

3. Functionality verification

3.1 Certificate issuing tool

The following report shows the results when the certificate issuance tool was actually executed.

3.1.1 Input Data

```
{
  "@context": [
    "https://www.w3.org/2018/credentials/v1"
  ],
  "id": "urn:uuid:12345-67890",
  "type": ["VerifiableCredential", "DisasterReliefVolunteerCredential"],
  "issuer": {
    "id": "https://disaster-response-headquarters.example.org",
    "name": "Disaster Response Headquarters"
  },
  "issuanceDate": "2024-11-03T00:00:00Z",
  "credentialSubject": {
    "id": "did:example:volunteer-001",
    "name": "John Doe",
    "role": "Heavy Machinery Operator",
    "skills": [
      "Excavator Operation",
      "Bulldozer Operation",
      "Crisis Communication"
    ]
  },
}
```

```
"certifications": [  
  {  
    "type": "HeavyMachineryCertification",  
    "issuedBy": "Local Training Institute",  
    "issueDate": "2023-05-01"  
  }  
],  
"authorizedRegions": [  
  {  
    "region": "Prefecture A, City B",  
    "validUntil": "2024-12-31"  
  }  
]  
}
```

Sending and receiving addresses

addr_test1qq54kguth0dtagn4j5skz3qwcm7tz2qrj8klrllfpfefe2pftv3chw76h638t9fpv9
zqa3huky5q8y0d78l7jznjn5qscstrm

3.1.2 Console output result(Frontend Side)

Signed Transaction (Hex) :

```
84a400818258209d1d5c1505e6ceab4e6821af1cda182c3287ea1446b213cc7b907505106a0a95000181
82583900295b238bbbdabea275952161440ec6fcb1280391edf1ffe90a729ca8295b238bbbdabea27595
2161440ec6fcb1280391edf1ffe90a729ca81b0000000253859d00021a00030d400758209d18dbac3ebd
de6a45a2e4f342b6950eafef5b5fef00022cba5828e1c4f46b73a100818258203745f60982871f6d49d0
eb0cf1b02b4eafd128479933311292387df6ed86fcad5840f4ad182a97c9ca6888985d5bfd735699f93f
abf3a3681787f2fd601064693f38f24d7be14bd84f57c9d21a917511a39df4a2f047c70d6a529745051e
98582405f5a11902d1a66840636f6e7465787481782668747470733a2f2f777772e77332e6f72672f32
3031382f63726564656e7469616c732f76317163726564656e7469616c5375626a656374a67161757468
6f72697a6564526567696f6e7381a266726567696f6e745072656665637475726520412c204369747920
426a76616c6964556e74696c6a323032342d31322d33316e63657274696669636174696f6e7381a36969
73737565446174656a323032332d30352d303168697373756564427978184c6f63616c20547261696e69
6e6720496e737469747574656474797065781b48656176794d616368696e657279436572746966696361
74696f6e62696478196469643a6578616d706c653a766f6c756e746565722d303031646e616d65684a6f
686e20446f6564726f6c6578184865617679204d616368696e657279204f70657261746f7266736b696c
6c738373457863617661746f72204f7065726174696f6e7342756c6c646f7a6572204f7065726174696f
6e7443726973697320436f6d6d756e69636174696f6e6269647475726e3a757569643a31323334352d36
373839306c69737375616e63654461746574323032342d31312d30335430303a30303a30305a66697373
756572a2626964783268747470733a2f2f64697361737465722d726573706f6e73652d68656164717561
72746572732e6578616d706c652e6f7267646e616d65781e446973617374657220526573706f6e736520
4865616471756172746572736474797065827456657269666961626c6543726564656e7469616c782144
6973617374657252656c696566566f6c756e7465657243726564656e7469616c
```

select mac UTXO address:

```
{
  "address": "addr_test1qq54kguth0dtagn4j5skz3qwcm7tz2qrj8klrllfpfefe2pftv3chw
    76h638t9fpv9zqa3huky5q8y0d78l7jznjn5qscstrm",
  "tx_hash": "9d1d5c1505e6ceab4e6821af1cda182c3287ea1446b213cc7b907505106a0a95",
  "tx_index": 0,
  "output_index": 0,
  "amount": [
    {
      "unit": "lovelace",
      "quantity": "9991400000"
    }
  ],
  "block": "21a599e2add362e7bba5c2fb5c0b380d844fa5fe4a8b12fa6932a034605e5955",
  "data_hash": null,
  "inline_datum": null,
  "reference_script_hash": null
}
```

