



# **Technical Publications**

**DOC2134521 Revision 1**

## **DoseWatch 3.1 DICOM CONFORMANCE STATEMENT**

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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 and RDSR.

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)
<b>Transfer</b>		
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	Yes (*)	Yes
Ultrasound Multi-frame Image Storage	No	Yes
MR Image Storage	No	Yes
Enhanced MR Image Storage	No	Yes
MR Spectroscopy Storage	No	Yes
Ultrasound 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(**)
Nuclear Medicine Image Storage	No	Yes(**)
X-Ray Radiation Dose SR	Yes	Yes
Enhanced SR Storage	Yes(*)	Yes
Radiopharmaceutical Radiation Dose Structured Report	Yes(*)	Yes(**)
Positron Emission Tomography Image Storage	No	Yes(**)
<b>Query/Retrieve</b>		
Patient Root Query/Retrieve Information Model – FIND	Yes	No
Patient Root Query/Retrieve Information Model – MOVE	Yes	No
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No
Patient/Study Only Query/Retrieve Information Model - FIND	Yes	No
Patient/Study Only Query/Retrieve Information Model - MOVE	Yes	No

<b>Workflow Management</b>		
Modality Performed Procedure Step SOP Class	Yes	Yes
Modality Worklist Information Model – FIND SOP Class	Yes	No

(\*) Supports only the forwarding of object produced by a modality. DoseWatch does not produce these objects.

(\*\*) Supported optionally.

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 (CT Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a CT Image Information Object.

**Section 4 (Digital Mammography X-Ray Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a MG Image Information Object.

**Section 5 (MR Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a MR Image Information Object.

**Section 6 (Secondary Capture Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a Secondary Capture Object.

**Section 7 (US Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a US Image Information Object.

**Section 8 (US Multi-frame Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a US Multi-frame Image Information Object.

**Section 9 (X-Ray Angiographic Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a XA Image Object.

**Section 10 (X-Ray RF Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the reading and storage of a RF Image Object.

**Section 11 (CT/X-Ray Radiation Dose Structured Report Information Object Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the storage and implementation of an CT/X-Ray Radiation Dose Structured Report.

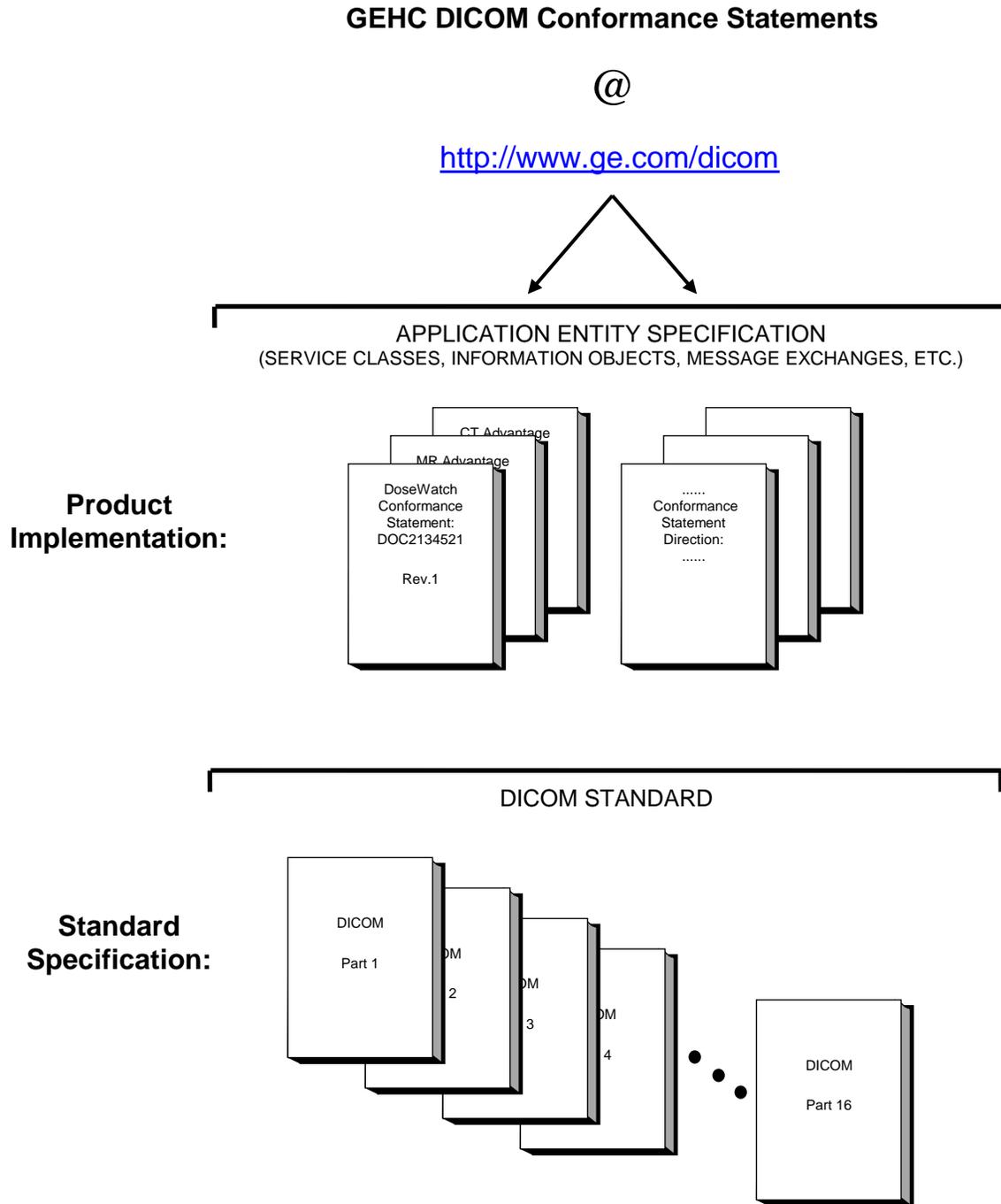
**Section 12 (Modality Worklist Information Model)**, which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

**Section 13 (Modality Performed Procedure Step Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the storage and implementation of a Modality Performed Procedure Step.

**Section 14 (Query Implementation)**, which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Query to a capable device.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM implementation. It is entitled:

**DoseWatch 3.1**  
*Conformance Statement for DICOM*  
**DOC2134521**

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>.

### 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 Standard, 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 (AET)** – 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-LS Lossless Image Compression, Explicit VR Little Endian.

**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
CAD	Computer Aided Detection
CR	Computed Radiography
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
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
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
IO	Intra-Oral X-ray
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LUT	Look-Up Table
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imagery (MRI)

MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NM	Nuclear Medicine
O	Optional (Key Attribute)
OCR	Optical Character Recognition
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
Q/R	Query and Retrieve
R	Required (Key Attribute)
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
SSDE	Size-Specific Dose Estimate
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
US	UltraSound
VL	Visible Light
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 initiating 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.

DoseWatch is able to query a PACS or a device to retrieve examinations.

### 2.2 IMPLEMENTATION MODEL

#### 2.2.1 Application Data Flow Diagram

The network application model for DoseWatch is shown in the following illustrations:

##### ILLUSTRATION 2-1 : RETRIEVE A MODALITY WORKLIST FROM A REMOTE SYSTEM

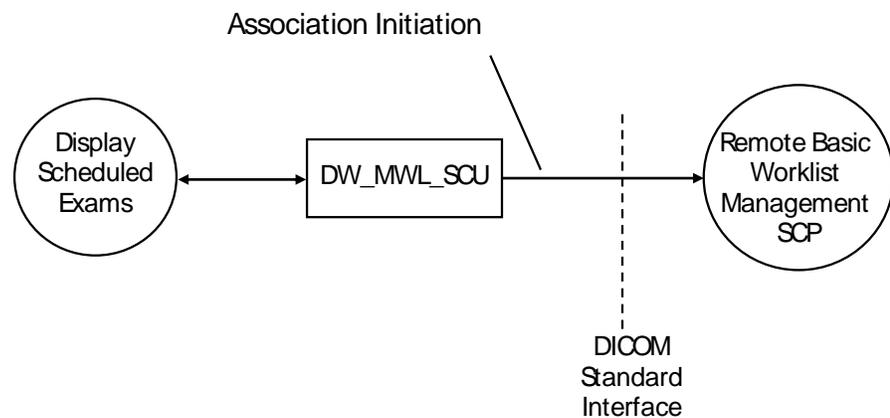


Illustration 2-2 : VERIFICATION REQUEST FROM A REMOTE AE

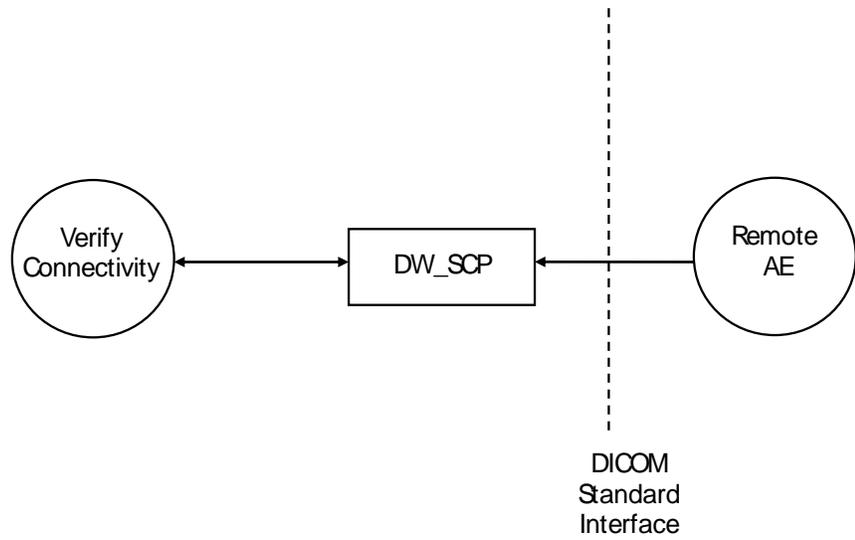


ILLUSTRATION 2-3 : RECEIVE INSTANCES FROM A REMOTE SYSTEM

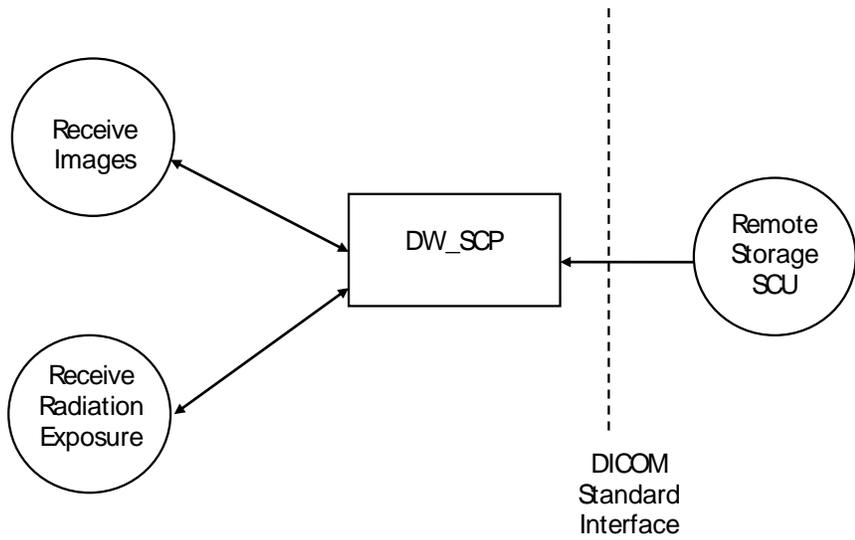


ILLUSTRATION 2-4 : RECEIVE MPPS MESSAGE FROM A REMOTE SYSTEM

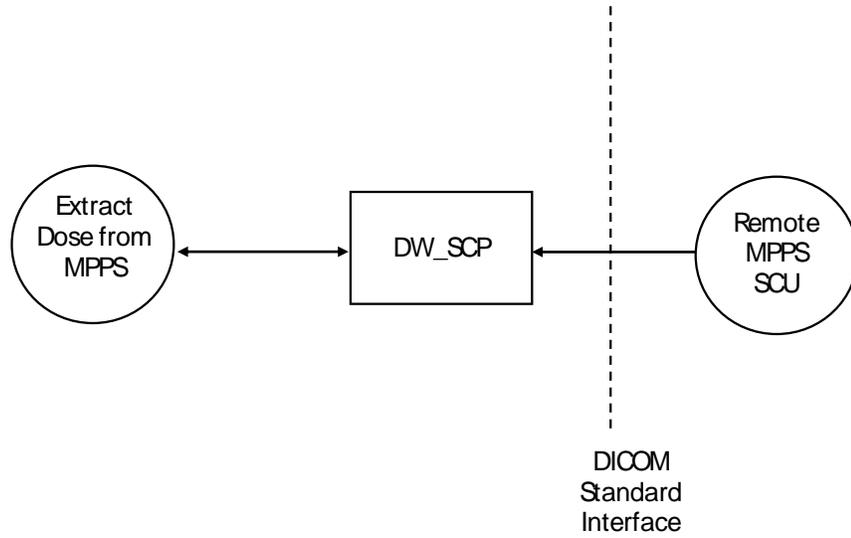


ILLUSTRATION 2-5 : FORWARD OR GENERATE MPPS MESSAGE TO A REMOTE SYSTEM

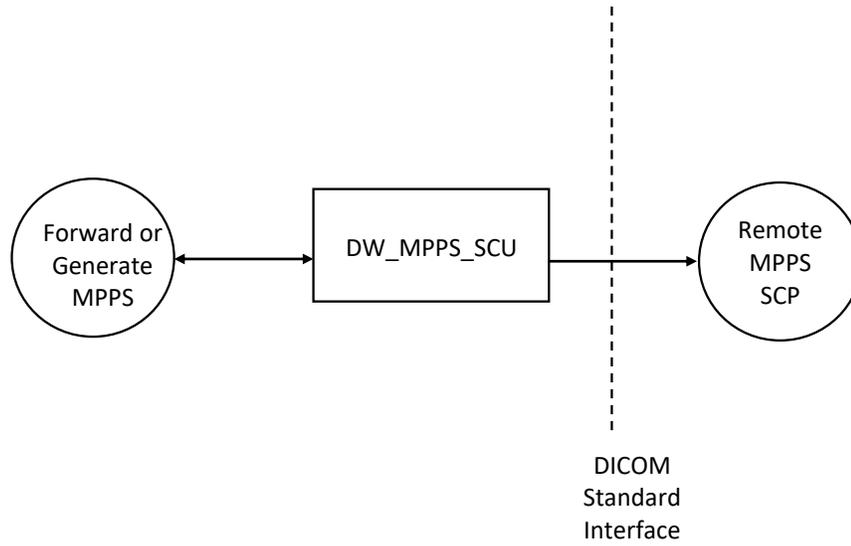


ILLUSTRATION 2-6 FORWARD OR GENERATE SR MESSAGE TO A REMOTE SYSTEM

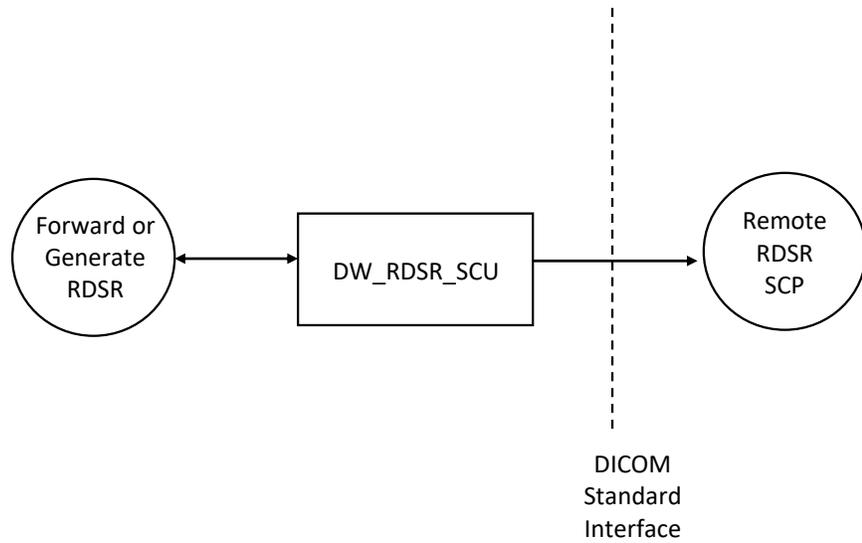
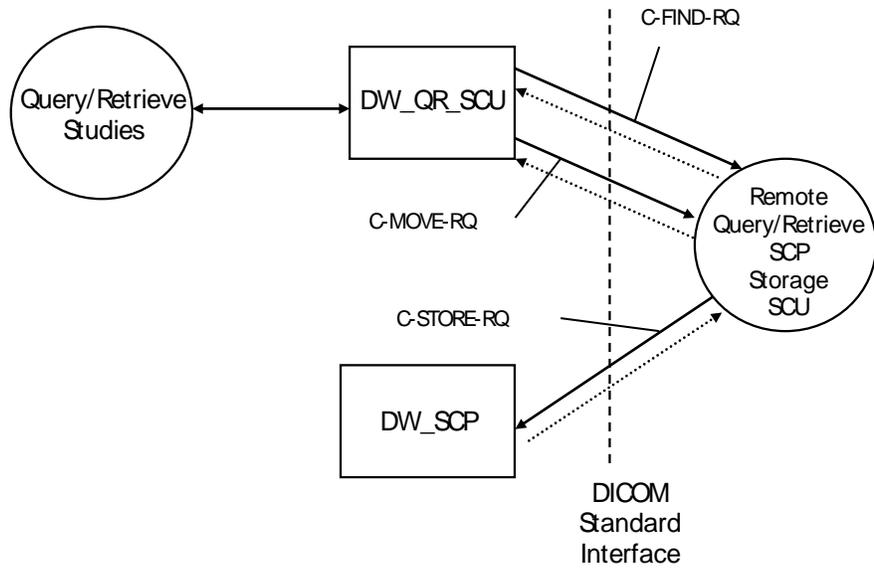


ILLUSTRATION 2-7 QUERY/RETRIEVE STUDIES FROM A PACS OR A DEVICE



## 2.2.2 Functional Definition of AE's

**Query Modality Worklist:** DoseWatch queries the Modality Worklist server to display the scheduled examinations for the devices 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.

**Verification Request from a remote AE:** If DoseWatch receives a C-ECHO-RQ message, it will respond with a C-ECHO-RSP message with a status "success".

**Receive Instances:** DoseWatch receives from a remote system a C-STORE-RQ messages. DoseWatch stores images from devices, stores image header in its database to process them and extracts dose or data usage related information. In addition, DoseWatch stores localizer images for SSDE calculation. DoseWatch responds with a C-STORE-RSP message. DoseWatch receives Radiation Dose Structured Reports from modalities (with a C-STORE operation), stores them in its database and extracts dose related information. In the case of Ultrasound images, DoseWatch extracts only the first frame for OCR analysis.

**Receive MPPS:** DoseWatch receives Modality Performed Procedure Step messages from devices, stores them in its database to extract dose related information. MPPS sent with the N-CREATE operation and the N-SET operation are considered. When the N-CREATE MPPS message is received, the DoseWatch waits for a N-SET message before integrating data.

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

**Generate MPPS messages:** If configured to do so, DoseWatch generates MPPS N-CREATE and N-SET messages to other DICOM system if the original device is not able to produce such a file.

**Forward SR messages:** If configured to do so, DoseWatch forwards Radiation Dose Structured Reports, Secondary Captures or Enhanced SR received from devices to other DICOM systems.

**Generate RDSR messages:** If configured to do so, DoseWatch generates a RDSR message to other DICOM system if the original device is not able to produce such a file.

**Query/Retrieve Studies:** DoseWatch queries a remote server listening at a TCP/IP port for incoming DICOM query messages. The query request (find matching patients or studies or series or images) is made by DoseWatch as Service Class User with a C-FIND-RQ operation. The remote server which acting as Service Class Provider responds (C-FIND-RSP) a list of DICOM objects corresponding to the request. DoseWatch performs a C-MOVE-RQ on the remote server and receives DICOM objects on the DoseWatch storage SCP listener.

## 2.2.3 Sequencing of Real-World Activities

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

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

The Query/Retrieve to another system can be triggered by an incoming DICOM communication (images, MPPS message or RDSR instance). In this case it is used to complete the information already received in the system. It can also be triggered periodically (every day) to get information from the day before.

### 2.3 AE SPECIFICATIONS

DoseWatch configuration allows the definition of up to three Application Entities as SCP to structure DICOM incoming dataflows:

- Each listener handles MPPS, images, RDSR and Secondary Captures.
- Each listener can be configured for specific scenarios and some SOP Classes or Transfer Syntaxes can be deactivated if necessary.
- The workflows can be dispatched on the three listeners if the user want to separated MPPS / image / RDSR workflows.

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, RDSR or MPPS message or use a custom AE title defined in the configuration. In the following section, “**DW\_MPPS\_SCU**” represents this DoseWatch Application Entity.

Additionally, the DoseWatch system can communicate dose information within DICOM RDSR messages sent to a remote AE. DoseWatch will re-use the AE Title of the modality which originally sent to DoseWatch information or use a custom AE title defined in the configuration. In the following section, “**DW\_RDSR\_SCU**” represents this DoseWatch Application Entity.

