Technical Publications

Direction DOC1203862
Revision 2

DoseWatch 1.3/1.4
DICOM CONFORMANCE STATEMENT

GE Healthcare

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CONFORMANCE STATEMENT OVERVIEW

DoseWatch implements DICOM services to facilitate the acquisition, monitoring and reporting of Radiation Exposure in the enterprise. Radiation dose information is either acquired from DICOM Radiation Dose SR instances, DICOM MPPS messages or DICOM image headers. DoseWatch is also able to communicate radiation dose information with other peers using MPPS.

Table 0.1 provides an overview of the network services supported by DoseWatch.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage	No	Yes
Digital X-Ray Image Storage – For Presentation	No	Yes
Digital X-Ray Image Storage – For Processing	No	Yes
Digital Mammography X-Ray Image Storage – For Presentation	No	Yes
Digital Mammography X-Ray Image Storage – For Processing	No	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	No	Yes
Digital Intra-oral X-Ray Image Storage – For Processing	No	Yes
CT Image Storage	No	Yes
Enhanced CT Image Storage	No	Yes
Secondary Capture Image Storage	No	Yes
X-Ray Angiographic Image Storage	No	Yes
Enhanced XA Image Storage	No	Yes
X-Ray Radiofluoroscopic Image Storage	No	Yes
Enhanced XRF Image Storage	No	Yes
X-Ray Radiation Dose SR	No	Yes
Positron Emission Tomography Image Storage	No	Yes
Workflow Management		
Modality Performed Procedure Step SOP Class	Yes	Yes
Modality Worklist Information Model – FIND SOP Class	Yes	No

DoseWatch does not support any Media Storage Application Profile.

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

Section 3 (X-Ray Radiation Dose Structured Report Information Object Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the storage of an X-Ray Radiation Dose Structured Report.

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1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.

GEHC DICOM Conformance Statements

@

http://www.ge.com/DICOM

APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

Product Implementation:

CT Advantage

MR Advantage

DoseWatch 1.3
Conformance
Statement
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Conformance
Statement
Direction:
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DICOM STANDARD

Standard Specification:

DICOM
Part 1

DICOM Part 2

DICOM Part 3

DICOM Part 4

DICOM
Part 16

This document specifies the DICOM implementation. It is entitled:

DoseWatch 1.3/1.4
Conformance Statement for DICOM
*Direction **DOC1203862***

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

> DICOM Secretariat
> NEMA
> 1300 N. 17th Street, Suite 1752
> Rosslyn, VA 22209
> USA
> Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and

of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

   Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

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

1.7 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.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

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

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

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

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

Service/Object Pair (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.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
CR	Computed Radiography
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
DX	Digital X-ray
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist

O	Optional (Key Attribute)
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RDSR	Radiation Dose Structured Report
RF	Radiofluoroscopy
RIS	Radiology Information System
RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
VR	Value Representation
XA	X-ray Angiography

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the DoseWatch compliance to DICOM requirements for **Networking** features.

The DoseWatch product uses DICOM to receive images, Performed Procedure Steps and Radiation Dose Structured Reports through 3rd-party systems initiated network associations.

DoseWatch is also able to automatically initiate DICOM associations to send radiation dose information to 3rd-party systems using MPPS messages or RDSR objects.

DoseWatch is able to query a Modality Worklist SCP to retrieve modality worklist procedure step for a specific application entity and map those elements to its existing database of exams.

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

The network application model for the DoseWatch 1.3/1.4 product is shown in the following Illustrations :
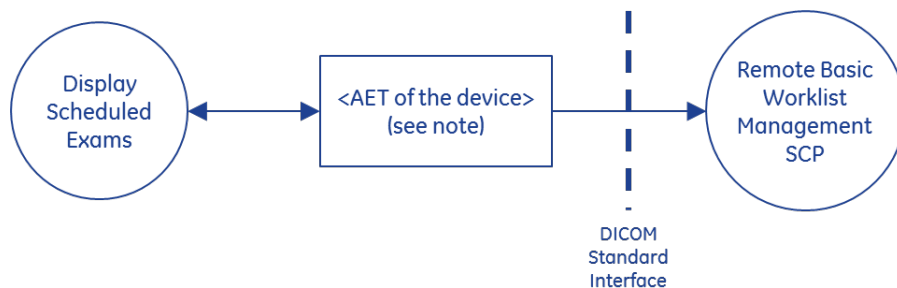
Note: DoseWatch establishes the DICOM association using the Application Entity Title of connected devices configured in its internal database.

