Evaluation Report for:
Play'n GO Malta Ltd.
Random Number Generator
Isaac_RNG version 1

Manufacturer:	**Play'n GO Malta Ltd.**
RNG Name:	**Isaac_RNG v1**
ATF Report Number:	**RNG.UK.PGO-OL.1001.02**
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Number of Pages:	**6**

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EVALUATION REPORT

Client name & Address:	Play'n GO Malta Ltd. Level 4, The Centre, Pjazza Tigné, Tigné Point Malta
Client Reference Number:	Client Submission Letter Dated 1st February 2018
Testing dates:	Start date: 5th February 2018 End date: 25th May 2018
Product / Game Description:	Isaac_RNG v1 Software Random Number Generator CHECKSUM: See paragraph 4.1
Test Category:	Random study
Jurisdictions Recommended:	UK
Technical Standard used for Evaluation:	Remote Gambling and software technical standards, June 2017
Location where test was performed:	BMM Spain Testlabs, s.l.u Parc Tecnològic del Vallés (C.E.N.T.) Avda. Parc Tecnològic del Vallés, 3 08290 – Cerdanyola del Vallés Barcelona – España
Location where report was issued:	BMM Spain Testlabs, s.l.u Parc Tecnològic del Vallés (C.E.N.T.) Avda. Parc Tecnològic del Vallés, 3 08290 – Cerdanyola del Vallés Barcelona – España
Conclusion:	Pass
BMM Reference Number:	PGO-OL.1001
Method/Procedures used:	EURAF-SPA-MO-41
Consultant(s):	Enric Ferrés

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1. SCOPE

Play'n GO Malta Ltd. has requested BMM to perform an evaluation of the Isaac_RNG v1. The evaluation was conducted against the UK aforementioned industry recognized standards for Random Number Generator (RNG) testing.

This evaluation includes an assessment of the algorithm implemented within the RNG.

2. WORK DESCRIPTION

The evaluation of the Isaac_RNG v1 consisted of a source code review and empirical statistical tests.

The industry recognized standard for statistical testing includes, but is not limited to: Chi-squared, Simple Number Frequency, Correlation tests, Run, Gap, Birthday Spacing, Coupon Collector, and Die Hard suite of tests. BMM also tested samples for generation and use without replacement. These tests are intended to verify the statistical properties of the RNG output and demonstrated the correct use of the RNG.

3. EVALUATION CARRIED OUT BY BMM

The source code review of the RNG and empirical statistical RNG testing of the Isaac_RNG v1 confirms:

- The Isaac_RNG v1 has a period of 2^{16583}.

- No secondary decision within the overall.

- That the draw RNG algorithm is capable of generating numbers or values that are scaled accurately for the system design.

- The method of generating these numbers or values is unbiased and unpredictable.

- The RNG itself is implemented into the system source code properly.

- The RNG program does not contain any malicious code that could significantly affect the outcome of the RNG.

- The RNG is cryptographically strong.

- The overall results of the statistical tests are probabilities that are expected to be uniformly distributed between 0 and 1.

4. EVALUATION DETAILS

4.1. DETAILS OF THE SOFTWARE USED FOR THE TEST

The following table details the relevant information for the Isaac_RNG v1 that has been evaluated as compliant to UK RNG Technical Standards:

Reference	Functionality
PlaynGO.Modules.Random.Isaac64.dll	RNG
Checksum-32	0004AE4C
CRC-16	1C00
CRC-32	AFBE26F9
MD5	B12DB3B45DD66807E1F3EE2B9572F004
SHA1	960ECA65832B6FEEE7826795FCCED41A558E5B4C

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4.2. STATISTICAL RESULTS

The RNG passed all tests within the expected 99% confidence range.

Number of tests: 3300

Low Outliers at 99%

Observed	Expected	Prob	Result
20	16.5	0.2238	PASS

High Outliers at 99%

Observed	Expected	Prob	Result
17	16.5	0.4836	PASS

| Overall KS Test		0.8126	PASS

Diehard	PASS
NIST	PASS

Overall RNG Statistical Tests, Frequency, GAP, Coupon Test Results

The results of the Statistical tests are probabilities that are expected to be uniformly distributed between 0 and 1. This chart shows those test results plotted against an expected result indicator of perfect distribution from 0 to along the lines of confidence interval 0.05 shown. This shows that the RNG stays within the expected outcome and produces statistically strong random numbers.

