

Technical Publication



DICOM CONFORMANCE STATEMENT

BrainLAB PatientBrowser 1.1

Revision 3

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0. Introduction

0.1 Purpose

This is a conformance statement for the BrainLAB software: PatientBrowser. The DICOM part of the application is used to browse and display DICOM files (network files as well as Part 10 files), query archives, retrieve DICOM data from archives, and send DICOM data to a storage SCP.

This DICOM Conformance Statement is written according to part PS 3.2 of [1].

0.2 Abbreviations

ACR	American College of Radiation
AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
NEMA	National Electrical Manufactures Association
Q/R	Query and Retrieve
SCU	Service Class User
SCP	Service Class Provider
SOP	Service Object Pair
UID	Unique Identifier
VR	Value Representation

0.3 References

[1] Digital Imaging and Communications in Medicine (DICOM) 3.0, NEMA PS 3.1-3.13



BrainLAB uses DICOM by Merge.

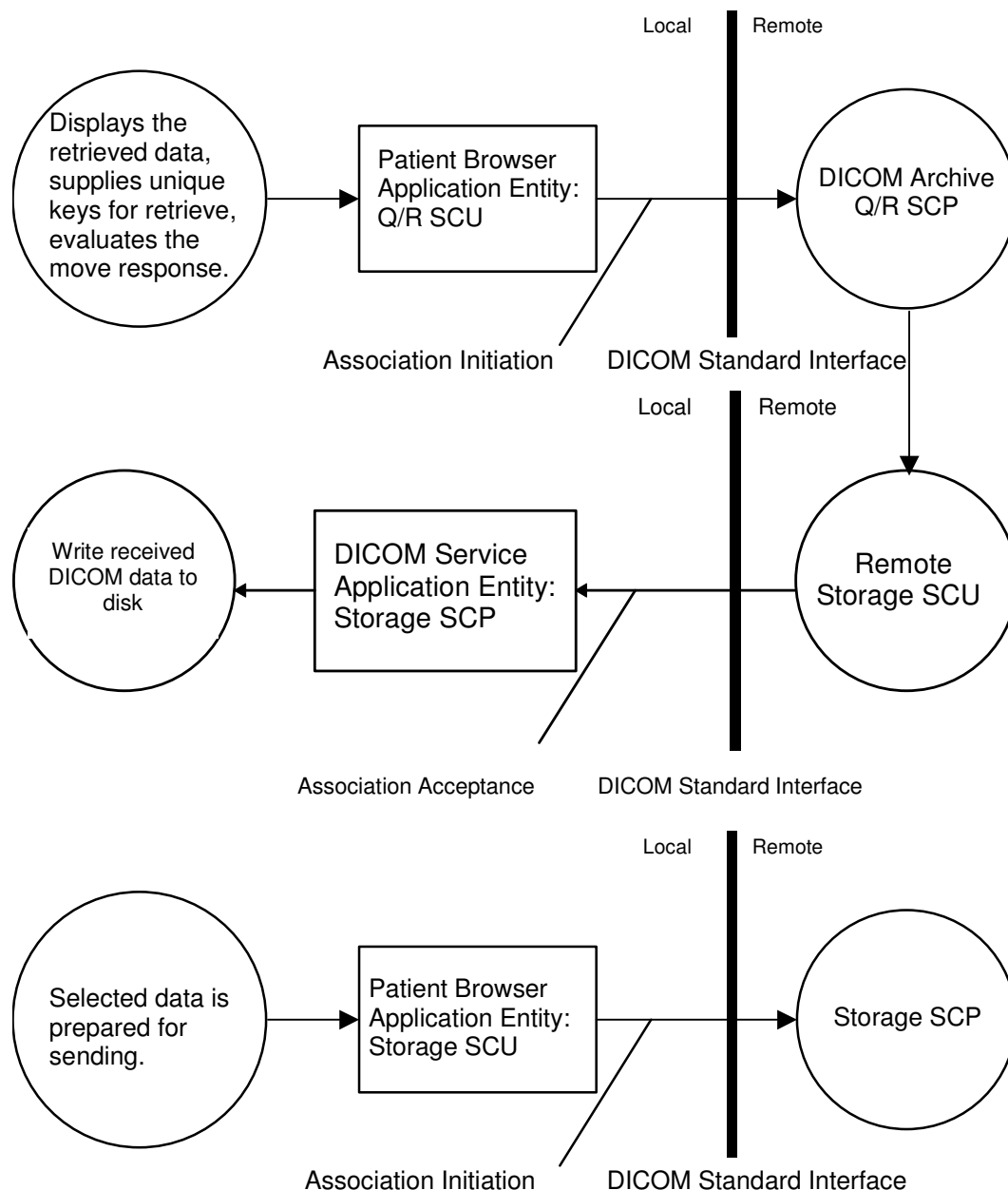
1. Implementation Model

The BrainLAB PatientBrowser is an implementation of

- A Query/Retrieve SCU to query DICOM archives and initiate a storage request from the queried archive.
- A Storage SCU which sends DICOM data to a Storage SCP.
- An application to convert DICOM RT data (RTPLAN, RTSTRUCT) into the BrainLAB file format

For the retrieve part of the DICOM Q/R service, the PatientBrowser uses the BrainLAB DICOM service (Storage SCP). This DICOM application is the target for the storage request of the remote archive.

1.1 Application Data Flow Diagram



1.2 Functional definition of Application Entity (AE)

All communications and data transfer with remote AE's are accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack.

- **Query and Retrieve:**
The PatientBrowser initiates an association as a Q/R SCU negotiating all models. The find request can be performed (depending on the negotiated models) on all DICOM levels (patient, study, series or instance). For a selected DICOM entity (patient, study, series or instance) a move request can be performed. The application supplies all unique keys for the requested level. The move response, indicating the storage-progress, is graphically evaluated.