Through its **DW\_MWL\_SCU** Application Entity, the DoseWatch system can query a RIS for scheduled exams to be displayed to end-users.

DoseWatch uses an additional Application Entity when it performs query/retrieve to a remote system. The default AET used is “**DW\_QR\_SCU**” and can be changed if needed.

#### 2.3.1 DW\_SCP AE Specification

The DW\_SCP Application Entities 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
Verification SOP Class	1.2.840.10008.1.1	No	Yes
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
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes

MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	No	Yes
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	No	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	No	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	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:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
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The maximum length PDU receive size for the DoseWatch Application Entity is: 16KB

<b>Maximum Length PDU</b>	<b>16KB (Configurable)</b>
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**2.3.1.1.2 Number of Associations**

The DW\_SCP will support a maximum of 50 simultaneous associations initiated by remote nodes. However 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:

<b>DoseWatch Implementation UID</b>	<b>1.2.840.113619.6.326</b>
<b>DoseWatch Implementation Version Name</b>	<b>dosewatch-3.1.0</b>

**2.3.1.2 Association Initiation Policy**

The DW\_SCP Application Entity does not initiate any Association.

**2.3.1.3 Association Acceptance Policy**

**2.3.1.3.1 Real World Activity : Verification request from Remote AE**

**2.3.1.3.1.1 Associated Real-World Activity**

This AE is indefinitely listening for associations. No operator action is required to respond to a verification message. The Real-World Activity associated with the verification request is to send a C-ECHO response message with a status of “success” to the requesting AE.

**2.3.1.3.1.2 Accepted Presentation Context Table**

Presentation Context Table - Accepted by AE DoseWatch_Receiver for Activity Verification request from Remote AE					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

**2.3.1.3.1.2.1 SOP Specific Conformance to C\_ECHO SCP**

The DW\_SCP provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an “Association Timer” with a timeout value of 60 seconds. This timeout is configurable if necessary.

**2.3.1.3.1.3 Presentation Context Acceptance Criterion**

The DW\_SCP 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 DW\_SCP will select the following Transfer Syntax:

- Implicit VR Little Endian

**2.3.1.3.2 Real World Activity : “Receive Instances”**

**2.3.1.3.2.1 Associated Real-World Activity**

A device 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. In the case of ultrasound multiframe images, only the first frame is kept for OCR analysis.

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by DW_SCP for Activity Receive Instances					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Enhanced XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Enhanced XRF Image Storage	1.2.840.10008.5.1.4.1.1.12.2.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None

Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	See Table <b>Transfer Syntax for Image Storage SOPClasses</b> below		SCP	None

<b>Transfer Syntax for Image Storage SOPClasses</b>	
<b>Name List</b>	<b>UID List</b>
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Little Endian	1.2.840.10008.1.2.2
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
JPEG Baseline (Processes 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Extended (Processes 3 & 5)	1.2.840.10008.1.2.4.52
JPEG Spectral Selection, Nonhierarchical (Processes 6 & 8)	1.2.840.10008.1.2.4.53
JPEG Spectral Selection, Nonhierarchical (Processes 7 & 9)	1.2.840.10008.1.2.4.54
JPEG Full Progression, Nonhierarchical (Processes 10 & 12)	1.2.840.10008.1.2.4.55
JPEG Full Progression, Nonhierarchical (Processes 11 & 13)	1.2.840.10008.1.2.4.56
JPEG Lossless, Nonhierarchical (Processes 14)	1.2.840.10008.1.2.4.57

JPEG Lossless, Nonhierarchical (Processes 15)	1.2.840.10008.1.2.4.58
JPEG Extended, Hierarchical (Processes 16 & 18)	1.2.840.10008.1.2.4.59
JPEG Extended, Hierarchical (Processes 17 & 19)	1.2.840.10008.1.2.4.60
JPEG Spectral Selection, Hierarchical (Processes 20 & 22)	1.2.840.10008.1.2.4.61
JPEG Spectral Selection, Hierarchical (Processes 21 & 23)	1.2.840.10008.1.2.4.62
JPEG Full Progression, Hierarchical (Processes 24 & 26)	1.2.840.10008.1.2.4.63
JPEG Full Progression, Hierarchical (Processes 25 & 27)	1.2.840.10008.1.2.4.64
JPEG Lossless, Nonhierarchical (Process 28)	1.2.840.10008.1.2.4.65
JPEG Lossless, Nonhierarchical (Process 29)	1.2.840.10008.1.2.4.66
JPEG Lossless, Nonhierarchical, First- Order Prediction (Processes 14 [Selection Value 1])	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG-LS Lossy (Near- Lossless) Image Compression	1.2.840.10008.1.2.4.81
JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90
JPEG 2000 Image Compression	1.2.840.10008.1.2.4.91
JPEG 2000 Part 2 Multicomponent Image Compression (Lossless Only)	1.2.840.10008.1.2.4.92
JPEG 2000 Part 2 Multicomponent Image Compression	1.2.840.10008.1.2.4.93

**2.3.1.3.2.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes**

The DW\_SCP AE does not provide any DICOM retrieve service to remote AE. DICOM Instances are received for the purpose of radiation dose calculation, equipment monitoring and practices improvement. They 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:

<b>Service Status</b>	<b>Status Code</b>	<b>Further Meaning</b>	<b>Status Code Explanation</b>	<b>Related Fields Sent Back to the SCU</b>
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 system. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.	
Error	B000	One or more failures	This status is returned due to internal errors such as a error when reading the DICOM stream received. The appropriate Status will be sent in the C-STORE Response. Error indication message is output to the Service Log.	

The DW\_SCP 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.

### 2.3.1.3.2.3 Presentation Context Acceptance Criterion

The DW\_SCP 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.

### 2.3.1.3.3 Real World Activity : “Receive MPPS”

#### 2.3.1.3.3.1 Associated Real-World Activity

A modality sends DICOM MPPS to DoseWatch. DoseWatch stores them in its database for further processing.

#### 2.3.1.3.3.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by DW_SCP for Activity Receive MPPS					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

#### 2.3.1.3.3.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The DW\_MPPS\_SCP 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 N-CREATE/N-SET Response. Error indication message is output to the Service Log.	

Error	0121	Missing Attribute Value	This status is returned when the N-CREATE received from the SCU does not contains the Study Instance UID.	Attribute Identifier List (0000,1005) returns the field Study Instance UID
Error	0121	Missing Attribute Value	This status is returned when the N-SET received from the SCU does not contains the field Requested Sop Instance UID (0000,1001)	Attribute Identifier List (0000,1005) returns the field Requested Sop Instance UID

**Note:** if the SCU does not provide the Affected SOP Instance UID (0000,1000) in the N-CREATE operation, DoseWatch does not consider it as an error and generates one for the SCU. The SCU is in charge to use it and to reuse it for the N-SET operation. The Affected SOP Instance UID starts with the DoseWatch prefix "1.2.840.113619.2.326".

### 2.3.1.3.3 Presentation Context Acceptance Criterion

The DW\_MPPS\_SCP evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

### 2.3.1.3.4 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.

## 2.3.2 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:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
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The maximum length PDU receive size for the DW\_MPPS\_SCU is:

<b>Maximum Length PDU</b>	<b>16KB (Configurable)</b>
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#### 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 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:

<b>DoseWatch Implementation UID</b>	<b>1.2.840.113619.6.326</b>
<b>DoseWatch Implementation Version Name</b>	<b>dosewatch-3.1.0</b>

**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 MPPS Instances (N-CREATE and N-SET) upon receiving DICOM images, secondary captures, RDSR and/or MPPS from a device. After the corresponding examination is created in the database, these MPPS instances shall be sent to the destination AE specified in DoseWatch configuration.

**2.3.2.2.1.1.2 Direct Forwarding Rules**

For devices 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).

**2.3.2.2.1.2 Proposed Presentation Context Table**

<b>Presentation Context Table - Proposed by AE DW_MPPS_SCU for Activity “Forward MPPS”</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
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 sent by the device.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	DICOM status is available in the DICOM logs of DoseWatch or in the gateway logs.
Success	0000		N-CREATE message is sent.

### 2.3.2.2.1.2.1.2 MPPS N-SET

The DW\_MPPS\_SCU AE includes attributes in the Modality Performed Procedure Step N-SET sent by the modality.

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

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	DICOM status is available in the DICOM logs of DoseWatch or in the gateway logs.
Success	0000		N-SET message is sent.

### 2.3.3 DW\_RDSR\_SCU AE Specification

The DW\_RDSR\_SCU Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID	SCU	SCP
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Yes	No
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Yes	No
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	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:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU size for the DW\_RDSR\_SCU is:

<b>Maximum Length PDU</b>	<b>16KB (configurable)</b>
---------------------------	----------------------------

##### 2.3.3.1.2 Number of Associations

The DW\_RDSR\_SCU AE will initiate a maximum of 1 simultaneous associations to remote nodes (association will be established when a DICOM RDSR message is

processed or when an examination is created in the database, depending on the configuration of the device in DoseWatch).

**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:

<b>DoseWatch Implementation UID</b>	<b>1.2.840.113619.6.326</b>
<b>DoseWatch Implementation Version Name</b>	<b>dosewatch-3.1.0</b>

**2.3.3.2 Association Initiation Policy**

When the DW\_RDSR\_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\_RDSR\_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.

**2.3.3.2.1 Real-World Activity “Forward SR”**

**2.3.3.2.1.1 Associated Real-World Activity**

**2.3.3.2.1.1.1 Post Process Forwarding Rules**

When configured to do so, DoseWatch will create a RDSR Instance upon receiving DICOM images, secondary captures, RDSR and/or MPPS from a device. After the corresponding exam is created in the database, this RDSR instance shall be sent to the destination AE specified in DoseWatch configuration. In that case only a RDSR file is generated, no Secondary capture nor enhanced SR are generated.

**2.3.3.2.1.1.2 Direct Forwarding Rules**

For modalities sending RDSR to DoseWatch, DoseWatch can be configured to forward the received RDSR, RRDSR, secondary capture or enhanced SR to a destination AE specified per RDSR 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).

**2.3.3.2.1.2 Proposed Presentation Context Table**

<b>Presentation Context Table - Proposed by AE DW_RDSR_SCU for Activity “Forward SR”</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
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### 2.3.3.2.1.2.1 SOP Specific DICOM Conformance Statement for X-Ray Radiation Dose Storage Classes, Enhanced SR , Secondary Capture Image Storage and Radiopharmaceutical Radiation Dose Structured Report

Following are the status codes that are more specifically processed when receiving a response from a RDSR SCP equipment:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	*	*	Status Processing error "F" is associated to the send request. DICOM status is available in the DICOM logs of DoseWatch or in the gateway logs.
Success	0000		RDSR/RRDSR/SC/Enhanced SR message is sent.

### 2.3.4 DW\_MWL\_SCU AE Specification.

The DW\_MWL\_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

### 2.3.4.1 Association Establishment Policies

#### 2.3.4.1.1 General

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

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU receive size for the DW\_MWL\_SCU AE is:

<b>Maximum Length PDU</b>	<b>16KB (configurable)</b>
---------------------------	----------------------------

#### 2.3.4.1.2 Number of Associations

The DW\_MWL\_SCU AE will initiate a maximum of 1 simultaneous association to remote nodes.

The DW\_MWL\_SCU AE does not accept DICOM associations.

#### 2.3.4.1.3 Asynchronous Nature

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

#### 2.3.4.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

<b>DoseWatch Implementation UID</b>	<b>1.2.840.113619.6.326</b>
<b>DoseWatch Implementation Version Name</b>	<b>dosewatch-3.1.0</b>

**2.3.4.2 Association Initiation Policy**

When the DW\_MWL\_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\_MWL\_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.

**2.3.4.3 Real-World Activity “Display Scheduled Exams”**

**2.3.4.3.1.1 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 device selected in DoseWatch configuration.

DoseWatch queries the worklist provider using each modality AE Title or can use its own AE Title, hence the association is kept open until each modality’s worklist has been queried.

**2.3.4.3.1.2 Proposed Presentation Context Table**

<b>Presentation Context Table – Proposed by AE DW_MWL_SCU for Activity “Display Scheduled Exams”</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
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.

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

The DW\_MWL\_SCU AE includes matching keys in the Modality Worklist queries as described in Section 2.3.4.3.1.2.1.1.

Modality Scheduled Procedure Steps returned by the SCP are displayed in the Scheduled Studies Worklist of DoseWatch and 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 15 minutes (configurable) 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.

#### 2.3.4.3.1.2.1.1 Modality Worklist Query Details

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

- ScheduledProcedureStepSequence/ScheduledProcedureStepStartDate with the current date or the X days to come (specified in the UI)
- ScheduledProcedureStepStartTime with the value "000000-235959"
- ScheduledStationAETitle with the AE Title that has initiated the DICOM association

The complete detail of the query sent can be found in section 12.

#### 2.3.4.4 Association Acceptance Policy

The DW\_MWL\_SCU Application Entity does not accept any DICOM associations.

#### 2.3.5 DW\_QR\_SCU AE Specification.

The DW\_QR\_SCU Application Entity 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
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	No
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	No

**2.3.5.1 Association Establishment Policies****2.3.5.1.1 General**

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

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU receive size for the DW\_QR\_SCU AE is:

<b>Maximum Length PDU</b>	<b>16KB (configurable)</b>
---------------------------	----------------------------

**2.3.5.1.2 Number of Associations**

The DW\_QR\_SCU AE will initiate a maximum of 1 simultaneous association to remote nodes.

The DW\_QR\_SCU AE does not accept DICOM associations.

**2.3.5.1.3 Asynchronous Nature**

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

**2.3.5.1.4 Implementation Identifying Information**

The Implementation UID for this DICOM Implementation is:

<b>DoseWatch Implementation UID</b>	<b>1.2.840.113619.6.326</b>
<b>DoseWatch Implementation Version Name</b>	<b>dosewatch-3.1.0</b>

**2.3.5.2 Association Initiation Policy**

When the DW\_QR\_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\_QR\_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.

**2.3.5.2.1 Real-World Activity “Query/Retrieve Exams”****2.3.5.2.1.1 Associated Real-World Activity**

When configured, DoseWatch can query a query/retrieve provider (i.e. PACS, Workstation, device...) to complete information previously received from a device. This may be triggered upon the reception of specific type of file (MPPS, Images, RDSR...) or periodically to retrieve examinations for specific day or specific device.

**2.3.5.2.1.2 Proposed Presentation Context Table**

<b>Presentation Context Table – Proposed by AE DW_QR_SCU for Activity “Query/Retrieve Exams”</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)

Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	yes(1)

(1) One extended negotiation is added for the relational-query support. If not supported, DoseWatch use the hierarchical mode.

### 2.3.5.2.1.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE , Study Root Query/Retrieve Information Model - MOVE and Patient/Study Only Query/Retrieve Information Model - MOVE SOP Classes

The C-MOVE-RQ will use the AE Title of the DoseWatch Application Entity as the Move Destination AE Title.

The DoseWatch does not generate any C-MOVE-CANCEL operation.

Following are the status codes that are more specifically processed when receiving messages from a **Retrieve** 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.

#### 2.3.5.2.1.2.1.1 Query Retrieve Details

The DoseWatch performs in the same association a C-FIND and C-MOVE on the entities returned by the C-FIND. Usually the C-FIND query is controlled by a template configured in the DoseWatch. This template describe the keys to query (described in section 0).

The DoseWatch does not support the C-FIND Cancel operation. If a failure status code is returned by the SCP during the C-FIND or the C-MOVE, the query/retrieve operation is stopped. DoseWatch generates an APPLICATION\_ERROR status message in the UI.

### **2.3.5.3 Association Acceptance Policy**

The DW\_QR\_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.

TLS configuration is supported on the DICOM Listener with TLSv1 and SSLv3 protocols.

### **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.

### **2.4.3 Additional Protocols**

The DoseWatch DICOM Stack is based on the standard Java Network stack and supports the DHCP protocol.

### **2.4.4 IPV4 and IPV6 Support**

The DoseWatch DICOM Stack is based on the standard Java Network stack and supports IPV4 and IPV6 protocols.

## **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's new feature "RRA for Pristina" does create Private Data Elements to provide the dose information and reason for Reject and Repeat Analysis (images deleted on the mammography device).

#### **2.5.1.2 Private SOP Classes**

DoseWatch can be configured to support private SOP classes for storage.

#### **2.5.1.3 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 documentations. The following sections only describe some items that are configurable.

## 2.6.1 AE Title/Presentation Address Mapping

### 2.6.1.1 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	DoseWatch uses connected devices' AET or DW_MWL_SCU	n/a
DoseWatch AEs	DW_SCP	2001
	DW_SCP (Instance 2) (optional)	2002
	DW_SCP (Instance 3) (optional)	2003
DoseWatch MPPS sender	When forwarding MPPS, DoseWatch uses MPPS origin's AET or DW_MPPS_SCU	n/a
DoseWatch RDSR Sender	When forwarding RDSR, DoseWatch uses RDSR origin's AET or DW_RDSR_SCU	n/a
DoseWatch Query/Retrieve SCU	DW_QR_SCU	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

The DoseWatch supports ISO\_IR 100 (Latin alphabet Number 1 supplementary set) as default and character sets such as ISO 2022 IR 13 and ISO 2022 IR 87 for Japanese are supported. Other character sets may be supported but have not been tested.

## 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. CT INFORMATION OBJECT IMPLEMENTATION

#### 3.1 INTRODUCTION

This section specifies the use of the DICOM CT Image IOD to represent the information included in CT Images **received** by this implementation. Corresponding attributes are conveyed using the module construct.

#### 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	Study/CTStudy
Series	Series/CTSeries
Image	DicomRawImage

#### 3.3 IOD MODULE TABLE

The Computed Tomography Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 3.5.

**TABLE 3-2**  
**CT IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
Series	General Series	Used	3.4.3.1
Frame of Reference	Frame of Reference	Not Used	
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	3.4.5.1
	Image Plane	Used	3.4.5.2
	Image Pixel	Used	3.4.5.3
	Contrast/Bolus	Used Required if contrast media was used in this image	3.4.5.4
	Device	Used	3.4.5.5

CT Image	Used	3.4.5.6
SOP Common	Used	3.4.5.7

### 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 CT Information Object.

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 supported.

#### 3.4.1 Patient Entity Modules

##### 3.4.1.1 Patient Module

TABLE 3-3  
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used: extracted for every DICOM Type received. Shall be formatted with LAST_NAME^FIRST_NAME^MIDDLE_NAME^SUFFIX^PREFIX Max length 255 characters for each subfields.
Patient ID	(0010,0020)	2	Used: extracted for every DICOM Type received. Max length 255 characters.
Issuer of Patient ID	(0010,0021)	3	Used: max length 50 characters, issuer of patient ID has to be declared in DoseWatch before receiving data. Named "Domain" in DoseWatch - IHE denomination. If not configured, a default domain configured in DoseWatch is used.
Patient's Birth Date	(0010,0030)	2	Used and combined with Patient's Birth Time into a single value: date value in database.
Patient's Birth Time	(0010,0032)	3	Used and combined with Patient's Birth Date into a single value: date value in database
Patient's Sex	(0010,0040)	2	Used, possible values used are O: other, F: female, M: male.

#### 3.4.2 Study Entity Modules

##### 3.4.2.1 General Study Module

TABLE 3-4  
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Used: max value 255 characters.

Study Date	(0008,0020)	2	Used: combined with Study Time. Use the timezone of DoseWatch to persist the study. Another field exists in DoseWatch where the date is also stored in GMT.
Study Time	(0008,0030)	2	Used: combined with Study Date.
Referring Physician's Name	(0008,0090)	2	Used: Extracted for every DICOM Type received. Shall be formatted with LAST_NAME^FIRST_NAME^MIDDLE_NAME^SUFFIX^PREFIX Max length 255 characters for each subfields.
Study ID	(0020,0010)	2	Used: max 255 characters.
Accession Number	(0008,0050)	2	Used: max 255 characters.
Study Description	(0008,1030)	3	Used: max 255 characters. Attached to site in DoseWatch and modality type for statistics.
Name of Physician(s) Reading Study	(0008,1060)	3	Used: extracted for every DICOM Type received. Shall be formatted with LAST_NAME^FIRST_NAME^MIDDLE_NAME^SUFFIX^PREFIX Max length 255 characters for each subfields.
Referenced Study Sequence	(0008,1110)	3	Used to read referenced SOP Instance UID
>Include 'SOP Instance Reference Macro'			

### 3.4.2.2 Patient Study Module

**TABLE 3-5  
PATIENT STUDY MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Patient's Size	(0010,1020)	3	Used. Unit: centimeter.
Patient's Weight	(0010,1030)	3	Used. Unit: kilogram.

### 3.4.3 Series Entity Modules

#### 3.4.3.1 General Series Module

**Table 3-6  
GENERAL SERIES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used. Modality managed by DoseWatch: CT, XA, MG, RF, NM, US, MR.
Series Instance UID	(0020,000E)	1	Used: max 255 characters.
Series Number	(0020,0011)	2	Used: max int length 11.
Series Date	(0008,0021)	3	Used: combined with Series Time. Use the timezone of DoseWatch to persist the Series.
Series Time	(0008,0031)	3	Used: combined with Series Date.

