Digital Imaging and Communications in Medicine (DICOM)

*Supplement 247: Eyecare Measurement Templates*

*Prepared by:*

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#  Document History

|  |  |  |
| --- | --- | --- |
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| 01 | 11-Oct-24 | Initial Draft for discussion at WG-9  |
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# Scope and Field of Application

This Supplement proposes to add templates, context groups, and coded vocabulary for key eyecare measurements to the Standard. These templates may be used in either Structured Reporting documents, or for structured content in an Encapsulated PDF object.

The focus of this Supplement is the set of “key” measurements clinically important for patient care. These are not intended to be a comprehensive set of ophthalmic measurements, although the extensible context groups and templates allow additional measurements beyond the specified key measurements to be included in SOP Instances.

The key measurements of this Supplement are primarily derived from analysis of images, in particular retinal optical coherence tomography (OCT) images. Note that there are several existing IODs that record measurements directly produced by various refractive devices that do not produce images (autorefraction, lensometry, keratometry, etc.), as well as more comprehensive visual field and macular thickness reports, which are not intended to be replaced by these more summary key measurement templates.

The IHE Eyecare domain defined within the Unified Eye Care Workflow Profile (as a draft for trial implementation) an option for Key Measurements in DICOM Encapsulated PDF [<https://www.ihe.net/uploadedFiles/Documents/Eye_Care/IHE_EyeCare_Suppl_Key_Measurement_PDF.pdf>]. That option specified templates, context groups, and coded vocabulary for various key measurements in ophthalmology to be encoded as structured content within Encapsulated PDF objects. WG-09 has determined that those should be formalized in the DICOM Standard, and that work informed the draft of this Supplement.

Some vocabulary may be submitted to LOINC for assignment of codes.

### SR and Encapsulated PDF

There is tension in clinical documentation between the needs for structured discrete data and human-readable content. In DICOM, discrete data is generally sent using Structured Reporting, and ready for display rendered data may be sent in an Encapsulated PDF. A given set of measurements may be sent in objects in both formats, with cross-reference to the other object using the Referenced Instance Sequence (0008,114A); note that the cross-reference is to an instance as a whole, not to individual measurements. Alternatively, discrete measurements may be included in an Encapsulated PDF object in the SR-like Content Sequence (0040,A730). The Templates defined in this Supplement may be used in either object type.

The DICOM Standard does not recommend the use of any particular approach to meeting the clinical documentation needs of the users. Such recommendation may be made by a professional society or a standards profiling effort. For example, the American Academy of Ophthalmology and the IHE Eyecare domain, considering the need to integrate legacy PDF-based systems, have in the past recommended use of Encapsulated PDF with the included SR-like Content Sequence for basic interoperability (see [https://www.aaojournal.org/article/S0161-6420(21)00164-0/fulltext](https://www.aaojournal.org/article/S0161-6420%2821%2900164-0/fulltext)), but those recommendations may not meet all use cases in the evolving interoperable healthcare IT environment.

# Open Issues for Public Comment

|  |  |  |
| --- | --- | --- |
| 1 | TIDs 60x2 – 60x9 | Should then invocations of the T60x1 measurement group section have VM 1-2 (limited to one each for L and R eye), or 1-n (e.g., to allow different sets of measurements with different grid positioning)? |
| 2 | TID 60x1 | Are there implementation concerns with the specifications for mandatory Content Items? TID 60x1 makes mandatory a Content Item for each concept specified in the invoking Template, i.e., in the Context Groups invoked for parameters $Measurement and $QualType. This manner of specifying multiple mandatory items has not previously been used in the Standard, and may have implications for software libraries, toolkits, and validators.Additionally, receiving implementations may need to better handle an absent NUM value with an associated reason code. |
| 3 | TID 60x2 | Is the use of Rational Numerator Value (0040,A162) and Rational Denominator Value (0040,A163) in a single NUM item as a supplement to a % value acceptable?A concern is that receiving implementations may ignore those type 3 attributes.Visual Field Fixation ratios in the IHE profile were represented as TEXT (‘Text string in the form of “number of <x> responses/number of trials”’). This is bad form for SR. However, encoding the ratio components as separate NUM Content Items does not seem to fit the model of key measurements. |
| 4 | TID 60x6, CID 42x5, CID 42x6 | Is the approach acceptable to post-coordinate Gangion Cell Layer measurement concepts with a topographical modifier specifying the layers included?The approach specified allows the same measurement concepts, but has the creator specify whether they were made solely on the GCL, on the Gangion Cell Layer + Inner Plexiform Layer (GCL-IPL), or on the entire Ganglion Cell Complex (GCL + IPL + RNFL). |
| 5 | TID 60x6, CID 42x7, CID 42x8 | Is the approach acceptable for allowing application specific definitions of GCL sectors, but using common measurement concepts for sectors with the same name but different spans? |
| 6 | Annex D nnn411-nnn422 | Are clockface position definitions clear? Positions go clockwise for the right eye, but counterclockwise for the left eye, when viewed from the anterior position (i.e., looking at the patient face on). |
| 7 | CID 42x1, CID 42x2, CID 42x3, CID 42x4, CID 42x6, CID 42x9, CID 42y0, Annex D | Are the identified key measurements necessary and sufficient for the purposes of patient care? Are there additional needed key measurements? Are there some identified measurements that are not useful and may be removed?Are all measurement definitions accurate? Do measurement definitions that include units of measure do so justifiably? |
| 8 |  | Should a new SOP Class be defined that makes SR content mandatory in an Encapsulated PDF SOP Instance? One intended use of these templates is for the SR-like content included in an EPDF. A separate SOP Class might better support conformance claims for systems that are providing such content, and would distinguish PDF display-only instances from those that also have processable discrete data. |
| 9 |  | Should a new Ophthalmology SR SOP Class be defined for these SR’s? For integration into enterprise EHRs, these SR instances might be transcoded (e.g., into FHIR) under the single document type “Ophthalmology Note” defined in LOINC. Such a SOP Class might facilitate handling such instances as a class for enterprise integration, but would be yet another SOP Class to be added to PACS and other systems. |
| 10 |  | Is the concept of “key measurements” necessary in the current interoperability environment? The IHE profile presumed Encapsulated PDF SOP Instances would be the basic mechanism for interoperability, and that key measurements included in the object would support basic needs for discrete data (e.g., in EHR summaries). As the interoperability environment in general evolves to a more data-rich approach, perhaps standardization should focus on defining comprehensive sets of ophthalmology measurements from which applications can select based on their specific use case. |
| 11 |  | Do all root node templates require a Value Set Constraint specification of “Root Node”?PS3.16 section 6.1.9.2 has no provision for this use, and it is inconsistently used in Annex A root containers, and it is redundant with the root specification above the table.  |

