



Verification report: ITL15306

NetEnt Product Services Ltd

Random Number Generator Certification Report

01 April 2015



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I. General information

No.	Description	Details
1.	Identification	NetEnt RNG
2.	Verification body issuing the certificate (test house)	iTech Labs Australia Suite 24, 40 Montclair Ave Glen Waverley, VIC 3150, Australia URL: http://www.itechlabs.com.au E-mail: info@itechlabs.com.au
3.	Guidelines used for testing	Malta Remote Gaming Regulations S.L.438.04
4.	Details of the module tested	NetEnt RNG
5.	Type of the module tested	Random Number Generator (RNG)
6.	Produced by	NetEnt Product Services Ltd The Marina Business Centre Abate Rigord Street Ta' Xbiex XBX 1120 Malta URL: www.netent.com
7.	Licensee details	Not applicable
8.	Date of request for verification	31 March 2015
9.	Date of completion	01 April 2015
10.	Results	Passed all tests
11.	Other records	This is a recertification of the NetEnt RNG. There are no changes to the functionality of the NetEnt RNG; however, the old common-service.jar is replaced with spp-rng-wrapper-1.0.0.jar. This is due to the following non-functional changes: <ul style="list-style-type: none">• Order of the import commands in the header of RandomGeneratorImpl.java• Dependency type in SPP has changed

II. Details of hardware

No.	Description	Details
1.	Produced by	Not applicable
2.	Identification of hardware	Not applicable
3.	Features that characterize the hardware	Not applicable
4.	Reference to verification	Not applicable
5.	Other records	Not applicable

III. Details of software components

No.	Description	Details
1.	Produced by	NetEnt Product Services Ltd The Marina Business Centre Abate Rigord Street



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		Ta' Xbiex XBX 1120 Malta URL: www.netent.com
2.	Details of the software components*	<code>random.fortuna.entropy.source.DevUrandomEntropySource.java</code> <code>random.fortuna.entropy.source.DiskWriteEntropySource.java</code> <code>random.fortuna.entropy.EntropyAccumulator.java</code> <code>random.fortuna.entropy.EntropyBytes.java</code> <code>random.fortuna.entropy.EntropyCollector.java</code> <code>random.fortuna.entropy.EntropyPool.java</code> <code>random.fortuna.entropy.source.EntropySource.java</code> <code>random.fortuna.FortunaGenerator.java</code> <code>random.fortuna.FortunaRandom.java</code> <code>random.fortuna.entropy.source.GarbageCollectionTimeEntropySource.java</code> <code>random.fortuna.entropy.source.HeapMemoryEntropySource.java</code> <code>random.fortuna.entropy.source.LoadAverageEntropySource.java</code> <code>random.fortuna.entropy.source.ObjectsPendingFinalizationEntropySource.java</code> <code>common.commonservice.service.random.RandomGeneratorImpl.java</code> <code>random.fortuna.seed.SecureRandomSeedGenerator.java</code> <code>random.fortuna.seed.SeedGeneratorFactory.java</code> <code>random.fortuna.seed.SeedGenerator.java</code> <code>random.fortuna.entropy.source.ThreadCpuTimeEntropySource.java</code> <code>random.fortuna.entropy.source.ThreadSchedulerEntropySource.java</code> <code>random.fortuna.seed.UnixSeedGenerator.java</code> <code>random.fortuna.entropy.source.UptimeEntropySource.java</code> <code>random.fortuna.entropy.source.UsedJvmMemoryEntropySource.java</code>
3.	Features that characterise the software object	See at the end of this table ¹
4.	Dimensioning of the component	See at the end of this table ²
5.	Reference to verification	Malta Remote Gaming Regulations S.L.438.04
6.	Other records	<p>This is a recertification of the NetEnt RNG.</p> <p>There are no changes to the functionality of the NetEnt RNG; however, the old common-service.jar is replaced with spp-rng-wrapper-1.0.0.jar.</p> <p>This is due to the following non-functional changes:</p> <ul style="list-style-type: none"> • Order of the import commands in the header of RandomGeneratorImpl.java • Dependency type in SPP has changed

*Refer to Appendix A for the size and Md5sum of each critical source file.

