



Gaming Associates

RNG Evaluation Report

Report Reference – WAZ-UK-250306-02-RC-R1

Dates of certification – 06-03-2025

Report prepared for – Volt Ent B.V

Compliance Status – Compliant

Jurisdiction – United Kingdom Gambling Commission (UKGC)

Technical Standards

Remote gambling and software technical standards May 2024

Testing Strategy for Compliance with Testing strategy for compliance with remote gambling and software technical standards, May 2024

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Company Information

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Date of Testing	19-04-2023 to 01-05-2023
Test Supervisor	Qasim Raza
Assessor	Moona Siddiqui

Accreditation

Gaming Associates (**ga**) is a UKAS accredited Testing Laboratory and Inspection Body number 9263 accredited to perform conformity assessment activities catered to remote gaming systems against the technical requirements set by regulatory authorities worldwide including United Kingdom (UK), Alderney, Italy, Denmark, Spain, Isle of Man, Malta, Gibraltar, Croatia, Romania, Portugal, Lithuania, Latvia, Ontario, Sweden, Greece etc. To obtain further information about the accreditation, please visit <https://gamingassociates.com/accreditations/>

Conclusions and Recommendations

Subject to the scope of testing and based on testing performed by **ga** for client's RNG has formed an opinion that the assessed RNG comply with the applicable technical standards of United Kingdom.

ga concludes and recommends that:

The current implementation of the client's RNG is suitable for use in gaming application and meets United Kingdom Gambling Commission (UKGC) requirements.

Qasim Raza

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06-03-2025

The Client

Manufacturer	Volt Ent B.V (Volt)
Address	Livestrong Building, Groot Kwartierweg 10, Curaçao, Dutch Caribbean
Website	N/A
Market	United Kingdom
Type of certification	RNG Certification
Technical guidelines used for testing	The above-mentioned product is compliant with the regulations listed below: • Remote gambling and software technical standards May 2024 • Testing Strategy for Compliance with Testing strategy for compliance with remote gambling and software technical standards, May 2024

Introduction

Volt Ent B.V (Volt) has requested Gaming Associates (**ga**) to evaluate their Random Number Generator (RNG) being used in online gaming

This report presents the results of evaluation performed by **ga** for the RNG against compliance requirements set by United Kingdom Gambling Commission (UKGC).

Description of the Change or Correction in the Report

This is a new certification report of the previously certified RNG. No additional testing is involved.

Scope of Testing

The scope of testing included compliance evaluation was performed against following compliance requirements set by United Kingdom Gambling Commission (UKGC).

- Remote gambling and software technical standards May 2024
 - RTS 7 – Generation of random outcomes

Test Methods

Testing for the RNG is conducted using following in-house developed test methods and quality procedures.

- QP15_ GA
- QP25_ GA
- TSM-UK_ GA
- TPM-01_ GA
- TPM-07_ GA

The testing included:

- statistical testing
- source code review
- documentation review

The test results have been provided in section Test Results against United Kingdom Gambling Commission (UKGC).

Test Summary

RNG details

Volt uses 64-bit ISAAC RNG, a publicly available source wrapped into C++ class. RNG is seeded with /dev/urandom Linux device-provided numbers. There is background cycling every 80-220 ms (period each time selected randomly from the range 80-220 ms). In the main server application, the RNG is a dynamically loadable object, isaac64.so, which implements the core random number generator. The random.so encapsulates it in a common interface and provides additional functionalities.

RNG Fingerprint

Critical Component	Version	Description	SHA-1 Hashes
Isaac64.so	1.0	Binary Critical Component with ISAAC64 RNG Code	AC44260D44B85F6EE77B37CDB429 152474C6E311
random.so	1.0	Binary critical component with all additional functions (background cycling, self-monitoring, reseeding, scaling)	0A5EC1C81AE8C5DB8D5ADF0B5F0 3160D71918D58

Test Results

The following table provides compliance status of the RNG against United Kingdom Gambling Commission (UKGC) requirements.

- **Compliant:** The RNG complies with the requirement.
- **Does Not Comply:** The RNG does not comply with the requirement.
- **Acknowledged:** The requirement is only a statement or information.
- **N/A:** The requirement is not applicable to the RNG.
- **Out of scope:** The requirement cannot be evaluated at this stage due to the current scope of testing or limitation of the test environment.

