



Elekta Limited

DICOM Conformance Statement
for
iViewGT™
Electronic Portal Imaging System
Release 3.4.1

Document Number: 4513 371 0678
Version: 1.2
Date: 26/02/2015

© 2015 Elekta Limited.
All rights reserved.

Issued By:

Elekta Limited
Linac House
Fleming Way
CRAWLEY
West Sussex RH10 9RR
United Kingdom

Tel: +44 (0)1293 544422

Fax: +44 (0)1293 654321

<http://www.elekta.com>

CONTENTS

CONTENTS	3
1 INTRODUCTION	5
1.1 SCOPE AND FIELD OF APPLICATION	5
1.2 INTENDED AUDIENCE.....	5
1.3 CONTENTS AND STRUCTURE	5
1.4 USED DEFINITIONS, TERMS AND ABBREVIATIONS.....	5
1.5 REFERENCES	5
1.6 IMPORTANT NOTES TO THE READER	6
2 IMPLEMENTATION MODEL	7
2.1 APPLICATION DATA FLOW DIAGRAM	7
2.2 FUNCTIONAL DEFINITION OF APPLICATION ENTITY	7
2.3 SEQUENCING OF REAL-WORLD ACTIVITIES.....	7
3 AE SPECIFICATIONS	9
3.1 IVIEWGT AE SPECIFICATION	9
3.1.1 Association Establishment Policies.....	9
3.1.2 Association Initiation Policy.....	9
3.1.3 Association Acceptance Policy	13
4 COMMUNICATION PROFILES	16
4.1 SUPPORTED COMMUNICATION STACKS	16
4.2 TCP/IP STACK.....	16
4.3 PHYSICAL MEDIA SUPPORT.....	16
5 EXTENSIONS/SPECIALISATIONS/PRIVATISATIONS	17
6 CONFIGURATION	18
6.1 AE TITLE/PRESENTATION ADDRESS MAPPING.....	18
6.1.1 Local AE Titles and Presentation Addresses.....	18
6.1.2 Remote AE Titles and Presentation Addresses.....	18
6.2 CONFIGURABLE PARAMETERS.....	18
7 SUPPORT OF EXTENDED CHARACTER SETS	19
APPENDIX A APPLIED RT IMAGE IOD AND MAPPING TO IVIEWGT DATABASE	20
A.1 EXPORT OF RT IMAGES	20
A.2 IMPORT OF RT IMAGES	25
APPENDIX B APPLIED SC IMAGE IOD AND MAPPING TO IVIEWGT DATABASE	29
B.1 EXPORT OF SC IMAGES	29
B.2 IMPORT OF SC IMAGES.....	34
APPENDIX C APPLIED RT PLAN IOD AND MAPPING TO IVIEWGT DATABASE	38
C.1 IMPORT OF RT PLANS.....	38
APPENDIX D EXTENDED IMAGE IMPORT CAPABILITY	40
D.1 C-STORE CONFORMANCE WHEN EXTENDED IMPORT IS ENABLED.	40
APPENDIX E C-STORE RESPONSE STATUS CODES	41

LIST OF TABLES

Table 1	SOP Classes supported by iViewGT as SCU.....	9
Table 2	SOP Classes supported by iViewGT as SCP.....	9
Table 3	Proposed Presentation Contexts for iViewGT Image Export.....	10
Table 4	Proposed Presentation Contexts for iViewGT Remote Database Query.....	11
Table 5	Patient Level Attributes used as Keys in C-FIND Queries.....	11
Table 6	Study Level Attributes used as Keys in C-FIND Queries.....	11
Table 7	Series Level Attributes used as Keys in C-FIND Queries.....	12
Table 8	Image Level Attributes used as Keys in C-FIND Queries.....	12
Table 9	Proposed Presentation Contexts for iViewGT Remote Image Retrieve.....	13
Table 10	Acceptable Presentation Contexts for iViewGT Image Storage.....	14
Table 11	Acceptable Presentation Contexts for Image Storage (Extended Import Option Enabled).....	14
Table 12	Acceptable Presentation Contexts for Verification.....	15
Table 13	Applied Modules in the RT Image IOD for Export (SCU Role).....	20
Table 14	RT Image Storage SOP Class (SCU) – Patient Module.....	20
Table 15	RT Image Storage SOP Class (SCU) – General Study Module.....	20
Table 16	RT Image Storage SOP Class (SCU) – RT Series Module.....	21
Table 17	RT Image Storage SOP Class (SCU) – General Equipment Module.....	21
Table 18	RT Image Storage SOP Class (SCU) – General Image Module.....	22
Table 19	RT Image Storage SOP Class (SCU) –Image Pixel Module.....	22
Table 20	RT Image Storage SOP Class (SCU) – RT Image Module.....	23
Table 21	RT Image Storage SOP Class (SCU) – SOP Common Module.....	24
Table 22	Applied Modules in the SC Image IOD for Import (SCP Role).....	25
Table 23	RT Image Storage SOP Class (SCP) – Patient Module.....	25
Table 24	RT Image Storage SOP Class (SCP) – General Study Module.....	26
Table 25	RT Image Storage SOP Class (SCP) – RT Series Module.....	26
Table 26	RT Image Storage SOP Class (SCP) – General Image Module.....	27
Table 27	RT Image Storage SOP Class (SCP) – Image Pixel Module.....	27
Table 28	RT Image Storage SOP Class (SCP) – RT Image Module.....	28
Table 29	RT Image Storage SOP Class (SCP) – SOP Common Module.....	28
Table 30	Applied Modules in the SC Image IOD for Export (SCU Role).....	29
Table 31	SC Image Storage SOP Class (SCU) – Patient Module.....	29
Table 32	SC Image Storage SOP Class (SCU) – General Study Module.....	29
Table 33	SC Image Storage SOP Class (SCU) – General Series Module.....	30
Table 34	SC Image Storage SOP Class (SCU) – General Equipment Module.....	30
Table 35	SC Image Storage SOP Class (SCU) – SC Equipment Module.....	31
Table 36	SC Image Storage SOP Class (SCU) – General Image Module.....	31
Table 37	SC Image Storage SOP Class (SCU) –Image Pixel Module.....	32
Table 38	SC Image Storage SOP Class (SCU) – SC Image Module.....	32
Table 39	SC Image Storage SOP Class (SCU) – SOP Common Module.....	32
Table 40	Applied Modules in the SC Image IOD for Import (SCP Role).....	34
Table 41	SC Image Storage SOP Class (SCP) – Patient Module.....	34
Table 42	SC Image Storage SOP Class (SCP) – General Study Module.....	35
Table 43	SC Image Storage SOP Class (SCP) – General Series Module.....	35
Table 44	SC Image Storage SOP Class (SCP) – General Image Module.....	36
Table 45	SC Image Storage SOP Class (SCP) – Image Pixel Module.....	36
Table 46	SC Image Storage SOP Class (SCP) – SC Image Module.....	37
Table 47	SC Image Storage SOP Class (SCP) – SOP Common Module.....	37
Table 48	Applied Modules in the RT Plan IOD for Import (SCP Role).....	38
Table 49	RT Plan Storage SOP Class (SCP) – Patient Module.....	38
Table 50	RT Plan Storage SOP Class (SCP) – RT Series Module.....	39
Table 51	RT Plan Storage SOP Class (SCP) – RT General Plan Module.....	39
Table 52	RT Plan Storage SOP Class (SCP) – SOP Common Module.....	39
Table 53	Additional SOP Classes supported by iViewGT as SCP (Extended Import Option Enabled).....	40
Table 54	Applied Modules in the Image IOD for Import (SCP Role: Extended Import).....	40
Table 55	C-STORE Status Codes.....	41

1 Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Elekta Limited. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X-1993 standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntax's.

