

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

Source : JAPAN

Title : Higher bit rate operation of Reference Model 7

1 Introduction

In this document simulation results at higher bit rate operation of Reference Model 7 are presented.

2 Simulation Results

Table 1 shows the comparison with RM4 and RM6 at $q=5$. The difference of SNR between RM6 and RM7 mainly depends on the first scene and following several scenes. See also Figure 1 and 2.

The statistics tables of RM7 are shown in the Table 2 and 3. And the characteristics of SNR versus bit rate are shown in the Figure 4, 5 and 6.

In this simulation a step size of the first scene is according to the following table. And the size of buffer is equal to 1/10 of bit rate per second.

Video channels $q=$	1	5	11	17	23
Stepsize	32	16	16	16	12

3 Observation

For the Figure 3 a stepsize of RM7 is less stable than RM6. Probably the reason is that number of MB in a GOB is increased to 33 from 22. But this problem will be reduced with controlling a stepsize on Macro block basis.

For the Figure 6 we can find that 1 kbits correspond to 0.03 ~ 0.06 dB for SNR in the region nearby 60 kbps. So 1 kbits improvement on the coding efficiency can contribute 0.03 ~ 0.06 dB improvement on SNR.

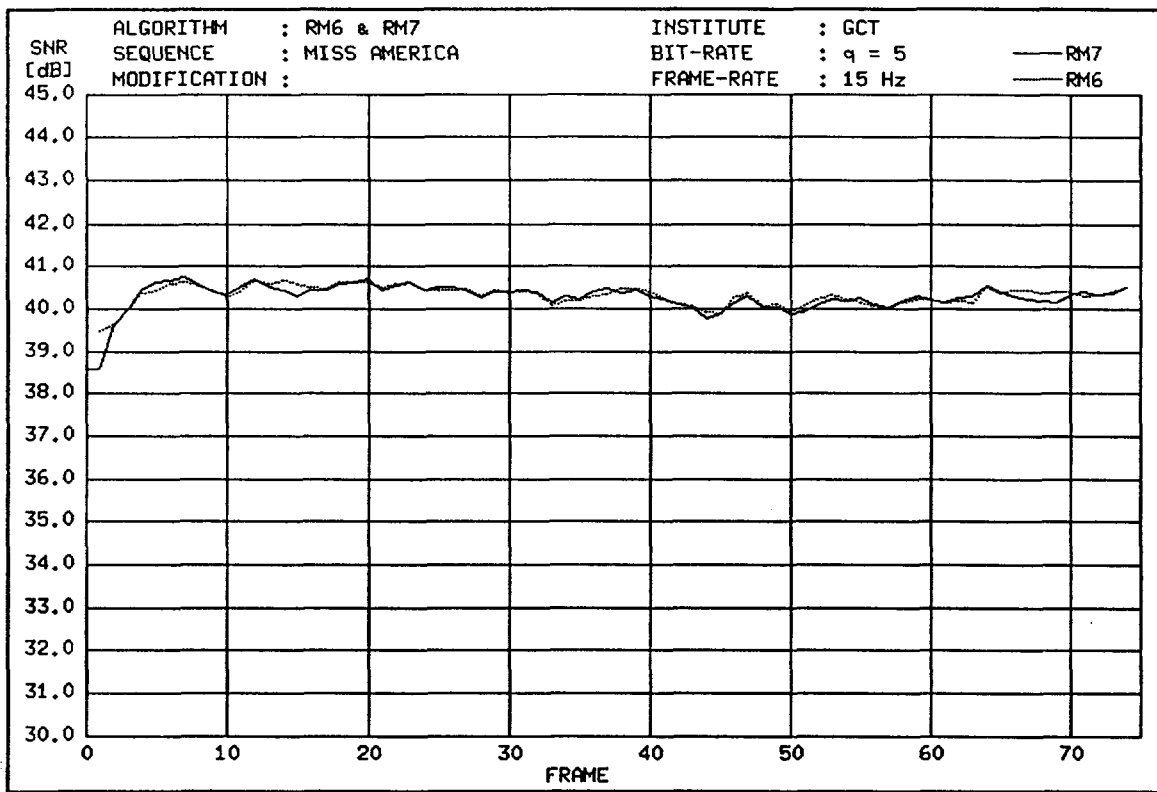


Figure 1: SNR for luminance "MISS AMERICA"