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Req #	Requirements	Compliance Status	Comments/Anomalies
RTS 7	Generation of random outcomes		
	Gaming (including bingo), lotteries, and betting on virtual events		
	RTS aim 7		
	To ensure that games and other virtual events operate fairly.	Acknowledged	
RTS 7A	RTS requirement 7A		
	Random number generation and game results must be 'acceptably random'. Acceptably random here means that it is possible to demonstrate to a high degree of confidence that the output of the RNG, game, lottery and virtual event outcomes are random through, for example, statistical analysis using generally accepted tests and methods of analysis. Adaptive behaviour (ie a compensated game) is not permitted.	Compliant	Volt is using C++ interface ISAAC Library. The raw and scaled random data generated by the RNG is found to be random and uniformly distributed. See Section: "Statistical testing of raw RNG output" and "Statistical testing results of scaled data".
	Where lotteries use the outcome of other events external to the lottery, to determine the result of the lottery the outcome must be unpredictable and externally verifiable.	N/A	The RNG does not rely on any external events.
	RTS implementation guidance 7A		
	a. RNGs should be capable of demonstrating the following qualities:	Acknowledged	
	i. the output from the RNG is uniformly distributed over the entire output range and game, lottery, or virtual event outcomes are distributed in accordance with the expected/theoretical probabilities	Compliant	It has been verified, through statistical analysis, that the scaled numbers generated from the RNG are uniformly distributed in accordance with the expected probabilities for gameplay. See Section: "Statistical testing of raw RNG output"

Req #	Requirements	Compliance Status	Comments/Anomalies
			and “Statistical testing results of scaled data”.
	ii. the output of the RNG, game, lottery, and virtual event outcomes should be unpredictable, for example, for a software RNG it should be computationally infeasible to predict what the next number will be without complete knowledge of the algorithm and seed value	Compliant	It is impossible to predict the outcomes of the RNG without the knowledge of seed value and algorithm.
	iii. random number generation does not reproduce the same output stream (cycle), and that two instances of a RNG do not produce the same stream as each other (synchronise)	Compliant	It is not likely that the RNG will reproduce a previous output stream as it has a large period. Also, it is very unlikely that two instances of RNG produce the same stream as the seed is random.
	iv. any forms of seeding and re-seeding used do not introduce predictability	Compliant	Seeding and re-seeding does not introduce any predictability as the seed is based on the /dev/urandom function.
	v. any scaling applied to the output of the random number generator maintains the qualities above.	Compliant	It has been verified through statistical analysis that the scaled numbers are random and uniformly distributed over the range required. See Section: “Statistical testing of raw RNG output” and “Statistical testing results of scaled data”.
	b. For lotteries using external events - where it is not practical to demonstrate 7A the events outcomes should be:	N/A	The RNG does not rely on any external events.
	i. unpredictable, that is, events should be selected only where they may reasonably be assumed to be random events		
	ii. unable to be influenced by the lottery operator (or external lottery manager)		
	iii. publicly available and externally verifiable, for example, events that are published in local or national press would be acceptable.		
	c. For games or virtual events that use the laws of physics to generate the outcome of the game (mechanical RNGs), the mechanical RNG used	N/A	The RNG does not rely on any external events.

Req #	Requirements	Compliance Status	Comments/Anomalies
	should be capable of meeting the requirements in a. where applicable and in addition:		
	i. the mechanical pieces should be constructed of materials to prevent decomposition of any component over time (eg a ball shall not disintegrate)		
	ii. the properties of physical items used to choose the selection should not be altered		
	iii. players should not have the ability to interact with, come into physical contact with, or manipulate the mechanics of the game.		
	d. Restricting adaptive behaviour prohibits automatic or manual interventions that change the probabilities of game outcomes occurring during play. Restricting adaptive behaviour is not intended to prevent games from offering bonus or special features that implement a different set of rules, if they are based on the occurrence of random events.	N/A	The RNG does not rely on any external events.
RTS 7B	RTS requirement 7B		
	As far as is reasonably possible, games and events must be implemented fairly and in accordance with the rules and prevailing payouts, where applicable, as they are described to the customer.	Compliant	The scope is limited to the RNG testing. Verification of complete game rules and payouts is out of scope.
	RTS implementation guidance 7B		
	a. Games should implement the rules as described in the rules available to the customer before play commenced.	Out of scope	The scope is limited to the RNG testing. Verification of complete game rules and payouts is out of scope.
	b. The mapping of the random inputs to game outcomes should be in accordance with prevailing probabilities, pay tables, etc.	Out of scope	The scope is limited to the RNG testing. Verification of complete game rules and payouts is out of scope.
	c. When random numbers, scaled or otherwise, are received, e.g. following a game requesting a sequence of random numbers, they are to be used in the order in which they are received. For example, they may not be discarded due to adaptive behaviour.	Compliant	The RNG provides scaled random numbers as requested by game and these numbers are used in the order they are received. No random numbers are discarded by the games.

