FAIRYPROOF

Chiliz Token

AUDIT REPORT

Version 1.0.0

Serial No. 20230829000012029

Presented by Fairyproof

August 29, 2023

01. Introduction

This document includes the results of the audit performed by the Fairyproof team on the Chiliz token issuance project.

Audit Start Time:

August 28, 2023

Audit End Time:

August 28, 2023

Audited Source File's Address:

https://etherscan.io/token/0x3506424f91fd33084466f402d5d97f05f8e3b4af#code

The goal of this audit is to review Chiliz Token's solidity implementation for its token issuance function, study potential security vulnerabilities, its general design and architecture, and uncover bugs that could compromise the software in production.

We make observations on specific areas of the code that present concrete problems, as well as general observations that traverse the entire codebase horizontally, which could improve its quality as a whole.

This audit only applies to the specified code, software or any materials supplied by the Chiliz Token team for specified versions. Whenever the code, software, materials, settings, environment etc is changed, the comments of this audit will no longer apply.

— Disclaimer

Note that as of the date of publishing, the contents of this report reflect the current understanding of known security patterns and state of the art regarding system security. You agree that your access and/or use, including but not limited to any associated services, products, protocols, platforms, content, and materials, will be at your sole risk.

The review does not extend to the compiler layer, or any other areas beyond the programming language, or other programming aspects that could present security risks. If the audited source files are smart contract files, risks or issues introduced by using data feeds from offchain sources are not extended by this review either.

Given the size of the project, the findings detailed here are not to be considered exhaustive, and further testing and audit is recommended after the issues covered are fixed.

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— Methodology

The above files' code was studied in detail in order to acquire a clear impression of how the its specifications were implemented. The codebase was then subject to deep analysis and scrutiny, resulting in a series of observations. The problems and their potential solutions are discussed in this document and, whenever possible, we identify common sources for such problems and comment on them as well.

The Fairyproof auditing process follows a routine series of steps:

1. Code Review, Including:

- Project Diagnosis

Understanding the size, scope and functionality of your project's source code based on the specifications, sources, and instructions provided to Fairyproof.

- Manual Code Review

Reading your source code line-by-line to identify potential vulnerabilities.

- Specification Comparison

Determining whether your project's code successfully and efficiently accomplishes or executes its functions according to the specifications, sources, and instructions provided to Fairyproof.

2. Testing and Automated Analysis, Including:

- Test Coverage Analysis

Determining whether the test cases cover your code and how much of your code is exercised or executed when test cases are run.

- Symbolic Execution

Analyzing a program to determine the specific input that causes different parts of a program to execute its functions.

3. Best Practices Review

Reviewing the source code to improve maintainability, security, and control based on the latest established industry and academic practices, recommendations, and research.

— Structure of the document

This report contains a list of issues and comments on all the above source files. Each issue is assigned a severity level based on the potential impact of the issue and recommendations to fix it, if applicable. For ease of navigation, an index by topic and another by severity are both provided at the beginning of the report.

— Documentation

For this audit, we used the following source(s) of truth about how the token issuance function should work:

