DICOM Conformance Statement

Application Annex:

RTgo

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ICAP-T-030001.09b

Corresponds to ICAP-W-030001.02

PHILIPS

Issued by:

Philips Medical Systems Netherlands BV, a Philips Healthcare company,

P.O. Box 10.000
5680 DA Best
The Netherlands

Email: dicom@philips.com
Internet: www.philips.com/dicom

Document Number: ICAP-PF.0028233
Date: 12-Apr-2017

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1. Introduction

This DICOM Conformance Statement annex is applicable to the RTgo plug-in that can be installed on top of MR software.

MR RT Plugin SW is interfaced with MR SW. This Plugin will include the MRCAT feature (previously this was part of MR SW) and new features for MR RT product, AutoContouring and Sim-to-treat SW options. The MRCAT images are transferred as CT objects and autocontouring is transferred as DICOM RT structures. This data is used by treatment planning systems.

The plug-in enables following applications,

- MR-only sim
  - MR images can be processed into CT-like MRCAT (MR for Calculating Attenuation) images, to provide the information that is needed for assigning Hounsfield units to various tissue types, facilitating MR-only treatment planning for radiation therapy
  - Images can be exported as CT images
- Auto-Contouring
  - A set of anatomical structures can be automatically generated based on MR images.
  - Contours can be exported as RT structure sets

1.1. Revision History

The revision history below provides dates and differences among individual document versions.

Table 1: Revision History

Document Version	Date of Issue	Status	Description
00	12-April-2017	Authorized	Final version.

1.2. Terminology

DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
UID	Unique Identifier
VR	Value Representation
RT	Radio Therapy

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2. Data Specifications

2.1. Supported IOD's

This section specifies each IOD accepted and / or created by RTgo.

ACCEPTED The applicable IOD is accepted for storage in the repository of the hosting platform and supported for import in RTgo for viewing and analysis.
CREATED The RTgo supports generation of derived data by using the applicable IOD and is able to store this data in the repository of the hosting platform.

Table 2: Supported IOD's

IOD		Support	
Name	**UID**	**ACCEPTED**	**CREATED**
CT Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.2	No	Yes
RT Structure Set Storage SOP Class	1.2.840.10008.5.1.4.1.1.481.3	No	Yes

2.1.1. Acceptance Criteria

RTgo doesn't accept RT Structure from other system.

Table 3: Created transfer syntaxes per IOD

IOD		Transfer Syntax	
Name	**UID**	**Name**	**UID**
CT Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2
RT Structure Set Storage SOP Class	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Implicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2

2.1.2. Contents of Created IOD's

This section specifies the IOD created by this application and specifies the content for each IOD (including private IODs).
For each attribute in the IOD the following information is supplied:

- Attribute name
- Tag
- VR – Value representation
- Value - specifies possible values
- Presence of value - specifies if attribute is always present or only under specific conditions
- Source of value - specifies the source of the value
- Comment - gives additional information on the attribute

Abbreviations used in the IOD tables for the column "Presence of Module" are:
ALWAYS The module is always present.
CONDITIONAL The module is used under specified condition.

Abbreviations used in the Module table for the column "Presence of Value" are:
ALWAYS The attribute is always present with a value
EMPTY The attribute is always present without any value (attribute sent zero length)
VNAP The attribute is always present and its Value is Not Always Present (attribute sent zero length if no value is present)
ANAP The attribute is present under specified condition – if present then it will always have a value

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The abbreviations used in the Module table for the column "Source" are:

AUTO The attribute value is generated automatically
CONFIG The attribute value source is a configurable parameter
COPY The attribute value source is another SOP instance
FIXED The attribute value is hard-coded in the application
IMPLICIT The attribute value source is a user-implicit setting
MPPS The attribute value is the same as that use for Modality Performed Procedure Step
MWL The attribute value source is a Modality Worklist
USER The attribute value source is explicit user input

2.1.2.1. Implementation Identifying Information

The value supplied for Implementation Class UID and version name are specified in table 4.

Table 4: DICOM Implementation Class and Version for Created Instances

Implementation Class UID	1.3.46.670589.54.2.16.4
Implementation Version Name	16.4.0.0

Note: The Implementation Class and Implementation Version for RTgo Plug-in DICOM export refers to different DICOM library and are therefore has different identification compared to the standard system.

