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

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SOURCE: CHAIRMAN
TITLE : IDCT SPECIFICATION

This document is issued to clarify the results of the Paris meeting (September 1988) on the subject matter. The content is a reproduction of Annex 4 to Doc. #395R plus a random number generator program which has been kindly provided by Mr. Haskell.

Please note the following two points;

- In Item 1, a method to arrange the random number generator output into 8x8 blocks is described for clarification.

- The required refresh interval "at least once every 128 coded frames" (see § 5.4/Doc. #395R) will be included in the appropriate part of the codec specification.

END

IDCT SPECIFICATION

1. Generate random integer pixel data values in the range -L to +H according to the attached random number generator (C version). Arrange into 8x8 blocks by allocating each set of consecutive 8 numbers in a row. Data sets of 10,000 blocks each should be generated for (L=256, H=255), (L=H=5) and (L=H=300).

2. For each 8x8 block, perform a separable, orthonormal, matrix multiply, Forward Discrete Cosine Transform (FDCT) using at least 64-bit floating point accuracy.

3. For each block, round the 64 resulting transformed coefficients to the nearest integer values. Then clip them to the range -2048 to +2047. This is the 12-bit input data to the inverse transform.

4. For each 8x8 block of 12-bit data produced by step 3, perform a separable, orthonormal, matrix multiply, Inverse Discrete Cosine Transform (IDCT) using at least 64-bit floating point accuracy. Round the resulting pixels to the nearest integer, and clip to the range -256 to +255. These blocks of 8x8 pixels are the "reference" IDCT output data.

5. For each 8x8 block of 12-bit data produced by step 3, use the proposed IDCT chip or an exact-bit simulation thereof to perform an Inverse Discrete Cosine Transform. Clip the output to the range -256 to +255. These blocks of 8x8 pixels are the "test" IDCT output data.

6. For each of the 64 IDCT output pixels and for each of the 10,000 block data sets generated above, measure the peak, mean and mean square error between the "reference" and "test" data.

7. For any pixel, the peak error should not exceed 1 in magnitude.
   For any pixel, the mean square error should not exceed 0.06.
   Overall, the mean square error should not exceed 0.02
   For any pixel, the mean error should not exceed 0.015 in magnitude.
   Overall, the mean error should not exceed 0.0015 in magnitude.

8. All-zeros in must produce all zeros out.

9. Rerun the measurements using exactly the same data values of step 1, but change the sign on each pixel.

```
                        /*L and H must be long, ie, 32 bits*/
long rand(L,H)
long   L,H;
{
static long   randx = 1;    /*long is 32 bits*/
static double    z = (double)0x7fffffff;

long   i,j;
double x;                   /*double is 64 bits*/

       randx = (randx * 1103515245) + 12345;
       i = randx & 0x7fffffff;                    /*keep 31 bits*/
       x = ( (double)i ) / z;                     /* range 0 to 1.0 */
       x *= (L+H);                          /* range 0 to L+H */
       j = x + 0.5;                         /*rounded integer*/
       return( j - L );
}
```