

Title: Adaptive Zonal Scanning at 64kbits/s
Source: UK

Previous papers [1, 2] outlined the concept of a form of adaptive zonal coding applied to a 64kbit/s codec model. The results presented in it were erroneous due to a software bug. New results are presented which indicate a small change in quality from a model run with no zonal coding. The codec model is a modified RM4. The principal modifications are

1. Macro blocks
2. Quantiser updated each macro block
3. Quantiser step size range is 4 to 64
4. Motion compensation maximum of ± 4 pels displacement
5. Only diagonal scanning class used.

Simulations were performed with three zones, all of which were scanned using diagonal scanning. The zone used for any particular block was a function of current quantiser step size. The situation is illustrated in Figure 1.

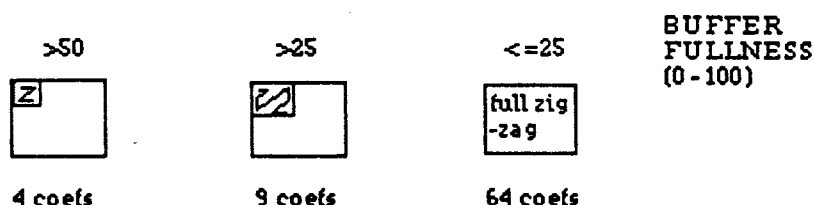


FIGURE 1

The statistics are shown in Table 1 and Graph Set 1. Table 1 shows results from a reference simulation also. Graph set 1 illustrates a comparison of a codec simulation with and without the zonal coding. The 'Reference' is the codec without the zonal coding. The reference simulation is identical to the simulation discussed herein except for the zonal coding. A sequence [Seq 1] to be shown illustrates the coding process on the 'Claire' sequence. The significant points are:

- 1] A reduction in the mean quantiser step size of 24%
- 2] A 5% reduction in the number of fixed blocks.
- 3] A decrease by 38% in the number of transmitted zeros accompanied by a 3% increase in the number of transmitted non-zeros
- 4] A reduction of the signal to noise ratio by 2dBs.

The processed sequence [Seq 1] is more 'soft' than the reference [Seq 2]. However some blocking artifacts are less objectionable and image recovery at the start of the sequence would appear to be more rapid.

Examining the buffer status in Graph Set 1, it would appear that zone 2 is the most frequently used zone. In an attempt to reduce the image softness, this zone was extended to 21 coefficients. Graph Set 2 and a processed sequence [Seq 3] illustrate the results. Graph Set 2 again shows a reference comparison as in Graph Set 1. The principal points from the statistical results are:

- 1] A reduction in the mean quantiser step size of 15%
- 2] A 3% reduction in the number of fixed blocks.
- 3] A decrease by 25% in the number of transmitted zeros accompanied by a 2% increase in the number of transmitted non-zeros
- 4] A reduction of the signal to noise ratio by 0.2dBs.

The processed sequence [Seq 3] is marginally better than the reference sequence in some ways. Blocking artifacts would appear to be marginally reduced. Only for the frames 30, 32, 66 and 73 does the signal to noise or subjective image quality appear worse than the reference. This is due to zone 1 being selected for large areas of the picture. A comparison of the reference sequence [Seq 2] and [Seq3] is shown in [Seq 4].

Conclusion

The results clearly show that care must be exercised in determining an optimum trade off between quantiser resolution and spatial resolution (determined by the zone size). Further work is required to determine if any further optimisation is possible. In previous work multiple scanning classes were used, here only the diagonal case has been examined, further work is required to see if anything is to be gained by applying this technique to multiple scanning classes.