# Closed Issues

|  |  |
| --- | --- |
| 1 | Structured as separate root templates to facilitate intra-department (PACS) management and search, rather than as a single master template with subsections for each class of measurements. [WG-9 consensus 12/2024] |
| 2 | Measurements should be post-coordinated with laterality, in contrast to current LOINC pre-coordinated RNFL measurements (LOINC Panel [86291-2](https://loinc.org/86291-2/)). [WG-9 consensus 12/2024]  |

# PS3.6

*Add new Context Group UIDs to PS3.6 Annex A*

**Table A-3. Context Group UID Values**

|  |  |  |  |
| --- | --- | --- | --- |
| **Context Group UID** | **Context Group Identifier** | **Context Group Name** | **Comment** |
|  |  |  |  |
| **1.2.840.10008.6.​1.​x1** | **CID 42x1** | **Visual Field Key Measurements** |  |
| **1.2.840.10008.6.​1.​x2** | **CID 42x2** | **Optic Disc Key Measurements** |  |
| **1.2.840.10008.6.​1.​x3** | **CID 42x3** | **RNFL Key Measurements** |  |
| **1.2.840.10008.6.​1.​x4** | **CID 42x4** | **Macular Thickness Key Measurements** |  |
| **1.2.840.10008.6.​1.​x5** | **CID 42x5** | **GCL Measurement Extent** |  |
| **1.2.840.10008.6.​1.​x6** | **CID 42x6** | **GCL Key Measurements** |  |
| **1.2.840.10008.6.​1.​x7** | **CID 42x7** | **GCL Sector Measurements** |  |
| **1.2.840.10008.6.​1.​x8** | **CID 42x8** | **GCL Sector Grid Methods** |  |
| **1.2.840.10008.6.​1.​x9** | **CID 42x9** | **Corneal Topography Key Measurements** |  |
| **1.2.840.10008.6.​1.​y0** | **CID 42y0** | **Endothelial Cell Count Key Measurements** |  |

# PS3.16

*Update TID 4019 PS3.16 Annex A with Item from TID 2102*

### TID 4019 Algorithm Identification

This Template details the algorithm unambiguously. Re-state the software identification from the [General Equipment Module](https://dicom.nema.org/medical/dicom/current/output/chtml/part03/sect_C.7.5.html#sect_C.7.5.1) of the SR IOD if all algorithms are unambiguously defined by that Module.

Type: Non-Extensible

Order: Significant

Root: No

**Table TID 4019. Algorithm Identification**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| 1 |  |  | TEXT | EV [(111001, DCM, "Algorithm Name")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111001) | 1 | M |  |  |
| 1b |  |  | CODE | EV [(111001, DCM, "Algorithm Name")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111001) | 1 | U |  |  |
| 2 |  |  | TEXT | EV [(111003, DCM, "Algorithm Version")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111003) | 1 | M |  |  |
| **2b** |  |  | **TEXT** | **EV**[**(122405, DCM, "Algorithm Manufacturer")**](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_122405) | **1** | **U** |  |  |
| 3 |  |  | TEXT | EV [(111002, DCM, "Algorithm Parameters")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111002) | 1-n | U |  |  |
| 4 |  |  | CODE | EV [(111000, DCM, "Algorithm Family")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111000) | 1 | U |  |  |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 1 | May be the same as the Manufacturer's Model Name (0008,1090) of the [General Equipment Module](https://dicom.nema.org/medical/dicom/current/output/chtml/part03/sect_C.7.5.html#sect_C.7.5.1), if the Algorithm is not distinguishable from the body of software that makes up the Equipment. |
| Row 2 | May be the same as Software Versions (0018,1020) of the [General Equipment Module](https://dicom.nema.org/medical/dicom/current/output/chtml/part03/sect_C.7.5.html#sect_C.7.5.1), if the latter is a single Value, or its multiple Values are combined into a single TEXT Content Item Value. |
| **Row 2b** | **May be the same as the Manufacturer (0008,0070) of the**[**General Equipment Module**](https://dicom.nema.org/medical/dicom/current/output/chtml/part03/sect_C.7.5.html#sect_C.7.5.1)**.** |

*New templates for PS3.16 Annex A*

### TID 60x1 Ophthalmology Measurements Group

This Template is a proper subset of [TID 1501](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1501), with some optional extensions, and may be processed by a receiving application in the same way. The parameters used in this Template are identical to those parameters as used in TID 1501. However, this Template is specialized for ophthalmology (finding site "Eye”), and makes mandatory a Content Item for each measuement or finding concept specified in the invoking Template in the Context Groups invoked for parameters $Measurement and $QualType. (TID 1501 has no mandatory content.)