Response:

```
{
  "code": "success",
  "data": "3f01c67ba4f0fd985eb22e3fb86fee59e8407adf1c345c2c871f52f97a25a385"
}
```

Block information:

```
{
  "hash": "3f01c67ba4f0fd985eb22e3fb86fee59e8407adf1c345c2c871f52f97a25a385",
  "block": "215a4e8369ddd973a24c6ef964d2e9e515fb417a408fcc63d428fbbbea622012",
  "block_height": 2865317,
  "block_time": 1731041107,
  "slot": 75357907,
  "index": 5,
  "output_amount": [
    {
      "unit": "lovelace",
      "quantity": "9991200000"
    }
  ],
  "fees": "200000",
  "deposit": "0",
  "size": 871,
  "invalid_before": null,
  "invalid_hereafter": null,
  "utxo_count": 2,
  "withdrawal_count": 0,
  "mir_cert_count": 0,
  "delegation_count": 0,
  "stake_cert_count": 0,
  "pool_update_count": 0,
  "pool_retire_count": 0,
  "asset_mint_or_burn_count": 0,
  "redeemer_count": 0,
  "valid_contract": true
}
```

Block Transactions:

```
[  
  "859254002797770a56c82708f30a760513f58ae6237927f6ee02338bf79bedd9",  
  "6addc5f8afdc91e9874600805fc8a40afcef730a864d7eb2869bb35655e60e22",  
  "adc864139990d6fe66d7440142d9d77a1d875897afd7a282b991aeabdbe2c01f",  
  "670e1b3b46d7791deb32107b180468aafb0594979c9525c5e977945589d82ce3",  
  "e5586f8dbe7a4c87df2355d4b2baf0947389cc50701eee43445e3c66aae04bcd",  
  "3f01c67ba4f0fd985eb22e3fb86fee59e8407adf1c345c2c871f52f97a25a385",  
  "af0013afcfa12401d899da580e6031446c330f4a4d4e707a57bdd5cbcb6d0c60"  
]
```

Transaction Hashes (SHA3-256):

```
[  
  "cf81a49d51b616b9badb35b49b43637fe48e7e6e68fcb368e95797fa8208ba2e",  
  "f9df2119ece0cb17a9ba50252ac8041719a45eaf352994128303546551872586",  
  "c33051e15854102e6dc02cf4f8ac4c6320807331e73de3947fb2bcce06cfd6ca",  
  "816ca477bedca3651df77494faf041c87d66598d1ab9b45dd96c7b4a17f3c1a0",  
  "e6313c311988f179d32640164472c97347a071e57ca4b2a4536e29e307cffe5e",  
  "447bca38f9315b7c1ee6d02ccf87da49fb4982867a92d911d3761959d01aa693",  
  "565823c4dc90c40314733c9e9ca89c776c5b945603495a71aea487446278fd4d"  
]
```

Merkle Tree:

```
[  
  "cf81a49d51b616b9badb35b49b43637fe48e7e6e68fcb368e95797fa8208ba2e",  
  "f9df2119ece0cb17a9ba50252ac8041719a45eaf352994128303546551872586",  
  "c33051e15854102e6dc02cf4f8ac4c6320807331e73de3947fb2bcce06cfd6ca",  
  "816ca477bedca3651df77494faf041c87d66598d1ab9b45dd96c7b4a17f3c1a0",  
  "e6313c311988f179d32640164472c97347a071e57ca4b2a4536e29e307cffe5e",  
  "447bca38f9315b7c1ee6d02ccf87da49fb4982867a92d911d3761959d01aa693",  
  "565823c4dc90c40314733c9e9ca89c776c5b945603495a71aea487446278fd4d"  
]
```

Merkle Path:

```
{  
  "position": "left",  
  "hash": "0b455a355919390bfc61082f3bdc339a402feec2184bb5e1cb66fe1bc2f3b699"  
}
```

Is the leaf hash valid in the Merkle tree? True

3.1.3 Console output result(Backend Side)

<Start time>

```
[ipdc@ip-172-31-3-109 ipdc]$ node cardano_server.mjs  
[2024-11-08T13:44:30.230] [INFO] system - cardano_server.mjs start
```

