

RAYTREAT 2024A SP1

DICOM Conformance Statement Accuray Driver

2024^A



RayStation

Declaration of conformity



Complies with Medical Device Regulation (MDR) 2017/745. A copy of the corresponding Declaration of Conformity is available on request.

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1 OVERVIEW

This document specifies the DICOM interface for the RaySearch Laboratories RayTreat treatment management system driver for use with the Accuray CyberKnife TomoTherapy treatment delivery device. The driver can export DICOM data associated with a treatment delivery session to the treatment delivery device, as well accept, validate, and store DICOM data related to patient positioning and treatment delivery results received from the treatment delivery device.

1.1 NETWORK SERVICES

SOP Class Name	SOP Class UID	Provider of Service (SCP)	User of Service (SCU)
Transfer			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
Spatial Registration (REG) Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Workflow Management			
Unified Procedure Step - Push SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.1	Yes	No
Unified Procedure Step - Pull SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Yes	No
Verification			
Verification SOP Class	1.2.840.10008.1.1	Yes	No

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3 INTRODUCTION

3.1 REVISION HISTORY

Date	Version	Comment
2021-02-10	1.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11A
2021-06-09	2.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11A SP1
2021-09-13	3.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11A SP2
2021-11-16	1.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11B
2022-03-18	2.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11B SP1
2022-04-27	3.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11B SP2
2022-06-23	4.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 11B SP3
2022-06-29	1.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 12A
2022-09-26	1.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 12A SP1
2024-05-08	1.0	CyberKnife and TomoTherapy Driver DCS for RayStation Release 2024A SP1

3.2 CYBERKNIFE AND TOMO DRIVER CHANGELOG

3.2.1 Updates between 2.2.0.0 (RayStation 8B) - 2.3.0.0 (RayStation 8B SP1)

- If an exception is thrown when processing the request queue, the driver application will now be taken down. It should then be automatically restarted by the Windows service manager. Previously, any further requests would instead fail and the driver would have to be restarted manually.
- Validation has been added to ensure that for plans with multiple isocenters, the differences in the delivery positions for each beam are as expected. This is done by comparing to the relative positions of the isocenters for each beam in the plan to the table top displacements in the patient setup sequence and the absolute table top positions in the control point sequence.

3.2.2 Updates between 2.3.0.0 (RayStation 8B SP1) - 3.0.0.0 (RayStation 9A)

- More detail in logging of plan validation results.
- Adding validation to make it impossible to have a second drivers connected to the same database as the first driver if the drivers has somehow been severely misconfigured.

3.2.3 Updates between 3.0.0.0 (RayStation 9A) - 9.1.0 (RayStation 9B)

- Uses the same version numbering as the corresponding RayStation release.
- Validates the checksums that are produced by RayStation DICOM export when plan is created by a RayStation version above 9.1.0.0 (RayStation 9B) and when the plan has DICOM attribute `Manufacturer Set to RaySearch Laboratories`.
- No longer validates that the plan has been asked for when setting session in progress.
- No longer requires machine to exist in MachineDB to be able to create tolerance tables.
- Automatic configuration of driver features, synchronizable through Clinic Settings.
- Logs more session information when first receiving it on the driver.
- Displays progress percentage in RayTreat while session is in progress.
- UPS and BDI is no longer sent as CONTINUATION if no meterset has been delivered, even if a treatment record has been received in a previous session for that fraction.
- Enables parsing of treatment records outside of a session context for offline recording. Validating the Treatment Machine Name, Current Fraction Number, Patient ID, Patient's Name, Patient's Sex, Patient's Birth Date and the Referenced SOP Instance UID of the Referenced RT Plan, in the Treatment Record.
- Now prefers the Study Instance UID of the Treatment Record to be the same as the plan that was delivered, also prefers the Referenced Series Sequence of the treatment record to contain a reference to the plan that was delivered. If set, this will enable better possibilities for offline treatment recording.
- Improved readability of DCS. Shows the correct indentation of attributes inside a sequence. Removes all attributes from the "Created SOP Instance(s)" chapter where the value is just read but never written. Type 1 values that are not actually read by us now has the comment "Value not read".
- No longer sends any BDI as part of the UPS (Even though one is created and sent for storage in the PACS).
- Immediately refreshes the plans Series Instance UID once reference is received from RayTreat. Since the Series Instance UID will be unknown to us because it was regenerated by iDMS. This is done by querying the PACS.

3.2.4 Updates between 9.1.0 (RayStation 9B) - 9.2.0 (RayStation 9B SP1)

- UPS for a session with a previous treatment record of 0 delivered MU now sends its treatment records in the Input Information Sequence as part of the UPS.
- Table top positions are now included when delivering QA session.

3.2.5 Updates between 9.2.0 (RayStation 9B SP1) - 10.0.0 (RayStation 10A)

- No changes affecting driver in this release.

3.2.6 Updates between 10.0.0 (RayStation 10A) - 10.1.0 (RayStation 10B)

- Parses out the `CurrentFractionNumber` for all beams in the treatment records and always expects all to be the same.
- Introduced `IsClinical` concept to the driver. A Clinical driver can never communicate with non-clinical RayTreat. Or vice versa.

- Made connection between driver and RayTreat more secure by forcing the usage of HTTPS for a clinical driver.
- New RaaS service now handles the data synchronization with the driver (all drivers will be connected to the same RaaS service). Driver will also always send the PACS data to this service instead of to RayTreat.

3.2.7 Updates between 10.1.0 (RayStation 10B) - 11.0.0 (RayStation 11A)

- Supports creating a TDW-1 Trial (Retired) BDI and sends it as part of the UPS again.
- Added feature to cache and send additional DICOM references in the UPS if such are created by RayStation. (IE: 2nd gen DICOM objects created for CyberKnife).
- Now supports receiving CMOVE requests. Supported SopClasses: RTPlan and BDI (Retired).
- Supports receiving empty table top positions in treatment record.

3.2.8 Updates between 11.0.0 (RayStation 11A) - 11.0.1 (RayStation 11A SP1)

- No changes affecting driver in this release.

3.2.9 Updates between 11.0.1 (RayStation 11A SP1) - 11.0.2 (RayStation 11A SP2)

- No changes affecting driver in this release.

3.2.10 Updates between 11.0.2 (RayStation 11A SP2) - 12.0.0 (RayStation 11B)

- RayTreat support opening a session earlier to view the setup instructions before going in progress. Driver instead limits the maximum number of available UPSs to 1.
- Fixed problem where approving a plan on the iDMS after checkin would cause the driver to deny all DICOM requests for that particular UPS.
- CFIND for UPS would previously only return UPS for plans where the Scheduled Station Name Code matched the RTPlans Treatment Machine Name. Now it's possible for the driver to map the Scheduled Station Name Code against a room and return RTPlans for all Treatment Machine Name machine models that are allowed to be delivered within the room.

