Taler Auditor Report

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The report was generated by the auditors at the following times:

Auditor	Start	End
Aggregation	Wed Jul 28 10:36:18 2021	Wed Jul 28 10:36:18 2021
Coins	Wed Jul 28 10:36:18 2021	Wed Jul 28 10:36:20 2021
Deposits	Wed Jul 28 10:36:20 2021	Wed Jul 28 10:36:20 2021
Reserves	Wed Jul 28 10:36:20 2021	Wed Jul 28 10:36:21 2021
Wire	Wed Jul 28 10:36:21 2021	Wed Jul 28 10:36:23 2021

In that time, the auditors processed the following table ranges:

Table	Start	End
Reserves Incoming	63	265
Reserves Out (withdraw)	5464	9109
Reserves Recoup	0	0
Reserves Close	0	0
Aggregation	33	168
Coin withdraw	5464	9109
Coin deposit	44	425
Coin melt	41	189
Coin refund	0	6
Coin recoup	0	0
Coin recoup refresh	0	0

Table 1: Serial number ranges of the tables processed by the audit.

In that time, the wire auditor processed the following table ranges:

Account	Table	Start	End
exchange-account-1	Reserves Incoming	63	265
	Outgoing wire transfers	33	167

Table 2: Range of account data processed by the wire auditor.

1 Operations

The balance of the escrow account should be **KUDOS:2651.44** (coins) plus **KUDOS:785.54** (reserves).
The active operational risk stands at **KUDOS:3939.55**.
Loss (actualized risk from recoups) is **KUDOS:0**.
Recoups of non-revoked coins are at **KUDOS:0** (coins) plus **KUDOS:0** (reserves).

2 Income

This section analyzes the income of the exchange operator from fees.

Table 3: Fee revenue summary

Category	Amount
Withdraw fees	KUDOS:27.06
Deposit fees	KUDOS:2.2
Melt fees	KUDOS:1.88
Refund fees	KUDOS:0.05
Aggregation fees	KUDOS:1.67

3 Lag

This section analyzes lag, which can be due to some component being behind in executing transactions. This is usually either the exchange's aggregator, the bank's wire transfer logic, or the synchronization of databases between exchange and auditor. Significant lag may be indicative of fraud, while moderate lag is indicative that the systems may be too slow to handle the load. Small amounts of lag can occur in normal operation.

3.1 Deposit lag

The total amount the exchange currently lags behind in deposits is **KUDOS:0**.

Note that some lag is perfectly normal, as tiny amounts that are too small to be wired are deferred beyond the due date, hoping that additional transfers will push them above the tiny threshold. Below, we report *non-tiny* wire transfers that are lagging behind.

No non-tiny wire transfers that are lagging behind detected.

3.2 Reserve closure lag

The total amount the exchange currently lags behind in reserve closures is **KUDOS:0**.

Note that some minimal lag may be normal as transactions may be in-flight.

No closure transfers that are lagging behind detected.

3.3 Deposit confirmation lag

This section analyzes the lag, which is by how much the exchange's database reporting is behind in providing us with information about deposit confirmations. Merchants probabilistically report deposit confirmations to the auditor directly, so if the exchange is slow at synchronizing its database with the auditor, some deposit confirmations may be known at the auditor only directly. However, any delta not accounted for by database synchronization delays is an indicator of a malicious exchange (or online singing key compromise) and should be answered by revoking the exchange's online siging keys.

The total amount the exchange currently lags behind is **KUDOS:0** from a total number of **0** deposit confirmations.

Note that some lag is perfectly normal. Below, we report *all* deposit confirmations that are lagging behind.

No deposit confirmations that are lagging behind detected.

4 Major irregularities

This section describes the possible major irregularities that the auditor has checked, and lists all of the actual irregularities encountered in detail.

4.1 Emergencies

Emergencies are errors where more coins were deposited than the exchange remembers issuing. This usually means that the private keys of the exchange were compromised (stolen or factored) and subsequently used to sign coins off the books. If this happens, all coins of the respective denomination that the exchange has redeemed so far may have been created by the attacker, and the exchange would have to refund all of the outstanding coins from ordinary users. Thus, the **risk exposure** is the amount of coins in circulation for a particular denomination and the maximum loss for the exchange from this type of compromise.

4.1.1 Emergencies by counting coins

No emergencies detected by counting coins.