The field of application is the integration of the Elekta Limited equipment into an environment of medical devices.

This Conformance Statement should be read in conjunction with the DICOM standard and its addenda.

1.2 Intended audience

This Conformance Statement is intended for:

- (potential) customers,
- system integrators of medical equipment,
- marketing staff interested in system functionality,
- software designers implementing DICOM interfaces

It is assumed that the reader is familiar with the DICOM standard.

1.3 Contents and structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2-1993. Additionally, the chapters following 7 specify the details of the applied IODs.

1.4 Used definitions, terms and abbreviations

- DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3-1993 and PS 3.4-1994.
- The word Elekta in this document refers to Elekta Limited.
- The word iViewGT in this document refers to the Elekta Limited iViewGT and iViewGT Portal Imaging Systems Release 3.4.1
- The term "local database" in this document is used to refer to an iViewGT database accessed directly by the local iViewGT application software (irrespective of whether the database itself is physically stored on the local machine or on another network server).
- The term "remote database" in this document is used to refer to a database accessed using the DICOM protocol.

1.5 References

[DICOM PS 3 2006]

The Digital Imaging and Communications in Medicine (DICOM) standard:
NEMA PS 3.X (X refers to the part 1 - 13) and Supplements.
National Electrical Manufacturers Association (NEMA) Publication Sales
1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

1.6 Important notes to the reader

This Conformance Statement by itself does not guarantee successful interoperability of Elekta equipment with non-Elekta equipment. The user (or user's agent) should be aware of the following issues:

- **Scope**

The goal of DICOM is to facilitate inter-connectivity rather than interoperability. Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a networked environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Elekta equipment with non-Elekta equipment. It is the user's responsibility to analyse thoroughly the application requirements and to specify a solution that integrates Elekta equipment with non-Elekta equipment.

- **Validation**

Elekta equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement. Where Elekta equipment is linked to non-Elekta equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Elekta is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Elekta reserves the right to make changes to its products or to discontinue its delivery. The user should ensure that any non-Elekta provider linking to Elekta equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Elekta equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

2 Implementation Model

The iViewGT system is an image capture system for use in generating radiotherapy portal images when attached to a Megavoltage X-ray therapy unit. It provides the following features:

- The application allows the operator to acquire portal images, which are then stored into a local database.
- The operator may copy images from a local database to remote databases.
- The operator may query remote databases and to retrieve selected remote images into a local database.
- The application receives images sent to it by remote applications and stores them into a local database.
- The application allows the operator, among other things, to view, analyse, process and print images stored in a local database.

The remote database access and image transfer functions are implemented using the DICOM query/retrieve and store services.

The viewing, analysis, processing and printing functions are primarily designed for images that have been acquired by the iViewGT system. When applied to images that are sent to iViewGT by means of DICOM, some of these functions may not perform optimally or may not be relevant.

2.1 Application Data Flow Diagram

iViewGT behaves as a single Application Entity (AE). The related Implementation Model is shown in Figure 1.

2.2 Functional definition of Application Entity

The iViewGT application entity acts as a Service Class User (SCU) of Query/Retrieve and Storage Service Classes, and as a Service Class Provider (SCP) of Verification and Storage Service Classes.

The Application Entity is active when the iViewGT system is switched on.

2.3 Sequencing of Real-World Activities

Not applicable.

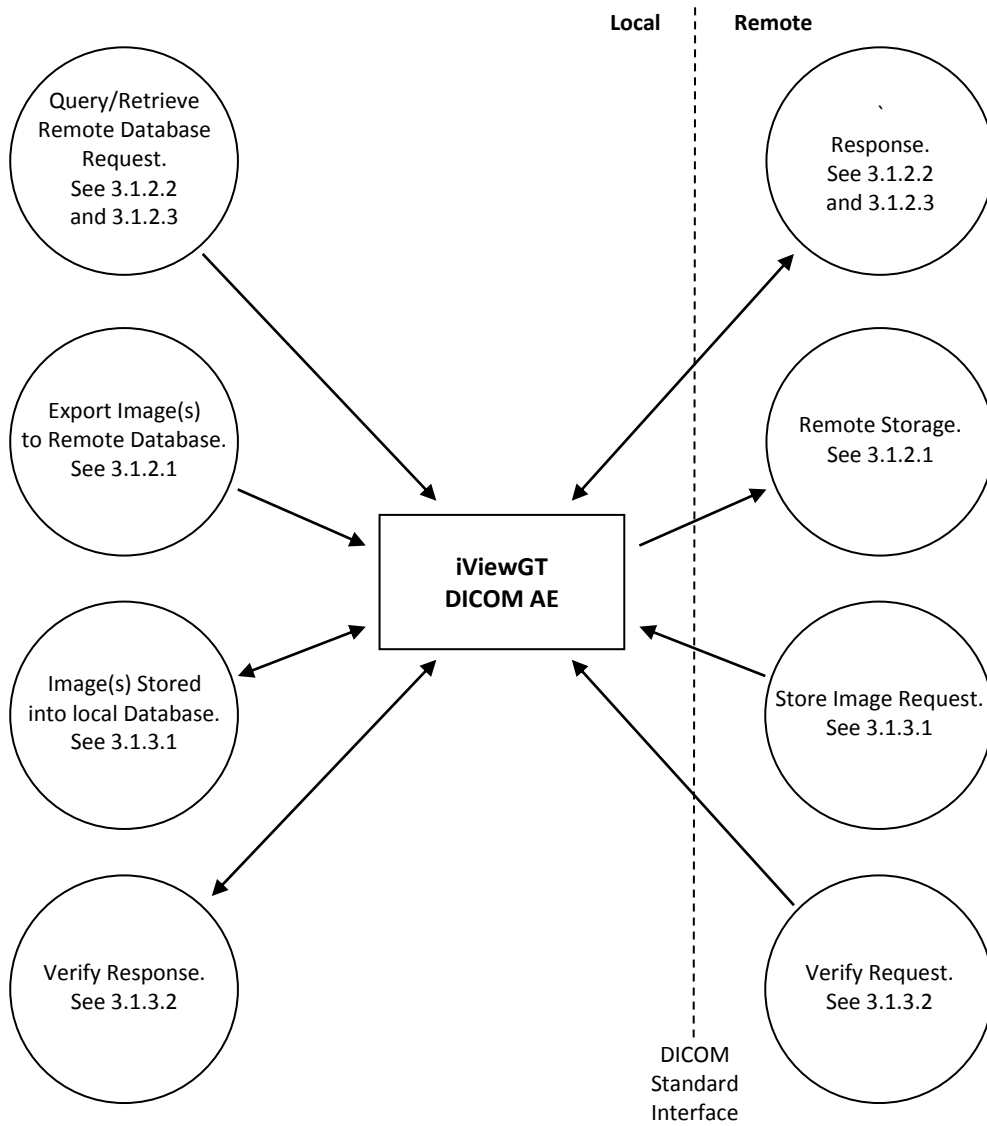


Figure 1 iViewGT Implementation Model

3 AE Specifications

3.1 iViewGT AE Specification

The iViewGT Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an SCU:

Table 1 SOP Classes supported by iViewGT as SCU

SOP Class Name	UID
Patient Root Query/Retrieve Info Model – FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Info Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2
SC Image Storage - STORE	1.2.840.10008.5.1.4.1.1.7
RT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.481.1

The iViewGT Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an SCP:

Table 2 SOP Classes supported by iViewGT as SCP

SOP Class Name	UID
SC Image Storage - STORE	1.2.840.10008.5.1.4.1.1.7
RT Image Storage – STORE	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
Verification	1.2.840.10008.1.1

3.1.1 Association Establishment Policies

3.1.1.1 General

The maximum PDU size for iViewGT is configurable from a minimum of 1024 bytes to a maximum of 31000 bytes. (The default is 16K = 16384 bytes).