- **Storage SCU:**
The PatientBrowser initiates an association with a Storage SCP negotiating all SOP's listed at 2.1.2. The selected DICOM data is checked for a valid SOP Class and is then sent to the remote Storage SCP.

1.3 Sequencing of real World Activities

Not applicable.

2. Application Entity Specifications

2.1 Specifications

On demand, the PatientBrowser sends out an Echo request in order to test the connection to a remote AE.

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

2.1.1 Query/Retrieve SCU AE

The PatientBrowser provides Standard Conformance to the following DICOM v3.0 SOP Classes as a Query/Retrieve SCU.

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

2.1.2 Storage SCU AE

The PatientBrowser provides Standard Conformance to the following DICOM v3.0 SOP Classes as a Storage SCU.

SOP Class Name	SOP Class UID
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
CR Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Stand-alone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Stand-alone Overlay Storage	1.2.840.10008.5.1.4.1.1.8
Secondary Capture (SC) Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound (US) Image Storage	1.2.840.10008.5.1.4.1.1.6.1
US Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Stand-alone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11
Nuclear Medicine (NM) Image Storage	1.2.840.10008.5.1.4.1.1.20
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Angiographic Bi-plane Image Storage	1.2.840.10008.5.1.4.1.1.12.3
X-Ray Radiofluoroscopic (RF) Image Storage	1.2.840.10008.5.1.4.1.1.12.2
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3

Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Photographic Image	1.2.840.10008.5.1.4.1.1.77.1.4
VL Slide-Coordinates Microscopic Image	1.2.840.10008.5.1.4.1.1.77.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6

2.1.3 Transfer syntax

The PatientBrowser supports the following transfer syntaxes. In an association negotiation the syntaxes are proposed in the order of appearance in the list.

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

2.2 Association establishment policies

2.2.1 General

The maximum PDU size is 28672 bytes.