4.1.2 Emergencies by value deposited

Note that emergencies by value deposited can *also* arise if the exchange fails to properly detect double spending (or simply fails to properly account for the remaining balance of a coin). Thus, if issues are listed here **in combination with** arithmetic problems (Section 4.2) issues, then they may not be a definitive indicator that the exchange's private signing key was compromised.

No emergencies by value detected.

4.2 Arithmetic problems

This section lists cases where the arithmetic of the exchange involving amounts disagrees with the arithmetic of the auditor. Disagreements imply that either the exchange made a loss (sending out too much money), or screwed a customer (and thus at least needs to fix the financial damage done to the customer).

Note that the deltas only sum up the issues where $P \neq 0$ as only then we can tell if the problem lead to a profit or loss.

The **P** column is set to "1" if the arithmetic problem was be determined to be profitable for the exchange, "-1" if the problem resulted in a net loss for the exchange, and "0" if this is unclear or at least the gain/loss is not easily determined from the amounts and thus not included in the totals.

4.2.1 For aggregation

No arithmetic problems detected.

4.2.2 For coins

No arithmetic problems detected.

4.2.3 For reserves

No arithmetic problems detected.

4.3 Reserve withdrawals exceeding balance

This section highlights cases where more coins were withdrawn from a reserve than the reserve contained funding for. This is a serious compromise resulting in proportional financial losses to the exchange.

Reserve	Loss
NYAK8BQ3M6NRJRX4HT8178KYVQDHCXXOX3ESKXPNWP27DYY5PC80	KUDOS:6.05
Total loss	KUDOS:6.05

Table 4: Reserves with withdrawals higher than reserve funding.

4.4 Claimed outgoing wire transfer inconsistencies

This section is about the exchange's database containing a justification to make an outgoing wire transfer for an aggregated amount for various deposits. It is reported as an inconsistency if the amount claimed for the wire transfer does not match up the deposits aggregated. This is about a *claimed* outgoing wire transfer as violations do not imply that the wire transfer was actually made (as that is a separate check). Note that not making the wire transfer would be reported separately in Section 4.9.

All aggregations matched up.

4.5 Coin history inconsistencies

This section lists cases where the exchange made arithmetic errors found when looking at the transaction history of a coin. The totals sum up the differences in amounts that matter for profit/loss calculations of the exchange. When an exchange merely shifted money from customers to merchants (or vice versa) without any effects on its own balance, those entries are excluded from the total.

All coin histories were unproblematic.

4.6 Operations with bad signatures

This section lists operations that the exchange performed, but for which the signatures provided are invalid. Hence the operations were invalid and the amount involved should be considered lost.

4.6.1 For aggregation

All signatures were valid.

4.6.2 For coins

All signatures were valid.

4.6.3 For reserves

The key given is always the key for which the signature verification step failed. This is the reserve public key for "withdraw" operations, the coin public key for

"recoup" operations, and the master public key for "recoup-master" operations (where the master's signature on the revocation is invalid).

All signatures were valid.

4.7 Actual incoming wire transfers

This section highlights cases where the exchange's record about incoming wire transfers does not match with that of the bank.

All incoming wire transfer amounts and subjects matched up.

4.8 Missattributed incoming wire transfers

This section lists cases where the sender account record of an incoming wire transfer differs between the exchange and the bank. This will cause funds to be sent to the wrong account when the reserve is closed and the remaining balance is refunded to the original account.

All incoming wire transfer sender accounts matched up.

4.9 Actual outgoing wire transfers

This section highlights cases where the exchange missbehaved with respect to outgoing wire transfers.

