Evaluation Report for
Intelligent Gaming (Pty) Ltd
CT–Interactive RNG
Version 6316

ATF Report Number:	**SAB.ITH.1119.01**
Date:	**25 April 2025**
Document Number:	**1**
Number of Pages:	**10**

BMM Testlabs South Africa (Pty) Ltd

bmmtestlabs southafrica (pty) ltd is a SANAS accredited testing laboratory number T0290 to ISO17025

Disclaimer: All results in this test report are subcontracted results.

Evaluation Report

Manufacturer Name & Address:	Intelligent Gaming (Pty) Ltd 240 Aitken Street, Midrand, 1685
Manufacturer Reference Number:	Service request Letter dated: 13-12-2024 Client reference: ITH
Local Supplier Name & Address:	Intelligent Gaming (Pty) Ltd 240 Aitken Street, Midrand, 1685
Testing dates:	Start date: 13-12-2024 End date: 14-04-2025
Product Style:	Random Number Generator
Jurisdictions Recommended:	Eastern Cape ☐ North West ☒ Free State ☐ Northern Cape ☐ Gauteng ☐ Western Cape ☒ KwaZulu-Natal ☐ Limpopo ☐ Mpumalanga ☒
Location where test was performed:	BMM Testlabs South Africa (Pty) Ltd No. 10 Brands Hatch Close, Kyalami Business Park Kyalami, Midrand 1685 South Africa
Location where report was issued:	BMM Testlabs South Africa (Pty) Ltd No. 10 Brands Hatch Close, Kyalami Business Park Kyalami, Midrand 1685 South Africa
Conclusion:	Pass
BMM Ref Number:	ITH.1119
Consultant(s):	Shaun Hose

TECHNICAL STANDARD(S) TESTED AGAINST

Technical Standard(s) used for Compliance Evaluation:	Comply		
	Yes	No	N/A
SANS 1718-1:2019 Edition 3, Casino equipment	☒	☐	☐

Approval Conditions
None.

1. PURPOSE

Intelligent Gaming (Pty) Ltd., requested BMM Testlabs South Africa (Pty) Ltd., hereinafter referred to as BMM, to evaluate CT–Interactive RNG Version 6316 for satisfactory operation in the relevant South African Gambling market.

***Disclaimer**: Random Number Generator evaluation below is a subcontracted test by a NATA-accredited testing laboratory, BMM Australia Pty Ltd, accreditation number 15122.*

2. PRODUCT CHARACTERISTICS (PRODUCT UNDER TEST)

The RNG is an implementation of dev/urandom which utilizes the Fortuna algorithm in the Linux environments.

3. BMM EVALUATION PERFORMED (SAMPLE UNDER TEST)

BMM has tested and confirmed compliance of the CT–Interactive RNG Version 6316 against the appropriate applicable technical requirements for the relevant South African Gambling markets. BMM performed the following tests to confirm compliance to the relevant regulatory specifications:

3.1 Random Number Generator Evaluation (BMM Checklist: APAC-AF-SAF-CH-18)

This test was performed to evaluate and verify that the random number generation is as specified in the technical documentation supplied by the manufacturer meets the requirements specified in technical standard. BMM has verified, through mathematical and statistical analysis, that the Random Number Generator (RNG) distributes numbers with fair distribution, lack of bias to particular outcomes and sufficient non-predictability.

The following sections describe the implementation of the RNG in the source code.

3.1.1 Seeding

The underlying RNG seeds itself internally with entropy drawn from various system sources.

3.1.2 Unpredictability

A secure algorithm is used, ensuring that it is infeasible to guess or determine the current RNG state, and hence all future output, by examining previous output. Entropy is continuously collected from various system sources and mixed into the RNG state to maintain security.

3.1.3 Scaling

Methods are provided for drawing random values in usable ranges from a uniform distribution without introducing bias.

