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TITLE: Report on IDCT Mismatch Experiments

1. Abstract

This document reports IDCT mismatch tests using several Japanese FHs and a BTRL's FH. Generally speaking, reproduced image degradations due to IDCT mismatch are not noticeable when cyclic refresh and motion-compensation are enabled. Unfortunately large degradations were observed with some combinations of codecs. The mechanism to cause such degradations is analized in Doc. #569. According to the document, a mismatch problem may be caused when quantization stepsize of 8, 24, 40 or 56 is used. In order to solve the problem, two kinds of modifications in quantization characteristics of the flexible hardware have been tested. With either modification, degradations due to IDCT mismatch become very small and are not observable under the normal condition where MC and cyclic refresh are used.

2. Conditions for experiments

Connecting independently developed codecs, reproduced images were observed carefully. In order to enphasize degradations due to IDCT mismatch, the following three conditions were used as far as possible:

1) turn cyclic refresh off

2) fix coding mode at INTER without scene change

3) fix MC vectors at zero

3. Experiment and Observation

3.1 Original Quantization Table

The results using the original FH quantization are shown in Table 1. For such cases as coder can not turn cyclic refresh off, tests were not carried out. From the table, the followings were observed:

1) In some combinations of coder and decoder, color blocks appear in few seconds. When red blocks appear in one direction, green blocks are seen in the other direction. In addition, the blocks appear immediately after scene change when step size is fixed at 8 (QUANT=3).

2) If color blocks do not appear with a combination, no reproduced image degradation is observed for at least 1 minutes.

The phenomenon described avobe is analized in Doc. #569. The IDCT output values for input values of +-12 were investigated and denoted in the table. In combinations of two codecs among A, C, D and F where the IDCT output values for input =+-12 are the same, the blocking phenomenon is not observed, while it is observed in combinations of two codecs where the IDCT output values for input=+-12 are different. These facts prove that the mismatch appears based on the analysis in Doc. #569 and that except the blocking phenomenon IDCT mismatch does not give noticeable degardation in the normal operation.

3.2 Modified Quantrization Table 1

Two modifications are introduced. One is a modification in quantization stepsize range which is not relevant to IDCT mismatch problem. The other modification is changes in representation levels for stepsize 8. Absolute values of all representation levels for stepsize 8 are increased by one. Table 2 shows the result of the IDCT mismatch experiments. In any combination, noticeable degradation due to IDCT mismatch was not found. To distinguish degradation due to IDCT mismatch from coding noises, loop-backed images and decoded images are compared. (See Figure 1) No difference was found in the two images for 4 seconds after scene change. After 8 sec, a slight defference could be seen when observed carefully. The difference became noticeable after 12 sec. The reproduced images from Decoder B looked like as if the input image were taken through a dirty glass. When MC was on, no difference was found in the two images for more than 20 sec after scene change.

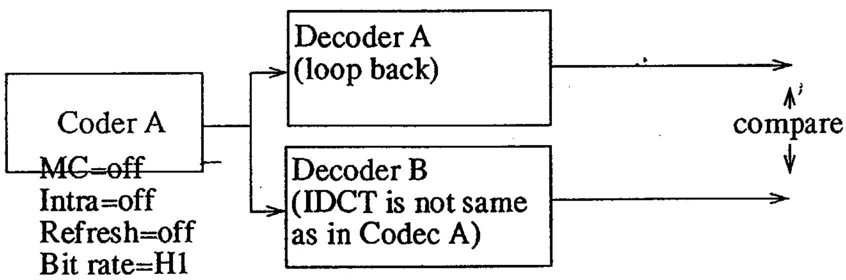

Figure 1.

3.3 Modified Quantization Table 2

Two modifications are introduced. One is the change in stepsize range same as in 3.2. The other is changes in all even quantization representation levels. Absolute values of all even representation levels are decreased by one. (See Doc. #570) Test was carried out among codecs A,B and H. In the reproduced images, no degradation, which is clearly due to IDCT mismatch, was observed. In fact it was difficult to distinguish whether the degradation is due to coding noise or IDCT mismatch in this test.

4. Conclusions

The following two conclusions can be derived from the experiments.

1) The occurence of the blocking phenomenon analyzed in Doc. #569 should be avoided by a certain method. A candidate of the method is to modifiy quantization representation levels.

2) If the phenomenon is avoided, there is no noticeable degradation due to IDCT mismatch when the IDCT and cyclic refresh specifications are met.

Receiver / Sender	A	B	C	D
A (NTT,KDD,NEC)		Red blocks, 2sec at H1	Luminance blocks, 1m at H0	
B (KDD,Mitsubishi)	Green blocks, (Q=3, fixed)		Green blocks, (Q=3, fixed)	
C (Fujitsu)		Red blocks (Q=3, fixed)		
D (OKI)				
E (Hitachi)	Blocks, 3sec at H0	Red blocks (Q=3, fixed, H0)		Red blocks(Q=3, fixed, H0)
F (GCT)			no error more than 2m at 2xB	
G				
H (BTRL)	Green blocks in few sec at H0	No error		
IDCT scheme, Comments, etc	Matrix, C=14,p=16 MC=INTRA=OFF	Matrix, C=14, P=16 (INMOS) MC=OFF	Matrix, C=14,P=16 MC=INTRA=OFF	FDCT
IDCT output for Qref=+-12	+2/-2	+2/-1	+2/-2	+2/-2

Receiver / Sender	E	F	G	H
A (NTT,KDD,NEC)	random noises, 10sec at H0	Block, 2m at 2xB		
B (KDD,Mitsubishi)	Green blocks (Q=3, fixed at H0)	Green block (Q=3, fixed)		No error
C (Fujitsu)		no error more than 2m at 2xB		
D (OKI)				
E (Hitachi)				
F (GCT)				
G				
H (BTRL)				
IDCT scheme, Comments, etc	Matrix,C=12, P=12 (Not enough precision to the spec.) MC=INTRA=OFF	FDCT, 32bits floating point		Matrix, C=14,P=16 (INMOS)
IDCT output for Qref=+-12	+1/-1	+2/-2		+2/-1

Table 1. Test 1 (FH spec quantizer)

B: V=48K 2B: V=112K H1: V=1500K
2xB: V=64K H0: V=320K

Receiver / Sender	A	B	D	
A (NTT,KDD,NEC)		Not noticeable for 12sec, H1	Not noticeable for > 20sec, H0	
B (KDD,Mitsubishi)	Not noticeable for >10sec, H1		Not noticeable for > 20sec, H0	
D (OKI)		Not noticeable for > 20sec, H0		

Table 2. Test 2 (Modified quantization table 1)