	LO	1	Medoro
(6FDB,1010)	Medoro Measurement Data Model Version	US	1	Version number of measurement data model
(6FDB,1011)	Medoro Measurement DW Version	LO	1	Version number of DW
(6FDB,1012)	Medoro Measurement Store Date	DA	1	Measurement Store Date
(6FDB,1013)	Medoro Measurement Store Time	TM	1	Measurement Store Time
(6FDB,1014)	Medoro Measurement Data	UT	1	Measurement Data
(6FDB,1015)	Medoro Measurement Calibration	DS	1	Measurement calibration Data
(6FDB,1050)	Medoro Categorization Tags	LO	1	MedoroCategorizationTags
(6FDB,1051)	Medoro Categorization Tags In Study	LO	1	MedoroCategorizationTagsInStudy
(6FDB,1052)	Medoro Categorization Tags In Study Operator And	LO	1	MedoroCategorizationTagsInStudyOperatorAnd
(6FDB,1053)	Medoro Study Flags	LO	1	MedoroStudyFlags
(6FDB,1060)	Medoro Number Of Recent Studies	US	1	Number of recent studies by date of store
(6FDB,1061)	Medoro Study Stored Date	DA	1	Date of storing study to PACS

Tag	Name	VR	VM	Value
(6FDB,1062)	Medoro Study Stored Time	DT	1	Time of storing study to PACS
(6FDB,1080)	Medoro VideoSync Group UID	UI	1	VideoSync Group UID
(6FDB,1081)	Medoro Video Part Count	US	1	Video Part Count
(6FDB,1082)	Medoro Video Part Index	US	1	Video Part Index
(6FDB,1083)	Medoro Video Part Duration	DS	1	Video Part Duration
(6FDB,1084)	Medoro Video Total Duration	DS	1	Video Total Duration
(6FDB,1085)	Medoro Video Marks	DS	1	Video Marks
(6FDB,1086)	Medoro Video PartsGroup UID	UI	1	Video PartsGroup UID
(6FDD,0010)	Private Creator	LO	1	Medoro Replica
(6FDD,1001)	Medoro Replicated UUIDs	LO	4	Replicated UUID hierarchy
(6FDD,1002)	Medoro Original Size	LO	1	Replicated original object size