

Title : 4/9CIF
Source : Japan

1. Introduction

The simulation results in this document show that for a complicated sequence RM5 processing of the 4/9 CIF sequence gives better results than RM5 processing of the full CIF sequence.

2. Decimation filter

For the decimation filter design a 7-tap hamming window was used. The filter coefficients are shown in Tables 1 and 2. The candidates for the decimation filters were 3,5,7 and 9tap filters truncated by rectangular, hamming and hanning windows. Subjective evaluation of the RM5 processed sequences was made for each filter.

3. Parameter tuning

The following parameters were tuned.

- (1) VLC table for relative addressing of non-fixed MB's.
- (2) VLC table for MB types.
- (3) 2-D VLC table.

Because tuning these parameters did not make a significant improvement in the picture quality, the original parameters were used for this simulation.

4. Simulation

Tables 3,4 and 5 and Figures 1,2,3 and 4 show the results for CIF,1/4CIF and 4/9CIF sequences. Table 6 and Figure 5 show the results for the 'Claire' sequence of '15Hz' 4/9CIF. The significant points are:

- (1) The subjective image quality of the 4/9CIF 'Salesman' and 'Swing' sequences appears better than CIF.
- (2) The SNR of the 15Hz 'Claire' sequence is the same as the 10Hz CIF.

5. Conclusion

As for a complicated sequence such as the 'Salesman' or the 'Swing', the resolution of 1/4CIF and the SNR of the full CIF are insufficient, besides, the resolution and the SNR of 4/9CIF are sufficient. As for a simple sequence such as the 'Claire', the increase in the frame rate up to 15Hz RM5 processing of 4/9CIF gives smooth object movements without a decrease in the SNR. These results clearly show that 4/9CIF should be included in the recommendation as proposed in the previous document#318.

Tap	-3	-2	-1	0	+1	+2	+3
Coef.	-2	0	64	132	64	0	-2

Table 1 : Decimation filter coefficient for CIF to 1/4CIF

Tap	-3	-2	-1	0	+1	+2	+3
Coef.0	0	-11	54	170	54	-11	0
Coef.1	-4	0	132	---	132	0	-4

Table 2 : Decimation filter coefficient for CIF to 4/9CIF

Table 3

Picture Format : FULL_CIF

Date : Sep 19, 1988

Bit-rate : 64 kbps

Frame-rate : 10 Hz

ITEM		CLAIRE	SWING	SALES	MISS
Number of coded pictures		164	124	149	49
SNR for luminance	Y	37.69	29.31	29.77	37.62
SNR for chrominance	U	38.57	32.07	37.42	37.72
	V	41.60	33.48	38.23	38.42
RMS for luminance	Y	3.33	8.73	8.28	3.36
RMS for chrominance	U	3.01	6.35	3.43	3.32
	V	2.12	5.40	3.13	3.06
Mean value of step size		23.01	29.00	35.26	23.77
Mean value of number of non-zero coefficients	Y	2.96	1.98	2.17	2.20
	C	1.39	1.69	1.15	1.34
Mean value of number of zeroes before the last NZ	Y	8.76	20.97	11.20	5.80
	C	3.55	13.16	1.88	3.38
Block type of MACRO	Fixed	286	275	258	230
	Fixed MC	7	1	7	25
	Coded	55	111	94	68
	Coded MC	46	7	34	71
Block type of Y	Fixed	1274	1379	1260	1131
	Fixed MC	93	18	83	263
	Coded	91	167	153	63
	Coded MC	124	18	86	125
Block type of C	Fixed	756	752	783	700
	Coded	34	38	8	91
Number of bits	Macro attr.	512	583	602	630
	EOB	1226	1428	1551	1685
	MV	435	75	338	778
	Coeff. Y	3496	3273	3380	2161
	Coeff. U	168	361	25	281
	Coeff. V	74	182	17	309
	TOTAL	5913	5904	5916	5847

