

**Digital Imaging and Communications in Medicine (DICOM)**

*Supplement 236: Structured Display for DICOM Waveforms*

*Prepared by: Working Group 32 Neurophysiology Waveforms*

**DICOM Standards Committee, Working Group 6**

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## Table of Contents

Document History .....	4
Open Issues .....	4
Closed Issues .....	5
Scope and Field of Application .....	5
Changes to NEMA Standards Publications PS3.2 Digital Imaging and Communications in Medicine (DICOM) Part 2: Conformance .....	7
Changes to NEMA Standards Publications PS3.3 Digital Imaging and Communications in Medicine (DICOM) Part 3: Information Object Definitions .....	7
7.13.mmm Montage Information Entity .....	9
A.1.2.nnn Waveform Presentation State IE .....	11
A.33.xx Waveform Presentation State IOD .....	11
A.33.xx.1 Waveform Presentation State IOD Description .....	11
A.33.xx.2 Waveform Presentation State IOD Entity-Relationship Model .....	11
A.33.xx.3 Waveform Presentation State IOD Module Table .....	11
A.33.xx.4 Waveform Presentation State IOD Constraints .....	12
A.33.xx.4.1 Waveform Presentation State Identification .....	12
A.33.xx.4.2 Waveform Annotation Module .....	12
A.33.yy Waveform Structured Display IOD .....	12
A.33.yy.1 Waveform Structured Display IOD Description .....	12
A.33.yy.2 Waveform Structured Display IOD Entity-Relationship Model .....	12
A.33.yy.3 Waveform Structured Display IOD Module Table .....	12
A.35.xx Waveform Annotation SR IOD .....	13
A.35.xx.1 Waveform Annotation SR IOD Description .....	13
A.35.xx.2 Waveform Annotation SR IOD Entity-Relationship Model .....	13
A.35.xx.3 Waveform Annotation SR IOD Module Table .....	13
A.35.xx.3.1 Waveform Annotation SR IOD Content Constraints .....	14
A.35.xx.3.1.2 Template Constraints .....	14
A.zz Waveform Montage .....	14
A.zz.1 Waveform Montage IOD Description .....	14
A.zz.2 Waveform Montage IOD Entity-Relationship Model .....	14
A.zz.3 Waveform Montage IOD Module Table .....	14
C.10.10.1 Waveform Annotation Attribute Descriptions .....	15
C.10.10.1.1 Referenced Channels .....	15
C.11.11 Presentation State Relationship Module .....	15
C.11.11.1 Presentation State Relationship Macro .....	15
C.11.aa Waveform Presentation Module Attributes .....	16
C.11.e Montage Channels Macro Attributes .....	17
C.11.bb Waveform Structured Display .....	18
C.11.cc Montage Definition Module .....	19
C.zz.a Montage Channels Module .....	20
Changes to NEMA Standards Publications PS 3.4 Digital Imaging and Communications in Medicine (DICOM) Part 4: Service Class Specifications .....	20
B.5 Standard SOP classes .....	20
Annex XX Waveform Presentation State Storage SOP Classes (Normative) .....	20
Changes to NEMA Standards Publications PS 3.6 Digital Imaging and Communications in Medicine(DICOM) Part 6: Data Dictionary .....	21

Changes to NEMA Standards Publications PS3.15 Digital Imaging and Communications in Medicine  
(DICOM) Part 15: Security and System Management Profiles .....22

Changes to NEMA Standards Publications PS3.16 Digital Imaging and Communications in Medicine  
(DICOM) Part 16: Content Mapping Resource.....23

    Neurophysiology Templates .....23

        TID XXXX Waveform Annotations.....23

Changes to NEMA Standards Publications PS3.17 Digital Imaging and Communications in Medicine  
(DICOM) Part 17: Explanatory Information .....24

    XXX Neurophysiology Waveform Presentation (Informative) .....24

1

## Document History

2022/06/06	Version 0		Initial version, fragmentary
2022/07/19	Version 1		First draft for wg-32
2022/09/20	Version 5		Draft for wg-06 / First Read
2022/10/14	Version 6		Changes after First Read
2022/11/11	Version 7		Added Cardio Use Case

2

## Open Issues

1.	<p>Q: Is there a general requirement to have a temporal assignment of display settings (filters and montages): When where which settings in place? Or is this information just relevant in conjunctions with annotations: which settings were in place when the observations were made.</p> <p><b>Proposed A: There could be an annotation "Display Settings changed".</b></p>
2.	<p>Q: A montage can combine any type of channels from different object types, not just EEG channels from Routine Scalp EEGs. A mechanism is required that provides the information about what type of object the channels belong to.</p>
3.	<p>Q: A concrete Presentation State / Structured Display object contains references to concrete SOP Instances - to concrete objects. It must be guaranteed that this reference works for recordings having been split to multiple files due to limitations on file size.</p>
4.	<p>Q: Should the Structured Display contain timing information? In a sense: for which time range should this display settings be used ...</p> <p>How should viewers behave? Do they switch the display (the filters, montages) when scrolling through the recording?</p>
5.	<p>Q: Presentation State Identification contains date/time, when the PR was created, and coded content descriptor and content creator (optional). Is this sufficient to meet legal and billing requirements or should the authorship be stored for every annotation individually?</p>
6.	<p>Q: How should color and shading be encoded in the Presentation State and in the Structured Display Object?</p>