Type: Extensible

Order: Non-Significant

Root: No

**Table TID 60x1.a. Parameters**

|  |  |
| --- | --- |
| **Parameter Name** | **Parameter Usage** |
| $TargetSiteMod | Value for Anatomic Location of measurement |
| $Method | Value for Measurement Method |
| $Measurement | Coded term or Context Group for Concept Name of mandatory measurements |
| $QualType | Coded term or Context Group for Concept Name of mandatory qualitative findings |
| $QualValue | Coded term or Context Group for value of qualitative finding |
| $OptMeasure | Coded term or Context Group for Concept Name of optional measurements |

**Table TID 60x1. Ophthalmology Measurements Group**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  | CONTAINS | CONTAINER | EV [(125007, DCM, "Measurement Group")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_125007) | 1 | M |  |  |
| 2 | > | HAS CONCEPT MOD | CODE | [EV [(363698007, SCT, "Finding Site")](http://snomed.info/id/363698007)](http://snomed.info/id/272741003)  | 1 | M |  | EV [(81745001, SCT, “Eye”)](http://snomed.info/id/81745001) |
| 3 | >> | HAS CONCEPT MOD | CODE | EV [(272741003, SCT, "Laterality")](http://snomed.info/id/272741003) | 1 | M |  | D[CID 247 “Laterality Left-Right Only”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_247.html) |
| 3 | >> | HAS CONCEPT MOD | CODE | EV [(106233006, SCT, "Topographical modifier")](http://snomed.info/id/106233006) | 1 | MC | IFF Template is invoked with a non-empty $TargetSiteMod parameter  | $TargetSiteMod |
| 4 | > | HAS CONCEPT MOD | CODE | EV [(370129005, SCT, "Measurement Method")](http://snomed.info/id/370129005) | 1 | MC | IFF Template is invoked with a non-empty $Method parameter  | $Method  |
| 5 | > | HAS OBS CONTEXT | CODE | EV [(370129005, SCT, "Measurement Method")](http://snomed.info/id/370129005) | 1 | MC | IFF measurements made with ROI or sector grid positioned differently from prior analyses | EV (nnn110, DCM, “Repositioned ROI or grid”) |
| 6 | > | HAS OBS CONTEXT | TEXT | EV [(112039, DCM, "Tracking Identifier")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_112039) | 1 | U |  |  |
| 7 | > | HAS OBS CONTEXT | UIDREF | EV [(112040, DCM, "Tracking Unique Identifier")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_112040) | 1 | U |  |  |
| 8 | > | CONTAINS | INCLUDE | D[TID 300 “Measurement”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_300) | 1-n | MC | IFF Template is invoked with a non-empty $Measurement parameter (see Content Item Description) | $Measurement = $Measurement |
| 9 | > | CONTAINS | CODE | $QualType | 1-n | MC | IFF Template is invoked with a non-empty $QualType parameter (see Content Item Description) | $QualValue |
| 10 | > | CONTAINS | INCLUDE | D[TID 300 “Measurement”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_300) | 1-n | U |  | $Measurement = $OptMeasure |
| 11 | > | CONTAINS | IMAGE | EV [(121112, DCM, “Source of Measurement”)](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_121112) | 1-n | U |  |  |
| 12 | > | CONTAINS | NUM | EV [(111694, DCM, "Image Set Quality Rating")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111694) | 1 | UC | XOR Row 12 | UNITS = EV ({0:100}, UCUM, "range:0:100")Value = 0 - 100 |
| 13 | > | CONTAINS | CODE | EV [(111101, DCM, “Image Quality”)](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111101) | 1 | UC | XOR Row 11 | [BCID 3114 Study Quality](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_3114.html) |
| 14 | > | CONTAINS | IMAGE | EV [(130401, DCM, "Visual explanation")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_130401) | 1 | U |  |  |
| 15 | > | CONTAINS | COMPOSITE | EV [(130401, DCM, "Visual explanation")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_130401) | 1 | U |  |  |
| 16 | > | CONTAINS | TEXT | EV [(121106, DCM, "Comment")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_121106) | 1 | U |  |  |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 8 | Mandatory numeric findings of the measurement group.Each Concept specified in the Value Set Constraints (i.e., as specified in the invoking Template $Measurement parameter) shall be encoded in a NUM Content Item. Note that the NUM Content Item allows an absent value with an associated reason code per [CID 42](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_42.html), e.g., (114007, DCM, “Measurement not attempted”). TID 300 Measurement defines an optional capability to specify properties of a measurement via [TID 310 Measurement Properties](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_310). TID 310 supports properties such as normality, statistical properties (through subsidiary [TID 311](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_311)), normal ranges (subsidiary [TID 312](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_312)), level of significance and more. Normality flags are highly useful and commonly provided by implementations. |
| Row 9 | Mandatory qualitative findings of the measurement group.Each Concept specified in the Value Set Constraints (i.e., as specified in the invoking Template $QualType parameter) shall be encoded in a CODE Content Item. |
| Row 10 | Optional numeric measurements of the measurement group. |
| Row 11 | Reference to the original image(s), e.g., Ophthalmic Tomography, that provided the data analyzed to produce the measurements in this group. |
| Rows 12, 13 | A numeric (row 12) or categorical (row 13) rating of the quality of the source images for the purpose of producing the measurements in this group. |
| Rows 14, 15 | May be a reference to a Secondary Capture Image (row 14) or Encapsulated PDF (row 15) rendering of the set of measurements and findings encoded in this Measurement Group, and possibly additional data. |

