

Specialists Group on Coding
for Visual Telephony

Title : RM5 improvements : Variable Thresholding technique.

Source : France

During the last period, several modifications have been attempted to improve the RM5 scheme. Hereafter some modifications are presented which allow to get better quality in some sequences that are particularly difficult to encode at 60 kbit/s. For example, the convergence on the SWING and SALESMAN sequences is faster and the final quality is really better.

MODIFICATION 1

The first -and more effective- modification consists in changing the thresholding.

In RM5, the value of the threshold T is the same as the first quantization level : $T = G$. In this method, the threshold is variable and its value depends on the length of strings of zeroes. It is then assumed that the transformed components have been scanned to form a one dimensional set of coefficients, before the quantization process. The accuracy of the coefficients is then 12 bits. Referring to this scale, the stepsize G is transmitted in each GOB header as in RM5, but the threshold T is modified within the block according to the variable thresholding algorithm as follows :

$T = G$

$T_{max} = G + G/2$

do while (scanning the block)

```
  if (coefficient < T) then
    if (T < Tmax) then
      T = T + 1
    else
      T = Tmax
    end if
  else
    T = G
  end if
```

end do

MODIFICATION 2

The second modification consists in changing the addressing mode of the 8×8 blocks.

In RM5, an End Of Block is transmitted for each of the 6 8×8 sub-blocks (encoded or not encoded) of a coded macro-block.

It has been noticed that more than half of the macro-blocks do not have their chrominance sub-blocks encoded.

It is proposed to use a block header containing one bit to signal whether the chrominance is coded or not, and 4 (resp. 6 bits) to signal the luminance coded sub-blocks (resp. luminance and chrominance coded sub-blocks).

Statistics show that there is a very little benefit in all the sequences except for MISS AMERICA in which a lot of chrominance sub-blocks are coded.

MODIFICATION 3

The third modification consists in replacing the remaining EOB by the transmission of the number of events.

With these modifications, a new 2-D VLC is employed in which the events $(0,+1)$ and $(0,-1)$ are 2 bit length word coded. In addition, there are some slight changes in the 2-D VLC table (without complete optimization up to now).

CONCLUSION

A great improvement has been observed in the SWING and SALESMAN sequences, in subjective quality as well as in terms of S.N.R. This improvement is mainly due to modification 1.

Actually, the Variable Thresholding technique speeds up the convergence of the coding scheme in all stationary parts of the images, which leads to save bits mostly in the background and implies a better coding of the moving parts.

Annexes : Numerical data charts
S.N.R. plots

Statistics : CLAIRE
 Bit rate : 59.4 Kbps
 Source : CNET/France
 Date : 30/08/88

Sequence Frame rate		RM5	RM5+
R.M.S.	Y:	3.28	3.20
	C:	2.58	2.51
S.N.R.	Y:	37.81	38.03
	C:	39.89	40.15
Step size		22.81	19.15
Non zeroes	Y:	3.07	3.14
	C:	1.50	1.84
Zeroes	Y:	8.19	5.32
	C:	3.91	2.94
MACRO BLOCK TYPE			
Overflow		0	0
Fixed		287	278
Fixed MC		7	7
Inter		52	62
Inter MC		48	47
NUMBER OF BITS			
MB Attributes		406	1039
Motion vectors		446	433
E O B		1211	810
Coefficients:	Y:	3605	3391
	C:	245	237
Total		5913	5910

Statistics : MISS A
 Bit rate : 59.4 Kbps
 Source : CNET/France
 Date : 30/08/88

Sequence Frame rate		RM5	RM5+
R.M.S.	Y:	3.33	3.27
	C:	3.05	2.97
S.N.R.	Y:	37.69	37.84
	C:	38.45	38.68
Step size		22.16	18.26
Non zeroes	Y:	2.53	2.61
	C:	1.31	1.33
Zeroes	Y:	6.76	4.42
	C:	2.74	1.52
MACRO BLOCK TYPE			
Overflow		0	0
Fixed		235	219
Fixed MC		25	20
Inter		63	81
Inter MC		72	74
NUMBER OF BITS			
MB Attributes		534	1547
Motion vectors		777	763
E O B		1629	683
Coefficients:	Y:	2361	2315
	C:	543	532
Total		5844	5840