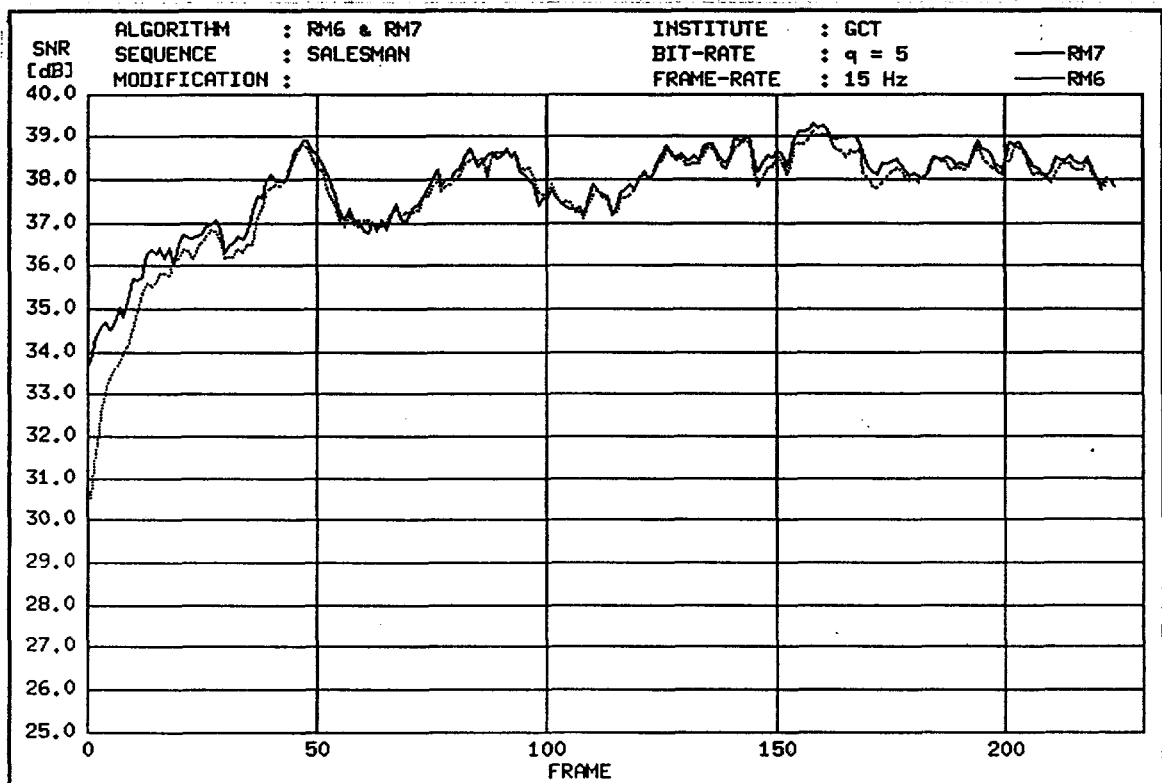


Figure 2: SNR for luminance "SALESMAN"

