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Experts Group for ATM Video Coding
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SOURCE : OKI Electric Industry Co., Ltd
TITLE : Rate control method based on sub-band coding for VBR video transmission
PURPOSE : Information

1. Introduction

This document describes a study of a maximum coding rate control method based on sub-band coding, and the effect of the method on subjective visual perception.

2. Coding system

7 sub-band coding (Figure 1 (a)(b))
LLLL : Intraframe DCT coding
LLLU~UU : Interframe prediction + DCT coding

3. Rate control method

A "jumping window" of 1 frame interval is taken as a rate observation window, and quantization is controlled starting from the band which is difficult for the eye to perceive so as to control the maximum rate.

(1) The coding rate for the previous frame ($I = I_{LLLL} + I_{LLLU} \cdots + I_{UU}$) is taken as a coding rate prediction value I_P for the current frame.
(2) I_P is compared with a maximum coding rate set value I_M, so as to calculate the difference $D = I_P - I_M$.
(3) If $D > 0$, the quantization stepsize for the UU band is adjusted, the prediction coding rate I_{PUU} is found from tables, and we re-write $D = D - (I_{UU} - I_{PUU})$.
(4) Procedure (3) is applied in the order UL, LU, LLUU, LLUL, LLLU until $D \leq 0$ (it is not applied to LLLL).
(5) Quantization and coding are performed using the stepsize chosen in (3).

4. Simulation results

The results given are for experiments carried out on 75 frames taken from the CCIR Rec. 601 test pictures "Table Tennis" and "Flower Garden". Table 1 shows the average coding rate and average SNR ; Figure 2(a)(b) show the time variation of SNR. The set maximum coding rates were 16 Mbps and 24 Mbps. With the exception of the initial frame and scene changes, the maximum coding rate was successfully controlled to the set rate.

5. Subjective evaluation

Subjective evaluation tests were performed on reconstructed images obtained by simulation. The evaluation method used was DSCQS which is described in the CCIR Rec. 500-3. Figure 3(a)(b) show the picture quality difference between the reference picture and reconstructed picture when the reference picture was given 100 points. For the most part, the results clear the broadcast quality distribution standards of CCIR Rep. AG/11 (-12%), but there is considerable deterioration of "Flower Garden" which originally had a high coding rate.

6. Conclusions

We have described studies of maximum coding rate control method and the effect of this control on subjective visual perception. As a results of evaluations, we confirmed that the maximum coding rate could be controlled to a suitable value except in the case of scene changes. Future topics include how to set the maximum coding rate and the average coding rate while satisfying quality requirements or achieving better quality.