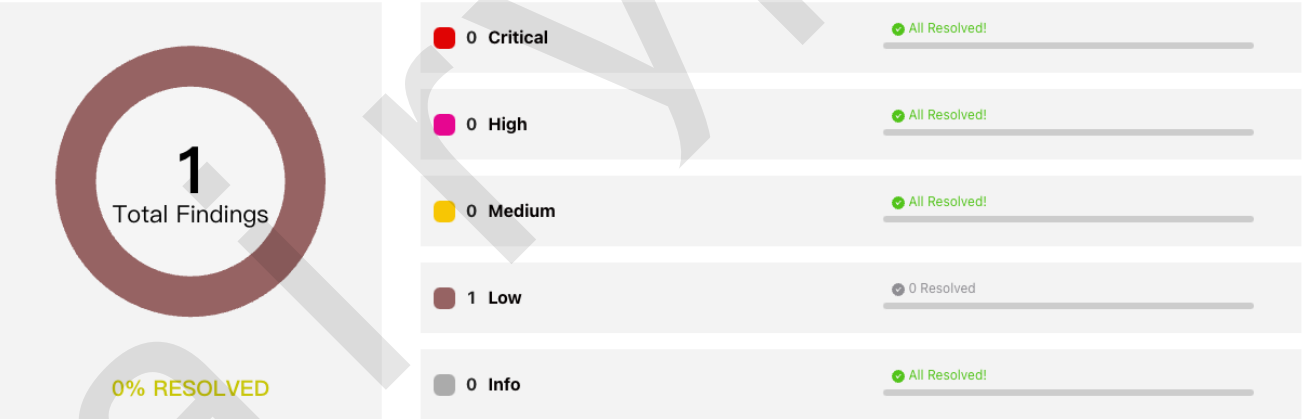
Website:https://www.chiliz.com/

Source Code: https://etherscan.io/token/0x3506424f91fd33084466f402d5d97f05f8e3b4af#code

These were considered the specification, and when discrepancies arose with the actual code behavior, we consulted with the Chiliz Token team or reported an issue.

— Comments from Auditor

Serial Number	Auditor	Audit Time	Result
2023082900012029	Fairyproof Security Team	Aug 28, 2023 - Aug 28, 2023	Low Risk



Summary:

The Fairyproof security team used its auto analysis tools and manual work to audit the project. During the audit, one issue of low-severity was uncovered. The Chiliz Token team acknowledged the issue.

02. About Fairyproof

Fairyproof is a leading technology firm in the blockchain industry, providing consulting and security audits for organizations. Fairyproof has developed industry security standards for designing and deploying blockchain applications.

03. Introduction to Chiliz Token

CHZ is the native digital token for the Chiliz sports & entertainment ecosystem currently powering Socios.com, ChilizX and the Chiliz Chain.It is the leading digital currency for sports and entertainment by the eponymous Malta-based FinTech provider. It operates the blockchain-based sports entertainment platform Socios, which enables users to participate in the governance of their favorite sports brands.

The above description is quoted from relevant documents of Chiliz Token.

04. Major functions of audited code

The audited code mainly implements a token issuance function. Here are the details:

- Blockchain: Ethereum
- Token Standard: ERC-20
- Token Address: 0x3506424f91fd33084466f402d5d97f05f8e3b4af
- Token Name: chiliZ
- Token Symbol: CHZ
- Decimals: 18
- Current Supply: 8,888,888,888
- Max Supply: 8,888,888,888
- Pausable: Yes

05. Coverage of issues

The issues that the Fairyproof team covered when conducting the audit include but are not limited to the following ones:

- Access Control
- Admin Rights

- Arithmetic Precision
- Code Improvement
- Contract Upgrade/Migration
- Delete Trap
- Design Vulnerability
- DoS Attack
- EOA Call Trap
- Fake Deposit
- Function Visibility
- Gas Consumption
- Implementation Vulnerability
- Inappropriate Callback Function
- Injection Attack
- Integer Overflow/Underflow
- IsContract Trap
- Miner's Advantage
- Misc
- Price Manipulation
- Proxy selector clashing
- Pseudo Random Number
- Re-entrancy Attack
- Replay Attack
- Rollback Attack
- Shadow Variable
- Slot Conflict
- Token Issuance
- Tx.origin Authentication
- Uninitialized Storage Pointer

06. Severity level reference

Every issue in this report was assigned a severity level from the following:

Critical severity issues need to be fixed as soon as possible.

High severity issues will probably bring problems and should be fixed.

Medium severity issues could potentially bring problems and should eventually be fixed.

Low severity issues are minor details and warnings that can remain unfixed but would be better fixed at some point in the future.

Informational is not an issue or risk but a suggestion for code improvement.

07. Major areas that need attention

Based on the provided source code the Fairyproof team focused on the possible issues and risks related to the following functions or areas.

- Function Implementation

We checked whether or not the functions were correctly implemented.
We didn't find issues or risks in these functions or areas at the time of writing.

- Access Control

We checked each of the functions that could modify a state, especially those functions that could only be accessed by owner or administrator
We didn't find issues or risks in these functions or areas at the time of writing.

- Token Issuance & Transfer

We examined token issuance and transfers for situations that could harm the interests of holders.
We found one issue, for more details please refer to [FP-1] in "09. Issue description".

