SIEMENS

FLUOROSPOT⁰ Compact VA0XX

AX

DICOM Conformance Statement

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1. Introduction

1.1 Overview

The Conformance Statement describes the DICOM interface and Compact DICOM offline media application for the Siemens FLUOROSPOT® Compact VA001 according to part PS 3.2 of [2].
The Fluorospot Compact DICOM offline media storage service implements FSC, FSU and/or FSR for the specified application profiles and the related SOP Class instances.
This introduction describes the application's implemented DICOM functionality in general terms.

1.2 Scope and Field

The Siemens product FLUOROSPOT® Compact is a Multipurpose System for digital R/F Procedures. The FLUOROSPOT® Compact is designed to be integrated into an environment of medical DICOM-based devices. FLUOROSPOT® Compact supports the storage of images utilizing the DICOM XRF IOD and SC IOD. This DICOM Conformance Statement refers to SIEMENS Fluorospot Compact product only.

1.3 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

1.4 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with Siemens and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [1]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

1. The comparison of different conformance statements is the first step towards assessing interconnectivity between Siemens and non-Siemens equipment.

2. Test procedures should be defined and tests should be performed by the user to validate the connectivity desired. DICOM itself and the conformance parts do not specify this.

3. The standard will evolve to meet the users' future requirements. Siemens is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

1.5 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Additional Definitions and Abbreviations are as follows

DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element with Composite information objects
ACR	American College of Radiology
AE	DICOM Application Entity
ASCII	American Standard Code for Information Interchange
DB	Database
DCS	DICOM Conformance Statement
FSC	File Set Creator
FSE	Field Service Engineer
FSR	File Set Reader
FSU	File Set Updater
IOD	DICOM Information Object Definition
ISO	International Standard Organisation
R	Required Key Attribute
NEMA	National Electrical Manufacturers Association
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
RWA	Real-World Activity
U	Unique Key Attribute

1.6 References

[1]   Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.13, 1996
[2]   Digital Imaging and Communications in Medicine (DICOM) 3.0, NEMA PS 3.10-12, 1998

1.7 Connectivity and Interoperability

The implementation of the Siemens DICOM interface has been carefully tested to assure correspondence with this Conformance Statement. But the Conformance Statement and the DICOM standard does not guarantee interoperability of Siemens modalities and modalities of other vendors. The user must compare the relevant Conformance Statements and if a successful interconnection should be possible, the user is responsible to specify an appropriate test suite and to validate the interoperability, which is required. A network environment may need additional functions out of the scope of DICOM.

2 Image Storage

2.1 Implementation Model

2.1.1 Application Data Flow Diagram

Image Send is performed on the user's request for each study completed or for specific images selected. Upon request, an association will be initiated, selected images will be sent to the remote node and the association will be closed.
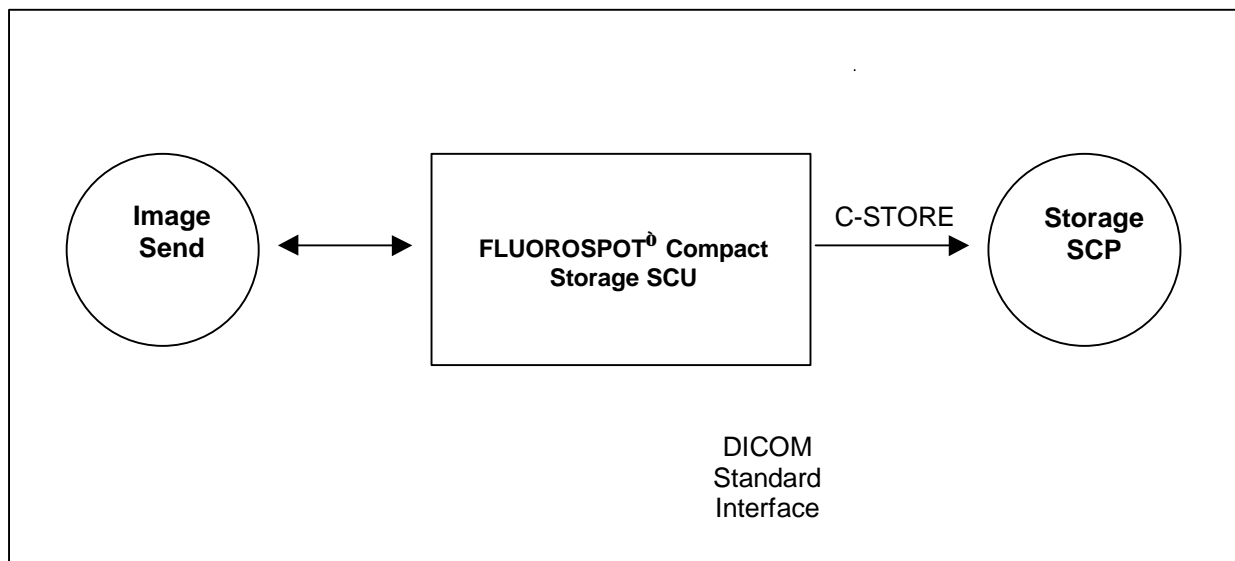
Figure 1: FLUOROSPOT® Compact DICOM Storage Implementation Model

