

C C I T T S G X V
WORKING PARTY XV/1

Specialists Group on Coding
for Visual Telephony

SOURCE : FRANCE

FOR INFORMATION

TITLE : IMPROVEMENTS ON THE RM5
ADAPTIVENESS OF THE 2D RUNLENGTH TABLE

-°-

INTRODUCTION

In the reference model n° 5 that is depicted in doc # 339, the coding is done by the use of a 2D run length table where each "event" is coded with a huffman's algorithm.

An event is a combination of a magnitude (non zero quantization index) and a RUN (number of zeroes preceeding the current non zero coefficient).

However, the "non zero" coefficients and the "zero" coefficients mainly depend on the quantizer step size (9). Then the 2D run length table must not to be the same for each quantizer.

On the other hand, the reference model uses the same table for the "events" of the chrominance signal. But the chrominance signal has not the same characteristics and this table must not have the same efficiency.

SIMULATION

First step

Using the reference model n° 5 at $p \times 59.4$ kbit/s (for $p = 1$ and $p = 5$), we have computed the probability of occurrence of each event for each quantizer and independently for both signals Y and U-V. In accordance with the probabilities, we have generated a set of VLC for each case using the huffman's algorithm.

It appears that :

- for the luminance, the sets of VLC are quite closed but it is possible to make out four main areas.
- for the chrominance, the statistics are almost the same and we have only defined one set of VLC.

This set is quite different of the four previous sets.

The 2D runlength tables are given figures 1-5. The control strategy is given figure 6.

Second step

We have included this 4+1 2D runlength tables in the reference model n° 5. The 2D table is taken according to the quantizer. All the results are given in the following pages. The curves show the improvements between the both models.

CONCLUSION

At 59,4 kbit/s, the bests improvements are obtained for the sequences SWING (+ 0,5dB for Y and + 0,6dB for C) and SALESMAN (+ 0,4dB for Y and + 0,3dB for C). For the others sequences the improvement of the SNR values is about + 0,2dB.

At 297 kbit/s, the improvements of the SNR values are smaller but the SNR never decreases.

ALGORITHM : RM5
 BIT RATE : 59,4 kbit/s
 SOURCE : ALCATEL FRANCE
 DATE : 1st SEPTEMBER 1988

NUMBER OF PICTURES CODED :

CLAIRE : 148
 SWING : 123
 TREVOR : 28

SEQUENCY	CLAIRE	SWING	TREVOR	
RMS Y	3,37	9,97	5,85	
RMS C	2,54	6,28	2,82	
SNR Y	37,57	28,16	32,79	
SNR C	40,02	32,17	39,14	
STEP SIZE	24,07	28,23		
NB OF NON ZEROES	2,78	1,91	2,03	
NB OF ZEROES	8,05	18,99	4,03	
////////////////////////////////////				
INTRA	0	0	0	
FIXED	281	264	235	
FIXED MC	6	2	37	
INTER	57	113	28	
INTER MC	50	7	93	
////////////////////////////////////				
MB ATTRIBUTES	422	511	476	
MOTION VECTORS	356	85	971	
E O B	1294	1459	1465	
COEFFICIENTS Y	3604	3225	2912	
COEFFICIENTS C	235	618	46	
////////////////////////////////////				
TOTAL	5911	5898	5870	

ALGORITHM : RM5
BIT RATE 59,4 kbit/s

NUMBER OF PICTURES CODED :

SOURCE ALCATEL FRANCE
DATE 1st SEPTEMBER 1988

SALESMAN : 138
MISS A : 48

SEQUENCY	SALESMAN	MISS A		
RMS Y	8,03	3,22		
RMS C	3,33	3,16		
SNR Y	30,04	37,71		
SNR C	37,67	38,13		
STEP SIZE	34,24	23,48		
NB OF NON ZEROES	2,22	1,93		
NB OF ZEROES	11,03	4,87		
////////////////////////////////////				
INTRA	0	0		
FIXED	258	224		
FIXED MC	7	22		
INTER	92	79		
INTER MC	35	69		
////////////////////////////////////				
MB ATTRIBUTES	504	573		
MOTION VECTORS	288	587		
E O B	1535	1790		
COEFFICIENTS Y	3535	2306		
C	46	621		
////////////////////////////////////				
TOTAL	5908	5877		

