

1	Status	Final Text
2	Date of Last Update	2015/09/16 (corrected 2015/10/16)
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7	Submission Date	2015/01/15

8	Correction Number CP-1458	
9	Log Summary: Value representation of real world value first and last values mapped	
10	Name of Standard	
11	PS3.3, PS3.6	
12	Rationale for Correction:	
13	The VR for the real world value mapping input values may be US or SS depending on the value of Pixel Representation, but this is	
14	not explicitly specified.	
15	Floating point values for the range of input values are added for use when an integer range is not sufficient (without invalidating the	
16	installed base that uses the existing attributes when they are sufficient).	
17	The use of the equation rather than lookup table method is required when floating point stored pixel values are used (since the	
18	meaning of looking up floating point values that lie between integer indices into a lookup table is not defined).	
19	<i>[Ed. Note: PS3.3 changes corrected on 2015/10/16 to make data element tags used consistent with PS3.6; first and last were swapped</i>	
20	<i>in text of 2015/09/16.]</i>	
21	Correction Wording:	

Amend DICOM PS3.3 as follows (changes to existing text are bold and underlined for additions and ~~struckthrough~~ for removals):

## C.7.6.16.2.11 Real World Value Mapping Macro

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**Table C.7.6.16-12b. Real World Value Mapping Item Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Real World Value First Value Mapped	(0040,9216)	<b>1C</b>	<p>Specifies the first stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) or Real World Value LUT (0040,9212) of this Item.</p> <p><b><u>Required if Pixel Data (7FE0,0010) or Real World Value LUT Data (0040,9212) is present or Double Float Real World Value First Value Mapped (0040,9214) is absent.</u></b></p> <p><b>Note</b></p> <p><b><u>This Attribute may be used even when Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are used instead of Pixel Data (7FE0,0010) if an integer of the size of this Attribute is sufficient to define the range.</u></b></p> <p>See Section C.7.6.16.2.11.1 for further explanation.</p>
Real World Value Last Value Mapped	(0040,9211)	<b>1C</b>	<p>Specifies the last stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) or Real World Value LUT (0040,9212) of this Item.</p> <p><b><u>Required if Pixel Data (7FE0,0010) or Real World Value LUT Data (0040,9212) is present or Double Float Real World Value Last Value Mapped (0040,9213) is absent.</u></b></p> <p><b>Note</b></p> <p><b><u>This Attribute may be used even when Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are used instead of Pixel Data (7FE0,0010) if an integer of the size of this Attribute is sufficient to define the range.</u></b></p> <p>See Section C.7.6.16.2.11.1 for further explanation.</p>
<b><u>Double Float Real World Value First Value Mapped</u></b>	<b><u>(0040,9214)</u></b>	<b>1C</b>	<p><b><u>Specifies the first stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) of this Item.</u></b></p> <p><b><u>Required if Real World Value First Value Mapped (0040,9216) is absent.</u></b></p> <p><b>Note</b></p> <p><b><u>The same Attribute with a double float precision value is used whether or not Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are present, an integer value is not sufficient.</u></b></p>

Attribute Name	Tag	Type	Attribute Description
<b><u>Double Float Real World Value Last Value Mapped</u></b>	<b><u>(0040,9213)</u></b>	<b><u>1C</u></b>	<b><u>Specifies the last stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) of this Item.</u></b> <b><u>Required if Real World Value Last Value Mapped (0040,9211) is absent.</u></b>  <b>Note</b>  <b><u>The same Attribute with a double float precision value is used whether or not Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are present, an integer value is not sufficient.</u></b>
Real World Value Intercept	(0040,9224)	1C	The Intercept value in relationship between stored values (SV) and the Real World values.  See Section C.7.6.16.2.11.1.2 for further explanation.  Required if <b><u>Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are present or</u></b> Real World Value LUT Data (0040,9212) is not present.
Real World Value Slope	(0040,9225)	1C	The Slope value in relationship between stored values (SV) and the real world values.  See Section C.7.6.16.2.11.1.2 for further explanation.  Required if <b><u>Float Pixel Data (7FE0,0008) or Double Float Pixel Data ((7FE0,0009) are present or</u></b> Real World Value LUT Data (0040,9212) is not present.
Real World Value LUT Data	(0040,9212)	1C	LUT Data in this Sequence.  Required if Real World Value Intercept (0040,9224) is not present.
LUT Explanation	(0028,3003)	1	Free form text explanation of the meaning of the transformation in this Item.
LUT Label	(0040,9210)	1	Label that is used to identify the transformation of this Item.
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### C.7.6.16.2.11.1 Real World Value Representation

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### C.7.6.16.2.11.1.2 Real World Values Mapping Sequence Attributes

The Real World Value First Value Mapped (0040,9216) and Real World Value Last Value Mapped (0040,9211) Attributes describe the range of stored pixel values that are mapped by the Sequence Item. Stored pixel values less than the first value mapped, or greater than the last value mapped have no real value attached.

When the Real World Value Intercept (0040,9224) and Real World Value Slope (0040,9225) attributes are supplied, the stored value (SV) is converted to a real world value (RV) using the equation:

$$RV = (\text{Real World Value Slope}) * SV + \text{Real World Value Intercept}$$

When the Real World Value LUT Data (0040,9212) attribute is supplied, Real World Values are obtained via a lookup operation. The stored pixel value of the first value mapped is mapped to the first entry in the LUT Data. Subsequent stored pixel values are mapped to the subsequent entries in the LUT Data up to a stored pixel value equal to the last value mapped.

The number of entries in the LUT data is given by:

$$\text{Number of entries} = \text{Real World Value Last Value Mapped} - \text{Real World Value First Value Mapped} + 1$$

**Note**

If the stored pixel values that are encoded as floating point rather than integer values, only the equation and not the lookup operation is defined.

The Value Representation of Real World Value First Value Mapped (0040.9216) and Real World Value Last Value Mapped (0040.9211) (US or SS) is determined by the value of Pixel Representation (0028.0103) in the case of integer pixel data, or is SS in the case of floating point pixel data if these Attributes are present.

**Note**

In practice, integer values may well be sufficient to define an input range that exceeds the actual stored floating point pixel value range. The reason to permit floating point alternatives to an integer range is that sometimes the stored floating point values may be very large and exceed what can be specified as an integer value.

Add new attributes to DICOM PS3.6 as follows (changes to existing text are bold and underlined for additions and ~~struckthrough~~ for removals):

## 6 Registry of DICOM Data Elements

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	
<u>(0040.9213)</u>	<u>Double Float Real World Value Last Value Mapped</u>	<u>DoubleFloatRealWorldValueLast ValueMapped</u>	<u>FD</u>	<u>1</u>	
<u>(0040.9214)</u>	<u>Double Float Real World Value First Value Mapped</u>	<u>DoubleFloatRealWorldValueFirst ValueMapped</u>	<u>FD</u>	<u>1</u>	