ILLUSTRATION 2–1 : RETRIEVE A MODALITY WORKLIST FROM A REMOTE SYSTEM
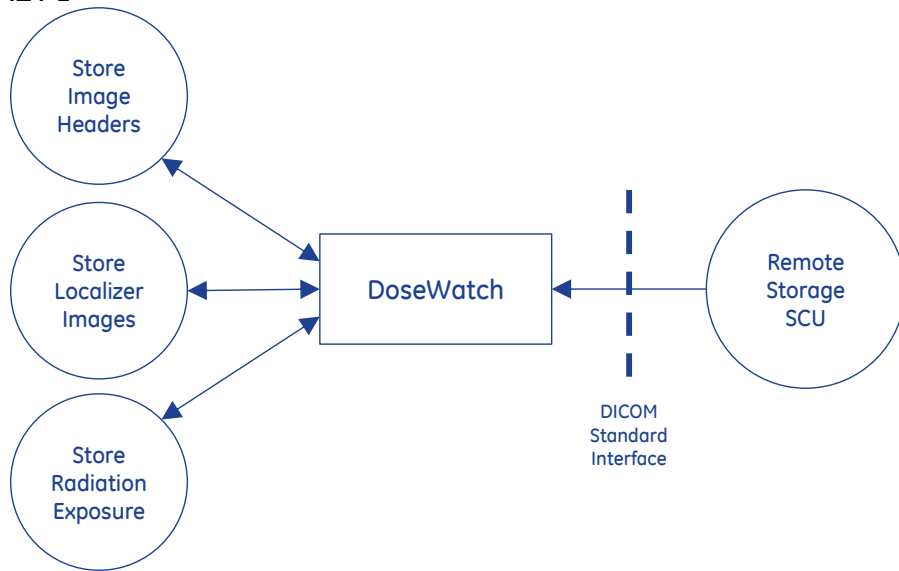
ILLUSTRATION 2–2 : RECEIVE INSTANCES FROM A REMOTE SYSTEM
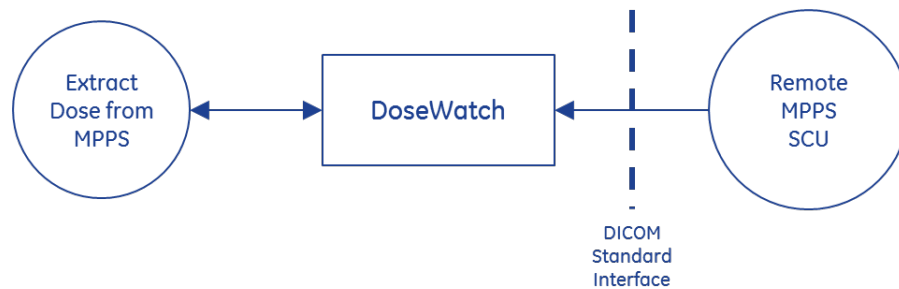
ILLUSTRATION 2–3 : RECEIVE MPPS MESSAGE FROM A REMOTE SYSTEM
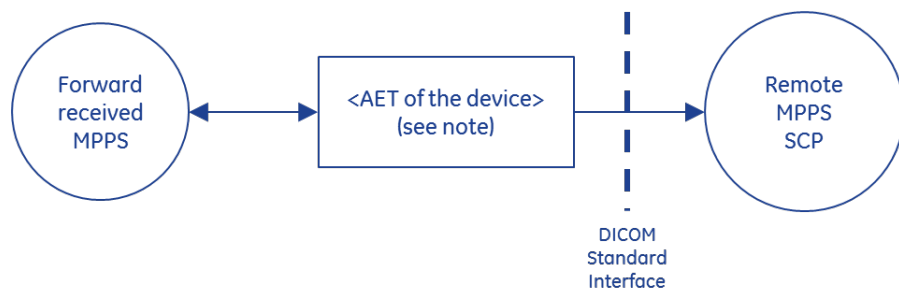
Note: when forwarding an MPPS, DoseWatch uses the AE Title of the MPPS origin.

ILLUSTRATION 2–4 : FORWARD MPPS MESSAGE TO A REMOTE SYSTEM

2.2.2 Functional Definition of AE's

DoseWatch queries the Modality Worklist server to display the scheduled exams for the modalities connected to DoseWatch. A background task also queries the Modality Worklist server to store modality scheduled procedure steps items in its internal database and reuse this content in some processing tasks.

DoseWatch receives images from modalities, stores image header in its database to process them and extract dose-related information. In addition, DoseWatch stores localizers images for SSDE calculation.

DoseWatch receives Modality Performed Procedure Step messages from modalities, stores them in its database to extract dose related information.

DoseWatch receives Radiation Dose Structured Reports from modalities, stores them in its database and extracts dose related information.

If configured to do so, DoseWatch forwards MPPS messages to other DICOM systems.

2.2.3 Sequencing of Real-World Activities

The forwarding of MPPS message to another system is triggered by an incoming DICOM communication (images, MPPS message or RDSR instance).

2.3 AE SPECIFICATIONS

DoseWatch configuration allows the definition of three Application Entities (respectively DW_MPPS_SCP, DW_RAW_SCP, DW_RDSR_SCP) to structure DICOM incoming dataflows:

- Modalities integrated with DoseWatch using MPPS only are configured to use the AE Title defined in the "MPPS Listener" of DoseWatch (**DW_MPPS_SCP by default)** as a destination;
- Modalities integrated with DoseWatch using images only are configured to use the AE Title defined in the "DICOM Listener" of DoseWatch(**DW_RAW_SCP** by default) AE Title as a destination;
- Modalities integrated with DoseWatch using Radiation Dose Structured Report only are configured to use the AE Title defined in the "Alternate DICOM Listener" of DoseWatch (**DW_RDSR_SCP** by default) AE Title as a destination;

Note: The AE Titles above may be customized in DoseWatch system configuration.

