



Animoca Brands – SHRD & CATA ERC20 Tokens & Polygon ERC20 Bridging Setup

Smart Contract Security Audit

Prepared by: Halborn

Date of Engagement: October 24th, 2022 – November 14th, 2022

Visit: Halborn.com

DOCUMENT REVISION HISTORY	3
CONTACTS	4
1 EXECUTIVE OVERVIEW	5
1.1 INTRODUCTION	6
1.2 AUDIT SUMMARY	6
1.3 TEST APPROACH & METHODOLOGY	6
RISK METHODOLOGY	7
1.4 SCOPE	9
2 ASSESSMENT SUMMARY & FINDINGS OVERVIEW	10
3 FINDINGS & TECH DETAILS	11
3.1 (HAL-01) POSSIBLE LOSS OF OWNERSHIP – MEDIUM	13
Description	13
Code Location	13
Risk Level	13
Recommendation	13
Remediation Plan	14
3.2 (HAL-02) DIFFERENT PRAGMA VERSIONS USED – INFORMATIONAL	15
Description	15
Code Location	15
Risk Level	15
Recommendation	15
Remediation Plan	15
4 MANUAL TESTING	17
5 RETESTING	20
5.1 AB01 – DEPOSIT REQUESTS ARE DECODED INCORRECTLY	21

Description	21
Risk Level:	23
Recommendation	24
Remediation Plan	24
5.2 AB02 - ONERC20RECEIVED HOOK USES ALWAYS THE FROM ADDRESS AS RECIPIENT	26
Description	26
Risk Level:	27
Recommendation	27
Remediation Plan	27
5.3 AB03 - ONERC20RECEIVED HOOK DOES NOT CHECK THAT DATA IS NOT THE ADDRESS 0	29
Description	29
Risk Level:	30
Recommendation	30
Remediation Plan	30
6 AUTOMATED TESTING	31
6.1 STATIC ANALYSIS REPORT	32
Description	32
Slither results	32
6.2 AUTOMATED SECURITY SCAN	58
Description	58
MythX results	58

DOCUMENT REVISION HISTORY

VERSION	MODIFICATION	DATE	AUTHOR
0.1	Document Creation	11/12/2022	Miguel Jalon
0.2	Draft Review	11/15/2022	Kubilay Onur Gungor
0.3	Draft Review	11/15/2022	Gabi Urrutia
1.0	Remediation Plan	11/22/2022	Miguel Jalon
1.1	Remediation Plan Review	11/22/2022	Kubilay Onur Gungor
1.2	Remediation Plan Review	11/22/2022	Gabi Urrutia
1.3	Document Updates	12/16/2022	Roberto Reigada

CONTACTS

CONTACT	COMPANY	EMAIL
Rob Behnke	Halborn	Rob.Behnke@halborn.com
Steven Walbroehl	Halborn	Steven.Walbroehl@halborn.com
Gabi Urrutia	Halborn	Gabi.Urrutia@halborn.com
Omar Alshaeb	Halborn	Omar.Alshaeb@halborn.com
Miguel Jalon	Halborn	Miguel.Jalon@halborn.com
Kubilay Onur Gungor	Halborn	Kubilay.Gungor@halborn.com

EXECUTIVE OVERVIEW

1.1 INTRODUCTION

Animoca Brands engaged Halborn to conduct a security audit on their smart contracts beginning on October 24th, 2022 and ending on November 14th, 2022. The security assessment was scoped to the smart contracts provided to the Halborn team.

1.2 AUDIT SUMMARY

The team at Halborn was provided three weeks for the engagement and assigned a full-time security engineer to audit the security of the smart contract. The security engineer is a blockchain and smart-contract security expert with advanced penetration testing, smart-contract hacking, and deep knowledge of multiple blockchain protocols.

The purpose of this audit is to:

- Ensure that smart contract functions operate as intended
- Identify potential security issues with the smart contracts

In summary, Halborn identified some security risks that were accepted and addressed by the Animoca Brands team.

1.3 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy in regard to the scope of this audit. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of the bridge code and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

- Research into architecture and purpose
- Smart contract manual code review and walkthrough
- Graphing out functionality and contract logic/connectivity/functions ([solgraph](#))
- Manual assessment of use and safety for the critical Solidity variables and functions in scope to identify any arithmetic related vulnerability classes
- Manual testing by custom scripts
- Scanning of solidity files for vulnerabilities, security hotspots or bugs. ([MythX](#))
- Static Analysis of security for scoped contract, and imported functions. ([Slither](#))
- Testnet deployment ([Brownie](#), [Remix IDE](#))

RISK METHODOLOGY:

Vulnerabilities or issues observed by Halborn are ranked based on the risk assessment methodology by measuring the **LIKELIHOOD** of a security incident and the **IMPACT** should an incident occur. This framework works for communicating the characteristics and impacts of technology vulnerabilities. The quantitative model ensures repeatable and accurate measurement while enabling users to see the underlying vulnerability characteristics that were used to generate the Risk scores. For every vulnerability, a risk level will be calculated on a scale of 5 to 1 with 5 being the highest likelihood or impact.

RISK SCALE - LIKELIHOOD

- 5 - Almost certain an incident will occur.
- 4 - High probability of an incident occurring.
- 3 - Potential of a security incident in the long term.
- 2 - Low probability of an incident occurring.
- 1 - Very unlikely issue will cause an incident.

RISK SCALE - IMPACT

- 5 - May cause devastating and unrecoverable impact or loss.
- 4 - May cause a significant level of impact or loss.

- 3 - May cause a partial impact or loss to many.
- 2 - May cause temporary impact or loss.
- 1 - May cause minimal or un-noticeable impact.

