BINGO 游戏共有 2 个独立玩法，JACKPOT 和旁注

- Jackpot，系统随机唱号 50 个球以内，涂满卡片（全部着色）之后，算做中奖 jackpot
- 旁注，系统随机唱号 44 个球以内，涂色指定图案即可中奖。
- 每种玩法下，卡片的投注额独立计算

  //举例：假如 jackpot 玩法费用为 10p；旁注玩法费用为 10p。同一张卡片，jackpot1 种玩法要付 10p；参与旁注玩法要付 10p；参与 jackpot 和旁注玩法要付 20p
- 用户必须参与 1 个玩法，或 2 个都参与

1.1 核心流程

- 游戏开始 -> 30 秒购买倒计时 -> 用户选择参与的游戏类型 -> 用户选择喜欢的卡片，购买 -> 购卡时间截止，系统开始唱号，连续唱号 44 球 -> 系统派彩旁注玩法，提示进入 jackpot 时间 -> 连续唱 6 个球，结束唱号（若唱号中途有人中奖 jackpot，则停止唱号） -> 系统派彩 -> 下一局开始投注

1.2 BINGO 卡片

- 卡片规格：

  单张卡片规格为：5 行 5 列；

  每个格子内填充 1 个数字信息，中心的格子不填充数字，是“free space”；

  单张卡片内所有数字取值范围为 1-75，数字不重复；

  - 数字取值范围（从左至右）：

    第 1 列 5 个数字在 1~15 内随机产生；

    第 2 列 5 个数字在 16~30 内随机产生；

    第 3 列 4 个数字在 31~45 内随机产生（中间格子是“free space”）；

    第 4 列 5 个数字在 46~60 内随机产生；

第 5 列 5 个数字在 61~75 内随机产生；

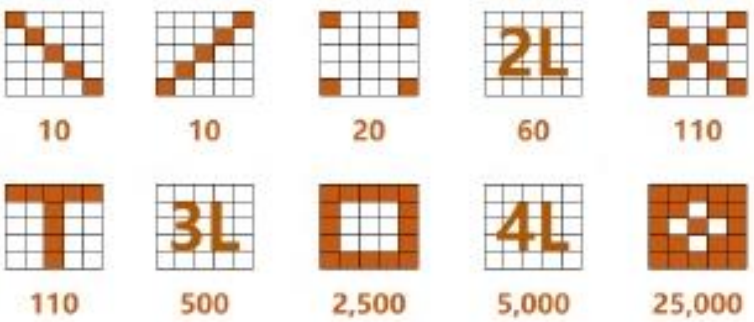
单张卡片，各列数字从上到下，按数字从小到大排序

1.3 中奖规则

- 旁注玩法中奖规则：本局唱出 44 个球时，用户卡片组成了系统指定图案，则获得相应奖金。
  - 中奖图案中，多个图案有完全包含关系的（如 3L 与 2L），以其中的最大赔率图案作为有效赔率

//2L 指任意两行涂满（free space 默认被涂色）；

  - 中奖图案中，该卡片的某个中奖图案，与该卡片的其他中奖图案，无完全被包含关系，则该图案赔率为有效赔率
  - 该卡片的总赔率，等于该卡片所有有效赔率之和
  - 旁注玩法单张卡片需付费 10p 时，中奖图案和相应奖金如下（客户端显示实际中奖奖金）



若转换为赔率，从左到右各图片的赔率是：

1; 1; 2; 6; 11

11；50；250；500；2500

1.4 试题

1、 请计算 50 个球唱出时，单张卡片全部涂色的概率

2、 请计算 Jackpot 玩法的理论返奖率（RTP）

2、请计算 44 个球唱出时，在单张卡片中，旁注玩法每个图形出现的概率

3、请计算 44 个球唱出时，旁注玩法的理论返奖率（RTP）

Evaluation Report for Game Da Vinc1 Secrets version v36.00 of Zitro S.à.r.l.