References

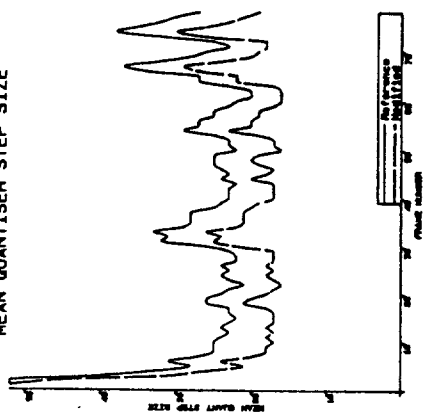
- [1].....CCITT SG XV WP1 Specialist Group on Video
Telephony Doc #260/87
- [2].....CCITT SG XV WP1 Specialist Group on Video
Telephony Doc #275/87

Seq 1.....Tape GGS/FEB88/1	Seq GGS/FEB88/MACRO6
Seq 2.....Tape GGS/FEB88/1	Seq GGS/FEB88/MACRO4
Seq 3.....Tape GGS/FEB88/1	Seq GGS/FEB88/MACRO7
Seq 4.....Tape GGS/FEB88/1	Seq GGS/FEB88/MACRO8

Item			RM64V8 2nd zone 9 coefs	RM64V8 2nd zone 21 coef	RM64V7 Ref.
1)RMS FOR LUMINANCE			4.59	3.77	3.63
2)SNR FOR LUMINANCE			34.93	36.72	36.94
3Mean value for step size			20.18	22.78	28.54
4)Mean value Non-zero coef			831	829	810
5)Mean value of Tx'd zeros			1230	1512	2067
6) Block type of Y	Fixed		271	278	287
	Intra				
	Filtered Fixed				
	Non-filt Fixed MC				
	Filtered Fixed MC				
	Non-filt Inter		87	59	50
	Filtered Inter				
	Non-filt Inter MC				
	Filtered Inter MC		57	58	57
	Filtered				
7) Block of type C	Fixed				
	Intra				
	Filtered Fixed				
	Non-filt Inter		41	38	32
	Filtered Inter				
	Filtered				
8) Number of bits	Attributes	Y			
		Cr			
		Cb			
		TOTAL			
	Class indices				
	EOB		1163	1095	996
	Motion vectors				
	Coefficients	Y	3662	3768	3992
		Cr	307	288	223
		Cb	153	149	118
		TOTAL			
	TOTAL			8342	8338

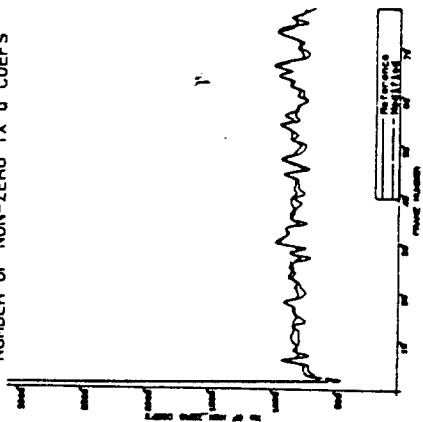
Table 1

MEAN QUANTISER STEP SIZE



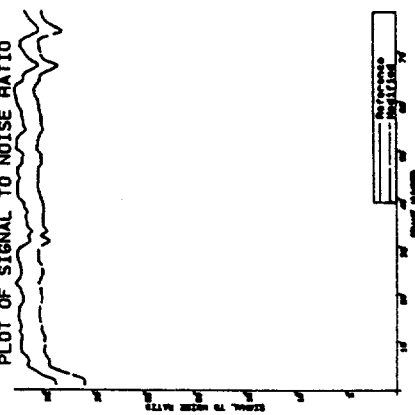
Mean value of reference = 0.50 dB
Mean value of modified = 0.50

NUMBER OF NON-ZERO TX'd COEFS



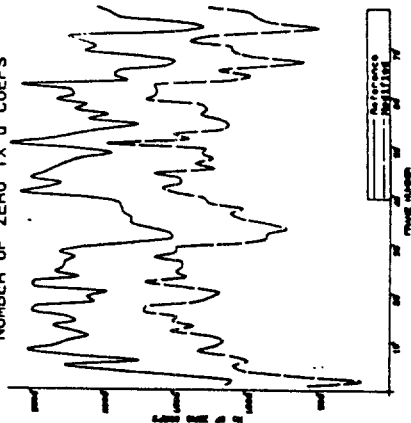
Mean value of reference = 8.10
Mean value of modified = 8.08