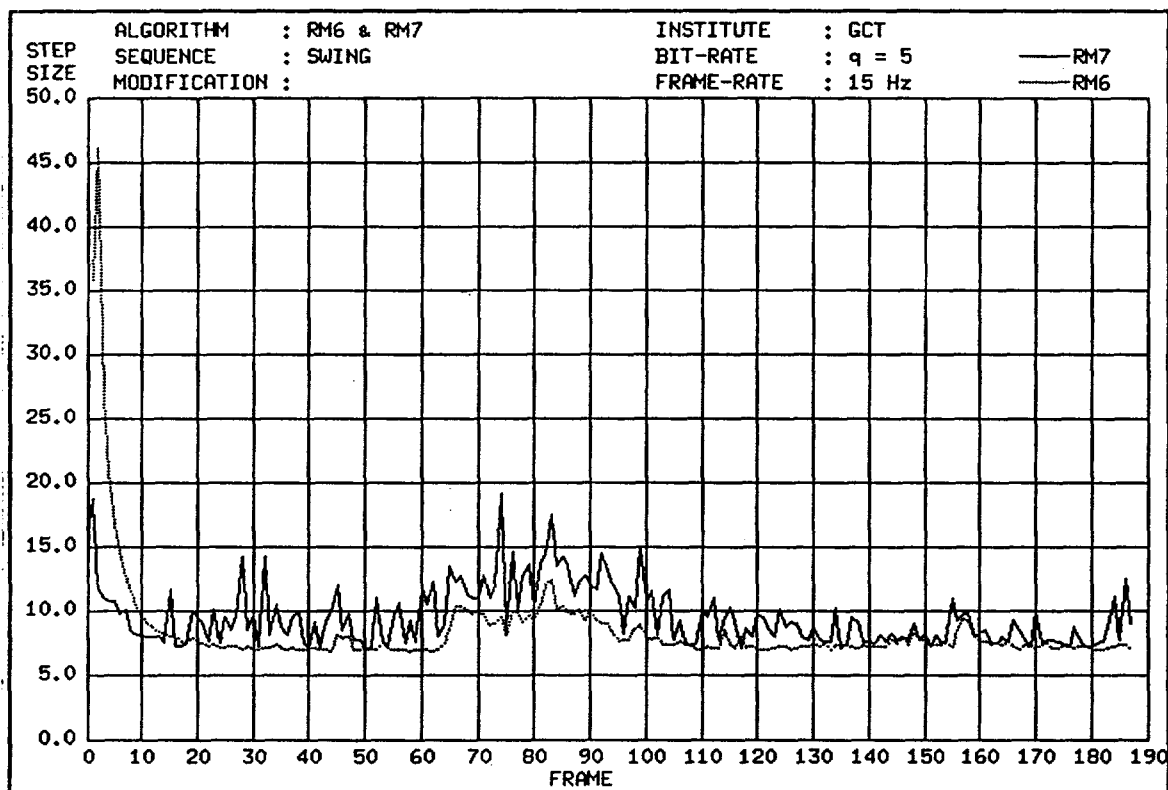


Figure 3: Ups and downs for stepsize "SWING at $q=5$ "

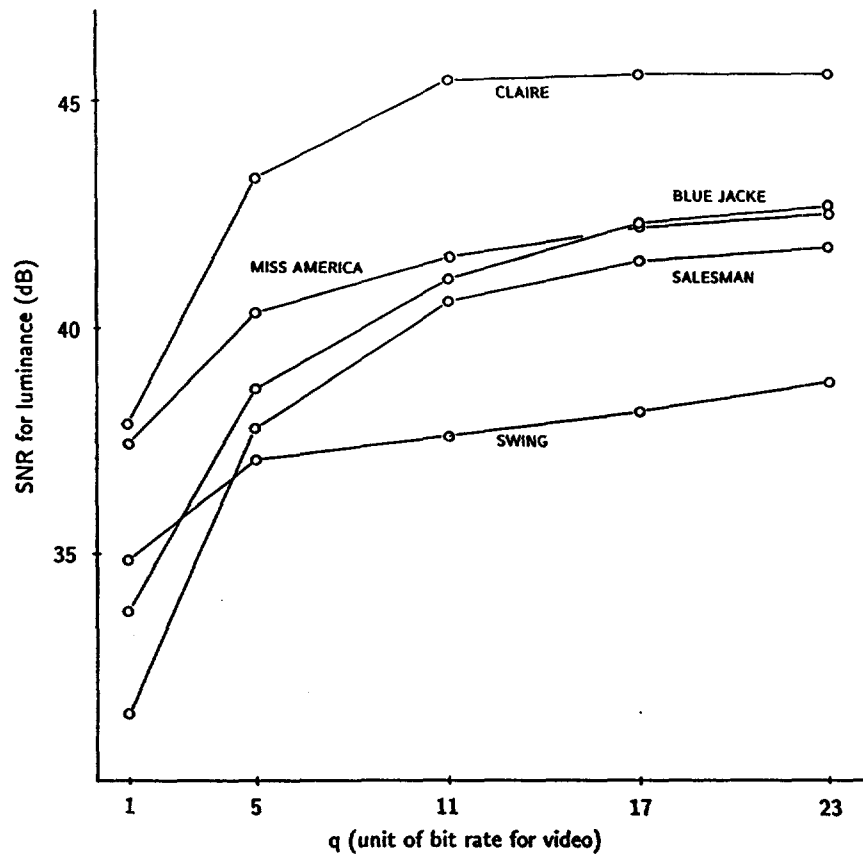


Figure 4: SNR for luminance vs. bit rate, frame rate 15 Hz

Table 1: Comparison with RM4 and RM6 at $q=5$

Sequence	MISS AMERICA			SALESMAN		
Frame rate	15 Hz			15 Hz		
Transmission rate	$q=5$			$q=5$		
Reference Model	RM4	RM6	RM7	RM4	RM6	RM7
RMS of luminance	2.5	2.45	2.46	3.7	3.40	3.30
SNR of luminance (dB)	40.2	40.36	40.32	36.8	37.50	37.76