Manufacturer:	**Zitro S.à.r.l.**
Game Name:	**Da Vinc1 Secrets v36.00**
Certification Report Number:	**PHI.ZIF.2136.01**
Document Number:	**1**
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Number of Pages:	**7**

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EVALUATION REPORT

Name and details of the applicant:	Marta Cuesta Quality Director
Name and details of the manufacturer:	Zitro S.à.r.l. 9 Allée Scheffer L-2520 - Luxembourg (Luxembourg)
Manufacturer reference number:	Test request from Zitro S.à.r.l., 26th May 2017
Testing dates:	Start date: 26th May 2017 End date: 27th July 2017
Type of test:	RTP and RNG evaluation.
Model, type and other identification:	Da Vinc1 Secrets v36.00
Model type:	Bingo Machine
Jurisdictions recommended:	GLI-11 v2.1. (RTP and RNG sections)
Technical Standard used for Evaluation:	GLI-11 v2.1.
Location where test was performed:	BMM Spain Testlabs, s.l. Parc Tecnològic del Vallés (C.E.N.T.) Avda. Parc Tecnològic del Vallés, 3 08290 – Cerdanyola del Vallés Barcelona – España
Location where report was issued:	BMM Spain Testlabs, s.l. Parc Tecnològic del Vallés (C.E.N.T.) Avda. Parc Tecnològic del Vallés, 3 08290 – Cerdanyola del Vallés Barcelona – España
Conclusion of Evaluation:	PASS
BMM Reference Number:	ZIF.2136
Method/Procedures used:	EURAF-SPA-MO-26
Test engineer:	Enric Ferrés

1. SCOPE

Zitro S.à.r.l. has requested BMM to evaluate the Return to The Player (RTP) of the Da Vinc1 Secrets game and to perform an analysis of the RNG used.

2. BMM EVALUATION PERFORMED

BMM performed simulations for the Da Vinc1 Secrets game and reviewed the RNG algorithm used by running various statistical tests.

3. Da Vinc1 Secrets RULES

BMM's evaluation of the Da Vinc1 Secrets game is based on the following rules:

Bingo is based on a universe of 90 balls, from which are used 60. From the used 60 balls are drawn 30 in each game. The player can select between one (1) to Four (4) different bingo cards (size 4 x 5) to play on in each game.

Winning combinations are determined by patterns. There are 19 possible winning patterns awarding 2 to 1500 credits. Multiple patterns may be awarded on a single card; however any pattern which is completely covered by another is not awarded.

The Bonus will be triggered if the player awards the second pattern, once the main game an extra game are finished. A board with 5 rows and 6 columns is displayed. The player choose an element of every row. There are 3 possible types of elements: Prizes as Credits, Wild (Pays every value of credits in the row) and Exit. The player choose one element of every row since he found an Exit, getting the credits earned in the process. The last row is special, in that one there are only 2 types of elements: MiniAcumulated and Exit.

The player may decide to activate the "SuperWin" mode. When this game mode is activated the player participates in the following additional games: "SuperBingo", "ThunderBall", "Rebajas", "JerryPot" and "Bobby". The player can only activate Superwin mode with 4 active cards by betting 1 additional credit.

After the first 30 balls are drawn, up to 10 extra balls may be purchased by the player. In order to play an extra ball there must be a possible award greater than or equal to 8.

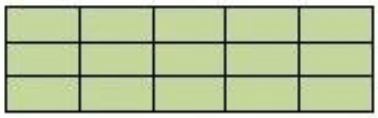
The cost of each extra ball is determined by the machine, taking into account the current win, the possible wins and how many extra balls have already been bought.