2.1.2 Functional Definition "Image Send"

The FLUOROSPOT® Compact DICOM Application Entity acts as a Service Class User (SCU) for the

- Storage Service Class (to store images in a remote DICOM Node)

The Image Send Functionality is initiated through the user interface. The remote destination has to be defined during the configuration procedure. It is part of such configuration which kind of IOD (RF or SC) will be sent to each destination. So it is possible that the user sends within the application a SC IOD to one destination (SCP) and a XRF IOD to another, without any additional configuration.

FLUOROSPOT® Compact will build a DICOM standard X-ray RF IOD or a SC IOD and initiates sequential associations for each image to be sent.

If the association can not be opened, a notification to check for network problems will appear on the user interface. FLUOROSPOT® Compact will not retry to initiate the association automatically. Retries must be done by the user.

During the transmission of images to the remote node, a status window will inform of the current transmission status.

2.1.3 Sequencing of Real-World Activities

not applicable

2.2 AE Specification

The FLUOROSPOT® Compact Application Entity provides Standard Conformance to the following DICOM SOP Classes as a SCU:

SOP Class Name	SOP Class UID
X-ray Radiofluoroscopy Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7

2.2.1 Association Establishment Policies

2.2.1.1 General

Application Context Name (ACN)	1.2.840.10008.3.1.1.1
PDU maximum length	16 kB

2.2.1.2 Number of Associations

FLUOROSPOT® Compact will attempt to initiate one association at a time.

2.2.1.3 Asynchronous Nature

Asynchronous communication, i.e. multiple outstanding transactions over a single association, is not supported.

2.2.1.4 Implementation Identifying Information

Implementation Class UID	"1.3.12.2.1107.5.3.4"
Implementation Version Name	"Siemens_FLC_10"

2.2.2 Association Initiation by Real-World Activity

FLUOROSPOT® Compact will attempt to initiate a new association for:

- DICOM Image Send (C-STORE)

2.2.2.1 Associated Real-World Activity

Image Send attempts to send an Image Object to a remote node. If the FLUOROSPOT®
Compact AE establishes an association to a remote AE, it will transfer selected images via the
open association. If the C-STORE response from the remote node contains a status other than
"Success" , the association is aborted. Image Send can be restarted at any time by user
interaction.

The DICOM target nodes will be configured by a FSE.

2.2.2.2 Proposed Presentation Context (Presentation Context Table)

The DICOM Interface of the FLUOROSPOT® Compact will propose the following presentation
contexts:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-ray Radiofluoroscopy Image Storage Service Class	1.2.840.10008.5.1.4.1.1.12.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Image Storage Service Class	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.2.2.3 SOP specific Conformance Statement

The DICOM images created by the DICOM interface of the FLUOROSPOT® Compact conform to
the DICOM XRF or SC IOD . Private elements and "retired" elements from earlier versions of the
standard are not contained in the objects.

The FLUOROSPOT® Compact implements all mandatory modules and some user optional
modules defined in the XRF or SC IOD module tables of the DICOM Standard (Tables A.16-1
and A.8-1 Part 3 of [1]). Within the modules all type 1 and type 2 attributes are supported.

Please refer to Annex A for a complete listing of all supported DICOM elements.

2.2.3 Association Acceptance Policy

not applicable

2.3 Communication Profiles

2.3.1 Supported Communication Stacks (part 8)

The DICOM Interface of the FLUOROSPOT® Compact provides DICOM TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

2.3.2 TCP/IP Stack

The DICOM Interface of the FLUOROSPOT® Compact uses the TCP/IP stack from the Windows NT 4.0 Operating system upon which it executes.

