Digital Imaging and Communications in Medicine (DICOM)

Supplement 127: CT Radiation Dose Reporting (Dose SR)

DICOM Standards Committee

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Scope and Field

This supplement to the DICOM standard introduces a template for Diagnostic X-ray CT Dose Reporting in DICOM. The concepts of Structured Reporting will be used in this context.

This document is a Supplement to the DICOM Standard. It is an extension to the following parts of the published DICOM Standard:

PS 3.3	Information Object Definitions
PS 3.16	Content Mapping Resource
PS 3.17	Explanatory Information

The supplement was developed by WG21 (Computed Tomography). In this supplement, radiation-related aspects of CT have been addressed with the advice of the International Electrotechnical Commission Subcommittee 62B (Diagnostic Imaging Equipment) Maintenance Team 38 (Computed Tomography). This report is based upon measurements in accordance with IEC 60601-2-44.

The Computed Tomography X-ray dose report is based on the SOP class of “X-ray Radiation Dose SR”. Specific templates for the recording of the dose and the acquisition parameters in a CT environment have been developed.

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Changes to NEMA Standards Publication PS 3.3-2007

74 ## Digital Imaging and Communications in Medicine (DICOM)

Part 3: Information Object Definitions

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Item #01: Change PS3.3 Section A.35.8.3.1.1:

A.35.8.3.1 X-ray Radiation Dose SR IOD Content Constraints

A.35.8.3.1.1 Template

The document may be constructed from Baseline TID 10001 "Projection X-ray Radiation Dose " **or Baseline TID 10011 "CT Radiation Dose"** (defined in PS3.16) invoked at the root node.

Note: This IOD may be used with other Templates defined for Dose Reporting. Such other Templates may be specialized for specific modalities or future dose measurement techniques.

Item #02: Change PS3.3 Section A.35.8.3.1.3:

A.35.8.3.1.3 Relationship Constraints

……

Table A.35.8-2

RELATIONSHIP CONTENT CONSTRAINTS FOR X-RAY RADIATION DOSE SR IOD

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
…	…	….
CONTAINER	**HAS OBS CONTEXT**	**DATETIME, CODE, TEXT, UIDREF, PNAME**
…	…	….

Change PS 3.3, C.8.15.3.8

C.8.15.3.8 CT Exposure Macro

Table C.8-124 specifies the attributes of the CT Exposure Functional Group Macro.

Table C.8-124
CT EXPOSURE MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
…			

Note: The dose that a patient receives in a given procedure ~~**should be found in the Radiation Module of the relevant Modality Performed Procedure Step IOD**~~ **may be reported in one or more instances of the Radiation Dose Report SOP Class using the CT Radiation Dose Template TID 10011.**

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108 **Changes to NEMA Standards Publication PS 3.16-2007**

Digital Imaging and Communications in Medicine (DICOM)

110 **Part 16: Content Mapping Resource**

Item #03: Add new Section to Annex A

CT RADIATION DOSE SR IOD TEMPLATES

The templates that comprise the CT Radiation Dose SR are interconnected as in Figure A-x.1

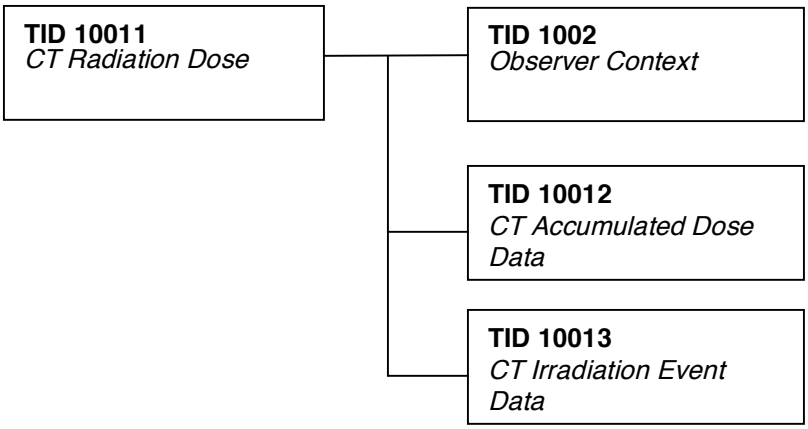

Figure A.x-1: CT Radiation Dose SR IOD Template Structure

TID 10011 CT Radiation Dose

This template defines a container (the root) with subsidiary content items, each of which corresponds to a single CT X-ray irradiation event entry. There is a defined recording observer (the system or person responsible for recording the log, generally the system). Accumulated values shall be kept for a whole Study or at least a part of a Study, if the Study is divided in the workflow of the examination, or a performed procedure step. Multiple CT Radiation Dose objects may be created for one Study.