3.1.1.2 Number of Associations

iViewGT will only ever attempt to initiate one association at a time as a result of local activities. The number of simultaneous pending associations supported by iViewGT as a Service Class Provider is configurable. The default is 5.

3.1.1.3 Asynchronous Nature

iViewGT does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: 1.3.46.423632.122000.3.4.1

The Implementation version name is: iView_3.4.1

3.1.2 Association Initiation Policy

iViewGT initiates associations as a result of the following local real-world activities:

- The operator requests export of one or more images from the local database to a remote application (see section 3.1.2.1 below)
- The operator queries a remote database (see section 3.1.2.2 below)
- The operator requests retrieval of one or more images following querying of a remote database (see section 3.1.2.3 below)

3.1.2.1 Export Image(s) from iViewGT to Remote Application

3.1.2.1.1 Associated Real World Activity

The operator exports one or more images from the local iViewGT database to a remote application by means of the Export function (accessed via the iViewGT system user interface in Administrator Mode). After selecting the image(s) to be exported, and nominating the remote peer DICOM application entity, the operator confirms the image transfer request.

iViewGT initiates one association to the selected peer and uses it to send the selected image(s) via C-STORE requests (and to receive the associated C-STORE Responses).

The association is released by iViewGT after successful transfer of the image(s), or, in the event of transfer errors, when iViewGT determines that too many errors have occurred.

3.1.2.1.2 Proposed Presentation Contexts

iViewGT will propose the following presentation contexts:

Table 3 Proposed Presentation Contexts for iViewGT Image Export

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.2.1.3 C-STORE SCU Conformance

While iViewGT is busy sending images to a SCP, the Busy status is displayed on the console and the user interface allows no interaction.

iViewGT has the following behaviour upon successful and unsuccessful transfer of images:

- Success (return status 0000)

The user is notified of progress during transfer and normal control is returned upon completion of all transfers.

- Refused (return status A7xx) Error (return status A9xx or Cxxx) and Warning (return status B00x)

The user is notified that an (unspecified) error occurred whilst transferring an image. If the failure was specifically due to a Network error the user is additionally notified of this, and any outstanding transfers are cancelled immediately. For any other transfer failures, iViewGT will attempt to continue transferring any remaining images in the selected set. If more than 5 transfer failures are reported during any export request the user is notified that too many errors have occurred, and any further outstanding transfers are cancelled.

APPENDIX A lists the applied DICOM attributes in the Secondary Capture IOD that are sent by iViewGT, and the mapping between these DICOM attributes and the iViewGT local database fields.

3.1.2.2 Query a Remote Database

3.1.2.2.1 Associated Real World Activity

The operator queries a remote database by means of the Patient DICOM Import function (accessed via the iViewGT system user interface in Administrator Mode). The function permits the operator to browse the lists of patients held on remote applications and their corresponding Patient/Study/Series/Image hierarchies.

- Each time the operator selects a remote DICOM application and clicks on query button (using patient name and/or patient ID filter or not), iViewGT initiates an association to the selected entity and uses it to send a single C-FIND request for the list of patients available (or matching the filters condition) on the remote system (and to receive the associated C-FIND responses). The association is released immediately by iViewGT once all C-FIND responses have been received.
- Each time the operator selects a Patient, Study or Series from those presented as a result of a query, iViewGT initiates a new association to the selected entity. This is used to send a single C-FIND request at the Level of Patient, Study, Series for the list of Studies, Series or Images available respectively (and to receive the associated C-FIND responses). The association is released immediately by iViewGT once all C-FIND responses have been received.

3.1.2.2.2 Proposed Presentation Contexts

iViewGT will propose the following presentation contexts:

Table 4 Proposed Presentation Contexts for iViewGT Remote Database Query

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Model Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.2.2.3 C-FIND SCU Conformance

iViewGT generates queries containing optional keys and displays the corresponding attributes from C-FIND responses into the user interface. If the remote application does not support optional keys (determined by service status Pending FF01) iViewGT will silently ignore those attributes, displaying them as blank, and continue to receive responses.

The Required, Unique and Optional keys used in iViewGT queries at the respective levels are listed below:

Table 5 Patient Level Attributes used as Keys in C-FIND Queries

Description	Tag	Type
Patients Name	(0010, 0010)	R
Patient ID	(0010, 0020)	U
Patient's Birth Date	(0010, 0030)	O
Patient's Sex	(0010, 0040)	O

Table 6 Study Level Attributes used as Keys in C-FIND Queries

Description	Tag	Type
Study Instance UID	(0020, 000D)	U
Study ID	(0020, 0010)	R
Study Date	(0008, 0020)	R

Study Time	(0008, 0030)	R
Accession Number	(0008, 0050)	R
Study Description	(0008, 1030)	O

Table 7 Series Level Attributes used as Keys in C-FIND Queries

Description	Tag	Type
Modality	(0008, 0060)	R
Series Instance UID	(0020, 000E)	U
Series Number	(0020, 0011)	R
Series Date	(0008, 0021)	O
Series Time	(0008, 0031)	O

Table 8 Image Level Attributes used as Keys in C-FIND Queries

Description	Tag	Type
Image Number	(0008, 0013)	R
SOP Instance UID	(0008, 0018)	U
Image Date	(0008, 0023)	O
Image Time	(0008, 0033)	O
RT Plan date	(300A,0006)	O
RT Plan time	(300A,0007)	O

3.1.2.3 Retrieve Image(s) from a Remote Database

3.1.2.3.1 Associated Real World Activity

The operator retrieves one or more images from a remote application by means of the Patient DICOM Import function, having first performed a query on the remote database (as described in section 3.1.2.2.1 above). After selecting the image(s) from a selected Series to be imported, the operator confirms the image transfer request.

iViewGT initiates one association to the selected peer and uses it to retrieve the selected image(s) via C-MOVE requests (and to receive the associated C-MOVE responses).

The association is released by iViewGT after successful transfer of the image(s), or, in the event of transfer errors, when iViewGT determines that too many errors have occurred.

3.1.2.3.2 Proposed Presentation Contexts

iViewGT will propose the following presentation contexts:

Table 9 Proposed Presentation Contexts for iViewGT Remote Image Retrieve

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Model Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2. 2	SCU	None

3.1.2.3.3 C-MOVE SCU Conformance

The iViewGT AE provides standard conformance.

C-MOVE requests are issued at the Image level for each image selected for retrieval.

3.1.3 Association Acceptance Policy

The iViewGT Application Entity accepts associations for the following purposes:

- To allow remote applications to store images into the local iViewGT database (see section 3.1.3.1 below)
- To allow remote applications to verify application level communication with iViewGT (see section 3.1.3.2 below)

iViewGT may accept association requests from remote stations depending on the iViewGT configuration:

- The Application Entity accepts requests from remote stations independent of the “calling AE title”, i.e. a remote application does not need to be known by iViewGT.
- The Application Entity can be configured to either accept or reject association requests from applications that offer a wrong “called AE title”, i.e. that incorrectly address the iViewGT AE. The iViewGT AE title is defined during configuration of the system (See Section 6.1.1). The default behaviour is to accept associations regardless of the called AE title offered.

