Technical Instructions for POS and Cash Register Developers

Version 2.3

Change Log

Author	Change	Version
DTI	The initial version of the document	1.0
DTI	1. Detailed description of Invoice Request and Invoice response are added to JSON protocol 2. Json protocol examples are updated to include Options and PAC 3. Serial protocol field descriptions are updated to provide better explanation of usage 4. Interpretations are updated 5. Procedure for obtaining digital certificates is detailed 6. GUID, RS232 and USB are added to the Interpretation section 7. Date and time formats are described in Data Structures section 8. Anatomy of Fiscal Invoice – descriptions are updated 9. Invoice format and examples are updated for Json-based protocol – Options are added to the InvoiceFiscalizationRequest 10. Invoice sample changed 11. Accepted syntax changes made by FRCS 12. Added Status and Error Codes 13. Common JSON Based Protocol for both HTTP and Serial connection 14. Added Hash field into Sign Invoice request and response 15. Added commands Attention and Get Signed Invoice 16. POS to E-SDC Communication over Serial Port is JSON based 17. Added description for tax labels calculation	2.0

DTI	1. Additional error codes added 2. Online POS and V-SDC integration 3. Rename Cashier and Total Amount fields in textual representation of the invoice 4. Cashier TIN optional changed to mandatory 5. Authority > Service 6. SDC returns four additional fields in **InvoiceFiscalizationResult** 7. Online POS and V-SDC integration	ver 2.1
DTI	1. Rename Cashier and Total Amount fields in textual representation of the invoice 2. Cashier TIN optional changed to mandatory 3. Authority to Service 4. SDC returns four additional fields in **InvoiceFiscalizationResult** 5. Province to District 6. Swagger to OpenAPI-Specification 7. Discount field is removed from specification. It is no longer required. 8. ReferentDocumentDateAndTime is added are required field for Copies and Refunds 9. Added field UnitPrice to InvoiceFiscalizationRequest 10. Added decimal format for InvoiceFiscalizationRequest 11. Added description for MRC in `InvoiceFiscalizationResonse` 12. Added Payment Method in Receipt example 13. Added generic errors codes 14. Assigned obsolete error codes 15. Deleted irrelevant error codes	ver 2.2
DTI	1. Minor additional explanation regarding buyer TIN and BuyerCostCentar ID 2. Fixed sample code for Online POS ("PaymentType") 3. Fixed footer link for Online POS to minimized js 4. Removed field ReferentDocumentDateAndTime 5. Added Fiscal Invoice definition 6. Anatomy of Fiscal Receipt improved definition and description 7. Normal Refund Receipt improved definition and description 8. Training or Proforma Receipt definition and description	ver 2.3

	9. Connected Scenarios improved description and sample code 10. JSON Based Protocol - improved common explanation for SignInvoice 11. JSON Based Protocol (POS to E-SDC Specific) - renamed	

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Introduction

Each POS, Cash register, ERP or invoice generation software (Accredited POS) shell be able to connect to a V-SDC or E-SDC and issue a fiscal invoice. Accredited POS are developed for different software and hardware platforms, designed to use a variety of communication standards to connect to other software or hardware components. As wide acceptance and low cost of integration are crucial for success of fiscalization a Tax Service is dedicated to provide a detailed integration instruction for all manufacturers and software developers.

This document gives technical guidelines and instructions for the implementation of Accredited POS and integration with TaxCore V-SDC service or E-SDC devices. These Instructions set standards enabling a seamless integration of a third-party Accredited POS or E-SDC with the TaxCore.

V-SDC service shall be widely available and accessible from the variety of Accredited POS devices and software solution.

Interpretations

Accredited POS (Accredited POS) is a computer program, electronic device or information system for issuing of receipts, in compliance with the requirements of the Regulation.

Electronic Fiscal Device (EFD) is composed of an Accredited POS and an E-SDC/V-SDC connected into one system. The EFD produces fiscal receipts and reports audit data to a Tax Service.

GUID is Globally Unique Identification Number. In its canonical textual representation, the sixteen octets of a UUID are represented as 32 hexadecimal (base 16) digits, displayed in five groups separated by hyphens, in the form 8-4-4-4-12 for a total of 36 characters (32 alphanumeric characters and four hyphens). For example: 123e4567-e89b-12d3-a456-426655440000.

HTTP (Hypertext Transfer Protocol) is an application protocol for distributed, collaborative, and hypermedia information systems.

HTTPS is a communications protocol for secure communication over a computer network which is widely used on the Internet. HTTPS consists of communication over Hypertext Transfer Protocol (HTTP) within a connection encrypted by Transport Layer Security.

Invoice, see Receipt.

Public Key Infrastructure (PKI) is a set of roles, policies, and procedures needed to create, manage, distribute, use, store, and revoke digital certificates and manage public-key encryption.

Receipt is a digitally signed acknowledgment that a specified payment has been received. A receipt records the sale of goods or a service fee. In this Law, receipt is used interchangeable with term invoice.

RS232 is a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a POS, and a DCE (data circuit-terminating equipment or data communication equipment), such as a E-SDC

Sales Data Controller (SDC) contains a Secure Element and is used to generate an invoice by signing request received from an Accredited POS and to produce audit data. It stores audit data to its own internal memory and enables local and remote audit. There are two implementations of SDC:

a) **External SDC (E-SDC)** is a black box that contains the Secure Element and enables semi-connected fiscalization scenarios
b) **Virtual Sales Data Controller (V-SDC)** is a web service operated by the Tax Service that exposes an SDC functionality to authorized taxpayers via the Internet. It contains and uses a Secure Element to sign invoices.

Secure Element (SE) is a fiscal component implemented as a special software or device designed to receive specific invoice data, to perform signing and data processing and to generate response data, sent back to the caller for further actions. The Response data provides authenticity of an invoice data. The Secure Element is issued and controlled by a Tax Service. The main purpose of the Secure Element is to sign invoices using the taxpayer's digital certificate, to control audits and maintain set of fiscal counters.

TaxCore (Fiscalization System) is set of web services, sites and database management software installed on the side of the Tax Service for communication with the Accredited POS and SE devices.
UID – Unique Identifier (8 alphanumeric characters) assigned to each Smart card and embedded into the subject field of a digital certificate.

USB is an industry standard that defines cables, connectors and communications protocols for connection, communication, and power supply between computers and devices.

UTP is also the most common cable used in the computer networking. Modern Ethernet, the most common data networking standard, can use UTP cables

Verification URL is a unified resource location used to verify particular invoice using web service provided by the Tax Service.

Development Environment

Development environment is accessible to all registered developers of Accredited POS components. The Development Environment exposes the same APIs and uses the same protocols as a Production environment.

Obtaining Test Certificates

As a developer of Accredited POS one can register on the Tax Service web site to obtain a set of test certificates and technical documentation. Test certificates shall enable a user to test both successful and failing scenarios, like trying to fiscalize invoice with expired certificate.

Obtaining Test SDC

Tax Service shall publish notification to all interested parties.

Obtaining Smart Cards

Accredited POS Vendors shall apply to the Tax Service and get test smart cards and digital certificates in PKCS 11 format to use for development, integration and testing purposes. In order to achieve that, follow these steps:

1. Primary contact registers with Tax Service using application form published on web site
2. Tax Service verifies application and sends enrolment request to primary contact by e-mail or SMS
3. Primary contact enters desired PIN code for their smartcard
4. Tax Service delivers smart card to the Primary contact
5. If additional smart cards are required, the Primary contact can submit request using Taxpayer Admin portal in staging environment (web address will be published on Tax Service Web Site)

Identification of Environment

Tax Service shall publish URL of both Staging and Production environment on their web site.

High Level Architecture of TaxCore

The electronic monitoring system for billing is an initiative undertaken by many countries for the purpose of reducing grey economy and tax evasion. An important and new component of this initiative is the certified systems put in place for taxpayers to electronically secure each transaction at the moment of sale.

TaxCore is built as set of semi-connected services exposing public APIs to enable integration of third-party solutions into the fiscalization ecosystem.

In order to have a true picture of taxpayer's business transactions and be able to expand the tax base and finance national needs, we are building an electronic invoicing system that will be used by taxpayers at their business premises.

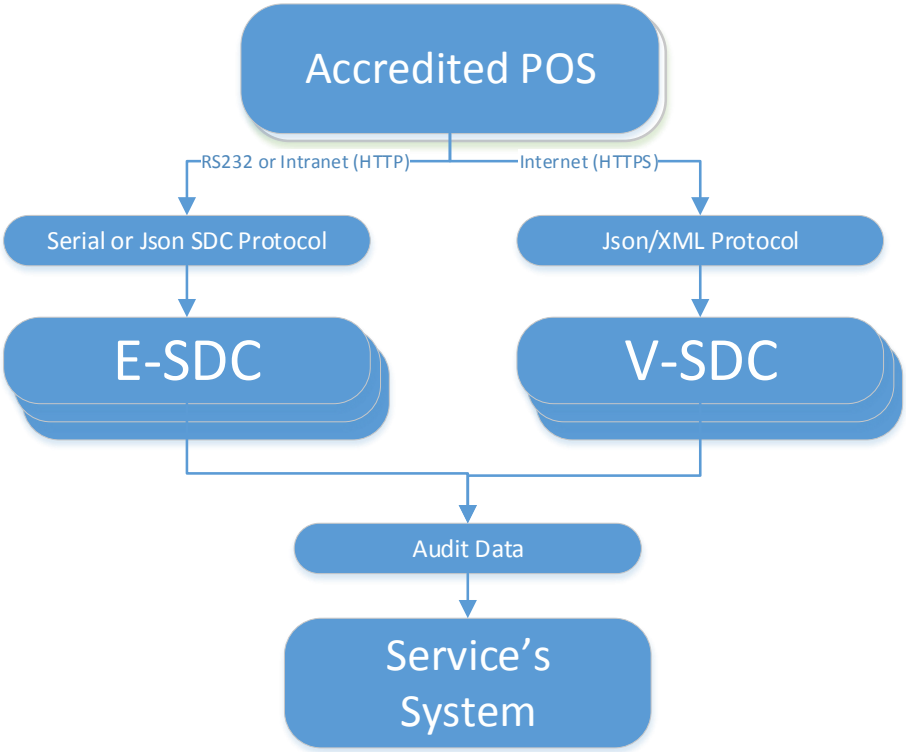


Figure 1 High Level Architecture of TaxCore

This document, will describe high level requirements for all possible scenarios in order for Accredited POS to be compliant. In the chapter Clients, there will be given examples of different POS systems and preferred methods of integration with TaxCore.

Target audience are software developers and manufacturers of all software applications and hardware utilized to create invoices or receipts.

Data Formats

Date and Time

Date and time sent by POS to E-SDC or V-SDC is local time.

Date and time generated by E-SDC or V-SDC and printed on a receipt is local time (Fiji Winter Time is used as local time if E-SDC cannot track daylight saving time).

JSON based protocols use date and time according to ISO 8601 where applicable (for example: 2017-05-17T10:46:51.910Z).

Binary based protocols (Serial Protocol Communication) use Unix Timestamp format formatted as 64bit unsigned integer Big Endian (for example: 1495018011910 is 2017-05-17T10:46:51.910Z)

Fiscal Invoice

Fiscal invoice is, by definition, a digitally signed acknowledgment that a specified payment has been received or refunded. Fiscal invoice consists of two parts – Invoice Request and Invoice Response.

Invoice Request is created by an Accredited POS and it contains the usual invoice information like items, tax labels and invoice number. The invoice request is submitted by the Accredited POS using standard, publicly available protocol for communication to V-SDC/E-SDC, using preferred technology of the POS system.

Invoice Response is generated by V-SDC or E-SDC after data validation. It is an integral part of any fiscal invoice. Without this information, an invoice could not be considered a legal fiscal invoice.

Each invoice is associated with one of following invoice types:

- “Normal”, as a result of a normal operation consisting of receiving the transmission of goods and provision of services;
- “Training”, for limited use in the training environment. It may be generated on the basis of information from a simulated receipt in “Normal” fiscal mode;
- “Copy”, re-issuing of a normal type receipt
- “Pro-forma”, which has the characteristics of an original receipt. However, such receipts are not fiscally usable for proof of transmission of goods and services.

Each invoice type is associated with one of following transaction types:

- sale;
- refund.

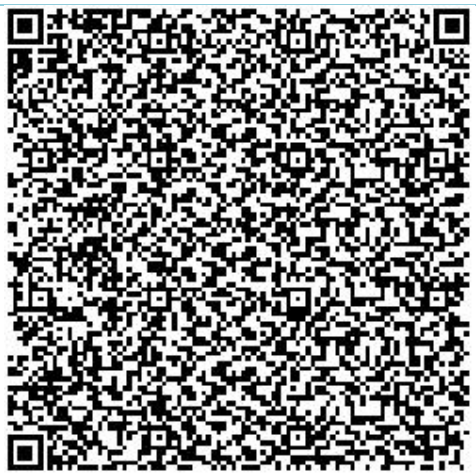
Each invoice type is associated with one of following payment types:

- cash
- card
- check
- wire transfer
- mobile money
- voucher
- other.

Anatomy of Fiscal Receipt

A receipt records the sale of goods or provision of a service. The table below explains the structure of a fiscal receipt. All elements are mandatory unless specified otherwise in the column Explanations. POS is free to print any content (coupons, logos, etc.) before beginning and after ending mark of the fiscal invoice.

Textual representation of Fiscal Invoice	Explanations
`` ============ FISCAL INVOICE ============ ```	**Title line** – marks the beginning of the fiscal part of receipt
`` TIN: 502579006 Company: Golf V Store: Sun Store Address: 7 Someplace District: Suva ```	**Header data** is provided by V-SDC or E-SDC during fiscalization of the invoice and returned to POS as part of the *InvoiceFiscalizationResult* object (explained in section Invoice Response).
`` Cashier TIN: 1234567890 ```	Cashier's identification. Local regulations might mandate POS to send particular data instead of cahier's name like Employee ID or some other information that uniquely identifies the POS cashier.
`` Buyer TIN: 5123456789 Buyer Cost Centre: 123 POS number: POS2017/998 POS time: 15/6/2017 8:56:23AM ```	**Buyer TIN** is mandatory only in case of B2B transaction and in that case, it must be printed on the receipt. **Buyer Cost Center** is optional and reserved for further use, it must be present only for B2B transactions. **POS (Invoice) Number** and **POS (Invoice) time** are optional fields.
`` Ref no: P22VC8VR-JTJC5V65-114906 ```	**Reference (Document) Number** is required only for Refund or Copy invoice type. In that case, **Ref no** must be printed on the receipt, containing **SDC Invoice No** of any issued Invoice or Refund, in format RequestedBy-SignedBy-OrdinalNumber. For any other invoice/transaction type (for example Normal Sale invoice referencing to Proforma Sale invoice) this field is optional.
`` --------------NORMAL SALE--------------- ```	**Invoice** and **transaction type** description. Normal Sale and Normal Refund are the most common types. Other types of transactions and invoices are defined in section Fiscal Invoice.
`` Items == Name Price Qty. Total Sport-100 Helmet, Blue (E) 34.99 10 349.90 Mountain Bike Socks, M (A) 9.03 4 36.12 HL Road Frame - Red, 58 (F, A) 1431.50 2 2863.00 Plastic bag (P) 0.10 5 0.50 ```	List of items with **gross price**, tax labels, unit price and quantity. Tax Labels and their validity dates shall be published by Tax Service.
`` -- Total Purchase: 3249.52 Payment Method: Cash == Label Name Rate Tax E STT 6.00% 19.81 A VAT 9.00% 219.51 F ECAL 10.00% 240.59 P PB 0.10$ 0.50 -- Total Tax: 480.41 ```	**Total Purchase**, **Tax items** and **Total Tax** are calculated by V-SDC or E-SDC during fiscalization of the invoice and are returned to POS as a part of the response. **Payment Method**: Cash, Card, Check, Wire Transfer, Voucher, Mobile Money, or Other. Taxpayer's tax liability is based on these tax amounts, calculated by V-SDC or E-SDC. Calculation is explained in the section Tax Amounts.
`` == SDC Time: 2017-06-15 08:56:25 SDC Invoice No: 7AF4D923-E3B30A31-234 Invoice Counter: 230/234NS == ```	Fiscal metadata added to the invoice through fiscalization. **SDC Invoice No** - Combination of Requested By (7AF4D923), Signed By (E3B30A31) and Ordinal Invoice Number (234) is system-wide unique identification of fiscal invoice. It may be used instead of current receipt/invoice number generated by POS. **SDC Time** is the official date and time relevant to the tax calculation and reporting. **Invoice Counter** is generated by V-SDC or E-SDC and explained in section Invoice Response, field IC.