The risk level is then calculated using a sum of these two values, creating a value of **10** to **1** with **10** being the highest level of security risk.

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
----------	------	--------	-----	---------------

- 10** - CRITICAL
- 9** - **8** - HIGH
- 7** - **6** - MEDIUM
- 5** - **4** - LOW
- 3** - **1** - VERY LOW AND INFORMATIONAL

1.4 SCOPE

IN-SCOPE:

The security assessment was scoped to the following smart contracts:

1) SHRD and CATA ERC20 tokens smart contracts

- REVVMotorsportShard.sol
- REVVRacingCatalyst.sol
- ERC20MintBurn.sol

Commit ID: 0ffc859794d3cd70928559fa03e48aeea8d7c36b

2) Polygon ERC20 bridging setup smart contracts:

- FxTokenMapping.sol
- FxErc20.sol
- FxErc20ChildTunnel.sol
- FxErc20FixedSupply.sol
- FxErc20FixedSupplyChildTunnel.sol
- FxErc20FixedSupplyRootTunnel.sol
- FxErc20MintBurn.sol
- FxErc20MintBurnChildTunnel.sol
- FxErc20FixedSupplyChildTunnel.sol
- FxErc20MintBurnRootTunnel.sol
- FxErc20RootTunnel.sol
- FxErc20Storage.sol

Halborn Audit Fixed Commit ID:

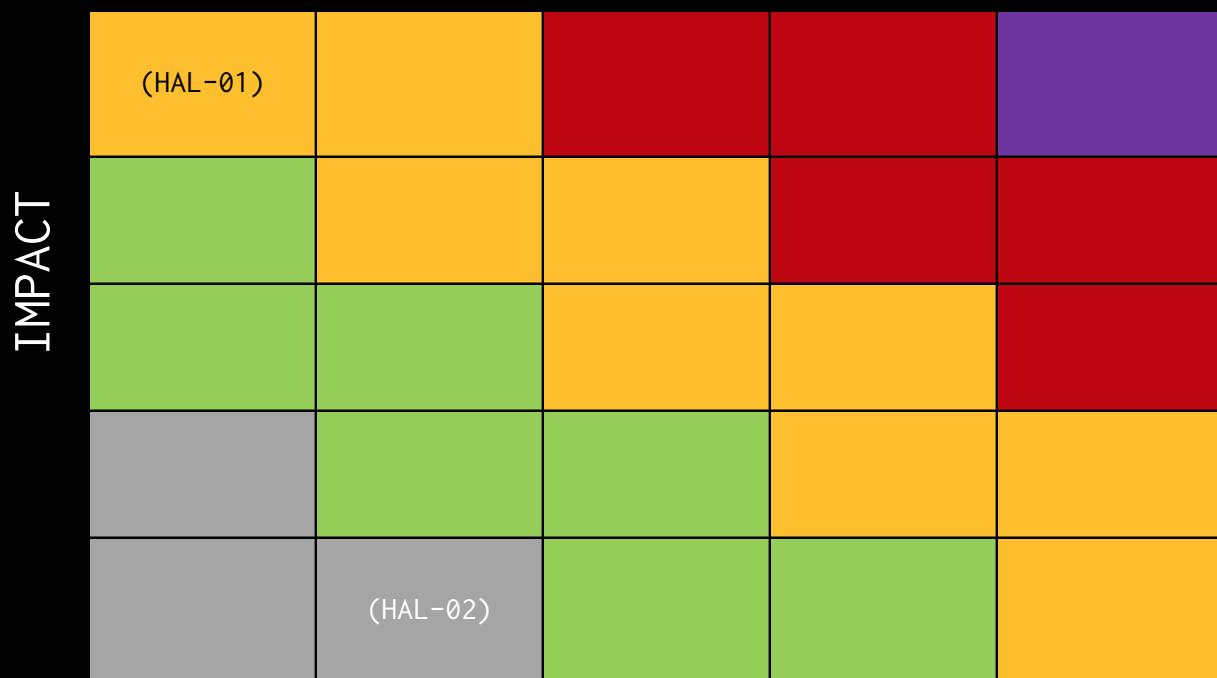
32f0c6d644eb85f760f90cbb772c32b458e8df9c

Final Commit ID which addresses the issues found by Animoca Brands team:
ac07a577f4c6545f2543f793fea6d4ee7b1ea928

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
0	0	1	0	1

LIKELIHOOD



EXECUTIVE OVERVIEW

SECURITY ANALYSIS	RISK LEVEL	REMEDIATION DATE
HAL01 - POSSIBLE LOSS OF OWNERSHIP	Medium	RISK ACCEPTED
HAL02 - DIFFERENT PRAGMA VERSIONS USED	Informational	ACKNOWLEDGED

FINDINGS & TECH DETAILS

3.1 (HAL-01) POSSIBLE LOSS OF OWNERSHIP - MEDIUM

Description:

When transferring ownership of the protocol, no checks are made on whether the new address is valid and active. In the event of an error in transferring ownership, the entire protocol loses its ownership, thus blocking critical functionalities.

Code Location:

Listing 1: ContractOwnershipStorage.sol (Line 58)

```
50 function transferOwnership(
51     Layout storage s,
52     address sender,
53     address newOwner
54 ) internal {
55     address previousOwner = s.contractOwner;
56     require(sender == previousOwner, "Ownership: not the owner");
57     if (previousOwner != newOwner) {
58         s.contractOwner = newOwner;
59         emit OwnershipTransferred(previousOwner, newOwner);
60     }
61 }
```

Risk Level:

Likelihood - 1

Impact - 5

Recommendation:

The ownership transfer process should be split into two different transactions, the first calls the `requestTransferOwnership` function, which

FINDINGS & TECH DETAILS

proposes a new owner for the protocol, and the second, the new owner accepts the proposal by calling the `acceptsTransferOwnership` function.