Wire transfer identifier Account	Wired Row	Justified Timestamp
6PYWFR0C0WBSYNMPNGAWR8R7A37 . . . exchange-account-1	KUDOS:0 59	KUDOS:4.98 Sat Jul 10 04:17:10 2021
9WN5XDBZJQEZ0ZYZFEXYB2560ZS . . . exchange-account-1	KUDOS:0 60	KUDOS:4.98 Sat Jul 10 05:35:14 2021
3X468NYS3WYFPAHNJD807CA60M1 . . . exchange-account-1	KUDOS:0 61	KUDOS:4.98 Sat Jul 10 06:02:18 2021
4SHFSX7W7Q4H4521MP310VCA41A . . . exchange-account-1	KUDOS:0 82	KUDOS:4.98 Sun Jul 11 06:01:36 2021
MF45RN1GHP9QWVSK3X8MCTKZ9X5 . . . exchange-account-1	KUDOS:0 89	KUDOS:4.98 Mon Jul 12 06:01:52 2021
SS5JVBCGD9MCAJ96ZZDAG6B3Q31 . . . exchange-account-1	KUDOS:0 90	KUDOS:4.98 Mon Jul 12 15:56:23 2021
4NQA5XSRYZGTJXQBPBZNCYRD5QX . . . exchange-account-1	KUDOS:0 91	KUDOS:4.98 Mon Jul 12 15:57:23 2021
E5DANP04749ZV4EY8085BP6MXTR . . . exchange-account-1	KUDOS:0 92	KUDOS:4.98 Mon Jul 12 19:50:35 2021
PGRXX5J5Q7DXJ6PR2ZK02GB3XHP . . . exchange-account-1	KUDOS:0 93	KUDOS:4.98 Mon Jul 12 19:51:35 2021
Wire transfer identifier **Account**	**Wired** **Row**	**Justified** **Timestamp**

Wire transfer identifier Account	Wired Row	Justified Timestamp
TTFF2T0FW93C305N66KFYKNSXR5 . . . exchange-account-1	KUDOS:0 96	KUDOS:4.98 Tue Jul 13 02:57:57 2021
5JS5XYFP4A5JGPW8HYKW2M36EPC . . . exchange-account-1	KUDOS:0 97	KUDOS:4.98 Tue Jul 13 06:02:10 2021
Z446H0MGJR52QZJ5GBA558W2245 . . . exchange-account-1	KUDOS:0 98	KUDOS:4.98 Tue Jul 13 13:56:35 2021
C5AF7PYQ0FFT9YRT3XGN77FSC6K . . . exchange-account-1	KUDOS:0 99	KUDOS:4.98 Tue Jul 13 14:11:36 2021
KQP0C7ASNETQ8V9R1TYQPS3WX6A . . . exchange-account-1	KUDOS:0 100	KUDOS:4.98 Tue Jul 13 14:14:36 2021
W9S81K516PMD3GFC27MR6AXA034 . . . exchange-account-1	KUDOS:0 101	KUDOS:4.98 Tue Jul 13 16:49:44 2021
5A7D1Y4E67CTKFFS59M16DSDESZ . . . exchange-account-1	KUDOS:0 102	KUDOS:4.98 Tue Jul 13 20:34:56 2021
Y16EM2BA6DEPPK87G7F41AQRWBX . . . exchange-account-1	KUDOS:0 105	KUDOS:4.98 Wed Jul 14 06:02:25 2021
059ZBGDN8TYHC2B1ZCVSDRT9S8F . . . exchange-account-1	KUDOS:0 109	KUDOS:4.98 Wed Jul 14 14:35:52 2021
HTQDW9DNSSMA91A0VNFNMH82MW1 . . . exchange-account-1	KUDOS:0 110	KUDOS:4.98 Wed Jul 14 14:40:53 2021
54D01HEZZNDAY5KA4YWYPR7FGJF . . . exchange-account-1	KUDOS:0 111	KUDOS:4.98 Wed Jul 14 15:34:56 2021
1KCGVGXVEAJBKCSTGBHKR5TMYR0 . . . exchange-account-1	KUDOS:0 112	KUDOS:4.98 Wed Jul 14 15:35:56 2021
JYDBJKX0QCMKC00B5A2452PJSRM . . . exchange-account-1	KUDOS:0 114	KUDOS:4.98 Wed Jul 14 17:52:03 2021
23168WJCJA8RH7RPH2BBABKZSMC . . . exchange-account-1	KUDOS:0 115	KUDOS:4.98 Wed Jul 14 20:23:13 2021
2FHQBYFERCHN3YRAQTMZ7FEN2XV . . . exchange-account-1	KUDOS:0 116	KUDOS:4.98 Thu Jul 15 06:01:46 2021
D12CRHAQEMENTY9YP3H4X0HKVNF . . . exchange-account-1	KUDOS:0 117	KUDOS:4.98 Thu Jul 15 17:50:22 2021
TSX01R3V8BQRX2YJ1WC1JTFKTQ4 . . . exchange-account-1	KUDOS:0 118	KUDOS:4.98 Thu Jul 15 20:06:29 2021
08RCAF986YSDA8169P2QV40W166 . . . exchange-account-1	KUDOS:0 119	KUDOS:4.98 Thu Jul 15 20:07:29 2021
8CN4QMT1YSWJQDQERT95BVVVW8E . . . exchange-account-1	KUDOS:0 120	KUDOS:4.98 Fri Jul 16 06:02:05 2021
R16JZW2WHTQT99P004123T0D3M2 . . . exchange-account-1	KUDOS:0 121	KUDOS:4.98 Fri Jul 16 12:20:27 2021
Wire transfer identifier **Account**	**Wired** **Row**	**Justified** **Timestamp**