<Receive time>

```
[2024-11-08T13:44:45.154] [INFO] system - ::ffff:92.203.104.75 -  
- "OPTIONS /submit HTTP/1.1" 200 13 "" "Mozilla/5.0 (Windows NT 10.0; Win64; x64)  
AppleWebKit/537.36 (KHTML, like Gecko) Chrome/130.0.0.0 Safari/537.36"  
84a400818258209d1d5c1505e6ceab4e6821af1cda182c3287ea1446b213cc7b907505106a0a9500018  
182583900295b238bbbdabea275952161440ec6fcb1280391edf1ffe90a729ca8295b238bbbdabea275  
952161440ec6fcb1280391edf1ffe90a729ca81b0000000253859d00021a00030d400758209d18dbac3  
ebd6e6a45a2e4f342b6950eafef5b5fef00022cba5828e1c4f46b73a100818258203745f60982871f6d  
49d0eb0cf1b02b4eafd128479933311292387df6ed86fcad5840f4ad182a97c9ca6888985d5bfd73569  
9f93fabf3a3681787f2fd601064693f38f24d7be14bd84f57c9d21a917511a39df4a2f047c70d6a5297  
45051e98582405f5a11902d1a66840636f6e7465787481782668747470733a2f2f7777772e77332e6f7  
2672f323031382f63726564656e7469616c732f76317163726564656e7469616c5375626a656374a671  
617574686f72697a6564526567696f6e7381a266726567696f6e745072656665637475726520412c204  
369747920426a76616c6964556e74696c6a323032342d31322d33316e63657274696669636174696f6e7  
381a3696973737565446174656a323032332d30352d303168697373756564427978184c6f63616c20547  
261696e696e6720496e737469747574656474797065781b48656176794d616368696e657279436572746  
96669636174696f6e62696478196469643a6578616d706c653a766f6c756e746565722d303031646e616  
d65684a6f686e20446f6564726f6c6578184865617679204d616368696e657279204f70657261746f726  
6736b696c6c738373457863617661746f72204f7065726174696f6e7342756c6c646f7a6572204f70657  
26174696f6e7443726973697320436f6d6d756e69636174696f6e6269647475726e3a757569643a31323  
334352d36373839306c69737375616e63654461746574323032342d31312d30335430303a30303a30305  
a66697373756572a2626964783268747470733a2f2f64697361737465722d726573706f6e73652d68656  
16471756172746572732e6578616d706c652e6f7267646e616d65781e446973617374657220526573706  
f6e736 5204865616471756172746572736474797065827456657269666961626c6543726564656e74696  
616c7821446973617374657252656c696566566f6c756e7465657243726564656e7469616c
```



```

Transaction sent successfully: {
  status: 200,
  statusText: 'OK',
  headers: Object [AxiosHeaders] {
    date: 'Fri, 08 Nov 2024 04:44:45 GMT',
    'content-type': 'application/json;charset=utf-8',
    'transfer-encoding': 'chunked',
    connection: 'close',
    vary: 'Origin',
    'access-control-allow-origin': '*',
    'bf-submit-server':
      'e1f4ccc29ee5a9bb1f2d55e35e58119727c3f3f0e0da9c0cf0a9582299058083',
    'cf-cache-status': 'DYNAMIC',
    'report-to': '["endpoints":
      [{"url":"https://a.nel.cloudflare.com/report/v4?s=Ix24pfKCKhf7kaJaDIAn
      FOJtmIAGs9X76AoseLb6Fibqf%2B1odiBlvKL6eYy8YwdNorv6bdGJcBEV0HGROXqnR%2Fh6FfhMjYCi
      ZYRYzNmOaVSS9rzK9DwOulXrX1SYxAHgAqf0gsAmeCyBX0CKoFTC"}], "group":"cf-nel",
      "max_age":604800}'],
    nel: '["success_fraction":0,"report_to":"cf-nel","max_age":604800]',
    server: 'cloudflare',
    'cf-ray': '8df2e8de98d9d753-NRT',
    'server-timing':
      'cfL4;desc="?proto=TCP&rtt=2207&sent=4&recv=5&lost=0&retrans=0&sent_bytes=2340&
      recv_bytes=1668&delivery_rate=1295749&wnd=252&unsent_bytes=0&cid=b787176dfb3
      348e0&ts=673&x=0"'
  },
  config: {
    transitional: {
      silentJSONParsing: true,
      forcedJSONParsing: true,
      clarifyTimeoutError: false
    },
    adapter: [ 'xhr', 'http', 'fetch' ],
    transformRequest: [ [Function: transformRequest] ],