PLOT OF SIGNAL TO NOISE RATIO



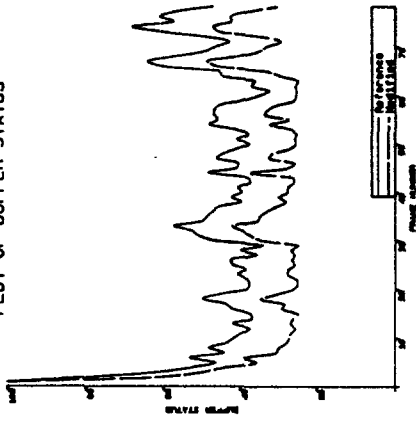
Mean value of reference = 5.1 dB
Mean value of modified = 5.1 dB

NUMBER OF ZERO TX'd COEFS



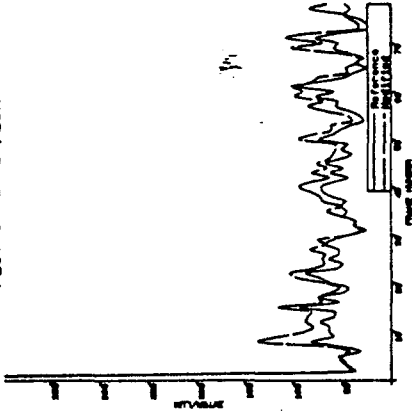
Mean value of reference = 5.01 dB
Mean value of modified = 5.00

PLOT OF BUFFER STATUS



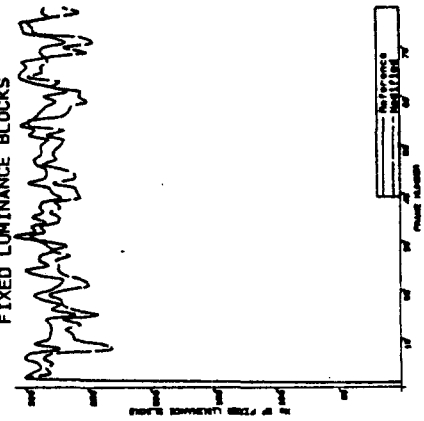
mean value of reference = 50.0000
mean value of modified = 51.7651

PLOT OF INTER/LUM



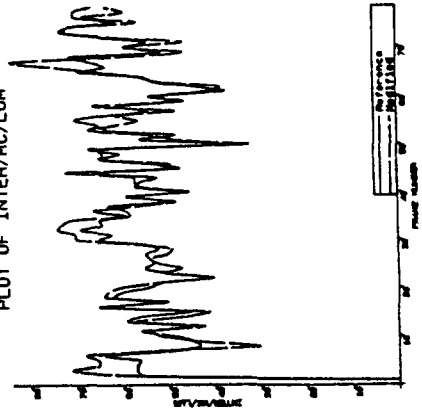
mean value of reference = 50.0000
mean value of modified = 51.0816

FIXED LUMINANCE BLOCKS



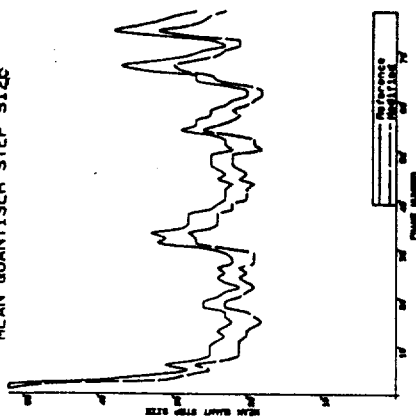
mean value of reference = 50.0000
mean value of modified = 51.7651

PLOT OF INTER/MC/LUM



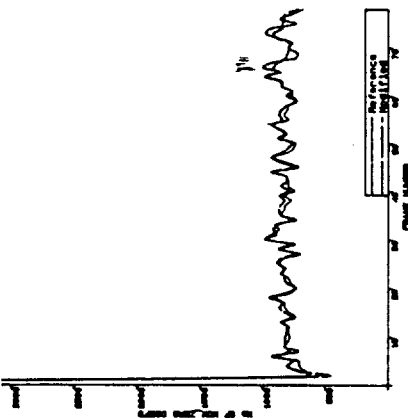
mean value of reference = 50.0000
mean value of modified = 51.1