- Query/Retrieve SCU
The PatientBrowser initiates an association as a Query/Retrieve SCU. Normally the first query opens this association. It remains open while further queries and retrieves can be performed. It can be closed manually.
- Storage SCU
The PatientBrowser initiates an association as a Storage SCU and sends all selected DICOM instances within this association. After the transfer has completed the association is closed automatically.

2.2.2 Number of associations

The number of simultaneous associations (with different or similar remote AE) is not restricted.

2.2.3 Asynchronous nature

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

2.2.4 Implementation identifying information

The Implementation Class Unique Identifier (UID) for the BrainLAB PatientBrowser Application Entity is: 1.2.276.0.20.1.2

2.2.5 Application Entity Title

The PatientBrowser application uses the same AET for the role as Query/Retrieve SCU and Storage SCU. The default AET is "PatientBrowser", but can be configured by an initialization file. See also 5.2.

2.3 Association Acceptance by real-world activity

Not applicable.

2.4 Association Initiation by real-world activity

2.4.1 Query/Retrieve SCU

2.4.1.1 Real-world activity - Find

2.4.1.1.1 Associated real-world activity

A C-FIND is performed when the user queries the remote Query/Retrieve SCP for patients, studies, series or instances.

- For the patient-root model, the user can restrict the patient-query by the following tags:

Description	Tag (hex)
Patient's Name	0010,0010
Patient ID	0010,0020

- For the study-root model, the user can restrict the patient/study-query by the following tags:

Description	Tag (hex)
Patient's Name	0010,0010
Patient ID	0010,0020
Study date	0008,0020

2.4.1.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax	Transfer	Syntax UID	Role	Extended Negotiation
All FIND SOP Classes as defined in 2.1.1 (All standard DICOM FIND SOP Classes)	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2.4.1.1.3 SOP specific conformance for all FIND SOP Classes

All FIND SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

2.4.1.2 Real-world activity - Move

2.4.1.2.1 Associated real-world activity

On user selection of a specific DICOM entity (patient, study, series or instance), a move request is performed. The storage target for receiving the DICOM data (the AET with which the move-request is equipped) must be one of the AET's known by the PatientBrowser.

2.4.1.2.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax	Transfer	Syntax UID	Role	Extended Negotiation
All MOVE SOP Classes as defined in 2.1.1 (All standard DICOM MOVE SOP Classes)	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2.4.1.2.3 SOP specific conformance for all MOVE SOP Classes

All MOVE SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

2.4.2 Storage SCU

2.4.2.1 Real-world activity - Storage

2.4.2.1.1 Associated real-world activity

On user selection of a local DICOM entity (patient, study, series or instance), a storage request is performed to send the DICOM data to a remote Storage SCP. The remote Storage SCP must be one of the AET's known by the PatientBrowser.

2.4.2.1.2 Proposed Presentation Contexts

Presentation Context Table				
Abstract Syntax	Transfer	Syntax UID	Role	Extended Negotiation
All Storage SOP Classes as defined in 2.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

2.4.2.1.3 SOP specific conformance for all Storage SOP Classes

All Storage SOP Classes are implemented according the DICOM standard. No extended negotiation is implemented.

3. Communication profiles

3.1 Supported Communication Stacks

The PatientBrowser supports the DICOM upper layer using TCP/IP.

3.2 TCP/IP Stack

The TCP/IP stack is inherited from the Windows® NT™ Operating system.

3.3 Physical Media Support

Ethernet v2.0, IEEE 802.3

3.4 Point to Point Stack

The 50-pin ACR-NEMA connection is not applicable to this product.

4. Extensions/ specializations/ privatizations

4.1 Standard extended/ specialized/ private SOP's

None supported.

4.2 Private Transfer Syntaxes

None supported.

5. Configuration

The PatientBrowser application references one configuration file, which is located in the operating systems directory.

5.1 AE title/ presentation address mapping

In the configuration file, the PatientBrowser application stores all registered remote DICOM AE's. The parameters associated with a single AE are the following:
Application Entity Title, TCP/IP listening port number, time-out for exchanging data, and the role of the remote AE (this can be Storage SCP, Query/Retrieve SCP or both).

