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Title: Some Modifications for Rate Control of TM1  
Purpose: Proposal for Core Experiments  
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## 1 Introduction

According to MPEG 92/160, TM1, the rate control is described to use three kinds of buffer for Q step control,  $d_j^i$ ,  $d_j^p$  and  $d_j^b$  for I, P and B-picture, respectively. As the reason why not to use a single buffer is missing in this document, we have examined to use a single buffer for Q step control. And we have estimated whether the initial value of *avg\_act* is adequate or not.

Some simulation results shows that a single buffer for Q step is enough for rate control step 2 and initial value of *avg\_act* described in rate control step 3 is not adequate.

## 2 Single Buffer for Step 2

As described in TM1, three kinds of buffer,  $d_j^i$ ,  $d_j^p$  and  $d_j^b$ , are to be estimated to derive Q step size,  $Q_j$ . One of the merits to use these may be to produce pictures at almost constant quality for each picture type. However, we should examine which Q control is better, estimated by three buffers or single buffer for MPEG2 Test Model. Here, we propose how to use single buffer for TM.

### 2.1 Estimating Q

For a single buffer control, Q step is calculated as following equations.

$$Q_j^i = \frac{d_j \times 31}{r} \quad (1)$$

$$Q_j^p = K_p \times \frac{d_j \times 31}{r} \quad (2)$$

$$Q_j^b = K_b \times \frac{d_j \times 31}{r} \quad (3)$$

$$d_0 = 10 \times \frac{r}{31} \quad (4)$$

And a single buffer fullness,  $d_j$ , is computed as following.

$$d_j = d_0 + B_{j-1} - \frac{T_{i,b,p} \times (j-1)}{MB\_cnt} \quad (5)$$

## 2.2 Comparison

Table 1 shows the simulation result of comparison between TM1 rate control and proposed single buffer control.

Table 1: Rate control of three buffers and single buffer

Sequence	# of Frames	# of buffer	SNR Y	SNR Cb	SNR Cr	Mean Bit Rate
Flower Garden	150	3	29.64	32.93	34.69	4001848.6
		1	29.69	32.99	34.75	4000029.4
Mobile & Calendar	150	3	28.34	34.24	34.26	4001290.0
		1	28.29	34.16	34.17	4000850.4
Bicycle	150	3	27.64	33.63	34.39	4003465.2
		1	27.61	33.59	34.34	4000426.4

Prediction: Frame/Field  
Bit Rate: 4 Mbps

As the result of simulation following points are to be stated.

1. SNRs are almost same both for single and three buffers.
2. Output bit rate is controlled tighter by single buffer than by three buffers.
3.  $K_p$  and  $K_b$  are almost sufficient for Q control, however, another values may be examined.

We conclude that single buffer control is enough and achieves tighter buffer control.

## 3 *avg\_act* in Step 3

Figure 1 shows the transition of *avg\_act* in coding frame order for the first GOP of several test sequences. For example, *avg\_act* of coding frame No. 0 means average value of the *act<sub>j</sub>* of No. 0 frame.

As showing the simulation results in Figure 1, the initial value of *avg\_act* 400 is not adequate. This value should be around 20,000.

## 4 Conclusion

As the simulation results of ours, followings are pointed.

1. Single buffer control in rate control step 2 for Q step is enough and achieves much tighter rate control.

Figure 1: Transition of *avg\_act*

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2. The initial value of *avg\_act* in rate control step 3 should be 20,000, not be 400.

We propose the modifications for TM rate control at above two points.