¹ Features that characterise the software object

No.	Item Name	Item Type	Description
1.	NetEnt RNG	Random Number Generator	<p>NetEnt RNG is the software architecture that generates Random Numbers used by the games for generating game outcomes. The RNG implementation uses Fortuna algorithm.</p> <p>Details of changes in this release of the RNG:</p> <p>The old common-service.jar is replaced with spp-rng-wrapper-1.0.0.jar.</p>



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			<p>This is due to the following non-functional changes:</p> <ul style="list-style-type: none"> • Order of the import commands in the header of RandomGeneratorImpl.java • Dependency type in SPP has changed <p>Functionality of the RNG remains unchanged.</p>
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² Dimensioning of the component

File Name	File size (in bytes)
spp-rng-wrapper-1.0.0.jar	4,988
fortuna-1.0.jar	24,633

IV. Details of tests

Product identification: NetEnt RNG

iTech Labs has conducted evaluation of the RNG by comparing the new source code of the RNG to the previously approved RNG to identify any changes. There were no changes to the functionality of the NetEnt RNG. Changes were related to:

- Order of the import commands in the header of RandomGeneratorImpl.java
- Dependency type in SPP has changed

The tests below were done as part of the original certification. They were not required to be run in this re-certification. They are included for information purposes.

No.	Tests Performed	Details of Tests	Results
1.	Source code examination	<p>The following source code evaluation was conducted:</p> <ol style="list-style-type: none"> Identification of algorithm; Security of internal state, seeding and re-seeding, thread safety; Scaling of numbers for slot games, Roulette and scratch tickets. 	<p>The RNG implementation uses Fortuna – an algorithm based on continuous reseeding from multiple entropy sources (this has been assessed and found acceptable). The Security of internal state, seeding, re-seeding and thread safety of PRNG is OK. The PRNG state is initialised from Entropy Sources.</p>
2.	Tests conducted	<ol style="list-style-type: none"> Marsaglia’s “Diehard” tests were applied to 2 sets of 80 million bits of raw 32 bit random numbers generated by the algorithm. The following diehard tests were conducted on 80 million bits for each test; <ol style="list-style-type: none"> BIRTHDAY SPACINGS OVERLAPPING 5-PERMUTATIONS BINARY RANK TEST for 31x31 matrices BINARY RANK TEST for 32x32 matrices BINARY RANK TEST for 6x8 matrices BITSTREAM TESTS ON 20-BIT Words BITSTREAM TESTS OPSO, OQSO, DNA COUNT-THE-1's IN A STREAM OF BYTES COUNT-THE-1's IN SPECIFIC BYTES PARKING LOT TEST MINIMUM DISTANCE TEST 	<ol style="list-style-type: none"> Marsaglia’s “Diehard” tests. Marsaglia’s “Diehard” tests passed satisfactorily. Chi-squared tests. <ol style="list-style-type: none"> Chisquare tests passed satisfactorily Range:0-1 DOF:1 Range:0-6 DOF:5 Range: 0 -31 DOF: 31 Range: 0 -32 DOF: 32 Range: 0 - 36 DOF: 36 Range: 0 - 62 DOF: 62 Range: 0 - 63 DOF: 63 Range: 0 - 64 DOF: 64 Range: 0 - 999 DOF: 999 Range: 0 -9999 DOF: 9999 Chisquare tests passed satisfactorily Range: 0 - 1,000,000; DOF: 198, 316, 442, 508 and 999 Range: 0 - 2,000,000; DOF: 198, 316, 442, 508 and 999 Shuffle tests passed satisfactorily