3.2.11 Updates between 12.0.0 (RayStation 11B) - 12.1.0 (RayStation 11B SP1)

- No changes affecting driver in this release.

3.2.12 Updates between 12.1.0 (RayStation 11B SP1) - 12.0.3 (RayStation 11B SP2)

- No changes affecting driver in this release.

3.2.13 Updates between 12.0.3 (RayStation 11B SP2) - 12.0.4 (RayStation 11B SP3)

- No changes affecting driver in this release.

3.2.14 Updates between 12.0.4 (RayStation 11B SP3) - 13.0.0 (RayStation 12A)

- No changes affecting driver in this release.

3.2.15 Updates between 13.0.0 (RayStation 12A) - 13.1.0 (RayStation 12A SP1)

- No changes affecting driver in this release.

3.2.16 Updates between 13.1.0 (RayStation 12A SP1) - 13.1.1 (RayStation 12A SP2)

- C-MOVE and BDI retrieval is now enabled for Tomo and CK drivers.
- CK and Tomo now accept treatment records while a UPS is in progress;

3.2.17 Updates between 13.1.1 (RayStation 12A SP2) - 15.1.0 (2024A SP1)

- CK and Tomo drivers will now reject RTRECORD if the session is in states CREATED or READY
- Driver now uses local filesystem as storage instead of SQL server. Also, all driver related data files (data, DICOM files, and logs) have been relocated to default location of %ProgramData%\RaySearch_Laboratories_AB\TreatmentDrivers. Typical size requirements is expected to be approximately 3 GB of disk space.

3.3 AUDIENCE

This document is written for users that need to understand how the RayTreat Accuray CyberKnife TomoTherapy driver (hereafter referred to simply as "the driver") 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.

3.4 REMARKS

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

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

3.4.1 Interoperability validation needed

When using the driver together with other software, the DICOM conformance statements must be compared and relevant validation tests run. The DICOM standard 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. RaySearch is also active within the IHE-RD. Contact RaySearch for more info regarding adherence to IHE-RD profiles.

3.4.2 DICOM revision

The module tables listed in the last two chapters are based on part 3 of the DICOM-standard edition 2020a. For extra clarity all attributes in the referenced modules have been listed, even the ones that are not used by the driver.

3.5 TERMS AND DEFINITIONS

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

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

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

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

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

Association – a network communication channel set up between Application Entities.

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

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

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

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.

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

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

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

Service/Object Pair (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 (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.

3.6 BASICS OF DICOM COMMUNICATION

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

Two Application Entities (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network “handshake”. One of the two devices must initiate an Association (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (Negotiation).

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

For each Presentation Context, the Association Negotiation also allows the devices to agree on Roles – which one is the Service Class User (SCU - client) and which is the

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Service Class Provider (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

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

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a Media Application Profile that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.7 ABBREVIATIONS

Name	Meaning
AE	Application Entity
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IHE / IHE-RO	Integrating the Healthcare Enterprise. IHE-RO deals with integrating Radiation Oncology.
IOD	Information Object Definition
JPEG	Joint Photographic Experts Group
MR	Magnetic Resonance Imaging
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
RT	Radiotherapy
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TDD	Treatment Delivery Device
TMS	Treatment Management System
TPS	Treatment Planning System

3.8 REFERENCES

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

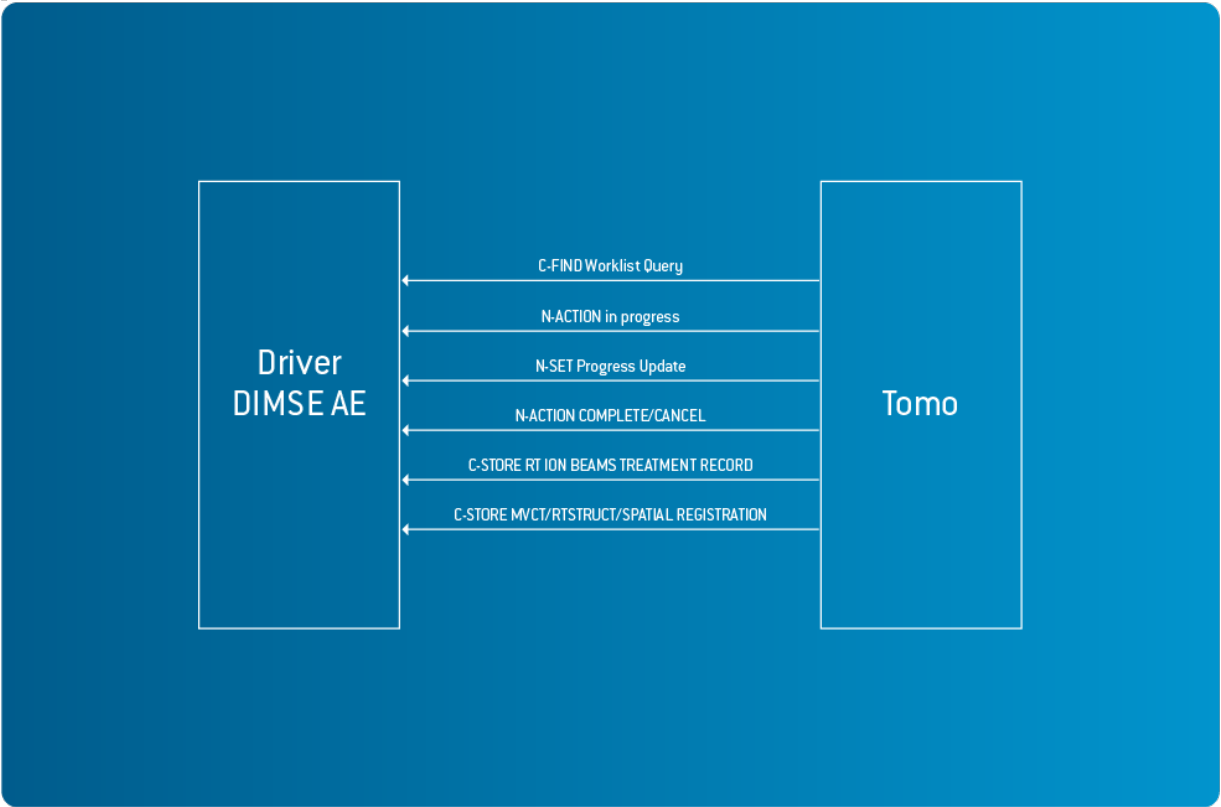
4 NETWORKING

The following diagram illustrates the application dataflow between the driver and the specific TDD.

