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December 16, 2014

Mr. Valter Delfraro Junior, Director
Ortiz Gaming
Avenida Ibirapuera, 2332 – Cj 32 – Torre II
Moema
04028-002 – São Paulo – SP
Brazil

RE: Update to **Gaming Laboratories International, LLC** Random
Number Generator Report dated November 7, 2014

Dear Mr. Delfraro:

By Random Number Generator Report November 7, 2014, **Gaming Laboratories International, LLC** provided a detailed explanation of the Random Number Generator (RNG) testing results of the Ortiz Gaming RNG, tested against the applicable GLI-19 v2.0 Section 4.0 Random Number Generator Technical Standards.

At the request of Ortiz Gaming, numerous changes have been made to the Random Number Generator Report, therefore please disregard the previous approval and refer to the enclosed report.

The attached report serves as a wholesale amendment and is intended to replace the original report in its entirety. We apologize for any inconvenience this may have caused you and/or your staff.

If you should have any questions regarding this matter, please feel free to contact our office.

Sincerely,
GAMING LABORATORIES INTERNATIONAL, LLC

Christine M. Gallo
Vice President of Technical Compliance and Quality Assurance

ENCLOSURE

RN-120-ORT-14-01

skr



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Ortiz Gaming
Avenida Ibirapuera, 2332 – Cj 32 – Torre II
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04028-002 – São Paulo – SP
Brazil

RE: Random Number Generator Report for Ortiz Gaming

Dear Mr. Delfraro:

Enclosed, please find a detailed explanation of the Random Number Generator (RNG) testing results of the Ortiz Gaming RNG, tested against the applicable GLI-19 v2.0 Section 4.0 Random Number Generator Technical Standards.

If you should have any questions regarding this Random Number Generator Report, please feel free to contact our office.

Sincerely,
GAMING LABORATORIES INTERNATIONAL, LLC

Christine M. Gallo
Vice President of Technical Compliance and Quality Assurance

ENCLOSURES

RN-120-ORT-14-01

el/gv/skr

Evaluating Location:

GLI World Headquarters
 600 Airport Road
 Lakewood, NJ 08701

RANDOMNESS REPORT FOR THE ORTIZ GAMING RNG

The intent of this report is to indicate that **Gaming Laboratories International, LLC** (GLI) has completed its evaluation of the Ortiz Gaming RNG random number generator (RNG), version 1.2.0, provided by Ortiz Gaming.

SECTION I – SCOPE OF TESTING

Ortiz Gaming submitted the required materials to GLI in order to conduct a random number generator analysis on the Ortiz Gaming RNG. The scope of this analysis was limited to software verification, source code review, and data analysis.

SECTION II – SOFTWARE VERIFICATION

GLI compiled the Ortiz Gaming RNG server at the GLI World Headquarters office and used this server for data collection.

The GLI Verify® (Version 7.0) signatures for the Ortiz Gaming RNG are as follows:

File	Version	Type	Signature
rng-server_1.2.0-1_amd64.deb	1.2.0	CDCK	EEF5
		SHA256	8F10D07D7F44DA7C15D5A760B616B57D5DE74CB1DD354B2647A4C166B29A9CCF
		SHA-1	3380111861DEC8250231B9EA8B041FFC9C0E8B32

Table 1. Digital Signatures

SECTION III – SOURCE CODE REVIEW

Ortiz Gaming submitted appropriate documentation and full source code which pertains to the generation of random numbers. GLI reviewed the source code provided by tracing the path of the RNG application from the initiation of the draw to the selected output of random numbers. GLI inspected the source code, where practicable, in an attempt to find any undisclosed switches or parameters having a possible influence on randomness and fair play. GLI assessed the ability of the RNG to produce all numbers within the desired ranges.

SECTION IV – DATA ANALYSIS

① Updates to the previously issued report dated November 7, 2014 were made which included numerous changes to the Random Number Generator Report. As stated previously, please disregard the previous approval.