Note: The "DICOM Listener" can be used to receive both images instances and RDSR objects. The use of the "Alternate DICOM Listener" is optional and this listener can be disabled.

In addition, since version 1.2, DoseWatch supports so-called hybrid mode where a modality can send images and/or MPPS and/or RDSR to the DoseWatch AE it is connected to.

As a consequence, all three DoseWatch AE have the same behavior when processing incoming DICOM data. In the following section, "DoseWatch" represents any of these three DoseWatch Application Entities.

The DoseWatch system can also communicate dose information within DICOM MPPS messages sent to a remote AE. When doing so, DoseWatch will re-use the AE Title of the modality which originally sent to DoseWatch the images or MPPS message. In the following section, "DW_MPPS_SCU" represents this DoseWatch Application Entity.

Through its DW_DMWL_SCU Application Entity, the DoseWatch system can query a RIS for scheduled exams to be displayed to end-users.

2.3.1 DoseWatch AE Specification

The DoseWatch Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

TABLE 2-1 SUPPORTED STORAGE SOP CLASSES

SOP Class Name	SOP Class UID	SCU	SCP
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	No	Yes
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes

TABLE 2-2 SUPPORTED MANAGEMENT SOP CLASSES

SOP Class Name	SOP Class UID	SCU	SCP
Modality Performed Procedure Step	1.2.840.10008.5.1.4.1.1.1	No	Yes

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DoseWatch Application Entity is: 16KB

Maximum Length PDU	16KB (Not Configurable)

DoseWatch rejects association requests from applications of which the AE Title is not registered within DoseWatch's configuration.

2.3.1.1.2 Number of Associations

The DoseWatch will support a maximum of 8 simultaneous associations initiated by remote nodes. More connections will be accepted by DoseWatch but having more than 8 simultaneous connection per node is not recommended.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

DoseWatch Implementation UID	1.2.40.0.13.1.1
DoseWatch Implementation Version Name	dcm4che-2.0

2.3.1.2 Association Initiation Policy

The DoseWatch Application Entity does not initiate any Association.

2.3.1.3 Association Acceptance Policy

2.3.1.3.1 Real-World Activity "Receive Instances"

2.3.1.3.1.1 Associated Real-World Activity

A modality sends DICOM images or Radiation Dose Structured Reports to DoseWatch. DoseWatch stores localizers images, other images' headers and RDSR in its database for further processing.

2.3.1.3.1.2 Accepted Presentation Context Table

TABLE 2-3 ACCEPTED PRESENTATION CONTEXTS FOR RECEIVE INSTANCES

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
Name	**UID**			
See Table 2-1 Supported Storage SOP Classes	See Table 2-1 Supported Storage SOP Classes	See Table 2-4 Transfer Syntaxes for Receive Instances	SCP	None
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	SCP	None

TABLE 2-4 TRANSFER SYNTAXES FOR RECEIVE INSTANCES

Transfer Syntax	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEG2000LosslessOnly	1.2.840.10008.1.2.4.90
JPEG2000	1.2.840.10008.1.2.4.91
JPEGLossless	1.2.840.10008.1.2.4.70

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The DoseWatch AE does not provide any DICOM retrieve service to remote AE. DICOM Instances are received for the sole purpose of radiation dose calculation and monitoring and are not intended to be displayed, nor retrieved or sent to other remote AE.

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Storage** :

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Success	0000		The Composite SOP Instance was successfully received, verified, and stored in the system repository.	
Error	0110	Processing Failure	This status is returned due to internal errors such as a processing failure response from the internal database or a filesystem operation. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.	

The DoseWatch AE supports Storage Level 0: for most images, only the DICOM header is stored in DoseWatch database; whole DICOM dataset is only stored for localizer images.

2.3.1.3.1.3 Presentation Context Acceptance Criterion

The DoseWatch AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

2.3.1.3.1.4 Transfer Syntax Selection Policies

Within each Presentation Context, the DoseWatch AE will accept the first proposed transfer syntax that it also supports for that Abstract Syntax.

2.3.1.3.2 Real-World Activity "Receive MPPS"

2.3.1.3.2.1 Associated Real-World Activity

A modality sends Modality Performed Procedure Step messages to DoseWatch. DoseWatch stores the message and processes it to extract dose related information.

2.3.1.3.2.2 Accepted Presentation Context Table

TABLE 2-5 ACCEPTED PRESENTATION CONTEXTS FOR RECEIVE MPPS

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	SCP	None
Modality Performed Procedure Step SOP Class	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	SCP	None

TABLE 2-6 TRANSFER SYNTAXES FOR RECEIVE MPPS

Transfer Syntax	UID
Implicit VR Little Endian	1.2.840.10008.1.2

2.3.1.3.2.3 Presentation Context Acceptance Criterion

The DoseWatch AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

2.3.1.3.2.4 Transfer Syntax Selection Policies

Within each Presentation Context, the DoseWatch AE will accept the first proposed transfer syntax that it also supports for that Abstract Syntax.