Overall Test Results
Values are sorted from least to greatest

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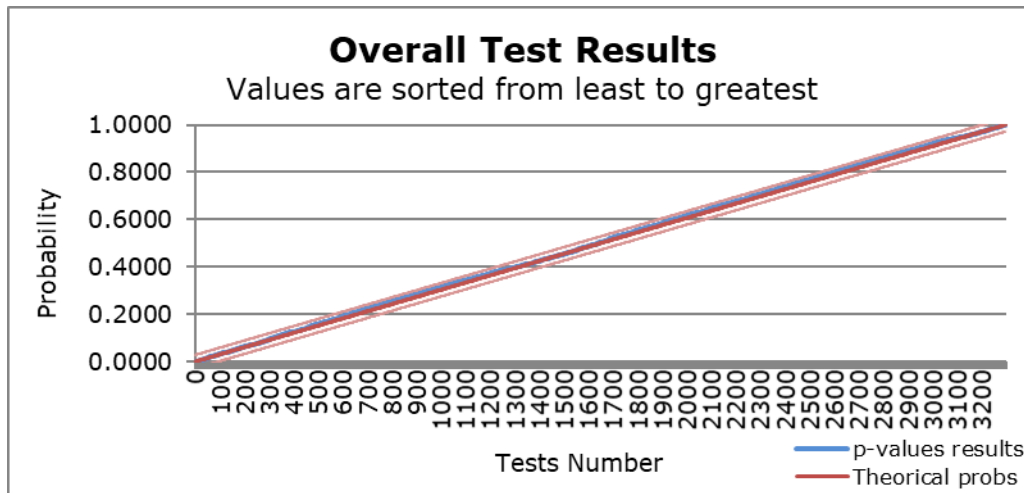
Frequency Test:

The Frequency test chart for the range of numbers from 0 to 255 with 1000000 samples displays the possible total count of each number and the actual total count of each number.
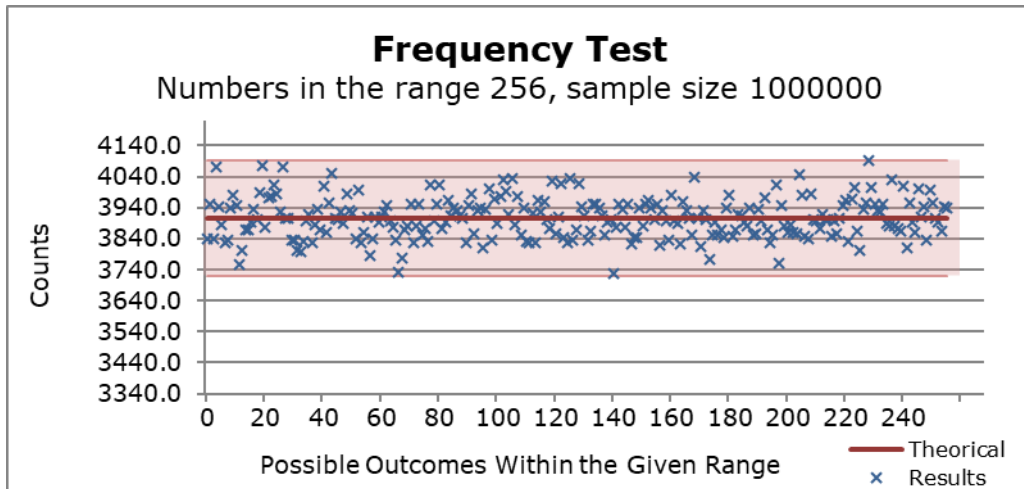

Gap Test:

The Gap test chart for the number 0 for 1000000 RNG samples generated with a range between zero (0) and 31. This test measures the expected distance between each occurrence of the number 0 and the actual distance between each occurrence over 1000000 RNG samples.
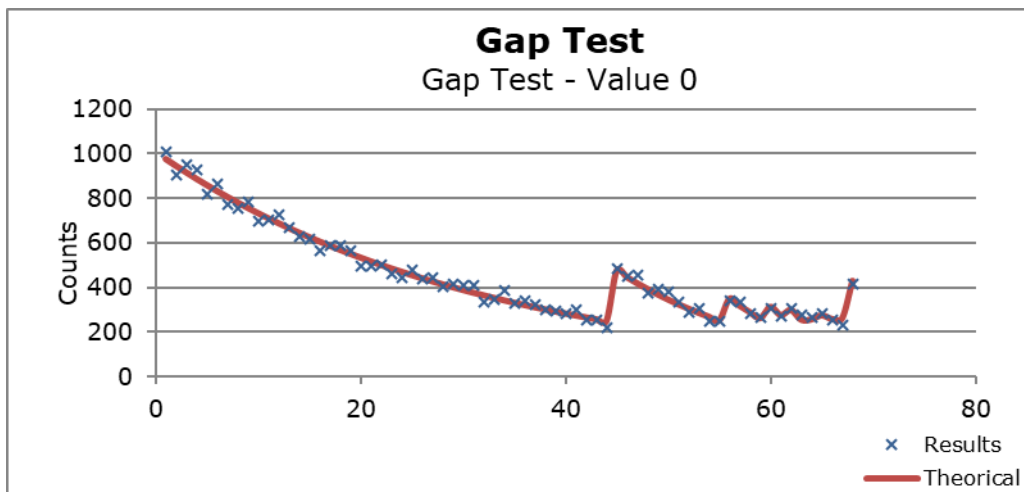
Coupon Test:

The Coupon test chart is for the range of numbers from 0 to 51 with 1000000 samples displays the possible number of selections required for a full set of numbers of 0 through 51.
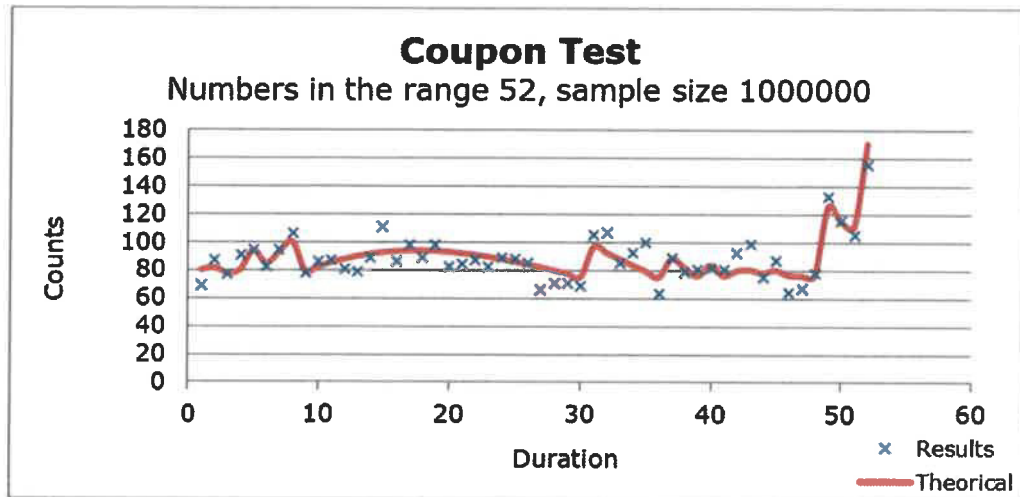
5. ADDITIONAL INFORMATION/OBSERVATIONS

MODIFICATION 1:

This report is a modification and replaces the report issued previously by BMM detailed in RNG.UK.PGO-OL.1001.01 – Isaac_RNG v1:

- On page 6, Section Coupon Test, the chart "Coupon Test" has been updated because typo error in the axis.

*The applicant is responsible to annul, eliminate, and/or to replace the previous evaluation report with this current evaluation report, and to communicate it to whom it is pertinent."

6. CONCLUSION

Accordingly, from the test results[1] obtained from the testing performed and results obtained, BMM Spain Testlabs s.l.u confirms that the item submitted under test conforms to all the relevant UK requirements described in the Scope section.

Yours faithfully,

BMM SPAIN TESTLABS S.L.U.

Mario Zilevski
Director of Technical Services – Europe

[1] The results included in this document are referred exclusively to the sampled tested, such as it is described in the corresponding section.

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