	**QR Code** contains Invoice verification URL. QR Code also contains Internal data and digital signature used for invoice verification. Invoice is verifiable by customer immediately after fiscalization. In case invoice/receipt is delivered as an electronic document (email), QR Code shall be substituted with Invoice verification URL in (clickable) hyperlink format. **NOTE:** This is just a sample QR code image, not an actual URL.
`======== END OF FISCAL INVOICE =========`	**Title line** – marks the end of the fiscal part of receipt
`This is custom Message`	Custom message returned from V-SDC or E-SDC

Normal Refund Receipt

Receipt for Normal Refund Invoice must contain visible markings “REFUND”, below the receipt header and above the item description section. Totals on the refund receipt are displayed as negative values, starting with (-), except for Total Purchase. Tax Items are displayed as positive values.

For Refund transaction type **Ref no** element is mandatory.

Example:

```
============ FISCAL INVOICE ============
TIN:                              502579006
Company:                             Golf V
Store:                            Sun Store
Address:                       7 Someplace
District:                             Suva
Cashier TIN:                      123456789
POS number:                  89347415-2017
POS time:              2018-03-09 14:57:25
Ref no:              7AF4D923-E3B30A31-234
-------------NORMAL REFUND--------------
Items
========================================
Name    Price        Qty.          Total
Sport-100 Helmet, Blue (E)
        34.99          10        -349.90
Mountain Bike Socks, M (A)
         9.03           4         -36.12
----------------------------------------
Total Purchase:                    386.02
Payment Method:                      Cash
========================================
Label        Name     Rate           Tax
E             STT    6.00%         19.81
A             VAT    9.00%          2.98
----------------------------------------
Total Tax:                          22.79
========================================
SDC Time:              2018-03-09 14:57:46
SDC Invoice No:    7AF4D923-E3B30A31-235
Invoice Counter:                  4/235NR
========================================
---- QR code omitted for simplicity ----
======== END OF FISCAL INVOICE =========
```

Training or Proforma or Copy Receipt

Receipt for Training or Proforma or Copy Invoice must contain visible markings “TRAINING” or “PROFORMA” or “COPY”, below the receipt header and above the item description section.

Receipt must also contain **“THIS IS NOT A FISCAL INVOICE”** below the total amount payable. Font size is at least twice the size of the text on the receipt that specifies the total amount payable.

Training or Proforma or Copy receipt is produced in the same way as normal, with an exception that totals are not accounted for.

For Copy invoice type **Ref no** element is mandatory.

Example:

```
===== THIS IS NOT A FISCAL RECEIPT =====
TIN:                              502579006
Company:                             Golf V
Store:                            Sun Store
Address:                        7 Someplace
District:                             Suva
Cashier TIN:                      123456789
POS number:                  89347415-2017
POS time:              2018-03-09 14:57:25
-------------TRAINING SALE--------------
Items
========================================
Name    Price        Qty.           Total
Sport-100 Helmet, Blue (E)
        34.99          10          349.90
Mountain Bike Socks, M (A)
         9.03           4           36.12
----------------------------------------
Total Purchase:                     386.02
Payment Method:                       Cash
========================================
      THIS IS NOT A FISCAL INVOICE
========================================
Label        Name     Rate            Tax
E             STT    6.00%          19.81
A             VAT    9.00%           2.98
----------------------------------------
Total Tax:                           22.79
========================================
SDC Time:              2018-03-08 14:57:46
SDC Invoice No:    7AF4D923-E3B30A31-236
Invoice Counter:                 1/236TS
========================================
---- QR code omitted for simplicity ----
===== THIS IS NOT A FISCAL RECEIPT =====
```

Tax Amounts

It is essential to note, that POS never uses other taxes except the ones received from SDC. POS displays the total prices and only the tax values received from SDC device, in the format described in previous section.

A tax label can fall into one of the three tax types: Tax, Tax on Total and Amount per Quantity.

Tax amount for a tax label is calculated per the following formulas:

Tax Type	Formula	Explanation
Tax	**Tax Amount** = ∑(Base price * (**Rate/100**))	for each item with this label
Tax on Total	**Tax Amount** = ∑(Total price * (**Rate/100**))	for each item with this label (Total price here is item base price with all other regular taxes included)
Amount per Quantity	**Tax Amount** = ∑(Fix amount * quantity)	for each item with this label, item quantity is multiplied with fix amount as defined by tax Service. If other tax labels are defined on item, those taxes are calculated on the remainder

Choosing an Appropriate Model

The following explanation should help you decide which fiscalization model is the most appropriate for your clients.

Typical process flow

This section describes a typical process flow for successful scenarios.

V-SDC

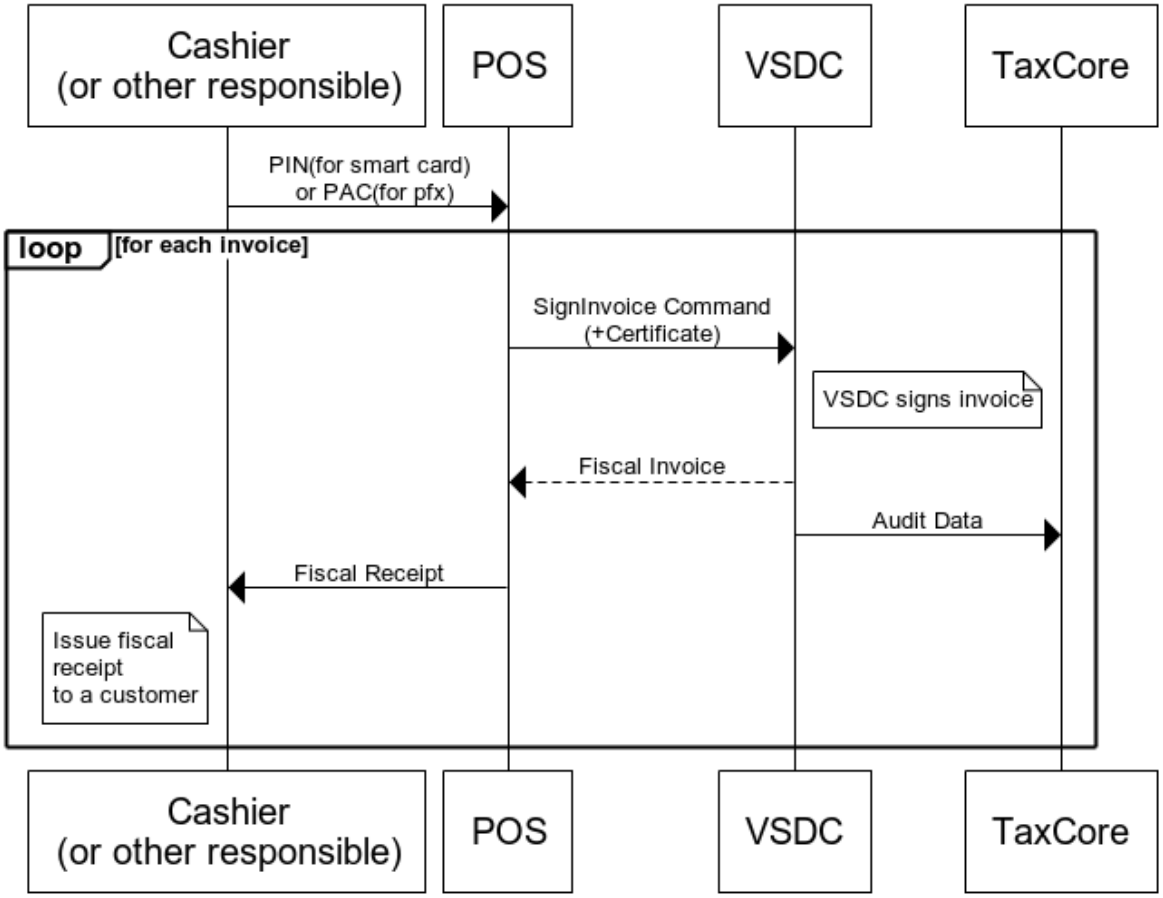


Figure 2 V-SDC process flow

E-SDC

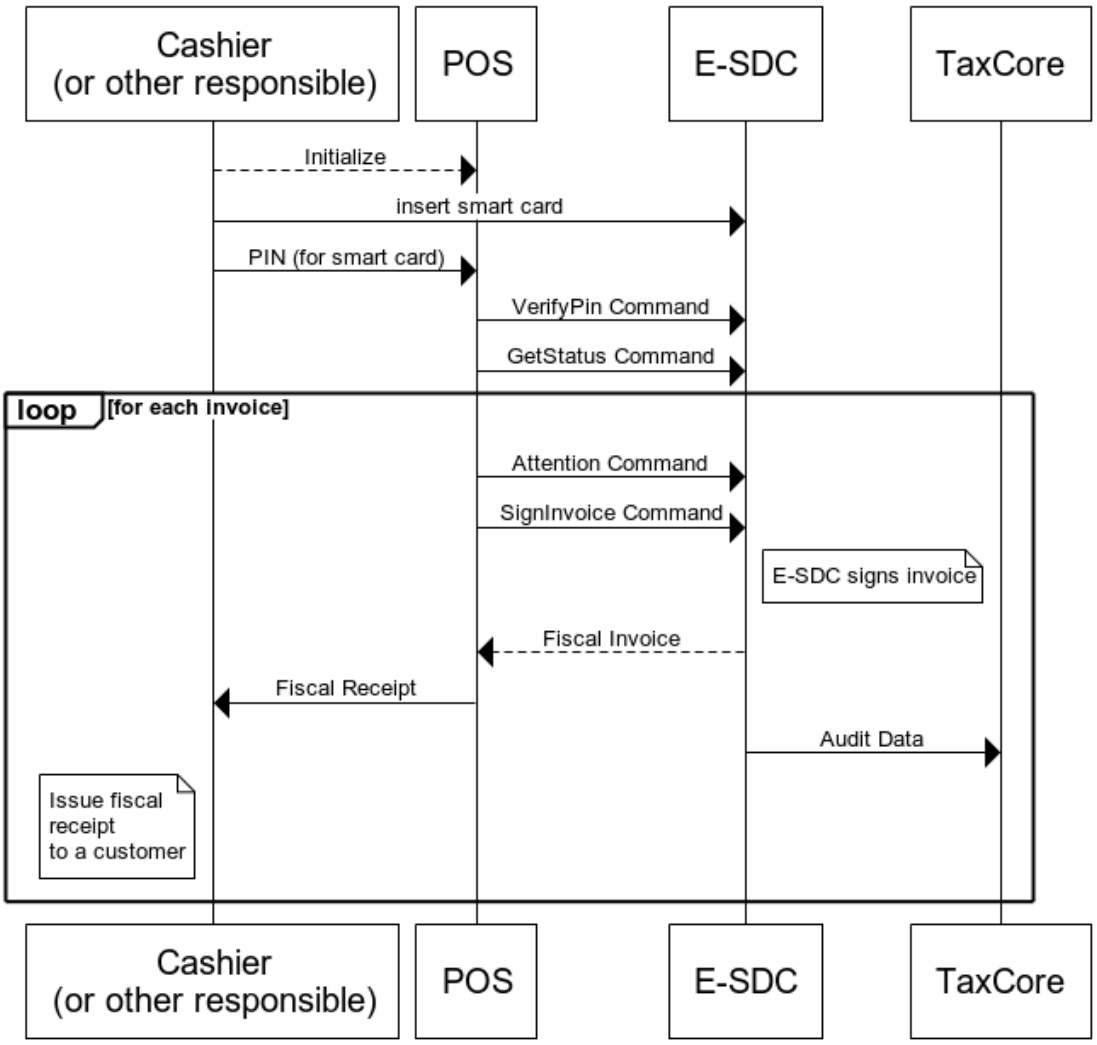


Figure 3 E-SDC process flow

V-SDC Pros and Cons

Pros

1. No specialized hardware is required
2. Accredited POS can be implemented as a mobile app
3. Compliance of the existing ERP system can be done quickly
4. Cost of fiscalization is reduced

Cons

1. Internet connection is required to issue a receipt

E-SDC Pros and Cons

Pros

1. Works without an internet connection
2. Supports older Cash registers with serial connection

Cons

1. Requires a specialized/dedicated hardware

2. Prone to physical damage
3. May require a specialized/dedicated hardware maintenance

Recommendation Examples

This section gives examples of the most common implementation scenarios, for different end users.

Small Shops

In small shops, it is possible to use all kinds of devices from tablets to POS applications. Choice of device generally depends on number of items, which are on sale list (PLU) or on the environmental conditions.

Agencies, Individuals and Travelling Salesmen

Agencies are not issuing large number of receipts and issuing is not time critical; mobile POS application connection to V-SDC will probably cover their needs.

Supermarkets

Supermarkets are using high volume POS systems with additional different peripherals. Due to the very nature of supermarket or shop sale process (on the counter) it is required to have offline capabilities to overcome interruptions of the internet connection.

Restaurants and Hotels

Restaurants have very specific applications. Proforma as transaction type is supported and recorded, and can be verified. Offline capabilities are also important because receipts have to be printed on demand.

Taxi Drivers

Taxi drivers use taximeters that measure parameters from ride. Old taximeters do this by mechanical methods; there are many challenges in their connection with modern EFD systems. If local regulations allow it, modern taxi terminals or mobile taxi applications are increasingly used worldwide (with GPS locator), which facilitates the connection with the EFD system. Taxi drivers prefer small and robust system. Depending on the chosen taximeter they can use E-SDC or V-SDC.

Remote Sites

POS on the remote or underground sites with unstable internet connection will have to work with E-SDC devices to provide customers with fiscal invoices. Local audits would be conducted by tax inspectors or taxpayers on a regular basis.

Malls, Shopping Areas

Areas with high concentration of small shops can contain wireless access point with a dedicated V-SDC for that area.

Enterprises

ERPs and Invoicing systems could utilize both V-SDC and on-site E-SDC device to fiscalize invoices. It is safe to assume this kind of establishments have permanent (or even redundant) internet connection. Fiscalization using V-SDC service would probably be the most appropriate solution.

Web Shops

Web Shop applications could connect to V-SDC service using digital certificate issued to Taxpayer to fiscalize invoice at the moment of payment.

Connected Scenarios

The simplest scenario is: a Client software application (usually POS) creates an invoice, applies tax labels and calls V-SDC web service to fiscalize the invoice. V-SDC authenticates the caller (verifies taxpayer's digital certificate), performs validation, calculates taxes based on applied tax labels, signs invoice and returns response to the Client.

V-SDC response consists of a digital signature of invoice data, internal encrypted message for Tax Service system, digital certificate metadata, textual representation of invoice, verification URL and optionally a QR code.