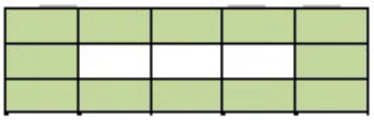
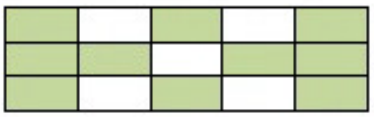
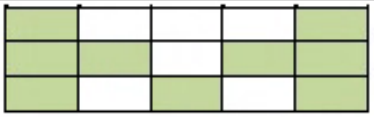
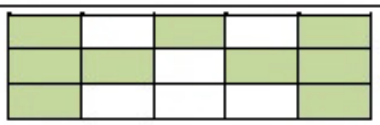
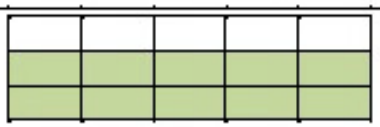
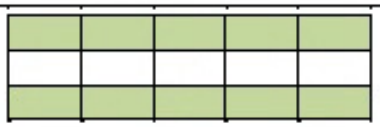
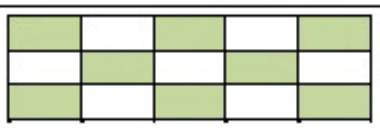
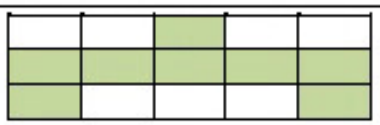
4. Da Vinc1 Secrets RTP RESULTS

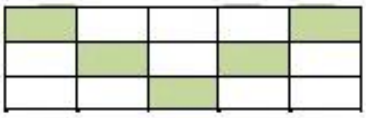
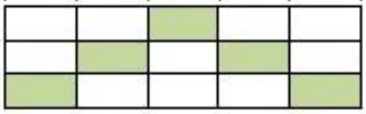
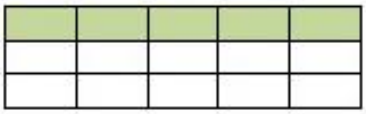
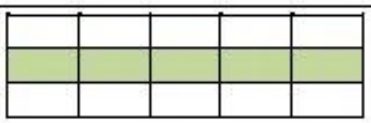
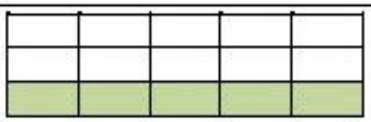
Verification of the theoretical return of the game is as specified in the technical documentation supplied by the manufacturer. This is performed by using BMM's proprietary mathematical analysis software (BMM checklist 'Mathematical Evaluation Testing'). The RTP's all meet minimum RTP requirements.

4.1. Base Game (No extra balls)

The following table shows BMM's calculated results for each bingo pattern after the first 30 balls are drawn (base game). Up to this point no extra feature has been awarded, except for the Bonus pay.

Pattern	Pay	Prob	RTP
	1500	0.000292%	0.437%

	300 + Bonus	0.005889%	4.711%
	400	0.015649%	6.259%
	300	0.023910%	7.173%
	100 + Bonus	0.056930%	6.547%
	100 + Bonus	0.056930%	6.547%
	100	0.080840%	8.084%
	40	0.039559%	1.582%
	40	0.039559%	1.582%
	40	0.033670%	1.347%
	40	0.188902%	7.556%
	10	0.212813%	2.128%
	10	0.212813%	2.128%
	8	0.511186%	4.089%

	4	2.134692%	8.539%
	4	2.134692%	8.539%
	2	2.529868%	5.060%
	2	1.745091%	3.490%
	2	2.529868%	5.060%
	RTP	90.86%	

4.2. Including Extra Balls

The following table shows BMM's RTPs with the effect of the extra balls:

	Cards Played				
Balls	1	2	3	4	4 with SuperWin
30	90.86%	90.86%	90.86%	90.86%	90.14%
31	90.82%	90.85%	90.70%	90.76%	90.61%
32	90.92%	90.84%	90.69%	90.75%	91.20%
33	90.71%	90.69%	90.49%	90.54%	91.57%
34	90.71%	90.61%	90.41%	90.47%	91.76%
35	90.60%	90.55%	90.35%	90.41%	91.49%
36	90.57%	90.52%	90.33%	90.39%	90.88%
37	90.49%	90.42%	90.26%	90.34%	90.34%
38	90.43%	90.39%	90.23%	90.30%	89.91%
39	90.41%	90.32%	90.19%	90.25%	89.52%
40	90.35%	90.30%	90.19%	90.22%	89.22%

BMM's calculation of Extra Balls resulted in a minimum RTP of 89.217% and maximum RTP of 91.760%, which is an RTP range of 2.54%.