3

## Closed Issues

1.	<p>Q: Should annotations also be included in the presentation state object or should annotations be saved separately - e.g. in a separate Structured Report document. If both is applicable: a clear distinction criterion is required: which annotations shall go to the display object, which go to the SR document.</p> <p>A: Annotations expressing clinical information (observations, measurements, ...) should go to a separate object, a DICOM Structured Report object.</p>
2.	<p>Q: What sort of time information is required for display relevant information (when a filter was applied, when the montage was changed)? Relative to the recording (ms or samples)?</p> <p>A: relative to the recording</p>

4

## Scope and Field of Application

5 This supplement introduces Service Classes for storage and exchange of presentation information for  
 6 DICOM waveform objects by adding Presentation State and Structured Display IODs and related Context  
 7 Groups. These store the display montages, i.e. calculative combinations of recorded channels, and  
 8 display filter settings, and many other display settings.

9 This supplement

- 10 • adds a Waveform Presentation State IE
- 11 • adds a Montage IE
- 12 • adds a SOP Class to store predefined Waveform Montages
- 13 • adds a SOP Class to store Waveform Presentation States
- 14 • adds a SOP Class to store a Waveform Structured Display
- 15 • adds a SOP Class to store observations and measurements as annotations
- 16 • <further to be added>...
- 17 • defines changes to Waveform Annotation Module and Presentation State Relationship Module

18

19 In clinical neurophysiology it is important to be able to recreate the presentation of the recorded data as it  
 20 was displayed during the recording or during review and reporting. This is important for example when  
 21 activity is noted by the operator during recording and that view needs to be recreated post hoc for  
 22 specialist review.

23 In cardiology technicians annotate previously recorded waveforms (e.g. from home monitoring holter  
 24 ECG) and highlight areas of interest. This information is essential input for the cardiologist who reviews  
 25 the ECG and finally provides the report.

26 Waveform Objects support limited display information, which has to be provided within the recorded  
 27 waveform objects. These attributes only cover color and scaling of waveform channels.

28 In neurophysiology a **Montage** defines a list of channels for visualization of the data which is created by a  
 29 list of original channel sources and the method for their mathematical (linear) recombination. In principle

30 **Montages** could be either predefined and referenced by an object identifier or defined for a specific  
 31 recording.

32 **Annotations** are textual or coded markers assigned to a specific area or position of a waveform, related to  
33 all channels or a selected set of channels. Annotations could observations as well as measurements.

34 A **Waveform Presentation State Object** stores annotations, montages, and filters for a given recording  
35 (patient related).

36 A **Waveform Structured Display Object** defines a screen layout as groups of traces with labels and  
37 vertical sizes, colors, gain, ... .

38 A **Waveform Annotation Structured Report** document provides clinical information related to a recording,  
39 which might be a cardiology study or a neurophysiology study.

40

41 **Changes to NEMA Standards Publications PS3.2**  
 42 **Digital Imaging and Communications in Medicine (DICOM)**  
 43 **Part 2: Conformance**

44 *Add the new SOP Classes to Table A.1-2. UID Values*

45 **Table A.1-2. UID Values**

UID Value	UID Name	Category
....		
		<u>Transfer</u>
...		

