CCITT SGXV
Working Party XV/1
Specialists Group on Coding
for Visual Telephony

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Title: PARTIAL SOLUTION TO IDCT MISMATCH PROBLEM

In document # 569 from the chairman it is reported that IDCT mismatch has occured in field trials although both IDCTs meet the CCITT specification. We feel that the general mismatch problem can not be completely solved, but the specific problems described in # 569 does have a solution which is given below.

The problem.

If one transform component F(u,v) is transmitted with u,v = 0 or 4 the inverse transformed values become

$$f(x,y) = \pm\ 1/8 * F(u,v)$$

If F(u,v) = 8m+4 the pixel values will be $\pm(m+\frac{1}{2})$ which may be interpreted differently in encoder and decoder and thus create mismatch.

If two components, 8m+i and 8n+j, are transmitted the pixel values will be $\pm m \pm n + 1/8*(\pm i \pm j)$ which creates the same problem if $\pm i \pm j = 4$ or 12.

A solution.

Several mismatch cases are avoided if the reconstruction levels in the inverse quantizer are odd numbers, which is achieved by the below formulas (see also Table 1).

rec = 0 lev = 0

a) step = 2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62 (=4k+2)

rec = + step * (lev+½)	lev > 0
rec = - step * (lev+½)	lev < 0

b) step = 4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64 (=4k)

rec = + step * (lev+½) - 1	lev > 0
rec = - step * (lev+½) + 1	lev < 0

Conclusion.

The given solution solves the already observed problem for the case that one or three components are non-zero. For two or four non-zero components the problem remains for some combinations of component values. For other frequencies than (u,v) = 0 or 4 the mismatch problem is as before.

step	lev = 0	1	2	3	4	5	...	127
2	0	3	5	7	9	11	...	255
4	0	5	9	13	17	21	...	509
6	0	9	15	21	27	35	...	765
8	0	11	19	27	35	43	...	1019
10	0	15	25	35	45	55	...	1275
12	0	17	29	41	53	65	...	1529
14	0	21	35	49	63	77	...	1785
16	0	23	39	55	71	87	...	2039
18	0	27	45	63	81	99	...	2295
20	0	29	49	69	89	109	...	2549
22	0	33	55	77	99	121	...	2805
24	0	35	59	83	107	131	...	3059
26	0	39	65	91	117	143	...	3315
28	0	41	69	97	125	153	...	3569
30	0	45	75	105	135	165	...	3825
32	0	47	79	111	143	175	...	4079
34	0	51	85	119	153	187	...	4335
36	0	53	89	125	161	197	...	4589
38	0	57	95	133	171	209	...	4845
40	0	59	99	139	179	219	...	5099
42	0	63	105	147	189	231	...	5355
44	0	65	109	153	197	241	...	5609
46	0	69	115	161	207	253	...	5865
48	0	71	119	167	215	263	...	6119
50	0	75	125	175	225	275	...	6375
52	0	77	129	181	233	285	...	6629
54	0	81	135	189	243	297	...	6885
56	0	83	139	195	251	307	...	7139
58	0	87	145	203	261	319	...	7395
60	0	89	149	209	269	329	...	7649
62	0	93	155	217	279	341	...	7905
64	0	95	159	223	287	351	...	8159

Table 1. Quantizer reconstruction values.