```

```

transformResponse: [ [Function: transformResponse] ],
timeout: 0,
xsrCookieName: 'XSRF-TOKEN',
xsrHeaderName: 'X-XSRF-TOKEN',
maxContentLength: -1,
maxBodyLength: -1,
env: { FormData: [Function], Blob: null },
validateStatus: [Function: validateStatus],
headers: Object [AxiosHeaders] {
  Accept: 'application/json, text/plain, */*',
  'Content-Type': 'application/cbor',
  project_id: 'preprod7DHcGID2pFZxqgFSjL84JXRrxCS7CbIf',
  'User-Agent': 'axios/1.7.7',
  'Content-Length': '872',
  'Accept-Encoding': 'gzip, compress, deflate, br'
},
method: 'post',
url: 'https://cardano-preprod.blockfrost.io/api/v0/tx/submit',
data: <Buffer 84 a4 00 81 82 58 20 9d 1d 5c 15 05 e6 ce ab 4e 68 21 af 1c da
18 2c 32 87 ea 14 46 b2 13 cc 7b 90 75 05 10 6a 0a 95 00 01 81 82 58 39 00
29 5b 23 8b ... 822 more bytes>
},
request: <ref *1> ClientRequest {
  _events: [Object: null prototype] {
    abort: [Function (anonymous)],
    aborted: [Function (anonymous)],
    connect: [Function (anonymous)],
    error: [Function (anonymous)],
    socket: [Function (anonymous)],
    timeout: [Function (anonymous)],
    finish: [Function: requestOnFinish]
  },
  _eventsCount: 7,
  _maxListeners: undefined,

```

```
outputData: [],
outputSize: 0,
writable: true,
destroyed: true,
_last: true,
chunkedEncoding: false,
shouldKeepAlive: false,
maxRequestsOnConnectionReached: false,
_defaultKeepAlive: true,
useChunkedEncodingByDefault: true,
sendDate: false,
_removedConnection: false,
_removedContLen: false,
_removedTE: false,
strictContentLength: false,
_contentLength: '872',
_hasBody: true,
_trailer: '',
finished: true,
_headerSent: true,
_closed: true,
socket: TLSSocket {
  _tlsOptions: [Object],
  _secureEstablished: true,
  _securePending: false,
  _newSessionPending: false,
  _controlReleased: true,
  secureConnecting: false,
  _SNICallback: null,
  servername: 'cardano-preprod.blockfrost.io',
  alpnProtocol: false,
  authorized: true,
  authorizationError: null,
  encrypted: true,
```

```
_events: [Object: null prototype],
_eventsCount: 9,
connecting: false,
_hadError: false,
_parent: null,
_host: 'cardano-preprod.blockfrost.io',
_closeAfterHandlingError: false,
_readableState: [ReadableState],
_maxListeners: undefined,
_writableState: [WritableState],
allowHalfOpen: false,
_socketname: null,
_pendingData: null,
_pendingEncoding: '',
server: undefined,
_server: null,
ssl: null,
_requestCert: true,
_rejectUnauthorized: true,
parser: null,
_httpMessage: [Circular *1],
write: [Function: writeAfterFIN],
[Symbol(res)]: null,
[Symbol(verified)]: true,
[Symbol(pendingSession)]: null,
[Symbol(async_id_symbol)]: 315,
[Symbol(kHandle)]: null,
[Symbol(lastWriteQueueSize)]: 0,
[Symbol(timeout)]: null,
[Symbol(kBuffer)]: null,
[Symbol(kBufferCb)]: null,
[Symbol(kBufferGen)]: null,
[Symbol(kCapture)]: false,
[Symbol(kSetNoDelay)]: false,
```

```

[Symbol(kSetKeepAlive)]: true,
[Symbol(kSetKeepAliveInitialDelay)]: 60,
[Symbol(kBytesRead)]: 968,
[Symbol(kBytesWritten)]: 1183,
[Symbol(connect-options)]: [Object],
[Symbol(RequestTimeout)]: undefined
},
_header: 'POST /api/v0/tx/submit HTTP/1.1\r\n' +
'Accept: application/json, text/plain, */*\r\n' +
'Content-Type: application/cbor\r\n' +
'project_id: preprod7DHcGID2pFZxqgFSjL84JXRrxCS7CbIf\r\n' +
'User-Agent: axios/1.7.7\r\n' +
'Content-Length: 872\r\n' +
'Accept-Encoding: gzip, compress, deflate, br\r\n' +
'Host: cardano-preprod.blockfrost.io\r\n' +
'Connection: close\r\n' +
'\r\n',
_keepAliveTimeout: 0,
_onPendingData: [Function: nop],
agent: Agent {
  _events: [Object: null prototype],
  _eventsCount: 2,
  _maxListeners: undefined,
  defaultPort: 443,
  protocol: 'https:',
  options: [Object: null prototype],
  requests: [Object: null prototype] {},
  sockets: [Object: null prototype] {},
  freeSockets: [Object: null prototype] {},
  keepAliveMsecs: 1000,
  keepAlive: false,
  maxSockets: Infinity,
  maxFreeSockets: 256,
  scheduling: 'lifo',