Table 4

Picture Format : 4/9_CIF

Date : Sep 19, 1988

Bit-rate : 64 kbps

Frame-rate : 10 Hz

ITEM		CLAIRE	SWING	SALES	MISS
Number of coded pictures		164	124	149	49
SNR for luminance	Y	38.83	35.41	32.97	39.53
SNR for chrominance	U	39.78	37.12	38.81	38.39
	V	43.11	38.13	40.02	39.26
RMS for luminance	Y	2.92	4.33	5.73	2.69
RMS for chrominance	U	2.62	3.55	2.93	3.07
	V	1.78	3.16	2.55	2.78
Mean value of step size		15.07	19.53	20.27	14.91
Mean value of number of	Y	4.62	4.42	4.02	3.34
non-zero coefficients	C	2.66	3.71	1.43	1.79
Mean value of number of	Y	12.39	27.98	15.50	8.56
zeroes before the last NZ	C	9.22	24.43	5.97	7.35
Block type of MACRO	Fixed	107	127	98	77
	Fixed MC	0	0	0	2
	Coded	53	48	68	64
	Coded MC	17	3	12	36
Block type of Y	Fixed	541	583	523	481
	Fixed MC	16	5	11	67
	Coded	104	122	142	84
	Coded MC	57	8	41	87
Block type of C	Fixed	327	318	343	264
	Coded	32	40	16	93
Number of bits	Macro attr.	310	264	331	358
	EOB	854	621	971	1205
	MV	147	27	106	309
	Coeff. Y	4136	3886	4355	3054
	Coeff. U	316	631	86	509
	Coeff. V	153	461	58	454
	TOTAL	5918	5893	5908	5891

Table 5

Picture Format : 1/4_CIF

Date : Sep 19, 1988

Bit-rate : 64 kbps

Frame-rate : 10 Hz

ITEM		CLAIRE	SWING	SALES	MISS
Number of coded pictures		164	124	149	49
SNR for luminance	Y	39.81	39.19	35.10	40.08
SNR for chrominance	U	40.29	39.88	40.15	38.97
	V	43.23	40.71	41.23	39.47
RMS for luminance	Y	2.61	2.80	4.48	2.53
RMS for chrominance	U	2.47	2.59	2.51	2.87
	V	1.76	2.35	2.21	2.71
Mean value of step size		11.04	10.62	14.32	11.92
Mean value of number of	Y	6.19	3.73	5.52	4.77
non-zero coefficients	C	3.24	3.61	1.98	2.65
Mean value of number of	Y	15.41	28.17	20.85	11.67
zeroes before the last NZ	C	13.80	25.56	14.41	13.63
Block type of MACRO	Fixed	44	44	45	31
	Fixed MC	0	0	0	0
	Coded	46	52	48	48
	Coded MC	8	1	5	19
Block type of Y	Fixed	266	249	254	238
	Fixed MC	6	1	1	26
	Coded	94	139	120	77
	Coded MC	28	5	18	53
Block type of C	Fixed	165	151	174	117
	Coded	30	44	23	79
Number of bits	Macro attr.	211	203	208	225
	EOB	657	654	646	810
	MV	70	13	40	159
	Coeff. Y	4261	3721	4680	3378
	Coeff. U	395	673	212	763
	Coeff. V	196	460	120	577
	TOTAL	5793	5726	5909	5914

Table 6

Statistics RM5

Sequence : CLAIRE 246 frames

Date : Sep 19, 1988

Bit-rate : 64 kbps

Frame-rate : 15 Hz

ITEM		MEAN	1st	2nd	3rd	15th
SNR for luminance	Y	38.27	33.88	33.25	34.50	38.02
SNR for chrominance	U	39.25	35.76	35.73	36.28	38.74
	V	42.65	40.11	39.73	40.17	42.49
RMS for luminance	Y	3.11	5.16	5.54	4.80	3.20
RMS for chrominance	U	2.78	4.15	4.17	3.91	2.95
	V	1.88	2.52	2.63	2.50	1.91
Mean value of step size		17.23	34.50	47.33	33.50	17.00
Mean value of number of	Y	3.76	3.47	1.85	2.53	3.70
non-zero coefficients	C	1.63	2.45	1.10	1.25	1.89
Mean value of number of	Y	12.30	4.08	6.33	7.70	12.10
zeroes before the last NZ	C	6.06	3.11	5.60	3.54	8.72
Block type of MACRO	Fixed	123	85	118	116	120
	Fixed MC	0	0	13	2	0
	Coded	43	95	30	46	47
	Coded MC	12	0	19	16	13
Block type of Y	Fixed	579	399	538	552	577
	Fixed MC	13	0	97	32	11
	Coded	86	321	54	96	91
	Coded MC	40	0	31	40	41
Block type of C	Fixed	335	296	350	332	342
	Coded	23	64	10	28	18
Number of bits	Macro attr.	275	180	285	290	283
	EOB	675	1140	588	744	720
	MV	108	0	256	144	104
	Coeff. Y	2670	8559	863	1803	2773
	Coeff. U	143	2043	59	146	136
	Coeff. V	69	1711	13	38	65
	TOTAL	3941	13633	2064	3165	4081