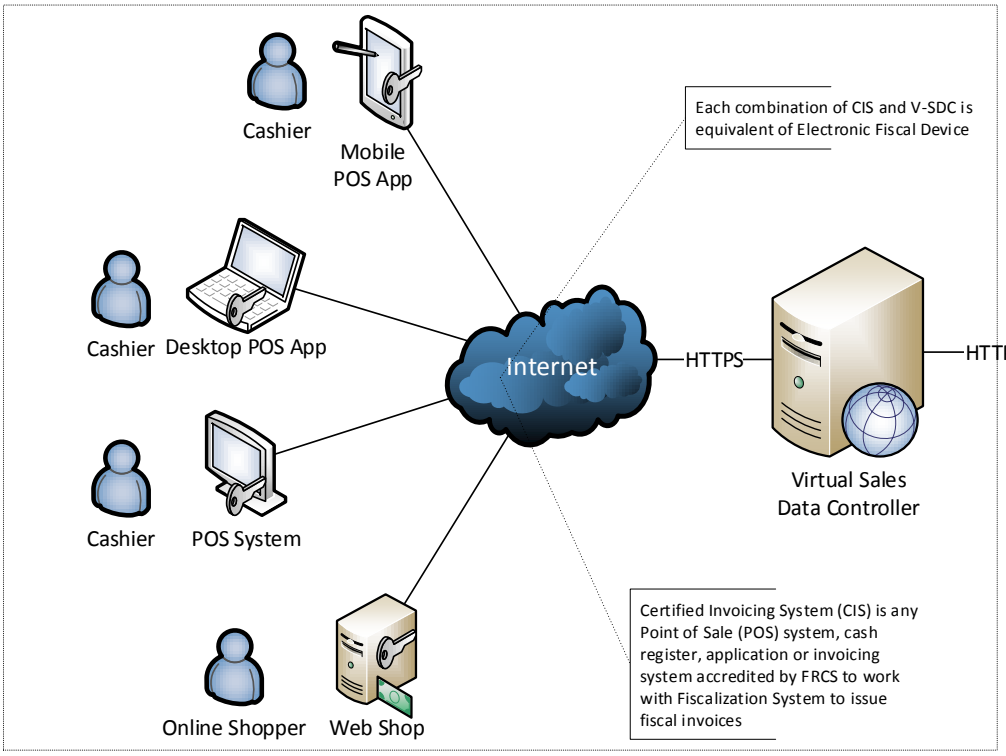


Figure 4 Connected Scenarios

Accredited POS prints textual representation of the invoice and QR code on a receipt. In case the receipt is delivered in electronic form, verification URL should be rendered as a 'clickable' hyperlink in email or web page.

Basically, the receipt fiscalization process consists of the following steps:

1. POS creates an invoice (standard fields like shopping items, see Data Structures)
2. POS submits invoice (JSON format) to V-SDC REST service for fiscalization. POS and V-SDC are mutually authenticated using digital certificates
3. V-SDC authenticates the caller (taxpayer), performs validations and returns result of the fiscalization (see Protocols section)
4. POS prints textual representation of the invoice and QR code containing Verification URL, on the receipt. Paper width should be 58mm / 2.28in or wider.

Accessing V-SDC API

Once valid Test certificate(s) are obtained you can access V-SDC API description on the following URL: https://vsdc.staging.vms.frcs.org.fj/Swagger (for Staging) or https://vsdc.vms.frcs.org.fj/Swagger (for Production).

This page contains *SignInvoice* service operation details, invoice format and some basic examples.

API is designed and based on OpenAPI-Specification V2 (https://github.com/OAI/OpenAPI-Specification). You can use OpenAPI-Specification code generators (e.g. https://swagger.io/swagger-codegen/) to quickly build proxy library for almost any programming language and platform.

Client Authentication

Accredited POS Systems are authenticated by V-SDC servers using client digital certificates distributed as PKCS11 file (*.pfx or *.p11) or on the Smart Cards.

You will be able to access the test system using test digital certificates only.

Example

This example illustrates how to create and initialize instance of **`HttpClient`** class in C# language, use it to authenticate against V-SDC and submit invoice.

When executing this code, you will be asked to provide PIN for the smart card certificate, which you selected in GetClientCertificate() method. In case you selected installed PFX certificate, which you obtained from the Tax Service, you will need to provide PAC value in field PAC.

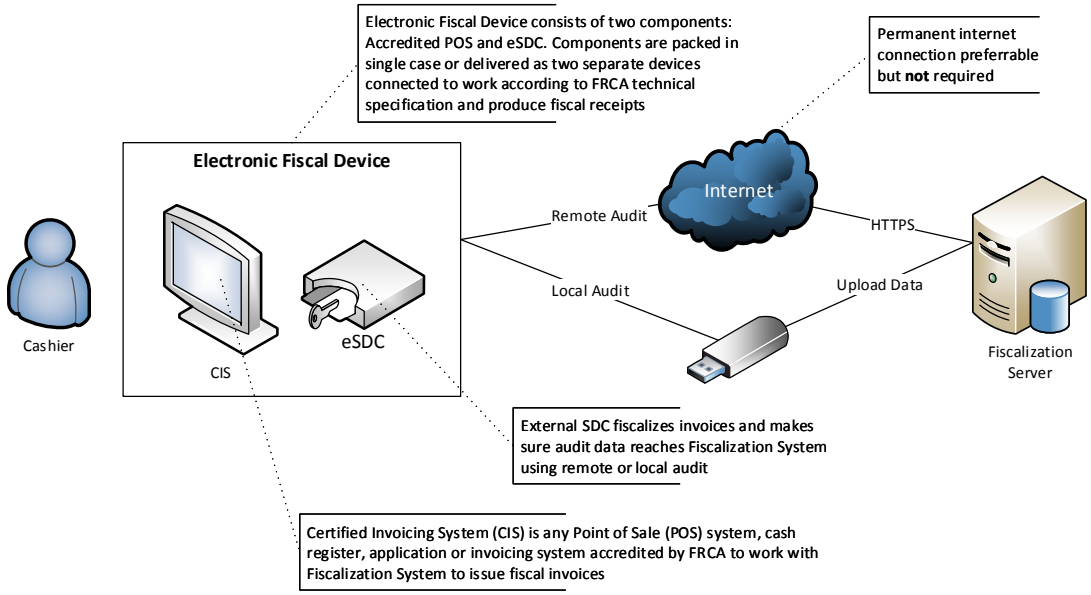
```
using System.Net;
using System.Net.Http;
using System.Security.Cryptography.X509Certificates;
using System.Text;

static void Main(string[] args)
{
    string invoiceRequest = @"{
       ""DateAndTimeOfIssue"": ""2017-06-15T08:56:23.286Z"",
       ""Cashier"": ""Oliver"",
       ""BD"": ""8902798054"",
       ""BuyerCostCenterId"": """",
       ""IT"": ""Normal"",
       ""TT"": ""Sale"",
       ""PaymentType"": ""Cash"",
       ""InvoiceNumber"": ""POS2017/998"",
       ""ReferentDocumentNumber"": ""ABCD1234-EFGH5678-198"",
       ""ReferentDocumentDateAndTime"": ""2017-06-07T09:33:52.187Z"",
       ""PAC"":"""",
       ""Options"":{
              ""OmitQRCodeGen"": ""1"",
              ""OmitTextualRepresentation"": ""1""},
       ""Items"": [{
              ""Name"": ""Sport-100 Helmet, Blue"",
              ""Quantity"": 2,
              ""UnitPrice"": 34.23,
              ""Labels"": [""A""],
              ""TotalAmount"": 68.46}],
       ""Hash"": ""W33lEEgkSRsqTFMO86a8Og==""}";

    var httpContent=new StringContent(invoiceRequest,Encoding.UTF8,"application/json");
    HttpClient client;
    WebRequestHandler handler;
    GetClientAndHandler(out handler, out client);

    var response = client.PostAsync($"api/Sign/SignInvoice", httpContent).Result;
    if (response.StatusCode == HttpStatusCode.OK)
    {
        var jsonString = response.Content.ReadAsStringAsync();
```

```
        jsonString.Wait();
        var invoiceResponse = jsonString.Result;
        Console.Write(invoiceResponse);
    }
}

static void GetClientAndHandler(out WebRequestHandler handler, out HttpClient client)
{
    handler = CreateWebRequestHandler();
    client = new HttpClient(handler);
    client.BaseAddress = new Uri("https://vsdc.staging.vms.frcs.org.fj/");
    client.DefaultRequestHeaders.Accept.Clear();
}

static WebRequestHandler CreateWebRequestHandler()
{
    var handler = new WebRequestHandler();
    var cert = GetClientCertificate();

    handler.ClientCertificateOptions = ClientCertificateOption.Manual;
    handler.ClientCertificates.Add(cert);

    return handler;
}

static X509Certificate2 GetClientCertificate()
{
    string certName = "9AH3 My Store inc.";
    var store = new X509Store(StoreName.My, StoreLocation.CurrentUser);
    store.Open(OpenFlags.OpenExistingOnly | OpenFlags.ReadOnly);

    return store.Certificates.Find(X509FindType.FindBySubjectName, certName, true)[0];
}
```

Semi-Connected Scenarios

Taxpayers will be encouraged to use online capabilities whenever possible – V-SDC service will be widely available and accessible from the variety of Accredited POS devices and software solution. But, in order to rollout a fiscalization system, it has to be able to close any possible gaps in fiscal discipline that may have arisen from a poor or no internet connection.

External Sales Data Controller (E-SDC) device exposes Json-based protocols for communication with the Accredited POS via RS232, USB-to-serial or UTP cable. E-SDC is using a Secure Element to digitally sign invoices received from the Accredited POS and to produce audit data. Audit data is stored on an E-SDC internal memory which enables local and remote audit.



Protocols

Status and Error Codes

Code	0-Info 1-Warning 2-Error	Description	Applies to
	INFO		
0000	All OK	Command is executed without warnings or errors	VSDC, E-SDC
0100	Pin OK	This code indicates that the provided PIN code is correct	E-SDC
0210	Internet Available	Internet Connection is available (optional)	E-SDC
0220	Internet Unavailable	Internet Connection is not available (optional)	E-SDC
	WARNINGS		
1100	Storage 90% Full	Storage used to store audit packages is 90% percent full. It is time to perform the audit.	E-SDC
1300	Smart Card is not present	Secure element card is not inserted in the E-SDC smart card reader	E-SDC
1400	Audit Required	Total Sale and Refund amount reached 75% of SE limit. It is time to perform the audit.	E-SDC
1500	Pin Code Required	Indicates that POS must provide the PIN code	E-SDC
1999	Undefined Warning	Something is wrong but specific warning is not defined for that situation. Manufacturer can use manufacturer-specific codes to describe warning in more details	E-SDC
	ERRORS		
2100	Pin Not OK	PIN code sent by the POS is invalid	E-SDC
2210	SE Locked	Secure Element is locked. No additional invoices can be signed before the audit is completed	E-SDC
2220	SE Communication Failed	E-SDC cannot connect to the Secure Element applet	E-SDC
2230	SE Protocol Mismatch	Secure Element does not support requested protocol version (reserved for later use)	E-SDC
2310	Invalid tax labels	Tax Labels sent by the POS are not defined	VSDC, E-SDC
2400	Not configured	SDC device is not fully configured for invoice signing (i.e. tax rates or verification URL are missing etc.)	E-SDC
2800	Field Required	The field is required	E-SDC
2801	Field Value Too Long	The length of the field value is longer than expected	VSDC, E-SDC
2802	Field Value Too Short	The length of the field value is shorter than expected	VSDC, E-SDC
2803	Invalid Field Length	The length of the field value is shorter or longer than expected	VSDC, E-SDC
2804	Field Out Of Range	The field value out of expected range	VSDC, E-SDC
2805	Invalid Field Value	The field contains invalid value	VSDC, E-SDC

2806	Invalid Data Format	The data format is invalid	VSDC, E-SDC
2807	List Too Short	The list contains less than minimum required elements count	VSDC, E-SDC
2808	List Too Long	The list exceeds maximum allowed elements count.	VSDC, E-SDC
	OBSOLETE		
~~**2811**~~	Invalid Invoice Type	Value of Invoice Type field is invalid or out of range (replaced with **2805**)	VSDC, E-SDC
~~**2812**~~	Invalid Transaction Type	Value of Transaction Type field is invalid or out of range (replaced with **2805**)	VSDC, E-SDC
~~**2813**~~	Invalid Payment Type	Value of Payment Type field is invalid or out of range (replaced with **2805**)	VSDC, E-SDC
~~**2814**~~	BuyerIdLenghtInBytes Length Exceeded	BuyerID field maximum length is exceeded (20 chars) (replaced with **2803**)	VSDC, E-SDC
~~**2815**~~	BuyerCostCenterId Length Exceeded	BuyerCostCenterId field maximum length is exceeded (15 chars) (replaced with **2803**)	VSDC, E-SDC
~~**2816**~~	POSInvoiceNumber Length Exceeded	POSInvoiceNumber field maximum length is exceeded (20 chars) (replaced with **2803**)	VSDC, E-SDC
~~**2817**~~	GTIN Length Invalid	POSInvoiceNumber field length is less than 8 or greater than 14 (replaced with **2803**)	VSDC, E-SDC
~~**2818**~~	Name Length Exceeded	Name field maximum length is exceeded (2048 chars) (replaced with **2803**)	VSDC, E-SDC
~~**2819**~~	Name is Required	Item name is required (replaced with **2800**)	VSDC, E-SDC
~~**2820**~~	Labels Length Exceeded	Label length is exceeded (replaced with **2803**)	VSDC, E-SDC

JSON Based Protocol (Common for POS to V-SDC or E-SDC)

JSON API is designed and based on OpenAPI-Specification V2 (https://github.com/OAI/OpenAPI-Specification). You can use OpenAPI-Specification code generators (e.g. https://swagger.io/swagger-codegen/) to quickly build a proxy library for almost any programming language and platform.

Sign Invoice Command

HTTP POST request data is sent to:

For V-SDC:	https://vsdc.staging.vms.frcs.org.fj/api/Sign (for Staging) or https://vsdc.vms.frcs.org.fj/api/Sign (for Production)
For E-SDC:	http://< ESDC_ip_address>/api/Sign

Invoice Request

Data Fields

Field	Description
DateAndTimeOfIssue	Current **Local** Date and Time in ISO 8601 format
IT	Invoice Type enumeration value
TT	Transaction Type enumeration value
PaymentType	Payment Type enumeration value
Cashier	Cashier's identification.
BD	Taxpayer ID of the Buyer. **It is mandatory for B2B** transactions, otherwise it's optional.

BuyerCostCenterId	Cost Center ID provided by buyer to the cashier in case Buyer's company wants to track spending in Taxpayer Portal. **It is optional and may exist only for B2B transactions, otherwise is shall be ignored by E-SDC.**
InvoiceNumber	Invoice number generated by POS.
ReferentDocumentNumber	Mandatory only in case Invoice Type is **Refund** or **Copy**. In both cases, this field must contain Invoice Number of previously issued Invoice or Refund. In any other case (for example Normal Sale invoice) this field is optional. ASCII, in ***RequestedBy-SignedBy-OrdinalNumber*** format
PAC	POS Access Code assigned to and used along with digital certificate distributed as PFX file, used to authenticate POS to VSDC. In case Smart Card is used to authenticate POS to V-SDC this field is not used and should be left blank.
Items (n)	Each invoice contains at least one Item in Items collection
GTIN	Global Trade Item Number (GTIN) is an identifier for trade items, incorporated the ISBN, ISSN, ISMN, IAN (which includes the European Article Number and Japanese Article Number) and some Universal Product Codes, into a universal number space.
Name	Human readable name of the product or service.
Quantity	Quantity of an item, e.g. 2 (pieces), 0.100 (grams).
UnitPrice	Unit price of the line item. Does not take part in tax calculation.
Discount	Discount applied, before **TotalAmount** is accounted for. It's not part of tax calculation.
TotalAmount	Gross price for the line item.
Labels	Array of labels. Each Label represents one of the Tax Rates applied on invoice item. Tax Items are calculated based on TotalAmount and applied Labels. In case no taxes are applicable on item this field is optional.
Options	Key/value collection defines output of V-SDC/E-SDC invoice fiscalization, to optimize resources. Key: **`OmitQRCodeGen`** Value: "1" to omit QR Code generation by E-SDC and "0" to generate and return QR code. Key: **`OmitTextualRepresentation`** Value: "1" to omit generation of textual representation by E-SDC and "0" to generate return textual representation to POS.
Hash	Base64 encoded MD5 hash of the request data (used only for E-SDC). It is used only for later invoice search.