Remediation Plan:

RISK ACCEPTED: The Animoca Brands team accepted the risk of this finding.

3.2 (HAL-02) DIFFERENT PRAGMA VERSIONS USED - INFORMATIONAL

Description:

Smart contracts use floating pragma `^0.8.8` and different pragma versions, like `0.8.17`. The latest pragma version, `0.8.17`, released on September 8, 2022, is used in some contracts, but `^0.8.8` is also used. It is recommended to avoid using floating pragmas as best practice.

Reference: [Solidity Releases](#)

Code Location:

Listing 2

```
1 - 0.8.17 (contracts/token/ERC20/REVVMotorsportShard.sol#2)
2 - 0.8.17 (contracts/token/ERC20/REVV RacingCatalyst.sol#2)
3 - ^0.8.8 (@animoca/ethereum-contracts/contracts/access/libraries/
↳ ContractOwnershipStorage.sol#2)
```

Risk Level:

Likelihood - 2

Impact - 1

Recommendation:

It is recommended to update the pragma versions used in the smart contracts and lock them all to the version `0.8.17`.

Remediation Plan:

ACKNOWLEDGED: The Animoca Brands team acknowledged this issue. The design is intended.

FINDINGS & TECH DETAILS

As a library, the project is open to different compilation options when re-usable contracts are concerned (abstract contracts, libraries, interfaces). The solidity version is the minimum version which allows to compile and passes the tests. The concrete contracts are designed to be directly deployed, in this case the latest solidity version is enforced.

MANUAL TESTING

Halborn performed several manual tests in the following contracts:

SHRD and CATA ERC20 tokens smart contracts

- REVVMotorsportShard.sol
- REVVRacingCatalyst.sol
- ERC20MintBurn.sol

Polygon ERC20 bridging setup smart contracts

- FxTokenMapping.sol
- FxErc20.sol
- FxErc20ChildTunnel.sol
- FxErc20FixedSupply.sol
- FxErc20FixedSupplyChildTunnel.sol
- FxErc20FixedSupplyRootTunnel.sol
- FxErc20MintBurn.sol
- FxErc20MintBurnChildTunnel.sol
- FxErc20FixedSupplyChildTunnel.sol
- FxErc20MintBurnRootTunnel.sol
- FxErc20RootTunnel.sol
- FxErc20Storage.sol

The manual tests were focused on testing the main functions of these contracts:

- approve()
- transfer()
- batchTransferFrom()
- burnFrom()
- batchBurnFrom()
- setTokenURI()
- mint()
- batchMint()
- permit()

- `safeTransferFrom()`
- `onERC20Received()`
- `withdrawTo()`
- `_withdraw()`
- `_syncDeposit()`
- `_sendDepositRequest()`
- `_deposit()`
- `_getMappedRootToken()`
- `_processMessageFromRoot()`
- `_mapToken()`
- `_initializeChildToken()`
- `safeTransferFrom()`

No other issues than those mentioned during manual testing have been found.

RETESTING

The issues described in this section were discovered by Animoca Brands post the original final report from Halborn done on the Commit ID [32f0c6d644eb85f760f90cbb772c32b458e8df9c](#).

The fixes applied on the issues found by Animoca Brands on the Commit ID [ac07a577f4c6545f2543f793fea6d4ee7b1ea928](#) were reviewed and retested by Halborn.

5.1 AB01 - DEPOSIT REQUESTS ARE DECODED INCORRECTLY

Description:

In the `FxERC20RootTunnel` contract the function `deposit()` is used to deposit assets into the Bridge:

```
Listing 3: FxERC20RootTunnel.sol (Lines 107,117,118)

75 function deposit(address rootToken, uint256 amount) external {
76     address depositor = _msgSender();
77     _depositFrom(rootToken, depositor, depositor, amount);
78 }
79
80 function depositTo(
81     address rootToken,
82     address receiver,
83     uint256 amount
84 ) external {
85     _depositFrom(rootToken, _msgSender(), receiver, amount);
86 }
87
88 function _deposit(
89     address rootToken,
90     address depositor,
91     address receiver,
92     uint256 amount
93 ) internal {
94     mapToken(rootToken);
95     _deposit(rootToken, amount);
```

```

96     _sendDepositRequest(rootToken, depositor, receiver, amount);
97 }
98
99 function _depositFrom(
100     address rootToken,
101     address depositor,
102     address receiver,
103     uint256 amount
104 ) internal {
105     mapToken(rootToken);
106     _depositFrom(rootToken, depositor, amount);
107     _sendDepositRequest(rootToken, depositor, receiver, amount);
108 }
109
110 function _sendDepositRequest(
111     address rootToken,
112     address depositor,
113     address receiver,
114     uint256 amount
115 ) internal {
116     // DEPOSIT, encode(rootToken, depositor, user, amount)
117     bytes memory message = abi.encode(DEPOSIT, abi.encode(
118         rootToken, depositor, receiver, amount));
119     _sendMessageToChild(message);
120     emit FxDepositERC20(rootToken, depositor, receiver, amount);
121 }
```

A message is sent to the child contract. The message is encoded as shown below:

```
bytes memory message = abi.encode(DEPOSIT, abi.encode(rootToken,
depositor, receiver, amount));
```

When the child receives the message the following functions are called:

Listing 4: FxERC20ChildTunnel.sol (Lines 83,85,86,95)

```

77     function _processMessageFromRoot(
78         uint256, /* stateId */
79         address sender,
80         bytes memory data
81     ) internal override validateSender(sender) {
82         // decode incoming data
```

```

83         (bytes32 syncType, bytes memory syncData) = abi.decode(
84     data, (bytes32, bytes));
85         if (syncType == DEPOSIT) {
86             _syncDeposit(syncData);
87         } else if (syncType == MAP_TOKEN) {
88             _mapToken(syncData);
89         } else {
90             revert FxERC20InvalidSyncType(syncType);
91         }
92     }
93
94     function _syncDeposit(bytes memory syncData) internal {
95         (address rootToken, address to, uint256 amount) = abi.
96     decode(syncData, (address, address, uint256));
97         address childToken = rootToChildToken[rootToken];
98
99         // deposit tokens
100        _deposit(childToken, to, amount);
101    }

```

The message is incorrectly decoded as the message was initially encoded as:

```
bytes memory message = abi.encode(DEPOSIT, abi.encode(rootToken,
depositor, receiver, amount));
```

and then decoded as:

```
(address rootToken, address to, uint256 amount)= abi.decode(syncData, (
address, address, uint256));
```

This leads to an incorrect `amount` being deposited.

Risk Level::

Likelihood - 5

Impact - 5

Recommendation:

It is recommended to correct the `abi.decode()` call in the `_syncDeposit()` function.

Remediation Plan:

The following code has been used to confirm the fix of this issue, the `oldSyncDeposit` function is using the wrongly code to decode the data and the `newSyncDeposit` function is using the correct one.

Listing 5: Test.sol (Lines 20,25)

```
0 // SPDX-License-Identifier: MIT
1 pragma solidity ^0.8.8;
2
3 contract Test {
4
5     address public _rootToken = 0
↳ xAb8483F64d9C6d1EcF9b849Ae677dD3315835cb2;
6     address public _depositor = 0
↳ x4B20993Bc481177ec7E8f571ceCaE8A9e22C02db;
7     address public _receiver = 0
↳ x78731D3Ca6b7E34aC0F824c42a7cC18A495cabab;
8     uint256 public _amount = 10;
9
10    event OldSyncDepositEvent(address indexed rootToken, address
↳ indexed to, uint256 amount);
11    event NewSyncDepositEvent(address indexed rootToken, address
↳ indexed depositor, address indexed receiver, uint256 amount);
12
13    function deposit() external {
14        bytes memory message = abi.encode(_rootToken, _depositor,
↳ _receiver, _amount);
15        oldSyncDeposit(message);
16        newSyncDeposit(message);
17    }
18
19    function oldSyncDeposit(bytes memory syncData) public {
20        (address rootToken, address to, uint256 amount) = abi.
↳ decode(syncData, (address, address, uint256));
21        emit OldSyncDepositEvent(rootToken, to, amount);
22    }
```

```

23
24     function newSyncDeposit(bytes memory syncData) public {
25         (address rootToken, address depositor, address receiver,
26         uint256 amount) = abi.decode(syncData, (address, address, address,
27         uint256));
28         emit NewSyncDepositEvent(rootToken, depositor, receiver,
29         amount);
30     }

```

And as can be seen in the following image, taking a look at the events generated, the previous code was setting an incorrect value to the amount parameter. By using the new code developed by Animoca Brands, the issue has been properly mitigated and all the parameters are correctly set.

```

>>> test = Test.deploy({'from': a[0]})

[Transaction sent: 0xecdcd85d89674b747881f890f01875d4c289afaf994d5bc25a2fcdd4b1f599
Gas price: 0.0 gwei Gas limit: 300000000 Nonce: 11
Test.constructor confirmed Block: 16191227 Gas used: 362191 (0.05%)
Test deployed at: 0x87a4340fE5f76377e0d69069504d060586282

>>> tx = test.deposit({'from': a[0]})

[Transaction sent: 0x6d07a3281717a17aefaf1ff0f870d1a374a46ee122ec3f5e52231be5a041a4e
Gas price: 0.0 gwei Gas limit: 300000000 Nonce: 12
Gas used: 20555 Block: 16191228 Gas used: 20555 (0.00%)

>>> tx.events[0]
OrderedDict([('rootToken', '0xAb8483F64d9C0d1EcF9b849Ae677d031583cb2'), ('to', '0x4B209938c48177ec7E8f571ceCaE8A9e22C02db'), ('amount', 68764683509152448527787505238253954984449848235)]
>>> tx.events[1]
OrderedDict([('rootToken', '0xAb8483F64d9C0d1EcF9b849Ae677d031583cb2'), ('depositor', '0x4B209938c481177ec7E8f571ceCaE8A9e22C02db'), ('receiver', '0x7873103ca6b7E84aC0F824c42a7c18a49Scab8'), ('amount', 10)])

```

SOLVED: The Animoca Brands team corrected the issue in the Commit ID d4b2d6f429541c0bdff6c36d15364c33c732161a

Listing 6: FxErc20ChildTunnel.sol (Line 122)

```

121     function _syncDeposit(bytes memory syncData) internal {
122         (address rootToken, address depositor, address receiver,
123         uint256 amount) = abi.decode(syncData, (address, address, address,
124         uint256));
125         address childToken = rootToChildToken[rootToken];
126         // deposit tokens
127         _deposit(childToken, receiver, amount);
128         emit FxErc20Deposit(rootToken, childToken, depositor,
129         receiver, amount);
130     }

```

5.2 AB02 - ONERC20RECEIVED HOOK USES ALWAYS THE FROM ADDRESS AS RECIPIENT

Description:

In the `FxERC20ChildTunnel.onERC20Received()` function is used to handle the receipt of ERC20 tokens as a withdraw request:

Listing 7: FxERC20ChildTunnel.sol (Lines 56-60)

```
43 /// @notice Handles the receipt of ERC20 tokens as a withdrawal
44 /// @dev Note: this function is called by an {ERC20SafeTransfer}
45 /// contract after a safe transfer.
46 /// @param operator The initiator of the safe transfer.
47 /// @param from The previous tokens owner.
48 /// @param value The amount of tokens transferred.
49 /// @param data Empty if the receiver is the same as the tokens
50 // sender, else the abi-encoded address of the receiver.
51 // @return magicValue `bytes4(keccak256("onERC20Received(address,
52 // address,uint256,bytes)"))` (`0x4fc35859`) to accept, any other
53 // value to refuse.
54 function onERC20Received(
55     address ,
56     address from,
57     uint256 value,
58     bytes calldata data
59 ) external returns (bytes4 magicValue) {
60     address receiver = from;
61     if (data.length != 0) {
62         (receiver) = abi.decode(data, (address));
63     }
64     _withdraw(msg.sender, from, value);
65     return ERC20Storage.ERC20_RECEIVED;
66 }
```

As we can see, the `receiver` state variable is not used in the `_withdraw()` call hence `from` address will always be the recipient in the `onERC20Received()` function.

Risk Level::

Likelihood - 4

Impact - 4

Recommendation:

It is recommended to update the `FxERC20ChildTunnel.onERC20Received()` function so it correctly uses the `receiver` variable in the `_withdraw()` call.

Remediation Plan:

SOLVED: The [Animoca Brands team](#) corrected the issue in the Commit ID [d4b2d6f429541c0bdff6c36d15364c33c732161a](#)

Listing 8: FxERC20ChildTunnel.sol (Lines 65-72)

```
55 /// @notice Handles the receipt of ERC20 tokens as a withdrawal
↳ request.
56 /// @dev Note: this function is called by an {ERC20SafeTransfer}
↳ contract after a safe transfer.
57 /// @dev Reverts with `FxERC20InvalidWithdrawalAddress` if `
↳ receiver` is encoded in `data` and is the zero address.
58 /// @dev Reverts with `FxERC20TokenNotMapped` if the child token (
↳ msg.sender) has not been deployed through a mapping request.
59 // @param operator The initiator of the safe transfer.
60 // @param from The previous tokens owner.
61 // @param value The amount of tokens transferred.
62 // @param data Empty if the receiver is the same as the tokens
↳ sender, else the abi-encoded address of the receiver.
63 // @return magicValue `bytes4(keccak256("onERC20Received(address,
↳ address,uint256,bytes)"))` (`0x4fc35859`) to accept, any other
↳ value to refuse.
64 function onERC20Received(address, address from, uint256 value,
↳ bytes calldata data) external returns (bytes4 magicValue) {
65     address receiver = from;
66     if (data.length != 0) {
67         (receiver) = abi.decode(data, (address));
68         if (receiver == address(0)) {
69             revert FxERC20InvalidWithdrawalAddress();
```

```
70     }
71 }
72 _withdraw(msg.sender, from, receiver, value);
73 _withdrawReceivedTokens(msg.sender, value);
74 return ERC20Storage.ERC20_RECEIVED;
75 }
```

5.3 AB03 - ONERC20RECEIVED HOOK DOES NOT CHECK THAT DATA IS NOT THE ADDRESS 0

Description:

The `onERC20Received()` function is used in multiple contracts to handle the receipt of ERC20 tokens as a deposit/withdraw request:

Listing 9: FxERC20RootTunnel.sol (Lines 65,68)

```
54 /// @notice Handles the receipt of ERC20 tokens as a deposit
55 /// @dev Note: this function is called by an {ERC20SafeTransfer}
56 /// @param operator The initiator of the safe transfer.
57 /// @param from The previous tokens owner.
58 /// @param value The amount of tokens transferred.
59 /// @param data Empty if the receiver is the same as the tokens
60 /// sender, else the abi-encoded address of the receiver.
61 function onERC20Received(
62     address,
63     address from,
64     uint256 value,
65     bytes calldata data
66 ) external returns (bytes4 magicValue) {
67     address receiver = from;
68     if (data.length != 0) {
69         (receiver) = abi.decode(data, (address));
70     }
71     _deposit(msg.sender, from, receiver, value);
72     return ERC20Storage.ERC20_RECEIVED;
73 }
```

The parameter `data` will be empty if the receiver is the same as the tokens sender, else it will be the abi-encoded address of the receiver, although the smart contract does not check anywhere that the `receiver` is not the

address(0).

Nevertheless, in case that the data is empty, the `if (data.length != 0)` code block would never be executed and the `receiver` would be the `from` address as expected. For this reason, we have set this finding as informational.

Risk Level::

Likelihood - 3

Impact - 4

Recommendation:

It is recommended to validate that the `receiver` address is never the `address(0)`.

Remediation Plan:

SOLVED: The Animoca Brands team corrected the issue in the Commit ID `d4b2d6f429541c0bdff6c36d15364c33c732161a`

Listing 10: FxERC20RootTunnel.sol (Lines 68-70)

```
64 function onERC20Received(address, address from, uint256 value,
65   bytes calldata data) external returns (bytes4 magicValue) {
66   address receiver = from;
67   if (data.length != 0) {
68     if (receiver == address(0)) {
69       revert FxERC20InvalidDepositAddress();
70     }
71   }
72   _deposit(msg.sender, from, receiver, value);
73   _depositReceivedTokens(msg.sender, value);
74
75   return ERC20Storage.ERC20_RECEIVED;
76 }
```

AUTOMATED TESTING

6.1 STATIC ANALYSIS REPORT

Description:

Halborn used automated testing techniques to enhance the coverage of certain areas of the scoped contracts. Among the tools used was Slither, a Solidity static analysis framework. After Halborn verified all the contracts in the repository and was able to compile them correctly into their ABI and binary formats, Slither was run on the all-scoped contracts. This tool can statically verify mathematical relationships between Solidity variables to detect invalid or inconsistent usage of the contracts' APIs across the entire code-base.