END

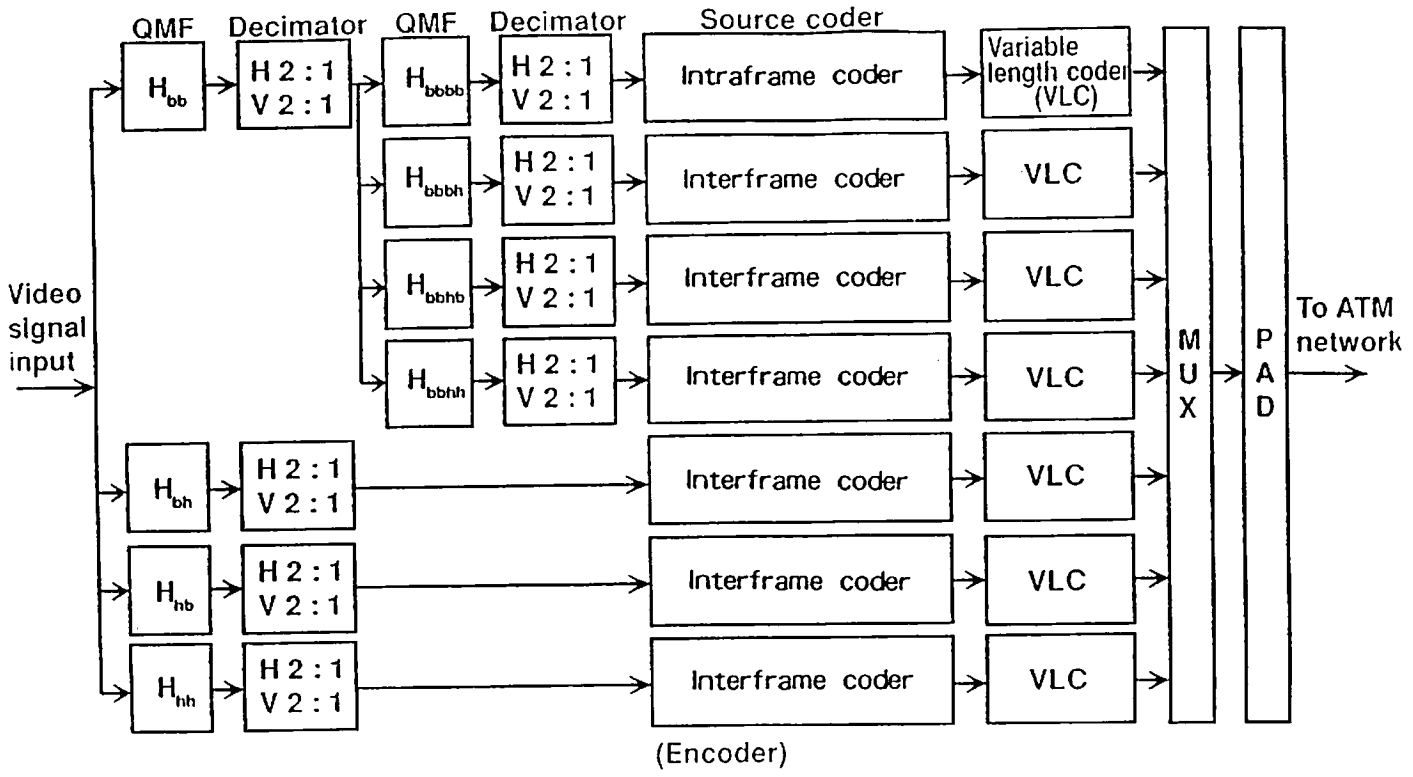

Figure 1(a) Encoder block diagram of variable rate video codec

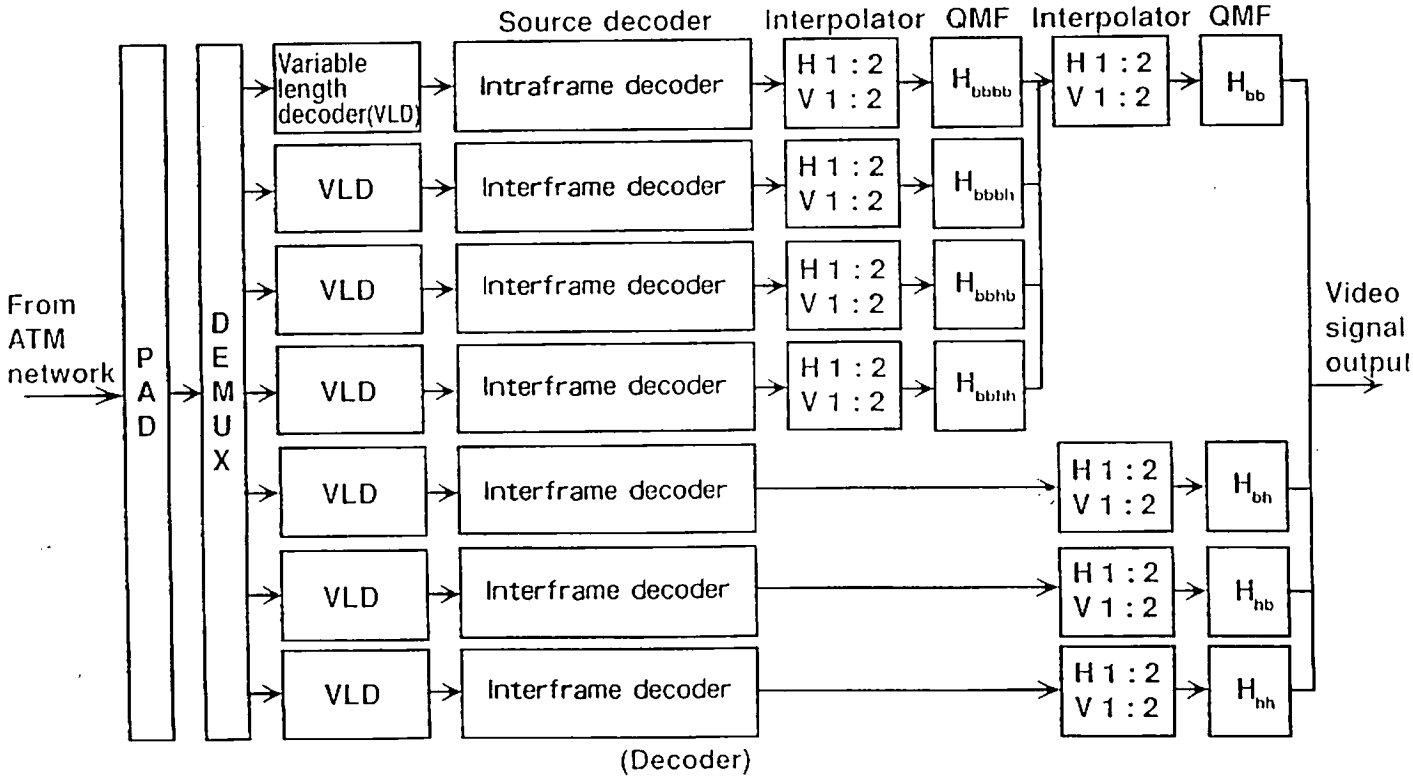

Figure 1(b) Decoder block diagram of variable rate video codec

	Table Tennis		Flower Garden	
	Average coding rate (Mbps)	Average Y-SNR (dB)	Average coding rate (Mbps)	Average Y-SNR (dB)
without rate control	19.138	37.53	28.717	39.06
Maximum 24 Mbps	18.579	37.28	24.035	36.78
Maximum 16 Mbps	15.291	35.91	16.526	32.23