Model

```
InvoiceFiscalizationRequest {
       DateAndTimeOfIssue (string, optional),
       Cashier (string, optional) Unicode MaxLength:50,
       BD (string, optional) ASCII MaxLength:20,
       BuyerCostCenterId (string, optional) Unicode MaxLength:15,
       IT (string) = ["Normal", "ProForma", "Copy", "Training"] (int) = [0,1,2,3],
       TT (string) = ["Sale", "Refund"] (int) = [0,1],
       PaymentType (string) = ["Other", "Cash", "Card", "Check", "WireTransfer",
       "Voucher", "MobileMoney" (int) = [0,1,2,3,4,5,6],
```

```
        InvoiceNumber (string, optional) Unicode MaxLength:60,
        ReferentDocumentNumber (string, optional),
        PAC (string, optional),
        Options (inline_model, optional),
        Items (Array[Item]) MinLength:1,
        Hash (string, optional) MaxLength:32
}

inline_model {
        OmitQRCodeGen (string, optional) = ["0", "1"] (int) = [0,1],
        OmitTextualRepresentation (string, optional) = ["0", "1"] (int) = [0,1]
}

Item {
        GTIN (string, optional) MinLength:8 MaxLength:14,
        Name (string) Unicode MaxLength:2048,
        Quantity (number) Decimal(14,3) MinValue:0.001,
        UnitPrice (number, optional) Decimal(14,2),
        Discount (number, optional) Decimal(14,2),
        Labels (Array[string], optional) MinLength:0,
        TotalAmount (number) Decimal(14,2)
}
```

Example

```
        {
          "DateAndTimeOfIssue": "2017-06-15T08:56:23.286Z",
          "Cashier": "123456789",
          "IT": "Normal",
          "TT": "Sale",
          "PaymentType": "Cash",
          "InvoiceNumber": "POS2017/998",
          "Options": {
            "OmitQRCodeGen" : "1" ,
            "OmitTextualRepresentation" : "0"
          },
          "Items": [
            {
              "Name": "Sport-100 Helmet, Blue",
              "Quantity": 2,
              "UnitPrice": 34.23,
              "Labels": [
                "A"
              ],
              "TotalAmount": 68.46
            }
          ],
          "Hash": "W33lEEgkSRsqTFMO86a8Og=="
        }
```

Invoice Response

Data Fields

Field	Description
RequestedBy	UID of digital certificate which requested signing. In case E-SDC is used, its value will be the same as SignedBy.
SignedBy	UID of digital certificate of secure element which signed invoice. In case E-SDC is used, its value will be the same as RequestedBy.
DT	Local Date and time in ISO 8601 format provided by E-SDC/V-SDC.
IC	Invoice Counter in format **TransactionTypeCounter/TotalCounter InvoiceCounterExtension**

	For Example: 14/17NS
InvoiceCounterExtension	First letters of Transaction Type and Invoice Type of the invoice. NS for Normal Sale, CR – Copy Refund, TS – Training Sale etc.
IN	Invoice number in format **RequestedBy-SignedBy-TotalCounter**
VerificationUrl	Verification URL generated through fiscalization.
VerificationQRCode	Base64 encoded byte array of GIF image.
Journal	Textual representation of the invoice.
Messages	Custom human readable message that shall be printed or displayed by POS.
TotalCounter	Total number of documents protected by this instance of Secure Element.
TransactionTypeCounter	Total number of documents of the selected transaction type protected by this instance of Secure Element.
TotalAmount	Sum of all Items totals – grand total billed to customer.
ID	Internal Data.
S	Digital Signature.
TaxItems	(for each label that exists on the invoice).
Label	Tax Label (i.e. A, F, G)
Name	Tax Category Name (i.e. VAT, Consumption)
Rate	TaxRate i.e. 12.50(%) or 0.10($)
Amount	Tax amount calculated by E-SDC. Refer to section Tax Amounts.
Hash	Hash received from POS in request field Hash (used only for E-SDC)
BusinessName	Taxpayer Business Name obtained from digital certificate.
LocationName	Location Name obtained from digital certificate.
Address	Street address obtained from digital certificate.
TIN	Tax Identification Number obtained from digital certificate.
District	District name obtained from digital certificate.
MRC	E-SDC manufacturer registration code (in format MakeCode-SW-Serial). -MakeCode: unique 2 characters obtained on Tax Service Accreditation -SW: software version -Serial: manufacturer serial number (max 32 characters)

Model

```
InvoiceFiscalizationResult {
	RequestedBy (string),
	DT (string),
	InvoiceCounterExtension (string),
	TaxItems (Array[TaxItem]) MinLength:0,
	VerificationUrl (string),
	VerificationQRCode (string, optional),
	Journal (string, optional),
	Messages (string, optional),
	SignedBy (string),
	ID (string),
	S (string),
	TotalCounter (integer),
	TransactionTypeCounter (integer),
	TotalAmount (number),
	Hash (string, optional),
```

```
      BusinessName (string, optional),
      LocationName (string, optional),
      TIN (string, optional),
      Address (string, optional),
      District (string, optional),
      MRC (string, optional)
}
```

TaxItem {
Label (string),
Amount (number),
Rate (number),
CategoryName (string)
}

Example


```
{
  "RequestedBy": "7AF4D923",
  "DT": "2017-06-14T19:56:25.2782924+13:00",
  "IC": "230/234NS",
  "InvoiceCounterExtension": "NS",
  "IN": "7AF4D923-E3B30A31-234",
  "TaxItems": [
    {
      "Label": "A",
      "CategoryName": "VAT",
      "Rate": 9.00
      "Amount": 5.6527
    }
   ],
  "VerificationUrl":"https://staging.vms.frcs.org.fj/v/?vl=AVAyMlZDOFZSSlRKQzVWNjUBAAAA
    AQAAAAAuGQ4AAAFeM%2BvCJgAAAAbDDPkm7R9I1NPLierP%2Bh3UQswb%2FXa8xYKiEnLjyClHqh6X26FruP
    VNksB7wMoG2LpA85uvbG9txf2CndYl5JZshBJsq7TLF%2BqOmRs3EaykUVf05mFbTrrgQmUROZE76lciqaxv
    aVEGK83ic1q2HVz0mryqHna6Iu%2FuTn4q2wQ4gJ9bc%2BD6pvyhY%2BZB8c3SgYNGPm4Eq81%2BC8tjJpPC
    YLlHrVKPjbQEE6FSm2II0YEeQqWEGNCHqatxHmjS8sJTT4BJJ%2FlhzTQyuFWoI5ko3oAm8AZsEdgx54oEEN
    r3LUm3Jg%2Fd75tGcUoweEngRfoEP0EiqaOkt2sdSg18hrjd4PUdZ8QUksSeIDmjLMsqZoLmGiqycdajhMN2
    eMeo%2B9LZ%2FhLnxDsROkbOWlArVGfQ%2B9MfBmyJsILCEIT6myTAC2HZCvQ%2Bc0MEO%2F0euynCkCQO6B
    Bv39zNn8yNRagmsEOslkQydty66gphme%2BCOx76u%2F4lCjxPOOxc%2F6zNR8SAe1MNaDPVH3PU7IlQdTox
    fXY3pvWSqtK%2FUY5JGXpvmMpLP6kUXr1qOCjt2Uj6QsH%2BbgwjEZVpHep%2Byh5myEQcI9A4NDUtoUjPpI
    TbOIxPO4vyne%2Bgv4UnpAKQigAv%2FywKeD9noHDgCiFSfLZCJ0IXMSleo%2BjIf%2BIfE2YXX84gH7n7Nc
    pn",
  "VerificationQRCode": null,
  "Journal": "============ FISCAL INVOICE ============\r\n
              TIN:                              502579006\r\n
              Company:                             Golf V\r\n
              Store:                            Sun Store\r\n
              Address:                        7 Someplace\r\n
              District:                              Suva\r\n
              Cashier TIN:                    123456789\r\n
              POS number:                    POS2017/998\r\n
              POS time:              2017-06-15 8:56:23\r\n
              --------------NORMAL SALE--------------\r\n
              Items\r\n
              ========================================\r\n
              Name    Price        Qty.          Total\r\n
              Sport-100 Helmet, Blue (A)              \r\n
                     34.23           2          68.46\r\n
              ----------------------------------------\r\n
              Total Purchase:                    68.46\r\n
              Payment Method:                     Cash\r\n
              ========================================\r\n
              Label        Name     Rate           Tax\r\n
```

```
            A             VAT    9.00%          5.65\r\n
            ----------------------------------------\r\n
            Total Tax:                           5.65\r\n
            ========================================\r\n
            SDC Time:             2017-06-15 8:56:25\r\n
            SDC Invoice No:    7AF4D923-E3B30A31-234\r\n
            Invoice Counter:               230/234NS\r\n
            ========================================\r\n
            ======== END OF FISCAL INVOICE =========\r\n",
 "Messages": "Success",
 "SignedBy": "E3B30A31",
 "ID":
  "BsMM+SbtH0jU08uJ6s/6HdRCzBv9drzFgqIScuPIKUeqHpfboWu49U2SwHvAygbYukDzm69sb23F/YKd1iX
  klmyEEmyrtMsX6o6ZGzcRrKRRV/TmYVtOuuBCZRE5kTvqVyKprG9pUQYrzeJzWrYdXPSavKoedroi7+5Ofir
  bBDiAn1tz4Pqm/KFj5kHxzdKBg0Y+bgSrzX4Ly2Mmk8JguUetUo+NtAQToVKbYgjRgR5CpYQY0Iepq3EeaNL
  ywlNPgEkn+WHNNDK4VagjmSjegCbwBmwR2DHnigQQ2vctSbcmD93vm0ZxSjB4SeBF+gQ/QSKpo6S3ax1KDXy
  GuN3g9Q==",
 "S":
  "HWfEFJLEniA5oyzLKmaC5hoqsnHWo4TDdnjHqPvS2f4S58Q7ETpGzlpQK1Rn0PvTHwZsibCCwhCE+pskwAt
  h2Qr0PnNDBDv9HrspwpAkDugQb9/czZ/MjUWoJrBDrJZEMnbcuuoKYZnvgjse+rv+JQo8TzjsXP+szUfEgHt
  TDWgz1R9z1OyJUHU6MX12N6b1kqrSv1GOSRl6b5jKSz+pFF69ajgo7dlI+kLB/m4MIxGVaR3qfsoeZshEHCP
  QODQ1LaFIz6SE2ziMTzuL8p3voL+FJ6QCkIoAL/8sCng/Z6Bw4AohUny2QidCFzEpXqPoyH/iHxNmF1/OIB+
  5+zXKZw==",
 "TotalCounter": 234,
 "TransactionTypeCounter": 230,
 "TotalAmount": 68.46,
 "Hash": "W33lEEgkSRsqTFMO86a8Og==",
 "BusinessName": "Golf V",
 "TIN": "502579006",
 "LocationName": "Sun Store",
 "Address": "7 Someplace",
 "District": "Suva"
}
```

Mapping Fiscal Invoice to Fiscal Receipt

In case POS does not use Journal (generated by E-SDC or V-SDC) as a content for a fiscal receipt, but it generates a custom designed receipt instead, it shall use the following element mappings:

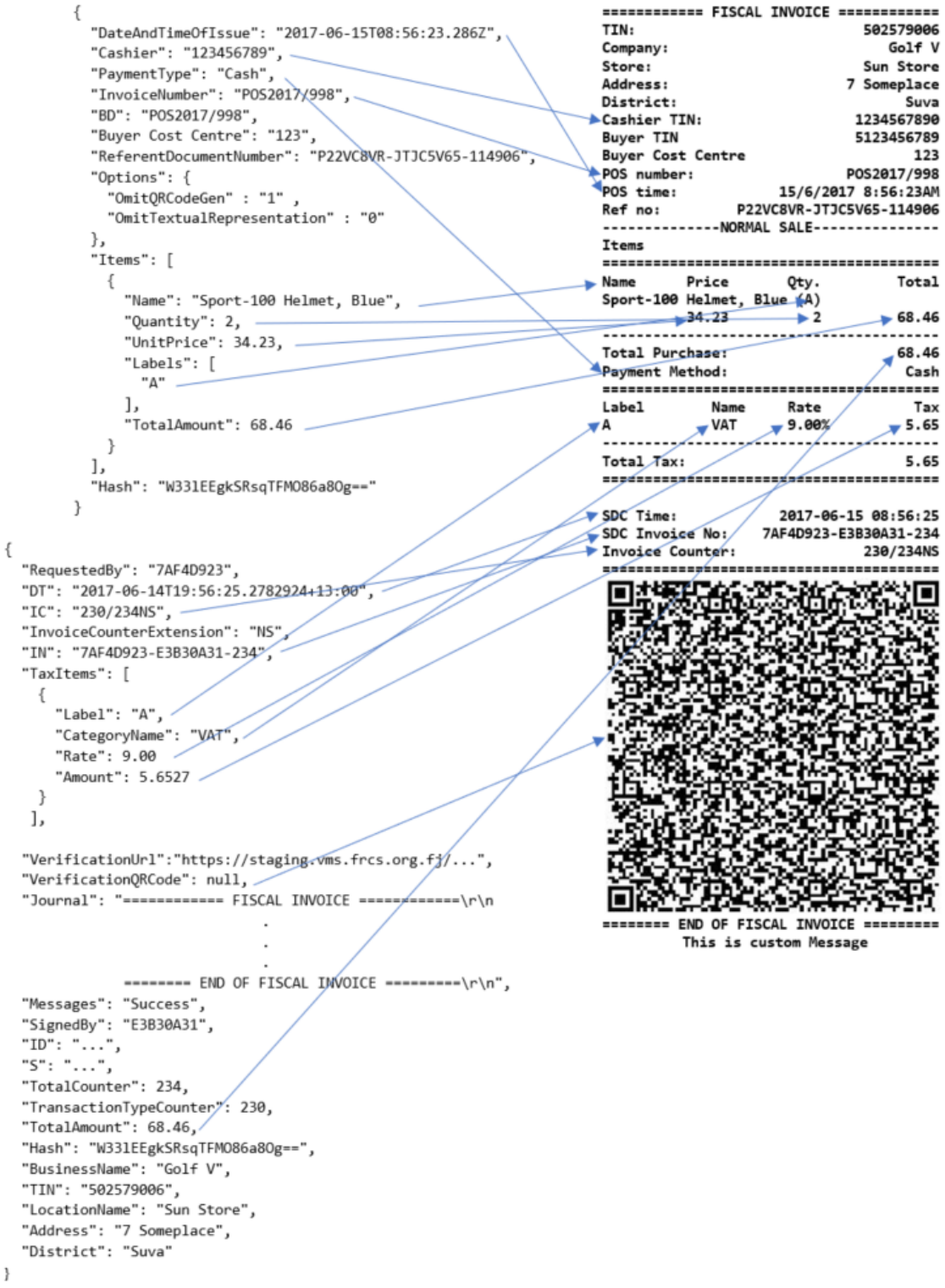


Figure 5 Mapping Fiscal Invoice to Fiscal Receipt

JSON Based Protocol (POS to E-SDC Specific)

There are 5 types of Commands (request/response) that can be used for communication between a POS and an E-SDC:

1. Get Status
2. Verify PIN
3. Sign Invoice
4. Attention
5. Get Last Signed Invoice

Get Status Command

This command is used to get status information from E-SDC.

Request Data

JSON data field with predefined string value.

Example

```
{
   "GS": "GetStatus"
}
```

Response Data

JSON formatted data in accordance with Table 1 Get Status response data.

Filed	Description	Example
IsPinRequired	If PIN is not entered, or if wrong PIN is entered in the previous attempt, this field shall be set to true; otherwise set to false	true
AuditRequired	If Audit is required, this field shall be set to true. Audit is required if Total Amount of all invoices is 75% or more of Maximum Limit. Maximum Limit and Total Amount are obtained from the Secure Element	False if Total Amount is 1554879 Maximum Limit is 9000000 True If Total Amount is 7504899 Maximum Limit is 10000000
DT	Current **Local** Date and Time in ISO 8601 format	2017-08-30T11:53:05+13:00
LastInvoiceNumber	Invoice number of the last invoice signed by this E-SDC.	ORG674J1-ORG674J1-98637
ProtocolVersion	Always 1.0.0.0	1.0.0.0
SecureElementVersion	Version of the Secure Element	1.0.0.0
HardwareVersion	Manufacturer-specific hardware version, if applicable	1.2.7.21
SoftwareVersion	Manufacturer-specific software version	1.7.6.5
DeviceSerialNumber	Manufacturer specific serial number	1289A24EB67F22C1
Make	Manufacturer specific Make Name	Acme
Model	Manufacturer specific Model Name	The Device 442
MSSC	Manufacturer Specific Errors, Warnings and info messages	Array of error codes
GSC	General Errors, Warnings and info	Array of error codes

	messages defined in section Status and Error Codes.