Slither results:

SHRD and CATA ERC20 tokens smart contracts

ERC20MintBurn

```

IERC20Permit is re-used:
- IERC20Permit (./, HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/interfaces/IERC20Permit.sol#8-56)
- IERC20Permit (./, HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/token/ERC20/extensions/draft-IERC20Permit.sol#14-60)

IERC20 is re-used:
- IERC20 (./, HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/interfaces/IERC20.sol#7-70)
- IERC20 (./, HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/token/ERC20/IERC20.sol#19-82)
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#name-reused

ERC298MinBurn (./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:ERC298SafeTransfersBase.safeTransferFrom(address,address,uint256,bytes) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/ERC298MinBurn.sol#25-33)
ERC298MinBurn (./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:ERC298SafeTransfers.safeTransferFrom(address,address,uint256,bytes) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/ERC298MinBurn.sol#35-48)
ERC298MinBurn (./, ./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:ERC298base.approve(address,uint256) (./, ./, /HALBORN/animocaBridge/node_modules/@C08base.sol#16-19)
ERC298MinBurn (./, ./, ./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:ERC298base.transferFrom(address,address,uint256) (./, ./, /HALBORN/animocaBridge/ERC298/base/ERC298base.sol#28-35)
ERC298MinBurn (./, ./, ./, ./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:IERC20.approve(address,uint256) (./, ./, /HALBORN/animocaBridge/node_modules/@an/IERC20.sol#29)
ERC298MinBurn (./, ./, ./, ./, ./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298/ERC298MinBurn.sol#19-63) has incorrect ERC721 function interface:IERC20.transferFrom(address,address,uint256) (./, ./, /HALBORN/animocaBridge/20/interfaces/IERC20.sol#54)
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#incorrect-erc721-interface

ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,[uint256]) totalValue (./, ./HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#213) is initialized
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,address,[uint256]) selfTransferTotalValue (./, ./HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#214)
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,address,[uint256]) i (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#1272) is local variable never initialized
TokenRecoveryBase.recoverERC721s([address],IERC721[],uint256) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/security/base/TokenRecoveryBase.sol#84) is a local variable never initialized
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,[uint256]) is (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#4469) is a local variable never initialized
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,[uint256]) i (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#4469) is a local variable never initialized
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,address,[uint256]) i (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#4469) is a local variable never initialized
ERC298Storage.batchTransferFrom(ERC298Storage.Layout,address,[uint256]) totalValue (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#4469) is a local variable never initialized
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#initialized-local-variable

ERC298MinBurn.constructor(string,string,uint8,IForwarderRegistry).forwarderRegistry (./, ./, ./pro/HALBORN/animocaERC29/contracts/token/ERC298MinBurn.sol#35) shadows:
- forwarderRegistry(forwarderRegistry) (./, ./, ./HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metats/ForwarderRegistryContext.sol#14-6) (function)
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#local-variable-shadowing

TokenRecoveryBase.recoverERC721s([address],IERC721[],uint256) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/security/base/TokenRecoveryBase.sol#73-86) has external calls inside i, tokenIds[i] (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/security/base/TokenRecoveryBase.sol#83)
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#calls-inside-a-loop

ERC298PermitStorage.permit(ERC298PermitStorage.Layout,address,address,uint256,uint256,uint256,uint8,bytes32,bytes2) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#52)
Dangerous comparisons:
- require(bool,string)(block.timestamp <= deadline,ERC298_expired permit) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#52)
Reference: https://github.com/crytic/lithium/wikid/Detector-Documentation#block-timestamp

AccessControlStorage.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/access/Libraries/AccessControlStorage.sol#10-19) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/access/Libraries/AccessControlStorage.sol#10-19)
ContractStorage.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/storage/Libraries/ContractStorage.sol#76-81) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/storage/Libraries/ContractStorage.sol#76-80)
InterfaceDetectionStorage.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/Libraries/InterfaceDetectionStorage.sol#42-47) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/Libraries/InterfaceDetectionStorage.sol#42-46)
ERC2771CallData.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metats/Libraries/ERC2771CallData.sol#9-11) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metats/Libraries/ERC2771CallData.sol#9-11)
ERC290DetailedStorage.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC290/Libraries/ERC290DetailedStorage.sol#81-84) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC290/Libraries/ERC290DetailedStorage.sol#81-85)
ERC290Metadata.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC290/Libraries/ERC290Metadata.layout.sol#35-40) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC290/Libraries/ERC290Metadata.layout.sol#35-39)
ERC298PermitStorage.DOMAIN_SEPARATOR() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#8-102) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#8-91)
ERC298PermitStorage.permit(ERC298PermitStorage.Layout,address,address,uint256,uint256,uint256,uint8,bytes32,bytes2) (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#104-109) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298PermitStorage.sol#104-108)
ERC298Storage.layout() (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#552-557) uses assembly
- INLINE ASM (./, ./, /HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC298/libraries/ERC298Storage.sol#554-556)
Address.verifyCallValue(uint256,uint256,uint256,uint256,uint256,uint256,uint256,uint256) uses assembly
StorageSlot.getAddressSlot(bytes32) (./, ./, /HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/utils/StorageSlot.sol#52-57) uses assembly
- INLINE ASL (./, ./, /HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/utils/StorageSlot.sol#54-56)
StorageSlot.getBoolSlot(bytes32) (./, ./, /HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/utils/StorageSlot.sol#62-67) uses assembly