### TID 60x2 Visual Field Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x2 Visual Field Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn100, DCM, “Visual Field Key Measurements”) | 1 | M |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | U |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Method = D[CID 4250. Visual Field Static Perimetry Test Pattern](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_4250.html)$Measurement = [DCID 42x1 Visual Field Key Measurements](#_CID_42x1_Visual)$QualType = EV [(111855, DCM, "Glaucoma Hemifield Test Analysis")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111855) $QualValue = D[CID 4254. Visual Field Static Perimetry Test Analysis Result](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_4254.html) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 may be invoked once per eye. Each invocation will instantiate a Content Item for each numeric measurement defined in [CID 42x1 Visual Field Key Measurements](#_CID_42x1_Visual) and for the qualitative finding [(111855, DCM, "Glaucoma Hemifield Test Analysis")](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_D.html#DCM_111855)[CID 42x1 Visual Field Key Measurements](#_CID_42x1_Visual) includes fixation false positive, false negative, and losses ratios. While these are specified as being reported in %, the NUM Content Item (see [PS3.3 Section C.18.1](https://dicom.nema.org/medical/dicom/current/output/chtml/part03/sect_C.18.html#sect_C.18.1)) allows the encoding of a Rational Numerator Value (0040,A162) and a Rational Denominator Value (0040,A163). Those attributes thus allow the supplemental specification of the ratio in the form of the number of false responses or losses (numerator) and the number of trials (denominator). |

### TID 60x3 Optic Disc Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x3 Optic Disc Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn101, DCM, “Optic Disc Key Measurements”) | 1 |  |  |  |
| 2 | **>** | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | **>** | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Measurement = [DCID 42x2 Optic Disc Key Measurements](#_CID_42x2_OCT) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured.  |

### TID 60x4 Retinal Nerve Fiber Layer Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x4 Retinal Nerve Fiber Layer Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn102, DCM, “RNFL Key Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Measurement = [DCID 42x3 RNFL Key Measurements](#_CID_42x3_OCT) |
| 6 | > | CONTAINS | INCLUDE | D[TID 300 “Measurement”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_300) | 1 | MC | IFF RNFL measurements made on both eyes | $Measurement = (nnn405, DCM, “Retinal nerve fiber layer symmetry”)$Units = (%, UCUM, "%") |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured. |

### TID 60x5 Macular Thickness Key Measurements

The macular grid used for the measurements of this template is based upon the grid employed by the Early Treatment of Diabetic Retinopathy Study (ETDRS) to measure area and proximity of macular edema to the anatomic center (fovea) of the macula. See [*ETDRS Report Number 10*](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_2.html#biblio_ETDRS_10).

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x5 Macular Thickness Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn103, DCM, “Macular Thickness Key Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Measurement = [DCID 42x4 Macular Thickness Key Measurements](#_CID_42x4_OCT) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured.  |

### TID 60x6 Ganglion Cell Layer Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x6 Ganglion Cell Layer Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn104, DCM, “GCL Key Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $TargetSiteMod = [DCID 42x5 GCL Measurement Extent](#_CID_42x5_GCL)$Method = [DCID 42x8 GCL Sector Grid Methods](#_CID_42x8_GCL)$Measurement = [DCID 42x6 GCL Key Measurements](#_CID_42x6_GCL)$OptMeasure = D[CID 42x7 GCL Sector Measurements](#_CID_42x7_GCL) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured. Approaches to measure the Ganglion Cell Layer thickness vary widely. This template requires the SOP Instance creator application to specify which other cell layers, if any, are measured with the GCL proper (using a concept from [CID 42x5 GCL Measurement Extent](#_CID_42x5_GCL)).Applications also use various approaches to identifying different sectors of the retina when measuring the GCL thickness. The sector definition used is specified by a concept from [CID 42x8 GCL Sector Grid Methods](#_CID_42x8_GCL). Measurements that match the sector names defined by the method may be selected from [CID 42x7 GCL Sector Measurements](#_CID_42x7_GCL) to be included in the key measurements.  |

### TID 60x7 Corneal Topography Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x7 Corneal Topography Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn105, DCM, “Corneal Topography Key Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Measurement = [DCID 42x9 Corneal Topography Key Measurements](#_CID_42x6_Corneal) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured.  |

### TID 60x8 Endothelial Cell Count Key Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x8 Endothelial Cell Count Key Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn106, DCM, “Endothelial Cell Count Key Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | M |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-2 | M |  | $Measurement = [DCID 42y0 Endothelial Cell Count Measurements](#_CID_42x7_Endothelial) |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured.  |

### TID 60x9 Ophthalmic Image ROI Measurements

Type: Extensible

Order: Non-Significant

Root: Yes

**Table TID 60x9 Ophthalmic Image ROI Measurements**

|  | **NL** | **Rel with Parent** | **VT** | **Concept Name** | **VM** | **Req Type** | **Condition** | **Value Set Constraint** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  | CONTAINER | EV (nnn107, DCM, “Ophthalmic Image ROI Measurements”) | 1 |  |  |  |
| 2 | > | HAS CONCEPT MOD | INCLUDE | D[TID 1204 “Language of Content Item and Descendants”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1204) | 1 | U |  |  |
| 3 | > | HAS OBS CONTEXT | INCLUDE | D[TID 1002 “Observer Context”](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/chapter_A.html#sect_TID_1002) | 1-n | U |  |  |
| 4 | > | HAS OBS CONTEXT | INCLUDE | D[TID 4019 Algorithm Identification](https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_TID_4019.html)  | 1 | U |  |  |
| 5 | > | CONTAINS | INCLUDE | [DTID 60x1 “Ophthalmology Measurements Group”](#_TID_60x1_Ophthalmology) | 1-n | M |  |  |

**Content Item Descriptions**

|  |  |
| --- | --- |
| Row 5 | TID 60x1 is invoked once per eye measured. No mandatory key measurements are specified. Creating applications may include any measurements or findings. |

*New context groups for PS3.16 Annex B*

### CID 42x1 Visual Field Key Measurements

Keyword: VisualFieldKeyMeasurements

FHIR Keyword: dicom-cid-42x1-VisualFieldKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x1