46

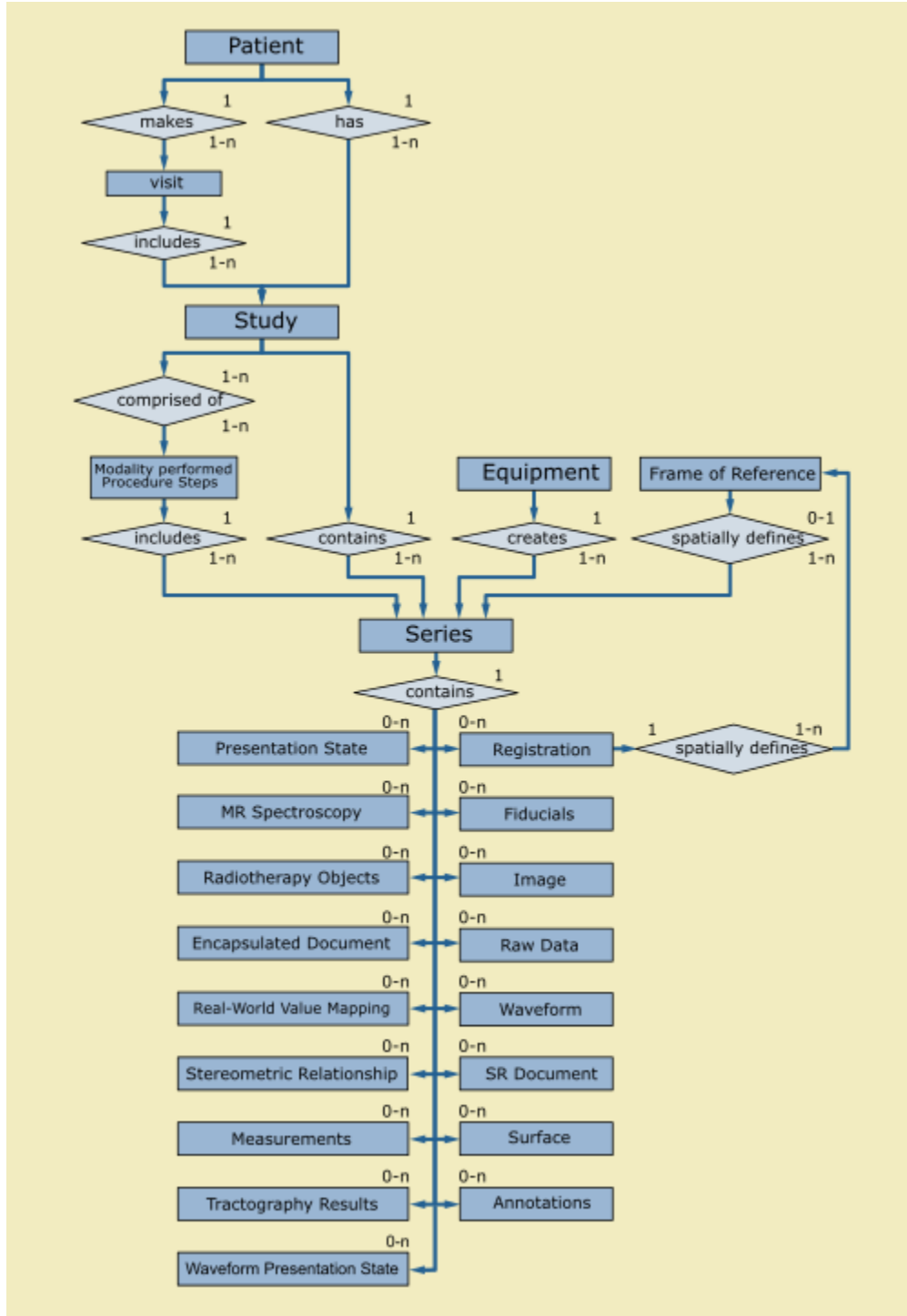
47 **Changes to NEMA Standards Publications PS3.3**  
 48 **Digital Imaging and Communications in Medicine (DICOM)**  
 49 **Part 3: Information Object Definitions**

50 *Add new IODs to Overview Table PS3.3 Table A.1-8:*

51 **t.b.d – not defined yet**

52

53 *Amend PS3.3 7 DICOM Model of the Real World by adding Waveform Presentation State IE*



55

56

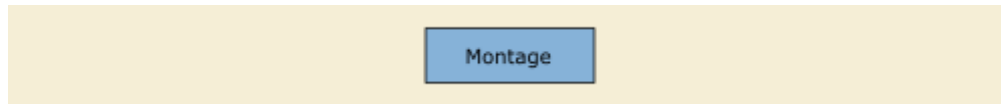
57 Add new IE to PS3.3 7.13 DICOM Model of the Real World for Non-Patient-Related Information



**58 7.13.mmm Montage Information Entity**

59 A Montage Information Entity comprises a list of waveform channels for visualization of the data which is  
60 defined by a list of original channel sources and the method for mathematical (linear) recombination of  
61 these original channel sources.