2.3.1.4 General behavior for DoseWatch Application Entities

This section describes the general behavior of DoseWatch Applications Entities when receiving DICOM Instances or MPPS messages.

When receiving DICOM instances (images or RDSR) or DICOM MPPS messages, DoseWatch AE

- Gets rid of pixel data (except for localizer images, structured reports and secondary captures)
- Stores the image header, RDSR or MPPS message in its database
- Associates the received data with existing patient/exam in its database, or creates new patient/exam in database
- Processes the instance header, RDSR or MPPS message to extract dose related information

2.3.1.4.1 Key identifiers

When registering received DICOM information in its database, DoseWatch will use the following key identifiers to match data with existing entities or create additional entries in its database:

Tag	VR	Description	Use in DoseWatch
		Patient	
(0010,0010)	PN	Patient's Name	Patient's Name (LAST^FIRST^MIDDLE)
(0010,0020)	LO	Patient ID	Patient ID or Medical Record Number
		Exam / Requested Procedure	
(0008,1155)	UI	Referenced Study SOP Instance UID	UID for the Study as created by the RIS, CVIS, or other IS managing the medical imaging activity. When provided, this UID prevails on the Study Instance UID to identify the exam in DoseWatch.
(0020,000D)	UI	Study Instance UID	Used to identify the exam in DoseWatch when the Study SOP Instance UID is not provided.
		Performed Procedure Step	
(0008, 0018) or (0008,1155)		Modality Performed Procedure Step UID	
		Series	
(0020,000E)	UI	Series Instance UID	Series Instance UID
		Image	
(0008,0016)	UI	SOP Class UID	Unique SOP class identifier
(0008,0018)	UI	SOP Instance UID	Unique SOP instance identifier
(0008,1155)	UI	Referenced SOP Instance UID	Referenced SOP Instance UID
		Irradiation Event	
(0008,3010)	UI	Irradiation Event UID	
		Equipment/Device	
(0008,1010)	SH	Station Name	Typically this is the hostname of the device

2.3.1.4.2 Exploited DICOM data elements

The following table provides an overview of data elements which are extracted by DoseWatch from received data sets.

The processing of received data, as well as the DICOM data being processed, is fully configurable per modality depending on vendor, model and software version. DoseWatch configuration allows to extract any needed data element from the DICOM header, RDSR or MPPS message. The table below is only provided for information and is not an exhaustive list of data elements used in DoseWatch.

Tag	VR	Description	Use in DoseWatch
(0008,0008)	CS	Image Type	Image identification characteristics
(0008,0016)	UI	SOP Class UID	Unique SOP class identifier
(0008,0018)	UI	SOP Instance UID	Unique SOP instance identifier
(0008,0020)	DA	Study Date	Date the study was started
(0008,0021)	DA	Series Date	Date the series was started

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Tag	VR	Description	Use in DoseWatch
(0008,0022)	DA	Acquisition Date	Date the acquisition was started
(0008,0023)	DA	Content Date	Date the content was started
(0008,0030)	TM	Study Time	Time when the study was started
(0008,0050)	SH	Accession Number	Accession number
(0008,0054)	AE	Retrieve AE Title	Retrieve AE Title
(0008,0060)	CS	Modality	The modality associated with this message
(0008,0080)	LO	Institution Name	Name of the hospital or institution
(0008,0081)	ST	Institution Address	Hospital or institution Address
(0008,0090)	PN	Referring Physician's Name	Name of physician ordering study
(0008,0104)	LO	Code Meaning	The code meaning of the SR item block
(0008,1030)	LO	Study Description	This is typically the protocol name
(0008,1032)	SQ	Procedure Code Sequence	Sequence that describes the procedure peformed
(0008,103E)	LO	Series Description	Describes the series
(0008,1040)	LO	Institutional Department Name	Department Name
(0008,1050)	PN	Performing Physician's Name	Physician Name
(0008,1060)	PN	Name of Physician(s) Reading Study	Name of Physician(s) Reading Study
(0008,1070)	PN	Operators' Name	Name or initials of the modality operator
(0008,1090)	LO	Manufacturer's Model Name	The common marketing name of the modality device
(0008,1140)	SQ	Referenced Image Sequence	Identifies other images significantly related
(0008,1155)	UI	Referenced SOP Instance UID	Referenced SOP Instance UID
(0010,0010)	PN	Patient's Name	Patient's Name (LAST^FIRST^MIDDLE)
(0010,0020)	LO	Patient ID	Patient ID or Medical Record Number
(0010,0030)	DA	Patient's Birth Date	Patient's Birth Date (YYYYMMDD)
(0010,0032)	TM	Patient's Birth Time	Patient's Birth Time
(0010,0040)	CS	Patient's Sex	Patient's Sex (M, F)
(0010,1020)	DS	Patient's Size	The patient's height (used for BMI)
(0010,1030)	DS	Patient's Weight	The patient's weight (used for BMI)
(0018,0022)	CS	Scan Options	Parameters of the scanning sequence
(0018,0050)	DS	Slice Thickness	Slice thickness, in mm
(0018,0060)	DS	KVP	Generator peak kilovoltage used, in kVP
(0018,0088)	DS	Spacing Between Slices	Spacing between slices, in mm (center to center)
(0018,0090)	DS	Data Collection Diameter	Size of data collection region, in mm
(0018,1030)	LO	Protocol Name	Series specific protocol name
(0018,1100)	DS	Reconstruction Diameter	Diameter of data used for reconstruchion, in mm
(0018,1110)	DS	Distance Source to Detector	Distance from sorce to dectector center, in mm
(0018,1111)	DS	Distance Source to Patient	Typically distance from source to isocenter, in mm
(0018,1120)	DS	Gantry/Detector Tilt	Gantry or detector tilt angle, in degrees
(0018,1130)	DS	Table Height	Distance from table top to isocenter, in mm
(0018,1140)	CS	Rotation Direction	Rotation direction (CW, CC)
(0018,1150)	IS	Exposure Time	X-ray exposure time, in mSec
(0018,1151)	IS	X-Ray Tube Current	X-Ray tube current, in mA