**Table CID 42x1 Visual Field Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn200 | Global Deviation from Normal | (dB, UCUM, "dB") |
| DCM | nnn201 | Localized Deviation From Normal | (dB, UCUM, "dB") |
| DCM | 111852 | Visual Field Index | (%, UCUM, "%") |
| DCM | nnn202 | Fixation false positive ratio | (%, UCUM, "%") |
| DCM | nnn203 | Fixation false negative ratio | (%, UCUM, "%") |
| DCM | nnn204 | Fixation losses ratio | (%, UCUM, "%") |

### CID 42x2 Optic Disc Key Measurements

Keyword: OpticDiscKeyMeasurements

FHIR Keyword: dicom-cid-42x2-OpticDiscKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x2

**Table CID 42x2** **Optic Disc Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn300 |  Cup to disc area ratio | ({ratio}, UCUM, "ratio")  |
| DCM | nnn301 |  Cup to disk ratio vertical | ({ratio}, UCUM, "ratio")  |
| DCM | nnn302 |  Cup to disk ratio horizontal | ({ratio}, UCUM, "ratio")  |
| DCM | nnn303 |  Optic disc rim area | (mm2, UCUM, "mm2") |
| DCM | nnn304 |  Optic disc cup area | (mm2, UCUM, "mm2") |
| DCM | nnn305 |  Optic disc area | (mm2, UCUM, "mm2") |
| DCM | nnn306 |  Optic disc cup volume | (mm3, UCUM, "mm3") |

### CID 42x3 RNFL Key Measurements

In encoding of clockface position measurements, positions in the right eye proceed in the natural clockwise direction as viewed from the anterior position, while positions in the left eye proceed in the counter-clockwise direction.

Keyword: RNFLKeyMeasurements

FHIR Keyword: dicom-cid-42x3-RNFLKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x3

**Table CID 42x3 RNFL Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn400 | Retinal nerve fiber layer average thickness | (um, UCUM, "um") |
| DCM | nnn401 | Retinal nerve fiber layer inferior thickness | (um, UCUM, "um") |
| DCM | nnn402 | Retinal nerve fiber layer superior thickness | (um, UCUM, "um") |
| DCM | nnn403 | Retinal nerve fiber layer temporal thickness | (um, UCUM, "um") |
| DCM | nnn404 | Retinal nerve fiber layer nasal thickness | (um, UCUM, "um") |
| DCM | nnn411 | RNFL clockface position 1 thickness | (um, UCUM, "um") |
| DCM | nnn412 | RNFL clockface position 2 thickness | (um, UCUM, "um") |
| DCM | nnn413 | RNFL clockface position 3 thickness | (um, UCUM, "um") |
| DCM | nnn414 | RNFL clockface position 4 thickness | (um, UCUM, "um") |
| DCM | nnn415 | RNFL clockface position 5 thickness | (um, UCUM, "um") |
| DCM | nnn416 | RNFL clockface position 6 thickness | (um, UCUM, "um") |
| DCM | nnn417 | RNFL clockface position 7 thickness | (um, UCUM, "um") |
| DCM | nnn418 | RNFL clockface position 8 thickness | (um, UCUM, "um") |
| DCM | nnn419 | RNFL clockface position 8 thickness | (um, UCUM, "um") |
| DCM | nnn420 | RNFL clockface position 10 thickness | (um, UCUM, "um") |
| DCM | nnn421 | RNFL clockface position 11 thickness | (um, UCUM, "um") |
| DCM | nnn422 | RNFL clockface position 12 thickness | (um, UCUM, "um") |
| DCM | nnn406 | Retinal ROI radius | (mm, UCUM, "mm") |

### CID 42x4 Macular Thickness Key Measurements

Keyword: MacularThicknessKeyMeasurements

FHIR Keyword: dicom-cid-42x4-MacularThicknessKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x4

**Table CID 42x4 Macular Thickness Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| LN | [57108-3](https://loinc.org/57119-0/panel#34476) | Macular grid.center point thickness by OCT | (um, UCUM, "um") |
| LN | [57109-1](https://loinc.org/57119-0/panel#34475) | Macular grid.center subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57110-9](https://loinc.org/57119-0/panel#34474) | Macular grid.inner superior subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57111-7](https://loinc.org/57119-0/panel#34473) | Macular grid.inner nasal subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57112-5](https://loinc.org/57119-0/panel#34472) | Macular grid.inner inferior subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57113-3](https://loinc.org/57119-0/panel#34471) | Macular grid.inner temporal subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57114-1](https://loinc.org/57119-0/panel#34470) | Macular grid.outer superior subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57115-8](https://loinc.org/57119-0/panel#34469) | Macular grid.outer nasal subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57116-6](https://loinc.org/57119-0/panel#34468) | Macular grid.outer inferior subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57117-4](https://loinc.org/57119-0/panel#34467) | Macular grid.outer temporal subfield thickness by OCT | (um, UCUM, "um") |
| LN | [57118-2](https://loinc.org/57119-0/panel#34466) | Macular grid.total volume by OCT | (uL, UCUM, "uL") |
| DCM | nnn250 | Average macular thickness | (um, UCUM, "um") |

Note : The Macular grid measurement concepts, based on the ETDRS grid, are included in LOINC panel [57119-0](https://loinc.org/57119-0/panel#34477) Optical coherence tomography panel.

### CID 42x5 GCL Measurement Extent

This Context Group specifies the retinal layers included in the ganglion cell layer (GCL) measurements.

Keyword: GCLMeasurementExtent

FHIR Keyword: dicom-cid-42x5-GCLMeasurementExtent

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x5

**Table CID 42x5 GCL Measurement** **Extent**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  |
| --- | --- | --- |
| SCT | 39197003 | Ganglion cell layer |
| DCM | nnn550 | GCL-IPL |
| DCM | nnn551 | Ganglion cell complex |

### CID 42x6 GCL Key Measurements

This Context Group includes key measurements of the ganglion cell layer (GCL) thickness, with or without adjacent layers as specified by the context of usage.