Statistics : SWING
 Bit rate : 59.4 Kbps
 Source : CNET/France
 Date : 30/08/88

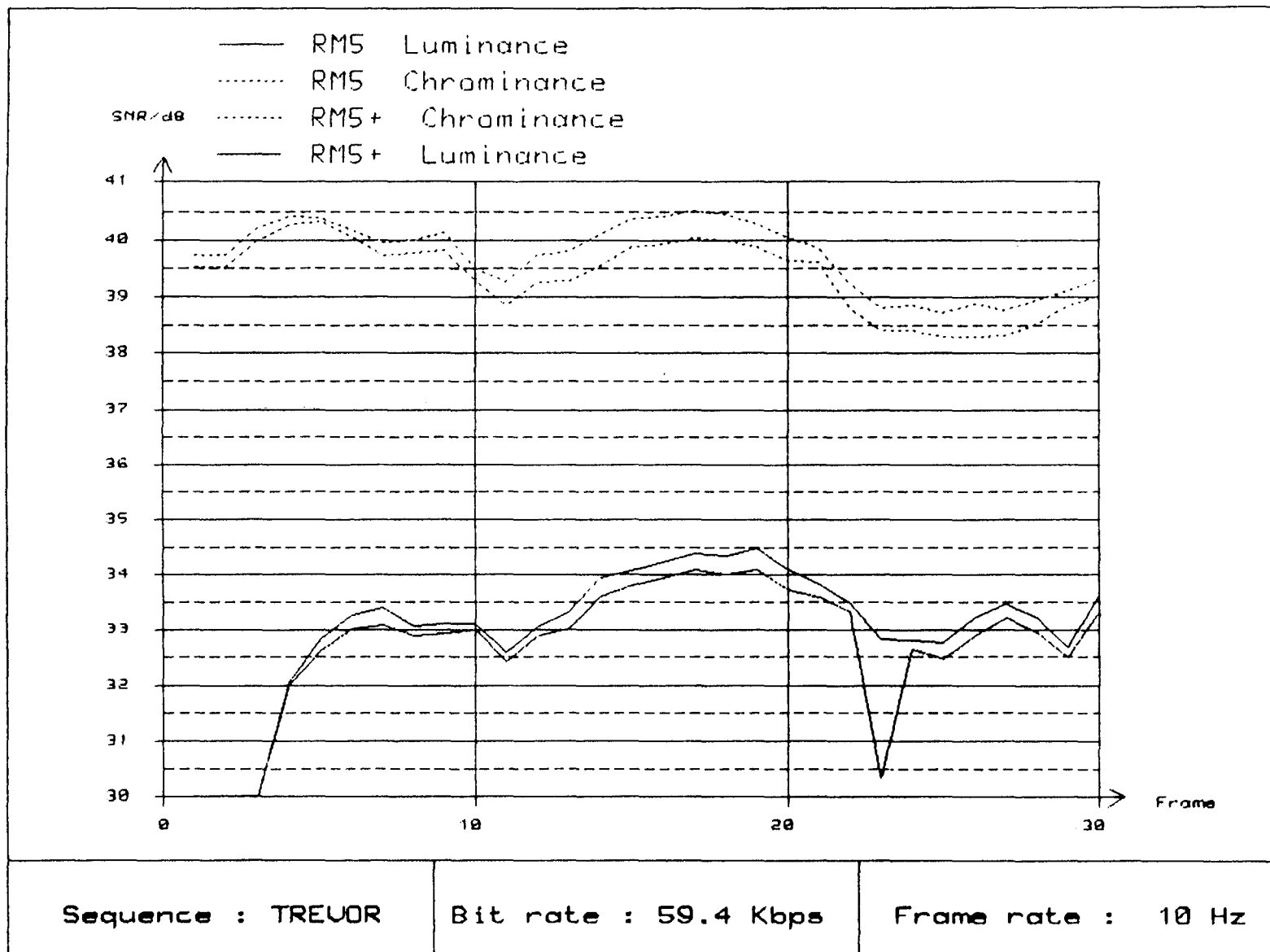
Sequence Frame rate		RM5	RM5+
R.M.S.	Y:	8.52	7.12
	C:	5.73	4.46
S.N.R.	Y:	29.52	31.08
	C:	32.96	35.14
Step size		28.22	21.86
Non zeroes	Y:	2.02	2.61
	C:	1.96	2.72
Zeroes	Y:	21.96	20.92
	C:	13.47	14.14
MACRO BLOCK TYPE			
Overflow		7	6
Fixed		268	284
Fixed MC		1	1
Inter		110	95
Inter MC		7	7
NUMBER OF BITS			
MB Attributes		496	1004
Motion vectors		78	75
E O B		1424	616
Coefficients:	Y:	3317	3469
	C:	591	731
Total		5906	5895