Performing Physicians' Name	(0008,1050)	3	Used: extracted for every DICOM Type received. Shall be formatted with LAST_NAME^FIRST_NAME^MIDDLE_NAME^SU FFIX^PREFIX Max length 255 characters for each subfields. In DoseWatch, stored at study level.
Protocol Name	(0018,1030)	3	Used: max 255 characters.
Series Description	(0008,103E)	3	Used: max 255 characters. Attached in DoseWatch with the modality for statistics.
Operators' Name	(0008,1070)	3	Used: extracted for every DICOM Type received. Shall be formatted with LAST_NAME^FIRST_NAME^MIDDLE_NAME^SU FFIX^PREFIX Max length 255 characters for each subfields. In DoseWatch, stored at study level.
Body Part Examined	(0018,0015)	3	Used. Stored as a target region.
Patient Position	(0018,5100)	2C	Used, values stored are HFP= Head First-prone, HFS=Head First-Supine, HFDR= Head First-Decubitus Right, HFDL = Head First-Decubitus Left, FFP = Feet First-Prone, FFS = Feet First-Supine, LFP = Left First-Prone, LFS = Left First-Supine, RFP = Right First-Prone, RFS = Right First-Supine, AFDR = Anterior First-Decubitus Right, AFDL = Anterior First-Decubitus Left, FFDR = Feet First-Decubitus Left, FFDL = Feet First-Decubitus Left, PFDR = Posterior First-Decubitus Right, PFDL = Posterior First-Decubitus Left.
Request Attributes Sequence	(0040,0275)	3	Used.
>Requested Procedure ID	(0040,1001)	1C	Used.
>Accession Number	(0008,0050)	3	Used.
>Referenced Study Sequence	(0008,1110)	3	Used.
>> Include 'SOP Instance Reference Macro'			
>Requested Procedure Description	(0032,1060)	3	Used.
>Requested Procedure Code Sequence	(0032,1064)	3	Used.
>>Include 'Code Sequence Macro'			
>Reason for the Requested Procedure	(0040,1002)	3	Used. Stored in an entity Requested Procedure.
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	Used.
>>Include' Code Sequence Macro'			
>Scheduled Procedure Step ID	(0040,0009)	1C	Used. Stored in an entity Scheduled Procedure.
>Scheduled Procedure Step Description	(0040,0007)	3	Used. Stored in an entity Scheduled Procedure.
>Scheduled Protocol Code Sequence	(0040,0008)	3	Used.
>>Include 'Code Sequence Macro'			
>>Protocol Context Sequence	(0040,0440)	3	Used. Stored in an entity Protocol.
>>>Include 'Content Item Macro'			

>>>Content Item Modifier Sequence	(0040,0441)	3	Not used.
>>>>Include 'Content Item Macro'			

### 3.4.4 Equipment Entity Modules

#### 3.4.4.1 General Equipment Module

**TABLE 3-7  
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used sometimes when data are retrieved from a PACS to use the right data dictionary.
Institution Name	(0008,0080)	3	Used: max 255 characters.
Institution Address	(0008,0081)	3	Used: max 255 characters.
Station Name	(0008,1010)	3	Used sometimes when data are retrieved from a PACS to use the right data dictionary.
Institutional Department Name	(0008,1040)	3	Used: max 255 characters.
Manufacturer's Model Name	(0008,1090)	3	Used sometimes when data are retrieved from a PACS to use the right data dictionary.
Software Versions	(0018,1020)	3	Used.
Pixel Padding Value	(0028,0120)	1C	Not Used.

### 3.4.5 Image Entity Modules

#### 3.4.5.1 General Image Module

**TABLE 3-8  
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used.
Image Type	(0008,0008)	3	See 3.4.5.6.1. Used: store only images starting with ORIGINAL\PRIMARY\ and containing AXIAL, LOCALIZER and FLUORO.
Acquisition Number	(0020,0012)	3	Used.

#### 3.4.5.2 Image Plane Module

**TABLE 3-9  
IMAGE PLANE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Used for the SSDE Feature.
Image Orientation (Patient)	(0020,0037)	1	Used for the SSDE Feature.
Image Position (Patient)	(0020,0032)	1	Used for the SSDE Feature.
Slice Thickness	(0018,0050)	2	Used for the SSDE Feature.

3.4.5.3 Image Pixel Module

TABLE 3-10  
 IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Used to read image by SSDE feature.
Photometric Interpretation	(0028,0004)	1	Used to read image by SSDE feature.
Rows	(0028,0010)	1	Used to read image by SSDE feature.
Columns	(0028,0011)	1	Used to read image by SSDE feature.
Bits Allocated	(0028,0100)	1	Used to read image by SSDE feature.
Bits Stored	(0028,0101)	1	Used to read image by SSDE feature.
High Bit	(0028,0102)	1	Used to read image by SSDE feature.
Pixel Representation	(0028,0103)	1	Used to read image by SSDE feature.
Pixel Data	(7FE0,0010)	1	PixelData are kept when the image is a localizer. Removed by default but can be kept when configured.

3.4.5.4 Contrast/Bolus Module

TABLE 3-11  
 CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Route	(0018,1040)	3	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Volume	(0018,1041)	3	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Start Time	(0018,1042)	3	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Total Dose	(0018,1044)	3	Used or extracted from OCR in the contrast screenshot.
Contrast Flow Rate(s)	(0018,1046)	3	Used or extracted from OCR in the contrast screenshot.
Contrast Flow Duration(s)	(0018,1047)	3	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Ingredient	(0018,1048)	3	Used or extracted from OCR in the contrast screenshot.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Used or extracted from OCR in the contrast screenshot.

3.4.5.5 Device Module

TABLE 3-12  
 DEVICE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Device Sequence	(0050,0010)	1	Used.
>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	3	Used.
>Manufacturer's Model Name	(0008,1090)	3	Used.
>Device Serial Number	(0018,1000)	3	Used.
>Device ID	(0018,1003)	3	Not Used.
>Device Length	(0050,0014)	3	Not Used.
>Device Diameter	(0050,0016)	3	Not Used.
>Device Diameter Units	(0050,0017)	2C	Not Used.
>Device Volume	(0050,0018)	3	Not Used.
>Inter-Marker Distance	(0050,0019)	3	Not Used.
>Device Description	(0050,0020)	3	Not Used.

3.4.5.6 CT Image Module

TABLE 3-13  
 CT IMAGE MODULE ATTRIBUTES

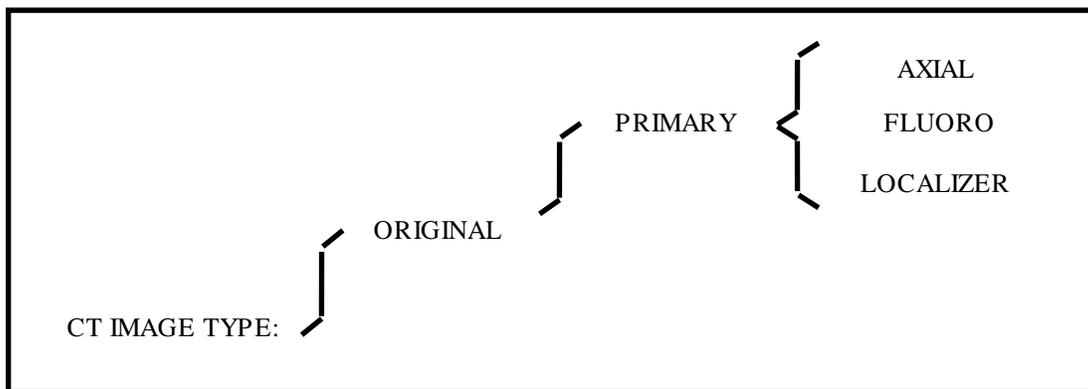
Attribute Name	Tag	Type	Use
Image Type	(0008,0008)	1	See 3.4.5.6.1. Used: store only images starting with ORIGINAL\PRIMARY\ and containing AXIAL, LOCALIZER and FLUORO.
Samples per Pixel	(0028,0002)	1	Used to read image by SSDE feature.
Photometric Interpretation	(0028,0004)	1	Used to read image by SSDE feature. MONOCHROME1 and MONOCHROME2 supported.
Bits Allocated	(0028,0100)	1	Used to read image by SSDE feature.
Bits Stored	(0028,0101)	1	Used to read image by SSDE feature.
High Bit	(0028,0102)	1	Used to read image by SSDE feature.
Rescale Intercept	(0028, 1052)	1	Used to read image by SSDE feature.
Rescale Slope	(0028,1053)	1	Used to read image by SSDE feature.
KVP	(0018,0060)	2	Used at CTseries level.
Acquisition Number	(0020,0012)	2	Used at CTseries level.
Scan Options	(0018,0022)	3	Used at CTseries level.
Data Collection Diameter	(0018,0090)	3	Used at CTseries level.
Data Collection Center (Patient)	(0018,9313)	3	Used at CTseries level.
Reconstruction Diameter	(0018,1100)	3	Used at CTseries level.
Distance Source to Detector	(0018,1110)	3	Used at CTseries level.
Distance Source to Patient	(0018,1111)	3	Used at CTseries level.

Gantry/Detector Tilt	(0018,1120)	3	Used at CTseries level.
Table Height	(0018,1130)	3	Used at CTseries level.
Rotation Direction	(0018,1140)	3	Used at CTseries level.
Exposure Time	(0018,1150)	3	Used at CTseries level.
X-ray Tube Current	(0018,1151)	3	Used at CTseries level.
Exposure	(0018,1152)	3	Used at CTseries level.
Filter Type	(0018,1160)	3	Used at CTseries level.
Generator Power	(0018,1170)	3	Used at CTseries level.
Focal Spot	(0018,1190)	3	Used at CTseries level.
Convolution Kernel	(0018,1210)	3	Used at CTseries level.
Revolution Time	(0018,9305)	3	Used at CTseries level.
Single Collimation Width	(0018,9306)	3	Used at CTseries level.
Total Collimation Width	(0018,9307)	3	Used at CTseries level.
Table Speed	(0018,9309)	3	Used at CTseries level.
Table Feed per Rotation	(0018,9310)	3	Used at CTseries level.
Spiral Pitch Factor	(0018,9311)	3	Used at CTseries level.
CTDIvol	(0018,9345)	3	Used at CTseries level.
CTDI Phantom Type Code Sequence	(0018,9346)	3	Used at CTseries level.

#### 3.4.5.6.1 Image Type

For CTseries DoseWatch supports the following type of images.

**ILLUSTRATION 3-1**  
**CT IMAGE TYPE DECISION TREE**



#### 3.4.5.7 SOP Common Module

**TABLE 3-14**  
**SOP COMMON MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used: max 255 characters.
SOP Instance UID	(0008,0018)	1	Used: max 255 characters.
Specific Character Set	(0008,0005)	1C	Used to read the object received, see 2.7.
Instance Number	(0020,0013)	3	Used.

### 3.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

### 3.6 DEVICES SUPPORTED BY DOSEWATCH

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
Arineta	CardioGraphe
Canon	Activion 16
	Aquilion
	Aquilion LB
	Aquilion Lightning
	Aquilion ONE Family
	Aquilion ONE GENESIS
	Aquilion PRIME
Astelion	
General Electric	BrightSpeed Edge 16 Slices
	BrightSpeed Elite 16 Slices
	BrightSpeed Elite 4/8 Slices
	BrightSpeed Elite Select 16 slices
	BrightSpeed QX/i
	Brivo CT385
	Discovery CT590 RT
	Discovery CT750 HD
	Discovery IQ
	Discovery LS
	Discovery MI
	Discovery NM/CT 670
	Discovery PET/CT 600
	Discovery PET/CT 610
	Discovery PET/CT 690
	Discovery PET/CT 710
	Discovery RT
	Discovery RX
	Discovery ST
	Discovery ST 16
	Discovery STE
	HiSpeed DX/i
	HiSpeed DX/iB
	HiSpeed LX/i
	HiSpeed QX/i
	LightSpeed 16
	LightSpeed Plus
	LightSpeed Pro16
	LightSpeed Pro32
	LightSpeed QX/i
	LightSpeed RT16
	LightSpeed RT

	LightSpeed Ultra
	LightSpeed VCT
	LightSpeed VCT XT
	LightSpeed VCT XTe
	LightSpeed Xtra
	Optima CT520
	Optima CT540
	Optima CT580
	Optima CT660
	Optima NM/CT 640
	Optima PET/CT 560
	Revolution ACT
	Revolution ACTs
	Revolution CT
	Revolution EVO
	Revolution Frontier
	Revolution GSI
	Revolution HD
Hitachi	SCENARIO
Medtronic	O-arm MVS O2
Morita	3D Accutomo 170
NeuroLogica	BodyTom
	CereTom
NewTom	5G
	VGi
Philips	BrightView XCT
	Brilliance Big Bore
	Brilliance-16
	Brilliance-40
	Brilliance-6
	Brilliance-64
	GEMINI GXL 16
	GEMINI TF
	iCT
	iCT 128
	iCT 256
	Ingenuity CT
	Ingenuity TF PET/CT
IQon	
MX 16-Slice	
Mx 8000 IDT	
Vereos Digital PET/CT	
Planmed	Planmed Verity

Siemens	Biograph 128 (mCT)
	Biograph 16 True Point
	Biograph 20 (mCT)
	Biograph 40 (mCT)
	Biograph 6
	Biograph 64
	SOMATOM Definition
	SOMATOM Definition AS
	SOMATOM Definition Edge
	SOMATOM Definition Flash
	SOMATOM Drive
	SOMATOM Emotion 16
	SOMATOM Emotion 6
	SOMATOM Force
	SOMATOM go.Up
	SOMATOM Perspective
	SOMATOM Scope
	SOMATOM Sensation 16

	SOMATOM Sensation 40
	SOMATOM Sensation 64
	SOMATOM Sensation Open
	Symbia Intevo
	Symbia T16
	Symbia T2
	Symbia T6
Toshiba	Activion 16
	Aquilion
	Aquilion LB
	Aquilion Lightning
	Aquilion ONE Family
	Aquilion ONE GENESIS
	Aquilion PRIME
	Astelion

## 4. DIGITAL MAMMOGRAPHY X-RAY INFORMATION OBJECT IMPLEMENTATION

### 4.1 INTRODUCTION

This section specifies the use of the DICOM Digital Mammography X-Ray Image IOD to represent the information included in MG Images received by this implementation. Corresponding attributes are conveyed using the module construct.

All field listed below are fields stored in database. Not all fields are displayed but they can all be exported into data exports for statistics needs.

### 4.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 4-1  
 MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/MGStudy
Series	Series/MGSeries
Image	DicomRawImage

### 4.3 IOD MODULE TABLE

The MG Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 4.5.

**TABLE 4-2  
 MG IMAGE 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	General Series	Used	3.4.3.1
	DX Series	Used	4.4.1.1
	Mammography Series	Used	4.4.1.2
Frame of Reference	Frame of Reference	Used Required if multiple images are obtained without releasing breast compression	4.4.2.1
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	3.4.5.1
	Image Pixel	Used	4.4.3.1
	Contrast/Bolus	Used	3.4.5.4

DX Anatomy Imaged	Used	4.4.3.2
DX Image	Used	4.4.3.3
DX Detector	Used	4.4.3.4
X-Ray Collimator	Used	4.4.3.5
DX Positioning	Used	4.4.3.6
X-Ray Acquisition Dose	Used	4.4.3.7
X-Ray Generation	Used	4.4.3.8
X-Ray Filtration	Used	4.4.3.9
X-Ray Grid	Used	4.4.3.10
Overlay Plane	Not Used	
VOI LUT	Not Used	
Image Histogram	Not Used	
Acquisition Context	Not Used	
Mammography Image	Used	4.4.3.11
SOP Common	Used	3.4.5.7

#### 4.4 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 Digital Mammography X-Ray Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional expected. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance as well as 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 supported.

##### 4.4.1 Series Entity Modules

###### 4.4.1.1 DX Series Module

TABLE 4-3  
DX SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used: shall be MG.
Presentation Intent Type	(0008,0068)	1	Used.

###### 4.4.1.2 Mammography Series Module

TABLE 4-4  
MAMMOGRAPHY SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used. Value is MG.
Request Attributes Sequence	(0040,0275)	3	Used.

>Requested Procedure ID	(0040,1001)	1C	Used.
>Accession Number	(0008,0050)	3	Used.
>Requested Procedure Description	(0032,1060)	3	Used.

**4.4.2 Frame Of Reference Entity Modules**

**4.4.2.1 Frame Of Reference Module**

**TABLE 4-5  
FRAME OF REFERENCE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Used.
Position Reference Indicator	(0020,1040)	2	Not Used.

**4.4.3 Image Entity Modules**

**4.4.3.1 Image Pixel Module**

**TABLE 4-6  
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Pixel Data	(7FE0,0010)	1	Not Used. Removed by default but can be kept by configuration if needed.

**4.4.3.2 DX Anatomy Imaged Module**

**TABLE 4-7  
DX ANATOMY IMAGED MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Laterality	(0020,0062)	1	Used.

**4.4.3.3 DX Image Module**

**TABLE 4-8  
DX IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used: Image type with the following keywords are kept : ORIGINAL\PRIMARY + : <ul style="list-style-type: none"> <li>• LEFT</li> <li>• RIGHT</li> <li>• TOMO</li> <li>• 5000</li> <li>• LOW_ENERGY</li> <li>• HIGH_ENERGY</li> <li>• RECOMBINED</li> <li>• CESM</li> <li>• PROJECTION</li> </ul>
Samples per Pixel	(0028,0002)	1	Not Used. No image read and displayed.

Photometric Interpretation	(0028,0004)	1	Not Used. No image read and displayed.
Bits Allocated	(0028,0100)	1	Not Used. No image read and displayed.
Bit Stored	(0028,0101)	1	Not Used. No image read and displayed.
High Bit	(0028,0102)	1	Not Used. No image read and displayed.
Pixel Representation	(0028,0103)	1	Not Used. No image read and displayed.
Pixel Intensity Relationship	(0028,1040)	1	Not Used. No image read and displayed.
Pixel Intensity Relationship Sign	(0028,1041)	1	Not Used. No image read and displayed.
Rescale Intercept	(0028,1052)	1	Not Used. No image read and displayed.
Rescale Slope	(0028,1053)	1	Not Used. No image read and displayed.
Rescale Type	(0028,1054)	1	Not Used. No image read and displayed.
Presentation LUT Shape	(2050,0020)	1	Not Used. No image read and displayed.
Lossy Image Compression	(0028,2110)	1	Not Used. No image read and displayed.
Lossy Image Compression Ratio	(0028,2112)	1C	Not Used. No image read and displayed.
Patient Orientation	(0020,0020)	1C	Used.
Burned In Annotation	(0028,0301)	1	Used.

#### 4.4.3.4 DX Detector Module

**TABLE 4-9**  
**DX DETECTOR MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Field of View Shape	(0018,1147)	3	Used.
Field of View Dimension(s)	(0018,1149)	3	Used.
Imager Pixel Spacing	(0018,1164)	1	Not Used.
Field of View Origin	(0018,7030)	1C	Used.
Field of View Rotation	(0018,7032)	1C	Used.
Field of View Horizontal Flip	(0018,7034)	1C	Used.

**TABLE 4-10**  
**DIGITAL X-RAY DETECTOR MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Detector Type	(0018,7004)	2	Used.
Detector Configuration	(0018,7005)	3	Used.
Detector Description	(0018,7006)	3	Used.
Detector ID	(0018,700A)	3	Used.
Date of Last Detector Calibration	(0018,700C)	3	Used.
Detector Binning	(0018,701A)	3	Used.
Detector Conditions Nominal Flag	(0018,7000)	3	Used.
Detector Temperature	(0018,7001)	3	Used.
Sensitivity	(0018,6000)	3	Used.
Detector Element Physical Size	(0018,7020)	3	Used.
Detector Element Spacing	(0018,7022)	3	Used.

Detector Active Shape	(0018,7024)	3	Used.
Detector Active Dimension(s)	(0018,7026)	3	Used.

#### 4.4.3.5 X-Ray Collimator Module

**TABLE 4-11**  
**X-RAY COLLIMATOR MODULE**

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	Used.
Collimator Left Vertical Edge	(0018,1702)	1C	Used.
Collimator Right Vertical Edge	(0018,1704)	1C	Used.
Collimator Upper Horizontal Edge	(0018,1706)	1C	Used.
Collimator Lower Horizontal Edge	(0018,1708)	1C	Used.

#### 4.4.3.6 DX Positioning Module

**TABLE 4-12**  
**DX POSITIONING MODULE**

Attribute Name	Tag	Type	Attribute Description
View Position	(0018,5101)	3	Used.
Distance Source to Patient	(0018,1111)	3	Used.
Distance Source to Detector	(0018,1110)	3	Used.
Estimated Radiographic Magnification Factor	(0018,1114)	3	Used.
Positioner Type	(0018,1508)	2	Used.
Positioner Primary Angle	(0018,1510)	3	Used.
Positioner Secondary Angle	(0018,1511)	3	Used.
Detector Secondary Angle	(0018,1531)	3	Used.
Column Angulation	(0018,1450)	3	Used.
Body Part Thickness	(0018,11A0)	3	Used.
Compression Force	(0018,11A2)	3	Used.
Paddle Description	(0018,11A4)	3	Used.