Keyword: GCLKeyMeasurements

FHIR Keyword: dicom-cid-42x6-GCLKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x6

**Table CID 42x6 GCL Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn406 | Retinal ROI radius | (mm, UCUM, "mm") |
| DCM | nnn500  | Average GCL thickness | (um, UCUM, "um") |
| DCM | nnn502 | Minimum GCL thickness  | (um, UCUM, "um") |

### CID 42x7 GCL Sector Measurements

This Context Group includes measurements of the ganglion cell layer (GCL) thickness in each retinal sector, with or without adjacent layers as specified by the context of usage, and with the span of each sector also defined by the context of usage.

Keyword: GCLSectorMeasurements

FHIR Keyword: dicom-cid-42x7-GCLSectorMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x7

**Table CID 42x7 GCL Sector Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn511 | Average GCL thickness superior sector | (um, UCUM, "um") |
| DCM | nnn512 | Average GCL thickness nasal-superior sector | (um, UCUM, "um") |
| DCM | nnn513 | Average GCL thickness nasal sector | (um, UCUM, "um") |
| DCM | nnn514 | Average GCL thickness nasal-inferior sector | (um, UCUM, "um") |
| DCM | nnn515 | Average GCL thickness inferior sector | (um, UCUM, "um") |
| DCM | nnn516 | Average GCL thickness temporal-inferior sector | (um, UCUM, "um") |
| DCM | nnn517 | Average GCL thickness temporal sector | (um, UCUM, "um") |
| DCM | nnn518 | Average GCL thickness temporal-superior sector | (um, UCUM, "um") |

### CID 42x8 GCL Sector Grid Methods

Keyword: GCLSectorGridMethods

FHIR Keyword: dicom-cid-42x8-GCLSectorGridMethods

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x8

**Table CID 42x8 GCL Sector Grid Methods**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  |
| --- | --- | --- |
| DCM | nnn560  | Hemifield sector grid |
| DCM | nnn561 | Elliptical annulus sector grid |
| DCM | nnn562  | Garway-Heath sector grid |
| DCM | nnn563 | Quadrant-octant sector grid |

### CID 42x9 Corneal Topography Key Measurements

Keyword: CornealTopographyKeyMeasurements

FHIR Keyword: dicom-cid-42x9-CornealTopographyKeyMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.x9

**Table CID 42x9 Corneal Topography Key Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn600 | Central keratometry minimum power  | ([diop], UCUM, "diopters") |
| DCM | nnn601 | Central keratometry minimum radius of curvature | (mm, UCUM, "mm") |
| DCM | nnn602 | Central keratometry minimum power axis | (deg, UCUM, "degrees") |
| DCM | nnn603 | Central keratometry maximum power | ([diop], UCUM, "diopters") |
| DCM | nnn604 | Central keratometry maximum radius of curvature | (mm, UCUM, "mm") |
| DCM | nnn605 | Central keratometry maximum power axis | (deg, UCUM, "degrees") |
| DCM | nnn606 | Minimum corneal thickness | (um, UCUM, "um") |

### CID 42y0 Endothelial Cell Count Measurements

Keyword: EndothelialCellCountMeasurements

FHIR Keyword: dicom-cid-42y0-EndothelialCellCountMeasurements

Type: Extensible

Version: 2025mmdd

UID: 1.2.840.10008.6.1.y0

**Table CID 42y0 Endothelial Cell Count Measurements**

| **Coding Scheme Designator** | **Code Value** | **Code Meaning**  | **Units of Measure** |
| --- | --- | --- | --- |
| DCM | nnn700 | Endothelial cell density | ({cells}/mm2, UCUM, "cells/mm2") |

*Update CID 222 with additonal SNOMED normality codes*

### CID 222 Normality

Keyword: Normality

FHIR Keyword: dicom-cid-222-Normality

Type: Extensible

Version: **~~20170914~~ 2025mmdd**

UID: 1.2.840.10008.6.1.27

**Table CID 222. Normality**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Coding Scheme Designator** | **Code Value** | **Code Meaning** | **SNOMED-RT ID** | **UMLS Concept Unique ID** |
| SCT | [17621005](http://snomed.info/id/17621005) | Normal | [G-A460](http://snomed.info/id/17621005) | [C0205307](http://uts.nlm.nih.gov/uts/umls/concept/C0205307) |
| SCT | [263654008](http://snomed.info/id/263654008) | Abnormal | [R-42037](http://snomed.info/id/263654008) | [C0205161](http://uts.nlm.nih.gov/uts/umls/concept/C0205161) |
| SCT | [371879000](http://snomed.info/id/371879000) | Abnormally High | [R-002C4](http://snomed.info/id/371879000) | [C1299351](http://uts.nlm.nih.gov/uts/umls/concept/C1299351) |
| SCT | [371880002](http://snomed.info/id/371880002) | Abnormally Low | [R-002C5](http://snomed.info/id/371880002) | [C1299352](http://uts.nlm.nih.gov/uts/umls/concept/C1299352) |
| SCT | [371934000](http://snomed.info/id/371934000) | Normality Undetermined | [R-0039B](http://snomed.info/id/371934000) | [C1299401](http://uts.nlm.nih.gov/uts/umls/concept/C1299401) |
| **SCT** | **442777001** | **Borderline high** |  |  |
| **SCT** | **442779003** | **Borderline low** |  |  |
| **SCT** | **394844007** | **Outside reference range** |  |  |
| **SCT** | **281302008** | **Above reference range** |  |  |
| **SCT** | **281300000** | **Below reference range** |  |  |
| **SCT** | **281301001** | **Within reference range**  |  |  |