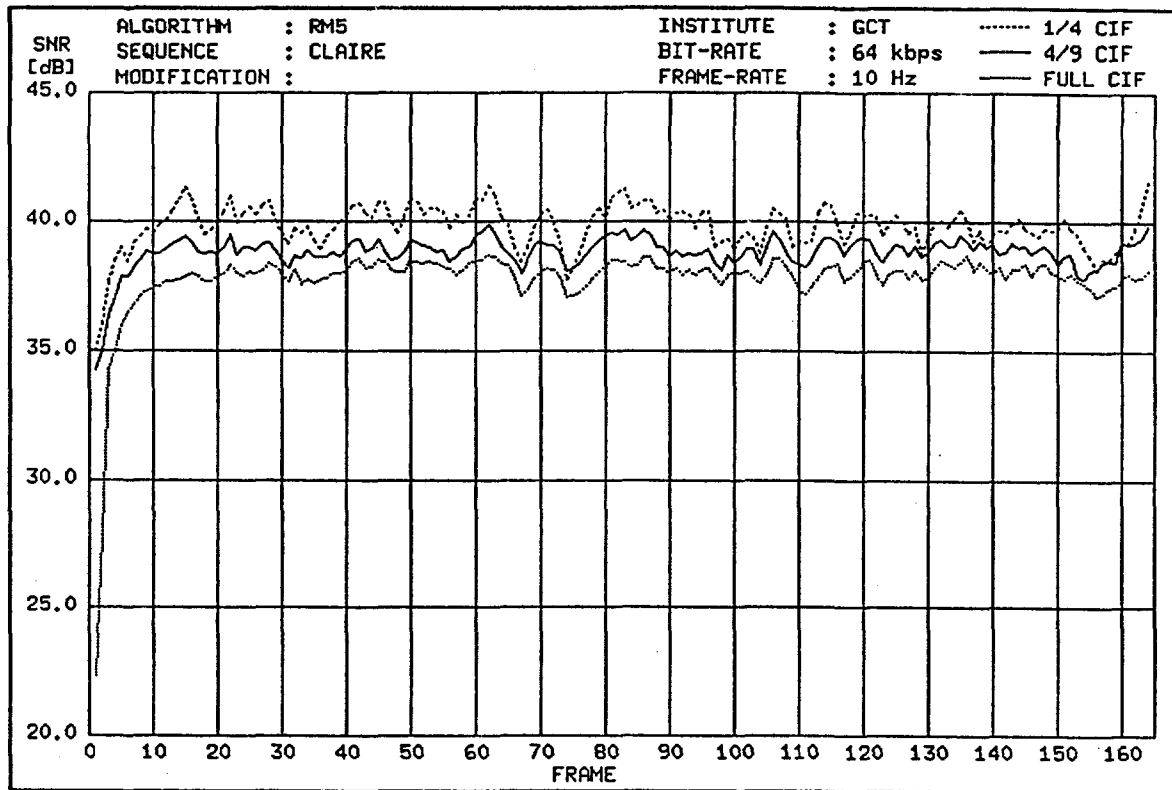


Figure 1: SNR for luminance, sequence : CLAIRE

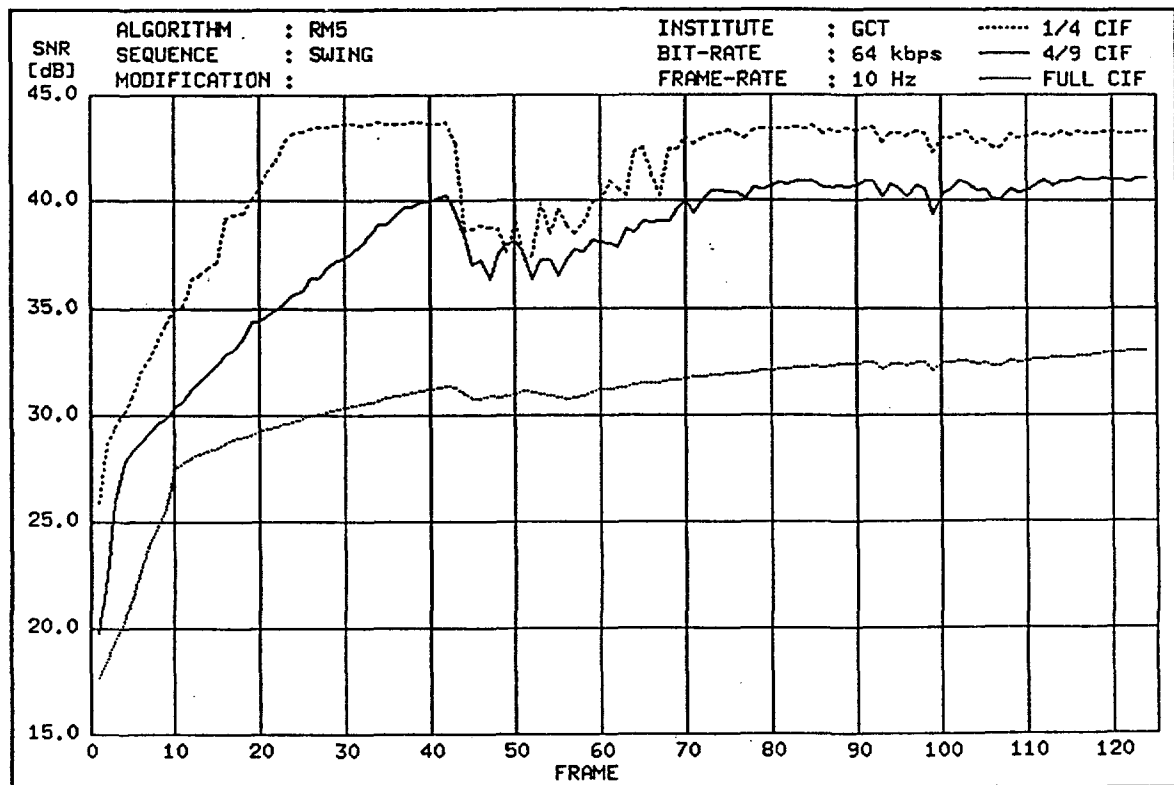