- State Update

We checked some key state variables which should only be set at initialization.
We didn't find issues or risks in these functions or areas at the time of writing.

- Asset Security

We checked whether or not all the functions that transfer assets were safely handled.
We didn't find issues or risks in these functions or areas at the time of writing.

- Miscellaneous

We checked the code for optimization and robustness.
We didn't find issues or risks in these functions or areas at the time of writing.

08. List of issues by severity

Index	Title	Issue/Risk	Severity	Status
FP-1	Token transfers can be paused	Token Issuance	Low	Acknowledged

09. Issue descriptions

[FP-1] Token transfers can be paused

Token Issuance Low Acknowledged

Issue/Risk: Token Issuance

Description:

In the current contract, token transfers can be paused, which may cause losses to token holders in certain scenarios.

Recommendation:

Consider properly using this function or removing it.

Update/Status:

The Chiliz Token team replied that it is a necessary function.

10. Recommendations to enhance the overall security

We list some recommendations in this section. They are not mandatory but will enhance the overall security of the system if they are adopted.

- N/A

11. Appendices

11.1 Unit Test

1. chiliZ.t.js

```
const { expect } = require("chai");
const { ethers } = require("hardhat");

describe("ChiliZ Token Test", function () {
  let owner, addr1;
  const totalSupply = ethers.parseEther("8888888888")
  const AddressZero = "0x0000000000000000000000000000000000000000"

  async function deployToken() {
    [owner, addr1] = await ethers.getSigners();
    const TorumToken = await ethers.getContractFactory("chiliZ");
    const instance = await TorumToken.deploy();
    return { instance };
  }

  describe("Deployment test", function () {
    it("Should set the correct metadata", async function () {
      const { instance } = await deployToken();

      expect(await instance.totalSupply()).equal(totalSupply);
      expect(await instance.balanceOf(owner.address)).equal(totalSupply);
      expect(await instance.name()).equal("chiliZ");
      expect(await instance.symbol()).equal("CHZ");
      expect(await instance.decimals()).equal(18);
    });
  });

  describe("Transactions test", function () {
    it("Should transfer tokens between accounts", async function () {
      const { instance } = await deployToken();
      const transferAmount = 5000;

      await expect(instance.transfer(addr1.address, transferAmount))
        .be.emit(instance, "Transfer").withArgs(owner.address, addr1.address,
transferAmount);
      expect(await instance.balanceOf(addr1.address)).to.equal(transferAmount);
    });
```

```
    it("Should be failed if sender doesn't have enough tokens", async function () {
      const { instance } = await deployToken();
      const initialOwnerBalance = await instance.balanceOf(owner.address);
      await expect(instance.connect(addr1).transfer(owner.address, 1)).to.reverted;
      expect(await instance.balanceOf(owner.address)).to.equal(initialOwnerBalance);
    });

    it("Should be failed if sender transfer to zero address", async function () {
      const { instance } = await deployToken();
      const transferAmount = 5000;
      await expect(instance.transfer(AddressZero, transferAmount)).to.reverted;
      await instance.approve(owner.address, transferAmount);
      await expect(instance.transferFrom(owner.address, AddressZero,
transferAmount)).to.reverted;
    });

    it("Should be successful if sender transfer to himself", async function () {
      const { instance } = await deployToken();
      const transferAmount = 5000;

      await expect(instance.transfer(owner.address, transferAmount))
        .be.emit(instance, "Transfer").withArgs(owner.address, owner.address,
transferAmount);
      await instance.approve(owner.address, transferAmount);
      await expect(instance.transferFrom(owner.address, owner.address, transferAmount))
        .be.emit(instance, "Transfer").withArgs(owner.address, owner.address,
transferAmount);
      expect(await instance.balanceOf(owner.address)).to.equal(totalSupply);
    });

    it("Should be successful if sender transfer zero amount", async function () {
      const { instance } = await deployToken();

      await expect(instance.transfer(addr1.address, 0))
        .be.emit(instance, "Transfer").withArgs(owner.address, addr1.address, 0);
      await expect(instance.transferFrom(owner.address, addr1.address, 0))
        .be.emit(instance, "Transfer").withArgs(owner.address, addr1.address, 0);
      expect(await instance.balanceOf(owner.address)).to.equal(totalSupply);
    });

    it("TransferFrom should need enough allowance", async function () {
      const { instance } = await deployToken();
      const transferAmount = 5000;

      await expect(instance.transferFrom(owner.address, addr1.address,
transferAmount)).to.reverted;
      await instance.approve(owner.address, transferAmount);
      await expect(instance.transferFrom(owner.address, addr1.address, transferAmount))
        .be.emit(instance, "Transfer").withArgs(owner.address, addr1.address,
transferAmount);
      expect(await instance.balanceOf(addr1.address)).to.equal(transferAmount);

      await instance.connect(addr1).approve(owner.address, transferAmount);
```

```
      await instance.transferFrom(addr1.address, owner.address, transferAmount)