Table 1 Get Status response data

Example

```
{
  "IsPinRequired": true,
  "AuditRequired": false,
  "DT": "2017-08-30T11:53:05+13:00",
  "LastInvoiceNumber": "ORG674J1-ORG674J1-98637",
  "ProtocolVersion" : "1.0.0.0",
  "SecureElementVersion" : "1.0.0.0",
  "HardwareVersion" : "1.2.7.21",
  "SoftwareVersion" : "1.7.6.5",
  "DeviceSerialNumber" : "1289A24EB67F22C1",
  "Make" : "Acme",
  "Model" : "The Device 442",
  "MSSC" : ["0440", "5541", "5442"],
  "GSC" : ["1100", "1101", "1102", "1103"]
}
```

Verify PIN Command

This command is used to verify a PIN entered by a cashier on a POS. PIN is verified by the E-SDC. Command should be provided each time the Secure Element smart card is inserted into the E-SDC reader.

Request Data

JSON string with PIN code sent from POS.

Example

```
{
   "VPIN": "1234"
}
```

Response Data

JSON string returned from E-SDC, content can be one of General Status Codes: 0100, 1300, 2100, 2210, 2220, 2230 or 2400. For more information consult Status and Error Codes.

Example

```
{
  "VPIN_GSC": "0100"
}
```

Attention Command

This command is used by POS to verify if ESDC is available. The command should be used prior to Sign Invoice or Send Pin requests. This significantly lowers possibility for communication errors, including timeout errors. Only if a valid response is received, the POS shall immediately send the next command.

Request Data

JSON data field with predefined string value.

Example

```
{
  "ATT": "Attention"
}
```

Response Data

JSON string returned from E-SDC, content can be General Status Code: 0000. For more information consult Status and Error Codes.

Example

```
{
  "ATT_GSC": "0000"
}
```

Get Last Signed Invoice Command

Get the last signed invoice. It is used in case POS did not get a response from ESDC after Sign Invoice Command was sent. The response is the same as for Sign Invoice Command. Hash field from response should be used to determine whether the last invoice was successfully signed.

Request Data

JSON data field with Hash string value of the last Sign Invoice Command request sent by POS.

Example

```
{
  "GI": "MDNDN0MwQUNFMzk1RDgwMQ=="
}
```

Response Data

Refer to response for Sign Invoice Command.

Error Messages Format

This section describes structure and format of error messages returned by SDC to POS.

Data Fields

Message	Human readable error information. If unsure which error message to return to a POS, use “The request is invalid” phrase
ModelState	Dynamic object containing key-value pairs of FieldName-ErrorCode .
Object	Name of the object (if applicable)
FieldName	Path to the field error codes are associated with. If some of the fields in the path is an array, order number shall be included in square brackets.
ErrorCode	Error code associated with a particular field, from the section Status and Error Codes

Model

```
ModelStateDictionary {
       Message (string),
       ModelState (Array(ModelError))
       }


ModelError {
       FieldName (Array[ErrorCode (string)])
}
```

Implementation example in C# programming language:

```
public class ModelStateDictionary
{
    public string Message { get; set; }
    public Dictionary<string, string[]> ModelState { get; set; }
}
```

Example

```
{
  "Message": "The request is invalid.",
```

```
  "ModelState": {
    "invoice.IT": [
      "1234"
    ],
    "invoice.Items[0].Labels[0]": [
      "1234"
    ],
    "invoice.Items[0].GTIN": [
      "1234",
      "5678"
    ]
  }
}
```

POS to E-SDC Communication over HTTP Protocol

E-SDC device should be equipped with an Ethernet port or a Wireless controller in accordance with IEEE 802.3, with speed no less than 100Mb/s, in order to access a local area network.

Physical connection to a network can be done with a standard LAN cable, Cat.5 or similar with better features. The ends of the cables should be equipped with RJ-45 plug male connectors, since an E-SDC is equipped with a female RJ-45 connector.

E-SDC should have globally unique MAC-48 address in accordance with IEEE 802, which is stored on a specialized MAC Address chip, or an address obtained by the authorized vendor stored in the permanent memory during the manufacturing.

IP Address and other network settings on an E-SDC should be configurable. Technical implementation of these features is in the scope of E-SDC manufacturer.

When an HTTP connection is used between a POS and an E-SDC, data is exchanged in JSON text-based format. POS device must be able to send JSON formatted data to the specified E-SDC IP address using HTTP protocol and to receive response data from the E-SDC using the same protocol.

Get Status Command

This command is used to get status information from E-SDC.

HTTP POST request is sent to: http://<E-SDC_ip_address>:<port>/api/Status/GetStatus

Example: http://192.168.88.112:8888/api/Status/GetStatus

Verify PIN Command

HTTP POST request data is sent to: http://<ESDC_ip_address>:<port>/api/Status/VerifyPin

Example: http://192.168.88.112:8888/api/Status/VerifyPin

Attention Command

HTTP POST request data is sent to: http://<ESDC_ip_address>:<port>/api/Status/Attention

Example: http://192.168.88.112:8888/api/Status/Attention

Sign Invoice Command

HTTP POST request data is sent to: http://<ESDC_ip_address>:<port>/api/Sign/SignInvoice

Example: http://192.168.88.112:8888/api/Sign/SignInvoice

Get Last Signed Invoice Command

HTTP POST request data is sent to: http://<ESDC_ip_address>:<port>/api/Sign/GetSignedInvoice

Example: http://192.168.88.112:8888/api/Sign/GetSignedInvoice

POS to E-SDC Communication over Serial Port

Some E-SDC developers could choose to support older Accredited POS devices by exposing a serial port data transfer protocol.

In that case, the Accredited POS must be connected to the E-SDC by using NULL MODEM (crossover) serial cable with Transmit (Tx), Receive (Rx) and common ground (GND) cores. Cables with integrated "Serial to USB" converters can be used, too. Physical parameters of the serial protocol are defined by the following parameters:

Databits	8
Parity	Non
Stopbits	1
Baudrate	115200 b/s
Handshake	Non

Above mentioned parameters are defined during the manufacturing process, they are hardcoded in hardware, so they can't be changed later. The Automatic baud rate detection is not possible.

The order of transmission of bits is LSB (least significant bit) first.

Initialization of the serial communication is always done by a POS, it is never started by an E-SDC. In normal working mode, when the communication is uninterrupted, every request from the POS to the E-SDC is followed by an appropriate response in the opposite direction.

Serial transmission protocol doesn't implement any error detection protocol by default, so SLIP protocol with Fletcher-16 checksum is used.

Serial port protocol defines the following commands that will be executed by POS: **VerifyPIN**, **SignInvoice, Attention**, **GetStatus** and **GetSignedInvoice**. All commands must be UTF-8 encoded string.

SLIP Protocol

The Serial Line Internet Protocol (SLIP) is an encapsulation of the Internet Protocol designed to work over serial ports and modem connections. It is documented in RFC 1055. On microcontrollers SLIP is the preferred way of encapsulating IP packets due to its very small overhead.

SLIP defines the following special bytes to be used:

Hex value	Dec Value	Oct Value	Abbreviation	Description
0xC0	192	300	END	Frame End
0xDB	219	333	ESC	Frame Escape
0xDC	220	334	ESC_END	Transposed Frame End
0xDD	221	335	ESC_ESC	Transposed Frame Escape

SLIP modifies a standard TCP/IP datagram by

- appending a special "END" byte to it, which distinguishes datagram boundaries in the byte stream,
- if the END byte occurs in the data to be sent, the two byte sequence ESC, ESC_END is sent instead (0xDB, 0xDC),
- if the ESC byte occurs in the data, the two byte sequence ESC, ESC_ESC is sent (0xDB, 0xDD).
- variants of the protocol may begin, as well as end, packets with END.

Therefore, an ESC byte in a SLIP packet shall always be followed by an ESC_END or an ESC_ESC byte; anything else shall be considered a protocol error. Although the implementation code proposed by RFC 1055 ignores such errors, ESDC and POS shall detect and report following SLIP errors:

- ESC character at the end of the packet.
- ESC character in the middle or at the beginning of packet but not followed by ESC_END or ESC_ESC characters.

Request

Every request sent from a POS over a serial communication protocol is a SLIP packet consisted of the following segments:

<Command><Payload><Checksum><SLIP End>

- Command identifier, 1 byte (alphanumeric) symbol that uniquely identifies command type.

Payload is a UTF-8 encoded JSON based command. Commands are defined in section JSON Based Protocol (Common for POS to V-SDC or E-SDC)

JSON API is designed and based on OpenAPI-Specification V2 (https://github.com/OAI/OpenAPI-Specification). You can use OpenAPI-Specification code generators (e.g. https://swagger.io/swagger-codegen/) to quickly build a proxy library for almost any programming language and platform.

Sign Invoice Command

HTTP POST request data is sent to:

For V-SDC:	https://vsdc.staging.vms.frcs.org.fj/api/Sign (for Staging) or https://vsdc.vms.frcs.org.fj/api/Sign (for Production)
For E-SDC:	http://< ESDC_ip_address>/api/Sign

Invoice Request

Data Fields

Field	Description
DateAndTimeOfIssue	Current **Local** Date and Time in ISO 8601 format
IT	Invoice Type enumeration value
TT	Transaction Type enumeration value
PaymentType	Payment Type enumeration value
Cashier	Cashier's identification.
BD	Taxpayer ID of the Buyer. **It is mandatory for B2B** transactions, otherwise it's optional.
BuyerCostCenterId	Cost Center ID provided by buyer to the cashier in case Buyer's company wants to track spending in Taxpayer Portal. **It is optional and may exist only for B2B transactions, otherwise is shall be ignored by E-SDC.**
InvoiceNumber	Invoice number generated by POS.
ReferentDocumentNumber	Mandatory only in case Invoice Type is **Refund** or **Copy**. In both cases, this field must contain Invoice Number of previously issued Invoice or Refund. In any other case (for example Normal Sale invoice) this field is optional.

	ASCII, in ***RequestedBy-SignedBy-OrdinalNumber*** format
PAC	POS Access Code assigned to and used along with digital certificate distributed as PFX file, used to authenticate POS to VSDC. In case Smart Card is used to authenticate POS to V-SDC this field is not used and should be left blank.
Items (n)	Each invoice contains at least one Item in Items collection
GTIN	Global Trade Item Number (GTIN) is an identifier for trade items, incorporated the ISBN, ISSN, ISMN, IAN (which includes the European Article Number and Japanese Article Number) and some Universal Product Codes, into a universal number space.
Name	Human readable name of the product or service.
Quantity	Quantity of an item, e.g. 2 (pieces), 0.100 (grams).
UnitPrice	Unit price of the line item. Does not take part in tax calculation.
Discount	Discount applied, before **TotalAmount** is accounted for. It's not part of tax calculation.
TotalAmount	Gross price for the line item.
Labels	Array of labels. Each Label represents one of the Tax Rates applied on invoice item. Tax Items are calculated based on TotalAmount and applied Labels. In case no taxes are applicable on item this field is optional.
Options	Key/value collection defines output of V-SDC/E-SDC invoice fiscalization, to optimize resources. Key: **`OmitQRCodeGen`** Value: "1" to omit QR Code generation by E-SDC and "0" to generate and return QR code. Key: **`OmitTextualRepresentation`** Value: "1" to omit generation of textual representation by E-SDC and "0" to generate return textual representation to POS.
Hash	Base64 encoded MD5 hash of the request data (used only for E-SDC). It is used only for later invoice search.

Model

```
InvoiceFiscalizationRequest {
       DateAndTimeOfIssue (string, optional),
       Cashier (string, optional) Unicode MaxLength:50,
       BD (string, optional) ASCII MaxLength:20,
       BuyerCostCenterId (string, optional) Unicode MaxLength:15,
       IT (string) = ["Normal", "ProForma", "Copy", "Training"] (int) = [0,1,2,3],
       TT (string) = ["Sale", "Refund"] (int) = [0,1],
       PaymentType (string) = ["Other", "Cash", "Card", "Check", "WireTransfer",
       "Voucher", "MobileMoney" (int) = [0,1,2,3,4,5,6],
       InvoiceNumber (string, optional) Unicode MaxLength:60,
       ReferentDocumentNumber (string, optional),
       PAC (string, optional),
       Options (inline_model, optional),
       Items (Array[Item]) MinLength:1,
       Hash (string, optional) MaxLength:32
}

inline_model {
       OmitQRCodeGen (string, optional) = ["0", "1"] (int) = [0,1],
       OmitTextualRepresentation (string, optional) = ["0", "1"] (int) = [0,1]
}
```

```
Item {
       GTIN (string, optional) MinLength:8 MaxLength:14,
       Name (string) Unicode MaxLength:2048,
       Quantity (number) Decimal(14,3) MinValue:0.001,
       UnitPrice (number, optional) Decimal(14,2),
       Discount (number, optional) Decimal(14,2),
       Labels (Array[string], optional) MinLength:0,
       TotalAmount (number) Decimal(14,2)
}
```

Example

```
       {
         "DateAndTimeOfIssue": "2017-06-15T08:56:23.286Z",
         "Cashier": "123456789",
         "IT": "Normal",
         "TT": "Sale",
         "PaymentType": "Cash",
         "InvoiceNumber": "POS2017/998",
         "Options": {
           "OmitQRCodeGen" : "1" ,
           "OmitTextualRepresentation" : "0"
         },
         "Items": [
           {
             "Name": "Sport-100 Helmet, Blue",
             "Quantity": 2,
             "UnitPrice": 34.23,
             "Labels": [
               "A"
             ],
             "TotalAmount": 68.46
           }
         ],
         "Hash": "W33lEEgkSRsqTFMO86a8Og=="
       }
```

Invoice Response

Data Fields

Field	Description
RequestedBy	UID of digital certificate which requested signing. In case E-SDC is used, its value will be the same as SignedBy.
SignedBy	UID of digital certificate of secure element which signed invoice. In case E-SDC is used, its value will be the same as RequestedBy.
DT	Local Date and time in ISO 8601 format provided by E-SDC/V-SDC.
IC	Invoice Counter in format **TransactionTypeCounter/TotalCounter InvoiceCounterExtension** For Example: 14/17NS
InvoiceCounterExtension	First letters of Transaction Type and Invoice Type of the invoice. NS for Normal Sale, CR – Copy Refund, TS – Training Sale etc.
IN	Invoice number in format **RequestedBy-SignedBy-TotalCounter**
VerificationUrl	Verification URL generated through fiscalization.
VerificationQRCode	Base64 encoded byte array of GIF image.
Journal	Textual representation of the invoice.
Messages	Custom human readable message that shall be printed or displayed by

	POS.
TotalCounter	Total number of documents protected by this instance of Secure Element.
TransactionTypeCounter	Total number of documents of the selected transaction type protected by this instance of Secure Element.
TotalAmount	Sum of all Items totals – grand total billed to customer.
ID	Internal Data.
S	Digital Signature.
TaxItems	(for each label that exists on the invoice).
Label	Tax Label (i.e. A, F, G)
Name	Tax Category Name (i.e. VAT, Consumption)
Rate	TaxRate i.e. 12.50(%) or 0.10($)
Amount	Tax amount calculated by E-SDC. Refer to section Tax Amounts.
Hash	Hash received from POS in request field Hash (used only for E-SDC)
BusinessName	Taxpayer Business Name obtained from digital certificate.
LocationName	Location Name obtained from digital certificate.
Address	Street address obtained from digital certificate.
TIN	Tax Identification Number obtained from digital certificate.
District	District name obtained from digital certificate.
MRC	E-SDC manufacturer registration code (in format MakeCode-SW-Serial). -MakeCode: unique 2 characters obtained on Tax Service Accreditation -SW: software version -Serial: manufacturer serial number (max 32 characters)