*New codes and definitions for PS3.16 Annex D*

## Annex D

| **Code Value** | **Code Meaning** | **Definition** | **Notes** |
| --- | --- | --- | --- |
| nnn100  | Visual Field Key Measurements | Clinically most significant measurements of patient Visual Field  |  |
| nnn101  | Optic Disc Key Measurements | Clinically most significant measurements of Optic Disc  |  |
| nnn102  | RNFL Key Measurements | Clinically most significant measurements of Retinal Nerve Fiber Layer  |  |
| nnn103  | Macular Thickness Key Measurements | Clinically most significant measurements of Macular Thickness  |  |
| nnn104  | GCL Key Measurements | Clinically most significant measurements of Gangion Cell Layer  |  |
| nnn105  | Corneal Topography Key Measurements | Clinically most significant measurements of Corneal Topography  |  |
| nnn106  | Endothelial Cell Count Key Measurements | Clinically most significant measurements of Endothelial Cell Count  |  |
| nnn107 | Ophthalmic Image ROI Measurements | Measurements of Ophthalmic Images based on a Region of Interest |  |
| nnn110 | Repositioned ROI or grid | Indicator that measurements were made with ROI or grid positioned differently than used for a prior measurement set  |  |
| nnn200 | Global Deviation from Normal | Weighted average deviation from the age corrected normal visual field, as decibel. Corresponds to Global Deviation from Normal (0024,0066) in the Results Normals Sequence (0024,0064) |  |
| nnn201 | Localized Deviation From Normal | Weighted square root of loss variance, as decibel. Corresponds to Localized Deviation From Normal (0024,0068) in the Results Normals Sequence (0024,0064) |  |
| nnn202 | Fixation false positive ratio | Estimated percentage of all patient responses that occurred at a time when no visual stimulus was present (false positive responses), as percent. Corresponds to False Positives Estimate (0024,0054) in the Visual Field Catch Trial Sequence (0024,0034) |  |
| nnn203 | Fixation false negative ratio | Estimated percentage of all stimuli that were not seen by the patient but were previously seen at a lower luminance earlier in the visual field test (false negative responses), as percent. Corresponds to False Negatives Estimate (0024,0046) in the Visual Field Catch Trial Sequence (0024,0034) |  |
| nnn204 | Fixation losses ratio | The ratio between the number of times a patient loses visual fixation while maintaining a visual gaze on a single location and the number of trials presented. Corresponds to ratio of Patient Not Properly Fixated Quantity (0024,0036) to Fixation Checked Quantity (0024,0035) in Fixation Sequence (0024,0032) |  |
| nnn250 | Average macular thickness | Average macular thickness across all ETDRS subfields |  |
| nnn300 | Cup to disc area ratio | Ratio of the optic disc cup area to the disc area |  |
| nnn301 | Cup to disc ratio vertical | Ratio of the vertical diameter of the physiological cup to that of the vertical diameter of the optic disc |  |
| nnn302 | Cup to disc ratio horizontal | Ratio of the horizontal diameter of the physiological cup to that of the vertical diameter of the optic disc |  |
| nnn303 | Optic disc rim area | Area of the rim portion of the optic disc |  |
| nnn304 | Optic disc cup area | Area of the cup portion of the optic disc |  |
| nnn305 | Optic disc area | Area of the optic disc |  |
| nnn306 | Optic disc cup volume | Volume of the cup portion of the optic disc |  |
| nnn400 | Retinal nerve fiber layer average thickness | Average measured thickness of the retinal nerve fiber layer (RNFL), i.e., the distance between the internal limiting membrane (ILM) and the Gangion Cell Layer (GCL), in all regions |  |
| nnn401 | Retinal nerve fiber layer inferior thickness | Average measured thickness of the retinal nerve fiber layer (RNFL), i.e., the distance between the internal limiting membrane (ILM) and the Gangion Cell Layer (GCL), in the inferior quadrant. |  |
| nnn402 | Retinal nerve fiber layer superior thickness | Average measured thickness of the retinal nerve fiber layer (RNFL), i.e., the distance between the internal limiting membrane (ILM) and the Gangion Cell Layer (GCL), in the superior quadrant. |  |
| nnn403 | Retinal nerve fiber layer temporal thickness | Average measured thickness of the retinal nerve fiber layer (RNFL), i.e., the distance between the internal limiting membrane (ILM) and the Gangion Cell Layer (GCL), in the temporal quadrant. |  |
| nnn404 | Retinal nerve fiber layer nasal thickness | Average measured thickness of the retinal nerve fiber layer (RNFL), i.e., the distance between the internal limiting membrane (ILM) and the Gangion Cell Layer (GCL), in the nasal quadrant. |  |
| nnn405 | Retinal nerve fiber layer symmetry | Symmetry between the two eyes of the average retinal nerve fiber layer (RNFL) thickness, as smaller value divided by larger value, represented as percent.  |  |
| nnn406 | Retinal ROI radius | Radius of circular area, or minor axis of eliptical area, used for measurement of retinal layer thicknesses |  |
| nnn411 | RNFL clockface position 1 thickness | Average measured retinal nerve fiber layer thickness at clockface position 1, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn412 | RNFL clockface position 2 thickness | Average measured retinal nerve fiber layer thickness at clockface position 2, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn413 | RNFL clockface position 3 thickness | Average measured retinal nerve fiber layer thickness at clockface position 3, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position. This is the nasal position. |  |
| nnn414 | RNFL clockface position 4 thickness | Average measured retinal nerve fiber layer thickness at clockface position 4, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn415 | RNFL clockface position 5 thickness | Average measured retinal nerve fiber layer thickness at clockface position 5, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn416 | RNFL clockface position 6 thickness | Average measured retinal nerve fiber layer thickness at clockface position 6. This is the inferior position. |  |