GLI conducted statistical data analysis of sufficient scope to certify the RNG for general use, for all possible game ranges up to and including 4,294,967,296, with the number of selections per draw up to and including 4096, in a with replacement or without replacement format as listed in Table 2 below. A set of numbers is said to be drawn *with replacement* if a number can be selected multiple times within the same draw. A set of numbers is said to be drawn *without replacement* if a number can only be selected once within the same draw. The scope of the certification is listed in the table below.

Range	Positions	Replacement
[Up to 4,294,967,296]	[Up to 4096]	[With or Without Replacement]

Table 2. Game Parameters

To provide this level of assessment, GLI selected 144 different test cases for statistical testing. The selection of test cases took into account broad coverage of range sizes, varying numbers of selections, and good coverage across with replacement and without replacement formats. Included in the tested parameters were some classic game formats, as well as ranges that isolate the performance of RNGs in different ways.

For a summary of the statistical tests applied to each data set, see *Appendix A*. For a description of the overall test methodology and a description of each test used, see *Appendix B*.

Overall, the RNG passed the battery of tests for each configuration at the 95%, 98%, and 99% confidence levels applied.

SECTION V - SUMMARY

Overall Evaluation of the Random Number Generator

GLI's conclusion based upon the tests applied to the Ortiz Gaming RNG data is that this random number generator has exhibited random behavior and is suitable for any games that use ranges up to and including 4,294,967,296 and up to and including 4,096 selections per draw, in a with replacement or without replacement format.

If a game utilizes a game format outside the scope of this certification, the RNG should be resubmitted to test that set of parameters.

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In this regard, the Client acknowledges that nothing in this Report is intended to create, nor shall it be deemed or construed to create, any relationship between **Gaming Laboratories International, LLC** ("GLI") and the Client other than that of independent entities contracting with each other solely for the purpose of the preparation and submission of the Report. Neither GLI nor the Client, nor any of their respective employees or representatives, shall be construed to be an agent, employer or representative of the other.

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The analysis provided by this Report applies exclusively to tests conducted on the specific hardware and software submitted by the Client. It is the responsibility of the manufacturer and/or developer of the subject hardware and software to apply for, obtain and maintain all necessary gaming licensure in each jurisdiction in which they do business, including state and tribal jurisdictions, where applicable. During the course of testing, GLI inspects for marks or symbols indicating that a device has undergone product safety compliance testing. GLI also performs, where practicable, a cursory review of submissions and information contained therein related to Electromagnetic Interference (EMI), Radio Frequency Interference (RFI), Magnetic Interference, Liquid Spills, Power Fluctuations and Environmental Conditions. Electrostatic Discharge Testing is intended only to simulate techniques observed in the field being used to attempt to disrupt the integrity of Electronic Gaming Devices. Compliance with any such regulations related to the aforementioned design is the sole responsibility of the device manufacturer; GLI accepts no responsibility, makes no representations and disclaims any liability with respect to all such non-gaming testing. The actual data showing the tests performed by GLI, and the excluded tests, are available to the Client upon written request.

All items identified in the “Certification of:” section on the first page of the report are considered certified as of the date shown in the “Date of Report:” section on the first page of the original GLI issued Report. All of the items are certified for use until such time notification is sent indicating that an item is no longer permitted to be used within the jurisdiction specified. Additional information regarding the validity of this certification can also be obtained via GLIAccess and/or the Evaluation and Certification Guide, which is available on the gaminglabs.com website. Use of the Certified Mark represents the users agreement to permit, allow and accommodate authorized representatives of GLI to perform a surveillance audit of the use of the Mark and to permit an authorized representative of the American Association of Laboratory Accreditation (A2LA) to perform a surveillance audit, at their discretion and at their expense, to confirm that the use of the Mark in no way implies that A2LA endorses or certifies any of the Marks, services or processes of the company, group or organization requesting the use of the GLI Certified Mark. With respect to analysis of new tables games, new paytables for electronic devices and other undertakings where GLI provides a mathematical review, the Client agrees to and acknowledges that due to complex mathematical processes, approximations and rounding errors that necessarily occur during any mathematical review, the results herein shall be understood by the recipient to be approximations and may fall within a range approximating the true mathematical results.