Tag	VR	Description	Use in DoseWatch
(0018,115A)	CS	Radiation Mode	Radiation Mode (CONTINUOUS, PULSED)
(0018,115E)	DS	Image and Fluoroscopy Area Dose Product	Image and Fluoroscopy DAP calculation , in mGy.cm
(0018,1160)	SH	Filter Type	Filter Type (STRIP, WEDGE, BUTTERFLY, MULTIPLE)
(0018,1170)	IS	Generator Power	X-ray generator power, in kW
(0018,1190)	DS	Focal Spot(s)	Focal spot size, in mm
(0018,1210)	SH	Convolution Kernel	Description of convolution kernel or algorithm
(0018,1510)	DS	Positioner Primary Angle	Position of the image intensifier, RAO to LAO direction
(0018,1511)	DS	Positioner Secondary Angle	Position of the image intensifier, CAU to CRA direction
(0018,5100)	CS	Patient Position	Patient position relitave to the equipment
(0018,7050)	CS	Filter Material	Filter Material (ALUMINUM, COPPER, LEAD, etc.)
(0018,8151)	DS	X-Ray Tube Current in µA	X-Ray Tube Current in µA
(0018,9305)	FD	Revolution Time	Revolution Time
(0018,9306)	FD	Single Collimation Width	Single Collimation Width
(0018,9307)	FD	Total Collimation Width	Total Collimation Width
(0018,9309)	FD	Table Speed	Table Speed
(0018,9310)	FD	Table Feed per Rotation	Table Feed per Rotation
(0018,9311)	FD	Spiral Pitch Factor	Spiral Pitch Factor
(0020,000D)	UI	Study Instance UID	Study Instance UID
(0020,000E)	UI	Series Instance UID	Series Instance UID
(0020,0010)	SH	Study ID	The study identifier from the modality device
(0020,0011)	IS	Series Number	The series identifier from the modality device
(0020,0012)	IS	Acquisition Number	The identifier of a single continuous data acquisition
(0020,0013)	IS	Instance Number	The identifier of a single image or object
(0020,0032)	DS	Image Position (Patient)	X, y, z coordinates of upper left pixel or voxel
(0020,1041)	DS	Slice Location	Slice Location
(0028,0010)	US	Rows	Number of rows in the pixel matrix
(0028,0011)	US	Columns	Number of columns in the pixel matrix
(0028,0030)	DS	Pixel Spacing	Distance between pixel centers, in mm
(0032,1032)	PN	Requesting Physician	Requesting Physician
(0040,0007)	LO	Scheduled Procedure Step Description	Scheduled Procedure Step Description
(0040,0241)	AE	Performed Station AE Title	Performed Station AE Title
(0040,0244)	DA	Performed Procedure Step Start Date	Performed Procedure Step Start Date
(0040,0245)	TM	Performed Procedure Step Start Time	Performed Procedure Step Start Time
(0040,0250)	DA	Performed Procedure Step End Date	Performed Procedure Step End Date
(0040,0251)	TM	Performed Procedure Step End Time	Performed Procedure Step End Time
(0040,0254)	LO	Performed Procedure Step Description	Performed Procedure Step Description
(0040,0270)	SQ	Scheduled Step Attributes Sequence	Scheduled Step Attributes Sequence
(0040,0300)	US	Total Time of Fluoroscopy	Total Time of Fluoroscopy
(0040,0301)	US	Total Number of Exposures	Total Number of Exposures
(0040,0302)	US	Entrance Dose	Estimated average entrance dose
(0040,0306)	DS	Distance Source to Entrance	The distance from the source to the estimated patient