4.1 IMPLEMENTATION MODEL

4.1.1 Application data flow

The following diagram illustrates the application data flow between the driver and the treatment delivery device.



The scenario starts with a C-FIND query for Unified Procedure Steps from the treatment delivery device. The treatment delivery device can then take responsibility for the UPS by setting it to IN PROGRESS. Once the UPS is IN PROGRESS, the driver will only allow requests corresponding to the current session until the session has been completed by the treatment delivery device.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of the driver Application Entity

The following operations are supported:

CT Image

- C-STORE for setup CT images. (TomoTherapy Only)
- C-MOVE for planning CT images

Spatial Registration [SRO]

- C-STORE for registration between setup and planning images.

RT Image

- C-MOVE for RT Images.

RT Structure Set

- C-STORE for planning RT Structure Set. (TomoTherapy Only)
- C-MOVE for planning RT Structure Set.

RT Beams Treatment Record

- C-STORE for delivery result.
- C-MOVE for previous delivered results.

Beams Delivery Instructions

- C-MOVE for BDIs related to the Unified Procedure Step.

Modality Performed Procedure Step - PULL

- C-FIND for worklist query.
- N-ACTION for UPS status changes.
- N-SET for progress update.

Verification

- C-ECHO for connection verification

4.1.3 Sequence of Real World Activities**4.1.3.1 Prepare session**

Once the patient is checked in to the session, Unified Procedure Steps will be created and available for Worklist queries.

4.1.3.2 Manual cancellation

The procedure step can be canceled by the user in the application. Further requests relation to the session will be rejected.

4.1.3.3 Complete session

All sessions, including canceled sessions, needs to be completed by the user in the application before another session can be started.

4.2 AE SPECIFICATIONS:**4.2.1 Driver Application Entity****4.2.1.1 SOP Classes**

SOP Class Name	SOP Class UID	Provider of Service (SCP)	User of Service (SCU)
Transfer			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Yes	No
Spatial Registration (REG) Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Workflow Management			
Unified Procedure Step - Push SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.1	Yes	No
Unified Procedure Step - Pull SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Yes	No
Verification			
Verification SOP Class	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

Not applicable

4.2.1.3 General

The DICOM standard Application context shall be specified.

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

The maximum PDU size is configurable and is set to 1 for SCU and unlimited for SCP. The configuration value can be found in the **dicomConfig** config section of the app config file.

4.2.1.4 Number of Associations

Any number of incoming concurrent associations are accepted.

4.2.1.5 Asynchronous Nature

The driver does not support asynchronous communication (multiple outstanding transactions over a single Association).

4.2.1.6 Implementation Identity Information

Not applicable

4.2.1.7 Association Initiation Policy

The implementation for this Application Entity is:

Implementation Class UID	1.3.6.1.4.1.30071.8
Implementation Version Name	fo-dicom-raysearch 5.0.2.2 (based on official fo-dicom 5.0.2)

Activity C-ECHO

4.2.1.7.1 Description and Sequencing of Activities

See C-ECHO in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

4.2.1.7.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.8 Activity C-FIND

4.2.1.8.1 Description and Sequencing of Activities

See C-FIND in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

4.2.1.8.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.9 Activity C-MOVE

4.2.1.9.1 Description and Sequencing of Activities

See C-MOVE in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

4.2.1.9.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.10 Activity C-STORE

4.2.1.10.1 Description and Sequencing of Activities

See C-STORE in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

4.2.1.10.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.10.3 Status Response

Service Status	Further meaning	Error Code	Reason
Failure	Storage Cannot Understand	Cxxx	Cannot find session or validation failed.
	SOP class not supported	0122	SOP class not supported.
Success	Success	0000	

4.2.1.11 Activity N-ACTION

4.2.1.11.1 Description and Sequencing of Activities

See N-ACTION in the DICOM standard, PS3.7 Chapter 10 https://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_10.html

4.2.1.11.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.11.3 Status Response

Service Status	Further meaning	Error Code	Reason
Refused	QueryRetrieveUnableToProcess	C000	Unknown SOP Instance UID.
	NoLongerUpdateUps	C300	The UPS may no longer be updated.
	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	AlreadyInProgress	C302	The UPS is already IN PROGRESS
	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	SopInstanceUidDoesNotExists	C307	Specified SOP Instance UID does not exist or is not a UPS instance managed by this SCP
Failure	AlreadyCanceled	B304	The UPS is already in the requested state of CANCELED.
	AlreadyCompleted	B306	The UPS is already in the requested state of COMPLETED.
Success	Success	0000	

4.2.1.12 Activity N-SET

4.2.1.12.1 Description and Sequencing of Activities

See N-SET in the DICOM standard, PS3.7 Chapter 10 https://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_10.html

4.2.1.12.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.12.3 Status Response

Service Status	Further meaning	Error Code	Reason
Refused	QueryRetrieveUnableToProcess	C000	Unknown SOP Instance UID.
	NoLongerUpdateUps	C300	The UPS may no longer be updated.

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	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	SopInstanceUidDoesNotExists	C307	Specified SOP Instance UID does not exist or is not a UPS instance managed by this SCP
Success	Success	0000	

5 MEDIA INTERCHANGE

Not applicable

6 TRANSFORMATION OF DICOM TO CDA

Not applicable

7 SUPPORT OF CHARACTER SETS

The driver supports the following charactersets in addition to the default

- ISO_IR 192

8 SECURITY

8.1 SECURITY PROFILES

No Security Profiles are supported.

8.2 ASSOCIATION LEVEL SECURITY

The driver checks the following values for validation of received Association Open Requests:

- Called AE Title.

8.3 APPLICATION LEVEL SECURITY

None supported.