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	<p>xii) THE 3DSPHERES TEST xiii) THE SQUEEZE test xiv) OVERLAPPING SUMS TEST xv) RUNS TEST xvi) CRAPS TEST</p> <p>b) The following Chi-squared tests were conducted on the scaled numbers.</p> <p>i) Scaling tests for slot games and Roulette games. The tests were conducted for ranges 1, 6, 31, 32, 36, 62, 63, 64, 999 and 9999.</p> <p>ii) Scaling tests for scratch tickets The tests were conducted for ranges 0-1,000,000 and 0-2,000,000</p> <p>c) Shuffling for single deck card games (without joker and one joker), 4 decks, 6 decks and 8 decks without joker.</p>	<p>Each of these tests was conducted for a total of over 1 million decks for sets ranging from 1,000 to 100,000 decks.</p> <p>1 deck 1 Joker</p> <table border="1"> <tr><td>Tests</td><td>DOF</td></tr> <tr><td>Suits</td><td>212</td></tr> <tr><td>Ranks</td><td>689</td></tr> <tr><td>Cards</td><td>2756</td></tr> </table> <p>1 deck no joker</p> <table border="1"> <tr><td>Tests</td><td>DOF</td></tr> <tr><td>Suits</td><td>156</td></tr> <tr><td>Ranks</td><td>624</td></tr> <tr><td>Cards</td><td>2652</td></tr> </table> <p>4 decks no joker</p> <table border="1"> <tr><td>Tests</td><td>DOF</td></tr> <tr><td>Suits</td><td>312</td></tr> <tr><td>Ranks</td><td>1248</td></tr> <tr><td>Cards</td><td>5304</td></tr> </table> <p>6 decks no joker</p> <table border="1"> <tr><td>Tests</td><td>DOF</td></tr> <tr><td>Suits</td><td>312</td></tr> <tr><td>Ranks</td><td>1248</td></tr> <tr><td>Cards</td><td>5304</td></tr> </table> <p>8 decks no joker</p> <table border="1"> <tr><td>Tests</td><td>DOF</td></tr> <tr><td>Suits</td><td>312</td></tr> <tr><td>Ranks</td><td>1248</td></tr> <tr><td>Cards</td><td>5304</td></tr> </table>	Tests	DOF	Suits	212	Ranks	689	Cards	2756	Tests	DOF	Suits	156	Ranks	624	Cards	2652	Tests	DOF	Suits	312	Ranks	1248	Cards	5304	Tests	DOF	Suits	312	Ranks	1248	Cards	5304	Tests	DOF	Suits	312	Ranks	1248	Cards	5304
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V. Complete requirements met by the tests

iTech Labs has evaluated the NetEnt RNG as per the relevant Malta Remote Gaming Regulations S.L.438.04. Evaluation details are given below:

Requirements	Results
Third Schedule – Regulation 25 Technical Requirement for Gaming System	
Third Schedule – 1	
Third Schedule – 1a	Not applicable
Third Schedule – 1b	Not applicable
Third Schedule – 2	Not applicable
Third Schedule – 3	
Third Schedule – 3a	Complies
Third Schedule – 3b	Complies
Third Schedule – 3c	Complies
Third Schedule – 4	Not applicable
Third Schedule – 5	Not applicable
Third Schedule – 6	
Third Schedule – 6a	Not applicable



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Third Schedule – 6b	Not applicable
Third Schedule – 6c	Not applicable
Third Schedule – 6d	Not applicable
Third Schedule – 6e	Not applicable
Third Schedule – 6f	Not applicable
Third Schedule – 7	Not applicable
Third Schedule – 8	
Third Schedule – 8a	Not applicable
Third Schedule – 8b	Not applicable
Third Schedule – 9	
Third Schedule – 9a	Not applicable
Third Schedule – 9b	Not applicable
Third Schedule – 9c	Not applicable
Third Schedule – 9d	Not applicable
Third Schedule – 9e	Not applicable
Third Schedule – 9f	Not applicable
Third Schedule – 9g	Not applicable
Third Schedule – 9h	Not applicable
Third Schedule – 9i	Not applicable
Third Schedule – 10	
Third Schedule – 10a	Not applicable
Third Schedule – 10b	Not applicable
Third Schedule – 10c	Not applicable

VI. Observations

None

VII. Conditions

None

VIII. Final declaration and conformity


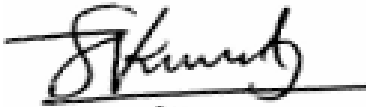
No.	Description	Details
1.	Certification	Date of certification: 01 April 2015 Software provider: NetEnt Product Services Ltd Licensee name: N/A Licensee site URLs: N/A Total number of pages: 9 This is to certify that iTech Labs has evaluated the Random Number Generator (RNG) used by NetEnt Product Services Ltd and found that the RNG complies with the relevant standards and is in conformity to the Remote Gaming Regulations 2004 and the Lotteries and Other Games Act applicable in Malta.



