

SMART CONTRACT CODE REVIEW AND SECURITY ANALYSIS REPORT

Customer: Terra Virtua

Date: July 12th, 2021



This document may contain confidential information about IT systems and the intellectual property of the Customer as well as information about potential vulnerabilities and methods of their exploitation.

The report containing confidential information can be used internally by the Customer, or it can be disclosed publicly after all vulnerabilities fixed — upon a decision of the Customer.

Document

Name	Smart Contract Code Review and Security Analysis Report for Terra Virtua.	
Approved by	Andrew Matiukhin CTO Hacken OU	
Туре	Tiers system	
Platform	Ethereum / Solidity	
Methods	Architecture Review, Functional Testing, Computer-Aided Verification, Manual Review	
Repository	https://github.com/thedavidmeister/tv-tier	
Commit	2e8465d4a4a23f4fd0aaafff9f759f8ad3d7d311	
Timeline	09 July 2021 - 12 July 2021	
Changelog	12 JULY 2021 - INITIAL AUDIT	

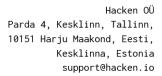




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Introduction

Hacken OÜ (Consultant) was contracted by Terra Virtua (Customer) to conduct a Smart Contract Code Review and Security Analysis. This report presents the findings of the security assessment of Customer's smart contract and its code review conducted between July 09^{th} , 2021 - July 12^{th} , 2021.

Scope

The scope of the project is smart contracts in the repository:

Repository: https://github.com/thedavidmeister/tv-tier Commit: 2e8465d4a4a23f4fd0aaafff9f759f8ad3d7d311

Files:

contracts/claim/TierByConstructionClaim.sol

contracts/libraries/TierUtil.sol
contracts/tier/AlwaysTier.sol

contracts/tier/ERC20BalanceTier.sol

contracts/tier/ERC20TransferTier.sol

contracts/tier/ITier.sol

contracts/tier/NeverTier.sol

contracts/tier/ReadOnlyTier.sol

contracts/tier/ReadWriteTier.sol

 $\verb|contracts/tier/TierByConstruction.sol|\\$

contracts/tier/ValueTier.sol

We have scanned this smart contract for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that are considered:

Category	Check Item
Code review	Reentrancy
	Ownership Takeover
	Timestamp Dependence
	■ Gas Limit and Loops
	DoS with (Unexpected) Throw
	DoS with Block Gas Limit
	Transaction-Ordering Dependence
	Style guide violation
	Costly Loop
	ERC20 API violation
	Unchecked external call
	Unchecked math
	Unsafe type inference
	Implicit visibility level
	Deployment Consistency
	Repository Consistency
	■ Data Consistency



Functional review	Business Logics ReviewFunctionality Checks
	Access Control & Authorization
	Escrow manipulation
	Token Supply manipulation
	Assets integrity
	User Balances manipulation
	 Data Consistency manipulation
	Kill-Switch Mechanism
	Operation Trails & Event Generation

Executive Summary

According to the assessment, the Customer's smart contract is well-secured.

Insecure	Poor secured	Secured	Well-secured
		You are here	

Our team performed an analysis of code functionality, manual audit, and automated checks with Mythril and Slither. All issues found during automated analysis were manually reviewed, and important vulnerabilities are presented in the Audit overview section. All found issues can be found in the Audit overview section.

Security engineers found no severity issues during the audit.

Notice: _afterClaim function implementation of TierByConstructionClaim contract is very important but not in the repository.



Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to assets loss or data manipulations.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions
Medium	Medium-level vulnerabilities are important to fix; however, they can't lead to assets loss or data manipulations.
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that can't have a significant impact on execution



Audit overview

■ ■ ■ Critical

No critical severity issues were found.

High

No high severity issues were found.

■ ■ Medium

No medium severity issues were found.

Low

No low severity issues were found.



Conclusion

Smart contracts within the scope were manually reviewed and analyzed with static analysis tools.

Audit report contains all found security vulnerabilities and other issues in the reviewed code.

Security engineers found no severity issues during the audit.



Disclaimers

Hacken Disclaimer

The smart contracts given for audit have been analyzed in accordance with the best industry practices at the date of this report, in relation to cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report (Source Code); the Source Code compilation, deployment, and functionality (performing the intended functions).

The audit makes no statements or warranties on security of the code. It also cannot be considered as a sufficient assessment regarding the utility and safety of the code, bugfree status or any other statements of the contract. While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only—we recommend proceeding with several independent audits and a public bug bounty program to ensure security of smart contracts.

Technical Disclaimer

Smart contracts are deployed and executed on blockchain platform. The platform, its programming language, and other software related to the smart contract can have its vulnerabilities that can lead to hacks. Thus, the audit can't guarantee the explicit security of the audited smart contracts.