9 ANNEXES

9.1 IOD CONTENTS

9.1.1 Created SOP Instance(s)

9.1.1.1 RT Plan IOD

IE	Module	Used
Patient	Patient Module	No
Study	General Study Module	No
Series	RT Series Module	No
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Tolerance Tables Module	Yes
	RT Beams Module	No
	RT Brachy Application Setups Module	No
	SOP Common Module	Yes

9.1.1.1.1 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Software Versions	(0018,1020)	LO	3	

9.1.1.1.2 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
Plan Intent	(300A,000A)	CS	3	
Referenced RT Plan Sequence	(300C,0002)	SO	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>RT Plan Relationship	(300A,0055)	CS	1	

9.1.1.1.3 RT Tolerance Tables Module

Attribute name	Tag	Vr	Type	Comment
Tolerance Table Sequence	(300A,0040)	SO	3	
>Tolerance Table Number	(300A,0042)	IS	1	
>Tolerance Table Label	(300A,0043)	SH	3	
>Gantry Angle Tolerance	(300A,0044)	DS	3	
>Beam Limiting Device Angle Tolerance	(300A,0046)	DS	3	
>Beam Limiting Device Tolerance Sequence	(300A,0048)	SO	3	
>>RT Beam Limiting Device Type	(300A,00B8)	CS	1	
>>Beam Limiting Device Position Tolerance	(300A,004A)	DS	1	
>Patient Support Angle Tolerance	(300A,004C)	DS	3	
>Table Top Pitch Angle Tolerance	(300A,004F)	FL	3	
>Table Top Roll Angle Tolerance	(300A,0050)	FL	3	
>Table Top Vertical Position Tolerance	(300A,0051)	DS	3	
>Table Top Longitudinal Position Tolerance	(300A,0052)	DS	3	
>Table Top Lateral Position Tolerance	(300A,0053)	DS	3	

9.1.1.1.4 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
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SOP Instance UID	{0008,0018}	UI	1	
RaySearch Private Creator	{4001,0010}	LO	3	RAYSEARCHLABS 2.0
RaySearch Checksum Algorithm Version	{4001,1060}	LO	3	
RaySearch Checksum Data	{4001,1061}	OB	3	

9.1.1.2 RT Beams Treatment Record IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	Yes
Treatment Record	RT General Treatment Record Module	Yes
	RT Patient Setup Module	Yes
	RT Treatment Machine Record Module	Yes
	RT Beams Session Record Module	Yes
	SOP Common Module	Yes

9.1.1.2.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	{0010,0010}	PN	2	
Patient ID	{0010,0020}	LO	2	
Patient's Birth Date	{0010,0030}	DA	2	
Patient's Sex	{0010,0040}	CS	2	

9.1.1.2.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	{0020,000D}	UI	1	
Study Date	{0008,0020}	DA	2	
Study Time	{0008,0030}	TM	2	
Referring Physician's Name	{0008,0090}	PN	2	
Study ID	{0020,0010}	SH	2	
Study Description	{0008,1030}	LO	3	

9.1.1.2.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	{0008,0060}	CS	1	Can only be updated by the driver to: RTRECORD.
Series Instance UID	{0020,000E}	UI	1	
Series Number	{0020,0011}	IS	2	
Operators' Name	{0008,1070}	PN	2	

9.1.1.2.4 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	{0008,0070}	LO	2	
Manufacturer's Model Name	{0008,1090}	LO	3	
Software Versions	{0018,1020}	LO	3	

9.1.1.2.5 RT General Treatment Record Module

Attribute name	Tag	Vr	Type	Comment
Instance Number	{0020,0013}	IS	1	

Treatment Date	{3008,0250}	DA	2	
Treatment Time	{3008,0251}	TM	2	
Referenced RT Plan Sequence	{300C,0002}	SQ	2	
>Referenced SOP Class UID	{0008,1150}	UI	1	
>Referenced SOP Instance UID	{0008,1155}	UI	1	
Referenced Treatment Record Sequence	{3008,0030}	SQ	3	
>Referenced SOP Class UID	{0008,1150}	UI	1	
>Referenced SOP Instance UID	{0008,1155}	UI	1	

9.1.1.2.6 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	{300A,0180}	SQ	1	
>Patient Setup Number	{300A,0182}	IS	1	
>Patient Position	{0018,5100}	CS	1C	
>Setup Technique	{300A,01B0}	CS	3	

9.1.1.2.7 RT Treatment Machine Record Module

Attribute name	Tag	Vr	Type	Comment
Treatment Machine Sequence	{300A,0206}	SQ	1	
>Manufacturer	{0008,0070}	LO	2	
>Institution Name	{0008,0080}	LO	2	
>Manufacturer's Model Name	{0008,1090}	LO	2	
>Device Serial Number	{0018,1000}	LO	2	

9.1.1.2.8 RT Beams Session Record Module

Attribute name	Tag	Vr	Type	Comment
Number of Fractions Planned	{300A,0078}	IS	2	
Primary Dosimeter Unit	{300A,00B3}	CS	1	
Treatment Session Beam Sequence	{3008,0020}	SQ	1	
>Referenced Beam Number	{300C,0006}	IS	3	
>Beam Name	{300A,00C2}	LO	3	
>Beam Type	{300A,00C4}	CS	1	
>Radiation Type	{300A,00C6}	CS	1	
>Beam Limiting Device Leaf Pairs Sequence	{3008,00A0}	SQ	1	
>>RT Beam Limiting Device Type	{300A,00B8}	CS	1	
>>Number of Leaf/Jaw Pairs	{300A,00BC}	IS	1	
>Referenced Patient Setup Number	{300C,006A}	IS	3	
>Number of Wedges	{300A,00D0}	IS	1	
>Number of Compensators	{300A,00E0}	IS	2	
>Number of Boli	{300A,00ED}	IS	2	
>Number of Blocks	{300A,00F0}	IS	2	
>Current Fraction Number	{3008,0022}	IS	2	
>Treatment Delivery Type	{300A,00CE}	CS	2	
>Treatment Termination Status	{3008,002A}	CS	1	
>Treatment Verification Status	{3008,002C}	CS	2	
>Specified Primary Meterset	{3008,0032}	DS	3	
>Delivered Primary Meterset	{3008,0036}	DS	3	

>Number of Control Points	{300A,0110}	IS	1	
>Control Point Delivery Sequence	{3008,0040}	SQ	1	
>>Referenced Control Point Index	{300C,00F0}	IS	3	
>>Treatment Control Point Date	{3008,0024}	DA	1	
>>Treatment Control Point Time	{3008,0025}	TM	1	
>>Specified Meterset	{3008,0042}	DS	2	
>>Delivered Meterset	{3008,0044}	DS	1	
>>Nominal Beam Energy	{300A,0114}	DS	3	
>>Wedge Position Sequence	{300A,0116}	SQ	3	
>>>Referenced Wedge Number	{300C,00C0}	IS	1	
>>>Wedge Position	{300A,0118}	CS	1	
>>Gantry Angle	{300A,011E}	DS	1C	
>>Gantry Rotation Direction	{300A,011F}	CS	1C	
>>Beam Limiting Device Angle	{300A,0120}	DS	1C	
>>Beam Limiting Device Rotation Direction	{300A,0121}	CS	1C	
>>Patient Support Angle	{300A,0122}	DS	1C	
>>Patient Support Rotation Direction	{300A,0123}	CS	1C	
>>Table Top Pitch Angle	{300A,0140}	FL	1C	
>>Table Top Pitch Rotation Direction	{300A,0142}	CS	1C	
>>Table Top Roll Angle	{300A,0144}	FL	1C	
>>Table Top Roll Rotation Direction	{300A,0146}	CS	1C	
>>Table Top Vertical Position	{300A,0128}	DS	2C	
>>Table Top Longitudinal Position	{300A,0129}	DS	2C	
>>Table Top Lateral Position	{300A,012A}	DS	2C	