```

AUTOMATED TESTING

AUTOMATED TESTING

AUTOMATED TESTING

AUTOMATED TESTING

Polygon ERC20 bridging setup smart contracts
FxTokenMapping.sol

FxErc20.sol

AUTOMATED TESTING

FxERC20ChildTunnel.sol

FxERC20FixedSupply.sol

AUTOMATED TESTING

FxERC20FixedSupplyChildTunnel.sol

AUTOMATED TESTING

AUTOMATED TESTING

```

        (success) = recipient.call.value(amount) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#63)
    low level call in Address.functionCallWithValue(address,bytes,uint256,string) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#120-139):
    -- (success,returnData) = target.call(value: value)(data) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#137)
    low level call in Address.functionStaticCallWithValue(address,bytes,string) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#157-166):
    -- (success,returnData) = target.staticcallWithValue(data) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#184-193):
    low level call in Address.functionDelegateCallWithValue(address,bytes,calldata) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#184-193):
    -- (success,returnData) = target.delegatecallWithValue(data) (./../HALBORN/animocaBridge/node_modules/OpenZeppelin/contracts/utils/Address.sol#191)
    Reference: https://github.com/crytic/solidity/wikidetector-Documentation#low-level-calls

Variable ForwarderRegistryContextBase._forwarderRegistry (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metatx/base/ForwarderRegistryContextBase.sol#11) is not in mixedCase
Function ERC20PermitBase.DOMAIN_SEPARATOR() (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/base/ERC20PermitBase.sol#35-37) is not in mixedCase
Function IERC20Permit.DOMAIN_SEPARATOR() (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/interfaces/IERC20Permit.sol#85) is not in mixedCase
Function ERC20PermitStorage.DOMAIN_SEPARATOR() (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20PermitStorage.sol#87-102) is not in mixedCase
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#conformance-to-solidity-naming-conventions

Variable ForwarderRegistryContextBase._forwarderRegistry (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metatx/base/ForwarderRegistryContextBase.sol#11) is too similar to ForwarderRegistry (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/metatx/ForwarderRegistryContext.sol#12)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#variable-names-are-too-similar

owner() should be declared external:
- ContractOwnershipBase.owner() (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/access/base/ContractOwnershipBase.sol#16-18)
transferOwnership(address newOwner) should be declared external:
- ContractOwnershipBase.transferOwnership(address) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/access/base/ContractOwnershipBase.sol#21-23)
allowance(address,address) should be declared external:
- ERC20Base.allowance(address,address) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/base/ERC20Base.sol#60-62)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#public-function-that-could-be-declared-external



### FxERC20MintBurnChildTunnel.sol


ERC20Storage.batchTransfer(ERC20Storage.Layout,address,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#213) is
ERC20Storage.batchTransferFrom(ERC20Storage.Layout,address,address,address[],uint256[]).selfTransferTotalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#45)
ERC20Storage.batchMint(ERC20Storage.Layout,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#46) is a local variable never
ERC20Storage.batchTransferFrom(ERC20Storage.Layout,address,address,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#46) is a local variable never
ERC20Storage.batchTransfer(ERC20Storage.Layout,address,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#46) is a local variable never
ERC20Storage.batchBurnFrom(ERC20Storage.Layout,address,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#49) is a local variable never
ERC20Storage.batchTransferFrom(ERC20Storage.Layout,address,address[],uint256[]).totalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#49) is a local variable never
ERC20Storage.batchMintFrom(ERC20Storage.Layout,address,address[],uint256[]).selfTransferTotalValue (...) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/token/ERC20/libraries/ERC20Storage.sol#49) is a local variable never
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#uninitialized-local-variables

FxERC20MintBurnChildTunnel._burnFrom(address,uint256) (..././../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20MintBurnChildTunnel.sol#52) ignores return value by IERC20Burnable(childToken).burnFrom
FxERC20MintBurnChildTunnel._withDrawFrom(address,uint256) (..././../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20MintBurnChildTunnel.sol#59) ignores return value by IERC20Burnable(childToken)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#unused-return

FxERC20ChildTunnel.constructor(address,address) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20ChildTunnel.sol#33) shadows:
- FxBaseChildTunnel.fxChild (..././../HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/tunnel/FxBaseChildTunnel.sol#23) (state variable)
FxERC20ChildTunnel.constructor(address,address,ForwaderRegistry).forwaderRegistry (..././../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20ChildTunnel.sol#35) shadows:
- ForwaderRegistryContext(forwaderRegistry) (./../pro/HALBORN/animocaBridge/contracts/forwaderRegistry/ForwaderRegistryContext.sol#14-16) (function)
FxERC20MintBurnChildTunnel.constructor(address,address,ForwaderRegistry).forwaderRegistry (..././../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20MintBurnChildTunnel.sol#16) shadows:
- FxBaseChildTunnel.fxChild (..././../HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/tunnel/FxBaseChildTunnel.sol#23) (state variable)
FxERC20MintBurnChildTunnel.constructor(address,address,ForwaderRegistry).childTokenLogic (..././../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20/FxERC20MintBurnChildTunnel.sol#17) shadows:
- ForwaderRegistryContext(forwaderRegistry) (./../pro/HALBORN/animocaBridge/contracts/forwaderRegistry/ForwaderRegistryContext.sol#14-16) (function)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#local-variable-shadowing

FxBaseChildTunnel.setFxRootTunnel(address) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/FxBaseChildTunnel.sol#37) lacks a zero-check on :
- FxRootTunnel (./../pro/HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/tunnel/FxBaseChildTunnel.sol#59)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#missing-zero-address-validation

Reentrancy in FxERC20ChildTunnel._withdrawFrom(address,address,uint256) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/ERC20/FxERC20ChildTunnel.sol#102-110):
External calls:
- rootToken = _getMappedRootToken(childToken) (./../pro/ERC20ChildTunnel.sol#97)
- FxRootToken = IfxERC20ChildTunnel.connectedToken() (./../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20/FxERC20ChildTunnel.sol#124)
Event emitted after the call(s):
- MessageSend(message) (./../pro/HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/tunnel/FxBaseChildTunnel.sol#46)
    sendMessageToRootToken(childToken,rootToken,receiver,amount) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/ERC20/FxERC20ChildTunnel.sol#109)
Reentrancy in FxERC20ChildTunnel._withdrawFrom(address,address,uint256) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/FxBaseChildTunnel.sol#121):
External calls:
- rootToken = _getMappedRootToken(childToken) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/ERC20/FxERC20ChildTunnel.sol#118)
    - rootToken = IfxERC20ChildTunnel.connectedToken() (./../pro/HALBORN/animocaBridge/contracts/fx-portal/FxERC20/FxERC20ChildTunnel.sol#124)
Event emitted after the call(s):
- MessageSend(message) (./../pro/HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/tunnel/FxBaseChildTunnel.sol#46)
    sendMessageToRootToken(childToken,rootToken,receiver,amount) (./../pro/HALBORN/animocaBridge/contracts/fx-portal/ERC20/FxERC20ChildTunnel.sol#120)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#reentrancy-vulnerabilities-3

InterfaceDetectionStorage.Layout (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/InterfaceDetectionStorage.sol#42-47) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/InterfaceDetectionStorage.sol#44-46)
ERC2771Calldata.data.msgSender() (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/ERC2771Calldata.sol#9-12) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/ERC2771Calldata.sol#10-12)
ERC20Storage.createClone(bytes32,address) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/ERC20Storage.sol#55-57) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/ERC20Storage.sol#55-56)
Create2.createClone(bytes32,address) (./../HALBORN/animocaBridge/node_modules/@maticnetwork/fx-portal/contracts/lib/Create2.sol#19-19) uses assembly
Address.getAddress(bytes32) (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/Address.sol#201-221) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/libraries/Address.sol#213-216)
StorageSlot.getAddressSlot(bytes32) (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#82-87) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#84-85)
StorageSlot.getStorageSlot(bytes32) (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#62-67) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#64-66)
StorageSlot.getByte32Slot(bytes32) (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#72-77) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#74-76)
StorageSlot.getStorageSlot(bytes32) (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#82-87) uses assembly
- INLINE ASM (./../HALBORN/animocaBridge/node_modules/@openzeppelin/contracts/storage/StorageSlot.sol#84-86)
Reference: https://github.com/crytic/solidity/wiki/Detector-Documentation#assembly-usage

Different versions of Solidity are used:
- Version used: ['0.8.17', '0.8.9', '0.8.1', '0.8.0']
- ^0.8.8 (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/InterfaceDetection.sol#2)
- ^0.8.8 (./../HALBORN/animocaBridge/node_modules/@animoca/ethereum-contracts/contracts/introspection/interfaces/IERC165.sol#2)