Table 1 Average coding rate and SNR

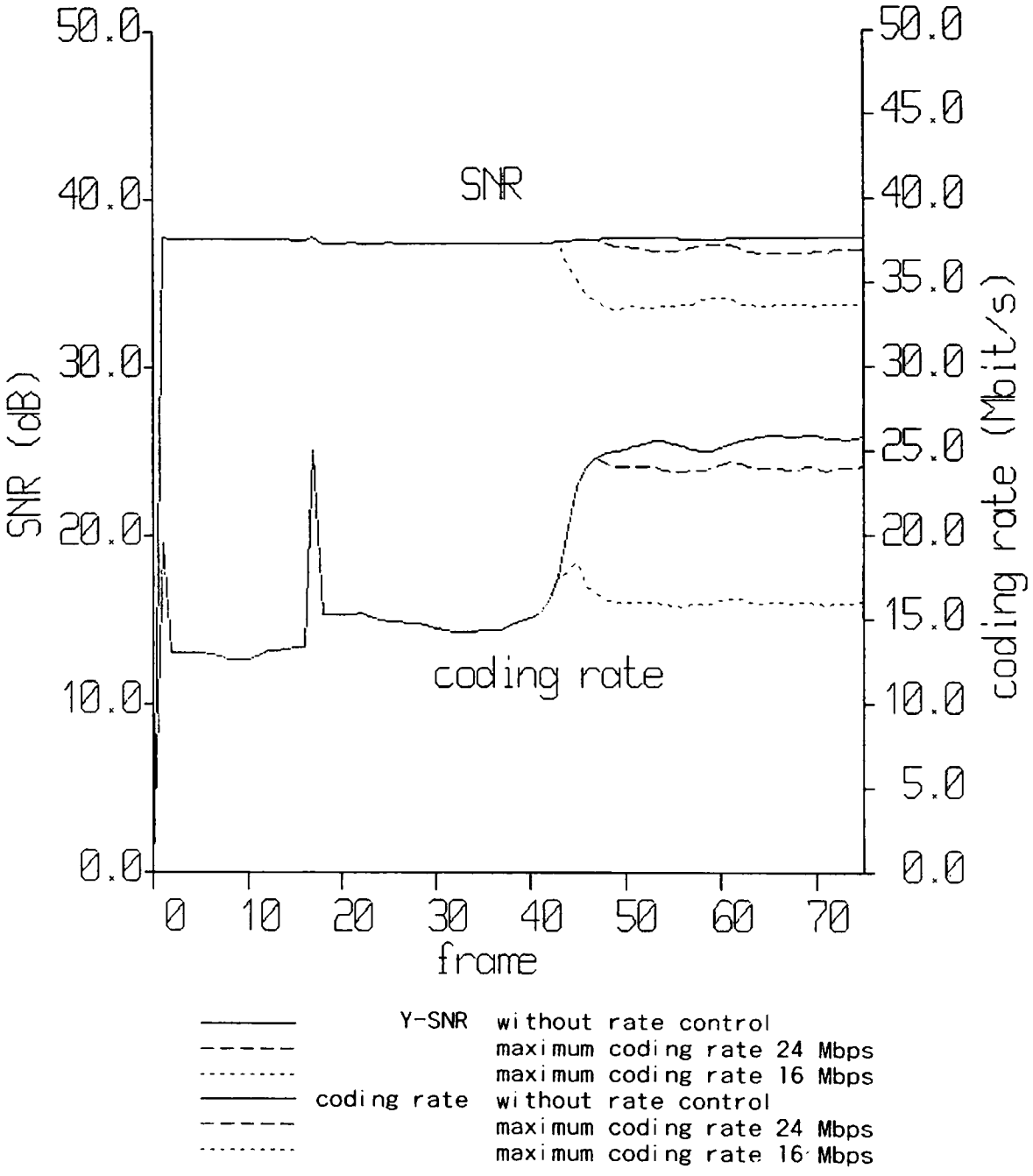

Figure 2(a) Time dependent variation of SNR and coding rate (Table Tennis)