TID 10011
CT RADIATION DOSE
Type: Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113701, DCM, “X-ray Radiation Dose Report”)	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, ”Procedure reported”)	1	M		EV (P5-08000,SRT, “Computed Tomography X-ray”)
3	>		INCLUDE	DTID (1002) Observer Context	1-n	M		
4	>	HAS OBS CONTEXT	DATETIME	EV (113809, DCM, “Start of X-ray Irradiation”)	1	M		

5	>	HAS OBS CONTEXT	DATETIME	EV (113810, DCM, “End of X-ray Irradiation”)	1	M		
6	>	HAS OBS CONTEXT	CODE	EV (113705, DCM, “Scope of Accumulation”)	1	M		DCID (10000) Scope of Accumulation
7	>>	HAS PROPERTIES	UIDREF	DCID (10001) UID Types	1	M		
8	>	CONTAINS	INCLUDE	DTID (10012) CT Accumulated Dose Data	1	M		
9	>	CONTAINS	INCLUDE	DTID (10013) CT Irradiation Event Data	1-n	M		
10	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

128 **Content Item Descriptions**

Row 3	The observer context may include both a Person Observer identification, as well as the identity of the equipment providing the values for the irradiation event (Device Observer identification), if not inherited.
Row 4	Start, Date Time of the first CT Irradiation Event of the accumulation
Row 5	End, Date Time of the last CT Irradiation Event of the accumulation

130 **TID 10012 CT Accumulated Dose Data**

This general template provides detailed information on CT X-ray dose value accumulations over several
132 irradiation events from the same equipment and over the scope of accumulation specified for the report (typically a Study or a Performed Procedure Step).

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136 **TID 10012**
CT ACCUMULATED DOSE DATA
Type: Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113811, DCM, ”CT Accumulated Dose Data”)	1	M		
2	>	CONTAINS	NUM	EV (113812, DCM, “Total Number of Irradiation Events”)	1	M		Units = EV ({events} UCUM, “events”)
3	>	CONTAINS	NUM	EV (113813, DCM, “CT Dose Length Product Total”)	1	M		Units = EV (mGycm, UCUM, “mGycm”)
4	>	CONTAINS	NUM	EV (113814, DCM, “CT Effective Dose Total”)	1	U		Units = EV (mSv, UCUM, “mSv”)
5	>>	HAS PROPERTIES	TEXT	EV (121406,DCM, “Reference Authority”)	1	MC	XOR row 6	

6	>>	HAS PROPERTIES	CODE	EV (121406,DCM, “Reference Authority”)	1	MC	XOR row 5	DCID (10015) CT Dose Reference Authority
7	>>	HAS CONCEPT MOD	CODE	EV (G-C036,SRT, “Measurement Method”)	1	M		DCID (10011) Effective Dose Evaluation Method
8	>>	HAS PROPERTIES	TEXT	EV (113815,DCM, “Patient Model”)	1	MC	IF the value of row 7 equals (113800, DCM, “DLP to E conversion via MC computation”) or equals (113801, DCM, “CTDIfreeair to E conversion via MC computation”)	
9	>>	HAS PROPERTIES	CONTAINER	EV (113816, DCM, “Condition Effective Dose measured”)	1	MC	IF the value of row 7 equals (113802, DCM, “DLP to E conversion via measurement”) or equals (113803, DCM, “CTDIfreeair to E conversion via measurement”)	
10	>>>	CONTAINS	TEXT	EV (113817,DCM, “Effective Dose Phantom Type”)	1	M		
11	>>>	CONTAINS	TEXT	EV (113818, DCM, “Dosimeter Type”)	1	M		
12	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