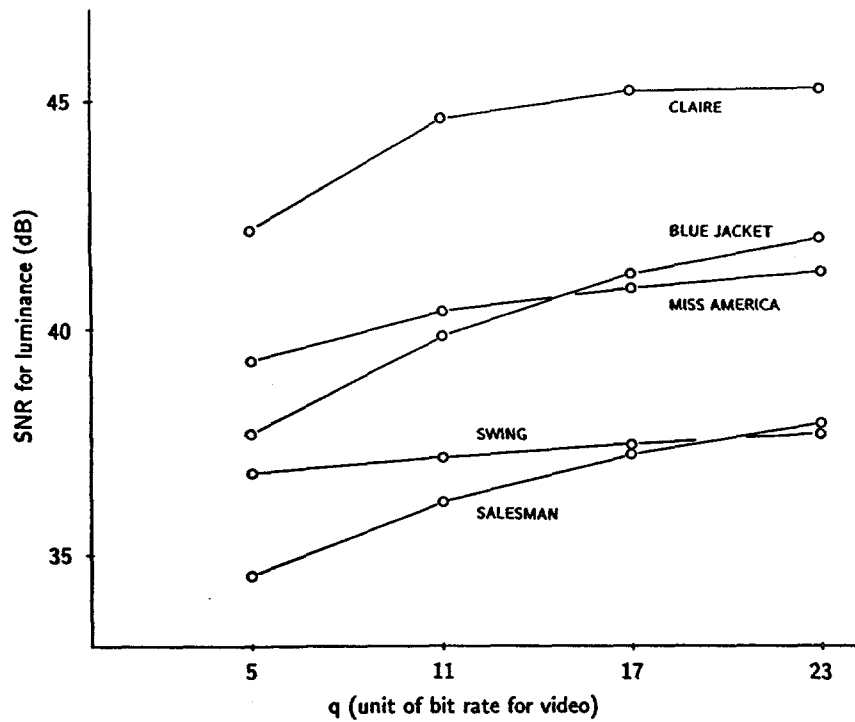


Figure 5: SNR for luminance vs. bit rate, frame rate 30 Hz

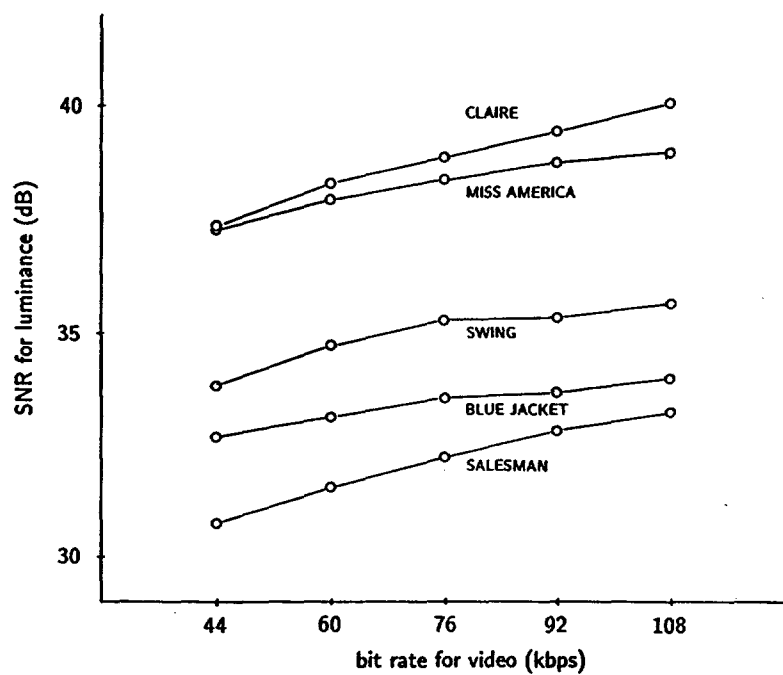


Figure 6: SNR for luminance vs. bit rate, frame rate 10 Hz

Table 2: Simulation Results of RM7 at $q=5$

Statistics RM7
Bit-rate : $q=5$

Institute : G.C.T.
Date : March 7, 1989
Frame-rate : 30 Hz

ITEM		blue	claire	miss	sales	swing
SNR for luminance	Y	38.67	43.29	40.32	37.77	37.09
SNR for chrominance	U	41.83	43.37	39.57	43.04	40.51
	V	40.64	46.06	41.85	43.99	40.61
RMS for luminance	Y	2.97	1.75	2.46	3.30	3.57
RMS for chrominance	U	2.07	1.73	2.68	1.80	2.40
	V	2.37	1.27	2.06	1.61	2.38
Mean value of step size		9.19	6.65	8.64	8.94	9.59
Mean value of number of non-zero coefficients	Y	5.90	5.21	3.49	5.65	3.40
	C	2.20	2.47	2.36	1.74	2.84
	Y and C	5.07	4.57	2.98	5.09	3.41
Mean value of number of zeroes before the last NZ	Y	13.31	9.86	9.88	14.86	36.78
	C	7.16	6.45	4.78	3.87	14.16
	Y and C	11.91	9.06	7.60	13.29	35.20
Block type of MACRO	Intra	0	0	0	1	0
	Fixed	193	179	85	199	179
	Fixed MC	0	0	1	0	2
	Coded	186	178	240	165	208
	Coded MC	17	38	70	31	7
Block type of Y	Fixed	1190	1115	1011	1128	1060
	Fixed MC	14	18	99	17	15
	Coded	324	315	287	333	489
	Coded MC	56	136	187	107	19
Block type of C	Fixed	682	656	409	719	747
	Coded	110	136	383	74	45
Number of bits	Macro attr.	1468	1546	2349	1349	1422
	EOB	1428	1642	2433	1409	1517
	MV	92	204	369	177	74
	Coeff. DC	4	0	0	15	8
	Coeff. Y	13547	13931	9707	15633	15590