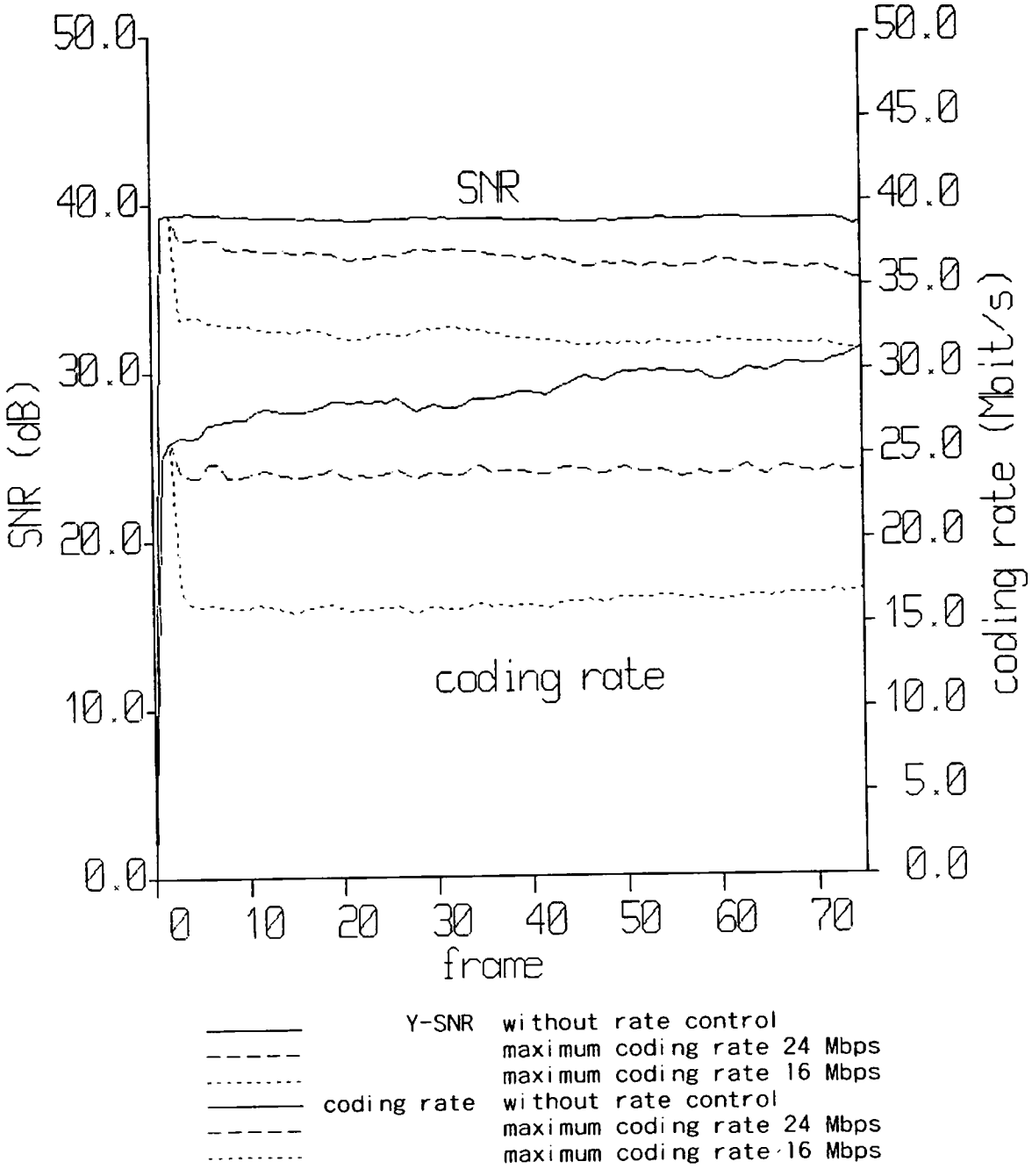

Figure 2(b) Time dependent variation of SNR and coding rate (Flower Garden)