You certify that you are the owner and/or authorized user of the product or submitted information and shall hold harmless and indemnify GLI for any violation of third party rights as a result of this submission.

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APPENDIX A: Statistical Test Summary

Range	Positions	Replacement	Test Names													
			Runs	Serial Corr.	Interplay Corr.	Adj. Max-Min	Adj. High-Low	Adj. Blocks	Coupon	Duplicates	Overlaps	Permutation	Tot. Dist.	Tot. Dist. by Pos.	Count of Counts	Diehard
[Up to 4,294,967,296]	[Up to 4096]	[With or Without Replacement]	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table A-1. Tests Applied

APPENDIX B: Test Descriptions

B.1 Definitions. The following terms apply to the below test descriptions. Randomness Device or Random Number Generator (RNG) output may be collected multiple numbers at a time. Each set of numbers is called a draw. Each individual number has a particular order within the *draw*. This is referred to as the number *position*.

B.2 Distribution Comparisons. Many of the tests compare an observed numerical distribution with an expected distribution. Unless otherwise specified, this is done by means of a statistical chi-square goodness-of-fit test. The value chi-square is computed in the standard way. If k is a possible value, o_k is the observed count of that value, and e_k is the expected count:

$$\chi^2 = \sum_k \frac{(o_k - e_k)^2}{e_k}$$

In the case where expected counts are too small for accurate use of the above formula, values are ‘binned’ together to ensure an appropriate minimum expected count. The resultant value for chi-square is compared against the distribution for the appropriate number of degrees of freedom. Unusually high (distribution mismatch) or unusually low (insufficient randomness) chi-square values can be causes for data failure.

B.3 Meta-testing. Evaluation of groups of p -values may include a meta-test for extremity of high or low p -values, a meta-test for frequency of high or low p -values, and a meta-test for uniformity of p -values, as appropriate.

B.4 Confidence Level. The statistical tests conducted by GLI are done at a particular *confidence level*. Common confidence levels used include 95%, 98%, and 99%, depending on jurisdictional requirements, and intended use of the RNG. High confidence level testing has low risk of mistakenly failing a good RNG, but higher risk of passing a bad RNG. Lower confidence level testing has increased power of detecting bad RNGs, while also increasing the risk of false failures of good RNGs. Specifically, the confidence level represents the probability that an ideal source of randomness would pass the testing. If an RNG passes statistical tests at a given confidence level, passage at all *higher* confidence levels is implied.

B.5 Tests. Some tests are only applicable to certain types of data. Some tests may be applied only to a portion of the data. Some tests may require that the data be parsed, binned, or otherwise transformed, as necessitated by data format.

Adjacency Blocks:

For each draw, the data is first sorted. Then the amount of contiguous blocks of numbers is counted. These statistics are then compared against the expected. For example, if a draw consists of the numbers

1, 5, 4, 2, 6, 9

the data would be sorted and separated into blocks. The resulting statistic would be 3.

Adjacency High-Low:

For each draw, the number of local extrema ('highs' and 'lows') in the data is recorded and compared with the expected distribution. These are also referred to as 'turning points'. For example, if a draw consists of the numbers

1, 3, 5, 7, 2, 9

there would be one local maximum (7) and one local minimum (2). The resulting statistic would be 2.

Adjacency Max-Min:

For each draw, the difference between the maximum and minimum values is calculated and recorded. This is compared with the expected theoretical distribution. For example, if a draw consists of the numbers

2, 3, 6, 7, 4

the resulting statistic would be 5, the difference between the maximum value (7) and the minimum value (2).

Count of Counts:

The Count of Counts test first counts the occurrences of each value in each position of the data. These counts are then tallied and compared with the expected distribution of counts for the draw size and range of values.

Coupon Collector's:

The Coupon Collector's Test is applied positionally. The data is parsed until all possible values have been observed, then the number of values checked is recorded and the count is restarted. This is compared with the expected distribution. For example, if the set of all possible values is $\{0, 1, 2\}$ and the first position of each draw is

1, 0, 1, 0, 2, 0, 1, 2, ...

then all values are observed in the first position by the fifth draw. All values are then observed within the next 3 draws, so the first two statistics for the first position would be 5 and 3.