3.1.3.1 Store Images into iViewGT Local Database

3.1.3.1.1 Associated Real World Activity

iViewGT accepts associations from remote systems that wish to send images for storage into a local iViewGT database.

3.1.3.1.2 Presentation Context Table

Any of the presentation contexts shown in Table 10 below are acceptable:

Table 10 Acceptable Presentation Contexts for iViewGT Image Storage

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

NOTE: If the iViewGT Extended Import capability has been enabled during configuration of the system, additional presentation contexts will also be acceptable, as shown in Table 11 below. See APPENDIX D.

Table 11 Acceptable Presentation Contexts for Image Storage (Extended Import Option Enabled)

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

3.1.3.1.3 C-STORE SCP Conformance

iViewGT provides standard conformance.

The AE is a Conformance Level 0 Storage SCP: not all DICOM Type 1 and 2 attribute are stored. APPENDIX A.2, B.2, C.1 specify which attributes from the received C-STORE requests are stored for internal iViewGT use.

All other received attributes will be discarded. Note in particular that iViewGT will generate a new SOP Instance UID for all stored images, to avoid the possibility of object inconsistency across systems should the image be re-exported.

For safety reasons, incoming images are stored into a local database dedicated to DICOM Import. An iViewGT function allows the subsequent interactive relocation of the images into the main iViewGT clinical database at the iViewGT operators' discretion.

The duration of the storage of the image is determined by the operator of the iViewGT system.

3.1.3.1.4 Presentation Context Acceptance Criterion

iViewGT accepts all contexts in the intersection of the proposed and acceptable presentation contexts. There is no check for duplicate contexts. Duplicate contexts are accepted.

3.1.3.1.5 Transfer Syntax Selection Policies

iViewGT prefers its native byte ordering (Little Endian) , and will prefer explicit over implicit VR.

3.1.3.2 Verify Application Level Communication

3.1.3.2.1 Associated Real World Activity

iViewGT accepts associations from systems that wish to verify the application level communication using the C-ECHO command.

3.1.3.2.2 Presentation Context Table

Any of the presentation contexts shown in Table 12 below are acceptable:

Table 12 Acceptable Presentation Contexts for Verification

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

3.1.3.2.3 C-ECHO SCP Conformance

iViewGT provides standard conformance.

3.1.3.2.4 Presentation Context Acceptance Criterion

iViewGT accepts all contexts in the intersection of the proposed and acceptable presentation contexts. There is no check for duplicate contexts. Duplicate contexts are accepted.

3.1.3.2.5 Transfer Syntax Selection Policies

iViewGT prefers its native byte ordering (Little Endian) , and will prefer explicit over implicit VR.

4 Communication Profiles

4.1 Supported Communication Stacks

The iViewGT application provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 TCP/IP Stack

iViewGT inherits its TCP/IP stack from the Microsoft Windows XP Professional SP2 (Version 4.0) operating system upon which it executes.

4.3 Physical Media Support

iViewGT supports Ethernet ISO.8802-3.

On all Elekta supplied hardware platforms connection types are 10/100/1000 BASE-T (RJ45 twisted pair).

5 Extensions/Specialisations/Privatisations

Not applicable.

6 Configuration

The configuration of an iViewGT system is done by means of editing a system-settings file and some DICOM-specific configuration files. Configuration changes are not effective until the iViewGT system is restarted.

Configuration is intended to be performed by Elekta service engineers only.

6.1 AE Title/Presentation Address mapping

6.1.1 Local AE Titles and Presentation Addresses

The local Application Entity Title is set via the iViewGT Workstation Name, which is configurable. If the Workstation Name does not form a legal AE Title, it is truncated into a legal AE title and the user is notified of the derived title. (AETitle should contain 16 characters maximum)

The listen port number is configurable. The default is 104.

6.1.2 Remote AE Titles and Presentation Addresses

For remote applications that only act as Service Class User, no information is needed.

For remote applications that act as Service Class Provider the following information must be provided:

- the remote AE Title.
- the IP address and optionally the host name.
- the port number at which the remote application accepts association requests.
- the SOP classes for which the application provides conformance as an SCP.
- a user-readable alias string for identifying the remote application within the iViewGT user interface, (this string is presented to the operator when selecting a remote system, not the Remote AE Title.)

6.2 Configurable Parameters

The Maximum PDU size is configurable.

The maximum number of simultaneous pending associations is configurable.

The AE can be configured either to accept or reject association requests offering an incorrect called AE title.

The Extended Import capability of the Image Import Service can be enabled or disabled. (See APPENDIX D)

DICOM Upper Layer Timeouts are configurable.

NOTE: It is theoretically possible to configure many other low-level DICOM parameters in iViewGT. To do so, however, could break conformance and is not generally recommended without specialist advice from Elekta.

7 Support of Extended Character Sets

None.

APPENDIX A Applied RT Image IOD and Mapping to iViewGT Database

A.1 Export of RT Images

The modules selected from the RT Image IOD table of DICOM for image export are given in Table 13 below. If a module is not listed, none of the attributes in that module is sent by iViewGT.

Table 13 Applied Modules in the RT Image IOD for Export (SCU Role)

IE	Module
Patient	Patient
Study	General Study
Series	RT Series
Equipment	General Equipment
Image	General Image
	Image Pixel
	RT Image
	SOP Common

Table 14 to Table 21 below specify the applied attributes for each module, and note their mappings from the iViewGT database. If an attribute is not listed it is not sent by iViewGT. If an attribute is listed without Notes, there is a mapping from a directly equivalent iViewGT database entry.

Table 14 RT Image Storage SOP Class (SCU) – Patient Module

Attribute Name	Tag	DICO M Type	Notes
Patients Name	(0010,0010)	2	Last^First^Middle^ (no Prefix or Suffix)
Patient ID	(0010, 0020)	2	
Patient's Birth Date	(0010, 0030)	2	
Patients Sex	(0010, 0040)	2	
Patient Comments	(0010, 4000)	3	

Table 15 RT Image Storage SOP Class (SCU) – General Study Module

Attribute Name	Tag	DICO M Type	Notes
Study Instance UID	(0020, 000D)	1	Treatment.UID (generated by iViewGT for native treatments) see Note I
Study Date	(0008, 0020)	2	Image acquisition date
Study Time	(0008, 0030)	2	Image acquisition time
Referring Physicians Name	(0008, 0090)	2	Patient.doctor^^^^

Study ID	(0020, 0010)	2	Treatment.ID (truncated to 16 characters if bigger and user warned)
Accession Number	(0008, 0050)	2	Empty
Study Description	(0008, 1030)	3	Treatment.Description

Note I Treatment created by DICOM Import:

When a treatment is created by a DICOM import, the treatment.UID is copied from the DICOM data. To avoid re-using at export time a code that doesn't belong to Elekta the study instance UID will be the treatment.UID with the first 20 characters replaced by the Elekta specific code and a machine specific code. (Basis of all DICOM UIDs generated by this station).

Table 16 RT Image Storage SOP Class (SCU) – RT Series Module

Attribute Name	Tag	DICOM Type	Notes
Modality	(0008, 0060)	1	"RTIMAGE"
Series Instance UID	(0020, 000E)	1	Field.UID (generated by iViewGT for native fields) see Note II
Series Number	(0020, 0011)	2	IF Field ID is numeric: Field.ID, ELSE: an internally generated unique fieldspecific number.
Series Description	(0008, 103E)	3	Field.ID:Field.Description

Note II Export of images belonging to fields created by DICOM Import:

When a field is created by a DICOM import, the treatment.UID is copied from the DICOM data. To avoid re-using at export time a code that doesn't belong to Elekta the study instance UID will be the treatment.UID with the first 20 characters replaced by the Elekta specific code and a machine specific code. (Basis of all DICOM UIDs generated by this station).