Wire transfer identifier Account	Wired Row	Justified Timestamp
ZJ4K1FY6TDW415311TYK52JJZ4Y . . . exchange-account-1	KUDOS:0 122	KUDOS:4.98 Fri Jul 16 15:13:36 2021
TC4A9VGPKDTQ2DXMAVZO2V5239X . . . exchange-account-1	KUDOS:0 123	KUDOS:4.98 Fri Jul 16 17:01:41 2021
8E91Y3PTT5K9E2RA3YR952BDDW5 . . . exchange-account-1	KUDOS:0 126	KUDOS:4.98 Sat Jul 17 06:02:22 2021
KGQ326Q8CCJYNNO15DZ255FBROC . . . exchange-account-1	KUDOS:0 128	KUDOS:4.98 Sun Jul 18 06:01:37 2021
6G1N3R61SYGWSEQW9SP53OK7Y45 . . . exchange-account-1	KUDOS:0 129	KUDOS:4.98 Sun Jul 18 13:56:01 2021
5RSQ2YQOM9PQ5NGV2WKFVY9ESD4 . . . exchange-account-1	KUDOS:0 130	KUDOS:4.98 Mon Jul 19 06:01:52 2021
K76CTDEM9NW8WP7MSPEE63J4QJ4 . . . exchange-account-1	KUDOS:0 131	KUDOS:4.98 Tue Jul 20 06:01:06 2021
5CSD9CO2CPOGY8E9GDM9KT8NNYW . . . exchange-account-1	KUDOS:0 133	KUDOS:4.98 Wed Jul 21 06:01:23 2021
9QESFTZWPYNEQ49S4DJOKV7ASJ6 . . . exchange-account-1	KUDOS:0 138	KUDOS:4.98 Wed Jul 21 16:22:55 2021
GFDF7KBOG7JKSOAKPQXZ6Y44KQS . . . exchange-account-1	KUDOS:0 139	KUDOS:4.98 Wed Jul 21 16:31:55 2021
NROI58PVNXXF98HKW1Z2SG9E6OF . . . exchange-account-1	KUDOS:0 140	KUDOS:4.98 Thu Jul 22 06:01:41 2021
KJ8CKKMAYW95NCWN4TW9G9HTKKM . . . exchange-account-1	KUDOS:0 142	KUDOS:4.98 Thu Jul 22 19:00:21 2021
FKJ347MD8KPM2GEYCF6MF6A8JSE . . . exchange-account-1	KUDOS:0 143	KUDOS:4.98 Fri Jul 23 06:01:58 2021
OPJHK5GORDFS1Q5T8V2K5XZD1EC . . . exchange-account-1	KUDOS:0 145	KUDOS:4.98 Sat Jul 24 06:01:15 2021
CSNHEJ4HCD5MRN1G6BGOWMVDKG7 . . . exchange-account-1	KUDOS:0 146	KUDOS:4.98 Sun Jul 25 06:01:29 2021
OJTA2KDN6AJ947MCA1N84CHKRFW . . . exchange-account-1	KUDOS:0 149	KUDOS:4.98 Mon Jul 26 06:01:42 2021
CDBA2P98QK6W163ZC4E933B9KQD . . . exchange-account-1	KUDOS:0 152	KUDOS:4.98 Mon Jul 26 16:35:17 2021
EA62XN42OK5XQEMPZAQ2TGH15A7 . . . exchange-account-1	KUDOS:0 159	KUDOS:4.98 Tue Jul 27 06:02:05 2021
A3YDCC5AWOKTAV5V1B48PH1GN9X . . . exchange-account-1	KUDOS:0 160	KUDOS:4.98 Tue Jul 27 07:28:09 2021
ZTKEWC938EKE1G7R4OPBGZO5T44 . . . exchange-account-1	KUDOS:0 161	KUDOS:4.98 Tue Jul 27 07:29:09 2021
Wire transfer identifier Account	Wired Row	Justified Timestamp

