

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

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SOURCE : NTT, KDD, NEC and FUJITSU

TITLE : REFERENCE MODEL SIMULATION

A reference model No.4 described in Annex 2 to Document #216R has been implemented by four Japanese Laboratories. The numerical data of the simulation have shown similar results. Compared with RM3, RM4 gives improvement of 0.2-0.7 dB in SNR for luminance. Two kinds of quantizer threshold which are $1.0 \times g$ and $1.5 \times g$ were examined based on RM4, and threshold of $1.0 \times g$ was better than or equal to that of $1.5 \times g$ in SNR evaluation for all of the sequences.

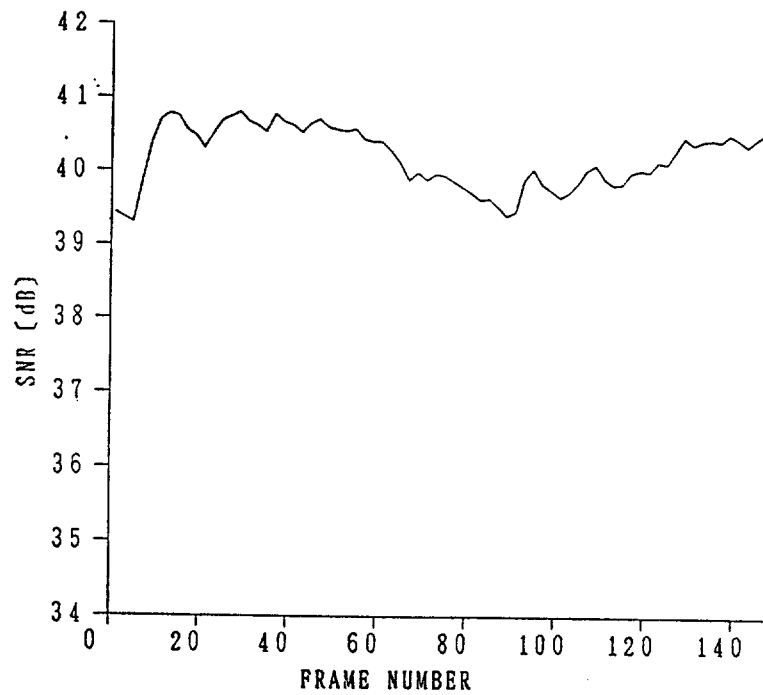
As a conclusion, RM4 gives better performance and can be used for algorithm comparison purpose.

One of these results is shown in annex. ...