MEAN QUANTISER STEP SIZE



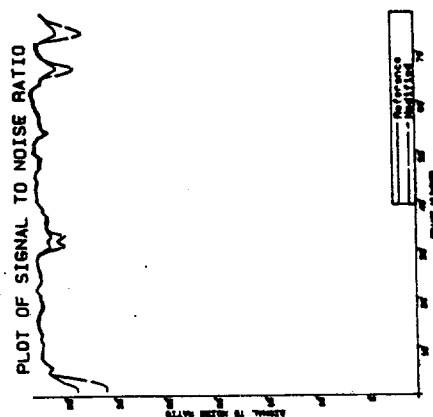
Mean value of reference = 05.4246
Mean value of modified = 05.70633

NUMBER OF NON-ZERO TX'D COEFS



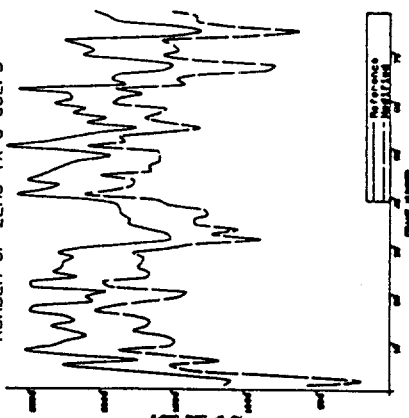
Mean value of reference = 3.10
Mean value of modified = 008.97964

PLOT OF SIGNAL TO NOISE RATIO



Mean value of reference = 05.4246
Mean value of modified = 05.70633

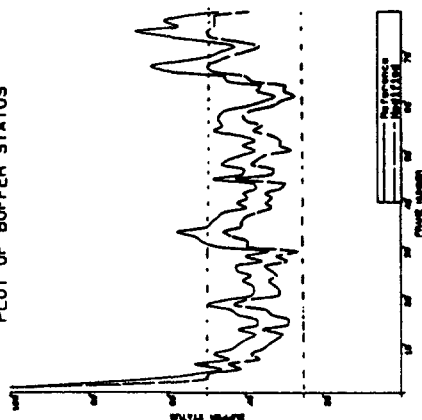
NUMBER OF ZERO TX'D COEFS



Mean value of reference = 05.4246
Mean value of modified = 008.97964

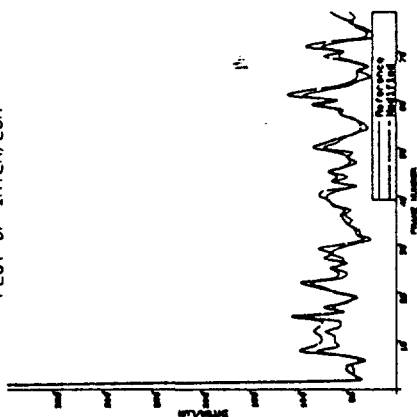
Graph Set 2

PLOT OF BUFFER STATUS



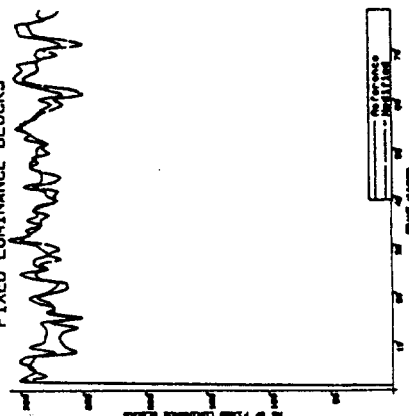
Mean value of reference = 28.000
Mean value of modified = 27.4

PLOT OF INTER/LUM



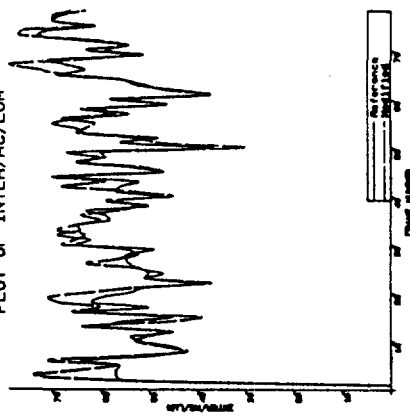
Mean value of reference = 28.0000
Mean value of modified = 28.00

FIXED LUMINANCE BLOCKS



Mean value of reference = 276.8841
Mean value of modified = 276.88074

PLOT OF INTER/MC/LUM



Mean value of reference = 28.00000
Mean value of modified = 28.00

Graph Set 2.