Table 17 RT Image Storage SOP Class (SCU) – General Equipment Module

Attribute Name	Tag	DICOM Type	Notes
Manufacturer	(0008, 0070)	2	"ELEKTA"
Station Name	(0008, 1010)	3	IF an iViewGT acquired image: Acquiring Station Name, ELSE: "UNKNOWN" + any available origin detail.
Manufacturers Model Name	(0008, 1090)	3	"Elekta iViewGT Electronic Portal Imaging"
Device Serial Number	(0018, 1000)	3	iViewGT Station Serial Number
Software Versions	(0018, 1020)	3	Software revision of EXPORTING Station

Table 18 RT Image Storage SOP Class (SCU) – General Image Module

Attribute Name	Tag	DICO M Type	Notes
Image Number	(0020, 0013)	2	An internally generated database-unique image specific number.
Image Date	(0008, 0023)	2C	Image acquisition date
Image Time	(0008, 0033)	2C	Image acquisition time
Derivation Description	(0008,2111)	3	IF an iViewGT acquired image: Empty ELSE "Imported into iViewGT"
Acquisition Date	(0008, 0022)	3	Image acquisition date
Acquisition Time	(0008, 0032)	3	Image acquisition time
Images in Acquisition	(0020, 1002)	3	1
Image Comments	(0020, 4000)	3	

Table 19 RT Image Storage SOP Class (SCU) –Image Pixel Module

Attribute Name	Tag	DICO M Type	Notes
Samples per Pixel	(0028, 0002)	1	1
Photometric Interpretation	(0028, 0004)	1	"MONOCHROME2"
Rows	(0028, 0010)	1	
Columns	(0028, 0011)	1	
Bits Allocated	(0028, 0100)	1	16
Bits Stored	(0028, 0101)	1	16
High Bit	(0028, 0102)	1	15
Pixel Representation	(0028, 0103)	1	0
Pixel Data	(7FE0, 0010)	1	
Planar Configuration	(0028, 0006)	1C	0
Pixel Aspect Ratio	(0028, 0034)	1C	
Window center	(0028,1050)	3	$(1 - \text{brightness}/100) * (\text{ActualMaxVal} - \text{ActualMinVal}) + \text{ActualMinVal}$

Window width	(0028,1051)	3	(1-contrast/100)*(ActualMaxVal - ActualMinVal)
--------------	-------------	---	---

Table 20 RT Image Storage SOP Class (SCU) – RT Image Module

Attribute Name	Tag	DICOM Type	Notes
Samples per pixel	(0028, 0002)	1	1
Photometric Interpretation	(0028, 0004)	1	"MONOCHROME2.
Pixel Representation	(0028, 0103)	1	0
Bits Allocated	(0028, 0100)	1	16
Bits Stored	(0028, 0101)	1	16
High Bit	(0028, 0102)	1	15
Image Type	(0008, 0008)	1	ORIGINAL\PRIMARY\PORTAL
RT Image label	(3002, 0002)	1	Label corresponding to the type of acquired image : Port : "iViewPortallImage" Open Field : "iViewOpenField" Double "iViewDoubleExp" IMRT "iViewIMRTSegment" IMRT Mult : "iViewIMRTMulti" Default "iView image"
Reported Values Origin	(3002, 000A)	2C	"OPERATOR"
RT Image Plane	(3002, 000C)	1	"NORMAL"
Gantry Angle	(300A, 011E)	3	IF Portal Dosimetry licensed and in iCom mode: Actual gantry angle corresponding to image. ELSE Gantry angle set for the field.
Image Plane Pixel Spacing	(3002, 0011)	2	If the Horizontal scale factor is defined this tag is populated.
RT Image Position	(3002, 0012)	2	If the image centre is defined this tag is populated
Radiation Machine SSD	(3002, 0024)	3	Field.SSD
RT Image SID	(3002, 0026)	2	Image.SID

Table 21 RT Image Storage SOP Class (SCU) – SOP Common Module

Attribute Name	Tag	DICO M Type	Notes
SOP Class UID	(0008, 0016)	1	1.2.840.10008.5.1.4.1.1.481.1
SOP Instance UID	(0008, 0018)	1	Image.UID (generated by iViewGT for natively acquired images, and images imported from any source, including DICOM)
Instance Creation Date	(0008, 0012)	3	Date of export
Instance Creation Time	(0008, 0013)	3	Time of export
Instance Creator UID	(0008, 0014)	3	Derived from 6-digit iViewGT workstation serial number. 1.3.46.423632 .<abcxyz>

A.2 Import of RT Images

The modules selected from the RT Image IOD table of DICOM for image import are given in Table 22 below. If a module is not listed, none of the attributes in that module is stored by iViewGT.

Table 22 Applied Modules in the SC Image IOD for Import (SCP Role)

IE	Module
Patient	Patient
Study	General Study
Series	General Series
Image	General Image
	Image Pixel
	RT Image
	SOP Common

Table 23 to Table 29 below specify, for each of the applied modules above, the attributes stored by iViewGT, and their mapping onto the iViewGT database.

Table 23 RT Image Storage SOP Class (SCP) – Patient Module

Attribute Name	Tag	DICOM Type	Notes
Patients Name	(0010,0010)	2	Split into Patient.Last, Patient.First, Patient.Middle (Prefix, Suffix not stored). See Note X below.
Patient ID	(0010, 0020)	2	Patient.ID TRUNCATED TO 20 CHARS MAX. See Note X below.
Patient's Birth Date	(0010, 0030)	2	
Patients Sex	(0010, 0040)	2	
Patient Comments	(0010, 4000)	3	

Note III Handling of Empty Patient Identification Attributes

The Patient ID (0010, 0020) and Patient Name (0010, 0010) attributes of the Patient Module are specified by DICOM as Type 2 and so may legally have zero length.

As a safety measure, incoming images are stored into a local database dedicated to DICOM Import purposes. An iViewGT function allows the interactive viewing, editing and, at the iViewGT operators discretion, deleting or relocation of the data into the main iViewGT clinical database.

Extreme caution is advised when handling data with limited Patient identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing empty Patient ID and/or Patient Name attributes is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 24 RT Image Storage SOP Class (SCP) – General Study Module

Attribute Name	Tag	DICO M Type	Notes
Study Instance UID	(0020, 000D)	1	Treatment.UID. See Note XI
Study Date	(0008, 0020)	2	Appended to Treatment.ID. See Note V
Study Time	(0008, 0030)	2	Appended to Treatment.ID See Note V

Note IV Logic in treatment record creation/selection:

Before creating a new treatment record , iViewGT searches the treatment table to match it with a record that has been previously created by a RT Plan or RT Image import.

If the RT Image contains a referenced RT Plan UID (first instance of a (300C,0002) Referenced RT Plan sequence, (0008,1155)Referenced SOP instance UID) we search for a treatment record that has this referenced plan UID as a Dicom UID.

If this search is successful we use the record otherwise we create a new one and use the referenced RT Plan UID as Dicom UID of the treatment .

If the RT Image doesn't contain a referenced RT Plan UID, we search for a treatment record that has the Study Instance UID (0020, 000D) as Dicom UID.

If this search is successful we use the record otherwise we create a new one and use the Study Instance UID as Dicom UID of the treatment.

Note V Treatment ID:

If the (0008,0020) Study Date is present then use the (0008,0020) Study Date and (0008, 0030) Study Time otherwise we use the (0008,0023) Image Date and (0008,0033)Time.

