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Specialists Group on Coding for Visual Telephony

SOURCE: VideoTelecom, Bellcore
TITLE: IDCT Mismatch

This document proposes a solution for the IDCT mismatch problem described in a letter from Mr. Okubo dated October 17. It seems that the fundamental cause of the IDCT mismatch problem is in the final rounding step when the 9 bit result is generated. Normally this is not a problem because the fractional portions of the IDCT usually do not exactly equal 0.5. If 16-bit arithmetic is used, and the integer portion is 9 bits, this allows for 7 factional bits. Assuming that the value of the fractional part is uniformly distributed between 0 and 1, the probability of generating exactly 0.5 is 1 out of 128.

However, there are certain cases where fractional values of 0.5 will be generated. Once solution that has been proposed is to restrict the input to the IDCT by modifying the quantizers. [redacted] An alternate solution is to tighten up the IDCT specification by adding the following:

There are cases where the ideal IDCT can generate rational results with fractional values of exactly $\pm$ 0.5, prior to rounding to 9 bits. For these cases the number should be rounded to the nearest more positive integer.

One such case occurs when all the coefficients are zero except for the DC coefficient. For this case the implementation of the IDCT must generate precise values. The values of all 64 pixels in the block must be equal to each other and are given by

int ((F(0,0) + 4)/8) for F(0,0) ≥ 0, and
-int((3 - F(0,0)/8) for F(0,0) < 0,

where F(0,0) is the 12 bit DC value.

Additionally, some test vectors should be defined for some of the other cases where rational values can be generated.

This method of rounding corresponds to method "a" in Mr. Okubo's letter. This method is consistent with the hardware technique that adds a value of 0.5 and discards the fractional part. The concerned IC manufacturers should be consulted prior to making a final change in the IDCT specification.