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Content Item Descriptions

Row 2	Total Number of CT irradiation events . A CT irradiation event is one continuous irradiation procedure and is defined through consistent acquisition parameters. In the case of dose modulation the calculations are based on the effective parameters (e.g. the effective mA recorded in the Mean X-ray Tube Current), and these acquisition parameters are consistent.
Row 3	The Dose Length Product (DLP) is calculated for every irradiation event. The Dose Length Product Total is the sum of the DLP values. The calculation is based on the $CTDI_{vol}$ result of each irradiation event.
Row 4	Effective dose (E, in units of mSv) evaluated as a total over the scope is defined in Row 6 of template TID 10011. Effective dose is defined by the reference in Rows 5 or 6 of this template. It may be calculated from a product of DLP and an ‘Effective Dose Conversion Factor’ (E/DLP). Or it may be calculated from a product of the Mean CTDIfree air and the ratio E/CTDIfree air. The ratios E/DLP or E/CTDIfree air may be evaluated either from computer simulations applying Monte Carlo (MC) sampling techniques or from dosimetric measurements in an anthropomorphic phantom, e.g., the Alderson-Rando phantom.. The specific method used is identified in Rows 7 through 11.
Row 5 - 6	Reference of the base publication defining the Effective Dose, either as a coded value, or a textual bibliographic reference. ICRP Publication 60 shall be referenced using the assigned coded value.
Row 7	Description of the method used for Effective Dose evaluations.
Row 8	Description of the reference-patient mathematical or computational model used when Effective Dose is derived via Monte Carlo simulations of radiation transport in such models. Examples of publications which specify particular reference patient models are NUREG/CR-1159, ORNL/NUREG/TM-367 (1980); NRPB-R186 (1985); GSF-Bericht S-885 (1986); Fill et al., Health Physics Vol. 86 (3): 253-272 (2004).
Row 9	Description of the condition Effective Dose measured

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TID 10013 CT Irradiation Event Data

144 This template conveys the dose and equipment parameters of a single irradiation event.

A CT irradiation event is the occurrence of irradiation being applied to a patient in single continuous time-
146 frame between the start (release) and the stop (cease) of the irradiation. Any on-off switching of the radiation source during the event shall not be treated as separate events; rather the event includes the
148 time between start and stop of radiation as triggered by the user, e.g., a single sequence of scanning comprised of multiple slices acquired with successive tube rotations and table increments shall be treated
150 as a single irradiation event. Depending on the examination workflow and the anatomical target region the CT irradiation event data may split into multiple instances of this template for better dose estimation. The
152 irradiation event is the “smallest” information entity to be recorded in the realm of Radiation Dose reporting. Individual Irradiation Events are described by a set of accompanying physical parameters that are
154 sufficient to understand the “quality” of irradiation that is being applied. This set of parameters may be different for the various types of equipment that are able to create irradiation events.

156 **TID 10013**
CT IRRADIATION EVENT DATA
158 **Type: Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113819, DCM, ”CT Acquisition”)	1	M		
2	>	CONTAINS	TEXT	EV (125203, DCM, “Acquisition Protocol”)	1	U		
3	>	CONTAINS	CODE	EV (123014 , DCM, ”Target Region”)	1	M		DCID (4030) CT and MR Anatomy Imaged
4	>	CONTAINS	CODE	EV (113820, DCM, “CT Acquisition Type”)	1	M		DCID (10013) CT Acquisition Types
5	>	CONTAINS	CODE	(G-C232, SRT, “Procedure Context”)	1	U		DCID (10014) Contrast Imaging Technique
6	>	CONTAINS	UIDREF	EV (113769, DCM, “Irradiation Event UID”)	1	M		
7	>	CONTAINS	NUM	EV (113821, DCM, “X-ray Filter Aluminium Equivalent”)	1	U		Units = EV (mm, UCUM, “mm”)
8	>	CONTAINS	CONTAINER	EV (113822, DCM, “CT Acquisition Parameters”)	1	M		
9	>>	CONTAINS	NUM	EV (113824, DCM, “Exposure Time”)	1	M		Units = EV (s, UCUM, “s”)
10	>>	CONTAINS	NUM	EV (113825, DCM, “Scanning Length”)	1	M		Units = EV (mm, UCUM, “mm”)
11	>>	CONTAINS	NUM	EV (113826, DCM, “Nominal Single Collimation Width”)	1	M		Units = EV (mm, UCUM, “mm”)
12	>>	CONTAINS	NUM	EV (113827, DCM, “Nominal Total Collimation Width”)	1	M		Units = EV (mm, UCUM, “mm”)