Model

```
InvoiceFiscalizationResult {
	RequestedBy (string),
	DT (string),
	InvoiceCounterExtension (string),
	TaxItems (Array[TaxItem]) MinLength:0,
	VerificationUrl (string),
	VerificationQRCode (string, optional),
	Journal (string, optional),
	Messages (string, optional),
	SignedBy (string),
	ID (string),
	S (string),
	TotalCounter (integer),
	TransactionTypeCounter (integer),
	TotalAmount (number),
	Hash (string, optional),
	BusinessName (string, optional),
	LocationName (string, optional),
	TIN (string, optional),
	Address (string, optional),
	District (string, optional),
	MRC (string, optional)
}

TaxItem {
Label (string),
Amount (number),
```

Rate (number),
CategoryName (string)
}

Example


```
{
  "RequestedBy": "7AF4D923",
  "DT": "2017-06-14T19:56:25.2782924+13:00",
  "IC": "230/234NS",
  "InvoiceCounterExtension": "NS",
  "IN": "7AF4D923-E3B30A31-234",
  "TaxItems": [
    {
      "Label": "A",
      "CategoryName": "VAT",
      "Rate": 9.00
      "Amount": 5.6527
    }
   ],
  "VerificationUrl":"https://staging.vms.frcs.org.fj/v/?vl=AVAyMlZDOFZSSlRKQzVWNjUBAAAA
    AQAAAAAuGQ4AAAFeM%2BvCJgAAAAbDDPkm7R9I1NPLierP%2Bh3UQswb%2FXa8xYKiEnLjyClHqh6X26FruP
    VNksB7wMoG2LpA85uvbG9txf2CndYl5JZshBJsq7TLF%2BqOmRs3EaykUVf05mFbTrrgQmUROZE76lciqaxv
    aVEGK83ic1q2HVz0mryqHna6Iu%2FuTn4q2wQ4gJ9bc%2BD6pvyhY%2BZB8c3SgYNGPm4Eq81%2BC8tjJpPC
    YLlHrVKPjbQEE6FSm2II0YEeQqWEGNCHqatxHmjS8sJTT4BJJ%2FlhzTQyuFWoI5ko3oAm8AZsEdgx54oEEN
    r3LUm3Jg%2Fd75tGcUoweEngRfoEP0EiqaOkt2sdSg18hrjd4PUdZ8QUksSeIDmjLMsqZoLmGiqycdajhMN2
    eMeo%2B9LZ%2FhLnxDsROkbOWlArVGfQ%2B9MfBmyJsILCEIT6myTAC2HZCvQ%2Bc0MEO%2F0euynCkCQO6B
    Bv39zNn8yNRagmsEOslkQydty66gphme%2BCOx76u%2F4lCjxPOOxc%2F6zNR8SAe1MNaDPVH3PU7IlQdTox
    fXY3pvWSqtK%2FUY5JGXpvmMpLP6kUXr1qOCjt2Uj6QsH%2BbgwjEZVpHep%2Byh5myEQcI9A4NDUtoUjPpI
    TbOIxPO4vyne%2Bgv4UnpAKQigAv%2FywKeD9noHDgCiFSfLZCJ0IXMSleo%2BjIf%2BIfE2YXX84gH7n7Nc
    pn",
  "VerificationQRCode": null,
  "Journal": "============ FISCAL INVOICE ============\r\n
              TIN:                              502579006\r\n
              Company:                             Golf V\r\n
              Store:                            Sun Store\r\n
              Address:                       7 Someplace\r\n
              District:                             Suva\r\n
              Cashier TIN:                      123456789\r\n
              POS number:                      POS2017/998\r\n
              POS time:              2017-06-15 8:56:23\r\n
              --------------NORMAL SALE---------------\r\n
              Items\r\n
              ========================================\r\n
              Name    Price        Qty.          Total\r\n
              Sport-100 Helmet, Blue (A)              \r\n
                      34.23           2          68.46\r\n
              ----------------------------------------\r\n
              Total Purchase:                    68.46\r\n
              Payment Method:                     Cash\r\n
              ========================================\r\n
              Label        Name     Rate           Tax\r\n
              A             VAT    9.00%          5.65\r\n
              ----------------------------------------\r\n
              Total Tax:                          5.65\r\n
              ========================================\r\n
              SDC Time:              2017-06-15 8:56:25\r\n
              SDC Invoice No:    7AF4D923-E3B30A31-234\r\n
              Invoice Counter:               230/234NS\r\n
              ========================================\r\n
              ======== END OF FISCAL INVOICE =========\r\n",
  "Messages": "Success",
  "SignedBy": "E3B30A31",
```

```
 "ID":
   "BsMM+SbtH0jU08uJ6s/6HdRCzBv9drzFgqIScuPIKUeqHpfboWu49U2SwHvAygbYukDzm69sb23F/YKd1iX
   klmyEEmyrtMsX6o6ZGzcRrKRRV/TmYVtOuuBCZRE5kTvqVyKprG9pUQYrzeJzWrYdXPSavKoedroi7+5Ofir
   bBDiAn1tz4Pqm/KFj5kHxzdKBg0Y+bgSrzX4Ly2Mmk8JguUetUo+NtAQToVKbYgjRgR5CpYQY0Iepq3EeaNL
   ywlNPgEkn+WHNNDK4VagjmSjegCbwBmwR2DHnigQQ2vctSbcmD93vm0ZxSjB4SeBF+gQ/QSKpo6S3ax1KDXy
   GuN3g9Q==",
 "S":
   "HWfEFJLEniA5oyzLKmaC5hoqsnHWo4TDdnjHqPvS2f4S58Q7ETpGzlpQK1Rn0PvTHwZsibCCwhCE+pskwAt
   h2Qr0PnNDBDv9HrspwpAkDugQb9/czZ/MjUWoJrBDrJZEMnbcuuoKYZnvgjse+rv+JQo8TzjsXP+szUfEgHt
   TDWgz1R9z1OyJUHU6MX12N6b1kqrSv1GOSRl6b5jKSz+pFF69ajgo7dlI+kLB/m4MIxGVaR3qfsoeZshEHCP
   QODQ1LaFIz6SE2ziMTzuL8p3voL+FJ6QCkIoAL/8sCng/Z6Bw4AohUny2QidCFzEpXqPoyH/iHxNmF1/OIB+
   5+zXKZw==",
 "TotalCounter": 234,
 "TransactionTypeCounter": 230,
 "TotalAmount": 68.46,
 "Hash": "W33lEEgkSRsqTFMO86a8Og==",
 "BusinessName": "Golf V",
 "TIN": "502579006",
 "LocationName": "Sun Store",
 "Address": "7 Someplace",
 "District": "Suva"
}
```

Mapping Fiscal Invoice to Fiscal Receipt

In case POS does not use Journal (generated by E-SDC or V-SDC) as a content for a fiscal receipt, but it generates a custom designed receipt instead, it shall use the following element mappings:

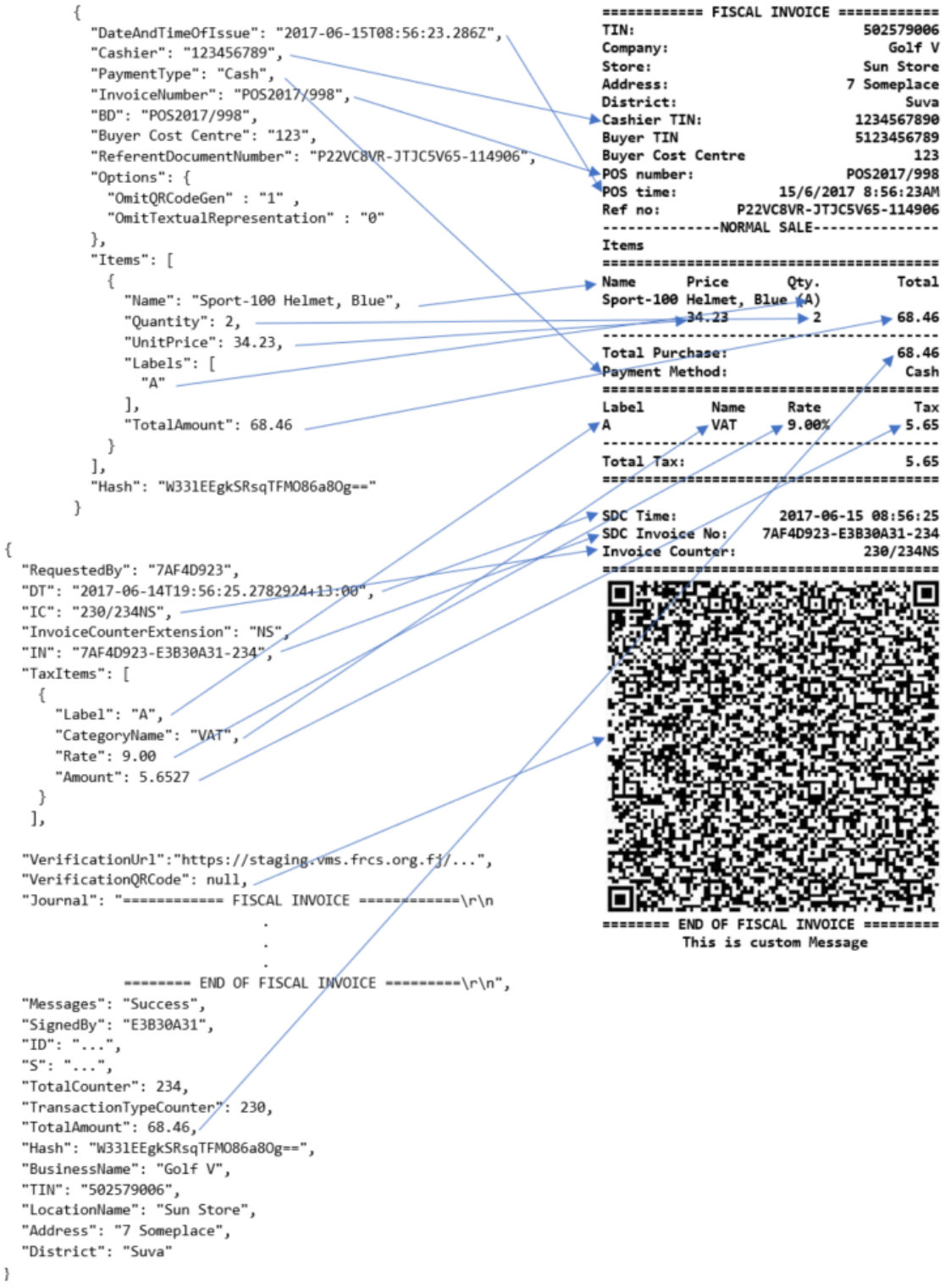


Figure 5 Mapping Fiscal Invoice to Fiscal Receipt

- JSON Based Protocol.
- Checksum is Fletcher-16 checksum calculated on <Command> and <Payload> segments, as defined in section Fletcher-16 checksum.

Example

The following is the example request bytes (in hexadecimal format) for the Verify PIN Command.

507B225650494E223A2231323334227DB6C4C0

Response

Every response sent by E-SDC to POS over a serial communication protocol is a SLIP packet consisted of the following segments:

<Payload><Checksum><SLIP End>

Payload is a UTF-8 encoded JSON based command response as defined in section JSON Based Protocol (Common for POS to V-SDC or E-SDC)

JSON API is designed and based on OpenAPI-Specification V2 (https://github.com/OAI/OpenAPI-Specification). You can use OpenAPI-Specification code generators (e.g. https://swagger.io/swagger-codegen/) to quickly build a proxy library for almost any programming language and platform.

Sign Invoice Command

HTTP POST request data is sent to:

For V-SDC:	https://vsdc.staging.vms.frcs.org.fj/api/Sign (for Staging) or https://vsdc.vms.frcs.org.fj/api/Sign (for Production)
For E-SDC:	http://< ESDC_ip_address>/api/Sign

Invoice Request

Data Fields

Field	Description
DateAndTimeOfIssue	Current **Local** Date and Time in ISO 8601 format
IT	Invoice Type enumeration value
TT	Transaction Type enumeration value
PaymentType	Payment Type enumeration value
Cashier	Cashier's identification.
BD	Taxpayer ID of the Buyer. **It is mandatory for B2B** transactions, otherwise it's optional.
BuyerCostCenterId	Cost Center ID provided by buyer to the cashier in case Buyer's company wants to track spending in Taxpayer Portal. **It is optional and may exist only for B2B transactions, otherwise is shall be ignored by E-SDC.**
InvoiceNumber	Invoice number generated by POS.
ReferentDocumentNumber	Mandatory only in case Invoice Type is **Refund** or **Copy**. In both cases, this field must contain Invoice Number of previously issued Invoice or Refund. In any other case (for example Normal Sale invoice) this field is optional. ASCII, in ***RequestedBy-SignedBy-OrdinalNumber*** format

PAC	POS Access Code assigned to and used along with digital certificate distributed as PFX file, used to authenticate POS to VSDC. In case Smart Card is used to authenticate POS to V-SDC this field is not used and should be left blank.
Items (n)	Each invoice contains at least one Item in Items collection
GTIN	Global Trade Item Number (GTIN) is an identifier for trade items, incorporated the ISBN, ISSN, ISMN, IAN (which includes the European Article Number and Japanese Article Number) and some Universal Product Codes, into a universal number space.
Name	Human readable name of the product or service.
Quantity	Quantity of an item, e.g. 2 (pieces), 0.100 (grams).
UnitPrice	Unit price of the line item. Does not take part in tax calculation.
Discount	Discount applied, before **TotalAmount** is accounted for. It's not part of tax calculation.
TotalAmount	Gross price for the line item.
Labels	Array of labels. Each Label represents one of the Tax Rates applied on invoice item. Tax Items are calculated based on TotalAmount and applied Labels. In case no taxes are applicable on item this field is optional.
Options	Key/value collection defines output of V-SDC/E-SDC invoice fiscalization, to optimize resources. Key: **`OmitQRCodeGen`** Value: "1" to omit QR Code generation by E-SDC and "0" to generate and return QR code. Key: **`OmitTextualRepresentation`** Value: "1" to omit generation of textual representation by E-SDC and "0" to generate return textual representation to POS.
Hash	Base64 encoded MD5 hash of the request data (used only for E-SDC). It is used only for later invoice search.

Model

```
InvoiceFiscalizationRequest {
	DateAndTimeOfIssue (string, optional),
	Cashier (string, optional) Unicode MaxLength:50,
	BD (string, optional) ASCII MaxLength:20,
	BuyerCostCenterId (string, optional) Unicode MaxLength:15,
	IT (string) = ["Normal", "ProForma", "Copy", "Training"] (int) = [0,1,2,3],
	TT (string) = ["Sale", "Refund"] (int) = [0,1],
	PaymentType (string) = ["Other", "Cash", "Card", "Check", "WireTransfer",
	"Voucher", "MobileMoney" (int) = [0,1,2,3,4,5,6],
	InvoiceNumber (string, optional) Unicode MaxLength:60,
	ReferentDocumentNumber (string, optional),
	PAC (string, optional),
	Options (inline_model, optional),
	Items (Array[Item]) MinLength:1,
	Hash (string, optional) MaxLength:32
}

inline_model {
	OmitQRCodeGen (string, optional) = ["0", "1"] (int) = [0,1],
	OmitTextualRepresentation (string, optional) = ["0", "1"] (int) = [0,1]
}
```

```
Item {
       GTIN (string, optional) MinLength:8 MaxLength:14,
       Name (string) Unicode MaxLength:2048,
       Quantity (number) Decimal(14,3) MinValue:0.001,
       UnitPrice (number, optional) Decimal(14,2),
       Discount (number, optional) Decimal(14,2),
       Labels (Array[string], optional) MinLength:0,
       TotalAmount (number) Decimal(14,2)
}
```

Example

```
       {
         "DateAndTimeOfIssue": "2017-06-15T08:56:23.286Z",
         "Cashier": "123456789",
         "IT": "Normal",
         "TT": "Sale",
         "PaymentType": "Cash",
         "InvoiceNumber": "POS2017/998",
         "Options": {
           "OmitQRCodeGen" : "1" ,
           "OmitTextualRepresentation" : "0"
         },
         "Items": [
           {
             "Name": "Sport-100 Helmet, Blue",
             "Quantity": 2,
             "UnitPrice": 34.23,
             "Labels": [
               "A"
             ],
             "TotalAmount": 68.46
           }
         ],
         "Hash": "W33lEEgkSRsqTFMO86a8Og=="
       }
```

Invoice Response

Data Fields

Field	Description
RequestedBy	UID of digital certificate which requested signing. In case E-SDC is used, its value will be the same as SignedBy.
SignedBy	UID of digital certificate of secure element which signed invoice. In case E-SDC is used, its value will be the same as RequestedBy.
DT	Local Date and time in ISO 8601 format provided by E-SDC/V-SDC.
IC	Invoice Counter in format **TransactionTypeCounter/TotalCounter InvoiceCounterExtension** For Example: 14/17NS
InvoiceCounterExtension	First letters of Transaction Type and Invoice Type of the invoice. NS for Normal Sale, CR – Copy Refund, TS – Training Sale etc.
IN	Invoice number in format **RequestedBy-SignedBy-TotalCounter**
VerificationUrl	Verification URL generated through fiscalization.
VerificationQRCode	Base64 encoded byte array of GIF image.
Journal	Textual representation of the invoice.
Messages	Custom human readable message that shall be printed or displayed by POS.

