RANDOM NUMBER GENERATOR EVALUATION REPORT

March 11th , 2013

Vera Kopja tal-Original

Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

INTRODUCTION

The results included in this report are a summary of the testing work explained in other documents and database archived by QUINEL. All are subject to a series of cautions, including:

1) Any Hardware provided for analysis and testing is configured identically to hardware in commercial use
2) Game software/ function provided for the testing and code review is declared by the customer to have the same behavior to the software/code in commercial use
3) Functionality made by the software in automatic test mode has a realistic behavior

The Recipient, by accepting and using this Report, declares to be aware and accept unconditionally all the terms and conditions set forth. If the Applicant and / or the Recipient does not agree on the terms and conditions set forth, Quinel reserves the right to cancel the certification provided with this Report, it follows therefore that the Recipient must immediately return all copies to Quinel of this Report and cannot use them nor refer to.

Vera Kopja tal-Original

Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

A) CERTIFICATION LAB

QUINEL
Address: Grundstrasse 2
Ch-6343 Rotkreuz (Switzerland)
Testing facility:
Via Prampolini, 28 43044 Lemignano di Collecchio (Parma) –Italy
email: info@quinel.it

B) SOFTWARE PROVIDER

RMI Limited
Vault 14, Level 2,
Valetta Waterfront,
Floriana FRN1914, Malta
Company number: C 59428

C) SYSTEM/MODULE TESTED

Binary module ***gameserver*** see Annex A.doc
Binary module ***lobbyserver*** see Annex B.doc
Related source code ***lobbyrndfiles.zip*** see Annex C.doc
Related source code ***rng_c++_classes.zip*** see Annex D.doc
Related source code ***rngtesting_webapp.7z*** see Annex E.doc
Related source code ***wc.zip*** see Annex F.doc

Date Completed: March 11th , 2013

D) PREVIOUS HISTORY OF SYSTEM/MODULE TESTED

During the certification process no bugs nor non-compliances were reported. The RNG module results compliant with the Malta Remote Gaming Regulation dated 2004 and further modifications.

E) EVALUATION PERFORMED

QUINEL has performed an evaluation of the RNG implementation as below:

1. Instruction Analysis: Security of Internal State, Thread Safety, Seeding and Re-Seeding

2. Tests executed:

The RNG has been tested on different sets of data:

- A) by extracting sets of Raw numbers (int32) from the raw generator
- B) by extracting sets of scaled numbers from the scaled generator
- B) by extracting shuffled decks with a test application directly on a clone of a production server.

The following tests were executed on data set, the result is reported alongside:

QUINEL Statistical tests:

On "A" set of number

- Marsaglia (DieHard) test	POSITIVE
- Nist test	POSITIVE

On "B" and "C" set of number

- Uniform distribution tests on groups of shuffled decks	POSITIVE
- Statistical independency on groups of shuffled decks	POSITIVE
- Multiple Runs Test on groups of decks	POSITIVE
- Automated statistical test (*Frequency test, Gap test, Order test, T-student test,Wilcox test, Shapiro test*) on groups of decks	POSITIVE
- Auto correlation on groups of shuffled decks	POSITIVE
- Cross correlation between groups of shuffled decks	POSITIVE
- Source code analysis	POSITIVE

The RNG Tests were executed to verify the compliance with the Malta Remote Gaming Regulation dated 2004 and further modifications.

F) EVALUATION RESULTS

1. Instruction Analysis

The entropy engine is the Hardware RNG "Quantis USB" produced by "ID QUANTIQUE SA" - Chemin de la Marberie 1227 Carougue – Ginevra Switzerland. This device produces a sequence of bits that are retrieved from the RNG software to create 32-bit integer.

Then this 32-bit integer is scaled to an upper limit number from 0 to 51, this scaled number is used from the well-known Fischer-Yates/Knuth shuffling algorithm on a deck of french cards according to the following pseudo code:

```
a. Reset the deck to a completely sorted state.
b. for i= 51 to 0
        1.    j= random number from 0 to i
        2.    swap cards in i and j locations.
```

2. Tests executed:

a) Marsaglia ("*diehard*") test: PASS
b) NIST test: PASS
c) Uniform distribution tests on scaled numbers: PASS
d) Statistical independence tests on scaled numbers: PASS
e) Run tests on scaled numbers: PASS
f) Auto correlation tests on scaled numbers: PASS
g) Cross correlation tests on scaled numbers: PASS
h) Statistical tests on scaled numbers: PASS
i) Source code analysis: PASS

G) NOTES

The Assembly ***gameserver*** (Annex A.doc) contains the game logic and it is no relevant for the RNG certification.

The Assembly ***lobbyserver*** (Annex B.doc) contains the management of lobby, in it there is also the management of random number used from the poker game to generate the outcome of any game event.

Vera Kopja tal-Original
Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

H) CERTIFICATION

Date: November 2nd, 2012
Software Provider: RMI Limited
Total Number of Pages: 6
QUINEL certifies that the RNG examined complies with the Remote Gaming Regulation of Malta dated 2004 and further modifications.

I) CONDITIONS

1) The game that will use the RNG subject to the present certification will create and shuffle a deck of 52 cards.

   The software that generates the numbers and shuffled decks is provided by RMI Limited.

2) Quinel has not verified directly the use of "Quantis USB" hardware. All the information about it are given directly from the applicant. It's under his responsibility to use this hardware device for real game/production purposes.

J) CONCLUSIONS

Whilst it's not possible to test all the possible variables in a laboratory environment, QUINEL has performed a series of tests effective for a submission as follow.

The random values produced by the Random Number Generator object of the present certification matches the requested confidence level of 95%.

QUINEL therefore certifies that the item tested complies with the Technical Standards requested.

Signed:

Date: March 11th , 2013

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original

Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

ANNEX A

FILE NAME	gameserver
SHA1	a021692aa5bed04d1cc6c5992d6953f86b443e29

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original
Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

ANNEX B

FILE NAME	lobbyserver
SHA1	a83c137d1dffcc0b8337d2e0476df7e32cd8c73a

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original
Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

ANNEX C

FILE NAME	lobbyrndfiles.zip
SHA1	6a0106467bcd580921e9b418df33668b8816403d

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original
Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

ANNEX D

FILE NAME	rng_c++_classes.zip
SHA1	616b15bcb2fe3e4a2d8fa704e195950c633190d3

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Oriġinal

Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

Page 1 of 1

ANNEX E

FILE NAME	rngtesting_webapp.7z
SHA1	843e6a5999095022b6bcda520ef0e55f6080373e

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original
Av. André Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914

QUINEL
QUALITY IN ELECTRONICS

ANNEX F

FILE NAME	wc.zip
SHA1	a9067a969bb24093b8d38f6309886553d2f52499

Date: March 11th, 2013

Signed:

Isacco Ceci
(QUINEL)

Vera Kopja tal-Original
Av. Andre Portelli LL.D.
EMD Advocates
Vaults 13-16,
Valletta Waterfront, FRN 1914