Tag	VR	Description	Use in DoseWatch
			surface, in mm
(0040,030E)	SQ	Exposure Dose Sequence	Exposure Dose Sequence
(0040,0310)	ST	Comments on Radiation Dose	Comments on Radiation Dose
(0040,0316)	DS	Organ Dose	Estimated average organ dose, in mGy
(0040,0340)	SQ	Performed Series Sequence	Performed Series Sequence
(0040,8302)	DS	Entrance Dose in mGy	Entrance Dose in mGy
(0040,A160)	UT	Text Value	Text Value within the Structured Report item
(0040,A730)	SQ	Content Sequence	Content Sequence
(0008,0070)	LO	Manufacturer	The manufacturer of the modality device
(0008,1010)	SH	Station Name	Typically this is the hostname of the device
(0018,1020)	LO	Software Version(s)	The software version on the device

2.3.2 DW_MPPS_SCU AE Specification

The DW_MPPS_SCU Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

2.3.2.1 Association Establishment Policies

2.3.2.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DW_MPPS_SCU is: 16KB

Maximum Length PDU	16KB

2.3.2.1.2 Number of Associations

The DW_MPPS_SCU AE will initiate a maximum of 1 simultaneous associations to remote nodes (association will be established when a DICOM an MPPS message is processed or when an exam is created in the database, depending on the configuration of the device in DoseWatch).

2.3.2.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.2.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

DoseWatch Implementation UID	1.2.40.0.13.1.1
DoseWatch Implementation Version Name	dcm4che-2.0

2.3.2.2 Association Initiation Policy

When the DW_MPPS_SCU Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The DW_MPPS_SCU AE proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

2.3.2.2.1 Real-World Activity "Forward MPPS"

2.3.2.2.1.1 Associated Real-World Activity

2.3.2.2.1.1.1 Post Process Forwarding Rules

When configured to do so, DoseWatch will create an MPPS Instance upon receiving DICOM images, secondary captures, RDSR and/or MPPS from a modality. After the corresponding exam is created in the database, this MPPS instance shall be sent to the destination AE specified in DoseWatch configuration.

2.3.2.2.1.1.2 Direct Forwarding Rules

For modalities sending MPPS to DoseWatch, DoseWatch can be configured to forward the received MPPS to a destination AE specified per MPPS source directly at the end of the DICOM association (in this case, it does not depend on the persistence of the study in the database).

For each kind of rules, DoseWatch is often configured to enhance the MPPS sent to remote AE by adding radiation dose related information into the "Comments on dose" field of the MPPS.

2.3.2.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE DW_MPPS_SCU for Activity "Forward MPPS"					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.2.2.1.2.1 SOP Specific DICOM Conformance Statement for Modality Performed Procedure Step SOP Class

2.3.2.2.1.2.1.1 MPPS N-CREATE

The DW_MPPS_SCU AE includes attributes in the Modality Performed Procedure Step N-CREATE as described in Section 2.3.2.2.1.2.1.3.

Following are the status codes that are more specifically processed when receiving an N-Create response from an **MPPS** SCP equipment:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	Status Processing error "F" is association to the send request. DICOM status is available in the DICOM logs of DoseWatch or in the gateway logs.
Success	0000		N-SET message is sent.

2.3.2.2.1.2.1.2 MPPS N-SET

DoseWatch always send COMPLETED status for N-SET messages.

The AE includes attributes in the Modality Performed Procedure Step N-SET as described in Section 2.3.2.2.1.2.1.3.

Following are the status codes that are more specifically processed when receiving an N-Set response from an **MPPS** SCP equipment:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	Status Processing error "F" is association to the send request. DICOM status is available in the DICOM logs of DoseWatch or in the gateway logs.
Success	0000		Status "C" is set to the send request.

2.3.2.2.1.2.1.3 MPPS Content Details

When forwarding MPPS messages received from a modality, DoseWatch only modifies the data elements as shown in the following table.

In the direct forwarding rule mode, all other MPPS attributes are kept unchanged with respect to the received MPPS. Refer to the MPPS source system DICOM Conformance Statement for further information about the MPPS content.

In the post-process rule mode, content of the forwarded MPPS is based on a configuration template. Most of the templates use the following DICOM tag dedicated to dose:

DICOM Tag	Description	Comments
(0040,0310)	Comments on radiation dose	DoseWatch adds a dose summary for the exam to the "Comments on radiation Dose" data element.

2.3.2.3 Association Acceptance Policy

The DW_MPPS_SCU Application Entity does not accept any incoming association.

2.3.3 DW_DMWL_SCU AE Specification

The DW_DMWL_SCU Application Entity (real application entity is the AE Title defined for the device configured in DoseWatch) provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No

2.3.3.1 Association Establishment Policies

2.3.3.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the DW_DMWL_SCU AE is:16KB

Maximum Length PDU	16KB

2.3.3.1.2 Number of Associations

The DW_DMWL_SCU AE will initiate a maximum of 1 simultaneous associations to remote nodes.

The DW_DMWL_SCU AE does not accept DICOM associations.

