DICOM Correction Item

Correction Number	CP-522

Log Summary: Clarification of 8 bit LUT encoding	

Type of Modification	Name of Standard
Addition	PS 3.3

Rationale for Correction

There have been different interpretations of the number of bits to be stored as LUT data in the case of 8 bit LUT entries.

The VR for all LUT Data attributes specifies a 16 bit value (US, SS or OW) in PS 3.6. PS 3.3 states that "the LUT Data shall be stored in a format equivalent to 8 or 16 bits allocated where the high bit is equal to bits stored - 1, where bits stored is the third value [of LUT Descriptor]."

In the case of 8 bits per entry (LUT Descriptor value 3 == 8) this means that BitsStored=8 and HighBit=7. Bits Stored specifies how many of the bits in the encoded word are significant; what is not clearly specified is how many Bits Allocated are expected (how long the encoded word is). Either one could:

- pack two 8 bit entires into one 16 bit US, SS or OW, as if Bits Allocated were 8, according to the packing rules in PS 3.5 that apply to Pixel Data, or

- pad the high 8 bits with zeroes and encoded the 8 bit entry in the low 8 bits of one 16 bit US, SS or OW, as if Bits Allocated were 8

The uncertainty arrises because it is not clear whether the wording is intended to mean:

- Bits Allocated should be 8 for 8 bit entries and 16 for 16 bit entries, or

- Bits Allocated should be 8 or 16 for 8 bit entries and 16 for 16 bit entries

Since there is no plausible reason to "waste" 8 high bits of zeroes for each 8 bit entry, it is believed that the intent was that the section be interpreted in the former manner.

It is proposed to clarify the text, and add a note indicating that alternative interpretations are incorrect, but may be detected by comparing the number of table entries with the actual value length of the attribute.

Sections of documents affected
PS 3.3

Correction Wording:

C.7.6.3.1.5   Palette Color Lookup Table Descriptor

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The third value specifies the number of bits for each entry in the Lookup Table Data. It shall take the value of 8 or 16. The LUT Data shall be stored in a format equivalent to 8 **bits allocated when the number of bits for each entry is 8,** ~~or~~ **and** 16 bits allocated **when the number of bits for each entry is 16,** where **in both cases** the high bit is equal to bits allocated-1. The third value shall be identical for each of the Red, Green and Blue Palette Color Lookup Table Descriptors.

> **Note: Some implementations have encoded 8 bit entries with 16 bits allocated, padding the high bits; this can be detected by comparing the number of entries specified in the LUT Descriptor with the actual value length of the LUT Data entry. The value length in bytes should equal the number of entries if bits allocated is 8, and be twice as long if bits allocated is 16.**

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C.11.1 Modality LUT Module

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C.11.1.1.1 LUT descriptor

The third value specifies the number of bits for each entry in the LUT Data. It shall take the value 8 or 16. The LUT Data shall be stored in a format equivalent to 8 **bits allocated when the number of bits for each entry is 8,** ~~or~~ **and** 16 bits allocated **when the number of bits for each entry is 16,** where **in both cases** the high bit is equal to bits allocated-1.

> **Note: Some implementations have encoded 8 bit entries with 16 bits allocated, padding the high bits; this can be detected by comparing the number of entries specified in the LUT Descriptor with the actual value length of the LUT Data entry. The value length in bytes should equal the number of entries if bits allocated is 8, and be twice as long if bits allocated is 16.**

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C.11.2 VOI LUT Module

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C.11.2.1.1 LUT Descriptor

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The third value specifies the number of bits for each entry in the LUT Data. If the VOI LUT is included in an Image IOD, the third value of LUT Descriptor (0028,3002) shall be 8 or 16 bits, unless otherwise specialized. If the VOI LUT is included in a Presentation State IOD, the third value of LUT Descriptor (0028,3002) shall be between 8 and 16 inclusive. The LUT Data shall be stored in a format equivalent to 8 **bits allocated when the number of bits for each entry is 8,** ~~or~~ **and** 16 bits allocated **when the number of bits for each entry is 16,** where **in both cases** the high bit is equal to bits allocated-1, **and** where bits stored is the third value.

> **Note: Some implementations have encoded 8 bit entries with 16 bits allocated, padding the high bits; this can be detected by comparing the number of entries specified in the LUT Descriptor with the actual value length of the LUT Data entry. The value length in bytes should equal the number of entries if bits allocated is 8, and be twice as long if bits allocated is 16.**

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C.11.6.1 Softcopy Presentation LUT Attributes

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C.11.6.1.1 LUT Descriptor

The third value specifies the number of bits for each entry in the LUT Data. The third value of the LUT Descriptor (0028,3002) shall be between 8 and 16 inclusive. The LUT Data shall be stored in a format equivalent to 8 **bits allocated when the number of bits for each entry is 8,** ~~or~~ **and** 16 bits allocated **when the number of bits for each entry is 16,** where **in both cases** the high bit is equal to bits allocated-1, **and** where bits stored is the third value.

> **Note:** **Some implementations have encoded 8 bit entries with 16 bits allocated, padding the high bits; this can be detected by comparing the number of entries specified in the LUT Descriptor with the actual value length of the LUT Data entry. The value length in bytes should equal the number of entries if bits allocated is 8, and be twice as long if bits allocated is 16.**

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