3.1.4 Software Details:

Product ID	Product Function	File Name	SHA1
CT–Interactive Random Number Generator	Random Number Generator	LinuxUrandom.pm	D6893CAA6F2B2A8414C67BA2140F08C19D3C73CE
		LinuxUrandomQueue.pm	DEE2C8460E56767EAA7EEB776F176EECBA00CEF7
		RNG.pm	B5ADAA3D6C44132799960B36889B2D9224553EF8

3.1.5 Statistical Test Results

Each test tests the hypothesis that the RNG is a random source of numbers. A "p-value" is produced for each test run, which is the probability that a truly random process would produce the same or a more extreme result. P-values are expected to be uniformly distributed between 0 and 1. Each test is performed at least 100 times, and the p-values for each test are evaluated using an Anderson-Darling test. This produces a single p-value, which is the probability that the individual p-values have been produced from a uniform distribution.

Finally, the p-values from each test in the same test suite are combined using the Holm-Bonferroni method to provide an overall p-value. This process adjusts each p-value to ensure that the overall probability of accepting the RNG as random matches the confidence interval used. The overall p-value, equal to the minimum of the adjusted p-values, is compared to a specific alpha value to determine if the RNG is accepted or rejected as being random for a specific confidence interval. For a 99% confidence interval, the alpha value used is 0.01.

The following tables summarise the test results. See Appendix A for a description of the statistical tests used.

Empirical Tests

Test	P-values	99% Confidence
Frequency Test	1.000000	PASS
Serial Correlation Test	1.000000	PASS
Runs Test	1.000000	PASS
Gap Test	1.000000	PASS
Coupon Collector Test	1.000000	PASS
Subsequences Test	1.000000	PASS
Poker Test	1.000000	PASS
Overall	**1.000000**	**PASS**

Conclusion: The RNG is **ACCEPTED** as random at the 99% confidence interval.

Diehard Tests

Test	P-values	99% Confidence
Binary Rank 32x32 Test	1.000000	PASS
Binary Rank 6x8 Test	1.000000	PASS
Birthday Spacings Test	1.000000	PASS
Bitstream Test	1.000000	PASS
Count The 1's Stream Test	1.000000	PASS
Count The 1's Specific Test	1.000000	PASS

Test	P-values	99% Confidence
Runs Test	1.000000	PASS
Squeeze Test	1.000000	PASS
Overall	**1.000000**	**PASS**

Conclusion: The RNG is **ACCEPTED** as random at the 99% confidence interval.

NIST Tests

Test	P-values	99% Confidence
Approximate Entropy Test	1.000000	PASS
Block Frequency Test	1.000000	PASS
Cumulative Sums Test	1.000000	PASS
Discrete Fourier Transform Test	1.000000	PASS
Frequency Test	1.000000	PASS
Linear Complexity Test	1.000000	PASS
Longest Run of Ones Test	1.000000	PASS
Non-Overlapping Template Matchings Test	1.000000	PASS
Overlapping Template Matchings Test	1.000000	PASS
Random Excursions Test	1.000000	PASS
Random Excursions Variant Test	1.000000	PASS
Rank Test	1.000000	PASS
Runs Test	1.000000	PASS
Serial Test	1.000000	PASS
Universal Test	1.000000	PASS
Overall	**1.000000**	**PASS**

Conclusion: The RNG is **ACCEPTED** as random at the 99% confidence interval.

4. ADDITIONAL INFORMATION

If the above **Error! Reference source not found.** requires any parameters in order to be configured for operation in the field the parameters must be those which are specified by the manufacturer and must comply with the jurisdictional/operational requirements.

5. SOFTWARE SIGNATURE VERIFICATION

5.1 Signature Verification Procedure:

- Open the “BMM Signatures V2.0.6” application tool.
- Select option “browse files”.
- Locate the file from the where it is saved.
- Add all files by clicking the “open” button on the open dialog window.
- Select the digital signature SHA1 to be calculated.
- The “BMM Signatures V2.0.6” application tool will calculate the signatures and the signatures will be displayed in the output panel.
- Save the results to a desired directory using the “export” button.

- The results will be saved as a csv file.
- The signatures can be compared to the signatures listed in this report

NB: *Where requested, BMM will supply the regulator/operator with BMM's proprietary verification tool* "BMM Signatures V2.0.6". A user manual will also be supplied.