2.3.3 Physical Media Support

The DICOM Interface of the FLUOROSPOT® Compact is indifferent to the physical medium over which TCP/IP executes.

2.4 Extensions/Specializations/Privatizations

2.4.1 Standard Extended / Specialized / Private SOPs

None

2.4.2 Private Transfer Syntaxes

None

2.5 Configuration

2.5.1 AE Title/Presentation Address Mapping

The Application Entity Title, Host name and Port number are defined via the service configuration tool. This tool is intended to be used by a FSE only.

2.5.2 Configurable Parameters

The Application Entity Titles, Host names and Port numbers are configured using the Service tool.

The type of IODs (XRF or SC) to be sent to the remote AE is also configured with this tool.

Other configurable default values are described in 2.5.2.2 and 2.5.2.3.

2.5.2.1 Number of Simultaneous Associations

FLUOROSPOT® Compact supports for one service only one association at a time.

2.5.2.2 Maximum PDU Size

- max PDU size: 16 kB

2.5.2.3 Time Out

- time-out until a SCP has to accept/reject an association request: 15 sec
- time-out for accepting a message over network: 15 sec

2.6 Support of Extended Character Sets

ISO-IR 100 (ISO 8859-1:1987 Latin Alphabet N 1. supplementary set)

3 Media Storage

3.1 Implementation Model

3.1.1 Application Data Flow Diagram
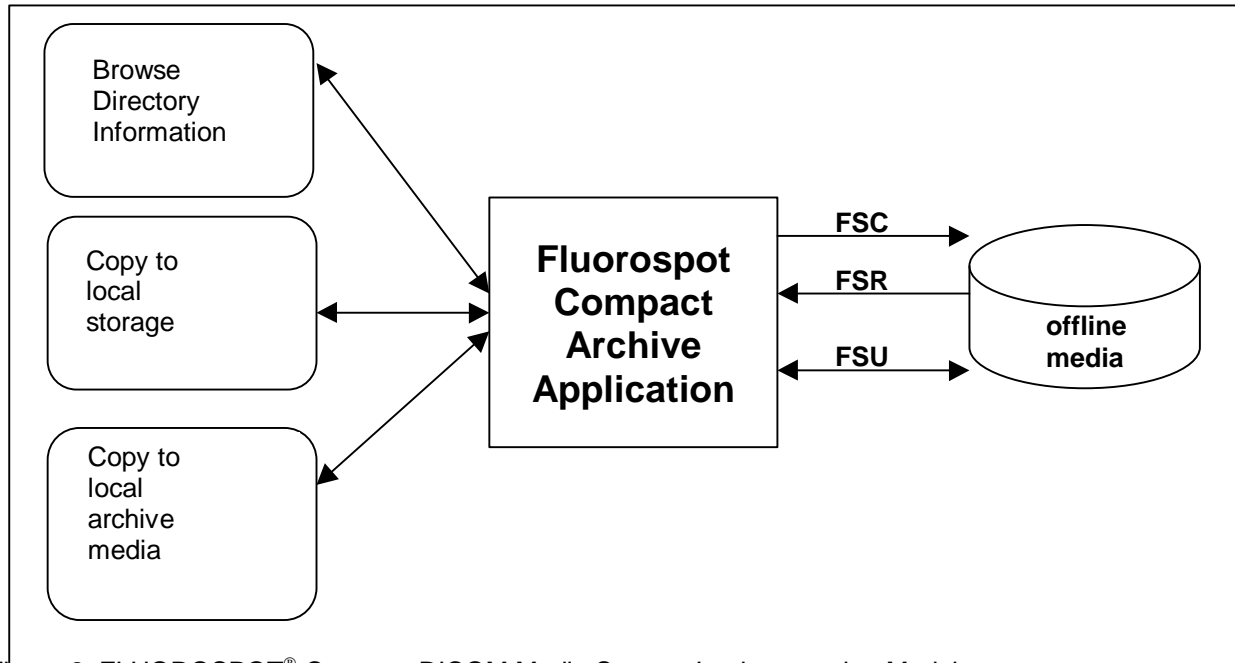
Figure 2: FLUOROSPOT® Compact DICOM Media Storage Implementation Model

The DICOM archive application will serve as an interface to the CD-R offline medium device. It reads the offline media directory into the browser and copies SOP instances to a medium or retrieve SOP Instances from the offline medium.
The DICOM Archive application will support CD-R only.

