



# Kambria

## Smart Contract Security Audit

Prepared by ShellBoxes

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# 1 Introduction

Kambria engaged [ShellBoxes](#) to conduct a security assessment on the Kambria beginning on Nov 21<sup>st</sup>, 2022 and ending Nov 24<sup>th</sup>, 2022. In this report, we detail our methodical approach to evaluate potential security issues associated with the implementation of smart contracts, by exposing possible semantic discrepancies between the smart contract code and design document, and by recommending additional ideas to optimize the existing code. Our findings indicate that the current version of smart contracts can still be enhanced further due to the presence of many security and performance concerns.

This document summarizes the findings of our audit.

## 1.1 About Kambria

Kambria, an open innovation platform for Deep Tech.

Issuer	Kambria
Website	<a href="https://kambria.io">https://kambria.io</a>
Type	Solidity Smart Contract
Documentation	KAT BEP20 Smart contract Documentation
Audit Method	Whitebox

## 1.2 Approach & Methodology

ShellBoxes used a combination of manual and automated security testing to achieve a balance between efficiency, timeliness, practicability, and correctness within the audit's scope. While manual testing is advised for identifying problems in logic, procedure, and implementation, automated testing techniques help to expand the coverage of smart contracts and can quickly detect code that does not comply with security best practices.

## 1.2.1 Risk Methodology

Vulnerabilities or bugs identified by ShellBoxes are ranked using a risk assessment technique that considers both the LIKELIHOOD and IMPACT of a security incident. This framework is effective at conveying the features and consequences of technological vulnerabilities.

Its quantitative paradigm enables repeatable and precise measurement, while also revealing the underlying susceptibility characteristics that were used to calculate the Risk scores. A risk level will be assigned to each vulnerability on a scale of 5 to 1, with 5 indicating the greatest possibility or impact.

- Likelihood quantifies the probability of a certain vulnerability being discovered and exploited in the untamed.
- Impact quantifies the technical and economic costs of a successful attack.
- Severity indicates the risk's overall criticality.

Probability and impact are classified into three categories: H, M, and L, which correspond to high, medium, and low, respectively. Severity is determined by probability and impact and is categorized into four levels, namely Critical, High, Medium, and Low.

Impact		Likelihood		
		High	Medium	Low
High		Critical	High	Medium
Medium		High	Medium	Low
Low		Medium	Low	Low

## 2 Findings Overview

### 2.1 Summary

The following is a synopsis of our conclusions from our analysis of the Kambria implementation. During the first part of our audit, we examine the smart contract source code and run the codebase via a static code analyzer. The objective here is to find known coding problems statically and then manually check (reject or confirm) issues highlighted by the tool. Additionally, we check business logics, system processes, and DeFi-related components manually to identify potential hazards and/or defects.

### 2.2 Key Findings

In general, this token contract is well-designed and constructed, but its implementation might be improved by addressing the discovered flaws, which include , **1** medium-severity, **3** low-severity vulnerabilities.

Vulnerabilities	Severity	Status
SHB.1. Power Centralization For The <b>MINTER_ROLE</b> User	<b>MEDIUM</b>	Fixed
SHB.2. Approve Race Condition	<b>LOW</b>	Fixed
SHB.3. The Owner Can Renounce Ownership	<b>LOW</b>	Fixed
SHB.4. Floating Pragma	<b>LOW</b>	Fixed

# 3 Finding Details

## SHB.1 Power Centralization For The **MINTER\_ROLE** User

- Severity: **MEDIUM**
- Likelihood: 2
- Status: Fixed
- Impact: 2

### Description:

The **mintTo** function allows any **MINTER\_ROLE** user to mint any **amount** of tokens to any **receiver** address. This represents a significant centralization where the **MINTER\_ROLE** has too much power in the contract. Having this logic, the minter can increase the totalSupply of the token therefore decreasing its value. The same issue was found in the **mint** function.