ALGORITHM : RM5 modified
BIT RATE 59,4 kbit/s

NUMBER OF PICTURES CODED :

SOURCE ALCATEL FRANCE
DATE 1st SEPTEMBER 1988

CLAIRE : 148
 SWING : 123
 TREVOR : 28

SEQUENCY	CLAIRE	SWING	TREVOR	
RMS Y	3,32	9,67	5,59	
RMS C	2,47	6,02	2,77	
SNR Y	37,71	28,41	33,18	
SNR C	40,28	32,53	39,27	
STEP SIZE	23,20	26,50	41,24	
NB OF NON ZEROES	2,87	2,00	2,09	
NB OF ZEROES	8,27	19,86	4,20	
////////////////////////////////////				
INTRA	0	0	0	
FIXED	278	255	233	
FIXED MC	6	2	35	
INTER	59	123	30	
INTER MC	50	8	95	
////////////////////////////////////				
MB ATTRIBUTES	428	542	479	
MOTION VECTORS	355	82	972	
E O B	713	852	759	
COEFFICIENTS Y	4135	3738	3592	
COEFFICIENTS C	282	684	60	
////////////////////////////////////				
TOTAL	5913	5898	5862	

ALGORITHM : RM5 modified
BIT RATE 59,4 kbit/s

NUMBER OF PICTURES CODED :

SOURCE ALCATEL FRANCE
DATE 1st SEPTEMBER 1988

SALESMAN : 138
MISS A : 48

SEQUENCY	SALESMAN	MISS A		
RMS Y	7,70	3,25		
RMS C	3,21	3,11		
SNR Y	30,40	37,90		
SNR C	38,00	38,28		
STEP SIZE	32,03	21,96		
NB OF NON ZEROES	2,31	2,14		
NB OF ZEROES	11,67	7,85		
////////////////////////////////////				
INTRA	0	0		
FIXED	249	243		
FIXED MC	7	9		
INTER	101	101		
INTER MC	36	43		
////////////////////////////////////				
MB ATTRIBUTES	531	555		
MOTION VECTORS	288	292		
E O B	829	948		
COEFFICIENTS Y	4192	3443		
COEFFICIENTS C	67	573		
////////////////////////////////////				
TOTAL	5907	5811		

ALGORITHM : RM5
 BIT RATE 297 kbit/s

NUMBER OF PICTURES CODED /
 WORKING FREQUENCY :

SOURCE ALCATEL FRANCE
 DATE 1st SEPTEMBER 1988

COST : 46 / 10 Hz
 JAPON : 28 / 15 Hz
 MISS A : 48 / 15 Hz
 SALESMAN : 138 / 10 Hz

SEQUENCY	COST	JAPON	MISS A	SALESMAN
RMS Y	3,21	3,02	2,52	4,01
RMS C	2,18	1,93	2,52	2,06
SNR Y	38,00	38,52	40,10	36,06
SNR C	41,38	42,41	40,12	41,83
STEP SIZE	13,14	11,24	10,77	12,57
NB OF NON ZEROES	4,75	3,55	2,81	3,89
NB OF ZEROES	10,85	11,88	9,95	26,77
////////////////////////////////////				
INTRA	0	0	0	0
FIXED	139	118	76	98
FIXED MC	0	0	0	0
INTER	122	248	264	237
INTER MC	132	28	55	59
////////////////////////////////////				
MB ATTRIBUTES	736	905	990	916
MOTION VECTORS	927	164	318	365
E O B	3065	3327	3834	3570
COEFFICIENTS Y	23315	14374	10183	24255
COEFFICIENTS C	1262	968	4688	571
////////////////////////////////////				
TOTAL	29305	19738	20013	29677

ALGORITHM : RM5 modified
BIT RATE 297 kbit/s

NUMBER OF PICTURES CODED /
WORKING FREQUENCY :