3.1.2 Functional definitions of AE's

The DICOM offline media storage application consisting of the DICOM Archive application entity interfaces the offline media. The DICOM Archive application supports:
1. creating a new File-set (FSC).
2. updating an existing File-set by adding new SOP Instances to the medium (FSU)
3. copying SOP Instances from the medium to local storage (FSR)
4. reading the File-set's DICOMDIR information and passing it to display applications.

3.1.3 Sequencing of Real-World Activities

There are no special sequencing requirements.

3.1.4 File Meta Information Options

Implementation Class UID	"1.3.12.2.1107.5.3.4"
Implementation Version Name	"FICompact_VA01A"

3.2 AE Specifications

3.2.1 DICOM Archive Specification

The DICOM Archive provides Standard conformance to Media Storage Service Class (Interchange Option).
The following Table shows the Application Profiles, Activities and roles for DICOM Archive.

Application Profiles Supported	Real World Activity	Role	SC Option
STD-GEN-CD	Browse Directory Information	FSR	Interchange
	Copy local Storage	FSR	Interchange
	Copy to archive media	FSC, FSU	Interchange

3.2.1.1 File Meta Information for the Application Entity

Not implemented.

3.2.1.2 Real-World Activities for this Application Entity

3.2.1.2.1 Real-World Activity: Browse Directory Information

The DICOM Archive application acts as FSR using the interchange option when requested to read the media directory.
The DICOM archive application will read the DICOMDIR and add the directory entries to the local database.

3.2.1.2.1.1 Application Profiles for the RWA: Browse Directory Information

See Table above for the Application Profiles listed that invoke this Application Entity for the Browse Directory Information RWA.

3.2.1.2.2 Real-World Activity: Copy to local Storage

The DICOM Archive application acts as FSR using the interchange option when requested to copy SOP Instances from the medium to the local storage.
The SOP Instance selected from the media directory will be copied into the local storage. Only SOP Instances, that are supported, can be retrieved from media storage.

SOP Class Name	SOP Class UID
X-ray Radiofluoroscopy Image Storage	1.2.840.10008.5.1.4.1.1.12.2

3.2.1.2.2.1 Application Profiles for the RWA: Import into local Storage

See Table 1: for the Application Profiles listed that invoke this Application Entity for the Copy to Local Storage RWA.

3.2.1.2.3 Real-World Activity: Copy to local Archive Media

The DICOM Archive application acts as FSU (for media with existing DICOM file-set) or FSC (media not initialized) using the interchange option when requested to copy SOP Instances from the local storage to local Archive medium.
The DICOM Archive application will receive a list of SOP Instances to be copied to the local archive medium. According to the state of the medium inserted (new medium, Medium with DICOM file-set) the SOP Instances are either updated or created on the media. Only valid SOP Instances are accepted.
The DICOM Archive application will not close the medium.

SOP Class Name	SOP Class UID
X-ray Radiofluoroscopy Image Storage	1.2.840.10008.5.1.4.1.1.12.2

3.2.1.2.3.1 Application Profiles for the RWA: Copy to local Archive Media

See Table 1: for the Application Profiles listed that invoke this Application Entity for the Copy to local Archive RWA.

3.3 Augmented and Private Profiles

3.3.1 Augmented Application Profiles

not applicable

3.3.2 Private Application Profiles

not applicable

3.4 Extensions, Specializations and privatizations of SOP Classes and transfer Syntaxes

Restrictions and Extensions:

1. It is possible to store images on CD in a "packed" manner. This will result in a DICOMDIR containing "PRIVATE" records instead of "IMAGE" records.
2. The Comment field of a study is stored in the DICOMDIR in the PATIENT_COMMENTS tag. (For some reason it is not stored in the STUDY_DESCRIPTION tag as it is done in the image header). Therefore, if several studies of the same patient are archived on a CD, only the comment field of the last study will be really saved. When the CD is read back, all studies of that patient will carry the same comment.
3. The physician in the study list is stored as REFERRING_PHYSICIAN in the DICOMDIR.
4. The sex stored in the DICOMDIR is always right, but the sex stored in the image header may show "O" (other). Studies retrieved from the CD keep the right sex because it is taken from the DICOMDIR.

