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

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TITLE: px64 FH Characteristics against Random Errors

1. Abstract

This document describes px64 FH characteristics against random errors. Using an error generator, random errors are inserted between a coder and a decoder. Accroding to reproduced image observations, transmission errors with an error rate below 3E-5 do not degrade the reproduced image when the FEC is utilized.

2. Experiment

Figure 1 shows the experiment configuration. The line interface used here is: transmission code=AMI, bit rate=1.5Mbps. It was ckecked in advance of inserting errors that no degradation is observed when the bit error rate is set to zero.

The FH used in this experiment has no special error resilience function. The error correction function is designed only to correct random errors.

Changing operation bit rate, bit error rate and the error correction enable switch of the decoder, reproduced images are observed for two minutes for each.

The results are shown in the next page. At 320Kbps for video, no error is observed when the error rate is 3.0E-5 with FEC while erroneous blocks are seen when it is 1.2E-7 without FEC. In this case, px64 FH performance against random errors is improved by a factor of more than two hundreds. For all tested bit rates, error rates below 3E-5 do not cause noticeable degradation.

3. Conclusion

px64 FH characteristics against random errors have been measured. For all bit rates, random errors with bit error rates below 3E-5 do not cause any degradation in rerpoduced images.

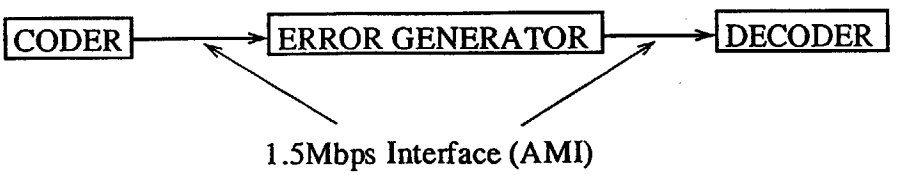

Figure 1. Experiment Configuration

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Conditions: 62.4kbps for video, Maximum frame rate=15 Hz, FCIF, Cyclic refresh

Error Rate	with FEC		without FEC	
	MTBE	Observation	MTBE	Observation
4.8E-4	4.4sec	image is always broken		
2.4E-4	31sec	2/3 of sequence is broken		
1.2E-4	3.8min	1/2 of sequence is broken		
6.0E-5	30min	no error		
3.0E-5	3.9h	no error	0.5sec	image is always broken
1.5E-5	31h		1.1sec	image is always broken
7.6E-6	10day		2.1sec	1/2 of sequence is broken
3.8E-6	2.6month		4.2sec	1/3-1/4 of sequence is broken
1.9E-6			8.4sec	broken once a minute

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Conditions: 312kbps for video, Maximum frame rate i=15 Hz, FCIF, Cyclic refresh

Error Rate	with FEC		without FEC	
	MTBE	Observation	MTBE	Observation
2.4E-4	5.9sec	image is always broken		
1.2E-4	44sec	90% of sequence is broken		
6.0E-5	5.8min	broken once two minute		
3.0E-5	45min	no error		
1.5E-5	6h	no error		
7.6E-6	1.9day		0.4sec	image is always broken
3.8E-6	15day		0.8sec	80% of sequence is broken
1.9E-6			1.6sec	40% of sequence is broken
9.6E-7			3.3sec	1/4 of sequence is broken
1.2E-7			26sec	broken once a minute

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Conditions: 1435.2kbps for video, Maximum frame rate=30Hz, FCIF, Cyclic refresh

Error Rate	with FEC		without FEC	
	MTBE	Observation	MTBE	Observation
1.2E-4	10sec	images is always broken		
6.0E-5	77sec	broken once two minutes		
3.0E-6	10min	nearly no error		

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NOTES:

image is always broken: at least one erroneous block is observed at any time.

?? of sequence is broken: at least one erroneous block is observed for ?? of sequence, e.g. when at least one erroneous block is observed for 30 seconds and no error for 90 seconds, then 1/4 of sequence is broken.

broken once a minute: a group of erroneous blocks caused by an uncorrected FEC frame is observed in a minute.