Table 5: List of created SOP Classes

SOP Class Name	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
RT Structure Set Storage SOP Class	1.2.840.10008.5.1.4.1.1.481.3

2.1.2.2. CT Image Storage SOP Class

Table 6: IOD of Created CT Image Storage SOP Class Instances

Information Entity	Module	Presence Of Module
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS
Study	Patient Study Module	CONDITIONAL
Series	General Series Module	ALWAYS
Frame of Reference	Frame of Reference Module	ALWAYS
Equipment	General Equipment Module	ALWAYS
Image	General Image Module	ALWAYS
Image	Image Plane Module	ALWAYS
Image	Image Pixel Module	ALWAYS
Image	CT Image Module	ALWAYS
Image	VOI LUT Module	ALWAYS
Image	SOP Common Module	ALWAYS
	Extended DICOM and Private attributes	ALWAYS

Table 7: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		ALWAYS	MWL, USER	-
Patient ID	0010,0020	LO		ALWAYS	MWL, USER	-
Patient's Birth Date	0010,0030	DA		ALWAYS	MWL, USER	-

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Patient's Sex	0010,0040	CS		ALWAYS	MWL, USER	-
Other Patient IDs	0010,1000	LO		ANAP	MWL, USER	

Table 8: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		ALWAYS	AUTO, MWL	-
Study Time	0008,0030	TM		ALWAYS	AUTO, MWL	-
Accession Number	0008,0050	SH		ALWAYS	AUTO, MWL, USER	-
Referring Physician's Name	0008,0090	PN		VNAP	MWL, USER	-
Study Description	0008,1030	LO		VNAP	MWL, USER	-
Study Instance UID	0020,000D	UI		ALWAYS	AUTO, MWL	-
Study ID	0020,0010	SH		ALWAYS	AUTO	-

Table 9: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Weight	0010,1030	DS		ALWAYS	MWL, USER	-
Medical Alerts	0010,2000	LO		ANAP	MWL, USER	-
Allergies	0010,2110	LO		ANAP	MWL, USER	-
Pregnancy Status	0010,21C0	US		ANAP	MWL, USER	-

Table 10: General Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Series Date	0008,0021	DA		ALWAYS	AUTO	Copy from MRCAT mDixon source scan.
Series Time	0008,0031	TM		ALWAYS	AUTO	Copy from MRCAT mDixon source scan.
Modality	0008,0060	CS	CT	ALWAYS	FIXED	
Series Description	0008,103E	LO		ANAP	AUTO, USER	
Performing Physicians' Name	0008,1050	PN		ANAP	AUTO, USER	
Body Part Examined	0018,0015	CS		ANAP	AUTO	
Protocol Name	0018,1030	LO		ALWAYS	USER	
Patient Position	0018,5100	CS		ALWAYS	AUTO	
Series Instance UID	0020,000E	UI		ALWAYS	AUTO	
Series Number	0020,0011	IS		ALWAYS	AUTO	
Laterality	0020,0060	CS		ANAP	USER	

Table 11: Frame of Reference Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Frame of Reference UID	0020,0052	UI		ALWAYS	AUTO	-
Position Reference Indicator	0020,1040	LO		EMPTY	FIXED	-

Table 12: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO		ALWAYS	FIXED	
Institution Name	0008,0080	LO		ALWAYS	CONFIG	Configured on the system.
Institution Address	0008,0081	ST		ANAP		
Station Name	0008,1010	SH		ALWAYS	CONFIG	Same as the Host Name.
Institutional Department Name	0008,1040	LO		ALWAYS	CONFIG	-

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Manufacturer's Model Name	0008,1090	LO		ALWAYS	FIXED	
Device Serial Number	0018,1000	LO		ALWAYS	AUTO	System serial number.
Software Version(s)	0018,1020	LO		ALWAYS	AUTO or COPY	The release text of the original Image.

Table 13: General Image Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Image Type	0008,0008	CS	DERIVED\PRIMARY\REFORMATTED\REFORMATTED\DERIVED	ANAP	AUTO	-
Acquisition Date	0008,0022	DA		ANAP	AUTO	-
Content Date	0008,0023	DA		ANAP	AUTO	-
Acquisition Time	0008,0032	TM		ANAP	AUTO	-
Content Time	0008,0033	TM		ANAP	AUTO	-
Acquisition Number	0020,0012	IS		ANAP	AUTO	
Instance Number	0020,0013	IS		VNAP	AUTO	

Table 14: Image Plane Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Slice Thickness	0018,0050	DS		VNAP	AUTO	-
Image Position (Patient)	0020,0032	DS		ALWAYS	AUTO	-
Image Orientation (Patient)	0020,0037	DS		ALWAYS	AUTO	-
Pixel Spacing	0028,0030	DS		ALWAYS	AUTO	-

