DICOM Correction Proposal

STATUS	Letter Ballot
Date of Last Update	2024/03/21
Person Assigned	Harry Solomon
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Submission Date	2023/07/10

Correction Number CP-2352
Log Summary: Clarify floating point Not a Number values
Name of Standard PS3.3, PS3.5
Rationale for Correction: The Standard explicitly specifies only in the context of OF and OD VRs (PS3.5 Section 8) that IEEE 754 NaN (Not a Number) and infinity values are valid. The VR definition Table 6.2-1 is ambiguous regarding FL and FD VRs, as they refer to "floating point number", and NaN is not a number. Definitions are updated to describe "floating point value", and to use full / official names. References to IEEE 754 are updated to the current version, whose title should be noted has changed from the term "floating point number representation" to "floating point arithmetic". See also CP2275.
Correction Wording:

*Update IEEE 754 reference and VR definitions in **PS3.5***

2 Normative References

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[IEEE 754] IEEE. ~~**1985**~~**2019**. ~~***32-bit and 64-bit***~~ ***IEEE Standard for*** *Floating Point* ***Arithmetic*** ~~***Number Representations***~~.**doi:10.1109/IEEESTD.2019.8766229**

6.2 Value Representation (VR)

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Table 6.2-1. DICOM Value Representations

VR Name	Definition	Character Repertoire	Length of Value
..			
FL Floating Point Single	Single precision binary floating point ~~**number**~~ **value** represented in **[**IEEE 754**]**~~**:1985 32-bit Floating Point Number Format**~~ **binary32 format. All [IEEE 754] values are permitted, including NaN (Not a Number) and infinity values.**	not applicable	4 bytes fixed
FD Floating Point Double	Double precision binary floating point ~~**number**~~ **value** represented in **[**IEEE 754**]**~~**:1985 64-bit Floating Point Number Format**~~. **binary64 format. All [IEEE 754] values are permitted, including NaN (Not a Number) and infinity values.**	not applicable	8 bytes fixed
…			
OD Other Double	A stream of ~~**64-bit**~~ **[**IEEE 754**]**~~**:1985 floating point words**~~ **binary64 values. All [IEEE 754] values are permitted, including NaN (Not a Number) and infinity values.**. OD is a VR that requires byte swapping within each 64-bit word when changing byte ordering (see Section 7.3).	not applicable	2^{32}-8 bytes maximum

OF Other Float	A stream of **~~32-bit~~ [**IEEE 754**]~~:1985 floating point words~~ binary32 values. All [IEEE 754] values are permitted, including NaN (Not a Number) and infinity values.** OF is a VR that requires byte swapping within each 32-bit word when changing byte ordering (see Section 7.3).	not applicable	2^{32}-4 bytes maximum
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8.1 Pixel and Overlay Data, and Related Data Elements

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For Pixel Data Values encoded in OF and OD, any value that is permitted by **~~the~~ [**IEEE 754**]~~:1985~~** may be used, including NaN, **~~+~~Positi**ve Infinity and **~~-~~Negati**ve Infinity. See Table 6.2-1

Note
Float**ing point binary32 and binary64 ~~and double float~~** pixel data values are not arbitrarily constrained to finite numbers, since it may be important for the application to signal that the result of a calculation that produced a pixel is an infinite value or not a number.

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*Update IEEE 754 reference and Add clarification to Floating Point and Double Floating Point Image Pixel Modules in **PS3.3***

2.6 Other References

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[IEEE 754] Institute of Electrical and Electronics Engineers. **~~1985~~2019**. ***~~32-bit and 64-bit~~ IEEE Standard for*** *Floating Point* ***Arithmetic~~ Number Representations~~***. **~~http://grouper.ieee.org/groups/754/~~** . **doi:10.1109/IEEESTD.2019.8766229**

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C.7.6.24 Floating Point Image Pixel Module

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Table C.7.6.24-1. Floating Point Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Float Pixel Padding Value	(0028,0122)	3	One limit (inclusive) of a range of pixel values used in an image to pad to rectangular format or to signal background that may be suppressed. **See Section C.7.6.24.1.**
Float Pixel Padding Range Limit	(0028,0124)	1C	Pixel value that represents one limit (inclusive) of a range of padding values used together with Float Pixel Padding Value (0028,0122). Required if Float Pixel Padding Value (0028,0122) is present. **See Section C.7.6.24.1.** Note 1. If only a single padding value rather than a range is required, then both Float Pixel Padding Value (0028,0122) and Float Pixel Padding Range Limit (0028,0124) will contain the same value. 2. The general considerations described in

Attribute Name	Tag	Type	Attribute Description
			Section C.7.5.1.1.2 may be helpful in understanding the corresponding floating point Attributes, but are not normative.

C.7.6.24.1 Float Pixel Padding Value and Float Pixel Padding Range Limit

Float Pixel Padding Value (0028,0122) and Float Pixel Padding Range Limit (0028,0124) may specify any valid [IEEE 754] value, including NaN (Not a Number) and infinity values.

Note **If using [IEEE 754] NaN values, it is recommended to set the sign bit to 0 and the *is quiet* bit to 1. The range of NaN bit combinations under this recommendation is 7FC00000H through 7FFFFFFFH).**

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C.7.6.25 Double Floating Point Image Pixel Module

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Table C.7.6.25-1. Double Floating Point Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Double Float Pixel Padding Value	(0028,0123)	3	One limit (inclusive) of a range of pixel values used in an image to pad to rectangular format or to signal background that may be suppressed. **See Section C.7.6.25.1.**
Double Float Pixel Padding Range Limit	(0028,0125)	1C	Pixel value that represents one limit (inclusive) of a range of padding values used together with Double Float Pixel Padding Value (0028,0123). Required if Double Float Pixel Padding Value (0028,0123) is present. **See Section C.7.6.25.1.** Note 1. If only a single padding value rather than a range is required, then both Double Float Pixel Padding Value (0028,0123) and Double Float Pixel Padding Range Limit (0028,0125) will contain the same value. 2. The general considerations described in Section C.7.5.1.1.2 may be helpful in understanding the corresponding floating point Attributes, but are not normative.

C.7.6.25.1 Double Float Pixel Padding Value and Double Float Pixel Padding Range Limit

Double Float Pixel Padding Value (0028,0123) and Double Float Pixel Padding Range Limit (0028,0125) may specify any valid [IEEE 754] value, including NaN (Not a Number) and infinity values.

Note **If using [IEEE 754] NaN values, it is recommended to set the sign bit to 0 and the *is quiet* bit to 1. The range of NaN bit combinations under this recommendation is 7FF8000000000000H through 7FFFFFFFFFFFFFFFH).**