#### 4.4.3.7 X-Ray Acquisition Dose Module

**TABLE 4-13**  
**X-RAY ACQUISITION DOSE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	3	Used.
X-Ray Tube Current	(0018,1151)	3	Used.
Exposure Time	(0018,1150)	3	Used.
Exposure	(0018,1152)	3	Used.
Distance Source to Detector	(0018,1110)	3	Used.
Distance Source to Patient	(0018,1111)	3	Used.
Body Part Thickness	(0018,11A0)	3	Used.

Relative X-Ray Exposure	(0018,1405)	3	Used.
Entrance Dose in mGy	(0040,8302)	3	Used.
Distance Source to Entrance	(0040,0306)	3	Used.
Comments on Radiation Dose	(0040,0310)	3	Used.
Half Value Layer	(0040,0314)	3	Used.
Organ Dose	(0040,0316)	3	Used.
Anode Target Material	(0018,1191)	3	Used.

#### 4.4.3.8 X-Ray Generation Module

**TABLE 4-14**  
**X-RAY GENERATION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
KVP	(0018,0060)	3	Used.
X-Ray Tube Current	(0018,1151)	3	Used.
Exposure Time	(0018,1150)	3	Used.
Exposure	(0018,1152)	3	Used.
Exposure Control Mode	(0018,7060)	3	Used.
Exposure Control Mode Description	(0018,7062)	3	Used.
Focal Spot	(0018,1190)	3	Used.
Anode Target Material	(0018,1191)	3	Used.

#### 4.4.3.9 X-Ray Filtration Module

**TABLE 4-15**  
**X-RAY FILTRATION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Filter Type	(0018,1160)	3	Used.
Filter Material	(0018,7050)	3	Used.
Filter Thickness Minimum	(0018,7052)	3	Used.
Filter Thickness Maximum	(0018,7054)	3	Used.

#### 4.4.3.10 X-Ray Grid Module

**TABLE 4-16**  
**X-RAY GRID MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Grid	(0018,1166)	3	Used.

#### 4.4.3.11 Mammography Image Module

**TABLE 4-17**  
**MAMMOGRAPHY IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used.
Positioner Type	(0018,1508)	1	Used.
Distance Source to Detector	(0018,1110)	3	Used.

Distance Source to Patient	(0018,1111)	3	Used.
Positioner Primary Angle	(0018,1510)	3	Used.
Positioner Secondary Angle	(0018,1511)	3	Used.
Image Laterality	(0020,0062)	1	Used.
Organ Exposed	(0040,0318)	1	Not Used. Usually use tag "Body Part Examined"
Breast Implant Present	(0028,1300)	3	Used.
View Code Sequence	(0054,0220)	1	
>Include 'Code Sequence Macro'			Not Used.
>View Modifier Code Sequence	(0054,0222)	2	Not Used.
>>Include 'Code Sequence Macro'			Not Used.

#### 4.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

#### 4.6 DEVICES SUPPORTED BY DOSEWATCH

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
Fujifilm	AMULET
	AMULET Innovality
General Electric	Senographe 2000D
	Senographe Crystal
	Senographe Essential
	Senographe Pristina
	Senographe DS
Hologic	Selenia Dimensions 3D
	Selenia Dimensions 2D
	Lorad Selenia
IMS	Raffaello Giotto Image
Philips	MicroDose L30
	MicroDose L50
	MicroDose SI
	MammoDiagnost DR
Planmed	Planmed Nuance
Siemens	MAMMOMAT Inspiration
Volpara	Volpara Server

## 5. MR INFORMATION OBJECT IMPLEMENTATION

### 5.1 INTRODUCTION

This section specifies the use of the DICOM MR Image IOD to represent the information included in MR Images received by this implementation. Corresponding attributes are conveyed using the module construct.

### 5.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 5-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/MRStudy
Series	Series/MRSeries
Image	DicomRawImage

### 5.3 IOD MODULE TABLE

The Magnetic Resonance Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 5.5

**TABLE 5-2**  
**MR IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
	Clinical Trial Study	Not Used	
Series	General Series	Used	3.4.3.1
	Clinical Trial Series	Not Used	
Frame of Reference	Frame of Reference	Used	5.4.1.1
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	5.4.2.1
	Image Plane	Used	5.4.2.2
	Image Pixel	Used	5.4.2.3
	Contrast/Bolus	Used	5.4.2.4

Device	Used	5.4.2.5
MR Image	Used	5.4.2.6
Overlay Plane	Not Used	
VOI LUT	Used	5.4.2.7
SOP Common	Used	3.4.5.7

## 5.4 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 MR Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes expected. 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 supported.

### 5.4.1 Frame Of Reference Entity Modules

#### 5.4.1.1 Frame Of Reference Module

**TABLE 5-3**  
**FRAME OF REFERENCE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	See 5.4.1.1.1 for further explanation.
Position Reference Indicator	(0020,1040)	2	Not Used.

##### 5.4.1.1.1 Frame Of Reference UID

Frame of Reference UID is stored in database for a futur usage. It's currently not used.

### 5.4.2 Image Entity Modules

#### 5.4.2.1 General Image Module

**TABLE 5-4**  
**GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used.
Patient Orientation	(0020,0020)	2C	Used stored as received.
Content Date	(0008,0023)	2C	Used. Store the date and time of the first and last image
Content Time	(0008,0033)	2C	Used. Store the date and time of the first and last image
Image Type	(0008,0008)	3	Used. All type read and stored See 5.4.2.6.1.
Acquisition Number	(0020,0012)	3	Not Used.
Acquisition Date	(0008,0022)	3	Used.
Acquisition Time	(0008,0032)	3	Used.
Acquisition DateTime	(0008,002A)	3	Not Used.

Referenced Image Sequence	(0008,1140)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	Not Used.
>>Include 'Code Sequence Macro'			
Derivation Description	(0008,2111)	3	Not Used.
Derivation Code Sequence	(0008,9215)	3	Not Used.
>Include 'Code Sequence Macro'			
Source Image Sequence	(0008,2112)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	Not Used.
>>Include 'Code Sequence Macro'			
>Spatial Locations Preserved	(0028,135A)	3	Not Used.
>Patient Orientation	(0020,0020)	1C	Used.
Referenced Instance Sequence	(0008,114A)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	1	Not Used.
>>Include 'Code Sequence Macro'			
Images in Acquisition	(0020,1002)	3	Not Used.
Image Comments	(0020,4000)	3	Not Used.
Quality Control Image	(0028,0300)	3	Not Used.
Burned In Annotation	(0028,0301)	3	Not Used.
Lossy Image Compression	(0028,2110)	3	Not Used.
Lossy Image Compression Ratio	(0028,2112)	3	Not Used.
Lossy Image Compression Method	(0028,2114)	3	Not Used.
Icon Image Sequence	(0088,0200)	3	Not Used.
>Include 'Image Pixel Macro'			
Presentation LUT Shape	(2050,0020)	3	Not Used.

#### 5.4.2.2 Image Plane Module

TABLE 5-5  
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Not Used.
Image Orientation (Patient)	(0020,0037)	1	Used.
Image Position (Patient)	(0020,0032)	1	Not Used.
Slice Thickness	(0018,0050)	2	Used.
Slice Location	(0020,1041)	3	Used. Store the location of the first image and the last image

5.4.2.3 Image Pixel Module

TABLE 5-6  
 IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Used.
Photometric Interpretation	(0028,0004)	1	Used.
Rows	(0028,0010)	1	Used.
Columns	(0028,0011)	1	Used.
Bits Allocated	(0028,0100)	1	Used.
Bits Stored	(0028,0101)	1	Used.
High Bit	(0028,0102)	1	Used.
Pixel Representation	(0028,0103)	1	Used.
Pixel Data	(7FE0,0010)	1	Not Used. Removed by default but can be kept when configured.
Planar Configuration	(0028,0006)	1C	Not Used.
Pixel Aspect Ratio	(0028,0034)	1C	Not Used.
Smallest Image Pixel Value	(0028,0106)	3	Not Used.
Largest Image Pixel Value	(0028,0107)	3	Not Used.
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not Used.
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not Used.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not Used.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not Used.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not Used.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not Used.
ICC Profile	(0028,2000)	3	Not Used.
Pixel Data Provider URL	(0028,7FE0)	1C	Not Used.
Pixel Padding Range Limit	(0028,0121)	1C	Not Used.

5.4.2.4 Contrast/Bolus Module

TABLE 5-7  
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used.
Contrast/Bolus Agent Sequence	(0018,0012)	3	Used.
>Include 'Code Sequence Macro'			
Contrast/Bolus Route	(0018,1040)	3	Used.
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Used.
>Include 'Code Sequence Macro'			
>Additional Drug Sequence	(0018,002A)	3	Not Used.
>>Include 'Code Sequence Macro'			
Contrast/Bolus Volume	(0018,1041)	3	Used.
Contrast/Bolus Start Time	(0018,1042)	3	Used.
Contrast/Bolus Stop Time	(0018,1043)	3	Not Used.
Contrast/Bolus Total Dose	(0018,1044)	3	Not Used.
Contrast Flow Rate(s)	(0018,1046)	3	Not Used.
Contrast Flow Duration(s)	(0018,1047)	3	Not Used.
Contrast/Bolus Ingredient	(0018,1048)	3	Not Used.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Used.

5.4.2.5 Device Module

TABLE 5-8  
DEVICE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Device Sequence	(0050,0010)	3	Used.
>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	3	Used.
>Manufacturer's Model Name	(0008,1090)	3	Used.
>Device Serial Number	(0018,1000)	3	Used.
>Device ID	(0018,1003)	3	Used.
>Device Length	(0050,0014)	3	Not Used.
>Device Diameter	(0050,0016)	3	Not Used.
>Device Diameter Units	(0050,0017)	2C	Not Used.
>Device Volume	(0050,0018)	3	Not Used.
>Inter-Marker Distance	(0050,0019)	3	Not Used.
>Device Description	(0050,0020)	3	Not Used.

## 5.4.2.6 MR Image Module

**TABLE 5-9  
MR IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Image Type	(0008,0008)	1	Used. By default only the value of the first image is used
Samples per Pixel	(0028,0002)	1	Used. By default only the value of the first image is used
Photometric Interpretation	(0028,0004)	1	Used. By default only the value of the first image is used
Bits Allocated	(0028,0100)	1	Used. By default only the value of the first image is used
Bits Stored	(0028,0101)	1	Not Used.
High Bit	(0028,0102)	1	Not Used.
Scanning Sequence	(0018,0020)	1	Used. By default only the value of the first image is used
Sequence Variant	(0018,0021)	1	Used. By default only the value of the first image is used
Scan Options	(0018,0022)	2	Used. By default only the value of the first image is used
MR Acquisition Type	(0018,0023)	2	Used. By default only the value of the first image is used
Repetition Time	(0018,0080)	2C	Used. By default only the value of the first image is used
Echo Time	(0018,0081)	2	Used. By default only the value of the first image is used
Echo Train Length	(0018,0091)	2	Used. By default only the value of the first image is used
Inversion Time	(0018,0082)	2C	Used. By default only the value of the first image is used
Trigger Time	(0018,1060)	2C	Not Used.
Sequence Name	(0018,0024)	3	Used. By default only the value of the first image is used
Angio Flag	(0018,0025)	3	Not Used.
Number of Averages	(0018,0083)	3	Used. By default only the value of the first image is used
Imaging Frequency	(0018,0084)	3	Used. By default only the value of the first image is used
Imaged Nucleus	(0018,0085)	3	Used. By default only the value of the first image is used
Echo Number	(0018,0086)	3	Used. By default only the value of the first image is used
Magnetic Field Strength	(0018,0087)	3	Used. By default only the value of the first image is used
Spacing Between Slices	(0018,0088)	3	Used. By default only the value of the first image is used

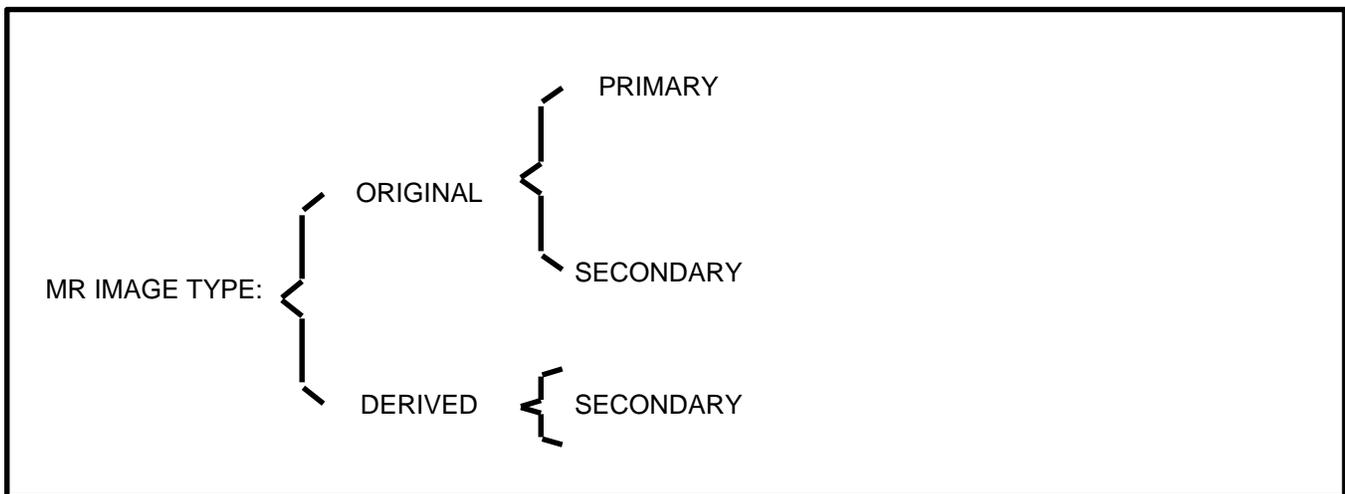
Number of Phase Encoding Steps	(0018,0089)	3	Used. By default only the value of the first image is used
Percent Sampling	(0018,0093)	3	Used. By default only the value of the first image is used
Percent Phase Field of View	(0018,0094)	3	Used. By default only the value of the first image is used
Pixel Bandwidth	(0018,0095)	3	Used. By default only the value of the first image is used
Nominal Interval	(0018,1062)	3	Not Used.
Beat Rejection Flag	(0018,1080)	3	Not Used.
Low R-R Value	(0018,1081)	3	Not Used.
High R-R Value	(0018,1082)	3	Not Used.
Intervals Acquired	(0018,1083)	3	Not Used.
Intervals Rejected	(0018,1084)	3	Not Used.
PVC Rejection	(0018,1085)	3	Not Used.
Skip Beats	(0018,1086)	3	Not Used.
Heart Rate	(0018,1088)	3	Not Used.
Cardiac Number of Images	(0018,1090)	3	Not Used.
Trigger Window	(0018,1094)	3	Not Used.
Reconstruction Diameter	(0018,1100)	3	Used. By default only the value of the first image is used
Receive Coil Name	(0018,1250)	3	Used. By default only the value of the first image is used
Transmit Coil Name	(0018,1251)	3	Used. By default only the value of the first image is used
Acquisition Matrix	(0018,1310)	3	Used. By default only the value of the first image is used
Phase Encoding Direction	(0018,1312)	3	Not Used.
Flip Angle	(0018,1314)	3	Used. By default only the value of the first image is used
SAR	(0018,1316)	3	Used. By default only the value of the first image is used
Variable Flip Angle Flag	(0018,1315)	3	Not Used.
dB/dt	(0018,1318)	3	Used. By default only the value of the first image is used
Temporal Position Identifier	(0020,0100)	3	Not Used.
Number of Temporal Positions	(0020,0105)	3	Not Used.
Temporal Resolution	(0020,0110)	3	Not Used.
Anatomic Region Sequence	(0008,2218)	3	Used. By default only the value of the first image is used
> Include 'Code Sequence Macro'			Used. By default only the value of the first image is used
> Anatomic Region Modifier Sequence	(0008,2220)	3	Not Used.
>> Include 'Code Sequence Macro'			Not Used.

Primary Anatomic Structure Sequence	(0008,2228)	3	Not Used.
> Include 'Code Sequence Macro'			
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not Used.
>> Include 'Code Sequence Macro'			Not Used.

**5.4.2.6.1 Image Type**

DoseWatch store any type of image for the MR modality, this allows to retrieve as much information as possible.

**ILLUSTRATION 5.4-1  
MR IMAGE TYPE DECISION TREE**



**5.4.2.7 VOI LUT module**

**TABLE 5-10  
VOI LUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	1C	Not Used.
>LUT Descriptor	(0028,3002)	1	Not Used.
>LUT Explanation	(0028,3003)	3	Not Used.
>LUT Data	(0028,3006)	1	Not Used.
Window Center	(0028,1050)	1C	Used. Only the first pair is read.
Window Width	(0028,1051)	1C	Used. Only the first pair is read.
Window Center & Width Explanation	(0028,1055)	3	Not Used.

**5.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES**

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

**5.6 DEVICES SUPPORTED BY DOSEWATCH**

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

<b>Manufacturer</b>	<b>Model</b>
General Electric	Discovery MR450 1.5T
	Discovery MR750 3.0T
	Optima MR360 1.5T
	Optima MR450w 1.5T
	SIGNA Artist
	Signa EXCITE HD 3.0T/1.5T
	SIGNA Explorer
	Signa HDxt 3.0T/1.5T
	SIGNA Pioneer 3.0T
	SIGNA Voyager – 70cm 1.5T
Siemens	MAGNETOM Aera 1.5T
	MAGNETOM Prismafit 3.0T
	MAGNETOM Skyra 3.0T
Philips	Achieva 3.0T TX
	Ingenia 1.5T CX

## 6. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

### 6.1 INTRODUCTION

This section specifies the use of the DICOM SC Image IOD to represent the information included in SC Images **received** by this implementation. Corresponding attributes are conveyed using the module construct.

DoseWatch use secondary captures of type Dose Report for example series 996 and 999 for GE CT, store them as images and process OCR on them if needed.

Secondary captures are used to extract information not available in other cases. They are used for CT studies, MG Studies, RF Studies and XA Studies.

### 6.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 6-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/CTStudy Study/MGStudy Study/RFStudy Study/XAStudy
Series	Series/CTSeries Series/MGSeries Series/RFSeries Series/XASeries
Image	DicomRawImage

### 6.3 IOD MODULE TABLE

The Secondary Capture Information Object Definition comprises the modules of the following table.

**TABLE 6-2**  
**SC IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
	Clinical Trial Study	Not Used	
Series	General Series	Not Used	
	Clinical Trial Series	Not Used	
Equipment	General Equipment	Not Used	
	SC Equipment	Not Used	
Image	General Image	Not Used	
	Image Pixel	Used	6.4.1.1
	Device	Not Used	
	SC Image	Not Used	
	Overlay Plane	Not Used	
	Modality LUT	Not Used	
	VOI LUT	Not Used	
	SOP Common	Not Used	

**6.4 INFORMATION MODULE DEFINITIONS**

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes expected. 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 supported.

### 6.4.1 Image Entity Modules

#### 6.4.1.1 Image Pixel Module

Grayscale and RGB secondary captures are supported for CT, XA and US with square pixels. Non square pixels may have a limited support.

**TABLE 6-3  
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Used to open image and perform OCR.
Photometric Interpretation	(0028,0004)	1	Used to open image and perform OCR.
Rows	(0028,0010)	1	Used to open image and perform OCR.
Columns	(0028,0011)	1	Used to open image and perform OCR.
Bits Allocated	(0028,0100)	1	Used to open image and perform OCR.
Bits Stored	(0028,0101)	1	Used to open image and perform OCR.
High Bit	(0028,0102)	1	Used to open image and perform OCR.
Pixel Representation	(0028,0103)	1	Used to open image and perform OCR.
Pixel Data	(7FE0,0010)	1	Used to open image and perform OCR.
Planar Configuration	(0028,0006)	1C	Used to open image and perform OCR.
Pixel Aspect Ratio	(0028,0034)	1C	Used to open image and perform OCR.
Smallest Image Pixel Value	(0028,0106)	3	Used to open image and perform OCR.
Largest Image Pixel Value	(0028,0107)	3	Used to open image and perform OCR.
Pixel Padding Range Limit	(0028,0121)	1C	Used to open image and perform OCR.

#### 6.4.1.2 Secondary captures used with OCR

OCR is used to extract specific information which can be found in the pixel data.

For GE CT systems the following secondary captures are used :

- series 996 is used to extract contrast information.
- series 999 is used to extract dose information.

For GE OEC systems, the series 1 is used to extract dose information.

For Toshiba systems, the series 9000 (may differ depend of the system or examination) is used to extract dose information.

For Siemens CT, the series 501 or 502 is used to extract contrast information.

## 7. US INFORMATION OBJECT IMPLEMENTATION

### 7.1 INTRODUCTION

This section specifies the use of the DICOM US Image IOD to represent the information included in US Images received by this implementation. Corresponding attributes are conveyed using the module construct.