9.1.1.2.9 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	{0008,0016}	UI	1	
SOP Instance UID	{0008,0018}	UI	1	

9.1.1.3 RT Beams Delivery InstructionRETIRED IOD

IE	Module	Used
Patient	Patient Module	Yes
	Clinical Trial Subject Module	No
Study	General Study Module	Yes
	Patient Study Module	No
	Clinical Trial Study Module	No
Series	General Series Module	Yes
	Clinical Trial Series Module	No
Equipment	General Equipment Module	Yes
Plan	RT Beams Delivery Instruction Module	Yes
	Common Instance Reference Module	No
	General Reference Module	No
	SOP Common Module	Yes

9.1.1.3.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
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Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Can only be updated by the driver to: M, F, O.

9.1.1.3.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

9.1.1.3.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Can only be updated by the driver to: PLAN.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Series Description	(0008,103E)	LO	3	

9.1.1.3.4 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	
Station Name	(0008,1010)	SH	3	

9.1.1.3.5 RT Beams Delivery Instruction Module

Attribute name	Tag	Vr	Type	Comment
Beam Task Sequence	(0074,1020)	SQ	1	
>Beam Task Type	(0074,1022)	CS	1	Can only be updated by the driver to: TREAT - Treat
>Treatment Delivery Type	(300A,00CE)	CS	1	Can only be updated by the driver to: TREATMENT, CONTINUATION.
>Continuation Start Meterset	(0074,0120)	FD	1C	
>Continuation End Meterset	(0074,0121)	FD	1C	
>Current Fraction Number	(3008,0022)	IS	1	
>Referenced Beam Number	(300C,0006)	IS	1	
>Table Top Vertical Setup Displacement	(300A,01D2)	DS	2	
>Table Top Longitudinal Setup Displacement	(300A,01D4)	DS	2	
>Table Top Lateral Setup Displacement	(300A,01D6)	DS	2	
>Referenced RT Plan Sequence	(300C,0002)	SQ	3	
>>Referenced Series Sequence	(0008,1115)	SQ	1C	
>>>Series Instance UID	(0020,000E)	UI	1	
>>>Retrieve AE Title	(0008,0054)	AE		
>>>Referenced SOP Sequence	(0008,1199)	SQ	1	
>>>>Referenced SOP Class UID	(0008,1150)	UI	1	

>>>Referenced SOP Instance UID	{0008,1155}	UI	1	
>>Study Instance UID	{0020,0000}	UI	1	
Omitted Beam Task Sequence	{300C,0111}	SQ	3	
>Referenced Beam Number	{300C,0006}	IS	1	
>Reason for Omission	{300C,0112}	CS	1	Can only be updated by the driver to: ALREADY_TREATED.

9.1.1.3.6 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	{0008,0016}	UI	1	
SOP Instance UID	{0008,0018}	UI	1	
Specific Character Set	{0008,0005}	CS	1C	
Instance Creation Date	{0008,0012}	DA	3	
Instance Creation Time	{0008,0013}	TM	3	

9.1.1.4 Unified Procedure Step RETIRED IOD

IE	Module	Used
Unified Procedure Step	SOP Common Module	Yes
	Unified Procedure Step Relationship Module	Yes
	Unified Procedure Step Scheduled Procedure Information Module	Yes
	Unified Procedure Step Progress Information Module	Yes
	Unified Procedure Step Performed Procedure Information Module	No
	Patient Demographic Module	No
	Patient Medical Module	No
	Visit Identification Module	No
	Visit Status Module	No
	Visit Admission Module	No
	Transaction Module	Yes

9.1.1.4.1 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	{0008,0016}	UI	1	
SOP Instance UID	{0008,0018}	UI	1	
Timezone Offset From UTC	{0008,0201}	SH	3	

9.1.1.4.2 Unified Procedure Step Relationship Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	{0010,0010}	PN		
Patient ID	{0010,0020}	LO		
Patient's Birth Date	{0010,0030}	DA		
Patient's Sex	{0010,0040}	CS		Can only be updated by the driver to: • M - Male • F - Female • 0 - Other
Referenced Request Sequence	{0040,A370}	SQ		
>Requested Procedure Code Sequence	{0032,1064}	SQ		
>>Code Value	{0008,0100}	SH	1C	
>>Coding Scheme Designator	{0008,0102}	SH	1C	
>>Coding Scheme Version	{0008,0103}	SH	1C	

>>Code Meaning	(0008,0104)	LO	1	
>Requested Procedure ID	(0040,1001)	SH		

9.1.1.4.3 Unified Procedure Step Scheduled Procedure Information Module

Attribute name	Tag	Vr	Type	Comment
Scheduled Procedure Step Priority	(0074,1200)	CS		Can only be updated by the driver to: - HIGH - High - MEDIUM - Medium - LOW - Low
Procedure Step Label	(0074,1204)	LO		
Scheduled Station Name Code Sequence	(0040,4025)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	
Scheduled Procedure Step Start DateTime	(0040,4005)	DT		
Expected Completion DateTime	(0040,4011)	DT		
Scheduled Workitem Code Sequence	(0040,4018)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	
Scheduled Processing Parameters Sequence	(0074,1210)	SQ		
>Value Type	(0040,A040)	CS	1	Can only be updated by the driver to: TEXT - Text
>Concept Name Code Sequence	(0040,A043)	SQ	1	
>>Code Value	(0008,0100)	SH	1C	
>>Coding Scheme Designator	(0008,0102)	SH	1C	
>>Code Meaning	(0008,0104)	LO	1	
>Text Value	(0040,A160)	UT	1C	
Input Information Sequence	(0040,4021)	SQ		
>Study Instance UID	(0020,0000)	UI	1	
>Referenced Series Sequence	(0008,1115)	SQ	1C	
>>Series Instance UID	(0020,000E)	UI	1	
>>Retrieve AE Title	(0008,0054)	AE		
>>Referenced SOP Sequence	(0008,1199)	SQ	1	
>>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>>Referenced SOP Instance UID	(0008,1155)	UI	1	
Study Instance UID	(0020,0000)	UI		
Input Availability Flag	(0040,4020)	CS	1	Can only be updated by the driver to: - COMPLETE - Complete - INCOMPLETE - Incomplete