6. CONCLUSION

As a result of statistical testing and source code review, BMM confirms that the CT–Interactive Random Number Generator Version 6316 provides uniformly random data suitable for its intended application. This RNG complies with the applicable requirements for operation in South Africa

7. COMPLIANCE CONFORMITY

BMM Testlabs South Africa (Pty) Ltd., has conducted a level of testing which has historically been adequate for a submission of this type. However, inherent in testing in a laboratory environment is the unavoidable limitations of it not being possible to verify the effects of all possible configurations and environments that occur in actual gaming venues. Accordingly, subject to the above comment, from the testing performed BMM Testlabs South Africa (Pty) Ltd. Confirms that the item under test (unless otherwise stated) conforms to the relevant South African technical requirements.

The results relate only to the items tested.

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Disclaimer 1*: BMM allows its clients to review the draft BMM Evaluation Report for content before it is sent to the NRCS. If BMM receives no queries within 30 days from date of issue as stated on page 1 of the BMM Evaluation Report, BMM Testlabs South Africa (Pty) Ltd., will take the report as correct and accepted.*

Disclaimer 2*: BMM shall not be liable to any other party with respect to the undertaking of this project, BMM will not and cannot warrant or guarantee, expressly or impliedly, any aspect of the product. BMM is not responsible for either the action or inaction of any governmental or regulatory authority.*

SANS1718-1:2019

Internal Reference	Description	Pass / Fail / N/A / Previously Certified	Certification Reference
APAC-AF-SAF-CH-07 APAC-AF-SAF-MO-07	Hardware Evaluation	N/A	
APAC-AF-SAF-CH-08 APAC-AF-SAF-MO-07	Bill Acceptor firmware and hardware evaluation	N/A	
APAC-AF-SAF-CH-09 APAC-AF-SAF-MO-09	Regression Test	N/A	
APAC-AF-SAF-CH-12 APAC-AF-SAF-MO-12	Source code evaluation	N/A	
APAC-AF-SAF-CH-15 APAC-AF-SAF-MO-15	Mathematical Evaluation	N/A	
APAC-AF-SAF-CH-16 APAC-AF-SAF-MO-16	Artwork Verification	N/A	
APAC-AF-SAF-CH-14	Combinations Test	N/A	

Internal Reference	Description	Pass / Fail / N/A / Previously Certified	Certification Reference
APAC-AF-SAF-MO-14			
APAC-AF-SAF-CH-05	Extra Test Plan	N/A	
APAC-AF-SAF-CH-18 APAC-AF-SAF-MO-18	Random Number Generator evaluation	Pass	
APAC-AF-SAF-CH-29 APAC-AF-SAF-MO-29	TITO (Ticket In, Ticket Out)	N/A	

Provincial Legislative Authorities (PLA) Rules & Regulations	Complies	
	Yes	No
Mpumalanga Mpumalanga Gambling Act, 1995 (Act No. 5 of 1995) As amended. Mpumalanga Gambling Regulations, 2014.	☒	☐
North West North West Gambling Board Act no. 2 of 2001 as amended. Rules in terms of Act no. 2 of 2001 as amended. Regulations in terms of Act no. 2 of 2001 as amended.	☒	☐
North West North West Gambling Board LPM Rules in terms of Act no. 2 of 2001 as amended.	☒	☐
Western Cape Western Cape Gaming and Racing Board Rules Act no.4 of 1996 as amended.	☒	☐

Yours sincerely,

Digitally signed by Ntakuseni Andrew Matamela
Date: 2025.04.25 14:39:22 +02'00'

Ntakuseni Matamela
Team Leader

APPENDIX A

The following tests were used to test the statistical properties of the RNG.

A1. EMPIRICAL TESTS

The Empirical Tests are based on the tests described by Donald Knuth in The Art of Computer Programming Volume 2: Seminumerical Algorithms (1968, revised in 1997). They test sequences of numbers scaled to specific ranges.

Frequency Test	Counts of each number occurring across the sample set.
Serial Correlation Test	Counts of non-overlapping groups of numbers occurring together. Group sizes of two, three, and four are tested separately.
Runs Test	Counts of ascending and descending sequences of numbers. Note that this is a different test to the Runs Test in the Diehard and NIST Tests.
Gap Test	Counts of the size of gaps between successive occurrences of a given number. Each number in the range is tested separately.
Coupon Collector Test	Counts of sequence lengths required to complete a full set of each number in the range.
Subsequences Test	Similar to the Serial Correlation Test for pairs of numbers, except looking at numbers separated by a specific gap. Step sizes of 5, 10, 15, and 20 are tested separately.
Poker Test	The sequence is split into groups of five. The number of unique values in each group is counted.