3.5 Configuration

3.5.1 AE Title Mapping

3.5.1.1 DICOM Media Storage AE Title

Not implemented

3.6 Support of Extended Character Sets

ISO-IR 100 (ISO 8859-1:1987 Latin Alphabet N 1. Supplementary set)

For Russian ISO-IR 144 is used.

Annex A: Siemens DICOM IOD Description

Module	Attribute Name	TAG	Type	Comments
Patient	Patient's Name	0010,0010	2	"Last Name^First Name"
	Patient ID	0010,0020	2	
	Patient's Birth Date	0010,0030	2	
	Patient's Sex	0010,0040	2	
General Study	Study Instance UID	0020,000D	1	
	Study Date	0008,0020	2	
	Study Time	0008,0030	2	
	Referring Physician's Name	0008,0090	2	Empty field
	Study ID	0020,0010	2	Request ID in Study List
	Accession Number	0008,0050	2	
	Study Description	0008,1030	3	Comment text box in Study list
General Series	Modality	0008,0060	1	"RF"
	Series Instance UID	0020,000E	1	
	Series Number	0020,0011	2	
	Performing Physician's Name	0008,1050	3	Physician field in Study list
	Protocol Name	0018,1030	3	Organ program
	Series Description	0008,103E	3	Organ field in Study list
General Equipment	Manufacturer	0008,0070	2	"SIEMENS "
	Institution Name	0008,0080	3	
	Manufacturer's Model Name	0008,1090	3	"FLUOROSPOT_COMPACT"
	Device Serial Number	0018,1000	3	
General Image	Image Number	0020,0013	2	
	Patient Orientation	0020,0020	2C	Empty field
	Image Date	0008,0023	2C	
	Image Time	0008,0033	2C	
	Acquisition Number	0020,0012	3	
	Image Comments	0020,4000	3	
Image Pixel or X-ray Image	Samples per Pixel	0028,0002	1	Always "1"
	Photometric Interpretation	0028,0004	1	MONOCHROME2
	Rows	0028,0010	1	1024
	Columns	0028,0011	1	1024
	Bits Allocated	0028,0100	1	16
	Bits Stored	0028,0101	1	10
	High Bit	0028,0102	1	9
	Pixel Representation	0028,0103	1	0000H
	Pixel Data	7FE0, 0010	1	
Overlay Plane (Only present if the image contains graphics)	Overlay Rows	6000,0010	1	1024
	Overlay Columns	6000,0011	1	1024
	Overlay Type	6000,0040	1	"G"
	Origin	6000,0050	1	1\1
	Overlay Bits Allocated	6000,0100	1	16
	Bit Position	6000,0102	1	15
VOI LUT	Window Center	0028,1050	3	-256.. 1280
	Window Width	0028,1051	1C	1.. 2048
SOP Common	SOP Class UID	0008,0016	1	
	SOP Instance UID	0008,0018	1	
	Specific Character Set	0008,0005	1C	"ISO_IR 100"

Table A.1: Elements included in both XRF and SC IODs

Module	Attribute	TAG	Type	Comments
X-Ray Image	Image Type	0008,0008	1	ORIGINAL / PRIMARY /SINGLE PLANE (acquired images)
				ORIGINAL / SECONDARY /SINGLE PLANE (post-processed images)
	Pixel Intensity Relationship	0028,1040	1	"LIN "
X-Ray Acquisition	KVP	0018,0060	2	
	Radiation Setting	0018,1155	1	"GR"
	Exposure Time	0018,1150	2C	
	Exposure	0018,1152	2C	
	Radiation Mode	0018,115A	3	"CONTINUOUS"
	Intensifier Size	0018,1162	3	
XRF Tomo Acquisition (Module included only in Tomographic images)	Tomo Layer Height	0018,1460	1	Always 0 (due to technical restrictions)
	Tomo Angle	0018,1470	3	
	Tomo Time	0018,1480	3	
Display Shutter	Shutter Shape	0018,1600	1	"RECTANGULAR"
	Shutter Left Vertical Edge	0018,1602	1C	
	Shutter Right Vertical Edge	0018,1604	1C	
	Shutter Upper Horizontal Edge	0018,1606	1C	
	Shutter Lower Horizontal Edge	0018,1608	1C	

Table A.2: Additional Standard elements included in RF IOD

Module	Attribute Name	TAG	Type	Comments
SC Equipment	Conversion Type	0008,0064	1	"DI"

Table A.3: Additional Standard elements included in Secondary Capture IOD