13	>>	CONTAINS	NUM	EV (113828, DCM, “Pitch Factor”)	1	MC	IF row 4 equals (P5-08001, SRT, “Spiral Acquisition”) or equals (113804, DCM, “Sequenced Acquisition”)	Units = EV ({ratio}, UCUM, “ratio”)
14	>>	CONTAINS	NUM	EV (113823, DCM, “Number of X-ray Sources”)	1	M		Units = EV ({X-ray sources}, UCUM, “X-ray sources”)
15	>>	CONTAINS	CONTAINER	EV (113831, DCM, “CT X-ray Source Parameters”)	1-n	M		
16	>>>	CONTAINS	TEXT	EV (113832, DCM, “Identification Number of the X-ray Source”)	1	M		
17	>>>	CONTAINS	NUM	EV (113733, DCM, “KVP”)	1	M		Units = EV (kV, UCUM, “kV”)
18	>>>	CONTAINS	NUM	EV (113833, DCM, “Maximum X-ray Tube Current”)	1	M		Units = EV (mA, UCUM, “mA”)
19	>>>	CONTAINS	NUM	EV (113734, DCM, “Mean X-ray Tube Current”	1	M		Units = EV (mA, UCUM, “mA”)
20	>>>	CONTAINS	NUM	EV (113834, DCM, “Exposure Time per Rotation”)	1	MC	IF row 4 does not equal (113805, DCM, “Constant Angle Acquisition”)	Units = EV (s, UCUM, “s”)
21	>	CONTAINS	CONTAINER	EV (113829, DCM, “CT Dose”)	1	MC	IF row 4 does not equal (113805, DCM, “Constant Angle Acquisition”)	
22	>>	CONTAINS	NUM	EV (113830, DCM, “Mean CTDIvol ”)	1	M		Units = EV (mGy, UCUM, “mGy”)
23	>>	CONTAINS	CODE	EV (113835, DCM, “CTDIw Phantom Type”)	1	M		DCID (4052) Phantom Devices
24	>>	CONTAINS	NUM	EV (113836, DCM, “CTDIfreeair Calculation Factor”)	1	U		Units = EV (mGy/mAs, UCUM, “mGy/mAs”)
25	>>	CONTAINS	NUM	EV (113837, DCM, “Mean CTDIfreeair”)	1	U		Units = EV (mGy, UCUM, “mGy”)
26	>>	CONTAINS	NUM	EV (113838, DCM, “DLP”)	1	M		Units = EV (mGycm, UCUM, “mGycm”)
27	>>	CONTAINS	NUM	EV (113839, DCM, “Effective Dose”)	1	U		Units = EV (mSv, UCUM, “mSv”)
28	>>>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, “Measurement Method“)	1	MC	IF row 27 is present	DCID (10011) “Effective Dose Evaluation Method”)
29	>>>>	HAS PROPERTIES	NUM	EV (113840, DCM, “Effective Dose Conversion Factor”)	1	MC	IF row 28 is present and equals (113800, DCM, “DLP to E conversion via MC computation”) or equals (113802, DCM, “DLP to E conversion via measurement”)	Units = EV (mSv/mGycm, UCUM, “mSv/mGycm”)
30	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