2.3.3.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.3.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

DoseWatch Implementation UID	1.2.40.0.13.1.1
DoseWatch Implementation Version Name	dcm4che-2.0

2.3.3.2 Association Initiation Policy

When the DW_DMWL_SCU Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The DW_DMWL_SCU proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

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2.3.3.2.1 Real-World Activity "Display Scheduled Exams"

2.3.3.2.1.1 Associated Real-World Activity

On a regular basis (configurable) or upon user request, the DoseWatch system shall query the DICOM Modality Worklist server associated to each modality in DoseWatch configuration.

DoseWatch queries the worklist provider using each modality AE Title, hence the association is kept open until each modality's worklist has been queried.

2.3.3.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE DW_DMWL_SCU for Activity "Display Scheduled Exams"					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian Explicit VR Little Endian (see note below)	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

Note: Implicit VR Little endian Transfer Syntax can be forced for a given device

2.3.3.2.1.2.1 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model - FIND SOP Class

The DW_DMWL_SCU AE includes matching keys in the Modality Worklist queries as described in Section 2.3.3.2.1.2.1.1.

Modality Scheduled Procedure Steps returned by the SCP are either displayed in the Scheduled Studies Worklist of DoseWatch or stored in the database for further processing. A Modality Worklist Request is sent by DoseWatch when the final user requests the list of scheduled studies or every 5 minutes by a batch job.

Following are the status codes that are more specifically processed when receiving messages from a **Modality Worklist** SCP equipment :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	The resulting list is considered as empty (not displayed or not stored). Details of the error are available in the DICOM or application logs.
Success	0000	Matching is complete - No final identifier is supplied	
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Receiving of matches continues.

DoseWatch does not generate C-FIND-CANCEL commands.

2.3.3.2.1.2.1.1 Modality Worklist Query Details

The following DICOM tags are sent in the Modality Worklist query:

- ScheduledProcedureStepSequence/ScheduledProcedureStepStartDate with the current date
- ScheduledProcedureStepStartTime with the value "000000-235959"
- ScheduledStationAETitle with the AE Title that has initiated the DICOM association

2.3.3.3 Association Acceptance Policy

The DW_DMWL_SCU Application Entity does not accept any DICOM associations.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the Windows Server Operating System.

2.4.2 Physical Media Support

The DoseWatch product is a software only solution and is expected to run with a 10/100 Mb/s or 1Gb/s auto-sensing Ethernet interface. Additional or alternate network interfaces may be available.

2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

2.5.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to all supported SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements.

Some private data elements can be read and processed by DoseWatch provided that they are specified in the source system DICOM Conformance Statement.

DoseWatch does not create any Private Data Elements.

2.5.1.2 Private SOP Classes

2.5.2 DoseWatch can be configured to support private SOP classes for storage.Private Transfer Syntaxes

No Private Transfer Syntax is supported.

2.6 CONFIGURATION

The exact method for configuring each configurable item is specified in other DoseWatch documentation. The following sections only describe some items that are configurable.

2.6.1 AE Title/Presentation Address Mapping

2.6.2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title

- Local Listening Port Number

The table below provides the default DoseWatch AE Titles and TCP port numbers:

Application Entity	AE Title	TCP Port
DoseWatch DICOM Modality Worklist SCU (DW_DMWL_SCU)	DoseWatch uses connected devices' AET	n/a
DoseWatch AEs	DW_RAW_SCP	2002
	DW_MPPS_SCP	2001
	DW_RDSR_SCP	2003
DoseWatch MPPS sender	When forwarding MPPS, DoseWatch uses MPPS origin's AET.	n/a

The following fields are configurable for every remote DICOM AE:

- Remote AE Title

- Remote IP Address

- TCP/IP Port Number

Note: All configurations must be performed by a GE Field Engineer.

2.7 SUPPORT OF EXTENDED CHARACTER SETS

DoseWatch supports ISO_IR 100 (Latin alphabet Number 1 supplementary set).

2.8 CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3. X-RAY RADIATION DOSE STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM X-Ray Radiation Dose SR IOD to represent results received by this implementation.

3.2 DOSEWATCH MAPPING OF DICOM ENTITIES

The DoseWatch maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 3-1
MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES

DICOM IE	DoseWatch **Entity**
Patient	Patient
Study	Exam
Series	Series
Document	Document

3.3 IOD MODULE TABLE

The X-Ray Radiation Dose Structured Report Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 3.5

The contents of the SR Document Content are constrained by the supported template, as identified in Section 3.4.5.2.1.1. Standard, Standard Extended and Private templates are further described in Section 3.5.

TABLE 3-2
STRUCTURE REPORT IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
Series	SR Document Series	Used	3.4.3.1
Equipment	General Equipment	Used	3.4.4.1
Document	SR Document General	Used	3.4.5.1
	SR Document Content	Used	3.4.5.2
	SOP Common	Used	3.4.5.3

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3.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the SR Information Objects.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what are the expected values when loading such instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not used.