Req #	Requirements	Compliance Status	Comments/Anomalies
	d. Numbers or sequences of numbers are not to be discarded, unless they fall outside the expected range of numbers required by the virtual event – such an occurrence should result in an error being logged and investigated.	Compliant	The RNG provides scaled random numbers according to the range required by the game. The scaled numbers do not fall outside the expected range required by the games.

Statistical testing of raw RNG output

Statistical analysis of RNG output has been performed for:

- Raw (binary) RNG output; and
- Scaled RNG output for games served by the RNG.

This section provides results of the statistical analysis.

Diehard test results

Following table presents the summary of diehard test results. These tests were applied on raw output of the RNG supplied by Volt.

Software RNG raw output

Data file: set1.bin

Test No.	Description	p-value	Test results (Pass/Fail)
1	BIRTHDAY SPACINGS TEST	0.377630	Pass
2	BINARY RANK TEST for 31x31 matrices	0.915700	Pass
3	BINARY RANK TEST for 32x32 matrices	0.463258	Pass
4	BINARY RANK TEST for 6x8 matrices	0.302838	Pass
5	BITSTREAM TEST	0.574843	Pass
6	Overlapping Pairs-Sparse-Occupancy (OPSO) Test	0.534343	Pass
7	Overlapping-Quadruples-Sparse-Occupancy (OQSO) Test	0.531342	Pass
8	DNA test	0.437435	Pass
9	COUNT-THE-1's TEST (i) byte stream for 2505.53 chi-square value (ii) byte stream for 2550.90 chi-square value	0.531165 0.764180	Pass Pass
10	COUNT-THE-1's TEST for specific bytes	0.455818	Pass
11	PARKING LOT TEST	0.671656	Pass
12	MINIMUM DISTANCE TEST	0.304662	Pass

Test No.	Description	p-value	Test results (Pass/Fail)
13	3DSPHERES TEST	0.898447	Pass
14	SQUEEZE TEST	0.327109	Pass
15	OVERLAPPING SUMS test	0.570378	Pass
16	THE RUN TEST (i) Runs up Test (ii) Runs Down Test (iii) Runs up Test (iv) Runs Down Test	0.905462 0.203241 0.101457 0.638235	Pass Pass Pass Pass
17	CRAPS TEST (i) No. of wins (ii) for throws/game	0.162720 0.410683	Pass Pass
18	OVERLAPPING 5-PERMUTATION TEST (i) Sample of 1,000,000 consecutive 5-tuples (ii) Sample of 1,000,000 consecutive 5-tuples	0.992455 0.873536	Pass Pass

Data file: set2.bin

Test No.	Description	p-value	Test results (Pass/Fail)
1	BIRTHDAY SPACINGS TEST	0.229702	Pass
2	BINARY RANK TEST for 31x31 matrices	0.375070	Pass
3	BINARY RANK TEST for 32x32 matrices	0.594261	Pass
4	BINARY RANK TEST for 6x8 matrices	0.777225	Pass
5	BITSTREAM TEST	0.541750	Pass
6	Overlapping Pairs-Sparse-Occupancy (OPSO) Test	0.570830	Pass
7	Overlapping-Quadruples-Sparse-Occupancy (OQSO) Test	0.442925	Pass
8	DNA test	0.433912	Pass
9	COUNT-THE-1's TEST (i) byte stream for 2569.99 chi-square value (ii) byte stream for 2510.80 chi-square value	0.838869 0.560699	Pass Pass
10	COUNT-THE-1's TEST for specific bytes	0.551594	Pass

Test No.	Description	p-value	Test results (Pass/Fail)
11	PARKING LOT TEST	0.297987	Pass
12	MINIMUM DISTANCE TEST	0.693955	Pass
13	3DSPHERES TEST	0.829640	Pass
14	SQUEEZE TEST	0.745645	Pass
15	OVERLAPPING SUMS test	0.975813	Pass
16	THE RUN TEST (i) Runs up Test (ii) Runs Down Test (iii) Runs up Test (iv) Runs Down Test	0.166272 0.853192 0.940851 0.956310	Pass Pass Pass Pass
17	CRAPS TEST (i) No. of wins (ii) for throws/game	0.288271 0.233608	Pass Pass
18	OVERLAPPING 5-PERMUTATION TEST (i) Sample of 1,000,000 consecutive 5-tuples (ii) Sample of 1,000,000 consecutive 5-tuples	0.227962 0.232004	Pass Pass

Statistical testing results of scaled data

Degrees of Freedom (DOF) statistical testing results

The following table describes the results of statistical testing performed on scaled data used to generate games results. The scaled data was generated using the same RNG which will be deployed in the production systems.

The data passed all statistical tests within 99% confidence interval which are accepted standard intervals for statistical tests of this nature. This confirms that the game outcomes are random and uniformly distributed over the range required by the games.