Table 25 RT Image Storage SOP Class (SCP) – RT Series Module

Attribute Name	Tag	DICO M Type	Notes
Series Instance UID	(0020, 000E)	1	Field.UID See Note VI
Series Number	(0020, 0011)	2	Field.ID. See Note VI
Laterality	(0020, 0060)	2C	Appended to Field.Site
Body Part Examined	(0018, 0015)	3	Field.Site
Patient Position	(0018, 5100)	2C	Field.Orientation Image.Orientation

Note VI Field ID:

If the RT Image contains information about a (300C,0006) Referenced Beam Number then we use it as a Field ID to search previously created (by an Image or a RT Plan import) record and if not found we create a new record with the beam number as Field ID.

The applied Series Number (0020, 0011) is specified by DICOM as Type 2 and so may legally have zero length. This field is normally used by iViewGT to identify the Field to be created or updated.

In the situation where (300C,0006) Referenced Beam Number, the Series Number attribute is used as Field ID.

If the Series Number attribute is empty, iViewGT will use the last 16 digits of the Series Instance

UID (0020, 000E) as a Field ID. In such cases it will also append the Field Description with the ":FLDID derived (SeriesInstanceUID)" to assist the operator.

Extreme caution is advised when handling data with limited Series identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing an empty Series Number attribute is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 26 RT Image Storage SOP Class (SCP) – General Image Module

Attribute Name	Tag	DICO M Type	Notes
Image Number	(0020, 0013)	2	Not stored
Patient Orientation	(0020, 0020)	2C	recorded in Image.Comments
Image Date	(0008, 0023)	2C	See Note V
Image Time	(0008, 0033)	2C	See Note V
Image Comments	(0020, 4000)	3	Image.Comments

Table 27 RT Image Storage SOP Class (SCP) – Image Pixel Module

Attribute Name	Tag	DICO M Type	Notes
Samples per Pixel	(0028, 0002)	1	Assumed to be 1. See Note XIII below.
Photometric Interpretation	(0028, 0004)	1	Assumed to be "MONOCHROME1" or "MONOCHROME2. See Note XIII below."
Rows	(0028, 0010)	1	Image.Height
Columns	(0028, 0011)	1	Image.Width
Bits Allocated	(0028, 0100)	1	Bits Allocated is 8 or 16
Bits Stored	(0028, 0101)	1	8 to 16
High Bit	(0028, 0102)	1	7 to 15
Pixel Representation	(0028, 0103)	1	Used to determine pixel scaling behaviour
Pixel Data	(7FE0, 0010)	1	Image pixel data interpreted. See Note XIII below.
Planar Configuration	(0028, 0006)	1C	Assumed to be 0. See Note XIII below.
Pixel Aspect Ratio	(0028, 0034)	1C	Image.Aspect

Note VII **Stored Image Formats:**

iViewGT will **always** assume that pixel data is organised as 1 sample per pixel, either MONOCHROME1 or MONOCHROME2 interpretation and will store images accordingly.

Table 28 **RT Image Storage SOP Class (SCP) – RT Image Module**

Attribute Name	Tag	DICO M Type	Notes
RT Image position	(3002, 0012)	2	Used to set the centre of the image
Image Plane Pixel Spacing	(0018, 1014)	2	

Table 29 **RT Image Storage SOP Class (SCP) – SOP Common Module**

Attribute Name	Tag	DICO M Type	Notes
SOP Class UID	(0008, 0016)	1	Not used.
SOP Instance UID	(0008, 0018)	1	Discarded. A new UID is generated for Image.UID
Specific Character Set	(0008, 0005)	1C	Not used.

APPENDIX B Applied SC Image IOD and Mapping to iViewGT Database

B.1 Export of SC Images

The modules selected from the Secondary Capture Image IOD table of DICOM for image export are given in Table 30 below. If a module is not listed, none of the attributes in that module is sent by iViewGT.

Table 30 Applied Modules in the SC Image IOD for Export (SCU Role)

IE	Module
Patient	Patient
Study	General Study
Series	General Series
Equipment	General Equipment
	SC Equipment
Image	General Image
	Image Pixel
	SC Image
	SOP Common

Table 31 to Table 39 below specify the applied attributes for each module, and note their mappings from the iViewGT database. If an attribute is not listed it is not sent by iViewGT. If an attribute is listed without Notes, there is a mapping from a directly equivalent iViewGT database entry.

Table 31 SC Image Storage SOP Class (SCU) – Patient Module

Attribute Name	Tag	DICO M Type	Notes
Patients Name	(0010,0010)	2	Last^First^Middle^^ (no Prefix or Suffix)
Patient ID	(0010, 0020)	2	
Patient's Birth Date	(0010, 0030)	2	
Patients Sex	(0010, 0040)	2	
Patient Comments	(0010, 4000)	3	

Table 32 SC Image Storage SOP Class (SCU) – General Study Module

Attribute Name	Tag	DICO M Type	Notes
Study Instance UID	(0020, 000D)	1	Treatment.UID (generated native by iViewGT for treatments) see Note I
Study Date	(0008, 0020)	2	Image acquisition date
Study Time	(0008, 0030)	2	Image Acquisition time.
Referring Physicians Name	(0008, 0090)	2	Patient.doctor^^^^

Study ID	(0020, 0010)	2	Treatment.ID (truncated to bigger 16 characters if and user warned)
Accession Number	(0008, 0050)	2	Empty
Study Description	(0008, 1030)	3	Treatment.Description

Table 33 SC Image Storage SOP Class (SCU) – General Series Module

Attribute Name	Tag	DICOM Type	Notes
Modality	(0008, 0060)	1	“CR”
Series Instance UID	(0020, 000E)	1	Field.UID (generated by iViewGT for native fields) see Note II and
Series Number	(0020, 0011)	2	IF Field ID is numeric: Field.ID, ELSE: an internally generated unique field-specific number.
Protocol Name	(0018, 1030)	3	“iView Electronic Portal Image”
Series Description	(0008, 103E)	3	Field.Description
Patient Position	(0018, 5100)	2C	Empty if position not specified by operator

Note VIII Series specific to secondary capture image:

As the same image can be sent as an RT Image and a SC image to different servers depending on their configuration, we could see in the field a RT image and a Secondary Capture sharing the same series UID. To avoid this situation we will add “.1” to the end of the series UID we would have used for RT Image (see Note II)

Table 34 SC Image Storage SOP Class (SCU) – General Equipment Module

Attribute Name	Tag	DICOM Type	Notes
Manufacturer	(0008, 0070)	2	“ELEKTA”
Station Name	(0008, 1010)	3	IF an iViewGT acquired image: Acquiring Station Name, ELSE: “UNKNOWN” + any available origin detail.
Manufacturers Model Name	(0008, 1090)	3	“Elekta iView Electronic Portal Imaging”
Device Serial Number	(0018, 1000)	3	iViewGT Station Serial Number
Software Versions	(0018, 1020)	3	Software revision of EXPORTING Station

Table 35 SC Image Storage SOP Class (SCU) – SC Equipment Module

Attribute Name	Tag	DICO M Type	Notes
Conversion Type	(0008, 0064)	1	"DV"
Modality	(0008, 0060)	3	"CR"
Secondary Device Capture ID	(0018, 1010)	3	IF an iViewGT acquired image: Acquiring Station Name, ELSE: "UNKNOWN" + any available origin detail.
Secondary Capture Device Manufacturer's Model Name	(0018, 1018)	3	"Elekta. iView Electronic Portal Imaging"
Secondary Capture Device Software Version	(0018, 1019)	3	Software revision of EXPORTING Station