### 7.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 7-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/USStudy
Series	Series/USSeries
Image	DicomRawImage

### 7.3 IOD MODULE TABLE

The Ultrasound Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 7.5 **Error! Reference source not found.**

**TABLE 7-2**  
**US IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
Series	General Series	Used	3.4.3.1
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Frame of Reference	Frame of Reference	Not Used	
	Synchronization	Not Used	
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	7.4.1.1
	Image Pixel	Not Used	
	Contrast/Bolus	Used	7.4.1.2
	Palette Color Lookup Table	Not Used	
	Device	Used	7.4.1.3

US Region Calibration	Not Used	
US Image	Used	7.4.1.4
Overlay Plane	Not Used	
VOI LUT	Not Used	
SOP Common	Used	3.4.5.7

#### 7.4 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 US Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes expected. 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 supported.

##### 7.4.1 Image Entity Modules

##### 7.4.1.1 General Image Module

**TABLE 7-3  
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used.
Patient Orientation	(0020,0020)	2C	Not Used.
Content Date	(0008,0023)	2C	Used.
Content Time	(0008,0033)	2C	Used with Content Date.
Image Type	(0008,0008)	3	Used.
Acquisition Number	(0020,0012)	3	Not Used.
Acquisition Date	(0008,0022)	3	Not Used.
Acquisition Time	(0008,0032)	3	Not Used.
Acquisition DateTime	(0008,002A)	3	Not Used.
Referenced Image Sequence	(0008,1140)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	Not Used.
>>Include 'Code Sequence Macro'			
Derivation Description	(0008,2111)	3	Not Used.
Derivation Code Sequence	(0008,9215)	3	Not Used.
>Include 'Code Sequence Macro'			
Source Image Sequence	(0008,2112)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	Not Used.
>>Include 'Code Sequence Macro'			
>Spatial Locations Preserved	(0028,135A)	3	Not Used.

>Patient Orientation	(0020,0020)	1C	Not Used.
Referenced Instance Sequence	(0008,114A)	3	Not Used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	1	Not Used.
>>Include 'Code Sequence Macro'			
Images in Acquisition	(0020,1002)	3	Not Used.
Image Comments	(0020,4000)	3	Not Used.
Quality Control Image	(0028,0300)	3	Not Used.
Burned In Annotation	(0028,0301)	3	Not Used.
Lossy Image Compression	(0028,2110)	3	Not Used.
Lossy Image Compression Ratio	(0028,2112)	3	Not Used.
Lossy Image Compression Method	(0028,2114)	3	Not Used.
Icon Image Sequence	(0088,0200)	3	Not Used.
>Include 'Image Pixel Macro'			
Presentation LUT Shape	(2050,0020)	3	Not Used.

## 7.4.1.2 Contrast/Bolus Module

**TABLE 7-4  
CONTRAST/BOLUS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used.
Contrast/Bolus Agent Sequence	(0018,0012)	3	Not Used.
>Include 'Code Sequence Macro'			
Contrast/Bolus Route	(0018,1040)	3	Used.
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Used.
>Include 'Code Sequence Macro'			
>Additional Drug Sequence	(0018,002A)	3	Not Used.
>>Include 'Code Sequence Macro'			
Contrast/Bolus Volume	(0018,1041)	3	Used.
Contrast/Bolus Start Time	(0018,1042)	3	Used.
Contrast/Bolus Stop Time	(0018,1043)	3	Not Used.
Contrast/Bolus Total Dose	(0018,1044)	3	Not Used.
Contrast Flow Rate(s)	(0018,1046)	3	Not Used.
Contrast Flow Duration(s)	(0018,1047)	3	Not Used.
Contrast/Bolus Ingredient	(0018,1048)	3	Not Used.
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Not Used.

7.4.1.3 Device Module

TABLE 7-5  
 DEVICE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Device Sequence	(0050,0010)	3	Used.
>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	3	Used.
>Manufacturer's Model Name	(0008,1090)	3	Used.
>Device Serial Number	(0018,1000)	3	Used.
>Device ID	(0018,1003)	3	Used.
>Device Length	(0050,0014)	3	Not Used.
>Device Diameter	(0050,0016)	3	Not Used.
>Device Diameter Units	(0050,0017)	2C	Not Used.
>Device Volume	(0050,0018)	3	Not Used.
>Inter-Marker Distance	(0050,0019)	3	Not Used.
>Device Description	(0050,0020)	3	Not Used.

7.4.1.4 US Image Module

This section specifies the Attributes that describe ultrasound images.

TABLE 7-6  
 US IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Samples Per Pixel	(0028,0002)	1	Not Used.
Photometric Interpretation	(0028,0004)	1	Not Used.
Bits Allocated	(0028,0100)	1	Not Used.
Bits Stored	(0028,0101)	1	Not Used.
High Bit	(0028,0102)	1	Not Used.
Planar Configuration	(0028,0006)	1C	Not Used.
Pixel Representation	(0028,0103)	1	Not Used.
Frame Increment Pointer	(0028,0009)	1C	Not Used.
Image Type	(0008,0008)	2	Used.
Lossy Image Compression	(0028,2110)	1C	Not Used.
Number of Stages	(0008,2124)	2C	Not Used.
Number of Views in Stage	(0008,212A)	2C	Not Used.
R Wave Time Vector	(0018,6060)	3	Not Used.
Ultrasound Color Data Present	(0028,0014)	3	Not Used.
Stage Name	(0008,2120)	3	Not Used.
Stage Code Sequence	(0040,000A)	3	Not Used.
> Include 'Code Sequence Macro'			Not Used.
Stage Number	(0008,2122)	3	Not Used.
View Name	(0008,2127)	3	Not Used.

View Number	(0008,2128)	3	Not Used.
Number of Event Timers	(0008,2129)	3	Not Used.
Event Elapsed Time(s)	(0008,2130)	3	Not Used.
Event Timer Name(s)	(0008,2132)	3	Not Used.
Anatomic Region Sequence	(0008,2218)	3	Not Used.
> Include 'Code Sequence Macro'			
>Anatomic Region Modifier Sequence	(0008,2220)	3	Not Used.
>> Include 'Code Sequence Macro'			
Primary Anatomic Structure Sequence	(0008,2228)	3	Not Used.
> Include 'Code Sequence Macro'			
>Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not Used.
>> Include 'Code Sequence Macro'			
View Code Sequence	(0054,0220)	3	Not Used.
> Include 'Code Sequence Macro'			
>View Modifier Code Sequence	(0054,0222)	3	Not Used.
>> Include 'Code Sequence Macro'			
Acquisition Datetime	(0008,002A)	1C	Not Used.
Trigger Time	(0018,1060)	3	Not Used.
Nominal Interval	(0018,1062)	3	Not Used.
Beat Rejection Flag	(0018,1080)	3	Not Used.
Low R-R Value	(0018,1081)	3	Not Used.
High R-R Value	(0018,1082)	3	Not Used.
Heart Rate	(0018,1088)	3	Not Used.
IVUS Acquisition	(0018,3100)	1C	Not Used.
IVUS Pullback Rate	(0018,3101)	1C	Not Used.
IVUS Gated Rate	(0018,3102)	1C	Not Used.
IVUS Pullback Start Frame Number	(0018,3103)	1C	Not Used.
IVUS Pullback Stop Frame Number	(0018,3104)	1C	Not Used.
Lesion Number	(0018,3105)	3	Not Used.
Output Power	(0018,5000)	3	Not Used.
Transducer Data	(0018,5010)	3	Used.
Transducer Type	(0018,6031)	3	Used.
Focus Depth	(0018,5012)	3	Not Used.
Preprocessing Function	(0018,5020)	3	Not Used.
Mechanical Index	(0018,5022)	3	Not Used.
Bone Thermal Index,	(0018,5024)	3	Not Used.
Cranial Thermal Index	(0018,5026)	3	Not Used.
Soft Tissue Thermal Index	(0018,5027)	3	Not Used.
Soft Tissue-focus Thermal Index	(0018,5028)	3	Not Used.

Soft Tissue-surface Thermal Index	(0018,5029)	3	Not Used.
Depth of Scan Field	(0018,5050)	3	Not Used.
Overlay Subtype	(60xx,0045)	3	Not Used.

### 7.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

### 7.6 DEVICES SUPPORTED BY DOSEWATCH

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
General Electric	LOGIQ e -2014
	LOGIQ E9 (with/without XDclear)
	LOGIQ F8
	LOGIQ S7
	LOGIQ S8 (with/without XDclear)
	Vivid E9 (with/without XDclear)
	Vivid E95
	Vivid iq
	Vivid S70
	Voluson 730
	Voluson E10
	Voluson E6
	Voluson E8
	Voluson S10
	Voluson S6
Voluson S8	
Philips	HD15

## 8. US MULTI-FRAME INFORMATION OBJECT IMPLEMENTATION

### 8.1 INTRODUCTION

This section specifies the use of the DICOM US Multi-Frame Image IOD to represent the information included in US Multi-Frame Images received by this implementation. Corresponding attributes are conveyed using the module construct.

### 8.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 8-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/USStudy
Series	Series/USSeries
Image	DicomRawImage

### 8.3 IOD MODULE TABLE

The Ultrasound Image Multi-Frame Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 8.5.

**TABLE 8-2**  
**US MULTI-FRAME IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
Series	General Series	Used	3.4.3.1
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Frame of Reference	Frame of Reference	Not Used	
	Synchronization	Not Used	
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	7.4.1.1
	Image Pixel	Not Used	
	Contrast/Bolus	Used	7.4.1.2
	Cine	Not Used	

Multi-Frame	Used	8.4.1.1
Frame Pointers	Not Used	
Palette Color Lookup Table	Not Used	
Device	Used	7.4.1.3
US Region Calibration	Not Used	
US Image	Used	7.4.1.4
VOI LUT	Not Used	
SOP Common	Used	3.4.5.7

**8.4 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 US Multi-Frame Information Object.

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 supported.

**8.4.1 Image Entity Modules**

**8.4.1.1 Multi-Frame Module**

**TABLE 8-3  
 MULTI-FRAME MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Used.
Frame Increment Pointer	(0028,0009)	1	Not Used.

**8.4.1.1.1 Number Of Frames and Frame Increment Pointer**

The number of frames is read and only the first frame is kept to run an OCR process.

**8.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES**

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

**8.6 DEVICES SUPPORTED BY DOSEWATCH**

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
General Electric	LOGIQ e -2014
	LOGIQ E9 (with/without XDclear)
	LOGIQ F8

	LOGIQ S7
	LOGIQ S8 (with/without XDclear)
	Vivid E9 (with/without XDclear)
	Vivid E95
	Vivid iq
	Vivid S70
	Voluson 730
	Voluson E10
	Voluson E6
	Voluson E8
	Voluson S10
	Voluson S6
	Voluson S8
Philips	HD15

## 9. X-RAY ANGIOGRAPHIC INFORMATION OBJECT IMPLEMENTATION

### 9.1 INTRODUCTION

This section specifies the use of the DICOM X-Ray Angiographic Image IOD to represent the information included in X-Ray Angiographic Images received by this implementation. Corresponding attributes are conveyed using the module construct.

The DICOM fields read for X-Ray Angiographic is limited in DoseWatch and completed with the usage of private interfaces for certain modalities.

### 9.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 9-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/XAStudy
Series	Series/XASeries
Image	DicomRawImage

### 9.3 IOD MODULE TABLE

The X-Ray Angiographic Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 9.5.

**TABLE 9-2**  
**X-RAY ANGIOGRAPHIC IMAGE IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not Used	
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
	Clinical Trial Study	Not Used	
Series	General Series	Used	3.4.3.1
	Clinical Trial Series	Not Used	
Frame of Reference	Synchronization	Not Used	
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Not Used	
	Image Pixel	Not Used	
	Contrast/Bolus	Used	3.4.5.4
	Cine	Not Used	
	Multi-Frame	Not Used	

Frame Pointers	Not Used	
Mask	Not Used	
Display Shutter	Not Used	
Device	Not Used	
Intervention	Not Used	
X-Ray Image	Not Used	
X-Ray Acquisition	Used	9.4.1.1
X-Ray Collimator	Not Used	
X-Ray Table	Not Used	
XA Positioner	Used	9.4.1.2
DX Detector	Not Used	
Overlay Plane	Not Used	
Multi-Frame Overlay	Not Used	
Modality LUT	Not Used	
VOI LUT	Not Used	
SOP Common	Used	3.4.5.7
Frame Extraction	Not Used	

#### 9.4 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 X-Ray Angiographic Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes expected. 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 supported.

##### 9.4.1 Image Entity Modules

##### 9.4.1.1 X-Ray Acquisition Module

**TABLE 9-3**  
**X-RAY ACQUISITION MODULE**

Attribute Name	Tag	Type	Attribute Description
KV	(0018,0060)	2	Used.
Radiation Setting	(0018,1155)	1	Not Used.
X-Ray Tube Current	(0018,1151)	2C	Used.
Exposure Time	(0018,1150)	2C	Used.
Exposure	(0018,1152)	2C	Used.
Grid	(0018,1166)	3	Used.
Average Pulse Width	(0018,1154)	3	Used.
Radiation Mode	(0018,115A)	3	Used.

Field of View Dimension(s)	(0018,1149)	3	Used.
Focal Spot(s)	(0018,1190)	3	Used.
Image and Fluoroscopy Area Dose Product	(0018,115E)	3	Used.

#### 9.4.1.2 XA Positioner Module

**TABLE 9-4**  
**XA POSITIONER MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Distance Source to Patient	(0018,1111)	3	Used.
Distance Source to Detector	(0018,1110)	3	Used.
Positioner Primary Angle	(0018,1510)	2	Used.
Positioner Secondary Angle	(0018,1511)	2	Used.

### 9.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

As DoseWatch is based on dictionary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

### 9.6 DEVICES SUPPORTED BY DOSEWATCH

Here is the list of devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
General Electric	Brivo OEC 865
	Discovery IGS 730
	Discovery IGS 740
	Innova 2000
	Innova 2100-IQ
	Innova 2121-IQ
	Innova 3100
	Innova 3100-IQ
	Innova 3131-IQ
	Innova 4100
	Innova 4100-IQ
	Innova IGS 520
	Innova IGS 530
	Innova IGS 540
	Innova IGS 620
	Innova IGS 630
	OEC 7900 Fluorostar
	OEC 8800 Flexiview
	OEC 9800
	OEC 9900 Elite
	OEC Elite
	OEC Elite CFD Vascular
	Optima CL323i
Hologic	Fluoroscan InSight
Philips	Allura Clarity

	Allura FD20/15
	Allura Xper
	Allura Xper FD10
	Allura Xper FD10/10
	Allura Xper FD20
	Allura Xper FD20/10
	Allura Xper FD20/20
	Azurion
	BV Endura
	BV Pulsera
	Integris Allura
	Integris H5000
	Integris V5000
Veradius	
Siemens	ARCADIS Avantic
	ARCADIS Orbic (3D)
	ARCADIS Varic
	Artis Pheno
	Artis Q
	Artis Q.zen
	Artis zee (with/without Pure)
	Artis zee Biplane (with/without Pure)
	Artis zee Ceiling
	Artis zee Floor
	Artis zee Multi-Purpose

	Artis zeego
	AXIOM Artis
	AXIOM Artis BA
	AXIOM Artis dBA
	AXIOM Artis dBC
	AXIOM Artis dFA
	AXIOM Artis dFC
	AXIOM Artis dMP
	AXIOM Artis dTA
	AXIOM Artis FA
	AXIOM Artis FC
	AXIOM Artis MP
	AXIOM Artis U
	Cios Alpha
	Cios Connect
	Cios Fusion
	SIREMOBIL Compact L
Swemac Imaging	Biplanar 500E
	Biplanar 600S
Thales	Duet DRF
Toshiba	Infinix DFP-8000D
	Infinix-i series
	INFX-8000C
	INFX-8000V
	Ultimax-i
Ziehm	Ziehm Solo
	Ziehm Vision
	Ziehm Vision FD

## 10. X-RAY RF INFORMATION OBJECT IMPLEMENTATION

### 10.1 INTRODUCTION

This section specifies the use of the DICOM X-Ray RF Image IOD to represent the information included in XRF Images **received** by this implementation. Corresponding attributes are conveyed using the module construct.

All fields listed below are fields stored in database. Not all fields are displayed but they can all be exported into data exports for statistics needs.

### 10.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 10-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/RFStudy
Series	Series/RFSeries
Image	DicomRawImage

### 10.3 IOD MODULE TABLE

The XRF Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 10.5.

**TABLE 10-2**  
**XRF IMAGE 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	General Series	Used	3.4.3.1
	Clinical Trial Series	Not Used	
Equipment	General Equipment	Used	3.4.4.1
Image	General Image	Used	10.4.1.1
	Image Pixel	Used	4.4.3.1
	Contrast/Bolus	Used	3.4.5.4
	Cine	Not Used	
	Multi-Frame	Not Used	
	Frame Pointers	Not Used	
	Mask	Not Used	

X-Ray Image	Used	10.4.1.2
X-Ray Acquisition	Used	10.4.1.3
X-Ray Collimator	Used	10.4.1.4
Display Shutter	Not Used	
Device	Not Used	
Intervention	Not Used	
X-Ray Table	Not Used	
XRF Positioner	Used	10.4.1.5
X-Ray Tomography Acquisition	Used	10.4.1.6
DX Detector	Used	10.4.1.7
Overlay Plane	Not Used	
Multi-Frame Overlay	Not Used	
Modality LUT	Used	10.4.1.8
VOI LUT	Used	10.4.1.9
SOP Common	Used	3.4.5.7
Frame Extraction	Not Used	

#### 10.4 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 X-Ray RF Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes expected. 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 supported.

##### 10.4.1 Image Entity Modules

##### 10.4.1.1 General Image Module

**TABLE 10-3  
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used.
Patient Orientation	(0020,0020)	2C	Used.
Content Date	(0008,0023)	2C	Used.
Content Time	(0008,0033)	2C	Used.
Image Type	(0008,0008)	3	Used.
Acquisition Date	(0008,0022)	3	Used.
Acquisition Time	(0008,0032)	3	Used.
Quality Control Image	(0028,0300)	3	Used.
Burned In Annotation	(0028,0301)	3	Used.

Lossy Image Compression	(0028,2110)	3	Used.
Presentation LUT Shape	(2050,0020)	3	Used.
Irradiation Event UID	(0008,3010)	3	Used.

#### 10.4.1.2 X-Ray Image Module

**TABLE 10-4**  
**X-RAY IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Lossy Image Compression	(0028,2110)	1C	Used.
Image Type	(0008,0008)	1	Used.
Pixel Intensity Relationship	(0028,1040)	1	Used.
Samples per Pixel	(0028,0002)	1	Used.
Photometric Interpretation	(0028,0004)	1	Used.
Bits Allocated	(0028,0100)	1	Used.
Bits Stored	(0028,0101)	1	Used.
High Bit	(0028,0102)	1	Used.
Pixel Representation	(0028, 0103)	1	Used.
Anatomic Region Sequence	(0008,2218)	3	Used.
> Include 'Code Sequence Macro'			

#### 10.4.1.3 X-Ray Acquisition Module

**TABLE 10-5**  
**X-RAY ACQUISITION MODULE**

Attribute Name	Tag	Type	Attribute Description
KV	(0018,0060)	2	Used.
Radiation Setting	(0018,1155)	1	Not Used.
X-Ray Tube Current	(0018,1151)	2C	Used.
X-Ray Tube Current in microA	(0018,8151)	3	Used.
Exposure Time	(0018,1150)	2C	Used.
Exposure	(0018,1152)	2C	Used.
Exposure in microAs	(0018,1153)	3	Used.
Grid	(0018,1166)	3	Used.
Field of View Shape	(0018,1147)	3	Used.
Field of View Dimension(s)	(0018,1149)	3	Used.
Imager Pixel Spacing	(0018,1164)	3	Used.
Pixel Spacing	(0028,0030)	1C	Used.
Focal Spot(s)	(0018,1190)	3	Used.
Image and Fluoroscopy Area Dose Product	(0018,115E)	3	Used.

**10.4.1.4 X-Ray Collimator****TABLE 10-6  
X-RAY COLLIMATOR MODULE**

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	Used.

**10.4.1.5 XRF Positioner Module****TABLE 10-7  
XRF POSITIONER MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Distance Source to Detector	(0018,1110)	3	Used.
Distance Source to Patient	(0018,1111)	3	Used.

**10.4.1.6 X-Ray Tomo Acquisition Module****TABLE 10-8  
X-RAY TOMO ACQUISITION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Tomo Layer Height	(0018,1460)	1	Used.
Tomo Angle	(0018,1470)	3	Used.
Tomo Time	(0018,1480)	3	Used.
Tomo Type	(0018,1490)	3	Used.
Tomo Class	(0018,1491)	3	Used.
Number of Tomosynthesis Source Images	(0018,1495)	3	Used.