Data file name: outputfile1 0-5.RES (Scaling range: 0 to 5)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	1.5350e+001	Pass
Runs-up	1,000,000	8.5783e-002	Pass
Runs-down	1,000,000	8.5777e-002	Pass

Data file name: outputfile2 0-5.RES (Scaling range: 0 to 5)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
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Chi-Square	1,000,000	3.1938e+000	Pass
Runs-up	1,000,000	8.5823e-002	Pass
Runs-down	1,000,000	8.5891e-002	Pass
Correlation Test	1,000,000	-7.8739e-005	Pass

Data file name: outputfile3 0-36-1.RES (Scaling range: 0 to 36)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	4.2540e+001	Pass
Runs-up	1,000,000	2.2122e-003	Pass
Runs-down	1,000,000	2.2963e-003	Pass

Data file name: outputfile4 0-36.RES (Scaling range: 0 to 36)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	3.6453e+001	Pass
Runs-up	1,000,000	2.3422e-003	Pass
Runs-down	1,000,000	2.4290e-003	Pass
Correlation Test	1,000,000	-3.1780e-004	Pass

Data file name: outputfile5 0-51.RES (Scaling range: 0 to 51)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	4.2927e+001	Pass
Runs-up	1,000,000	1.2253e-003	Pass
Runs-down	1,000,000	1.1836e-003	Pass

Data file name: outputfile6 0-51.RES (Scaling range: 0 to 51)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	5.5957e+001	Pass
Runs-up	1,000,000	1.2163e-003	Pass
Runs-down	1,000,000	1.1973e-003	Pass
Correlation Test	1,000,000	6.4473e-005	Pass

Data file name: outputfile11 0-99.RES (Scaling range: 0 to 99)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	1.1874e+002	Pass

Runs-up	1,000,000	3.9485e-004	Pass
Runs-down	1,000,000	4.3081e-004	Pass

Data file name: outputfile33 0-99.RES (Scaling range: 0 to 99)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	8.3505e+001	Pass
Runs-up	1,000,000	4.1734e-004	Pass
Runs-down	1,000,000	4.0972e-004	Pass
Correlation Test	1,000,000	-3.1338e-005	Pass

Data file name: outputfile16 0-415.RES (Scaling range: 0 to 415)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	4.1416e+002	Pass
Runs-up	1,000,000	1.5568e-004	Pass
Runs-down	1,000,000	1.5605e-004	Pass

Data file name: outputfile17 0-415.RES (Scaling range: 0 to 415)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	4.3208e+002	Pass
Runs-up	1,000,000	1.5544e-004	Pass
Runs-down	1,000,000	1.5351e-004	Pass
Correlation Test	1,000,000	-4.7228e-004	Pass

Data file name: outputfile18 0-774.RES (Scaling range: 0 to 774)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	7.4744e+002	Pass
Runs-up	1,000,000	1.4881e-004	Pass
Runs-down	1,000,000	1.5066e-004	Pass

Data file name: outputfile19 0-774.RES (Scaling range: 0 to 774)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	7.7525e+002	Pass
Runs-up	1,000,000	1.5107e-004	Pass
Runs-down	1,000,000	1.4422e-004	Pass

Correlation Test	1,000,000	-2.7094e-004	Pass
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Data file name: outputfile27 0-5000000.RES (Scaling range: 0 to 5000000)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	5.0026e+006	Pass
Runs-up	1,000,000	1.5010e-004	Pass
Runs-down	1,000,000	1.4465e-004	Pass

Data file name: outputfile32 0-5000000.RES (Scaling range: 0 to 5000000)

Statistical test	Sampling size	Sum of square of residuals	Pass/Fail
Chi-Square	1,000,000	5.0040e+006	Pass
Runs-up	1,000,000	1.5121e-004	Pass
Runs-down	1,000,000	1.5793e-004	Pass
Correlation Test	1,000,000	-5.8667e-005	Pass

References

1. RNG Description file "RNG Tester Info.docx".

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Disclaimer

ga has reported on what it has discovered throughout the assessment of the client’s RNG, and the components listed in the section RNG Fingerprint of this report, related to the technical scope of testing as per jurisdictional requirements.

Inherently there are limitations in performing compliance testing within a laboratory environment and accordingly **ga** has undertaken its best endeavours to ensure a thorough assessment is performed and conclusion stated.

Document Control

Version	Description	Date
V0.1	Initial draft – MUHA	28-02-2025
V0.2	Reviewed and Updated - MSID	03-03-2025
V0.3	QA – QRAZ	04-03-2025
V1.0	Final Report	06-03-2025

End of Document