9.1.1.4.4 Unified Procedure Step Progress Information Module

Attribute name	Tag	Vr	Type	Comment
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Procedure Step State	(0074,1000)	CS		Can only be updated by the driver to: • SCHEDULED - Scheduled • IN PROGRESS - In Progress • CANCELED - Canceled • COMPLETED - Completed
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9.1.1.4.5 Transaction Module

Attribute name	Tag	Vr	Type	Comment
Transaction UID	(0008,1195)	UI	3	

9.1.2 Usage of Attributes From Received IODs

9.1.2.1 CT Image IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	No
Image	General Image Module	No
	Image Plane Module	No
	Image Pixel Module	No
	Contrast/Bolus Module	No
	CT Image Module	Yes
	Multi-energy CT Image Module	No
	SOP Common Module	Yes

9.1.2.1.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	

9.1.2.1.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,0000)	UI	1	

9.1.2.1.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Series Description	(0008,103E)	LO	3	
Patient Position	(0018,5100)	CS	2C	

9.1.2.1.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	

9.1.2.1.5 CT Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	Value not read
Samples per Pixel	(0028,0002)	US	1	Value not read
Photometric Interpretation	(0028,0004)	CS	1	Value not read
Bits Allocated	(0028,0100)	US	1	Value not read
Bits Stored	(0028,0101)	US	1	Value not read
High Bit	(0028,0102)	US	1	Value not read
Rescale Intercept	(0028,1052)	DS	1	Value not read
Rescale Slope	(0028,1053)	DS	1	Value not read
KVP	(0018,0060)	DS	2	If larger than 1000 the image received will be registered as an MVCT instead of as an CBCT.
Table Height	(0018,1130)	DS	3	
Patient Support Angle	(300A,0122)	DS	3	
Table Top Pitch Angle	(300A,0140)	FL	3	
Table Top Roll Angle	(300A,0144)	FL	3	
Table Top Longitudinal Position	(300A,0129)	DS	3	
Table Top Lateral Position	(300A,012A)	DS	3	

9.1.2.1.6 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.2 RT Structure Set IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	No
Structure Set	Structure Set Module	Yes
	ROI Contour Module	Yes
	RT ROI Observations Module	Yes
	SOP Common Module	Yes

9.1.2.2.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	

9.1.2.2.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.2.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.2.4 Structure Set Module

Attribute name	Tag	Vr	Type	Comment
Structure Set Label	{3006,0002}	SH	1	Value not read
Referenced Frame of Reference Sequence	{3006,0010}	SQ	3	
>Frame of Reference UID	{0020,0052}	UI	1	Value not read
>RT Referenced Study Sequence	{3006,0012}	SQ	3	
>>Referenced SOP Class UID	{0008,1150}	UI	1	Value not read
>>Referenced SOP Instance UID	{0008,1155}	UI	1	Value not read
>>RT Referenced Series Sequence	{3006,0014}	SQ	1	
>>>Series Instance UID	{0020,000E}	UI	1	
>>>Contour Image Sequence	{3006,0016}	SQ	1	
>>>>Referenced SOP Class UID	{0008,1150}	UI	1	
>>>>Referenced SOP Instance UID	{0008,1155}	UI	1	
Structure Set ROI Sequence	{3006,0020}	SQ	1	Value not read

9.1.2.2.5 ROI Contour Module

Attribute name	Tag	Vr	Type	Comment
ROI Contour Sequence	{3006,0039}	SQ	1	
>Referenced ROI Number	{3006,0084}	IS	1	
>Contour Sequence	{3006,0040}	SQ	3	
>>Contour Geometric Type	{3006,0042}	CS	1	Value not read
>>Number of Contour Points	{3006,0046}	IS	1	Value not read
>>Contour Data	{3006,0050}	DS	1	

9.1.2.2.6 RT ROI Observations Module

Attribute name	Tag	Vr	Type	Comment
RT ROI Observations Sequence	{3006,0080}	SQ	1	
>Observation Number	{3006,0082}	IS	1	Value not read
>Referenced ROI Number	{3006,0084}	IS	1	
>RT ROI Interpreted Type	{3006,00A4}	CS	2	
>ROI Physical Properties Sequence	{3006,00B0}	SQ	3	
>>ROI Physical Property	{3006,00B2}	CS	1	
>>ROI Physical Property Value	{3006,00B4}	DS	1	

9.1.2.2.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	{0008,0016}	UI	1	
SOP Instance UID	{0008,0018}	UI	1	

9.1.2.3 RT Plan IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Patient Setup Module	Yes

	RT Fraction Scheme Module	Yes
	RT Beams Module	Yes
	RT Brachy Application Setups Module	No
	SOP Common Module	Yes

9.1.2.3.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	

9.1.2.3.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

9.1.2.3.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.3.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	

9.1.2.3.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Software Versions	(0018,1020)	LO	3	

9.1.2.3.6 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
RT Plan Label	(300A,0002)	SH	1	
RT Plan Geometry	(300A,000C)	CS	1	Value not read

9.1.2.3.7 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	(300A,0180)	SQ	1	
>Patient Setup Number	(300A,0182)	IS	1	
>Patient Position	(0018,5100)	CS	1C	
>Setup Technique	(300A,01B0)	CS	3	

9.1.2.3.8 RT Fraction Scheme Module

Attribute name	Tag	Vr	Type	Comment
Fraction Group Sequence	(300A,0070)	SQ	1	
>Fraction Group Number	(300A,0071)	IS	1	Value not read

>Number of Fractions Planned	(300A,0078)	IS	2	
>Number of Beams	(300A,0080)	IS	1	Value not read
>Number of Brachy Application Setups	(300A,00A0)	IS	1	Value not read