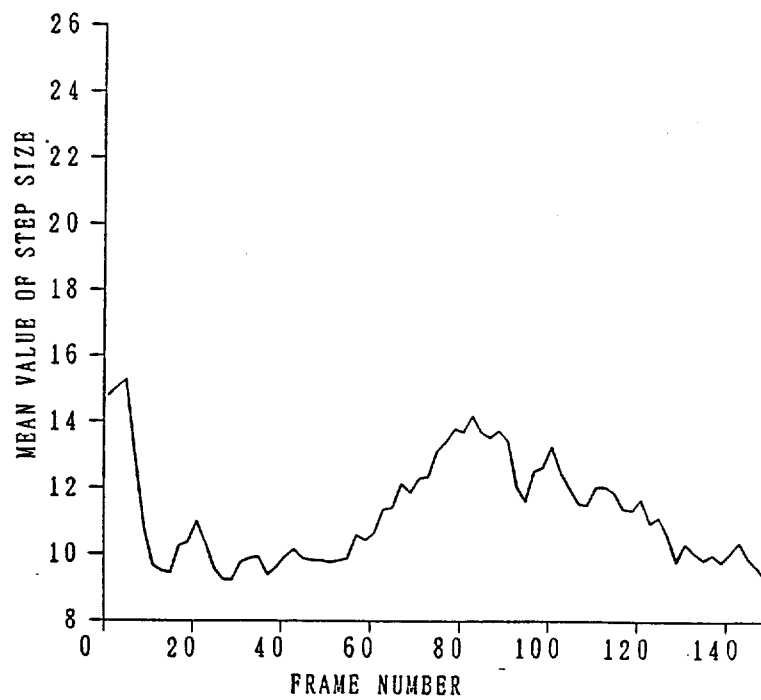
Annex

Evaluation table of RM4

Items			M A		C J		S P - T R	
			15th	Average	15th	Average	15th	Average
1) R. M. S for luminance			2.4	2.5	3.1	3.1	4.0	3.3
2) SNR for luminance			40.7	40.2	38.2	38.3	36.1	37.6
3) Mean value of the step size			9.8	11.1	11.8	11.6	17.0	13.7
4) Mean value of the number of non-zero coefficients			2.6	2.6	3.3	3.2	3.8	4.2
5) Mean value of the number of zeroes before the last non-zero coefficient			8.1	6.9	8.3	8.6	6.7	6.8
6) Block type of Y	Fixed		1014	989	941	937	650	772
	Intra		0	1	1	2	14	43
	Filtered Fixed		87	81	52	74	84	64
	Non-filt Fixed MC		30	56	25	18	37	27
	Filtered Fixed MC		16	58	18	15	146	61
	Non-filt Inter		246	152	341	344	179	141
	Filtered Inter		109	72	84	78	68	54
	Non-filt Inter MC		48	85	64	65	181	170
	Filtered Inter MC		34	88	58	51	225	251
	Filtered		246	300	212	219	523	430
7) Block type of C	Fixed		283	330	571	571	519	567
	Intra		0	1	0	0	19	10
	Filtered Fixed		96	81	43	36	61	58
	Non-filt Inter		191	164	143	150	77	77
	Filtered Inter		222	216	35	34	116	81
	Filtered		318	297	78	70	177	138
8) Number of bits	Attributes	Y	2886	2996	2934	3004	4107	3566
		Cr	741	712	461	466	625	525
		Cb	1097	1002	438	466	563	565
		Total	4724	4710	3833	3936	5295	4656
	Classification indexes		874	797	1096	1079	1334	1318
	EOB		1700	1559	1452	1449	1758	1654
	Motion Vectors		1024	2308	1320	1192	4712	4073
	Coefficients	Y	7065	6351	11456	10872	14694	16298
		Cr	1361	1470	497	567	1352	839
		Cb	3355	2692	360	402	919	878
		Total	11781	10513	12313	11841	16965	18015
	Total		20103	19887	20014	19497	30064	29714