```

AUTOMATED TESTING

FxERC20FixedSupplyChildTunnel.sol

AUTOMATED TESTING

- As a result of the tests carried out with the Slither tool, some results were obtained and reviewed by Halborn. Based on the results reviewed, some vulnerabilities were determined to be false positives.

6.2 AUTOMATED SECURITY SCAN

Description:

Halborn used automated security scanners to assist with detection of well-known security issues, and to identify low-hanging fruits on the targets for this engagement. Among the tools used was MythX, a security analysis service for Ethereum smart contracts. MythX performed a scan on all the contracts and sent the compiled results to the analyzers to locate any vulnerabilities.

MythX results:

SHRD and CATA ERC20 tokens smart contracts

ERC20MintBurn.sol

Report for contracts/fx-portal/ERC20/FxERC20MintBurn.sol https://dashboard.mythx.io/#/console/analyses/fc66e8e4-8a87-4bf3-88c8-1983cb1e4a31			
Line	SWC Title	Severity	Short Description
14	(SWC-123) Requirement Violation	Low	Requirement violation.

Polygon ERC20 bridging setup smart contracts

FxERC20.sol

Report for contracts/fx-portal/ERC20/FxERC20.sol https://dashboard.mythx.io/#/console/analyses/31819dac-2203-4a16-87df-531a76cf9864			
Line	SWC Title	Severity	Short Description
2	(SWC-103) Floating Pragma	Low	A floating pragma is set.

FxERC20ChildTunnel.sol

Report for contracts/fx-portal/ERC20/FxERC20ChildTunnel.sol https://dashboard.mythx.io/#/console/analyses/a61344a-6a8e-462a-adef-8971bf0e8f1e			
Line	SWC Title	Severity	Short Description
2	(SWC-103) Floating Pragma	Low	A floating pragma is set.

FxERC20RootTunnel.sol

Report for contracts/fx-portal/ERC20/FxERC20RootTunnel.sol https://dashboard.mythx.io/#/console/analyses/39e5abfe-4b39-424b-bf01-545ac6479e63			
Line	SWC Title	Severity	Short Description
2	(SWC-103) Floating Pragma	Low	A floating pragma is set.
22	(SWC-108) State Variable Default Visibility	Low	State variable visibility is not set.

FxERC20MintBurn.sol

Report for contracts/fx-portal/ERC20/FxERC20MintBurn.sol https://dashboard.mythx.io/#/console/analyses/fc66e8e4-8a87-4bf3-88c8-1983cb1e4a31			
Line	SWC Title	Severity	Short Description
14	(SWC-123) Requirement Violation	Low	Requirement violation.

- No major issues found by Mythx.

THANK YOU FOR CHOOSING
 HALBORN