9.1.2.3.9 RT Beams Module

Attribute name	Tag	Vr	Type	Comment
Beam Sequence	(300A,00B0)	SO	1	
>Beam Number	(300A,00C0)	IS	1	
>Beam Name	(300A,00C2)	LO	3	
>Beam Type	(300A,00C4)	CS	1	
>Radiation Type	(300A,00C6)	CS	2	
>Beam Limiting Device Sequence	(300A,00B6)	SO	1	Value not read
>Treatment Delivery Type	(300A,00CE)	CS	3	
>Number of Wedges	(300A,00D0)	IS	1	
>Number of Compensators	(300A,00E0)	IS	1	
>Number of Boli	(300A,00ED)	IS	1	
>Number of Blocks	(300A,00F0)	IS	1	
>Number of Control Points	(300A,0110)	IS	1	Value not read
>Control Point Sequence	(300A,0111)	SO	1	
>>Control Point Index	(300A,0112)	IS	1	
>>Nominal Beam Energy	(300A,0114)	DS	3	
>>Gantry Angle	(300A,011E)	DS	1C	
>>Gantry Rotation Direction	(300A,011F)	CS	1C	
>>Beam Limiting Device Angle	(300A,0120)	DS	1C	
>>Beam Limiting Device Rotation Direction	(300A,0121)	CS	1C	
>>Patient Support Angle	(300A,0122)	DS	1C	
>>Patient Support Rotation Direction	(300A,0123)	CS	1C	
>>Table Top Pitch Angle	(300A,0140)	FL	1C	
>>Table Top Pitch Rotation Direction	(300A,0142)	CS	1C	
>>Table Top Roll Angle	(300A,0144)	FL	1C	
>>Table Top Roll Rotation Direction	(300A,0146)	CS	1C	
>>Table Top Vertical Position	(300A,0128)	DS	2C	
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>>Table Top Lateral Position	(300A,012A)	DS	2C	
>>Isocenter Position	(300A,012C)	DS	2C	

9.1.2.3.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	
RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
RaySearch Checksum Algorithm Version	(4001,1060)	LO	3	RaySearch checksum algorithm version used to calculate the checksum of the plan.
RaySearch Checksum Data	(4001,1061)	OB	3	RaySearch custom checksum calculation specific for the current checksum algorithm version.

9.1.2.4 RT Beams Treatment Record IOD

IE	Module	Used
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Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	No
Treatment Record	RT General Treatment Record Module	Yes
	RT Patient Setup Module	Yes
	RT Treatment Machine Record Module	Yes
	RT Beams Session Record Module	Yes
	SOP Common Module	Yes
	Common Instance Reference Module	Yes

9.1.2.4.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	{0010,0010}	PN	2	
Patient ID	{0010,0020}	LO	2	
Patient's Birth Date	{0010,0030}	DA	2	
Patient's Sex	{0010,0040}	CS	2	

9.1.2.4.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	{0020,0000}	UI	1	

9.1.2.4.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	{0008,0060}	CS	1	Value not read
Series Instance UID	{0020,000E}	UI	1	

9.1.2.4.4 RT General Treatment Record Module

Attribute name	Tag	Vr	Type	Comment
Instance Number	{0020,0013}	IS	1	Value not read
Treatment Date	{3008,0250}	DA	2	
Treatment Time	{3008,0251}	TM	2	
Referenced RT Plan Sequence	{300C,0002}	SQ	2	
>Referenced SOP Class UID	{0008,1150}	UI	1	
>Referenced SOP Instance UID	{0008,1155}	UI	1	

9.1.2.4.5 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	{300A,0180}	SQ	1	
>Patient Setup Number	{300A,0182}	IS	1	Value not read

9.1.2.4.6 RT Treatment Machine Record Module

Attribute name	Tag	Vr	Type	Comment
Treatment Machine Sequence	{300A,0206}	SQ	1	
>Treatment Machine Name	{300A,00B2}	SH	2	Used for validation purposes when reading treatment record from disk.

9.1.2.4.7 RT Beams Session Record Module

Attribute name	Tag	Vr	Type	Comment
Primary Dosimeter Unit	{300A,00B3}	CS	1	
Treatment Session Beam Sequence	{3008,0020}	SQ	1	

>Referenced Beam Number	{300C,0006}	IS	3	
>Beam Name	{300A,00C2}	LO	3	
>Beam Type	{300A,00C4}	CS	1	Value not read
>Radiation Type	{300A,00C6}	CS	1	Value not read
>Beam Limiting Device Leaf Pairs Sequence	{3008,00A0}	SQ	1	Value not read
>Number of Wedges	{300A,00D0}	IS	1	Value not read
>Current Fraction Number	{3008,0022}	IS	2	
>Treatment Delivery Type	{300A,00CE}	CS	2	
>Treatment Termination Status	{3008,002A}	CS	1	
>Specified Primary Meterset	{3008,0032}	DS	3	
>Specified Secondary Meterset	{3008,0033}	DS	3	
>Delivered Primary Meterset	{3008,0036}	DS	3	
>Delivered Secondary Meterset	{3008,0037}	DS	3	
>Specified Treatment Time	{3008,003A}	DS	3	
>Delivered Treatment Time	{3008,003B}	DS	3	
>Number of Control Points	{300A,0110}	IS	1	Value not read
>Control Point Delivery Sequence	{3008,0040}	SQ	1	
>>Treatment Control Point Date	{3008,0024}	DA	1	Value not read
>>Treatment Control Point Time	{3008,0025}	TM	1	Value not read
>>Delivered Meterset	{3008,0044}	DS	1	
>>Gantry Angle	{300A,011E}	DS	1C	
>>Patient Support Angle	{300A,0122}	DS	1C	
>>Table Top Pitch Angle	{300A,0140}	FL	1C	
>>Table Top Roll Angle	{300A,0144}	FL	1C	
>>Table Top Vertical Position	{300A,0128}	DS	2C	
>>Table Top Longitudinal Position	{300A,0129}	DS	2C	
>>Table Top Lateral Position	{300A,012A}	DS	2C	
>Tomo Registration	{300D,0010}	LO	3	TOMO_HA_01
>Tomo Registration Translation	{300D,10B0}	DS	3	
>Tomo Registration Rotation	{300D,10B1}	DS	3	
>Tomo bug Hi art 3.6.1	{300D,0010}	LO	3	LO
>Tomo Registration Translation Bug	{300D,10B0}	DS	3	
>Tomo Registration Rotation Bug	{300D,10B1}	SH	3	

9.1.2.4.8 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	{0008,0016}	UI	1	
SOP Instance UID	{0008,0018}	UI	1	

9.1.2.4.9 Common Instance Reference Module

Attribute name	Tag	Vr	Type	Comment
Referenced Series Sequence	{0008,1115}	SQ	1C	
>Series Instance UID	{0020,000E}	UI	1	Used to find the series of the Referenced RT Plan {300C,0002}.
>Referenced Instance Sequence	{0008,114A}	SQ	1	
>>Referenced SOP Class UID	{0008,1150}	UI	1	Used to find the series of the Referenced RT Plan {300C,0002}.
>>Referenced SOP Instance UID	{0008,1155}	UI	1	Used to find the series of the Referenced RT Plan {300C,0002}.