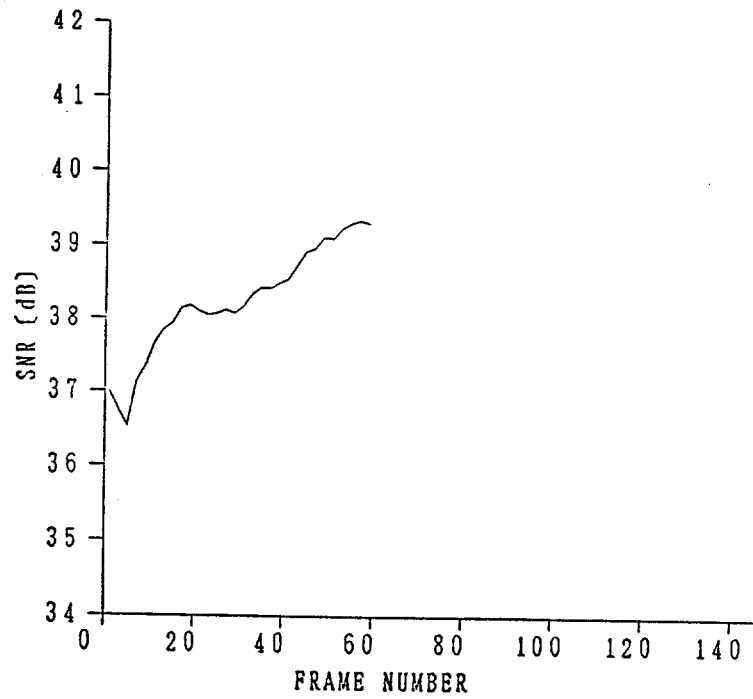


(a) SIGNAL TO NOISE RATIO

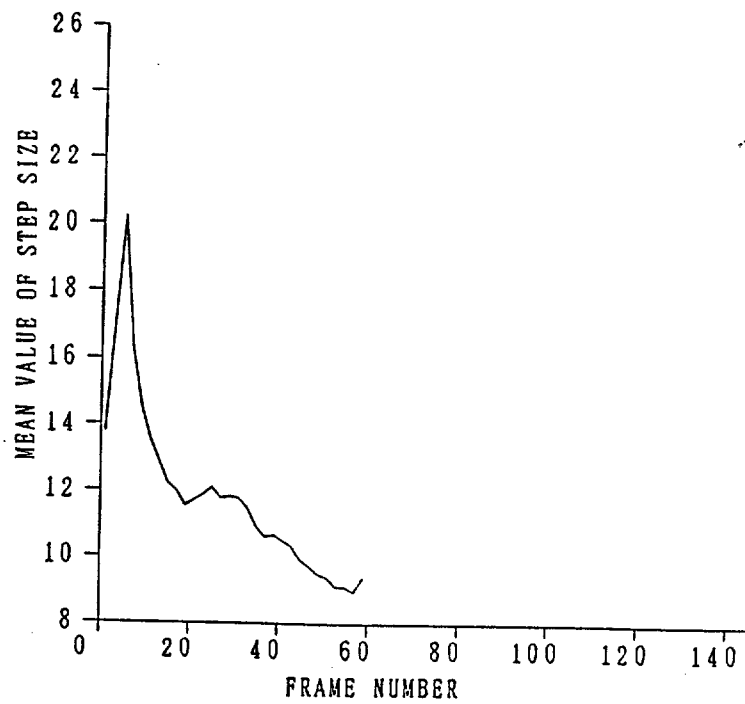


(b) MEAN VALUE OF STEP SIZE

RESULT OF RM4
(Sequence: Miss America)