	Coeff. U	470	1253	3377	454	718
	Coeff. V	847	529	1397	200	426
	TOTAL	17860	19108	19636	19240	19759

Table 3: Simulation Results of RM7 at $q=23$

Statistics RM7
Bit-rate : $q=23$

Institute : G.C.T.
Date : March 7, 1989
Frame-rate : 30 Hz

ITEM		blue	claire	miss	sales	swing
SNR for luminance	Y	42.02	45.23	41.24	37.87	37.66
SNR for chrominance	U	42.86	45.21	40.19	42.87	41.75
	V	42.08	47.25	42.82	43.83	41.77
RMS for luminance	Y	2.02	1.40	2.21	3.26	3.34
RMS for chrominance	U	1.84	1.40	2.49	1.83	2.09
	V	2.01	1.11	1.84	1.64	2.08
Mean value of step size		4.54	4.05	6.04	7.49	6.14
Mean value of number of non-zero coefficients	Y	6.11	5.15	4.41	5.17	3.98
	C	2.33	2.25	3.57	2.26	2.55
	Y and C	4.26	4.36	4.07	4.94	3.94
Mean value of number of zeroes before the last NZ	Y	19.59	11.12	31.67	40.51	42.43
	C	9.54	7.43	7.97	5.12	11.62
	Y and C	14.69	10.11	22.08	37.74	40.96
Block type of MACRO	Intra	0	0	0	0	0
	Fixed	26	103	24	89	36
	Fixed MC	0	0	0	0	0
	Coded	363	272	288	266	348
	Coded MC	7	21	84	41	11
Block type of Y	Fixed	975	1010	751	735	515
	Fixed MC	2	4	30	13	13
	Coded	581	490	497	683	1023
	Coded MC	27	80	306	153	33
Block type of C	Fixed	216	575	246	720	735
	Coded	576	217	546	72	57
Number of bits	Macro attr.	2919	2142	2682	1914	2227
	EOB	3087	2276	3464	2346	2775
	MV	34	92	555	206	101
	Coeff. DC	0	0	0	2	1
	Coeff. Y	24175	17679	27254	40009	39004
	Coeff. U	4897	1826	8428	672	786
	Coeff. V	6578	819	2753	253	477
	TOTAL	41692	24837	45139	45406	45374