DieHard:

The DieHard Battery of Tests is a standard assessment of the randomness in raw outcomes generated from an RNG. The collection, designed by George Marsaglia, tests for a variety of patterns in the individual binary bits of RNG output. GLI uses a custom implementation to conduct DieHard testing.

Duplicates:

The Duplicates Test counts the number of times a draw is exactly duplicated in the data. In the case that a particular draw is repeated more than twice, every possible way to generate a duplicate is counted. This is compared against the theoretical distribution to verify that the number of duplicate draws falls within expected bounds. For example, consider the dataset consisting of the following draws of two numbers each.

- a) 1, 3
- b) 4, 1
- c) 1, 3
- d) 1, 3
- e) 4, 1
- f) 3, 1

The duplicate pairs are (a, c) , (a, d) , (c, d) , and (b, e) , for a total of 4 duplicates. (f) is not counted as a duplicate since the draw must match in order as well as values.

Interplay Correlation:

The Interplay Correlation Test measures statistical correlation between different positions of the same draw. For each pair of positions, statistical correlation is calculated as in the Serial Correlation Test. In the case of without replacement data, an adjustment is made to account for the expected resulting negative correlation.

Overlaps:

The Overlaps Test compares consecutive draws for overlapping values. The number of overlapping values is recorded for each pair of draws. This observed distribution of overlaps is then compared against the expected distribution. For example, if the following draws are observed consecutively,

a) 1, 4, 5, 6

b) 4, 1, 7, 6

the number of overlaps would be 3, representing the values 1, 4, and 6.

Permutation:

The Permutation Test is a test applicable to data that represents a reordering of numbers. Each draw can be considered as a permutation of the original ordering. Every permutation can be decomposed into disjoint cycles, which represent the possible positions a number would occupy if the same permutation is applied repeatedly. For each draw, three statistics are collected based on the cycle decomposition:

- The number of cycles.
- The size of the smallest cycle.
- The size of the largest cycle.

Each of these statistics generates a distribution of observations which are compared with their respective expected distributions. For example, if the following draw were observed as a reordering of the numbers from 1 to 6,

1, 3, 5, 4, 2, 6

the cyclic decomposition would be (1)(2 3 5)(4). 1, 4, and 6 remain in their original positions, so they form their own cycles. The values 2, 3, and 5 are shuffled, so they form a single cycle together. The total number of cycles is 4, the smallest cycle has size 1, and the largest cycle has size 3.

Runs:

The Wald-Wolfowitz Runs Test is applied to each position within the draw. A center is established, typically the data median, and the number of 'runs' above and below the center are tallied. Values exactly equal to the center are discarded. This is compared to the expected distribution, which depends on the number of values above and below the center. For example, if the numbers drawn at a particular position were

2, 3, 1, 5, 4, 7, 3, 2, 3, 2, 3, 2, 6, 7, 3, 5

and the established center were the data median of 3, the data would be parsed for runs above 3 and runs below 3.

2, 3, 1, 5, 4, 7, 3, 2, 3, 2, 3, 2, 6, 7, 3, 5

This would be counted as 4 runs.

Serial Correlation:

The Serial Correlation Test measures statistical correlation between consecutive draws of the same position. For each position, the sample Pearson correlation coefficient is calculated. If X represents the first number, and Y the number that follows, then the coefficient is

$$r = \frac{cov(X, Y)}{S_X S_Y}$$

where s denotes the sample standard deviation. The coefficients are used to generate a p -value for each position.

Total Distribution:

The Total Distribution Test is a simple tally of all observed values throughout the data. This is compared with the expected distribution. Typically the expected distribution is a uniform distribution. In the case of unequal weighting of values, an appropriate discrete distribution is used.

Total Distribution by Position:

The Total Distribution by Position Test tallies the observed distribution of values for each position within the draw. Each of these distributions is then compared with the expected.