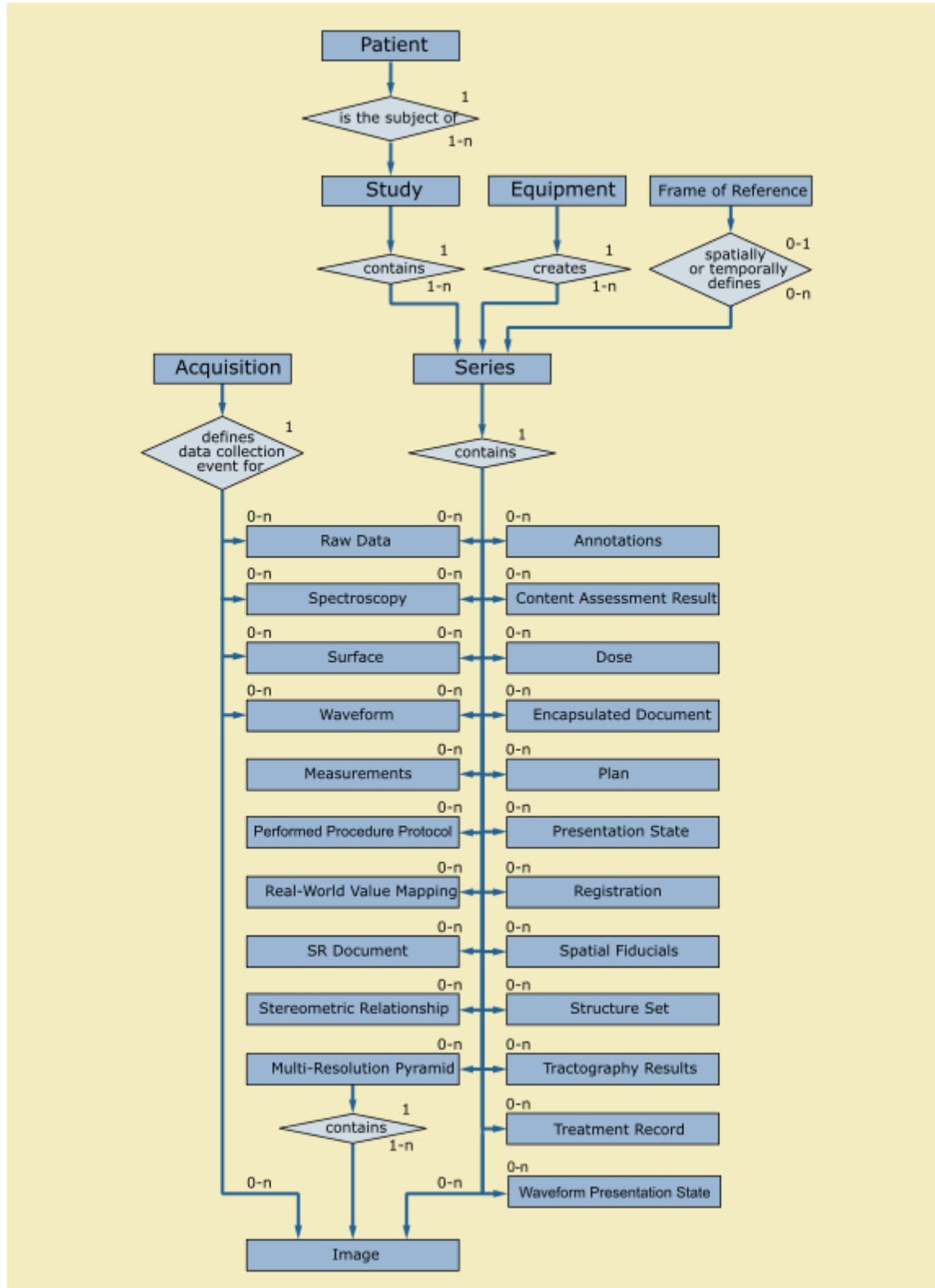
62 Remark: This requires that the object that makes use of the montage uses the same channels (montage  
63 references the common acquisition position, the patient data object (the EEG waveform object) also  
64 references the same acquisition position)



65

66

67 *Amend PS3.3 A.1.2 IOD Entity-Relationship Model by adding the Waveform Presentation State IE*



68

69

Add the following new content to PS3.3 Section A.1.2.xx ...

70 **A.1.2.nnn Waveform Presentation State IE**

71 The Waveform Presentation State IE defines how referenced waveform objects will be presented.

72 Annotations, Montages, and Display Filters may be included within a Waveform Presentation IE if this  
73 information is to be applied to the referenced waveform(s).

74

75 *Add the following new content to PS3.3 Section A.33.xx ...*76 **A.33.xx Waveform Presentation State IOD**77 **A.33.xx.1 Waveform Presentation State IOD Description**78 The Waveform Presentation State Information Object Definition (IOD) specifies information that may be  
79 used to present (display) waveform objects that are referenced from within the IOD.80 **A.33.xx.2 Waveform Presentation State IOD Entity-Relationship Model**81 This IOD uses the E-R Model in Section A.1-2, with only the Waveform Presentation State IE below the  
82 Series IE.83 **A.33.xx.3 Waveform Presentation State IOD Module Table**

84 Table A.33.xx.1-1 specifies the Modules of the Waveform Presentation State IOD.

85

**Table A.33.xx-1- Waveform Presentation State IOD Modules**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Presentation Series	C.7.3.3	M
Frame of Reference	Synchronization	C.7.4.2	C – Required if time synchronization was applied.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Waveform Presentation State	Presentation State Identification	C.11.10	M
	Presentation State Relationship	C.11.11	M
	Waveform Annotation Module	C.10.10	C – Required if annotation is present
	Waveform Presentation	C.11.aa	U

	SOP Common	C.12.1	M
--	------------	--------	---

86

87 **A.33.xx.4 Waveform Presentation State IOD Constraints**88 **A.33.xx.4.1 Waveform Presentation State Identification**

89 t.b.d. &lt;Concept Name Code&gt; - List of codes describing the PR (“during recording”, “post-hoc”, ...)

90 **A.33.xx.4.2 Waveform Annotation Module**

91 For Concept Name Code Sequence (0040,A043) in Waveform Annotation Sequence (0040,B020) DCID  
 92 3035 “EEG Annotation – Neurophysiologic Enumeration”, DCID 3038 “Pattern Event”, and DCID 3040  
 93 “EEG Annotation - Neurological Monitoring Measurement” shall be used.

94 Note

95 Annotations can be stored either in the Waveform Annotation Module of the waveform to which they apply, or in  
 96 a separate Structured Report object. The Waveform Annotation Module is only intended for annotations  
 97 made at the time of acquisition.

98

99 **A.33.yy Waveform Structured Display IOD**100 **A.33.yy.1 Waveform Structured Display IOD Description**

101 The Waveform Structured Display Information Object Definition (IOD) specifies an Instance of a single  
 102 screen structured display that has been created for a Patient. It references specific waveform or other  
 103 composite SOP Instances from one or more Studies for that Patient, or for other Patients for comparison,  
 104 arranged in a specific presentation layout. Presentation of waveforms within the structured display may  
 105 be controlled by referenced Waveform Presentation State Instances.