      expect(await instance.balanceOf(addr1.address)).to.equal(0);
    });
  });


  describe("Allowance test", function () {
    it("Should update the allowance after approving", async function () {
      const { instance } = await deployToken();
      const approveAmount = 1000

      await expect(instance.approve(addr1.address, approveAmount))
        .to.emit(instance, "Approval").withArgs(owner.address, addr1.address,
approveAmount);
      const allowance = await instance.allowance(owner.address, addr1.address);
      expect(allowance).to.equal(approveAmount);
      // increse allowance again
      await expect(instance.increaseAllowance(addr1.address, approveAmount))
        .to.emit(instance, "Approval").withArgs(owner.address, addr1.address, approveAmount
* 2);
      expect(await instance.allowance(owner.address, addr1.address)).to.equal(approveAmount
* 2);
      // decrease allowance
      await expect(instance.decreaseAllowance(addr1.address, approveAmount))
        .to.emit(instance, "Approval").withArgs(owner.address, addr1.address,
approveAmount);
    });

    it("Should overflow when increasing allowance with a very large number", async function
() {
      const { instance } = await deployToken();
      const largeNumber = ethers.MaxUint256;

      await expect(instance.increaseAllowance(addr1.address, largeNumber))
        .to.emit(instance, "Approval").withArgs(owner.address, addr1.address, largeNumber);

      expect(await instance.allowance(owner.address, addr1.address)).to.equal(largeNumber);
      await expect(instance.increaseAllowance(addr1.address, 1)).to.reverted;
    });

    it("Should underflow when decreasing allowance below zero", async function () {
      const { instance } = await deployToken();
      const approveAmount = ethers.parseEther("1000");
      await instance.approve(addr1.address, approveAmount);

      await expect(instance.decreaseAllowance(addr1.address, approveAmount + 1n))
        .to.reverted;
      expect(await instance.allowance(owner.address,
addr1.address)).to.equal(approveAmount);
    });
  });

  describe("Pausable functionality tests", function () {
```

```
    it("Should not allow non-pausers to pause/unpause the contract", async function () {
      const { instance } = await deployToken();

      await expect(instance.connect(addr1).pause()).to.be.reverted;
      await expect(instance.connect(addr1).unpause()).to.be.reverted;
    });

    it("Should pause the contract by pauser and emit Paused event", async function () {
      const { instance } = await deployToken();

      await expect(instance.pause()).to.emit(instance, "Paused")
        .withArgs(owner.address);

      expect(await instance.paused()).to.equal(true);
    });

    it("Should not allow pausing if already paused", async function () {
      const { instance } = await deployToken();

      await instance.pause();
      await expect(instance.pause()).to.be.reverted;
    });

    it("Should unpause the contract by pauser and emit Unpaused event", async function () {
      const { instance } = await deployToken();

      await instance.pause();
      await expect(instance.unpause()).to.emit(instance, "Unpaused")
        .withArgs(owner.address);

      expect(await instance.paused()).to.equal(false);
    });

    it("Should not allow unpausing if not paused", async function () {
      const { instance } = await deployToken();

      await expect(instance.unpause()).to.be.reverted;
    });

    // Assuming "transfer" is modified with "whenNotPaused" modifier in the ERC20Pausable
contract
    it("Should not allow token functions to be called when paused", async function () {
      const { instance } = await deployToken();
      const transferAmount = 1000;

      await instance.pause();
      await expect(instance.transfer(addr1.address, transferAmount)).to.be.reverted;
      await expect(instance.approve(addr1.address, transferAmount)).to.be.reverted;
    });
  });

  describe("PauserRole functionality tests", function () {
    it("Should set the contract deployer as the initial pauser", async function () {
```

```
      const { instance } = await deployToken();
      expect(await instance.isPauser(owner.address)).to.equal(true);
    });

    it("Should allow pauser to add another pauser and emit PauserAdded event", async
function () {
      const { instance } = await deployToken();

      await expect(instance.addPauser(addr1.address)).to.emit(instance,
"PauserAdded").withArgs(addr1.address);
      expect(await instance.isPauser(addr1.address)).to.equal(true);
    });

    it("Should not allow non-pausers to add a pauser", async function () {
      const { instance } = await deployToken();
      await expect(instance.connect(addr1).addPauser(addr1.address)).to.be.reverted;
    });

    it("Should allow a pauser to renounce its role and emit PauserRemoved event", async
function () {
      const { instance } = await deployToken();
      await instance.addPauser(addr1.address);
      await expect(instance.connect(addr1).renouncePauser()).to.emit(instance,
"PauserRemoved").withArgs(addr1.address);
      expect(await instance.isPauser(addr1.address)).to.equal(false);
    });

    it("Should not allow non-pausers to renounce pauser role", async function () {
      const { instance } = await deployToken();
      await expect(instance.connect(addr1).renouncePauser()).to.be.reverted;
    });
  });
});
```