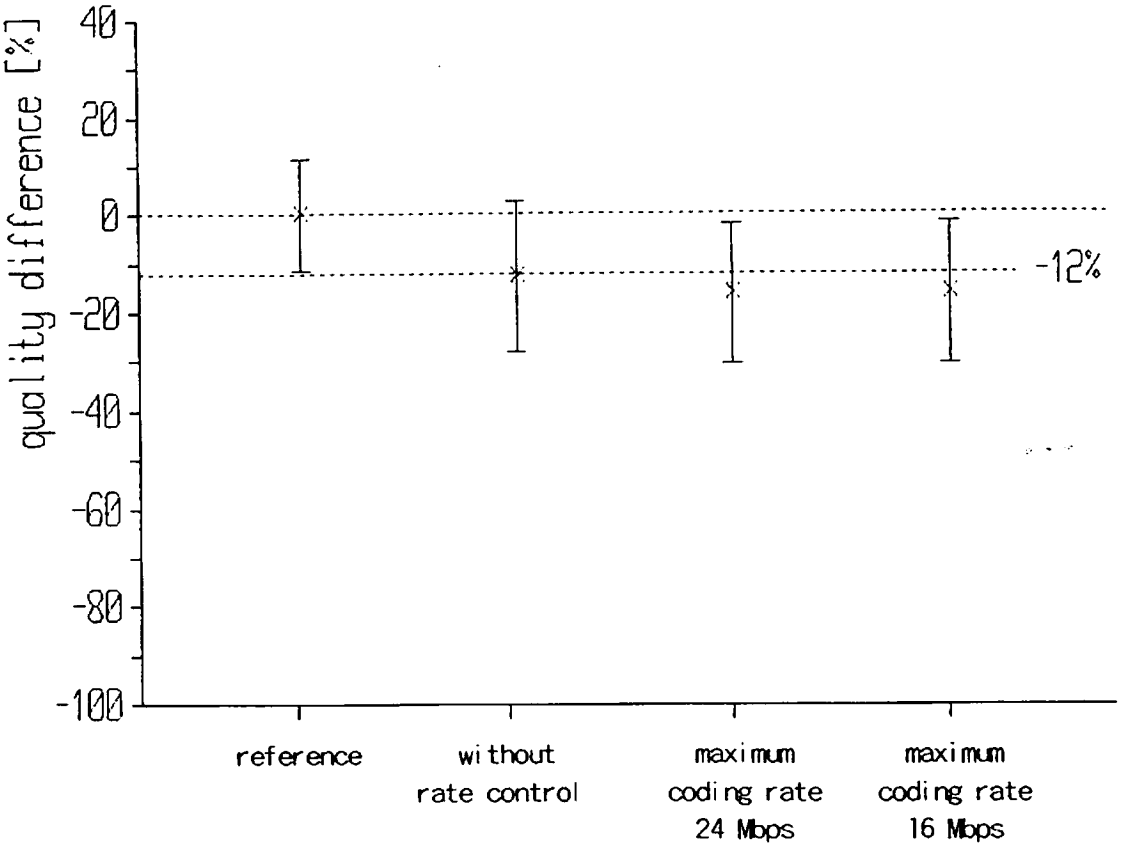

Figure 3(a) Results of subjective assessment (Table Tennis)

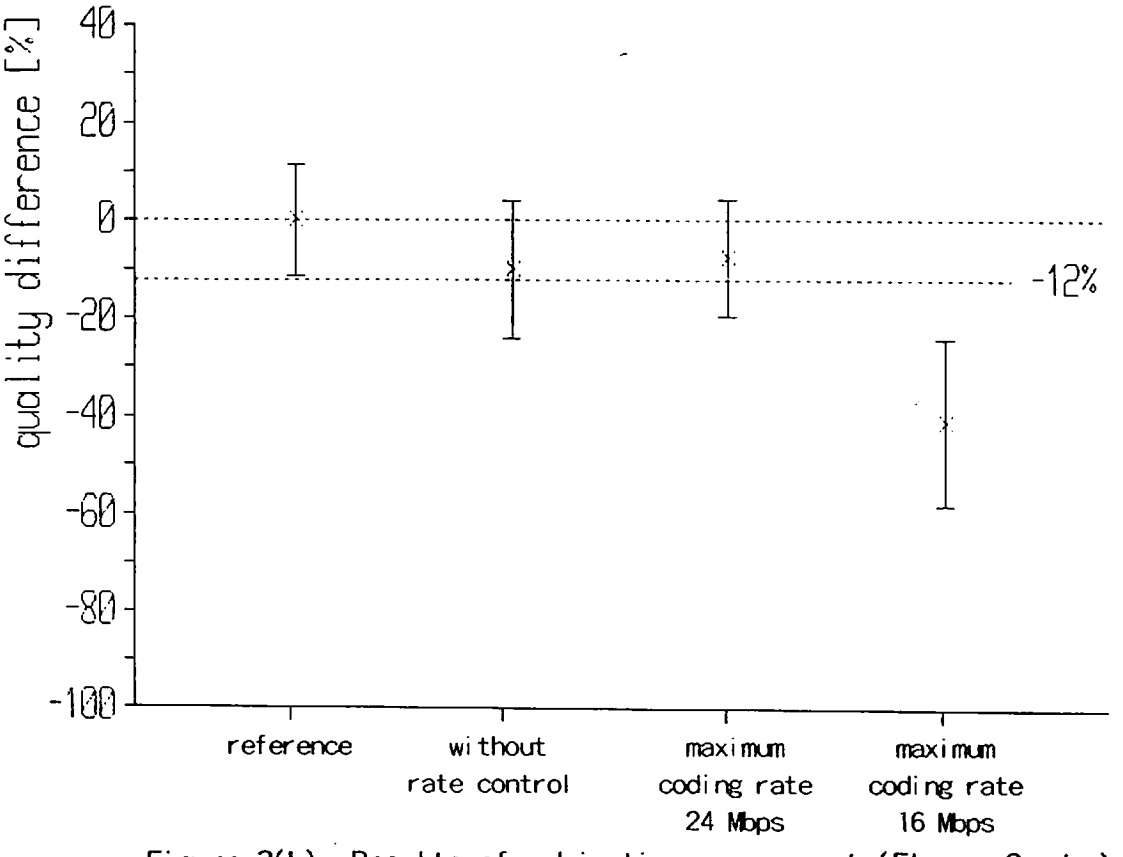

Figure 3(b) Results of subjective assessment (Flower Garden)