106 **A.33.yy.2 Waveform Structured Display IOD Entity-Relationship Model**

107 This IOD uses the E-R Model in Section A.1-2, with only the Waveform Presentation IE below the Series  
 108 IE.

109 **A.33.yy.3 Waveform Structured Display IOD Module Table**

110 Table A.33.yy.1-1 specifies the Modules of the Waveform Structured Display IOD

111

**Table A.33.yy-1- Waveform Structured Display IOD Modules**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Presentation Series	C.7.3.3	M
Frame of Reference	Synchronization	C.7.4.2	C – Required if time synchronization was applied.
Equipment	General Equipment	C.7.5.1	M

	Enhanced General Equipment	C.7.5.2	M
Waveform Presentation State	Waveform Structured Display	C.11.bb	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M

112

113

114 *Add the following new content to PS3.3 Section A.35.xx ...*

### 115 **A.35.xx Waveform Annotation SR IOD**

#### 116 **A.35.xx.1 Waveform Annotation SR IOD Description**

117 The Waveform Annotation SR Information Object Definition (IOD) conveys observations and  
 118 measurements detected by either a human viewer or analysis software. The content may include both  
 119 text and encoded information, numerical measurements, time coordinates or intervals, and references to  
 120 waveform SOP instances and dedicated channels within them, and waveform display states and  
 121 dedicated channels within them, respectively.

#### 122 **A.35.xx.2 Waveform Annotation SR IOD Entity-Relationship Model**

123 This IOD uses the E-R Model in Section A.1-2, with only the SR Document IE below the Series IE.

#### 124 **A.35.xx.3 Waveform Annotation SR IOD Module Table**

125 Table A.35.xx.1-1 specifies the Modules of the Waveform Annotation SR IOD.

126

**Table A.35.xx-1 Waveform Annotation SR IOD Modules**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Presentation Series	C.7.3.3	M
Frame of Reference	Synchronization	C.7.4.2	C – Required if time synchronization was applied.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
SR Document	SR Document General	C.17.2	M
	SR Document Content	C.17.3	M

	SOP Common	C.12.1	M
--	------------	--------	---

127

128 **A.35.xx.3.1 Waveform Annotation SR IOD Content Constraints**

129 **A.35.xx.3.1.2 Template Constraints**

130 The document shall be constructed from TID XXXX “Waveform Annotations” invoked at the root node.

131

132 **A.zz Waveform Montage**

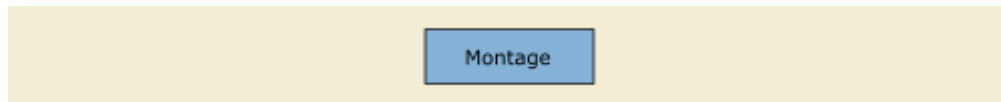
133 **A.zz.1 Waveform Montage IOD Description**

134 ...this is the pendant to the color palette .. queryable information – t.b.d: description

135

136 **A.zz.2 Waveform Montage IOD Entity-Relationship Model**

137 A Montage is not related to other Information Entities of the DICOM real-world model, as it is not  
 138 associated with a specific Patient. The E-R model for the Montage IOD is shown in Figure A.zz.2-1.



139

140 **Figure A.zz.2-1. Waveform Montage IOD E-R Model**

141 **A.zz.3 Waveform Montage IOD Module Table**

142 Table A.zz.1-1 lists the Modules of the Montage IOD

143 **Table A.zz-1. Waveform Montage Modules**

IE	Module	Reference	Usage
Montage	Montage Definition	C.11.dd	M
	Montage Environment	t.b.d.	U
	Montage Channels	C.zz.a	M
	SOP Common	C.12.1	M

144

145

146

147 *Change Waveform Annotation Module PS 3.3 Section C.10.10*

148 **C.10.10.1 Waveform Annotation Attribute Descriptions**

149 **C.10.10.1.1 Referenced Channels**

150 Referenced Waveform Channels (0040,A0B0) is a multi-value Attribute that lists the channels to which an  
 151 annotation of a waveform applies. Each channel is specified as a pair of values (M,C).

152 **If the Annotations relate to a waveform object**, the first value is the ordinal of the Item of Waveform  
 153 Sequence (5400,0100) (i.e., the Multiplex Group Number) and the second value is the ordinal of the Item  
 154 of the Channel Definition Sequence (003A,0200) Attribute (i.e., the Waveform Channel Number) within  
 155 the multiplex group.

156 **If the Annotations relate to a waveform presentation state object, the first value is the ordinal of**  
 157 **the Item of Waveform Presentation Sequence (ggga,eeee) and the second value is the ordinal of**  
 158 **the Item of the Montage Definition Sequence (ggga,eeeb) Attribute (i.e., the Montage Channel**  
 159 **Number) within the Waveform Presentation.**

160 **If Montage Presentation Sequence contains a Montage Name instead of a Montage Definition**  
 161 **Sequence, the first value is the ordinal of the Item of Waveform Presentation Sequence**  
 162 **(ggga,eeee) and the second value is the ordinal of the Item of the Montage Definition Sequence**  
 163 **(ggga,eeeb) Attribute (i.e., the Montage Channel Number) within the identified Montage object.**

164 **If the Waveform Presentation State contains no Waveform Presentation Sequence (ggga,eeee) the**  
 165 **Annotations shall be assigned to the waveform objects identified by the items in Referenced**  
 166 **Series Sequence (0008,1115).**

167  
 168 If the specified channel number is 0, the annotation applies to all channels in the multiplex group or  
 169 Waveform Presentation Item.