160 **Content Item Descriptions**

Row 2	User-defined type of clinical acquisition protocol for creating images or image-derived measurements. May be taken from Protocol Name (0018,1030) or from Performed Procedure Step Description (0040,0254).
Row 3	The target region is the anatomy exposed.
Row 4	Description of the method used during acquisition of this CT irradiation event, may be derived from Acquisition Type (0018,9302).
Row 5	The acquisition was performed with or without contrast medium application.
Row 7	Thickness of an equivalent filter constructed from aluminum.
Row 9	Total time the patient has received X-ray exposure during the irradiation event.
Row 10	For Spiral scanning, the scanning length is normally the table travel in mm during the tube loading. For Sequenced scanning, the scanning length is the table travel between consecutive scans times the number of scans. For Stationary and Free scanning, the scanning length is the nominal width of the total collimation.
Row 11	The value of the nominal width (referenced to the location of the isocenter along the z axis) of a single collimated slice in mm.
Row 12	The value of the nominal width (referenced to the location of the isocenter along the z axis) of the nominal total collimation in mm over the area of active X-ray detection (z-coverage).
Row 13	Pitch Factor: For Spiral Acquisition, the Pitch Factor is the ratio of the Table Feed per Rotation to the Nominal Total Collimation Width. For Sequenced Acquisition, the Pitch Factor is the ratio of the Table Feed per single sequenced scan to the Nominal Total Collimation Width.
Row 15	CT X-ray source parameters related to the acquisition. For each X-ray source an item must be present.
Row 16	Identification Number of the X-ray source. Identifies the particular X-ray source (in a multi-source CT system) for which the set of X-ray source parameter values is reported.
Row 17	KVP value as measured/recorded by system.
Row 19	Mean tube current as measured/recorded by system.
Row 20	Exposure time as measured/recorded by the system per rotation.
Row 21	CT Dose for one acquisition
Row 22	"Mean $CTDI_{vol}$" refers to the average value of the $CTDI_{vol}$ applied within this acquisition. $CTDI_{vol}$ is the volume $CTDI_w$, where $CTDI_w$ is the weighted computed tomography dose index 100 as defined in IEC 60601-2-44. For Sequenced and Spiral scanning, $CTDI_{vol} = CTDI_w$/Pitch Factor. For Stationary and Free scanning, $CTDI_{vol} = CTDI_w \times$ Cumulative Exposure Time/ Exposure Time Per Rotation. See also CTDIvol (0018,9345) and Spiral Pitch Factor (0018,9311) in the Enhanced CT Information Object Description (PS 3.3).
Row 23	The type of phantom used for CTDI measurement according to IEC 60601-2-44 (e.g. Head 16 cm diameter PMMA, Body 32 cm diameter PMMA).
Row 24	The $CTDI_{free\ air}$ Calculation Factor is the $CTDI_{free\ air}$ per mAs, expressed in units of mGy/mAs. The $CTDI_{free\ air}$ Calculation Factor may be used in one method calculating Dose. For example, for this acquisition, Effective Dose = Mean X-ray Tube Current $\times$ Cumulative Exposure Time $\times$ $CTDI_{free\ air}$ Calculation Factor $\times$ (Effective Dose/ $CTDI_{free\ air}$).

Row 25	Mean $CTDI_{free\ air}$ is the mean CTDI for this acquisition, evaluated free-in-air according to IEC 60601-2-44. Mean $CTDI_{free\ air}$ = Mean X-ray Tube Current × Cumulative Exposure Time × $CTDI_{free\ air}$ Calculation Factor. The $CTDI_{free\ air}$ may be used in one method of calculating Effective Dose.
Row 26	For Spiral scanning, DLP = $CTDI_{vol}$ × Scanning Length. For Sequenced scanning, DLP = $CTDI_{vol}$ × Nominal Total Collimation Width × Cumulative Exposure Time / Exposure Time per Rotation. For Stationary and Free scanning, DLP = $CTDI_{vol}$ × Nominal Total Collimation Width (according to IEC 60601-2-44).
Row 27	Effective Dose in mSv of the single continuous time-frame of the irradiation computed as described in TID 10012.
Row 29	The Effective Dose Conversion Factor is the ratio of the Effective Dose to the DLP, expressed in units of mSv/mGycm, and it is used as a factor in one method of estimating Effective Dose. Monte Carlo Simulations (or dosimetric measurements in an anthropomorphic phantom, e.g., the Alderson-Rando phantom) may be used as a basis for the evaluation of Effective Dose Conversion Factors.

