

DICOM Correction Proposal Form

Tracking Information - Administration Use Only	
Correction Proposal Number	CP- 136
STATUS	Draft
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Person Assigned	
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Correction Number	CP-136
Log Summary: VRs for waveform encoding	
Type of Modification	Name of Standard
Addition of new items	PS 3.5-1998
<p>Rationale for Correction</p> <p>The forthcoming Waveform IOD needs to encode in an attribute a large set ($> 2^{16}$) of waveform samples. Clearly, the VR needs to be one which uses a 32-bit length in explicit VR syntaxes. In the current set of VRs, this is only OB and OW.</p> <p>The waveform samples may be up to 32 bits in length, with a variety of potential encodings.</p> <p>There needs to be a clear definition in Part 5 of the means of encoding waveform data, comparable to the definition of pixel encoding. It needs to handle the size of the data set, as well as the size of the waveform samples. It must also fit within the general structure of DICOM syntax.</p>	
<p>Sections of documents affected</p> <p>PS3.5, Sections 6, 7, 8, and Annex A</p>	
<p>Correction Wording:</p> <p>See below ...</p>	

Add to PS 3.5 section 6.2 - Value representation (VR):

**Table 6.2-1
DICOM VALUE REPRESENTATIONS**

VR Name	Definition	Character Repertoire	Length of Value
OL Other Long String	A string of 32-bit longwords. OL is a VR which requires byte order reversal within each longword when changing between Little Endian and Big Endian byte ordering (see Section 7.3).	not applicable	Multiple of 4 bytes

Add to PS 3.5 section 6.4 - Value multiplicity (VM) and delimitation:

Data Elements with a VR of SQ, OW, [OL](#), or OB shall always have a Value Multiplicity of one.

Add to PS 3.5 section 7.1.2 - Data Element Structure With Explicit VR:

... OB, [OL](#), OW, SQ or UT ... [all occurrences]

Add to PS 3.5 section 7.3 - Big Endian Versus Little Endian Byte Ordering:

- 2-byte US, SS, OW and each component of AT
- 4-byte [OL](#), UL, SL, and FL
- 8 byte FD

Modify PS 3.5 Section 8:

Section 8 Encoding of Pixel [and Waveform](#) Data

[8.1 PIXEL DATA AND RELATED DATA ELEMENTS](#)

The Pixel Data Element (7FE0,0010) shall be used for the exchange of encoded graphical image data. ...

~~**8.1 PIXEL DATA ENCODING OF RELATED DATA ELEMENTS**~~

Encoded Pixel Data of various bit depths shall be accommodated. The following three Data Elements shall define the Pixel structure: ...

[8.3 WAVEFORM DATA AND RELATED DATA ELEMENTS](#)

[The DICOM protocol provides for the exchange of encoded time-based signals, or waveforms. In legacy Composite Information Object Definitions \(in PS 3.3\) this data is encoded in Curve Repeating Groups \(see Section 7.6\), particularly in the Curve Data \(50xx,3000\) or Audio Sample Data \(50xx,200C\) elements. In all new IODs, this type of data is encoded in the Waveform Data Element \(5400,1010\).](#)

Note: Per Section 7.6, an IOD supporting multiple sets of Waveform Data must encapsulate Data Element (5400,1010) within a Sequence.

Encoded Waveform Data of various bit depths is accommodated through the Waveform Bits Allocated (5400,1004) Data Element. This element defines the size of each waveform data sample within the Waveform Data (5400,1010). Allowed values are 8, 16, and 32 bits; these correspond to VR of the Waveform Data (5400,1010) of OB, OW, and OL, respectively.

Under the Default Transfer Syntax, all multiple-byte data samples in the Waveform Data (5400,1010) are transmitted in little-endian order. Conversion of a SOP Instance from the Default Transfer Syntax to an Explicit VR Transfer Syntax (uncompressed) requires the interpretation of the Waveform Bits Allocated (5400,1004) Data Element, to determine if the Waveform Data has a VR of OB, OW, or OL.

Additional data elements related to Waveform Data may also be encoded with VR of OB, OW, or OL, as determined by the Waveform Bits Allocated Data Element.

As with Pixel Data, the negotiated Transfer Syntax (see Section 10 and Annex A) may specify compression of Waveform Data. Compressed Waveform Data shall be carried in an Encapsulated Format within the Waveform Data Element, in a manner similar to the Encapsulated Format for pixel data.

Note: Although no Transfer Syntax for compressed waveforms has yet been defined, this is an expected future capability within DICOM.

8.4 SOP INSTANCES WITH BOTH PIXEL AND WAVEFORM DATA

DICOM allows SOP instances to include both image and waveform data. In such cases, the waveform data is considered ancillary to the image data. Any attributes which might be applicable to either images or waveforms shall be interpreted as applying to the image data.

Note: For instance, the Modality (0008,0060) attribute will indicate the imaging modality.

Modify PS 3.5 Annex A:

A.1 DICOM IMPLICIT VR LITTLE ENDIAN TRANSFER SYNTAX

...