5.2 Configurable parameters

The BrainLAB initialization file is used for configuring the following DICOM network parameters for the PatientBrowser application:
Application Entity Title and TCP/IP Listening port number.
Furthermore the initialization file holds the information whether the PatientBrowser should check for the installed and properly running BrainLAB Dicom service (Storage SCP) (see also '1. Implementation Model' for this subject).

6. Support of extended character sets

Not supported.

7. Specific Conformance to Information Objects

This section describes the requirements on the DICOM RT data, which shall be converted into the BrainLAB format. Conversion can be performed with DICOM RTPLAN and RTSTRUCT, which contain the following tags:

7.1 RT Plan

The RT Plan is used for receiving the isocenter coordinates and for referencing the RT Structure Set. The following tags are used to convert the RT Plan:

Description	Tag (hex)	Remark on the value
Patient Module		
Patient's Name	0010,0010	Mandatory, may not be NULL
Patient ID	0010,0020	Mandatory, may not be NULL
General Study Module		
Study Instance UID	0020,000D	Mandatory, may not be NULL
RT Series Module		
Modality	0008,0060	Must be RTPLAN
Series Instance UID	0020,000E	Mandatory, may not be NULL
RT General Plan Module		
RT Plan Geometry	300A,000C	Must be PATIENT
Referenced Structure Set Sequence	300C,0060	Mandatory, may not be NULL
>Referenced SOP Instance UID	0008,1155	Mandatory, may not be NULL
RT Beams Module		
Beam Sequence	300A,00B0	Mandatory, may not be NULL
>Beam Number	300A,00C0	Mandatory, may not be NULL
>Beam Type	300A,00C4	Mandatory, may not be NULL
>Number of Control Points	300A,0110	Mandatory, may not be NULL
>Control Point Sequence	300A,0111	Mandatory, may not be NULL
>>Isocenter Position	300A,012C	Mandatory, may not be NULL
SOP Common Module		
SOP Class UID	0008,0016	Must be 1.2.840.10008.5.1.4.1.1.481.5
SOP Instance UID	0008,0018	Mandatory, may not be NULL

7.2 RT Structure Set

The RT Structure Set is used for receiving the data of contour objects (CLOSED_PLANAR) and for referencing the images.

Additionally the RT Structure Set Isocenters can be received (POINT of ROI Interpreted Type: ISOCENTER).

The following tags are used to convert the RT Structure Set:

Description	Tag (hex)	Remark on the value
Patient Module		

Patient's Name	0010,0010	Mandatory, may not be NULL
Patient ID	0010,0020	Mandatory, may not be NULL
General Study Module		
Study Instance UID	0020,000D	Mandatory, may not be NULL
RT Series Module		
Modality	0008,0060	Must be RTSTRUCT
Series Instance UID	0020,000E	Mandatory, may not be NULL
Structure Set Module		
Referenced Frame of Reference Sequence	3006,0010	Optional: If this sequence is available it may have only one item (only a single referenced frame of reference).
>Frame of Reference UID	0020,0052	Mandatory, may not be NULL
>RT Referenced Study Sequence	3006,0012	Mandatory, may not be NULL
>>Referenced SOP Instance UID	0008,1155	Mandatory, may not be NULL
>>RT Referenced Series Sequence	3006,0014	Mandatory, may not be NULL
>>>Series Instance UID	0020,000E	Mandatory, may not be NULL
>>>Contour Image Sequence	3006,0016	Mandatory, may not be NULL
>>>>Referenced SOP Instance UID	0008,1155	Mandatory, may not be NULL
>>>>Referenced SOP Class UID	0008,1150	Mandatory, may not be NULL
Structure Set ROI Sequence	3006,0020	Mandatory, may not be NULL
>ROI Number	3006,0022	Mandatory, may not be NULL
>Referenced Frame of Reference UID	3006,0024	Mandatory, may not be NULL. Must be equal among all items, including the Frame of Reference UID in the Referenced Frame of Reference SQ (3006,0010).
>ROI Name	3006,0026	Mandatory, may not be NULL
>ROI Description	3006,0028	Optional
ROI Contour Module		
ROI Contour Sequence	3006,0039	Mandatory, may not be NULL
>Referenced ROI Number	3006,0084	Mandatory, may not be NULL
>Contour Sequence	3006,0040	Mandatory, may not be NULL
>>Contour Image Sequence	3006,0016	Optional , if this sequence is available it may have only one item.
>>>Referenced SOP Instance UID	0008,1155	Mandatory, may not be NULL
>>Contour Geometric Type	3006,0042	The contour will only be taken if CLOSED_PLANAR . The Structure Set Isocenter will only be taken if POINT (see ROI Interpreted Type).
>>Contour Offset Vector	3006,0045	Optional
>>Contour Data	3006,0050	Mandatory, may not be NULL