Item #04: Add the following CID's to Part 16 Annex B:

CID 10011 Effective Dose Evaluation Method

Context ID 10011
Effective Dose Evaluation Method

Type: Extensible Version: 20071031

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	113800	DLP to E conversion via MC computation
DCM	113801	CTDIfreeair to E conversion via MC computation
DCM	113802	DLP to E conversion via measurement
DCM	113803	CTDIfreeair to E conversion via measurement

CID 10013 CT Acquisition Type

Context ID 10013
CT Acquisition Type

Type: Extensible Version: 20071031

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	113804	Sequenced Acquisition
SRT	P5-08001	Spiral Acquisition
DCM	113805	Constant Angle Acquisition
DCM	113806	Stationary Acquisition
DCM	113807	Free Acquisition

CID 10014 Contrast Imaging Technique

Context ID 10014
Contrast Imaging Technique

Type: Extensible Version: 20071031

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	P5-00100	Diagnostic radiography with contrast media
SRT	P5-0808E	CT without contrast

CID 10015 CT Dose Reference Authorities

Context ID 10015
CT Dose Reference Authorities

Type: Extensible Version: 20071031

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	113808	ICRP Pub 60

Item #05: Add the following Definitions to Annex D

DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition
	…	
113800	DLP to E conversion via MC computation	Effective Dose evaluation from the product of Dose Length Product (DLP) and the Effective Dose Conversion Factor (E/DLP in units of mSv/mGy-cm), where the ratio is derived by means of Monte Carlo computations.
113801	CTDIfreeair to E conversion via MC computation	Effective Dose evaluation from the product of the Mean $CTDI_{free\ air}$ and the ratio $E/CTDI_{free\ air}$ (mSv/mGy), where the ratio is derived by means of Monte Carlo computations
113802	DLP to E conversion via measurement	Effective Dose evaluation from the product of Dose Length Product (DLP) and the Effective Dose Conversion Factor (E/DLP in units of mSv/mGy-cm), where the ratio is derived by means of dosimetric measurements with an anthropomorphic phantom
113803	CTDIfreeair to E conversion via measurement	Effective Dose evaluation from the product of the Mean $CTDI_{free\ air}$ and the ratio $E/CTDI_{free\ air}$ (mSv/mGy), where the ratio is derived by means of dosimetric measurements with an anthropomorphic phantom

113804	Sequenced Acquisition	The CT acquisition was performed by acquiring single or multi detector data while rotating the source about the gantry while the table is not moving. Additional slices are acquired by incrementing the table position and again rotating the source about the gantry while the table is not moving.
113805	Constant Angle Acquisition	The CT acquisition was performed by holding the source at a constant angle and moving the table to obtain a projection image (e.g. localizer).
113806	Stationary Acquisition	The CT acquisition was performed by holding the table at a constant position and acquiring multiple slices over time at the same location.
113807	Free Acquisition	The CT acquisition was performed while rotating the source about the gantry while the table movement is under direct control of a human operator or under the control of an analysis application (e.g. fluoro).
113808	ICRP Pub 60	Reference authority 1990 Recommendations of the International Commission on Radiological Protection (ICRP Publication 60, published as the Annals of the ICRP Vol. 21, No. 1-3, Pergamon Press, 1991)
113809	Start of X-ray Irradiation	Start, DateTime of the first X-ray Irradiation Event of the accumulation within a Study
113810	End of X-ray Irradiation	End, DateTime of the last X-ray Irradiation Event of the accumulation within a Study
113811	CT Accumulated Dose Data	X-ray dose accumulated over multiple CT irradiation events, e.g., for a study or a performed procedure step.
113812	Total Number of Irradiation Events	Total number of events during the defined scope of accumulation
113813	CT Dose Length Product Total	The total dose length product defined scope of accumulation
113814	CT Effective Dose Total	The total Effective Dose at the defined scope of accumulation
113815	Patient Model	Identification of the reference-patient model used when Effective Dose is evaluated via Monte Carlo calculations or from a Dose Length Product conversion factor based on Monte Carlo calculations
113816	Condition Effective Dose measured	References the physical phantom and the type of dosimeter used when measurements are done to establish Effective Dose Conversion Factors (E/DLP) or ratios $E/CTDI_{free\ air}$
113817	Effective Dose Phantom Type	Type of Effective Dose phantom used