TotalCounter	Total number of documents protected by this instance of Secure Element.
TransactionTypeCounter	Total number of documents of the selected transaction type protected by this instance of Secure Element.
TotalAmount	Sum of all Items totals – grand total billed to customer.
ID	Internal Data.
S	Digital Signature.
TaxItems	(for each label that exists on the invoice).
Label	Tax Label (i.e. A, F, G)
Name	Tax Category Name (i.e. VAT, Consumption)
Rate	TaxRate i.e. 12.50(%) or 0.10($)
Amount	Tax amount calculated by E-SDC. Refer to section Tax Amounts.
Hash	Hash received from POS in request field Hash (used only for E-SDC)
BusinessName	Taxpayer Business Name obtained from digital certificate.
LocationName	Location Name obtained from digital certificate.
Address	Street address obtained from digital certificate.
TIN	Tax Identification Number obtained from digital certificate.
District	District name obtained from digital certificate.
MRC	E-SDC manufacturer registration code (in format MakeCode-SW-Serial). -MakeCode: unique 2 characters obtained on Tax Service Accreditation -SW: software version -Serial: manufacturer serial number (max 32 characters)

Model

```
InvoiceFiscalizationResult {
	RequestedBy (string),
	DT (string),
	InvoiceCounterExtension (string),
	TaxItems (Array[TaxItem]) MinLength:0,
	VerificationUrl (string),
	VerificationQRCode (string, optional),
	Journal (string, optional),
	Messages (string, optional),
	SignedBy (string),
	ID (string),
	S (string),
	TotalCounter (integer),
	TransactionTypeCounter (integer),
	TotalAmount (number),
	Hash (string, optional),
	BusinessName (string, optional),
	LocationName (string, optional),
	TIN (string, optional),
	Address (string, optional),
	District (string, optional),
	MRC (string, optional)
}

TaxItem {
Label (string),
Amount (number),
Rate (number),
```

```
CategoryName (string)
}
```

Example


```
{
  "RequestedBy": "7AF4D923",
  "DT": "2017-06-14T19:56:25.2782924+13:00",
  "IC": "230/234NS",
  "InvoiceCounterExtension": "NS",
  "IN": "7AF4D923-E3B30A31-234",
  "TaxItems": [
    {
      "Label": "A",
      "CategoryName": "VAT",
      "Rate": 9.00
      "Amount": 5.6527
    }
   ],
  "VerificationUrl":"https://staging.vms.frcs.org.fj/v/?vl=AVAyMlZDOFZSSlRKQzVWNjUBAAAA
    AQAAAAAuGQ4AAAFeM%2BvCJgAAAAbDDPkm7R9I1NPLierP%2Bh3UQswb%2FXa8xYKiEnLjyClHqh6X26FruP
    VNksB7wMoG2LpA85uvbG9txf2CndYl5JZshBJsq7TLF%2BqOmRs3EaykUVf05mFbTrrgQmUROZE76lciqaxv
    aVEGK83ic1q2HVz0mryqHna6Iu%2FuTn4q2wQ4gJ9bc%2BD6pvyhY%2BZB8c3SgYNGPm4Eq81%2BC8tjJpPC
    YLlHrVKPjbQEE6FSm2II0YEeQqWEGNCHqatxHmjS8sJTT4BJJ%2FlhzTQyuFWoI5ko3oAm8AZsEdgx54oEEN
    r3LUm3Jg%2Fd75tGcUoweEngRfoEP0EiqaOkt2sdSg18hrjd4PUdZ8QUksSeIDmjLMsqZoLmGiqycdajhMN2
    eMeo%2B9LZ%2FhLnxDsROkbOWlArVGfQ%2B9MfBmyJsILCEIT6myTAC2HZCvQ%2Bc0MEO%2F0euynCkCQO6B
    Bv39zNn8yNRagmsEOslkQydty66gphme%2BCOx76u%2F4lCjxPOOxc%2F6zNR8SAe1MNaDPVH3PU7IlQdTox
    fXY3pvWSqtK%2FUY5JGXpvmMpLP6kUXr1qOCjt2Uj6QsH%2BbgwjEZVpHep%2Byh5myEQcI9A4NDUtoUjPpI
    TbOIxPO4vyne%2Bgv4UnpAKQigAv%2FywKeD9noHDgCiFSfLZCJ0IXMSleo%2BjIf%2BIfE2YXX84gH7n7Nc
    pn",
  "VerificationQRCode": null,
  "Journal": "============ FISCAL INVOICE ============\r\n
              TIN:                              502579006\r\n
              Company:                             Golf V\r\n
              Store:                            Sun Store\r\n
              Address:                       7 Someplace\r\n
              District:                              Suva\r\n
              Cashier TIN:                    123456789\r\n
              POS number:                    POS2017/998\r\n
              POS time:              2017-06-15 8:56:23\r\n
              --------------NORMAL SALE---------------\r\n
              Items\r\n
              ========================================\r\n
              Name    Price        Qty.          Total\r\n
              Sport-100 Helmet, Blue (A)              \r\n
                      34.23           2          68.46\r\n
              ----------------------------------------\r\n
              Total Purchase:                    68.46\r\n
              Payment Method:                     Cash\r\n
              ========================================\r\n
              Label        Name     Rate           Tax\r\n
              A             VAT    9.00%          5.65\r\n
              ----------------------------------------\r\n
              Total Tax:                          5.65\r\n
              ========================================\r\n
              SDC Time:              2017-06-15 8:56:25\r\n
              SDC Invoice No:    7AF4D923-E3B30A31-234\r\n
              Invoice Counter:               230/234NS\r\n
              ========================================\r\n
              ======== END OF FISCAL INVOICE =========\r\n",
  "Messages": "Success",
  "SignedBy": "E3B30A31",
```

```
 "ID":
   "BsMM+SbtH0jU08uJ6s/6HdRCzBv9drzFgqIScuPIKUeqHpfboWu49U2SwHvAygbYukDzm69sb23F/YKd1iX
   klmyEEmyrtMsX6o6ZGzcRrKRRV/TmYVtOuuBCZRE5kTvqVyKprG9pUQYrzeJzWrYdXPSavKoedroi7+5Ofir
   bBDiAn1tz4Pqm/KFj5kHxzdKBg0Y+bgSrzX4Ly2Mmk8JguUetUo+NtAQToVKbYgjRgR5CpYQY0Iepq3EeaNL
   ywlNPgEkn+WHNNDK4VagjmSjegCbwBmwR2DHnigQQ2vctSbcmD93vm0ZxSjB4SeBF+gQ/QSKpo6S3ax1KDXy
   GuN3g9Q==",
 "S":
   "HWfEFJLEniA5oyzLKmaC5hoqsnHWo4TDdnjHqPvS2f4S58Q7ETpGzlpQK1Rn0PvTHwZsibCCwhCE+pskwAt
   h2Qr0PnNDBDv9HrspwpAkDugQb9/czZ/MjUWoJrBDrJZEMnbcuuoKYZnvgjse+rv+JQo8TzjsXP+szUfEgHt
   TDWgz1R9z1OyJUHU6MX12N6b1kqrSv1GOSRl6b5jKSz+pFF69ajgo7dlI+kLB/m4MIxGVaR3qfsoeZshEHCP
   QODQ1LaFIz6SE2ziMTzuL8p3voL+FJ6QCkIoAL/8sCng/Z6Bw4AohUny2QidCFzEpXqPoyH/iHxNmF1/OIB+
   5+zXKZw==",
 "TotalCounter": 234,
 "TransactionTypeCounter": 230,
 "TotalAmount": 68.46,
 "Hash": "W33lEEgkSRsqTFMO86a8Og==",
 "BusinessName": "Golf V",
 "TIN": "502579006",
 "LocationName": "Sun Store",
 "Address": "7 Someplace",
 "District": "Suva"
}
```

Mapping Fiscal Invoice to Fiscal Receipt

In case POS does not use Journal (generated by E-SDC or V-SDC) as a content for a fiscal receipt, but it generates a custom designed receipt instead, it shall use the following element mappings:

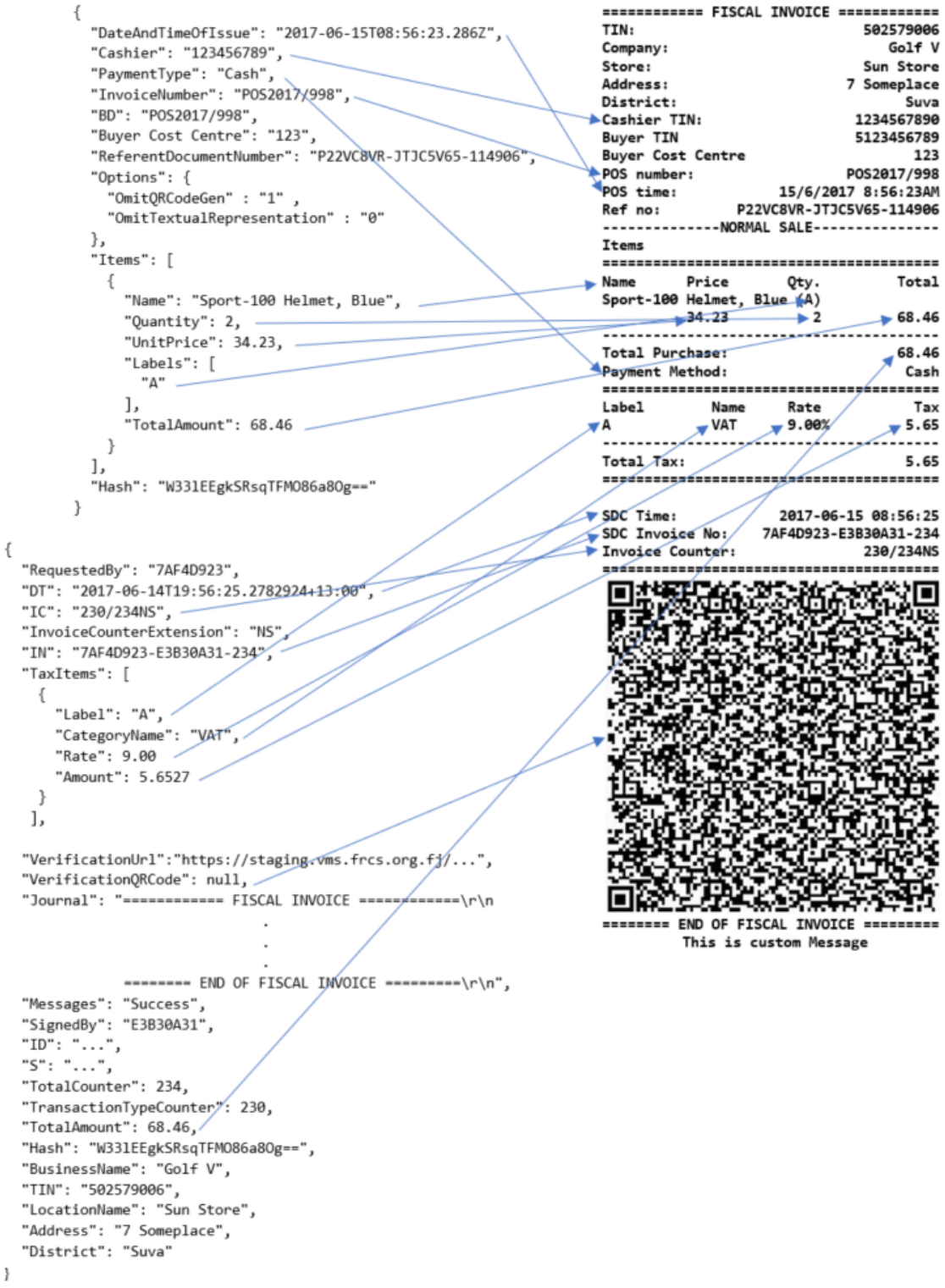


Figure 5 Mapping Fiscal Invoice to Fiscal Receipt

- JSON Based Protocol.
- Checksum is Fletcher-16 checksum calculated on <Payload> segment, as defined in section Fletcher-16 checksum.

Example

The following is the example response bytes (in hexadecimal format) for the successful Verify PIN Command response.

7B225650494E5F475343223A2230313030227D67F8C0

Fletcher-16 checksum

The following code represents optimized C language 8-bit implementation of the checksum calculation (https://en.wikipedia.org/wiki/Fletcher%27s_checksum):

```
uint16_t fletcher16(uint8_t* dataIn, uint16_t bytes)
{
    uint16_t sum1 = 0xff, sum2 = 0xff;
    uint16_t tlen;
    while (bytes){
        tlen = bytes >= 20 ? 20 : bytes;
        bytes -= tlen;
        do {
            sum2 += sum1 += *dataIn++;
        } while (--tlen);
        sum1 = (sum1 & 0xff) + (sum1 >> 8);
        sum2 = (sum2 & 0xff) + (sum2 >> 8);
    }
    /* Second reduction step to reduce sums to 8 bits */
    sum1 = (sum1 & 0xff) + (sum1 >> 8);
    sum2 = (sum2 & 0xff) + (sum2 >> 8);
    return sum2 << 8 | sum1;
}
```

Timeouts

All requests should use timeout period of 10 seconds. If there was no response within timeout period this is considered as a timeout error.

In case of the timeout error on Attention request, POS should simply repeat this request.

Timeout error on Sign Invoice request should be handled by sending Get Signature request until proper response is received:

- If Hash field from Get Signature response is different from the currently processed invoice, POS should repeat Sign Invoice request because it means that ESDC did not sign that last invoice.
- If Hash field from Get Signature response is the same as for currently processed invoice, POS can finish processing current invoice.

It is important for POS to ensure that hash of the currently processing invoice is stored in non-volatile memory until invoice is successfully signed. This ensures that invoice can be signed even in case of POS power failure.

In case of timeout error on Get Signature request, POS should simply repeat this request.

Please note that it is good practice to send Attention request and wait for valid response before sending any other Command.

GetStatus Command

GetStatus Command is used by a POS to gather information on state of the connected E-SDC device.

Command Identifier: S (“0x53” in hexadecimal).

Verify PIN Command

This command is used to provide a PIN code to the Secure Element.

Command Identifier: P (“0x50” in hexadecimal).

Sign Invoice Command

Sign Invoice Command performs the tax calculation, creates a verification URL, applies a digital signature and optionally generates a QR code and a textual representation of the invoice.

Command Identifier: I (“0x49” in hexadecimal).

Attention Command

This command is used by POS to verify if E-SDC is available.

Command Identifier: A (“0x41” in hexadecimal).

Get Signed Invoice Command

This command is used by POS to get the last signed invoice.

Command Identifier: G (“0x47” in hexadecimal).

POS to E-SDC Communication over TCP

Shall be supported in the future revision of the document.

Online POS and V-SDC integration

Since Taxpayers are encouraged to use online POS capabilities, TaxCore supports scenarios for browser based client applications. Accredited online POS shall create **Invoice Requests**, and submit them via HTTP protocol directly to V-SDC API, using **digital certificate** issued to Taxpayer. This process shall complete invoice fiscalization with signed invoice returned to online POS.

