

VITESSE

07-236r0

Statistical Confidence Levels of Test Results

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YOUR PARTNER FOR SUCCESS

Original Work Done By:

- Eric Kvamme – LSI
 - Analysis was done for SATA phy working group

-  Need to define test time to gain confidence on the test results
-  If a test is run $1e12$ bit time with zero errors, confidence is very low to achieve a BER of $1e-12$, when the test is repeated
-  Longer the test time higher the confidence in the result. If the test is run for infinite time the confidence is 100%

 Analysis was done based on Poisson Distribution

 Should be a reasonable approximation

- $C = 1 - e^{(-nb)}$ or $n = -\ln(1-C)/b$

- Where

- $C =$ confidence factor

- $n =$ number of bits

- $b =$ desired BER

- $P(x) = ((nb)^x * e^{(-nb)}) / (x!)$

- Where

- $P =$ probability of event



- $x =$ number of errors

Confidence Factor with 0 bit Errors

	Confidence Factor (%)					
	95	96	97	98	99.1	99.9955
Total Number of Bits	3.0E12	3.2E12	3.5E12	3.9E12	4.7E12	1.00E+13
Test Time (Sec)	499	536	584	652	785	1668
Test Time (Min)	8.3	8.9	9.7	10.9	13.2	27.8

 Confidence that we have a good part with given BER error threshold

	Number of Errors					
	0	1	2	3	4	5
1.0E12	63.2%	26.4%	8.0%	1.9%	0.4%	0.1
4.7E12	99.1%	95%	83.8%	67.6%	48.9%	31.6%
1.0E13	99.9%	99.9%	99.7%	98.9%	97.07%	93.3

-  Ideally run the test for 27.8 minutes ($1E13$ bits) for up to 4 error gives us 95% Confidence level
-  At a minimum run the test for 13.2 minutes ($4E12$ bits) for up to 1 error gives us 95% Confidence level