

Privacy Cash security review

Intro

This security review was conducted by kriko.eth. The subject was the Privacy Cash Solana program and its ZK circuit at commit 8880a7d.

Risk Classification

The risk is assessed based on the severity matrix:

Likelihood		Impact	
	HIGH	MEDIUM	LOW
HIGH	CRITICAL	HIGH	MEDIUM
MEDIUM	HIGH	MEDIUM	LOW
LOW	MEDIUM	LOW	INFO

Findings Summary

Total issues discovered:

Severity	Count
Critical	0
High	0
Medium	0
Low	0
Info	1

Engagement Summary

The subject Solana program and circuits were reviewed and no critical security issue or an issue leading to loss of user funds was discovered. One informational finding was identified regarding fee recipient bypassing, which the client confirmed is intentional by design to maintain decentralization.

Informational Findings

PRCS-I01: Users can bypass protocol fees by controlling fee recipient in proof generation

Summary

The unconstrained fee recipient account allows users to generate proofs with their own accounts as fee recipients, enabling fee bypass and avoidance.

Finding Description

The `transact` function accepts an unconstrained `fee_recipient_account` that must match the fee recipient included in the user-generated zero-knowledge proof's external data hash. Since users generate their own proofs off-chain, they can specify the fee recipient account to an account they control:

```
#[account(mut)]
/// CHECK: user should be able to send fees to any types of accounts
pub fee_recipient_account: UncheckedAccount<'info>,
```

While the protocol likely expects users to use a designated fee recipient via the frontend, technically sophisticated users can bypass the frontend and generate proofs with their own wallet as the fee recipient. The proof will validate successfully since the fee recipient was correctly included in the hash, but fees flow to the user's account instead of the protocol.

Impact Explanation

This vulnerability allows users to completely bypass and avoid protocol fees by redirecting them to accounts they control, undermining the protocol's economic model and sustainability.

Likelihood Explanation

The issue requires technical knowledge to generate custom proofs and bypass the frontend, but provides strong economic incentive through substantial fee savings on high-value transactions.

Recommendation

Consider creating a fee recipient PDA that accumulates all fees, with admin-controlled withdrawal functionality and constrain the `fee_recipient` account to match this PDA's seeds. This would ensure all fees flow to a deterministic protocol-controlled account.

Client response

The client indicated this behavior is by design, emphasizing that the protocol should remain fully decentralized.