### Files Affected:

#### SHB.1.1: BEP20Token

```
884 function mint(uint256 amount) public onlyRole(MINTER_ROLE) returns (
    ↪ bool) {
885     _mint(_msgSender(), amount);
886     return true;
887 }
888
889 function mintTo(address receiver,uint256 amount) public onlyRole(
    ↪ MINTER_ROLE) returns (bool) {
890     _mint(receiver, amount);
891     return true;
892 }
```

## Recommendation:

Consider having a limited maximum supply, or the `MINTER_ROLE` should be a DAO or a multisig wallet.

## Updates

The Kambria team has resolved the issue by limiting the supply to 5 billion ( $5 \times 10^9$ ).

### SHB.1.2: BEP20Token

```
706 function mint(uint256 amount) public onlyRole(MINTER_ROLE) returns (
    ↪ bool) {
707     require(_totalSupply+amount<=5*1e9, "Max total supply is 5
        billion");
708     _mint(_msgSender(), amount);
709     return true;
710 }
711
712 function mintTo(address receiver,uint256 amount) public onlyRole(
    ↪ MINTER_ROLE) returns (bool) {
713     require(_totalSupply+amount<=5*1e9, "Max total supply is 5
        billion");
714     _mint(receiver, amount);
715     return true;
716 }
```

## SHB.2 Approve Race Condition

- |                        |                 |
|------------------------|-----------------|
| • Severity: <b>LOW</b> | • Likelihood: 1 |
| • Status: Fixed        | • Impact: 2     |



## Description:

The standard [ERC20](#) implementation contains a widely known race condition in its [approve](#) function.

## Exploit Scenario:

A spender can witness the token owner broadcast a transaction altering their approval and quickly sign and broadcast a transaction using [transferFrom](#) to move the current approved amount from the owner's balance to the spender. If the spender's transaction is validated before the owner's, the spender will be able to get both approval amounts of both transactions.

## Files Affected:

### SHB.2.1: BEP20Token

```
817 function approve(address spender, uint256 amount) external returns (bool
    ↪ ) {
818     _approve(_msgSender(), spender, amount);
819     return true;
820 }
```

## Recommendation:

We recommend using [increaseAllowance](#) and [decreaseAllowance](#) functions to modify the approval amount instead of using the [approve](#) function to do so.

## Updates

The Kambria team resolved the issue by disabling the [approve](#) function and using the [increaseAllowance](#) and the [decreaseAllowance](#) functions.

### SHB.2.2: BEP20Token

```
639 function approve(address spender, uint256 amount) external {
640     revert("The approve function is disabled, use the increaseAllowance and
    ↪ decreaseAllowance");
```

## SHB.3 The Owner Can Renounce Ownership

- Severity: **LOW**
- Likelihood: 1
- Status: Fixed
- Impact: 2

### Description:

Typically, the account that deploys the contract is also its owner. Consequently, the owner is able to engage in certain privileged activities in his own name. In smart contracts, the `renounceOwnership` function is used to renounce ownership, which means that if the contract's ownership has never been transferred, it will never have an owner, rendering some owner-exclusive functionality unavailable.

### Files Affected:

#### SHB.3.1: BEP20Token

```
698 contract BEP20Token is Context, IBEP20, Ownable, AccessControl {
```

### Recommendation:

We recommend that you prevent the owner from calling `renounceOwnership` without first transferring ownership to a different address. Additionally, if you decide to use a multi-signature wallet, then the execution of the `renounceOwnership` will require at least two or more users to be confirmed. Alternatively, you can disable the Renounce Ownership functionality by overriding it.

### Updates

The Kambria team resolved the issue by removing the `renounceOwnership` function.

## SHB.4 Floating Pragma

- Severity: **LOW**
- Status: Fixed
- Likelihood: 1
- Impact: 1

### Description:

The contract makes use of the floating-point pragma **0.8.0**. Contracts should be deployed using the same compiler version. Locking the pragma helps ensure that contracts will not be unintentionally deployed using another pragma, which in some cases may be an obsolete version that may introduce issues to the contract system.

### Files Affected:

#### SHB.4.1: BEP20Token

```
5 // SPDX-License-Identifier: MIT
6 pragma solidity ^0.8.13;
```

### Recommendation:

Consider locking the pragma version. It is advised that floating pragma should not be used in production. Both `truffle-config.js` and `hardhat.config.js` support locking the pragma version.