Online POS **shall** submit requests to V-SDC API **directly,** in order to create HTTP request with client certificate. For client-side JavaScript based applications, in order to achieve the best user experience, the most common solution is using AJAX. For security reasons, browsers restrict cross-origin HTTP requests initiated from within the scripts. TaxCore offers a solution for online POS, which shall overcome issues with CORS and digital certificates sent from client.

We recommend the usage of a secure network communication with SSL protocol for online POS, although the V-SDC API will accept requests from unsecure online POS.

Quick start

Our pre-built TaxCore element is used to collect data from online POS page. Online POS prepares Invoice Request data for this page thus TaxCore element can collect and send this data to V-SDC. Quick integration can be achieved as follows:

1. Online POS needs to provide page for collecting and sending **Invoices**. This is **integration point** on POS side.
2. Add the following script tag to integration point, with src attribute reffering to taxcore.min.js file:
   `<script src="[vsdcurl]/onlinepos/v1/taxcore.min.js"></script>`

   Instead of **[vsdcurl]** provide correct V-SDC URL for appropriate environment.[1]
3. Add TaxCore Sign Element to your integration point with required id and data-* attributes.

```
<!--TaxCore html element-->
<button id="taxcore_sign_element"
        data-taxcore-vsdc-url="[vsdcurl]"
        data-taxcore-input-id="[inputDataContainerId]"
        data-taxcore-output-id="[outputDataContainerId]">Sign Invoice</button>
```

- **Id** attribute is required and it must be equal to string **"taxcore_sign_element"**.
- **vsdcurl** – provide V-SDC API url
- **inputDataContainerId** – provide id of HTML tag element which contains invoice request json, usually input tag
- **outputDataContainerId** – provide id of HTML tag element which will be populated by response from V-SDC API

[1] For example, js file location at staging environment is
`<script src="https://vsdc.staging.vms.frcs.org.fj/onlinepos/v1/taxcore.min.js"></script>`

4. Click on the TaxCore Sign Element in order to receive signed invoice as value of HTML tag element with id equal to provided [**outputDataContainerId]**

Detailed specs

There are two important components which enable the integration of online POS with V-SDC.

1. taxcore.min.js file
2. taxcore sign element

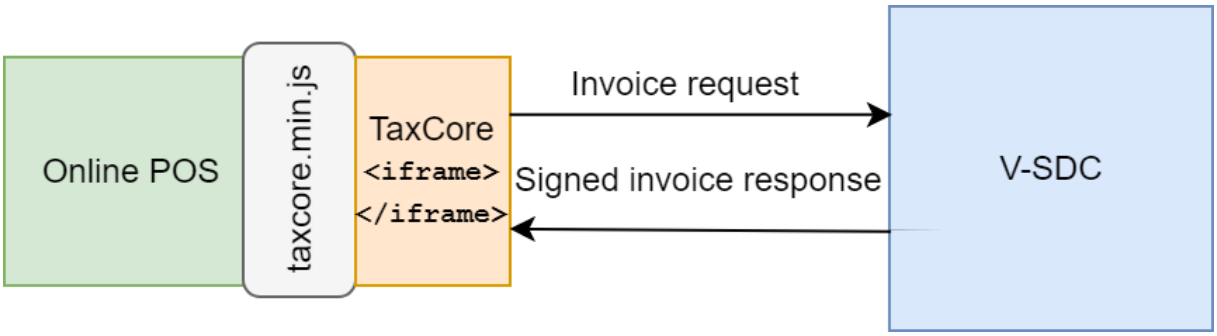
Note: Both components must exist at integration point for successful integration. JavaScript will first try to find taxcore sign element with `id="taxcore_sign_element"`. If it can't be found, exception will be thrown with appropriate message (e.g. "*Could not find taxCoreElement. Check if you have valid html tag with expected id taxcore_sign_element*").

TaxCore JavaScript file - taxcore.min.js

First step in enabling your online POS application page to work with V-SDC is to include script reference to **taxcore.min.js** file, provided by TaxCore. This JavaScript will prepare your page to handle HTTP invoice requests to V-SDC API.

Online POS must directly submit data to V-SDC API to transport digital certificate over network from client side (in this case from Taxpayer's web browser). In order to achieve this requirement, taxcore.min.js script will create **<iframe> element** within online POS, effectively embedding V-SDC HTML page into the current POS page. POS (Parent page) sends messages to iframe (Child page), and then iframe performs post to V-SDC. By doing so, we can overcome CORS issues with digital certificates, since client certificate in CORS preflight OPTIONS requests is omitted[2].

The other features, provided by this js file are related to sending and receiving data to and from V-SDC. Your online POS needs to prepare data for input and to handle returned data. All other job is delegated to taxcore.min.js.



taxcore.min.js as communication interface between POS and V-SDC

[2] https://www.w3.org/TR/cors/#cross-origin-request-with-preflight-0

After successfully creating iframe element, we can send messages between Online POS parent page and TaxCore child page. Responsibility of initiating the message is part of the second component *TaxCore Sign Element* described in the next section.

TaxCore Sign Element

TaxCore Sign element is nothing more than an HTML tag with predefined id, that you'll place at your online POS page. Its task is to collect invoice data and forward them to V-SDC.

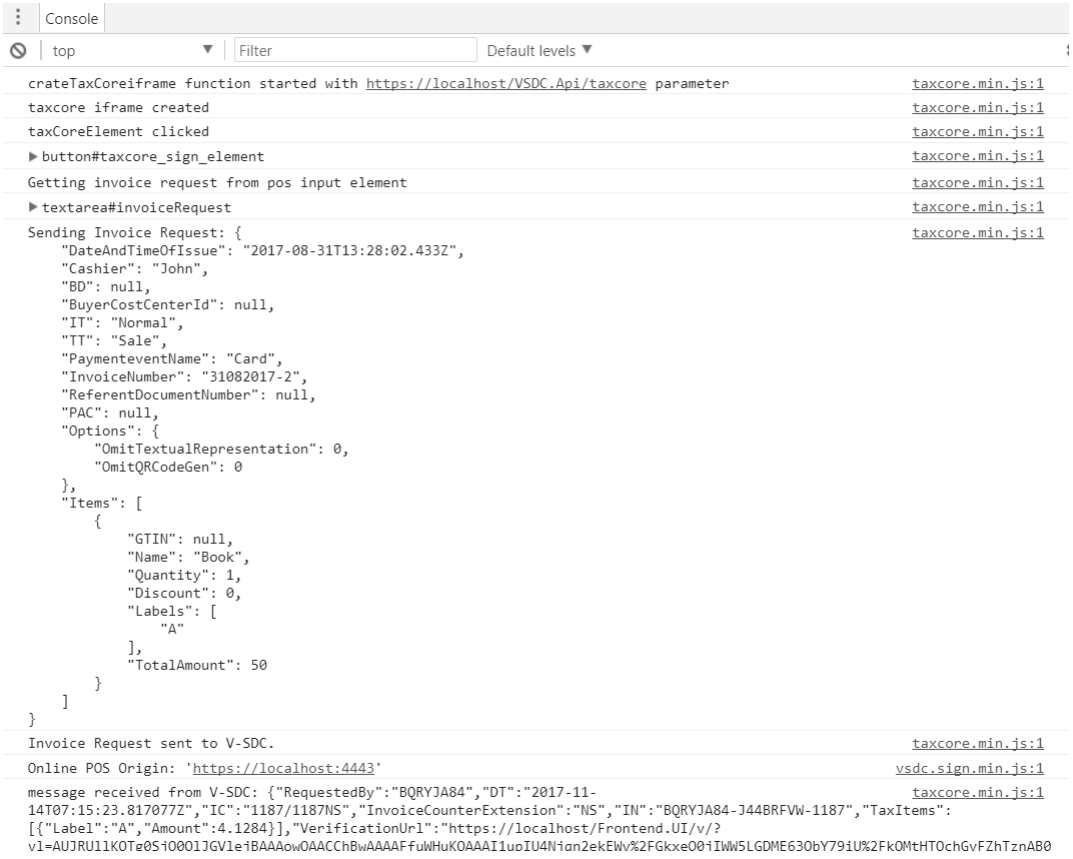
Note: The id of TaxCore Sign Element **must** be equal to string **"taxcore_sign_element"**, so that code in taxcore.min.js could be able to find it. Otherwise, the data collection would not be possible.

The best practice for this element is to be clickable HTML element, e.g. a button, but it's not restricted to it. TaxCore Sign Element is also used to configure its behavior using HTML data-* attributes, as follows:

```
<!--TaxCore html element-->
<button id="taxcore_sign_element"
    data-taxcore-vsdc-url="https://vsdc.staging.vms.frcs.org.fj/"
    data-taxcore-input-id="invoiceRequest"
    data-taxcore-output-id="invoiceResponse"
    data-taxcore-invoice-request=""
    data-taxcore-debug="true"
    data-taxcore-signed-invoice-response="">
Sign Invoice
</button>
```

Data attribute	Restriction	Description
data-taxcore-vsdc-url	Required	V-SDC URL
data-taxcore-input-id	required if **data-taxcore-invoice-request** attribute is not used	Id of the HTML element on POS page, which contains prepared invoice request as required JSON scheme
data-taxcore-output-id	It is optional, since V-SDC will always store signed invoice response at **data-taxcore-signed-invoice-response** attribute	Id of the HTML element on POS page, used to store signed invoice response JSON from V-SDC
data-taxcore-invoice-request	required if **data-taxcore-input-id** attribute is not used	If you do not want to use separate HTML element for invoice request JSON, you can store it at this data attribute, and it will be collected when TaxCore Sign Element is clicked
data-taxcore-signed-invoice-response		This is default storage location for signed invoice response JSON from V-SDC. It will be always populated

data-taxcore-debug	Optional	Used to log relevant information during invoice fiscalization. Log is written to the browser console



Logs written to browser console when data-taxcore-debug is set to true

Subscribe to TaxCore messages

If you need to perform some tasks, after message from V-SDC is received, you can listen on the following event and do the necessary handling. For example, the following code will be executed after signed invoice response JSON from V-SDC is written to appropriate storage location.

```
// Listen to message from taxcore
window.onmessage = function (e) {
    console.log(e.data);
}
```

Supported browsers

Online POS and V-SDC are tested with the following browsers:

- Google Chrome 61.0.3163.100+
- Microsoft Internet Explorer 11
- Microsoft Edge 40.15063.674.0+
- Firefox 56.0.2+
- Opera 48+

All current major browsers are supported.

Example of integration using simple HTML page

The following code is an example of a simple integration. The HTML serves as an integration point for V-SDC. Instead of this HTML, you should use page of your online POS application.

```
<!DOCTYPE html>
<html>
<head>
    <title>Online POS</title>
    <meta charset="utf-8">
</head>
<body>
    <h1>Online POS</h1>
    <label for="invoiceRequest">Invoice request json</label>
    <textarea id="invoiceRequest" cols="100" rows="30" style="display:block"></textarea>
    <label for="taxcore_sign_element">Send Invoice Request:</label>
    <!--TaxCore HTML element-->
    <button id="taxcore_sign_element"
                data-taxcore-vsdc-url="https://vsdc.staging.vms.frcs.org.fj/"
                data-taxcore-input-id="invoiceRequest"
                data-taxcore-output-id="results"
                data-taxcore-invoice-request=""
                data-taxcore-debug="true"
                data-taxcore-signed-invoice-response="">Sign Invoice</button>
    <label for="results">Received Signed Invoice:</label>
    <textarea readonly id="results" cols="100" rows="30"></textarea>
    <!-- TAXCORE.JS -->
    <script src="https://vsdc.staging.vms.frcs.org.fj/onlinepos/v1/taxcore.min.js"></script>
    <!-- Custom script at Online POS -->
    <script>
        document.getElementById("invoiceRequest").innerHTML =
                JSON.stringify(CreateExampleInvoiceRequest(), undefined, 4);

        document.getElementById("taxcore_sign_element").dataset.taxcoreInvoiceRequest =
                JSON.stringify(CreateExampleInvoiceRequest());

        // Listen to messages from TaxCore
        window.onmessage = function (e) {
            console.log(e.data);
        }

        function CreateExampleInvoiceRequest() {
            var invoiceRequest = {
                "DateAndTimeOfIssue": "2017-08-31T13:28:02.433Z",
                "Cashier": "John",
                "BD": null,
                "BuyerCostCenterId": null,
                "IT": "Normal",
                "TT": "Sale",
                "PaymentType": "Card",
                "InvoiceNumber": "31082017-2",
                "ReferentDocumentNumber": null,
                "PAC": null,
                "Options": {
                    "OmitTextualRepresentation": 0,
                    "OmitQRCodeGen": 0
```

```
                },
                "Items": [
                    {
                        "GTIN": null,
                        "Name": "Book",
                        "Quantity": 1,
                        "Labels": [
                            "A"
                        ],
                        "TotalAmount": 50
                    }
                ]
            };

            return invoiceRequest;
        }
    </script>
</body>
</html>
```

Test Cases

Regardless of the type of invoicing system you are building, the same test cases shall apply.

Different invoice use cases and their appropriate labels are presented in the following table

INVOICE TYPE	TRANSACTION TYPE	Invoice label
Normal	Sales	NS
Normal	Refund	NR
Copy	Sales	CS
Copy	Refund	CR
Training	Sales	TS
Training	Refund	TR
Proforma	Sales	PS
Proforma	Refund	PR

Table 2 Invoice Use Cases

Issue Invoice

Receipt must contain visible markings Receipt Type “NORMAL”, “COPY”, “TRAINING” or “PROFORMA”.

Steps

Cashier on Accredited POS is selecting invoice type, and then registering transaction by: typing items, selecting items from previously made list or scanning bar code with bar code reader. At the end cashier chooses the payment method and finishes the invoice.

Accredited POS is sending message to E-SDC. After successful invoice data verification, invoice is signed, counters and totals are updated and internal data is completed.

E-SDS is sending back Invoice response to Accredited POS.

Receipt is delivered to the customer.

Expected Result

Fiscal receipt is the final result of this procedure. The receipt can be printed or sent by SMS or email message if customer is asking for it. Every receipt is digitally signed. Internal data is stored in the data base of the TaxCore. Valid QR code is at the end of the receipt. Receipt counter is in the form a/b IL (a-total number of signed invoices per type/ b-total number of signed invoices, IL – Invoice label).

Accredited POS is sending message to E-SDC. After successful invoice data verification, invoice is signed and invoice counters are updated.

E-SDS is sending back Invoice response to Accredited POS.

Receipt is issued.

Issue Normal Sale or Refund B2B Invoice

B2B invoice supports all invoice types and transaction types. At a beginning of invoice creation cashier must ask buyer for Buyers TIN, and optionally Buyer Cost Center.

Special Cases

In addition to all abovementioned, any combination of the previous test cases is possible.

All payments shall conform to the following rules:

- If the payment is not considered as a daily turnover, then no fiscal receipt shall be issued for that payment (as it is not an actual transaction).
- If the payment is considered as advance payment, then fiscal receipt shall be issued as a NORMAL-SALE transaction.

The following examples illustrate applications of these rules:

Deposit

Depending of the purpose of a taken deposit, this case can be resolved in two ways:

1. If the Deposit is subject of some internal agreement/document (not considered as a daily turnover), then no fiscal receipt shall be issued for the Deposit. Only final SALE is a NORMAL-SALE transaction.
2. If the Deposit is considered as advance payment, then fiscal receipt shall be issued as a NORMAL-SALE transaction. It is advised to name this Item similar to “40% of an Item”.

When Items are ready for Delivery and final SALE, POS shall provide one or both of the following options:

1. Create another transaction (“60% of an Item”), or
2. Create another two transactions: NORMAL-REFUND (“40% of an Item”) and NORMAL-SALE (“Item”).

Quotes

Assuming no advance payment takes part in the transaction, this is a PROFORMA-SALE transaction.

Layby / Installments

This is an advance payment and shall be treated as NORMAL-SALE, and fiscal receipts shall be issued. It is advised to name each installment similar to “10% Item”. When the last installment payment is made, POS shall provide one or both of the following options:

1. Create another transaction for the last installment (“15% Item”), or
2. For each previous payed installment create transactions of type NORMAL-REFUND (“X% Item”), followed with one NORMAL-SALE (“Item”).