170  
 171 **Note**

172 As an example, an annotation that applies to the entire first multiplex group and channels 2 and 3 of the third  
 173 multiplex group would have Referenced Channels value 0001 0000 0003 0002 0003 0003.

174  
 175  
 176 *Change Waveform Annotation Module PS 3.3 Section C.11.11 to include waveforms*

177 **C.11.11 Presentation State Relationship Module**

178 Table C.11.11-1 specifies the Attributes of the Presentation State Relationship Module, which describe  
 179 the images **or waveforms** to which a Presentation State applies.

180  
 181 **Table C.11.11-1. Presentation State Relationship Module Attributes**

Attribute Name	Tag	Type	Attribute Description
<i>Include Table C.11.11-1b "Presentation State Relationship Macro Attributes"</i>			

182  
 183 **C.11.11.1 Presentation State Relationship Macro**

184 **Table C.11.11-1b. Presentation State Relationship Macro Attributes**

185

Attribute Name	Tag	Type	Attribute Description
Referenced Series Sequence	(0008,1115)	1	Sequence of Items where each Item includes the Attributes of one Series to which the Presentation applies. One or more Items shall be included in this Sequence.
>Series Instance UID	(0020,000E)	1	Unique identifier of a Series that is part of the Study defined by the Study Instance UID (0020,000D) in the enclosing Data Set. Note The Study Instance UID (0020,000D) value will be that of the presentation state itself, unless the Macro is invoked from Blending Sequence (0070,0402) in the Presentation State Blending Module, in which case it will be explicitly specified.
>Referenced Image Sequence	(0008,1140)	1	The set of images and frames <b>or waveforms</b> to which the Presentation applies. These shall be of the Study defined by Study Instance UID (0020,000D) and the Series defined by Series Instance UID (0020,000E). One or more Items shall be included in this Sequence. The referenced SOP Class shall be the same for all Images <b>or waveforms</b> in any Item of this Referenced Series Sequence (0008,1115).
>>Include Table 10-3 "Image SOP Instance Reference Macro Attributes"			

186

187

Add the following new content to PS 3.3 Section C.11 ...

188

**C.11.aa Waveform Presentation Module Attributes**

189

190 This Module contains attributes describing the presentation of waveform channels.

190

191 Table C.11-aa specifies the Attributes that identify and describe the Waveform Presentation Channels.

191

192

**Table C.11-aa Waveform Presentation Module Attributes**

Attribute Name	Tag	Type	Description
<u>Waveform Presentation Sequence</u>	<u>(ggga,ee ea)</u>	<u>1</u>	<u>Description of Waveform Presentations.</u>  <u>One or more items are permitted in this sequence.</u>
<u>&gt;Number of Presentation Channels</u>		<u>1</u>	<u>Number of channels for this Waveform Presentation.</u>



<b>&gt;Montage Definition Sequence</b>	<b>(ggga,ee eb)</b>	<b>1C</b>	<b>Definition of a montage as a sequence of items. Each item represents a single channel calculated for presentation. One or more items shall be included in this sequence. Ordering of Items in this Sequence is significant for reference to specific channels.</b>
<b>&gt;&gt;Include Table C.11.e-1. Montage Channels Macro Attributes</b>			
<b>&gt;Montage Name (identifier (UID))</b>		<b>1C</b>	<b>C – Required if a montage object is defined and (ggga,eeeb) Montage Definition Sequence is not defined</b>

193

194

195

**C.11.e Montage Channels Macro Attributes**

196

**Table C.11.e-1. Montage Channels Macro Attributes**

Attribute Name	Tag	Type	Description
<b><u>Montage Channel Number</u></b>			<b><u>The number of the montage channel</u></b>
<b><u>Montage Channel Label</u></b>			<b><u>Text label for channel, which may be used for display purposes</u></b>
<b><u>Montage Channel Source Sequence</u></b>			<b><u>A coded descriptor of the waveform channel source (metric, anatomical position, function, and technique).</u></b>  <b><u>Only a single Item shall be included in this Sequence.</u></b>
<b><u>&gt;Include Code Sequence Macro Attributes</u></b>			
<b><u>Contributing Channel Sources Sequence</u></b>			<b><u>A sequence of items each representing a channel contributing to this montage.</u></b>
<b><u>&gt;Calculatory Weight</u></b>			<b><u>The weight of the contribution of this channel.</u></b>
<b><u>&gt;Contributing Channel Source Sequence</u></b>			<b><u>A coded descriptor of the contributing waveform channel source (metric, anatomical position, function, and technique).</u></b>  <b><u>Only a single Item shall be included in this Sequence.</u></b>