Wire transfer identifier Account	Wired Row	Justified Timestamp
VGDS21J6CG4FPMQT1YVA8KE16QD . . . exchange-account-1	KUDOS:0 162	KUDOS:4.98 Tue Jul 27 07:50:10 2021
QZSDPGNCSHHRZEX7A9Y3YBBPNMF . . . exchange-account-1	KUDOS:0 163	KUDOS:4.98 Tue Jul 27 10:09:17 2021
0WY25EVR4AR97QCTBPZJY8NEMQV . . . exchange-account-1	KUDOS:0 164	KUDOS:4.98 Tue Jul 27 10:10:18 2021
JWDWMQG3FRW21APQ1KS9RFEPH5C . . . exchange-account-1	KUDOS:0 165	KUDOS:4.98 Tue Jul 27 10:27:19 2021
03B9Z3XJ4AGS59T862CFPS7DBN8 . . . exchange-account-1	KUDOS:0 167	KUDOS:4.98 Wed Jul 28 06:01:26 2021
H5MF9K4KC7ECEMN705BYAKGXGZB . . . exchange-account-1	KUDOS:0.08 0	KUDOS:0 Fri Jul 09 17:16:03 2021
4YQ4JQSO4C3GR1ST6VPJSJFFE8A . . . exchange-account-1	KUDOS:0.98 0	KUDOS:0 Fri Jul 09 18:32:08 2021
H6KMXZK0PQ649WYE3P4Y05DXQQ8 . . . exchange-account-1	KUDOS:0.48 0	KUDOS:0 Fri Jul 09 18:57:09 2021
Total deltas	KUDOS:1.54	- KUDOS:268.92

Table 5: Outgoing wire transfer amounts not matching up.

5 Minor irregularities

5.1 Denominations without auditor signature

This section highlights denomination keys that lack a proper signature from the taler-auditor-offline tool. This may be legitimate, say in case where the auditor's involvement in the exchange business is ending and a new auditor is responsible for future denomnations. So this must be read with a keen eye on the business situation.

All denominations officially audited by this auditor.

5.2 Incorrect reserve balance summary in database

This section highlights cases where the reserve balance summary in the database does not match the calculations made by the auditor. Deltas may indicate a corrupt database, but do not necessarily translate into a financial loss (yet).

All balances matched up.

5.3 Wire table issues

This section describes issues found by the wire auditor that do not have a clear financial impact.

No wire row inconsistencies found.

5.4 Outgoing wire transfer subject issues

This section describes issues found by the wire auditor that relate to outgoing wire transfers subjects being duplicated.

No wire format inconsistencies found.

5.5 Wire fee structure inconsistencies

This section lists cases where the exchange's database may be ambiguous with respect to what wire fee it charges at what time.

No wire fee timing issues detected.

5.6 Other issues

This section describes issues found that do not have a clear financial impact.

5.6.1 For aggregation

No row inconsistencies found.

5.6.2 For coins

No row inconsistencies found.

5.6.3 For reserves

No row inconsistencies found.

6 Delays and timing

This section describes issues that are likely caused simply by some job process of the exchange not running properly or not having caught up with the work load yet.

6.1 Delayed closure of reserves

This section describes cases where the exchange did not close a reserve and wire back the remaining funds when the reserve expired.

Reserve	Expired	Balance
NYAK8BQ3M6NRJRX4HT8178KYVQDHCXXOX3ESKXPNWP ...	Thu Jan 01 01:00:00 1970	KUDOS:0
Sum		KUDOS:0

Table 6: Reserves not closed on time.

6.2 Hanging refresh operations

This section describes cases where the exchange booked a coin as spent from `/refresh/melt` but where the wallet did not yet complete `/refresh/reveal`. This may happen even if the exchange is correct.

All melted coins were refreshed.

6.3 Denomination key invalid at time of withdrawal

This section lists cases where a denomination key was not valid for withdrawal at the time when the exchange claims to have signed a coin with it. This would be irregular, but has no obvious financial implications.

All denomination keys were valid at the time of withdrawals.

6.4 Wire transfer timestamp issues

This section lists issues with wire transfers related to timestamps.

No timestamp issues detected.