A2. DIEHARD TESTS

The Diehard Tests are based on the test suite published by George Marsaglia in 1995. They test sequences of raw binary output from the RNG.

Binary Rank 32x32 Test	Matrices are created using 32 32-bit words. The ranks of the resulting matrices are counted.
Binary Rank 6x8 Test	Same as the Binary Rank 32x32 Test, except each matrix is formed using 6 values, each taking 8 bits from successive 32-bit words with a specific offset. All possible offsets are tested separately.
Birthday Spacings Test	32-bit words are taken as values, sorted, and the spacings between them calculated. The number of spacings of the same size are counted.
Bitstream Test	Blocks of 2^18 values are treated as a stream of overlapping 20-bit values. The number of possible 20-bit values that are not found in each block is counted.
Count The 1's Stream Test	8-bit values are taken and assigned a “letter” based on the number of one’s appearing in the binary representation of each value. Overlapping groups of 5 “letters” are counted.
Count The 1's Specific Test	Similar to the Count The 1’s Stream Test, except 8-bit values are taken from successive 32-bit words with a specific offset. All possible offsets are tested separately.
Runs Test	Counts sequences of increasing and decreasing 32-bit words. Note that this is a different test to the Runs Test in the Empirical and NIST Tests.
Squeeze Test	A value of 2^31 is repeatedly multiplied by 32-bit words, dividing by 2^32 and taking the ceiling of the result each time. The number of successive words that are required to reduce the value down to 1 is counted. The value is reset to 2^31 and the process is repeated.

A3. NIST TESTS

The NIST Tests are based on the suite of tests released by the National Institute of Standards and Technology in Special Publication 800-22, Revision 1a (revised April 2010). They test sequences of raw binary output from the RNG.

Approximate Entropy Test	Similar to the Serial Test, count each possible m-bit value, except it does so for two adjacent m bit lengths and compares the two.
Block Frequency Test	Similar to the Frequency Test, except the data is split into equally sized blocks. The number of ones and zeroes in each block is counted.
Cumulative Sums Test	Random walks are created by converting the data to +1 / -1 for 1 / 0 respectively and summing consecutive values.
Discrete Fourier Transform Test	The data is transformed using a Discrete Fourier Transform. The number of peaks within the 95% threshold are counted.
Frequency Test	The number of ones and zeroes in the binary output is counted.
Linear Complexity Test	The length of the linear complexity of the random sequence is determined.
Longest Run of Ones Test	The data is split into equally sized blocks. The longest run of ones in each block is determined and counted.
Non-Overlapping Template Matchings Test	The data is split into equally sized blocks. Each block is searched for a specific pattern of bits and counted. A separate test is run for various bit patterns. Each bit pattern searched does not overlap with itself. That is, when the pattern is matched, the end of the pattern cannot be the start of another match.
Overlapping Template Matchings Test	Similar to the Non-Overlapping Template Matchings Test, except only one pattern is searched, which may overlap with itself.
Random Excursions Test	As with the Cumulative Sums Test, random walks are created by converting the data to +1 / -1 for 1 / 0 respectively and summing consecutive values. The number of times a given state is visited between returns to zero are counted. Separate tests are run for various states from -4 to +4, not including 0.
Random Excursions Variant Test	Similar to the Random Excursions Test, except the number of times the given state is visited is counted for the entire sequence. Separate tests are run for various states from -9 to +9, not including 0.
Rank Test	Matrices are created using 32 32-bit words. The ranks of the resulting matrices are counted. Note that this is fundamentally the same test as the Binary Rank 32x32 Test in the Diehard Tests, although the implementation may differ.
Runs Test	Runs of consecutive bits of the same value of various lengths are counted.
Serial Test	Counts of each possible m-bit values. Separate tests are run for various m bit lengths.
Universal Test	Distances between repeated patterns of bits are counted.

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