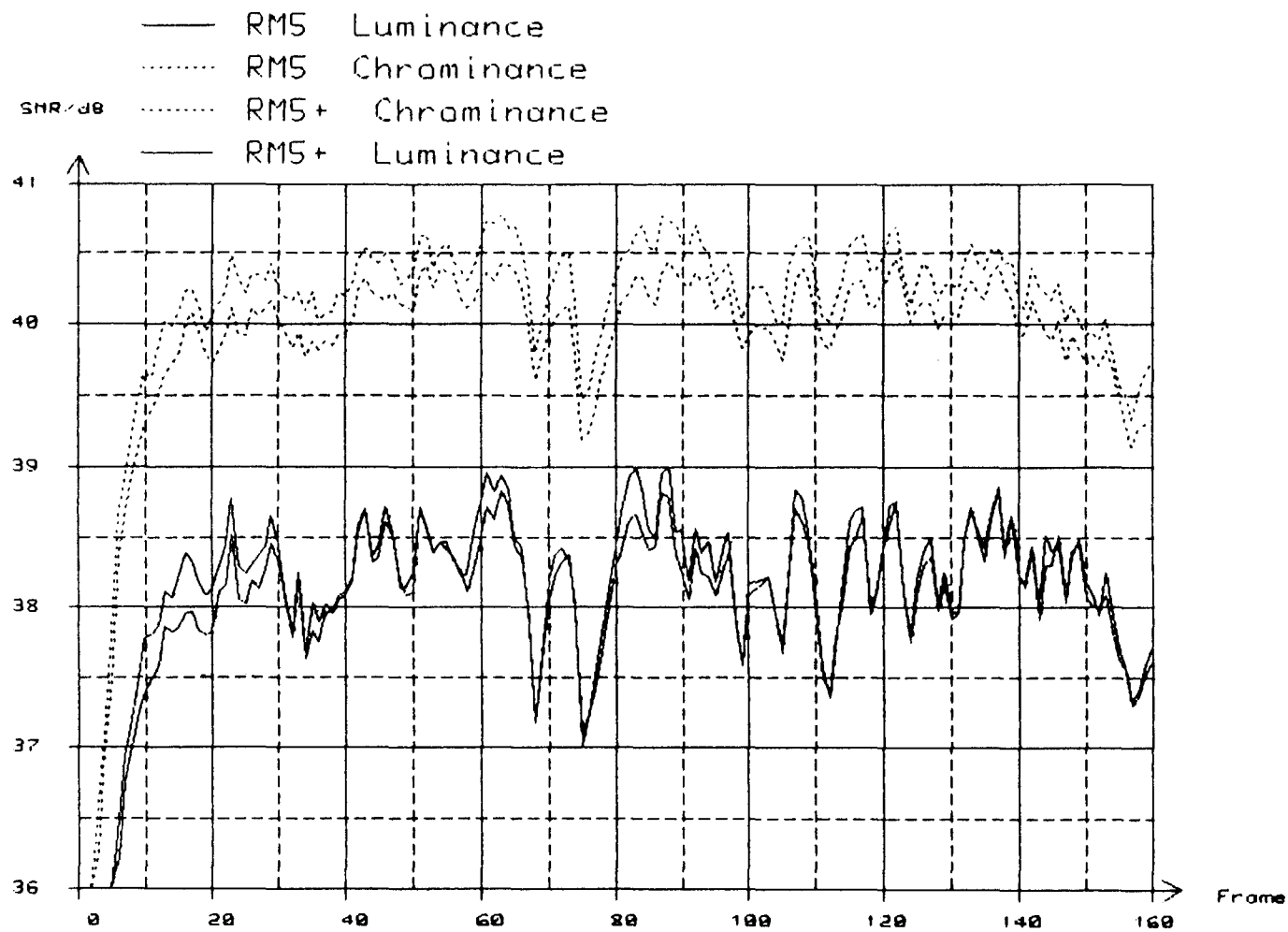
Statistics : TREVOR
 Bit rate : 59.4 Kbps
 Source : CNET/FRANCE
 Date : 30/08/88

Sequence Frame rate		RM5	RM5+
R.M.S.	Y:	5.90	5.62
	C:	2.77	2.66
S.N.R.	Y:	32.71	33.14
	C:	39.27	39.64
Step size		43.20	38.52
Non zeroes	Y:	2.03	2.10
	C:	1.06	1.08
Zeroes	Y:	4.40	3.55
	C:	.41	.36
MACRO BLOCK TYPE			
Overflow		1	0
Fixed		233	230
Fixed MC		39	35
Inter		29	31
Inter MC		92	97
NUMBER OF BITS			
MB Attributes		482	1166
Motion vectors		1049	1067
E O B		1453	646
Coefficients:	Y:	2842	2934
	C:	40	42
Total		5866	5855

Statistics : SALESMAN
 Bit rate : 59.4 Kbps
 Source : CNET/France
 Date : 30/08/88

Sequence Frame rate		RM5	RM5+
R.M.S.	Y:	8.15	7.18
	C:	3.27	2.92
S.N.R.	Y:	29.91	31.01
	C:	37.85	38.82
Step size		34.80	26.68
Non zeroes	Y:	2.36	2.95
	C:	1.21	1.26
Zeroes	Y:	12.56	10.57
	C:	2.27	2.12
MACRO BLOCK TYPE			
Overflow		2	1
Fixed		255	260
Fixed MC		8	7
Inter		94	89
Inter MC		35	36
NUMBER OF BITS			
MB Attributes		518	1149
Motion vectors		346	350
E O B		1551	704
Coefficients:	Y:	3456	3645
	C:	44	60
Total		5915	5908





Sequence : CLAIRE

Bit rate : 59.4 Kbps

Frame rate : 10 Hz