2. output:

```
  Chiliz Token Test
    Deployment test
      ✓ Should set the correct metadata (788ms)
    Transactions test
      ✓ Should transfer tokens between accounts
      ✓ Should be failed if sender doesn't have enough tokens (55ms)
      ✓ Should be failed if sender transfer to zero address
      ✓ Should be successful if sender transfer to himself (40ms)
      ✓ Should be successful if sender transfer zero amount
      ✓ TransferFrom should need enough allowance (43ms)
    Allowance test
      ✓ Should update the allowance after approving
      ✓ Should overflow when increasing allowance with a very large number
```

```
    ✓ Should underflow when decreasing allowance below zero
  Pausable functionality tests
    ✓ Should not allow non-pausers to pause/unpause the contract
    ✓ Should pause the contract by pauser and emit Paused event
    ✓ Should not allow pausing if already paused
    ✓ Should unpause the contract by pauser and emit Unpaused event
    ✓ Should not allow unpausing if not paused
    ✓ Should not allow token functions to be called when paused
  PauserRole functionality tests
    ✓ Should set the contract deployer as the initial pauser
    ✓ Should allow pauser to add another pauser and emit PauserAdded event (38ms)
    ✓ Should not allow non-pausers to add a pauser
    ✓ Should allow a pauser to renounce its role and emit PauserRemoved event
    ✓ Should not allow non-pausers to renounce pauser role


  21 passing (1s)
```

11.2 External Functions Check Points

1. File: contracts/chiliZ.sol

(Empty fields in the table represent things that are not required or relevant)

contract: chiliZ is ERC20, ERC20Detailed, ERC20Pausable

Index	Function	Visibility	StateMutability	Permission Check	IsUserInterface	Unit Test	Notes
1	transfer(address,uint256)	public			Yes	Passed	whenNotPaused
2	transferFrom(address,address,uint256)	public			Yes	Passed	whenNotPaused
3	approve(address,uint256)	public			Yes	Passed	whenNotPaused
6	paused()	public	view			Passed	
7	pause()	public				Passed	onlyPauser、whenNotPaused
8	unpause()	public				Passed	onlyPauser、whenNotPaused
9	isPauser(address)	public	view			Passed	
10	addPauser(address)	public				Passed	onlyPauser
11	renouncePauser()	public				Passed	onlyPauser
12	totalSupply()	public	view			Passed	
13	balanceOf(address)	public	view			Passed	
14	allowance(address,address)	public	view			Passed	
15	increaseAllowance(address,uint256)	public			Yes	Passed	whenNotPaused
16	decreaseAllowance(address,uint256)	public			Yes	Passed	whenNotPaused
17	name()	public	view			Passed	
18	symbol()	public	view			Passed	
19	decimals()	public	view			Passed	

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