**10.4.1.7 DX Detector Module****TABLE 10-9  
DX DETECTOR MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Detector Type	(0018,7004)	2	Used.
Detector Configuration	(0018,7005)	3	Used.
Detector ID	(0018,700A)	3	Used.
Detector Binning	(0018,701A)	3	Used.
Detector Conditions Nominal Flag	(0018,7000)	3	Used.
Detector Temperature	(0018,7001)	3	Used.
Sensitivity	(0018,6000)	3	Used.
Detector Element Physical Size	(0018,7020)	3	Used.
Detector Element Spacing	(0018,7022)	3	Used.
Detector Active Shape	(0018,7024)	3	Used.
Detector Active Dimension(s)	(0018,7026)	3	Used.
Field of View Shape	(0018,1147)	3	Used.
Field of View Dimension(s)	(0018,1149)	3	Used.

Field of View Origin	(0018,7030)	1C	Used.
Field of View Rotation	(0018,7032)	1C	Used.
Field of View Horizontal Flip	(0018,7034)	1C	Used.
Imager Pixel Spacing	(0018,1164)	1	Used.
Pixel Spacing	(0028,0030)	1C	Used.

#### 10.4.1.8 Modality LUT module

**TABLE 10-10**  
**MODALITY LUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Rescale Slope	(0028,1052)	1C	Used.
Rescale Intercept	(0028,1053)	1C	Used.
Rescale Type	(0028,1054)	1C	Used.

#### 10.4.1.9 VOI LUT module

**TABLE 10-11**  
**VOI LUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	1C	Used.
>LUT Descriptor	(0028,3002)	1	Used.
>LUT Explanation	(0028,3003)	3	Used.
>LUT Data	(0028,3006)	1	Used.
Window Center	(0028,1050)	1C	Used.
Window Width	(0028,1051)	1C	Used.
Window Center & Width Explanation	(0028,1055)	3	Used.

### 10.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

As DoseWatch is based on dictionary proprietary technology it is possible to read and store advanced private data attributes. They won't be listed below as DoseWatch is a multi-manufacturer and multi-modalities Dose Tracking System, the list will be too exhaustive to produce.

### 10.6 DEVICES SUPPORTED BY DOSEWATCH

Here are devices managed by DoseWatch. Other devices can be integrated upon request.

Manufacturer	Model
ADORA	Adora
AGFA	DR 400
	DR 600
	DX-D 100
	DX-D 300
	DX-D 500
	DX-D 600
	DX-D 800
Arcoma	Precision

Carestream	DR 3500
	DR 7500
	DR 9500
	DRX-1
	DRX-Ascend
	DRX-Evolution
	DRX-Excel Plus
	DRX-Mobile Retrofit
	DRX-Revolution

CAT Medical Systems	Helios DRF
Control-X Medical LTD	Perform-X AT
DMS Imaging	Platinum
EOS Imaging	EOS
Fujifilm	DR-ID 300CL
	FCR Go 2
	FDR AcSelerate
	FDR Go
General Electric	FDR Smart f
	Brivo XR385
	Connexity
	Definium 5000
	Definium 6000
	Definium 8000
	Definium AMX 700
	Discovery RF180
	Discovery XR650
	Discovery XR656
	Optima XR200amx
	Optima XR220amx
	Optima XR240
	Optima XR646
	Precision 500D
Precision 600FP	
Proteus XR/a	
Proteus XR/f	
Revolution XRd	
General Medical Merate	Opera Swing
	Opera T90
	Opera T2000tr
Hologic	Delphi W
	Discovery DXA system
	QDR Explorer
Instrumentarium	ORTHOPANTOMOGRAPH® OP300
	ORTHOPANTOMOGRAPH OP200 D
Italray	X-Frame DR2T System
KaVo	ORTHOPANTOMOGRAPH OP 3D Pro
Konica Minolta	AeroDR X30
	AeroDR X70
Mecall	EIDOS RF430
	EIDOS RF 439
OrthoScan	OrthoScan HD Mini C-arm
Philips	CombiDiagnost R90
	DigitalDiagnost
	DigitalDiagnost R1.5.3.1
	EasyDiagnost Eleva DRF
	Essenta DR Compact

	Juno DRF
	MobileDiagnost wDR
	MultiDiagnost Eleva
	PCR Eleva CosimaX ProGrade
Planmeca	Planmeca ProMax 3D Max
PrimaX	CLISSIS EXEL DRF
	Kalos
	Primo-W
Radiologia	Transportix B-D-C
Samsung	GF50
	GF70
	XGEO GC80
	XGEO GC85A
Shimadzu	MobileDaRt Evolution
	RADspeed DR
	SonialVision G4
	UD150V-40
Siemens	AXIOM Aristos FX Plus
	AXIOM Aristos MX
	AXIOM Aristos TX
	AXIOM Aristos VX
	AXIOM Iconos MD
	AXIOM Iconos R200
	AXIOM Sireskop SD
	Fluorospot Compact FD
	FLUOROSPOT H
	Luminos
	Luminos Agile
	Luminos dRF
	Luminos dRF Max
	Luminos Fusion
	Mobilett Mira
	Mobilett Mira Max
	Mobilett XP Digital
	Multix Fusion
	Multix Fusion Max
	UROSKOP Access
	UROSKOP Omnia
	Ysio
	Ysio Max
STEPHANIX	Evidence DReam
	Evolution HV
	D²RS
Swissray	ddRFormula
	ddRCombi Plus
Toshiba	DRAD-3000A
	RADREX-i -TFD-3000B
Villa Sistemi Medicali	Apollo EZ DRF
Xograph	buckyStar
	Triathlon T3

## 11. CT/X-RAY RADIATION DOSE STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

### 11.1 INTRODUCTION

This section specifies the use of the DICOM CT/X-Ray Radiation Dose SR IOD to represent results **produced and received** by this implementation. Corresponding attributes are conveyed using the module construct.

### 11.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 11-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	CTStudy XAShudy MGStudy RFStudy
Series	CTSeries XASeries MGSeries RFSeries
Document	DicomMessage

### 11.3 IOD MODULE TABLE

The CT/X-Ray Radiation Dose Structured Report Information Object Definitions comprise the modules of the following tables.

The contents of the SR Document Content are constrained by the supported template, as identified in Section 11.4.3.4.1. Standard, Standard Extended and Private templates are further described in Section 11.5.

**TABLE 11-2**  
**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	11.4.2.1
Synchronization	Synchronization	Not Used	

Equipment	General Equipment	Used	3.4.4.1(for SR Reading) 11.4.1.1 (for SR production)
	Enhanced General Equipment	Used	11.4.1.2
Document	SR Document General	Used	11.4.3.1
	SR Document Content	Used	11.4.3.2
	SOP Common	Used	11.4.3.3

#### 11.4 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 and expected. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance as well as 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 supported.

##### 11.4.1 Equipment Entity Modules

###### 11.4.1.1 General Equipment Module

The module defined below is used only when DoseWatch is producing RDSR.

**TABLE 11-3  
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Use "GE Medical Systems".
Institution Name	(0008,0080)	3	Use the name of the institution if provided by the original modality.
Institution Address	(0008,0081)	3	Use the address of the institution if provided by the original modality.
Station Name	(0008,1010)	3	Use "DoseWatch".
Institutional Department Name	(0008,1040)	3	Use the department name if provided by the original modality.
Manufacturer's Model Name	(0008,1090)	3	Use "DoseWatch".

###### 11.4.1.2 Enhanced General Equipment Module

**TABLE 11-4  
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	1	Used. Use "GE Medical Systems" when producing RDSR.
Manufacturer's Model Name	(0008,1090)	1	Used. Use "DoseWatch" when producing RDSR.

Device Serial Number	(0018,1000)	1	Used. Use installation number when producing RDSR: format PYYXXXXXX where P is for Production, YY is for the year, XXXXXX is a random generated installation number
Software Version	(0018,1020)	1	Used. Use the current DoseWatch software version when producing RDSR.

## 11.4.2 Series Entity Modules

### 11.4.2.1 SR Document Series Module

**TABLE 11-5**  
**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.
> <i>Referenced SOP Class UID</i>	(0008,1150)	1	Used.
>Referenced SOP Instance UID	(0008,1155)	1	Used.

## 11.4.3 Document Entity Modules

### 11.4.3.1 SR Document General Module

**TABLE 11-6**  
**SR DOCUMENT GENERAL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Used.
Completion Flag	(0040,A491)	1	Used. Always use COMPLETED when producing RDSR.
Verification Flag	(0040,A493)	1	Used. Always use UNVERIFIED when producing RDSR.
Content Date	(0008,0023)	1	Used.
Content Time	(0008,0033)	1	Used.
Referenced Request Sequence	(0040,A370)	1C	Not Used.
>Study Instance UID	(0020,000D)	1	Not Used.
>Referenced Study Sequence	(0008,1110)	2	Not Used.
>>Include 'SOP Instance Reference Macro'			
>Accession Number	(0008,0050)	2	Not Used.
>Placer Order Number/Imaging Service Request	(0040,2016)	2	Not Used.

>Filler Order Number/Imaging Service Request	(0040,2017)	2	Not Used.
>Requested Procedure ID	(0040,1001)	2	Not Used.
>Requested Procedure Description	(0032,1060)	2	Not Used.
>Requested Procedure Code Sequence	(0032,1064)	2	Not Used.
>>Include 'Code Sequence Macro'			
Performed Procedure Code Sequence	(0040,A372)	2	Used when producing RDSR.
>Include 'Code Sequence Macro'			

#### 11.4.3.2 SR Document Content Module

**TABLE 11-7**  
**SR DOCUMENT CONTENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
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.
Continuity of Content	(0040,A050)	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	
> Insert SR DocumentContent Module			Recursive inclusion to create document content tree. See section 11.4.3.4 for the list of supported templates

#### 11.4.3.3 SOP Common Module

**TABLE 11.4-5**  
**SOP COMMON MODULE ATTRIBUTES USED FOR RDSR GENERATION**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used. Use 1.2.840.10008.5.1.4.1.1.88.67 when producing RDSR.
SOP Instance UID	(0008,0018)	1	Used: max 255 characters.
Specific Character Set	(0008,0005)	1C	Used to read the object received, see 2.7.
Instance Number	(0020,0013)	3	Used.
Contributing Equipment Sequence	(0018,A001)	3	Used.
>Purpose of Reference Code Sequence	(0040,A170)	1	Use (109101, DCM, "Acquisition Equipment") when producing RDSR.
>>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	1	Used. Use the Manufacturer of the device which sent the examination when producing RDSR.

>Station Name	(0008,1010)	3	Used. Use the station of the device which sent the examination as configured in DoseWatch when producing RDSR.
>Manufacturer's Model Name	(0008,1090)	3	Used. Use the Manufacturer's Model Name of the device which sent the examination when producing RDSR.

**11.4.3.4 SR Document Content Descriptions**

**11.4.3.4.1 Content Template**

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

**TABLE 11-8  
SR ROOT TEMPLATES**

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

Refer to section 11.5 for a detailed description of the supported templates.

**11.5 STANDARD, STANDARD EXTENDED AND PRIVATE TEMPLATES**

The Product supports the Standard Extended and Private Templates defined in the following sections.

**11.5.1 Standard Templates**

The Product supports the following standard templates for SOP Instances created by this product.

**11.5.1.1 Template ID 10001 X-Ray Radiation Dose**

This Template defines the structure of the X-Ray Radiation Dose SR **produced** by DoseWatch. The template declared in DoseWatch can be easily changed if needed. Currently the SR Generated is defined for XA and MG modalities. There is no SR generated for RF modality.

**TABLE 11-9 TID 10001.  
PROJECTION X-RAY RADIATION DOSE**

	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		Root node
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, "Procedure reported")	1	M		DT (113704, DCM, "Projection X-Ray") DT (P5-40010, SRT, "Mammography")
3	>>	HAS CONCEPT MOD	CODE	EV (G-C0E8, SRT, "Has Intent")	1	M		DCID 3629 "Procedure Intent". Use (R-002E9, SRT, "Combined Diagnostic and

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
								Therapeutic Procedure") in XA Modalities. Use (R-408C3, SRT, "Diagnostic Intent") in MG Modalities.
5	>		INCLUDE	DTID 1002 "Observer Context"	2	M		See TID 1002. Observer context for device and TID 1002. Observer context for person
6	>	HAS OBS CONTEXT	CODE	EV (113705, DCM, "Scope of Accumulation")	1	M		(113014, DCM, "Study") Always used
7	>>	HAS PROPERTIES	UIDREF	DCID 10001 "UID Types"	1	M		Use Study Instance UID
11	>	CONTAINS	INCLUDE	DTID 10002 "Accumulated X-Ray Dose"	1	MC	IFF Single Plane system	\$Plane = EV (113622, DCM, "Single Plane") See TID 10002. Accumulated X-Ray Dose
12	>	CONTAINS	INCLUDE	DTID 10002 "Accumulated X-Ray Dose"	1	MC	IFF Biplane system	\$Plane = EV (113620, DCM, "Plane A") See TID 10002. Accumulated X-Ray Dose
13	>	CONTAINS	INCLUDE	DTID 10002 "Accumulated X-Ray Dose"	1	MC	IFF Biplane system	\$Plane = EV (113621, DCM, "Plane B") See TID 10002. Accumulated X-Ray Dose
14	>	CONTAINS	INCLUDE	DTID 10003 "Irradiation Event X-Ray Data"	1-n	MC		See TID 10003. Irradiation Event X-Ray Data
18	>	CONTAINS	CODE	EV (113854, DCM, "Source of Dose Information")	1	M		(113856, DCM, "Automated Data Collection") is always used

**TABLE 11-10 TID 1002.**  
**OBSERVER CONTEXT FOR DEVICE**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (121005, DCM, "Observer Type")	1	MC	IF Observer type is device	"Device" is used
3		HAS OBS CONTEXT	INCLUDE	DTID 1004 "Device Observer Identifying Attributes"	1	MC	IF Row 1 value = (121007, DCM, "Device")	See TID 10004. Accumulated Fluoroscopy and Acquisition Projection X-Ray Dose

**Table 11-11 TID 1004.**  
**DEVICE OBSERVER IDENTIFYING ATTRIBUTES**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			UIDREF	EV (121012, DCM, "Device Observer UID")	1	M		DoseWatch UID is used "1.2.840.113619.2.326"
2			TEXT	EV (121013, DCM, "Device Observer Name")	1	U		Use the AET of the device as configured in DoseWatch
3			TEXT	EV (121014, DCM, "Device Observer Manufacturer")	1	U		Use the manufacturer of the device as configured in DoseWatch
4			TEXT	EV (121015, DCM, "Device Observer Model Name")	1	U		Use the model name as configured in DoseWatch

**TABLE 11-12 TID 1002.**  
**OBSERVER CONTEXT FOR PERSON**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (121005, DCM, "Observer Type")	1	MC	IF Observer type is device	(121006, DCM, "Person") is used
2		HAS OBS CONTEXT	INCLUDE	DTID 1003 "Person Observer Identifying Attributes"	1	MC	IF Row 1 value = (121006, DCM, "Person") or Row 1 is absent	See TID 1003. Person Observer Identifying Attributes

**TABLE 11-13 TID 1003.**  
**PERSON OBSERVER IDENTIFYING ATTRIBUTES**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			PNAME	EV (121008, DCM, "Person Observer Name")	1	M		Use the name of the operator who performed the study
3			CODE	EV (121010, DCM, "Person Observer's Role in the Organization")	1	U		Use (121083, DCM, "Technologist")
4			CODE	EV (121011, DCM, "Person Observer's Role in this Procedure")	1	U		Use (121099, DCM, "Assisting")

**TABLE 11-14 TID 10002.**  
**ACCUMULATED X-RAY DOSE**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113702, DCM, "Accumulated X-Ray Dose Data")	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (113764, DCM, "Acquisition Plane")	1	M		(113620, DCM, "Plane A") (113621, DCM, "Plane B")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
								(113622, DCM, "Single Plane") used for Mammography
10	>	CONTAINS	INCLUDE	DTID 10004 "Accumulated Fluoroscopy and Acquisition Projection X-Ray Dose"	1	MC	IFF TID (10001) Row 4 = (113957, DCM, "Fluoroscopy-Guided Projection Radiography System") or TID (10001) Row 2 = (113704, DCM, "Projection X-Ray") and TID (10001) Row 4 is absent)	See TID 10004. Accumulated Fluoroscopy and Acquisition Projection X-Ray Dose
11	>	CONTAINS	INCLUDE	DTID 10005 "Accumulated Mammography X-Ray Dose"	1	MC	IFF TID (10001) Row 2 = (P5-40010, SRT, "Mammography")	See Table 11-19 TID 10005. Accumulated Mammography X-Ray Dose
12	>	CONTAINS	INCLUDE	DTID 10007 "Accumulated Total Projection Radiography Dose"	1	MC	IFF TID (10001) Row 4 = (113958, DCM, "Integrated Projection Radiography System") or TID (10001) Row 4 = (113957, DCM, "Fluoroscopy-Guided Projection Radiography System") or TID (10001) Row 2 = (113704, DCM, "Projection X-Ray") and TID (10001) Row 4 is absent)	See Table 11-19 TID 10007. Accumulated Total Projection Radiography Dose

**TABLE 11-15 TID 10003.**  
**IRRADIATION EVENT X-RAY DATA**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113706, DCM, "Irradiation Event X-Ray Data")	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (113764, DCM, "Acquisition Plane")	1	M		(113620, DCM, "Plane A") (113621, DCM, "Plane B") (113622, DCM, "Single Plane") used for MG
3	>	CONTAINS	UIDREF	EV (113769, DCM, "Irradiation Event UID")	1	M		Use a DoseWatch generated UID
6	>	CONTAINS	DATETIME	DT (111526, DCM, "DateTime Started")	1	M		Use the series date if provided by the device. Use the study date if nothing was provided

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
7	>	CONTAINS	CODE	EV (113721, DCM, "Irradiation Event Type")	1	M		(P5-06000, DCM, "Fluoroscopy") (113612, DCM, "Stepping Acquisition") (113613, DCM, "Rotational Acquisition") (113611, DCM, "Stationary Acquisition") used by default if not provided by modality
8	>	CONTAINS	TEXT	EV (125203, DCM, "Acquisition Protocol")	1	U		Use the series' protocol name provided. If nothing provided the node won't be added
9	>	CONTAINS	CODE	EV (T-D0005, SRT, "Anatomical structure")	1	U		Use (T-04000, SRT, "Breast") for Mammography.
10	>>	HAS CONCEPT MOD	CODE	EV (G-C171, SRT, "Laterality")	1	UC	If anatomy is bi-lateral	(G-A100, SRT, "Right") (G-A101, SRT, "Left") (G-A103, SRT, "Unilateral") used in Mammography if not provided by the modality.
14	>	CONTAINS	CODE	EV (113745, DCM, "Patient Table Relationship")	1	U		Use values defined in DCID 21 "Patient Equipment Relationship" (F-10470, SRT, "headfirst") used if not provided by modality
15	>	CONTAINS	CODE	EV (113743, DCM, "Patient Orientation")	1	U		Use values defined in DCID 19 "Patient Orientation" (F-10450, SRT, "recumbent") used in XA if not provided by modality (F-10440, SRT, "erect") used in Mammography.
16	>	CONTAINS	CODE	EV (113744, DCM, "Patient Orientation Modifier")	1	M		Use values defined in DCID 20 "Patient Orientation Modifier" (F-10340, SRT, "supine") used in XA if not provided by modality (F-10310, SRT, "prone") used in Mammography if not provided by modality.
17	>	CONTAINS	CODE	EV (123014, DCM, "Target Region")	1	M		Use values defined in DCID 4031 "Common Anatomic Regions". (T-D0010, SRT, "Entire body") used in XA if not provided by modality (T-04000, SRT, "Breast") used in Mammography if not provided by modality.
18	>	CONTAINS	NUM	EV (122130, DCM, "Dose Area Product")	1	MC		UNITS = EV (Gy.m2, UCUM, "Gy.m2")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
20	>	CONTAINS	NUM	EV (111638, DCM, "Patient Equivalent Thickness")	1	U		Units = EV (mm, UCUM, "mm")
21	>	CONTAINS	NUM	EV (111636, DCM, "Entrance Exposure at RP")	1	MC	IF TID (10001) Row 2 = (P5-40010, SRT, "Mammography") and (TID (10001) Row 9 is absent or value is (R-0038D, SRT, "Yes")) and (TID (10001) Row 10 is absent or value is (R-0038D, SRT, "Yes"))	UNITS = EV (mGy, UCUM, "mGy")
22	>	CONTAINS	TEXT	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 21 is present and Row 23 is not present	"Entrance exposure to a 4.2 cm breast thickness" used in Mammography if not provided by modality.
23	>	CONTAINS	CODE	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 21 is present and Row 22 is not present	DCID 10025 "Radiation Dose Reference Points" (113860, DCM, "15cm from Isocenter toward Source") used in XA if not provided by modality
28	>	CONTAINS	INCLUDE	DTID 10003B "Irradiation Event X-Ray Source Data"	1	MC		See TID 10003B. Irradiation Event X-Ray Data
29	>	CONTAINS	INCLUDE	DTID 10003C "Irradiation Event X-Ray Mechanical Data"	1	MC		See TID 10003C. Irradiation Event X-Ray Mechanical Data