Figure 2: SNR for luminance, sequence : SWING

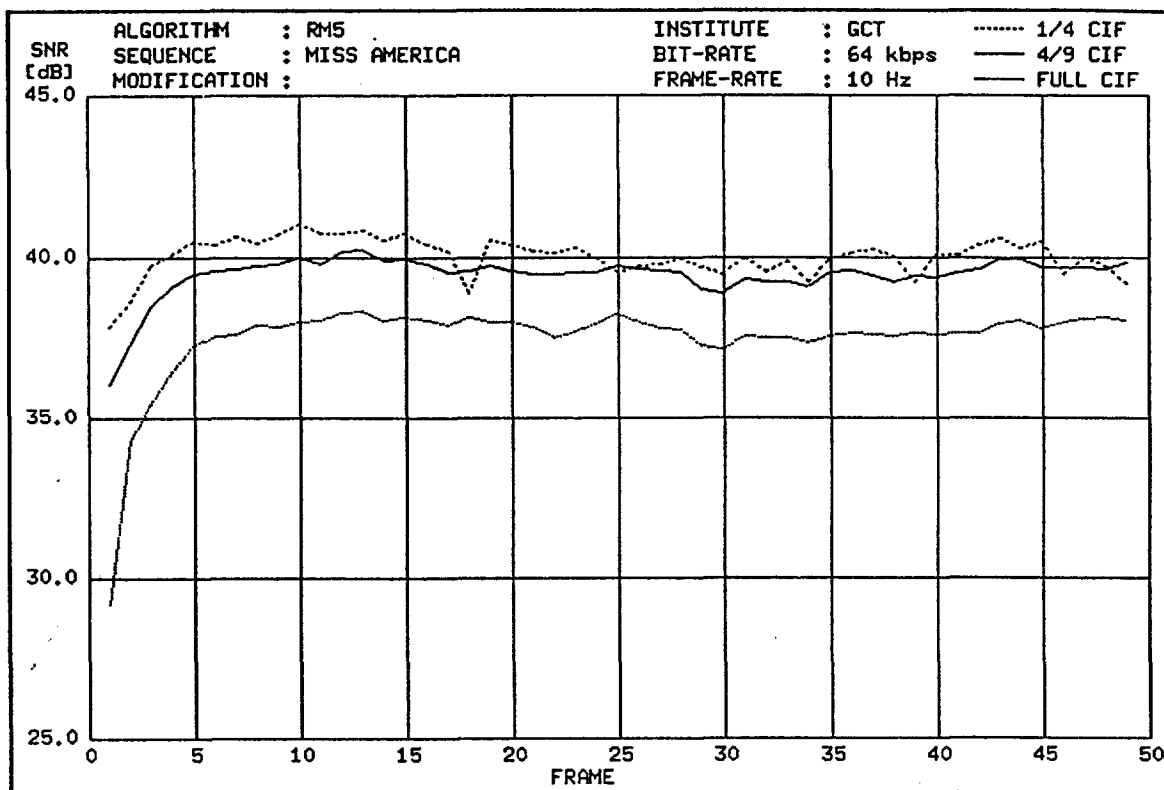