9.1.2.5 Spatial Registration IOO

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
	Spatial Registration Series Module	No
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	No
Spatial Registration	Spatial Registration Module	Yes
	Common Instance Reference Module	Yes
	SOP Common Module	Yes

9.1.2.5.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	{0010,0010}	PN	2	
Patient ID	{0010,0020}	LO	2	
Patient's Birth Date	{0010,0030}	DA	2	
Patient's Sex	{0010,0040}	CS	2	

9.1.2.5.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	{0020,0000}	UI	1	

9.1.2.5.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	{0008,0060}	CS	1	Value not read
Series Instance UID	{0020,000E}	UI	1	
Patient Position	{0018,5100}	CS	2C	

9.1.2.5.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	{0020,0052}	UI	1	

9.1.2.5.5 Spatial Registration Module

Attribute name	Tag	Vr	Type	Comment
Content Date	{0008,0023}	DA	1	Value not read
Content Time	{0008,0033}	TM	1	Value not read
Instance Number	{0020,0013}	IS	1	Value not read
Content Label	{0070,0080}	CS	1	Value not read
Registration Sequence	{0070,0308}	SQ	1	
>Frame of Reference UID	{0020,0052}	UI	1C	
>Referenced Image Sequence	{0008,1140}	SQ	1C	
>>Referenced SOP Class UID	{0008,1150}	UI	1	
>>Referenced SOP Instance UID	{0008,1155}	UI	1	
>Matrix Registration Sequence	{0070,0309}	SQ	1	
>>Matrix Sequence	{0070,030A}	SQ	1	
>>>Frame of Reference Transformation Matrix	{3006,00C6}	DS	1	
>>>Frame of Reference Transformation Matrix Type	{0070,030C}	CS	1	Value not read

9.1.2.5.6 Common Instance Reference Module

Attribute name	Tag	Vr	Type	Comment
Referenced Series Sequence	(0008,1115)	SQ	1C	
>Series Instance UID	(0020,000E)	UI	1	Used to match RT Struct and Image against Spatial registration
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>Referenced SOP Instance UID	(0008,1155)	UI	1	

9.1.2.5.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.6 RT Beams Delivery Instruction RETIRED IOD

IE	Module	Used
Patient	Patient Module	No
	Clinical Trial Subject Module	No
Study	General Study Module	Yes
	Patient Study Module	No
	Clinical Trial Study Module	No
Series	General Series Module	Yes
	Clinical Trial Series Module	No
Equipment	General Equipment Module	No
Plan	RT Beams Delivery Instruction Module	Yes
	Common Instance Reference Module	No
	General Reference Module	No
	SOP Common Module	Yes

9.1.2.6.1 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.6.2 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.6.3 RT Beams Delivery Instruction Module

Attribute name	Tag	Vr	Type	Comment
Beam Task Sequence	(0074,1020)	SQ	1	
>Beam Task Type	(0074,1022)	CS	1	Value not read
>Treatment Delivery Type	(300A,00CE)	CS	1	Supported values: TREATMENT, CONTINUATION.
>Continuation Start Meterset	(0074,0120)	FD	1C	
>Continuation End Meterset	(0074,0121)	FD	1C	
>Current Fraction Number	(3008,0022)	IS	1	Value not read
>Referenced Beam Number	(300C,0006)	IS	1	
Omitted Beam Task Sequence	(300C,0111)	SQ	3	
>Referenced Beam Number	(300C,0006)	IS	1	
>Reason for Omission	(300C,0112)	CS	1	Value not read

9.1.2.6.4 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.7 Unified Procedure Step RETIRED IOD

IE	Module	Used
Unified Procedure Step	SOP Common Module	Yes
	Unified Procedure Step Relationship Module	Yes
	Unified Procedure Step Scheduled Procedure Information Module	Yes
	Unified Procedure Step Progress Information Module	Yes
	Unified Procedure Step Performed Procedure Information Module	No
	Patient Demographic Module	No
	Patient Medical Module	No
	Visit Identification Module	No
	Visit Status Module	No
	Visit Admission Module	No
	Transaction Module	Yes

9.1.2.7.1 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Value not read
SOP Instance UID	(0008,0018)	UI	1	
Timezone Offset From UTC	(0008,0201)	SH	3	

9.1.2.7.2 Unified Procedure Step Relationship Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN		
Patient ID	(0010,0020)	LO		

9.1.2.7.3 Unified Procedure Step Scheduled Procedure Information Module

Attribute name	Tag	Vr	Type	Comment
Scheduled Station Name Code Sequence	(0040,4025)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	Value not read
Scheduled Procedure Step Start DateTime	(0040,4005)	DT		The date used to filter the UPSs to return in the worklist query. Supports either a range in the format 'yyyyMMddHHmmss-yyyymmddHHmmss' or a single date in the format 'yyyymmddHHmmss'.
Scheduled Workitem Code Sequence	(0040,4018)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	
Study Instance UID	(0020,000D)	UI		
Input Availability Flag	(0040,4020)	CS	1	Value not read

9.1.2.7.4 Unified Procedure Step Progress Information Module

Attribute name	Tag	Vr	Type	Comment
Procedure Step State	(0074,1000)	CS		

Procedure Step Progress Information Sequence	(0074,1002)	SQ		
>Procedure Step Progress	(0074,1004)	DS		
>Procedure Step Progress Description	(0074,1006)	ST		

9.1.2.7.5 Transaction Module

Attribute name	Tag	Vr	Type	Comment
Transaction UID	(0008,1195)	UI	3	

9.1.3 Attribute Mapping

Not applicable

9.1.4 Coerced/Modified Fields

Not applicable

9.2 DATA DICTIONARY OF PRIVATE ATTRIBUTES

All used Private Creators are listed in the table below. Usage of Private Attributes are listed in each module specification.

Attribute name	Tag	VR	VM	Value
RaySearch Private Creator	(4001,0010)	LO	1	RAYSEARCHLABS 2.0
Tomo bug Hi art 3.6.1	(3000,0010)	LO	1	LO
Tomo Registration	(3000,0010)	LO	1	TOMO_HA_01

9.3 CODE TERMINOLOGY AND TEMPLATES

Not applicable

9.4 GRAYSCALE IMAGE CONSISTENCY

Not applicable

9.5 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOP CLASSES

9.5.1 Standard extended SOP Class

9.5.2 Specialized SOP Class

Not applicable

9.5.3 Private SOP Class

Not applicable

9.6 PRIVATE TRANSFER SYNTAXES

Not applicable



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