<b>&gt;&gt;Include Code Sequence Macro Attributes</b>			
<b><u>Source Waveform Sequence</u></b>	<b><u>(003A,020A)</u></b>	<b><u>3</u></b>	<b><u>Reference to a DICOM Waveform from which this channel was derived.</u></b>  <b><u>One or more items are permitted in this sequence.</u></b>
<b>&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes</b>			
<b><u>&gt; Referenced Waveform Channels</u></b>	<b><u>(0040,A0B0)</u></b>	<b><u>1</u></b>	<b><u>Identifies the waveform multiplex group and channel within the referenced SOP Instance. Pair of Values (M,C)</u></b>
<b><u>Channel Derivation Description</u></b>	<b><u>(003A,020C)</u></b>	<b><u>3</u></b>	<b><u>Additional description of the waveform channel derivation</u></b>
<b><u>Filter Low Frequency Characteristics Sequence</u></b>	<b><u>(003A,0318)</u></b>	<b><u>1C</u></b>	<b><u>The properties of low frequency (high-pass) filters used for the waveform montage. Required if a high-pass filter is applied to display the waveform data.</u></b>  <b><u>Shall not be present otherwise</u></b>
<b><u>Filter High Frequency Characteristics Sequence</u></b>	<b><u>(003A,0219)</u></b>	<b><u>1C</u></b>	<b><u>The properties of high frequency (low-pass) filters used for the waveform montage.</u></b>  <b><u>Required if a low-pass filter is applied to display the waveform data.</u></b>
<b><u>Notch Filter Characteristics Sequence</u></b>	<b><u>(003A,0321)</u></b>	<b><u>3</u></b>	<b><u>The properties of notch filters used to display the waveform data.</u></b>

197

198

199

**C.11.bb Waveform Structured Display**

200

Table C.11-a specifies the Attributes that identify and describe the Waveform Structured Display Properties.

201

202

Describes the traces: what should be displayed where ... color, things like that

203

**The Structured Display Object contains references to the objects to be displayed**

204

- For a Patient

205

- For one or more Studies of a patient or studies of another patient (in comparison)

206

- Contains references to the objects to be displayed

207

- defines the screen layout; describes waveform traces

208

- Presentation States are used to define how each of the objects looks like. The Presentation State defines the basic physical properties (filters, montages).

209

210

- There could also be text annotations.

211 Reuse as much as possible from Structured Display Module C.11.16 – extended with Waveforms as  
 212 objects to display.

213 The Structured Display Module C.11.16. contains a reference to a Hanging Protocol, that shall be used.

- 214 • As a pendant to the Image Box (C.11.17) → “Trace Box” – group of Traces with similar properties  
 215 (scale, color, gain, ...)
- 216 **(!! Image Box C.11.17 already supports to refer to Waveform Instances)**
- 217 • Space between the Traces ( = channels or presentation channels)

219

220 **Table C.11-bb Waveform Structured Display Module Attributes**

Attribute Name	Tag	Type	Description
<not yet defined>			

221

222 **C.11.cc Montage Definition Module**

223 This Module contains ...

224 **Table C.11.cc-1 Waveform Montage Definition Module Attributes**

Attribute Name	Tag	Type	Description
<b><u>Montage Name</u></b>		<b>1</b>	<b><u>A name ...</u></b>
<b><u>Montage Description</u></b>		<b>1</b>	<b><u>Free text description for the montage</u></b>
<b><u>Montage Creator</u></b>		<b>1</b>	<b><u>Who created the montage</u></b>
<b><u>Montage Creation DateTime</u></b>		<b>1</b>	<b><u>When was this montage created</u></b>
<b><u>Montage Definition Sequence</u></b>		<b>1</b>	<b><u>Sequence that describes the type of neurophysiology study to which this montage could be applied</u></b>

<u>Waveform Sets Sequence</u>	<u>1</u>	<u>Sequence describing one or more types of Waveform Sets to which this montage applies</u>

225

226 **C.zz.a Montage Channels Module**

227 This Module contains ...

228 **Table C.zz.a-1. Waveform Montage Channels Module Attributes**

Attribute Name	Tag	Type	Description
...			
>Include Table C.11.e-1. Montage Channels Macro Attributes			
...			

229

230 **Changes to NEMA Standards Publications PS 3.4**

231

232 **Digital Imaging and Communications in Medicine (DICOM)**  
 233 **Part 4: Service Class Specifications**

234 *Add new SOP Class to PS3.4 Annex B tables*

235 **B.5 Standard SOP classes**

236 The SOP Classes in the Storage Service Class identify the Composite IODs to be stored. Table B.5-1  
 237 identifies Standard SOP Classes.

238 **Table B.5-1. Standard SOP Classes**

SOP Class Name	SOP Class UID	IOD Specification (defined in PS 3.3)
...	...	...

239

240

241 *Add the following to PS3.4*

242 **Annex XX Waveform Presentation State Storage SOP Classes (Normative)**

243 **< ... compare to Annex N Softcopy Presentation State Storage SOP Classes ... >**

244 **Changes to NEMA Standards Publications PS 3.6**  
 245  
 246 **Digital Imaging and Communications in Medicine(DICOM)**  
 247 **Part 6: Data Dictionary**

248 *Add new Elements to PS3.6 6 Table 6-1. Registry of Data Elements*

249 **Table 6-1. Registry of DICOM Data Elements**

Tag	Name	Keyword	VR	VM	
...					

