



Gambling Commission  
approved Test House  
Accredited to  
ISO/IEC 17025:2005

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**Report to Sterling Management Centre Limited**

**Test Report for the Sterling Lotteries  
Random Number Generator**

Report Reference ID	Issue Date
CAST/CTL-026/UKGC/26001/01	16/01/2009

**Executive Summary**

Sterling Lotteries' Random Number Generator application has been tested by CAST for fairness and compliance with the applicable sections of the Gambling Commission's Technical Standards.

The random numbers generated have been tested using a variety of industry-standard statistical tests. No issues have been identified and the random number generator is considered to be fit for purpose.

**Authorisation**

Approved by:   
CTL Quality Manager

**Disclaimer**

This test report and accompanying documents are provided "as is" with no warranties whatsoever. All software and hardware includes defects and nothing in this document is intended to represent or warrant that testing was complete and without error. The gaming system manufacturer remains solely responsible for the design, sale and functionality of their product(s), including any liability arising from legal infringement or product warranty.



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The Centre for Advanced Software Technology Limited (CAST Ltd) is a wholly-owned subsidiary of Bangor University.  
CAST Ltd is located at Technium CAST, part of the Technium Network in Wales.



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## Introduction

The Centre for Advanced Software Technology Limited (CAST) is a wholly-owned subsidiary of Bangor University. CAST is a commercial operation located separately from the University at the Welsh Assembly Government's 'Technium CAST' facility in North Wales. CAST's Compliance Testing Laboratory (CTL) has been established to provide compliance testing and related services to the gaming industry.

CAST is fully approved by the UK Gambling Commission and accredited to ISO/IEC 17025:2005 (by the United Kingdom Accreditation Service, UKAS) to undertake compliance testing of all categories of modern gaming systems and related equipment. CAST's ISO 17025 accreditation schedule is downloadable from the UKAS website<sup>1</sup>. The Gambling Commission's list of approved Test Houses is published on their website.<sup>2</sup>

## Scope of ISO/IEC 17025:2005

CAST's ISO/IEC 17025:2005 accreditation covers the testing of gaming systems for compliance with the full scope of the Gambling Commission's applicable Technical Standards. In the following sections, ISO/IEC 17025:2005 inspection reports are labelled to distinguish them from non-ISO assessments, interpretations and suggestions.

## Caveats

The results presented in this document are a summary of the testing work detailed in other documents and data files archived by CAST. All are subject to a number of caveats, including:

- Any hardware provided for inspection and testing is configured identically to hardware in commercial use.
- Game software / source code provided for automated testing and/or code review is declared by the customer to behave identically to the software / code in commercial use.
- Decisions taken by the supplied software in automatic test mode are reasonable emulations of those that would be expected to be taken by real players.

All efforts have been taken to ensure that the testing undertaken has been as exhaustive as necessary to demonstrate compliance or non-compliance. CAST takes on trust that all test items (including all hardware and software), all documentation and all communications are accurate, truthful, and that there is no intention to deceive or subvert the assessment of compliance.

## Quality Control

The monitoring of this testing project was the responsibility of CAST's Quality Manager and every effort has been made to ensure the accuracy of the information contained herein. If errors or omissions are discovered, please contact us with details as soon as possible. CAST reserves the right to revise and reissue this Test Report if additional relevant information comes to light.

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<sup>1</sup> Follow the 'View Full Schedule (PDF)' link here: [http://www.ukas.org/testing/lab\\_detail.asp?lab\\_id=2613](http://www.ukas.org/testing/lab_detail.asp?lab_id=2613)

<sup>2</sup> See <http://www.gamblingcommission.gov.uk/Client/mediadetail.asp?mediaid=183> (click the 'Test Houses' PDF link on the right hand side).

## Testing Overview

### ***Customer Contacts***

The customer liaison for this testing project was Karl Wild.

### ***Dates***

Testing was undertaken during December 2008.

### ***Test Item***

The Sterling Lotteries Random Number Generator (RNG) was supplied in the form of a compiled Microsoft Access 2002 (Service Pack 3) database. The program runs on the Microsoft Windows XP and Microsoft Windows Vista operating systems.

### ***Applicable Standards and Regulations***

The supplied RNG has been tested for randomness and fairness in accordance with the applicable sections of the Gambling Commission's Remote Gambling and Software Technical Standards. Specifically, our testing strategy addressed the requirements of Section 7A (part a) which is reproduced below:

RTS 7 – Generation of random outcomes

#### **Gaming (including bingo), lotteries, and betting on virtual events**

##### **RTS implementation guidance 7A**

- a. Random number generators should be capable of demonstrating the following qualities:
  - i. the output from the random number generator is uniformly distributed over the entire output range and game, lottery, or virtual event outcomes are distributed in accordance with the expected/theoretical probabilities;
  - 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;
  - iii. random number generation does not reproduce the same output stream (cycle), and that two instances of a random number generator do not produce the same stream as each other (synchronise);
  - iv. any forms of seeding and re-seeding used do not introduce predictability; and
  - v. any scaling applied to the output of the random number generator maintains the qualities above.

## Test Methods

The supplied random number generator produces a number between 0 and 9,999,999. For the purposes of testing, ten sets of 100,000 numbers were generated and output to standard text files using the supplied application.

The numbers were tested using CTL's normal methods based on the empirical tests described by Donald Knuth in "The Art of Computer Programming: Seminumerical Algorithms Volume 2". Specifically, the following tests were applied:

- Frequency Test
- Serial Test
- Gaps Test
- Runs Test
- Poker Test
- Permutations Test
- Coupons Test

## Empirical Testing Results

<b>Test Item</b>	Sterling RNG.mdb MD5 checksum = 8653229c499561c604eb66f6ef02118f
<b>Summary</b>	<p>The supplied software random number generator produces a stream of numbers in the interval 0 to 9,999,999. Ten sets of 100,000 numbers were generated using the supplied application.</p> <p>The numbers were tested using CTL's normal methods based on the empirical tests described by Donald Knuth in The Art of Computer Programming: Seminumerical Algorithms, Volume 2.</p>
<b>Sample Size</b>	1,000,000 (10 sets of 100,000)
<b>Results</b>	<p>In 125 individual tests, only 7 results fell outside of the 95% confidence interval (as expected).</p> <p>The numbers are distributed over the entire specified range and each stream of numbers generated was found to be unique. No evidence was found of any predictability, dependency or repetition or of any short or long term patterns.</p> <p>Therefore the numbers are judged to be sufficiently random for conformance with the Gambling Commission Remote Gambling and Software Technical Standards, specifically the requirements of section 7A part a.</p>