### Updates

The Kambria team resolved the issue by locking the pragma version to **0.8.13**.

## 4 Best Practices

### BP.1 Remove SafeMath Library

#### Description:

The SafeMath library validates if an arithmetic operation would result in an integer overflow/underflow. If it would, the library throws an exception, effectively reverting the transaction.

Since Solidity [0.8](#), the overflow/underflow check is implemented.

You don't need the SafeMath library for a solidity compiler version [0.8.13](#), it's recommended to change all arithmetic operations in the contract :

- `x.add(y)` to `x + y`
- `x.sub(y)` to `x - y`
- `x.mul(y)` to `x * y`
- ...

#### Files Affected:

BP.1.1: BEP20Token

```
699     using SafeMath for uint256;
```

#### Status - Fixed

### BP.2 Initialize State Token Attributes In The Contract Declaration

#### Description:

Try initializing the tokens `"_name," "_symbol,"` and `"_decimals"` directly in the contract declaration as [constant](#) variables instead of initializing them in the [constructor\(\)](#).

## Files Affected:

### BP.2.1: BEP20Token

```
711     constructor() {  
712         _name = 'Kambria Token';  
713         _symbol = 'KAT';  
714         _decimals =18;
```

## Status - Fixed

# BP.3 Set The Admin Role In The Constructor

## Description:

To set the [ADMIN\\_ROLE](#) as an admin role of [MINTER\\_ROLE](#), you don't need to override the [getRoleAdmin](#) function;instead, use the admin role setter function [setRoleAdmin\(MINTER\\_ROLE,ADMIN\\_ROLE\)](#) in the constructor.

## Files Affected:

### BP.3.1: BEP20Token

```
737     function getRoleAdmin(bytes32 role) public view virtual override  
        ↪ returns (bytes32) {  
738         if(role == MINTER_ROLE){  
739             return ADMIN_ROLE;  
740         }  
741         else{  
742             return 0;  
743         }  
744     }
```

Status - Fixed

## BP.4 Remove Unnecessary Functions

Description:

Use the `grantRole` function from `AccessControl` to assign a `role` to a specific `account`, and remove the `grantMinterRole` and `grantAdminRole` functions from the `BEP20Token` contract.

Files Affected:

### BP.4.1: BEP20Token

```
722     function grantMinterRole(address account) public onlyRole(ADMIN_ROLE)
        ↪ returns (bool) {
723         _grantRole(MINTER_ROLE, account);
724         return true;
725     }
726     function grantAdminRole( address account) public virtual onlyOwner {
727         _grantRole(ADMIN_ROLE, account);
728     }
```

Status - Fixed

## BP.5 Remove Zero Initialization

Files Affected:

### BP.5.1: BEP20Token

```
715     _totalSupply = 0;
716     _balances[msg.sender] = _totalSupply;
```

Status - Fixed

# 5 Tests

## Results:

-> Contract: `BEP20Token` (20 passing)

- ✓ Should return owner address
- ✓ Should return ADMIN\_ROLE address
- ✓ Should return MINTER\_ROLE address
- ✓ Should return allowance
- ✓ Should return decimals
- ✓ Should return token name
- ✓ Should return symbol
- ✓ Should return boolean
- ✓ Should return totalSupply
- ✓ Should return Boolean
- ✓ Should return balanceOf an account
- ✓ test mint 10000 amount
- ✓ test mintTo 10000 amount
- ✓ test decreaseAllowance
- ✓ test grantRole
- ✓ test renounceRole
- ✓ test revokeRole

✓ test increaseAllowance

✓ test transfer

✓ test burn



## 6 Conclusion

In this audit, we examined the design and implementation of Kambria contract and discovered several issues of varying severity. Kambria team addressed all the issues raised in the initial report and implemented the necessary fixes.

However Shellboxes' auditors advised Kambria Team to maintain a high level of vigilance and participate in bounty programs in order to avoid any future complications.

# 7 Disclaimer

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