Table 15: Image Pixel Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Samples per Pixel	0028,0002	US	1	ALWAYS	FIXED	
Photometric Interpretation	0028,0004	CS		ALWAYS	FIXED	
Rows	0028,0010	US		ALWAYS	IMPLICIT	
Columns	0028,0011	US		ALWAYS	IMPLICIT	
Bits Allocated	0028,0100	US	16	ALWAYS	FIXED	
Bits Stored	0028,0101	US	12	ALWAYS	IMPLICIT	
High Bit	0028,0102	US	11	ALWAYS	IMPLICIT	
Pixel Representation	0028,0103	US	0	ALWAYS	IMPLICIT	
Pixel Data	7FE0,0010	OB or OW		ANAP	IMPLICIT	

Table 16: CT Image Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Image Type	0008,0008	CS	DERIVED\PRIMARY\REFORMATTED\REFORMATTED\DERIVED	ALWAYS	AUTO	
KVP	0018,0060	DS	0	VNAP	FIXED	Derived from MR image so no KVP

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Acquisition Number	0020,0012	IS		VNAP	AUTO	
Samples per Pixel	0028,0002	US		ALWAYS	AUTO	
Photometric Interpretation	0028,0004	CS	MONOCHROME2	ALWAYS	AUTO	
Bits Allocated	0028,0100	US		ALWAYS	AUTO	
Bits Stored	0028,0101	US		ALWAYS	AUTO	
High Bit	0028,0102	US		ALWAYS	AUTO	
Rescale Intercept	0028,1052	DS		ALWAYS	AUTO	
Rescale Slope	0028,1053	DS	1	ALWAYS	AUTO	
Rescale Type	0028,1054	LO	HU	ANAP	FIXED	

Table 17: VOI LUT Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Window Center	0028,1050	DS		ANAP	AUTO	
Window Width	0028,1051	DS		ANAP	AUTO	

Table 18: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Specific Character Set	0008,0005	CS		ANAP	AUTO	
Instance Creation Date	0008,0012	DA		ANAP	AUTO	
Instance Creation Time	0008,0013	TM		ANAP	AUTO	
SOP Class UID	0008,0016	UI		ALWAYS	AUTO	
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO	
Instance Number	0020,0013	IS		ANAP	AUTO	

Table 19: Private Tags

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Private Creator Group 2005	2005,0010	LO	Philips MR Imaging DD 006	ANAP	AUTO	
RT blob data	2005,1588	LO		ANAP	AUTO	
RT Generated Series	2005,1589	LO		ANAP	AUTO	This is a string identifying the version of the plug-in.

2.1.2.3. RT Structure Set Storage SOP Class

Table 20: IOD of Created RT Structure Set Storage SOP Class Instances

Information Entity	Module	Presence Of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
Study	Patient Study	ALWAYS
Series	RT Series	ALWAYS
Equipment	General Equipment	ALWAYS
Structure Set	Structure Set	ALWAYS
Structure Set	ROI Contour	ALWAYS
Structure Set	RT ROI Observations	ALWAYS
Structure Set	SOP Common	ALWAYS
	Extended DICOM and Private attributes	CONDITIONAL

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Table 21: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		ALWAYS	MWL, USER	
Patient ID	0010,0020	LO		ALWAYS	MWL, USER	
Patient's Birth Date	0010,0030	DA		ALWAYS	MWL, USER	
Patient's Sex	0010,0040	CS		ALWAYS	MWL, USER	
Other Patient IDs	0010,1000	LO		VNAP	MWL, USER	

Table 22: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		ALWAYS	AUTO, MWL	
Study Time	0008,0030	TM		ALWAYS	MWL	
Accession Number	0008,0050	SH		ALWAYS	AUTO, MWL, USER	
Referring Physician's Name	0008,0090	PN		VNAP	MWL, USER	
Study Description	0008,1030	LO		VNAP	MWL, USER	
Study Instance UID	0020,000D	UI		ALWAYS	AUTO, MWL	
Study ID	0020,0010	SH		ALWAYS	AUTO	

Table 23: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Weight	0010,1030	DS		ALWAYS	MWL, USER	
Medical Alerts	0010,2000	LO		ANAP	MWL, USER	-
Allergies	0010,2110	LO		ANAP	MWL, USER	-
Pregnancy Status	0010,21C0	US		ANAP	MWL, USER	-

Table 24: RT Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Modality	0008,0060	CS	RTSTRUCT	ALWAYS	FIXED	Applied value: RTSTRUCT
Series Description	0008,103E	LO		ANAP	AUTO, USER	
Series Instance UID	0020,000E	UI		ALWAYS	AUTO	
Series Number	0020,0011	IS		ALWAYS	AUTO	
Operator's Name	0008,1070	PN		EMPTY	FIXED	

Table 25: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO		ALWAYS	FIXED	
Institution Name	0008,0080	LO		ALWAYS	CONFIG	
Institution Address	0008,0081	ST		ANAPCV	CONFIG	
Station Name	0008,1010	SH		ALWAYS	CONFIG	Same as the Host Name.
Institutional Department Name	0008,1040	LO		ALWAYS	CONFIG	
Manufacturer's Model Name	0008,1090	LO		ALWAYS	FIXED	
Device Serial Number	0018,1000	LO		ALWAYS	FIXED	
Software Version(s)	0018,1020	LO		ALWAYS	FIXED	