Figure 3: SNR for luminance, sequence : MISS AMERICA

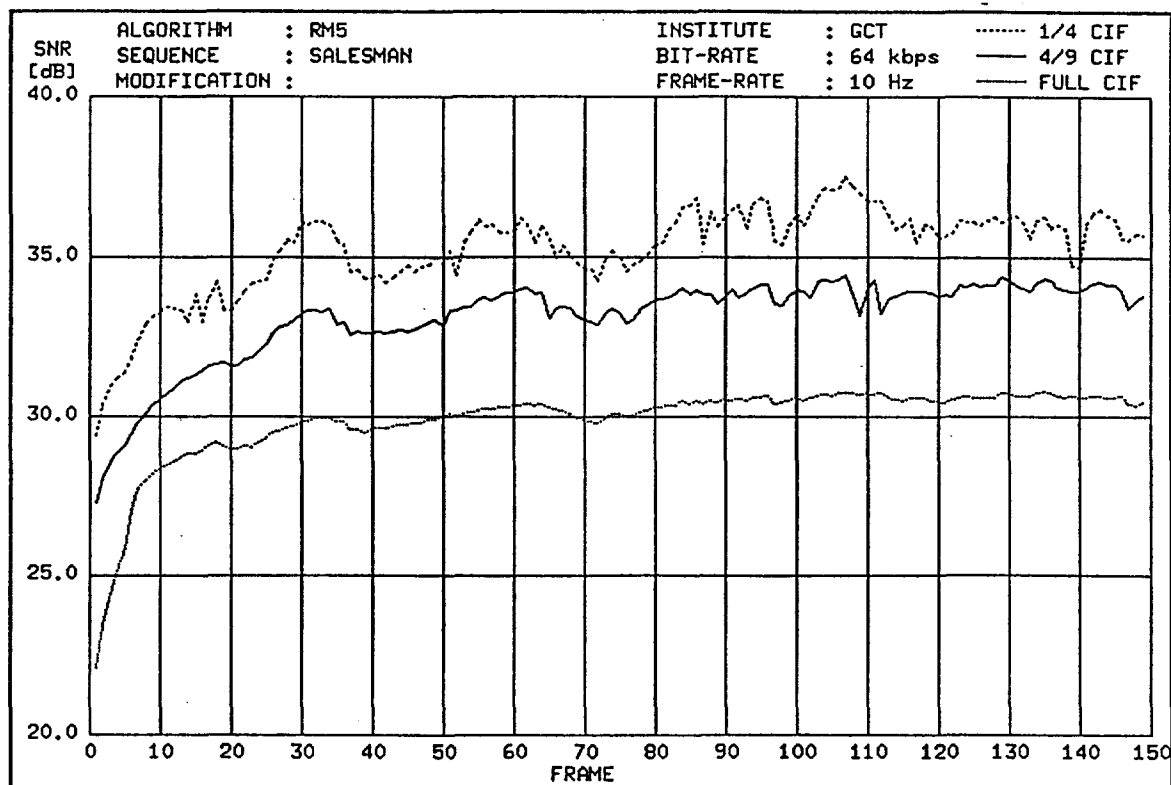


Figure 4: SNR for luminance, sequence : SALESMAN