113818	Dosimeter Type	Type of dosimeter used
113819	CT Acquisition	General description of the CT Irradiation event
113820	CT Acquisition Type	Method of the CT acquisition
113821	X-ray Filter Aluminum Equivalent	Thickness of an equivalent filter in mm in Aluminum
113822	CT Acquisition Parameters	General description of the acquisition parameters
113823	Number of X-ray Sources	Number of X-ray sources
113824	Exposure Time	Total time the patient has received X-ray exposure during the irradiation event
113825	Scanning Length	Length of the table travel during the entire tube loading, according to IEC 60601-2-44 NOTE: Scanning Length might be longer than the programmed acquisition length
113826	Nominal Single Collimation Width	The value of the nominal width referenced to the location of the isocenter along the z axis of a single row of acquired data in mm
113827	Nominal Total Collimation Width	The value of the nominal width referenced to the location of the isocenter along the z axis of the total collimation in mm over the area of active X-ray detection
113828	Pitch Factor	For Spiral scanning: Pitch Factor = (Table Feed per Rotation (mm))/(Nominal Total Collimation Width (mm)) For Sequenced scanning: Pitch Factor = (Table Feed per single Sequenced scan (mm))/(Nominal Total Collimation Width (mm))
113829	CT Dose	General description of CT dose values
113830	Mean CTDIvol	"Mean $CTDI_{vol}$" refers to the average value of the $CTDI_{vol}$ associated with this acquisition.
113831	CT X-ray Source Parameters	Identification, tube-potential, tube-current, and exposure-time parameters associated with an X-ray source during an acquisition.
113832	Identification of the X-ray Source	Identifies the particular X-ray source (in a multi-source CT system) for which the set of X-ray source parameter values is reported.
113833	Maximum X-ray Tube Current	Maximum X-ray tube current
113834	Exposure Time per Rotation	The exposure time for one rotation of the source around the object in s
113835	CTDIw Phantom Type	A label describing the type of phantom used for $CTDI_W$ measurement according to IEC 60601-2-44 (Head 16 cm diameter PMMA, Body 32 cm diameter PMMA)

113836	CTDIfreeair Calculation Factor	The $CTDI_{free\ air}$ Calculation Factor is the $CTDI_{free\ air}$ per mAs, expressed in units of mGy/mAs. The $CTDI_{free\ air}$ Calculation Factor may be used in one method calculating Dose.
113837	Mean CTDIfreeair	The average value of the free-in-air CTDI associated with this acquisition.
113838	DLP	Dose Length Product (DLP), expressed in mGy-cm, is an index characterizing the product of the $CTDI_{vol}$ and the length scanned. For Spiral scanning, DLP = $CTDI_{vol}$ × Scanning Length. For Sequenced scanning, DLP = $CTDI_{vol}$ × Nominal Total Collimation Width × Cumulative Exposure Time / Exposure Time per Rotation. For Stationary and Free scanning, DLP = $CTDI_{vol}$ × Nominal Total Collimation Width.
113839	Effective Dose	Effective dose in mSv
113840	Effective Dose Conversion Factor	Effective Dose per DLP, reference value for Effective Dose calculation, expressed in mSv/mGycm

Item #06: Code Definitions extended

DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition
113690	IEC Head Dosimetry Phantom	~~**A label describing the type of**~~ Phantom used for CTDI measurement in head modes according to IEC 60601-2-44 **(Head 16 cm diameter Polymethyl methacrylate PMMA)**
113691	IEC Body Dosimetry Phantom	~~**A label describing the type of**~~ Phantom used for CTDI measurement in body modes according to IEC 60601-2-44 **(Body 32cm diameter Polymethyl methacrylate PMMA)**

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198 **Item #07: Extend new reference to PS3.16 section 2 "Normative references"**

RFC 3066	Tags for the Identification of Languages, Internet Engineering Task Force
IEC 60601-2-44	**Medical Electrical Equipment – Part 2-44: Particular Requirements for the Safety of X-ray Equipment for Computed Tomography**

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Changes to NEMA Standards Publication PS 3.17-2007

210 ## Digital Imaging and Communications in Medicine (DICOM)

Part 17: Explanatory Information

212

Item #08: Add text to "Radiation Dose Reporting Use Cases Annex AA"

ANNEX AA: Radiation Dose Reporting Use Cases (Informative)

AA.2 DEFINITIONS

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Accumulated Dose Values

Accumulated Dose Values describe the integrated results of performing multiple irradiation events. The scope of accumulation is typically a study or a performed procedure step**. Multiple Radiation Dose objects may be created for one Study or one Radiation Dose object may be created for multiple performed procedures.**