SOURCE ALCATEL FRANCE
DATE 1st SEPTEMBER 1988

COST : 46 / 10 Hz
 JAPON : 28 / 15 Hz
 MISS A : 48 / 15 Hz
 SALESMAN : 138 / 10 Hz

SEQUENCY	COST	JAPON	MISS A	SALESMAN
RMS Y	3,22	2,98	2,52	3,98
RMS C	2,19	1,92	2,52	2,06
SNR Y	37,96	38,64	40,11	36,13
SNR C	41,33	42,46	40,11	41,83
STEP SIZE	13,19	10,93	10,71	12,41
NB OF NON ZEROES	4,76	3,58	2,83	3,94
NB OF ZEROES	10,87	11,91	10,04	27,06
////////////////////////////////////				
INTRA	0	0	0	0
FIXED	138	109	72	95
FIXED MC	0	0	0	0
INTER	123	258	268	239
INTER MC	132	27	55	50
////////////////////////////////////				
MB ATTRIBUTES	739	932	998	922
MOTION VECTORS	927	161	320	367
E O B	2284	2795	3233	2915
COEFFICIENTS Y	23917	14628	10269	24811
COEFFICIENTS C	1403	1217	5161	656
////////////////////////////////////				
TOTAL	29270	19733	19981	29671

FIGURE 1

eob = 2

ZONE 1 2D FOR Y

[illegible]

ZONE 3 2D FOR Y

[illegible]

ZONE 4 (2D LUMINANCE)

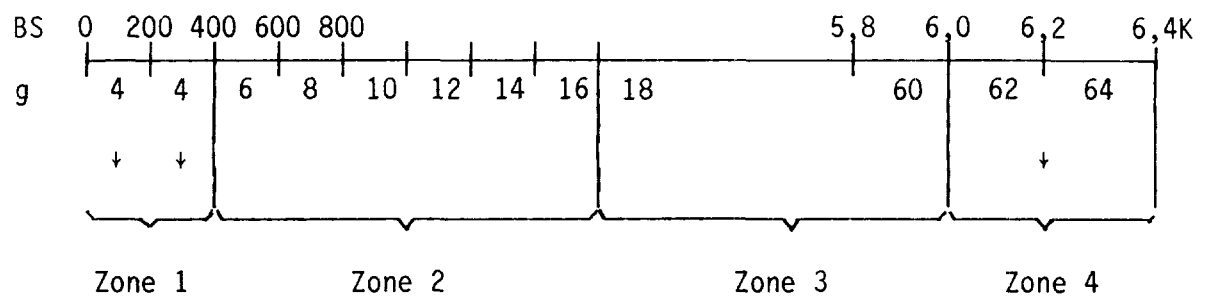
[illegible]

2D FOR CHROMINANCE

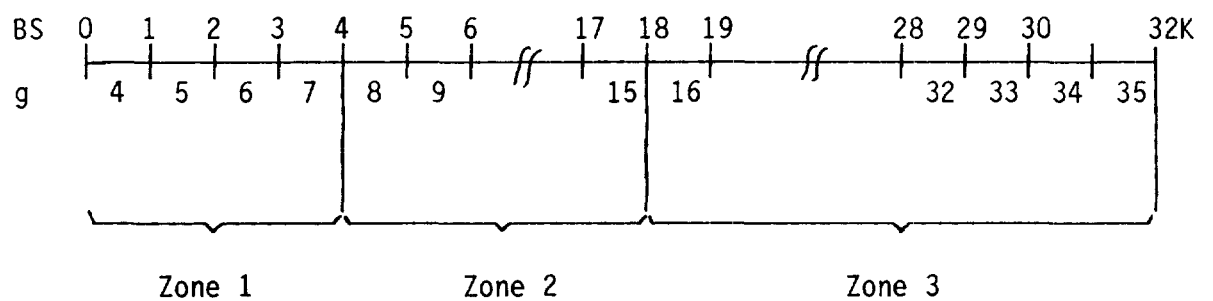
[illegible]

CHOICE OF THE AREAS $f(ctp)$

$p = 1 \Rightarrow$ 59,4 kbit/s



$p = 5 \Rightarrow$ 297 kbit/s



F I G U R E 6