```

```
    maxTotalSockets: Infinity,
    totalSocketCount: 0,
    maxCachedSessions: 100,
    _sessionCache: [Object],
    [Symbol(kCapture)]: false
  },
  socketPath: undefined,
  method: 'POST',
  maxHeaderSize: undefined,
  insecureHTTPParser: undefined,
  path: '/api/v0/tx/submit',
  _ended: true,
  res: IncomingMessage {
    _readableState: [ReadableState],
    _events: [Object: null prototype],
    _eventsCount: 4,
    _maxListeners: undefined,
    socket: [TLSSocket],
    httpVersionMajor: 1,
    httpVersionMinor: 1,
    httpVersion: '1.1',
    complete: true,
    rawHeaders: [Array],
    rawTrailers: [],
    aborted: false,
    upgrade: false,
    url: '',
    method: null,
    statusCode: 200,
    statusMessage: 'OK',
    client: [TLSSocket],
    _consuming: true,
    _dumped: false,
    req: [Circular *1],
```

```

    responseUrl: 'https://cardano-preprod.blockfrost.io/api/v0/tx/submit',
    redirects: [],
    [Symbol(kCapture)]: false,
    [Symbol(kHeaders)]: [Object],
    [Symbol(kHeadersCount)]: 28,
    [Symbol(kTrailers)]: null,
    [Symbol(kTrailersCount)]: 0,
    [Symbol(RequestTimeout)]: undefined
  },
  aborted: false,
  timeoutCb: null,
  upgradeOrConnect: false,
  parser: null,
  maxHeadersCount: null,
  reusedSocket: false,
  host: 'cardano-preprod.blockfrost.io',
  protocol: 'https:',
  _redirectable: Writable {
    _writableState: [WritableState],
    _events: [Object: null prototype],
    _eventsCount: 3,
    _maxListeners: undefined,
    _options: [Object],
    _ended: true,
    _ending: true,
    _redirectCount: 0,
    _redirects: [],
    _requestBodyLength: 872,
    _requestBodyBuffers: [],
    _onNativeResponse: [Function (anonymous)],
    _currentRequest: [Circular *1],
    _currentUrl: 'https://cardano-preprod.blockfrost.io/api/v0/tx/submit',
    [Symbol(kCapture)]: false
  },

```

```

[Symbol(kCapture)]: false,
[Symbol(kBytesWritten)]: 0,
[Symbol(kEndCalled)]: true,
[Symbol(kNeedDrain)]: false,
[Symbol(corked)]: 0,
[Symbol(kOutHeaders)]: [Object: null prototype] {
  accept: [Array],
  'content-type': [Array],
  project_id: [Array],
  'user-agent': [Array],
  'content-length': [Array],
  'accept-encoding': [Array],
  host: [Array]
},
[Symbol(kUniqueHeaders)]: null
},
data: '3f01c67ba4f0fd985eb22e3fb86fee59e8407adf1c345c2c871f52f97a25a385'
}
{
  code: 'success',
  data: '3f01c67ba4f0fd985eb22e3fb86fee59e8407adf1c345c2c871f52f97a25a385'
}

[INFO] system - ::ffff:92.203.104.75 - - "POST /submit HTTP/1.1" 200 92 "" "Mozilla/5.0
(Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/130.0.0.0
Safari/537.36"

```