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		It is hereby certified that the RNG used by the game types listed in Appendix B are compliant with the technical requirements set in the Third Schedule of the Malta Remote Gaming Regulations 2004 and that the RNG was tested as an integral part of the gaming system.
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Signatures:

 <hr/> <p>Gyulserian Hyussein Senior Consultant iTech Labs Australia 01 April 2015</p>	 <hr/> <p>Kiren Sreekumar Principal Consultant iTech Labs Australia 01 April 2015</p>
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IX. Conclusion

<p>While it is not possible to test all possible scenarios in a laboratory environment, iTech Labs has conducted a level of testing appropriate for a submission of this type. Accordingly, subject to the above comments, iTech Labs certifies that the items under test comply with the relevant Technical Standards, unless otherwise stated.</p>
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Appendix A

No	File Name	Size (in bytes)	Md5sum*
1.	random.fortuna.entropy.source.DevUrandomEntropySource.java	1,221	21D8A5F72A14DD2B514BA08172B5F936
2.	random.fortuna.entropy.source.DiskWriteEntropySource.java	1,674	D56E0181C4C9E7F5AD6B490A0FB3A146
3.	random.fortuna.entropy.EntropyAccumulator.java	3,929	5D1D26CE5E79521D7F905E3B445003DC
4.	random.fortuna.entropy.EntropyBytes.java	1,322	D81D563523660FA7E8D5E052C8361B65
5.	random.fortuna.entropy.EntropyCollector.java	950	E7D31EA7B677424C8F84F1DF6371694D
6.	random.fortuna.entropy.EntropyPool.java	2,983	3BA6100409AC2CB2A425D21021717C98
7.	random.fortuna.entropy.source.EntropySource.java	214	D5FD6ED6274FA207D4BB54C702D3EE8D
8.	random.fortuna.FortunaGenerator.java	3,427	87DD948316AA7006EC89F62AB7FDF92F
9.	random.fortuna.FortunaRandom.java	5,387	C3F706EEEF948B4631441E4FCOB3957B
10.	random.fortuna.entropy.source.GarbageCollectionTimeEntropySource.java	741	00E5BC07289BF5A1AE2B36A53604E557
11.	random.fortuna.entropy.source.HeapMemoryEntropySource.java	671	70A908470B2F715107CC5812759606E6
12.	random.fortuna.entropy.source.LoadAverageEntropySource.java	778	C90409BB799E1C134414D99AB4D690A4
13.	random.fortuna.entropy.source.ObjectsPendingFinalizationEntropySource.java	694	0E6478E94ADCC4D7BFB3AA85FD4F8156
14.	common.commonservice.service.random.RandomGeneratorImpl.java	1,345	91C3A9952D36622FFB052BED8BFB7130
15.	random.fortuna.seed.SecureRandomSeedGenerator.java	591	CCCD173A5DE409C928E308CDB6CE01AA
16.	random.fortuna.seed.SeedGeneratorFactory.java	298	A5DAB6B442D1EEC499079D36FAE2E405
17.	random.fortuna.seed.SeedGenerator.java	120	941D2DCF0490F688D10CB6198BD3A398
18.	random.fortuna.entropy.source.ThreadCpuTimeEntropySource.java	756	DDA7D8A879169F9D4B130EA10AF9898E
19.	random.fortuna.entropy.source.ThreadSchedulerEntropySource.java	892	F46297F8CAAD8EEBE25E75ECECB4FE1E
20.	random.fortuna.seed.UnixSeedGenerator.java	635	0CB69D20880F4EED9D6C3E59DE4B5402
21.	random.fortuna.entropy.source.UptimeEntropySource.java	859	0614B2D9106BC865461450EA4060E5E2
22.	random.fortuna.entropy.source.UsedJvmMemoryEntropySource.java	717	FD66967A3E039A6197086BD6C2DC8F0A

*Md5sum is calculated using the Linux program md5sum.



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Appendix B

No.	Game types
1.	Slot games
2.	Roulette games (single zero and double zero)
3.	Scratch Ticket Games
4.	Card Games - single deck card games (without joker and one joker), 4 decks, 6 decks and 8 decks without joker