250  
251

252 *Add new SOP Classes to PS3.6 Annex A Table A-1:*

253

UID Value	UID Name	UID Type	Part
...	...	...	...

254  
255

256 *Add new Context Group UID Values to Table A-3:*

257

Context UID	Context Identifier	Context Group Name
...	...	...

258  
259

260  
261  
262  
263

**Changes to NEMA Standards Publications PS3.15**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 15: Security and System Management Profiles**

264 *Add new Data Elements to PS3.15 Annex E*

265 **Table E.1-1. Application Level Confidentiality Profile Attributes**

Attribute Name	Tag	Retd. (from PS3.6)	In Std. Comp. IOD (from PS3.3)	Basic Prof.	Rtn. Safe Priv. Opt.	Rtn. UIDs Opt.	Rtn. Dev. Id. Opt.	Rtn. Inst. Id. Opt.	Rtn. Pat. Chars. Opt.	Rtn. Long. Full Dates Opt.	Rtn. Long. Modif. Dates Opt.	Clean Desc. Opt.	Clean Struct. Cont. Opt.	Clean Graph. Opt.

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**Changes to NEMA Standards Publications PS3.16**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 16: Content Mapping Resource**

272 *Amend Annex A by adding Template TID XXXX Waveform Annotations*

273 **Neurophysiology Templates**

274  
275  
276  
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278  
279  
280

**TID XXXX Waveform Annotations**

This Root Template encodes a list of Neurophysiology Annotations consisting of lists of measurements or observations .... added by ... when doing post-hoc review ...

Shall also be suitable for cardio-annotations – same template, different CIDs

281 Type: Extensible or Non-Extensible  
282 Order: Significant or Non-Significant  
283 Root:Yes

284  
285 **Table TID XXXX. Post-hoc Annotations**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER		1	M		
<t.b.d.>								

286  
287

288 *Amend existing context groups*

289  
290  
291  
292  
293

## Changes to NEMA Standards Publications PS3.17

### Digital Imaging and Communications in Medicine (DICOM) Part 17: Explanatory Information

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#### XXX Neurophysiology Waveform Presentation (Informative)

<In this chapter we should point out, what the new DICOM SOP Classes should be used for>

In clinical neurophysiology it is important to be able to recreate the display of the recorded data as it was displayed during the recording or during review and reporting.

**Montages** could be either predefined and referenced by an object identifier or defined for a specific recording.

A **Waveform Presentation State Object** stores annotations, filters, and montages used for a given recording (patient related). A Waveform Presentation State object is stored together with the waveform study (e.g. a Routine Scalp EEG recording) and can be exchanged between systems.

A **Waveform Structured Display Object** defines the screen layout (groups of traces with labels and vertical sizes, colors, gain, ....).

#### **Use case: Recording**

A technician performs an EEG recording. From time to time he changes the filter settings and also the montages, for example to check the quality of the recording. If abnormalities occur or if external circumstances change that could be of importance for the evaluation of the recording, the technician adds an annotation at this point.

In addition to the annotations, the recording system also saves the current filter settings and the montage selected for the display in a waveform presentation state object.

#### **Use case: post hoc Review**

A physician acting as a post hoc reviewer looks through a completed EEG recording and marks potential epileptic patterns. The annotations added by the technician during the recording are shown. The physician has the option of using the settings for display filters and montage stored in the presentation state object generated during recording.

If he adds annotations, these are stored as well.

#### **Use case: Defining a Screen Layout**

A physician acting as a post hoc reviewer looks through the data and marks potential epileptic patterns, possibly already annotating morphological/topographical groups. He defines a screen layout by arranging groups of channels from that recording at specific positions with different colors ...

He then stores the layout in a Waveform Structured Display object as additional object in this study.

#### **Use case: Electronic Health Record**

An epilepsy patient is treated in another organization and the neurologist wants to see the EEGs and findings of previous epilepsy monitoring recordings (accessible via the patient's health record).

The main use cases that would make use of the new IODs are:



- 340 1) Neurophysiology:  
341 a) Recording: It is required to save the annotations added by the EEG technician during recording  
342 and the display settings used at the time of annotation.  
343 b) Post-hoc review: When the doctor views the recording he can see the annotations added during  
344 recording. He may want to use the settings stored in the Recording Presentation State. The  
345 doctor marks relevant sections or positions in the EEG and adds a description. From time to time  
346 he may want to change the display parameters and store such settings (unrelated to time or the  
347 annotations).  
348 2) Cardiology:  
349 a) Home performed Holter ECG: Data acquired by a patient during 24 h / 1 week home ECG  
350 monitoring are viewed by a holter technician, He annotates the waveforms and highlights areas of  
351 interest.  
352 b) The cardiologist reviews the data and may send the data back to the technologist or change the  
353 diagnosis. Finally she signs the report and sends it to the information system.  
354 3) Automated waveform analysis: Store observations and measurements as annotations and the  
355 settings used by algorithms in waveform analysis software  
356

357 All these use cases require time locked annotations with identification of authorship and situation of  
358 annotation ('during acquisition' versus 'post hoc')

359