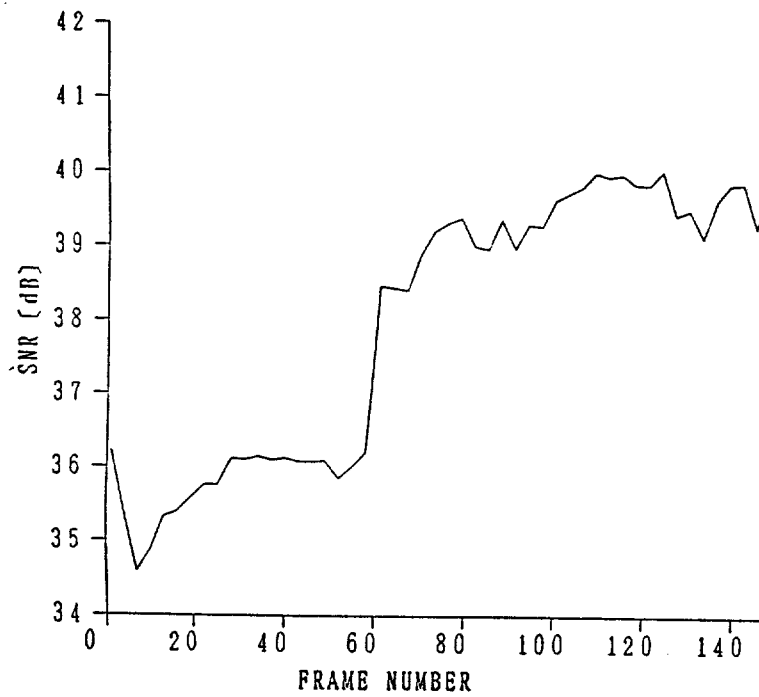


(a) SIGNAL TO NOISE RATIO

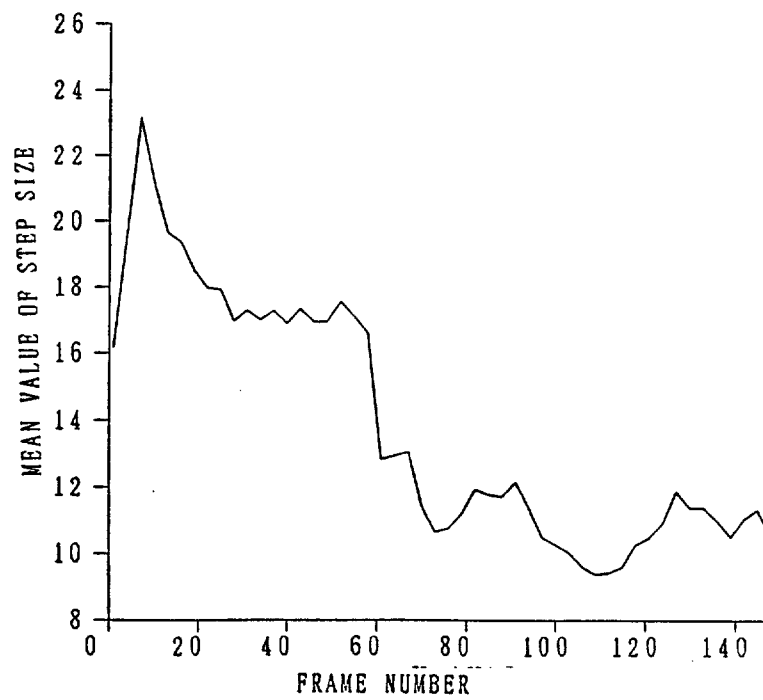


(b) MEAN VALUE OF STEP SIZE

RESULT OF RM4
(Sequence: Checked Jacket)



(a) SIGNAL TO NOISE RATIO



(b) MEAN VALUE OF STEP SIZE

RESULT OF RM4
(Sequence: Spiit-Trevor)

Comparison between RM 4 and RM 3

Sequence : Miss America

Items	R M 4		R M 3	
	15th	Average	15th	Average
1) R.M.S for luminance	2.4	2.5	2.4	2.5
2) SNR for luminance	40.7	40.2	40.5	40.0
3) Mean value of the step size	9.8	11.1	7.2	8.2
4) Mean value of the number of non-zero coefficients	2.6	2.6	2.4	2.5
5) Mean value of the number of zeroes before the last non-zero coefficient	8.1	6.9	7.1	6.3

Sequence : Checked Jacket

Items	R M 4		R M 3	
	15th	Average	15th	Average
1) R.M.S for luminance	3.1	3.1	3.4	3.3
2) SNR for luminance	38.2	38.3	37.6	37.6
3) Mean value of the step size	11.8	11.6	8.8	8.8
4) Mean value of the number of non-zero coefficients	3.3	3.2	3.6	3.0
5) Mean value of the number of zeroes before the last non-zero coefficient	8.3	8.6	9.1	8.1

Sequence : Split-Trevor

Items	R M 4		R M 3	
	15th	Average	15th	Average
1) R.M.S for luminance	4.0	3.3	4.2	3.5
2) SNR for luminance	36.1	37.6	35.7	37.2
3) Mean value of the step size	17.0	13.7	12.7	10.3
4) Mean value of the number of non-zero coefficients	3.8	4.2	3.6	3.9
5) Mean value of the number of zeroes before the last non-zero coefficient	6.7	6.8	6.2	6.3

Comparison of quantizer threshold

Sequence : Miss America

Items	1.0 * g (R M 4)		1.5 * g	
	15th	Average	15th	Average
1) R. M. S for luminance	2.4	2.5	2.4	2.5
2) SNR for luminance	40.7	40.2	40.7	40.3
3) Mean value of the step size	9.8	11.1	6.7	7.6
4) Mean value of the number of non-zero coefficients	2.6	2.6	2.5	2.6
5) Mean value of the number of zeroes before the last non-zero coefficient	8.1	6.9	7.4	6.7

Sequence : Checked Jacket

Items	1.0 * g (R M 4)		1.5 * g	
	15th	Average	15th	Average
1) R. M. S for luminance	3.1	3.1	3.3	3.2
2) SNR for luminance	38.2	38.3	37.8	38.0
3) Mean value of the step size	11.8	11.6	8.2	8.0
4) Mean value of the number of non-zero coefficients	3.3	3.2	3.0	2.9
5) Mean value of the number of zeroes before the last non-zero coefficient	8.3	8.6	7.1	7.6

Sequence : Split-Trevor

Items	1.0 * g (R M 4)		1.5 * g	
	15th	Average	15th	Average
1) R. M. S for luminance	4.0	3.3	4.1	3.4
2) SNR for luminance	36.1	37.6	36.0	37.4
3) Mean value of the step size	17.0	13.7	12.2	9.9
4) Mean value of the number of non-zero coefficients	3.8	4.2	3.8	4.0
5) Mean value of the number of zeroes before the last non-zero coefficient	6.7	6.8	6.4	6.6