3.4.1 Patient Entity Modules

3.4.1.1 Patient Module

Patient's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents...) or the nature of the device (manufacturer, model, software version...)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used

3.4.2 Study Entity Modules

3.4.2.1 General Study Module

Study's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents...) or the nature of the device (manufacturer, model, software version...)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-4
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Used
Study Date	(0008,0020)	2	Used
Study Time	(0008,0030)	2	Used
Referring Physician's Name	(0008,0090)	2	Used
Study ID	(0020,0010)	2	Used
Accession Number	(0008,0050)	2	Used
Study Description	(0008,1030)	3	Used
Name of Physician(s) Reading Study	(0008,1060)	3	Used
Referenced Study Sequence	(0008,1110)	3	Used
>*Include 'SOP Instance Reference Macro'*			
Procedure Code Sequence	(0008,1032)	3	Used
>*Include 'Code Sequence Macro'*			

3.4.2.2 Patient Study Module

Study's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-5
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Size	(0010,1020)	3	Used
Patient's Weight	(0010,1030)	3	Used

3.4.3 Series Entity Modules

3.4.3.1 SR Document Series Module

SR Document's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-6
SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used
Series Instance UID	(0020,000E)	1	Used
Series Number	(0020,0011)	1	Used
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Series Description	(0008,103E)	3	Used
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Used
> *'Referenced SOP Class / Instance UIDs'*			

3.4.4 Equipment Entity Modules

3.4.4.1 General Equipment Module

SR Document's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…).

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-7
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used
Institution Name	(0008,0080)	3	Used
Institution Address	(0008,0081)	3	Used
Station Name	(0008,1010)	3	Used
Institutional Department Name	(0008,1040)	3	Used
Manufacturer's Model Name	(0008,1090)	3	Used

3.4.5 Document Entity Modules

3.4.5.1 SR Document General Module

SR Document's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-8
SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Used
Referenced Request Sequence	(0040,A370)	1C	Used
>Study Instance UID	(0020,000D)	1	Used
>Referenced Study Sequence	(0008,1110)	2	Used
>>*Include 'SOP Instance Reference Macro'*			
>Accession Number	(0008,0050)	2	Used
>Placer Order Number/Imaging Service Request	(0040,2016)	2	Used
>Filler Order Number/Imaging Service Request	(0040,2017)	2	Used
>Requested Procedure ID	(0040,1001)	2	Used
>Requested Procedure Description	(0032,1060)	2	Used
>Requested Procedure Code Sequence	(0032,1064)	2	Used
>>*Include 'Code Sequence Macro'*			
Performed Procedure Code Sequence	(0040,A372)	2	Used
>*Include 'Code Sequence Macro'*			

3.4.5.2 SR Document Content Module

SR Document's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-9
SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Content Template Sequence	(0040,A504)	1C	Used
>Mapping Resource	(0008,0105)	1	Used
>Template Identifier	(0040,DB00)	1	Used
Value Type	(0040,A040)	1	Used
Concept Name Code Sequence	(0040,A043)	1C	Used
>*Include 'Code Sequence Macro'*			
Content Sequence	(0040,A730)	1C	Used
> Relationship Type	(0040,A010)	1	

Attribute Name	Tag	Type	Attribute Description
> *Insert SR DocumentContent Module*			Recursive inclusion to create document content tree. See section 3.4.5.2.1.1 for the list of supported templates

3.4.5.2.1 SR Document Content Descriptions

3.4.5.2.1.1 Content Template

The product supports the following root Templates for SR SOP Instances created, processed, or displayed by the product.

TABLE 3-10
SR ROOT TEMPLATES

SOP Class	Template ID	Template Name	Use
X-Ray Radiation Dose SR	10001	X-Ray Radiation Dose	Display
	10011	CT Radiation Dose	Display

3.4.5.3 SOP Common Module

SOP's information used in DoseWatch depend on the configuration of the device: it may differ from one system to another due to the nature of the DICOM objects parsed (MPPS events, secondary captures, SR documents…) or the nature of the device (manufacturer, model, software version…)

The DICOM tags listed below are just indications of common tags used in most of the cases. Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

TABLE 3-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used
SOP Instance UID	(0008,0018)	1	Used
Specific Character Set	(0008,0005)	1C	Used
Contributing Equipment Sequence	(0018,A001)	3	Used
>Manufacturer	(0008,0070)	1	Used
>Institution Name	(0008,0080)	3	Used
>Institution Address	(0008,0081)	3	Used
>Station Name	(0008,1010)	3	Used
>Institutional Department Name	(0008,1040)	3	Used
>Manufacturer's Model Name	(0008,1090)	3	Used
>Device Serial Number	(0018,1000)	3	Used
>Software Versions	(0018,1020)	3	Used
Instance Number	(0020,0013)	3	Used

3.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

DoseWatch may support Standard and Private Attributes in Standard Extended SR SOP Instances as Type 3 data elements. Private tags supported by DoseWatch depend on configuration and vary from one device to another.

Please refer to DoseWatch integration specialist to have the list of DICOM tags used for a specific device integration.

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