RT ROI Observations Module		
RT ROI Observations Sequence	3006,0080	Optional
>Observation Number	3006,0082	Mandatory, may not be NULL
>Referenced ROI Number	3006,0084	Mandatory, may not be NULL
>ROI Observation Label	3006,0085	Optional
>ROI Observation Description	3006,0088	Optional
>RT ROI Interpreted Type	3006,00A4	Mandatory, may be NULL. The Contour Geometric Type POINT is only imported if the RT ROI Interpreted Type is ISOCENTER.
>ROI Interpreter	3006,00A6	Mandatory, may be NULL
SOP Common Module		
SOP Class UID	0008,0016	Must be 1.2.840.10008.5.1.4.1.1.481.3
SOP Instance UID	0008,0018	Mandatory, may not be NULL

7.3 CT Images

For the Dicom RT Import the CT images must fulfill the following requirements:

Description	Tag (hex)	Remark on the value
Patient Module		
Patient's Name	0010,0010	Mandatory, may not be NULL
Patient ID	0010,0020	Mandatory, may not be NULL
General Study Module		
Study Instance UID	0020,000D	Mandatory, may not be NULL
General Series Module		
Modality	0008,0060	Must be CT
Series Instance UID	0020,000E	Mandatory, may not be NULL
Patient Position	0018,5100	Must be one of HFP, HFS, FFP or FFS
Frame of Reference Module		
Frame of Reference UID	0020,0052	Mandatory, may not be NULL
General Image Module		
Image Type	0008,0008	Mandatory, Value 3 may not be of Defined Term LOCALIZER.
Image Plane Module		
Pixel Spacing	0028,0030	Mandatory, equal in X and Y
Image Orientation (Patient)	0020,0037	Mandatory, only pure axial is permitted. (No gantry tilt!)
Image Position (Patient)	0020,0032	Mandatory, only Z value may change. (No table shift!)
Slice Thickness	0018,0050	Mandatory, may not be Zero
Image Pixel Module		

Samples per Pixel	0028,0002	Mandatory, must be 1
Photometric Interpretation	0028,0004	Mandatory, must be MONOCHROME2
Rows	0028,0010	Mandatory, must equal Columns
Columns	0028,0011	Mandatory, must equal Rows
Bits Allocated	0028,0100	Mandatory, must be 16
Bits Stored	0028,0101	Mandatory, must be between 12 and 16
High Bit	0028,0102	Mandatory, must be one less than value of Bits Stored
Pixel Representation	0028,0103	Mandatory, may not be NULL
Pixel Data	7FE0,0010	Mandatory, may not be NULL
CT Image Module		
Rescale Intercept	0028,1052	Mandatory, may not be NULL
Rescale Slope	0028,1053	Mandatory, may not be NULL
SOP Common Module		
SOP Class UID	0008,0016	Must be 1.2.840.10008.5.1.4.1.1.2
SOP Instance UID	0008,0018	Mandatory, may not be NULL

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