Table 36 SC Image Storage SOP Class (SCU) – General Image Module

Attribute Name	Tag	DICO M Type	Notes
Image Number	(0020, 0013)	2	An internally generated database-unique image-specific number.
Image Date	(0008, 0023)	2C	Image acquisition date
Image Time	(0008, 0033)	2C	Image acquisition time
Image Type	(0008, 0008)	3	IF an iViewGT acquired image: ORIGINAL\\PRIMARY ELSE: DERIVED\\SECONDARY
Derivation Description	(0008,2111)	3	IF an iViewGT acquired image: Empty ELSE "Imported into iView"
Acquisition Date	(0008, 0022)	3	Image acquisition date
Acquisition Time	(0008, 0032)	3	Image acquisition time
Images in Acquisition	(0020, 1002)	3	1
Image Comments	(0020, 4000)	3	

Table 37 SC Image Storage SOP Class (SCU) –Image Pixel Module

Attribute Name	Tag	DICO M Type	Notes
Samples per Pixel	(0028, 0002)	1	1
Photometric Interpretation	(0028, 0004)	1	"MONOCHROME2"
Rows	(0028, 0010)	1	
Columns	(0028, 0011)	1	
Bits Allocated	(0028, 0100)	1	8 or 16
Bits Stored	(0028, 0101)	1	8 to 16
High Bit	(0028, 0102)	1	7 to 15
Pixel Representation	(0028, 0103)	1	0
Pixel Data	(7FE0, 0010)	1	
Planar Configuration	(0028, 0006)	1C	0
Pixel Aspect Ratio	(0028, 0034)	1C	
Window center	(0028,1050)	3	$(1 - \text{brightness}/100) * (\text{ActualMaxVal} - \text{ActualMinVal}) + \text{ActualMinVal}$
Window width	(0028,1051)	3	$(1 - \text{contrast}/100) * (\text{ActualMaxVal} - \text{ActualMinVal})$

Table 38 SC Image Storage SOP Class (SCU) – SC Image Module

Attribute Name	Tag	DICO M Type	Notes
Date of Secondary Capture	(0018, 1012)	3	Image acquisition date
Time of Secondary Capture	(0018, 1014)	3	Image acquisition time

Table 39 SC Image Storage SOP Class (SCU) – SOP Common Module

Attribute Name	Tag	DICO M Type	Notes
SOP Class UID	(0008, 0016)	1	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008, 0018)	1	Image.UID (generated by iViewGT for natively acquired images, and images imported from any source, including DICOM) see Note IX

Instance Creation Date	(0008, 0012)	3	Date of export
Instance Creation Time	(0008, 0013)	3	Time of export
Instance Creator UID	(0008, 0014)	3	Derived from 6-digit iViewGT workstation serial number. 1.3.46.423632 .<abcxyz>

Note IX SOP Instance UID specific to Secondary capture:

Server configurations determine the choice of Secondary Capture or RT Image when exporting. To avoid an identical UID being used for both Secondary Capture and RT Image “.1” is appended to Image.UID when exporting Secondary Capture images.

B.2 Import of SC Images

The modules selected from the Secondary Capture Image IOD table of DICOM for image import are given in Table 40 below. If a module is not listed, none of the attributes in that module is stored by iViewGT.

Table 40 Applied Modules in the SC Image IOD for Import (SCP Role)

IE	Module
Patient	Patient
Study	General Study
Series	General Series
Image	General Image
	Image Pixel
	SC Image
	SOP Common

Table 41 to Table 47 below specify, for each of the applied modules above, the attributes stored by iViewGT, and their mapping onto the iViewGT database.

Table 41 SC Image Storage SOP Class (SCP) – Patient Module

Attribute Name	Tag	DICOM Type	Notes
Patients Name	(0010,0010)	2	Split into Patient.Last, Patient.First, Patient.Middle (Prefix, Suffix not stored). See Note X below.
Patient ID	(0010, 0020)	2	Patient.ID TRUNCATED TO 20 CHARS MAX. See Note X below.
Patient's Birth Date	(0010, 0030)	2	
Patients Sex	(0010, 0040)	2	
Patient Comments	(0010, 4000)	3	

Note X Handling of Empty Patient Identification Attributes

The Patient ID (0010, 0020) and Patient Name (0010, 0010) attributes of the Patient Module are specified by DICOM as Type 2 and so may legally have zero length.

As a safety measure, incoming images are stored into a local database dedicated to DICOM Import purposes. An iViewGT function allows the interactive viewing, editing and, at the iViewGT operators discretion, deleting or relocation of the data into the main iViewGT clinical database.

Extreme caution is advised when handling data with limited Patient identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing empty Patient ID and/or Patient Name attributes is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 42 SC Image Storage SOP Class (SCP) – General Study Module

Attribute Name	Tag	DICOM Type	Notes
Study Instance UID	(0020, 000D)	1	Treatment.UID. See Note XI below.
Study Date	(0008, 0020)	2	Appended to Treatment.Description
Study Time	(0008, 0030)	2	Appended to Treatment.Description
Referring Physicians Name	(0008, 0090)	2	Appended to Treatment.Description
Study ID	(0020, 0010)	2	Treatment.ID. See Note XI below.
Accession Number	(0008, 0050)	2	Appended to Treatment.Description. See Note XI below.
Study Description	(0008, 1030)	3	Treatment.Description

Note XI Handling of Empty Study ID Attribute

The applied Study ID (0020, 0010) is specified by DICOM as Type 2 and so may legally have zero length. This field is normally used by iViewGT to identify the Treatment to be created or updated.

In the situation where the Study ID attribute is empty, iViewGT will attempt to use the Accession Number (0008, 0050, Type 2) attribute as a Treatment ID instead. In such cases it will also append the Treatment Description with the text ":TRTID derived (Accession No.)" to assist the operator.

In the situation where both the Study ID and Accession Number attributes are empty, iViewGT will use the last 16 digits of the Study Instance UID (0020, 000D) as a Treatment ID. In such cases it will also append the Treatment Description with the text ":TRTID derived (StudyInstanceUID.)" to assist the operator.

Extreme caution is advised when handling data with limited Study identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing an empty Study ID attribute is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 43 SC Image Storage SOP Class (SCP) – General Series Module

Attribute Name	Tag	DICOM Type	Notes
Series Instance UID	(0020, 000E)	1	Field.UID . See Note XII below
Modality	(0008, 0060)	1	Not stored
Series Number	(0020, 0011)	2	Field.ID. See Note XII below
Laterality	(0020, 0060)	2C	Appended to Field.Site
Series Date	(0008, 0021)	3	Appended to Field.Description
Series Time	(0008, 0031)	3	Appended to Field.Description

Protocol Name	(0018, 1030)	3	Appended to Field.Description
Series Description	(0008, 103E)	3	Field.Description
Body Part Examined	(0018, 0015)	3	Field.Site
Patient Position	(0018, 5100)	2C	Field.Orientation

Note XII Handling of Empty Series Number Attribute

The applied Series Number (0020, 0011) is specified by DICOM as Type 2 and so may legally have zero length. This field is normally used by iViewGT to identify the Field to be created or updated.

In the situation where the Series Number attribute is empty, iViewGT will use the last 16 digits of the Series Instance UID (0020, 000E) as a Field ID. In such cases it will also append the Field Description with the ":FLDID derived (SeriesInstanceUID)" to assist the operator.