| nnn417 | RNFL clockface position 7 thickness | Average measured retinal nerve fiber layer thickness at clockface position 7, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn418 | RNFL clockface position 8 thickness | Average measured retinal nerve fiber layer thickness at clockface position 8, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn419 | RNFL clockface position 9 thickness | Average measured retinal nerve fiber layer thickness at clockface position 9, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position. This is the temporal position. |  |
| nnn420 | RNFL clockface position 10 thickness | Average measured retinal nerve fiber layer thickness at clockface position 10, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn421 | RNFL clockface position 11 thickness | Average measured retinal nerve fiber layer thickness at clockface position 11, in the clockwise direction for the right eye and the counter-clockwise direction for the left eye, as viewed from an anterior position |  |
| nnn422 | RNFL clockface position 12 thickness | Average measured retinal nerve fiber layer thickness at clockface position 12. This is the superior position. |  |
| nnn500 | Average GCL thickness | Average thickness of the ganglion cell layer  |  |
| nnn502 | Minimum GCL thickness  | Lowest thickness of the ganglion cell layer over a single meridian crossing the annulus |  |
| nnn511 | Average GCL thickness superior sector | Average ganglion cell layer thickness in the superior sector as defined by the measurement method |  |
| nnn512 | Average GCL thickness nasal-superior sector | Average ganglion cell layer thickness in the nasal-superior sector as defined by the measurement method |  |
| nnn513 | Average GCL thickness nasal sector | Average ganglion cell layer thickness in the nasal sector as defined by the measurement method |  |
| nnn514 | Average GCL thickness nasal-inferior sector | Average ganglion cell layer thickness in the nasal-inferior sector as defined by the measurement method |  |
| nnn515 | Average GCL thickness inferior sector | Average ganglion cell layer thickness in the inferior sector as defined by the measurement method |  |
| nnn516 | Average GCL thickness temporal-inferior sector | Average ganglion cell layer thickness in the temporal-inferior as defined by the measurement method sector |  |
| nnn517 | Average GCL thickness temporal sector | Average ganglion cell layer thickness in the temporal sector as defined by the measurement method |  |
| nnn518 | Average GCL thickness temporal-superior sector | Average ganglion cell layer thickness in the temporal-superior sector as defined by the measurement method |  |
| nnn550 | GCL-IPL | Ganglion cell layer (GCL) plus inner plexiform layer (IPL) |  |
| nnn551 | Ganglion cell complex | Ganglion cell layer (GCL) plus inner plexiform layer (IPL) plus retinal nerve fiber layer (RNFL) |  |
| nnn560  | Hemifield sector grid | Circular measurement area with measurements on 180° hemifield sectors centered on vertical and horizontal axes (superior, inferior, nasal, temporal). |  |
| nnn561 | Elliptical annulus sector grid | Measurement area of an elliptical annulus, inner minor axis radius of 0.5 mm, outer minor axis of 2.0 mm aligned vertically, inner major axis radius of 0.6 mm, outer major axis of 2.4 mm aligned horizontally, divided into six 60° sectors with boundaries beginning at 30° from vertical (superior, nasal-superior, nasal-inferior, inferior, temporal-inferior, temporal-superior).  |  |
| nnn562  | Garway-Heath sector grid | Circular measurement area, divided into six sectors – a 110° nasal sector and a 90° temporal sector centered on the fovea-Bruch's membrane opening (BMO) axis, and four 40° sectors (temporal-superior, nasal-superior, nasal-inferior, temporal-inferior) |  |
| nnn563 | Quadrant-octant sector grid | Circular measurement area, divided into six sectors – 90° nasal and temporal quadrants centered on the horizontal axis, and four 45° octants (temporal-superior, nasal-superior, nasal-inferior, temporal-inferior) |  |
| nnn600 | Central keratometry minimum power  | The lowest refractive power in the central zone (for example central 3mm), as diopters Note: This code is related to DICOM attribute Keratometric Power (0046,0076) within the attribute Flat Keratometric Axis Sequence (0046,0080). |  |
| nnn601 | Central keratometry minimum radius of curvature  | The longest radius of curvature of the two most extreme orthogonal keratometry measurements in the central zone (for example central 3mm), as mmNote: This code is related to DICOM attribute Radius of Curvature (0046,0075) within the attribute Flat Keratometric Axis Sequence (0046,0080). |  |
| nnn602 | Central keratometry minimum power axis | The meridian of the lowest power radius of the two most extreme orthogonal keratometry measurements in the central zone (for example central 3mm), as degrees Note: This code is related to DICOM attribute Keratometric Axis (0046,0077) within the attribute Flat Keratometric Axis Sequence (0046,0080). |  |
| nnn603 | Central keratometry maximum power  | The highest refractive power in the central zone (for example central 3mm), as dioptersNote: This code is related to DICOM attribute Keratometric Power (0046,0076) within the attribute Steep Keratometric Axis Sequence (0046,0074). |  |
| nnn604 | Central keratometry maximum radius of curvature  | The shortest radius of curvature of the two most extreme orthogonal keratometry measurements in the central zone (for example central 3mm), as mmNote: This code is related to DICOM attribute Radius of Curvature (0046,0075) within the attribute Steep Keratometric Axis Sequence (0046,0074). |  |
| nnn605 | Central keratometry maximum power axis | The meridian of the highest power radius of the two most extreme orthogonal keratometry measurements in the central zone (for example central 3mm), as degrees Note: This code is related to DICOM attribute Keratometric Axis (0046,0077) within the attribute Steep Keratometric Axis Sequence (0046,0074). |  |
| nnn606 | Minimum corneal thickness | The thickness of the cornea at the location representing the minimum measurable thickness, as microns |  |
| nnn700 | Endothelial cell density | The density of endothelial cells present on the innermost surface of the cornea, as cells/mm2 |  |