- c) The encoding of the Data Elements of the Data Set shall be as follows according to their Value Representations:

For all Value Representations defined in this part, except for the Value Representations OB, OL, and OW, the encoding shall be in Little Endian as specified in Section 7.3.

For the Value Representations OB, OL, and OW, the encoding shall meet the following specification depending on the Data Element Tag:

Data Element (7FE0,0010) Pixel Data has the Value Representation OW and shall be encoded in Little Endian.

Data Element (60xx,3000) Overlay Data has the Value Representation OW and shall be encoded in Little Endian.

Data Element (50xx,3000) Curve Data has the Value Representation OB with its component points (n-tuples) having the Value Representation specified in Data Value Representation (50xx,0103). The component points shall be encoded in Little Endian.

Data Element (5400,0010) Waveform Data

where Waveform Bits Allocated (5400,1004) has a value of 8 shall have Value Representation OB and shall be encoded in Little Endian;

where Waveform Bits Allocated (5400,1004) has a value of 16 shall have Value Representation OW and shall be encoded in Little Endian;

where Waveform Bits Allocated (5400,1004) has a value of 32 shall have Value Representation OL and shall be encoded in Little Endian;

...

A.2 DICOM LITTLE ENDIAN TRANSFER SYNTAX (EXPLICIT VR)

...

- c) The encoding of the Data Elements of the Data Set shall be as follows according to their Value Representations:

For all Value Representations defined in this part, except for the Value Representations OB, OL, and OW, the encoding shall be in Little Endian as specified in Section 7.3.

For the Value Representations OB, OL, and OW, the encoding shall meet the following specification depending on the Data Element Tag:

Data Element (7FE0,0010) Pixel Data

where Bits Allocated (0028,0100) has a value greater than 8 shall have Value Representation OW and shall be encoded in Little Endian;

where Bits Allocated (0028,0100) has a value less than or equal to 8 shall have the Value Representation OB or OW and shall be encoded in Little Endian.

Data Element (60xx,3000) Overlay Data

where Bits Allocated (60xx,0100) has a value greater than 8 shall have Value Representation OW and shall be encoded in Little Endian;

where Bits Allocated (60xx,0100) has a value less than or equal to 8 shall have the Value Representation OB or OW and shall be encoded in Little Endian.

Data Element (50xx,3000) Curve Data has the Value Representation specified in its Explicit VR Field. See the specification of the Curve Data Module in PS 3.3 for the enumerated list of allowable VRs. The component points shall be encoded in Little Endian.

Data Element (5400,0010) Waveform Data has the Value Representation specified in its Explicit VR Field. The component points shall be encoded in Little Endian.

...

A.3 DICOM BIG ENDIAN TRANSFER SYNTAX (EXPLICIT VR)

...

- c) The encoding of the Data Elements of the Data Set shall be as follows according to their Value Representations:

For all Value Representations defined in this part, except for the Value Representations OB, OL, and OW, the encoding shall be in Big Endian as specified in Section 7.3.

For the Value Representations OB and OW, the encoding shall meet the following specification depending on the Data Element Tag:

Data Element (7FE0,0010) Pixel Data

where Bits Allocated (0028,0100) has a value greater than 8 shall have Value Representation OW and shall be encoded in Big Endian;

where Bits Allocated (0028,0100) has a value less than or equal to 8 shall have the Value Representation OB or OW and shall be encoded in Big Endian.

Data Element (60xx,3000) Overlay Data

where Bits Allocated (60xx,0100) has a value greater than 8 shall have Value Representation OW and shall be encoded in Big Endian;

where Bits Allocated (60xx,0100) has a value less than or equal to 8 shall have the Value Representation OB or OW and shall be encoded in Big Endian.

Data Element (50xx,3000) Curve Data has the Value Representation specified in its Explicit VR Field. See the specification of the Curve Data Module in PS 3.3 for the enumerated list of allowable VRs. The component points shall be encoded in Big Endian.

[Data Element \(5400,0010\) Waveform Data has the Value Representation specified in its Explicit VR Field. The component points shall be encoded in Big Endian.](#)

...

A.4 TRANSFER SYNTAXES FOR ENCAPSULATION OF ENCODED PIXEL DATA

...

- c) The encoding of the Data Elements of the Data Set shall be as follows according to their Value Representations:

For all Value Representations defined in this part of the DICOM Standard, except for the Value Representations OB, [OL](#), and OW, the encoding shall be in Little Endian as specified in Section 7.3.

For the Value Representations OB, [OL](#), and OW, the encoding shall meet the following specification depending on the Data Element Tag:

...

Data Element (50xx,3000) for Curve Data has the Value Representation specified in its Explicit VR Field. See the specification of the Curve Data Module in PS 3.3 for the enumerated list of allowable VRs. The component points shall be encoded in Little Endian.

[Data Element \(5400,0010\) Waveform Data has the Value Representation specified in its Explicit VR Field. The component points shall be encoded in Little Endian.](#)

...