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Table 26: Frame of Reference Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Frame Of Reference UID	0020,0052	UI	1.3.46.670589.11.0.5.0.4952.20170130100321360000	ALWAYS	AUTO	

Table 27: Structure Set Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Structure Set Label	3006,0002	SH	MR-RT	ALWAYS	FIXED	
Structure Set Name	3006,0004	LO	MR-RT	ALWAYS	FIXED	
Structure Set Description	3006,0006	ST	MR-RT AutoContouring	ALWAYS	FIXED	
Structure Set Date	3006,0008	DA		ALWAYS	AUTO	
Structure Set Time	3006,0009	TM		ALWAYS	AUTO	
Referenced Frame of Reference Sequence	3006,0010	SQ		ALWAYS	AUTO	
>Frame of Reference UID	0020,0052	UI		ALWAYS	AUTO	
>RT Referenced Study Sequence	3006,0012	SQ		ALWAYS	AUTO, MWL	
>>Referenced SOP Class UID	0008,1150	UI	1.2.840.10008.5.1.4.1.1.2	ALWAYS	AUTO	Applied value: 1.2.840.10008.5.1.4.1.1.2
>>Referenced SOP Instance UID	0008,1155	UI		ALWAYS	AUTO	
>>RT Referenced Series Sequence	3006,0014	SQ		ALWAYS	AUTO	
>>>Series Instance UID	0020,000E	UI		ALWAYS	AUTO	
>>>Contour Image Sequence	3006,0016	SQ		ALWAYS	AUTO	
>>>>Referenced SOP Class UID	0008,1150	UI		ALWAYS	AUTO	Applied value: 1.2.840.10008.5.1.4.1.1.2
>>>>Referenced SOP Instance UID	0008,1155	UI		ALWAYS	AUTO	
Structure Set ROI Sequence	3006,0020	SQ		ALWAYS	AUTO	
>ROI Number	3006,0022	IS		ALWAYS	AUTO	
>Referenced Frame of Reference UID	3006,0024	UI		ALWAYS	AUTO	
>ROI Name	3006,0026	LO		ALWAYS	CONFIG	
>ROI Generation Algorithm	3006,0036	CS		ALWAYS	FIXED	Applied value: AUTOMATIC

Table 23: ROI Contour Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
ROI Contour Sequence	3006,0039	SQ		ALWAYS	AUTO	
>ROI Display Color	3006,002A	IS		ALWAYS	CONFIG	
>Contour Sequence	3006,0040	SQ		VNAP	AUTO	Sequence may be empty or zero length if ROI does not contain any contours
>>Contour Image Sequence	3006,0016	SQ		ANAP	AUTO	
>>>Referenced SOP Class UID	0008,1150	UI		ANAP	AUTO	Applied value: 1.2.840.10008.5.1.4.1.1.2
>>>Referenced SOP Instance UID	0008,1155	UI		ANAP	AUTO	
>>Contour Geometric Type	3006,0042	CS		ANAP	AUTO	
>>Number of Contour Points	3006,0046	IS		ANAP	AUTO	

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Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
>>Contour Data	3006,0050	DS		ANAP	AUTO	
>Referenced ROI Number	3006,0084	IS		ALWAYS	AUTO	

Table 24: RT ROI Observations Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
RT ROI Observations Sequence	3006,0080	SQ		ALWAYS	AUTO	
>Observation Number	3006,0082	IS		ALWAYS	AUTO	
>Referenced ROI Number	3006,0084	IS		ALWAYS	AUTO	
>RT ROI Interpreted Type	3006,00A4	CS	EXTERNAL, ORGAN	ALWAYS	AUTO	
>ROI Interpreter	3006,00A6	PN		ALWAYS	FIXED	

Table 30: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Specific Character Set	0008,0005	CS		ALWAYS	AUTO	Default: ISO_IR 100.
Instance Creation Date	0008,0012	DA		ALWAYS	AUTO	
Instance Creation Time	0008,0013	TM		ALWAYS	AUTO	
SOP Class UID	0008,0016	UI		ALWAYS	FIXED	Applied value: 1.2.840.10008.5.1.4.1.1.481.3
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO	

Table 31: Private Tags

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Private Creator Group 2005	2005,0010	LO	Philips MR Imaging DD 006	ANAP	AUTO	
RT blob data	2005,1588	LO		ANAP	AUTO	
RT Generated Series	2005,1589	LO		ANAP	AUTO	This is a string identifying the version of the plug-in.

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