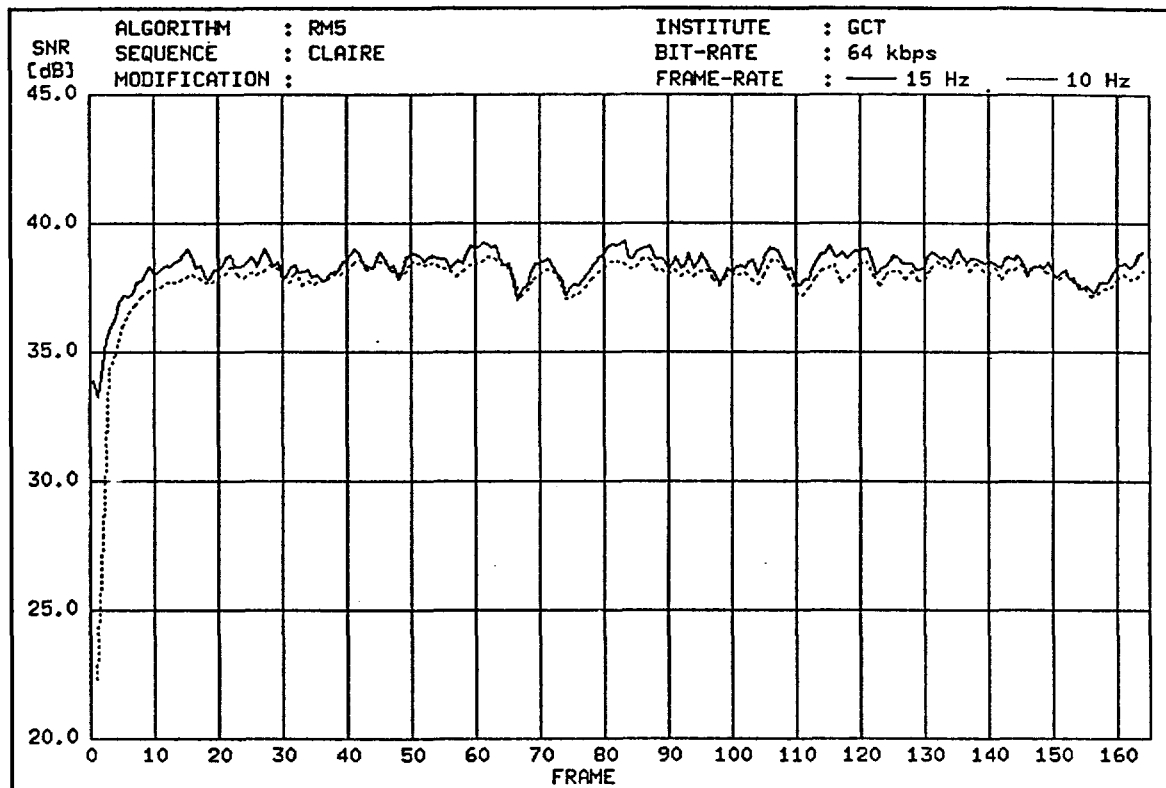


Figure 5: SNR for luminance, frame rate : 15Hz 4/9 CIF
10Hz Full CIF