**TABLE 11-16 TID 10003B.  
IRRADIATION EVENT X-RAY SOURCE DATA**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (113738, DCM, "Dose (RP) ")	1	MC	IF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray") AND any of the values of TID (10001) Row 18 are not (113858, DCM, "MPPS Content")	UNITS = EV (Gy, UCUM, "Gy")
2			TEXT	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 1 is present and Row 3 is not present	"Entrance exposure to a 4.2 cm breast thickness" used in Mammography if not provided by modality.
3			CODE	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 1 is present and Row 2 is not present	DCID 10025 "Radiation Dose Reference Points" (113860, DCM, "15cm from Isocenter toward Source") used in XA if not provided by modality
4			NUM	EV (111631, DCM, "Average Glandular Dose")	1	MC	IFF TID (10001) Row 2 = (P5-40010, SRT, "Mammography")	UNITS = EV (mGy, UCUM, "mGy")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
5			CODE	EV(113732, DCM, "Fluoro Mode")	1	UC	IFF TID (1003) Row 7 value = (P5-06000, SRT, "Fluoroscopy")	(113630, DCM, "Continuous") used in XA if not provided by modality (113631, DCM, "Pulsed")
6			NUM	EV (113791, DCM, "Pulse Rate")	1	MC	IFF Row 5 value = (113631, DCM, "Pulsed")	UNITS = EV({pulse}/s, UCUM, "pulse/s") Give the frames per second given by the device
7			NUM	EV (113768, DCM, "Number of Pulses")	1	MC	IFF Row 5 is not present or Row 5 is present and equals (113631, DCM, "Pulsed")	UNITS = EV (1, UCUM, "no units") 1 for Mammography
8	>	HAS CONCEPT MODE	CODE	EV (121401, DCM, "Derivation")	1	MC	IFF count of pulses in Row 7 is estimated	EV (R-10260, SRT, "Estimated")
9			NUM	EV (113793, DCM, "Pulse Width")	1	U		UNITS = EV (ms, UCUM, "ms")
10			NUM	EV (113742, DCM, "Irradiation Duration")	1	U		UNITS = EV (s, UCUM, "ms")
11			NUM	EV (113733, DCM, "KVP")	1	M		UNITS = EV (kV, UCUM, "kV")
12			NUM	EV (113734, DCM, "X-Ray Tube Current")	1	MC	IF Row 15 is not present	UNITS = EV (mA, UCUM, "mA")
13			NUM	EV (113767, DCM, "Average X-Ray Tube Current")	1	U		UNITS = EV (mA, UCUM, "mA")
14			NUM	EV (113824, DCM, "Exposure Time")	1	MC	IF Row 15 is not present	UNITS = EV (ms, UCUM, "ms")
15			NUM	EV (113736, DCM, "Exposure")	1	MC	IF Row 12 and 14 are not present	UNITS = EV (uA.s, UCUM, "uA.s")
16			NUM	EV (113766, DCM, "Focal Spot Size")	1	U		UNITS = EV (mm, UCUM, "mm")
17			CODE	EV (111632, DCM, "Anode Target Material")	1	U		DCID 10016 "Anode Target Material" (C-150F9, SRT, "Molybdenum or Molybdenum compound") used in Mammography if not provided by modality
18			CONTAINER	EV (113771, DCM, "X-Ray Filters")	2	U		
19	>	CONTAINS	CODE	EV (113772, DCM, "X-Ray Filter Type")	1	U		(113651, DCM, "Wedge filter") (113652, DCM, "Butterfly filter") (113653, DCM, "Flat filter") (111609, DCM, "No Filter") (113650, DCM, "Strip filter") used in Mammography and XA if not provided by modality.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
20	>	CONTAINS	CODE	EV (113757, DCM, "X-Ray Filter Material")	1	U		Use values in DCID 10006 "X-Ray filter Materials" (C-120F9, SRT, "Aluminum or Aluminum compound") used in XA if not provided by modality (C-150F9, SRT, "Molybdenum or Molybdenum compound") used in Mammography if not provided by modality.
21	>	CONTAINS	NUM	EV (113758, DCM, "X-Ray Filter Thickness Minimum")	1	U		Filled with what device sent. Display two decimals
22	>	CONTAINS	NUM	EV (113773, DCM, "X-Ray Filter Thickness Maximum")	1	U		Filled with what device sent. Display two decimals
23			NUM	EV (113790, DCM, "Collimated Field Area")	1	U		UNITS = EV (m2, UCUM, "m2"). Display two decimals
24			NUM	EV (113788, DCM, "Collimated Field Height")	1	U		UNITS = EV (mm, UCUM, "mm"). Display two decimals
25			NUM	EV (113789, DCM, "Collimated Field Width")	1	U		UNITS = EV (mm, UCUM, "mm"). Display two decimals
26			CODE	EV (111635, DCM, "X-Ray Grid")	1-n	U		(111642, DCM, "Focused Grid") used in XA if not provided by modality (111643, DCM, "Reciprocating grid") (111644, DCM, "Parallel Grid") (111645, DCM, "Crossed Grid") (111646, DCM, "No grid") (111641, DCM, "Fixed Grid") used in Mammography if not provided by modality.

TABLE 11-17 TID 10003C.  
IRRADIATION EVENT X-RAY MECHANICAL DATA

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
2			NUM	EV (112011, DCM, "Positioner Primary Angle")	1	UC	XOR Row 6	UNITS = EV (deg, UCUM, "deg"). Display two decimals.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
3			NUM	EV (112012, DCM, "Positioner Secondary Angle")	1	UC	XOR Row 6	UNITS = EV (deg, UCUM, "deg"). Display two decimals.
4			NUM	EV(113739, DCM, "Positioner Primary End Angle")	1	UC	IFF TID (10003) Row 7 value = (1136313, DCM, "Rotational Acquisition")	UNITS = EV (deg, UCUM, "deg")
5			NUM	EV(113740, DCM, "Positioner Secondary End Angle")	1	UC	IFF TID (10003) Row 7 value = (1136313, DCM, "Rotational Acquisition")	UNITS = EV (deg, UCUM, "deg")
6			NUM	EV (113770, DCM, "Column Angulation")	1	UC	XOR Rows 2, 3	UNITS = EV (deg, UCUM, "deg")
7			NUM	EV(113754, DCM, "Table Head Tilt Angle")	1	U		UNITS = EV (deg, UCUM, "deg")
8			NUM	EV(113755, DCM, "Table Horizontal Rotation Angle")	1	U		UNITS = EV (deg, UCUM, "deg")
9			NUM	EV(113756, DCM, "Table Cradle Tilt Angle")	1	U		UNITS = EV (deg, UCUM, "deg")
10			NUM	EV (111633, DCM, "Compression Thickness")	1	U		UNITS = EV (mm, UCUM, "mm")
11			NUM	DCID 10008 "Dose Related Distance Measurements"	1-n	U		UNITS = EV (mm, UCUM, "mm") Table 11-20 CID 10008.

**TABLE 11-18 TID 10004.**  
**ACCUMULATED FLUOROSCOPY AND ACQUISITION PROJECTION X-RAY DOSE**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (113722, DCM, "Dose Area Product Total")	1	M		UNITS = EV (Gy.m2, UCUM, "Gy.m2") Re-use the data the modality sent
2			NUM	EV (113725, DCM, "Dose (RP) Total")	1	MC	IF any of the values of TID (10001) Row 18 are not (113858, DCM, "MPPS Content"). May be present otherwise.	UNITS = EV (Gy, UCUM, "Gy") Re-use the data the modality sent
3			NUM	EV (113726, DCM, "Fluoro Dose Area Product Total")	1	MC	IFF TID (10003) Row 7 value = (P5-06000, SRT, "Fluoroscopy") for at least one irradiation event	UNITS = EV (Gy.m2, UCUM, "Gy.m2") Re-use the data the modality sent
4			NUM	EV (113728, DCM, "Fluoro Dose (RP) Total")	1	MC	IF TID (10003) Row 7 value = (P5-06000, SRT,	UNITS = EV (Gy, UCUM, "Gy")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
							"Fluoroscopy") for at least one irradiation event AND any of the values of TID (10001) Row 18 are not (113858, DCM, "MPPS Content").	Re-use the data the modality sent
5			NUM	EV (113730, DCM, "Total Fluoro Time")	1	MC	IF TID (10003) Row 7 value = (P5-06000, SRT, "Fluoroscopy") for at least one irradiation event.	UNITS = EV (s, UCUM, "s") Re-use the data the modality sent
6			NUM	EV (113727, DCM, "Acquisition Dose Area Product Total")	1	M		UNITS = EV (Gy.m2, UCUM, "Gy.m2") Re-use the data the modality sent
7			NUM	EV (113729, DCM, "Acquisition Dose (RP) Total")	1	MC	IF any of the values of TID (10001) Row 18 are not (113858, DCM, "MPPS Content"). May be present otherwise.	UNITS = EV (Gy, UCUM, "Gy") Re-use the data the modality sent
8			NUM	EV (113855, DCM, "Total Acquisition Time")	1	M		UNITS = EV (s, UCUM, "s") Re-use the data the modality sent
11			CODE	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 2, Row 4 or Row 7 is present and Row 12 is not present.	DCID 10025 "Radiation Dose Reference Points" (113860, DCM, "15cm from Isocenter toward Source") used for XA if not provided by modality
10			TEXT	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 2, Row 4 or Row 7 is present and Row 11 is not present.	

**TABLE 11-19 TID 10005.  
ACCUMULATED MAMMOGRAPHY X-RAY DOSE**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (111637, DCM, "Accumulated Average Glandular Dose")	1-2	M		UNITS = EV (mGy, UCUM, "mGy")
2	>	HAS CONCEPT MOD	CODE	EV (G-C171, SRT, "Laterality")	1	M		(T-04030, SRT, "Left breast") (T-04020, SRT, "Right breast") (T-04080, SRT, "Both breasts")

**TABLE 11-19 TID 10007.**  
**ACCUMULATED TOTAL PROJECTION RADIOGRAPHY DOSE**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (113722, DCM, "Dose Area Product Total")	1	M		UNITS = EV (Gy.m2, UCUM, "Gy.m2")
2			NUM	EV (113725, DCM, "Dose (RP) Total")	1	MC	IF TID (10001) Row 4 = (113958, DCM, "Integrated Projection Radiography System") or any of the values of TID (10001) Row 18 are not (113858, DCM, "MPPS Content").	UNITS = EV (Gy, UCUM, "Gy")
5			CODE	EV (113780, DCM, "Reference Point Definition")	1	MC	IF any of (113725, DCM, "Dose (RP) Total"), (113728, DCM, "Fluoro Dose (RP) Total") or (113729, DCM, "Acquisition Dose (RP) Total") are present, and Row 6 is not present.	DCID 10025 "Radiation Dose Reference Points" (113860, DCM, "15cm from Isocenter toward Source") used for XA if not provided by modality
6			TEXT	EV (113780, DCM, "Reference Point Definition")	1	MC	IF any of (113725, DCM, "Dose (RP) Total"), (113728, DCM, "Fluoro Dose (RP) Total") or (113729, DCM, "Acquisition Dose (RP) Total") are present, and Row 5 is not present.	

**TABLE 11-20 CID 10008.**  
**DOSE RELATED DISTANCE MEASUREMENTS**

Code Scheme Designator	Code Value	Code Meaning	Comment
DCM	113748	Distance Source to Isocenter	Display two decimals
DCM	113737	Distance Source to Reference Point	Display two decimals
DCM	113750	Distance Source to Detector	Display two decimals
DCM	113751	Table Longitudinal Position	Display two decimals
DCM	113752	Table Lateral Position	Display two decimals
DCM	113753	Table Height Position	Display two decimals
DCM	113792	Distance Source to Table Plane	Display two decimals
DCM	113759	Table Longitudinal End Position	Display two decimals
DCM	113760	Table Lateral End Position	Display two decimals
DCM	113761	Table Height End Position	Display two decimals

**11.5.1.2 Template ID 10011 CT Radiation Dose**

This Template defines the CT Radiation Dose Report generated by the DoseWatch. This template is easily editable in the software if needed.

**TABLE 11-201 TID 10011.**  
**CT Radiation Dose**

	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		Root node
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, "Procedure reported")	1	M		EV (P5-08000, SRT, "Computed Tomography X-Ray")
3	>>	HAS CONCEPT MOD	CODE	EV (G-C0E8, SRT, "Has Intent")	1	M		DCID 3629 "Procedure Intent"
4	>		INCLUDE	DTID 1002 "Observer Context"	2	M		See TID 1002. Observer context for device and TID 1002. Observer context for person
5	>	HAS OBS CONTEXT	DATETIME	EV (113809, DCM, "Start of X-Ray Irradiation")	1	M		Based on the study start of X-Ray Irradiation if provided. If not the the study date is used
6	>	HAS OBS CONTEXT	DATETIME	EV (113810, DCM, "End of X-Ray Irradiation")	1	M		Based on the study end of X-Ray Irradiation if provided. If not the the study date is used
7	>	HAS OBS CONTEXT	CODE	EV (113705, DCM, "Scope of Accumulation")	1	M		DCID 10000 "Scope of Accumulation" Use (113014, DCM, "Study")
8	>>	HAS PROPERTIES	UIDREF	DCID 10001 "UID Types"				Use (110180, DCM, "Study Instance UID")
9	>	CONTAINS	INCLUDE	DTID 10012 "CT Accumulated Dose Data"	1	M		See TID 10012. CT Accumulated Dose Data
14	>	CONTAINS	INCLUDE	DTID 10013 "CT Irradiation Event Data"	1-n	M		Iterate of all series received to display: protocol, target region, Irradiation event UID, exposure time, scanning length, nominal single collimation width, number of X-Ray- Sources ... See TID 10013. CT Irradiation Event Data
15	>	CONTAINS	CODE	EV (113854, DCM, "Source of Dose Information")	1	M		Use (113856, DCM, "Automated Data Collection")

The table below lists the fields used for CT Accumulated Dose Data. They are all based on information given by the modality.

**TABLE 11-212 TID 10012.**  
**CT ACCUMULATED DOSE DATA**

	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		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
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 (mGy.cm, UCUM, "mGy.cm")
7	>>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	M		Use (113936, DCM, "AAPM 204 Sum of Lateral and AP Dimension")

The table below lists the fields used for each irradiation events. They are all based on information given by the modality.

**TABLE 11-223 TID 10013.**  
**CT IRRADIATION EVENT DATA**

	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		Use the serie protocol name
3	>	CONTAINS	CODE	EV (123014, DCM, "Target Region")	1	M		DCID 4030 "CT, MR and PET Anatomy Imaged" Use (T-D0010, SRT, "Entire body") if not provided by modality.
4	>	CONTAINS	CODE	EV (113820, DCM, "CT Acquisition Type")	1	M		Value can be : Constant Angle Acquisition Spiral Acquisition Stationary Acquisition Sequenced Acquisition. Use (113804, DCM, "Sequenced Acquisition") if not provided by modality.
6	>	CONTAINS	UIDREF	EV (113769, DCM, "Irradiation Event UID")	1	M		Use a UID generated by DoseWatch
7	>	CONTAINS	CONTAINER	EV (113822, DCM, "CT Acquisition Parameters")	1	M		
8	>>	CONTAINS	NUM	EV (113824, DCM, "Exposure Time")	1	M		UNITS = EV (s, UCUM, "s")
9	>>	CONTAINS	INCLUDE	DTID 10014 "Scanning Length"	1	M		
10	>>	CONTAINS	NUM	EV (113826, DCM, "Nominal Single Collimation Width")	1	M		UNITS = EV (mm, UCUM, "mm")
11	>>	CONTAINS	NUM	EV (113827, DCM, "Nominal Total Collimation Width")	1	M		UNITS = EV (mm, UCUM, "mm")
12	>>	CONTAINS	NUM	EV (113828, DCM, "Pitch Factor")	1	MC	IF row 4 equals (P5-08001, SRT, "Spiral	UNITS = EV ({ratio}, UCUM, "ratio")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
							Acquisition") or equals (113804, DCM, "Sequenced Acquisition")	
13	>>	CONTAINS	NUM	EV (113823, DCM, "Number of X-Ray Sources")	1	M		UNITS = EV ({X-Ray sources}, UCUM, "X-Ray sources")
14	>>	CONTAINS	CONTAINER	EV (113831, DCM, "CT X-Ray Source Parameters")	1-n	M		
15	>>>	CONTAINS	TEXT	EV (113832, DCM, "Identification of the X-Ray Source")	1	M		Use 1 if not provided by modality.
16	>>>	CONTAINS	NUM	EV (113733, DCM, "KVP")	1	M		UNITS = EV (kV, UCUM, "kV")
17	>>>	CONTAINS	NUM	EV (113833, DCM, "Maximum X-Ray Tube Current")	1	M		UNITS = EV (mA, UCUM, "mA")
18	>>>	CONTAINS	NUM	EV (113734, DCM, "X-Ray Tube Current")	1	M		UNITS = EV (mA, UCUM, "mA")
19	>>>	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" Use (113691, DCM, "IEC Body Dosimetry Phantom") if not provided by modality.
26	>>	CONTAINS	NUM	EV (113838, DCM, "DLP")	1	M		UNITS = EV (mGy.cm, UCUM, "mGy.cm")
28	>>>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	MC		DCID 10011 "Effective Dose Evaluation Method"
30	>>	CONTAINS	NUM	EV (113930, DCM, "Size Specific Dose Estimation")	1-n	U		UNITS = EV (mGy, UCUM, "mGy")
31	>>>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	M		Use (113936, DCM, "AAPM 204 Sum of Lateral and AP Dimension")
32	>>>>	INFERRED FROM	NUM	EV (113931, DCM, "Measured Lateral Dimension")	1	MC	IF row 31 equals (113934, DCM, "AAPM 204 Lateral Dimension") or (113936, DCM, "AAPM 204 Sum of	UNITS = EV (mm, UCUM, "mm")

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
							Lateral and AP Dimension")	
33	>>>>	INFERRED FROM	NUM	EV (113932, DCM, "Measured AP Dimension")	1	MC	IF row 31 equals (113935, DCM, "AAPM 204 AP Dimension") or (113936, DCM, "AAPM 204 Sum of Lateral and AP Dimension")	UNITS = EV (mm, UCUM, "mm")
34	>>>>	INFERRED FROM	NUM	EV (113933, DCM, "Derived Effective Diameter")	1	MC	IF row 31 equals (113934, DCM, "AAPM 204 Lateral Dimension") or (113935, DCM, "AAPM 204 AP Dimension") or (113936, DCM, "AAPM 204 Sum of Lateral and AP Dimension") or (113937, DCM, "AAPM 204 Effective Diameter Estimated From Patient Age")	UNITS = EV (mm, UCUM, "mm") Calculated with (Measured Lateral Dimension* Measured AP Dimension)^1/2

## 12. MODALITY WORKLIST QUERY IMPLEMENTATION

### 12.1 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed.

### 12.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 12-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM	DoseWatch Entity
Scheduled Procedure Step	ScheduledProcedureStep
Requested Procedure	RequestedProcedure
Imaging Service Request	ImagingServiceRequest
Visit	N/A
Patient	Patient

### 12.3 WORKLIST QUERY MODULE TABLE

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

**TABLE 12-2**  
**MODALITY WORKLIST INFORMATION MODEL MODULES**

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	12.4.1.1
	Scheduled Procedure Step	12.4.1.2
Requested Procedure	Requested Procedure	12.4.2.1
Imaging Service Request	Imaging Service Request	12.4.3.1
Visit	Visit Identification	12.4.4.1
	Visit Status	12.4.4.2
Patient	Patient Identification	12.4.5.1
	Patient Demographic	12.4.5.2
	Patient Medical	12.4.5.3

### 12.4 WORKLIST QUERY MODULE DEFINITIONS

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the query key attributes contained within the Modality Worklist Information Model.

**12.4.1 Common Scheduled Procedure Step Entity Modules**

**12.4.1.1 SOP Common Module**

**TABLE 12-3  
 SOP COMMON MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Specific Character Set	(0008,0005)	O	1C	

**12.4.1.1.1 Specific Character Set**

The attribute Specific Character Set (0008,0005) will not be sent, unless Patient Name is sent with a matching key that includes a non-ASCII character; in that case, the configured extended character set identifier will be sent. Only non-ASCII characters that may be entered from the console keyboard, as described in Section 2.7, may be included in the matching key value.

The AE will use any Specific Character Set value returned in a Scheduled Procedure Step Identifier in the images created pursuant to that Scheduled Procedure Step. Text attributes, including Patient and Physician names, that include non-ASCII characters will be displayed as described in Section 2.7.

**12.4.1.2 Scheduled Procedure Step Module**

**TABLE 12-4  
 SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	
>Scheduled Station AE Title	(0040,0001)	R	1	Used.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1 *	Used.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1 *	Used.
>Scheduled Procedure Step End Date	(0040,0004)	O	3	Used.
>Scheduled Procedure Step End Time	(0040,0005)	O	3	Used.
>Modality	(0008,0060)	R	1 *	Used.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	Used.

>Scheduled Procedure Step Description	(0040,0007)	O	1C *	Used.
>Scheduled Station Name	(0040,0010)	O	2	Used.
>Scheduled Procedure Step Location	(0040,0011)	O	2	Used.
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	Used.
>>Code Value	(0008,0100)	O	1	Used.
>>Coding Scheme Designator	(0008,0102)	O	1	Used.
>>Coding Scheme Version	(0008,0103)	O	3	Used.
>>Code Meaning	(0008,0104)	O	3	Used.
>Pre-Medication	(0040,0012)	O	2C	Used.
>Scheduled Procedure Step ID	(0040,0009)	O	1	Used.
>Requested Contrast Agent	(0032,1070)	O	2C	Used.
>Scheduled Procedure Step Status	(0040,0020)	O	3	Used.
>Comments on the Scheduled Procedure Step	(0040,0400)	O	3	Used.