Extreme caution is advised when handling data with limited Series identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing an empty Series Number attribute is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 44 SC Image Storage SOP Class (SCP) – General Image Module

Attribute Name	Tag	DICOM Type	Notes
Image Number	(0020, 0013)	2	Not stored
Patient Orientation	(0020, 0020)	2C	Recorded in Image.Comment
Image Date	(0008, 0023)	2C	Not stored
Image Time	(0008, 0033)	2C	Not stored
Image Comments	(0020, 4000)	3	Image.Comments

Table 45 SC Image Storage SOP Class (SCP) – Image Pixel Module

Attribute Name	Tag	DICOM Type	Notes
Samples per Pixel	(0028, 0002)	1	Assumed to be 1. See Note XIII below.
Photometric Interpretation	(0028, 0004)	1	Assumed to be "MONOCHROME1" or MONOCHROME2. See Note XIII below."
Rows	(0028, 0010)	1	Image.Height
Columns	(0028, 0011)	1	Image.Width

Bits Allocated	(0028, 0100)	1	Bits Allocated is 8 or 16
Bits Stored	(0028, 0101)	1	8 to 16
High Bit	(0028, 0102)	1	7 to 15
Pixel Representation	(0028, 0103)	1	Used to determine pixel scaling behaviour
Pixel Data	(7FE0, 0010)	1	Image pixel data interpreted. See Note XIII below.
Planar Configuration	(0028, 0006)	1C	Assumed to be 0. See Note XIII below.
Pixel Aspect Ratio	(0028, 0034)	1C	Image.Aspect

Note XIII Stored Image Formats

iViewGT will **always** assume that pixel data is organised as 1 sample per pixel, either MONOCHROME1 or MONOCHROME2 interpretation and will store images accordingly.

Table 46 SC Image Storage SOP Class (SCP) – SC Image Module

Attribute Name	Tag	DICOM Type	Notes
Date of Secondary Capture	(0018, 1012)	3	Image.Acquisition Date
Time of Secondary Capture	(0018, 1014)	3	Image.Acquisition Time

Table 47 SC Image Storage SOP Class (SCP) – SOP Common Module

Attribute Name	Tag	DICOM Type	Notes
SOP Class UID	(0008, 0016)	1	Not used.
SOP Instance UID	(0008, 0018)	1	Discarded. A new UID is generated for Image.UID
Specific Character Set	(0008, 0005)	1C	Not used.

APPENDIX C Applied RT Plan IOD and Mapping to iViewGT Database

C.1 Import of RT Plans

The modules selected from the RT Plan IOD table of DICOM for image import are given in Table 40 above. If a module is not listed, none of the attributes in that module is stored by iViewGT.

Table 48 Applied Modules in the RT Plan IOD for Import (SCP Role)

IE	Module
Patient	Patient
Series	RT Series
Image	General Plan
	SOP Common

Table 41 to Table 47 above specify, for each of the applied modules above, the attributes stored by iViewGT, and their mapping onto the iViewGT database.

Table 49 RT Plan Storage SOP Class (SCP) – Patient Module

Attribute Name	Tag	DICOM Type	Notes
Patients Name	(0010,0010)	2	Split into Patient.Last, Patient.First, Patient.Middle (Prefix, Suffix not stored). See Note XIV
Patient ID	(0010, 0020)	2	Patient.ID TRUNCATED TO 20 CHARS MAX. See Note XIV
Patient's Birth Date	(0010, 0030)	2	
Patients Sex	(0010, 0040)	2	
Patient Comments	(0010, 4000)	3	

Note XIV Handling of Empty Patient Identification Attributes

The Patient ID (0010, 0020) and Patient Name (0010, 0010) attributes of the Patient Module are specified by DICOM as Type 2 and so may legally have zero length.

As a safety measure, incoming images are stored into a local database dedicated to DICOM Import purposes. An iViewGT function allows the interactive viewing, editing and, at the iViewGT operators discretion, deleting or relocation of the data into the main iViewGT clinical database.

Extreme caution is advised when handling data with limited Patient identification information present. It is the responsibility of the iViewGT operator to ensure that incoming image data containing empty Patient ID and/or Patient Name attributes is correctly identified and qualified before relocation into the main iViewGT Clinical database.

Table 50 RT Plan Storage SOP Class (SCP) – RT Series Module

Attribute Name	Tag	DICO M Type	Notes
Series Instance UID	(0020, 000E)	1	Field.UID .
Laterality	(0020, 0060)	2C	Appended to Field.Site
Body Part Examined	(0018, 0015)	3	Field.Site

Table 51 RT Plan Storage SOP Class (SCP) – RT General Plan Module

Attribute Name	Tag	DICO M Type	Notes
RT Plan label	(300A, 0002)	1	Used for Treatment ID. See Note XV
RT Plan name	(300A, 0003)	3	Used for Treatment ID. See Note XV
RT Plan description	(300A, 0004)	3	Treatment. description = "DICOM :." + RT Plan description
RT Plan date	(300A, 0006)	2	Appended to Treatment.description
RT plan time	(300A, 0007)	2	Appended to Treatment.description

Note XV Treatment ID:

The treatment Id is a concatenation of the plan label and the plan name. If a plan previously imported had the same name and label, iViewGT will add a numeric prefix, incrementing the prefix until a unique treatment ID is found.

Table 52 RT Plan Storage SOP Class (SCP) – SOP Common Module

Attribute Name	Tag	DICO M Type	Notes
SOP Instance UID	(0008, 0018)	1	Treatment.DicomUID

APPENDIX D Extended Image Import Capability

In addition to the SOP classes supported by iViewGT as SCP listed in Table 2 on page 9 above, the iViewGT AE has the optional ability to store images of types other than Secondary Capture and RT Image.

This feature is provided to extend the potential usefulness of the system as a general-purpose image viewing station, and is configurable to be enabled or disabled.

NOTE: The viewing, analysis, processing and printing functions within iViewGT are primarily designed for portal images acquired by the iViewGT system. When applied to images that are sent to iViewGT by means of DICOM, in particular from modalities other than Portal Imagers, some of these functions may not perform optimally or may not be relevant.

When the capability is enabled the following additional SOP classes are supported by iViewGT as SCP:

Table 53 Additional SOP Classes supported by iViewGT as SCP (Extended Import Option Enabled)

SOP Class Name	UID
CR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.1
CT Image Storage - STORE	1.2.840.10008.5.1.4.1.1.2
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4

The modules selected from the Image IOD's for Extended Image Import are given in Table 54 below. If a module is not listed, none of the attributes in that module is stored by iViewGT.

Table 54 Applied Modules in the Image IOD for Import (SCP Role: Extended Import)

IE	Module
Patient	Patient
Study	General Study
Series	General Series
Image	General Image
	Image Pixel
	SOP Common

For the modules listed in Table 54, the attributes stored by iViewGT, and their mapping onto the iViewGT database are as listed in the respective tables in Section A.2 above.

D.1 C-STORE Conformance when Extended Import is Enabled.

With Extended Import enabled, iViewGT will provide standard conformance as a Conformance Level 0 Storage SCP for Secondary Capture.

For the additional SOP classes listed in Table 53 above, however, note the following:

- Should the images be re-exported, they will be exported as Secondary Capture, not as the original SOP class (the new SOP Instance UID generated at Storage time will be used).

APPENDIX E C-STORE Response Status Codes

Table 55 below lists the specific status code values returned by Elekta iViewGT in a C-STORE response.

Table 55 C-STORE Status Codes

Service Status	Further Meaning	Status Code Values
Refused	Out of Resources	A7xx
	- This plan or a RT image referencing this plan is already in the iViewGT DB	A701
Success		0000