All results of RTP comply with GLI-11 v2.1. standards.

5. RNG ANALYSIS

The RNG algorithm used by Zitro S.à.r.l. is an implementation of the KISS; this is a known RNG algorithm with good statistical properties.

BMM examined the RNG source code and performed statistical tests on various sets of RNG samples.

5.1. Source Code Review

The RNG is an implementation of the KISS algorithm which has a cycle over 2^{123}. The implementation scales numbers from KISS using double precision arithmetic. Seeding of the RNG includes system time in nanoseconds.

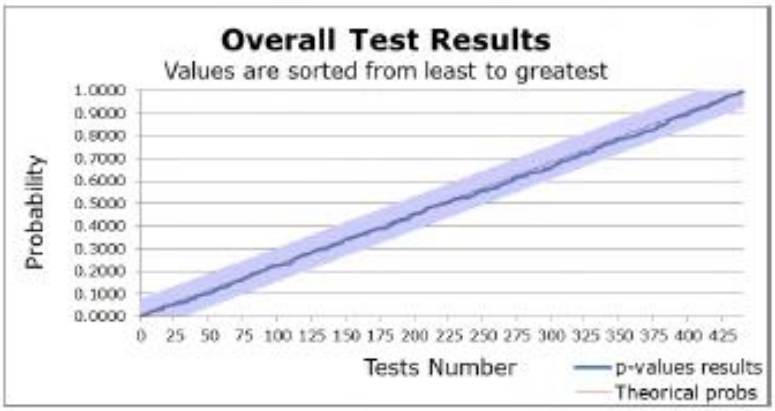
Zitro S.à.r.l. have used an unbiased scaling algorithm to generate random numbers in any desired range, as required in GLI-11 v2.1. (section 3.3).

5.2. Statistical Testing

Statistical tests were performed on both the seeding algorithm and the KISS algorithm.

The following tests were performed on each sample:

- Frequency – frequency of each number across the entire sample set.
- Gap – counts of the size of gaps between successive occurrences of numbers across the entire sample set.
- Coupon Collector – counts of how long it takes to collect complete sets of numbers.
- Sum Frequency – frequency of each total sum taken for each result set. For example, the set 1,5,7,8 has a total sum of 21.
- Sum Runs – count of ascending and descending sequences of total sums taken for each result set.
- Column Frequency – frequency of each number for each position in the results. For example, each of the numbers in the first position, or in the second position.
- Column Gap – counts of the size of gaps between successive occurrences of numbers for each position in the results.
- Diagonal Frequency – counts of each number found in ascending positions from one result set to the next. For example, the number found in the first position in the first set, the second number of the second set, and so on. The position used wraps back to the first position once it has moved beyond the size of the sets.
- Kolmogorov-Smirnov – test of the linear distribution of the chi-square probability results.



The RNG algoritms were also evaluated using the Diehard battery of tests. All tests passed.

6. ADDITIONAL INFORMATION/OBSERVATIONS

N/A

7. CONCLUSION

All calculations[1] obtained by BMM's on the RTP of Da Vinc1 Secrets complies with the GLI-11 v2.1. standard (section 3.4).

The RNG algoritm used[1] passes all statistical tests, and its implementation complies with the requirements in the aforementioned GLI-11 v2.1. standard (section 3.4).

Yours sincerely,

Ariana Cardenas Firmado digitalmente por Ariana Cardenas Fecha: 2017.08.01 15:39:50 +02'00'

ENRIC FERRÉS DECLAIR Firmado digitalmente por ENRIC FERRÉS DECLAIR Fecha: 2017.08.01 16:01:00 +02'00'

PSD Manager
Ariana Cárdenas

Mathematician
Enric Ferrés

[1] The results included in this document refer exclusively to the sample tested, such as it is described in the corresponding section.