**Note:** \* in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

#### 12.4.1.2.1 Scheduled Station AE Title

The AE title used to query the worklist on the RIS is either the AET of the device as it is setuped in DoseWatch or a DoseWach AET specified in the configuration. The first case allows no further configuration on the RIS to perform the query.

#### 12.4.2 Common Requested Procedure Entity Modules

##### 12.4.2.1 Requested Procedure Module

**TABLE 12-5**  
**REQUESTED PROCEDURE MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Requested Procedure ID	(0040,1001)	O	1	Used.
Requested Procedure Description	(0032,1060)	O	1C	Used.

Requested Procedure Code Sequence	(0032,1064)	O	1C	Used.
>Code Value	(0008,0100)	O	1	Used.
>Coding Scheme Designator	(0008,0102)	O	1	Used.
>Coding Scheme Version	(0008,0103)	O	3	Used.
>Code Meaning	(0008,0104)	O	3	Used.
Study Instance UID	(0020,000D)	O	1	Used.
Study Date	(0008,0020)	O	3	Used.
Study Time	(0008,0030)	O	3	Used.
Requested Procedure Priority	(0040,1003)	O	2	Used.
Requested Procedure Location	(0040,1005)	O	3	Used.
Reporting Priority	(0040,1009)	O	3	Used.
Reason for the Requested Procedure	(0040,1002)	O	3	Used.
Requested Procedure Comments	(0040,1400)	O	3	Used.

**Note:** \* in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

### 12.4.3 Common Imaging Service Request Entity Modules

#### 12.4.3.1 Imaging Service Request Module

**TABLE 12-6**  
**IMAGING SERVICE REQUEST MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Accession Number	(0008,0050)	O	2 *	Used.
Requesting Physician	(0032,1032)	O	2	Used.
Referring Physician's Name	(0008,0090)	O	2	Used.
Requesting Service	(0032,1033)	O	2	Used.
Imaging Service Request Comments	(0040,2400)	O	3	Used.
Placer Order Number / Imaging Service Request	(0040,2016)	O	3	Used.

Filler Order Number / Imaging Service Request	(0040,2017)	O	3	Used.
Order entered by...	(0040,2008)	O	3	Used.
Order Entere's Location	(0040,2009)	O	3	Used.
Order Callback Phone Number	(0040,2010)	O	3	Used.

**Note:** \* in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

#### 12.4.4 Common visit Entity Modules

##### 12.4.4.1 Visit Identification

**TABLE 12-7**  
**VISIT IDENTIFICATION MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Admission ID	(0038,0010)	O	2	Requested.

##### 12.4.4.2 Visit Status

**TABLE 12-8**  
**VISIT STATUS MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Current Patient Location	(0038,0300)	O	2	Requested.

#### 12.4.5 Common Patient Entity Modules

##### 12.4.5.1 Patient Identification

**TABLE 12-9**  
**PATIENT IDENTIFICATION MODULE ATTRIBUTES**

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Patient's Name	(0010,0010)	R	1 *	Requested.
Patient ID	(0010,0020)	R	1 *	DoseWatch search into database for existing patient to display the dose records and dose alerts prior examination.
Issuer of Patient ID	(0010,0021)	O	3*	DoseWatch search into database for existing patient to display the dose records and dose alerts prior examination.

**Note:** \* in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

12.4.5.2 Patient Demographic

TABLE 12-10  
 PATIENT DEMOGRAPHIC MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Patients Birth Date	(0010,0030)	0	2 *	Requested.
Patient's Sex	(0010,0040)	0	2 *	Requested.
Confidentiality constraint on patient data	(0040,3001)	0	2	Requested.
Patient's Size	(0010,1020)	0	3	Requested.

**Note:** \* in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

12.4.5.3 Patient Medical

TABLE 12-11  
 PATIENT MEDICAL MODULE ATTRIBUTES

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Note
Patient State	(0038,0500)	0	2	Requested.
Pregnancy Status	(0010,21C0)	0	2	Requested.
Medical Alerts	(0010,2000)	0	2	Requested.
Contrast Allergies	(0010,2110)	0	2	Requested.
Special Needs	(0038,0050)	0	2	Requested.

## 13. MODALITY PERFORMED PROCEDURE STEP IMPLEMENTATION

### 13.1 INTRODUCTION

This section specifies the use of the DICOM Modality Performed Procedure Step information included in the MPPS **received and produced** by this implementation.

This feature works in conjunction with DICOM Modality Worklist, if installed. However the conformance of this feature is independent of Modality Worklist feature. For information on conformance of Modality Worklist feature to DICOM standard please refer to the appropriate section in this document.

### 13.2 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 13-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM IE	DoseWatch Entity
Patient	Patient
Study	Study/CTStudy Study/MGStudy Study/RFStudy Study/XAStudy Study/MRStudy Study/USStudy
Series	Series/CTSeries Series/MGSeries Series/RFSeries Series/XASeries Series/MRSeries Series/USSeries

### 13.3 RELATIONSHIP BETWEEN SCHEDULED AND PERFORMED PROCEDURE STEPS

As of now, DoseWatch does not have a strong correlation between Scheduled Procedure Steps and Performed Procedure Steps. It means that there can be one-to-one, multiple-to-one, one/multiple-to-multiple or zero-to-one relationships between these two entities.

### 13.4 MODALITY PERFORMED PROCEDURE STEP MODULE TABLE

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

**TABLE 13-2**  
**MODALITY PERFORMED PROCEDURE STEP MODULES**

Module Name	Reference
SOP Common	13.5.1

Performed Procedure Step Relationship	13.5.2
Performed Procedure Step Information	13.5.3
Image Acquisition Results	13.5.4
Radiation Dose	13.5.5
Billing and Material Management Codes	13.5.6

### 13.5 MODALITY PERFORMED PROCEDURE STEP MODULE DEFINITIONS

Please refer to DICOM Standard PS 3.3 (Information Object Definitions) for a description of each of the attributes contained within the Modality Performed Procedure Step Information Object Definition.

The modules defined below concern only information created by DoseWatch when an MPPS message is sent to a peer.

#### 13.5.1 SOP Common Module

TABLE 13-3  
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Specific Character Set	(0008,0005)	1C	1C	Not Used. Default one (ISO_IR 192) is used if not defined.

#### 13.5.2 Performed Procedure Step Relationship Module

Attribute Name	Tag	Type for SCU - N-CREATE
		Post-Processing
Scheduled Step Attributes Sequence	(0040,0270)	1, Sequence with 1 item produced.
>Study Instance UID	(0020,000D)	1, filled from DICOM data received (Images, RDSR, MPPS, ...).
>Referenced Study Sequence	(0008,1110)	2, always empty.
>>Referenced SOP Class UID	(0008,1150)	1, not sent.
>>Referenced SOP Instance UID	(0008,1155)	1, not sent.
>Accession Number	(0008,0050)	2, filled from DICOM data received (Images, RDSR, MPPS, ...).
>Placer Order Number/Imaging Service Request	(0040,2016)	3, not sent.
>Filler Order Number/Imaging Service Request	(0040,2017)	3, not sent.
>Requested Procedure ID	(0040,1001)	2, always empty.
>Requested Procedure Code Sequence	(0032,1064)	3, not sent.

>>Code Value	(0008,0100)	1, not sent.
>>Coding Scheme Designator	(0008,0102)	1, not sent.
>>Code Meaning	(0008,0104)	1, not sent.
>Requested Procedure Description	(0032,1060)	2, always empty.
>Scheduled Procedure Step ID	(0040,0009)	2, always empty.
>Scheduled Procedure Step Description	(0040,0007)	2, always empty.
>Scheduled Protocol Code Sequence	(0040,0008)	2, always empty.
>>Code Value	(0008,0100)	1, not sent.
>>Coding Scheme Designator	(0008,0102)	1, not sent.
>>Coding Scheme Version	(0008,0103)	3, not sent.
>>Code Meaning	(0008,0104)	3, not sent.
Patient's Name	(0010,0010)	2, filled from DICOM data received (Images, RDSR, MPPS, ...).
Patient ID	(0010,0020)	2, filled from DICOM data received (Images, RDSR, MPPS, ...).
Issuer of Patient ID	(0010,0021)	3, not sent.
Patient's Birth Date	(0010,0030)	2, filled from DICOM data received (Images, RDSR, MPPS, ...).
Patient's Sex	(0010,0040)	2, filled from DICOM data received (Images, RDSR, MPPS, ...).
Referenced Patient Sequence	(0008,1120)	2, always empty.
>Referenced SOP Class UID	(0008,1150)	1, not sent.
>Referenced SOP Instance UID	(0008,1155)	1, not sent.
Admission ID	(0038,0010)	3, not sent.
Issuer of Admission ID	(0038,0011)	3, not sent.
Service Episode ID	(0038,0060)	3, not sent.
Issuer of Service Episode ID	(0038,0061)	3, not sent.
Service Episode Description	(0038,0062)	3, not sent.

## 13.5.3 Performed Procedure Step Information Module

**TABLE 13-4**  
**PERFORMED PROCEDURE STEP INFORMATION MODULE ATTRIBUTES**

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Performed Procedure Step ID	(0040,0253)	1	-	Generated.
Performed Station AE Title	(0040,0241)	1	-	Use the AET of the device producing the DICOM data (MPPS, Images, RDSR, ...).
Performed Station Name	(0040,0242)	2	-	Use the Station Name of the device producing the DICOM data (MPPS, Images, RDSR, ...).
Performed Location	(0040,0243)	2	-	Always empty.
Performed Procedure Step Start Date	(0040,0244)	1	-	Use the Study Date of the device producing the DICOM data (MPPS, Images, RDSR, ...).
Performed Procedure Step Start Time	(0040,0245)	1	-	Use the Study Time of the device producing the DICOM data (MPPS, Images, RDSR, ...).
Performed Procedure Step Status	(0040,0252)	1	3	IN PROGRESS for N-CREATE, COMPLETED for N-SET.
Performed Procedure Step Description	(0040,0254)	2	3	Use the Study Description of the device producing the DICOM data (MPPS, images, RDSR, ...)
Performed Procedure Type Description	(0040,0255)	2	3	Always empty.
Procedure Code Sequence	(0008,1032)	2	3	Always empty.
>Code Value	(0008,0100)	1	1	Not sent.
>Coding Scheme Designator	(0008,0102)	1	1	Not sent.
>Coding Scheme Version	(0008,0103)	3	3	Not sent.
>Code Meaning	(0008,0104)	3	3	Not sent.
Performed Procedure Step End Date	(0040,0250)	2	3	Always empty.
Performed Procedure Step End Time	(0040,0251)	2	3	Always empty.
Comments on the Performed Procedure Step	(0040,0280)	3	3	Not sent.
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	3	Not sent.
>Code Value	(0008,0100)	1	1	Not sent.
>Coding Scheme Designator	(0008,0102)	1	1	Not sent.
>Coding Scheme Version	(0008,0103)	3	3	Not sent.
>Code Meaning	(0008,0104)	3	3	Not sent.

## 13.5.4 Image Acquisition Results Module

**TABLE 13-5**  
**IMAGE ACQUISITION RESULTS MODULE ATTRIBUTES**

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Modality	(0008,0060)	1	-	Use the Modality of the device producing the DICOM data (MPPS, images, RDSR, ...).
Study ID	(0020,0010)	2	-	Use the Study ID of the device producing the DICOM data (MPPS, images, RDSR, ...).
Performed Protocol Code Sequence	(0040,0260)	2	3	Always empty.
>Code Value	(0008,0100)	1	1	Not sent.
>Coding Scheme Designator	(0008,0102)	1	1	Not sent.
>Coding Scheme Version	(0008,0103)	3	3	Not sent.
>Code Meaning	(0008,0104)	3	3	Not sent.
Performed Series Sequence	(0040,0340)	2	3	Always empty for N-CREATE, used in N-SET.
>Performing Physician's Name	(0008,1050)	2	2	Always empty.
>Protocol Name	(0018,1030)	1	1	Filled with "Irrelevant information produced by DoseWatch"
>Operator's Name	(0008,1070)	2	2	Always empty.
>Series Instance UID	(0020,000E)	1	1	Filled with a generated UID.
>Series Description	(0008,103E)	2	2	Filled with "Irrelevant information produced by DoseWatch"
>Retrieve AE Title	(0008,0054)	2	2	Filled with the AET of the device producing the DICOM data (MPPS, images, RDSR, ...).
> Archive Requested	(0040,A494)	3	3	Not sent.
>Referenced Image Sequence	(0008,1140)	2	2	Always empty.
>>Referenced SOP Class UID	(0008,1150)	1	1	Not sent.
>>Referenced SOP Instance UID	(0008,1155)	1	1	Not sent.
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	2	2	Always empty.
>>Referenced SOP Class UID	(0008,1150)	1	1	Not sent.
>>Referenced SOP Instance UID	(0008,1155)	1	1	Not sent.

## 13.5.5 Radiation Dose Module

This Module has been retired. See PS3.3 2017c. But it may be used in MPPS generated by DoseWatch software or on old devices still using this module in their implementation.

TABLE 13-6  
RADIATION DOSE MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Anatomic Structure, Space or Region Sequence	(0008,2229)	3	3	Not sent.
> 'Code Sequence Macro'	(0020,0010)	3	3	Not sent.
Total Time of Fluoroscopy	(0040,0300)	3	3	Use the Total Time of Fluoroscopy sent by the device producing the DICOM data (MPPS, images, RDSR, ...).
Total Number of Exposures	(0040,0301)	3	3	Use the Total Number of Exposures sent by the device producing the DICOM data (MPPS, images, RDSR, ...).
Distance Source to Detector (SID)	(0018,1110)	3	3	Not sent.
Distance Source to Entrance	(0040,0306)	3	3	Not sent.
Entrance Dose	(0040,0302)	3	3	Not sent.
Entrance Dose in mGy	(0040,8302)	3	3	Not sent.
Exposed Area	(0040,0303)	3	3	Not sent.
Image Area Dose Product	(0018,115E)	3	3	Not sent.
Comments on Radiation Dose	(0040,0310)	3	3	Filled with different content depending on the information to provide in the MPPS. Usually dose information.
Exposure Dose Sequence	(0040,030E)	3	3	May be sent in some cases.
>Radiation Mode	(0018,115A)	3	3	Not sent.
>KVp	(0018,0060)	3	3	Use the KVp sent by the device producing the DICOM data (MPPS, images, RDSR, ...).
>X-ray Tube Current in $\mu$ A	(0018,8151)	3	3	Not sent.
>Exposure Time	(0018,1150)	3	3	Use the Exposure Time sent by the device producing the DICOM data (MPPS, images, RDSR, ...).
>Filter Type	(0018,1160)	3	3	Not sent.
>Filter Material	(0018,7050)	3	3	Not sent.

13.5.6 Billing and Material Management Codes Module

TABLE 13-7  
BILLING AND MATERIAL MANAGEMENT CODES MODULE ATTRIBUTES

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Billing Procedure Step Sequence	(0040,0320)	3	3	Not sent.
> 'Code Sequence Macro'	(0020,0010)	3	3	Not sent.
Film Consumption Sequence	(0040,0321)	3	3	Not sent.

>Number of Films	(2100,0170)	3	3	Not sent.
>Medium Type	(2000,0030)	3	3	Not sent.
>Film Size ID	(2010,0050)	3	3	Not sent.
Billing Supplies and Devices Sequence	(0040,0324)	3	3	Not sent.
>Billing Item Sequence	(0040,0296)	3	3	Not sent.
>> 'Code Sequence Macro'	(0040,0303)	3	3	Not sent.
>Quantity Sequence	(0040,0293)	3	3	Not sent.
>>Quantity	(0040,0294)	3	3	Not sent.
>>Measuring Units Sequence	(0040,0295)	3	3	Not sent.
>>> 'Code Sequence Macro'	(0018,115A)	3	3	Not sent.

## 14. QUERY IMPLEMENTATION

### 14.1 DOSEWATCH MAPPING OF DICOM ENTITIES

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

**TABLE 14-1**  
**MAPPING OF DICOM ENTITIES TO DOSEWATCH ENTITIES**

DICOM	DoseWatch Entity
Patient	Patient
Study	Study
Series	Serie
Image	DicomRawImage/ DicomMessage

### 14.2 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Query/Retrieve Information Model.

#### 14.2.1 Common Query Keys

The query key attributes specified in this section are used at all levels and in all classes of query.

**TABLE 14-2**  
**Q/R PATIENT LEVEL COMMON RETRIEVE ATTRIBUTES**

Attribute Name	Tag	Type	SCU Use
Specific Character Set	(0008,0005)	-	See 2.7
Query Retrieve Level	(0008,0052)	-	Set to level of query: PATIENT STUDY SERIES IMAGE
Retrieve AE Title	(0008,0054)	-	Used

#### 14.2.1.1 Q/R Common Attribute Descriptions

#### 14.2.2 Patient Level

This section defines the keys at the Patient Level of the Patient Root and Patient/Study Only Query/Retrieve Information Models that are supported by this implementation.

**TABLE 14-3**  
**PATIENT LEVEL ATTRIBUTES FOR THE PATIENT ROOT**  
**QUERY/RETRIEVE INFORMATION MODEL**

Attribute Name	Tag	Type	SCU Use
Patient's Name	(0010,0010)	R*	Used in Query. The name comes from a previous study and triggered with a post processing element. Elements to query are described in a template.

Patient ID	(0010,0020)	U*	Used in Query. The ID comes from a previous study and triggered with a post processing element. Elements to query are described in a template.
Patient's Birth Date	(0010,0030)	O*	Used in Query. The birthdate comes from a previous study and triggered with a post processing element. Elements to query are described in a template.
Patient's Sex	(0010,0040)	O*	Used in Query. The sex comes from a previous study and triggered with a post processing element. Elements to query are described in a template.
Issuer of Patient Id	(0010,0021)	O	Used in Query. The issuer of patient id come from a previous study or DoseWatch configuration and triggered with a post processing element. Elements to query are described in a template.

**Note:** \* in the *Type* column indicates that this information is displayed on screen, if available.

#### 14.2.3 Study Level – Patient Root, Patient/Study Only

This section defines the keys at the Study Level of the Patient Root and Patient/Study Only Query/Retrieve Information Models that are supported by this implementation.

**TABLE 14-4**  
**STUDY LEVEL ATTRIBUTES FOR THE PATIENT ROOT**  
**QUERY/RETRIEVE INFORMATION MODEL**

Attribute Name	Tag	Type	SCU Use
Study Date	(0008,0020)	R*	Used.
Study Time	(0008,0030)	R*	Used.
Accession Number	(0008,0050)	R*	Used.
Study ID	(0020,0010)	R*	Used.
Study Instance UID	(0020,000D)	U	Used.
Modalities in Study	(0008,0061)	O*	Used.
Issuer of Patient ID	(0010,0021)	O	Used.

**Note:** \* in the *Type* column indicates that this information is displayed on screen, if available.

#### 14.2.4 Study Level – Study Root

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE 14-5**  
**STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT**  
**QUERY/RETRIEVE INFORMATION MODEL**

Attribute Name	Tag	Type	SCU Use
Study Date	(0008,0020)	R*	Used.

Study Time	(0008,0030)	R*	Used.
Accession Number	(0008,0050)	R*	Used.
Study ID	(0020,0010)	R*	Used.
Patient's Name	(0010,0010)	R*	Used.
Patient ID	(0010,0020)	R*	Used.
Study Instance UID	(0020,000D)	U	Used.
Modalities in Study	(0008,0061)	O*	Used.
Referring Physician's Name	(0008,0090)	O	Used.

**Note:** \* in the *Type* column indicates that this information is displayed on screen, if available.

#### 14.2.5 Series Level

This section defines the keys at the Series Level of the Patient Root and Study Root Query/Retrieve Information Models that are supported by this implementation.

**TABLE 14-6**  
**SERIES LEVEL ATTRIBUTES FOR THE**  
**QUERY/RETRIEVE INFORMATION MODEL**

Attribute Name	Tag	Type	SCU Use
Modality	(0008,0060)	R*	Used
Series Number	(0020,0011)	R*	Used
Series Instance UID	(0020,000E)	U	Used
Number of Series Related Instances	(0020,1209)	O	Used

**Note:** \* in the *Type* column indicates that this information is displayed on screen, if available.

#### 14.2.6 Image Level

This section defines the keys at the Image Level of the Patient Root and Study Root Query/Retrieve Information Models that are supported by this implementation.

**TABLE 14-7**  
**IMAGE LEVEL ATTRIBUTES FOR THE**  
**QUERY/RETRIEVE INFORMATION MODEL**

Attribute Name	Tag	Type	SCU Use
Instance Number	(0020,0013)	R*	Used
SOP Instance UID	(0008,0018)	U	Used
SOP Class UID	(0008,0016)	O	Used

**Note:** \* in the *Type* column indicates that this information is displayed on screen, if available.

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